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Buffalo BikeShare Demonstration Project

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Abstract

This report documents the startup and continued operation of Buffalo BikeShare, a service offered by Shared Mobility Inc., one of the first “sharing” organizations to offer both cars and bikes for shared use. When installed in 2012, the system was the first commercial deployment of Social Bicycles, a dock-less bike share system that uses on-board wireless technology to enhance personal mobility. The GPS-enabled “smart” bicycles work with regular bike racks making the system both affordable and scalable. As a valued alternative transportation option, Buffalo BikeShare currently has bicycles stationed in Downtown Buffalo, at Buffalo Niagara Medical Campus and at the University of Buffalo’s North and South campuses.

Acknowledgments

Buffalo BikeShare would like to acknowledge everyone that helped make this project successful. Creighton Randall, former executive director of Buffalo CarShare, spearheaded this idea years ago by writing and negotiating the NYSERDA funding proposal. Stacy Sauvageau, Ryan Mccuba, and Anders Gunnensen took part in the operations and the maintenance of the system. The Buffalo Niagara Medical Campus supported the concept from day one, and continually leads Buffalo in innovation. Chris Austin, James Simon, and Ryan MacPherson of the University at Buffalo, continually supported the system. Ryan Rzepecki, CEO of Social Bicycles, developed the system and took calls at all hours of the night. And finally, Joe Tario of NYSERDA and Bob Ancar of the NYS Department of Transportation, continually supported environmentally friendly and innovative transportation in New York State.

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1 History of the Project

The Buffalo BikeShare project included three years of experimentation, testing, and implementation of the first commercial Social Bicycles (SoBi) system, which was the highest tech bikesharing system in the United States. When the project concluded on September 7, 2014, it had exceeded expectations.

The project's goals were to:

1. Advance State and federal livability goals through development of a bicycle sharing program.
2. Utilize Buffalo BikeShare as a real-time transportation planning and urban design tool.
3. Demonstrate bicycle sharing to be a viable, convenient, healthy, and sustainable transportation option in a city in an Upstate New York without ongoing public subsidy.

In 2011, SoBi was one of four teams considered by Buffalo BikeShare to provide the hardware and software to operate a bikeshare system in Buffalo. Buffalo BikeShare selected SoBi based on its use of wireless technology to enhance personal mobility, affordability, and technological upside in comparison to traditional bikeshare systems that currently were in the market. Unlike traditional dock based systems, SoBi bikes allowed Buffalo BikeShare to forego the purchase of expensive kiosks¹ and racks to set up a system. Additional positive characteristics associated with the SoBi bikeshare system are its innovative use of wireless, solar-powered mobile technology, and GPS tracking through central servers to enable the deployment of an affordable, scalable, intelligent, and easy to understand bikesharing network. Other attributes include a single administrative platform with the ability to identify and archive real-time activity and previous history of users, bicycle distribution patterns, maintenance records, and payments and messaging records.

1.1 Phase 1 (March 2012 to June 2013)

Because SoBi was a start-up company, Buffalo BikeShare expected some initial system development and deployment issues. Key technical, operational, and managerial hurdles encountered during Phase 1 included:

- Solar powered batteries that drained at a quicker rate than expected.
- GPS connections that were less than accurate, resulting in some difficulties in tracking and locating the SoBi bicycles.
- Locking mechanisms that failed to fully function at times, leaving the SoBi bikes prone to locking errors and potential theft.

¹ Kiosks are the infrastructure that allows payment by credit card, and typically cost around \$35,000.

- Software inconsistencies that made it difficult for Buffalo BikeShare to easily monitor, track, manage, and operate the SoBi bicycle network.
- Minimal user interfaces that were somewhat difficult to understand without additional instruction.
- After these challenges were documented, SoBi provided a “boots-on-the-ground” team of designers and engineers that worked closely with Buffalo BikeShare to rectify these difficulties. This effort enhanced the SoBi bikeshare system, increasing accessibility, reliability, convenience, and safety for Buffalo BikeShare’s membership.

1.2 Phase 2 (June 2013 to December 2015)

In Phase 2 of this project, SoBi deployed additional software and hardware updates and modifications that considerably improved the stability, functionality, and reliability of the SoBi system. These updates and modifications included:

- Battery life – extended the length of the solar-powered charge of the SoBi on-board batteries. Figure 1 shows SoBi’s battery drain over a one-week period.
- GPS technology improvements – extended the range and real-time tracking ability, thus enabled Buffalo BikeShare to more effectively monitor and manage. Figure 2 shows two GPS trips tracked (one before and one after the software upgrade).
- Locking mechanisms – design improvements were made that eliminated locking errors encountered by users.
- Newly designed bikes – based on feedback provided by Buffalo BikeShare’s membership, improvements were made to SoBi bikes that included installation of firmer, more functional handlebar grips, installation of sturdier kickstands, improvements to LCD screen prompts that facilitated easier rental and access to the SoBi bikes, and design changes of the SoBi bike frames that allowed users greater comfort, safety, accessibility, and reliability.

Buffalo BikeShare was satisfied with these Phase 2 improvements and initiated conversations with Social Bicycles that would achieve greater levels of scalability, flexibility, operability, and affordability with the end goal to expand Buffalo BikeShare operations and reach to greater numbers of residential neighborhoods, college settings, and corporate campuses.

Figure 1. Battery Level Over a 5-day Period

Only 10% of the bike battery drained during this time.

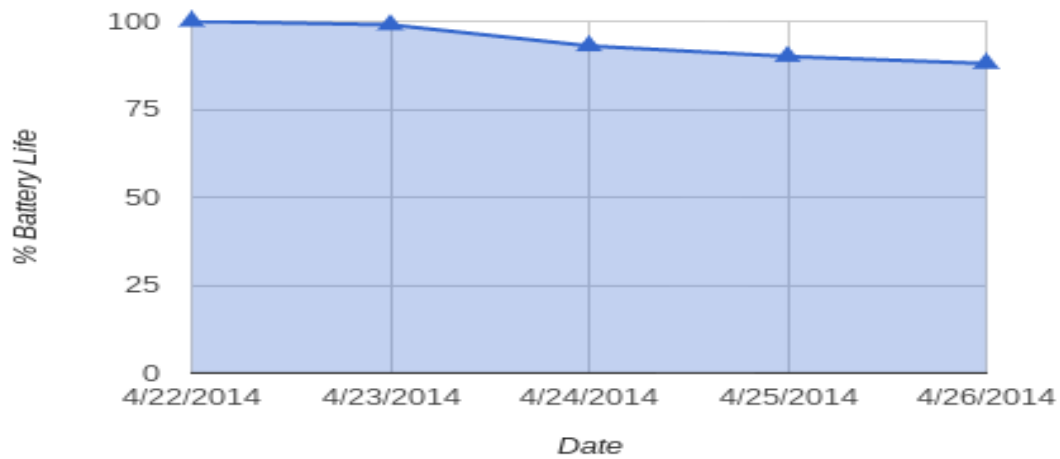
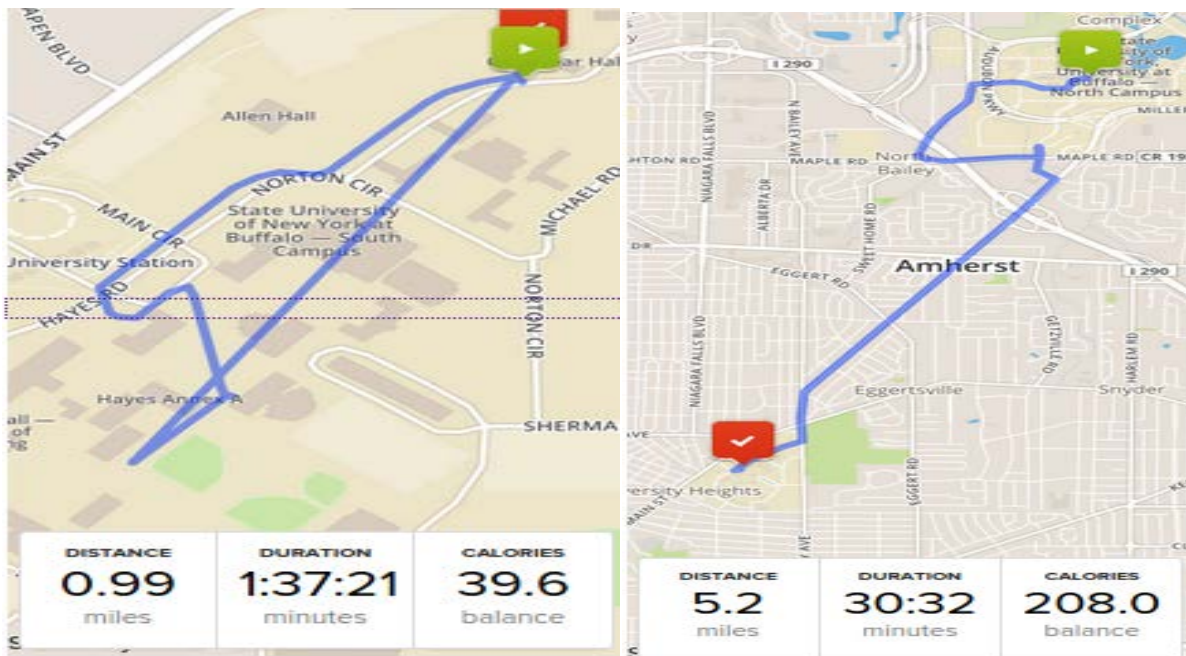


Figure 2. Old GPS vs. New GPS

Old GPS on the left shows bikes not accurately displaying trip distance and location. On the right, new GPS displays provided more accurate tracking of the bicycles.



2 Buffalo BikeShare System

In 2012, the University at Buffalo (UB) voiced an interest in supporting a campus bike sharing system. During Phase 1 (2012-2013), Buffalo BikeShare was the mediator between SoBi and UB. After the 2013 launch, Buffalo BikeShare shifted energy during Phase 2 from mediator to operating of a small bike sharing system.

The 2013 UB contract incorporated 25 total bikes at North and South Campus. The purpose of this first year was to increase knowledge of the system by offering highly discounted memberships. Buffalo BikeShare saw immediate success of the system by signing up 249 users. During the same time period, Buffalo BikeShare started testing a handful of bikes downtown, handpicking riders and users to test the system within the city.

The success of the 2013 system encouraged UB to renew a contract for 2014, increasing the number of bikes from 25 to 40. The increase of bikes can now be supported by a more stable bike sharing technology and thus gave Buffalo BikeShare the confidence to handle a much bigger system. Unfortunately, other factors caused a decrease of members joining that year:

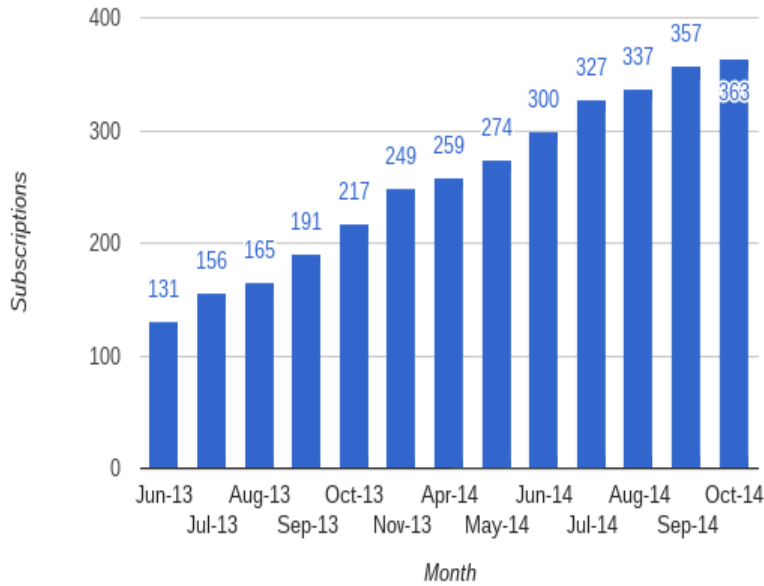
1. UB representatives wanted to start charging students for the use of the bicycles at the cost of \$30 per season. In 2013, the cost was \$10 per student.
2. Weather was much colder than previous years. Biking weather started about a month later (mid-April).² With UB's academic schedule ending in May, weather negatively affected the system's popularity.

At the same time, Buffalo's city system opened for beta riding in 2014. Starting with 5 bikes per week into the downtown system, the Buffalo BikeShare deployed a total of 75 bikes by mid-summer 2014.

With more bicycles and less new subscriptions than the previous year, Buffalo BikeShare learned about how cost and weather can dramatically affect numbers. New subscribers fell from 249 in 2013, to 114 in 2014 (see Figure 3). (Technology limitations in 2013 resulted in lost data before June.)

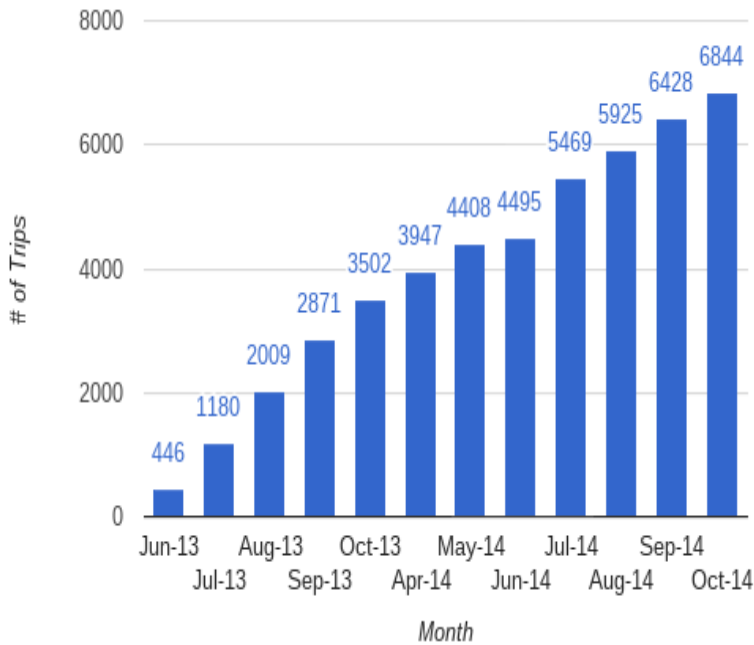
² 2014 was the 10th coldest year in over 100 years. (weather.com)

Figure 3. Cumulative Subscriptions for 2013 and 2014



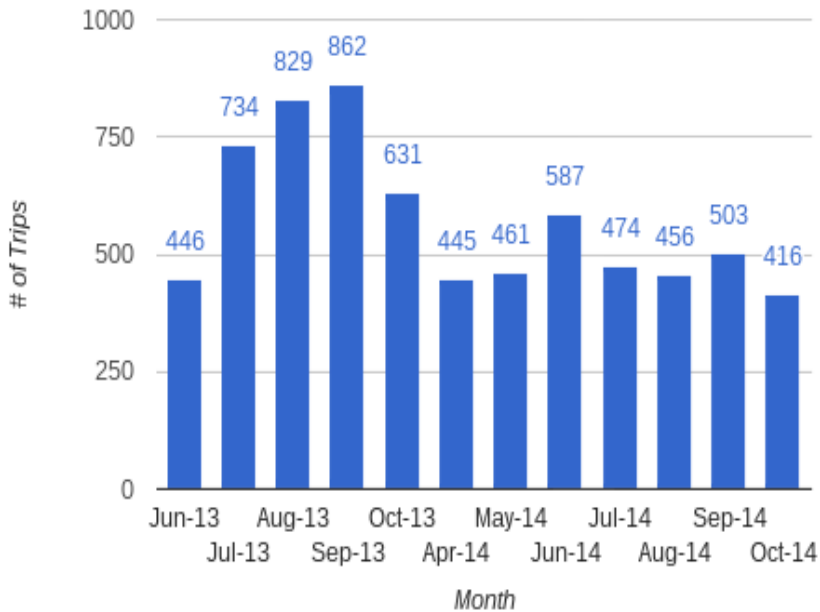
As shown in Figure 4, total number of trips also decreased in 2014 in comparison to 2013. With two less months of data, 2013 accrued about the same amount of trips than 2014 (3,502 in 2013 to 3,342 in 2014). Trip data were not stored correctly before June 2013. SoBi fully overhauled their technology thus resulting in a better bike sharing system, but data were lost.

Figure 4. Total Cumulative Trips



There are too many variables to determine why in certain months more trips were taken than others. Figure 5 displays number of trips associated with the coinciding month. In September 2013, 862 total trips were taken, while in September 2014 (503) trips were taken. This could be a result of number new applicants, school being in session, and weather.

Figure 5. Trips per Month



In 2013 a trip averaged .91 miles, while in 2014 trips went up to 1.46 miles. Even though less trips were completed in 2014, user were riding for longer distances. A total of 8119.8 from 2013 to 2014. Figure 6, above displays general trends as more trips were taken in warmer months. In August of 2013, 772 trips were taken, while in October of 2013 only 487 trips were taken--even though school was in session during the October time period.

Figure 6. Miles per Month

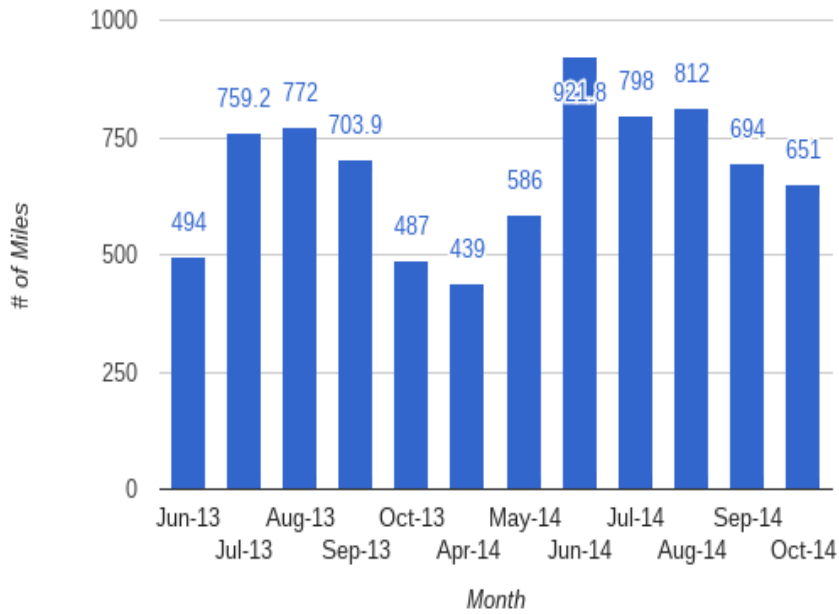


Figure 7 shows how these statistics can be further broken down regarding average distance per weekday. The difference between a long weekend bike ride versus the commuter bike ride to class was evident. The weekday average was 1.05 miles per trip, while weekend average was 1.86 miles.

Figure 7. Average Distance per Day

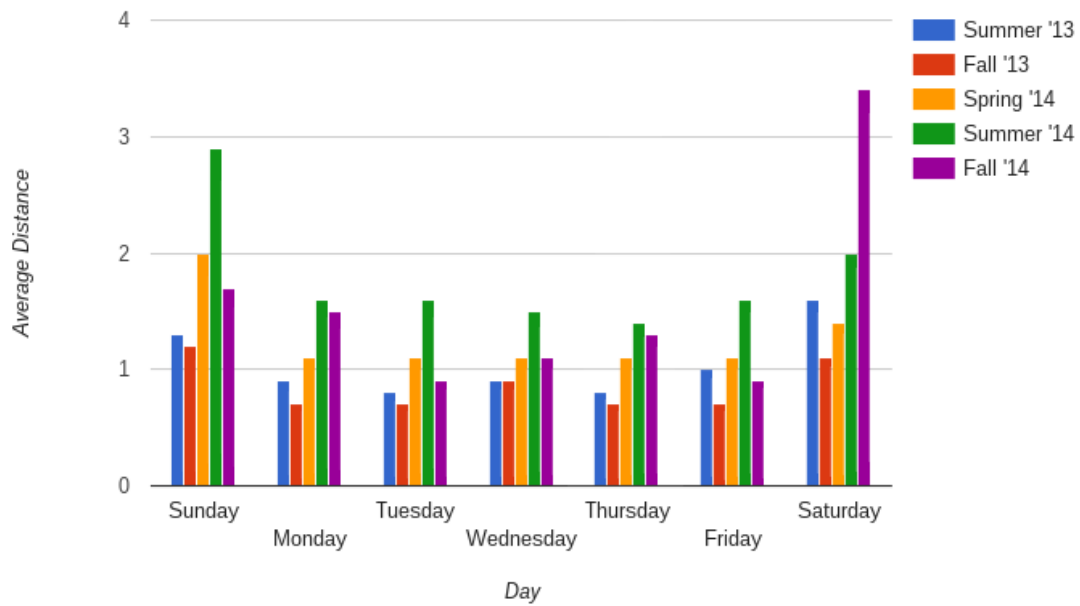


Figure 8 and Figure 9 illustrate a weekday and a weekend trip taken by the membership. The first trip (Figure 8) is a student member going around the campus quickly and efficiently for 0.58 miles. The weekend trip (Figure 9) was 14.1 miles along a popular long trail.

Figure 8. Weekday Trip (0.58 miles on Campus)

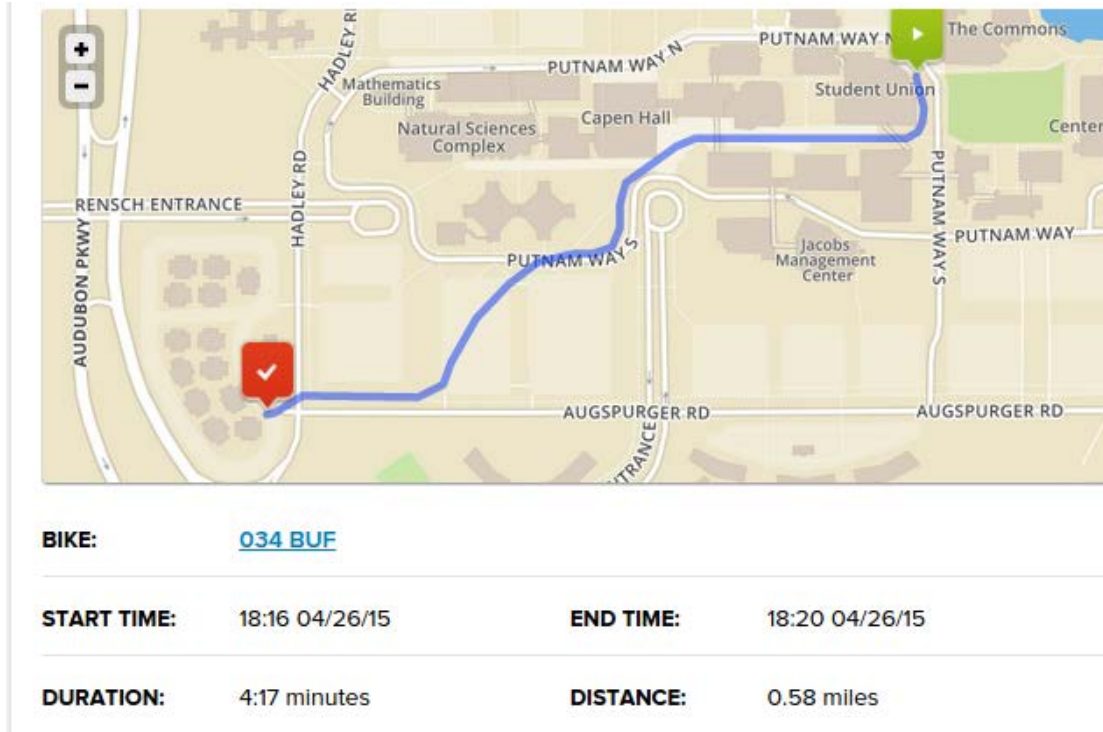
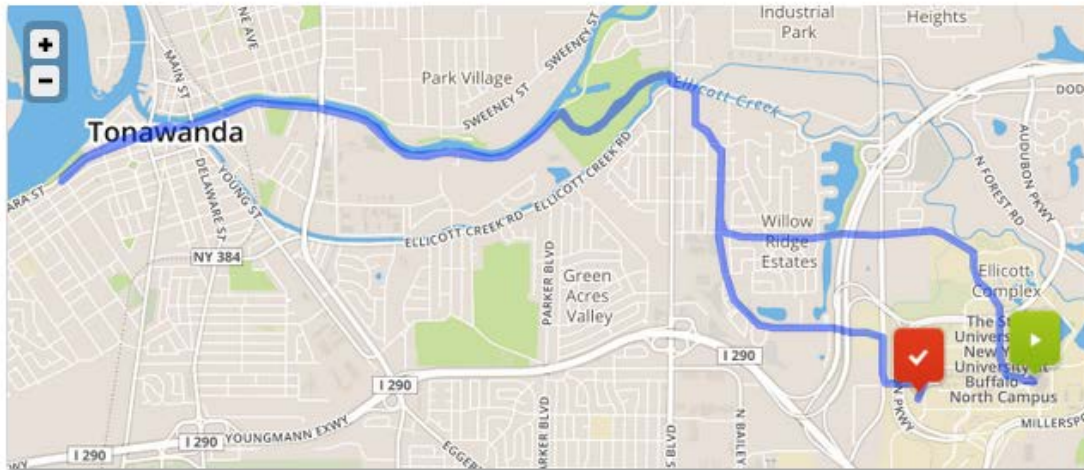


Figure 9. Weekend Trip (14.1 miles)



BIKE: [035 BUF](#)

START TIME: 15:02 04/26/15

END TIME: 17:44 04/26/15

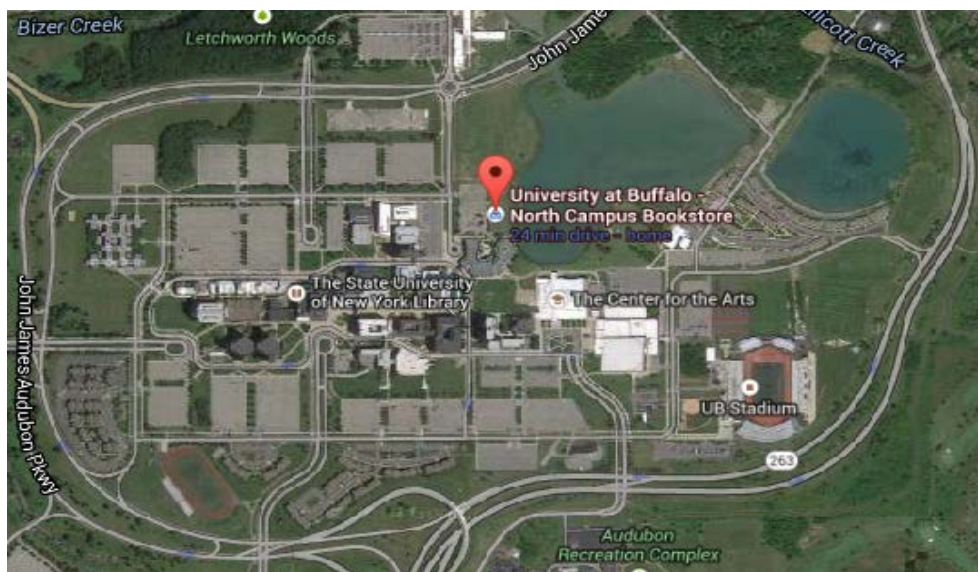
DURATION: 2:42:43 minutes

DISTANCE: 14.1 miles

3 City and University System

Operationally, Buffalo BikeShare decided in 2012 that it would be easiest to split the system in two by location. A downtown system, used for mostly testing by handpicking applicants, and an open university system (UB North Campus) that was mostly isolated from surrounding areas because of being “road locked” by the Audubon Parkway (see Figure 10). Splitting the systems gave Buffalo BikeShare the ability to really dive into the bike technology during the first season in 2013. Bike malfunctions such as GPS were much more manageable with a confined geographic system.

Figure 10. Majority of Bikes Located at the University at Buffalo Campus



Trips associated with the university system were mostly used to go to and from class (on and off campus) and to the surrounding trails. Figure 11 and Figure 12 show data collected from GPS in the bikes to see where users were making trips.

Figure 11. Heat Map UB North

A GPS heat map that shows that the majority of the trips by students were on campus.

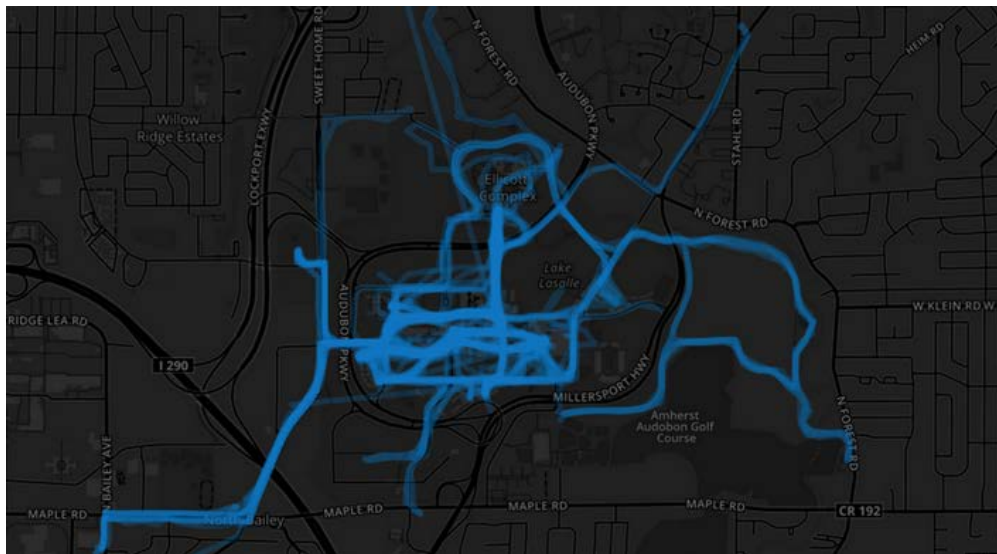
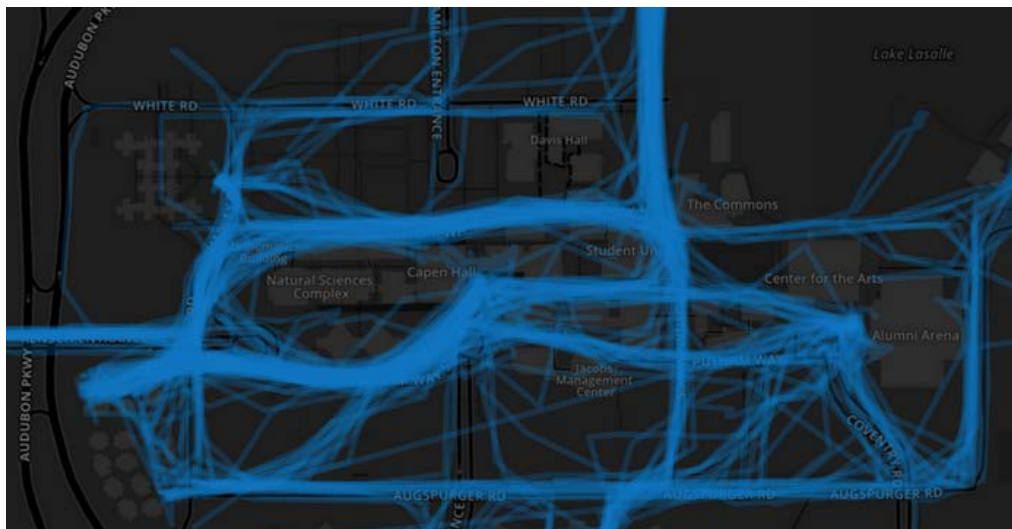


Figure 12. Detailed Heat Map UB North



To help manage the city system, Buffalo BikeShare created hub locations. For example Porter Ave., Broadway and Richmond has better bike infrastructure for riding (but were outside the service area). It was apparent from GPS tracking data that Buffalo BikeShare members were utilizing these safe routes when going outside the system area. (Figure 13 and Figure 14.)

Figure 13. Heat Map Downtown Buffalo

Many of these trips are on very popular biking corridors in the city of Buffalo.

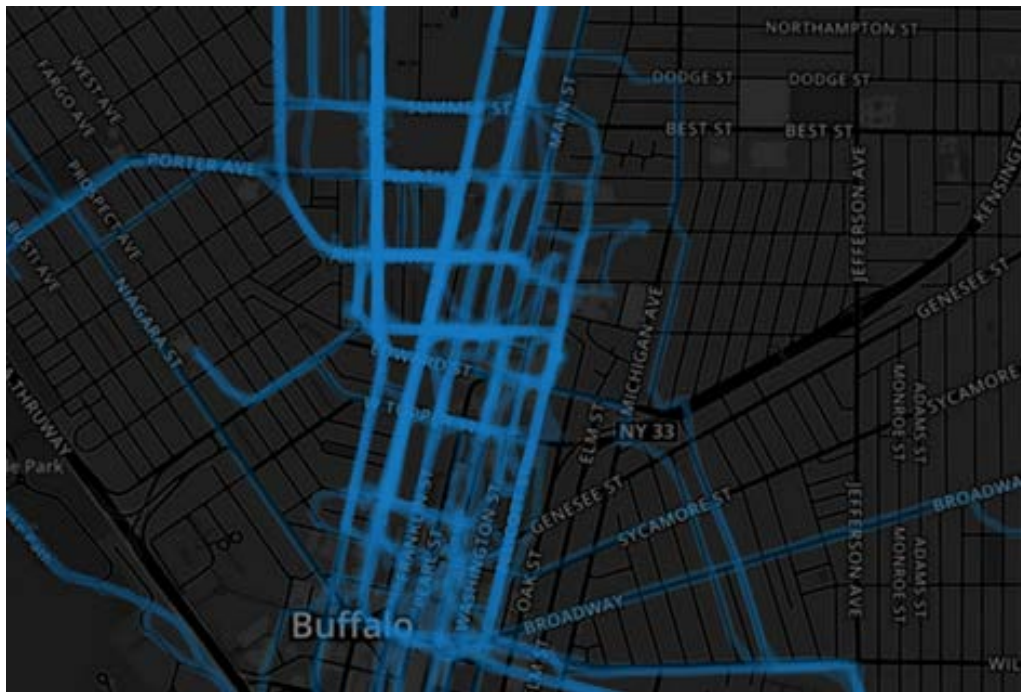
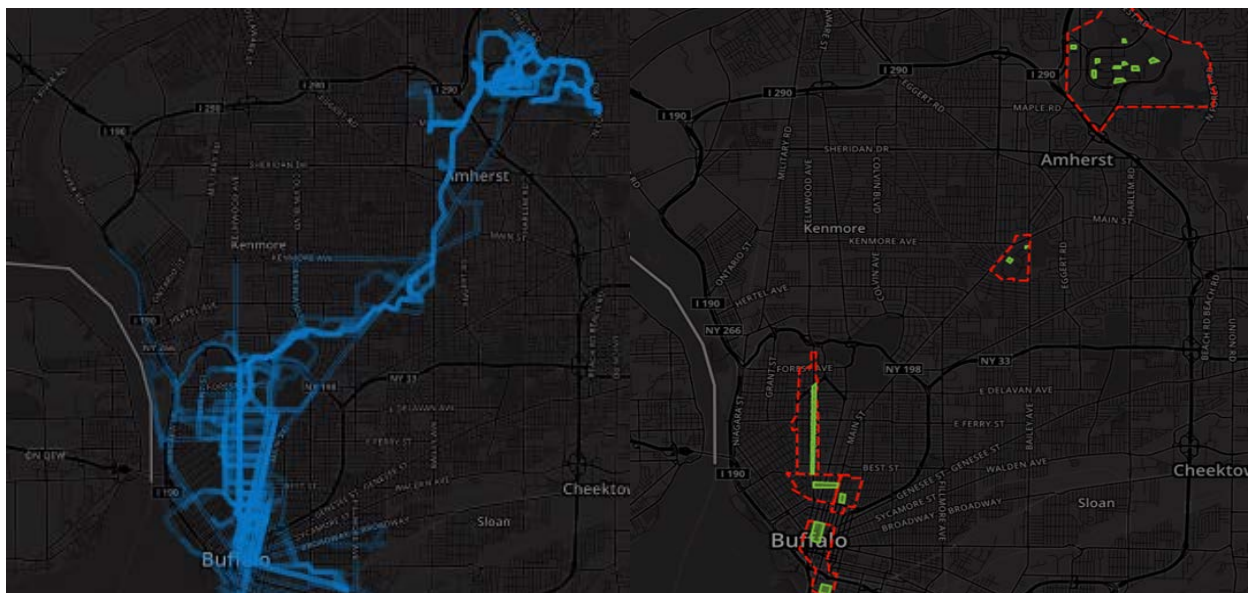


Figure 14. Heat Map System Area

Members ride bikes between system areas (UB North to UB South to the City).



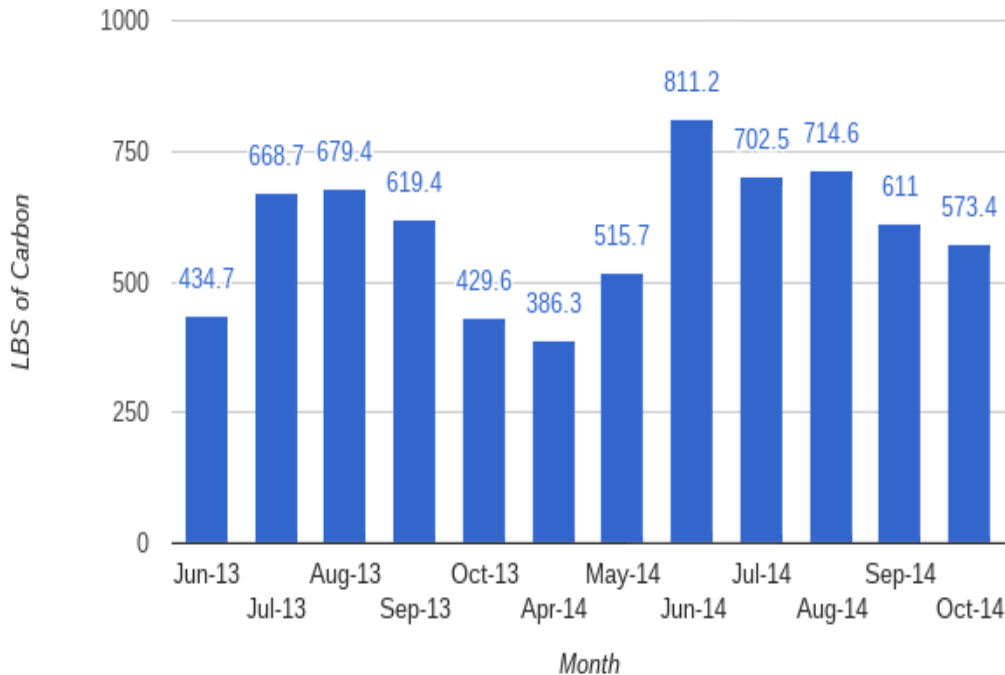
For redistribution purposes, Buffalo BikeShare put a heavy fine on users locking outside the system area--which worked well preventing members parking the bikes anywhere outside the system areas. The SoBi system also allowed push notification (text messages to cellphones) about bringing the bikes back to hub location to avoid fines.

3.1 Carbon Saved

The amount of carbon saved was calculated by using U.S. Environmental Protection Agency averages for vehicles emitting 411 grams of carbon dioxide (CO₂) per mile (0.88 pounds) in comparison to bike riding, which emits 0 grams of CO₂ per mile. In 2013, Buffalo BikeShare calculated approximately 2,883 pounds of carbon saved (Figure 15). In 2014, even though the number of people joining the system decreased, more mileage accumulated.

Figure 15. Carbon Saved Per Month

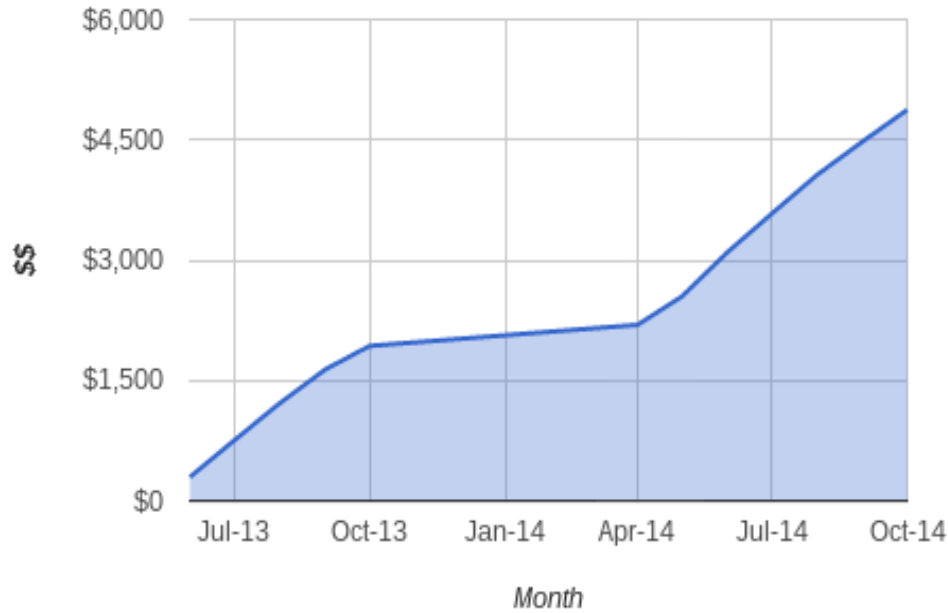
Displays approximately per month carbon saved. Over a two-year period, approximately 7,100 pounds of carbon were saved.



3.2 Approximate Money Saved

Money saved was calculated by using the U.S. Internal Revenue Service cost to drive of \$0.58 per mile. Over the two-year period, Buffalo BikeShare saved its users a total of \$4,872.³ Figure 16 displays cumulative money saved, with approximately \$792.00 saved directly from gas purchases.⁴

Figure 16. Cumulative Money Saved



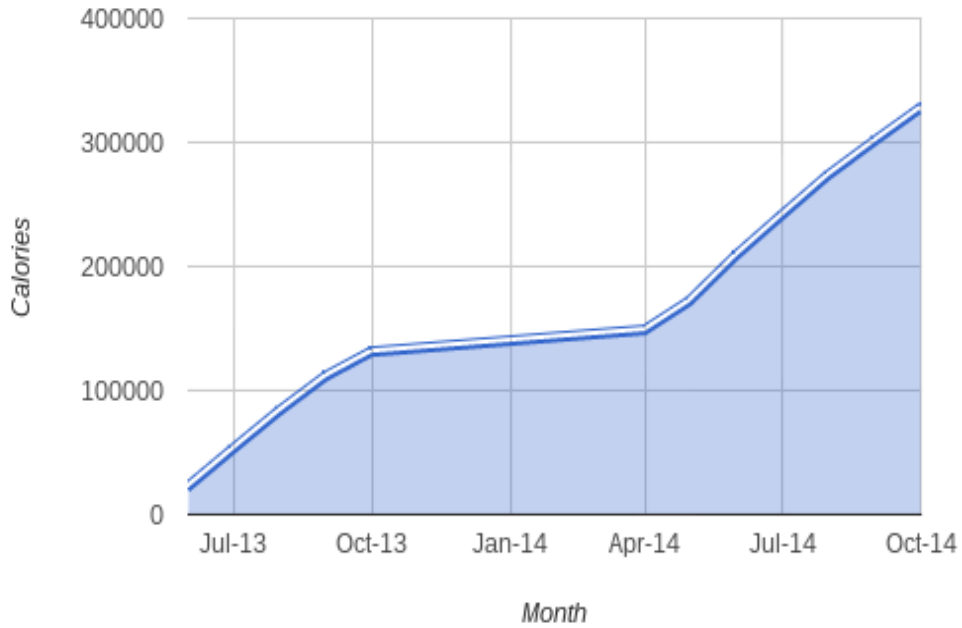
³ This is assuming the cost of bike sharing is free. For the systems at UB and City, the cost of riding was not calculated because the costing was in an experimental phase.

⁴ Total miles rode divided by 21 (average car consumption) multiplied by \$2.00 (average cost of gas in Buffalo).

3.3 Calories Burned

Bicycling has a well-documented past regarding health benefits. Figure 17 displays 324,000 cumulative calories burned by using Buffalo BikeShare bikes over the two-year period. This number was calculated with Wisconsin Department of Health's value of 40 calories burned per mile of riding a bicycle.

Figure 17. Calories Burned



4 Demonstration Projects

In 2014, Buffalo BikeShare submitted a winning proposal to a request for proposals (RFP) to demonstrate bike sharing across four cities in Capital Region of New York State (Albany, Saratoga Springs, Schenectady and Troy).⁵ In a six-week project, Buffalo BikeShare moved from city to city implementing unique marketing plans and deploying a small 20-bike system. Buffalo BikeShare also conducted bike safety and bike sharing surveys to help determine feasibility.⁶ Buffalo BikeShare sees these projects to help financially sustain the organization during the off peak times of the year (winter in Buffalo) and create partnerships with other cities within New York State. These projects, unlike other feasibility studies, give municipalities the ability to see a system in their community before purchasing.⁷

The following sections provide results for demonstration projects in the four cities.

4.1 Albany

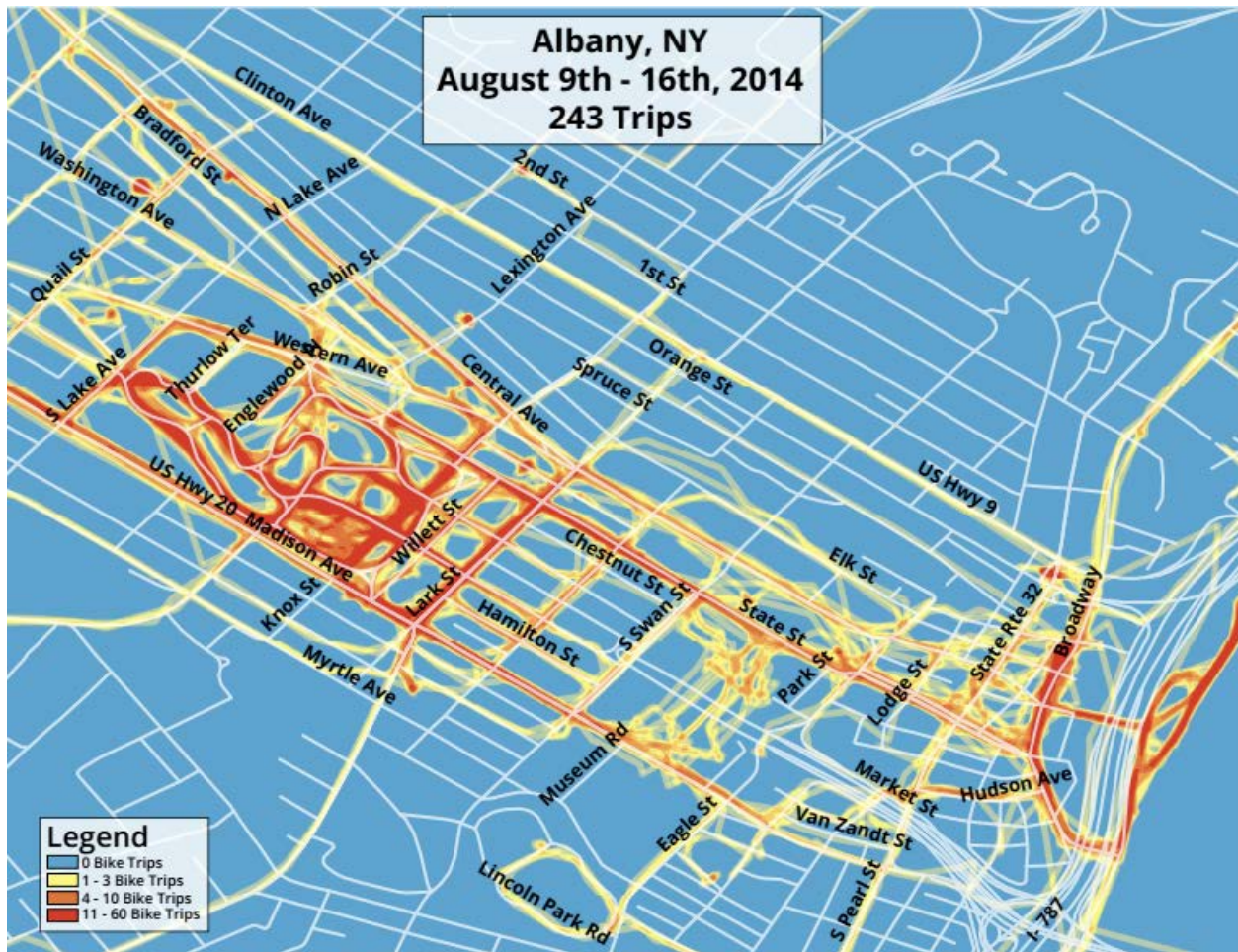
- Total Miles Ridden: 413.82 miles
- Average Ride Length: 1.7 miles
- Total Rides: 243
- Test Rides: 51
- Member Rides: 192
- Active Members: 76
- Female Members: 40
- Male Members: 36

⁵ The New York Times, http://www.nytimes.com/2014/10/06/nyregion/facing-many-obstacles-bike-sharing-slowly-gains-traction-upstate.html?_r=0

⁶ Buffalo BikeShare's work in the Capital region influenced a 2015 bike sharing request for information (RFI) for the region.

⁷ In 2015, Buffalo BikeShare was awarded another demonstration in Jackson Hole, WY.

Figure 18. Albany – Heat Map of Trips Taken



4.2 Saratoga Springs

- Total Miles Ridden: 403.74 miles
- Average Ride Length: 2.42 miles
- Total Rides: 167
- Test Rides: 57
- Member Rides: 114
- Active Members: 58
- Female Members: 27
- Male Members: 31

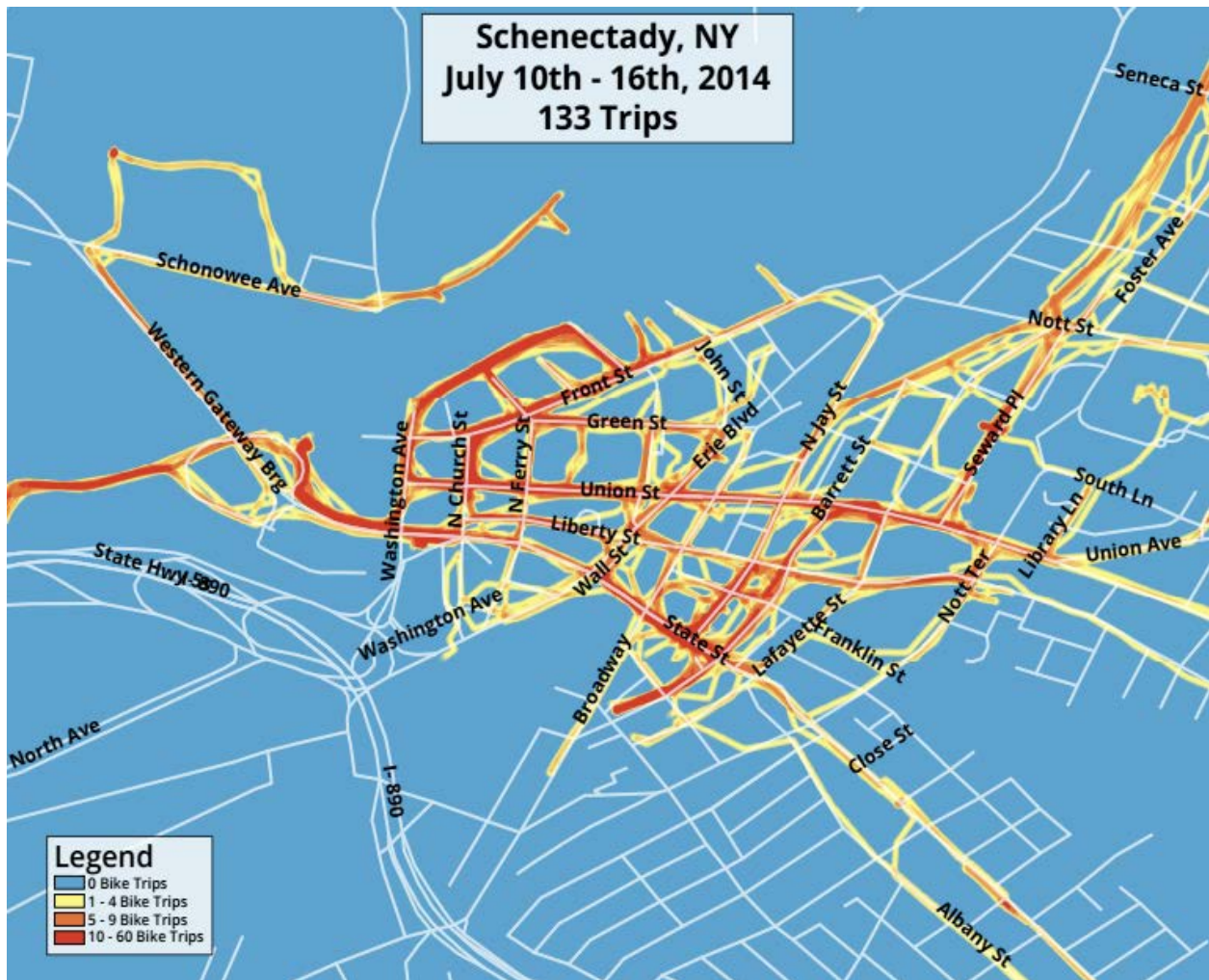
Figure 19. Saratoga Springs – Heat Map of Trips Taken



4.3 Schenectady

- Total Miles Ridden: 173.74 miles
- Average Ride Length: 1.31 miles
- Total Rides: 133
- Test Rides: 34
- Member Rides: 99
- Active Members: 37
- Female Members: 17
- Male Members: 20

Figure 20. Schenectady – Heat Map of Trips Taken



4.4 Troy

- Total Miles Ridden: 137.53 miles
- Average Ride Length: 0.85 miles
- Total Rides: 162
- Test Rides: 54
- Member Rides: 108
- Active Members: 33
- Female Members: 14
- Male Members: 19

Figure 21. Troy – Heat Map of Trips Taken



5 Next Steps

Buffalo BikeShare is confident regarding the next steps of the system. After thoroughly testing the Social Bicycles system, Buffalo BikeShare is now looking toward a sponsorship of an entire system (a 200 to 300 bike fleet). The major benefits of the SoBi system is the flexibility of operating a system with hubs (custom racks), docks (credit card processing units) and existing bike infrastructure. Buffalo BikeShare is looking to do a combination of all three of these ways of operating.

Along with a city wide system, Buffalo BikeShare is in discussions with other campuses and universities in the area. Buffalo State College and Canisius College have expressed interest in a system. The other major barrier from a citywide implementation is access to the city right of way and deploying custom racks. Even with the support of a corporate sponsor (Figure 22), the city of Buffalo must support the expansion of a system.

Figure 22. Corporate-Sponsored SoBi Credit Card Dock in Tampa, FL



Buffalo BikeShare also sees possibilities and revenue stream of doing demonstration/feasibility projects throughout the state and country. Communities who have expressed interest in these demonstrations are smaller and less dense than typical bicycles sharing locations. Buffalo BikeShare feels these untapped markets are perfect for an innovative (and more affordable) bicycle sharing systems.

6 Conclusion and Impacts

Even though this project took longer than anticipated to develop and conclude, the basic principle of has been fully achieved. Buffalo BikeShare tested, debugged, implemented a new environmentally friendly technologies and, because of the success, is now looking to expand its bike sharing system through the city of Buffalo at a much larger scale. Buffalo BikeShare is currently seeking corporate sponsorship.

Buffalo is just one part of the success of this project, as it is now benefiting the entire State. The Capital Region is looking into bike sharing in a more seriously, in part because of the demonstration project done by Buffalo BikeShare. SoBi, whose first major market was Buffalo, is now growing into markets across the country. Buffalo BikeShare's demonstration and upcoming feasibility projects across New York State and the country is spreading the knowledge base created by this project. NYSERDA funding has provided the insight into a new technology that is reliable and environmentally friendly.

The project met its goals as follows:

1. Advance State and federal livability goals through development of a bicycle sharing program. As quantified in Table 1, the Contractor has documented that bikeshare provides economic, environmental and health benefit to the community.
2. Utilize Bikeshare network as a real-time Transportation Planning and Urban Design tool. Buffalo BikeShare's demonstration projects and feasibility studies using SoBi Bikes achieved this goal. This goal is part of Buffalo BikeShare's long term strategy. With the help of SoBi, Buffalo BikeShare will be able to provide real-time data to communities that are interested in planning of bike sharing system.
3. Demonstrate bicycle sharing to be viable in a city in Upstate New York without ongoing public subsidy. Buffalo BikeShare is currently sufficient as a small bicycles sharing system. The contract with the University at Buffalo has been well received (Figure 23) and the intake from membership and use makes the system self-sufficient. Buffalo BikeShare hopes to be much bigger in the future as a 75-bike system is not large enough for a city wide system. Moreover, proving the SoBi system is a viable option, now opens many other cities in New York State to a bike sharing option because SoBi is more affordable to operate than other systems such as Citi Bike.

Table 1. Project Proposed Impacts vs. Actual

	Proposed Impact	Actual Impact
Number of Members	600	363
Number of trips	10,000	6,844
Carbon Saved	N/A ⁸	7,144
Gallons of Gas	N/A ⁹	369
Direct Savings (.58 per mile)	N/A	\$4,872
Calories Burned	-	324,792
Miles Rode	-	8,119

Figure 23. A satisfied BikeShare user at the University at Buffalo



⁸ At the time of the proposal, there was no data on CO₂ impacts of bike sharing.

⁹ At the time of the proposal, there was no data on gas consumption reduction with bike sharing.

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