Tar Heel Bikes

Bike Sharing on the UNC Campus: Review of Current Program and Expansion Potential

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*This paper represents the work done by a UNC-Chapel Hill undergraduate student team. It is not a formal report of the Institute for the Environment, nor is it the work of UNC-Chapel Hill faculty.*
Abstract

For the 2014 Spring Environmental Capstone, a group of seven students were assigned Tar Heel Bikes as a client. This was one of six different capstone projects completed in spring 2014. The team was tasked with profiling current users and operations of Tar Heel Bikes on the University of North Carolina at Chapel Hill campus. This was done through data analysis of past users, and by gathering new data via surveys of current users and the general student body, as well as with GPS data collected by tracking individual bikes used in the Tar Heel Bikes system. The team was able to discern certain patterns and provide recommendations to help Tar Heel Bikes improve its operational processes and grow successfully beyond the four residence halls it currently services.
Executive Summary

Introduction
This capstone team worked with Tar Heel Bikes (THB), a pilot bike share program serving the student residents of four south campus dorms on the University of North Carolina at Chapel Hill (UNC) campus. Various research methods were used to understand current ridership trends, to quantify public support for expansion, and to identify potential areas for improvement within the current Tar Heel Bikes operation. The team comprised seven undergraduates with diverse majors, and was advised by Dr. Elizabeth Shay of the Institute for the Environment and the Curriculum for the Environment and Ecology, and by Jill Mead, a Masters candidate in the Department of City and Regional Planning.

Methods
The team’s primary objectives were to understand how current users experience the THB program, get a sense for where the bikes are going (spatial and temporal patterns), and gauge interest on campus for an expanded program. The team began with background research and a literature review. They then conducted analyses of ridership check-out information compiled in StarRez (a system for tracking student services) and collected new data: GPS spatial analysis, a current-user survey and a general student body interest survey. The Institutional Review Board (IRB) reviewed the research plan and determined the project was exempt from further review. The team acquired check-out information for the first year of the pilot program. From this data, the team was able to analyze the ridership by sex, residence hall, number of individuals using the program, total rides per individual and distribution of rides per month. The team affixed GPS units to eight THB bikes stationed at the four south campus residence halls, to gather geospatial information regarding the bikes’ locations for one week. The team analyzed this information using the software program QTravel and identified the destinations of trips and the likely purposes for using the bikes. The team then conducted a current-user survey in which residence hall desk staff distributed the surveys to THB users as they checked out or returned bikes. This survey asked the riders about their experience using bikes from THB and their experience riding around campus. The last method employed by the team was a general student body interest survey over a four-day period. During this time, the team asked students around campus to comment on their overall transportation preferences at UNC as well as their interest in future expansion of the bike share program around campus and in Chapel Hill.

Results and Findings
StarRez Check-out Data: Approximately 57% of the users were male, and 4% of users accounted for 29% of the rides. Ehringhaus Residence Hall had five percentage points more of its residents using THB than the other residence halls, at 15.6%, compared to 10.6 and 10.3 for Hinton James and Craige, respectively.

GPS spatial analysis: The data suggest that 52% of the trips taken were for academic purposes, linking students from South Campus to North Campus academic buildings; hot spots included the Genome Sciences area and the Davis Library area on campus.
Current-user survey: The team collected only six current-user surveys. The results of this preliminary sample indicate that respondents mainly used the bikes to get to campus because it was faster than walking, and that they were generally satisfied with the program.

General student body interest survey: Lack of bike safety and inadequate bike lanes on campus hinder THB ridership; more people know about THB who live off-campus than on-campus; 60% of people familiar with THB heard about it through a friend or saw the bikes; and the majority of students view it as a useful program and would like to see the program expanded to other dorms.

Conclusions
There is an unequivocal interest in the expansion of the current bike share system to other on-campus residence halls. Of all THB trips taken (figure on left), 52% are to class; 80% of destinations are on-campus.

Among all THB users, 77% use the bikes only 1-5 times (figure on right), suggesting that ridership retention is a main challenge to THB.

Recommendations
After analyzing the data, the team has three primary recommendations for Tar Heel Bikes. First, Tar Heel Bikes should work to improve current operational processes. The team believes this will help to improve brand image and ridership experience. Several ways the team could improve are to organize the bike keys into designated boxes, prominently mark designated THB bike racks, and streamline the maintenance process. Second, the team suggests that Tar Heel Bikes enhance visibility and marketing so that more students know about the program. This can be achieved through displaying THB brand and possible destinations on THB racks. The team also views Week of Welcome and Orientation as great platform for THB advertisement, particularly for THB target population of on-campus residents. Finally, the team believes Tar Heel Bikes can take an active role in lobbying the University and the Town of Chapel Hill to increase bike infrastructure.
Introduction

In recognition of the positive environmental and physical benefits of biking, the Bike Share Task Force and the Resident Hall Association created the University of North Carolina at Chapel Hill’s (“UNC”) first bicycle share program, called Tar Heel Bikes (THB), in 2012. Tar Heel Bikes is structured as a bike library through which community members of four south campus residence halls can check out a bicycle with their student identification card (“One Card”) free of charge and return it to the check-out location by the end of the day, similar to any other enhancements obtained from the community front office. Tar Heel Bikes maintains a twofold mission: to increase student mobility and access to bicycles, and to promote sustainability and cultivate a biking culture on the Chapel Hill campus (Tar Heel Bikes, 2014). With over 1,200 check-outs in its pilot year, THB fulfills an obvious need for south campus residents.

The current Tar Heel Bikes operation is a two-year pilot program that is available to the more than 3,000 students at the Craige, Ehringhaus, Hinton James, and Morrison Residence Halls, with a fleet of 30 Kona AfricaBike cruisers. Mechanics from a local non-profit bike advocacy organization, the ReCYCLEry, assist in the maintenance of the bicycle fleet. Tar Heel Bikes is run by an all-student board: Akhil Jariwala and Danny Allen, the THB founders, lead a group of 15 students who coordinate marketing and outreach, operations improvements, fundraising and expansion planning.

Purpose of this Capstone Project

As the final year of Tar Heel Bike’s pilot program drew to a close in 2014, the student-led THB Steering Committee sought strategic recommendations to improve the design of the program, optimize user experience, and gauge expansion opportunities. Data about the bike share had been collected since the inception of THB in 2012 using a computer system called StarRez, which manages the information for all enhancement items and services offered from the front office of the residence halls. This data includes check-out information on bike usage that had yet to be analyzed. However, THB had not yet been able to capture substantial qualitative data on user satisfaction. In order to enhance program effectiveness and prepare for the next stage of expansion, Tar Heel Bikes required feedback on its pilot program.

This student-led research team took on the challenge of describing current users and their THB use patterns, as well as surveying the campus community to gauge interest in extended bike share opportunities. The team utilized current-user and general student body interest surveys together with GPS analysis to fulfill the goal of collecting the information needed to improve the user experience, improve the design of the program, and offer insight into expansion opportunities.
Introduction to the Capstone Process

The environmental capstone class (ENST/ENVR 698) involves team research projects that combine the education, research and outreach missions of UNC’s environmental curriculum. Projects are intended to require interdisciplinary research. Teams of undergraduate environmental students conduct the capstones in their junior or senior years. The projects are a learning experience for students that teach skills for conducting team-based research typical of professional practice. Capstone projects are intended to address a significant environmental issue in order to help Carolina find solutions to the issues that face surrounding communities.

This capstone research complements the UNC Campus Bicycling Environment capstone from spring 2011, which assessed the University of North Carolina at Chapel Hill’s current support of bicycling and bicyclists, and conducted a bicyclist and pedestrian survey to develop recommendations to improve the bicycling environment at Carolina.
Literature Review

Overview of bike share generations
Bike share systems are often categorized in three generations. A first-generation bike share does not employ a formal check-out station or designated bicycle-docking space. Instead bikes are placed around the bike share system’s intended jurisdiction and are available for use free of charge. Second-generation systems employ check-out stations that are supervised by a person who is responsible for program enrollment and bicycle distribution. Third-generation systems utilize electronic check-out stations; bikes are checked out with technology like “electronically locking racks and bike locks, telecommunication systems, smartcards and fobs, mobile phone access, and on-board computer” rather than by a person, making the checkout process more efficient (DeMaio, 2009). The THB program is currently in the second-generation stage, with aspirations of eventually evolving into a third-generation platform.

History of Bike shares
Bike sharing was started in Amsterdam in 1965 (DeMaio, 2009). The program model was conceived so that residents who did not own a bike could have easy accessibility to cycling. This bike share system consisted of distinct unlocked white bicycles that were placed around the city of Amsterdam. Access to the bicycles was free of cost. The “White Bicycle” program was ultimately unsuccessful, but served as a proof-of-concept that a bike share system could increase mobility for citizens and visitors, and serve as an alternate to private and mass transit (DeMaio, 2009). Various first- and second-generation bike shares were subsequently implemented all across Europe. Successful ones may serve as models for THB. The first third-generation bike share system was implemented at Portsmouth University in England in 1996. Students used a magnetic card to check out and unlock bikes. This campus-based bike share may also serve as a valuable model for THB as they look into third-generation expansion. The first large-scale, city-wide third-generation bike share system was established in 2005 when Velo’v launched a bicycle sharing program in Lyon, France.

As of 2012, there were about 450 bike share systems in existence (O’Brien et al., 2013). European cities are at the forefront of bike share systems because of their increased infrastructure capacity for bikes, and therefore account for most of the current operations (Nakamura, 2011). According to the handbook Optimizing Bike Sharing in European Cities, the average density of bikes in current urban European bike share schemes is about 14.8 bicycles/10,000 inhabitants and about 1.5 stations/10,000 inhabitants (2011).
Potential Impacts of Bike-Sharing Systems

Bike share systems have numerous potential impacts on cycling visibility, human health, and the environment. *The Bike Share Planning Guide* states that bike sharing decreases auto-dependence and therefore reduces traffic congestion, increases mobility, and improves the air quality of a community (2009). The guide also states that bike shares can improve the cycling culture of a city by improving the image of cycling and therefore attracting new cyclists (2009, pg. 14). These benefits are valuable to the UNC campus. Increases in total cyclists have not been coupled with increased accident rates in cities like Berlin and Stockholm; this observation supports the theory that increased cycling visibility increases cycling safety (*Bike Share Planning Guide*, 2009, pg. 14). Cycling has been observed to extend the accessibility of public transit by complementing public transit and improving the “first mile/last mile” connection (DeMaio, 2009).

Future of Bike-Sharing

Fourth-generation bike shares are meant to employ advanced technology in order to improve the efficiency, sustainability, and usability of cycling (DeMaio, 2009). Potential advancements cited by *The Bike Share Planning Guide* include modular, moveable stations that can be relocated to meet the cycling needs of the season and city, solar cells that power stations and communications, and universal cards that are integrated with public transit system (2009). DeMaio suggests improvements to be made toward distribution with incentives for trips to either leave or arrive at certain stations, expansion of rechargeable batteries at service stations, better tracking of bikes with GPS devices in order to collect stolen bikes and retrieve useful data, and pedaling assistance to allow for accessible bikes (2009). In the future, THB may explore some of these options.

Best Practices

The *Optimizing Bike Sharing in European Cities* handbook highlights several cases where bike share systems have failed due to poor practices. Previous failures were due to “under-dimensioned” systems (insufficient accessibility due to lack of stations and bikes), sparse station networking, lack of integration with public transit, and poor visibility and marketing. Tar Heel Bikes also must grapple with lack of stations, and must take note of the impact of poor visibility and marketing. The key factors of survival included a good cycling infrastructure in the city, accessible bike share schemes, low theft and vandalism, and low cost per bike ride (2009). The UNC campus infrastructure may need to be improved in order to increase the chances of survival for THB. The handbook also mentioned that communities where bicycle ownership is already high might have problems with managing a successful bike share system because the customer base would already be low (2009).
**Methods**

**Summary of Tasks**
To begin the project, the team met with the client to establish goals. They decided that the objectives of the project were:

- To understand how current users experience the program
- To get a sense for where the bikes are going, in what kind of spatial and temporal patterns
- To gauge interest on campus for an expanded program

To accomplish these goals, the team completed the following:

1) Analysis of check-out data from pilot year using data stored from the StarRez system
2) Collection of new data on the program using a survey tool and GPS units
3) Collection of new data on potential interest of an expanded program using a survey tool

A literature review was conducted to educate team members on the challenges and opportunities available to bike shares and to gain general background knowledge of bike shares. The next stage involved all team members completing CITI certification for Social and Behavioral Research. Once CITI certification was obtained, the team submitted their request for research and began the Internal Review Board (IRB) process. Upon obtaining IRB approval from the UNC from the Office of Human Research Ethics, the team began gathering information from various sources. To develop a basic profile of THB customers and their use patterns, we obtained records of check-in and check-out times from the StarRez system, with data for the pilot program, which we analyzed for trends using Excel. The team developed survey questions for the two different surveys, as well as a plan for GPS implementation. The team collected survey data through personally administered pen-and-paper surveys by standing in “The Pit,” a popular public space for students, with their general student body interest surveys. Current-user surveys were distributed to desk staff in residence halls, to be handed to users upon bicycle checkin. The survey results were then coded into Excel and analyzed for significant trends. Observational anecdotes and casual interviews between team members and members of the campus community also proved to be valuable for supplementary information on the program. Recommendations grew from conclusions drawn from all of these sources.

**IRB Review**
The team submitted an application to the Institutional Review Board (IRB) because most of the research methods used in this study involve human subjects. The IRB is a unit of the University of North Carolina at Chapel Hill’s Office of Human Research Ethics. Its purpose is to ensure uniform treatment of all potential human subjects, mainly to safeguard against any physical and psychological harm, including breaches in confidentiality.
The research of this team involved four different elements reviewed by IRB. The general student-body interest survey did not ask for any identifying information and was therefore anonymous, meaning the risk level to the participant was low (see appendix B). The current-user survey for Tar Heel Bikes participants included a consent form, where a rider could elect to provide their email if he or she is interested in being contacted to participate in a future focus group session (see appendix A). The focus group session was not conducted by the capstone due to time constraints. However, the plan created to implement the focus group could be used by Tar Heel Bikes to gain first-hand information on the user experience of their service at a later date (see appendix C). The identifying information (name, email) was to be collected on a different sheet of paper and kept separately from survey responses to ensure confidentiality. The team created a standard message to send to all participants who provided their email for follow up contact (see appendix D). The focus group script was also submitted to IRB to ensure that research plan and surveys were ethically sound.

The final, and most complicated, part of the IRB application was explaining how the team proposed to use GPS units attached to selected Tar Heel Bikes to obtain data points for spatial analysis. The GPS data is a cornerstone of the analysis, but also had the most potential for confidentiality concerns. The team was concerned about the potential for harm if a student took a bike to a location they would not want to publicly disclose. To minimize this potential conflict, the team notified Tar Heel Bikes users if their bike had a GPS unit attached. Therefore, they had the option to choose a different bike if they did not feel comfortable participating in this portion of our research project. The team carefully designed this process to take every possible measure to protect subjects against potential harm.

**StarRez Data from Pilot Year**

*Obtaining the StarRez Data*

The current check-out data is managed by StarRez, a computer program that collects user information for the check-out and check-in of enhancement items, including Tar Heel Bikes. The StarRez data utilized by the team covered approximately one year, from January 2013 to March of 2014. Historical StarRez data recorded the following information:

- Trip number
- Randomized user IDs
- User gender
- Check-out date/time
- Check-in date/time
- International student (Y/N)
- Transfer student (Y/N)
- Building of check-out
The capstone team sought to use the StarRez dataset to compile a number of general descriptive statistics. While the original dataset included a total of 1103 entries, numerous entries were determined to contain significant errors or unexplained discrepancies for check-out and check-in dates and times. When calculating the difference between the times individual bikes were checked in and when they were initially checked out, 163 entries were identified as having been checked out for longer than one day. Seeing that current THB operational practices mandate that all bikes be checked in before midnight on the day of check-out raised obvious flags. Conferencing with the THB steering committee and a Resident Hall Association (RHA) community manager to pinpoint the cause of the discrepancies determined that check-out durations in the one- to three-day timeframe can be described by the following scenarios:

- Desk staff have keys left at the desk or outside the office by students who return late, and thus check them in the following morning.
- Some desk staff do not know how to check back in Tar Heel Bikes, so they wait until someone else comes on shift to check them in.
- Students return the bikes a day late.
- Students return the bikes after the weekend, keeping them longer than the allowed period.

Ultimately, it was decided that any record with a check-out duration under three days’ time is likely reliable enough to be included in the final dataset. All entries with check-out durations exceeding three days were removed from the dataset. Thus, 53 entries were removed in total, dropping the size of the total dataset to 1050 entries.

**Method for Coding StarRez Data**

The 1050 remaining StarRez entries were then coded into Excel and analyzed to find the following descriptive statistics:

- Rides per month
- Rides per day of the week
- Average number of rides (male/female)
- Percentage repeat users
- Average check-out duration
- Male/female user percentage
- Users per building
- Rides per building
- Most popular daily check-out times
GPS Spatial Analysis

Preparing the GPS Spatial Study
The team decided to conduct a GPS spatial analysis of current Tar Heel Bikes usage to gain a more comprehensive understanding of where the bikes were going. Spatial analysis provides information on data that is not adequately covered by survey questions, such as routes used and more specific data on destinations. With IRB approval, the team attached GPS units to the bikes to record the routes taken by Tar Heel Bikes users. All identifying information was separated from the data, so that the team could not match a route to a specific user.

The team borrowed sixteen GPS devices from the UNC Department of City and Regional Planning. The GPS units were attached to bicycles, with two units at each of the four south campus dorms, for a total of eight units deployed each day. These eight units were alternated every day with charged units. In order to cover the cost of replacement for any units lost or broken during the study, the team presented an implementation plan in front of the THB steering committee; the team requested financial coverage for any lost or broken unit as well as assistance from THB in man-power to deploy and retrieve GPS units at the start and finish of each day. The THB steering committee agreed to allocate $800, $100 per unit in the field at one time, towards insurance. They set a trigger to stop the study at two lost units. They also designated three THB team members to help with deploying the units.

Implementing the GPS Spatial Analysis
The team planned to track two bikes at each dorm on south campus. Change purses were attached under the bike seat and used zip-ties to fasten the pouches to the bike. The units were then placed inside of ziplock bags that were then put inside of the change purses. Tar Heel Bikes volunteers separated the units between the dormitories, with four units for each dorm. One volunteer supervised Hinton James and Ehringhaus, while the other two supervised Craige and Morrison. Two units per dorm were deployed each day, while the other two were charged in preparation for the following day. The deployed units and charging units were alternated each day throughout the course of the study. At the end of the study, the team collected the units from the THB members and continued with analysis of the collected data. The study ran eight days: from Thursday, April 10, until Thursday, April 18. After completing the study, the team uploaded the GPS information on QTravel Travel Software, analyzed each trip, and recorded the destination and route taken. Five of the sixteen GPS devices only recorded drift points, so the team threw out those datasets. Any obvious drift point routes, for example a route that was a straight line from Ehringhaus to the Dean Dome and not following any specific roads or paths, were also thrown out. Results of the spatial analysis of the remaining eleven GPS units were reviewed for significant trends, displayed visually in the results section.
Method for Coding GPS Data
The team analyzed the data on a trip-by-trip basis. For each trip, the team recorded destination, purpose of trip (on-campus recreation, off-campus recreation, academic and grocery), and route notes. To determine purpose of a trip, the team made assumptions by linking the destination with the purpose of buildings in close proximity to the stops. For instance, if the bike stopped in front of the Undergraduate Library, the team labeled this an “academic trip.” Off-campus recreation encapsulates any trip to an off-campus location that is not a retail or grocery location. On-campus recreation includes other dormitories, campus dining facilities, and campus athletic facilities. Assumptions were necessary and thus there is room for error. The final destinations of the bikes may not have indicated the final destination of the rider. This is a limitation to GPS analysis, but under the assumption that riders parked their bikes at their final destinations, the data is valid.

The QTravel Travel Software showed the plotted GPS coordinates (one marked approximately every thirty seconds) and connected them to show the route. Destinations were determined to be at any consecutive GPS coordinates recorded in the same spot for an extended period of time (at least ten minutes for the purpose of this study). The team counted the number of destinations and trips and calculated the percentage of trips that traveled on roads, the percentage of each type of trip, and the percentage of trips that included multiple destinations. The team also plotted each destination on a map of downtown Chapel Hill and Carrboro to create a THB footprint, an outline of the program capturing all plotted destination point, and to locate any hot spot regions with multiple destinations.

Surveys
Developing the Survey Instruments
Dillman (2000) describes the goal of writing a self-administered survey as creating survey questions that respondents will interpret in the same way, will respond to accurately, and will answer (2000). Dillman outlines eight criteria for assessing potential survey questions, as well as 19 principals for the wording of questions. Additionally, Dillman describes the three fundamental question structures (open-ended, closed-ended, and scalar) and their appropriateness for different types of survey goals. With this in mind, and utilizing the spring 2011 capstone on Bicycling Environments survey as a model, the team developed, piloted, and revised a number of survey questions. The team determined that a mix of closed-answer, closed-answer with open comment, and scalar question structure was most appropriate to achieve their goals. Drafts were sent to the client for additional feedback and to confirm that the questions appropriately aimed at answering the questions that Tar Heel Bikes wanted answered.
From this process, the team created two separate one-page, double-sided surveys: a current-user survey and a general student body survey. The current-user survey aimed to further understand how students currently use the bikes they borrow and their satisfaction with the Tar Heel Bikes program. Questions included reason for use, ease of check-in and check-out processes, destinations to which users traveled, and the visibility of the Tar Heel Bike program (see appendix A). The general student body survey aimed to gauge campus awareness of the Tar Heel Bikes and reception to potential expansion of the bike share program. Questions also sought responses about travel preferences, knowledge about the program, and interest in expanding Tar Heel Bikes to the broader campus community (see appendix B).

**Survey Distribution**

**Current-User Survey**
The current-user survey was designed to be administered to users when they check in bicycles, to solicit information about the biking experience, and to understand the profile of current users. The client expressed interest in being informed of all contact with RHA and the Department of Housing, and was subsequently kept aware of team activities via consistent communication. Working through contacts facilitated by Tar Heel Bikes, the team contacted Office Assistants (OAs) and Resident Assistants (RAs) of the South Campus dorms that have implemented the bike share program and asked them to distribute surveys to bike share users when they checked in their bikes. The team constructed and delivered survey packets containing copies of the survey and directions for distribution and collection to each of the four residence halls. The RAs and OAs were instructed to collect all completed responses in the packet. The identity of students who participated in this convenience sample was kept anonymous from the capstone team members.

**Student Body Survey**
Team members distributed the student body survey centrally on campus, in areas of high student density. The team focused efforts on administering the survey to students in “The Pit,” a common meeting place in the center of campus near the libraries, cafeteria, and student store. During pleasant weather, The Pit is a popular place for members of the campus community to socialize and eat. Additionally, due to its centralized location, students traverse it frequently on their way to classes and other engagements on campus. Over a period of four days, team members collected 152 unique responses to the survey through random solicitation. The anonymous surveys collected no personal identifying information.

**Method for Coding Survey Data**
Results of the survey were coded into an Excel workbook and analyzed to find the following information:

- Profile of survey participant
- On- and off-campus transportation preferences
- Cycling preferences
Gauged value of Tar Heel Bikes program
- Interest in Tar Heel Bikes expansion

Data from the mix of categorical and optional short-answer responses provided both simple descriptive statistics and more narrative text responses. Results of these surveys can provide directive ideas for a future focus group with incoming students and potential THB users.

**Focus Group Guide**

Stewart’s (2007) “focus group theory” describes focus groups as a uniquely valuable qualitative tool due to the following opportunities: focused research, group interaction, in-depth data, and humanistic properties. Focus groups allow for participant interaction and facilitate detailed answers to questions as individuals accept, reject, and collaborate on ideas. Researchers are able to engage in empathy, openness, and active listening in order to encourage participants to share more information than they may with another qualitative tool, such as a survey.

Building on Stewart’s guide, the goals of our survey instrument, and the interests of the client, the team developed a set of questions for the focus group. Drafts were shared with Tar Heel Bikes for revision before being submitted to IRB for approval.

The Capstone team aimed to conduct focus groups in order to understand if there were user concerns not adequately captured by the survey of current bike share users. Focus group participants were to be drawn from the pool of current users who voluntarily provided their contact information to the RA or OA upon the return of the survey. The team planned to encourage a pool of current users to attend the focus groups with food incentives.

While time constraints ultimately prevented the team from conducting these discussions, the Tar Heel Bikes steering committee could use the focus group guides constructed by the team and approved by IRB in future if they chose to seek more detailed feedback about the existing program (see appendix C and D). Questions were designed to probe topics such as ease of the check-out process, condition of the bikes, campus bikeability, and opinions on the potential expansion of the program. Feedback from the focus groups could be compared with the results from both the user surveys and the student body in order to understand whether responses were generally consistent or different than those collected by the survey. The predictably more detailed responses from the focus group could also provide deeper insight into current user satisfaction and supply Tar Heel Bikes with a more specific understanding of the programs current successes and limitations.
Results and Findings

Analysis of data revealed a number of interesting trends in Tar Heel Bike use and student attitude towards bike shares.

Results from StarRez Data

The capstone team obtained historical check-out data from the past year of operation in order to characterize who has been using THB since its launch. After all anomalous points were removed from the set, we compiled the data that follow. Figure 1 shows that ridership is higher in warmer months, experiencing significantly more rides August-October than December-February.

Average rides per day of the weeks were fairly constant (Figure 2), with the exception of Sunday and Monday, when fewer rides are taken.

![Rides Per Month](chart)

**Figure 1. Monthly ridership**

![Average Rides Per Day of Week](chart)

**Figure 2. Use per day of the week**
Figure 3 and 4 illustrate check-out and check-in times throughout the day. The majority of bikes were checked out between 9 a.m. and noon; this is the timeframe when most students are traveling to class.

![Checkout Time, Frequency](image)

**Figure 3. Most frequent check-out time**

The majority of bikes were checked in between 5 p.m. and midnight.

![Check-In Time, Frequency](image)

**Figure 4. Most frequent check-in time**

Figures 5 and 6 illustrate the breakdown of THB riders in the pilot year, and the frequency with which they use the service. Significantly more men than women are THB customers. This trend is
consistent with global patterns that suggest a larger percentage of males regularly use bike shares (DeMaio, 2009).

![Male/Female User Breakdown](image)

*Figure 5. Males to female ridership*

Not only are more males using THB than females, but individual males rode THB bikes with more frequency often than individual females (5.80 rides per male vs. 4.79 rides per female).

![Average Number of Rides](image)

*Figure 6. Average number of rides per use*

Figure 7 has a number of interesting takeaways. To start, 77% of THB users have only ridden Tar Heel Bikes one to five times. Contrary to what one might assume, the cohort of users who have ridden bikes one-five times accounts for only 29% of total THB rides. Thus, a large percentage of THB users account for a small percentage of total rides. Four percent of THB users (seven individuals) are responsible for nearly a third of all THB rides (29%).
Figures 8 and 9 break down rides and riders by residence hall. Hinton James has the most rides at 452 (Figure 8), followed by Ehringhaus, and Craige with 332 and 266, respectively.

Likewise, Hinton James has the greatest number of users (Figure 9). When accounting for the student capacity of each dorm, Ehringhaus has the greatest percentage residents who use THB (15.6%), followed by Hinton James (10.6%), and Craige (10.3%). To obtain these percentages,
we multiplied the total capacity of each building by 90% (to assume a 90% occupancy rate), and divided total users by the assumed occupied capacity of each building.

![Users Per Building](image)

**Figure 9. Riders per residence hall**

**Results from GPS Spatial Analysis**

After one week of tracking eight bikes with GPS units, the team was able to gather information on 20 individual rides with a total of 25 destinations. Although 20 rides are not enough to establish statistical significance, the team analyzed the information as a first step in exploring ways to expand current knowledge of how Tar Heel Bikes are being used.

The GPS spatial analysis allowed the team to see where the bikes were taken. The team plotted the destinations on a map, shown in Figure 10. This map shows the program footprint, which is the amount of area covered by the program.
Then the team split the map into geographic regions to identify any hot spots. The regions are shown on Figure 11. There are at least three destinations in section A, C and D. This map can be used in assessing locations of possible check-out kiosks for expansion.

Figure 10. Bike use footprint

Figure 11. Bike destinations separated into ‘hot spot’ regions
The spatial analysis allowed the team to see where the users stopped and left the bikes. The team divided up the destinations into four categories: academic, on-campus recreation, off-campus recreation, and grocery/retail. Figure 12 shows that, 52% of THB trips were for academic purposes; 28% of trips were for on campus recreation, 12% were for off campus recreation, and 8% were for grocery shopping or other retail.

![Type of Trip](image)

**Figure 12. Purpose of trip taken via bike**

This data suggests that there is a demand for THB for multiple purposes in Chapel Hill. While the majority of users used the bikes to get to classes, the bikes are also used for on-campus connectivity and as transportation to off-campus locations. The team observed four off-campus locations, Weaver Street Market, off-campus housing, the NC Botanical Garden and off-campus recreation facilities.

Figure 13 shows the percentage of trips in which the rider traveled on roads shared with automobiles. More than one-third (35%) of the total trips included travel on roads, while 100% of off-campus trips included travel on roads. If bike paths were available, the rider used them in 100% of off-campus trips.
Despite the small sample size, the team believes that this observation is a testament that if bike paths are available, the rider will use them. However, we do not have information as to how many people chose not to bike to a desired destination because there were no available bike paths.

Figure 14 shows that 15% of trips contained multiple destinations. This data suggests that many of the bikers use the bikes as a means to get to a destination, park the bike in an academic area of campus, then walk between destinations. This is supportive evidence that if THB is going to expand to a next generation bike share, it would be appropriate for them to have a distribution area in the academic areas of campus. In looking at the hotspot map, two potential locations of on-campus check out areas are “The Pit” and near the Genome Sciences Building.

There are several key takeaways from the GPS analysis. The first is that the majority of the rides are for academic purposes. Also, only 15% of the rides went to multiple destinations. Finally,
users took the bikes to off-campus destinations, showing the team that THB can be used to link students to previously hard to reach destinations.

**Results of General Student Body Interest Survey**

**Survey Participants**
A total of 151 students participated in the survey. The participants of the general student body survey represented similar demographics with that of the whole university. Among survey participants, 32% were males while 68% were female (Figure 15a); this runs counter to the university’s gender ratio of 58% female to 42% male (US News and World, 2014). The sample of survey participants contained a greater share of seniors than sophomores and an equal share of juniors and first-years; 36% of participants were seniors, 27% were first-years, 14% were sophomores, and 23% were juniors (Figure 15b). Nearly half (48%) of survey participants were off-campus residents and 52% were on-campus residents (Figure 15c); 54% of UNC’s population lives off campus while 46% lives on campus (US News and World, 2014).

![Figure 15. Survey participants: sex, year, residence](image)

**Transportation Preferences**
All 151 students who participated in the survey responded that they travel around campus by walking. Other forms of transportation were much less popular; 24 participants indicated they used the on-campus bus system, 16 traveled by bike, and 2 traveled with skateboards (Figure 16). Various modes of transportation from off-campus locations to campus were popular amongst the sample population.
Of the 72 off-campus students who participated in the survey, 39 traveled from their off-campus residences to campus by walking, 37 by bus, 26 by bike, and 20 by personal vehicle (Figure 17).

**Bicycle Preferences**

Two questions regarding the participants’ current bicycle usage were included in the survey. The first asked whether the participants owned a bike. A total of 57 participants responded that they own a bike, while 93 did not (Figure 18).
The next question asked whether the participants would ride a bicycle more if they could rent one for free. Altogether, 77 participants responded they would ride a bicycle if they could rent one, 47 would not, and 27 were unsure (Figure 19).

The last questions asked why participants would not ride a bike. Some 33 responded that they already have their own bikes, 26 do not feel safe riding a bike on campus, 26 said there are not adequate bike lanes, 16 indicated that the campus terrain is too hilly, 14 do not enjoy biking, 14 prefer different forms of transportation, 7 believe that there are not enough bike racks on campus, and 2 do not know how to ride a bike (Figure 20)
Figure 20. Participant assessment of bicycling limitations

Perceived Value and Interest in Program
The survey contained several questions regarding the perceived value of the current bike library model and the interest in potential expansion. Of the 151 participants, 115 believed that Tar Heel Bikes is a useful program; 11 participants believed that it was not a useful program and 25 participants were unsure (Figure 21).
In addition, 139 participants wanted to see the bike library system extended to other residence halls, 25 were unsure, and 3 did not want the system extended (Figure 22).

![Figure 22. Participant interest in on-campus expansion](image)

Because a recent campaign has lobbied for a third-generation system, the team also asked participants if they wanted to see the system extended to off-campus residents. A total of 101 students said they would like to see the system extended to off-campus residents, 6 said no, and 43 were unsure (Figure 23).

![Figure 23. Participant interest in off-campus expansion](image)
A follow-up question asked the participants to rate their interest in extending the bike share system to off-campus students on a scale of 1 (no interest) to 5 (very interested) (results indicated in Figure 24).

![Figure 24. Participant interest in off-campus bike share (5 is high)](image)

Students were also asked to indicate how much they would be willing to pay in student fees in order to support the expansion of the Tar Heel Bikes program (results indicated in Figure 25).

![Figure 25. Participant willingness to pay for THB](image)
Prior Knowledge of Program

The majority of students did not know about the Tar Heel Bikes prior to this survey; 59 participants had prior knowledge, 83 did not, and 9 knew about the program but were unsure of the program’s details (Figure 26).

![Prior to this survey had you heard about Tar Heel Bikes?](image)

**Figure 26. Previous knowledge of THB program**

The participants with prior knowledge indicated how they knew about the Tar Heel Bikes program; 28 knew about the program because a friend told them about it, 25 saw the bikes, 13 had seen a flyer, 6 read an email, 5 saw a poster, and 4 saw a newspaper article (Figure 27).

![How did you hear about Tar Heel Bikes](image)

**Figure 27. Sources of information about THB program**
Discussion
The results of this survey reveal several interesting trends. First, most of the student population sampled believes that a bike library is a useful program for on-campus residents. They want to see the program extended to other residence halls. Many of the survey participants also believed that a bike share program would be useful for off-campus residents. Despite the high interest in the program, over half of the participants had no prior knowledge of Tar Heel Bikes before taking the survey. Most participants with prior knowledge of the program discovered Tar Heel Bikes by either seeing a bike or by word of mouth, rather than by Tar Heel Bikes marketing campaign materials such as flyers, newspaper ads/stories, and emails. The amount of money the participants were willing to spend was inversely proportional to the general interest; while most participants were very interested in expanding the bike library program, the majority only wanted to pay zero to two dollars in bike share related student fees. The average fee participants were willing to pay was $3.19.

Although the perceived value of the program is high, the on-campus customer base may be limited due to pre-established preferences. Many students preferred other forms of on-campus transportation, such as walking and bus systems, to bicycles. These preferences are greatly influenced by perceived on-campus bicycle safety. Most of the students who said that they do not ride bikes indicated that they used other forms of transportation because they do not feel safe on a bike and because there are not adequate bike lanes on campus. This indicates that a major hurdle to program expansion may be the poor bicycle infrastructure of campus. Many participants also indicated that they would not use Tar Heel Bikes because they already owned a bike. According to Optimizing Bike Sharing in European Cities, one of the main deterrents of a successful bike share program is when everyone who would ride a bike already owns a bike and therefore has no need to check a bike out (2009). Further study into the bicycle ownership of potential customers would be valuable in determining the possibility for expansion.

Results of Current-User Survey
Unfortunately, the team received only six responses to the current-user survey distributed to the four residence halls during the two-week period. The low response rate may be the result of a variety of factors; low ridership due to poor weather, lack of accountability for users to respond, inadequate length of sampling period, or a combination of these. Additionally, implementation of the surveys into the residence halls was hindered by communication difficulties between the desk staff, upper management, and the team.

Some preliminary conclusions may still be drawn from the limited sample. Half of the respondents were first-year students, and four out of the six respondents lived in Ehringhaus. Only one of the respondents went to an off-campus location, and five out of the six went to North Campus (the Pit, Davis Library, or the Undergraduate Library). The second most
popular locations were other locations on north campus, encompassing the Lower Quad (Polk Place). These results compliment the GPS spatial analysis.

Four out of the six respondents said their purpose for using a Tar Heel Bike was that using a bike was faster than walking, and the same four out of six used it to get to campus for class. Again, the same number of respondents said the Tar Heel Bike service was not well advertised. The most positive trend from the current-user survey was that five out of the six respondents rated the comfort of the bikes as either “very comfortable” or “somewhat comfortable.” These results suggest that Tar Heel Bikes might aim to improve their marketing and visibility to increase ridership.

**Conclusions from Findings**

Utilizing the results from our surveys, the GPS units, and pilot year check-out data, the team delineated three overarching themes. The first, and most significant, is that there is an unequivocal interest in the expansion of the current bike share system to at least the rest of UNC residence halls. This theme is seen from the general student body interest survey, and could potentially be used in support of a student fee or to validate the expansion process for THB. The second theme the team identified is that the primary purpose of using THB is for students to get to class. The majority of GPS data points gathered showed trips to and from north campus (Polk Place, the Pit, the Undergraduate Library, and Davis Library). This was confirmed by the limited results from the current-user survey, where most respondents said their primary purpose for using a THB was to get to class using a bike, which they said is faster than walking. The last theme the team saw was that 77% of users only use the service one to five times, and this was shown through the pilot year’s check-out data utilizing the StarRez system. From this statistic, the team can conclude that THB has low user retention. This gives THB the data necessary to implement solutions in order to expand overall ridership and improve rider retention.
Recommendations

From the results and findings, as well as from direct observation, the team was able to construct recommendations for Tar Heel Bikes. The recommendations could be separated into four themes under two broader categories of short- and long-term impact:

1. In the short term, THB could have direct impact by addressing:
   a. Current operational processes
   b. Visibility and marketing
   c. Current user satisfaction

2. In the long term, THB could have indirect impact by addressing:
   a. Bike safety and infrastructure

Short-Term, Direct Impact

Improving Current Operational Processes

Brand Experience

Rather than focus on external factors that could possibly cause a rider to use THB fewer than five times (such as lack of bike infrastructure or the hilly topography of Chapel Hill), the team decided to focus on more relevant and actionable possible causes that THB can directly impact. One such item is Tar Heel Bikes’ brand experience. When visiting the four residence halls where THB currently operates, the team observed in multiple instances that keys were missing or mislabeled, various bikes were damaged or broken, and there were multiple non-Tar Heel Bikes on designated Tar Heel Bikes racks. These are all issues that—if experienced by a first-time user—may decrease their likelihood to reuse the service. For instance, if a first-time user receives a key that is mislabeled, they may be required to go back and forth between the desk staff and bikes until they match a key with the correct bike. Likewise, when the rider returns from their trip, they may have a difficult time returning the bike to its proper location because the racks are inundated with non-Tar Heel Bikes. These reasons can contribute to why a rider may not check out a THB again.

There are several simple solutions that can be implemented to improve user brand experience:

Organize bike keys into designated boxes

Tar Heel Bikes can start by visiting each of its current residence hall locations, identifying and correcting mislabeled bikes and keys, and place keys in designated boxes. By organizing keys into separate boxes, THB can ensure that fewer keys are misplaced. THB could also specify a separate section of the same key box or an entirely different key box where desk staff can place the keys of broken or damaged bikes. This would prevent the desk staff from accidentally checking out broken bikes.
Prominently mark designated THB bike racks:
The next solution is to install permanent signs next to the Tar Heel Bikes’ racks to remind non-Tar Heel Bikes users to avoid parking their bikes on THB racks. Currently, the only distinction between THB racks and regular dorm racks is their blue color. A simple sign can dually act as effective marketing and a reminder that THB racks are only for Tar Heel Bikes, thus reducing the number of non-Tar Heel Bikes that populate the racks.

Flag Non-THB bikes that occupy THB racks:
To the same effect, Tar Heel Bikes can flag non-Tar Heel Bikes that currently occupy their racks with a ribbon or a small message, reminding the bike owner that THB racks are off-limits.

Streamline maintenance process:
Finally, THB can work to improve communication between all parties involved in the bike repair process, including: the Department of Housing and Residential Education, the NC ReCYCLEry, and Tar Heel Bikes. By increasing both the frequency and depth of communication between these parties, THB can improve bike service and increase individual bike uptime.

Enhance Visibility and Marketing
The results of the General Body Survey indicate that more off-campus students know about the program than on-campus students. This survey also showed that most students who know about Tar Heel Bikes learned about the program either by word of mouth or by seeing the actual bikes. These findings led the capstone team to believe that increasing program visibility and improved targeting of marketing campaigns could be very effective in increasing ridership. The team came up with a number of solutions:

Prominently display THB brand and possible destinations at THB racks
Larger, more explicit signage displaying the THB brand logo would serve the primary purpose of catching the attention of those passing by THB racks. Viewing the GPS data collected makes it apparent that the majority of trips are taken to campus, with a small percentage of rides ending more than a half-mile away from residence hall starting points. This lack of trip diversity could be attributed to a narrow image of the value of the THB services; students may believe that the bikes are only worth using to travel to and from class. To solve this problem, new signage could include a map of UNC’s campus and the surrounding region with possible suggested destinations. Included on the signs, THB could also illustrate the time savings gained by riding to each respective destination as opposed to walking. When placed next to a THB rack, this signage would have the added benefit of distinguishing THB racks from dorm racks, thus decreasing the number of non-THB bikes using the racks. An example of a possible signage is illustrated below (Figure 28).
Underclassmen are the primary target market for the current THB library system. This is because Tar Heel Bikes is available only at South Campus residence halls, which are primarily occupied by first- and second-year students. Increasing Tar Heel Bikes campus presence during Orientation and UNC Week of Welcome is an easy way to reach their target demographic. Tar Heel Bikes could also partner with the Department of Housing and Residential Education to ensure that RAs emphasize the many benefits that THB offers.

Collect More User Data
While participation in the user survey was low, the team still has recommendations for THB so that they can effectively gather information about the current user experience in the future. Rather than attempting to survey students who are checking in or checking out a Tar Heel Bike, THB could seek out the 77% of students who checked out a bike only one to five times in order to observe potential improvements in their system. This could be done by distributing a survey in “The Pit” that is specifically advertised to previous users of Tar Heel Bikes. THB could also
implement a focus group with willing user survey participants by using the script that the capstone team composed.

**Long-Term, Indirect Impact**

*Lobby for Bike Safety*

The general student body interest survey indicated that many potential users do not feel comfortable biking around campus either because they did not feel safe biking at UNC or because of lacking designated bike lanes and insufficient bike infrastructure.

While Tar Heel Bikes cannot directly solve this problem, in its role as the most visible campus bike organization, THB can continue to be a vocal supporter of improvements to bike infrastructure on campus. THB can also consider partnering with UNC Public Safety, North Carolina Department of Transportation, and Chapel Hill Planning to crowd source comprehensive and financially feasible solutions to improve bike infrastructure. After compiling a number of potential solutions, THB can work with the local Chapel Hill and Carrboro community to build grassroots support and petition for added investment to improve the bikeability of the Chapel Hill/Carrboro area. Once adequate support has been garnered, solutions can be presented to the town council of Chapel Hill where meaningful conversations can be raised.

**Implementation**

Tar Heel Bikes can ensure that the recommended solutions are effectively implemented by creating subcommittees to accomplish each task. These subcommittees can then be populated with members of the THB steering committee. In addition to implementing the various recommendations, these members would be responsible for continually monitoring the status of keys, bikes, racks, and procedural compliance of residence hall and NC ReCYCLEry staff. These THB subcommittee members would also be required to conduct such analysis on a weekly, bi-weekly, or monthly basis. After visiting all dorms and recording findings, subcommittee members can then report metrics back to the THB steering committee at weekly meetings. These reports would include various data including but not limited to the number of damaged or broken bikes, how long it is taking bikes to be fixed, the number of active bikes, and the number of mislabeled or unlabeled keys. Subcommittee members can also speak with desk staff to field any questions, identify and systemic, recurring problems, and subsequently develop timely solutions at THB steering committee meetings. These recommendations would go help improve user experience.
Conclusion

Since its inception in 2012, Tar Heel Bikes has shown that it functions as a valuable program on the University of North Carolina at Chapel Hill campus. The current user data gathered via the StarRez system, survey tools, and GPS spatial analysis indicated important themes in ridership: most trips are made to on-campus locations, and by a small number of repeat riders. From such results, the team generated helpful recommendations for improving the current operational processes and marketing of the THB program. Data gathered from the general student body interest survey indicates that there is significant interest in an expansion of the program. This support is consistent with THB goals for campus-wide expansion. However, THB should not neglect barriers to future success, such as infrastructure limitations, that may hinder expansion. The results of this study indicate that indirect limitations, such as the lack of appropriate bike lines and bike safety on campus, influence bike use on campus.

The limitations of this study leave room for further analysis. As mentioned, response rate on the current-user survey was low. Tar Heel Bikes or another research project may wish to explore this dimension further in order to get more detailed feedback on the program. The results of this capstones team’s research, as well as the focus group guide, may provide a basis for future research on current user satisfaction.

We hope that the information contained in this report has provided Tar Heel Bikes with valuable insight into current user satisfaction and use patterns, as well as information that will be helpful for further operational improvements and eventual expansion. Tar Heel Bikes stands in a position of potential long-term success as a permanent service for the campus and broader Chapel Hill community. It is the hope of this capstone team that the research gathered for this analysis will be utilized by THB as they continue to uphold their mission for increasing bicycle mobility and access on the UNC campus.
Acknowledgements

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- **THB Steering Committee** - Akhil Jariwala, Kevin Chu, & all others who assisted
- **Department of Housing and Residential Education Desk staff**
Works Cited


Appendix A. Current-User Survey

![Survey Image]

This brief survey was designed by a UNC-Chapel Hill student team as part of a capstone project with the Institute for the Environment. Your responses will help us make strategic recommendations to the Tar Heel Bikes program, to assist them in improving and expanding this bicycle lending program. The survey does not ask for personal identifying information. There is no known benefit or harm to you.

For more information, contact THBsurvey@gmail.com

What is your age? _____ male _____ female?

What is your residence hall? _____ Craig _____ Hinton James _____ Morrison _____ Ehringhaus

What is your class? _____ First-year _____ Sophomore _____ Junior _____ Senior

Where did you go?

1. What areas do you typically visit with your Tar Heel Bike? (Check all that apply.)
   - North Campus—Upper Quad (McCorkie Place)
   - North Campus—Lower Quad (Polk Place)
   - North Campus—Pit, Davis Library, and/or Undergraduate Library
   - South Campus
   - Franklin Street and Chapel Hill business district
   - Other (Please elaborate)

2. What is your typical purpose for checking out a Tar Heel Bike? (Check all that apply.)
   - To get to class
   - To get to campus (not for class)
   - To get to work
   - To run errands
   - As recreation
   - Other (Please elaborate)

3. Why did you choose to rent a Tar Heel Bike today? (Check all that apply.)
   - I do not have my own bike
   - It is faster than walking
   - I enjoy the exercise
   - I was late to class
   - Other (Please elaborate)

Your biking experience:

4. How often do you utilize the Tar Heel Bike service?
   - Almost every day
   - Several times per week
   - Once per week
   - A few times per month
   - A few times per semester
   - First time user

5. Would you choose to check out a Tar Heel Bike again?
   - Yes
   - No
   - Maybe

   Please elaborate.
6. Rate bike availability:
   1 - I can always get a bike
   2 - I can usually get a bike
   3 - I sometimes get a bike
   4 - I can rarely get a bike

7. Rate bike condition:
   1 - The bikes are outstanding and in great working order
   2 - The bikes are very nice, with few flaws
   3 - The bikes are adequate
   4 - The bikes are sometimes broken and/or missing parts
   5 - The bikes are rarely in good condition, and are usually broken and missing parts

8. Rate your comfort on the bike:
   1 - Very comfortable
   2 - Somewhat comfortable
   3 - Uncomfortable
   4 - Very uncomfortable

   Please elaborate.

9. If offered, would you check out a helmet?
   □ Yes
   □ No
   □ Maybe

   Please elaborate.

10. Rate your overall experience with Tar Heel Bikes:
    1 - Extremely satisfied
    2 - Satisfied
    3 - Neutral
    4 - Disappointed
    5 - Very disappointed

Visibility:
11. Do you think the Tar Heel Bike service is well advertised?
   □ Yes
   □ No

12. What type of notification is likely to get your attention? (Check all that apply.)
    □ Listserv emails
    □ More signs for the Tar Heel Bikes (on racks, around campus, etc.)
    □ Print advertisement (Daily Tar Heel, other university publications, etc.)
    □ Flyers (On bulletin boards, in halls, bathrooms, etc.)
    □ Other

   Please elaborate.

Additional comments?

Would you be willing to participate in a group discussion about Tar Heel Bikes? Free pizza and soda dinner provided! If interested, please give your email to the RA/0A when turning in this survey.
Appendix B. General student body interest survey

This brief survey was designed by a UNC-Chapel Hill student team as part of a capstone project with the Institute for the Environment. Your responses will help us make strategic recommendations to the Tar Heel Bikes program, to assist them in improving and expanding this bicycle lending program. The survey does not ask for personal identifying information. There is no known benefit or harm to you.

For more information, contact THBsurvey@gmail.com

What is your age? (optional)

Are you ___ male ___ female?

What is your class? ___ First-year ___ Sophomore ___ Junior ___ Senior ___ Not Applicable

1. Classification (Check all that apply.)
   - Student, full-time
   - Student, part-time
   - Faculty, full-time
   - Faculty, part-time
   - Staff, full-time
   - Staff, part-time
   - Guest/Visitor

2. Do you live on campus?
   - Yes
   - No

3. If yes, which residence hall?

4. If you do not live on campus, how do you typically travel to campus? (Check all that apply.)
   - Personal vehicle
   - Bus
   - Bike
   - Motorcycle or scooter
   - Walk
   - Other (Please elaborate.)

5. Once on campus, how do you typically get around?
   - Walk
   - Bus
   - Bike
   - Other (Please elaborate.)

6. Do you own a bike?
   - Yes
   - No

7. Would you ride a bike more often if you could borrow one for free?
   - Yes
   - No
   - Not sure

8. If you would not borrow a bike, what are your reasons? (Check all that apply.)
   - I have my own bike
   - I do not feel safe on a bike (traffic, pedestrians, etc.)
   - I do not enjoy biking
   - I do not know how to ride a bike
   - I prefer different forms of transportation
   - Other (Please elaborate.)
Tar Heel Bikes is a free bike-share program founded by students and currently operated through the Residential Housing Association (RHA). It is operated as a library system, in which residents of on-campus residence halls can check out a bike through the RHA enhancements system.

It is currently offered to residents of the Craig, Morrison, Hinton James, and Ehringhaus resident halls.

9. Prior to this survey, had you heard of the Tar Heel Bikes program?
   - Yes
   - No
   - I had heard of it, but was not sure of the specifics

10. If yes to question 9, how did you hear about the Tar Heel Bikes program?
    - Friend
    - Email
    - Poster
    - Other (Please elaborate.)

11. Do you think Tar Heel Bikes is a useful program to have on campus?
    - Yes
    - No
    - Not sure

    Comments:

12. Would you like to see the bike share system extended to other residence halls?
    - Yes
    - No
    - May be

    Comments:

13. Would you like to see the bike share extended to off-campus residents?
    - Yes
    - No
    - May be

    Comments:

14. On a scale from 1 to 5, how interested are you in having the bike share service extended to off-campus residents?

    Not Interested at all  1  2  3  4  5  Extremely Interested

15. What amount would you be willing to add to your student fee per semester in order to fund a bike share program that would accommodate off-campus residents? (For reference, the Renewable Energy Fee proposed and passed by students is under $5. The Student Transit/Safe Ride Fee charged this semester is $7.17)
    - $0
    - $1-$2
    - $3-$4
    - $5
    - $6-$10
    - $10+
Appendix C. Focus group guide

Hello, and welcome to this focus group for Tar Heel Bikes. We are a student group doing research about the service as it is now, what can be improved, and what purposes current users utilize the service for most frequently.

Since you are all current users, we want to know your thoughts and recommendations. We will go through a list of questions and encourage you to say anything you think is relevant to the Tar Heel Bikes experience, and we will record and write down your answers. The more information we get, the better we can improve the service for all future users. All of the information we collect today is anonymous. A few ground rules: one person talking at a time, and everyone gets a turn. Let’s begin.

I. First, let’s start with the bikes themselves.
1. What do you like best about the bikes?
2. What do you like the least?
3. Do you usually wear a helmet?
4. Would you like to see a basket on the front or back?
5. Do you ever find any mechanical problems or broken parts on the bike—Which parts? What were the problems?
6. Are the seats comfortable?
7. What do you think about the brakes?
8. Are there any more safety features you would like to see installed?

II. Let’s move on to the check-in/out process.
1. Do you think that the current process is efficient?
2. Do you think the process for reporting bike damages and getting bike repairs is adequate?
3. Are you ever unable to rent a bike?

III. Let’s talk about UNC’s bikeability.
1. Do you feel safe riding around campus? Are there times of the day you feel more or less safe?
2. Do you generally bike on the road or sidewalk?
3. Do you ride the bike through or around campus? Or do you lock it to a rack and walk from class to class?
4. Do you ever find the hills too challenging to bike?
5. Have you ever had an accident when using Tar Heel Bikes?

IV. Tar Heel Bikes is exploring a potential expansion to different parts of campus.
1. Where would you put another Tar Heel Bikes check-in/out station on campus?

Wrap-up
Thank you for taking time to meet and talk with us. We will forward the information we collected and give our recommendations to Tar Heel Bikes so that they can improve the user experience. Feel free to contact us if you have any questions.
Appendix D. Focus group follow up email

Dear PARTICIPANT,

You are being contacted because you indicated in a previous survey that you are interested in participating in a focus group regarding the current state of the Tar Heel Bikes program. We are a Capstone project with the Environmental Sciences department. Our primary objective is to collect feedback about the Tar Heel Bikes model in order to create a more efficient, enjoyable, and accessible experience for on-campus residents using Tar Heel Bikes. The focus group will be a casual round table discussion where participants can provide input about how they believe Tar Heel Bikes can improve its program model. We will be holding the focus group on DATE AND TIME in PLACE. This date and time is flexible depending on the availability of willing participants. If you are still interested in assisting in creating a better campus bikeshare, please RSVP to the focus group by responding to this email with your availability. Your input is valuable to our Capstone project and Tar Heel Bikes, so as compensation for your time we will provide ITEM.

Thank you for filling out our initial survey. We look forward to hearing from you soon.

Sincerely,
The Tar Heel Bikes Capstone Project Team