

Feasibility Study for a Pittsburgh Bike Share

Heinz Systems Synthesis Team

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1. Executive Summary



1.1 Executive Summary

Overview

This report disseminates the results of a suitability study of a bike share system for Pittsburgh. Bike share programs offer an opportunity to be at the cutting edge of transportation planning. In 2001, five bike share systems were in place worldwide. This year, 375 systems are operational in 33 countries, constituting a fleet of 236,000 bikes. This growth in bike share programs, taken with the proliferation of bike infrastructure, indicates that bicycle-as-transportation is a legitimate mode of transportation today and in the future. This is true of the United States, as it is worldwide.

Similarly, Pittsburgh is on the rise. In addition to sitting in the top tier of “America’s Most Livable Cities”, Pittsburgh, for the first time in decades, is getting younger. This report seeks to answer the question: Is bike sharing a good fit for Pittsburgh? To best answer this, the following information was studied:

- Research on bike share system management structure and implementation;
- Results of other bike share programs around the world, and;
- Relevant characteristics about Pittsburgh such as employment, residential and transportation trends.

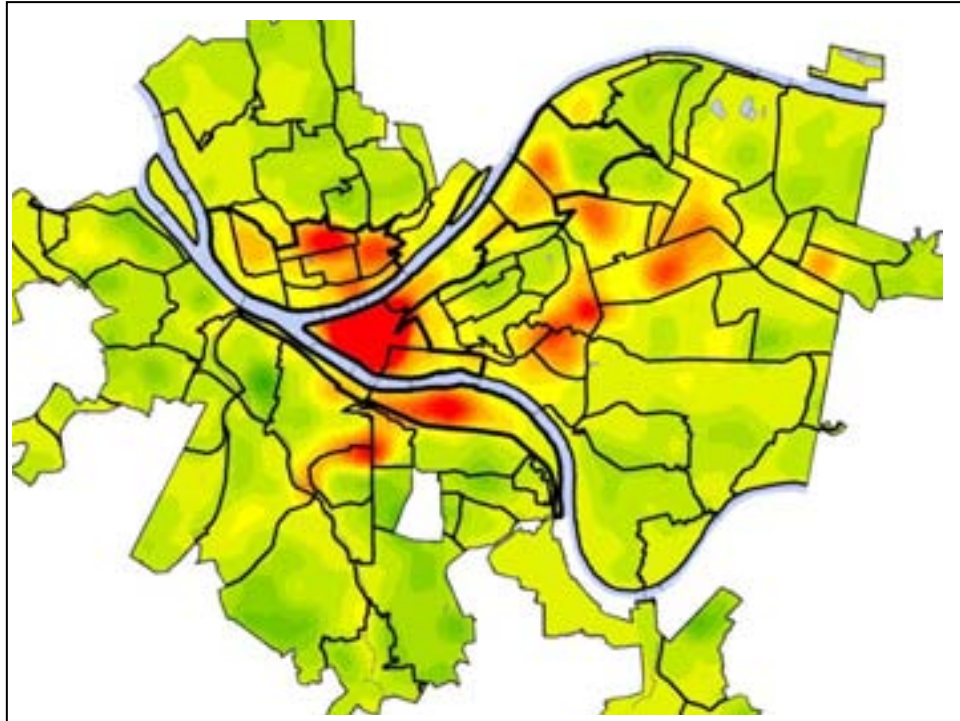
Feasibility Analysis

The feasibility analysis reports the results of a study of Pittsburgh and bike-sharing systems to determine if and how a bike share program will work in Pittsburgh. Studying Pittsburgh, this report analyzed demographic, transportation, employment, housing, and recreation data, in addition to conducting a survey of potential users. To understand bike sharing, outcomes of existing bike share programs were analyzed, current research of trends was consulted, and individuals involved in other programs were interviewed.

Analysis of Pittsburgh demographics and survey responses indicated that Pittsburgh contains a strong market for bike sharing. Sixty percent of respondents answered “yes” or “probably” to the question asking if they would use a bike share program.

Furthermore, analysis of transportation habits in Pittsburgh indicated a potential for a level of bike share usage in line with other programs in comparable cities. The table below indicates the predicted levels of daily bike share usage in Pittsburgh. Detailed information concerning this analysis can be found in the “Demand Analysis” sections below.

	Total Trips Estimated	Bike Estimate	Station Estimate
Low	1,380	180	15
Medium	3,102	404	34
High	3,851	502	42



An analysis of points within Pittsburgh rated each section of the city on 11 factors that positively influence bike share usage. The map below indicates the areas in the city that will be most likely to host successful bike share stations, where red areas are best suited for bike-share stations.

To determine if such a system can be financially sustainable, a revenue prediction model was developed that included results of the demand analysis. The revenue prediction model projects that in one of the three likely demand scenarios membership and use fee revenues will exceed annual operating costs.

A cost benefit analysis also supported the proposition that bike sharing will benefit Pittsburgh. The table below outlines results of the cost-benefit analysis for a bike share system in Pittsburgh over five years.

	5 Year Total	Year 1	Year 2	Year 3	Year 4	Year 5
Total Costs	\$(37,675,520)	\$(8,801,246)	\$(6,699,173)	\$(7,034,132)	\$(7,385,838)	\$(7,755,130)
Total Benefits	\$49,323,556	\$8,925,063	\$9,371,942	\$9,841,200	\$10,333,958	\$10,851,393
Net Present Value	\$11,648,036	\$123,818	\$2,672,769	\$2,807,068	\$2,948,119	\$3,096,263

Management and Funding Structure Analysis

This report also outlines options to be considered when determining the management structure and funding sources for a Pittsburgh bike share program. Specifically, the range of involvement of local government entities was analyzed through research and by consulting local stakeholders to determine the benefits and shortcomings of each potential management structure option. This report will recommend that decision makers examine the rating criteria and determine which considerations are most important before moving forward with any of the options.

The management structure recommendations also outline potential liability considerations. The benefits for and arguments against each option are given.

The final section of this report groups potential funding sources into public and private options. Public sources are divided into federal and state level sources. Private funding options include both foundations and private-sector sources that can be targeted. The report explains that other bike share programs have utilized each of these options, with most programs deploying a mix of sources. All funding options were analyzed using criteria to determine the history of funding similar projects, amenability to the goals of bike-share programs, and feasibility.

Conclusion

The report concludes that Pittsburgh meets most of the general criteria that have been indicative of the success of bike share systems in other cities. The populations most likely to take part in bike sharing are in place and growing, transportation habits of people in Pittsburgh align with those of people in cities with successful programs, and the area being considered is an appropriate starting point. Demand and cost estimates predict that, upon the acquisition of capital investment, a Pittsburgh bike-sharing system can be financially sustainable, as revenues from user fees will exceed annual operating costs under some, but not all, likely scenarios.

Necessary choices that decision makers will need to make will include the management structure of the program, the source of start-up capital and the strategies to gain non-user generated revenues, such as advertisers or sponsors.

2. Pittsburgh Demand for a Bike Share



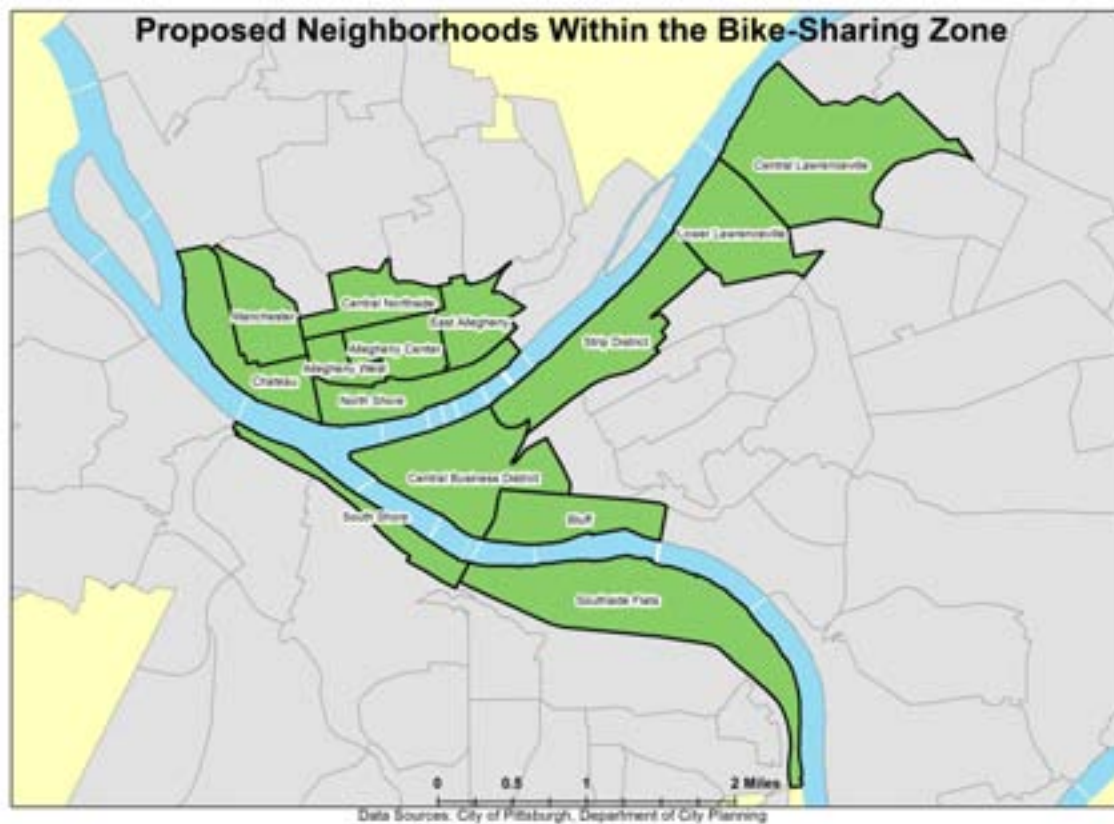
2.1 Indicators

Overview

The market analysis looks at the current bicycling trends in Pittsburgh as well as the demographics of the city and the target area. Using Seattle's study as a benchmark, we looked at similar indicators of potential demand, which included residents, jobs, cyclists, and students.

Target Area

The original target area included Downtown, the Strip District, the North Shore and the South Side. Based on a location analysis that will be discussed in further detail in the Site Suitability Analysis section of this report, the size of the target area was enlarged to include more of the North Side as well as Lawrenceville.



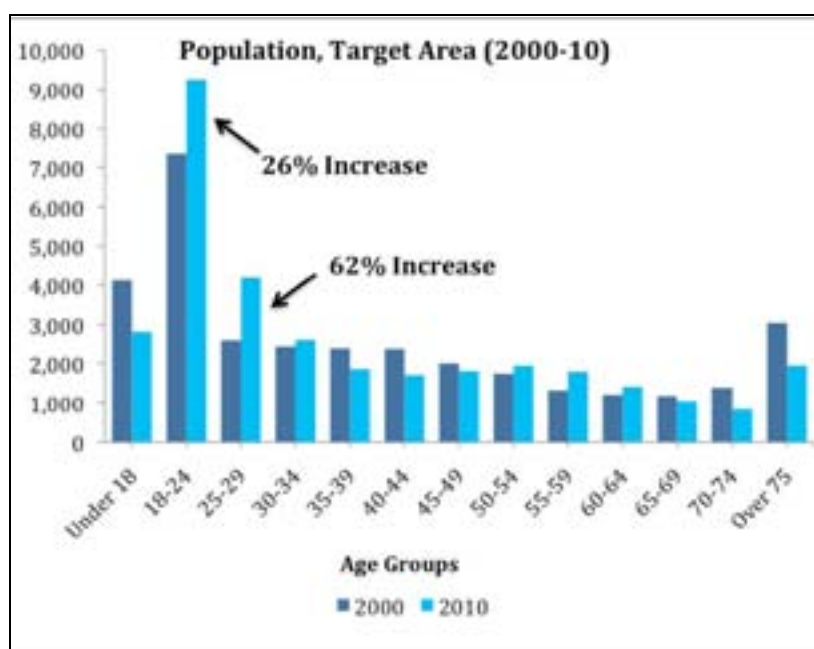
Residents

The population of Pittsburgh has steadily declined from a high of 680,000 in 1950, due to a multitude of factors that includes both the collapse of the steel industry and the migration of city residents to the suburbs.

The 2010 census placed the population at 305,704, making Pittsburgh the 59th largest city in the United States.¹ While many cities retain suburban populations in their population counts, Pittsburgh does not, and at only 55.6 square miles, Pittsburgh is the 6th smallest major city in the country.²

Population, City of Pittsburgh (2000-10)				
Age	Population		Change	
	2000	2010	Number	Percent
0-17	66,508	49,799	-16,709	-25.1%
18-24	49,461	57,745	8,284	16.7%
25-44	95,730	83,730	-12,000	-12.5%
45-64	67,830	72,279	4,449	6.6%
65+	55,034	42,151	-12,883	-23.4%
Total	334,563	305,704	-28,859	-8.6%
Source: U.S. Census 2000 and 2010				

Within the city, some neighborhoods have grown substantially while others have significantly declined in population. In the past ten years, the overall population in the target neighborhoods grew, with significant gains in the 18-34 age group³, a group that has high potential for bike share use. Studies conducted in France, Denmark and Norway indicate that potential bike share customers are likely to be younger individuals in their twenties and thirties.⁴



¹ "2010 Census Interactive Population Search." *2010 Census*. N.p., n.d. Web. 9 Dec. 2011. <<http://2010.census.gov/2010census/popmap/ipmtxt.php?fl=42:4261000>>.

² Miller, Harold D.. "Regional Insights: Pittsburgh's a national player in jobs per square mile but needs more population." *Post-Gazette.com*. N.p., n.d. Web. 9 Dec. 2011. <<http://www.post-gazette.com/pg/08216/901307-432.stm>>.

³ "2010 Census." *2010 Census*. N.p., n.d. Web. 9 Dec. 2011. <<http://2010.census.gov/2010census/>>.

⁴ "2008 Bike Share Program Report." *Pioneer Valley Planning Commission* Oct. 2008:<http://www.pvpc.org>. Web. 13 Dec. 2011.

Workers

Commuting workers are an important component of bike share users. While much of the population has left the city limits, the jobs have not. Pittsburgh has the 6th highest worker density in the country, and ranks 25th in the nation in total employment with a total of over 300,000 city jobs.⁵ City residents fill only a third of those jobs, with almost 200,000 people commuting to Pittsburgh to work each day.⁶

The Pittsburgh Downtown Partnership's Work Force Study (see the chart to the right) was used to gain insight into the number of employees within the target area. Although their area scope was more limited than the projected bike share zone, it can be stated that the majority of the jobs within the target area are included in the 126,370 figure.⁷

Students

The post-secondary school student population is important to view as a separate component from the general population when determining demand for a bike share. According to the Seattle study, university students fit the profile of bike share users, who are most likely to be 18-34 years in age with a high level of education.⁸ Since students are likely to be without personal vehicles and will likely appreciate the cost advantages of a bike share program over a personal bike that has the potential to be damaged or stolen, a strong student presence could be valuable to the success of a bike share program.

The student population in the City of Pittsburgh increased by 21% (or 14,839 people) from 1996 to 2009. This brings the total number of students in Pittsburgh to 82,293.⁹ Within the target area, the student population increased by 20% (or by 6,826 students) to over 40,000 students at the schools listed below.¹⁰

2010 Downtown Employee Count

Number of Employees by Industry Class & Census Tract

Source: Work Force Study

	Uptown	Golden Triangle	Strip District	South Shore	North Shore	Total
Total	6,374	97,503	12,585	4,099	5,809	126,370



Source: Pittsburgh Downtown Partnership

⁵ Miller, Harold D.. "Regional Insights: Pittsburgh's a national player in jobs per square mile but needs more population." *Post-Gazette.com*. N.p., n.d. Web. 9 Dec. 2011. <<http://www.post-gazette.com/pg/08216/901307-432.stm>>.

⁶ Miller, Harold D.. "Regional Insights: Pittsburgh's a national player in jobs per square mile but needs more population." *Post-Gazette.com*. N.p., n.d. Web. 9 Dec. 2011. <<http://www.post-gazette.com/pg/08216/901307-432.stm>>.

⁷ "Downtown Pittsburgh: Living, Working & Commuting." *Pittsburgh Downtown Partnership*. p.7. 2010.

⁸ "Seattle Bike Share Feasibility Study." *University of Washington*. Web. 13 Dec. 2011. <www.seattlebikeshare.org/Seattle_Bike-Share_files/SeattleBikeShareChapters1-4.pdf>.

⁹ "IPEDS Data Center." *National Center for Education Statistics (NCES) Home Page, a part of the U.S. Department of Education*. N.p., n.d. Web. 10 Dec. 2011. <<http://nces.ed.gov/ipeds/datacenter>>

¹⁰ "IPEDS Data Center." *National Center for Education Statistics (NCES) Home Page, a part of the U.S. Department of Education*. N.p., n.d. Web. 10 Dec. 2011. <<http://nces.ed.gov/ipeds/datacenter>>

Name	1996	2009	Growth Trend
Art Institute of Pittsburgh	2,447	2,765	13%
Community College of Allegheny County	16,816	20,520	22%
Duquesne University	9,362	10,294	10%
Point Park University	2,297	3,985	73%
Le Cordon Bleu Institute of Culinary Arts	664	835	26%
Total	33,582	40,408	20%

Cyclists & Walkers

Despite the challenging topography of Pittsburgh, cycling and bike commuting continues to grow. Bike commuting grew 269% in the 10-year span from 2000 to 2010, placing Pittsburgh at 13th in the nation for bike commuting.¹¹

Pittsburgh ranks very highly in non-driving commutes and over 30% of city residents commute to their jobs without using a car. The city is 4th in the nation for commutes that involve biking and walking and 7th in the nation for commutes that involve bikes, walking and public transit.¹² For a simple breakdown of single-method commuting, the graph below shows primary modes of transportation by percentages of the population.

The Pittsburgh Downtown Partnership's Resident Survey reported that 91% of residents walk and 27% of residents bike (note: their primary means of transportation was not indicated.)¹³ Results from Denver indicate that the percentage of nearby residents that walk to work has been one of the most important factors in determining a bike station's success.¹⁴

2010 Commuting Data largest 60 cities							
Rank	City	State	Bike	Walk	Drove alone	Public transit (no taxi)	No car available (car-free)
	average of the top 60		1.10	3.88	70.44	8.78	7.28
	median of the top 60		0.7	2.5	74.7	4.3	4.7
1	Portland	OR	6	5.3	58.8	12.1	7
2	Seattle	WA	3.6	8.6	52.3	18.2	8.6
3	Minneapolis	MN	3.5	6.7	61.2	15.2	8.2
4	San Francisco	CA	3.5	9.4	36	34.1	21.6
5	Washington	DC	3.1	11.8	34.8	38.3	27.1
6	Tucson	AZ	3	3.1	74.7	2.8	4.7
7	Sacramento	CA	2.5	2.9	72.6	3.3	3.8
8	Denver	CO	2.2	3.9	70.3	6.2	4.7
9	Tampa	FL	1.9	2.2	75.6	3.6	4.8
10	Oakland	CA	1.8	3.6	57	17.2	8.4
11	Philadelphia	PA	1.8	8.3	49.9	27.2	19.1
12	New Orleans	LA	1.8	5.4	69.2	7.3	8.6
13	Pittsburgh	PA	1.6	10.8	53.8	18	11.6
14	Honolulu	HI	1.6	9.2	56.7	13.2	7.4
15	Boston	MA	1.4	15.8	38.3	32.8	24.7
16	Albuquerque	NM	1.4	1.7	81.1	2.4	2.4
17	Chicago	IL	1.3	6.5	50.2	26.5	15.3

Source: Bike Pittsburgh, 2010 ACS Survey

¹¹ "Can you jump 269%? The 'Burgh did." *Post-Gazette Blogs*. N.p., n.d. Web. 13 Dec. 2011. <<http://blogs.sites.post-gazette.com/index.php/news/city-walkabout/29979-can-you-jump-269-the-burgh-did?cmpid=bcpanel9>>.

¹² "Can you jump 269%? The 'Burgh did." *Post-Gazette Blogs*. N.p., n.d. Web. 13 Dec. 2011. <<http://blogs.sites.post-gazette.com/index.php/news/city-walkabout/29979-can-you-jump-269-the-burgh-did?cmpid=bcpanel9>>.

¹³ "PDP Study Profiles Downtown Pittsburgh Residents, Commuters and Workers | Pittsburgh Downtown Partnership." *Downtown Pittsburgh | The Pittsburgh Downtown Partnership*. N.p., n.d. Web. 10 Dec. 2011. <<http://www.downtownpittsburgh.com/news/pdp-study-profiles-downtown-pittsburgh-residents-commuters-and-workers>>.

¹⁴ Voeller, Gabrielle. "Optimizing the Locations of Bike-Sharing Stations in Denver, Colorado: A Suitability Analysis." 2011.

2.2 Survey Findings

Overview

In the demographic analysis section, this report demonstrates that there is potential for a bike share program in Pittsburgh. However, Pittsburgh is introducing bike share for the first time. Therefore, it is important to explore and incorporate the opinions and attitudes of the population. Incorporating their feedback would help ensure the success and sustainability of a bike share program.

Survey Methodology

A survey was created (see Appendix I and Appendix II) using the best practices of other bike share surveys from other cities, such as Washington, DC and Hamilton, Ontario. The survey for Pittsburgh was conducted through the use of an online form and through one-on-one interviews on the street in the target neighborhoods. Through the course of the survey collection phase, there were multiple attempts to reach out to key bike share stakeholders in an attempt to make the sample population more representative of Pittsburgh as a whole. These populations included residents, community groups, schools, and businesses.

In total, 291 responses were received. This included 225 online surveys and 66 in-person surveys. Although the number of responses was sufficient for statistical analysis, there is some bias. This is because:

- Surveys were distributed through social media such as Facebook and Twitter. These methods will only reach people who use these sources of social media regularly and may or may not be more receptive to bike sharing.
- People who are interested in bike sharing are more likely to take the survey.

Survey Summary

In the process of researching the bike share use potential, people voiced strong interests not only in using but also in supporting a bike share program in Pittsburgh.

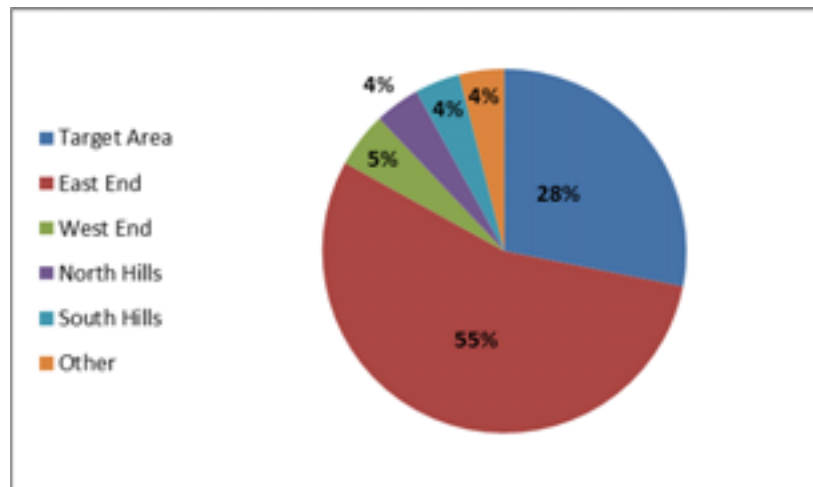
It was found that the results are quite positive for implementing a bike share program in Pittsburgh. Besides the use potential, the user patterns were also explored such as bike share use purpose and transportation modes.

Survey Respondents

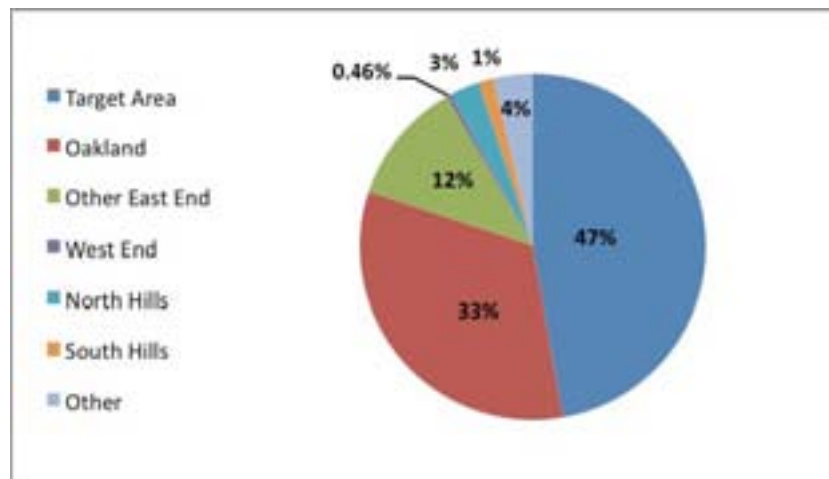
From the survey analysis, a relatively significant proportion of the respondents are from the target area. 28% live in the target area and 47% work in the target area.

The respondent profile represents key demographic groups that would need to use the bike share program in order to ensure its success. Thus, their feedback is critical for the planning of a bike share system.

Where respondents live:



Where respondents work:

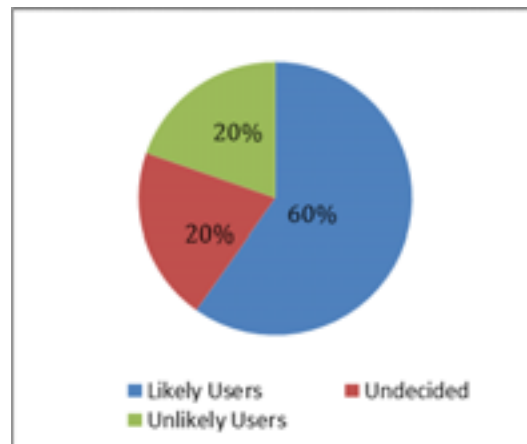


Use potential

The survey indicates that the use potential for a bike share program is very high. Nearly 60% of the respondents answered that they would use or would be likely to use a bike share program. 20% of the respondents were neutral to a bike share and the remaining respondents unlikely to use a bike share.

Besides the use potential, respondents showed great interest in bike shares as well. 129 (63%) out of 199 who filled out the survey would like to receive future updates about a bike share.

Use Likelihood:



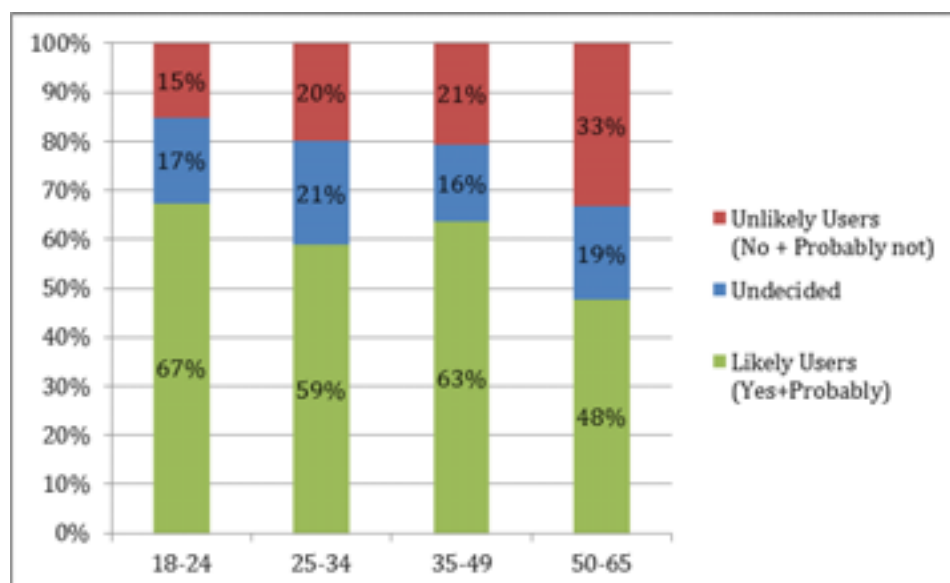
Use Potential by Age and Gender

As the use potential is high, more detailed questions were raised, including: Which demographic groups are the most likely bike share users? Who can be motivated to use bike share? And what is the gap between different user groups? This project analyzed the usage trend by subgroups to provide more in-depth insights into the potential users of a bike share program.

The project ruled out two age groups. This included the age groups under 18 and over 65. First, the numbers were not statistically significant because the survey received too few responses from these age groups. Secondly, people under 18 are not included due to liability concerns of minors.

Different age groups have similar bike share use potential. On average, 59% of users indicated that they would be likely to use a bike share program. Despite the general similarity in likelihood across age groups, there are slight fluctuations. Young people, from 18 to 24, are most receptive to a bike share program.

Use potential by age group:

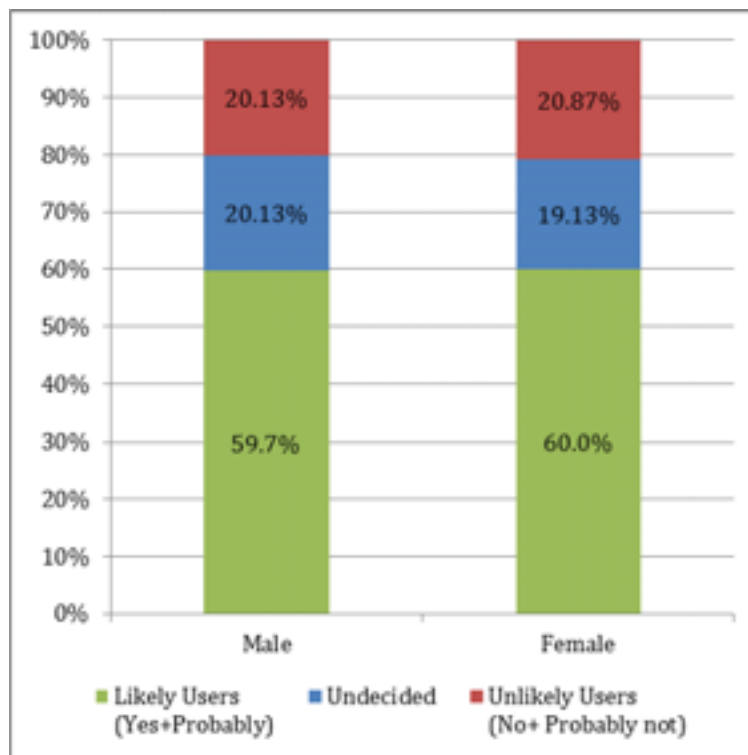


Respondents by age:

Age	Total Count	Potential Users			Undecided	Non potential user		
		Yes	Probably	Total	Not sure	Probably not	No	Total
under 18	1	0	0	0	0	0	1	1
18-24	46	16	15	31	8	6	1	7
25-34	141	38	45	83	30	20	8	28
35-49	63	18	22	40	10	6	7	13
50-65	21	3	7	10	4	5	2	7
over 65	2	0	0	0	1	0	1	1
Total	274	75	89	164	53	37	20	57

In terms of gender, the survey received more responses from men (159) than women (115). However, in the responses, men and women have the same use potential, which is different from the majority of other cities' actual experience.

Use potential by gender:

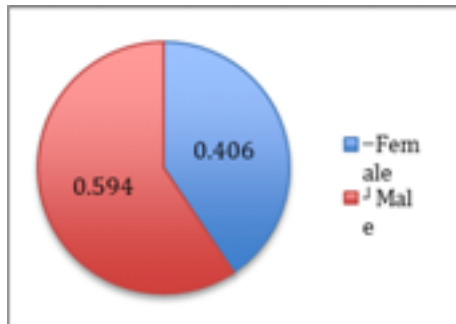


Respondents by gender:

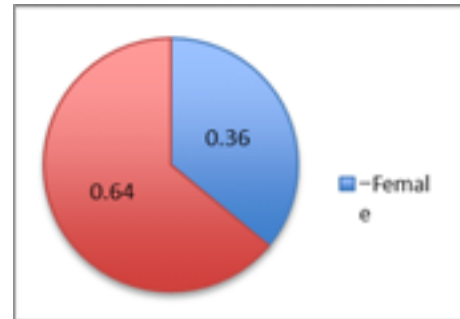
Gender	Total Count	Likely Users			Undecided	Unlikely Users		
		Yes	Probably	Total	Not sure	Probably not	No	Total
Male	159	45	50	95	32	22	10	32
Female	115	30	39	69	22	14	10	24
Total	274	75	89	164	54	36	20	56

In Lyon and Paris, there are more male bike share users than female users. For example, the Vélo'v bike share program has 59.4% male users and the Vélib bike share program has 64% male users. In Barcelona, there is an even share among male and female users.

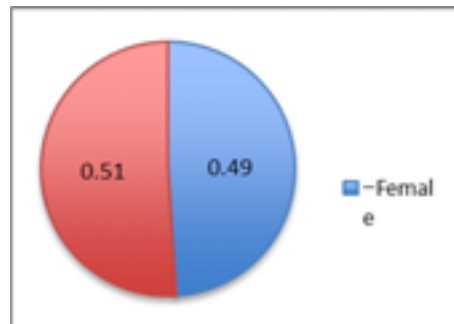
Lyon: Vélo'v



Paris: Vélib'



Barcelona: Bicing

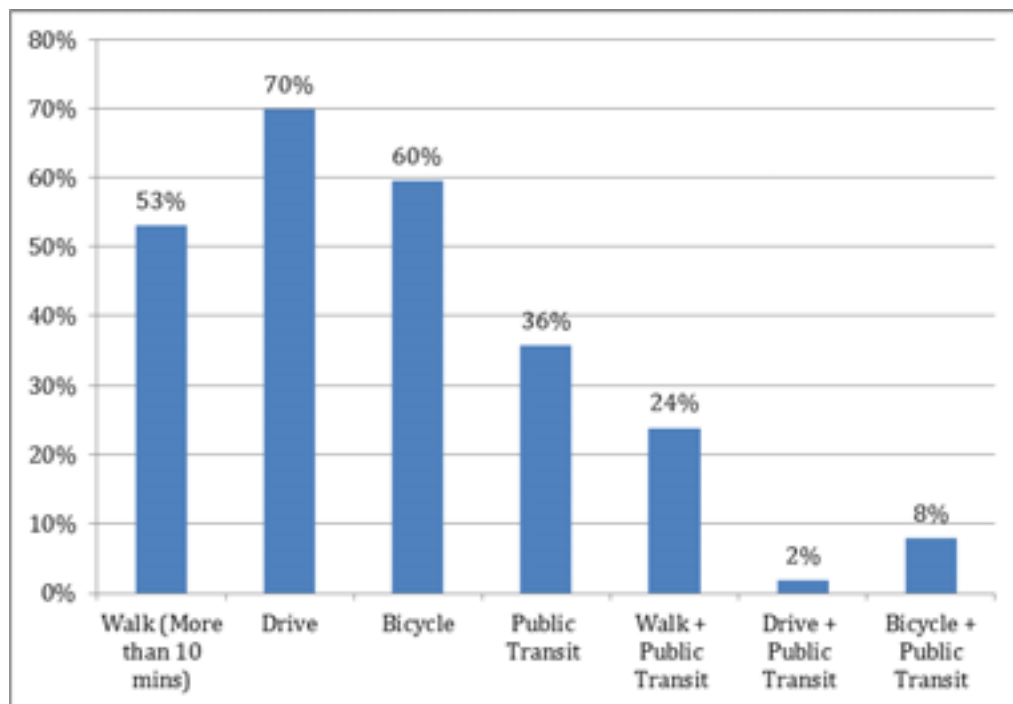


Transportation Mode

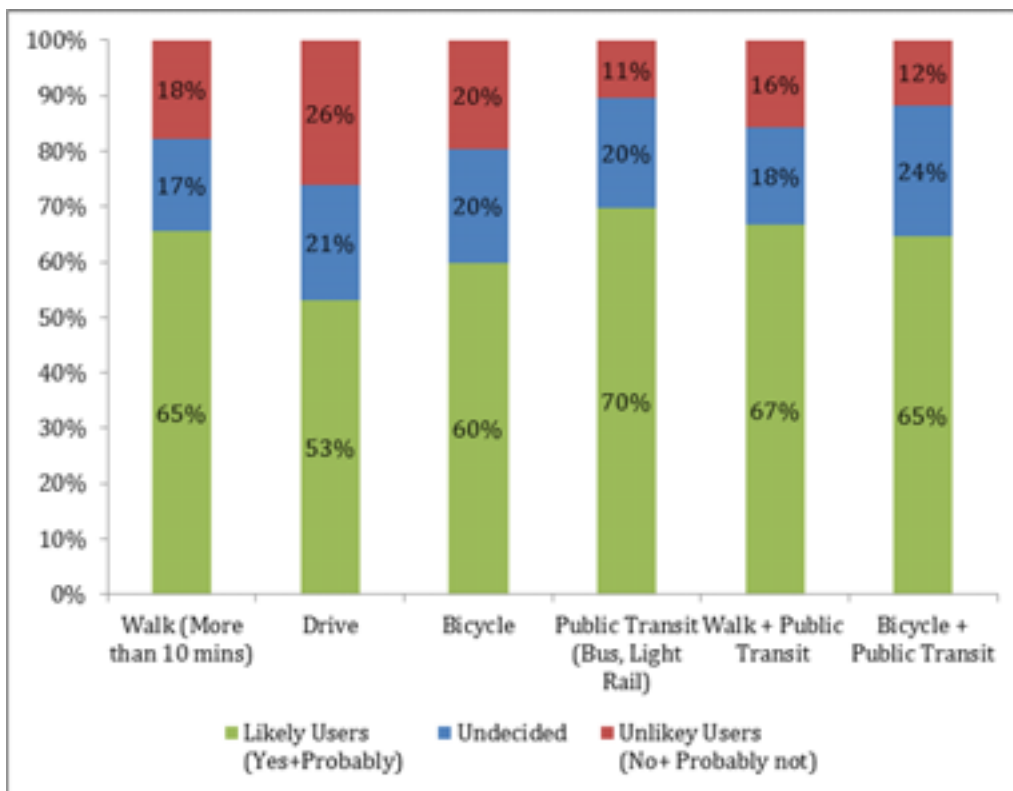
Respondents were asked to identify their current mode of transportation. The top three modes identified were driving (70%), biking (60%), and walking (53%).

The use potential of a bike share program for all respondents was found to be similar regardless of the current mode of transportation used. However, as expected, it should be noted that respondents who drive, 26% of respondents, were the most likely to say that they were unlikely to use a bike share system.

Transportation mode:



Potential bike share users in each transportation mode:



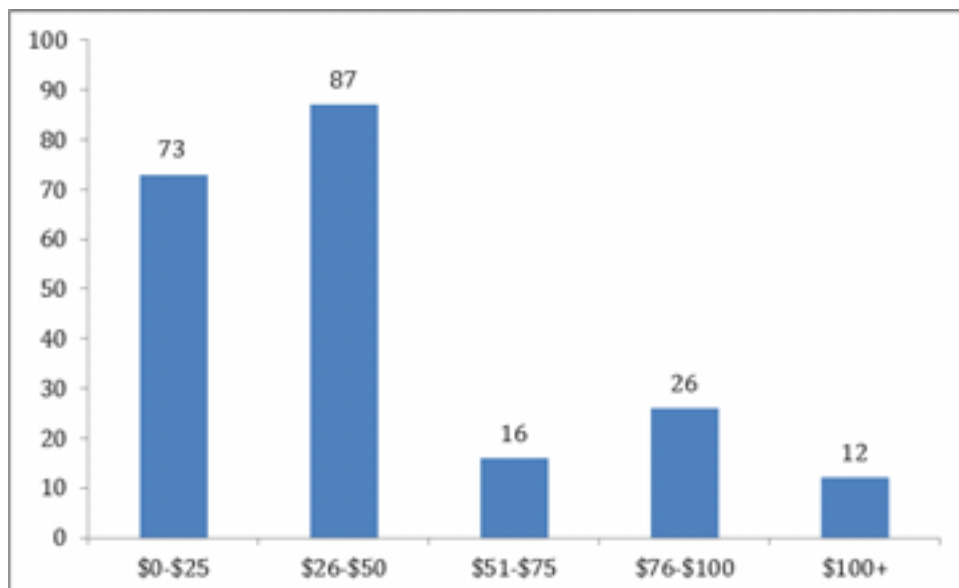
Respondents by transportation mode:

Transportation Mode	Total Count	Likely Users		Undecided	Unlikely Users	
		Yes	Probably		Probably Not	No
Walk (More than 10 minutes)	113	36	38	19	15	5
Drive	149	28	51	31	27	12
Bicycle	127	29	47	26	20	5
Public Transit	76	22	31	15	7	1
Walk + Public Transit	51	19	15	9	8	0
Drive + Public Transit	4	0	2	2	0	0
Bicycle + Public Transit	17	4	7	4	2	0

Annual Fee

A question related to the annual fee that people would be willing to pay for a bike share program was also included in the survey. Respondents were initially given no information about the cost of other programs. The distribution of responses centered on the median value of \$50, but was slightly skewed towards lower values.

Willingness to Pay:



Median Annual Fee:

Amount	# people
\$10 and under	29
\$15	4
\$20	20
\$25	20
\$30	21
\$40	13
\$50	53
\$60	4
\$70	3
\$75	8
\$80	1
\$90	2
\$100	23
\$120	2
\$150	5
\$180	1
\$250	2
\$300	1
\$365	1

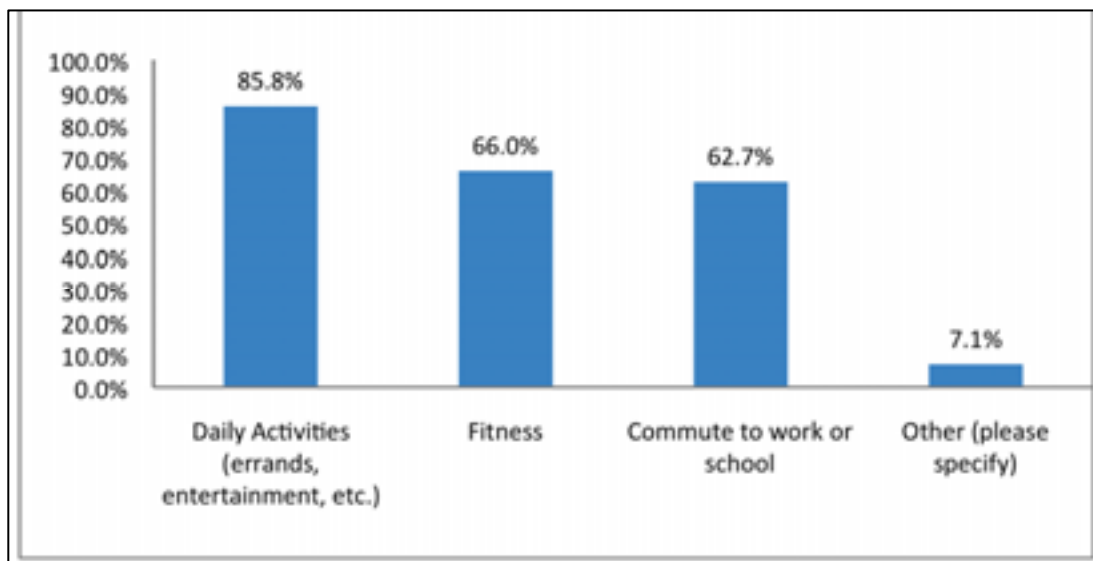
Once respondents were given more fee information from other bike share programs, most adjusted their answers. . Specifically, the survey told respondents that the bike share program of Washington, DC charges users an annual fee of \$75 per year, leading to:

- 63 people (average \$34) willing to pay more
- 26 people (average \$123) wanted to pay less
- 111 people (average \$44) didn't change their original amounts.

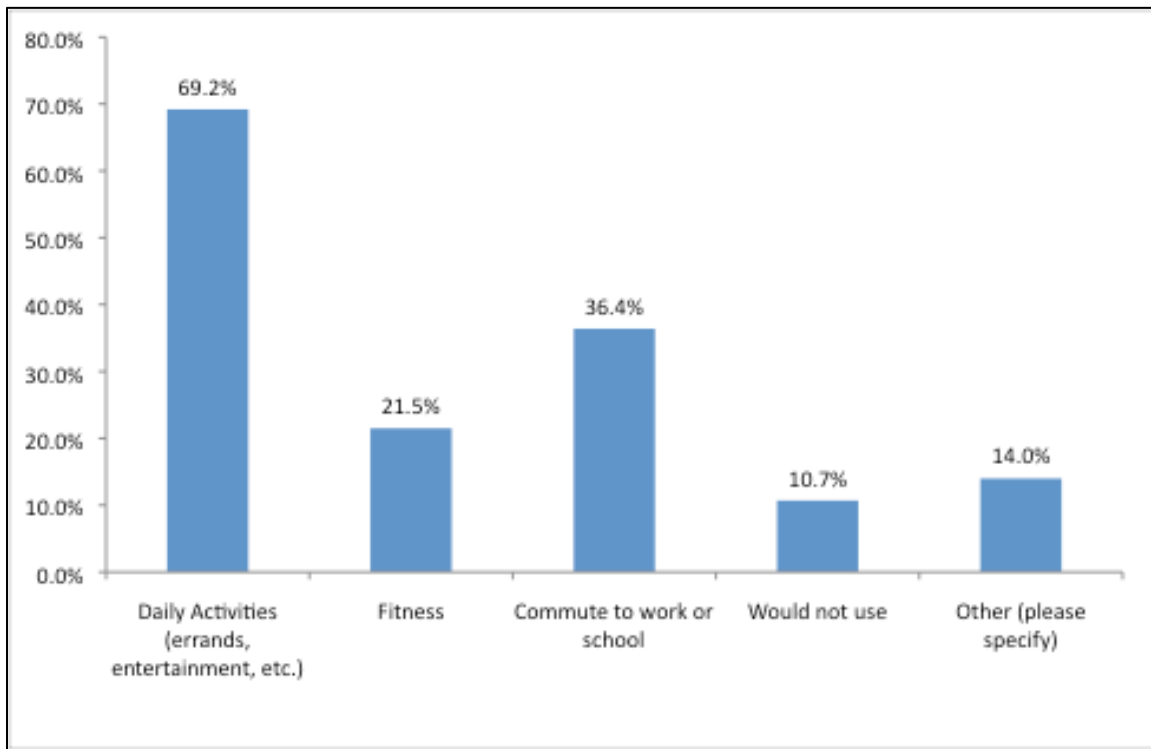
Bike Use Purpose

The survey asked cyclists about their current bike use for and potential users about which purposes they were most likely to use a bike share program. The results were the same, which indicates public interest in having bicycles available for personal use. Survey responses of potential users indicated much less interest for using bicycles for fitness or to commute to work or school.

Purpose of bike use from cyclists:



Purpose of bike share use from potential users:



Barriers and Important Features

The bike share survey identified the top ten barriers of cycling in Pittsburgh. The main concerns are lack of on-road cycling facilities, not feeling comfortable cycling in the winter, and terrain. In 2009, the city had about 14.5 miles of bike lanes or shared lanes. Pittsburgh officials had planned to add bike lanes or shared lane markings to as many as 10 streets by February 2010.¹⁵ The responses indicate that there are still concerns about the lack of bike lanes needed to facilitate a successful bike share program.

This question also allowed users to identify other concerns outside of those listed. The most common answers reflected the unfriendly driving culture, the lack of traffic law enforcement, and clothing concerns.

¹⁵Pittsburgh's bike lanes peddle sharing the road. (n.d.). *TribLive*.
<http://www.pittsburghlive.com/x/pittsburghtrib>. Retrieved August 8, 2009.

Top 10 Barriers to Cycling in Pittsburgh:

Rank	Barriers	Response Count	%
1	Lack of on-road cycling facilities (safe bike lanes, signed bike routes, adequate bike parking, etc.)	133	68%
2	Not comfortable cycling in the winter	119	61%
3	Terrain	102	52%
4	Other weather concerns (such as rain, wind, heat, etc.)	82	42%
5	Not comfortable riding with traffic on roads	81	41%
6	Transporting large items or passengers	63	32%
7	Trip distance is too long/takes too much time to travel by bicycle	39	20%
8	Other (steep hills, lack of law enforcement for cars, driving culture, clothes issues , etc.)	34	17%
9	Lack of off-road trails	31	16%
9	Concern about bicycle theft and security	31	16%

The most important bike share features were also quantified. 72% of respondents identified locations of bike share stations as being a top need. The more dense location is, the more flexible, in terms of trips, a bike share program can provide users. However, it should be noted that there is a trade-off between number of location and costs.

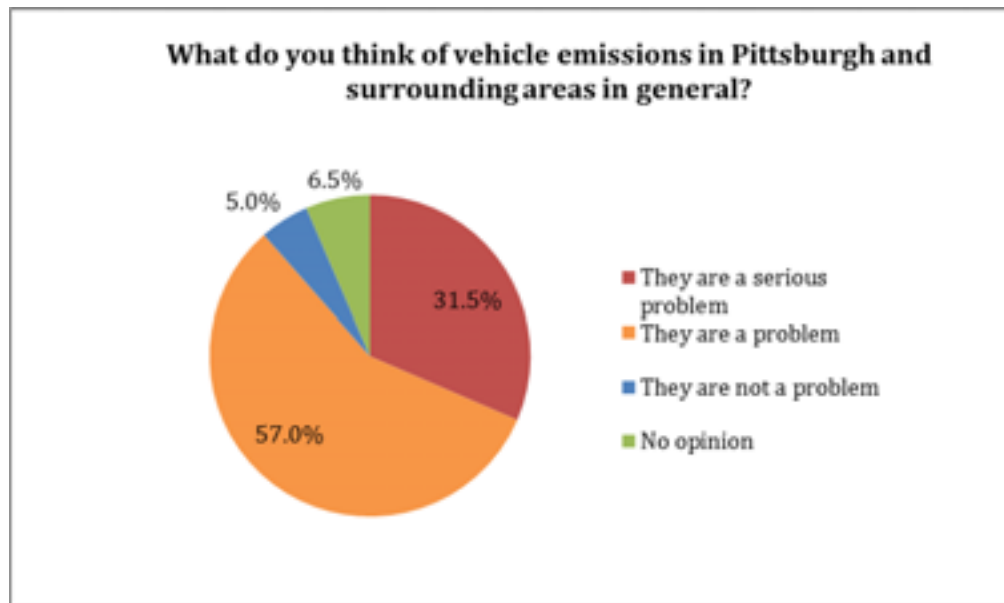
Top 8 Important Features of Bike Share in Pittsburgh:

Rank	Features	Response Count	%
1	Numerous locations around town to pick-up and drop-off bicycles	144	72%
2	Low cost to rent a bicycle	105	53%
3	Convenient transaction system	73	37%
4	Bicycles available at transit stations and bus stops	72	36%
5	Bicycle lending near place of work	69	35%
6	Incentives for use (e.g. discounts at local businesses, prize draws for cycling accessories, free cycling training, etc.)	25	13%
7	High quality state-of-the-art bicycles	22	11%
8	Other (adjustable helmet available, etc.)	13	7%

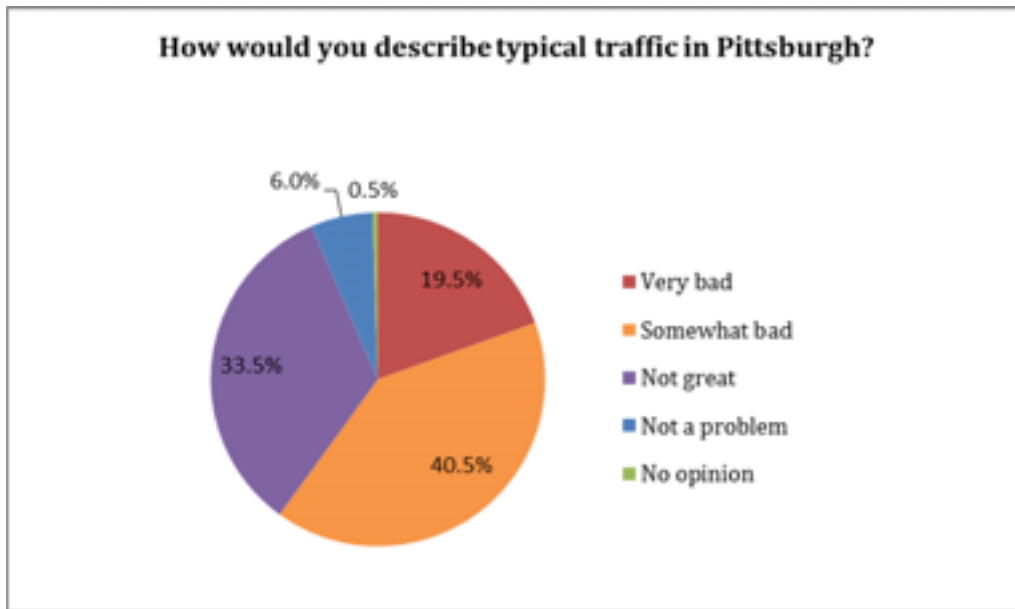
Support of a Bike Share

The Southwestern Pennsylvania's Transportation Management Association (TMA) works to address the challenges of the region. This includes: reducing traffic congestion, improving air quality, and making transportation systems more responsive and efficient.¹⁶ Therefore, attitudes of respondents enhance the necessity of implementing bike share programs in Pittsburgh as bike share programs help alleviate these problems based on previous experience.

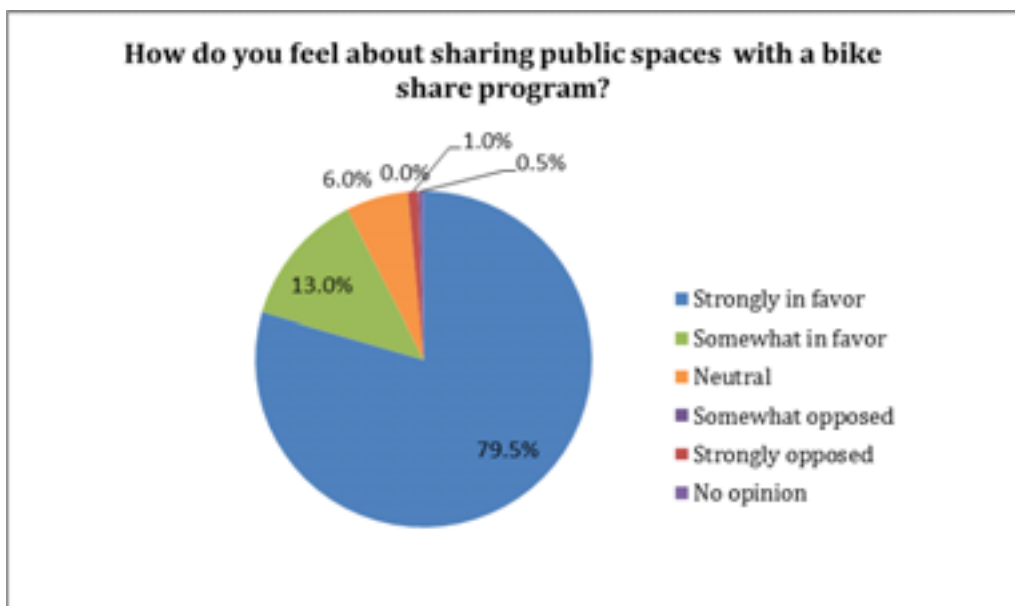
According to the survey results, about 60% of respondents believe that traffic is bad in Pittsburgh, 57% of respondents think that greenhouse gas emissions are a problem, and 31% of respondents feel that vehicle emissions are a significant issue.



¹⁶ Getting To & Around Town. (n.d.). *The Pittsburgh Downtown Partnership*. Retrieved December 12, 2011, from <http://www.downtownpittsburgh.com/getting-around/getting-to-downtown/Alternative-transportation>.



Additionally, bike share programs received resounding support from those who will not use a bike share program. Bike share programs typically utilize sidewalk space for bike stations and will result in more bikes on the road. About 80% of respondents are in favor of sharing public spaces such as roads and sidewalks with bikes and bike stations while 13% of respondents feel somewhat in favor. Thus, over 93% of total respondents favor and support a bike share program in Pittsburgh.



3. Implementation



3.1 Site Suitability and Location Analysis

Overview

The intent of this section is build off of the research provided in the market analysis section in order to provide a geographic assessment of the viability of bike sharing in the City of Pittsburgh. This assessment was conducted using a number of factors that ultimately represent, in some way, demand for a bike share program. The analysis focuses on the initially proposed bike share zone of Downtown Pittsburgh, the North Shore, the South Shore/South Side, and the Strip District. However, all of the City of Pittsburgh was mapped using the identified factors and recommendations will be made to expand the initial target bike share zone.

Factors Influencing Demand for Bike Share Systems

Transportation systems are most effective when they offer users the means to get from one place to another quickly and efficiently. A bike share system must be large enough to capture both trip origin and trip destination points within its service area.¹⁷ If that is not possible, a bike share system needs, at the very least, decent connections to other modes of transportation to allow users the ability to complete their trips.

Many other cities that have implemented bike share programs have used population density and employment density as criteria for mapping where bike share systems would be located. The Velib program in Paris used population density and employment density as its criteria, as well as information about trips to retail locations and major attractions.¹⁸

Transportation infrastructure has also been identified by a number of cities as an important factor in defining the success of bike share programs. Usage patterns of Velib stations are closely paired with the Paris Metro system.¹⁹ Additionally, the presence of cycling infrastructure has been critical to the success of European bike share systems. Many cities that have implemented bike share systems have rapidly expanded their bike infrastructure to provide a safer riding experience.²⁰ In the North American context, transportation connectivity factors including the number of nearby bus stops, the mileage of nearby designated bike routes, and the presence of other nearby B-Cycle stations were found to be statistically significant in differentiating stations with high usage from stations with low usage.²¹

The analysis done on behalf of the City of Philadelphia has been the most comprehensive analysis of predictive factors for bike share systems.²² The analysis identified ten factors tied to trip origins, trip attractions, and network/facility factors. The methodology used in this report is largely built off of the Philadelphia analysis.

¹⁷ New York City, Department of City Planning. *Bike-Share Opportunities in New York City*. Spring 2009.

¹⁸ JzTI, Bonnette Consulting, and the Delaware Valley Regional Planning Commission. *Philadelphia Bikeshare Concept Study*. February 2010.

¹⁹ Nair, Rahul, et. al. "Large-Scale Vehicle Sharing Systems: Analysis of Velib'." *International Journal of Sustainable Transportation*. 2011.

²⁰ JzTI, Bonnette Consulting, and the Delaware Valley Regional Planning Commission. *Philadelphia Bikeshare Concept Study*. February 2010.

²¹ Voeller, Gabrielle. "Optimizing the Locations of Bike-Sharing Stations in Denver, Colorado: A Suitability Analysis." 2011.

²² Krykewycz, Gregory R., et al. "Defining a primary market and estimating demand for major bicycle sharing program in Philadelphia, Pennsylvania." *Transportation Research Record: Journal of the Transportation Research Board* 2143 (2011): 117-124.

A number of other factors may influence the success of bike sharing in Pittsburgh. Most cities that have implemented bike share systems are much flatter than Pittsburgh. Slopes at a grade of 4% to 8% are considered a major barrier for bicycle riders.²³ Pittsburgh has no shortage of slopes at those grades or higher. A factor analyzing topography will be included in the analysis to measure the impact of this issue. The rivers of Pittsburgh may also serve as a geographic barrier. Bicycles would be required to use the same bridges as automobiles and pedestrians to cross the rivers. If the current bridge network does not have the capacity to accommodate another mode of transportation, bike share flows may stay contained on a particular side of the river.

Factors Analyzed and Methodology for Bike Share Location Analysis

The factors that were used to determine the best locations for bike sharing in Pittsburgh borrowed heavily from the analysis done on behalf of the City of Philadelphia. This report mapped 11 factors to generate heat maps that identify the best locations for bike sharing in Pittsburgh. Those factors are presented in the table on the following page.

Unique to this analysis was the inclusion of the “Elevation Change from Downtown” factor. Conceptually, Downtown Pittsburgh will be the center of a Pittsburgh bike share system. This factor attempts to calculate the potential climb for people to bike from Downtown to another neighborhood. Heat maps of each individual factor are included in Appendix III.

The methodology steps for analyzing the factors were as follows:

1. 11 factors were identified and the necessary GIS datasets were located and modified to provide a suitable analysis.
2. Each census block in the City of Pittsburgh was assessed a value for each one of these factors based on U.S. Census data for population factors or proximity in the case of the rest of the factors.
3. Each of the 11 factors was normalized to a scale with a mean of zero and a standard deviation of one by using the following equation:

$$\text{Normalized Score for Factor} = \frac{\text{Factor Score for Block} - \text{Avg. Factor Score for All Blocks}}{\text{Standard Deviation of Factor Score for All Blocks}}$$

4. A weighted sum was calculated using the weights that will be presented in the next section. The resulting weighted sum maps were classified and displayed using 1/3rd standard deviation classifications.

²³ Midgely, Peter. “Bicycle-Sharing Systems: Enhancing Sustainable Mobility in Urban Areas.” Background Paper No. 8. United Nations Commission on Sustainable Development. May 2011.

Factor	What it Measures	Data Source	Buffer Distance Used
Population Density*	Population between the ages of 18 and 64	2010 U.S. Census - Table P12	N/A
Non-Institutional Group Population*	Mostly student populations	2010 U.S. Census - Table QT-P13	N/A
Job Density*	All jobs using 2010 Cycle 9 Employment Projections	Southwest Pennsylvania Commission, Cycle 9 Forecast	N/A
Retail Job Density*	All retail jobs using 2010 Cycle 9 Employment Projections	Southwest Pennsylvania Commission, Cycle 9 Forecast	N/A
Trip Generators*	Tourist attractions (museums, stadiums, entertainment venues, etc.), schools, universities, hospitals, cemeteries	Southwest Pennsylvania Commission	Weighted by proximity within 500 Meters
Parks*	All parks	City of Pittsburgh, Department of City Planning	Weighted by proximity within 500 Meters
Transit Stations*	Pittsburgh stops on the East Busway, West Busway, South Busway and the T	City of Pittsburgh, Department of City Planning	Weighted by proximity within 500 Meters
Existing Bike Infrastructure*	Existing bike lanes, bike trails, and bike-friendly streets	City of Pittsburgh, Department of City Planning	Weighted by proximity within 500 Meters
Planned Bike Infrastructure	Planned bike lanes, bike trails, and bike-friendly streets	City of Pittsburgh, Department of City Planning	Weighted by proximity within 500 Meters
PAT Stops (includes Transit Stations)*	All bus stops and transit stops	City of Pittsburgh, Department of City Planning	Weighted by proximity within 500 Meters
Elevation Change from Downtown	Difference in elevation relative to a point in Downtown Pittsburgh	City of Pittsburgh, Department of City Planning	N/A

* Factor was used by Krykewycz et. al.

Weights of Factors Used in Analysis

Krykewycz et. al. applied equal weights to all of their factors, only making adjustments by lowering the weight for parks and raising the weight for their “proximity to rail stations” factor.²⁴ The simplicity of their weighting is understandable due to the little research that has been done to identify the relative importance of these predictive factors. However, this report does attempt to apply variable weights to different factors using new research conducted on the first phase of B-Cycle’s bike share program in Denver.

Voeller has identified a number of factors that have been shown to be predictive in identifying bike share stations in Denver with higher usage. Those factors include: the percentage of walking commuters in the area, bicycle infrastructure mileage in close proximity, the number of bus stops in the area, the number of B-cycle stations nearby, the level of mixed land-use nearby, and the number of jobs nearby.²⁵

Voeller’s research was the starting point for establishing the weights for the “Denver Analysis” set of weights in this analysis. However, it is important to note that while population density was not a significant factor, it was fairly uniform across the B-Cycle service area and thus may likely still be important.²⁶ Additionally, elevation changes were not included in Voeller’s analysis due to the flat nature of the topography of Denver. Finally, bike infrastructure was found to be important in Voeller’s analysis. However, it was not given a high weight in this report due to concerns that Pittsburgh’s existing bike infrastructure is so small that it may overvalue, for example, locations that have one existing bike lane nearby (which will score very high in comparison to most areas that do not have any bike lanes nearby). With those considerations in mind, and with the knowledge of the relevant factors that have been discussed as contributing factors in other cities, the weights were developed as shown in the table below.

²⁴ Krykewycz, Gregory R., et al. "Defining a primary market and estimating demand for major bicycle sharing program in Philadelphia, Pennsylvania." Transportation Research Record: Journal of the Transportation Research Board 2143 (2011): 117-124.

²⁵ Voeller, Gabrielle. “Optimizing the Locations of Bike-Sharing Stations in Denver, Colorado: A Suitability Analysis.” 2011.

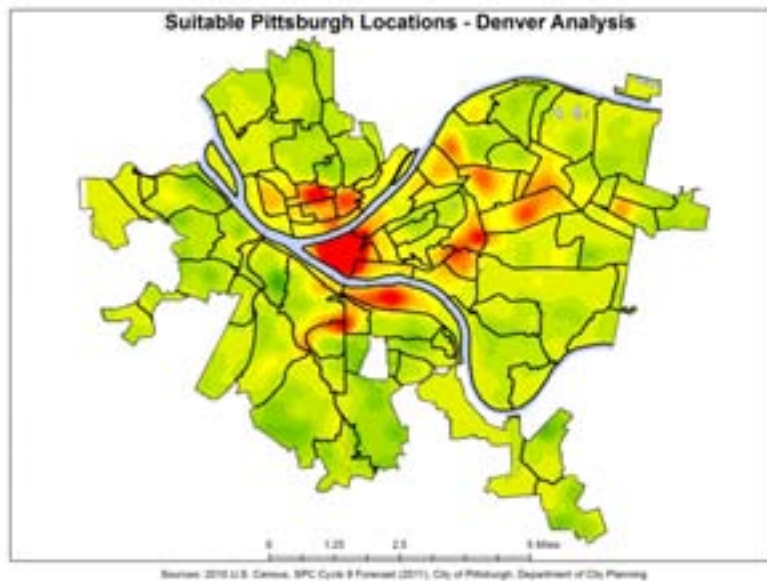
²⁶ Voeller, Gabrielle. Phone Conversation with Greg Zavacky. Nov. 18, 2011.

Another iteration was conducted with a different set of weights that will be called “High Pop., Transit, and Topography,” which emphasizes the population, transit, and elevation change factors more heavily. The primary set of weights for this analysis will be the “Denver Analysis” weights, but the “High Pop., Transit, and Topography” weights were chosen to show how the maps might contrast depending on how the respective weighting of factors is toggled. An “Equal Weights” set of weights was also used, but was not included in this report due to the high level of similarity between its results and the results of the “Denver Analysis” weights.

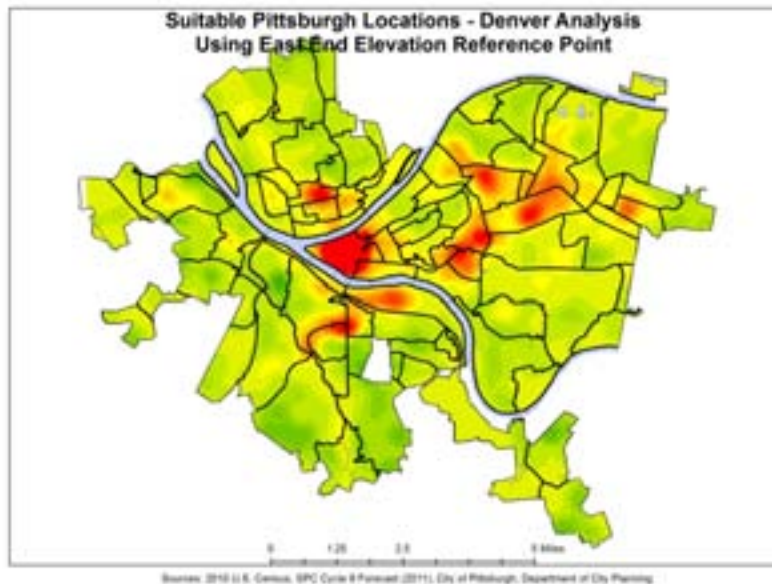
Weights Used to Calculate Pittsburgh Bike Share Site Suitability Maps		
Factor	Denver Analysis	High Pop., Transit, and Topography
Population Density	12%	13%
Non-Institutional Group Population	9%	7%
Job Density	12%	6%
Retail Job Density	9%	6%
Trip Generators	9%	6%
Parks	3%	2%
Transit Stations (Busway and T Stops)	12%	17%
Existing Bike Infrastructure	5%	8%
Planned Bike Infrastructure	5%	5%
PAT Stops (includes Transit Stations)	12%	8%
Elevation Change from Downtown	12%	22%

Site Suitability of Bike Sharing in Pittsburgh

The results of the heat mapping exercise indicate that the pre-identified target bike share zone neighborhoods of Downtown Pittsburgh, the North Shore, the South Shore and South Side, and the Strip District all appear to be favorable for bike sharing. Two different iterations of site suitability heat maps based on the weights above are shown below. The scale of colors indicates that locations that are red are most suitable to a bike share system, while locations that are green are the least suitable. Locations that are yellow are average.



While the viability of the target area has been confirmed, it is also widely apparent that there are several other areas that appear to be feasible for bike sharing. Adjacent to the target area, Lawrenceville and multiple neighborhoods in North Side also score very well. Additionally, the East End neighborhoods of Oakland, Shadyside, Bloomfield, Friendship, and East Liberty also appear to be suitable locations for a bike share system. However, the maps displayed above are skewed towards Downtown due to the use of the “Elevation Change from Downtown” factor that displays elevation change from a point in Downtown Pittsburgh. To further assess the viability of the East End, the same maps were generated using a new elevation change metric that instead calculates the change in elevation from a point near the Cathedral of Learning on the University of Pittsburgh campus in Oakland. Those maps are displayed below.



The difference between the two sets of maps is most pronounced in the map entitled “Suitable Pittsburgh Locations – High Pop., High Transit, High Topography,” which weights the elevation difference factor much higher. It is clear that when the elevation difference factor favors the East End neighborhoods, these neighborhoods appear to be almost as favorable to a bike share system as Downtown Pittsburgh and its surrounding neighborhoods.

Validation of Site Suitability Analysis – Mapping Minneapolis

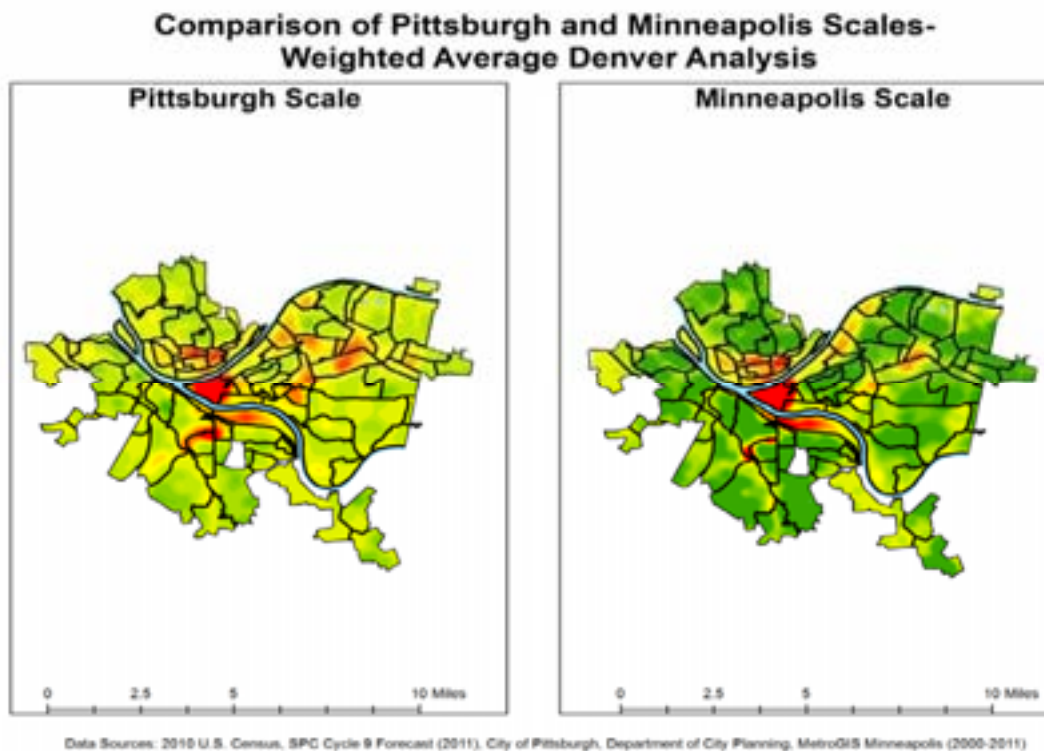
While it is now clear which neighborhoods in Pittsburgh would be best suited for a bike share system, it is not entirely apparent that Pittsburgh would compare favorably to other cities that have

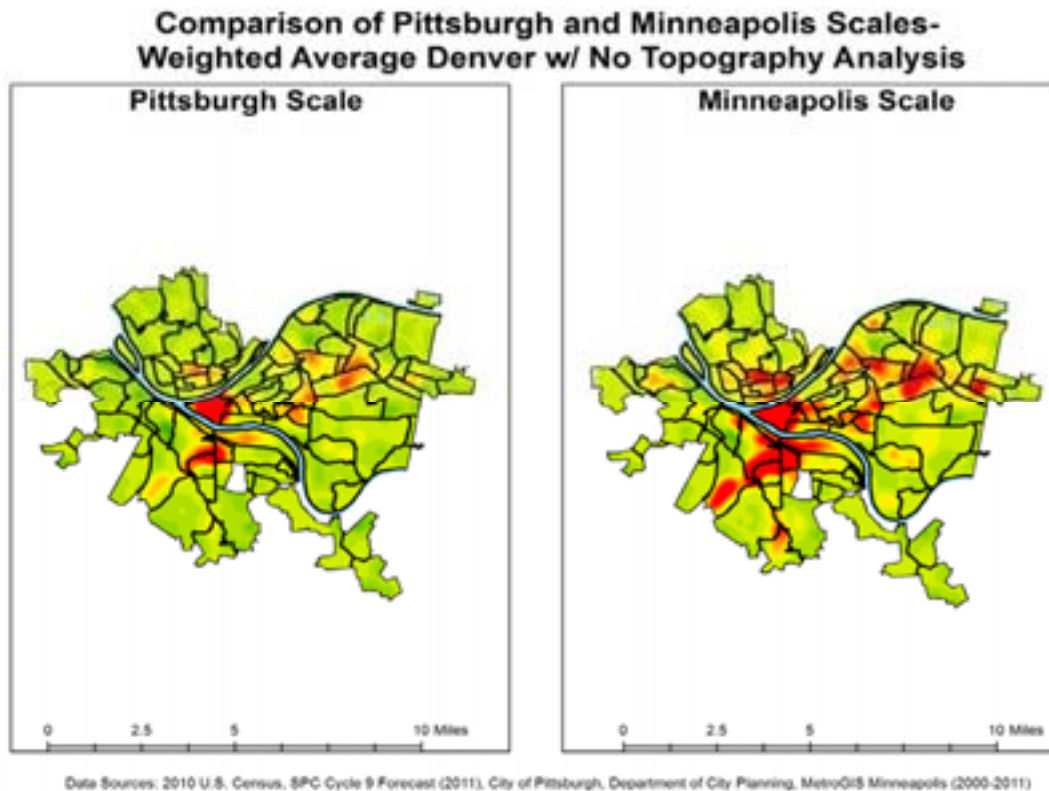
implemented bike share systems. To explore this concern, the city of Minneapolis was mapped using the same factors due to city similarities regarding total population, size, and population density. However to complete the analysis, the factors of existing bike infrastructure, planned bike infrastructure, and major trip generators were eliminated due to differences in the definitions of these metrics across the two cities.

The ultimate goal is to determine whether or not a city block in Pittsburgh would truly be suitable for bike share by completing a “What if?” analysis where the block is compared to blocks in Minneapolis rather than in Pittsburgh. Each factor was already normalized for the Pittsburgh site suitability exercise by using the following formula:

$$\text{Normalized Score for Factor} = \frac{\text{Factor Score for Block} - \text{Avg. Factor Score for All Blocks}}{\text{Standard Deviation of Factor Score for All Blocks}}$$

To complete this analysis, scores were normalized using the mean and standard deviations of the equivalent factors in Minneapolis rather than using the means and standard deviations for Pittsburgh blocks. The comparison will display two heat maps for Pittsburgh blocks. One will be the already completed analysis where factors were normalized using the block means and standard deviations of Pittsburgh. The other will be the analysis completed using the block means and standard deviations of Minneapolis. The maps below show the results.





In the first of the two comparisons, which is an adjusted version of the “Denver Analysis” weights, it appears that the target bike share area of Pittsburgh compares very favorably in comparison to Minneapolis, but the rest of the city scores very poorly. However, Minneapolis is a flat city with little change in elevation from point to point throughout the city, whereas Pittsburgh has high fluctuations in elevation. The second of the two pairs of maps shows the same analysis, but with the elevation change factor removed. In this comparison, Pittsburgh compares very well to Minneapolis. Many more neighborhoods are now bright red relative to the original analysis.

As discussed earlier, topography can be a significant barrier to implementing a successful bike share system. However, on all other metrics, Pittsburgh appears to compare very favorably to Minneapolis, a city that has already successfully implemented a bike share system.

Recommended Bike Share Zone

The analyses above have shown that Downtown Pittsburgh and the surrounding areas are suitable for bike sharing. However, the South Side Flats is the only neighborhood in the initial target bike share zone where there is a high percentage of residential land use. The concern must be whether or not the bike share system has the possibility to serve as a mode of transportation that can get people from an origin point (in this case, their homes) to a destination point. The pre-identified target area has many destination points, but few origin points.

In order to address the above issue, this report recommends the expansion of the bike share zone to into Lawrenceville and further into the North Side. The map of the recommended bike share zone is below.



Lawrenceville and the North Side neighborhoods are more residential than most of the initially targeted bike share zone. Inclusion of these neighborhoods will help to ensure that the bike share system is not solely used for trips that occur while people are already in Downtown or in the immediately adjacent areas.

As discussed above, the East End neighborhoods of Oakland, Shadyside, Bloomfield, Friendship, and East Liberty all scored very well in the heat mapping analysis. However, the inclusion of those neighborhoods in the first phase of a bike share program in Pittsburgh is not recommended. The historical precedent has been that bike sharing has been mostly implemented in cities that are relatively flat. The proposed bike share zone in the map above meets that criterion. There is very little elevation change from any of the proposed neighborhoods to any other proposed neighborhood. The introduction of more elevation may result in higher management costs of the program due to the need to reposition bikes.

The concern with the inclusion of the East End neighborhoods is that slope grades between 4% and 8% are considered to be a “significant constraint” for bicycle usage.²⁷ One of the primary access points for bicycle riders between the proposed area and the East End neighborhoods is Liberty Avenue, which has a grade that is around 4% from the point where it leaves the Strip District and passes through Lawrenceville into Bloomfield.

However, it is plausible that the East End neighborhoods could have been a candidate area in which to locate a bike share network without the inclusion of the original target area. It is clearly the next and potentially last phase for bike sharing in Pittsburgh in the event that the first phase is successful. There are enough potential trips from origins to destinations that occur in the East End neighborhoods to make it a strong potential expansion zone for a bike share program.

²⁷ Midgely, Peter. “Bicycle-Sharing Systems: Enhancing Sustainable Mobility in Urban Areas.” Background Paper No. 8. United Nations Commission on Sustainable Development. May 2011.

There are a number of strategies that could be deployed to link the original target area and the East End neighborhoods. One is to purchase Pedalec bikes, or bikes with electric pedal assistance, which can provide the extra boost that cyclists need to traverse hills.²⁸ Those bikes could be placed at strategic locations to allow bikes to be used by users of the bike share to climb into the East End neighborhoods. Another strategy would be to allow users to take the bikes to and from the East End using the new bike racks that the Port Authority of Allegheny County has placed on all of its buses.²⁹ However, both of those options offer potential cost and implementation concerns that would need to be addressed with all stakeholders prior to implementation.

In conclusion, the target bike share zone of Downtown Pittsburgh, the North Shore, the South Shore and South Side, and the Strip District has been confirmed. North Side and Lawrenceville neighborhoods are recommended to be included in the first phase as well to enable the bike share system to provide more coverage to areas with residential populations. The East End neighborhoods are the clear next phase in the event that the first phase is successful. However, it is recommended that they not be included in the first phase due to concerns in managing issues around the elevation change between the proposed area and the East End neighborhoods.

²⁸ DeMaio, Paul. "Bike-sharing: History, Impacts, Models of Provision, and Future." Journal of Public Transportation. Vol. 12, No. 4, 2009.

²⁹ Port Authority of Allegheny County. "Bikes on Transit." Accessed at <http://www.portauthority.org/paac/RiderServices/BikesonTransit.aspx> on December 8th, 2011.

3.2 Program Size

Overview

The goal of estimating the demand for bike share in Pittsburgh was to determine the amount of bikes and stations the network would support at an optimal level of bikes-per-member. When a bike share system runs properly, all individuals who want to pick up a bike, at any particular station, can find one and can also find a spot to return the bike at any particular station. Historical data provides ratios of bikes-per-trip and bikes-per-station. It was then necessary to estimate the number of daily trips that would take place. Knowing the number of daily trips lent the appropriate number to derive the number of bikes and stations that the system could support.

To find the expected number of bike share trips in Pittsburgh, the number of trips that take place by each mode of transportation in the projected bike-share target area was estimated. Rates of diversion were then applied from each mode of transportation (e.g. public transportation) to a bike share bike. The diversion rates that were applied were obtained from experiences of other bike share programs in Paris, Lyons, and Barcelona.

Methodology

The following estimates were used to determine how many trips, bikes and stations could be expected in Pittsburgh, with the explanation of methodology found below.

- Numbers of trips by each mode of commuters, as determined by American Community Surveys, that occurred in the census tracts within our bike-share network;
- Numbers of trips by each mode by residents of the bike share target area, as found by the 2010 census;
- Numbers of trips by visitors to the area, as expressed by the Pittsburgh Downtown Partnership;
- Numbers of trips by students in the target area, as found by the 2010 census.

The table below visually represents the method of determining total daily trips currently occurring in the target area by commuters by each mode of transportation³⁰.

Census Tract	Commuters by car	Commuters by public transportation	Commuters by walking	Commuters by bicycle
Census Tract – Golden Triangle	GT _{car}	GT _{pt}	GT _{walk}	GT _{bike}
Census Tract – Strip District	SD _{car}	SD _{pt}	SD _{walk}	SD _{bike}
Census Tract – etc.
	Total Commuters in Target Area by Car	Total Commuters in Target Area by Public Transportation	Total Commuters in Target Area by Walking	Total Commuters in Target Area by Bicycle

³⁰ American Community Survey. Means of Transportation to Work by Selected Characteristics:2005-2009
American Community Survey 5-Year Estimates. 2010. October 2011
<http://factfinder.census.gov/servlet/STGeoSearchByListServlet?_lang=en&_ts=341798185280>.

The average mode share in the target area was applied to the total numbers of commuters, residents, visitors and students following the assumption that all populations travel in the same way using the same modes of transportation. The mode share percentages are found in the table below.

Percentage of mode of transportation in bike-share target area					
Drive Alone	Carpool	Public Transportation	Walk	Bike	Other
45%	10%	20%	21%	3%	1%

The total number of employees in the target area was found using the Southwest Pennsylvania Commission Cycle 9 Forecast³¹. The transportation mode percentages were multiplied by the total numbers of employees in the area.

Worker Population Assumptions

The average number of daily trips per worker was assumed to be one. This analysis originally accounted for two trips per worker per workday, but a considerable proportion of the working population does not work every day of the week. Thus, by adjusting down to one trip per day per worker, part-time workers who do not work every day were then factored in, as well as the fact that full-time employees do not always travel to work five days per week.

Resident Population Assumptions

The total number of residents in the target area was similarly determined by adding the residents in each census tract, as given by the 2010 Census³². The numbers of residents by each mode were multiplied by 4.13, to estimate the number of trips by residents in the target area. This is the average number of trips per day taken by the average person given by transportation engineers³³. The mode share proportions found for commuters were applied to residents to divide the trips into the number of trips taken using each transportation mode.

Visitor Population Assumptions

The daily number of visitors in the target area (1,386,601³⁴) was estimated by multiplying the total yearly estimated number of visitors to the city by the expected proportion that is in the target area. To determine this proportion, the average proportion of workers and residents in Pittsburgh that work and live in the target area was calculated. The formula below illustrates this calculation.

³¹ Southwest Pennsylvania Commission. Southwest Pennsylvania Commission Cycle 9 Forecast. 2011. October 2011 <http://www.spcregion.org/data_datalib.shtml>.

³² "2010 Census Interactive Population Search." *2010 Census*. N.p., n.d. Web. 9 Dec. 2011. <<http://2010.census.gov/2010census/popmap/ipmtext.php?fl=42:4261000>>.

³³ Research and Innovative Technology Administration Bureau of Transportation Statistics. Mean Number of Trips by All Persons by Sex, Age, Driver Status, Worker Status and Medical Condition. 2001. December 2011 <http://www.bts.gov/publications/highlights_of_the_2001_national_household_travel_survey/html/table_a09.html>.

³⁴ "Pittsburgh, Pennsylvania ++ Pittsburgh.Net." Pittsburgh, Pennsylvania ++ Pittsburgh.Net. N.p., n.d. Web. 12 Dec. 2011. <<http://pittsburgh.net>>.

$$\left(\frac{\# \text{ of Workers in Target Area}}{\# \text{ of Workers in Pittsburgh}} + \frac{\# \text{ of Residents in Target Area}}{\# \text{ of Residents in Pittsburgh}} \right) \div 2$$

The result of this equation (0.356) is the proportion to apply to the number of visitors in Pittsburgh to obtain the total number of visitors in the target area. The 4.13 multiplier was applied to these visitors to determine the number of daily trips projected in the target area. As with residents, we applied the mode share percentages found for workers to the trips made by visitors, assuming the percentages to be about the same for all groups. This assumption is expected to provide estimates that conservatively predict the numbers of public-transportation users and walkers for the visitors.

Student Population Assumptions

The number of students residing in school-based housing in the target area was found by the 2010 census³⁵. The number of students was multiplied by 4.13 to find the total number of trips by students. While students are likely to have significantly different transportation habits than other individuals, the same transportation mode share percentages was applied to the student population totals, providing a conservative estimate of trips in the target area by students by each mode.

The table below gives the total daily trips by each population by mode of transportation.

Workers	Total Trips by Car	Number of Trips by Public Transit	Number of Trips by Walking	Number of Trips by Bicycle
	171,739	63,629	68,012	7,120
Residents	Total Trips by Car	Number of Trips by Public Transit	Number of Trips by Walking	Number of Trips by Bicycle
	48,332	17,907	19,140	2,004
Visitors	Total Trips by Car	Number of Trips by Public Transit	Number of Trips by Walking	Number of Trips by Bicycle
	6,917	2,563	2,739	287
Students	Total Trips by Car	Number of Trips by Public Transit	Number of Trips by Walking	Number of Trips by Bicycle
	8,799	3,260	3,485	365

³⁵ " IPEDS Data Center." *National Center for Education Statistics (NCES) Home Page, a part of the U.S. Department of Education*. N.p., n.d. Web. 10 Dec. 2011. <<http://nces.ed.gov/ipeds/datacenter>

User survey analysis of bike share programs in Lyon, Paris and Barcelona provided diversion rates describing the percent of trips taken using each of modes that shifted to bike share³⁶. The results were organized from lowest to highest values for each mode and used as potential levels of predicted diversion rates for Pittsburgh. The diversion rate levels are as follows:

Diversion Rates by Mode					
	Car	Public Transit	Walk	Bike	New Trips
Low	0.06%	1.40%	0.48%	1.80%	1.10%
Middle	0.14%	3.80%	0.56%	2.60%	2.20%
High	0.18%	4.60%	0.64%	3.40%	4.40%

The figures above were applied to the number of total trips to give the expected number of daily bike share trips in the target area for low, medium and high predictions.

Estimated Bike Share Trips by Workers and Mode Diverted						
	Car	Public Transportation	Walk	Bike	New Trips	Total
Low	52	445	163	64	8	732
Middle	120	1209	190	93	35	1,648
High	155	1463	218	121	86	2043

Estimated Bike Share Trips by Visitors and Mode Diverted						
	Car	Public Transportation	Walk	Bike	New Trips	Total
Low	1	97	12	49	2	161
Middle	2	263	14	71	8	358
High	2	318	16	93	19	449

³⁶ JzTI and Bonnette Consulting. Philadelphia Bikeshare Concept Study. Concept Study. Philadelphia, 2010.

Estimated Bike Share Trips by Residents and Mode Diverted						
	Car	Public Transportation	Walk	Bike	New Trips	Total
Low	29	251	92	36	4	412
Middle	68	680	107	52	20	927
High	87	824	122	68	48	1,150

Estimated Bike Share Trips by Students and Mode Diverted						
	Car	Public Transportation	Walk	Bike	New Trips	Total
Low	5	46	17	7	1	75
Middle	12	124	20	9	4	169
High	16	150	22	12	9	209

Results

Total predicted bike share trips at each level are found below.

Total Estimated Bike Share Trips	
Low	1,380
Middle	3,102
High	3,851

The number of daily trips provided the basis for the calculated number of bikes and stations. On average, data has shown that a bike-share bicycle is used 7.67 times per day³⁷. Therefore, by dividing the total numbers of trips projected by 7.67, the optimal number of bicycles needed to develop a successful bike share system is found. The model allowed for an average of 12 bicycles per station. This was used to calculate the number of stations in the system. The standard of 12 bicycles per station was decided on because it falls in the middle of the range found in other

³⁷ Bike Share Studio. Seattle Bicycle Share. Feasibility Study. University of Washington College of Built Environments. Seattle, n.d.

programs. The estimated numbers of trips, bicycles, and stations best suited for Pittsburgh's system are found below.

	Total Trips Estimated	Bike Estimate	Station Estimate
Low	1,380	180	15
Medium	3,102	404	34
High	3,851	502	42

The tables below encapsulate recommendations concerning the size of the program to be implemented in Pittsburgh. The recommended numbers of bicycles and stations supports the outcome of predictions that were based on other determinants such as geographic size of the proposed program area as well as by comparing Pittsburgh to cities similar in size, densities, location, and culture.

Station and Bike Level Benchmarks from Bike Share in Other Cities		
	Number of Stations	Number of Bikes
Minneapolis³⁸	65	700
Madison³⁹	35	350
Denver⁴⁰	51	510
Boston⁴¹	61	600

Area-Based Station Estimation		
Target Area Size	Conversion	Stations
Approx. 2.25 sq. mi.	20 stations/sq. mi.	45

³⁸ Over the Bars in Wisconsin. Bike sharing, what is it and how does it work? 11 February 2011. October 2011 <<http://overthebarsinmilwaukee.wordpress.com/2011/02/10/bike-sharing-what-is-it-and-how-does-it-work/>>.

³⁹ Ibid.

⁴⁰ "Denver Bikes | Denver Bike Sharing Program | B-Cycle | bicycle.com ." Denver Bikes | Denver Bike Sharing Program | B-Cycle | bicycle.com . N.p., n.d. Web. 12 Dec. 2011. <http://denver.bicycle.com>

⁴¹ Hubway. About Hubway. 2011. December 2011 <<http://www.thehubway.com/about>>.

Recommendation

Data from existing programs and information describing the current activity and capacity of Pittsburgh to support a bike share system were analyzed and utilized to create models. This modeling supports estimates based on benchmarking and the geographic size of the proposed system. These results are provided, again, below. It is important to recognize, however, that the model can be altered and new numbers, derived from priorities and expectations of decision makers can be imputed.

	Total Trips Estimated	Bike Estimate	Station Estimate
Low	1,380	180	15
Medium	3,102	404	34
High	3,851	502	42

3.3 Management Structure

Overview

Evaluating the various management structures that other bike share programs have used and understanding their compatibility with the goals of the City of Pittsburgh is a major factor in determining the feasibility of a bike share. This section will:

- Provide a general overview of three management structures;
- Define roles and responsibilities; and
- Outline recommendations for Pittsburgh's bike share management structure. The recommendation will be based on a quantitative decision matrix that evaluated qualitative information.

In addition, the matrix is based on a ranking of criteria by the client; therefore, depending on the final agreed-upon goals for a Pittsburgh bike share, the recommendation may change based on a different ranking of criteria.

This section will analyze the following three management structures:

- For-profit
- Public Private Partnership
- Nonprofit

The overview will examine the Management, Legal and Funding aspects of running a bike share program in Pittsburgh.

Management includes understanding the differences between responsibilities related to covering costs and operating the bike share. There are some models where one entity is both the owner and the operator, whereas there are other models where two or more entities share these responsibilities based on contractual obligations. In many cases, a vendor is also another party involved in running a bike share. Vendors provide the physical infrastructure, such as bikes and stations, to implement a program. The operator, instead, focuses on running the day-to-day operations of a bike share. Day-to-day responsibilities might include monitoring trip patterns to optimize the number of bikes at each station, relocating bikes at the end of the day, managing customer service inquiries, supporting membership sales and usage fees, etc.

Legal issues refer to any liability restrictions that directly relate to a specific management structure. For example, each model has different insurance options available for protecting liability within a bike share.

Funding sources will be expanded upon in "Section 4. Paying for a Pittsburgh Bike Share." Each structure has a unique set of funding options available to help cover capital and/or operating costs. This report considered funding sources from federal and state government programs, private foundations and local businesses.

The purpose of the chart below is to compare various management structure designs that are specifically tailored to a Pittsburgh bike share.

Overview⁴²:

	Pittsburgh Model	For-Profit	Public Private Partnerships	Nonprofit
Management	Contract Type	Franchise Contract (i.e. PNC Bank)	Service Contract (i.e. Alta Bike Share)	Franchise Contract (i.e. Bike PGH subsidiary)
	Operator	Franchisee	Contractor	Franchisee
	Vendor	Franchisee or Contract out Services (BIXI)	Contractor or Contract out Services (BIXI)	Franchisee or Contract out Services (BIXI)
	Capital Costs Assumed by	Franchisee	City of Pittsburgh	Franchisee
	Operating Costs Assumed by	Franchisee	Contractor	Franchisee
Legal	Liability Issues*	Vendor required to provide insurance coverage; City could still be liable;	City would roll Bike Share into general insurance coverage; Increased risk	Nonprofit would provide insurance coverage by finding best policy; Minneapolis has not had issues with this model
Funding	Primary Federal Support***	Metropolitan and Statewide Planning Program, CMAQ, Energy Efficiency and Conservation Block Grant Program, Urbanized Area Formular Program, Federal Liviability Program, Highway Safety Improvement Program,	Metropolitan and Statewide Planning Program, CMAQ, Energy Efficiency and Conservation Block Grant Program, Urbanized Area Formular Program, Federal Liviability Program, Highway Safety Improvement Program,	Metropolitan and Statewide Planning Program, CMAQ, Energy Efficiency and Conservation Block Grant Program, Urbanized Area Formular Program, Federal Liviability Program, Highway Safety Improvement Program,
	Primary State Support	Advantage Ben Franklin Alternative and Clean Energy Program	Urban Development Smart Transportation	Marketing to Attract Tourist Neighborhood Assistance Program Urban Development Alternative and Clean Energy Program
	Primary Private Support	Large company headquartered within the target area (i.e. PNC Bank, BNY Mellon)	Sponsorship Opportunities	Sponsorship Opportunities
	Primary Foundation Support**	None	(1) Bill & Melinda Gates Foundation	(4) Bill & Melinda Gates, Heinz Endowment, PNC Foundation, Hillman
	Secondary Foundation Support**	None	(3) Richard King Mellon, Colcom, The William and Flora Hewlett	(10) Richard King Mellon, Pittsburgh Foundation, McCune, Colcom, Highmark, Claude Worthington Benedum, Bayer USA, John R McCune, General Motors, The William and Flora Hewlett

* It is possible for the different insurance coverages to be applicable to different management structures. For instance, the City could roll the liability coverage into its general insurance policy yet still have the program be run by a for-profit entity.

** Most Foundations prefer 'non-profit' and or states that only tax-exempt under Section 501(c)(3) of the U.S. Internal Revenue Code and designated as public charities under Section 509(a) are eligible for grants.

*** Any entity whether it be for profit, non-profit or government run would be eligible for DOT grants as long as they can meet specified government procurement rules further along in the planning process.

⁴² New York City, Department of City Planning. *Bike-Share Opportunities in New York City*. Spring 2009.

For-Profit

As shown above, the for-profit model involves a franchise contract where a large company is responsible for all program costs. JCDecaux, a for-profit company, operates the bike share program of Paris (Velib). JCDecaux is responsible for both the capital and operating costs of the program. In addition, JCDecaux also runs the day-to-day operations of the bike share.⁴³ In a for-profit model, the franchisee could also be the operator of the program, or they could contract out the operations. In Pittsburgh, the for-profit model would most likely fit with a large company headquartered in the target area. In terms of liability issues, in a for-profit management structure, the for-profit company is required to provide insurance coverage. However, even with a for-profit owning the liability, the City of Pittsburgh could still be liable. Funding sources would be limited to some federal and state grants, in addition to the budgeted amount that the company allocates for the bike share.

Public Private Partnership (PPP)

In a public private partnership, the City would contract out the operations to an experienced bike share operator, such as Alta Bike Share or B-Cycle. The city would have control over the contractor through a contract approved through a public tender process. Washington, D.C. and Arlington's Capital Bikeshare is one of the more successful bike share PPP models. The contractor can then decide if a vendor is necessary for supplying the proper infrastructure. In most PPP models, the City of Pittsburgh would be responsible for covering the capital costs and the operator would be responsible for the operating costs. In terms of insurance coverage, the City could roll the bike share under its general insurance policy, at the cost of accruing more risk. PPP models are very attractive for securing funding from diverse sources because they are eligible for public and private funding, in addition to business sponsorships.

Nonprofit

Nonprofit models are somewhat similar to for-profit models in terms of management and legal concerns. The nonprofit would be responsible for both the capital and operating costs, and the nonprofit would also have the option to contract out services to an operator and/or vendor. Additionally, the nonprofit would be required to provide insurance. Minneapolis' Nice Ride is a nonprofit, and they have not had any insurance issues after two years in operations.⁴⁴ In terms of funding sources, a nonprofit is more similar to a PPP because nonprofits are also eligible for a wide range of funding options, including public, private and business sponsorships.

While each model has been successful for other bike shares around the world, it is important to outline the goals for a bike share program in Pittsburgh, and to match those goals with an appropriate management structure. The decision matrix below compares the three management structures across 10 criteria that were developed based on success and failure factors from other bike shares.

⁴³ Merlini, Marc. JC Decaux. Phone Conversation. 28 October 2011.

⁴⁴ "Nice Ride MN." Nice Ride MN. N.p., n.d. Web. 12 Dec. 2011. <www.niceridemn.org>.

Recommendations⁴⁵

	For-Profit	Public Private Partnership	Nonprofit	Criteria	Weighting	Ranking
Program Success: How successful has the program been with membership?	3	3	3	3: Exceeded expectations 2: Met expectations 1: Did not meet expectations	0.19	1
Short-term Sustainability: How does the program fund operating expenses?	3	2	2	3: Mostly operating revenues 2: Mix of revenues and subsidies 1: Mostly subsidies	0.17	2
Financial Success: Has the model been proven (is the model on track to be) financially successful?	3	3	3	3: Revenue positive within 3-5 years 2: Revenue neutral within 3-5 years 1: Revenue negative within 3-5 years	0.15	3
Compatibility: How realistic is this model in Pittsburgh	1	2	3	3: Realistic and enthusiastic support 2: Somewhat realistic and moderate support 1: Not realistic and no support	0.13	4
Flexibility: Does the program have flexibility to expand?	2	3	2	3: Both bikes/stations and locations 2: Either bikes or locations 1: No expansion	0.11	5
Long-term Sustainability: How does the program fund capital expenses?	2	3	3	3: Many funding opportunities available 2: Limited funding opportunities available 1: No funding opportunities available	0.09	6
Community Support: How many stakeholders will be involved in the process?	1	3	3	3: Government, Nonprofit and Business communities 2: Only two communities will be directly involved 1: Only one community will be directly involved	0.07	7
Elasticity of Demand: How much does the program charge for annual subscription/membership?	1	3	2	3: Greater than \$70 2: Between \$50 - \$70 1: Less than \$50	0.03	10
Timeframe: How long does it take to launch a station?	3	2	1	3: 3 months or less 2: Between 3 and 6 months 1: More than 6 months	0.03	10
Complexity: To what degree are legal issues a barrier?	1	2	3	3: Not a major barrier 2: Will need a moderate amount of coordination 1: Major barrier	0.03	10
Weighted Score	2.28	2.64	2.63			
Scoring based on:	Velib	Capital BikeShare	Denver B-Cycle			

⁴⁵ Velib: Merlini, Marc. JC Decaux. Phone Conversation. 28 October 2011; NYC Department of City Planning. *Bike-Share Opportunities in New York City*. Spring 2009; Transport for London. *Feasibility Study for a Central London Cycle Hire Scheme*. November 2008; JZTI, Bonnette Consulting, and Delaware Valley Regional Planning Commission. *Philadelphia Bikeshare Concept Study*. February 2010; Midgely, Peter. "Bicycle-Sharing Systems: Enhancing Sustainable Mobility in Urban Areas." Background Paper No. 8. United Nations Commission on Sustainable Development. May 2011. ; "Paris - Vélib' - vélos en libre-service à Paris - Site Officiel." Paris - Vélib' - vélos en libre-service à Paris - Site Officiel. N.p., n.d. Web. 12 Dec. 2011. <<http://en.velib.paris.fr>>.

Capital BikeShare: DeMaio, Paul. MetroBike. Phone Conversation. 28 October 2011; Kaplan, Melanie. *D.C. Unveils Country's Largest Bike Share Program*. Smart Planet. 15 November 2010. Web. 9 December 2011; Schmitt, Angie. One Year In, Capital Bikeshare Shatters Expectations; "Capital Bikeshare." Capital Bikeshare. N.p., n.d. Web. 12 Dec. 2011. <<http://capitalbikeshare.com>>.

Denver B-Cycle: 2010 *Annual Report*. Denver Bike Sharing; "Denver Bikes | Denver Bike Sharing Program | B-Cycle | bicycle.com ." Denver Bikes | Denver Bike Sharing Program | B-Cycle | bicycle.com . N.p., n.d. Web. 12 Dec. 2011. <http://denver.bicycle.com>;

In order to assign quantitative scores for each management structure, this report used an existing bike share program as a proxy for its management structure. For example, the Denver B-Cycle program was used as an example of a nonprofit model. Then, each program was evaluated against the following criteria:

1. *How successful has the program been with membership?*
All models have demonstrated success at increasing membership over time; therefore, all models were assigned the highest score of three.
2. *How does the program fund operating expenses?*
In terms of short-term sustainability, it is important to consider liquidity of each management structure. For-profit models tend to be the most liquid since they can draw on company resources. PPP and nonprofit structures are more reliant on outside support, resulting in less liquidity.
3. *Has the model been proven financially successful?*
This criterion was hard to assess because there is a lack of public information and each program has a different definition for financial success. Based on conversations with representatives for Velib and Capital Bikeshare, both programs are considered financially sustainable. Based on Denver's 2010 Annual Report, Denver B-Cycle operated with a net income of \$1.5 million⁴⁶, suggesting the nonprofit model is also sustainable.
4. *How realistic is this model in Pittsburgh?*
Based on stakeholder meetings and discussions, the City of Pittsburgh is hesitant to be involved in the running of a bike share program, and it seemed as if there was a push to have a nonprofit run the program. In addition, nonprofits are very well supported in Pittsburgh, which makes it even more feasible that a nonprofit model would fit well in Pittsburgh. The for-profit model is not likely to happen in Pittsburgh because of the immense risk and investment costs for which a business would be accountable.
5. *Does the program have flexibility to expand?*
Based on a conversation with a representative from Capital BikeShare, the PPP model seems most prepared for growth and expansion⁴⁷. Within a PPP model, the city can write the terms of expansion into the contract so that each expansion location is subject to the same terms as the original bike share, which cuts down on implementation time for future locations.
6. *How does the program fund capital expenses?*
As mentioned above, for-profit models have limited financing options because of their tax status. Alternatively, a PPP or nonprofit structure is eligible for public, private and business sponsorship funding options.
7. *How many stakeholders will be involved in the process?*
Nonprofits and City governments almost always engage in lengthy community outreach and education process to gain buy-in. This process achieves support and anticipation for the program before implementation. For-profit models, instead, focus on quick entry into the marketplace. For-profits are not limited by internal funding constraints, and thus are not as

⁴⁶ Denver B-Cycle: 2010 *Annual Report*. Denver Bike Sharing.

⁴⁷ DeMaio, Paul. MetroBike. Phone Conversation. 28 October 2011.

reliant on others for implementation. While this is a plus for liquidity, it is a negative aspect of successful program development.

8. *How much does the program charge for annual membership/subscription?*

This criterion is not as important as others listed above because it varies more based on geography than it differs by management structure. Regardless, Capital BikeShare's annual subscription price of \$75 is higher than the corresponding subscription prices in Denver or Paris.

9. *How long does it take to launch a station?*

Similar to the community support criteria, a for-profit has a much faster go-to-market strategy because of the capacity to fund program elements faster than other models. Alternatively, the nonprofit model requires intense coordination with community partners and funding sources to execute program changes.

10. *To what degree are legal issues a barrier?*

For-profit companies will take on a large risk of damaging their reputation should anything unfortunate happen while owning the bike share. Because of this negative risk potential, for-profit companies face more legal implications.

Based on the ranking and weights given to the 10 criteria, a public private partnership model provides the best fit for Pittsburgh. The nonprofit model has an almost identical score, suggesting this structure could also work well in Pittsburgh. As mentioned earlier, this matrix is malleable and can be adjusted depending on the rankings and weights assigned to the list of criteria. At this point, given the preferred rankings of the client, this report recommends moving forward with either a public private partnership or nonprofit management structure.

3.4 Liability

Overview

There are five different forms of liability coverage.

1. *City Insurance Policy*: The City of Pittsburgh could roll the bike share's liability coverage into its current general insurance policy. This will ensure full coverage, however, it could expose the City to higher levels of risk and cost. This has not been used for a large-scale bike share program.⁴⁸ Currently, Pittsburgh is self-insured. To maintain self-insurance status Pittsburgh must comply with three Pennsylvania requirements:
 - a. Maintain an irrevocable trust fund (satisfied with Pittsburgh's contribution to the General fund);
 - b. Satisfy the financial responsibility requirements established by Pennsylvania; and
 - c. Establish liability reserves based upon expected future payments.

The City of Pittsburgh complied with all three requirements during 2010.⁴⁹ Presently, "the City is exposed to various risks of loss related to torts; theft of, damage to, and destruction of assets; injuries to employees; and natural disasters. The City covers all claim settlements and judgments, not covered by insurance, within its General and Capital Projects Funds."⁵⁰

Pittsburgh could legally separate the bike share program from the City and report it as a component unit. Component units are "entities that are legally separate from the primary government."⁵¹ A Board of Directors would be responsible for all activities and operations of the bike share program. Board members could be chosen in such a way that would allow the City to effectively govern the bike share program. Component units, such as the Pittsburgh Water and Sewer Authority (PWSA), are self-insured for general liability coverage and have established Self-Insured Escrow Funds to cover potential liability claims.⁵²

2. *Transit Operator*: Bike share liability could be incorporated into the existing plan of the Port Authority of Allegheny County. Currently, Port Authority's expenses for injuries and damages totaled \$3.6 million in the 2010 fiscal year.⁵³ Due to the financial condition of the Port Authority, this approach may not be feasible.
3. *Non-Profit Organization*: A non-profit could provide liability and insurance coverage. This organization would work with a variety of insurance agencies to determine the best coverage.⁵⁴ This approach has been taken by Minneapolis where a "new local non-profit

⁴⁸ JzTI, Bonnette Consulting, and Delaware Valley Regional Planning Commission. "Philadelphia Bikeshare Concept Study". February 2010. Page 68.

⁴⁹ Office of City Controller. Comprehensive Annual Financial Report. December 31, 2010. Page I-6.

⁵⁰ Office of City Controller. Comprehensive Annual Financial Report. December 31, 2010. Page I-7.

⁵¹ Office of City Controller. Comprehensive Annual Financial Report. December 31, 2010. Page 26.

⁵² Office of City Controller. Comprehensive Annual Financial Report. December 31, 2010. Page 34.

⁵³ Port Authority of Allegheny County. Operating and Capital Improvement Budgets. June 20, 2010. Page xxi.

⁵⁴ JzTI, Bonnette Consulting, and Delaware Valley Regional Planning Commission. "Philadelphia Bikeshare Concept Study". February 2010. Page 68.

organization is being created in order to provide insurance for the bike share system.”⁵⁵ According to Alison Cohen, the president of Alta Bicycle Share, “liability has not been an issue.”⁵⁶ *Vendor*: If a private vendor is selected, Pittsburgh could require the vendor to incorporate its own private insurance coverage. However, the City could potentially still be liable and, as previous bike share vendors have not been required to provide insurance coverage, this may prevent vendors from bidding for the Pittsburgh bike share program.⁵⁷

4. *User’s Responsibility*: It is possible “to require the bike share user to provide insurance coverage as indicated in a waiver signed by users.”⁵⁸ The City could still be liable in certain situations.

Finally, government officials may be immune from lawsuits if acting within their official duties – a concept known as sovereign immunity. In Pennsylvania, this was established with the Sovereign Immunity Act.⁵⁹ While there are exceptions where an official or agency might be liable, the Sovereign Immunity Act limits damages to \$250,000 against the Commonwealth of Pennsylvania and \$500,000 against local agencies and municipalities.⁶⁰ If a municipality is involved then the plaintiff “must establish, for a pain and suffering recover, permanent loss of bodily function, permanent disfigurement or permanent dismemberment or medical expenses exceed the sum of \$1,500.”⁶¹

⁵⁵ JzTI, Bonnette Consulting, and Delaware Valley Regional Planning Commission. “Philadelphia Bikeshare Concept Study”. February 2010. Page 69.

⁵⁶ Pacocha, Matt. “Bike Sharing Takes Hold in the US”. <http://www.printfriendly.com/print/v2?url=http%3A%2F%2Fwww.bikeradar.com%2Fnews%2Farticle%2Fbike-sharing-takes-hold-in-the-us-31479%2F%2523.TluYB3dLAUo.printfriendly>. August 29, 2011.

⁵⁷ JzTI, Bonnette Consulting, and Delaware Valley Regional Planning Commission. “Philadelphia Bikeshare Concept Study”. February 2010. Page 69.

⁵⁸ JzTI, Bonnette Consulting, and Delaware Valley Regional Planning Commission. “Philadelphia Bikeshare Concept Study”. February 2010. Page 69.

⁵⁹ 62 PA. Cons. Stat § 1702.

⁶⁰ Murphy, Carol A. “A Primer for Pennsylvania Municipal Liability Issues”. Margolis Edelstein. Philadelphia, PA. http://www.margolisedelstein.com/files/primer_for_pa_municipal_liab_-_murphy_2009.pdf. Page 7.

⁶¹ Murphy, Carol A. “A Primer for Pennsylvania Municipal Liability Issues”. Margolis Edelstein. Philadelphia, PA. http://www.margolisedelstein.com/files/primer_for_pa_municipal_liab_-_murphy_2009.pdf. Page 14.

4. Paying for a Pittsburgh Bike Share



4.1 Memberships and Use Fee Revenue

Overview

Estimating the potential operating revenues or losses from a Pittsburgh bike share is an important factor in determining the feasibility of establishing a bike share program. From the beginning, key stakeholders requested that operating revenues cover operating costs. Using the revenue model of New York City, this report used demographic data from the U.S. Census as inputs for demand, and benchmarked data from other cities as inputs for cost. As shown below, all cells with a light orange fill represent input cells. It is important to note that this revenue model only reflects revenues based on memberships and use fees, which are fees charged to users for using a bike beyond the 30 minute “free” period.

Demand Assumptions⁶²

Total Subscribers	Assumptions	Projected Uptake**	Phase 1
Residents in target area*	Variable	3.0%	31,379
PGH and Out of City workers in target area	Variable	1.5%	194,785
Leisure tourists (less than 4 days)	85%	4.5%	813,746
Leisure tourists (more than 4 days)	15%	3.0%	143,602
Leisure Tourists*	957,348		

Total Trips	Assumptions	Projected Uptake**	Phase 1	Times	Weeks	Product
Residents in target area	4x/week	3.0%	135,557	4	36	144
PGH and Out of City workers in target area	3x/week	1.5%	315,552	3	36	108
Leisure tourists (less than 4 days)	1x	4.5%	36,619	1	1	1
Leisure tourists (more than 4 days)	4x	3.0%	17,232	4	1	4

More Assumptions	
Total Employed in Target Area Using TAZ Zones	209,518
Total Living in Target Area Using 2010 Census	26,546
Total Living and Employed in Target Area	14,866
% of Living in PGH that are Employed in PGH	56%

* Includes 4,833 students residing in dorms

In order to calculate the potential customer base, this report identified four categories of users: residents, workers, leisure tourists (less than four days) and leisure tourists (more than four days). A different assumption was made for each group of users for their projected uptake and their use rates. The New York City feasibility study originally applied uptake rates – the estimated percentage of a certain population that will use the bike share – that were based on program data from bike shares in Europe.⁶³ The original uptake rates were 3%, 6% and 9%.⁶⁴ European bike shares found that the highest uptake rates occurred among short-term tourists, and the lowest uptake rates were seen among workers in the target area. This information helped to determine the projected uptake for each population of potential users. It was decided to reduce the uptake rates for the Pittsburgh model to reflect the differences between New York City and Pittsburgh; therefore, the final uptake rates used in the revenue model are 1.5%, 3% and 4.5%. The uptake rates of 1.5%, 3% and 4.5% represent a conservative estimate of how many people will use a Pittsburgh bike share. Increasing these rates will increase the number of people expected to use the

⁶² 2010 U.S. Census; Pittsburgh.net; New York City Department of City Planning. *Bike-Share Opportunities in New York City*. Spring 2009. 8 December 2011.

⁶³ New York City, Department of City Planning. *Bike-Share Opportunities in New York City*. Spring 2009. 8 December 2011.

⁶⁴ Ibid.

bike share, thus increasing the number of bikes and stations, in addition to increasing costs and revenues.

The assumptions for how many times per week a certain population would use a bike share also came from New York's assumptions. In this case, Pittsburgh and New York should not differ because relative travel patterns between residents and workers should be consistent across geographies.

All of the demographic information was taken from the 2010 U.S. Census, and "residents in target area" does include students living in dorms. In order to maintain a conservative model, it was decided that students would be just as likely as the resident population to use a bike share. Finally, it is important to note that this revenue model assumed a bike share in Pittsburgh would operate for 36 weeks, a time period that is approximately from April through November, which is similar to other programs such as Denver and Minneapolis.⁶⁵

Cost Assumptions⁶⁶

Capital Costs					
City	Montreal	New York	Washington, D.C.	Lyon	Paris
Program	Bixi	2007 Estimate	SmartBike Expansion	Velov'	Velib'
Operator	Statonnement de Montreal	ClearChannel Adshel	ClearChannel Adshel	JCDecaux	JCDecaux
Number of Bicycles	2400	500	500	1000	20600
Capital Cost	N/A	1,800,000	1,800,000	N/A	90,000,000
Capital Cost/Bike	3,000	3,600	3,600	4,500	4,400

Operating Costs						
City	Montreal	New York	Washington, D.C.	Barcelona	Lyon	Paris
Program	Bixi	2007 Estimate	SmartBike Expansion	Bicing	Velov'	Velib'
Operator	Statonnement de Montreal	ClearChannel Adshel	ClearChannel Adshel	ClearChannel Adshel	JCDecaux	JCDecaux
Number of Bicycles	2400	500	500	3000	1000	20600
Operating Cost	N/A	972,000	800,000	4,500,000	1,550,000	35,000,000
Operating Cost/Bike	1,200	1,944	1,600	1,500	1,500	1,700

The capital and operating costs above represent the financial planning estimates of current and proposed bike share programs. This model is based on a \$3,600 capital cost per bike and \$1,600 operating cost per bike, which is a middle of the road estimate for implementing a bike share. New York City also used these same cost assumptions in their model. It was outside the scope of this report to model costs based on the level of technology used within bikes and bike stations.

However, there are very few vendors that offer similar products, and costs are relatively centered on assumptions used in this model. Of course, there are specific features, such as the use of electric bikes, which would vastly increase the capital and operating costs per bike.

⁶⁵ "Denver Bikes | Denver Bike Sharing Program | B-Cycle | bicycle.com ." Denver Bikes | Denver Bike Sharing Program | B-Cycle | bicycle.com . N.p., n.d. Web. 12 Dec. 2011. <http://denver.bicycle.com>; "Nice Ride MN." Nice Ride MN. N.p., n.d. Web. 12 Dec. 2011. <www.niceridemn.org>.

⁶⁶ Ibid.

Revenue Assumptions and Model⁶⁷

Demand Assumptions	Total Possible	Projected	Projected	Projected
Residents in target area*	31,379	3.0%	3.0%	3.0%
PGH and Out of City workers in target area	194,785	1.5%	1.5%	1.5%
Leisure tourists (less than 4 days)	813,746	4.5%	4.5%	4.5%
Leisure tourists (more than 4 days)	143,602	3.0%	3.0%	3.0%
Trips/Year**		504,960	504,960	504,960
Trips/Year***		347,760	347,760	347,760
Trips longer than 30 minutes (5%)**	2.5%	12,624	12,624	12,624
Trips longer than 30 minutes (5%)***	2.5%	8,694	8,694	8,694
Cost Assumptions	Rates	Projected	Projected	Projected
Total Capital Costs	3600	\$ 648,000	\$ 1,454,400	\$ 1,807,200
Total Operations Costs	1600	\$ 345,600	\$ 775,680	\$ 963,840
Annual Membership and Use Fee Reven	Rates	Projected	Projected	Projected
Annual Pass (residents)	\$ 50	\$ 47,069	\$ 47,069	\$ 47,069
Annual Pass (non-residents)	\$ 50	\$ 146,089	\$ 146,089	\$ 146,089
Week Pass	\$ 15	\$ 64,621	\$ 64,621	\$ 64,621
Day Pass	\$ 5	\$ 183,093	\$ 183,093	\$ 183,093
Use Fees (1/2 hr)	\$ 3.00	\$ 26,082	\$ 26,082	\$ 26,082
Total Membership and Use Fee Revenue		\$ 466,953	\$ 466,953	\$ 466,953
Net Revenue		\$ (526,647)	\$ (1,763,127)	\$ (2,304,087)
Other Assumptions				
Number of Bicycles		180	404	502
Increase in operating costs for each 3% increase in uptake		20%	20%	20%

*Includes 4,833 students residing in dorms

**Number of trips calculated from demand assumptions of 1.5%, 3% and 4.5% uptake rates

***Number of trips taken from low, medium, high estimates - will be used for Use Fee Revenue Model

Annual fee taken from survey

Week pass taken from Washington, D.C.

Day pass and Use fees (60-90 minutes cost) taken from Minneapolis

Pittsburgh.net provided tourist numbers (Scaled down to target area)

36 weeks is April through November

⁶⁷ "Nice Ride MN." Nice Ride MN. N.p., n.d. Web. 12 Dec. 2011. www.niceridemn.org; "Capital Bikeshare." Capital Bikeshare. N.p., n.d. Web. 12 Dec. 2011. <http://capitalbikeshare.com>; "Pittsburgh, Pennsylvania ++ Pittsburgh.Net." Pittsburgh, Pennsylvania ++ Pittsburgh.Net. N.p., n.d. Web. 12 Dec. 2011. <<http://pittsburgh.net>>.

In the revenue model above, the projected uptake rates, demographic information and capital and operating costs were all taken from the preceding assumption tables. New assumptions introduced in this table include: percent of trips longer than 30 minutes, trips per year, membership and use fee prices, operating cost increases, and number of bikes.

The percent of trips lasting longer than 30 minutes was derived from the assumption of New York City that 5% of their trips would be longer than 30 minutes.⁶⁸ Similar to previous adjustments, this report decided to reduce this number by half to reflect the small target area size for Pittsburgh.

The number of trips is an input that the revenue model uses to quantify the revenue associated with use fees, which are assumed to be generated for 2.5% of total trips - a very small impact on total revenue. The model above shows two calculations for number of trips. The first row is based on the assumed uptake rates. The second row is based on values generated from the demand section of this report that used diversion rates from past programs. The revenue model will use the latter calculation of trips for the remainder of this analysis. As seen above, both calculations are very similar and help to validate both analyses. It is important to also validate these calculations against the experiences of current bike share programs. Within their first year of operations, Denver and Minneapolis both centered around 100,000 trips, which is far below the expected number of trips within this report.⁶⁹ While the discrepancy is slightly disconcerting, it is comforting to see the total number of trips in Minneapolis exceeding 200,000 for 2011. This represents an almost 100% increase over the previous year.⁷⁰ Therefore, this report will continue to use the calculated number of trips based on diversion rates.

The membership and use fee revenues were all taken from benchmarking programs in other cities, in addition to incorporating information from what potential users would be willing to pay as determined by the market survey previously discussed in this report. Ultimately, the prices for use fees and day passes were taken from Minneapolis. This is because their program is comparable in size and scope to a future Pittsburgh bike share program. The \$50 annual membership was taken directly from survey respondents. This fee reflects a lower average membership fee as compared to other programs. For example, Minneapolis charges \$60 and Denver charges \$65 for an annual subscription.⁷¹ Thus, the \$50 assumption will also help project a more conservative picture of operating revenues.

New York City's revenue model incorporated a 20% increase in operating costs conditioned on an increase in uptake rates. This report assumed a similar cost increase for each increase in uptake.

Finally, the number of bikes is an important input for calculating the capital and operating costs. This revenue model used the low, medium and high projection of bikes from the demand analysis.

Discussion and Interpretation

Based on the finding of the revenue model, a Pittsburgh bike share would cover operating expenses with operating costs only at the low number of bikes (180); however, this model only incorporates

⁶⁸ NEW YORK CITY Department of City Planning. *Bike-Share Opportunities in New York City*. Spring 2009. Web. 8 December 2011.

⁶⁹ *Bike sharing, what is it and how does it work*. Over the Bars in Wisconsin. 10 February 2011. Web. 9 December 2011.

⁷⁰ *Nice Ride Reaches 200,000 Trips for 2011*. Nice Ride MN. 20 October 2011. Web. 8 December 2011.

⁷¹ "Denver Bikes | Denver Bike Sharing Program | B-Cycle | bcycle.com ." Denver Bikes | Denver Bike Sharing Program | B-Cycle | bcycle.com . N.p., n.d. Web. 12 Dec. 2011. <http://denver.bcycle.com>; "Nice Ride MN." Nice Ride MN. N.p., n.d. Web. 12 Dec. 2011. <www.niceridemn.org>.

revenue from memberships and use fees, whereas other programs receive revenues from a range of sources. For example, a breakdown of the total revenue from Denver shows that sponsorships and other contributions could be an effective source of revenue.

Denver's Total Resources⁷²:

Resource Line Item	Percent
Capital Grants & Contributions	55%
Sponsorships	26%
Membership Fees	9%
Usage Fees	5%
Operating Grants & Contributions	4%
Gifts in Kind – Goods	1%

In Denver's first year of operations, only 14% of revenues came from bike share operations. Based on the revenue model of Pittsburgh, at the low, medium and high projection of bikes, membership and use fees account for 47%, 21% and 17% of the total operating and capital costs, respectively. Therefore, Pittsburgh's projected revenue from bike share operations is expected to at least match Denver's membership and use fee revenue. This breakdown is significant in showing the importance of utilizing multiple funding sources. If membership and use fee revenues account for 21% of needed resources, then Pittsburgh could look

into sponsorships and grants to help fund the remaining 79%, which is not uncommon for bike share programs. Additional funding sources will be described in more detail in the "Private and Public Funding Options" sub-sections below.

As mentioned above, at the low number of bikes, a Pittsburgh bike share would cover 100% of operating expenses. At the medium number of bikes, 404, membership and usage fee revenues would cover 60% of operating expenses. Lastly, a bike share with 502 bikes would expect to generate membership and usage fee revenues that cover 48% of operating expenses.

In nominal terms, a Pittsburgh bike share can expect to bring in almost \$500,000 in membership and usage fee revenue in the first year of operations. The total cost (capital and operations) can expect to range from \$1 million to over \$2.5 million, depending on the size of the program. These figures are consistent with other U.S. successful bike share programs.

⁷² 2010 Annual Report. Denver Bike Sharing

4.2 Private Funding Options

4.2.1 Local Businesses

Overview

There are four primary ways that private companies have traditionally supported bike shares:

- 1) Having a company sponsor the entire program; or
- 2) Having them sponsor particular stations; or
- 3) Providing general advertising at stations and on the bikes themselves; or
- 4) Making agreements where cities turn over a large amount of advertising space in exchange for the company paying to run the program.

A primary example of a company sponsoring an entire program is Barclays Bank, which sponsors the London bike share and got naming rights for the program, which is called Barclays Cycle Hire.⁷³ Barclays paid \$25 million Euros to have the naming rights of the program.⁷⁴ Additionally, for the Nice Ride Minnesota bike share program, Blue Cross Blue Shield of Minnesota is contributing \$715,000 from a tobacco settlement to become the title sponsor of the program.⁷⁵

In terms of sponsoring individual stations, Denver Bike Share is leading the way by allowing companies to select a station of their choice to sponsor. Sponsors typically select stations for strategic purposes (i.e. a key demographic is more likely to use it or the station is nearby to their operations, etc). Denver charges \$30,000 annually for the sponsorship rights per station; \$20,000 annually if the company will commit to a three year agreement.⁷⁶

Many bike shares sell advertising in both their stations and on their bikes. Given that the law allows the city government in Washington, D.C. to sell advertising space on bus shelters, they are now trying to sell advertising space at the 92 stations of Capital BikeShare.⁷⁷ Boston is now also selling advertising space to close a \$500,000 gap in their budget.⁷⁸

Many bike share programs are using a powerful narrative to get prospective sponsors. For example, the DecoBike Miami Beach program enables DecoBike to claim that it is promoting a healthy lifestyle, which may help it draw additional customers.⁷⁹

⁷³Barclays Cycle Here Website, Main site <http://www.tfl.gov.uk/roadusers/cycling/14808.aspx>.

⁷⁴ BBC Website "Barclays' £25m sponsorship of London cycle hire scheme." May 28, 2010 <http://www.bbc.co.uk/news/1018283>.

⁷⁵ Nice Ride Minnesota Website, Archives Section "Minnesota Announces Locations for New Stations." May 19, 2011.

https://www.niceridemn.org/news/2011/05/19/43/nice_ride_minnesota_announces_locations_for_new_station.

⁷⁶ Denver Bike Share Website, Sponsorship section <http://www.denverbikesharing.org/sponsorship.php>.

⁷⁷ Neibauer, Michael "DC Eyes Bike Share Advertising." *Washington Business Journal* April 7, 2011 <http://www.bizjournals.com/washington/blog/2011/04/dc-eyes-bike-share-advertising.html?page=all>.

⁷⁸ McFarland, Andrew "SELDC approves bike-sharing ads for South End." *South End News* October 6, 2011. <http://www.mysouthend.com/index.php?ch=blog&sc=&sc2=news&sc3=&id=125437>.

⁷⁹ Decobike Miami Beach Website, Partners Section <http://decobike.com/partners.php>.

In Paris, in exchange for JCDecaux covering the expenses of the bike share program, the city gave the company 1,628 city-owned billboards on which JCDecaux is allowed to sell the advertising space and keep any resulting profits.⁸⁰

Lastly, some bike shares are being proactive in encouraging employers to buy bike share memberships as a benefit to provide to their employees. Capital BikeShare is one such example.⁸¹ Another example of such a system is the Eco Pass System used in San Jose, California. The below table describes the pricing structure for an Eco Pass in San Jose (the costs are per employee). A similar proposal where the price depends on the size of the company can be implemented by a bike share system.

Company Location/Regular Service Level

Downtown San Jose	1 - 99 Employees \$144	100 - 2,999 Employees \$108	3,000- 14,999 Employees \$72	15,000 + Employees \$36
Areas served by bus & light rail	1 - 99 Employees \$108	100 - 2,999 Employees \$72	3,000- 14,999 Employees \$36	15,000 + Employees \$18
Areas served by bus only	1 - 99 Employees \$72	100 - 2,999 Employees \$36	3,000- 14,999 Employees \$18	15,000 + Employees \$9

Methodology

In order to rank the most promising private companies, a set of metrics were created using three different categories. To be considered “Primary,” a company would need to have a favorable response to at least two of the three metrics.

The three metrics were:

1. Has the company undertaken a recent sponsorship opportunity?
2. Have they sponsored anything comparable to a bike share?
3. Does their business mission have any synergies with a bike share program?

The results are shown below in Appendix A.

⁸⁰ Anderson, John Ward “Paris Embraces plan to become city of bikes.” *Washington Post* March 24, 2007 <http://www.washingtonpost.com/wp-dyn/content/article/2007/03/23/AR2007032301753.html>.

⁸¹ Perkins, Michael “CaBi Goes Corporate, Should Consider Eco Pass Model.” Greater, Greener Washington Website October 26, 2010 <http://greatergreaterwashington.org/post/7719/cabi-goes-corporate-should-consider-eco-pass-model/>.

4.2.2 Foundations

Methodology

This section looks at funding opportunities available through foundations. To analyze this section further, the list of *“Top 50 U.S. Foundations Awarding Grants in the Pittsburgh, PA Metropolitan Area (2009)”* (See Appendix B) was obtained. From the list, the foundations that awarded the largest grant amounts to Pittsburgh were studied to assess their suitability towards supporting a Pittsburgh bike share program.

In this regard, three criteria were used: mission statements, previous support for bike-related projects, and support for other similar programs. Each foundation was scored using a four category matrix that was defined by the number of these three criteria that were satisfied. The summary of this matrix is seen below.

Category 1	Satisfy three criteria
Category 2	Satisfy two criteria (Mission and Supported similar programs)
Category 3	Satisfy one criteria (Mission has a similar match but towards different needs.)
Category 4	Satisfy zero criteria (Mission does not match)

Results

Among the list of 50 foundations, six foundations were classified as Category 1 (primary funding) and eight foundations were classified as Category 2 (secondary funding). In addition, many of the foundations in Category 1 and 2 are based in Pennsylvania, which may increase the likelihood that they would support a Pittsburgh bike share program.

It is strongly recommended that a bike share program apply for support from both primary funding and secondary funding sources. While grant amounts vary, the highest awards were generally given to universities and to international projects. Therefore, a bike share may not be likely to receive the highest grant amounts from these sources. It is also important to note that most foundations only support nonprofit organizations, thus foundational funding opportunities may only be able to be leveraged if the management structure model is that of the nonprofit model discussed in the “Management Structures” section of this report.

Primary Funding (Category 1)

Name	total given to Pittsburgh (\$)	# Grants	Average to Pitt
Colcom Foundation	10,229,000	38	269,184
Gates, Bill and Melinda Foundation*	43,437,987	7	6,205,427
Heinz Endowments	32,048,064	237	135,224
Hillman Family Foundation	2,115,000	28	75,536
Mellon, Richard King Foundation	39,424,600	168	234,670
PNC Foundation	4,519,840	61	74,096

Max. award - general (\$)	Grants to PPP	Grants to Nonprofit
1,000,000	Y	Y
1,500,000,000	Y	Y
1,000,000		Y
5,000,000		Y
3,750,600	Y	Y
NA		Y

Secondary Funding (Category 2)

Name	total given to Pittsburgh (\$)	# Grants	Average to Pitt
Bayer USA Foundation	788,155	32	24,630
General Motors Foundation, INC*	787,660	2	393,830
Hewlett, William and Flora Foundaion*	784,745	1	784,745
Highmark Foundation	6,566,754	25	262,670
McCune Foundation	16,801,789	102	164,723
McCune, John R Charitable Trust*	1,900,000	52	36,538
Pittsburgh Foundation	21,094,346	365	57,793
Worthington Benedum, Claude Foundation	2,487,900	35	71,083

Max. award - general (\$)	Grants to PPP	Grants to Non-Profit
NA		Y
27,125,000		Y
50,000,000	Y	Y
3,500,000		Y
1,200,000		Y
100,000		Y
2,836,517	Y?	Y
2,000,000		Y

PPP = Public Private Partnership

Notes:

* Non-Pennsylvania based foundation,

** Year end 2010.⁸² All other amounts are year-end 2009.

⁸² "foundationcenter.com." *foundationcenter.com*. N.p., n.d. Web. 14 Dec. 2011. <<http://foundationcenter.com>>

4.3 Public Funding Options

4.3.1 State

Methodology

As seen in the analysis above, it may be necessary to secure funding to cover capital costs and/or operating costs, depending on the size of the program. Therefore, this report analyzed various funding opportunities. In addition to federal funding and private partnerships, state funding opportunities were also explored.

Results

Each funding opportunity offers different grant amounts, qualifications, and eligibilities as seen below. The "Eligibility" category has been classified to indicate the management structure model that must be adopted by the bike share to enable its eligibility for the various funding sources. This report found that funding opportunities in Pennsylvania are limited in amounts and in the number of sources. However, it should be noted that funding amounts and sources are often fluid on an annual basis.

The table below shows the summary of findings⁸³. Please refer to Appendix C for more detailed information on these opportunities.

Name of Program	Grant Amount	Eligibility	Note
Advantage Grant	Max \$7,500	For-Profit	For 'small businesses', Pollution Prevention and Energy Efficiency (P2E2) projects are eligible for this grant.
Alternative and Clean Energy Program	\$3M and loans up to \$5M	Nonprofit, PPP, For-Profit	For the utilization, development and construction of alternative and clean energy projects.
Ben Franklin Technology Partner's Challenge Grant and Alternative Energy Development Program	Unknown	For-Profit	Shows strong interest in the use of innovative technology (e.g. swipe card, bike-locating tool)
Marketing to attract tourists	Unknown	Non-Profit	Promotes increasing the lengths of visitors' stays. Shows strong interest in developing and enhancing tourists' experiences.
Neighborhood Assistance Program	Tax credits equal to 35% of project	Non-Profit	Help in community services and serve 'distressed areas'. Possible for future phases.
Pennsylvania Community Transportation Initiative (PCTI) Programs	Max \$300,000 (planning), Max \$1,500,000	PPP	Part of 'Smart Transportation'. Goals: lower gas usage, promote projects with a high value/price ratio, enhance local network, accommodate all modes of travel.
Transit Research & Demonstration Program	Unknown	PPP	Bus and metro ride, it would work well. Past project includes bike station feasibility study.
Tourist Program Development	\$5,000-\$100,000	Nonprofit	Help increase the length of visitor's stay
Urban Development	\$5,000-\$100,000	PPP	Improve the stability of community' and 'enhance the health, welfare and quality of citizens.'

PPP = Public Private Partnership

⁸³ newPA.com | State of Innovation." *newPA.com | State of Innovation*. N.p., n.d. Web. 14 Dec. 2011. <http://newpa.com>; "Pennsylvania Department of Transportation." *Pennsylvania Department of Transportation*. N.p., n.d. Web. 14 Dec. 2011. <http://www.dot.state.pa.us>; "Pennsylvania Department of Environmental Protection." *Pennsylvania Department of Environmental Protection*. N.p., n.d. Web. 14 Dec. 2011. <www.depweb.state.pa.us>

4.3.2 Federal

Overview

More and more federal funding programs are becoming open to funding bike share programs. The official language from the Federal Transit Administration (FTA) about the eligibility of bike share programs is as follows:

“Several commenters expressed a hope that FTA would eventually expand funding eligibility to include bicycle sharing initiatives. These commenters believed that bicycle sharing systems assist commuters with the “first and last mile” problem by linking them to public transportation during the beginning and ending of their commutes.

The FTA agrees that bicycle sharing systems provide meaningful access to public transportation and help address the problem of the “first and last mile.” Moreover, bicycle sharing programs, like all forms of active transportation, provide numerous benefits, such as reduced carbon emissions and improved public health.

Federal Transit Law limits the use of FTA funds for “public transportation.” Historically, FTA has not included “bicycle” within the definition of “public transportation.” Therefore, while a grantee may use FTA funds to purchase aspects of a bicycle sharing system if those aspects are located near public transportation stops and stations, an FTA grantee may not use FTA funds to purchase bicycles, regardless of whether those bicycles comply with Federal Buy America requirements.”⁸⁴

The rules regarding federal funding should also be noted. From the FTA: “Bicycle and pedestrian projects are broadly eligible for funding from almost all the major Federal-aid highway, transit, safety, and other programs. Bicycle projects must be “principally for transportation, rather than recreation, purposes” and must be designed and located pursuant to the transportation plans required of States and Metropolitan Planning Organizations.”⁸⁵

Lastly, it is important to note that some grants that were used to fund programs in other U.S. cities were available through stimulus funding. Thus, the future availability of these funds is dubious.

Methodology

In order to rank the most promising federal funding opportunities, a set of metrics was created. To be considered “Primary,” a federal funding opportunity would need to have a favorable response to at least two of the three metrics. For federal funding programs, the three metrics were:

1. Has the program been active in the past two years?
2. Has it funded bike share programs or similar programs?
3. Has the program been used for funding in Southwest Pennsylvania?

⁸⁴ <http://www.federalregister.gov/articles/2011/08/19/2011-21273/final-policy-statement-on-the-eligibility-of-pedestrian-and-bicycle-improvements-under-federal#h-23>

⁸⁵ <http://www.fhwa.dot.gov/environment/bikeped/bp-broch.htm>

Appendix D discusses the most promising federal funding sources, many of which have been successfully used by bike share programs across the country.

5. The Case for a Bike Share in Pittsburgh



5.1 Cost-Benefit Analysis

Overview

The purpose of the Cost Benefit Analysis (CBA) is to help in decision-making and enable an effective distribution of public resources. In the case of a Pittsburgh bike share, a CBA aids in evaluating the efficient use of funds, whether public or private, for the program. Below is an *ex ante* CBA – constructed when a project is under consideration.⁸⁶ This CBA used the Capital BikeShare Cost Benefit Analysis as a template. Changes were made to reflect the differences between cities.

By weighing the present value of economic benefits against the present value of economic costs, the net economic benefit emerges. If the net economic benefit is positive, then the benefits outweigh the costs and the project shows promise. If the net benefit is negative, then the costs exceed the benefits and stakeholders should proceed with trepidation. There are clear financial costs and benefits, such as operating costs and revenues, as well as intangible, qualitative costs and benefits, such as public health benefits. All social cost and benefits were monetized using values derived from the U.S. Department of Transportation and the U.S. National Highway Traffic Safety Administration.

Over the course of five years, the costs of a bike share program projects to be \$28,252,263. Costs include capital and operating costs, travel time costs, and costs related to bicycle accidents.

Over the same time period, total benefits projects to be \$31,882,257. Benefits include fuel savings, user cost savings, travel time savings, congestion reduction benefits, environmental benefits, public health benefits, and benefits related to a decrease in auto accidents.

Thus, a bike share program will have a net present value of \$3,629,994 over five years.

Assumptions

Making assumptions is critical in CBA methodology. For the Pittsburgh bike share, there were cost, operational, mode shift, car, emissions, and price assumptions that had to be made. These figures feed into the main CBA as components of calculations to estimate costs and benefits. The best available data from federal agencies and benchmarked figures from other bike share cities served as a framework for many assumptions.

Cost and Revenue Assumptions

Capital Costs	\$3,600 cost per new bike in the first year. \$500 per bike in subsequent years. ⁸⁷
Operation Costs	\$1,600 per bike in operating costs. ⁸⁸
Projected Revenue	Based off user fees, daily pass, and annual pass. ⁸⁹ Assumes 5% annual increase.

Bike Operating Assumptions

Number of bikes	404, ⁹⁰ assumes an annual 5% increase.
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⁸⁶ Boardman, Anthony E., David H. Greenberg, Aidan R. Vining, and David L. Weimer. Cost-Benefit Analysis: Concepts and Practice. Upper Saddle River, New Jersey. Pearson Education, Inc. Page 4. 2006.

⁸⁷ See, Financing a Bike Share – Revenue Model.

⁸⁸ See, Financing a Bike Share – Revenue Model.

⁸⁹ See, Financing a Bike Share – Revenue Model.

⁹⁰ See, Demand Analysis.

Number of trips, per day	3,102, ⁹¹ assumes an annual 5% increase.
Average bike trip length, miles	1.5 miles ⁹²
Average bike speed	10 miles per hour

Bike Mode Shift Assumptions

Percent of riders shifted from auto to bike	8%
Percent of riders shifted from public transit to bike	50%
Percent of riders shifted from walk to bike	26%
Percent of riders shifted from taxi to bike	3%
Percent of riders shifted from personal bike to bike share	5%

Mode shift assumptions are based off the average of four cities: Paris, Barcelona, Lyon, and London.

	Paris	Barcelona	Lyon	London	Average
Transit	65%	51%	50%	34%	50%
Walk	20%	26%	37%	21%	26%
Car/Motorcycle	8%	10%	7%	6%	8%
Personal Bike	-	-	4%	6%	5%
Taxi	5%	-	0%	-	3%
No Travel	0%	-	2%	23%	8%

Auto Operating Assumptions

Average cost	\$0.55 per mile. ⁹³
Average auto speed	21.07 miles per hour ⁹⁴

Other Mode Assumptions

Average walk speed	3 miles per hour
Average bus speed	12.1 miles per hour

Emissions Assumptions⁹⁵

NO _x cold starts	5 grams per day
NO _x running exhaust	20.2 grams per day
VOC cold start	7.7 grams per day
VOC running exhaust	7.8 grams per day
CO ₂ cold start	88 grams per day
CO ₂	251 grams per day

Price Assumptions

Value of time (per auto driver) ⁹⁶	\$13.91
Value of time (per auto passenger)	\$13.91
Value of time (per bus rider)	\$16.09
Value of time (bike/ped)	\$13.91

⁹¹ See, Demand Analysis.

⁹² Based on the 2007/2008 Household Travel Survey conducted by the National Capital Region Transportation Planning Board (TPB). Released April 2009.

⁹³ Use of Federal mileage reimbursement rate.

⁹⁴ Based off a National Capital Region Transportation Planning Board (TPB) travel demand model.

⁹⁵ U.S. Department of Transportation, Federal Highway Administration. Transportation Air Quality and Figures. Vehicle Emissions.

http://www.fhwa.dot.gov/environment/air_quality/publications/fact_book/page15.cfm.

⁹⁶ U.S. Department of Transportation. Emil H. Frankel, Assistant Secretary for Transportation Policy. "Valuation of Travel time in Economic Analysis". 2007.

Value of time (waiting, walk access, etc.)	\$26.21
Auto operating cost, total, per mile	\$0.3370
Transit user cost, per mile	\$1.5000
Bike sharing operating cost, per mile	\$0.05
VOC cost ⁹⁷	\$1,700.00
NO _x cost	\$4,000.00
CO ₂ cost	\$33.00
Avg. fare - bus transit (Pittsburgh, \$ per 1.5 mile trip)	\$2.25
Avg. fare - taxi (Pittsburgh, \$ per 1.5 mile trip)	\$5.00
Avg. parking cost, \$ per day ⁹⁸	\$11.38
Health care increase for people not completing 30 minutes ⁹⁹	\$0.05
Percent of those biking who do not meet activity guidelines	0.2
Health care savings of one minute increase of daily average physical activity (\$/minute)	\$16.39
Congestion cost from additional automobile, per VMT	\$0.054
Accident cost from additional automobile, per VMT	\$0.02
Fuel Price, per gallon gasoline	\$3.33
Fuel Price, per gallon diesel	\$3.48

Accident cost, per person affected¹⁰⁰

Minor	\$12,000
Moderate	\$93,000
Serious	\$345,000
Severe	\$1,125,000
Critical	\$4,575,000
Fatality	\$6,000,000

Costs

The CBA begins with the outlay of costs, which includes monetary costs such as capital, operating, and maintenance. The final cost, accident costs, had to be monetized using the best available information from the federal and Pennsylvania Departments of Transportation.

In addition to the capital costs, operating costs, and revenue, to fully quantify the cost and benefits of a bike share program, one must measure the social value of the impacts. To measure the “shadow prices,” this report uses previously estimated shadow prices. These estimates were then inserted into the CBA for the proposed bike share program. As the timing of the costs and benefits may differ, a social discount rate is necessary to make future costs and benefits comparable to costs and benefits realized in the present.¹⁰¹ For the purposes of the Pittsburgh bike share, 3% and 7% discount rates were chosen. This follows guidelines set by the Office of Management and Budget (OMB), the General Accounting Office (GAO), the Congressional Budget Office (CBO), and the Environmental Protection Agency (EPA).¹⁰²

⁹⁷ U.S. Department of Transportation. TIGER Guidelines. <http://www.dot.gov/tiger/application-resources.html#BCAG>.

⁹⁸ Pittsburgh Parking Authority. Average Pittsburgh daily parking rates.

⁹⁹ Rails-to-Trails Conservancy. “Active Transportation for America. The Case for Increase Federal Investment in Bicycling and Walking. 2008.

¹⁰⁰ U.S. Department of Transportation. Joel Szabat, Deputy Assistant Secretary for Transportation Policy. “Treatment of Economic Value of a Statistical Life in Departmental Analyses.” 2009.

¹⁰¹ Boardman, Anthony E., David H. Greenberg, Aidan R. Vining, and David L. Weimer. Cost-Benefit Analysis: Concepts and Practice. Upper Saddle River, New Jersey. Pearson Education, Inc. Page 236. 2006.

¹⁰² Boardman, Anthony E., David H. Greenberg, Aidan R. Vining, and David L. Weimer. Cost-Benefit Analysis: Concepts and Practice. Upper Saddle River, New Jersey. Pearson Education, Inc. Page 268. 2006.

Travel Time Costs

Time spent traveling, which many are willing to pay to avoid, is a cost.¹⁰³ Travel time costs projected to be \$2.3 million in the first year of the program and increasing to \$2.8 million by the fifth year.

$$\begin{aligned}\text{Travel Time Costs} &= (\text{Value of Time, \$/trip} * \# \text{ Trips per Day}) * 365 \\ \text{Value of Time/Trip} &= \text{Value of Time, \$/hour} * \text{Bike Hours, trip} \\ \text{Bike Hours, \$/trip} &= \text{Average Bike Trip Length} / \text{Average Biking Speed}\end{aligned}$$

Accident Costs

Any bike share program increases the number of bicyclists and the number of bike trips. Unfortunately, this also means that an increase in the number of bicycling crashes and deaths is likely. A 1.1% bike crash rate was obtained from the Pennsylvania Department of Transportation¹⁰⁴ as was a 0.9% death rate per biking crash. Fatalities are measured at \$6 million per fatality, within the range of current empirical estimates of the value of a statistical life.¹⁰⁵ Due to the proposed location of the bike share program—in the city with low traffic speeds and visible roadways—injuries were assumed to be minor in nature and valued at \$12,000 per injury.¹⁰⁶ Total costs due to bike accidents projects to be at \$2.2 million in the first year of the program, increasing to \$2.7 million by the fifth year.

$$\begin{aligned}\text{Accident Costs} &= \text{Fatality Costs} + \text{Injury Costs} \\ \text{Injury Costs} &= (\text{Bike Trips} * \text{Crash Rate}) * \text{Cost per Injury} \\ \text{Fatality Costs} &= [(\text{Bike Trips} * \text{Crash Rate}) * \text{Fatality Rate per Crash}] * \text{Cost per Fatality}\end{aligned}$$

Benefits

The second portion of a CBA is the outlay of benefits. The major benefits of the proposed bike share are fuel savings, user cost savings, time savings, congestion reduction, emissions reduction, improved public health, and accident reduction.

Fuel Savings

A shift from fuel-driven modes of transportation to biking will correlate with a decrease in fuel usage. Fuel usage was quantified using the standard mileage rates set by the IRS when computing the deductible costs of operating an automobile.¹⁰⁷ Fuel savings projects to be \$95,000 in the first year and increases to just over \$116,000 by the fifth year.

$$\begin{aligned}\text{Fuel Savings} &= \text{VMT Reduced} * \text{Average Operating Cost per mile} \\ \text{VMT} &= (\text{Bike Trips} * \text{Mode Shift}) * \text{Average Bike Trip Length} \\ \text{Average Operating Cost} &= \text{Federal Reimbursement Rate}\end{aligned}$$

¹⁰³ Boardman, Anthony E., David H. Greenberg, Aidan R. Vining, and David L. Weimer. Cost-Benefit Analysis: Concepts and Practice. Upper Saddle River, New Jersey. Pearson Education, Inc. Page 415. 2006.

¹⁰⁴ Pennsylvania Crash Facts and Statistics. 2006.

¹⁰⁵ Boardman, Anthony E., David H. Greenberg, Aidan R. Vining, and David L. Weimer. Cost-Benefit Analysis: Concepts and Practice. Upper Saddle River, New Jersey. Pearson Education, Inc. Pages 405 - 407. 2006.

¹⁰⁶ U.S. Department of Transportation. Joel Szabat, Deputy Assistant Secretary for Transportation Policy. "Treatment of Economic Value of a Statistical Life in Departmental Analyses." 2009.

¹⁰⁷ IRS. Standard Mileage Rates. <http://www.irs.gov/taxpros/article/0,,id=156624,00.html>.

User Cost Savings

These savings reflect the difference in per mile user fees when individuals shift from auto, taxi, transit, walking and personal bike to using the bike share program. The daily cost to park was also reflected as a net savings. Savings projects to be \$2.2 million in the first year and increases to over \$2.6 million by the fifth year.

$$\begin{aligned} \text{User Cost Savings} &= (\text{User Costs} * \text{Average Bike Trip Length}) * (\text{Bike Trips} * \text{Mode Shift}) \\ \text{User Costs} &= (\text{User Costs, [Auto, taxi, transit, walk, person bike, parking]} * \text{User Costs, Bike}) \\ \text{User Costs, Bike} &= \text{Total Revenue} / \text{Bike Miles Traveled} \\ \text{Bike Miles Traveled} &= \text{Bike Trips} * \text{Average Bike Trip Length} \end{aligned}$$

Travel Time Savings

As mentioned in the cost section, time spent traveling, which many are willing to pay to avoid, is a cost. Therefore, any difference in time between modes of transportation is a source of saving. Savings projects to be \$3 million in the first year of the program and increasing to over \$3.6 million in the fifth year of the program.

$$\text{Time Cost Savings} = \text{Trips Shifted} * (\text{Time Cost, \$/trip [auto, taxi, transit, walk]} * \text{Bike Time Cost, \$/trip})$$

Congestion Reduction Benefits

As total vehicle miles are reduced, with individuals shifting to biking from other modes of transportation, there is societal value in traffic reduction and minimized wear on the roads. Savings project to be over \$9,000 for the first year, increasing to over \$11,000 in the fifth year of the program.

$$\text{Congestion Reduction Benefits} = (\text{Total VMT Reduced}) * (\text{Congestion Cost From Addition Auto, per VMT})$$

Emission Reduction Benefits

Pollution results in both public health costs and costs unrelated to health. Health costs include the costs of premature death and the costs of illness.¹⁰⁸ Non-health costs include environmental costs, corrosion to buildings, cars, and materials, and loss of views.¹⁰⁹ Pollutants emitted from motor vehicles include volatile organic compounds (VOCs), nitrogen oxides (NO_x), and carbon dioxides (CO₂).

The EPA has estimated the cold start emission and running emissions of a typical car.¹¹⁰ Cold start emission accounts for the “first few minutes of driving, which generate higher emissions because

¹⁰⁸ Burtraw, Dallas, Alan Krupnick, Erin Mausur, David Austin, and Deirdre Farrell. “Costs and Benefits of Reducing Air Pollutants Related to Acid Rain”. Contemporary Economic Policy. Pages 379 - 400. 1998.

¹⁰⁹ Boardman, Anthony E., David H. Greenberg, Aidan R. Vining, and David L. Weimer. Cost-Benefit Analysis: Concepts and Practice. Upper Saddle River, New Jersey. Pearson Education, Inc. Page 415. 2006.

¹¹⁰ U.S. Department of Transportation, Federal Highway Administration. Transportation Air Quality and Figures. Vehicle Emissions.

http://www.fhwa.dot.gov/environment/air_quality/publications/fact_book/page15.cfm.

the emission control equipment has not reached its optimal operating temperature.”¹¹¹ Running emissions account for the pollutants, which are “emitted from the vehicle’s tailpipe during driving and idling after the vehicle is warmed up.”¹¹²

	Grams/per day	Pounds	Tons	Per mile	Per Year
Ozone NOx					
Cold Start (g/trip)	5	0.011023114	5.51156E-06	1.96841E-07	7.18471E-05
Running (g/m)	20.2	0.044533382	2.22667E-05	7.95239E-07	0.000290262
Cost per ton					0.000362109
VOC					
Cold start	7.7	0.016975596	8.4878E-06	3.03136E-07	0.000110645
Running	7.8	0.017196058	8.59803E-06	3.07072E-07	0.000112081
Cost per ton					0.000222726
CO2					
Cold Start	88	0.194006812	9.70034E-05	3.46441E-06	0.001264509
Running	251	0.553360339	0.00027668	9.88143E-06	0.003606724
Cost per ton					0.004871232

The emissions reductions were monetized using values derived from the National Highway Traffic Safety Administration (NHTSA).¹¹³ Emission reduction benefits projects to be over \$400,000 the first year of the program to over \$500,000 by the fifth year of the program.

Pollutants per Year = (Total VMT Reduced)(Vehicle Pollutants Emitted, year)*
Vehicle Pollutants Emitted = Avg. Emission of a Car / Average Vehicle Miles Traveled, day)
Total Emission Reductions, \$ = (Pollutants per Year)(Pollutant Cost)*

Public Health Benefits

These benefits reflect the change in health care cost for individuals who do not ordinarily complete 30 minutes of daily exercise.¹¹⁴ This is coupled with the percent of those who use the bike share program and do not meet the exercise recommendations. Public health benefits project to be over \$11,000 the first year of the program and increasing to \$13,000 in the fifth year of the program.

Health Care Savings = (Health care cost increase for people not completing 30 min. of daily exercise)(Bike Trips*Percent of those biking who do not meet activity recommendations)*

Accident Reduction Savings

¹¹¹ U.S. Department of Transportation, Federal Highway Administration. Transportation Air Quality and Figures. Vehicle Emissions.

http://www.fhwa.dot.gov/environment/air_quality/publications/fact_book/page15.cfm.

¹¹² U.S. Department of Transportation, Federal Highway Administration. Transportation Air Quality and Figures. Vehicle Emissions.

http://www.fhwa.dot.gov/environment/air_quality/publications/fact_book/page15.cfm.

¹¹³ U.S. Department of Transportation. TIGER Guidelines. <http://www.dot.gov/tiger/application-resources.html#BCAG>.

¹¹⁴ Rails-to-Trails Conservancy. “Active Transportation for America. The Case for Increase Federal Investment in Bicycling and Walking. 2008.

As VMT is reduced, there is a corresponding decrease in auto, taxi and public transit accidents. These savings were monetized using the accident costs from each addition vehicle, per VMT.¹¹⁵ Savings project to be at over \$3,000 for the first year with an increase to \$4,000 by the fifth year of the program.

$$\text{Reduced Accident Costs} = (\text{Total VMT Reduced}) * (\text{Accident Cost, per VMT})$$

Results

The net present value represents the present value of benefits less costs and signifies the final value of the program. After considering a variety of costs and benefits implicit to a bike share in Pittsburgh, over the course of five years the final net present value is \$3,629,994. This is a positive indicator that a bike share will be a successful and beneficial program for the city.

Conclusions

After measuring monetary and social benefits and costs, the end result shows that benefits outweigh costs. While many assumptions had to be made along the way, the best available data was utilized to derive the best projections possible for individual costs and benefits. As data becomes available, it is possible to adjust parameters and re-calculate elements of the CBA. To this extent, this CBA is just an *ex ante* perspective into what has the potential to be a long-term program in the city. New information can inform *ex post* analysis to measure the actual costs and benefits of the program once it is in operation. This CBA can provide a framework for such an endeavor or serve as the basis of analysis for a CBA required for grant applications.

¹¹⁵ Based on a previous Bike Share cost-benefit model that used received guidance from the National Highway Traffic Safety Administration (NHTSA).

6. Next Steps



The below steps were outside our scope of work, but we believe they are necessary for the successful implementation of a bike share program.

- Phase Planning (that includes the East End)
- Community Outreach and Education
 - o Larger survey to estimate demand
 - o Development of a website for public engagement
- Send out a Request for Proposals
- Secure Funding
 - o Additional survey of businesses to determine advance subscription potential that could defray capital costs
- Determine Locations for Stations and Capacities
 - o Identify best possible station network with an optimization analysis that maximizes the weighted averages of individual factors
 - o Assess impact of increased bike traffic on road infrastructure

7. Appendices



Appendix A. Local Businesses

Pittsburgh has several Fortune 500 companies headquartered within the city and throughout the metropolitan area. Additionally, UPMC the second largest employer in Pennsylvania is centered in Pittsburgh. Below are companies representing the best sponsorship opportunities:

UPMC

UPMC sponsors health-related causes, most notably the UPMC Pittsburgh Half Marathon.¹¹⁶ Furthermore, they have invested in big programs such as the Pittsburgh Promise, which pays for college for achieving students in Pittsburgh Public Schools.¹¹⁷ UPMC, along with PNC, American Eagle Outfitters, Dick's Sporting Goods, and Verizon are among the prime sponsors of the Consol Energy Center.¹¹⁸

PNC Bank

PNC Bank is the seventh largest bank in the country.¹¹⁹ PNC Bank has sponsored extensively within Pittsburgh, most notably PNC Park, home of the Pittsburgh Pirates.¹²⁰ PNC Bank also is a gold sponsor of the National Veterans Wheelchair Games, and presents the Pittsburgh Triathlon & Adventure Race.^{121 122}

Highmark

Highmark is a large insurance company with 11,000 Pittsburgh-based employees. They are the name sponsor of Highmark Sports Works at Carnegie Science Center.¹²³ They were also among the Signature & Attraction Sponsors for Light Up Night Pittsburgh.¹²⁴

Heinz

Heinz is a historic Pittsburgh company that has a worldwide presence. Sponsorships include Heinz Field, home of the Pittsburgh Steelers and Pittsburgh Panthers.¹²⁵

¹¹⁶ Pittsburgh Marathon Website, Half Marathon Section

http://www.pittsburghmarathon.com/Top_Nav/Half_Marathon/HALF_MARATHON_INFORMATION.htm

¹¹⁷ UPMC Website Media Relations Section

<http://www.upmc.com/MediaRelations/factsheets/Pages/promise-summary.aspx>

¹¹⁸ Muret, Don "Penguins add five news sponsors for Consol Energy Center." *Pittsburgh Business Journal* July 12, 2010. <http://www.bizjournals.com/pittsburgh/stories/2010/07/12/daily1.html?page=all>

¹¹⁹ Grocer, Stephen "Ranking the 50 biggest U.S. Banks from bofa to commerce bankshares." *Wall Street Journal* March 24, 2011 <http://blogs.wsj.com/deals/2011/03/24/ranking-the-50-biggest-u-s-banks-from-bofa-to-commerce-bancshares/>.

¹²⁰ Dvorchak, Robert "PNC Park: The Political Struggle Over Financing PNC Park Went into Extra Innings." *Pittsburgh Post-Gazette* April 15, 2001.

¹²¹ Piranha Sports Website, Race 45 Section, <http://www.piranha-sports.com/Race45.aspx>.

¹²² Pittsburgh VA Website, Sponsors Section <http://www.pittsburgh.va.gov/NVWG/sponsorship.asp>.

¹²³ Carnegie Science Center Website, Highmark Sportsworks Section

<http://www.carnegiesciencecenter.org/exhibits/highmark-sportsworks/>.

¹²⁴ Duquesne Light up the Night Website, Main page <http://www.downtownpittsburgh.com/duquesne-light-light-up-night>.

¹²⁵ Deckard, Linda "Heinz Pours Itself into 57 Million Naming Rights Deal in Pittsburgh" June, 25 2001 All Business <http://www.allbusiness.com/services/amusement-recreation-services/4568098-1.html>.

BNY Mellon

With 7,000 Pittsburgh based employees, BNY Mellon ranks as the eighth largest bank in the US.¹²⁶ The bank is the name sponsor of BNY Grand Classics of the Pittsburgh Symphony Orchestra.¹²⁷

PPG

PPG is an international company headquartered in downtown Pittsburgh. They are the name sponsor of the PPG Zoo & Aquarium. Additionally, "Chairman and CEO Charles Bunch announced a \$6.9 million contribution over 10 years and introduced the PPG Conservation and Sustainability Fund. This fund awards grants to help support a variety of field studies and projects with a multidisciplinary approach to conservation."¹²⁸

American Eagle Outfitters

American Eagle Outfitters is a worldwide retailer headquartered on the South Side. They are the name sponsor of the North Shore music venue Stage AE.¹²⁹ In a very applicable sponsorship, American Eagle Outfitters was the name sponsor for the American Eagle Pro Cycling Tour of Pennsylvania.¹³⁰

Dick's Sporting Goods

Dick's is a nationwide sporting goods retail chain. Dick's is headquartered near the Pittsburgh International Airport. Dick's is the primary sponsor of the Dick's Sporting Goods Pittsburgh Marathon. Additionally, the company and the marathon have agreed to a ten-year extension, which will give Dick's Sporting Goods naming rights to the marathon until 2021.¹³¹

Comcast

Comcast is one of the largest communication companies in the country with its main services being cable television, internet and phone. Locally, they have sponsored the Allegheny County Library Foundation's "One Book, One Community" program, Hispanic Latino Center's Workforce Solutions Project, Pittsburgh Cares and the Urban League of Pittsburgh's Post-Secondary Preparation Program.¹³²

Alcoa

¹²⁶ Grocer, Stephen "Ranking the 50 biggest U.S. Banks from bofa to commerce bankshares." *Wall Street Journal* March 24, 2011 <http://blogs.wsj.com/deals/2011/03/24/ranking-the-50-biggest-u-s-banks-from-bofa-to-commerce-bancshares/>.

¹²⁷ Pittsburgh Symphony Orchestra Website, Upcoming shows Blog <http://blogs.pittsburghsymphony.org/2011/02/pittsburgh-symphony-orchestra-announces-2011-2012-bny-mellon-grand-classics-seas/>.

¹²⁸ Tascarella, Patty "PPG, Pittsburgh Zoo Renew Partnership." August 16, 2011 <http://www.bizjournals.com/pittsburgh/news/2011/08/16/ppg-pittsburgh-zoo-renew-partnership.html>.

¹²⁹ Pittsburgh Steelers Website, News Section <http://www.steelers.com/news/article-1/American-Eagle-Outfitters-secure-naming-rights-of-North-Shore-entertainment-complex/4d2d7e9b-15c9-423c-99e6-4b125abc1678>.

¹³⁰ Pro Cycling Tour Website, Events Section <http://procyclingtour.com/about-events.htm>

¹³¹ Street & Smith's Sports Business Journal Daily "Dick's Sporting Goods Extends Sponsorship of Pittsburgh Marathon Through '21." May 17, 2011 <http://www.sportsbusinessdaily.com/Daily/Issues/2011/05/17/Marketing-and-Sponsorship/Dicks-marathon.aspx>.

¹³² Comcast Website, Foundation Section <http://www.comcast.com/corporate/about/inthecommunity/foundation/programs-funded.aspx>.

Aluminum producer headquartered on the North Shore. They have been sponsors of many programs nationwide including America Recycles Day,¹³³ environmental education for teachers,¹³⁴ and National Park Foundation Leadership Summit.¹³⁵

Consol Energy

Consol Energy is a regional electric producer, which has many sponsorships around the city, most notably the new arena for the Pittsburgh Penguins where they signed a 21-year naming rights deal.¹³⁶

Giant Eagle

Giant Eagle has several sponsorships in the city and in the region. These include the MS Bike to the Bay,¹³⁷ Giant Eagle Multisport Festival,¹³⁸ PodCamp Pittsburgh,¹³⁹ and the University of Akron athletic program.¹⁴⁰

Duquesne Light

Duquesne Light is the name sponsor for Duquesne Light Up Night in Downtown.¹⁴¹ Additionally, in light of recent floods, Duquesne Light sponsored the Pittsburgh Home & Garden Show.¹⁴²

GNC

GNC sponsors the GNC Live Well Pittsburgh Health and Fitness Expo.¹⁴³ GNC also sponsors the March of Dimes.¹⁴⁴

Pittsburgh Post-Gazette

The Pittsburgh Post Gazette is presently in the Diamond Circle of sponsors for the Pittsburgh CIO.¹⁴⁵ The newspaper also sponsored the Pittsburgh Home & Garden Show in 2011.¹⁴⁶

¹³³ America Recycles Day, Sponsors Section <http://americarecyclesday.org/sponsors-partners>

¹³⁴ Alcoa Website, News Section <http://education.une.edu/alcoa-foundation-sponsors-environmental-education-for-teachers-800537362/>.

¹³⁵ Alcoa Website, News Section

http://www.alcoa.com/global/en/news/news_detail.asp?newsYear=2007&pageID=20071018005666en.

¹³⁶ Pittsburgh Penguins Website, News Section "CONSOL Energy Acquires Naming Rights to New Pittsburgh Arena." December 15, 2008 <http://penguins.nhl.com/club/news.htm?id=496458>.

¹³⁷ National MS Society Website, Event Page

http://bikeoho.nationalmssociety.org/site/PageServer?pagename=BIKE_OHO_Sponsors.

¹³⁸ Giant Eagle Multi Sport Festival Website, Sponsor Page

<http://gianteaglemultisportfestival.com/sponsorship.html>.

¹³⁹ Pod Camp Pittsburgh Website, News Section <http://podcamppittsburgh.com/2011/08/giant-eagle-market-district-sponsors-podcamp-pittsburgh-6/>.

¹⁴⁰ University of Akron Website, News Section

http://www.uakron.edu/about_ua/news_media/news_details.dot?newsId=8822&pageTitle=UA+News&crumbTitle=Giant+Eagle+Becomes+Zips+Athletics+Corporate+Partner.

¹⁴¹ Duquesne Light up the Night Website, Main page <http://www.downtownpittsburgh.com/duquesne-light-light-up-night>.

¹⁴² PR NewsWire, United Business Media, News Releases Section <http://www.prnewswire.com/news-releases/duquesne-light-and-pittsburgh-home--garden-show-to-provide-platform-to-aid-families-rebuilding-from-hurricane-ivan-floods-54132132.html>.

¹⁴³ Pittsburgh Marathon, Health and Wellness Expo Section,

http://www.pittsburghmarathon.com/Top_Nav/Expo/EXPO_INFORMATION_AND_SCHEDULE.htm.

¹⁴⁴ GNC Website, Media Section <http://gnc.mediaroom.com/index.php?s=43&item=83>.

Pittsburgh Tribune-Review

The Pittsburgh Tribune-Review is the second largest newspaper in the region. They were named a sponsor of the TribMedia Amphitheater.¹⁴⁷

First Niagara

First Niagara Bank is based in Buffalo, but has a presence in the Pittsburgh area. They are one of the chief sponsors of TiE Pittsburgh, which is an Entrepreneurship program.¹⁴⁸

K & L Gates

K & L Gates is one of the largest law firms in the region. They have sponsored the 3 Rivers Venture Fair. ¹⁴⁹

¹⁴⁵ Pittsburgh CLO Website, Corporate Sponsors Section <http://www.pittsburghclo.org/pages/corporate-sponsors>.

¹⁴⁶ Pittsburgh About Website, Events Section http://pittsburgh.about.com/od/events/p/home_show.htm.

¹⁴⁷ Encore Magazine "Pittsburgh Tribune Signs Naming Rights Deal with Station Square Amphitheatre May 7, 2010. <http://encore.celebrityaccess.com/index.php?encoreId=247&articleId=35045>

¹⁴⁸ Pittsburgh tie Website, Sponsors Page <http://pittsburgh.tie.org/page/sponsors>.

¹⁴⁹ 3 Rivers Venture Fair Website, Sponsors Page <http://3rvf.com/sponsors/sponsors.php>.

Appendix B. Foundation Options

FC Stats: The Foundation Center's Statistical Information Service
(foundationcenter.org/fcinfo/funders/statistics/)

Top 50 U.S. Foundations Awarding Grants in the Pittsburgh, PA, Metropolitan Area, circa 2009

Foundation Name	Foundation State	Foundation Type ¹	Total Dollars Awarded	No. of Grants
1. Bill & Melinda Gates Foundation	WA	IN	\$ 43,437,987	7
2. Richard King Mellon Foundation	PA	IN	39,424,600	168
3. The Heinz Endowments	PA	IN	32,048,064	237
4. The Pittsburgh Foundation	PA	CM	21,094,346	365
5. Eden Hall Foundation	PA	IN	18,828,167	67
6. McCune Foundation	PA	IN	16,801,789	102
7. Colcom Foundation	PA	IN	10,229,000	38
8. The Grable Foundation	PA	IN	9,518,751	175
9. Highmark Foundation	PA	CS	6,566,754	25
10. Thomas J. and Sandra L. Usher Charitable Foundation	FL	IN	6,045,000	29
11. The PNC Foundation	PA	CS	4,519,840	61
12. Boston Foundation, Inc.	MA	CM	2,500,000	1
13. Claude Worthington Benedum Foundation	PA	IN	2,487,900	35
14. The Andrew W. Mellon Foundation	NY	IN	2,322,000	6
15. Hillman Foundation	PA	IN	2,115,000	28
16. John R. McCune Charitable Trust	OH	IN	1,900,000	52
17. The Robert Wood Johnson Foundation	NJ	IN	1,507,083	5
18. The John D. and Catherine T. MacArthur Foundation	IL	IN	1,485,000	3
19. Lilly Endowment Inc.	IN	IN	1,480,550	4
20. The Henry Luce Foundation, Inc.	NY	IN	1,110,000	3
21. FISA Foundation	PA	IN	1,095,584	28
22. The Campbell Family Foundation	CA	IN	943,000	4
23. Denis Duke Charitable Foundation	NY	IN	900,000	2
24. The David and Lucile Packard Foundation	CA	IN	875,000	1
25. The Andy Warhol Foundation for the Visual Arts	NY	IN	866,000	2
26. Bayer USA Foundation	PA	CS	788,155	32
27. General Motors Foundation, Inc.	MI	CS	787,660	2
28. William G. McGowan Charitable Fund, Inc.	IL	IN	786,000	3
29. The Spencer Foundation	IL	IN	784,745	4
30. The William and Flora Hewlett Foundation	CA	IN	750,000	1
31. Lumina Foundation for Education, Inc.	IN	IN	750,000	1
32. Alfred P. Sloan Foundation	NY	IN	747,666	8
33. The Susan Thompson Buffett Foundation	NE	IN	713,020	5
34. Sarah Scafe Foundation, Inc.	PA	IN	700,000	7
35. Roy A. Hunt Foundation	PA	IN	656,000	36
36. Citizens Charitable Foundation	MA	CS	516,606	17
37. Silicon Valley Community Foundation	CA	CM	496,791	6
38. Alcoa Foundation	PA	CS	465,000	16
39. Sundine Foundation, Inc.	NY	IN	460,000	6
40. The Harry and Jeanette Weinberg Foundation, Inc.	MD	IN	490,000	5
41. Freeman Foundation	NY	IN	417,988	1
42. Dominion Foundation	PA	CS	408,500	23
43. The Eaton Charitable Fund	OH	CS	314,448	13
44. Flight Attendant Medical Research Institute, Inc.	FL	IN	298,375	3
45. St. Jude Medical Foundation	MIN	CS	280,000	6
46. The Hearst Foundation, Inc.	NY	IN	275,000	3
47. The Virginia G. Piper Charitable Trust	AZ	IN	250,000	1
48. Intel Foundation	OR	CS	239,852	4
49. Eli & Elyse Broad Foundation	CA	IN	235,688	2
50. Helene Fuld Health Trust	NY	IN	225,000	1
Total			\$ 242,544,909	1,654

Source: The Foundation Center, 2011. Based on all grants of \$10,000 or more awarded by a national sample of 1,384 larger U.S. foundations (including 800 of the 1,000 largest ranked by total giving). For community foundations, only discretionary grants are included. Grants to individuals are not included in the file. The search set includes only the larger U.S. foundations awarding grants in the metropolitan area. Grants by smaller local foundations are not represented. Metropolitan areas are designated by the U.S. Office of Management and Budget (OMB).

¹IN=Independent Foundation; CM=Community Foundation; CS=Corporate Foundation; OP=Operating Foundation.

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Appendix C. State Funding

Notation used:

DCED: Department of Community and Economic Development

DEP: Department of Environment Protection

BFTP: Ben Franklin Technology Partner

Advantage Grant
(‘Providing 50 percent matching grants, up to a maximum of \$7,500 to enable a Pennsylvania small business to adopt or acquire energy efficient or pollution prevention equipment or processes’)
Grant Amount
Maximum grant of \$7,500
Why would a Pittsburgh Bike Share be suitable for this grant?
Pollution Prevention and Energy Efficiency (P2E2) projects are eligible for this grant. Past projects include high-efficiency lighting systems, building insulation, paint spray booth, and water conservation. Will not be able to fund an entire Pittsburgh bike share program but may be able to contribute funding to a part of it (e.g. solar fixtures for stations).
Recommendations (Timeline, restrictions, etc.)
To be eligible for this program, a Pittsburgh bike share program has to be a ‘small business.’ The grant is given each fiscal year and the deadline for 2011 was in September. Check back early in 2012 for a new schedule.
Source
http://www.portal.state.pa.us/portal/server.pt/community/financial_assistance/10495/advantage_grant/553249

Alternative and Clean Energy Program
(‘For the utilization, development and construction of alternative and clean energy projects’)
Grant Amount

Grants up to \$2 million and loans and loan guarantees up to \$5 million
Why would a Pittsburgh Bike Share be suitable for this grant?
This program is administered by DCEP and DEP. To be eligible for this grant, a Pittsburgh bike share can be either run by a for-profit or a non-profit organization or by local governments. Past project examples include an energy efficient lighting installation at a county courthouse and a new biomass plant that will reduce natural gas use at a school.
Recommendations (Timeline, restrictions, etc.)
Continue to monitor the future availability of this program.
Source
www.newpa.com http://www.newpa.com/sites/default/files/uploads/Commonwealth%20Financing%20Authority/Alternative-and-Clean-Energy---Factsheet.pdf

Ben Franklin Technology Partner's Challenge Grant and Alternative Energy Development Program (AEDP)
('Well-designed energy efficient or pollution prevention projects can help small businesses cut costs and reduce the risk of regulatory problems, while simultaneously protecting the environment.')
Grant Amount
N/A
Why would a Pittsburgh Bike Share be suitable for this grant?
BFTP's mission is to promote the transformation of Pennsylvania's economy through the use of technology, innovation, and strategic partnerships that foster a favorable business environment for high-growth companies. A Pittsburgh bike share program may qualify due to the use of new technologies such as a swipe card or bike-locating tools.
Recommendations (Timeline, restrictions, etc.)
For this grant, the applicant must be a for-profit enterprise to be eligible. Continue to monitor for the next phase of available funding.
Source
http://www.newpa.com/sites/default/files/uploads/BenFranklinTechnologyPartners_Guidelines_10-2.pdf

Marketing to Attract Tourists
Grant Amount
N/A
Why would a Pittsburgh Bike Share be suitable for this grant?
If a Pittsburgh bike share program can help facilitate visitors staying in the City of Pittsburgh longer, then it may be a suitable applicant for this program.
Recommendations (Timeline, restrictions, etc.)
Applicant must be a nonprofit organization and must show a strong interest in promoting and enhancing the average tourist's experience in the city. Applications are accepted throughout the year.
Source
http://www.newpa.com/sites/default/files/uploads/Marketing/2011_MarketingToAttractTourists_Guidelines.pdf

Neighborhood Assistance Program (NAP)
Grant Amount
Tax credits equal to 55 percent of the project.
Why would a Pittsburgh Bike Share be suitable for this grant?
'Projects must serve distressed areas or serve neighborhoods and fall under one of the following categories: affordable housing programs, community service, crime prevention, education, job training or neighborhood assistance.' A bike share could offer another mode of transportation for users in distressed areas and provide neighborhood assistance.
Recommendations (Timeline, restrictions, etc.)
A Pittsburgh bike share would need to be a non-profit and serve 'distressed areas' (see guideline for more detail). The deadline for the regular tax credit for this year was Nov 10, 2011.
Source
http://www.newpa.com/sites/default/files/uploads/Community%20Affairs%20&%20Development/Community%20Empowerment/NAP_Guidelines_2011.pdf

Pennsylvania Community Transportation Initiative (PCTI) (Part of 'Smart Transportation' from Pennsylvania Department of Transportation)
Grant Amount
A maximum of \$300,000 for planning, and a maximum of \$1,500,000 for implementation.
Why would a Pittsburgh Bike Share be suitable for this grant?
As long as a bike share can show that it can integrate best practices from 'Smart Transportation', it would work well. A bike share would certainly be suitable for lowering gas usage, promoting other modes of transportation, and enhancing the local network.
Recommendations (Timeline, restrictions, etc.)
A bike share would need to be owned by a government entity, such as a municipal government or a transportation authority. Application was due September 2010. Check back next year for new timeline.
Source
http://www.ncentral.com/uploads/Trans/PDF/PCTI Program Guide.pdf , http://www.smart-transportation.com/

Public Transportation Grant Program Transit Research & Demonstration Program (‘For innovative projects that enhance the attractiveness of public transportation.’)
Grant Amount
Up to 80% funding with the applicant being responsible for the remaining 20%
Why would a Pittsburgh Bike Share be suitable for this grant?
A Pittsburgh bike share could serve to enhance multimodal connectivity between bikes and bus/transit options. One example of a past project was a bike share feasibility study.
Recommendations (Timeline, restrictions, etc.)
This grant may not be available any longer. Continue to monitor for any developments.

Source
http://www.dot.state.pa.us/Internet/Bureaus/pdBPT.nsf/infoTransitResDemProg?OpenForm

Urban Development Program (‘For projects furthering community and economic development and/or redevelopment in urban areas...’)
Grant Amount
\$5,000-\$100,000
Why would a Pittsburgh Bike Share be suitable for this grant?
If a bike share program is run by a government entity or a nonprofit organization, it is eligible. A bike share would help to provide transportation options for residents that would help to ‘improve the stability of the community’ and ‘enhance the health, welfare, and quality of life for citizens.’
Recommendations (Timeline, restrictions, etc.)
Apply via DCED application. The deadline for Round 4 was March 21, 2011. Continue to monitor for next round of funding.
Source
PA Department of Community and Economic Development http://www.newpa.com/sites/default/files/uploads/UrbanDevelopmentGuidelines2010.pdf

Appendix D. Federal Funding

Federal funding sources for bike share programs are in a fluid state at the moment. This report selected funding programs that are the most promising for a bike share program through their history of being used by other bike share programs throughout the country.

Congestion Mitigation and Air Quality Improvement (CMAQ)

Created in 1990, this is a very well funded program (\$6 billion dollar authorization for 5 years).¹⁵⁰ Boston was able to use CMAQ funding for the second year of their bike share program, as well as the first year of their bike share programs in Cambridge and Brookline.¹⁵¹ The Alexandria, Virginia satellite branch of Capitol BikeShare got \$700,000 in CMAQ funding.¹⁵² Transportation Solutions in Denver teamed up with the University of Denver to apply for CMAQ funding.¹⁵³

TIGER III

4.5% of funding from Tiger I & Tiger II were appropriated to bicycle and pedestrian programs. Tiger I allocated \$43.5 million to two bicycle-alone companies (in Philadelphia and Indianapolis); Tiger II allocated \$25.2 million to two bicycle-alone companies (in California and Arkansas).¹⁵⁴ Capital BikeShare, particularly Montgomery County, Maryland, applied for Tiger funding in both Tiger I & Tiger II, but was not awarded money, though they were a finalist in Tiger II.¹⁵⁵ One troubling development has been the recent political pressure to focus solely on rail, transit, road and cargo for Tiger III, despite only 4.5% of funds from Tiger I and Tiger II were spent on bicycle and pedestrian programs.¹⁵⁶

Metropolitan and Statewide Planning Program

This is an intriguing opportunity as the region has had success with this grant previously. Additionally, two of the eligibility requirements that a program can qualify through are very applicable to a bike share:

- 1) Increase the safety of the transportation system for motorized and nonmotorized users

¹⁵⁰ Department of Transportation Website, CMAQ Section

http://www.fhwa.dot.gov/environment/air_quality/cmaq/.

¹⁵¹ Boston Region Metropolitan Planning Organization Website, The Clean Air and Mobility Program Section
http://www.ctps.org/bostonmpo/3_programs/7_clean_air_mobility/clean_air_mobility.html.

¹⁵² Local Motion, City of Alexandria, VA, Bike Sharing Section
<http://alexandriava.gov/localmotion/info/default.aspx?id=55082>

¹⁵³ Transportation Solutions "2011 Program and Organization Objectives." March 2011
<http://www.transolutions.org/files/Transportation%20Solutions%202011%20Work%20Plan.pdf>

¹⁵⁴ <http://dc.streetsblog.org/2011/11/29/is-congress-trying-to-put-the-kibosh-on-tiger-funding-for-bikeped/>.

¹⁵⁵ Snyder, Tanya "Is Congress Trying to Put the Kibosh on TIGER Funding for Bike/Ped" DC.StreetsBlog November 29, 2011 <http://greatergreaterwashington.org/post/12458/montgomery-considers-many-ways-to-fund-bike-sharing/>.

¹⁵⁶ Ehl, Larry "Did TIGER II Spend Too Much on Bicycle-Pedestrian Projects." *Transportation Issues Daily* November 29, 2011 <http://www.transportationissuesdaily.com/tag/tiger/>.

2) Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and state and local planned growth and economic development patterns.¹⁵⁷

There has been considerable spending through this program. In the five years from 2005-2009, the program spent \$403 million on metropolitan and \$84 million on statewide planning totaling \$487 million.¹⁵⁸

Sustainable Communities Regional Planning Grants

Some of the eligibility requirements include:

- 1) Energy use and climate change; and
- 2) Public health and environmental impact.

These grants place a priority on investing in partnerships, including nontraditional partnerships (e.g., arts and culture, recreation, public health, food systems, regional planning agencies and public education entities) that translate the Federal Livability Principles into strategies that direct long-term development and reinvestment, demonstrate a commitment to addressing issues of regional significance, use data to set and monitor progress toward performance goals, and engage stakeholders and residents in meaningful decision-making roles.¹⁵⁹ This program is administered through HUD in coordination with the Federal DOT and EPA. State transportation agencies that help fund Denver Bike Share and Hubway in Boston were awarded money through this program – \$4.5 million for Denver and \$1.8 million for Boston.¹⁶⁰

The Non-motorized Transportation Pilot Program (NTPP)

While this grant program is not as fully developed as the others it meets the goals of a bike share very nicely. Minneapolis received \$25 million for Bike Walk Twin Cities. Get About Columbia, a biking program in Columbia, Missouri also received the same grant amount, as did Walk, Bike Marin a program in Marin County, California. Lastly, Sheboygan County, Wisconsin received the same amount for their biking and walking programs.¹⁶¹

Energy Efficiency and Conversation Block Grant Program

Denver and Washington, D.C. were able to use funds from this program to help cover their bike share capital costs.¹⁶² This program is administered through the federal Department of Energy.

¹⁵⁷ U.S. Department of Transportation, Federal Transit Administration Website, Grant Programs Section http://www.fta.dot.gov/grants/13093_3563.html.

¹⁵⁸ U.S. Department of Transportation, Federal Transit Administration Website, Grant Programs Section http://www.fta.dot.gov/documents/FTA_Metropolitan_and_State_Planning_Fact_Sheet_Sept05.pdf.

¹⁵⁹ U.S. Department of Housing and Urban Development Website, Sustainable Housing Communities Section http://portal.hud.gov/hudportal/HUD?src=/program_offices/sustainable_housing_communities/sustainable_communities_regional_planning_grants.

¹⁶⁰ Steuteville, Robert "2011 Sustainable Communities Grants Announced." *New Urban News* November 21, 2011 <http://newurbannetwork.com/article/2011-sustainable-communities-grants-announced-15603>.

¹⁶¹ U.S. Department of Transportation, Federal Highway Administration Website, Environment Section <http://www.fhwa.dot.gov/environment/bikeped/ntpp.htm>.

¹⁶² "Riding to Sustainability: Bike Sharing Takes Off." *Energy.Gov* December 3, 2010 <http://energy.gov/articles/riding-sustainability-bike-sharing-takes>.

San Antonio's B-Cycle program was partly funded through this program.¹⁶³ Oklahoma City received a \$5.4 million dollar grant through this program, with plans to use a portion of the funds on their proposed bike share program.¹⁶⁴

Transportation Enhancement Programs

These programs have traditionally been used to fund bike lanes to make commuting via cycling easier. The current budget is \$928 million. The program has come under attack recently by some in Congress who see funds invested in cycling as outside the traditional role of government. The future of the program to fund cycling activities is not known.

Primary Possible Federal Funding Sources			
Name of Program	Was Funding Available Within the Past Two Years?	Has Funding Been Used for Other Bike Share Programs?	Has Funding Been Authorized in Southwest PA?
CMAQ	Yes	Yes	Yes
Energy Efficiency and Conservation Block Grant Program	Yes	Yes	No
Highway Bridge Funding Program	Yes	No	Yes
Job Access and Reverse Commute Program	Yes	No	Yes
Metropolitan and Statewide Planning Program	Yes	No	Yes
Nonmotorized Transportation Pilot Program	Yes	Yes	No
Smart Growth Funding Program	Yes	Yes	No
Sustainable Communities Regional Planning Grant	Yes	Yes	Yes
Tiger II, Tiger III	Yes (for Tiger II), None yet for Tiger III	Yes	No
Transportation, Community, and System Preservation Program	Yes	No	Yes
Transportation Enhancement Activities	Yes	No	Yes
Urbanized Area Formula Program	Yes	No	Yes
Secondary Possible Funding sources			
Federal Lands Highway Program	Yes	No	No
Federal Livability Program	Yes	No	No
Highway Safety Improvement Program	Yes	No, rules recently changed that would enable perspective bike share to apply	No
Land and Water Conservation Fund	Yes	No	No
Safe Routes to School Program	Yes	No	No

¹⁶³ Allen, Todd " Bike Sharing in Texas: San Antonio Rolls Out Program Aimed at Energy Efficiency and Public Health." *Energy.Gov* August 8, 2011 <http://energy.gov/articles/bike-sharing-texas-san-antonio-rolls-out-program-aimed-energy-efficiency-and-public-health>

¹⁶⁴Oklahoma City Website, Office of Sustainability Section <http://www.okc.gov/sustain/EECS.html>.

Appendix E. Technology and Design Considerations

Changes in the level of technology used for bike share programs have been used to define ‘generations’ of bike share systems. The first generation of bike share systems, which began to appear during the mid-1960s, consisted of unlocked bikes that had no designated stations. The White Bikes program in Amsterdam had distinctly identifiable white bikes that were left around the city for use free of charge. The second generation of bike share systems (1992-1995) incorporated the use of locked bikes and docking stations. A good example is the Bicyklen program in Copenhagen. The bikes were available free of charge but were accessed by inserting coins into the bike stations (the money was returned upon the bike’s return). The third generation of bike systems (started around 1998) is the model that is utilized in most bike share programs now. This generation uses smart card technology that must be used at access kiosks at specific stations. Smart card usage and kiosk accesses allowed bike share systems to design an array of membership options for users (for example, annual memberships versus day-ride passes), which helped bike share systems generate additional revenue. The innovation of fourth generation bike share systems is under way. This new generation may include, on a system by system basis, the following innovations: solar-powered docking systems, electric bicycles, GPS tracking, and real-time mobile, web or phone applications that can help users find available bikes and stations. The bike share system in Lyon, France is a leading fourth generation bike share system.¹⁶⁵ Among other fourth generation systems, Boston’s and Miami’s systems use solar-powered station kiosks.

Modern technology is also used in the design of bikes for bike share. The best bikes are suitable to be used by all sizes of users, while being theft-resistant, safe, easily maintained, and “green”. For example, New York’s bike share bikes are made by a Canadian company that makes ‘heavy-duty, theft-resistant bikes called Bixis for fleet use.’¹⁶⁶ Copenhagen’s bike share system put a lot of effort in designing its bikes. It even sponsored an international competition in 2009 to help achieve its goal.¹⁶⁷

The use of electric bikes, oftentimes referred to as Pedalecs, may be another option for Pittsburgh. Pittsburgh could become the first ever American bike share to use electric bikes. Electric bikes have a motor, which can assist users in pedaling when it is more difficult to do so, especially in scenarios where users are attempting to climb hills. The availability of electric bikes will enable a Pittsburgh bike share system to potentially recruit more users while expanding the potential area of service to include hillier neighborhoods. The first U.S. electric bike share program was tested in October 2011, at the University of Tennessee. It was a small research program with 20 bikes in total, of which 14 were

¹⁶⁵ *Bicycle-Sharing Schemes: Enhancing Sustainable Mobility in Urban Areas*, United Nations Department of Economic and Social Affairs. May 2011.

¹⁶⁶ Baer, April. New York May Become Newest Bike-Share Mecca. NPR. November 14, 2011 <http://www.npr.org/2011/11/14/141348852/new-york-may-become-newest-bike-sharing-mecca>

¹⁶⁷ CPH Bike-Share Competition, 2009 <http://www.cphbikeshare.com/winners.aspx>

electric bikes.¹⁶⁸ Tokyo has already implemented an electric bike share program this year. This program is a pilot program that will run until August of 2012 with 30 total bikes.¹⁶⁹

A redistribution system for bikes can also be implemented to address high-demand areas. Thus, the system would be more efficient and responsive to consumer demand. For example, Alta Bicycle Share has developed tools such as 'methods to stage bicycles in anticipation of demand and real-time routing of maintenance trucks based on truck locations and demand.'¹⁷⁰ Redistribution efforts would be particularly useful for Pittsburgh when it hosts big events such as Steelers' football games.

However, it is important to note that the design of bikes and the technology utilized by the bike share system will impact capital and operating costs. It is strongly advised that decision makers continue to explore the available technologies as they consider what type of a bike share system would be most appropriate for Pittsburgh. It is also recommended that these steps be made during the initial planning phases, because these changes will affect capital and operating costs, which may necessitate the need to identify additional funding sources.

¹⁶⁸ Electric Bike Share System Tested at College, Earth Techling , October 15, 2011, <http://www.earthtechling.com/2011/10/electric-bike-share-program-tested-at-college/>

¹⁶⁹ MetroBike, December 3, 2011, <http://bike-sharing.blogspot.com/>

¹⁷⁰ Bicycle Share Operations, Alta Bike Share, http://www.altaplanning.com/App_Content/files/Alta_BikeShare_Operations.pdf

Appendix F. Downtown Pittsburgh In-person Survey

Thank you for taking the Pittsburgh bike share survey! We are a student group exploring the potential for a bike share program in downtown Pittsburgh and nearby neighborhoods.

What is Bike Sharing: A Bike sharing program is networks of public bicycle distributed around a city for use at low costs. Bicycles can be picked up at any bike station and returned to any bike station, which is ideal for short trips.

1. Where do you live?
2. Where do you work or go to school?
3. Have you ever ridden a bike on urban streets?
3. For what purpose do you use your bike? OPTIONAL
 - Recreation
 - Fitness
 - Commute to work or school
 - Other (specify)
5. Will you use a bike share program if Pittsburgh has one?
 - Yes
 - Probably
 - Not sure
 - Probably not
 - No
6. How much would you be willing to pay for an annual membership that let you use a bike in downtown Pittsburgh whenever you wanted, up to 30 minutes at a time, for no additional cost?
7. Would you like to be entered to win a \$25 gift card? If so, what's your email address?
8. Would you like to receive future updates on this project?
9. Age
10. Gender

Appendix G. Downtown Pittsburgh Online Survey

Thank you for taking the Pittsburgh bike share survey! We are a student group exploring the potential for a bike share program in Pittsburgh, PA - looking at a phased approach that would start in downtown and nearby neighborhoods.

A bike share program lets a member check out a bike from a network of automated stations, ride to their destination, and return the bike to a different station. Check out the Capital Bike Share system in Washington, D.C. to see how it works. http://www.capitalbikeshare.com/how_it_works

Please fill out the survey to the best of your ability; it should take no more than 10 minutes. The survey closes on October 31, 2011. Thanks again for your feedback!

1. Please tell us your age

- ☐ Under 18
- ☐ 18-24
- ☐ 25-34
- ☐ 35-49
- ☐ 50-65
- ☐ Over 65
- ☐ Not willing to share

2. Please tell us your gender

- ☐ Male
- ☐ Female
- ☐ Other (please specify)

3. What is your occupation?

4. What is your zip code?

Zip:

5. Is your primary residence in one of these locations?

- ☐ Downtown Pittsburgh

- Strip District
- South Side
- North Side
- Lawrenceville
- Hill District
- Uptown
- Other (please specify)

6. What are the cross-streets closest to where you live?

7. Do you work or go to school in one of these locations?

- Downtown Pittsburgh
- Strip District
- South Side
- North Side
- Lawrenceville
- Hill District
- Uptown
- Other (please specify)

8. What are the cross-streets closest to where you work or go to school?

9. Which of the following modes of transportation do you use on a weekly basis?

- Walk (More than 10 mins)
- Drive
- Bicycle
- Public Transit (Bus, Light Rail)
- Walk + Public Transit (a trip that includes both modes)
- Drive + Public Transit (a trip that includes both modes)
- Bicycle + Public Transit (a trip that includes both modes)

10. Currently, how many short trips (less than 2 miles) do you make per week in the downtown area, using any mode of transportation?

- ☐ None
- ☐ 1-5 trips per week
- ☐ 6-10 trips per week
- ☐ 11-20 trips per week
- ☐ More than 20 trips per week

11. Have you used a bike:

- ☐ in the past week?
- ☐ in the past month?
- ☐ in the past six months?
- ☐ in the past year?

12. For what purpose do you use your bike? Check all that apply.

- ☐ Random(errands, appointments, visit friends and etc.)
- ☐ Fitness
- ☐ Commute to work or school
- ☐ Other (please specify)

13. Have you ever ridden a bike on urban streets?

- ☐ Yes
- ☐ No

14. How long is your average bike ride?

- ☐ Under 10 mins
- ☐ 10-30 mins
- ☐ 30-60mins
- ☐ more than 1 hour

15. Are you familiar with the idea of bike sharing programs, like Capital Bike Share in Washington DC and Nice Ride in Minneapolis?

- ☐ Yes, very familiar
- ☐ Aware of bike sharing programs, but not completely familiar with the idea
- ☐ No, the idea is new to me

16. Will you use a bike sharing program if Pittsburgh has one?

- ☐ Yes
- ☐ Probably
- ☐ Not sure
- ☐ Probably not
- ☐ No

17. How frequently would you use this system?

- ☐ Daily
- ☐ Once or twice a week
- ☐ Once or twice a month
- ☐ Rarely
- ☐ Unsure

18. What do you think you would use a bike share program for? Check all that apply.

- ☐ Random(errands, appointments visit friends and etc.)
- ☐ Fitness
- ☐ Commute to work or school
- ☐ Would not use
- ☐ Other

Please specify:

19. How much would you be willing to pay for an annual membership that let you use a bike in downtown Pittsburgh whenever you wanted, up to 30 minutes at a time, for no additional cost?

20. The annual membership fee for Capital Bike Share (DC) is \$75, for Nice Bikes (Minn) the fee is \$60.

Does this change your answer about an annual fee?

- I'd be willing to pay more than I suggested
- I'd want to pay less than I suggested
- My previous answer would not change

21. What do you think are some of the "barriers" to cycling in Pittsburgh, or reasons why you don't use a bicycle more often? Please choose top five barriers.

- Lack of on-road cycling facilities (such as safe bike lanes, signed bike routes, adequate bike parking, etc.)
- Lack of off-road trails
- Terrain
- Don't know the best route for cycling
- Not comfortable riding with traffic on roads
- Trip distance is too long/takes too much time to travel by bicycle
- Transporting large items or passengers
- Not comfortable cycling in the winter (because of cold temperatures, snow, ice, etc.)
- Other weather concerns (such as rain, wind, heat, etc.)
- Concern about bicycle theft and security
- Uncomfortable/Unfamiliar with bikes
- Do not own or have access to a bicycle
- Other (please specify)

22. What features would make you most likely to use a bike sharing program? Please choose top three features.

- Low cost to rent a bicycle

- Bicycle lending at place of work
- High quality state-of-the-art bicycles
- Numerous locations around town to pick-up and drop-off bicycles
- Bicycles available at transit stations and bus stops
- Convenient transaction system
- Incentives for use (e.g. discounts at local businesses, prize draws for cycling accessories, free cycling training, etc.)
- I would not use the bike share program
- Other (please specify)

23. Please name some places where you'd like to have bike stations. (Examples: Heinz Field, 6th and Liberty, 200 Ross Street)

24. How do you feel about sharing public spaces (roads, sidewalks and etc.) with a bike share program?

- Strongly in favor
- Somewhat in favor
- Neutral
- Somewhat opposed
- Strongly opposed
- No opinion

25. What do you think of vehicle emissions in Pittsburgh and surrounding areas in general?

- They are a very serious problem
- They are a problem
- Not a very serious problem
- Not a problem at all

26. How would you describe traffic congestion in an average week in Pittsburgh?

- Very serious

- Serious
- Not serious
- No problem

27. Do you think a bike share program would help or hurt traffic congestion in Pittsburgh?

- Help
- Hurt
- Don't know
- Don't care

28. In order to enter to win a \$25 gift card, please give us your email address. We promise not to spam you!

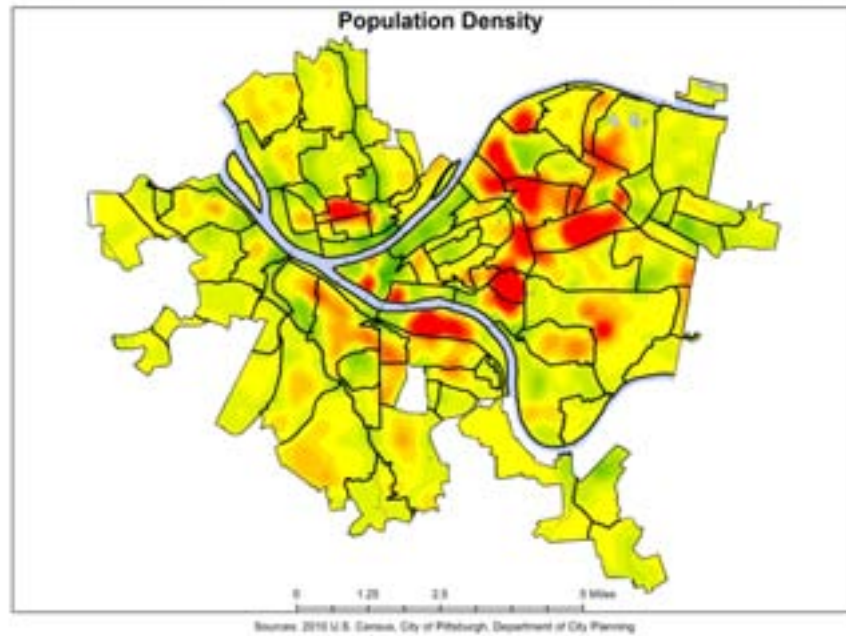
29. Are you interested in receiving future updates about this program via email?

- Yes
- No

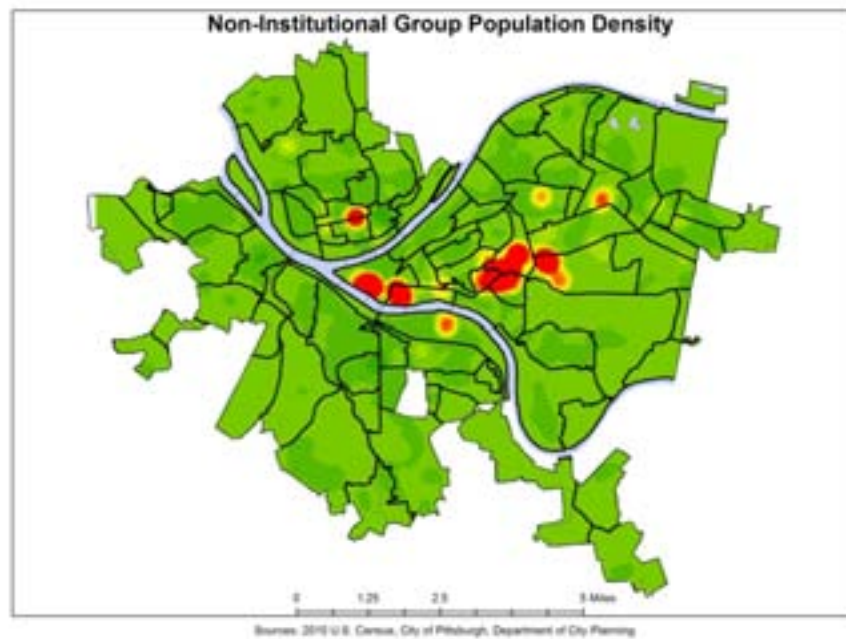
30. Your comments are welcome:

Appendix H. Individual Factor Heat Maps

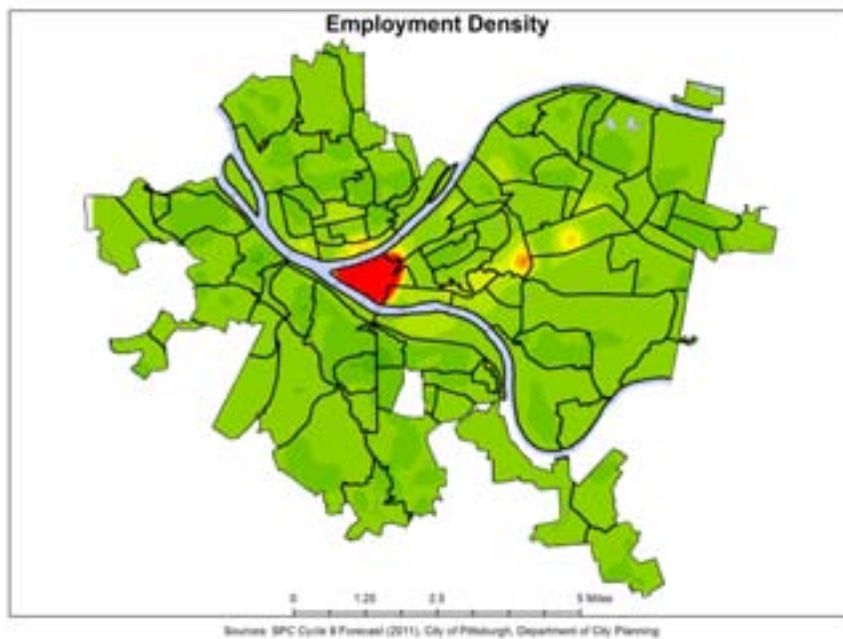
Population Density



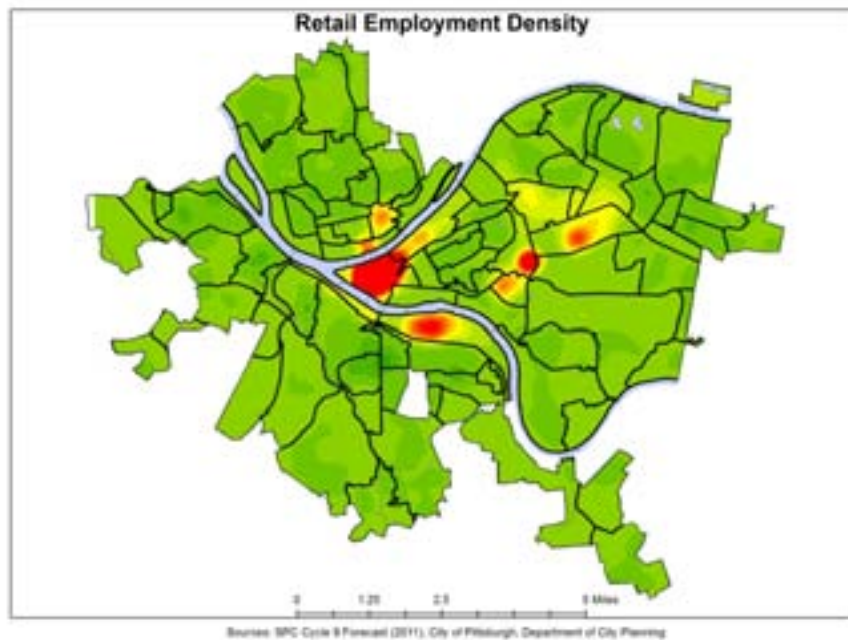
Non-Institutional Group Population Density



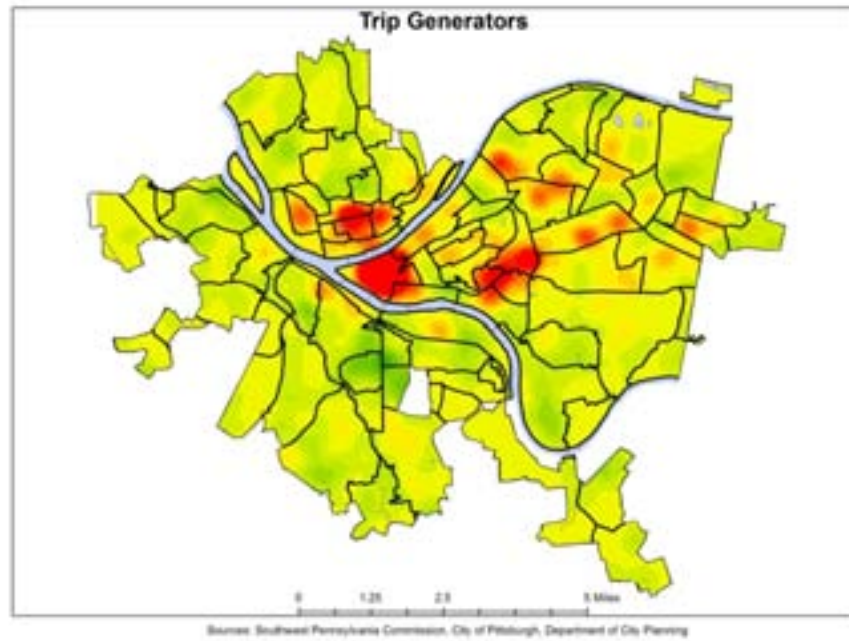
Employment Density



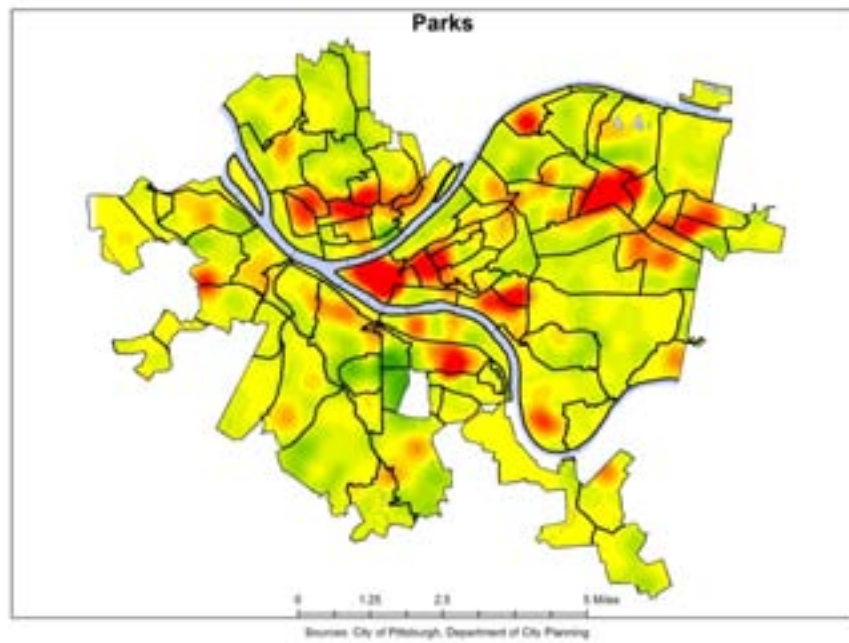
Retail Employment Density



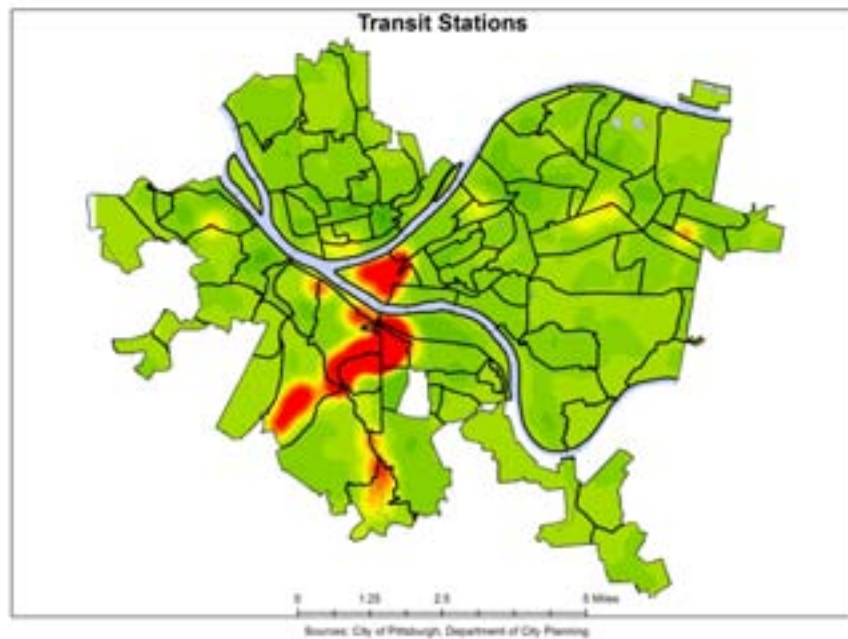
Trip Generators



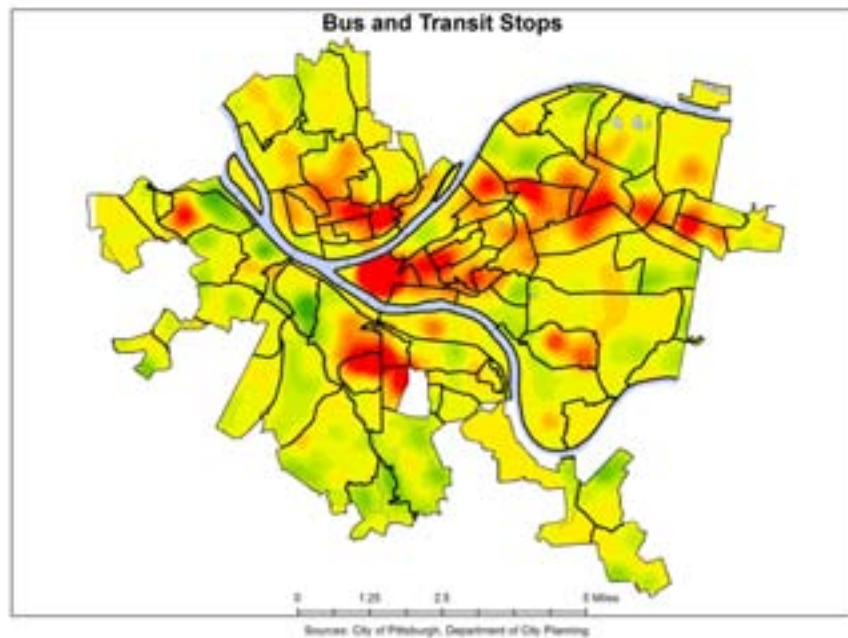
Parks



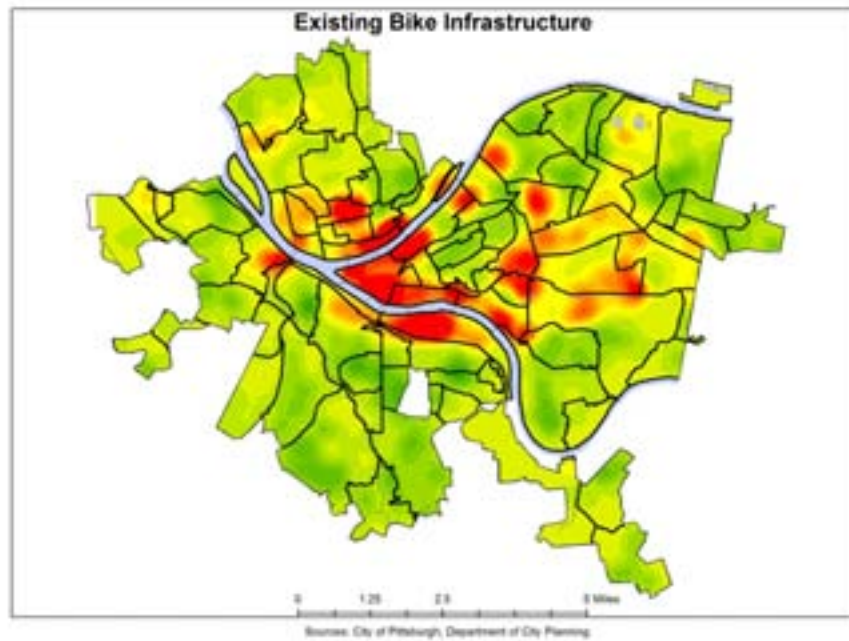
Transit Stations



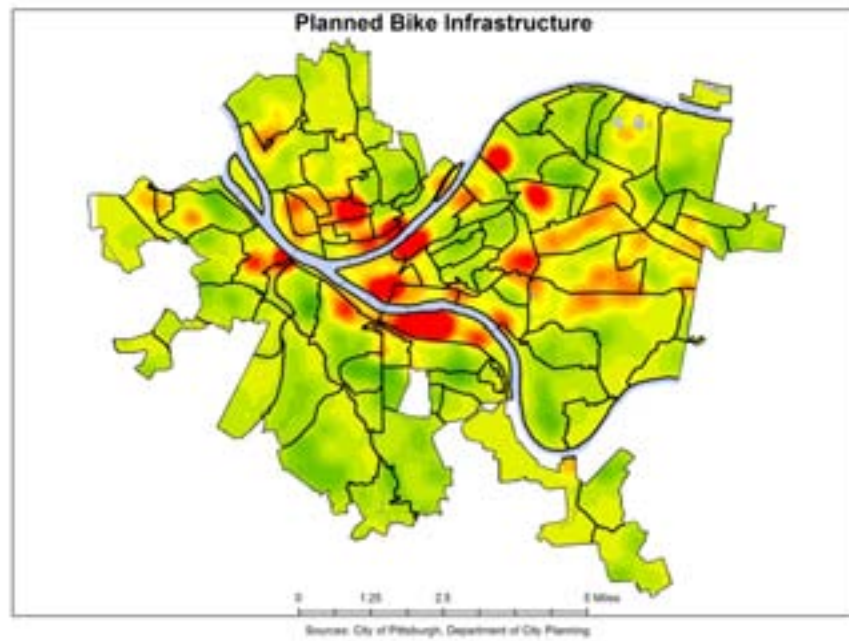
Bus and Transit Stops



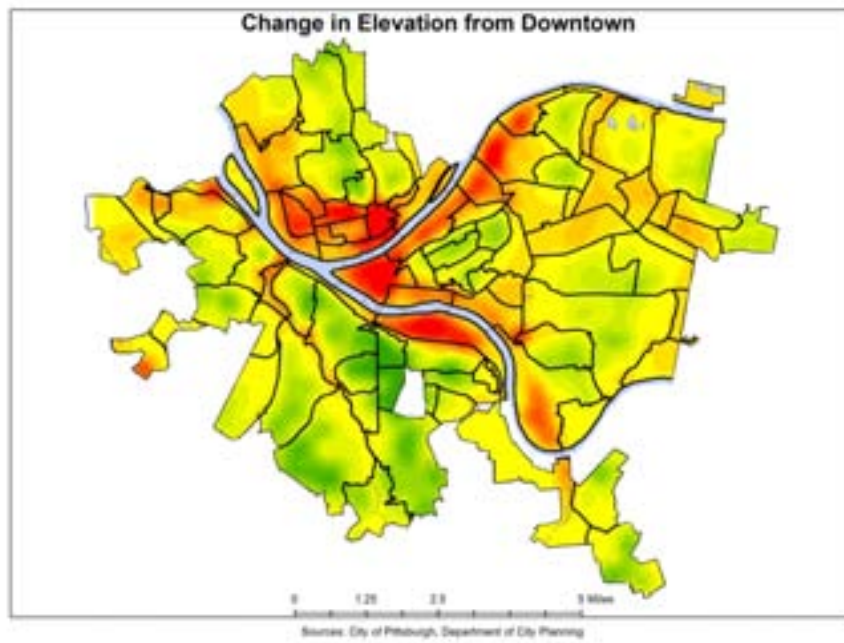
Existing Bike Infrastructure



Planned Bike Infrastructure



Change in Elevation from Downtown



Appendix I. Interviews

Interview #1

Capital BikeShare - Washington, D.C. and Arlington, VA

Source: Paul DeMaio

Organization/Management Structure:

Capital BikeShare is a *public-private partnership* (PPP) where Washington, D.C. and Arlington contract out the operations of their bike share services. Arlington did the initial RFP, and then they invited other jurisdictions (Washington, D.C.) because they knew it would be important to build a regional service model. The PPP model took approximately two years to launch, and this was mostly due to the public tender because it had not been done before. In the future, expanding to other jurisdictions will take significantly less time. The local jurisdictions are responsible for:

- Overseeing the contractor (Alta Bicycle Share)
- Responding to public inquiries
- Dealing with weather issues
- Providing funding (Each jurisdiction is responsible for their share)
- Making long-term decisions (i.e. expansion)

Important Considerations:

When using a public-private partnership model, consensus building and group decision-making are key components of a successful program. In addition, government support and funding are constant challenges that need to be planned for and included from the beginning of the planning phase. The business and cycling advocacy communities are two additional stakeholders that are integral for implementing a bike share. The business community offers both financial support, and the opportunity to partner for land and access to sidewalks. In most cases, the sidewalks that will be targeted for bike stations will be owned by local businesses, and gaining their support early in the process will help avoid potential barriers. The cycling advocacy community will help to encourage public support.

Measurement

When Capital BikeShare was first launched, the primary goal was to get more people biking more often. Capital BikeShare tracks various metrics, and they also distribute an annual survey to gauge name recognition and customer satisfaction. As of their most recent survey, Capital BikeShare reported 91% name recognition. Success factors include having a dedicated following of cyclists, environmentalists, marketers and county and city staff that have helped launch and expand the program. Quantitative metrics include:

- Number of trips (ridership)
- Number of bikes in service (performance and safety)
- Number of empty/full instances (customer service)
- Number of members (membership)

Most recently, Capital BikeShare celebrated their one-millionth trip, which has far exceeded their initial expectations. In addition to bike-related metrics, Capital Bikeshare has just initiated a member-specific dashboard that will measure distance traveled, calories burned and carbon offset.

Financials

Planning and implementation costs for Capital Bikeshare totaled US\$5 million. As of May 2011, it cost \$41,500 to install a station with 6 docks and \$49,300 each for larger stations with 14 docks. Each bicycle costs about \$1,000. First-year operating costs were US\$2.3 million for 100 stations, and the annual operating cost per bike is \$1,860.

Capital BikeShare earns revenue through memberships, usage fees, and sponsorships. In addition to individual memberships, Capital BikeShare offers corporate partnerships to employers who pay a discounted rate for their employees to join the service. This revenue source has not been a significant contributor to revenue.

While Capital BikeShare is not revenue positive as of yet, they are able to cover 73% of operating expenses with operating revenues. All capital costs are covered by other funding sources, such as government subsidies. As was mentioned in organization structure, each jurisdiction is responsible for their own funding. Currently, Washington, D.C. accounts for 78% of the service, and Arlington pays for 12%. Arlington has secured a range of funding from state and county sources (i.e. Department of Transportation), and they are currently applying for CMAQ funding. Washington, D.C. has funded all their costs through CMAQ funding. Critical success factors include focusing on increasing both the number of memberships and trips taken.

Legal

Within a public private partnership, the contractor (Alta Bicycle Share) needs to maintain a good level of insurance. Additionally, it is important to hire a reliable equipment vendor to minimize risk. Alta Bicycle Share hired Bixi as their equipment vendor. To date, Capital Bikeshare has not had any legal issues; however, it is important to be smart about writing the contract so that expansions of the bike share into other jurisdictions can be eligible for the same pricing as the original location(s).

Operations Planning

Capital BikeShare created a “heat map” to identify station locations. The county created the map using data such as: population, employment density, transit and bike facility locations, and other destinations.

Interview #2

Velib - Paris, France

Source: Marc Merlini, JCDecaux

Organization/Management Structure:

Velib is operated by JCDecaux, an advertising company, in exchange for access to build street furniture. JCDecaux is both the operator and the equipment vendor - they build everything. JCDecaux provides all the financing for the bike share service, and in return, they get compensated with street advertising. The local government (City of Paris) has a detailed contract and service level agreement with JCDecaux that outlines three main responsibilities:

- Availability
- Security
- Maintenance

JCDecaux manages customer relationships, subscriptions and complaints, and financial invoices. The contract is written such that JCDecaux is able to make decisions about expanding the program within the stated limits. JCDecaux manages the day-to-day operations, which means they repair bikes and infrastructure, and they relocate bikes overnight because of traffic congestion during the day.

The timeframe for implementing this model depends on if JCDecaux has the necessary furniture available. Once the contract was accepted, it only took 2-3 months to launch the program. However, JCDecaux just recently built street furniture for Japan, and because of the language differences, it took 6 months to fully launch.

Important Considerations:

One major benefit of the advertising/for-profit model is JCDecaux's competitive advantage for any future tenders to have advertising on the street. One major drawback is the inherent risk of tarnishing the brand's image because of poor service quality.

It is very difficult to understand why some cities are more successful than others. JCDecaux also manages Dublin's bike share program, and they initially thought Dublin would be too small to sustain a successful service. The service was launched with 40 stations and 450 bikes, and JCDecaux was expecting 2,500 subscribers by the end of the first year. Instead, Dublin had 10,000 subscribers in the first two weeks. Now, the program has 500 bikes, 30,000 subscribers, 6,000 trips daily and a maximum of 12 uses per bike per day.

Measurement

Each year, JCDecaux distributes a customer satisfaction survey. The most recent survey found a 90% customer satisfaction rate. While JCDecaux does include an environmental impact metric in their annual report, it was stressed that the metric is not very accurate because of the difficulty in knowing mode shift data.

JCDecaux also tracks usage. In year 3, usage started to decrease because the membership/subscription process was not flexible enough for customer's needs. JCDecaux modified the system so customers could use credit cards online to subscribe to Velib. In year 3 there were only 160,000 subscribers and now that number has increased to 210,000. JCDecaux modified the process to be simple and reliable.

Financials

While JCDecaux would not disclose their financials, it was mentioned that before operating Velib, JCDecaux's Paris market share was approximately \$30 million, and now it has more than doubled to \$67 million. While this says nothing about the profitability of the bike share services, it does support the for-profit/advertising model as a successful way to impact the business branding/image.

JCDecaux pays \$1500-\$2500 per bike per year to cover both capital and operating costs. Revenue includes payments for usage fees, memberships/subscriptions and punishments. If a bike is not returned within seven days, the rider must pay 150 Euros. If the bike is found within the seven-day limit, the rider instead is forced to pay 35 Euros. Sometimes riders do not properly attach the bike to the station, and this causes the system to identify the bike as "missing".

According to our benchmarking, revenues from subscriptions and from bicycle hire charges are paid to the Paris town hall. However, JCDecaux benefits from a profit-sharing scheme based on the quality and efficiency of the service. The amount of the profit sharing is capped at 12% of the sum of annual advertising revenues and annual bicycle hire revenues. " JCDecaux got to erect 1,628 billboards to rent; it invested nearly \$142 million to set up the rental bike system and the billboards, and must provide maintenance and replace stolen bikes; the city of Paris gets the proceeds from the usage of the bikes plus some royalties from JCDecaux. So far, according to Rémy Pheulpin, the company's executive vice president, it has put up 1,500 billboards in a year and expects to make about \$94 million a year from them. The company stands to begin turning a considerable profit if not next year, then in the third year of its 10-year contract. The city has received \$31.5 million from subscribers and users of the bikes, plus an additional \$5.5 million a year, fixed in the contract, from advertising royalties, according to Céline Lepault, the Vélib' project manager for City Hall."

Legal

While a for-profit/advertising structure is intended to positively impact the business image, it can also just as easily be damaged because of legal issues. In Paris, JCDecaux has no liability with the bike share service, and thus, feels it is a safe investment decision. However, JCDecaux was in talks with Chicago to bring their model to the states, and JCDecaux was not willing to take on the risk of tarnishing their image because legal and liability issues are different in the U.S. as compared to Europe.

Operations Planning

The most important lesson learned is that the bike system needs to be dense. Velib has stations located every 300-500 meters. When initially planning the station locations, JCDecaux analyzed both where people live and work to understand weekday usage, and then they conducted a separate analysis for weekend usage. This analysis is used to transport bikes to fit demand patterns.

Surprisingly, Paris did not have much infrastructure to support a bike share program at the launch; however, the city decided to invest in more bike lanes as the bike share program began service.