Bikeshare Implementation White Paper

A How-to Guide to Planning and Installing a Bikeshare System

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Abstract:

Implementing a bikeshare system requires coordination between the city local government, the sponsor(s), the vendor, the operator, and ultimately the average user. How bikesharing goes from an idea to equipment installation is the primary focus of this white paper. This paper offers an cross-analysis of six different feasibility studies to identify patterns and discussions often found from feasibility studies. The planning phase for a bikeshare system, factors for ideal station locations, and the station installation process are the main subjects discussed in this white paper regarding the implementation phase.

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1. What Does the Implementation Process Look Like?

Implementing a bikeshare is a project that requires coordination between the city local government, the sponsor(s), the vendor, the operator, and ultimately with the average user. This paper explains the process of planning a bikeshare system and more specifically the station locations and equipment implementation.

Once a community is certain that it wants to pursue a bikeshare system, it is critical to plan out the process, which normally requires a feasibility study or something of the equivalent. Feasibility studies establish the basics about bikesharing, how a bikeshare would fit in a given community, and a preliminary plan for station location, business models, and other parts of the bikeshare planning process. There are significant factors that determine how a bikeshare will work in certain communities. Local geography and demographics, funding, and political/local community support each play a significant role in the implementation and planning process. Sometimes it's in a community's best interest to lease a trial system in lieu of a feasibility study, which depends on funding sources and scale of the project.

Alta station installation.

The moment a community identifies its goals and has planned at least some funding and project management, the implementation phase begins. For more on the process of establishing goals and expectations for a bikeshare system, check out A2B Bikeshare's Funding White Paper, which offers a framework with which to plan goals and expectations effectively. Once goals and expectations are set, questions about feasibility arise, namely how large should the system be, where should stations be located, and how will the system be installed. Answering these questions requires coordination and communication between the vendor, operator, local government officials, sponsors, and others who would be involved in a bikeshare project.

This report focuses on the different aspects of the implementation planning phase. Six different feasibility studies are analyzed to show how other communities determined feasibility. Knowing what communities look for in a feasibility study can help a community disregard the need for investing in an expensive feasibility study. This report will also focus on determining station location, the different factors and actors to take into account when deciding on a station location, and the installation of different stations. Understanding the implementation phase in full is critical to the establishment of an optimal bikeshare system.

2. Questions to Consider for the Planning Phase

A community needs to hold preliminary discussions about bikesharing before any planning can be done. Identifying goals and expectations of what the system will look like, why the system would be beneficial to the community, and the challenges that lie ahead are the main criteria a community should consider in preliminary discussions. Ann Arbor, for example, held preliminary discussions between the University of Michigan, the Clean Energy Coalition (non-profit owner and operator of the Ann Arbor bikeshare system), the Ann Arbor Area Transportation Authority (abbreviation: AATA), and the Ann Arbor local government before bikesharing became a serious project.[1] The prospect of a new transportation network that solves issues such as the "last mile" problem or dependency on the car should be enticing to communities, but it takes extensive coordination, planning, and research to make bikeshare a reality. If a community becomes seriously interested in a bikeshare project, then it needs to do extensive research on bikesharing and set clear goals and expectations.

While a genuine interest sows the seeds for a bikeshare, communities need to first determine if bikesharing is feasible and desirable for them. This may or may not require a feasibility study. Ann Arbor, for example, did not use a feasibility study to determine if bikesharing would fit in their community. If these factors listed below are answered and addressed properly, a feasibility study may be superfluous. A2B Bikeshare's other white papers also help answer these difficult questions:

- Is a bikeshare system feasible for our community? (A2B Bikeshare's Funding Paper and this white paper)
- What are the goals and expectations for our bikeshare system? (Framework in A2B Bikeshare's Funding White Paper)
- How does a bikeshare benefit our community? (A2B Bikeshare's Impact White Paper)
- How does our community compare to others that already have a bikeshare system? (Framework in this white paper)
- How does our local context affect our potential for a bikeshare system? (A2B Bikeshare's Implementation White Paper)
- Will there be user demand when our system is built? (This white paper and A2B Bikeshare's Impact White Paper)
- What is our financial and revenue plan / how much will this cost? (A2B Bikeshare's Funding White Paper)
- What business model should we select? (A2B Bikeshare's Funding White Paper)
- Where do we want bikesharing stations to be located? (This white paper)

[1] Helmholdt, Nick (Interview: May 12, 2014), Clean Energy Coalition, ArborBike Operations Manager.

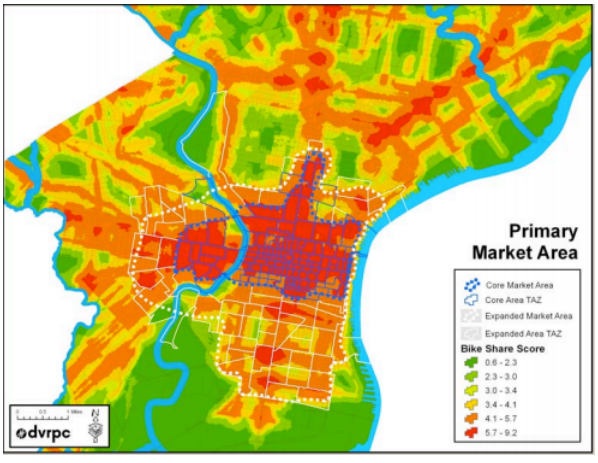
These questions vary in difficulty to answer, but these are the basic questions that need to be answered in the planning phase, which may or may not require a feasibility study. The next section will analyze each question listed above (minus the questions about stations, which will be answered in greater detail in section 4) and how it has been answered by different feasibility studies in the past.

3. How Six Communities Addressed Feasibility and the Planning Phase: A Feasibility Study Analysis

How to determine feasibility for your community?

A community wants to feel secure in knowing that their community's bikeshare system will work and have enough demand to be worthwhile. This question used to be more difficult to answer, but with the advent of fourth generation bikeshare technology, more communities than ever before are becoming feasible for bikesharing. Fourth generation bikeshare technology has made trial lease programs, financial sustainability, and greater levels of flexibility a reality, which changes the dynamic of the feasibility question.

As a rule, feasibility studies explain what bikesharing is, how it can benefit a community, how one community compares to another, offers a local context analysis, a user demand analysis, a financial and revenue plan, a recommended business model, and a heat map for station location planning (e.g. Philadelphia heat map below).



Feasibility is ultimately answering questions about bikesharing being beneficial enough to a community in exchange for the cost. Will there be enough user demand, will people ultimately ride the bikes out there, will the community be able to absorb the cost? These are the types of questions that ultimately offer an answer for feasibility in a community. If a community is unsure about the benefits of bikesharing, A2B Bikeshare offers an Impact White Paper that explains in detail exactly how bikesharing can benefit a community.

There are also alternatives to the feasibility study, e.g. leasing a trial system and using the data received from the trial system to determine feasibility. This has been done before, e.g. the city of Hoboken, NJ trialling a SoBi system for a year with data results afterwards. The advantages of doing a trial system is seeing the effects of bikesharing in a community concretely rather than in theory. It can provide real user data and show which locations were effective and if the system altogether was effective. This can be a more ideal option for a smaller community looking to experiment with a bikeshare system. For large communities looking to implement and plan a large system or a system that obtains a significant portion of public funds, a feasibility study is as a rule necessary.

The next section is going to detail six different feasibility studies that answer the feasibility and planning questions for communities in the past, which will help

communities understand what types of questions feasibility studies answer. There are also alternatives to the feasibility study, e.g. using data received from a trial system to largely determine feasibility, which in some cases can be about as cost-efficient as a feasibility study. For large communities looking to implement and plan a large system or a system that obtains a significant portion of public funds, a feasibility study is almost certainly necessary.

Comparative Analysis of Six Different Feasibility Studies:

In this section, I analyze six different community feasibility studies to see how communities use feasibility studies and if they answer the questions listed above. The communities below are the feasibility studies that I chose to analyze (hyperlink to the studies provided below):

Providence, RI

San Mateo, CA

Philadelphia, PA

Pittsburgh, PA

Cincinnati, OH

Memphis, TN

Here were the topics that emerged from each feasibility study (x/6 stands for the amount of feasibility studies that discuss the various topics):

Benefits of bikesharing (4/6):
Providence, San Mateo, Pittsburgh, Memphis.

Comparative analysis to previous bikeshare systems (5/6):
Providence, San Mateo, Philadelphia, Cincinnati, Memphis.

Local context analysis (5/6):
Providence, San Mateo, Philadelphia, Cincinnati, Memphis.

User demand analysis (5/6):
San Mateo, Philadelphia, Pittsburgh, Cincinnati, Memphis.

Financial & revenue plan / Cost analysis (5/6):
Providence, Philadelphia, Pittsburgh, Cincinnati, Memphis.

Selection of a business model (6/6):
Providence, San Mateo, Philadelphia, Pittsburgh, Cincinnati, Memphis.

Station location planning / Heat map (6/6):
Providence, San Mateo, Philadelphia, Pittsburgh, Cincinnati, Memphis.

An immediate observation can be made from this feasibility study analysis: station location planning is of primary importance in these studies, and a definitive plan is needed to properly install a bikeshare system within budget constraints, geographical challenges, and proper amounts of projected demand.

The different points covered in feasibility studies help answer the more broad question of goals and expectations of a system. Knowing the benefits of a bikeshare is essential to maintaining the big picture with why bikesharing is worth investing in. A comparative analysis helps communities measure how expansive their system should be and how to determine what's ideal relative to other systems. A local context analysis tells how a bikeshare system will fit in a community and takes a look at potential

challenges (e.g. hills). The user demand analysis is almost an extension of the benefits, showing who the end user will probably be (often younger individuals in their twenties and thirties according to studies done in France, Denmark and Norway as cited in Pittsburgh's feasibility study)[2] and how great the demand will be. If there's a college/university campus or high demographic of young people in the area, then the demand for bikesharing will be greater. With a better understanding of the benefits, population demographics, and potential challenges of a local area, a community can answer part of the feasibility question and fully answer what their goals and expectations are.

The benefits question is answered through a mix of studies and surveys that show the overwhelmingly positive environmental, economic, health, and overall social impact of a bikeshare system. To examine this question further in depth, read A2B Bikeshare's Impact White Paper, which goes into greater detail on why these systems produce a net positive for communities who choose to invest in them.

Feasibility studies used a few methods to compare themselves to other bikeshare systems. Providence, for example, compared itself to the city of Avignon in France due to having a similar population size and density.[3] Philadelphia compared these characteristics between six different systems: population, population density, number of bikeshare bicycles, residents/bike, and the operator.[4] San Mateo compared funding and management models in their feasibility study to gain a better idea of how they could fund their own program, noting that most U.S. systems use mainly state and federal public funding and private sponsorship funding.[5] There are many directions that a community can take to compare themselves to other previous communities, but finding communities in the most similar situation to yours is ideal. There's little utility in comparing Memphis' population to that of New York City's, but there is much greater utility in comparing Memphis' population to that of Nashville and Chattanooga, TN.[6] Now that more bikeshare programs have rolled out in the US, it is unproblematic to find communities with similar demographics or geography that have a system close to the one your community desires.

No one knows your community better than you do, which is why it's important to analyze how a bikeshare would work given your local context. Many feasibility studies analyze the demographics and geography of a community, mainly focusing on the what the community has that would allow a bikeshare

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[2] Pioneer Valley Planning Commission (October 2008): "2008 Bike Share Program Report" http://www.pvpc.org. Retrieved 13 Dec. 2011.

[3] Providence Bikeshare Feasibility Study, p. 4.

[4] Philadelphia Bikeshare Feasibility Study, p. 6.

[5] San Mateo Bikeshare Feasibility Study, p. 11.

[6] Memphis Bikeshare Feasibility Study, p. 22.

to succeed and the challenges a community faces that would hinder a bikeshare. For example, the Providence feasibility study discusses the compact urban core, significant population of students, and its overall good bicycle infrastructure in place as strengths for Providence's ability to host a bikeshare, but also addresses the challenges of some steep hills, lack of existing or planned bike facilities on many key streets and an Interstate highway that would prove to be a major barrier for bicyclists.[7] Cincinnati's feasibility study offers a thorough local analysis including these characteristics: Population characteristics such as population density, age, employment, average age, and visitor information.[8]

Existing advertising regulations and ordinances (many communities, including Cincinnati, ban station advertising, sometimes even on-the-bike advertising can be banned. An exception is needed to allow advertising.)

Topography and climate: Cincinnati has a steep grade that separates the uptown and central downtown areas, and climate is most ideal between May and September.

Land use and infrastructure installation: Cincinnati has narrow sidewalks and premium downtown parking space that may not be able integrate a bikeshare station, but a station will be installed wherever possible.

Transit integration solutions, discussing where a bikeshare station would optimally integrate with current public transportation, solving the "last mile" problem.

These are the types of characteristics that a community should analyze and plan for before installing a system. Dense population sectors, active population sectors (i.e. tourist attractions, museums, high commercial and recreational activity, high employment sectors), current bicycle infrastructure, and physical characteristics of a community all play integral roles in the success of a bikeshare system and thus should be analyzed carefully.

Once a local analysis has been conducted, an accurate user demand projection can be assessed. The model used to forecast demand in the Memphis feasibility study is an ideal starting point. It predicts ridership and expansion through Alta's Bike Share Demand Model, an empirical model based on "observed monthly station demands compared to surrounding land use and demographics."[9] A local analysis should offer one a good preliminary idea of how high user demand there will be for a bikeshare system (i.e. high population density, good bicycle infrastructure, and relatively flat land will yield a high demand bikeshare.) Alta's demand model was based on previous bikeshare ridership data in the southeast of the U.S. and then applied to preliminary station planning and extrapolated to annual forecasts, yielding an estimate for Memphis' ridership demand. The forecast takes into account expansion plans and natural growth once the system becomes more familiar to users. Below is a table that projects the user demand of the first three years for Memphis' bikeshare system.

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[7] Providence Bikeshare Feasibility Study, p. 1.

[8] Cincinnati Bikeshare Feasibility Study, p. 16-28.

[9] Memphis Bikeshare Feasibility Study, p. 56.

Station/Bike Fleet Size	Projected Trips Generated	Projected Trips/Bike/ Day
39/390	170,000	1.19
56/525	230,000	1.20
63/580	287,000	1.36

There are other methods, however, in figuring out user demand. Pittsburgh's feasibility study uses data collected from surveys given to residents in Pittsburgh. The survey was conducted through the use of an online form and through one-on-one interviews on the street in target neighborhoods.[10] There were potential biases in the survey since they were distributed on social media such as Facebook and Twitter, which means that only those who regularly use social media were reached, and people already interested in bikesharing would be more likely to take the survey. Despite potential data skewing from a potentially biased audience, the survey results were overall positive. About 60% of respondents answered that they would use or be likely to use a bikeshare program, while about 20% were undecided and about 20% were not interested in using a bikeshare system. Data was broken down by:

Age group (unsurprisingly, 18-24 year olds were the most likely users, while 50-65 year olds were the least likely users, though the gap was below 20%).

Gender (almost identical interest between both genders).

Current methods of transportation (highest proportion of people were drivers and were the least likely to use bikeshare, though bicyclists, those who walked, and those who used public transit were also common and were likelier to use a bikeshare).

Median annual fee (people were most likely to purchase an annual membership for $50).

Bike use purpose (86% for daily activities, 66% for fitness, 63% for commuting to work).

These survey measurements help build an idea for who the end user is going to be and are vital to building a well-received bikeshare. Clean Energy Coalition, the non-profit operator for the Ann Arbor system, did not conduct a feasibility study and used survey data to gain a better understanding of who the end user is and where stations could ideally be located.[11] Projections are useful in estimating the usage of a system, while surveys are useful in learning who the end user is going to be, where a station would be ideally located from a user's perspective, and introducing the concept of bikesharing to the general public. It is highly recommended that a community use surveys to gain data on the end user and ideal station locations.

Identifying a business plan for who the owner and operator will be is of vital importance to the planning stage, as is identifying funding

[10] Pittsburgh Bikeshare Feasibility Study, p. 13.

[11] Helmholdt, Nick (Interview: May 12, 2014), Clean Energy Coalition, ArborBike Operations Manager.

and a revenue stream. There are three basic business models that most communities employ, namely a publicly owned, contractor operated system, a nonprofit owned and operated system, and a privately owned and operated system.[12] Each have their different sets of advantages and disadvantages, and different communities fit different profiles more ideally. For a more in-depth look at the different business models, check out either our Funding White Paper or the report titled "Bike Sharing in the United States: State of the Practice and Guide to Implementation."

Once a business model is identified, finding funding is a major step in the planning process. Identifying sources of government funding such as CMAQ funding, state D.O.T. funding, local government funding, sponsorships, and revenue from user fees and potentially advertisements are all commonly used sources of funding. Finding funding can be what makes or breaks a bikeshare system, so it is important to look into it in-depth. For more information on the funding process, check out A2B Bikeshare's Funding White Paper.

[12] Models inspired by: Toole Design Group / Pedestrian and Bicycle Information Center for USDOT Federal Highway Administration (September 2012) "Bike Sharing in the United States: State of the Practice and Guide to Implementation" Retrieved 27 May 2014.

4. The Station Planning Phase — How Does a Community Most Effectively Plan Station Locations?

There are definitive factors that determine a station's A community should be mindful that the regular townspeople are going to be the ones using the bikes, therefore they should be contacted frequently to find the most optimal and desired station locations. ArborBike in Ann Arbor, for example, used user surveys to determine location, but there are other methods beyond the survey to determine station location. According to the report "Bike Sharing in the United States: State of the Practice and Guide to Implementation,"[13] these are the different aspects to look for in a heat map:

- Population density
- Employment density
- Proximity to colleges and universities
- Retail/commercial activity density
- Available bicycle infrastructure
- Proximity to tourist attractions and recreation areas
- Available transit
- Topography

These are the attributes taken into account when producing a heat map, and together they produce a score. These are mostly intuitive measurements. Higher population density, for example, will translate to higher congestion and correlate to a greater need for a bikeshare. The major, simple indicator to measure demand for a bikeshare is by measuring the popularity of a certain area, which shows both the demand for an area and the congestion that comes with high demand.

Employment density plays a great role for multiple reasons. Sponsors may promote bikesharing to their employees in the form of discounted annual memberships. Blue Cross Blue Shield does this in Chicago. BCBS is the main sponsor of the Divvy system in Chicago, and they offer employees a discounted $30 corporate annual membership rate to promote ridership.[14]

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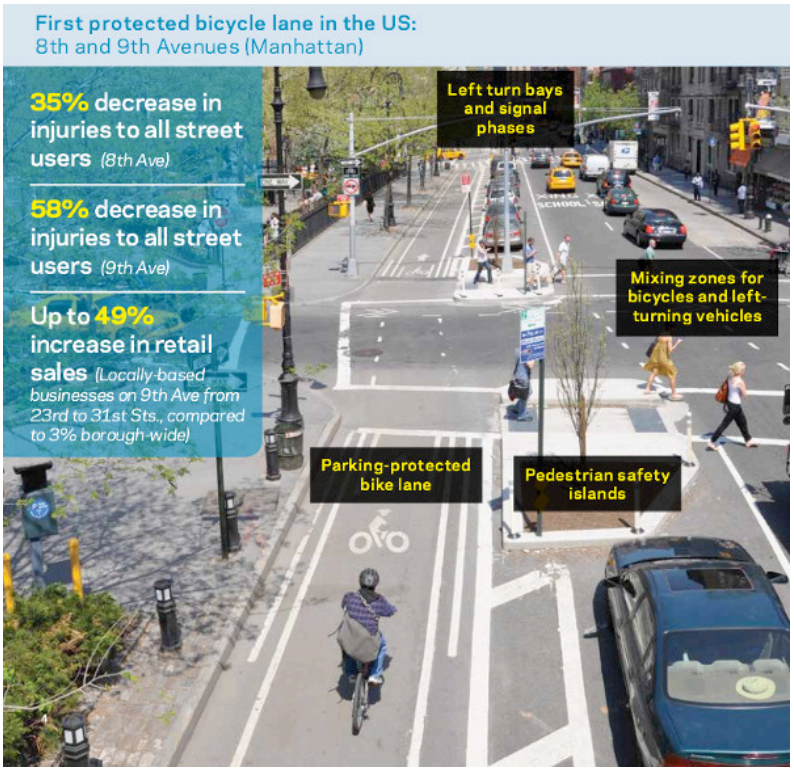
[13] Toole Design Group / Pedestrian and Bicycle Information Center for USDOT Federal Highway Administration (September 2012) "Bike Sharing in the United States: State of the Practice and Guide to Implementation" p. 10.

[14] Blue Cross Blue Shield of Illinois (May 2014), "Mayor Emanuel, Blue Cross and Blue Shield of Illinois Announce Partnership to Support Divvy Bike Share System" PRNewswire.

Proximity to a college or university positively is highly correlated to the need for bikeshare stations since college students fit the youth profile (youth more likely to ride bikes) and are less likely to own a personal vehicle.[15]

If there is high retail and commercial activity in the area, then congestion will be higher and demand for a bikeshare will be higher.[16] Additionally, increased bicycling rates stimulate further economic activity and can increase the local retail and commercial demand. When New York City created protected bike lanes on 8th and 9th Avenue, there was a 49% increase in retail sales, compared to a 3% increase borough wide.[17]

The Effects of protected bike lanes in New York according to NYC DOT



Bikeshare does well in commercial and retail zones, and commercial and retail zones stand to benefit from the increased commerce caused by bikeshare. To the left is an image that shows the layout and effects of protected bike lanes on 8th and 9th Avenues, courtesy of the Measuring the Street study.

Available bicycle infrastructure plays a large role in bicycle ridership because it usually means safer, easier bicycling, a major factor for ridership. As the image to the left demonstrates, there are significant decreases in injuries with bike lanes, which leads to higher security for bikers and drivers while

[15] Toole Design Group / Pedestrian and Bicycle Information Center for USDOT Federal Highway Administration (September 2012) "Bike Sharing in the United States: State of the Practice and Guide to Implementation" p. 17.

[16] Toole Design Group / Pedestrian and Bicycle Information Center for USDOT Federal Highway Administration (September 2012) "Bike Sharing in the United States: State of the Practice and Guide to Implementation" p. 17.

[17] New York City DOT (2012): "Measuring the Street: New Metrics for the 21st Century Streets".

increasing bicycle ridership.[18] If a community has already put in the work for a friendly bicycling environment that makes bicycling a safe, desirable option for users, then bikesharing will succeed more. A multiple regression analysis done by Buck and Buehler on Capital Bikeshare found a statistically significant relationship between the number of bikesharing trips and bike lane supply after controlling for population, retail destinations in the vicinity of stations, and the percentage of households without a car.[19] There was also a significant relationship between the presence of bicycle lanes and Capital Bikeshare usage, showing the importance of infrastructure in bikeshare ridership.[20]

Another study conducted in Toronto analyzed the Bloor-Danforth corridor, a commercial zone in Toronto that has ideal attributes for a bikeshare lane while experiencing one of the highest incidences of bicycle collisions in the city. The main findings were that only 10% of patrons drive to the Bloor Annex neighborhood to shop, patrons arriving by foot and bicycle visit the most often and spend the most money per month, and that reallocating on-street parking space into a bike lane would significantly increase commercial activity, reduce traffic accidents, and increase bicycle ridership.[21]

Not every community, however, has robust bicycle infrastructure. Cincinnati, for example, surveyed local bicyclists in 2011 and asked them about their overall satisfaction with bicycling in the city. Those surveyed rated their overall bicycle experience a "C," though the silver lining was the "B+" rating received for the city recognizing bicycle infrastructure deficiencies and increasing their efforts to make bicycle infrastructure improvements. While it's more ideal to already have robust bicycle infrastructure, an honest effort to improve bicycle infrastructure goes a long way in increasing bicycling rates in a community.

Proximity to tourist and recreational attractions also plays a role similar to proximity to commercial and retail zones, and the bigger the tourist attraction, the more usage. Locating a bikeshare station near tourist attractions offers tourists an alternative way to navigate a city, which can both reduce congestion caused by tourism [22] and give tourists a novel, potentially more enjoyable mode of sightseeing transportation. According to Capital Bikeshare data from January, 2012, the 6th most common one-way trip was tourists sightseeing Washington D.C. from the Smithsonian station back to the Smithsonian station, with 3,586 of such trips

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[18] New York City DOT (2012): "Measuring the Street: New Metrics for the 21st Century Streets".

[19] Buck, Darren / Buehler, Ralph (November 2011): "Bike Lanes and Other Determinants of Capital Bikeshare Trips".

[20] Ibid.

[21] The Clean Air Partnership (February 2009) "Bike Lanes, On-Street Parking and Business A Study of Bloor Street in Toronto's Annex Neighbourhood".

[22] Nijkamp, Peter / Riganti, Patrizia (2006): "Congestion in Popular Tourist Areas: A Multi-Attribute Experimental Choice Analysis of Willingness-To-Wait in Amsterdam".

lasting an average of 2 hours, 48 minutes, which also raised a large amount of revenue for the rest of the bikeshare system.[23]

Tourist destinations increase demand for bikeshare stations (e.g. Washington D.C. tourism).

As displayed in the Philadelphia feasibility study, an integrated bikeshare network is key for tourist areas since it eliminates non-integrated bike rental programs. Washington D.C. used to have four organizations with closed and non-integrated bikeshare programs, namely the DC Department of Transportation, the National Park Service, Washington DC (the City), and Capitol Hill, which limited each bikeshare's success.[24] Capital Bikeshare today emphasizes how successful an integrated system can be, with over 450,000 daily members as of May 2014 and 310,322 riders during the month of May, 2014 alone.[25]

The ultimate goal of a station is to act as another form of public transportation, which means that it's important to locate stations near current public transportation. Locating a bikeshare station near a bus station or a train station is optimal to fully integrate transportation networks together, which helps solve the "last mile" problem more effectively while offering better public transit accessibility.

Finally, topography plays a large role in bikesharing. Cyclists generally dislike riding up slopes greater than 4 percent, and will almost certainly avoid riding up slopes greater than 8 percent.[26] This creates a significant barrier for communities with hills, but it can be overcome. Barcelona's downtown, for example, lies at the bottom of a bowl-shaped valley, which means that

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[23] Alpert, David (January 2012): "Capital Bikeshare data already yields interesting facts" Greater Greater Washington. Retrieved 27 May 2014.

[24] Philadelphia Bikeshare Feasibility Study, p. 24.

[25] Capital Bikeshare Dashboard Main Metrics, http://cabidashboard.ddot.dc.gov/CaBiDashboard/, Retrieved 7 July 2014.

[26] Midgely, Peter (May 2011): "United Nations Department of Economic and Social Affairs. Bicycle-Sharing Schemes: Enhancing Sustainable Mobility in Urban Areas." Global Transport Knowledge Partnership, International Road Federation, Background Paper No. 8.

people happily ride bicycles from uptown stations down to downtown stations, but they normally use other methods of transportation on the way back home. This problem is usually solved through redistribution, which means that vehicles take bicycles from low-lying stations up to uphill stations, which adds to operational costs, but greatly helps the efficacy of operating a bikeshare.[27] Topography needs to be taken into account for bikeshare station size and location.

Not every station can be ideal, and it's up to a community to weigh the efficacy of each station location based on varying factors listed above, but the forest (an integrated bicycle transportation network that connects the community) should not be lost in the trees (individual station evaluations). Bikeshare stations need to fit within a larger network, thus distance plays a large role in installing stations. According to the report "Public Bikesharing in North America: Early Operator and User Understanding," operators stated that bikeshare stations are optimally located between 300 yards to 1/4 of a mile, and only about 15% of operators thought it was appropriate for stations to be located over 1/2 mile apart.[28] Optimal distance from a public transit station was less clear between operators, with 33% stating that less than 25 yards away was optimal, 33% between 300 yards-1/4 mile distance, and 33% in between (n=9).[29] It's important that the network of stations are close enough together in addition to each individual station location being well planned.

Stations can be planned taking all of these factors into account. There are different methods for planning station locations and different values placed on each of the 8 factors listed above. Each factor either delineates popularity of an area (population density, employment density, retail/ commercial activity density, proximity to tourist attractions and recreation areas), infrastructure conducive to bikesharing in a given area (available bicycle infrastructure, available transit), and challenges for station location (topography, potentially space and land use for bicycle infrastructure). With the popularity factors in mind, visibility of stations should be no problem, which increases the usability of a system. It's also important for stations to be properly placed apart so that the network is effective. The planning phase can be a complicated one, but if it's known who's going to be leading the process and what the goals and expectations of a bikeshare program are, then it's a very manageable task to locate stations.

The next section will highlight the basic details of station land usage, visibility requirements, and general installation instructions.

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[27] Midgely, Peter (May 2011): "United Nations Department of Economic and Social Affairs. Bicycle-Sharing Schemes: Enhancing Sustainable Mobility in Urban Areas." Global Transport Knowledge Partnership, International Road Federation, Background Paper No. 8, p. 7.

[28] Shaheen et al. (July, 2012) "Public Bikesharing in North America: Early Operator and User Understanding" p. 37.

[29] Ibid, p. 38.

5. The Station Planning Phase — How Does a Community Most Effectively Plan Station Locations?

While the last section detailed what factors contribute to locating a bikeshare station, this section focuses on the specifications, land area usage, visibility needs, and overall installation process that goes with bikeshare stations.

Docking stations vary in size, some taking up larger amounts of space than others. It can be a challenge for a community to find space for bikeshare stations since space is often at a premium, especially in downtown areas. Cincinnati, for example, took into account the size of stations and how they would fit throughout their city. They saw sidewalks, on-street locations, and off-street sites as different location options for stations. This was their analysis of each location:

Sidewalks: many of the sidewalks in Cincinnati are generally quite narrow. Bike share stations are approximately 6 feet deep with bikes parked. The Engineering Department should be consulted to determine what width of sidewalk is considered appropriate to maintain sufficient pedestrian circulation. This may vary depending on the volume of pedestrians.

On-street: many Downtown streets have peak hour parking restrictions to allow for an additional motor vehicle travel lane during peak times. Stations cannot be placed in 'on-street' locations on these streets, but could be placed on the sidewalk if there is space.

Off-street: station locations in publicly owned plazas, public spaces, or in parks would require consultation with the relevant city or agency department. Agreements would need to be negotiated between the owner / operator and the individual land owner for stations placed on private lands.[30]

These are all realistic considerations when choosing a location. Below is an image from Toole Design Group that shows the dimensions of an 11 station Capital Bikeshare dock. Sizes do not vary greatly between other third generation vendors (e.g. B-Cycle, DecoBike). The height dimension is determined by the need for solar panels.[31]

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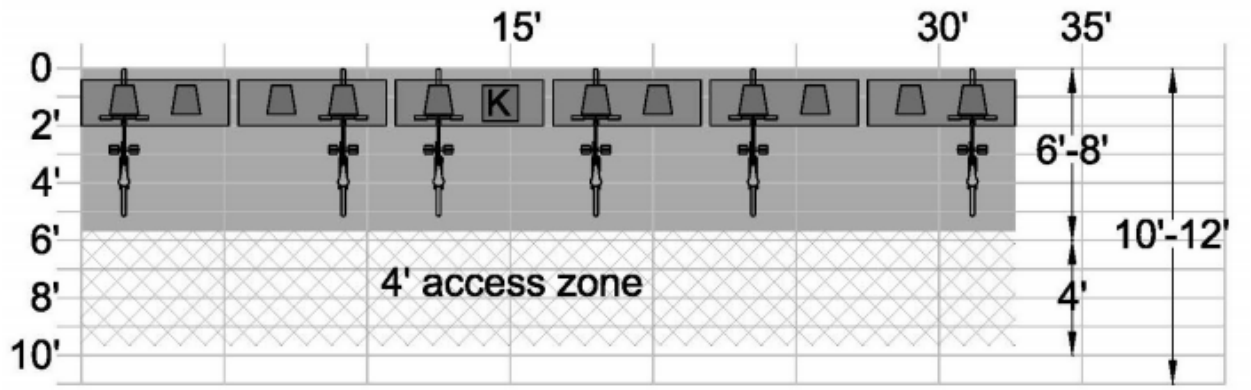
[30] Cincinnati Bikeshare Feasibility Study, p. 23.

[31] Toole Design Group / Pedestrian and Bicycle Information Center for USDOT Federal Highway Administration (September 2012) "Bike Sharing in the United States: State of the Practice and Guide to Implementation" p. 17.



Zoning requirements for an average kiosk based system. K stands for kiosk.

Docks	Width	Station Depth	Access Depth	Total Depth	Weight
11	31’9”	6’	6’	12’	4000 lb
15	41’7”	6’	6’	12’	5200 lb
19	51’5”	6’	6’	12’	6400 lb
13 (U-shaped)	24’6”	12’6”	12’	24’6”	4600 lb
17 (U-shaped)	24’6”	12’6”	12’	24’6”	5800 lb

Data courtesy of http://www.nbtc.org/download/bikesharepresent2011.pdf

Stations require installation from the vendor and coordination from the project manager.[32] Some vendors are able to offer more basic racks, which cost less, can be moved more easily, and take up less space due to technology being on the bike (example of rack seen below). Smaller stations mean more location options, which could be relevant for a community like Cincinnati where sidewalk and on-street space is at a premium.

An example of smaller station dimensions would be an 11 bike A2B Bikeshare rack, which comes at a 27’6” width with no kiosk, smaller than other current rack options. They’re also easier to install since the electronics are on the bike rather than in a kiosk, reducing the difficulty that comes with planning and installing stations.[33] Further details on other systems’ station technologies can be found in A2B Bikeshare’s Technology White Paper.

There are important station guidelines to follow that require official city surveying and approval. Utilities (i.e. water, sewer, IT, telephone, wires, electricity, etc.) cannot be interfered with in the installation process, and access to those utilities must be available at all times. A civil engineer and city approval is necessary to survey a station location for

[32] Helmholdt, Nick (Interview: May 12, 2014), Clean Energy Coalition, ArborBike Operations Manager.

[33] Official A2B Bikeshare website: https://www.a2bbikeshare.com/. Retrieved 27 May 2014.

utilities and determine that no utilities are interfered with. No amount of planning can skip this step, since it's not clear where the utilities are until you start surveying. Another requirement is that station siting requires adequate clear space for pedestrians, bike share users, and other normal activities on the street. In addition, stations situated in the public right of way must comply with the Americans with Disabilities Act and other local ordinances regarding sidewalk furnishings (i.e. fire hydrants, street trees, etc.). Once permission is gained from the local city government officials (and potentially other actors such as universities, corporations, or other off-street sites), then the installation process can progress to full installation of station equipment.[34]

The installation process is more straightforward than the planning process, but it can still take months to properly survey, coordinate with different levels of bureaucracy, and install the station itself. Having a clear vision and good planning makes this process easier, but installation is very manageable with the right people doing the task and proper support from various officials tied to the project.

A2B Bikeshare rack with bikes pictured above. Takes up less space than third generation bike racks, requires no kiosk. For more information, refer to A2B Bikeshare's Technology White Paper.

[34] Helmholdt, Nick (Interview: May 12, 2014), Clean Energy Coalition, ArborBike Operations Manager.

6. Concluding Remarks

Building an effective bikeshare system requires strong coordination between the city local government, the sponsor(s), the vendor, the operator, and ultimately with the average user. Using an analysis of 6 feasibility studies, various bikeshare studies, and an interview with Nick Helmholdt, the ArborBike operations manager from Clean Energy Coalition, this white paper explored the different aspects of determining feasibility, planning station locations, and installing a system.

The main focuses from bikeshare feasibility studies are as followed: the benefits a community will receive from a bikeshare system, how it compares to communities that already have a bikeshare system, how a bikeshare would work within a given local context, how much user demand there would be for a bikeshare, what the financial plan is moving forward, and who the operator and owner of a system will be.

Once those questions are answered, then it becomes imperative to find ideal station locations, which are primarily influenced by population density, employment density, proximity to colleges and universities, retail/ commercial activity density, available bicycle infrastructure, proximity to tourist attractions and recreation areas, available transit, and topography. These factors influence individual station locations, but the system must be well integrated, meaning stations must be relatively close to one another (about 1/4 mile distance is optimal), they must be highly visible, and they must be easily accessible.

Kiosk-based systems require more intense installation than “smart-bike” systems, which can significantly effect the installation process. Systems that require no kiosks significantly increase the flexibility of station location planning and installation, which can change the planning process to allow for more expansive, small-station coverage. This can also allow for less desirable station areas to receive coverage. For more information on the different vendors in bikesharing and their different technologies, check out A2B Bikeshare’s Technology White Paper.

When station locations are planned, then the installation process begins, which requires stations to not interfere with utilities and gain formal permission from community officials to install stations. Through understanding the planning and installation process and what different bikeshare vendors offer, a community can comfortably plan and deploy a fully functioning robust bikeshare system.

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