

D.C. Dockless Bikeshare: A First Look

Virginia Tech | Spring 2018

Executive Summary

A studio class at Virginia Tech (“VT”) conducted a study of the five dockless bikeshare systems that are currently operating in the city. This study is an analysis of the demographic and geographic data related to dockless bike riders in the District of Columbia (the “District”). The dockless bikeshare data was compared to the existing Capital Bikeshare (“CaBi”) docked system. Data was collected about racial/ethnic origin, gender, and other demographic data of both dockless bikeshare and CaBi riders during the study period to evaluate any relevant differences between the rider groups. This study is intended for those interested in the demographic and geographic reach of dockless systems as compared to traditional bikeshare systems in the District, and those interested in the issue of transportation equity in the District’s bikeshare options.

The data was collected using three methods. Primarily, an intercept survey was conducted at various points throughout the District to gather demographic data of dockless bike riders. Secondly, a manual screenline count of bike riders was conducted at two locations—Pennsylvania Avenue N.W. between 14th and 15th St. N.W. and the 11th Street Bridge—to gather demographic data of dockless and CaBi riders and to count all types of bicycles traveling through those locations at specified times. Lastly, geographic information system (GIS) analysis was conducted to gather data about peak usage times and geographic reach of dockless bikes in the District.

The purpose of this study was to investigate whether dockless and CaBi riders have different demographic profiles, and whether dockless and CaBi systems overall have a different geographic reach. The results of both the survey (with 49 respondents) and screenline counts suggest that dockless bike riders were, on average, a more racially diverse set of riders than CaBi members. In addition, the results of the survey indicated that dockless bike riders have a slightly higher proportion of riders that were women as compared to CaBi members. The intercept survey data also suggested that dockless bike riders may have a lower household income than CaBi members. Finally, the GIS data showed that dockless bike ridership is much higher in the afternoon than in the morning as compared to CaBi ridership, and dockless bike riders have a proportionally more geographically dispersed pattern than CaBi riders.

With regard to the issue of transportation equity, the limited data collected in this study suggest dockless bikes proportionally may have more riders that are from historically disadvantaged races and lower household incomes than CaBi. In addition, the geographic data suggest that dockless bikes are more accessible than CaBi in certain geographic areas of the District.

Study Limitations

The study has a few limitations related to data analysis. The majority of the field work was conducted in the later stages of the winter season. Weather conditions encountered by researchers included snow, ice, rain, high winds, and low temperatures which affected the sample size and response rates (n=49). There were two screenline count locations, and approximately four locations for intercept surveys.

For future studies we recommend: (1) conducting a future study during the warmer late spring and summer seasons which may be more conducive to observing a larger number of bikers overall, especially dockless bike riders; (2) increasing and dispersing the number of count and survey locations throughout the District; and (3) conducting the count and survey time periods during off-peak hours to gather more data about dockless bike riders.

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Overview

Since September 2017, five dockless bikeshare companies have been operating in the District. During this trial period, DDOT has limited initial operation to a maximum of 400 bicycles per dockless bikeshare company. In contrast to CaBi, dockless bikes operate without a docking station and can potentially reach new geographic areas and attract different riders within the District. Currently, there has been little information collected regarding the demographics of dockless bikeshare users and the geographic reach of the system. To fill this need, VT collect and analyzed data on user demographics and geographic reach of the new dockless bikeshare systems and to compare results to the existing CaBi system. VT students used various methods to collect and analyze dockless bikeshare data between January and April 2018. VT students developed the following research questions in coordination with DDOT:

1. What is the demographic profile of dockless bikeshare users in the District?
2. What is the geographic reach of the dockless bikeshare system?
3. Does the dockless bikeshare system solve transportation equity problems in the city in general and for bikeshare in particular?

The Five Dockless Companies

The five dockless bikeshare companies in the District differ in many aspects from the docking station-based CaBi system. All of the dockless bikeshare companies are private transportation businesses that operate on a revenue-generating model. Each dockless company owns, operates and maintains their own fleet of bicycles. Dockless bikes are not required to be docked at a station like CaBi bikes. Subsequently, the dockless bikes, unencumbered by required docking stations, may have the potential to be widely dispersed throughout the District.

Conversely, CaBi requires participating jurisdictions to purchase docking stations and bicycles. CaBi's management company, Motivate, has a contract with local jurisdictions to maintain, rebalance, and operate the bikeshare system. The jurisdictions participate in identifying and establishing the bikeshare station locations. Revenue collected from daily and membership users helps offset the costs of infrastructure and operations in each jurisdiction. Table 1 below provides a summary of each bikeshare company operating in the District.

Table 1: The Five Dockless Bike Companies in DC

Bike Name	Bike Features	User Pricing	Year Founded	Company HQ
Ofo	Solid non-deflatable tire	\$1 per Hour	2014	Peking, China US HQ is in San Francisco
Lime Bike	3 and 8 Speed	\$1 per 30 minutes	2017	San Mateo, CA
Spin	Single Speed	\$1 per 30 minutes	2016	San Francisco, CA
Jump	Electric Assist	\$2 per 30 minutes	2010	Brooklyn, NY
MoBike	Airless Tire, Drive Shaft/ Chainless, Disk Brakes	\$1 per 30 minutes	2016	Shanghai, China
CaBi (Operated by Motivate)	3 Speed, Docked System	\$2 per 30 minutes	2010	Brooklyn, NY

Overview

VT developed three different approaches to study and identify the geographic reach and rider demographics of dockless bikeshare: intercept surveys with dockless bike riders, screenline bicycle counts, and analysis of GIS data.

GIS data from each dockless bikeshare system was obtained from DDOT for the entire geography of the District. For the intercept surveys and screenline counts, three locations were initially selected based on observation of parked dockless bikes within the GIS data. The 11th Street Bridge was selected to capture ridership activity between Wards 7 & 8 and downtown. Union Station was added to the study area later in the observation period due to inclement weather conditions that impacted data collection at the other locations.

The final study areas were:

- [Pennsylvania Avenue \(surveys and counts\)](#)
- [Chinatown \(surveys\)](#)
- [11th Street Bridge \(surveys and counts\)](#)
- [Union Station \(surveys\)](#)

Intercept Surveys

The goal of the survey was to identify customer motivations for using dockless bikeshare as well as potential alternative modes of travel riders would use if dockless bikeshare was not available. VT modeled most of the questions after the 2016 Capital Bikeshare Member Survey Report to assure comparability with CaBi data. We collected responses from 49 dockless riders using either intercept surveys or online questionnaires containing 14 questions. Information regarding question type, construction of the survey, and analysis performed can be found in Appendix A.

Screenline Counts

Screenline bicycle counts were conducted to gather information regarding gender, ethnicity, and type of dockless bike used by dockless bike riders. VT also counted riders on private bikes and CaBi to have a complete baseline comparison. A total of 720 bikes at both the Pennsylvania Avenue and 11th Street Bridge locations were counted during peak morning, afternoon and Saturday time periods. Appendix B provides a detailed description of the methodology used for the screenline counts.

Vendor GPS Trip Data

VT also compared CaBi and dockless bikeshare trip patterns through the analysis of trip data. CaBi data was obtained from an open-source data portal. Data collected from the five dockless bikeshare companies was provided by DDOT. VT analyzed over 980,000 CaBi trip records and over 150,000 dockless bikeshare trip records to highlight geographic areas of bikeshare usage as well as identify the peak time periods on weekdays and weekends. A detailed description of methods used to explore CaBi and dockless bikeshare data is discussed in Appendix C.

Intercept Survey

Overview Of Results

Responses were near even between the two genders for dockless riders, 53 percent male and 47 percent female. Survey respondents were more likely White or Caucasian with 71 percent of respondents identifying as such. 17 percent of respondents identified as Black or African-American. Approximately half of the 49 respondents identified either in the 25-34 or 35-44 age brackets.

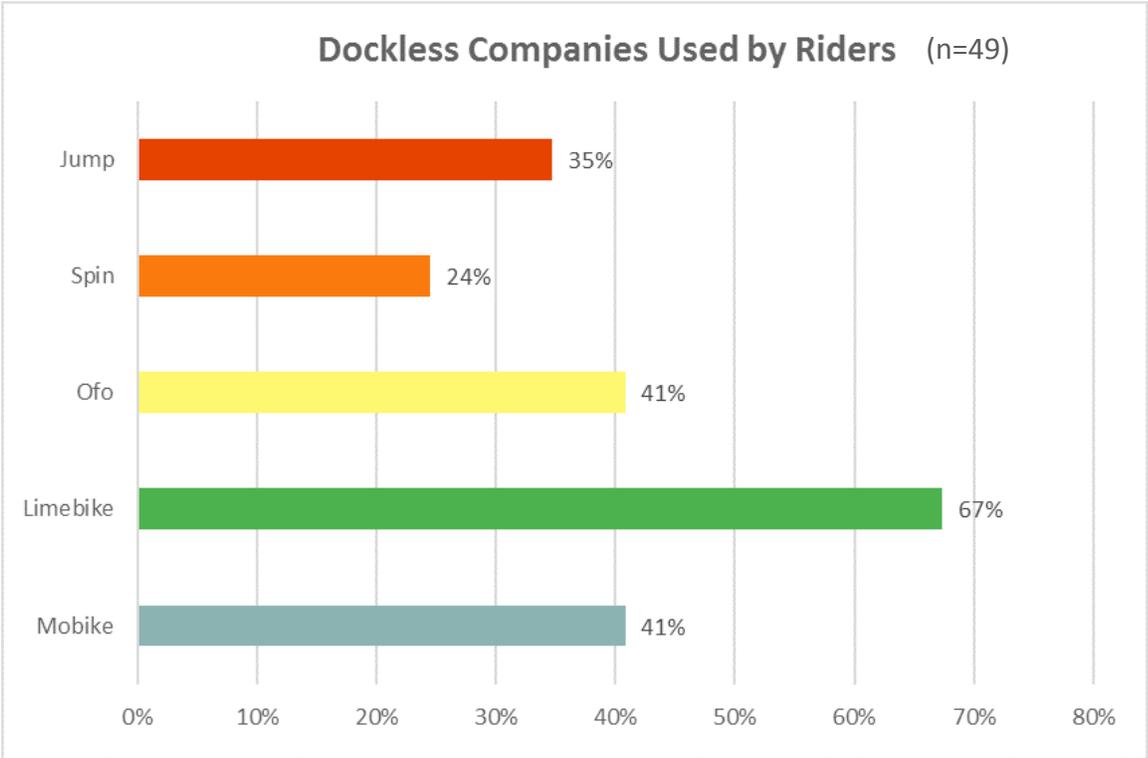
Dockless bike riders that were surveyed tended to have a higher educational achievement than the population average: 29 percent of respondents identified having a four-year college degree and 33 percent identified having an advanced degree. Over 70 percent of the respondents identified making \$50,000 or more a year in income, while almost one quarter of respondents identified making less than \$35,000 a year.

Several questions identified what motivations and reasons were involved in deciding to utilize dockless bikeshare. The top three motivations for riding dockless bikeshare were (1) to get around more easily, (2) the enjoyment of biking, and (3) for exercise and fitness. The top reason identified by 55 percent of respondents as to why they utilized the services was that dockless bikeshare was the quickest way to get to their intended destination. 12 percent of respondents indicated that the top reason they used dockless bikeshare was because CaBi was not available at the start or end of their trip. Furthermore, CaBi members tended to ride CaBi more frequently compared to dockless riders using dockless bikeshare; as only 12 percent of respondents took more than 20 trips on a dockless bike in the last 30 days, compared to 28 percent of CaBi respondents. This is likely due to heavy daily usage among CaBi members at peak commute times, compared to a more spotty and balanced usage of dockless bikeshare.

Intercept Survey

Q1 Which Dockless Systems Are Used?

Respondents were asked which dockless bikeshare companies they had used and were permitted to check multiple companies. The majority of survey respondents (67 percent) had used LimeBike, and 41 percent had used Ofo and/or Mobike. 35 percent of respondents reported using JUMP, while only 24 percent reported using Spin. Approximately half of respondents reported using only one dockless bikeshare company. The other half of respondents used more than one dockless bikeshare company: 14 percent reported using two companies, 20 percent used three, 4 percent used four, and 10 percent used all five dockless bikeshare companies operating in the District.

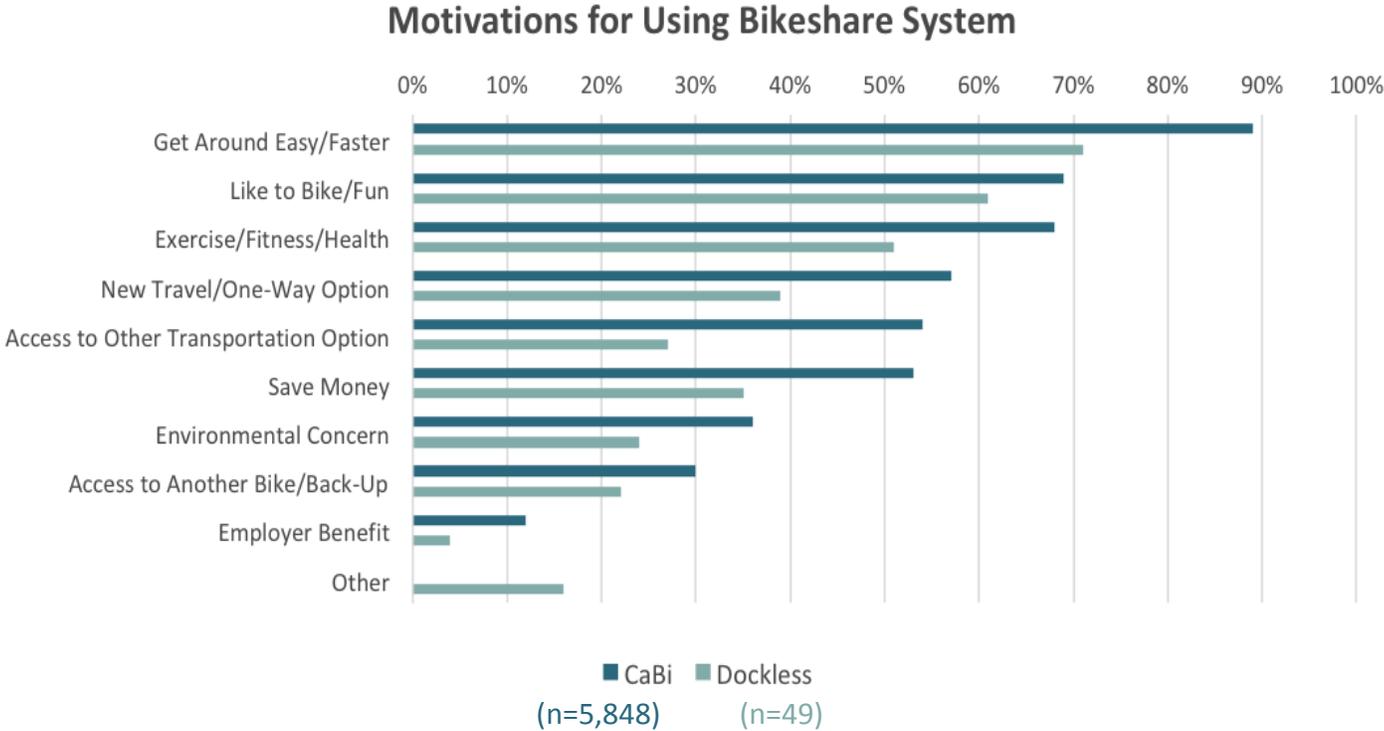


Survey Figure 1: Companies Used By Riders (49 Respondents)

Intercept Survey

Q2 Bike Rider Motivations To Choose Bikeshare System

In order to identify what motivated members to use dockless bikeshare, respondents were shown a list of ten possible motivations and were asked to check all that applied. The primary reason reported was access and speed; over 70 percent of respondents said their ability to get around more easily or quickly was a motivation. This is similar to the 2016 Capital Bikeshare Member Survey Report where the vast majority of CaBi riders (89%) also reported that getting around easier and quicker as the top motivation. The top four motivations for dockless bikeshare and CaBi survey respondents were the same: to get around easier and faster (71% vs. 89%), like to bike (61% vs. 69%), to get some exercise (51% vs. 68%), and a new one-way travel option (39% vs. 57%). The least common motivations for dockless bikeshare and CaBi survey respondents were having access to another bike, concern about the environment, and employer benefits.



Survey Figure 2: Motivations Compared For Bikeshare Systems (49 Respondents for Dockless Bike Riders. 5,848 Respondents for CaBi Bike Riders)

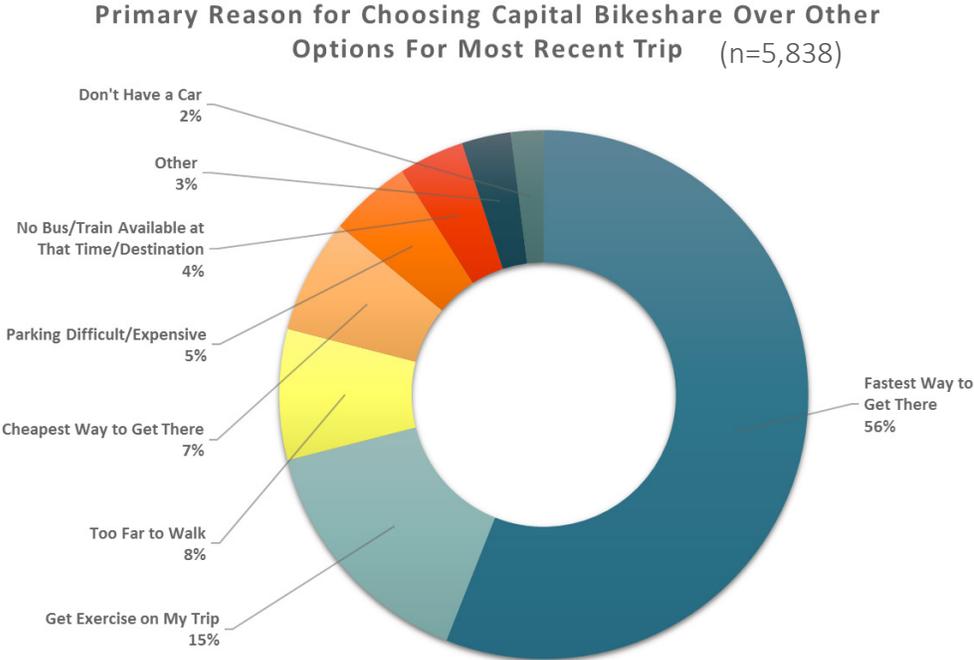
Intercept Survey

Q3 Primary Reason For Using Dockless Bikeshare For The Most Recent Trip

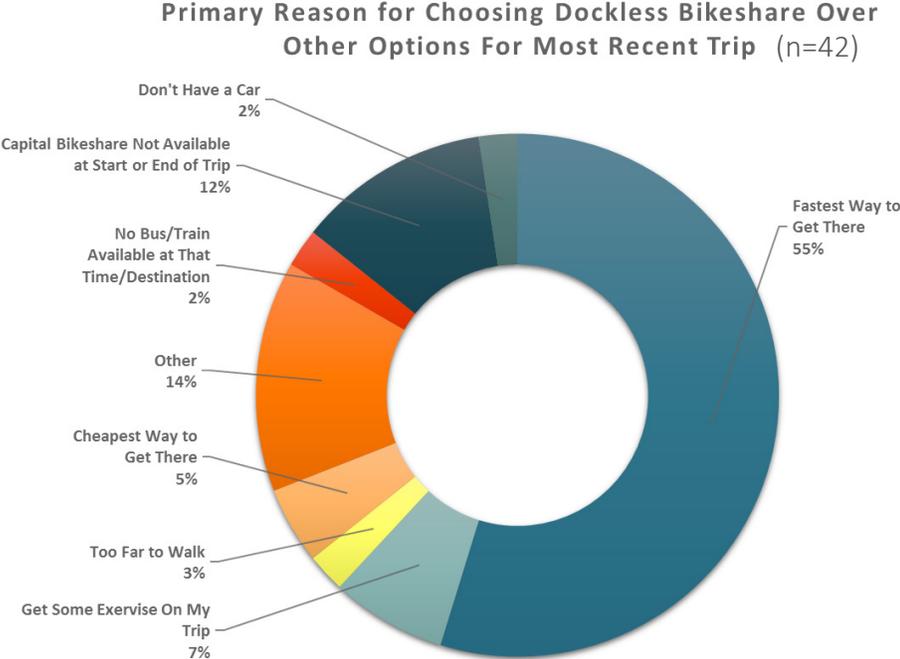
Respondents were also asked about the primary reason for choosing dockless bikeshare over other travel options for their most recent trip. Respondents were asked to select only one response of nine possible reasons. The majority of dockless and CaBi riders reported the primary reason for choosing that mode was because it was the fastest way to get to their destination. 12 percent of dockless bikeshare respondents indicated the primary reason for their mode choice was the unavailability of CaBi at their origin and/or destination. About 7 percent of dockless riders reported the desire to get exercise on their trip, compared to approximately 15 percent of CaBi survey respondents. About 5 percent of both dockless and CaBi survey respondents reported the cost of the trip (cheapest way to get there) as the primary factor driving their mode choice. Both groups also reported the lack of a car and no bus/train availability as the least common reasons for their mode choice.

Intercept Survey

Q3 Primary Reason For Using Dockless Bikeshare For The Most Recent Trip



CaBi Survey Figure 3: Primary Reason For Using CaBi Bikeshare For The Most Recent Trip (5,838 Respondents)



Dockless Survey Figure 3: Primary Reason for Using Dockless Bikeshare For the Most Recent Trip (42 Respondents)

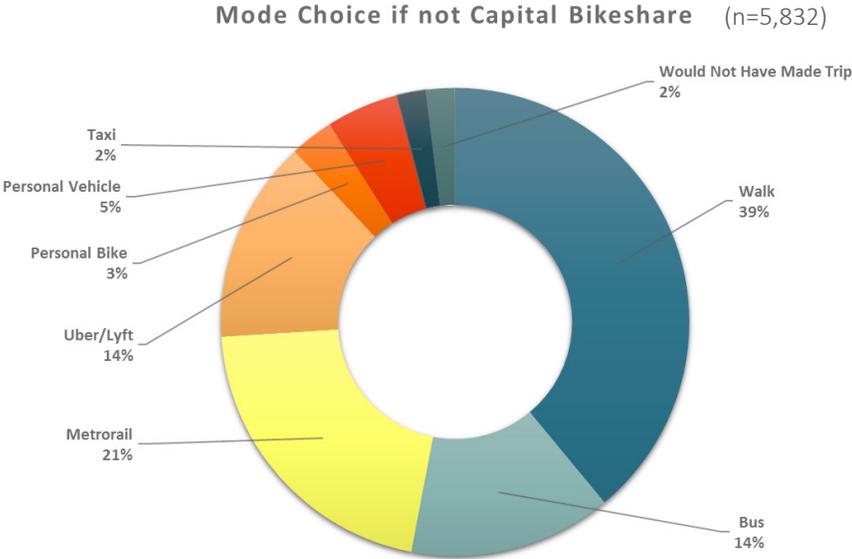
Intercept Survey

Q4 Alternative choice if dockless bikeshare had not been available

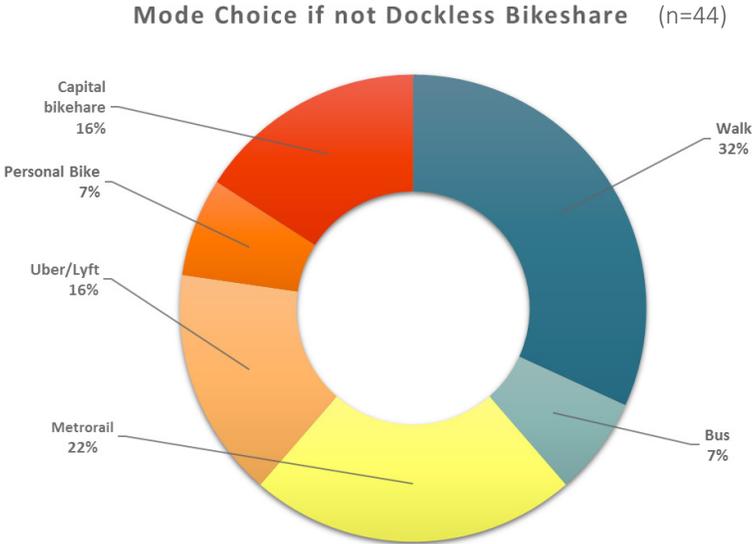
Survey respondents were asked how they would have made their most recent trip if bikeshare had not been available. Dockless bikeshare and CaBi survey respondents showed strong similarities. For both groups of bikeshare riders, the majority of trips would have been completed by walking to their destination. The second largest alternative mode choice for each group was Metrorail: 22 percent of dockless rider respondents and 21 percent of CaBi respondents said they would have chosen Metrorail if they had not chosen bikeshare. Similarly, about 15 percent of both groups said they would have taken Uber or Lyft to complete their trip. Furthermore, there was some evidence of dockless bikeshare providing an alternative to CaBi as 16 percent of dockless rider respondents reported they would have taken CaBi if dockless was not available.

Intercept Survey

Q4 Alternative Choice If Dockless Bikeshare Had Not Been Available



CaBi Survey Figure 4: Alternative Choice If CaBi Bikeshare Had Not Been Available (5,832 Respondents)



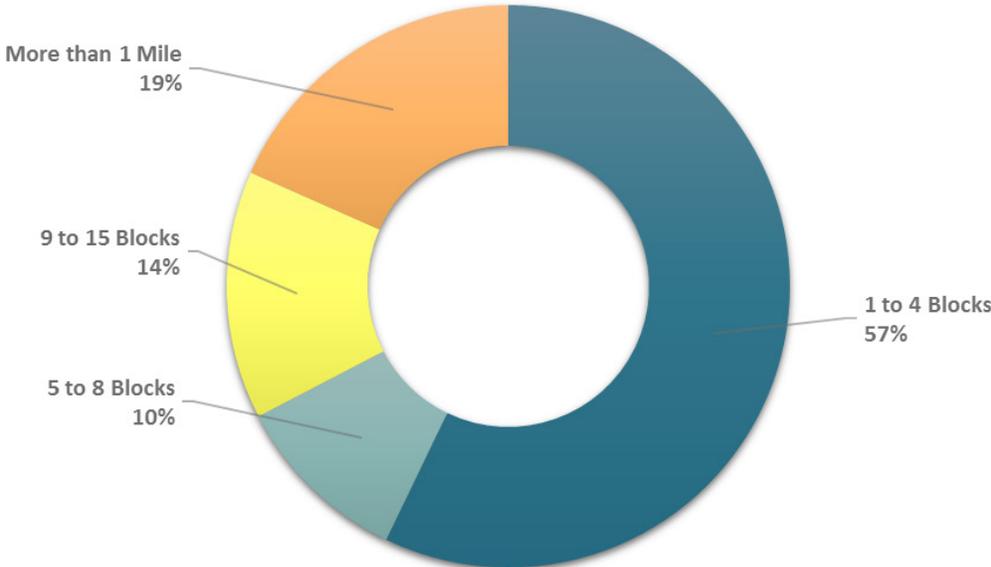
Dockless Survey Figure 4: Alternative Choice If Dockless Bikeshare Had Not Been Available (44 Respondents)

Intercept Survey

Q5 How Far Did You Travel To Get To The Dockless Bike?

Over half of survey respondents were able to unlock a dockless bike within 1-4 blocks of their starting location. The remaining respondents traveled over five blocks to locate a dockless bike. The length of the distance traveled to unlock a dockless bike could have an effect on an individual's transportation mode choice. No comparable data was available for Capital Bikeshare members.

Distance Traveled to Unlock Dockless Bike (n=49)



Dockless Survey Figure 5: Distance Traveled To Unlock Dockless Bike (49 Respondents)

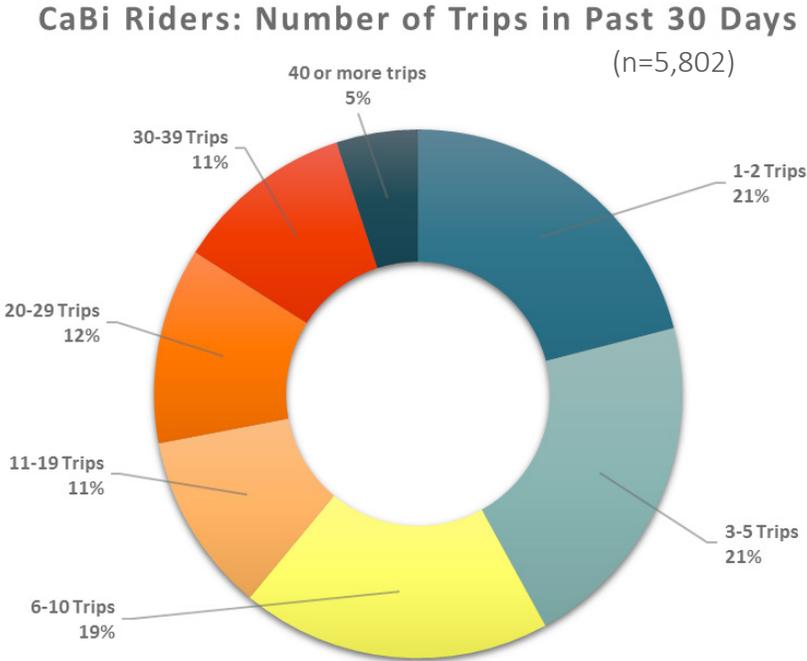
Intercept Survey

Q6 Dockless Bike Use Frequency In Last Month

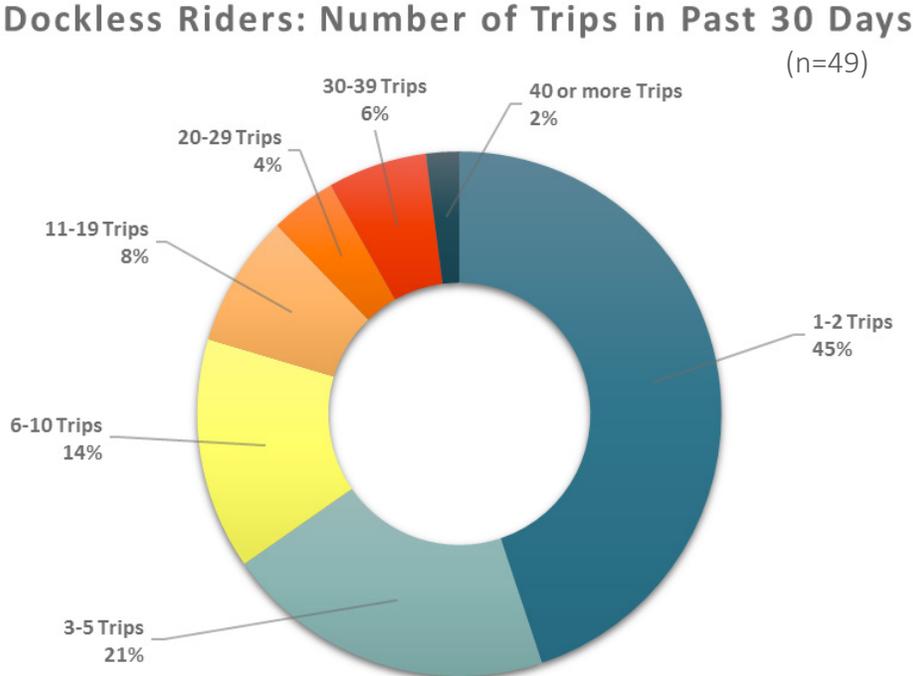
Survey respondents were asked how many trips involved using dockless bikeshare in the last 30 days. There was a significant difference in the frequency of dockless bikeshare trips compared to CaBi. Almost half of the dockless bikeshare survey respondents (45 percent) had only made 1-2 trips in the past 30 days. The 2016 Capital Bikeshare Member Survey Report indicates the majority (58 percent) of CaBi riders take more than six trips in 30 days. In addition, only 12 percent of respondents took more than 20 trips on a dockless bike in the last 30 days, compared to 28 percent of CaBi respondents. This is likely a result of heavy commuter usage by CaBi members (CaBi survey only surveyed members) compared to dockless bikeshare.

Intercept Survey

Q6 Dockless Bike Use Frequency In Last Month



CaBi Survey Figure 6: CaBi Bike Use Frequency In The Last Month (5,802 Respondents)

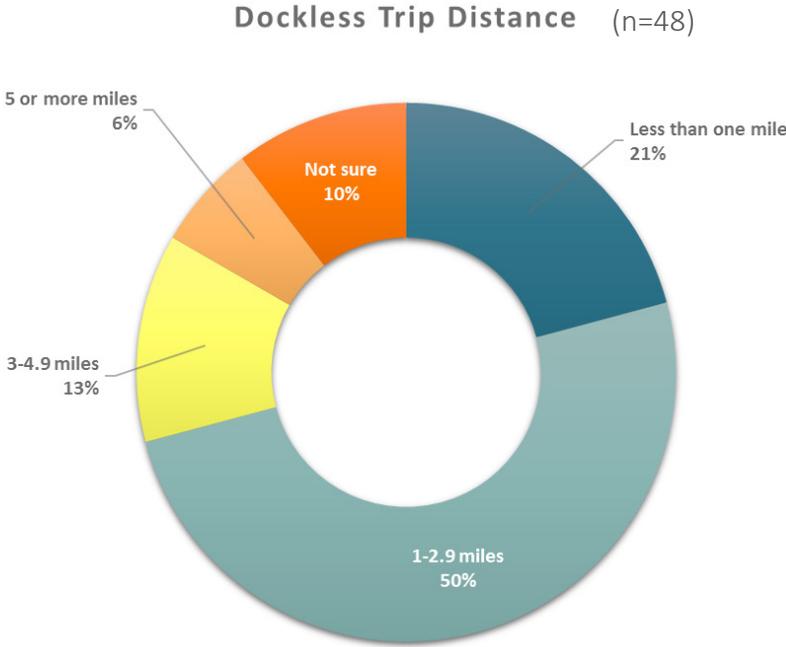


Dockless Survey Figure 6: Dockless Bike Use Frequency In The Last Month (49 Respondents)

Intercept Survey

Q7 How Long Is Your Typical Dockless Bikeshare Trip?

For a typical dockless bikeshare trip, respondents were asked to estimate their trip distance. There is a strong indication that dockless bikes provide an alternative mode choice for trips shorter than three miles and may fill some first/last mile transportation gaps. About 21 percent of dockless bikeshare survey respondents reported their typical bikeshare trip to be less than one mile, with half reporting that their typical trip was between one and three miles. No comparable data was available for Capital Bikeshare members.

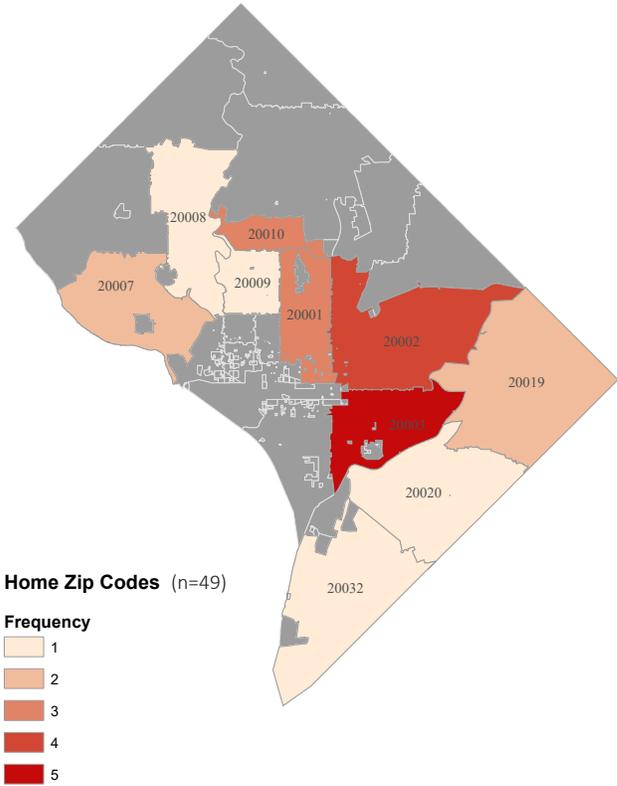


Dockless Survey Figure 7:
How Long Is Your Typical Dockless Bikeshare Trip? (48 Respondents)

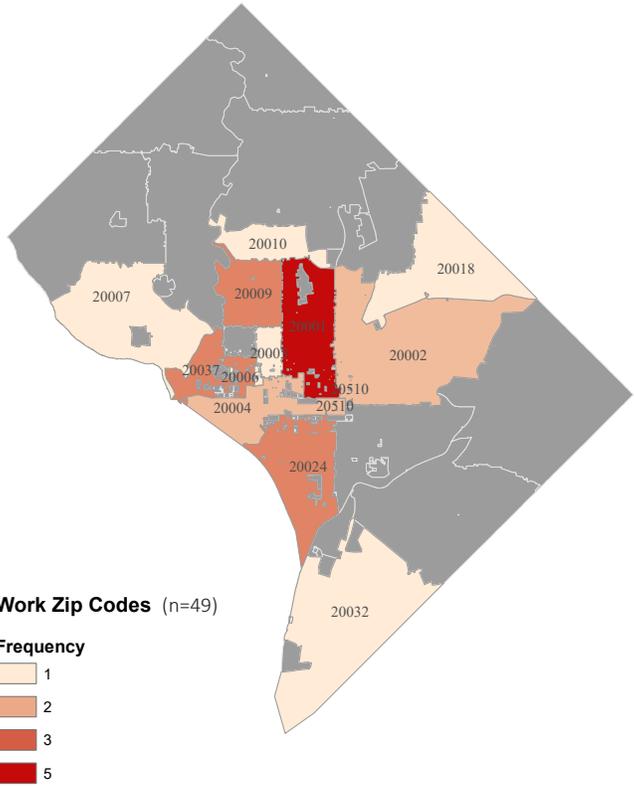
Intercept Survey

Q8+Q9 Origin And Destinations - Zip Code Analysis

Survey respondents were asked to enter the zip code for their work and home addresses. The most common work zip code was 20001, which covers the Bloomingdale, Truxton Circle, Shaw, and Mount Vernon Triangle neighborhoods. The most common home zip code was 20003, which covers the Capitol Hill, Hill East, and Navy Yard neighborhoods. This was likely due to the fact that the 20003 zip code was very close to the Union Station survey location. About 20 percent of the work zip code addresses were outside of the Washington, D.C. metro area. Half of the home zip codes were from outside the District. Of these addresses, about half were still from the Washington, D.C. metro area, while the other half were out of town visitors. Note there was no comparable zip code based CaBi data in the 2016 Capital Bikeshare Member Survey Report.



Dockless Survey Figure 8: Origin Zip Code Analysis (49 Respondents)

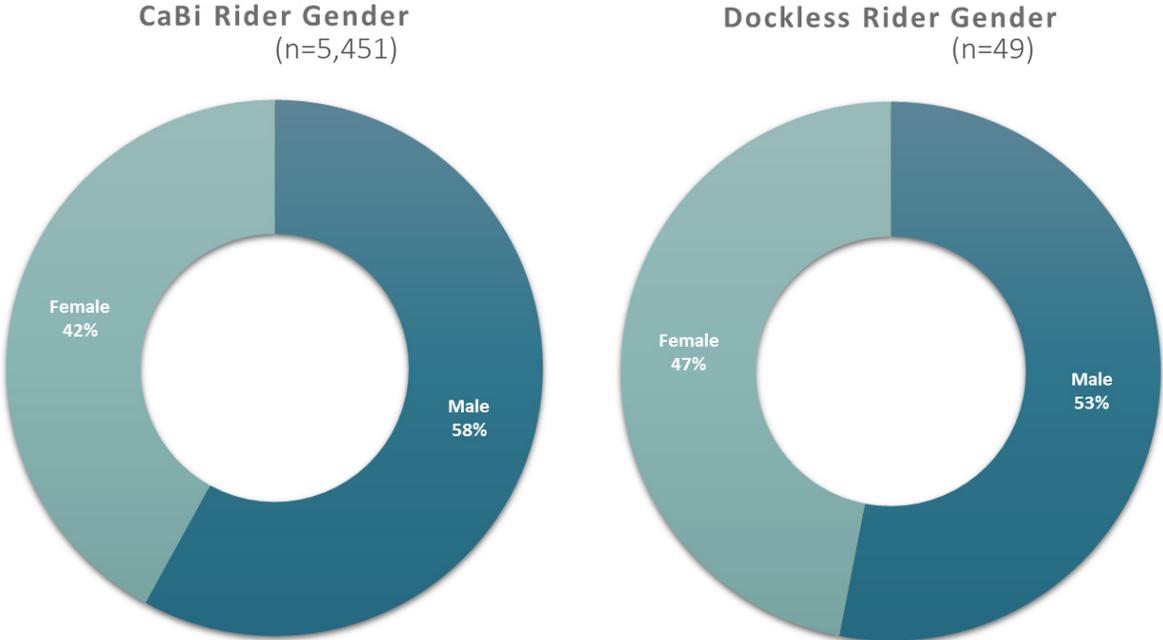


Dockless Survey Figure 9: Destination Zip Code Analysis (49 Respondents)

Intercept Survey

Q10 Dockless Bike Riders By Gender

The gender splits between riders of dockless bikeshare and CaBi were generally the same. The majority of riders were male, but dockless bike riders seemed to have a slightly higher proportion of women riders.



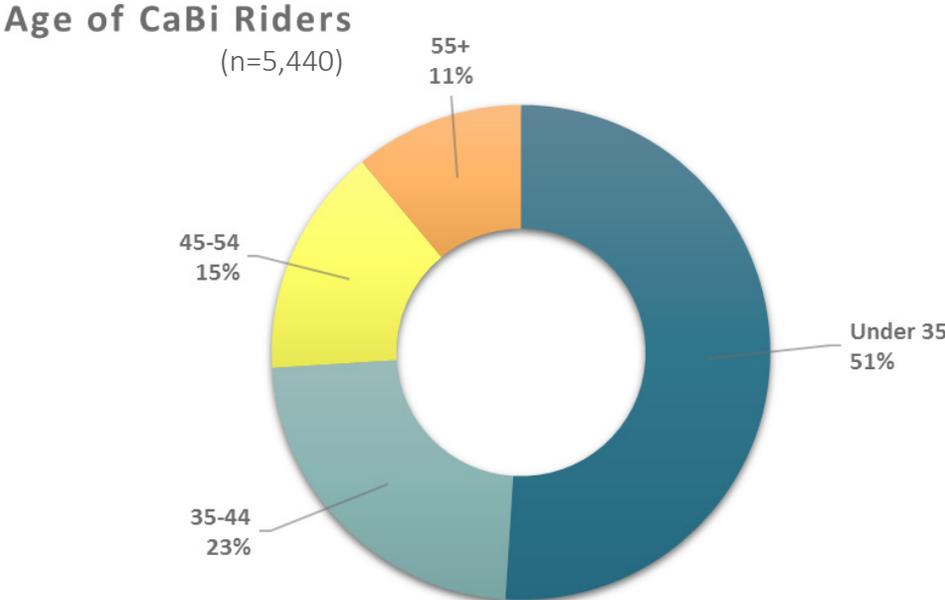
CaBi Survey Figure 10: CaBi Riders By Gender (5,451 Respondents)

Dockless Survey Figure 10: Dockless Riders By Gender (49 Respondents)

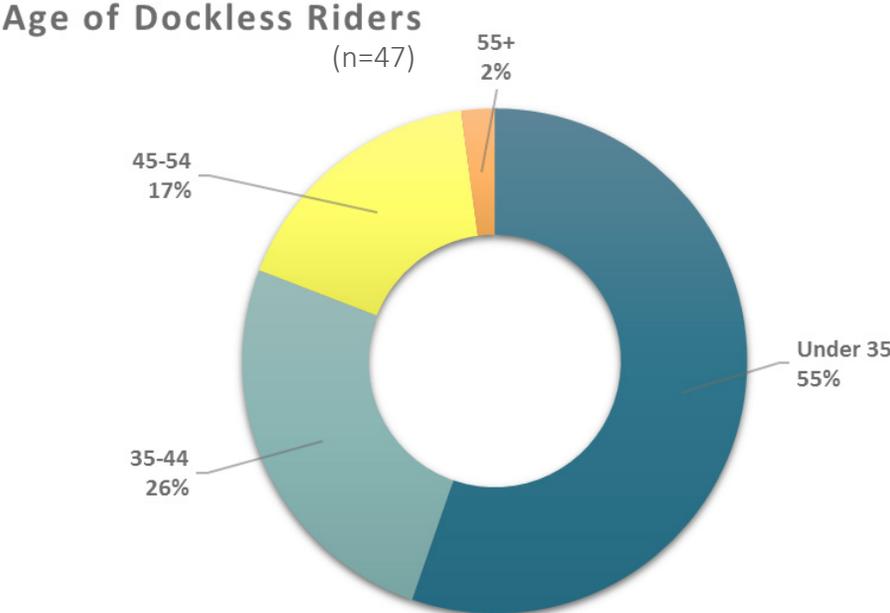
Intercept Survey

Q11 Dockless Bike Riders By Age

The age of respondents showed that the under 35 age group made up over half of the dockless bike riders. This is generally consistent with CaBi for the same age group. However, the proportion of riders over the age of 55 was much larger for CaBi at 11 percent than dockless bikeshare at only 2 percent of respondents.



CaBi Survey Figure 11: CaBi Riders By Age

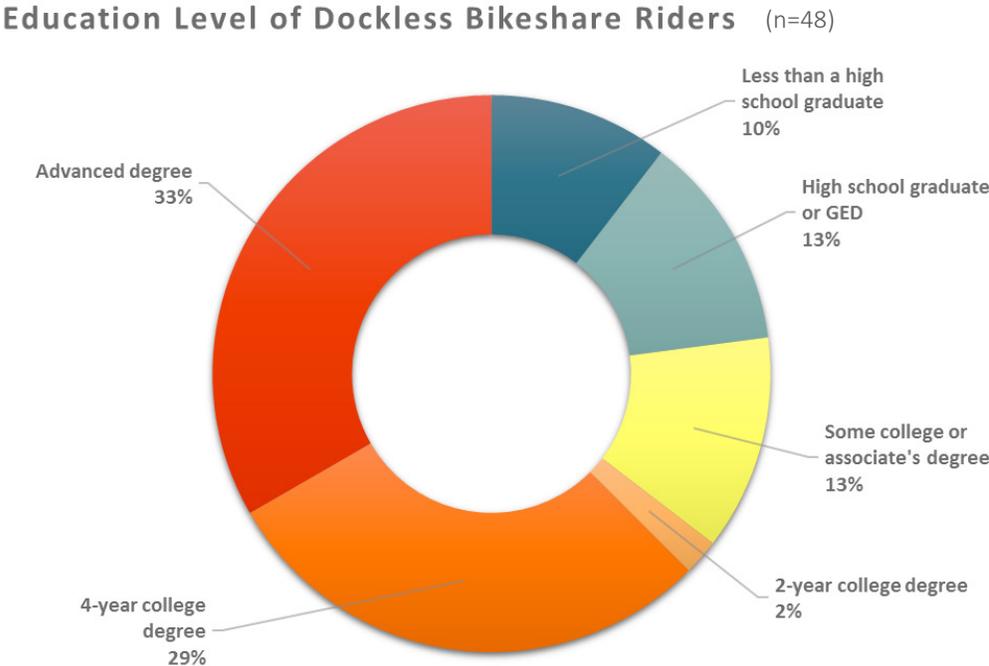


Dockless Survey Figure 11: Dockless Riders By Age

Intercept Survey

Q12 Educational Level Of Dockless Bike Riders

Respondents were asked to indicate their educational attainment. The survey respondents were highly educated with 62 percent attaining a 4-year college degree and 33 percent attaining an advanced degree. These results were slightly higher than U.S. Census data that shows approximately 55 percent of residents within the District holding at least a 4-year college degree. The U.S. Census also indicates that approximately one-third of District residents hold an advanced degree which is similar to the dockless rider survey respondents. No education level data was available for Capital Bikeshare members.

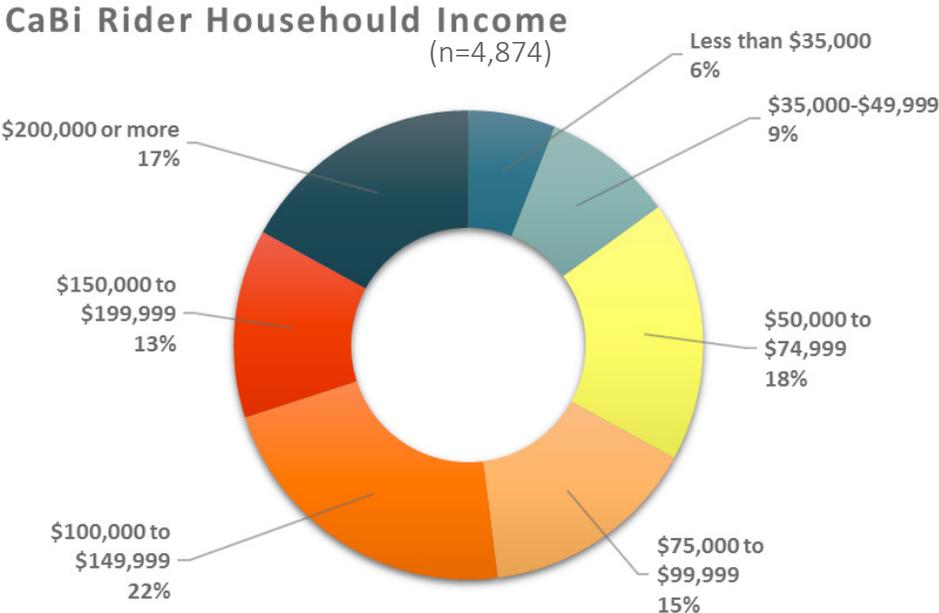


Dockless Survey Figure 12: Education Level Of Dockless Bike Riders

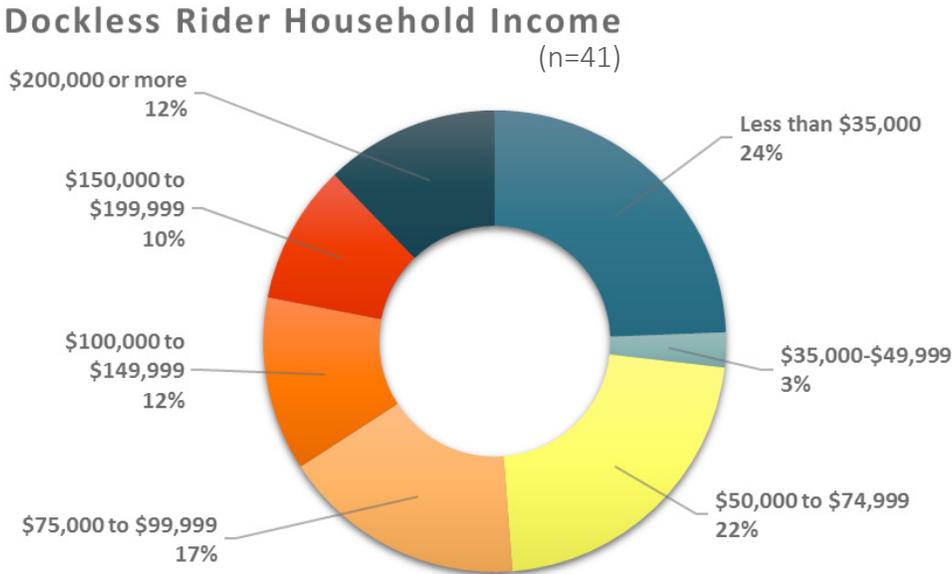
Intercept Survey

Q13 Dockless Bike Riders Income Levels

Respondents were also asked about their income levels. The survey results indicated a larger proportion of dockless bike riders earned less than \$35,000 as compared to CaBi riders. The 2016 Capital Bikeshare Member Survey Report indicated that the largest user group had income within the \$100,000- \$149,000 range. For dockless bike riders, the \$100,000- \$149,000 income range was the fourth largest group at 12 percent of those surveyed.



CaBi Survey Figure 13: CaBi Rider Household Income (4,874 Respondents)

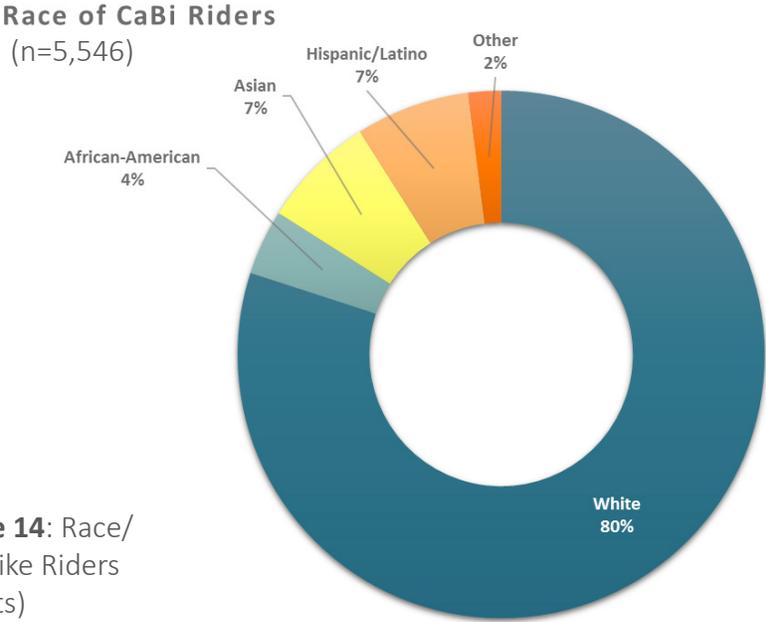


Dockless Survey Figure 13: Dockless Rider Household Income (41 Respondents)

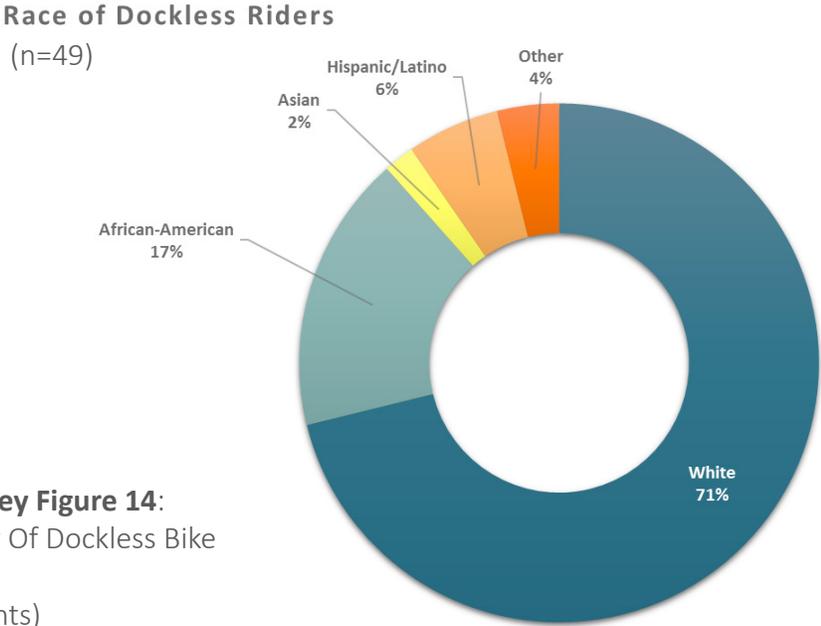
Intercept Survey

Q14 Race/Ethnicity

Similar to the results of the 2016 Capital Bikeshare Member Survey Report, the majority of dockless bike riders are White or Caucasian. However, the survey results showed that the second largest ethnic group of dockless bike riders are African-Americans. In the 2016 Capital Bikeshare Member Survey Report, African-American riders ranked as the fourth largest user group.



CaBi Survey Figure 14: Race/Ethnicity Of CaBi Bike Riders (5,546 Respondents)



Dockless Survey Figure 14: Race/Ethnicity Of Dockless Bike Riders (49 Respondents)

Screenline Counts

Screenline count data was collected over a four week period during peak usage times. A total of 720 bikes were observed using the facilities during peak time frames at the two locations (Pennsylvania Avenue and 11th Street Bridge) during the observation periods. The total screenline count data collected indicated that 79 percent of riders were on private bikes, 18 percent used CaBi, and only 3 percent of the riders counted used a dockless bike.

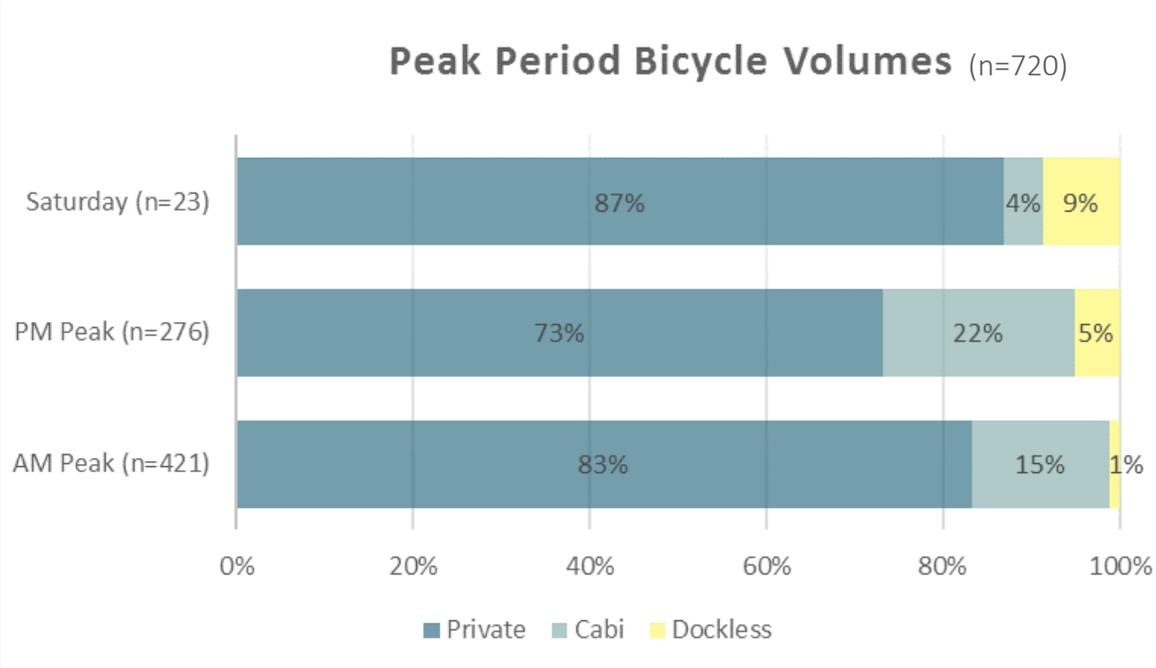
The screenline count results identified patterns of bike usage amongst bike type, race and gender. Approximately five percent of bikes counted during each afternoon count session were dockless. The majority of bike riders counted at the two locations used private bikes over any type of bikeshare system. Screenline counts observed a 60/40 split between men and women cyclists riding CaBi and dockless bikes, respectively.

The screenline count results were limited due to the seasonal constraint of collecting data during low temperatures and various periods of inclement weather conditions. Dates, times, and locations of screenline counts are provided in Appendix B.

Screenline Counts

1 Dockless System Used

The screenline count data showed that a majority of riders used private bikes. Riders that used either bikeshare system made up a small minority of observations. For example, out of the 720 bikes observed during peak periods, 570 were private (79 percent of total bikes), 124 were on CaBi (18 percent), and 26 were on dockless (3 percent). There was a lower share of dockless bikes observed during the AM peak periods (1 percent) compared to the PM peak (5 percent), representing an average of 1.67 bikes during the AM peak versus 4.67 bikes during PM peak. Although we performed two weekend counts, the results were low and not analyzed further.

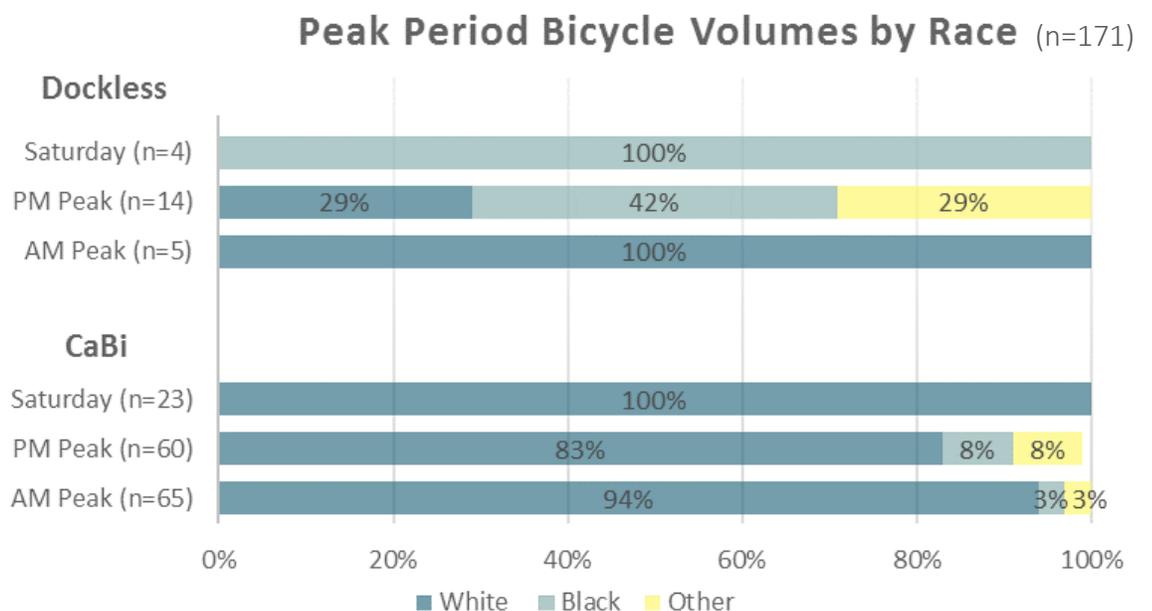


Screenline Figure 1: Peak Period Bicycle Volumes

Screenline Counts

2 Race/Ethnicity

Screenline counts showed that most CaBi riders during peak periods were White (89 percent), with Black riders and other races splitting the remaining share of the ridership (6 percent, respectively). The AM peak share of White riders was 93 percent which was higher than the PM peak share of 84 percent. The balance of the AM peak share was evenly split between Black riders (3 percent) and riders of other races (3 percent). Likewise, the remaining PM peak share of CaBi riders by race was also evenly split between Black riders (8 percent) and riders of other races (8 percent). Keeping in mind the small number of dockless riders observed, the racial share was more evenly distributed for dockless bike riders. Although White dockless bike riders still comprised the majority of trips (42 percent), Black riders made up 32 percent of trips, while other races made up the remaining 21 percent. Surprisingly, our counters exclusively observed White riders during the AM peak counts. However, the PM peak counts showed a more equitable share, with Black riders making up 42 percent of trips compared to 29 percent of White riders, and 29 percent of other races. This distribution could indicate that dockless bikes are serving more diverse backgrounds than CaBi.

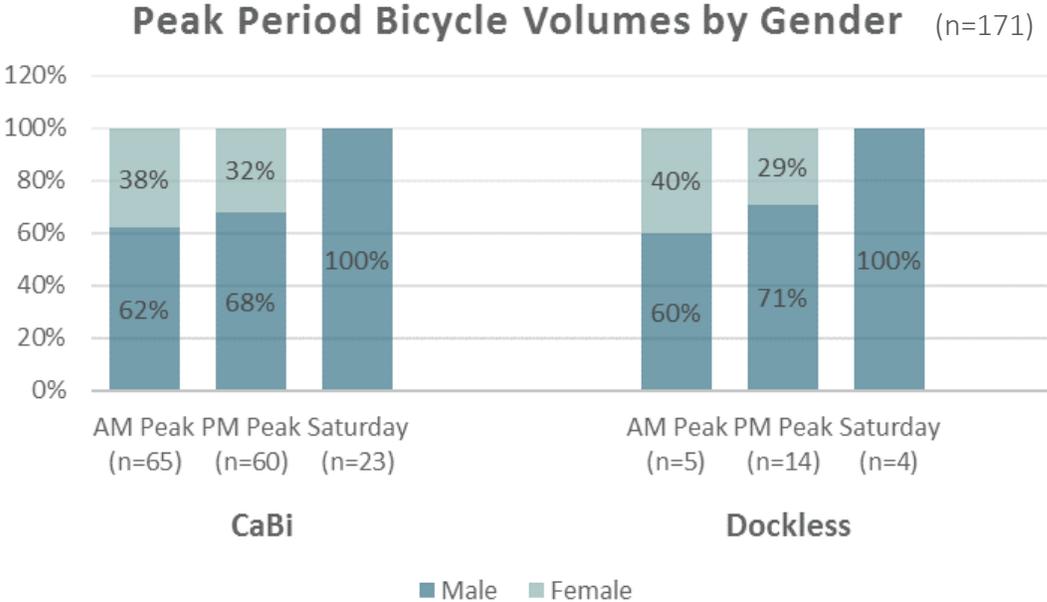


Screenline Figure 2: Peak Period Bicycle Volumes By Race

Screenline Counts

3 Gender

Screenline counts showed the gender balance between CaBi and dockless bike riders was almost the same for both bikeshare systems, where 3 out of 5 riders were male. Our observations from the AM peak period indicated that 62 percent of CaBi riders were male and 38 percent were female. This data was compared to 60 percent of dockless riders being male and 40 percent female. The PM peak gender balance skewed more towards males, with a 68 percent male and 32 percent female balance for CaBi riders versus a 71 percent male and 29 percent female balance among dockless bike riders. Overall, the gender balance for both peak periods was 64 percent male and 36 percent female among CaBi riders versus 60 percent male and 40 percent female among dockless riders. Considering that the aggregate number of dockless riders for both peak periods (26) was much lower than aggregate CaBi riders for both periods (124), there was only a 4 percentage point difference between the gender share of both bikeshare systems. This indicated that there were slightly more females among peak dockless trips compared to peak CaBi trips.



Screenline Figure 3: Peak Period Bicycle Volumes By Gender

Trip & Geolocation Data Analysis

Using the data DDOT provided, we created one master dataset combining data for all dockless systems. The data consisted of 171,997 trip records from September 2017 to January 2018. However, the datasets needed some filtering and conversions to make them consistent between all dockless bikeshare companies and CaBi. Time zone conversions were made so that all times were in Eastern Standard Time (EST) and data for trips shorter than one minute in duration were removed during the data cleaning process which is explained in more detail in Appendix C. In order to get a complete dataset comprising all the companies, October 2017 was used as the start date for all data records. This resulted in four complete months of data for analysis.

The analysis of weekday and weekend usage patterns of dockless bikeshare was compared to CaBi. The weekday afternoon usage patterns showed a significant difference in the afternoon peak. For the dockless system, the afternoon usage peak was greatly higher than the morning peak. Additionally, the peak hour for dockless bikeshare in the morning was about one hour later than CaBi. There were no significant differences in weekend usage patterns between dockless bikeshare and CaBi.

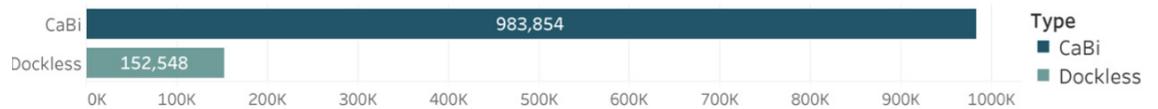
Utilization rates for each dockless bikeshare company was estimated for trips, distance, and duration. Given some data uncertainties for the data of the dockless system, CaBi had the highest number of trips per bike.

Dockless Activity Hot Spots were overlaid with CaBi station activity maps. The activity areas for CaBi and dockless bikeshare companies were similar - the majority of activity was in Wards 1, 2, and 6. There was little activity for both CaBi and dockless bikeshare east of the Anacostia river in Wards 7 and 8.

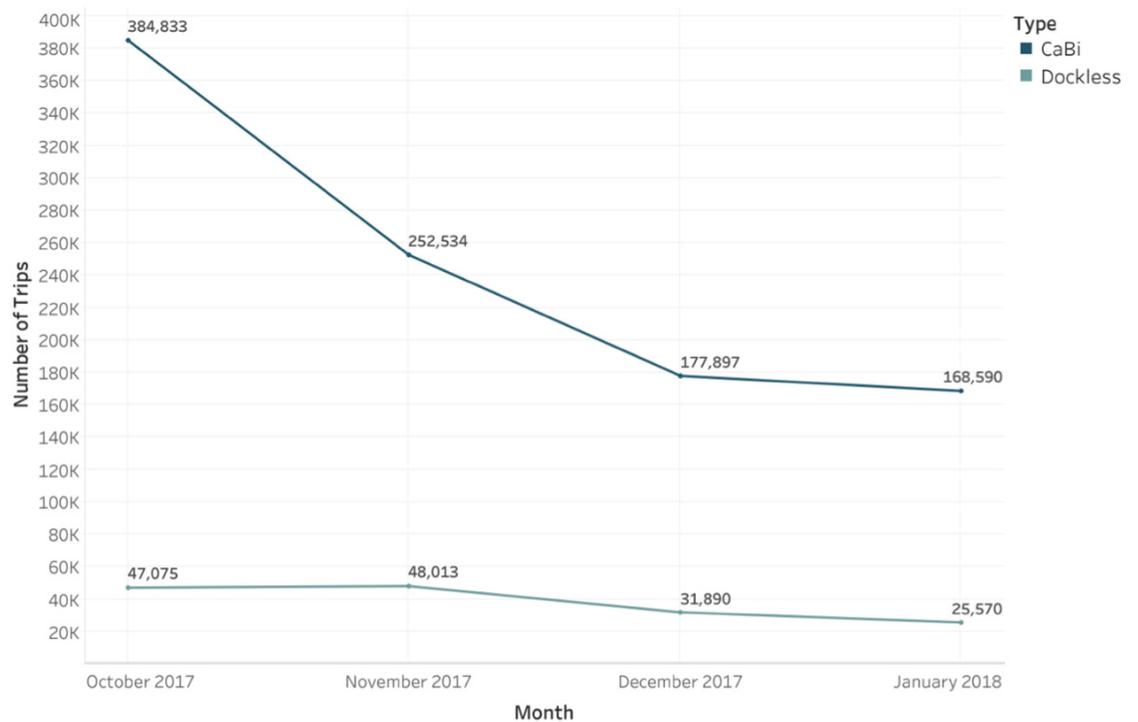
Trip & Geolocation Data Analysis

1 Bikeshare Ridership

According to an analysis of CaBi and dockless bikeshare historical data, the total number of CaBi trips was 6.45 times that of dockless bikeshare trips between October 2017 and January 2018. Both types of bikeshare systems experienced a decline in ridership as temperatures dropped, but the monthly number of CaBi trips decreased much faster than dockless trips. The biggest gap between the numbers of CaBi and dockless trips was in October 2017, and the smallest gap was in January 2018.



GIS Figure 1: Total Trips CaBi vs Dockless (October 2017- January 2018)

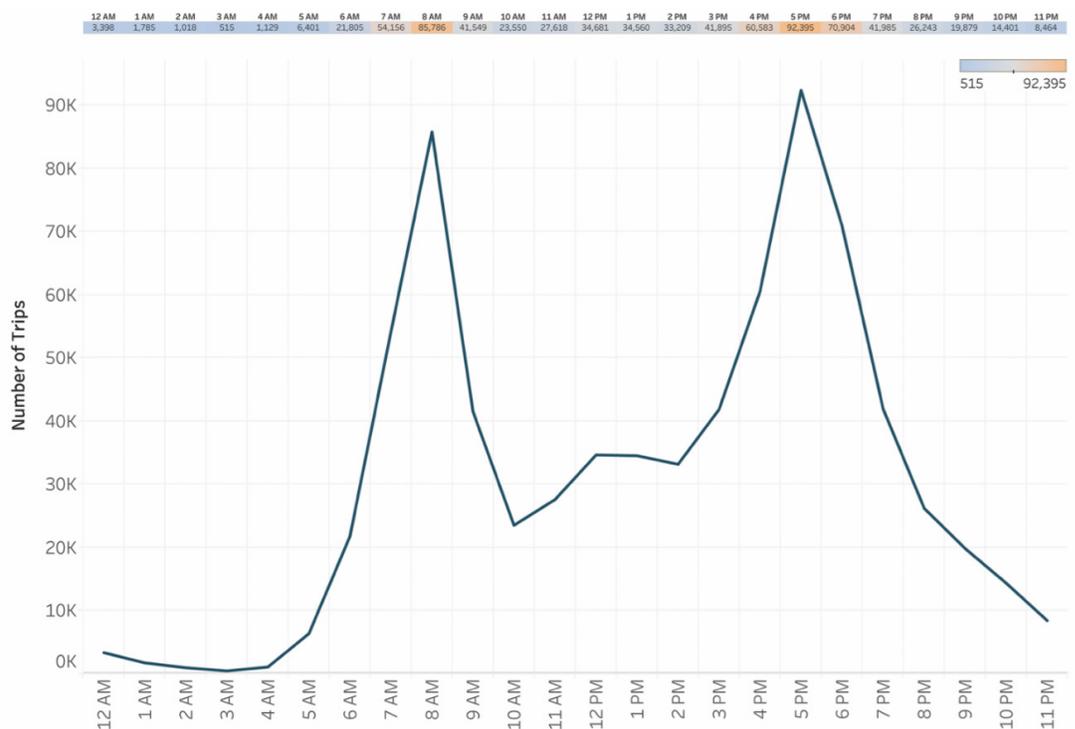


GIS Figure 2: Monthly Trips CaBi vs Dockless (October 2017- January 2018)

Trip & Geolocation Data Analysis

2 Trip Patterns On Weekdays

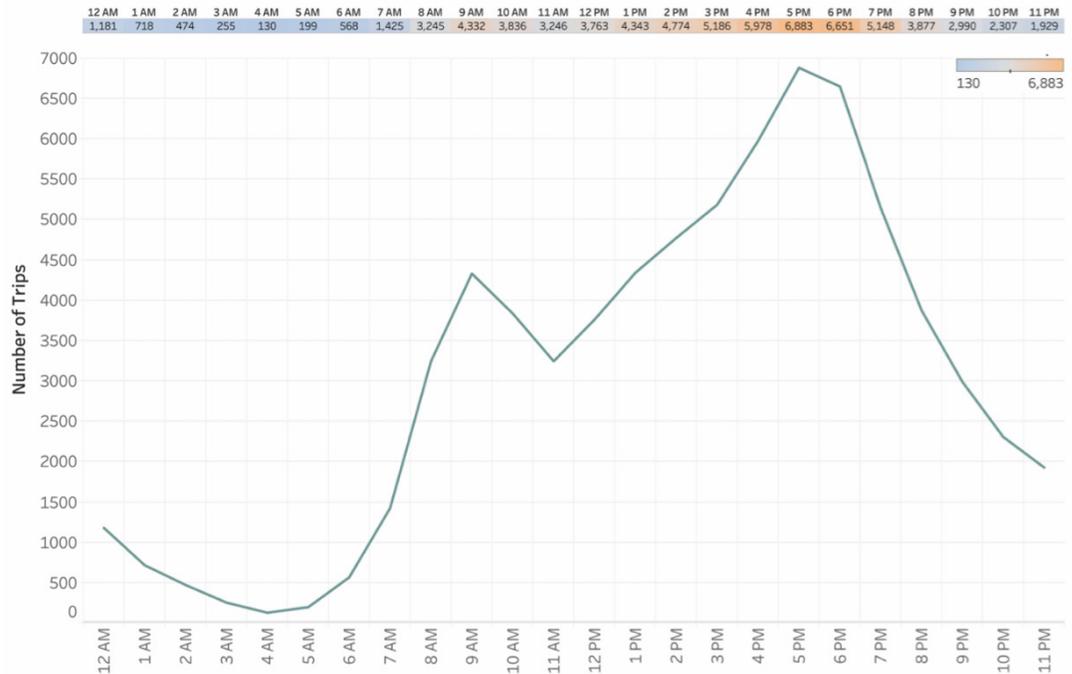
CaBi and dockless bikeshare have two peak hours on weekdays: one in the morning and one in the afternoon. The morning peak hours are different depending on the bikeshare system. The CaBi peak hour is in the morning between 8AM and 9AM, while peak dockless bikeshare trips occur one hour later between 9AM and 10AM. Although CaBi's morning and afternoon peaks are similar in magnitude, dockless bikeshare experiences more ridership in the afternoon than in the morning. On weekdays, CaBi ridership is much more concentrated in its peak hours than for dockless systems, which indicates that dockless trips are more dispersed over the hours before and after the peak periods.



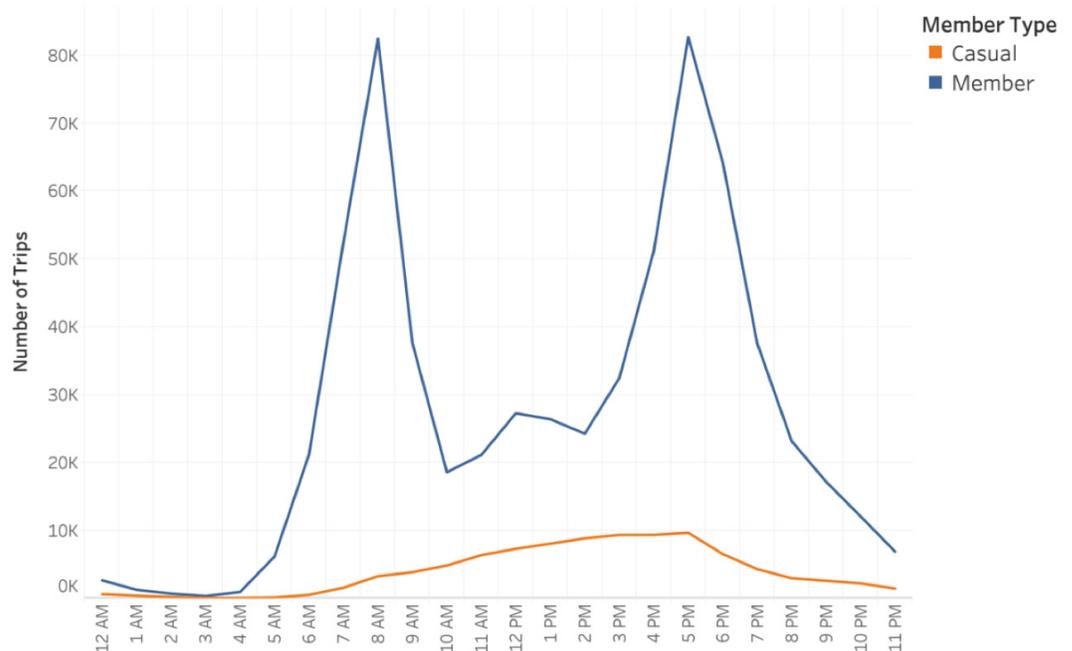
GIS Figure 4: CaBi Weekday Rider Peaks (October 2017- January 2018)

Trip & Geolocation Data Analysis

2 Trip Patterns On Weekdays



GIS Figure 5: Dockless Weekday Rider Peaks (October 2017- January 2018)

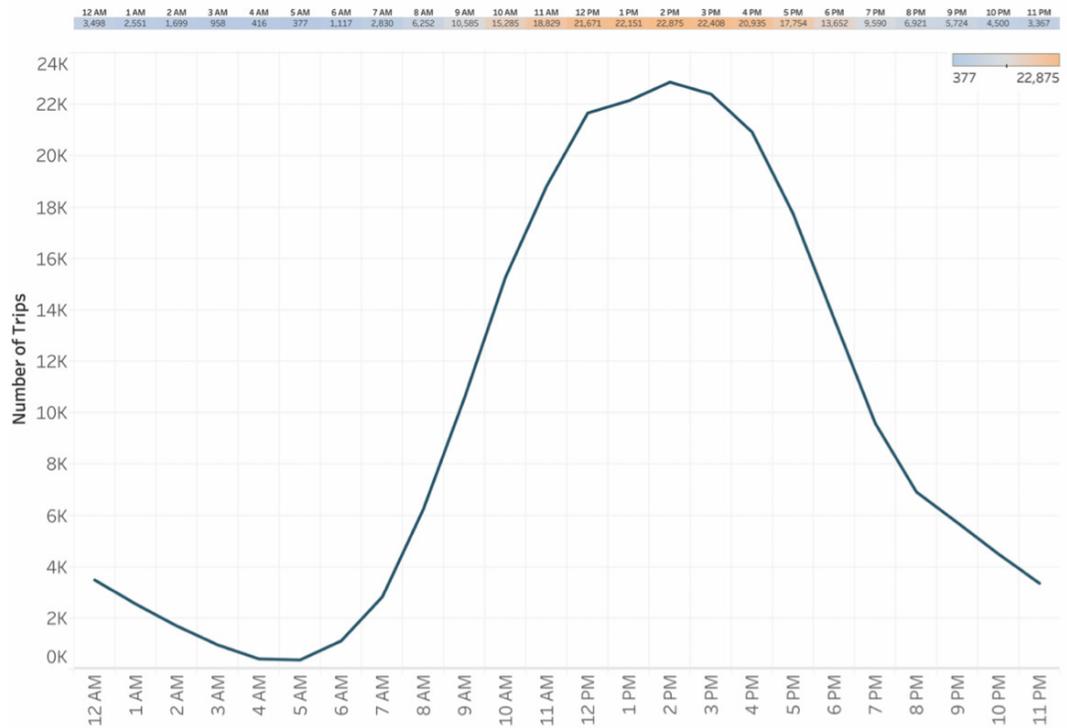


GIS Figure 6: CaBi Weekday Rider Peaks By Member Type (October 2017- January 2018)

Trip & Geolocation Data Analysis

3 Trip Patterns On Weekend

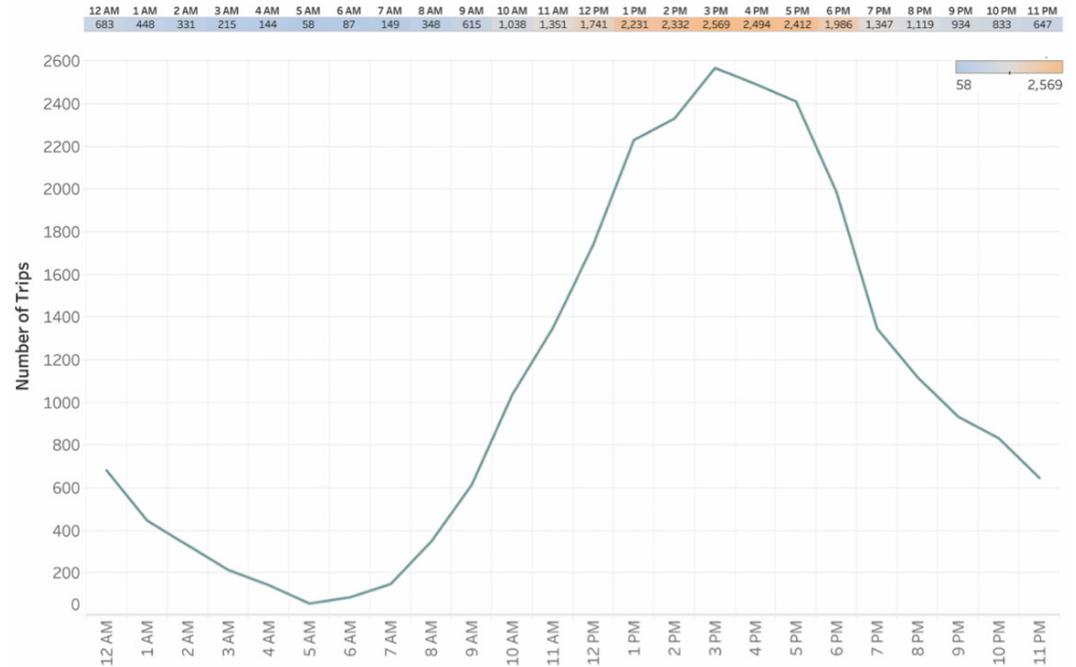
The CaBi and dockless bikeshare trip temporal patterns are similar on weekends. The bikeshare usage starts to increase at 5AM and peaks in the early afternoon. Eventually, usage patterns drop to the lowest point at 5AM.



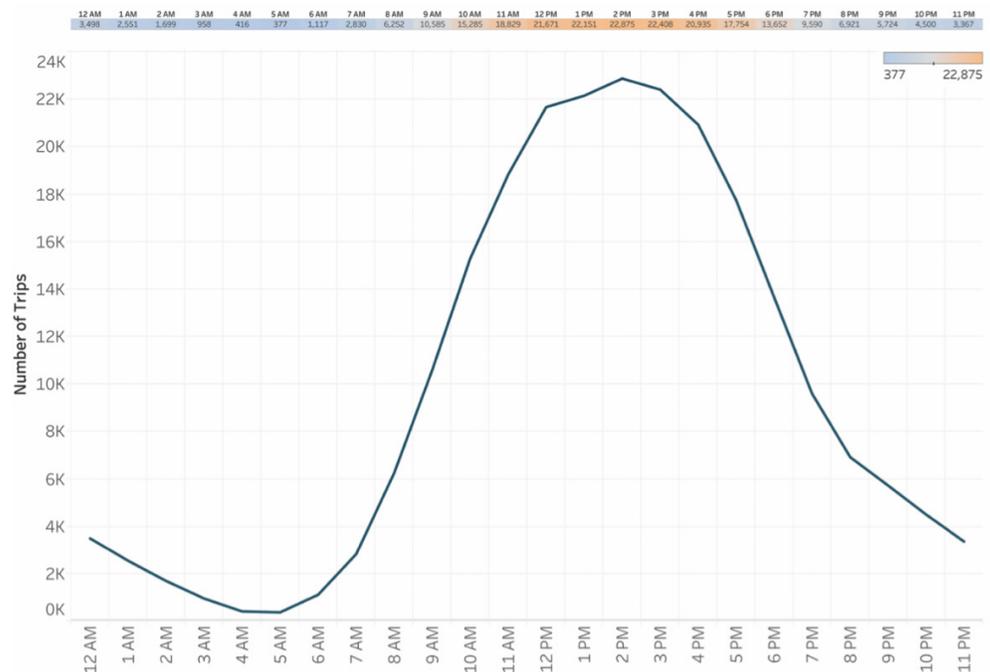
GIS Figure 8: CaBi Weekend Rider Peaks (October 2017- January 2018)

Trip & Geolocation Data Analysis

3 Trip Patterns On Weekend



GIS Figure 9: Dockless Weekend Rider Peaks (October 2017- January 2018)



GIS Figure 10: CaBi Weekend Rider Peaks By Member Type (October 2017- January 2018)

Trip & Geolocation Data Analysis

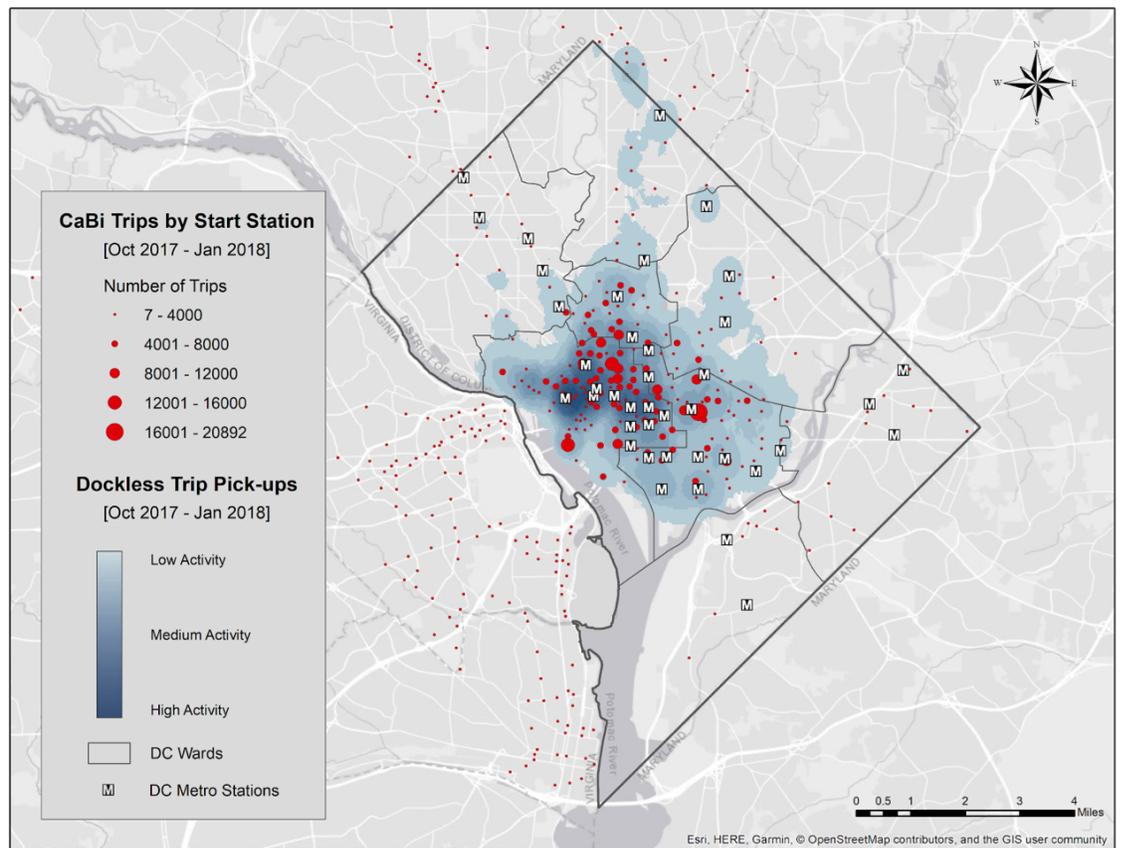
4 Bikeshare Utilization Rate

Please note: The bike fleet counts used for this analysis were based on counting the unique bike identifier numbers in the data. Using this method, we found that the total counts of unique identifiers exceeded the 400 bike limit imposed by DDOT. This may be due to maintenance of the bicycles.

Trip & Geolocation Data Analysis

4 Dockless Bikeshare And CaBi Heat Map and Metro Stations

Ridership activity at CaBi stations was compared to dockless bikeshare activity using area heat maps based on trip starts (see GIS Figure 8). CaBi and dockless bikeshare both showed heavy usage concentrated in Wards 1, 2, and 6. We did not observe significant hotspot activity for CaBi or dockless bikeshare trips east of the Anacostia River. The most dense areas for dockless bikeshare trips were in Dupont Circle, Downtown, and Capitol Hill. Other neighborhoods with low to medium density of dockless bikeshare included Silver Spring (close to the border of the District), Brookland, Woodridge, Brentwood, Trinidad, and the Carver/Langston neighborhoods. In Wards 3, 4, and 5, dockless trips were concentrated in the areas around Metro stations. The CaBi stations near these areas had comparatively low ridership. Some of the CaBi stations with the highest ridership were not areas most popular for dockless bikeshare, including Columbus Circle/Union Station, North Capitol St. and F St. NW, Lincoln Memorial, Jefferson Memorial, and Eastern Market / Pennsylvania Ave and 7th St SE.



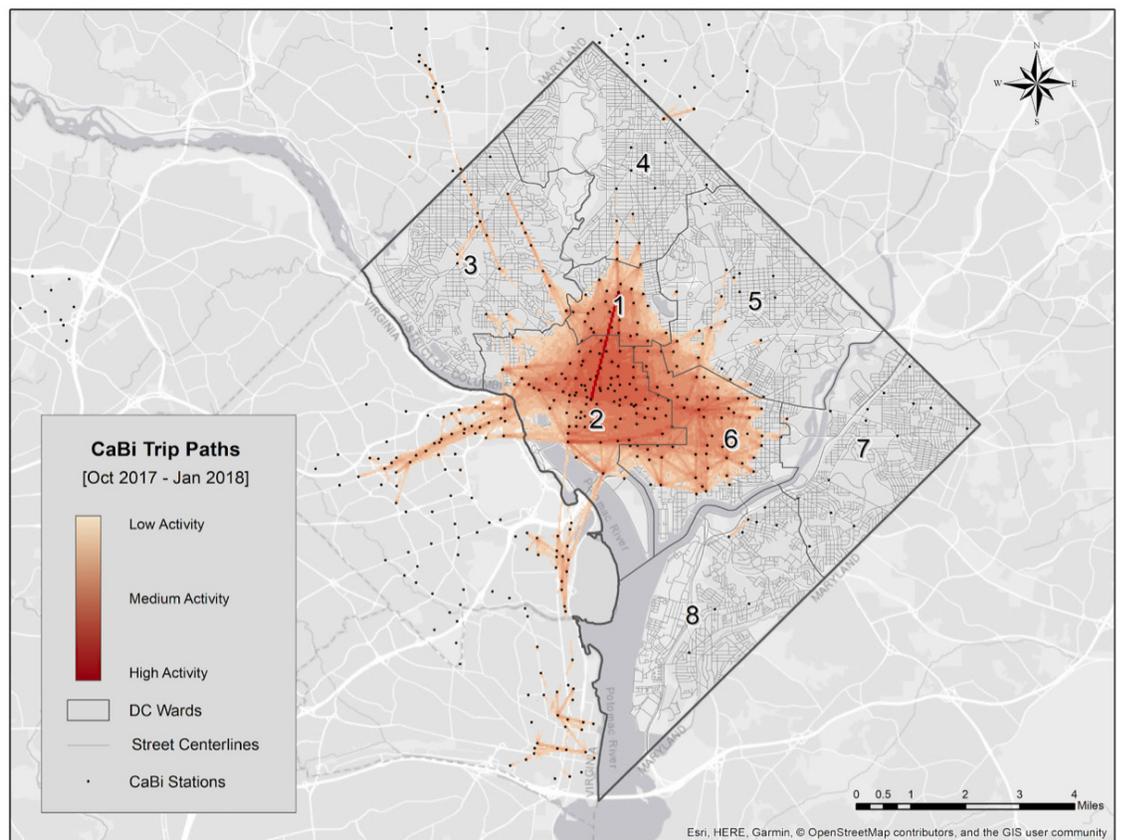
GIS Figure 11: CaBi and Dockless Pickup Heat Map (October 2017- January 2018)

Trip & Geolocation Data Analysis

5 Most Used Path

The two charts below depict an analysis of straight lines drawn between start and end points of CaBi and dockless bikeshare trips across the region using a method called line-density analysis.

The CaBi map below shows that the line between the 14th & Irving St. NW CaBi station and 18th St. & Pennsylvania Ave. NW CaBi station was the most traveled and shows up as the bright red line. This shows that the path between these two stations was the most used. For CaBi, the most traveled routes within the District were concentrated in Wards 1, 2, and 6. Other CaBi paths with higher activity were between the District, the Rosslyn-Ballston Corridor using the Key Bridge, and Crystal City using the 14th St. Bridge.

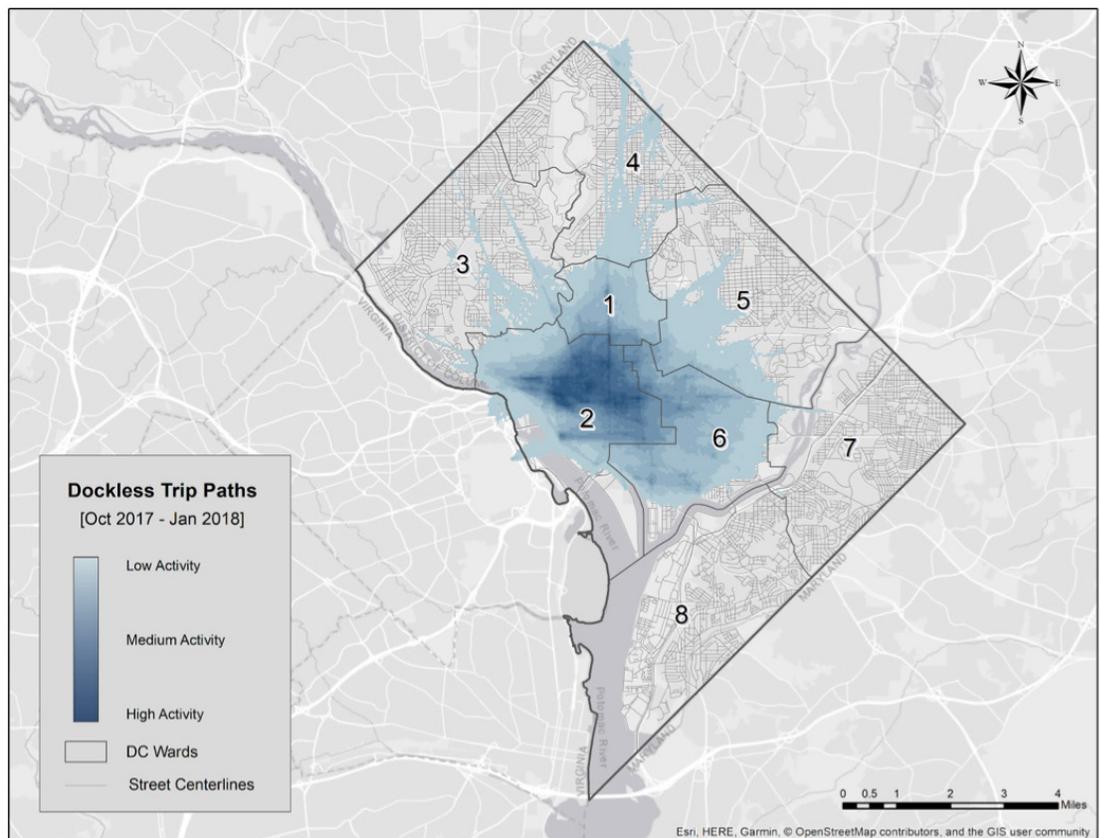


GIS Figure 12: CaBi Busiest Paths Map

Trip & Geolocation Data Analysis

5 Most Used Path

The dockless path analysis shows similar patterns of heavy usage between Wards 1, 2, and 6. However, dockless has a higher proportion of trips into Wards 3, 4, and 5. There is a strong linear pattern showing dockless bikeshare rider activity along Connecticut Ave. NW, Wisconsin Ave. NW, and Georgia Ave. Figures 12 and 13 suggest that Wards 3, 4, and 5 account for a greater share of trips by dockless bikes than for CaBi. For CaBi trips in Wards 3, 4, and 5 account for a lower share of overall CaBi trips. However, the total number of trips is almost 7 times greater for CaBi than for the dockless bikeshare systems. In Figure 12, high CaBi ridership volumes in Wards 1, 2, and 6 prevent display of existing CaBi trips in Wards 3, 4, and 5. However, this does not mean that there are no CaBi trips in those Wards.



GIS Figure 13: Dockless Busiest Paths Map

Intercept Survey

Dockless intercept survey results (n=49) showed a similar result for demographics observed during screenline counts as compared with the most recent 2016 Capital Bikeshare Member Survey Report. The majority of dockless riders interviewed were White (71 percent), while Black riders were the second largest racial group at 17 percent. The results of the 2016 Capital Bikeshare Member Survey Report show that White riders accounted for 80 percent of users, with Black riders ranked fourth at 4 percent of users. Another significant finding discovered while comparing survey results from dockless bikeshare and CaBi was a difference in rider household income levels. The dockless bikeshare survey results indicated a larger share of riders earn less than \$35,000 compared to CaBi survey respondents. CaBi reported that its largest income group was \$100,000 to \$149,000 at 22 percent. This income level ranked fourth in the dockless survey at 12 percent.

Screenline Counts

Our screenline counts showed that the majority of bike riders utilize private bikes in the District. 79 percent of the riders we observed were using private bikes, while 18 percent were using CaBi, and 3 percent were using dockless bikeshare. With some variation for different peaks, the gender split for both CaBi and dockless riders was relatively similar with 3 out of 5 riders being male. There was a noticeable demographic difference between the two types of bikeshare. Observations of CaBi riders showed that 89 percent of riders were White with other races splitting the remaining share of ridership. In our small sample of dockless riders, (n=720) the results were more evenly distributed by race/ethnicity: 42 percent of riders were White, 32 percent of riders were Black, and other races represented 21 percent of the total.

Trip & Geolocation Data Analysis

Analysis of geolocation and trip data for the dockless systems revealed differences in hourly usage patterns, geographic dispersion and utilization rates. Hourly analysis of ridership on weekday activity showed peak dockless activity was slightly later than CaBi. Additionally the dockless hourly activity did not exhibit the deep valley between the peaks exhibited by CaBi riders. Dockless' ridership activity peak in the afternoon was much higher than the morning peak. Analysis of location activity showed similar results for CaBi and dockless riders, Wards 1, 2, and 6 had the most activity for both systems. However, the dockless ridership patterns in Wards 3, 4, and 5, and the commute between Silver Spring and the District was not as prominent in the CaBi trip data. Generally the dockless bikeshare had a comparatively larger expanse of activity over the city proportionally than that of CaBi- indicating that the majority of CaBi trips is more concentrated. Given the greater number of CaBi bikes in the city, however, means that CaBi also reaches other parts of the city.

STUDY LIMITATIONS

1

There are several limitations of this study. Primarily, the majority of the field work was conducted in the later stages of the winter season. Weather conditions encountered by researchers included snow, ice, rain, high winds, and low temperatures which affected the sample size and response rates. Some scheduled field sessions were cancelled due to inclement weather, and subsequently limited the amount of collected data.

2

Secondly, there were only two screenline count locations, and four locations for intercept surveys. Additional locations may have provided more data and insight into ridership patterns throughout the District. In addition, counts were mostly conducted during peak commuting hours on weekdays. Weekday counts conducted during off-peak commuting hours may have provided useful data about dockless bike riders.

3

Lastly, the screenline count data is limited by the subjective observations of counters in the field, and is therefore subject to a certain degree of human error. Every effort was made during the count sessions to observe and record data of the highest quality, however, there is an inherent degree of error when conducting a manual screenline count.

Recommendations For Future Research

1

Conduct a future study during the warmer late spring and summer seasons. This may be more conducive to observing a larger number of bikers overall, especially dockless bike riders.

2

Disperse and increase the number of count and survey locations throughout the District. It would be useful to have count and survey locations at major entrances into the District to gain data about commuters from the surrounding suburbs of Maryland and Virginia.

3

Schedule count and survey time periods during off-peak hours to gather more data about dockless bike riders.

Demographic Profile of Dockless Bike Riders

Regarding race/ethnicity and gender, our data (n=49), collected in two areas of the city (at the 11th Street bridge and in downtown), suggested that dockless bike riders are a more diverse set of riders than CaBi members responding to CaBi's annual survey. The data collected for the intercept surveys showed dockless riders were 71 percent White compared to 80 percent White for CaBi. In addition, the screenline count data showed dockless bike ridership at 42 percent White, whereas 89 percent of CaBi riders were White. The survey also showed that dockless bikes have a higher proportion of riders who are women at 47 percent compared to 42 percent for the CaBi membership survey. Our sample, collected at only two locations in the city, suggests that dockless riders are overall more diverse than CaBi members responding to CaBi's annual survey.

Regarding household income, the majority of dockless bike riders reported their income to be less than \$35,000. The majority of CaBi members reported their income to be between \$100,000 and \$149,999.

Dockless bike riders are overall slightly younger than CaBi members. The survey data showed 55 percent of dockless bike riders were under the age of 35, whereas 51 percent of CaBi members surveyed were under the age of 35.

Geographic Reach of Dockless Bikes

The GIS data showed that dockless bike trips are comparatively more spread out than CaBi trips within the geography of the District, and particularly in the vicinity of Metro stations. CaBi trip routes out of the District skew towards Northern Virginia, whereas dockless bike trips out of the District skew towards Maryland and particularly the Silver Spring area.

Equity

Our data suggest that more people of color and women are using dockless bikes than CaBi on a proportional basis. Also, the non-permanent nature of dockless bikes potentially allows them to be much more accessible to undeserved portions of the District. It is unclear whether the issue of transportation equity with regard to bikeshare overall in the District has been solved with the introduction of the five dockless companies. However, initial data analysis suggests that the rider demographics and geographic reach has made bikeshare more available and accessible.

Appendix A: Intercept Survey Methodology

Study Areas

In determining our study areas for both surveys and screenline counts, we wanted to identify areas that would provide us with a cross section of various bicycle riders. GIS data from CaBi was used to identify areas with both high and low usage throughout the City. Google Earth was used to help identify potential survey sites based off of land uses, transportation infrastructure, as well as proximity to recreational and institutional locations. We also monitored dockless bikeshare applications for an extended period to identify potential survey sites that would provide us with the highest response rate.

Based off our observations, we initially chose two distinctive destinations for intercept surveys. Pennsylvania Avenue was chosen due to the dedicated cycle track within the median as well as controlled light signals that require cyclists to stop at red signals which could facilitate interviews. The 11th Street Bridge was selected due to its proximity to the lower income community of Anacostia and infrequency of CaBi trips within the area. The Columbus Circle/Union Station location was later added due to the nearby cycling infrastructure and the popularity of Union Station as a commuting hub.

The three final locations for intercept surveys were: Pennsylvania Avenue near Archives Metro station, 11th street bridge near the Washington Navy Yard, and Columbus Circle and the Union Station Area

Additionally, we moved several blocks in different directions from established locations to capture increased dockless bicycle traffic in their immediate surroundings. The exact locations of intercept surveys were left at the discretion of the individual based on observed bikeshare activity and nearby parked dockless bikes. We also left several flyers advertising our survey on parked dockless bikes. These flyers contained unique links to online versions of the survey discussed below.

Intercept Survey Design

We identified four themes of questions for the intercept survey based on conversations with DDOT and the study goals. The four themes included: Rider Characteristics, Dockless Provider Used, Trip Purpose, Alternative Modes

A literature review was performed to identify existing data regarding bicycling in the District as well as best practices for intercept survey methods. Students utilized the 2016 Capital Bikeshare Member Survey Report to identify existing questions and data to assure comparability with new data collected from dockless bikeshare riders. Most of the questions contained in the final draft questionnaire were unique. For questions from the 2016 Capital Bikeshare Member Survey Report, we modified word choice in questions from the report to reflect dockless bikeshare instead of CaBi. Best practices on intercept surveying were utilized from the Transportation Research Board in construction and layout of the final draft questionnaire.

Appendix A: Intercept Survey Methodology

The questionnaire was produced on an 8 and ½ by 11-inch piece of white paper with Virginia Tech logos on the front and back. A brief synopsis on the reason for the survey and a disclaimer on privacy preceded the questions. Fourteen questions total were selected and placed on both sides of the paper. A space at the bottom of the back page was included for respondents to provide an email address to enter a raffle for an annual CaBi membership provided on behalf of DDOT.

We also created an online version of the paper survey for self-administration of potential respondents who would not be able to complete the paper version. The online version was constructed in Google Forms mirroring the paper version with minor changes in appearance as well as flow of the survey. Three versions of the Google Form was created, one for each geographic location and later for a general online survey posted to social media. Flyers were designed with Virginia Tech logos asking for respondents help by answering a dockless bikeshare survey with the potential to win a CaBi membership. A distinctive Google shortened link and a QR code were generated for each form used to separate the data.

Data from both paper intercept surveys and online equivalents were stored in a secure Google drive with limited access. A code book was constructed to classify responses and perform data analysis. Email addresses collected from the respondents for the CaBi incentive were stored separate from the survey responses to ensure no data that could identify respondents was stored within the same document.

Survey Scheduling

We constructed a schedule for both bicycle screenline counts and survey data collection. Students signed up for shifts based on personal availability to collect data as well as peak bicycle usage times. The schedule for survey administration was kept to daylight hours only. Students were required to work in pairs to conduct surveys while a single student was allowed to collect bicycle counts data. Both weekday and weekend collections were performed. Shift times varied depending on type of day and included both morning and afternoon times.

Initially, only one data collection week was scheduled at the study locations. However, cold and rainy weather, and availability changes required additional weeks. The survey period lasted from March 19th to April 13th, 2018.

Appendix B: Screenline Count Methodology

Purpose

The purpose of the screenline count portion of the dockless bikeshare study was to provide data related to dockless bikeshare riders such as: Race/ethnicity, Gender, Dockless bike company.

This data describes the demographic composition of dockless bikeshare riders as well as their choice of dockless bike company. This information will assist DDOT in future policy discussions regarding dockless bikeshare and provide insight into any user demographic differences that are present between riders of CaBi and dockless bikeshare systems.

Locations

The screenline counts were conducted at the following locations within the District: The 11th Street Bridge, Pennsylvania Avenue (between 14th and 15th St NW). These locations were chosen due to relatively high amounts of bicycle traffic and bicycle infrastructure.

Times

The counts were primarily conducted during the morning and evening rush hours during weekdays and weekends. Both weekdays and weekends were included in the bike count to capture both commuter and casual bike traffic.

Counts were successfully conducted at the following times (by location):

The 11th Street Bridge

3:00 - 4:00 p.m.; Sunday, March 25, 2018

5:00 - 6:00 p.m.; Tuesday, March 27, 2018

3:00 - 4:00 p.m.; Saturday, March 31, 2018

5:00 - 6:00 p.m.; Tuesday, April 3, 2018

8:00 - 9:00 a.m.; Wednesday, April 4, 2018

8:00 - 9:00 a.m.; Thursday, April 5, 2018

Pennsylvania Avenue (between 14th and 15th St. NW)

8:00 - 9:00 a.m.; Tuesday, March 27, 2018

5:00 - 6:00 p.m.; Tuesday, March 27, 2018

8:00 - 9:00 a.m.; Monday, April 2, 2018

5:00 - 6:00 p.m.; Tuesday, April 3, 2018

5:00 - 6:00 p.m.; Wednesday, April 4, 2018

8:00 - 9:00 a.m.; Thursday, April 5, 2018

Count Method

- A manual screenline count method was used to collect the data for this study. Riders were counted as they physically passed a visual marker at the specified count location.
- Count forms were completed by human counters in the field in the vicinity of the above locations. Counters recorded the race/ethnicity, gender, and the type of dockless bike utilized by each rider.
- For data comparison, counters also recorded the number of CaBi riders and their demographic information, limited to race/ethnicity and gender.
- Counters also recorded the number of private bicycle riders. Demographic information was not collected for this group.

Appendix B: Screenline Count Methodology

Counters

- Counters consisted of students from Virginia Tech
- There was at least one counter at each count location during each completed count period.

Count Forms

Two count forms were used by counters in the field (Appendix D):

Screenline Count Form - Bike Type

- One page document (8 ½" x 11") with a table for counters to record data.
- This form was used primarily to record the number of bikes as classified in the following categories: CaBi, Ofo, Spin, Limebike, Jump, Mobike, and private bikes.
- Counters recorded the date, location, weather conditions, and cardinal direction (when necessary).

Screenline Count Form - Race/Ethnicity and Gender

- One page document (8 ½" x 11") with a table for counters to record data
- This form was used primarily to record the demographic information (race/ethnicity and gender) of CaBi and dockless bike riders. Race/ethnicity was classified as follows: White/Caucasian, Black/African-American, Hispanic/Latino, Other/Unknown. Gender was classified as: Male, Female, and Other/Unknown. The information gathered was based on the subjective judgment of the counter.
- Counters recorded the date, location, weather conditions, and cardinal direction (where necessary).

Logistics

Data collection:

- Counters recorded demographic information of CaBi and dockless riders.
- Counters recorded the number and type of dockless bike by vendor on the "Screenline Count Form - Bike Type".
- Counters used tick-marks to count the number of all bikes on the "Screenline Count Form - Bike Type".
- Counters used the notations of "M" and "F" to count the number of male and female dockless and CaBi riders on the "Screenline Count Form - Gender/Race".
 - Counters made notations of "M" and "F" in the appropriate race/ethnicity category.
 - When race or gender was either unknown or did not fit into any specific racial or ethnic category, a notation of "O" was placed in the appropriate race/ethnicity or gender category.

Data processing:

- Count forms were physically turned into a designated count shift captain for the safekeeping of records.
- Data was entered into an electronic database (Microsoft Excel) for further analysis and quality control.

Data presentation:

Data was organized and analyzed, in preparation for a final report and presentation to DDOT.

Appendix B: Screenline Count Methodology

Screenline Count Limitations

A manual screenline count, by definition, is prone to human error. The method used in the count portion of this study was completely reliant upon the visual observation of the counters. Every effort was made to ensure the highest quality data observation and recordation. However, the data is dependent upon how the counter, at a specific time and location, visually observed the data and manually entered it into the tables on the count forms.

The screenline count was also limited by the low number of count locations. Counts were conducted at two locations - the 11th Street Bridge and Pennsylvania Avenue between 14th and 15th St. NW. Additional count locations may have resulted in useful data about riders in different parts of the District.

Weekday counts were conducted only during morning and afternoon peak rush hour times between 8-9AM and 5-6PM. Counts conducted during off-peak hours during weekdays could have also contributed useful data about casual weekday riders.

Appendix C: Bikeshare GIS Data Methodology

Purpose

The District offers two options for individuals interested in using bicycles for a variety of transport needs. There is the CaBi system and there is the dockless bikeshare system. The geography of the District and street infrastructure in certain areas is conducive toward ridership. Given the interest and investment in these bikeshare systems, understanding the ridership patterns of the system as a whole can help to optimize resources moving forward.

Data Source and Description

To compare spatial and temporal patterns of CaBi and dockless bikeshare trips, we took a quantitative research approach. The CaBi trip history data was obtained from an open data portal. DDOT publishes monthly CaBi data on the website and then binds historical data by season or year, which can be accessed via <https://s3.amazonaws.com/capitalbikeshare-data/index.html>. The variables of historical CaBi trips in the dataset include duration, start date, end date, start station number, start station, end station number, end station, bike number, and member type.

DDOT shared the dockless bikeshare data obtained from five companies with Virginia Tech under Non-Disclosure Agreements. The raw dockless data contains 171,997 records beginning at the launch of the pilot program on September 20, 2017 through January 31, 2018.

Appendix C: Bikeshare GIS Data Methodology

Data Cleaning

Before conducting our data analysis, we took several steps to clean the data. The major steps we took are described as follows:

1. Change time zone. To ensure accurate results, it was necessary to change all the time zones to EST before conducting any temporal analysis.
2. Check trip duration. We created a new column to calculate dockless trip duration using EndTime minus StartTime to calculate the trip duration in minutes. We examined the CaBi trip duration and found all the trips last at least one minute. We decided to use the same standard to validate dockless trips.

After completing the data cleaning and filtering process between October 2017 and January 2018, there were 152,548 records used to conduct our data analysis.

Appendix D: Screenline Count Form

Appendix D-1: Screenline Count form Bike Type

Counter Name: _____

Page ____ of ____

Screenline Count Form – Bike Type (V1a)

Date: _____ ____/____/2018	Location: _____ Direction (Circle One): North South East West N/A
Count Period: From ____ : ____ AM/PM To ____ : ____ AM/PM	Weather: _____

Directions: Place a tick mark for every bike that passes in the following table.

	Capital Bikeshare	Ofo	Spin	Limebike	Jump	Mobike	Private
NUMBER OF BIKES							
TOTAL							

Appendix D: Screenline Count Form

Appendix Figure D-2: Screenline Count Form Gender/Race

Counter Name: _____ Page _____ of _____

Screenline Count Form – Gender / Race (V1b)

Date: __/__/2018	Location: _____ Direction (Circle One): North South East West N/A
Count Period: From ____: ____ AM/PM To ____: ____ AM/PM	Weather: _____

Directions: For each bike that passes, place the following symbol in the corresponding box:
M = Male F = Female O = Other/Unknown

Race	Capital Bikeshare	Ofo	Spin	Limebike	Jump	Mobike
White / Caucasian						
Black / African American						
Hispanic / Latino						
Other / Unknown						
TOTAL						

Appendix D: Intercept Survey

Appendix Figure D-3: Survey Form (Front)



Virginia Tech needs your feedback on dockless bikeshare. Responses collected from this survey will help DDOT improve bikeshare services in the city.

Completing the following survey is voluntary. Information collected is anonymous. This survey is designed to be completed within five minutes. After completion, you will be given an opportunity to win a Capital Bikeshare membership.

1. Which dockless bikeshare providers have you used? (Select all that apply)
 - Mobike
 - Limebike
 - Ofo
 - Spin
 - Jump
 - Don't know
2. What motivated you to use dockless bikeshare? (Select all that apply)
 - Save money on transportation
 - Get around more easily, faster, more conveniently
 - Like to bike, fun way to travel
 - Exercise, fitness, health
 - Concern about environment
 - Access to another bike/backup bike
 - Access to other form of transportation,
 - New travel option/one-way travel option
 - Employer benefit
 - Other (please specify):

3. Thinking about your most recent dockless bikeshare trip, what was the primary reason that you chose dockless bikeshare for that trip over other travel options? (Select only one)
 - It was the fastest way to get there
 - It was the cheapest way to get there
 - To get some exercise on my trip
 - Parking is difficult at that time or at that destination
 - No bus/train at that time or to that destination
 - Capital Bikeshare not available at start or end of trip
 - Don't have a car
 - Too far to walk
 - Other (please specify):

4. If dockless bikeshare had not been available for your last trip, how would you have made that trip? (Select only one)
 - Walk
 - Bus
 - Metrorail
 - Drive a personal vehicle, carshare vehicle, or other motor vehicle
 - Taxi
 - Uber, Lyft
 - Ride with/dropped off by a friend, family member, or other person
 - Personal bike
 - Capital Bikeshare
 - Would not have made this trip
 - Other (please specify):

5. Thinking about your most recent dockless bikeshare trip, about how far did you travel to get to the dockless bike?
 - 1 to 4 blocks (about 1/4 mile)
 - 5 to 8 blocks (about 1/2 mile)
 - 9 to 12 blocks (about 3/4 mile)
 - 13 to 15 blocks (about 1 mile)
 - More than 1 mile
 - Not sure
6. In the past 30 days, about how many dockless bikeshare trips did you make? If you are not sure, provide your best estimate. (Please enter numerical value, with no commas).
_____ trips
7. Approximately how long is your typical dockless bikeshare trip?
 - Less than 1 mile (13-15 blocks)
 - 1-2.9 miles
 - 3-4.9 miles
 - 5 or more miles
 - Not sure

TURN OVER FOR NEXT SECTION

Appendix D: Intercept Survey

Appendix Figure D-3: Survey Form (Back)



8. What is your home Zip Code?

9. What is your work Zip Code?

10. Are you male or female?
- Male
 - Female
 - Other
 - Prefer not to answer
11. What is your age?
- 16 – 17 years old
 - 18 - 24
 - 25 - 34
 - 35 - 44
 - 45 - 54
 - 55 - 64
 - 65 years or older
 - Prefer not to answer
12. What is the highest level of education you have completed?
- Less than high school
 - High school/GED
 - Some college
 - 2-year college degree
 - 4-year college degree
 - Advanced degree (Masters, Doctoral)
 - Prefer not to answer
13. Approximately what was your total household income last year? (If you live with roommates or other persons who are unrelated to you, please report your individual income).
- less than \$10,000
 - \$10,000 - \$14,999
 - \$15,000 - \$24,999
 - \$25,000 - \$34,999
 - \$35,000 - \$49,999
 - \$50,000 - \$74,999
 - \$75,000 - \$99,999
 - \$100,000 – \$124,999
 - \$125,000 - \$149,999
 - \$150,000 - \$199,999
 - \$200,000 or more
 - Prefer not to answer
14. Which categories best describe your race/ethnicity? (You may select multiple options)
- White
 - Hispanic, Latino, or Spanish origin
 - Black or African-American
 - Asian
 - American Indian or Alaska Native
 - Middle Eastern or North African
 - Native Hawaiian or other Pacific Islander
 - Other (please specify): _____
 - Prefer not to answer

Enter your email below for the chance to win a Capital Bikeshare membership! Email addresses will be used solely to contact winners of the Capital Bikeshare raffle. Email addresses will NOT be distributed for the purposes of spam or advertising.

Email: _____

This completes the Virginia Tech dockless bikeshare survey. Thank you for your participation. Please return the survey to the administrator.

LOCATION: _____
TIME: _____

Appendix D: Intercept Survey Flyer

Appendix Figure D-4: Survey Flyer for Downtown Locations



In collaboration with the District Department of Transportation, Virginia Tech is conducting research on the new dockless bikeshare systems operating in D.C. Here's how you can help! Please fill out this survey prior to March 31st at the link below!

Complete the survey for a chance to win a Capital Bikeshare Membership!



<https://goo.gl/ChEvfn>



Appendix D: Intercept Survey Flyer

Appendix Figure D-4: Survey Flyer for 11th Street Bridge Location



In collaboration with the District Department of Transportation, Virginia Tech is conducting research on the new dockless bikeshare systems operating in D.C. Here's how you can help! Please fill out this survey prior to March 31st at the link below!

Complete the survey for a chance to win a Capital Bikeshare Membership!



<https://goo.gl/8Pv949>



Appendix E: Times And Locations VT Conducted Intercept Surveys

Appendix E: Intercept Survey Data Collection				
Intercept Survey Collection				
Location: 11th Street Bridge				
	8-9 a.m.	10-2 p.m.	3:30-6:30 p.m.	TOTAL HOURS
Sunday, March 25, 2018		✓		4
Wednesday, March 28, 2018	✓			1
Friday, April 13, 2018	✓			1
<i>Total hours of intercept surveys collected at 11th Street Bridge</i>				6
Location: Chinatown (Near 7th and F St.)				
	8-9 a.m.	10-2 p.m.	3:30-6:30 p.m.	TOTAL HOURS
Monday, March 19, 2018	✓		✓	4
Thursday, March 22, 2018			✓	3
Sunday, March 25, 2018		✓		4
<i>Total hours of intercept surveys collected in Chinatown</i>				11
Location: Columbus Circle/Union Station				
	8-9 a.m.	10-2 p.m.	3:30-6:30 p.m.	TOTAL HOURS
Monday, March 26, 2018			✓	3
Wednesday, March 28, 2018	✓			1
Thursday, March 29, 2018			✓	3
Saturday, March 31, 2018		✓		4
Monday, April 2, 2018			✓	1.5
Wednesday, April 4, 2018	✓			1
Thursday, April 5, 2018	✓		✓	2
Friday, April 13, 2018			✓	1
<i>Total hours of intercept surveys collected at Union Station</i>				16.5
Total # of hours collecting intercept surveys				33.5

Appendix F: Times And Locations VT Conducted Screenline Counts

Appendix F: Screenline Count Data Collection				
Screenline Count Collection				
Location: 11th Street Bridge				
	8-9 a.m.	3-4 p.m.	5-6 p.m.	TOTAL HOURS
Sunday, March 25, 2018		✓		1
Tuesday, March 27, 2018			✓	1
Saturday, March 31, 2018		✓		1
Tuesday, April 3, 2018			✓	1
Wednesday, April 4, 2018	✓			1
Thursday, April 5, 2018	✓			1
<i>Total hours of screenline count data collected at 11th Street Bridge</i>				6
Location: Pennsylvania Avenue (between 14th and 15th)				
	8-9 a.m.	3-4 p.m.	5-6 p.m.	TOTAL HOURS
Tuesday, March 27, 2018	✓		✓	2
Monday, April 2, 2018	✓			1
Tuesday, April 3, 2018			✓	1
Wednesday, April 4, 2018			✓	1
Thursday, April 5, 2018	✓			1
<i>Total hours of screenline count data collected at Pennsylvania Ave.</i>				6
Total # of hours collecting screenline count data				12

DDOT

Kimberly Lucas
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Jonathan Rogers

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Fanglan Chen
Hazel Ventura
James Mills
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Randy Cole
Ryan Johnson
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