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Evaluation Study of the Bike Share Program in Fargo, North Dakota



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ABSTRACT

The growing popularity of bike share programs in the United States has prompted many cities to implement bike share systems to enhance mobility and health in their communities. Major advantages of bike share program include increased transportation options for the public, improved health and fitness, reduced environmental impacts due to mode shift from automobiles to bicycles, affordability, and improved community connectivity. The advantages, applicability, and impact of bike share programs in large urban areas have been well studied and documented. However, because of the spread of this program in smaller cities and communities, there is a need to study the public attitudes toward bike share programs as well as the benefits, applicability, and use of the program in smaller communities.

This study investigates the effectiveness of the Great Rides Bike Share program that was launched in 2015 in the small urban area of Fargo, North Dakota. Eleven bike share stations were installed in Fargo with 101 bikes. Stations were primarily concentrated on the North Dakota State University (NDSU) campus and downtown Fargo. Primary objectives of the study were to understand user opinions on the bike share program, analyze demand for the bike share program, study the impact of the program on NDSU student travel behavior and shifts in mode shares, analyze the livability benefits from the bike share program, and analyze origin-destination trip data to understand the user trips patterns and needs.

Three online surveys were conducted, mostly of NDSU students. One survey was conducted before the launch of the program and two were conducted after the program was initiated. Regression analyses were conducted to estimate the impacts of weather and other factors on bike share use in Fargo and to estimate the impacts of bike share use on bus ridership. The study examined mode shifts and whether bike share has a substitute or complementary relationship with transit in Fargo.

The program has proven to be highly successful in its first two years. A significant number of NDSU students chose bike share as a primary or secondary mode of transportation. The introduction of bike share in Fargo has increased overall mode shares for bicycling among NDSU students. Students who live closer to campus and have a bike share station accessible tend to choose the bike share program for traveling to and from campus. The program was also found to improve livability in Fargo by providing more travel options for NDSU students and riders and, at the same time, provides access to more locations than the transit service that was already available. Bus ridership decreased following the introduction of the bike share program. An analysis of the data indicated that bike share did have a negative impact on bus ridership, but other factors were more important contributors to the decline in bus use.

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1. INTRODUCTION

The concept of bike sharing has existed around the world for several decades. However, the prevalence and popularity of bike share programs has increased rapidly, both in the United States and internationally, in the last decade. This increase has been facilitated by the advent of third-generation bike share systems featuring smart cards and key fobs that can electronically lock or unlock bicycles from docking stations (Shaheen et al. 2010). Initially implemented in larger cities, the programs' effectiveness and applicability is prompting smaller communities to launch their own programs. Benefits of bike share programs include access to a low-cost public transportation option, improved health through increased physical activity, improved connectivity, flexible mobility, emission reduction, reduced fuel use, support for multimodal connections, and a reduction of congestion on roadways (Shaheen et al. 2010, Kisner 2011). As of March 2017, there were about 1,232 cities worldwide with bike share programs and more than 2,650,000 bike share bicycles and pedelecs (electric-assisted bicycles) in use in these cities. About 382 more cities were planning or constructing bike share programs (Meddin 2017).

While Europe and Asia lead the world in bike share programs, a growing number of North American cities are adopting bike share. As of 2017, 119 U.S. cities (refer Appendix A for a list of U.S. bike share programs), five Canadian cities, and four Mexican cities had bike share systems (Firestine 2016, Meddin 2016). The first third-generation bike share program in the United States was in Tulsa, Oklahoma. Tulsa Townies launched in 2007 (Shaheen et al. 2012).

The advantages of urban bicycling have been widely studied and published. Consequently, U.S. cities have focused on building additional bicycling infrastructure in recent years, investing in bike share programs, bike lanes, separated bike lanes, greenways, etc., to enhance bicycle activity and safety (Pucher et al. 2010).

While the advantages, applicability, and impact of bike share in large urban areas have been well studied, these programs are spreading into smaller cities and communities where their impacts have been less researched. There is a need to study the public attitudes toward bike share programs as well as the benefits, applicability, and use of the program in those communities.

In Fargo, North Dakota, a small urban community with an estimated 2015 population of 119,000, bicycling is increasingly being encouraged through bike lanes, shared bike paths, roadway signage, and the recent introduction of a bike share program. The Great Rides Bike Share program launched in Fargo, ND, in March 2015. Bike share stations are primarily focused on the North Dakota State University (NDSU) campus and downtown Fargo. Because the city has basic bicycling infrastructure in place, the program was launched without much effort or extra expenditure for bicycling infrastructure.

Because Fargo, ND, is a small city with an operational bike share program, an evaluation study was conducted to examine the demand for the program, potential user's opinions about the program, the impact of bike share program on travel behavior and bus use, and other bike share rider characteristics.

1.1 Objectives

The objectives of the study are as follows:

- 1) Conduct a literature review about various aspects of bike share programs, its growth in the United States, modal shifts resulting from bike sharing, factors affecting bike share programs, and health benefits of bike share programs.
- 2) Study the attitude of NDSU students and the Fargo public towards the Great Rides Bike Share program, the impact of a bike share program on travel behavior, and types of trips served by the bike share program in the city of Fargo, ND.
- 3) Analyze the origin-destination trips of Great Rides Bike Share riders to understand various bike share ridership characteristics.
- 4) Analyze the livability benefits of a bike share program in Fargo, ND. These benefits would include availability and use of a full range of transportation choices, access to recreational areas or other activities, improved and better connectivity in the city, improved health, and increased public transportation options.

1.2 Organization of Report

The report is organized as follows. Section 2 provides a review of previous research on bike share programs. This includes a discussion of the growth in bike share programs, demographics of bike share users, impacts of bike share programs on mode shares, factors impacting the use of bike share or personal bicycling, and health impacts of bike share programs. The next section describes the Great Rides Bike Share program in Fargo, ND, including a description of the network, the membership plans, and the funding structure. The program is unique in that NDSU student fees are used to help fund it, and students can ride for free, using their student ID cards to check out bikes. Section 4 describes the methods used in the study, which included a series of surveys, mostly of NDSU students, and an analysis of Great Rides Bike Share trip data and ridership data from the local transit system, MATBUS. The travel behavior of students is examined in Section 5. This analysis is based on results of surveys conducted of students before and after the launch of the bike share system. In Section 6, an analysis of the Great Rides Bike Share ridership data is presented. This includes an analysis of variations in ridership, station-to-station trip analysis, trends in ridership, and a model of bike share use that estimates the impacts of weather and other factors on ridership. Section 7 examines how the introduction of the bike share program has influenced mode shares, overall bicycle use, and MATBUS ridership. Expansion opportunities are discussed in Section 8. Section 9 focuses on the livability benefits of the program, and the final section provides a summary and conclusions.

2. LITERATURE REVIEW

2.1 Bicycle Use in the United States

Compared to other countries with similar levels of development and weather conditions, the United States has lagged far behind in promoting bicycling and making it safer (Pucher and Buehler 2006). In countries in Western Europe, the share of urban trips made by bicycle is 5-10%, and, in countries like Denmark and Netherlands, the share is as high as 20%, making bicycling an integral part of their urban transportation system. In contrast, only 0.6% of all trips in United States are made by bicycle (McKenzie 2014). Although Canada has a colder climate than the United States, Canadians bicycle three times more than Americans, which can be attributed to higher urban densities and mixed-use development, safer cycling conditions, and more extensive bicycling infrastructure. Policies to facilitate higher urban densities, lower car use, and more mixed-use development are the main factors contributing to extensive bicycling in Europe and Canada. Another factor is gasoline prices, which, compared to those in the United States, are almost three times higher in Western Europe and twice as high in Canada (Pucher and Buehler 2006).

2.2 Growth of Bike Share Programs

With the advent of third-generation bike share programs in the United States since 2010, many cities are beginning to implement these programs because of their numerous benefits such as access to a low-cost public transportation option, health benefits from increased physical activity, improved connectivity, flexible mobility, emission reductions, reduced fuel use, support for multimodal connections, and reduction of congestion on roadways (Shaheen et al. 2010, Kisner 2011). As discussed by DeMaio (2009), bike share providers in the United States and around the world have included governments, quasi-governmental transport agencies, universities, non-profits, advertising companies, and for-profits. Bike share programs in North America have been funded through a combination of sources, primarily sponsorships and user fees (Shaheen et al. 2012). As of April 2016, there were 70 bike share systems operating 3,378 bike share stations operating in 104 U.S. cities (Firestone 2016).

2.3 Demographics of Bike Share Users

Buck et al. (2013) studied the demographics of short-term users and annual members of the Capital Bikeshare program in Washington, D.C., and found that bike share users are different from regular area bicyclists. Compared to regular area bicyclists, bike share users were more likely to be women, younger, have low incomes, and were less likely to own bicycles or automobiles (Buck et al. 2013). On the other hand, Rixey (2013) showed positive impacts of income and education on bike share use. Rixey also found a negative correlation between the non-white population and bike share use.

2.4 Impacts of Bike Share Programs on Mode Shares

Bike share programs can both substitute for and complement public transit services. Bike share users may use the program as a substitute for transit, reducing transit use, but connections

between bike share systems and transit allow for a complementary relationship. Bike share can extend the reach of public transit by improving access to transit and reducing first-mile/last-mile problems. In fact, 84% of bike share stations in the United States are within one block of a transit bus stop, and another 10% are within two blocks (Firestone 2016). These connections provide the opportunity for inter-modal trips.

Some studies have shown a reduction in car use following the implementation of a bike share program. Fishman et al. (2014a) studied the extent to which a bike share program could replace car trips by examining survey and trip data of bike share programs in Melbourne, Brisbane, Washington, D.C., London, and Minneapolis/St. Paul and observed a car substitution rate of 2% for London, 7% for Washington, D.C., 19% for Minneapolis/St. Paul and Melbourne, and 21% for Brisbane. A reduction of approximately 55,900 miles annually of motor vehicle trips in Melbourne and Minneapolis/St. Paul and a reduction of 151,174 miles annually of motor vehicle trips in Washington, D.C. was observed due to bike share use (Fishman et al. 2014a). The study also found substantial motor vehicle use for performing bicycle rebalancing operations, but the mean reduction in car use due to bike share was more than twice the distance traveled by operator support vehicles. Efficiency and sustainability, however, could be improved by innovative techniques to minimize manual rebalancing operations (Fishman et al. 2014a).

In addition to reduced car use, studies have also found a reduction in use of public transportation. Many people appear to prefer bicycling, and studies show a modal shift among those cities that have bike-sharing (Shaheen et al. 2012, Shaheen et al. 2013, Martin and Shaheen 2014). Shaheen et al. (2013) studied the modal shift resulting from bike share programs in four North American cities and concluded that bike sharing reduced personal driving, bus and rail use, and taxi use. Reduced car use has positive environmental benefits through decreased emissions. Reduced transit use can also be beneficial in areas where transit use is at capacity. In these cases, shifts from transit to bike share can create more available capacity on public transportation vehicles.

While there is evidence that bike share systems have led to reduced car use, other research suggests that the majority of bike share users are substituting biking for transit or walking, rather than cars (Fishman et al. 2013). Buck et al. (2013) and LDA Consulting (2012) found that bike share trips mainly replace public transit and walking trips in Washington, DC. Murphy (2016) concluded that shared modes (which include bike share, car-share, and ride-sourcing) generally complement public transit, substituting more for automobile trips, but the results specific to bike-sharing were different. Their results showed that bike share users would be most likely to take public transit or use a private bicycle if bike sharing was not available.

In some instances, however, bike-sharing has increased the number of people using public transportation (Shaheen et al. 2013). The circumstances and operational environments may influence the relationship between bike share and transit use. Martin and Shaheen (2014) conducted a study to analyze the public transit modal shift dynamics in response to bike share programs in Washington, DC, and Minneapolis/St. Paul, MN, and found modal shifts away from public transit in some areas and toward public transit in other areas. Shifts away from transit were found to be most prominent in core urban environments with high population density because bike-sharing offers faster, cheaper, and more direct connections for short trips which were previously made by transit. However, modal shifts towards transit were more prevalent in lower-density regions in the urban periphery because bike-sharing provides new connections by

bridging the gap in existing transportation networks by solving first-mile and last-mile problems. The authors concluded that bike-sharing may be more complementary to public transit in small- and mid-size communities and can be a substitute to public transit in larger cities (Martin and Shaheen 2014).

2.5 Factors Impacting Use of Bike Share or Personal Bicycling

Cock (2016) cited the following quantitative factors as being key to success for bike share programs: residential density, employment density, demographic factors, regional/national destinations, presence of college campuses, existing or planned bicycle facilities, and the size and use of the transit system. He noted that, in smaller cities, employment and residential density and the extent of transit may not contribute to successful bike sharing, but the other factors can lead to success, especially the presence of college campuses and bicycle facilities. Cock also listed the following qualitative factors impacting success: land use or infrastructure barriers, topography, expense and availability of parking, barriers to bicycle ownership, strength of local car culture, recreational trails, and being the region's primary market.

For small cities, Cock (2016) identified the following as being primary criteria for the success of bike share programs: presence of college campuses, bicycle facilities, recreational areas, being the region's primary market, and topography. Cock (2016) studied successful bike share programs in small U.S. cities, including Great Rides Bike Share in Fargo, ND, and identified factors leading to success. He noted that the system in Fargo is successful because of each of these criteria, especially because of its use by college students.

Existing studies on bike share use have focused on weather variables, temporal variables, and spatial variables. For example, Faghih-Imani et al. (2014) developed a model of station-level hourly arrival and departure rates for the bike share system in Montreal based on these three groups of independent variables. Research also shows that bike share members place an importance on convenience and value for money, which are important factors motivating the use of these programs (Fishman et al. 2013).

2.5.1 Weather

Faghih-Imani et al. (2014) analyzed hourly station-level arrival and departure rates in Montreal and found a positive correlation between temperature and bike share use. They found that humidity had a negative impact on use, and rainy weather had a negative impact on departure rates.

Gebhart and Noland (2014) studied the impact of weather conditions on bike share trips in Washington, DC, by analyzing Capital Bikeshare's hourly trip data and relating it to hourly weather data. The study suggested that adverse weather conditions such as cold temperatures, rain, high humidity, and increased wind speed decreased bike share activity. Similar results were also observed in a study conducted by El-Assi et al. (2015) for a bike share system in Toronto.

Similar to other studies, Gebhart and Noland (2014) showed that the number of trips decreased as temperatures decreased, but the number also decreased when temperatures were above 90 degrees. They also found that there is less bike share use when it is dark outside, independent of

any temperature effects. Gebhart and Noland (2014) noted that, while many of the effects were not surprising, the impacts may be less pronounced than many would assume. Their results also suggest that the availability of transit influences how potential users respond to adverse weather conditions. They found that more people will choose to bike in the rain or cold if transit is less of an option.

In addition to these studies on bike share systems, many studies have analyzed the effect of weather on bicycling in general. Precipitation, cold temperature, wind, and snow have been shown to have significant negative impacts on bicycle trips made (Sears et al. 2012, Nosal and Miranda-Moreno 2014, Spencer et al. 2013, Hjorthol 2016). Studies have found, though, that leisure trips are more sensitive to weather conditions than commute trips, and weekend trips are more sensitive to weather conditions than weekday trips (Nosal and Miranda-Moreno 2014, Miranda-Moreno and Nosal 2011). Sears et al. (2012) studied bicycle commuting in Vermont and found that the likelihood of biking increased by 5% with a 1 mph decrease in wind speed and by 3% with every 1°F increase in morning temperature, and the likelihood of bike commuting more than doubled on days with no morning precipitation.

While adverse weather and low temperatures decrease bicycling and bike share activity, there are a significant number of year-round bicyclists who are comfortable riding their bicycles in freezing temperatures (as cold as -20°C) (Amiri and Sadeghpour 2015). Many Canadian and European cities have facilitated bicycling activity through winters and found that, although winter bicycling is not an option for many users, 10-20% of the users bicycle in winter in freezing conditions when proper winter maintenance and snow clearing is performed (Miranda-Moreno et al. 2013, Miranda-Moreno and Nosal 2011, Amiri and Sadeghpour 2015, Spencer et al. 2013, Bergstrom and Magnusson 2003). Also, studies have shown that better winter maintenance of bicycle facilities and infrastructure has improved the willingness of people to bicycle (Miranda-Moreno et al. 2013, Amiri and Sadeghpour 2015, Bergstrom and Magnusson 2003).

Shirgaokar and Gillespie (2016) studied the strategies that winter cyclists follow to adapt to street conditions during harsh winters in Edmonton, Canada. They found that cyclists felt that snow, unsafe conditions, lack of public awareness, and parked vehicles are barriers for riding on roadways with vehicular traffic. Infrastructure improvements that can facilitate winter cycling include snow clearing, separated bike path with network connectivity, public education, and destination amenities (Shirgaokar and Gillespie 2016).

2.5.2 Temporal Variables

Bike share use can vary based on time of day, day of week, or time of year. Analysis by Faghih-Imani et al. (2014) in Montreal regarding time-of-day variations found 1) use is greater during the afternoon/evening hours, 2) there is a higher concentration of arrival rates in the central business district in the morning peak hour, suggesting use for daily commute, and 3) bike flows are more spatially widespread in the evening peak compared to the morning peak. Faghih-Imani et al. also found that people were more likely to bike on the weekdays than the weekends, and use increased on Friday and Saturday nights. Gebhart and Noland (2013) also showed differences between peak and non-peak periods within the day for bike share use in Washington, DC, as well as seasonal variations after accounting for weather and darkness effects.

2.5.3 Spatial Variables

Spatial variables such as bicycle infrastructure and land-use/built environment variables can have significant impacts on bike share use. A number of studies, including research in Montreal, Toronto, Minneapolis/St. Paul, Washington, DC, Denver, and Australia, have found these variables to be important. These studies found the presence of bicycle infrastructure to be crucial. Bike share use has increased when there are more bicycle facilities, such as bicycle lanes, paths, etc. (Faghih-Imani 2014, El-Assi et al. 2015, Fishman et al. 2014b, Rixey 2013, Wang et al. 2016).

Population density, job density, and access to restaurants and other commercial activity have been shown to have positive impacts on bike share use (Faghih-Imani et al. 2014, Rixey 2013, Wang et al. 2016). Wang et al. (2016) concluded that, in general, bike share programs are best suited for locations with higher population densities which have the scope to access a higher number of destinations. Distance to the central business district has been shown to have a negative effect on station use (Faghih-Imani et al. 2014, Wang et al. 2016). Faghih-Imani et al. (2014) and El-Assi et al. (2015) both found that stations located near university campuses had increased demand, as did stations located near a transit station. Proximity to a network of other bike share stations is also important (Rixey 2013, Wang et al. 2016), as is the walkability of the neighborhood (Faghih-Imani et al. 2014). Neighborhood sociodemographic characteristics have also been found to have significant impacts on bike share use (Wang et al. 2016, Rixey 2013).

2.6 Health Impacts of Bike Share Programs

By increasing bicycle mode shares and use of active transportation, bike share programs have the potential to provide health benefits to users. Alberts et al. (2012) found that many users of the Capital Bikeshare program in Washington, DC, reported an increase in the amount of time per week spent performing moderate to strenuous physical activities, suggesting that the bike share program has had a positive effect on health. They noted, though, that the areas of the city using the program the least could potentially have the most to gain in terms of health benefits.

While the increased physical activity resulting from bicycling can have positive health effects, increased exposure to air pollution and traffic injuries can have negative effects. Woodcock et al. (2014) studied each of these factors as they modeled the health impacts of the London bike share system. They found that, even after accounting for increased exposure to air pollution and bicycle injuries, the bike share system had positive health effects. This result was partially due to the observed injury rates for the bike share system being lower than that for cycling in general in London. The researchers noted that their results could underestimate lifetime health benefits because they did not account for the possibility that using the bike share system at a young age could increase the probability of bicycling throughout life. The study did not examine long-term effects.

The lower bike share injury rates found by Woodcock et al. (2014) are consistent with other research. Martin et al. (2016) found that collision and injury rates for bike sharing are lower than previously computed rates for personal bicycling. They speculated that the lower injury rates could be due to bike sharing rider behavior and bike sharing bicycle design, which promotes stability and limited speeds.

3. GREAT RIDES BIKE SHARE PROGRAM

The Great Rides Bike Share program launched in Fargo, ND, in March 2015. The program is managed by Great Rides Inc. Fargo, a non-profit organization. Great Rides Bike Share is a BCycle system, which means BCycle is a vendor providing the bikes, docks, technology, and all other infrastructure. Including Great Rides Bike Share, there are 35 BCycle systems operating in cities across United States (BCycle, 2016).

Fargo City Commissioner Mike Williams was instrumental bringing technology-based bike share systems to the attention of NDSU student government and was a leader and member of Great Rides steering committee. The NDSU student government initiated the introduction of the bike share program in Fargo, ND, by voting to use student fees to help fund the program. Although the bike share program would also be useful to Fargo residents, many of the proposed bike share stations were planned so that they would be most useful for NDSU students.

Initially, the bike share program planned to launch in fall 2014. Because the major user base of the system would be NDSU students, the Great Rides steering committee wanted students to be able to checkout bikes using their student ID cards so they would not have to carry an extra membership card. To do so, BCycle developed new multi-frequency, radio frequency identification or MF-RFID technology and worked with NDSU to create a software solution (Marich 2015). The technology preparation at BCycle for making the NDSU ID cards compatible for bike checkouts at docking stations pushed the launch date to spring 2015. Great Rides Bike Share is the first bike share system of its kind in the United States that incorporates bike checkouts with student ID cards as well as bike share memberships. Allowing students to checkout bikes with their ID cards lowers the barriers to use. The story of bike share in Fargo and bike share recap document is presented in Appendix B.

3.1 Stations and Bicycles

Great Rides Bike Share launched in March 2015 with 101 bikes at 11 stations. Figure 3.1 shows the station locations. Bike share stations are primarily located on the NDSU campus and in downtown Fargo. The main NDSU campus is about 1-2 miles from downtown, and NDSU has three buildings downtown, about a mile from the main campus, that are also used for classes (to be precise, it is 1.3 miles from the NDSU Memorial Union to Barry Hall downtown). The downtown buildings have limited parking, but the local transit system, MATBUS, provides public transportation between campus and downtown.

Four bike share stations are located on the NDSU main campus (High Rise Complex, Memorial Union, University Village, and Wallman Wellness Center), two stations are located near NDSU buildings downtown (Barry Hall and Renaissance Hall), and five more stations are located at various activity-generating places downtown (Sanford Medical Center, Great Northern Bicycle Company, US Bank Plaza, MATBUS Center Downtown, and Fercho YMCA). Appendix C provides a description and possible user use for each station.



Figure 3.1 Great Rides Bike Share Station Location Map and Bike Routes in Fargo, ND
Source: (Bike FM, 2016)

Figure 3.2 shows the U.S. Bank bike share station in downtown Fargo. All bike share stations have a similar plan including bike docks, bikes, kiosk, a solar panel for powering the station (nine of 11 stations are solar powered; the remaining two are AC powered), and a map module. All 101 bikes are identical, with a low cross bar (kick/step through frame), quick adjustable seat, basket for carrying personal items or small baggage, integrated lock for parking at bicycle racks, headlight, and a tail-light.



Figure 3.2 U.S. Bank Bike Share Station

Great Rides added additional bike docks in August 2015 to the High Rise Complex and Memorial Union because of the high demand at these stations and complaints about the lack of available docks upon arrival. The number of bikes and stations did not change during the second year of operations. Table 3.1 illustrates bike dock counts at the 11 bike share stations. A total of 179 bike docks were available at the 11 stations in 2016. While the Great Rides fleet consists of 101 bikes, only 80-95 bikes are typically available at any given time to maintain a 2:1 dock to bike ratio for effective bike share operations. Also, because some bikes in the fleet need maintenance work or repairs at any given time, availability of all 101 bikes would be practically impossible.

Great Rides Bike Share is a seasonal program that suspends operations during the winter (November – March). During winter, all bikes and stations are removed from the streets and winterized. Also, expert technicians give all bikes full overhauls and maintenance so they are ready for the next season (Great Rides Bike Share, 2016).

Table 3.1 Dock Count for Great Rides Bike Share Stations

Station	Dock Count
High Rise Complex	Initially: 18, After August, 2015: 22
Memorial Union	Initially: 15, After August, 2015: 30
University Village	22
Wallman Wellness Center	11
US Bank Plaza	17
Barry Hall	18
Renassance Hall	14
Great Northern Bicycle Co.	11
Sanford Medical Center	11
Fercho YMCA	14
MATBUS Center Downtown	9

3.2 Membership

NDSU students, Fargo-Moorhead residents, and Fargo/NDSU visitors can use the Great Rides Bike Share Program through any of the following: NDSU student membership, Great Rides Bike Share membership, or a guest pass. Membership (which includes a seasonal pass) for full-time enrolled NDSU student is included as part of the mandatory student fee at NDSU. To use the bike share program, students simply need to activate their membership by logging into their student accounts and agreeing with the Great Rides Bike Share service contract. Later, they can checkout bikes using their NDSU student ID card.

The rest of the public can choose to purchase a monthly membership at \$15 per month or an annual membership at \$75 per year. Individuals can also purchase a guest pass membership at bike share station kiosks using their credit/debit card at a rate of \$4 per hour; all trips under one hour are included, and longer trips are charged extra. Student members and Great Rides members can make unlimited 30 minute rides between any of the 11 bike share stations. Bikes at bike share stations are available to checkout from 6:00 a.m. until 11:59 p.m.

A total of 8,100 NDSU students were enrolled as bike share riders in 2015, and 5,346 were enrolled as bike share riders for the year 2016 (Table 3.2). Table 3.2 also shows the number of Great Rides bike share members and guest users each year. A reduction of all types of membership was observed in 2016 compared to 2015. More explanation will be provided on this observation in the upcoming sections.

Table 3.2 Bike Share Riders Categorized by Member Type

Membership Type	2015	2016
Members (monthly/annual)	114	67
Guests	1,756	1,285
NDSU students	8,103	5,346
Total riders	9,973	6,698

3.3 Funding

The cost of each bike is \$1,234. A number of sponsors provided funding for capital. Before the launch of the program, Great Rides established two categories of sponsors: capital sponsors and station sponsors. Capital sponsors and capital sponsorship funds have helped Great Rides Bike Share invest in the initial capital to secure initial deposit, technology, bike fleet, site preparation work, and operating supplies to launch the bike share program. A majority of the capital sponsor organizations have signed a contract to make yearly payments of their sponsorship over a five-year term. In return, logos of the capital sponsors are placed on the map module at each station. Five different capital sponsors and their sponsorship amounts are summarized in Table 3.3. Station sponsorship includes approximately \$30,000 for an agency/organization to have a station near their location. Table 3.3 identifies all the station sponsors, their sponsorship amounts, and stations sponsored.

Operation costs for the program typically comes from membership fees from day pass users, monthly members, annual members, and NDSU students. Great Rides receives an annual payment of \$65,000 from NDSU for bike share student memberships. Great Rides also receives other operating budget through ad sponsorships that are sold on the bikes.

Table 3.3 Sponsors for Great Rides Bike Share Program

Capital Sponsors		
Sponsor	Amount Sponsored	
Dakota Medical Foundation	\$50,000	
Swanson Health Products	\$50,000	
Forum Communications Company	\$10,000	
Sanford Health	\$50,000	
Xcel Energy	\$25,000	
Station Sponsors		
Sponsor	Amount Sponsored	Station/Stations Sponsored
YMCA	\$30,000	Fercho YMCA
NDSU Student Government	\$65,000	Memorial Union, Wallman Wellness Center, and Renaissance Hall
NDSU Impact Fund	\$30,000	High Rise Complex and University Village
Kilbourne Group	\$30,000	US Bank Plaza
Great Northern Bicycle Co.	\$30,000	Great Northern Bicycle Co.
The Barry Foundation	\$30,000	Barry Hall
City of Fargo	\$30,000	MATBUS Center Downtown and Sanford Station

4. METHODS

To examine the Great Rides Bike Share program, the study conducted a series of surveys, analyzed bike share and transit ridership data, and explored how the program contributes to livability in the community.

4.1 Surveys

Surveys were conducted of NDSU students before and after the launch of the bike share program. Because NDSU students are the primary users of the system, surveying them would provide useful information regarding opinions on the system and its impacts on travel behavior. Three surveys were conducted of NDSU students. One of the surveys was also sent to NDSU faculty and staff, non-NDSU Great Rides bike share members, and guest bike share users.

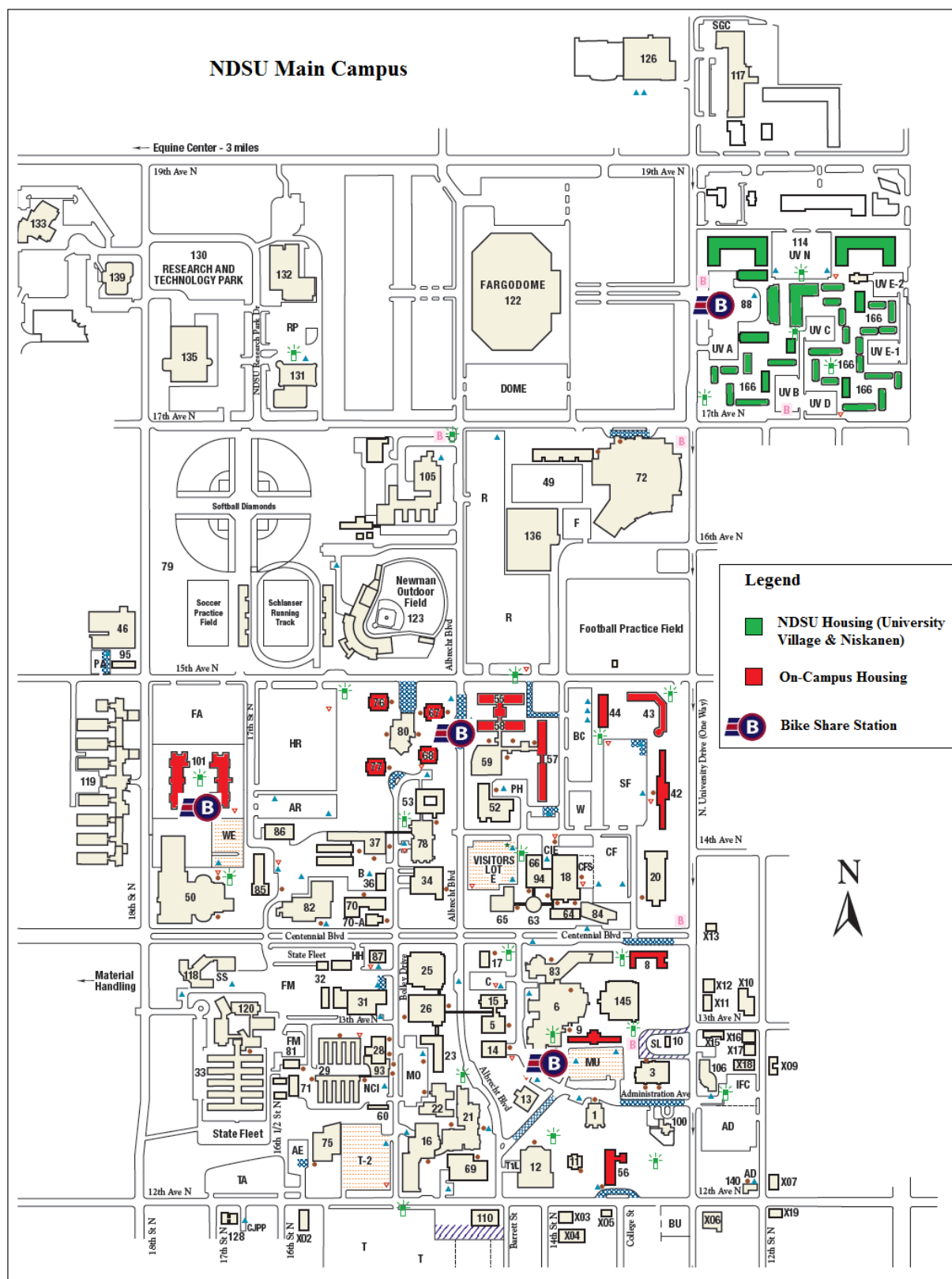
4.1.1 Survey Design and Administration

Survey 1 was conducted in March 2015 before Great Rides Bike Share began operations; Survey 2 was conducted in October 2015 near the end of the first year of operation; and Survey 3 in April 2016, after the program had been in operation for more than a year. Appendices D, E, and F show the questionnaires used for the three surveys. The target audience for survey 1 and survey 3 was all NDSU students, whether or not they use the bike share program. The target audience for survey 2 was all bike share users.

Results from the surveys can be used to examine changes in travel behavior. Surveys 1 and 3 contained a similar set of questions that were designed to identify changes in student travel behavior or student opinions from before the launch of the bike share program to more than a year after it had been in operation. The two surveys asked students to identify which mode of transportation they use most often as well as all modes that they use for trips to campus, trips within campus, and trips between campus and downtown. Survey 3 also differentiated between winter travel and non-winter travel. Survey 2 contained a different set of questions, but also captured important bike share use characteristics and travel behavior information.

Surveys 1 and 3 also collected information about survey respondents such as if they live on-campus or off-campus, how far they live from campus if they live off-campus, and if they have regular access to a motor vehicle or personal bicycle. Such characteristics might influence travel behavior and mode choice.

The surveys classified student residence locations into three categories: 1) on-campus housing, 2) off-campus housing, and 3) University Village and Niskanen Apartments (UV/NA). The last of these categories refers to university apartments located just off campus. Figure 4.1 illustrates the on-campus housing locations and NDSU housing locations in and around NDSU main campus.



All three surveys were conducted online using Qualtrics software, and all were distributed to NDSU students by email using the student listserv. The second survey was also emailed to NDSU staff and faculty and posted on Facebook to reach non-NDSU users.

4.1.2 Survey Response and Respondent Characteristics

A total of 860 survey responses were received for survey 1; 654 responses were received for survey 2; and 483 responses were received for survey 3. While survey 2 was conducted of all bike share users, 92% of the respondents were NDSU students.

Women represented a greater share of respondents than men for each survey (Table 4.1). However, it cannot be concluded that women represent a greater share of bike share users. Because the Great Rides Bike Share trip data obtained did not include demographic details of the riders, the gender distribution of bike share users was not analyzed.

Table 4.1 Summary of Surveys Conducted for the Study

Survey Characteristics		Survey 1	Survey 2	Survey 3
<i>Survey Conducted: Month and Year</i>		March 2015	October 2015	April 2016
<i>Survey Audience</i>		NDSU Students	NDSU Students, Faculty, Staff, non-NDSU GRBSP Members, and GRBSP Guest Members	NDSU Students
Number of Responses		860	654	483
<i>Gender Distribution</i>	Male	48.5%	41.0%	43.9%
	Female	51.5%	58.0%	56.1%
<i>Student Class</i>	Freshman	16.5%	NA	21.5%
	Sophomore	18.2%	NA	15.2%
	Junior	19.8%	NA	18.1%
	Senior	25.8%	NA	23.0%
	Graduate	19.7%	NA	21.7%
<i>Student Residence</i>	On-Campus	27.6%	NA	29.6%
	Off-Campus	61.4%	NA	58.9%
	UV/NA*	11.0%	NA	11.5%
<i>Regular Access to Motor vehicle?</i>	Yes	80.9%	NA	83.9%
	No	19.1%	NA	16.1%
<i>Regular Access to Bicycle you Own?</i>	Yes	48.1%	NA	41.5%
	No	51.9%	NA	58.5%
<i>Ever Used GRBSP?</i>	Yes	NA	NA	31.7%
	No	NA	NA	68.3%
UV/NA*: University Village / Niskanen Apartments				

The surveys had a somewhat uniform distribution of respondents by student class. A majority of the NDSU students who responded to the surveys lived off-campus (about 60% in each survey) followed by on-campus and then UV/NA. In both survey 1 and survey 3, more than 80% of respondents reported having regular access to a motor vehicle, while the number of respondents who had access to a bicycle they own decreased slightly from 48% to 42%. About 32% of respondents to survey 3 reported using the bike share program.

4.2 Analysis of Great Rides Bike Share and MATBUS Ridership Data

Great Rides Bike Share data for 2015 and 2016 were analyzed to identify trip characteristics and ridership trends. From the Great Rides Bike Share ridership database, data for each bike share trip included: rider membership type (student, member, guest user), bike number used for the trip, bike checkout information (station, date, and time), and bike return information (station, date, and time). The data were analyzed to identify variations in ridership based on season, day of the week, and time of the day, as well as changes in ridership from 2015 to 2016. Data for specific stations were also analyzed to identify stations with the greatest use and station-to-station travel patterns.

A regression model was developed to determine the impact of various factors on daily bike share ridership. As shown in previous research, weather can have a significant impact on bike share use. The model developed in this study estimated daily ridership as a function of weather variables (temperature, precipitation, and wind), and other factors such as whether or not school is in session and if it is a weekday or weekend.

Ridership data from MATBUS, the local transit agency, were also analyzed to further study the relationship between bike share use and transit ridership. NDSU students are the primary users of Great Rides Bike Share and are also among the most frequent users of MATBUS. Bus routes serving the NDSU campus and surrounding areas are among the most-used routes in the city. Similar to bike share, NDSU students can ride MATBUS free (because of financial agreement between NDSU and MATBUS) using their student ID card. Given the high level of transit use by NDSU students, it is interesting to study the impact of the new bike share system on transit ridership. Previous research has shown that bike share can substitute for transit, but in some cases it also complements it. Combined with survey data on travel behavior, MATBUS ridership data can be analyzed to determine if the introduction of bike share has had any effect on transit ridership. Using daily bus and bike share ridership data, the study developed a regression model to estimate the impact of bike share use on bus ridership.

5. TRAVEL BEHAVIOR OF STUDENTS

Survey 1 and survey 3 included a series of questions regarding student travel behavior, mode choice, and factors affecting mode choice. The surveys collected information on travel to campus for off-campus students, travel on campus, and travel between campus and downtown. Appendix D and Appendix F present the questions used in survey 1 and survey 3 for understanding student's travel behavior. Comparing responses from survey 1, which was conducted just before the launch of the bike share program, and survey 3, conducted more than a year later, provides insights on whether the introduction of bike share had a significant impact on student travel behavior. One difference between the surveys is that survey 3 differentiated between winter trips and non-winter trips when asking about which mode students use most often.

For both the before and after surveys, 11% of the total respondents lived in University Village or Niskanen Apartments (UV/NA). The location of UV/NA, as shown in Figure 4.1, is approximately one mile from the NDSU Memorial Union. Students of all classes live in UV/NA, except for freshman students. Most freshman students live on-campus as the Department of Residence Life has a policy that requires first-year students to live on campus.

About 61% of students responding to the before survey and 55% of those responding to the after survey lived off campus. A majority of the off-campus students lived in north Fargo, which is where the NDSU campus is located (Figure 5.1). In the two surveys, about 20-24% of respondents lived less than ¼ mile from campus, close to half lived within one mile of campus, about 26-29% lived one to five miles from campus, and the remainder of students traveled farther distances to campus (Figure 5.2). Survey 3 included a greater percentage of respondents living farther from campus, which could be due to either a shift in student residence patterns or survey nonresponse error resulting in an over- or under-representation of some groups. Given that survey 3 was taken just one year after survey 1, the latter is more likely.

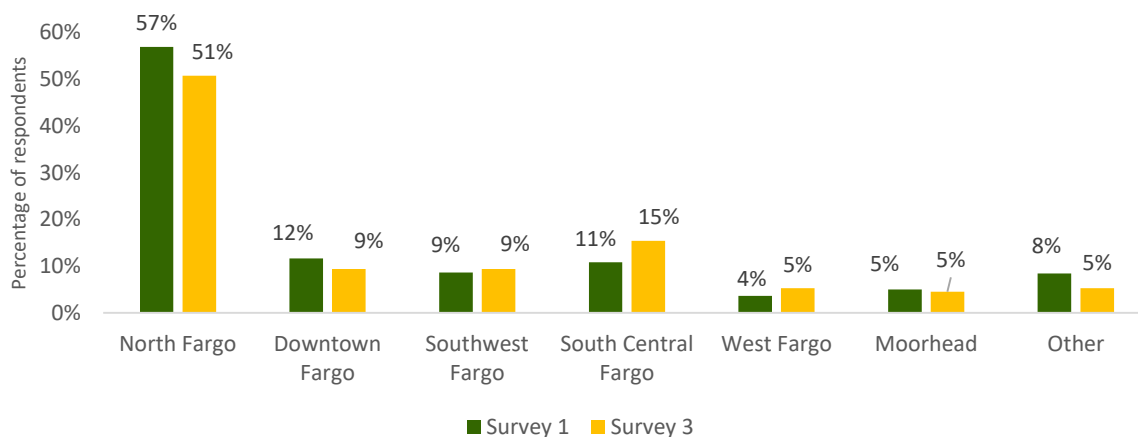


Figure 5.1 Off-Campus Student Residences in Fargo-Moorhead Area

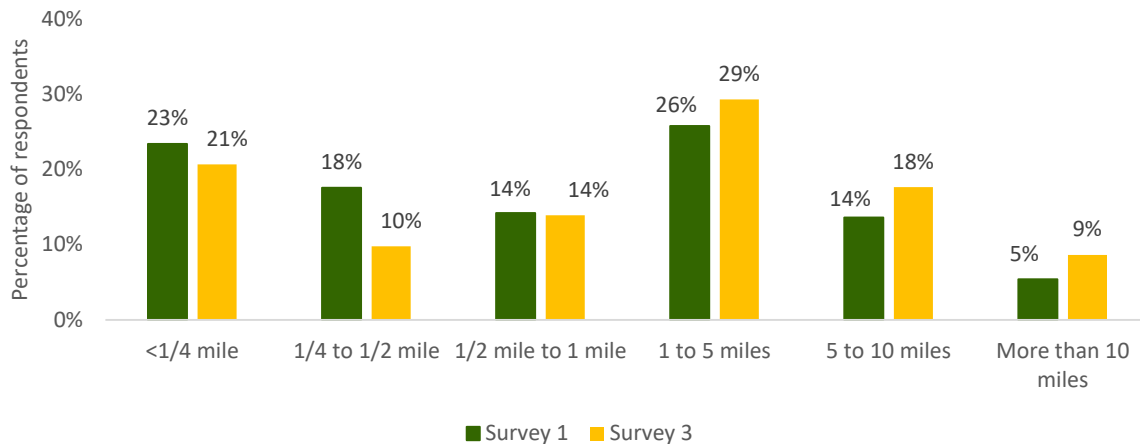


Figure 5.2 Distance of Residence from NDSU Campus for Off-Campus Students

5.1 Vehicle and Bicycle Ownership

Motor vehicle ownership and bicycle ownership was categorized based on students' residence categories (Figure 5.3). While a majority of students in all locations own a motor vehicle, students living off-campus were most likely to have access to a vehicle (>90%). Similarly, bicycle ownership was observed to be higher among off-campus students.

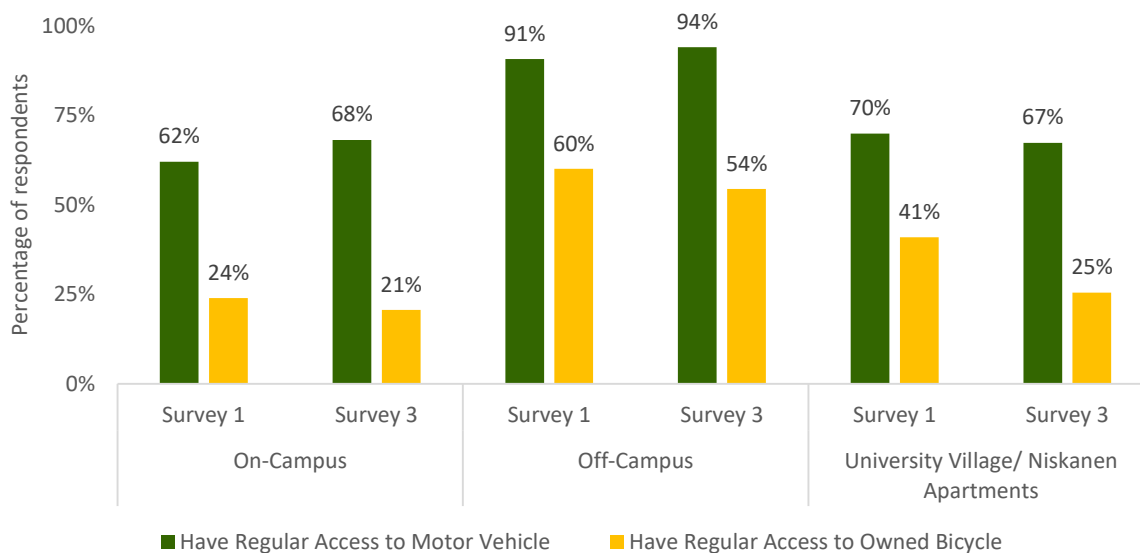


Figure 5.3 Motor Vehicle Ownership and Bicycle Ownership for NDSU Students Living On-Campus Vs. Off-Campus Vs. University Village/ Niskanen Apartments

It is interesting to note that while the percentage of students with access to a personal bicycle decreased from survey 1 to survey 3 among students living in all three locations, the decrease was most significant among students living in UV/NA. A bike share station is located at the

University Village apartments, and trips from UV/NA to campus are well-served by the bike share program. The distance between UV/NA and the center of campus is approximately one mile and it takes approximately 15-20 minutes for students to walk to campus compared to about five minutes to bicycle to campus. The bicycle is an attractive mode of travel for this trip, and the results suggest that some students could be substituting bike share for their own personal bicycle. In areas well-served by bike share, there is less of a need for students to own a bicycle.

Figure 5.3 shows that access to a vehicle increased among both on-campus and off-campus students, but decreased among UV/NA students. As shown previously in Table 4.1, the overall percentage of respondents having access to a vehicle increased from 80.9% to 83.9%. Data from the NDSU parking office supports this finding. The number of students with parking permits increased by 5.2% from 2014/15 to 2015/16. (The number of permits was higher in 2013/14 than in 2014/15 but still 1.4% lower than that for 2015/16.)

Motor vehicle ownership and bicycle ownership was further categorized based on student class year, as shown in Figure 5.4. Bicycle ownership is shown to increase as the student class year increased and is highest among seniors and graduate students. Further, bicycle ownership decreased among all class categories in survey 3.

About 50% of students in survey 1 and survey 3 have a parking permit. This is similar to the parking permit data, which indicates about 45% of students have a parking permit. Based on survey 1 results, a majority of the students find NDSU parking either very convenient (12%) or somewhat convenient (52%). Similarly, a majority of the students think NDSU parking is either very affordable (11%) or somewhat affordable (54%).

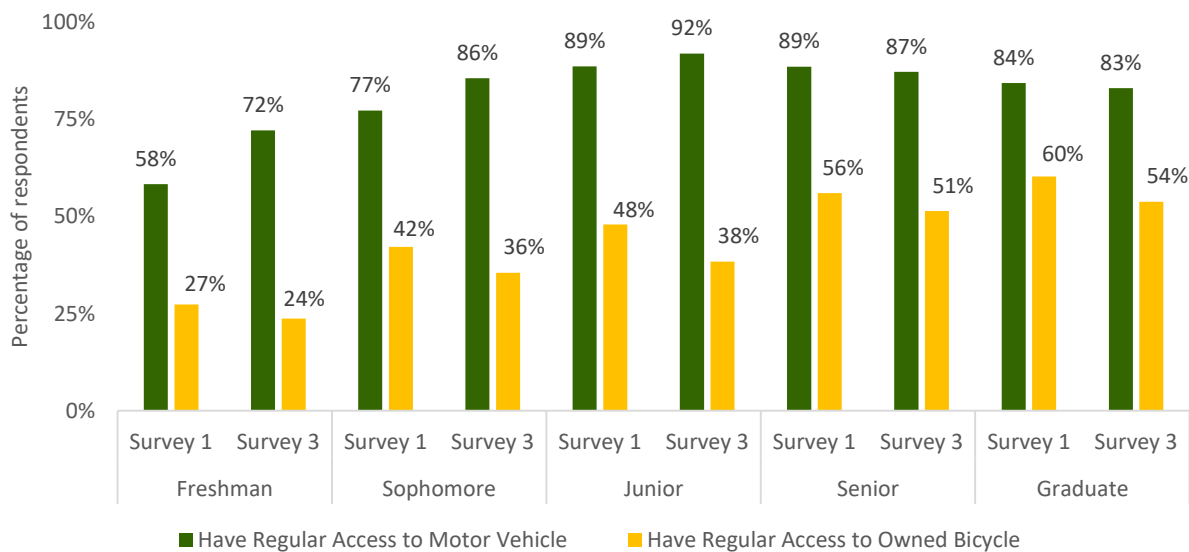


Figure 5.4 Motor Vehicle Ownership and Bicycle Ownership for NDSU Students Categorized by Class

5.2 Survey Response Regarding Bike Share Use

The initial survey captured information about student awareness of bike share and their anticipated use of bike share. The follow-up survey collected information regarding their use of bike share.

5.2.1 Before the Launch

Before the bike share program was operational, 76% of the survey 1 respondents knew about the concept of a bike share program and 14% had used a bike share program in a different city. About 59% of the survey 1 respondents knew about Great Rides Bike Share before the launch. Among the respondents who knew about the upcoming launch, a majority knew through a friend, Facebook, or the newspaper. A majority of respondents (60%) did not know that the students would be able to use the program for free using their student ID card.

Most (85%) respondents replied that that they would or would possibly use the Great Rides program after its launch (Figure 5.5). When asked about the proposed bike share locations, students indicated they would most likely use stations at the NDSU Wallman Wellness Center and the NDSU Memorial Union, although all 11 stations were found to be useful for a significant number of students (>9%) (Figure 5.6). About 46% of respondents indicated they were at least somewhat likely to use bike share for trips on campus, and 39% said the same for trips between campus and downtown (Figure 5.7). Regarding the dissemination of information, email was found to be the most preferred method of communication, followed by Facebook (Figure 5.8).

Will you use the bike share program when it launches in Fargo?

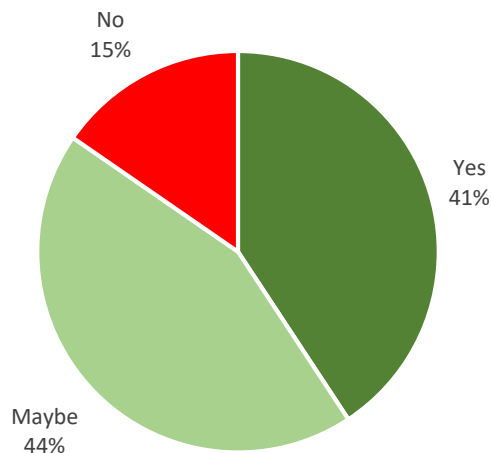


Figure 5.5 Willingness to Use Great Rides Bike Share Program

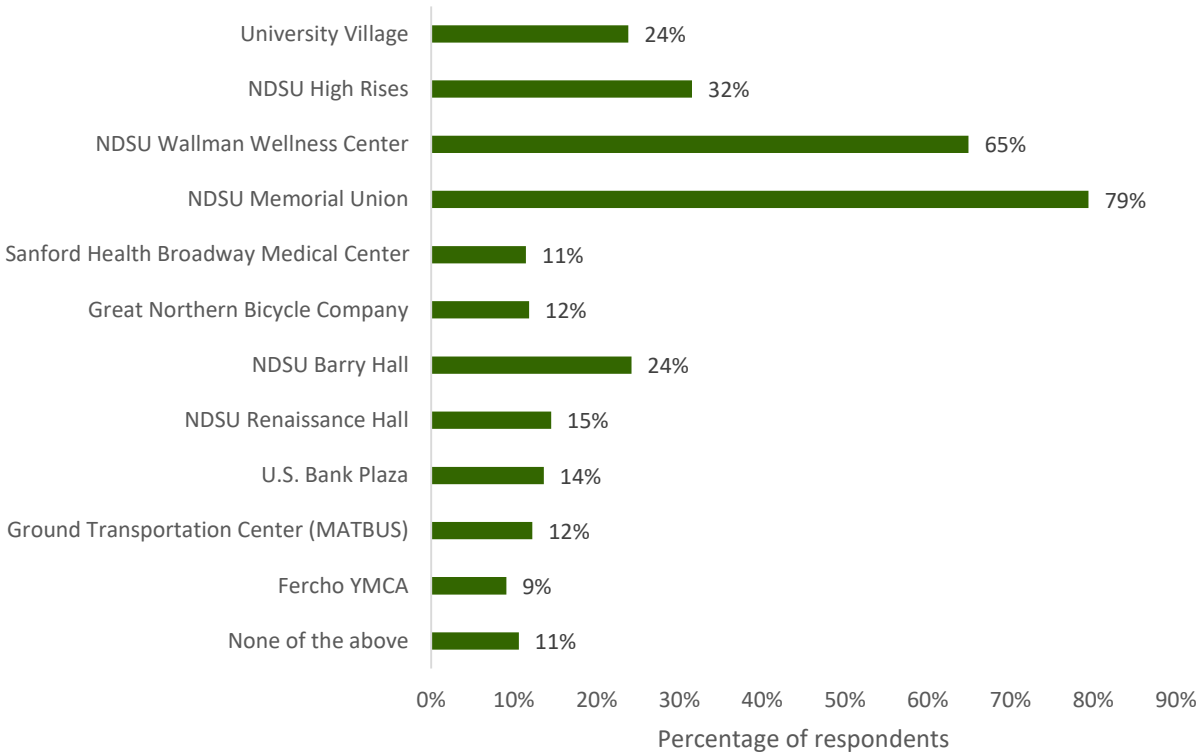


Figure 5.6 Locations Student Respondents Indicated Before the Launch that they would Possibly Use

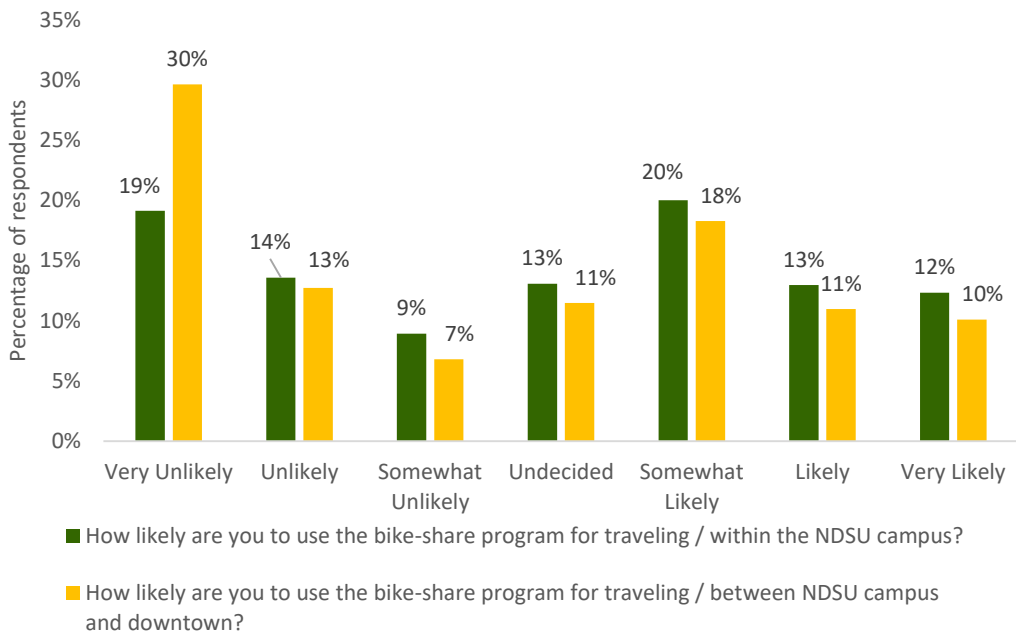


Figure 5.7 Likelihood to Use Bike Share Program in NDSU Campus and Between NDSU Campus and Downtown

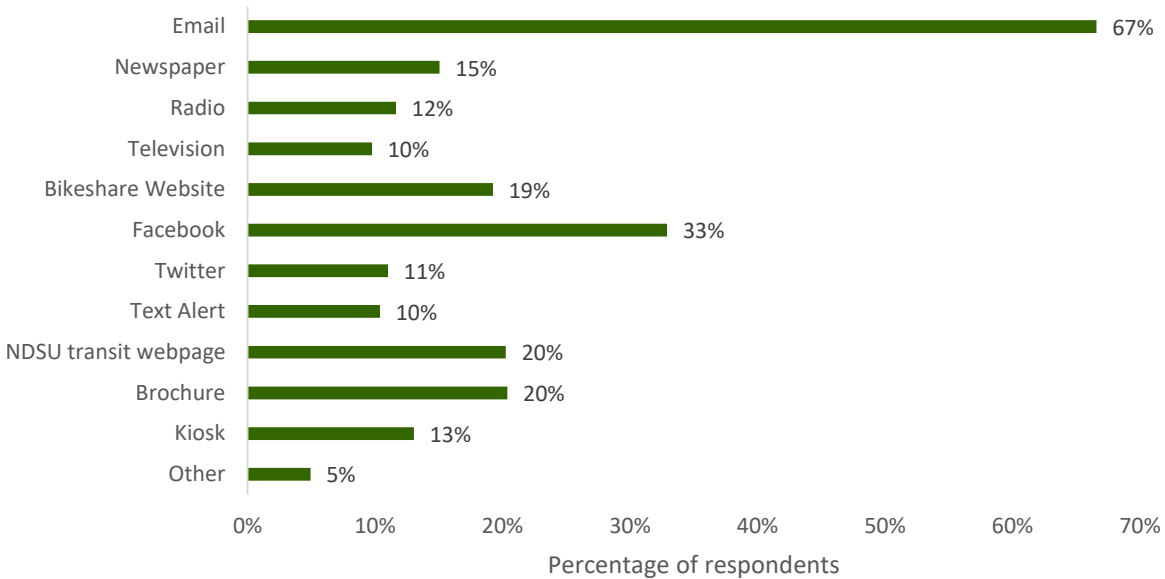


Figure 5.8 Preferred Method for Receiving Bike Share Information

5.2.2 After the Launch

Most students were aware of the bike share program after it had been in operation for a year, as indicated by the 95% of survey 3 respondents who said they were aware of Great Rides Bike Share. About 32% of the survey 3 respondents reported that they had used bike share. While respondents reported using bike share for various trip purposes, trips on campus were the most common trip type. Among bike share users, 83% reported using bike share for trips on campus, and about half reported using it for trips between campus and downtown (Figure 5.9).

Among the respondents who had used the bike share program, the largest share (44%) made 1-4 one-way trips per week. About 14% made five or more trips per week, and very few (3%) made 11 or more one-way trips per week (Figure 5.10).

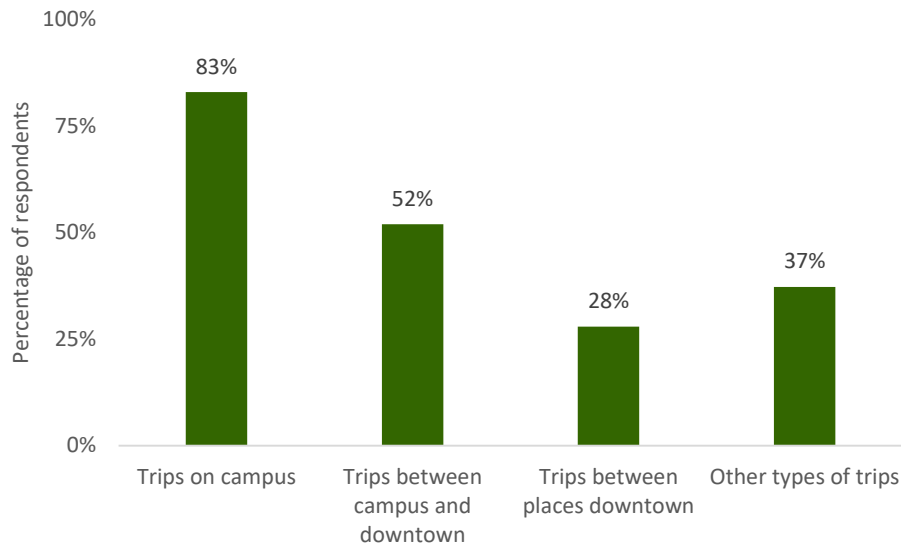


Figure 5.9 Type of Trips Served by Great Rides Bike Share Program

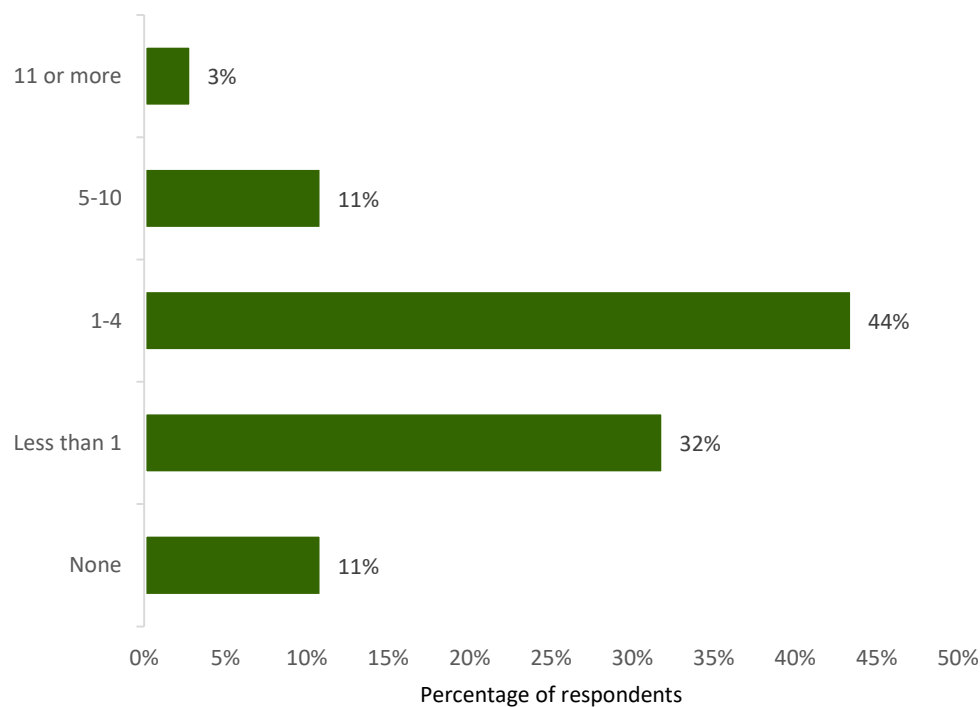


Figure 5.10 Number of One-way Trips Made using Great Rides Bike Share in a Week

About 80% of the survey respondents felt that they have more transportation options available for their traveling needs with the availability of Great Rides Bike Share. There are also a significant number of students who use both MATBUS and the bike share program to complete a

single one-way trip (4% of respondents use frequently, and 17% of respondents use once in a while).

When asked about how the Great Rides Bike Share service can be improved, some of the most common suggestions were:

- Increase the time limit of free bike share checkout from 30 minutes to 45 minutes or 1 hour for allowing longer bicycle trips and for running errands (12 responses).
- Increase the number of docks at bike share stations as sometimes there are no empty docks available at high-demand NDSU bike share stations (11 responses).
- Have more bike share stations on campus to increase the chances of finding an empty dock close near your destination; add more bike share stations near University Village/Fargo Dome as the bikes/docks at University Village do not meet the demand (10 responses).

5.3 Survey Response Regarding MATBUS Use and Satisfaction

Survey 1 and survey 3 included questions about MATBUS use among NDSU students. About 83% of survey 1 respondents and 85% of survey 3 respondents had used MATBUS. More than half of the students (~55%) among both survey 1 and survey 3 respondents were regular MATBUS riders (~14% students made 11 or more one-way trips per week, ~20% students made 5 to 10 one-way trips per week, and ~24% students made 1 to 4 one-way trips per week) (Table 5.1). Most respondents (87%) from the two surveys mentioned “school” as top purpose for their MATBUS trip. However, various other trip purposes such as social/recreation, work, grocery shopping, general shopping, attending organization meetings, personal business, and medical appointments were also mentioned by a significant percentage of students.

Also, almost all the students from survey 1 and survey 3 mentioned that the quality of MATBUS service was excellent, good, or satisfactory. Responses for the two surveys regarding MATBUS quality of service were nearly identical. The results are also similar to those from a previous survey conducted of NDSU students during the 2010-2011 school year (Mattson et al. 2012).

Table 5.1 MATBUS Use Characteristics and Feedback

MATBUS Usage Questions		Survey 1	Survey 3
One-way trips made on bus each week	Less than 1 per week	44.9%	44.6%
	1 to 4	20.5%	24.2%
	5 to 10	20.7%	18.7%
	11 or more	14.0%	12.4%
Purpose of each bus trip	School	87.5%	87.6%
	Grocery shopping	10.8%	11.6%
	General shopping	10.4%	8.8%
	Work	12.3%	13.5%
	Medical Appointments	2.7%	3.0%
	Social/recreation	14.1%	17.4%
	Personal business	8.9%	6.6%
	Organization meetings	9.2%	7.2%
	other	3.0%	3.3%
Overall quality of MATBUS service	Excellent	21.8%	22.4%
	Good	54.6%	55.0%
	Satisfactory	21.2%	20.2%
	Poor	1.9%	1.9%
	Very poor	0.4%	0.6%

When asked about how the MATBUS service can be improved, some of the most common suggestions from survey 3 respondents were:

- Add MATBUS service on Sundays to help students with grocery shopping and errands.
- Add more MATBUS service in evenings, weekends, and during breaks.
- MATBUS is not on time. It is either too early or late.
- Need a mobile app for realtime MATBUS location tracking and forecasting. (MATBUS released such an app after the survey was conducted.)
- Add direct MATBUS service between NDSU and South Fargo (West Acres Mall, Target, Walmart etc.)

5.4 Trips to Campus

A majority (>60%) of the UV/NA residing students make 1-2 one-way trips to and from campus each day, while more than a quarter make 3-4 one-way trips (Table 5.2). The follow-up survey included a greater percentage of respondents making 5 or more trip per day. A majority (>66%) of the off-campus students make 1-2 one-way trips to and from campus, while about 17-23% make 3-4 one-way trips.

Table 5.2 Number of One-Way Trips Per Day

Student Residence	Survey 1 (Before)	Survey 3 (After)
University Village/Niskanen Apartments	<p>5+ 2% 3-4 27% 1-2 63% <1 8%</p>	<p>5+ 8% 3-4 28% 1-2 62% <1 2%</p>
Off-campus	<p>5+ 1% 3-4 23% 1-2 67% <1 8%</p>	<p>5+ 2% 3-4 17% 1-2 71% <1 9%</p>

5.5 Modes Used to Travel to Campus

Survey 1 and survey 3 both asked UV/NA and off-campus students to identify which mode of transportation they use most often when traveling to campus. Survey 3 differentiated between winter and non-winter trips. An additional question asked respondents to indicate all modes that they use, even if they use them just occasionally. This question did not differentiate between winter and non-winter months and was worded the same in both surveys, allowing for a direct comparison.

5.5.1 University Village/Niskanen Apartments Students

Since UV/NA is close to campus, very few students drive to campus. Most either use MATBUS, walk, or ride a bicycle. In both before and after surveys, MATBUS was shown to be the mode of transportation used the most (Table 5.3).

Results from survey 3 show significant differences in mode shares between winter and non-winter months. During non-winter months, MATBUS was most often chosen 45% of the time, walking 28%, personal bicycle 13%, and bike share 8%. In winter months, walking and bicycling decreases significantly and is replaced by increased use of MATBUS. Survey results show that in the winter, MATBUS is most often chosen 91% of the time, walking 4%, and bicycling 2%. Because survey 1 did not differentiate between winter and non-winter months, a direct comparison is difficult, but results suggest an increase in bicycle use.

Table 5.3 Mode Choice for Students Living in University Village/ Niskanen Apartments

	Survey 1 (Before)	Survey 3 (After)
Mode used most often (% of Respondents)	MATBUS	77%
	Walk	10%
	Personal bicycle	2%
	Bike share	0%
	Drive alone	7%
	Carpool	0%
	Motorcycle	1%
	Other	3%
	NA	
Non-winter months - Mode used most often (% of Respondents)	NA	
	MATBUS	45%
	Walk	28%
	Personal bicycle	13%
	Bike share	8%
	Drive alone	0%
	Carpool	2%
	Motorcycle	2%
	Other	2%
Winter months - Mode used most often (% of Respondents)	NA	
	MATBUS	91%
	Walk	4%
	Personal bicycle	2%
	Bike share	0%
	Drive alone	4%
	Carpool	0%
	Motorcycle	0%
	Other	0%
All modes used (% of Respondents)	MATBUS	74%
	Walk	89%
	Personal bicycle	45%
	Bike share	0%
	Drive alone	52%
	Carpool	34%
	Motorcycle	1%
	Other	3%
	NA	
	MATBUS	96%
	Walk	85%
	Personal bicycle	28%
	Bike share	66%
	Drive alone	49%
	Carpool	25%
	Motorcycle	2%
	Other	2%
	NA	

Regarding student response to all modes used, results show that most students walk and use MATBUS. MATBUS use increased from 74% to 96%. Results also show a decrease in personal bicycle use from 45% to 28% but an overall increase in bicycling as 66% of respondents had used Great Rides Bike Share. Automobile use was found to decrease slightly.

5.5.2 Off-Campus Students

The single-occupancy automobile is the most common mode of transportation for off-campus students to campus, though other modes, including MATBUS, walking, and bicycling are also commonly used (Table 5.4). Survey 3 shows that automobile (drive alone) mode share increases from 40% during non-winter months to 45% during the winter, while the MATBUS share also increases (9% to 17%) and personal bicycle mode share decreases from 16% to 3%. Comparing responses from the before and after surveys regarding all modes used show that automobile use increased, walking and personal bicycle use decreased slightly, MATBUS use was unchanged, and overall bicycle use (including both personal bicycle and bike share use) increased.

While the bicycling behavior (using personal bicycle and bike share) increased in the after survey (45% before vs. 57% after (38% + 19%)), the increase was not as great as that observed among UV/NA residents because many off-campus students live greater distances from campus. Further, unless off-campus students live downtown or near the University Village, there would not be a bike share station close enough to their residence.

Note that these results could be influenced by the fact that the follow-up survey included a greater share of respondents living farther from campus, so a larger automobile share is expected. Therefore, it is important to examine mode use for off-campus students categorized by how far they live from campus.

Table 5.5 shows modes used based on the distance of residence from campus, and Table 5.6 shows the same categorized by the part of the metro area in which the student lives. Off-campus students tend to walk mostly to campus when they are living close to campus (less than 1 mile). Automobile (drive alone) use is shown to increase among students as the distance from campus increases. While some students living less than ¼ of a mile from campus use MATBUS, use of MATBUS tends to be greatest among students living more than ¼ of a mile and less than five miles from campus. After the bike share launch, while the primary mode choice trend seems to be similar, bicycle use increased among students living less than one mile from campus.

Overall, students closest to campus mostly walk. Bicycling and use of transit increases for students living more than ¼ of a mile from campus, and use of these modes begins to diminish beyond a certain trip distance. The automobile is the dominant mode for trips of more than five miles.

Table 5.4 Mode Choice for Students Living Off-Campus

	Survey 1 (Before)	Survey 3 (After)
Mode used most often (% of Respondents)	MATBUS 16%	NA
	Walk 31%	
	Personal bicycle 8%	
	Bike share 0%	
	Drive alone 41%	
	Carpool 2%	
	Motorcycle 0%	
	Other 1%	
Non-winter months - Mode used most often (% of Respondents)	NA	MATBUS 7%
		Walk 27%
		Personal bicycle 16%
		Bike share 2%
		Drive alone 40%
		Carpool 3%
		Motorcycle 2%
		Other 2%
Winter months - Mode used most often (% of Respondents)	NA	MATBUS 19%
		Walk 25%
		Personal bicycle 3%
		Bike share 0%
		Drive alone 45%
		Carpool 6%
		Motorcycle 0%
		Other 1%
All modes used (% of Respondents)	MATBUS 42%	MATBUS 42%
	Walk 55%	Walk 55%
	Personal bicycle 45%	Personal bicycle 45%
	Bike share 0%	Bike share 0%
	Drive alone 69%	Drive alone 69%
	Carpool 26%	Carpool 26%
	Motorcycle 4%	Motorcycle 4%
	Other 3%	Other 3%

Table 5.6 shows that students living downtown are more likely than other off-campus students to use MATBUS. Trips from downtown to campus are well-served by transit. Results from the two surveys show that about three-quarters of students living downtown use transit at least occasionally to travel to campus. The results also show that downtown students are more likely than other off-campus students to use bike share to travel to campus, which is expected since the

only off-campus bike share stations are located downtown. Eight percent of survey 3 respondents who live downtown reported they mostly use bike share to travel to campus during the months in which the program is in operation. Overall, students living in north Fargo or downtown Fargo are the most likely to ride a bicycle to campus or use transit.

Table 5.5 Mode of Transportation Mostly Used and Occasionally Used to Travel for NDSU Off-Campus Students Living at Various Distances from NDSU Campus

	n	Walk	Bicycle	Bike Share	Automobile (drive alone)	Carpool	MATBUS	Motorcycle	Other
Survey 1: Mode of Transportation Mostly Used for Travel									
Total	500	30.8%	8.0%	NA	41.6%	2.0%	16.4%	0.0%	1.2%
> 1/4 mile	117	72.6%	9.4%	NA	6.0%	0.0%	10.3%	0.0%	1.7%
1/4 to 1/2 mile	88	43.2%	14.8%	NA	17.0%	3.4%	20.5%	0.0%	1.1%
1/2 to 1 mile	71	40.8%	8.5%	NA	28.2%	2.8%	19.7%	0.0%	0.0%
1 to 5 miles	129	1.6%	7.8%	NA	60.5%	0.8%	27.9%	0.0%	1.6%
5 to 10 miles	68	0.0%	0.0%	NA	91.2%	5.9%	1.5%	0.0%	1.5%
More than 10 miles	27	0.0%	0.0%	NA	96.3%	0.0%	3.7%	0.0%	0.0%
Survey 3: Mode of Transportation Mostly Used for Travel (Non-Winter Months)									
Total	266	26.7%	15.8%	2.3%	40.2%	3.4%	7.1%	2.3%	1.5%
> 1/4 mile	55	74.5%	14.5%	1.8%	3.6%	0.0%	3.6%	0.0%	1.8%
1/4 to 1/2 mile	26	57.7%	19.2%	0.0%	7.7%	0.0%	7.7%	3.8%	0.0%
1/2 to 1 mile	37	40.5%	27.0%	2.7%	18.9%	2.7%	8.1%	0.0%	0.0%
1 to 5 miles	78	0.0%	21.8%	3.8%	56.4%	3.8%	10.3%	2.6%	0.0%
5 to 10 miles	47	0.0%	2.1%	2.1%	72.3%	10.6%	8.5%	4.3%	0.0%
More than 10 miles	23	0.0%	4.3%	0.0%	78.3%	0.0%	0.0%	4.3%	13.0%
Survey 3: Mode of Transportation Mostly Used for Travel (Winter Months)									
Total	266	25.2%	2.6%	0.0%	45.5%	5.6%	19.2%	0.4%	1.1%
> 1/4 mile	55	78.2%	1.8%	0.0%	9.1%	1.8%	9.1%	0.0%	0.0%
1/4 to 1/2 mile	26	30.8%	7.7%	0.0%	15.4%	3.8%	38.5%	3.8%	0.0%
1/2 to 1 mile	37	37.8%	2.7%	0.0%	27.0%	8.1%	24.3%	0.0%	0.0%
1 to 5 miles	78	2.6%	3.8%	0.0%	60.3%	6.4%	25.6%	0.0%	0.0%
5 to 10 miles	47	0.0%	0.0%	0.0%	76.6%	10.6%	12.8%	0.0%	0.0%
More than 10 miles	23	0.0%	0.0%	0.0%	82.6%	0.0%	4.3%	0.0%	13.0%
Survey 1: All Modes Used at Least Occasionally (more than one mode selected)									
Total	500	54.8%	45.4%	NA	69.2%	25.8%	42.4%	3.8%	2.6%
> 1/4 mile	117	88.9%	50.4%	NA	59.0%	23.9%	41.0%	3.4%	4.3%
1/4 to 1/2 mile	88	83.0%	55.7%	NA	67.0%	30.7%	52.3%	2.3%	1.1%
1/2 to 1 mile	71	70.4%	67.6%	NA	66.2%	21.1%	57.7%	5.6%	2.8%
1 to 5 miles	129	27.9%	45.7%	NA	69.0%	25.6%	48.8%	3.9%	2.3%
5 to 10 miles	68	11.8%	14.7%	NA	85.3%	25.0%	16.2%	2.9%	2.9%
More than 10 miles	27	11.1%	7.4%	NA	88.9%	33.3%	11.1%	7.4%	0.0%
Survey 3: All Modes Used at Least Occasionally (more than one mode selected)									
Total	266	51.5%	38.0%	19.2%	81.6%	30.5%	42.9%	3.4%	4.1%
> 1/4 mile	55	96.4%	32.7%	30.9%	74.5%	21.8%	32.7%	0.0%	7.3%
1/4 to 1/2 mile	26	80.8%	53.8%	19.2%	69.2%	26.9%	76.9%	3.8%	0.0%
1/2 to 1 mile	37	83.8%	64.9%	27.0%	78.4%	35.1%	54.1%	0.0%	2.7%
1 to 5 miles	78	28.2%	42.3%	16.7%	84.6%	29.5%	51.3%	3.8%	1.3%
5 to 10 miles	47	14.9%	21.3%	6.4%	93.6%	46.8%	25.5%	4.3%	4.3%
More than 10 miles	23	13.0%	8.7%	13.0%	82.6%	17.4%	17.4%	13.0%	13.0%

Table 5.6 Mode of Transportation Mostly Used and Occasionally Used to Travel for NDSU Off-Campus Students Living at Various Locations in Fargo-Moorhead Area

	n	Walk	Bicycle	Bike Share	Automobile (drive alone)	Carpool	MATBUS	Motorcycle	Other
Survey 1: Mode of Transportation Mostly Used for Travel									
Total	499	30.9%	8.0%	NA	41.5%	2.0%	16.4%	0.0%	1.2%
North Fargo	284	50.0%	10.9%	NA	20.1%	0.4%	17.6%	0.0%	1.1%
Downtown Fargo	58	10.3%	10.3%	NA	36.2%	5.2%	36.2%	0.0%	1.7%
Southwest Fargo	43	0.0%	0.0%	NA	93.0%	4.7%	0.0%	0.0%	2.3%
Southcentral Fargo	54	3.7%	0.0%	NA	79.6%	1.9%	13.0%	0.0%	1.9%
West Fargo	18	5.6%	0.0%	NA	88.9%	5.6%	0.0%	0.0%	0.0%
Moorhead	25	0.0%	4.0%	NA	80.0%	4.0%	12.0%	0.0%	0.0%
Other	17	17.6%	11.8%	NA	58.8%	5.9%	5.9%	0.0%	0.0%
Survey 3: Mode of Transportation Mostly Used for Travel (Non-Winter Months)									
Total	266	26.7%	15.8%	2.3%	40.2%	3.4%	7.1%	2.3%	1.5%
North Fargo	135	45.2%	20.7%	2.2%	19.3%	1.5%	7.4%	2.2%	0.7%
Downtown Fargo	25	32.0%	24.0%	8.0%	20.0%	0.0%	16.0%	0.0%	0.0%
Southwest Fargo	25	4.0%	8.0%	0.0%	76.0%	12.0%	0.0%	0.0%	0.0%
Southcentral Fargo	41	0.0%	9.8%	2.4%	68.3%	4.9%	12.2%	2.4%	0.0%
West Fargo	14	0.0%	0.0%	0.0%	71.4%	14.3%	0.0%	7.1%	7.1%
Moorhead	12	0.0%	8.3%	0.0%	75.0%	0.0%	0.0%	8.3%	0.0%
Other	14	7.1%	7.1%	0.0%	71.4%	0.0%	0.0%	0.0%	14.3%
Survey 3: Mode of Transportation Mostly Used for Travel (Winter Months)									
Total	266	25.2%	2.6%	0.0%	45.5%	5.6%	19.2%	0.4%	1.1%
North Fargo	135	43.0%	3.0%	0.0%	23.0%	5.2%	25.2%	0.7%	0.0%
Downtown Fargo	25	32.0%	8.0%	0.0%	32.0%	0.0%	28.0%	0.0%	0.0%
Southwest Fargo	25	4.0%	0.0%	0.0%	84.0%	12.0%	0.0%	0.0%	0.0%
Southcentral Fargo	41	0.0%	2.4%	0.0%	70.7%	7.3%	19.5%	0.0%	0.0%
West Fargo	14	0.0%	0.0%	0.0%	78.6%	14.3%	7.1%	0.0%	0.0%
Moorhead	12	0.0%	0.0%	0.0%	91.7%	0.0%	0.0%	0.0%	0.0%
Other	14	0.0%	0.0%	0.0%	71.4%	0.0%	7.1%	0.0%	21.4%
Survey 1: All Modes Used at Least Occasionally (more than one mode selected)									
Total	499	54.9%	45.7%	NA	69.1%	25.9%	42.5%	3.8%	2.6%
North Fargo	284	78.5%	57.7%	NA	63.7%	23.9%	44.4%	4.6%	3.2%
Downtown Fargo	58	41.4%	56.9%	NA	62.1%	34.5%	77.6%	1.7%	0.0%
Southwest Fargo	43	14.0%	16.3%	NA	81.4%	27.9%	23.3%	7.0%	4.7%
Southcentral Fargo	54	14.8%	18.5%	NA	79.6%	20.4%	38.9%	3.7%	0.0%
West Fargo	18	22.2%	11.1%	NA	94.4%	38.9%	5.6%	0.0%	0.0%
Moorhead	25	8.0%	28.0%	NA	76.0%	24.0%	24.0%	0.0%	8.0%
Other	17	41.2%	29.4%	NA	82.4%	29.4%	17.6%	0.0%	0.0%
Survey 3: All Modes Used at Least Occasionally (more than one mode selected)									
Total	266	51.1%	38.0%	19.2%	81.6%	30.5%	42.9%	3.4%	4.1%
North Fargo	135	80.7%	48.9%	23.0%	75.6%	28.1%	49.6%	3.0%	5.2%
Downtown Fargo	25	60.0%	52.0%	48.0%	88.0%	32.0%	72.0%	0.0%	0.0%
Southwest Fargo	25	8.0%	20.0%	16.0%	92.0%	48.0%	24.0%	0.0%	0.0%
Southcentral Fargo	41	4.9%	26.8%	4.9%	85.4%	36.6%	39.0%	2.4%	2.4%
West Fargo	14	28.6%	0.0%	0.0%	100.0%	14.3%	21.4%	14.3%	0.0%
Moorhead	12	8.3%	33.3%	0.0%	83.3%	33.3%	16.7%	8.3%	0.0%
Other	14	21.4%	14.3%	14.3%	78.6%	14.3%	14.3%	7.1%	21.4%

5.6 Modes Used to Travel on Campus

All students were asked about their travel between locations on campus. In both the before and after surveys, walking is the predominant mode of transportation on campus (Table 5.7). MATBUS is shown to be more popular in winter months when 15% of respondents said they most often choose MATBUS, compared to 5% in non-winter months. In the after survey for non-winter months, 6% of respondents said they most commonly choose personal bicycle, and another 6% most commonly choose bike share. Comparing all modes used in the before and after survey shows mostly unchanged walking rates and use of MATBUS, while personal bicycle use decreased slightly and overall bicycle use increased given the introduction of bike share. In the before survey, 29% of respondents indicated that they use a personal bicycle for on-campus trips. In the after survey, 25% said they use a personal bicycle and 43% answered that they use bike share. This result shows increased bicycling use among students.

Table 5.7 Mode Choice for Students On-Campus

	Survey 1 (Before)	Survey 3 (After)
Mode used most often (% of Respondents)	MATBUS 9%	NA
	Walk 82%	
	Personal bicycle 3%	
	Bike share 0%	
	Automobile 5%	
	Other 0%	
Non-winter months - Mode used most often (% of Respondents)	NA	MATBUS 6%
		Walk 74%
		Personal bicycle 6%
		Bike share 6%
		Automobile 6%
		Other 2%
Winter months - Mode used most often (% of Respondents)	NA	MATBUS 15%
		Walk 73%
		Personal bicycle 3%
		Bike share 0%
		Automobile 8%
		Other 1%
All modes used (% of Respondents)	MATBUS 47%	MATBUS 49%
	Walk 87%	Walk 90%
	Personal bicycle 29%	Personal bicycle 25%
	Bike share 0%	Bike share 43%
	Automobile 30%	Automobile 35%
	Other 4%	Other 3%

5.7 Modes Used to Travel Between the NDSU Campus and Downtown

NDSU students were also asked about travel between the NDSU main campus and downtown. NDSU students frequently travel downtown to the NDSU buildings located there and for other various activities. Two bike share stations are located at the university's downtown campus buildings, which are approximately 1.3 and 1.7 miles from the main campus. Further, five additional stations are located at various locations in downtown Fargo.

A little more than 60% of both before and after survey respondents replied that they travel between campus and downtown. Frequency of travel between the main NDSU campus and downtown is illustrated in Figure 5.11.

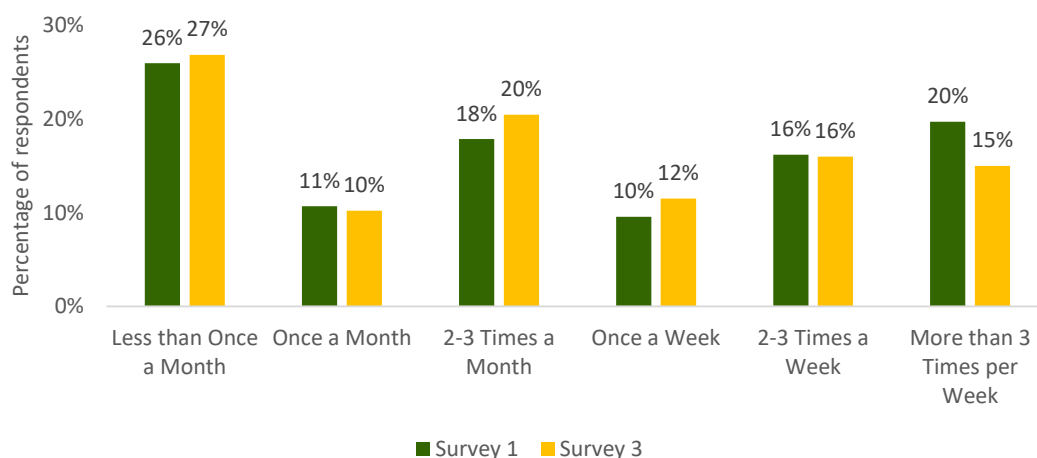
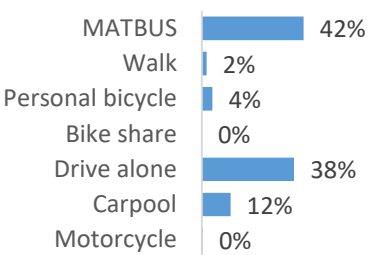
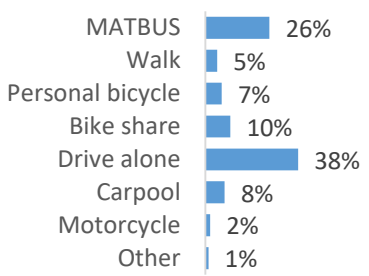
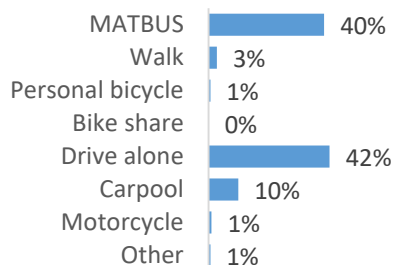
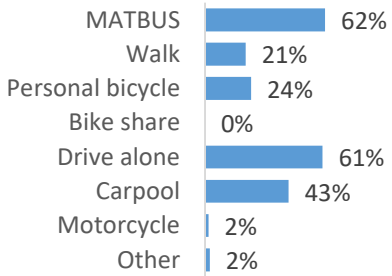
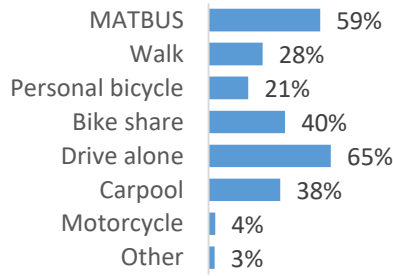


Figure 5.11 Frequency of Travel Between NDSU Campus and Downtown Fargo among NDSU Students

MATBUS and single-occupancy vehicles are the most common modes of travel between campus and downtown (Table 5.8). In the after survey, 9% of respondents most frequently used bike share and 6% most frequently used a personal bicycle for travel between campus and downtown in non-winter months. Bicycle use for these trips in the winter is minimal. Overall, 36% of respondents reported using bike share for trips between campus and downtown in the after survey, and 19% reported using a personal bicycle (compared to 24% in the before survey). The combined used of personal bicycles and bike share shows a significant increase in bicycle trips between campus and downtown. Responses suggest there may be some corresponding decrease in MATBUS and carpool trips.

Table 5.8 Mode Choice for Students Travelling Between NDSU Main Campus and Downtown Fargo

	Survey 1 (Before)	Survey 3 (After)
Mode used most often (% of Respondents)	 <p>MATBUS 42%</p> <p>Walk 2%</p> <p>Personal bicycle 4%</p> <p>Bike share 0%</p> <p>Drive alone 38%</p> <p>Carpool 12%</p> <p>Motorcycle 0%</p>	NA
Non-winter months - Mode used most often (% of Respondents)	NA	 <p>MATBUS 26%</p> <p>Walk 5%</p> <p>Personal bicycle 7%</p> <p>Bike share 10%</p> <p>Drive alone 38%</p> <p>Carpool 8%</p> <p>Motorcycle 2%</p> <p>Other 1%</p>
Winter months - Mode used most often (% of Respondents)	NA	 <p>MATBUS 40%</p> <p>Walk 3%</p> <p>Personal bicycle 1%</p> <p>Bike share 0%</p> <p>Drive alone 42%</p> <p>Carpool 10%</p> <p>Motorcycle 1%</p> <p>Other 1%</p>
All modes used (% of Respondents)	 <p>MATBUS 62%</p> <p>Walk 21%</p> <p>Personal bicycle 24%</p> <p>Bike share 0%</p> <p>Drive alone 61%</p> <p>Carpool 43%</p> <p>Motorcycle 2%</p> <p>Other 2%</p>	 <p>MATBUS 59%</p> <p>Walk 28%</p> <p>Personal bicycle 21%</p> <p>Bike share 40%</p> <p>Drive alone 65%</p> <p>Carpool 38%</p> <p>Motorcycle 4%</p> <p>Other 3%</p>

5.8 Factors Influencing the Mode of Transportation Used to Travel to Campus

Nearly all UV/NA residents responded that their choice for mode of transportation to campus is influenced by the weather (Table 5.9). This is consistent with the previous responses showing a significant decrease in walking and bicycling during the winter months. Travel time and convenience are also important factors contributing to mode choice.

For off-campus students, the most significant factor influencing the mode of transportation used to travel to campus is travel time (80% for before survey and 78% for after survey), while weather and convenience are the next most important factors (Table 5.9). About half of off-campus respondents also consider cost of parking and parking availability as important.

Table 5.9 Factors Influencing the Mode of Transportation Used to Travel to Campus

Student Residence	Survey 1 (Before)	Survey 3 (After)
University Village/Niskanen Apartments	Weather 93.5%; Travel time 75%; Convenience 69.6%; Parking availability 54.4%; Cost of parking 47.8%; Vehicle cost 16.3%	Weather 98.1%; Travel time 84.9%; Convenience 77.4%; Parking availability 45.3%; Cost of parking 43.4%; Vehicle cost 11.3%
Off-campus students	Travel time 80.1%; Weather 79.3%; Convenience 70.7%; Cost of parking 52.4%; Parking availability 50.8%; Vehicle cost 18.9%; Other 5.4%	Travel time 77.5%; Weather 73%; Convenience 74.5%; Cost of Parking 44.9%; Parking availability 47.6%; Vehicle cost 11.2%

6. GREAT RIDES BIKE SHARE PROGRAM RIDERSHIP DATA ANALYSIS

Great Rides Bike Share trip data for 2015 and 2016 were acquired from the Great Rides Bike Share program website (www.greatridesbikeshare.com) and analyzed for bike share trip characteristics, bike share memberships, travel behavior etc. From the Great Rides Bike Share ridership database, data for each bike share trip included: rider membership type (student, member, guest user), bike number used for the trip, bike checkout information (station, date, and time), and bike return information (station, date, and time). While most trips were made between 11 official stations, there were also some trips in the database including repair shop, and other pop-up stations which were either checkout locations or destination locations. These trips were removed from the database as they were not regular bike share rides, but maintenance operations or special event trips. Further, bike share trips that began and ended at the same station and had a trip duration of less than one minute were deleted from the database, as it was assumed that users may have changed their minds and decided not to use the bike after checkout.

A total of 138,463 bike share trips were made in 2015; 95.4% of the trips were made by NDSU students, 1.4% were made by bike share members, and 3.2% were made by guest users. A total of 98,767 trips were made in 2016; 96.1% of the trips were made by NDSU students, 1% were made by bike share members, and 2.9% were made by guests. The proportion of various bike share user memberships were almost similar among the two years of bike share operations.

6.1 Trips per Bike per Day

For a small system in a small city, ridership has been high, even after the decrease in 2016. Comparing trips per bike per day illustrates Great Rides' success (Figure 6.1). Great Rides averaged 6.1 trips per bike per day in 2015 and 4.4 trips per bike per day in 2016. During the busy fall season, trips per bike per day averaged 10.9 in 2015 and 7.4 in 2016. These measures compare favorably with those from the largest bike share systems in the country. New York's Citi Bike, the largest bike share system in the United States, averaged about 5.0 trips per bike per day in 2015-2016, surpassing 7 trips per bike per day in just one month during that period (compiled from Citi Bike 2017). The next two largest systems, Divvy Bikes in Chicago and Capital Bikeshare in Washington, DC, averaged about 2.1 and 2.5 trips per bike per day, respectively, for 2015 and 2016 (compiled from Divvy Bikes 2017 and Capital Bike Share 2017). Nice Ride Bike Share in Minneapolis-St. Paul averaged about 1.25 trips per bike per day during that two-year period (compiled from Nice Ride Minnesota 2017). Even in the slower summer period, Great Rides has averaged 1.4-2.0 trips per bike per day.

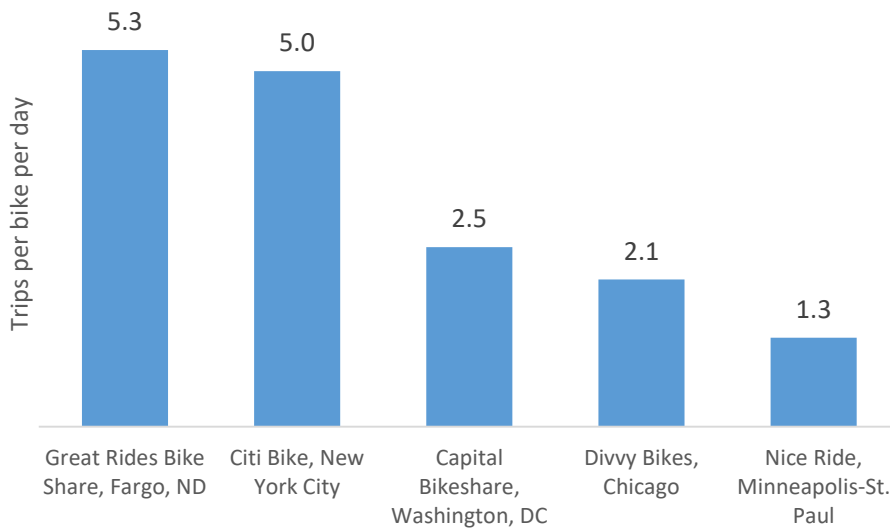


Figure 6.1 Trips per Bike per Day for Select Bike Share Systems, 2015-2016

6.2 Variations in Ridership

6.2.1 Seasonal, Daily, and Hourly Variations

Figure 6.2 plots rides per day in 2015 and 2016. In 2015, the system launched on March 15 and closed for the season on November 1. The system re-opened on March 28, 2016, and ran through November 5, 2016. The figure shows that ridership dropped in its second year of operation. Seasonal variation in the two years was very similar. Since most users of the system are college students, ridership has been substantially lower during the summer months (from mid-May until late August) when significantly fewer students are on campus.

The figure illustrates three distinct seasonal periods as determined by the school schedule. During the spring, use has been initially slow to take off due to cold temperatures or students being on spring break, but then has been relatively high through April and early May. During summer months (from mid-May until late August), there are significantly fewer students on campus. After much lower levels of use throughout the summer, ridership spiked both years in late August when students returned to school and reached its highest levels in late August and early September. Ridership has then gradually declined through the fall until the program closes at the end of October or early November. The spring, summer, and fall seasons all show significant day-to-day variation (especially in the spring and fall), possibly because of variations in the weather or differences between weekday and weekend ridership.

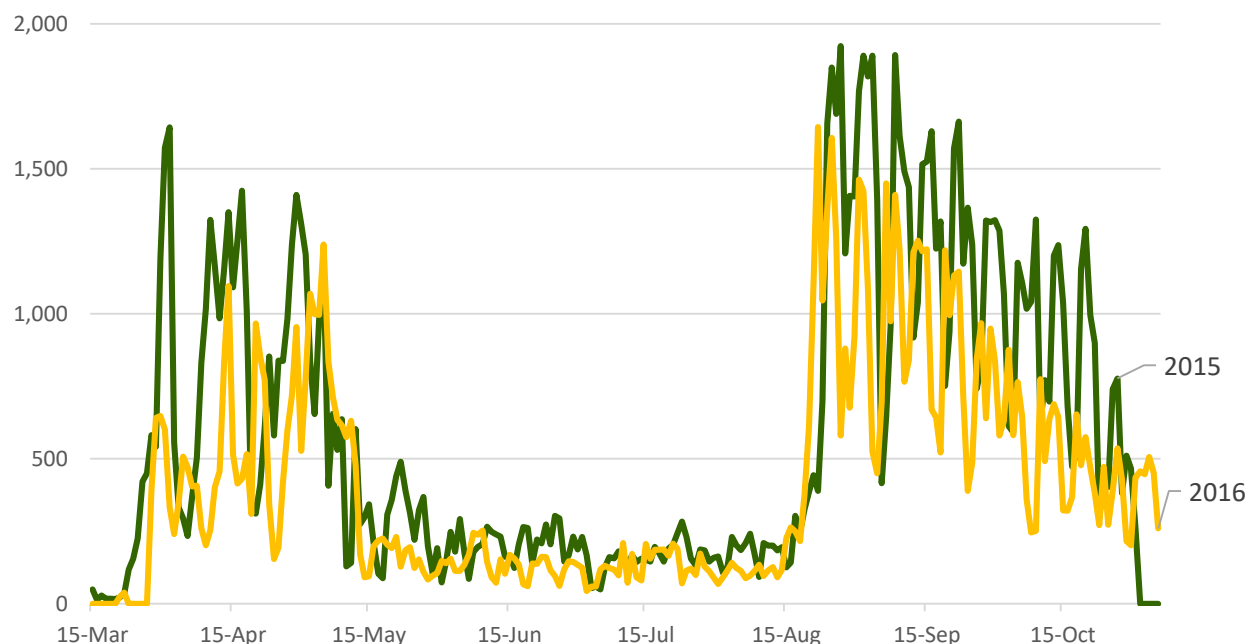


Figure 6.2 Great Rides Bike Share Rides per Day

Tables 6.1 and 6.2 show the average number of rides per day for each season, along with standard deviation and minimum and maximum values, for 2015 and 2016, respectively. (The first week of the bike share in 2015 is not included because students were on spring break and ridership was unusually low.) As shown in Table 6.3, there is also day-to-day variation, with lower ridership on the weekends. Differences between weekdays and weekends could be expected because of differences between weekday and weekend travel patterns.

Table 6.1 Rides per Day, by Season. 2015

	Average	Standard Deviation	Minimum	Maximum
Spring (March 23-May 15)	748	426	118	1,643
Summer (May 16 - Aug 21)	204	86	50	490
Fall (Aug 22 - Oct 31)	1,098	453	264	1,924

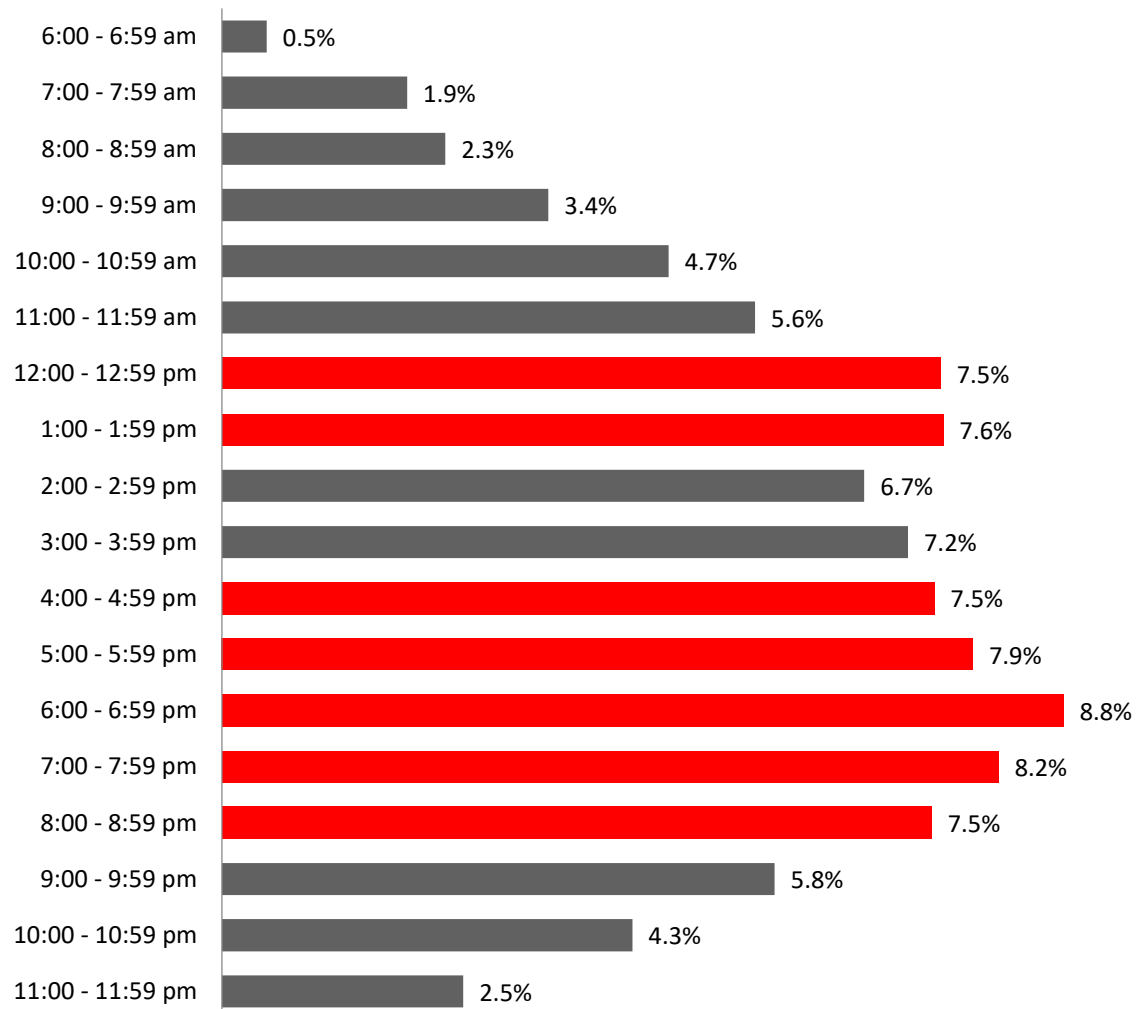
Table 6.2 Rides per Day, by Season, 2016

	Average	Standard Deviation	Minimum	Maximum
Spring (March 28-May 13)	573	271	154	1,239
Summer (May 14 - Aug 19)	141	56	44	378
Fall (Aug 20 - Nov 5)	746	370	202	1,645

Table 6.3 Average Rides per Day, by Day of Week and Season, 2015 and 2016

	2015			2016		
	Spring	Summer	Fall	Spring	Summer	Fall
Sunday	532	148	783	434	107	542
Monday	655	189	1,256	528	139	838
Tuesday	875	216	1,452	553	163	826
Wednesday	812	231	1,288	725	161	864
Thursday	796	247	1,267	770	158	974
Friday	774	232	1,044	549	156	741
Saturday	766	166	639	407	101	460

There are also variations in bike share use by time of day, as shown in Figure 6.3. Checkouts increase throughout the morning until reaching a midday peak. Use drops after 2:00 p.m. before increasing again. The 4:00 p.m. to 9:00 p.m. period accounts for 40% of all checkouts. The peak one-hour period is from 6:00 p.m. to 6:59 p.m., accounting for 8.8% of checkouts.

**Figure 6.3** Percentage of Bike Share Checkouts by Time of Day, 2015 and 2016

6.2.2 Weather Variations

Survey results showed that weather is one of the most important factors students consider when choosing their mode of travel. Individuals may be more likely to choose bike share if weather conditions are favorable. Figures 6.4 and 6.5 plot bike share use and average daily high temperatures for the spring period in 2015 and 2016, respectively. Figures 6.6 and 6.7 plot the same for fall period in the two years. While the two variables do not follow each other perfectly, there is an apparent correlation. During the fall period, ridership and temperatures followed a similar downward trend in both years.

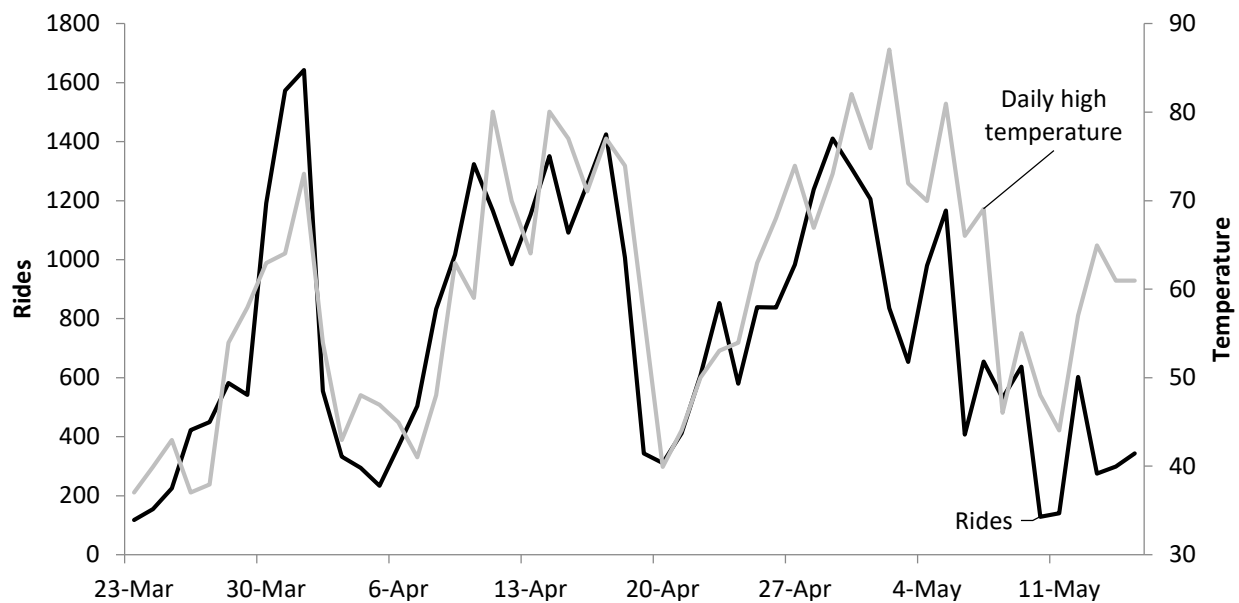


Figure 6.4 Bike Share Rides and Daily High Temperature, Spring Period 2015

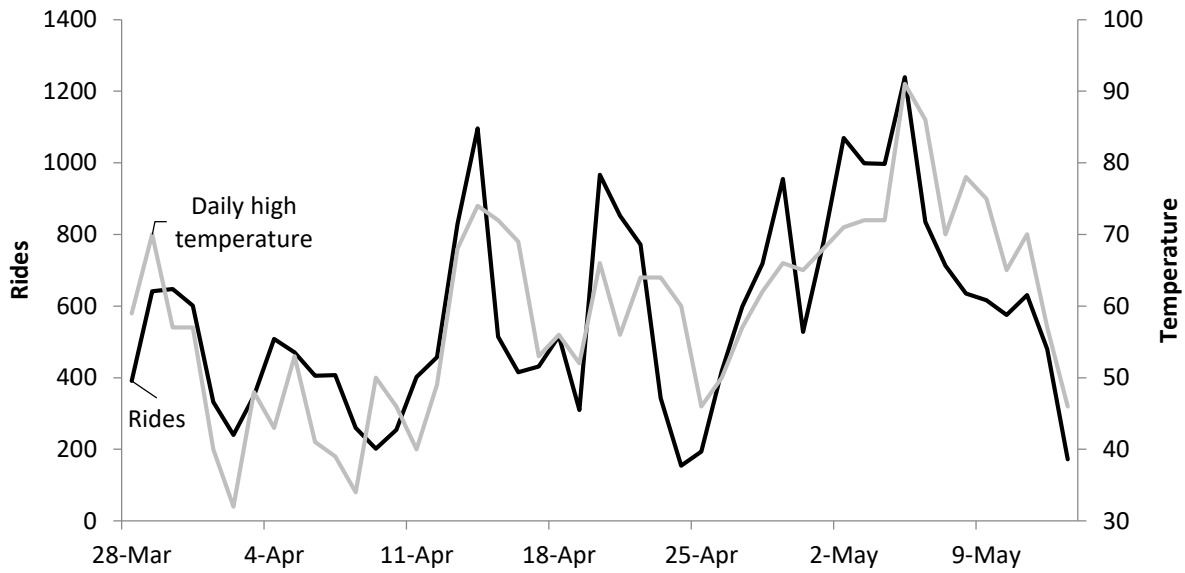


Figure 6.5 Bike Share Rides and Daily High Temperature, Spring Period 2016

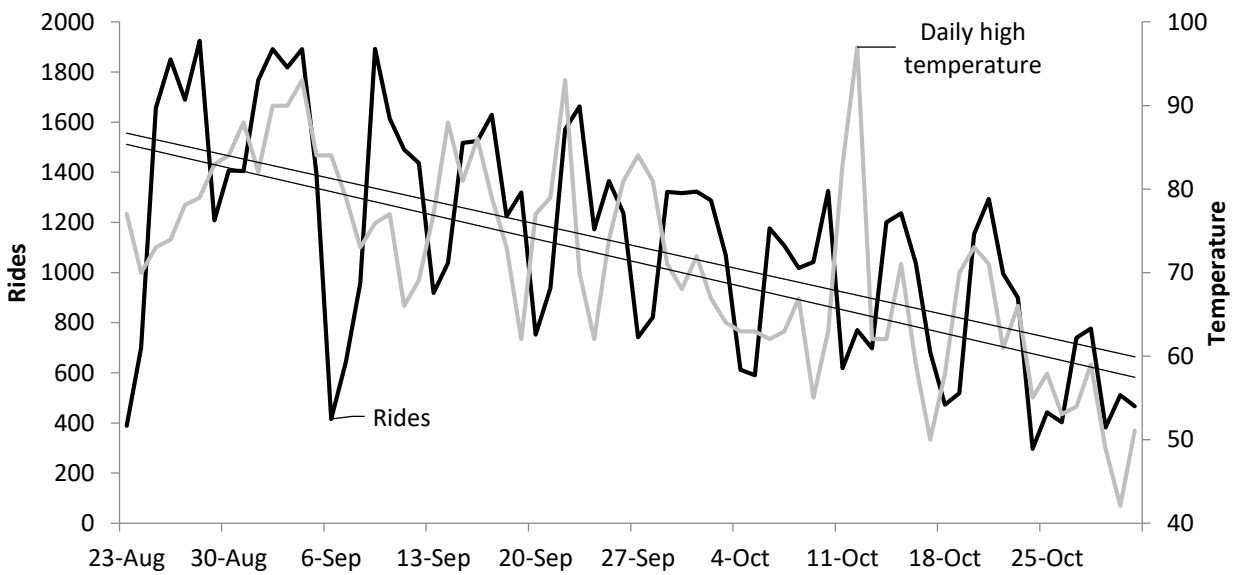


Figure 6.6 Bike Share Rides and Daily High Temperature, Fall Period 2015

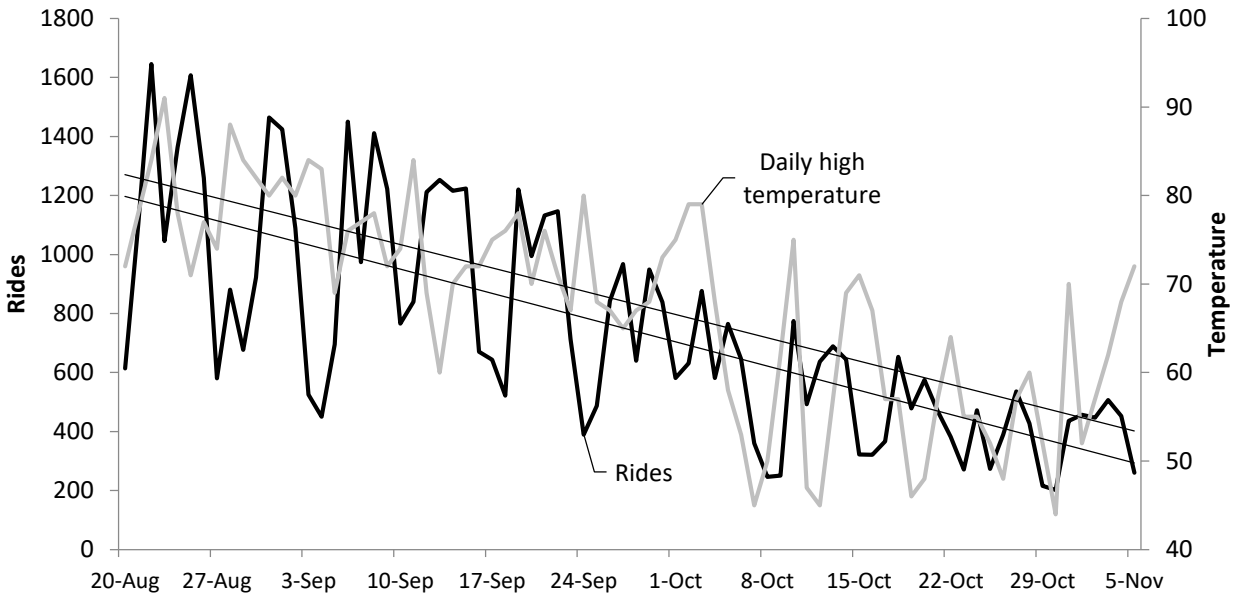


Figure 6.7 Bike Share Rides and Daily High Temperature, Fall Period 2016

Because of the lower bike share use in the summer months, the data show no overall correlation between temperature and rides, but the correlation is apparent when each season is examined separately. The correlation between the two variables is 0.71 during the spring periods and 0.53 during the fall. However, no correlation between temperature and bike share use was found for the summer.

6.3 Station-to-Station Bike Share Trip Analysis

Tables 6.4 and 6.5 show the percentages of bike share trips in 2015 and 2016 made between various stations. As the tables show, bike share stations at the High Rise Complex, Memorial Union, University Village, and Wallman Wellness Center were the four stations generating the most rides. About 86% of total bike share trips in 2015 and 90% of the total trips in 2016 originated from these four stations.

Table 6.4 Trip Matrix for Percentage of Station-to-Station Bike Share Trips in 2015

		Trip Destination Location of Bike Share Trip										
		High Rise Complex	Memorial Union	University Village	Wallman Wellness Center	US Bank Plaza	Barry Hall	Renaissance Hall	Great Northern Bicycle Co.	Sanford Medical Center	Fercho YMCA	MATBUS Center Downtown
Trip Origin Location of Bike Share Trip	High Rise Complex	9.27%	12.06%	5.78%	5.27%	0.23%	0.33%	0.09%	0.14%	0.15%	0.04%	0.05%
	Memorial Union	11.79%	6.13%	4.45%	3.63%	0.39%	0.60%	0.31%	0.25%	0.26%	0.07%	0.09%
	University Village	5.60%	4.27%	3.10%	2.08%	0.11%	0.17%	0.08%	0.05%	0.09%	0.03%	0.04%
	Wallman Wellness Center	5.53%	3.58%	1.84%	1.95%	0.08%	0.15%	0.05%	0.05%	0.06%	0.03%	0.03%
	US Bank Plaza	0.30%	0.41%	0.13%	0.07%	0.82%	0.12%	0.10%	0.12%	0.16%	0.12%	0.05%
	Barry Hall	0.36%	0.59%	0.17%	0.14%	0.14%	0.37%	0.16%	0.03%	0.03%	0.06%	0.04%
	Renaissance Hall	0.13%	0.29%	0.06%	0.04%	0.12%	0.18%	0.30%	0.04%	0.04%	0.04%	0.04%
	Great Northern Bicycle Co.	0.15%	0.20%	0.07%	0.05%	0.15%	0.04%	0.04%	0.34%	0.07%	0.05%	0.04%
	Sanford Medical Center	0.15%	0.20%	0.09%	0.04%	0.19%	0.04%	0.05%	0.08%	0.23%	0.06%	0.04%
	Fercho YMCA	0.07%	0.08%	0.02%	0.02%	0.12%	0.04%	0.04%	0.06%	0.05%	0.36%	0.03%
	MATBUS Center Downtown	0.08%	0.09%	0.06%	0.04%	0.06%	0.03%	0.02%	0.03%	0.03%	0.02%	0.14%

Table 6.5 Trip Matrix for Percentage of Station-to-Station Bike Share Trips in 2016

		Trip Destination Location of Bike Share Trip										
		High Rise Complex	Memorial Union	University Village	Wallman Wellness Center	US Bank Plaza	Barry Hall	Reniasance Hall	Great Northern Bicycle Co.	Sanford Medical Center	Fercho YMCA	MATBUS Center Downtown
Trip Origin Location of Bike Share Trip	High Rise Complex	7.91%	15.93%	6.21%	4.30%	0.16%	0.35%	0.09%	0.12%	0.13%	0.03%	0.04%
	Memorial Union	15.69%	5.18%	5.55%	3.38%	0.24%	0.53%	0.22%	0.17%	0.17%	0.07%	0.07%
	University Village	6.21%	5.29%	1.84%	1.77%	0.10%	0.12%	0.04%	0.07%	0.05%	0.02%	0.04%
	Wallman Wellness Center	4.43%	3.54%	1.51%	0.90%	0.03%	0.11%	0.03%	0.03%	0.02%	0.01%	0.01%
	US Bank Plaza	0.23%	0.24%	0.10%	0.04%	0.66%	0.07%	0.07%	0.12%	0.11%	0.07%	0.03%
	Barry Hall	0.38%	0.54%	0.10%	0.10%	0.10%	0.24%	0.07%	0.04%	0.03%	0.02%	0.03%
	Reniasance Hall	0.11%	0.18%	0.04%	0.04%	0.09%	0.06%	0.20%	0.03%	0.01%	0.04%	0.02%
	Great Northern Bicycle Co.	0.14%	0.13%	0.06%	0.04%	0.13%	0.03%	0.02%	0.39%	0.07%	0.06%	0.03%
	Sanford Medical Center	0.07%	0.14%	0.08%	0.03%	0.11%	0.04%	0.02%	0.07%	0.16%	0.04%	0.03%
	Fercho YMCA	0.04%	0.09%	0.02%	0.01%	0.09%	0.03%	0.03%	0.04%	0.01%	0.32%	0.02%
	MATBUS Center Downtown	0.05%	0.07%	0.07%	0.01%	0.04%	0.02%	0.01%	0.03%	0.02%	0.02%	0.11%

The high demand found at the four bike share stations on the NDSU campus can be attributed to the fact that many students use bike share for trips between their residence (High Rise Complex and other on-campus housing, Niskanen Apartments, University Village, and near-campus housing) and school, and for travel purposes on campus. Also, because bike share is free for all NDSU students, there is little to discourage them from using bike share regularly or from trying it occasionally.

While the bike share stations located downtown do not generate as many trips, the downtown stations cannot be compared to NDSU campus stations because bike share membership for NDSU students is included in their student fees and non-NDSU users must purchase monthly or guest passes. Table 6.6 shows that the percentage of trips made by Great Rides Bike Share members and guest users are significantly greater at downtown non-NDSU locations, compared to the NDSU locations. However, the percentage of trips made can create confusion about understanding the actual number of trips made by Great Rides Bike Share members and guest users. Table 6.7 shows that the number of bike share trips made by Great Rides members and guest users are spread out equally among NDSU bike share stations and non-NDSU bike share stations. The US Bank Plaza station is the busiest location for Great Rides members and guest users.

Table 6.6 Bike Share Membership Categorization for Checkouts at 11 Bike Share Stations for 2015 and 2016 Seasons – Percentage of Total Trips

	Student Membership		Members		Guest Users	
	2015	2016	2015	2016	2015	2016
High Rise Complex	98.2%	97.6%	0.5%	0.1%	1.3%	2.2%
Memorial Union	97.8%	98.7%	0.4%	0.2%	1.8%	1.1%
University Village	98.5%	98.6%	0.3%	0.2%	1.2%	1.1%
Wallman Wellness Center	96.3%	98.7%	2.3%	1.1%	1.4%	0.2%
US Bank Plaza	61.3%	52.9%	12.1%	16.6%	26.6%	30.4%
Barry Hall	94.6%	94.5%	1.9%	2.4%	3.5%	3.1%
Renissance Hall	87.2%	84.4%	3.4%	3.5%	9.5%	12.1%
Great Northern Bicycle Co.	59.3%	51.9%	13.5%	18.0%	27.2%	30.1%
Sanford Medical Center	72.8%	73.9%	6.2%	10.2%	21.0%	15.9%
Fercho YMCA	51.1%	42.5%	12.7%	15.7%	36.2%	41.8%
MATBUS Center Downtown	71.1%	74.8%	8.3%	4.5%	20.6%	20.7%

Table 6.7 Bike Share Membership Categorization for Checkouts at 11 Bike Share Stations for 2015 and 2016 Seasons – Total number of Trips

	Student Membership		Members		Guest Users	
	2015	2016	2015	2016	2015	2016
High Rise Complex	45,425	34,022	225	40	618	781
Memorial Union	37,868	30,468	160	75	687	341
University Village	21,317	15,147	66	37	261	176
Wallman Wellness Center	17,764	10,357	432	115	255	20
US Bank Plaza	2,044	909	402	286	887	523
Barry Hall	2,726	1,547	56	39	100	51
Renissance Hall	1,556	692	60	29	169	99
Great Northern Bicycle Co.	1,003	567	228	197	459	329
Sanford Medical Center	1,171	573	100	79	337	123
Fercho YMCA	632	298	157	110	447	293
MATBUS Center Downtown	605	332	71	20	175	92

The Great Rides Bike Share program was established with the help of multiple corporate sponsors that supported the creation of stations near their locations. Some of these corporate sponsors are located downtown. Therefore, bike share stations in downtown are vital for providing multiple transportation options for both the public and NDSU students.

At downtown non-NDSU bike share stations (US Bank Plaza, Great Northern Bicycle Company, Sanford Medical Center, Fercho YMCA, and MATBUS Center Downtown), while bike share riders often checkout bikes from one station and return them at a different station, a significant number of bikes are returned to the same station from which they are checked out. This implies that many of the bike share rides downtown at non-NDSU stations are made for running errands, probably made by people working/living nearby the bike share station. However, this trend is not observed among the four stations located on NDSU campus or at the two stations located near NDSU buildings downtown.

6.4 Reduction of Bike Share Trips in 2016 Compared to 2015

Total bike share trips declined 29% in 2016, compared to what was observed in the first year of operations. Figure 6.8 illustrates bike share checkouts for each station for the two years of operations, which shows that bike share checkouts declined for each station in 2016. Further, Figure 6.9 graphically and geographically illustrates bike share checkouts by station for the two years, and Figure 6.10 shows the percentage reduction of trips by station. Six of the seven stations downtown and the station at Wallman Wellness Center experienced a reduction in trips of more than 40% in 2016, while the other stations had reductions of 20% or more.

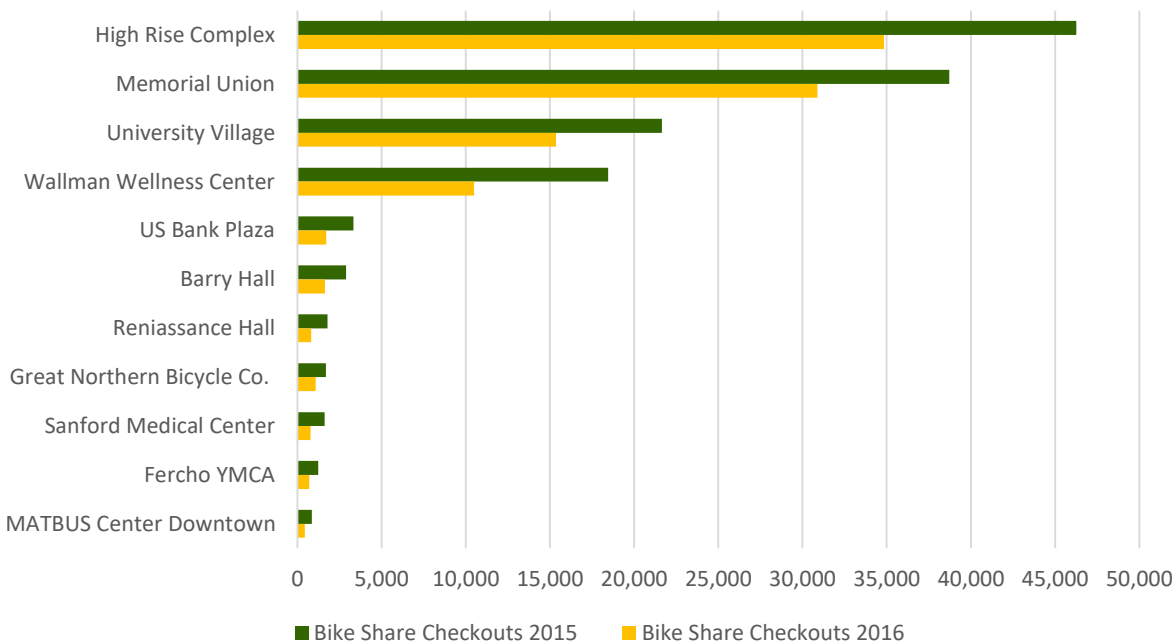


Figure 6.8 Bike Share Checkouts by Station for the Seasons 2015 and 2016

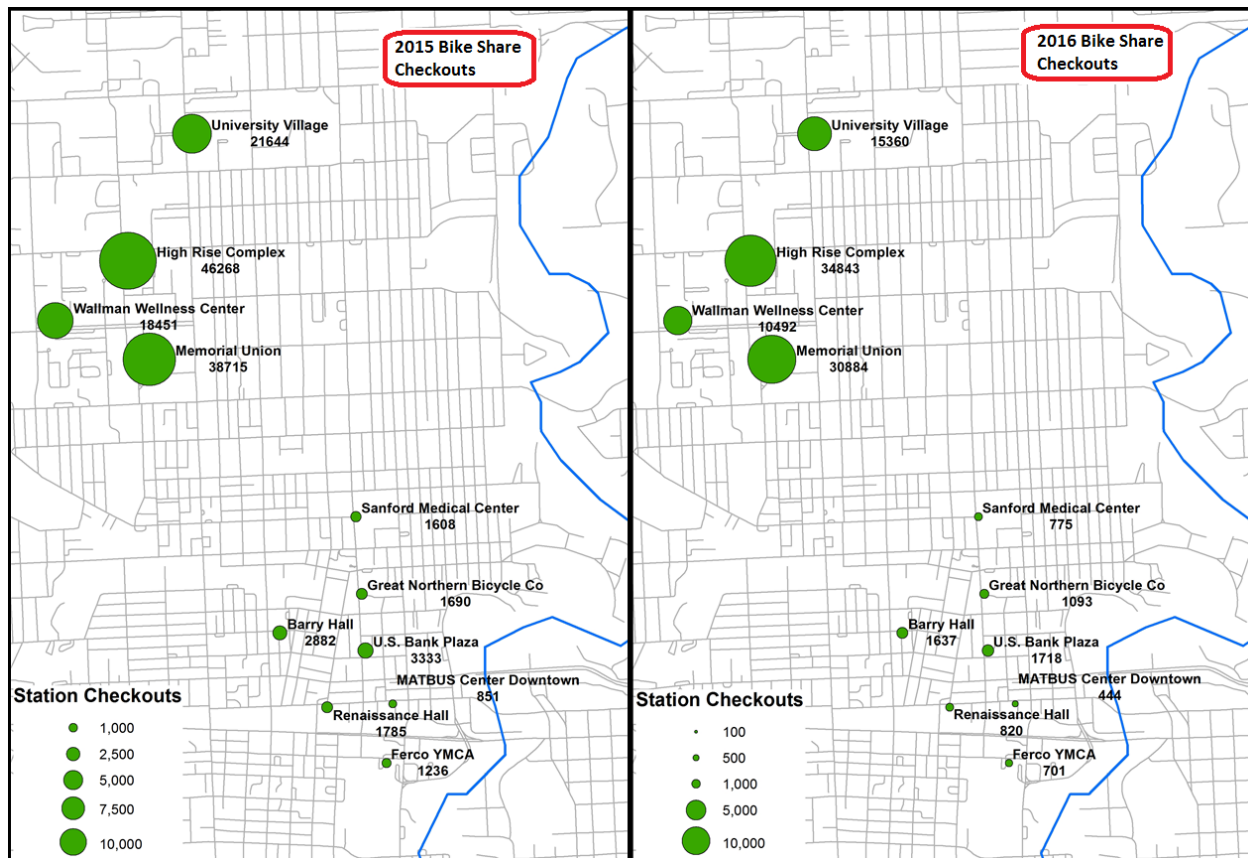


Figure 6.9 Bike Share Checkouts Geographically Illustrated for Two Seasons of Operations

One possible reason for this consistent reduction among all stations could be that people tend to experiment and try new transportation options or new technologies when introduced and decide if they would work out for them on a long-term basis. The high level of ridership the first year could have been influenced to some extent by this novelty effect. The level of use during the initial year was very high, compared to other bike share systems. In fact, immediately after its launch, the system experienced record-setting use for a system of its size (Marich 2015). Given that bike sharing has become very popular recently across the country, the introduction of the system in Fargo provided the opportunity for NDSU students and the public to try the novel new travel alternative. The decline in 2016 could be due to the novelty having worn off. However, overall use in 2016 was still good for a system of its size, and with just two years of data, it is not possible to determine if the decline is a long-term trend or just a one-year drop to a more sustainable level of use.

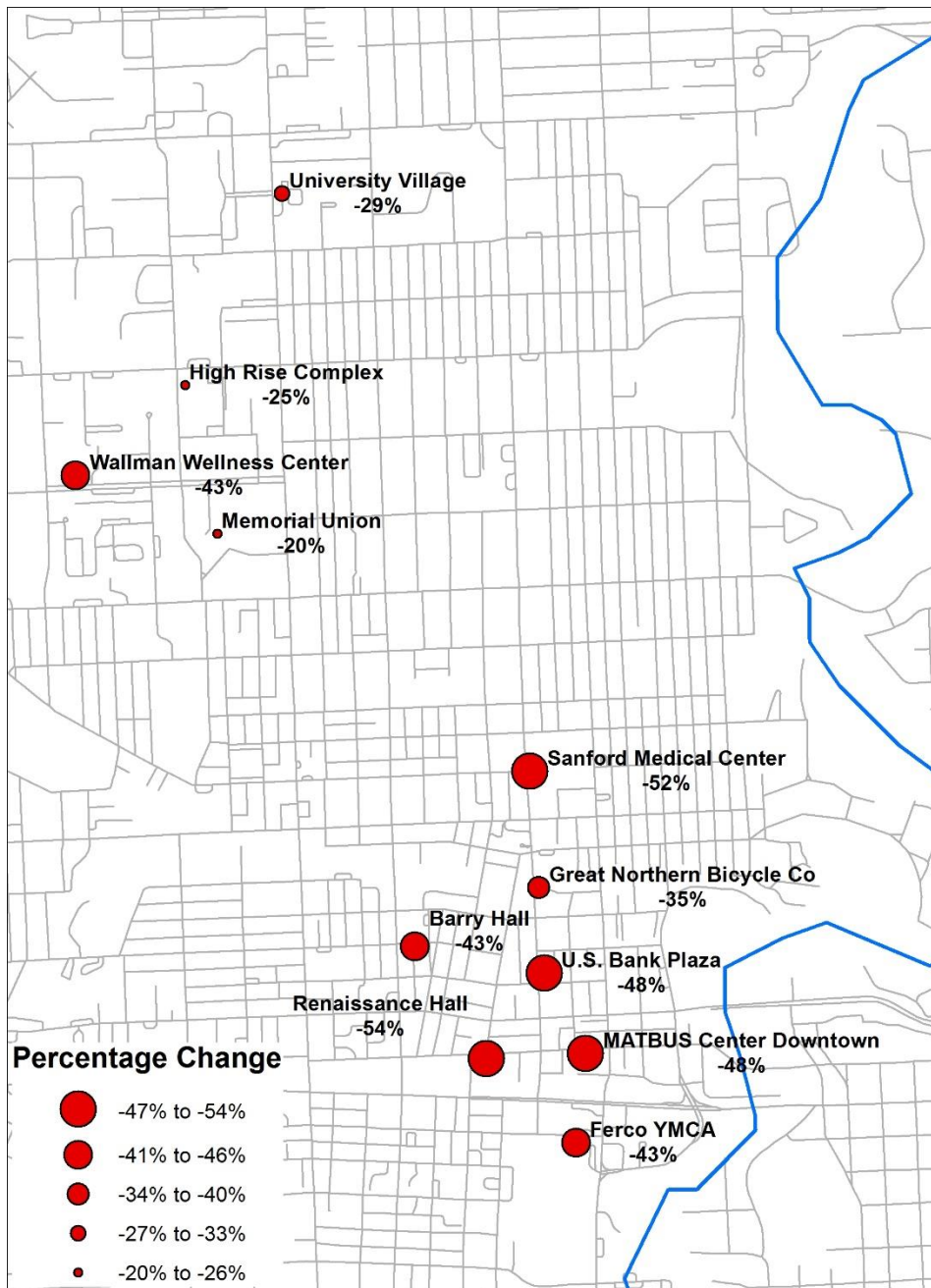


Figure 6.10 Percentage Decrease of Bike Share Trips in 2016 Compared to 2015 Season

6.5 Modeling Bike Share Ridership

A ridership model was developed to estimate the impact of temporal, spatial, and weather variables on ridership for Great Rides Bike Share. Because most bike share trips in Fargo are made by NDSU students, bike share usage can be modeled as a function of variables impacting the total number of trips being made by students and variables affecting students' propensity to choose bike share. Factors impacting the total number of trips being made include whether or not school is in session and if it is a weekend or weekday, both temporal variables. Factors influencing choice of mode include the weather and the amount of daylight in the day, as well as spatial variables that could be favorable to bike share use. There may also be a downward trend in bike share usage as ridership was lower in 2016. Important weather variables include the temperature, precipitation, and wind. Daylight could be important because bike usage in the early morning and evening hours could be greater when the sun rises earlier or sets later.

Temperature might not have a linear impact on ridership. In the spring and fall months when temperatures are cooler, an increase in the temperature may have a significant impact on bike share use, whereas in the summer, when temperatures are generally warm, bike share use might not be significantly influenced by day-to-day variations in temperature. Further, hot weather can have a negative impact on ridership. It is hypothesized that temperatures have a quadratic relationship with ridership, such that the positive impacts on ridership from rising temperatures will diminish at higher temperatures, and that increases in temperature beyond a certain point will have a negative impact on ridership.

Important spatial variables that could influence the use of bike share at a particular station include whether the station is on a college campus, the presence of other stations nearby, the capacity of the station, the population density near the station, and the walkability and bicycle friendliness of the area surrounding the station. Walkability is determined by pedestrian friendliness and the distance to nearby places, and bicycle friendliness is influenced both by the existing of bicycle infrastructure and the topography.

Even though access to transit could have an effect on bike share use, the variable is not included in the model because the 11 stations have similar access to transit. All are located near transit stops. Access to recreational areas was also not included in the model, because none of the stations directly serve a recreational trail.

While many of the stations have similar spatial characteristics, there is one main difference in that some stations are on campus and others are downtown. Given the large share of trips taken on campus, it is hypothesized that the presence on a college campus has a significant positive impact. Furthermore, the temporal and weather variables could impact ridership differently on the campus stations compared to the downtown stations.

6.5.1 Model and Data

Daily bike share usage for an individual station is modeled as follows:

$$\ln R_{it} = \alpha_0 + \alpha_1 Temp_t + \alpha_2 Temp_t^2 + \alpha_3 Precip_t + \alpha_4 Wind_t + \alpha_5 Daylight_t + \alpha_6 School_t + \alpha_7 Wkend_t + \alpha_8 D16_t + \alpha_9 Campus_i + \alpha_{10} NearbySt_i + \alpha_{11} WalkScore_i + \alpha_{12} BikeScore_i + \alpha_{13} PopDen_i + \alpha_{14} Capacity_{it} + \alpha_{15} Temp_t * Campus_i + \alpha_{16} Temp_t^2 * Campus_i + \alpha_{17} Precip_t * Campus_i + \alpha_{18} Wind_t * Campus_i + \alpha_{19} Daylight_t * Campus_i + \alpha_{20} School_t * Campus_i + \alpha_{21} Wkend_t * Campus_i + \alpha_{22} D16_t * Campus_i$$

where R_{it} = number of bike share checkouts at station i in day t

$Temp_t$ = high temperature on day t , measured in degrees Fahrenheit

$Temp_t^2$ = high temperature on day t , measured in degrees Fahrenheit, squared

$Precip_t$ = amount of precipitation on day t , measures in tenths of an inch

$Wind_t$ = average wind speed on day t , measured in miles per hour

$Daylight_t$ = hours of daylight on day t

$School_t$ = dummy variable equal to 1 for spring and fall semesters when school was in session and 0 for the summer period

$Wkend_t$ = dummy variable equal to 1 for the weekend and 0 for weekdays

$D16_t$ = dummy variable equal to 1 for the year 2016 and 0 for 2015

$Campus_i$ = dummy variable equal to 1 if station i is on the college campus and 0 otherwise

$NearbySt_i$ = number of bike share stations within 500 meters of station i

$WalkScore_i$ = the Walk Score at station i

$BikeScore_i$ = the Bike Score at station i

$PopDen_i$ = population density near station i

$Capacity_{it}$ = number of docks at station i .

A summary of the data is shown in Table 6.8. The dependent variable is the natural log of bike share rides per day at an individual station. Weather data for Fargo, North Dakota, were obtained from the National Oceanic and Atmospheric Administration (2016). It is hypothesized that ridership will decrease with increases in precipitation and wind.

Table 6.8 Summary Statistics

Variable	Description	Mean	Standard Deviation	Minimum	Maximum
R_{it}	Daily number of bike share trips at station i	48	97	0	730
$Temp_t$	Daily high temperature (degrees Fahrenheit)	72	13	32	97
$Precip_t$	Daily precipitation (tenths of an inch)	0.81	2.56	0	26.0
$Wind_t$	Average daily wind speed (mph)	10.9	4.6	2.2	24.4
$Daylight_t$	Time from sunrise to sunset (hours)	13.8	1.7	9.8	15.9
$School_t$	Dummy variable for if school is in session	0.56	0.50	0	1
$Wkend_t$	Dummy variable for weekend or holiday	0.30	0.46	0	1
$D16_t$	Dummy variable for year 2016	0.50	0.50	0	1
$Campus_i$	Dummy variable for station on campus	0.36	0.48	0	1
$NearbySt_i$	Number of stations within 500 meters	1.45	1.37	0	4
$WalkScore_i$	Walk Score (0-100 index)	75	22	39	96
$BikeScore_i$	Bike Score (0-100 index)	89	4.5	81	94
$PopDen_i$	Population density (per square mile) within quarter mile of station	5,669	2,186	2,807	10,163
$Capacity_{it}$	Number of docks at station	15.7	5.4	9	30

It is hypothesized that ridership will increase as the amount of daylight in the day increases. It is also expected that ridership is significantly higher during spring and fall semesters, compared to the summer, and lower on the weekends. The weekend variable also includes school holidays. The dummy variable for the year 2016 will show if ridership declined in 2016 after accounting for all other variables.

The Walk Score and Bike Score for each location were obtained from the Walk Score (2017) website. Walk Score measures the walkability of a location based on the distance to different types of amenities and the pedestrian friendliness as determined by metrics such as block length and intersection density, while Bike Score measures whether an area is good for biking based on bicycle infrastructure, topography, road connectivity, and destinations (Walk Score 2017). Bike share usage is expected to be greater at stations that are more pedestrian and bicycle friendly, as well as areas with greater population density. Population density was measured using 2010 Census data for Census blocks within a quarter mile of the station. Ridership at a station is also expected to be higher if there is a greater number of stations within a short distance or if the station has a higher number of docks.

The model also includes a number of interaction variables between the campus dummy variable and the weather, daylight, and temporal variables. The intent is to determine if the weather, daylight, and temporal variables have different impacts on campus stations as compared to the non-campus stations.

The model uses panel data, with data for 11 stations over 446 days. Results were estimated using a one-way random effects model using the Panel procedure in SAS 9.4. Since some stations had no trips on some days, the dependent variable was transformed to $\ln(R_{it}+1)$.

6.5.2 Results

Results are shown in Table 6.9. The estimated parameters show the percentage change in ridership given a one-unit increase in the variable. The weather variables are all statistically significant at the 1% level with the expected signs, as is the variable for daylight time. The results confirm that temperature has a quadratic relationship with ridership, as shown in Figure 6.11. At higher temperatures, the impacts of temperature changes on ridership diminish, and ridership begins to decrease when temperatures exceed 81 degrees. Figure 6.12 plots the percentage change in ridership that would result from a one-degree increase in temperature, at different temperature levels. For example, if the temperature is 30 degrees, a one-degree increase would increase ridership by 5.4%; if the temperature is 60 degrees, a one-degree increase would increase ridership by 2.2%; and if the temperature is 90 degrees, a one-degree increase would decrease ridership by 0.9%. The results also show that precipitation and wind have negative effects on bike share use, as expected, and that ridership is higher when there are more hours of daylight.

The interaction variables for temperature and wind are insignificant, indicating that the impacts of these variables are similar for the campus and non-campus stations. On the other hand, the campus stations were found to be somewhat less sensitive to precipitation. Results also suggest that while the amount of daylight impacts use of downtown stations, it has almost no effect on ridership for the campus stations. Results show that daily ridership decreases by 5.2% at downtown stations and 3.2% at campus stations for every tenth of an inch of precipitation for the day; ridership decreases by 2.1% for every one-mile-per-hour increase in the day's average wind speed; and ridership increases 21% at downtown stations for every additional hour of daylight.

Table 6.9 Results from Bike Share Ridership Model

Variable	Parameter Estimate	Standard Error	p value
<i>Intercept</i>	-5.22	2.457	0.0338*
<i>Temp</i>	0.0844	0.0084	<.0001**
<i>Temp</i> ²	-0.0005	0.0001	<.0001**
<i>Precip</i>	-0.0515	0.0050	<.0001**
<i>Wind</i>	-0.0235	0.0029	<.0001**
<i>Daylight</i>	0.2100	0.0115	<.0001**
<i>School</i>	1.068	0.0421	<.0001**
<i>Wkend</i>	-0.0374	0.0276	0.1742
<i>D16</i>	-0.4568	0.0249	<.0001**
<i>Temp*Campus</i>	0.0093	0.0139	0.5055
<i>Temp</i> ² * <i>Campus</i>	-0.00003	0.0001	0.7855
<i>Precip*Campus</i>	0.0196	0.0082	0.0173*
<i>Wind*Campus</i>	0.0086	0.0049	0.0766
<i>Daylight*Campus</i>	-0.2031	0.0193	<.0001**
<i>School*Campus</i>	0.7761	0.0699	<.0001**
<i>Wkend*Campus</i>	-0.4800	0.0457	<.0001**
<i>D16*Campus</i>	0.0311	0.0444	0.4842
<i>Campus</i>	4.719	0.9463	<.0001**
<i>NearbySt</i>	0.1116	0.1251	0.3725
<i>WalkScore</i>	0.0074	0.0210	0.7226
<i>BikeScore</i>	-0.0133	0.0231	0.5647
<i>PopDen</i>	0.00008	0.00004	0.0521
<i>Capacity</i>	0.0312	0.0051	<.0001**
R ² = 0.4888			

*,** = significance at the 5%, 1% levels, respectively

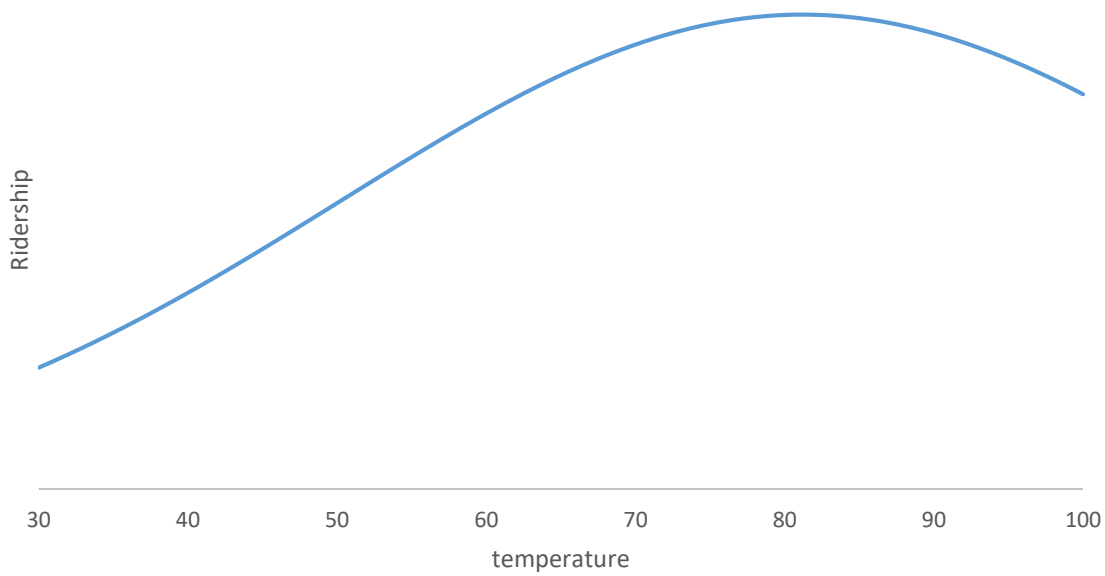


Figure 6.11 Quadratic Relationship between Temperature and Ridership

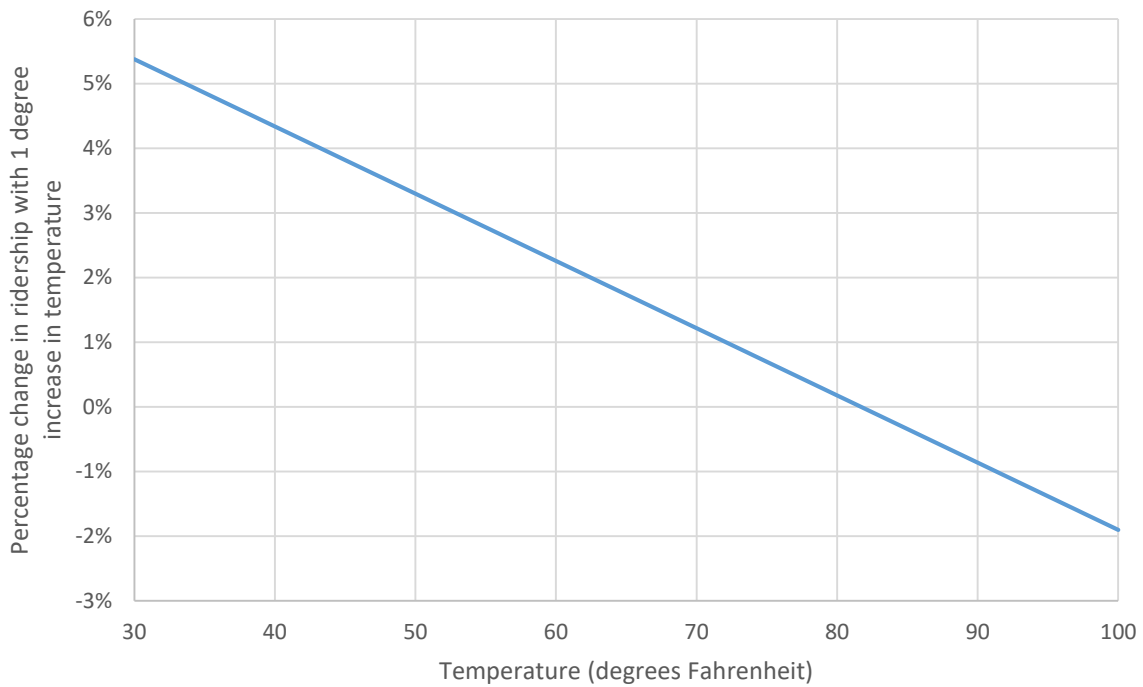


Figure 6.12 Impact of Temperature Changes on Ridership at Different Temperature Levels

Significantly higher ridership is found for all stations when school is in session, though the impact is found to be greater for the stations on campus. Results indicate that ridership is lower on the weekends for the stations on campus but not for the downtown stations, and the results show a significant decrease in ridership in 2016, with no significant difference between the campus and non-campus stations.

The campus variable is significant and large in magnitude, showing substantially greater usage at stations on campus. Population density is positive and marginally significant, and the capacity of the stations is shown to have a positive impact on usage, though this effect could be overestimated as station capacity was likely chosen based on expected demand. The other spatial variables were insignificant, likely because of the small number of stations with limited variation in spatial characteristics.

7. IMPACTS OF BIKE SHARE ON MODE SHARES, BICYCLE USE, AND MATBUS RIDERSHIP

The impact of the bike share program in Fargo on mode shares, overall bicycle use, and MATBUS ridership can be analyzed by comparing mode choice responses from survey 1 (before the launch) and survey 3 (one year after the launch), examining travel behavior responses from survey 2, and studying MATBUS ridership data.

7.1 Comparison of Survey 1 and Survey 3 Results

Sections 5.5, 5.6, and 5.7 provide information on student responses before the launch of the bike share program and again when the program was in its second year of operation. As discussed in these sections, the results suggest there may have been some changes in travel behavior and mode shares. Because survey 1 did not differentiate between winter and non-winter months regarding the mode used most often, direct comparisons between the two surveys are difficult, as the winter and non-winter responses would need to be averaged in survey 3. However, both surveys asked the same question regarding all modes served, allowing for direct comparison.

For University Village and Niskanen Apartments (UV/NA) students traveling to campus, there may be some decrease in personal bicycle use (though this cannot be concluded with any certainty based on the survey results), but overall bicycling to campus appears to be greater due to the significant use of the bike share program. Bike share use may be substituting for either walking or using MATBUS, which is the most commonly use mode for these trips. MATBUS use, according to survey results, is much lower in the months when bike share is in operation, but it is not clear from the responses if transit use is lower than it was prior to the implementation of bike share. In fact, almost all UV/NA respondents from survey 3 reported using MATBUS at least some of the time.

The bike share program would be expected to have a smaller impact on off-campus students traveling to campus, with the possible exception of students living downtown. Other off-campus students do not have access to the program for traveling to campus, because all stations are either on campus or downtown. Survey results suggest the program may have had a small negative impact on use of MATBUS by downtown students. In survey 1, 78% of downtown respondents reported using MATBUS to travel to campus at least some of the time, and in survey 3, the response decreased to 72%.

Bike share is popular for trips on campus. The use of bike share on campus is likely substituting for trips that would have been made either by walking, riding MATBUS, or using a personal bicycle. However, it is difficult to determine from the survey responses the impacts on each of these modes.

Regarding trips between campus and downtown, responses suggest there could be some decrease in the use of MATBUS. But, again, is it difficult to conclude with any certainty based solely on the responses to these surveys.

7.2 Summary of Survey 2 Results

Survey 2 directly asked bike share users if they are using MATBUS and other modes more or less often. About 5% of survey 2 respondents reported using MATBUS more because of bike share, but about 30% mentioned that their MATBUS use has decreased, suggesting an overall decrease in transit use (Figure 7.1). Also, interestingly, 30% of the respondents reported a decrease in their personal car use because of the availability of bike share. While close to half also reported a decrease in walking activity, about 50% felt that they have been receiving more exercise (with most of the remainder saying that they have been receiving about the same amount of exercise).

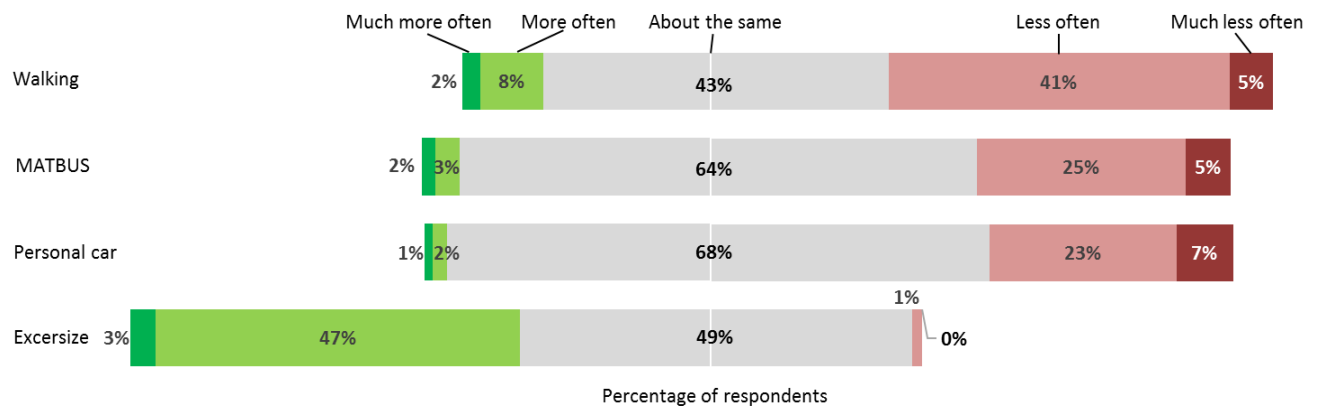


Figure 7.1 Effect of Great Rides Bike Share Program on Walking Activity, MATBUS Use, Personal Car Use, and Exercise Received

When respondents were asked how their bike share trips could be made if Great Rides Bike Share was not available, users most commonly mentioned walking (73%), followed by a personal vehicle (30%), or MATBUS (28%). Eleven percent of the respondents answered that they would not make the trip in the absence of bike share, which means there are exclusive trips being made because of the availability of the bike share program (Figure 7.2).

How would the bike share trip be made in the absence of Great Rides Bike Share?

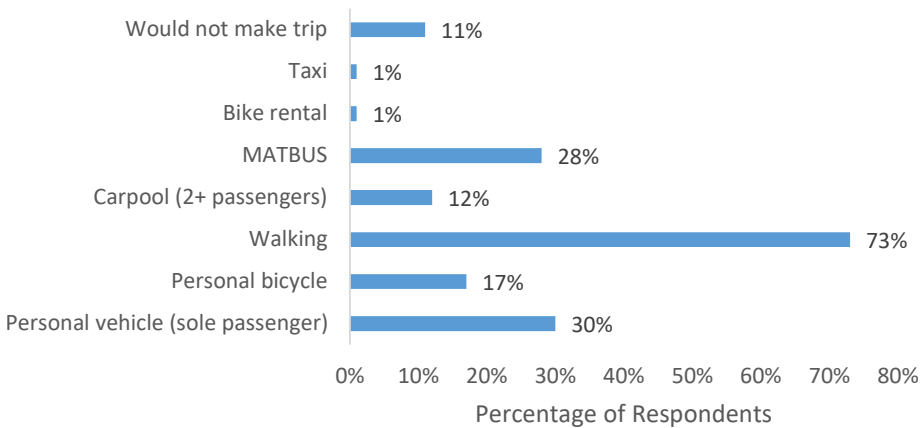


Figure 7.2 How Bike Share Trips could be made if Bike Share were not an Option

Responses from survey 2 suggest an overall increase in bicycling activity. Among survey 2 respondents, 79% were at least occasional bicycle users before the launch of the bike share program, and 86% reported using bike share after the program launched. An analysis of respondents' previous bicycling frequency and bike share frequency is illustrated in Figure 7.3. The figure shows that the percentage of people who never bicycled or bicycled less than once per month decreased after the launch, and the percentage of people who bicycled more frequently increased. Overall, the bicycle riding profile of the survey 2 respondents moved toward more frequent bicycling.

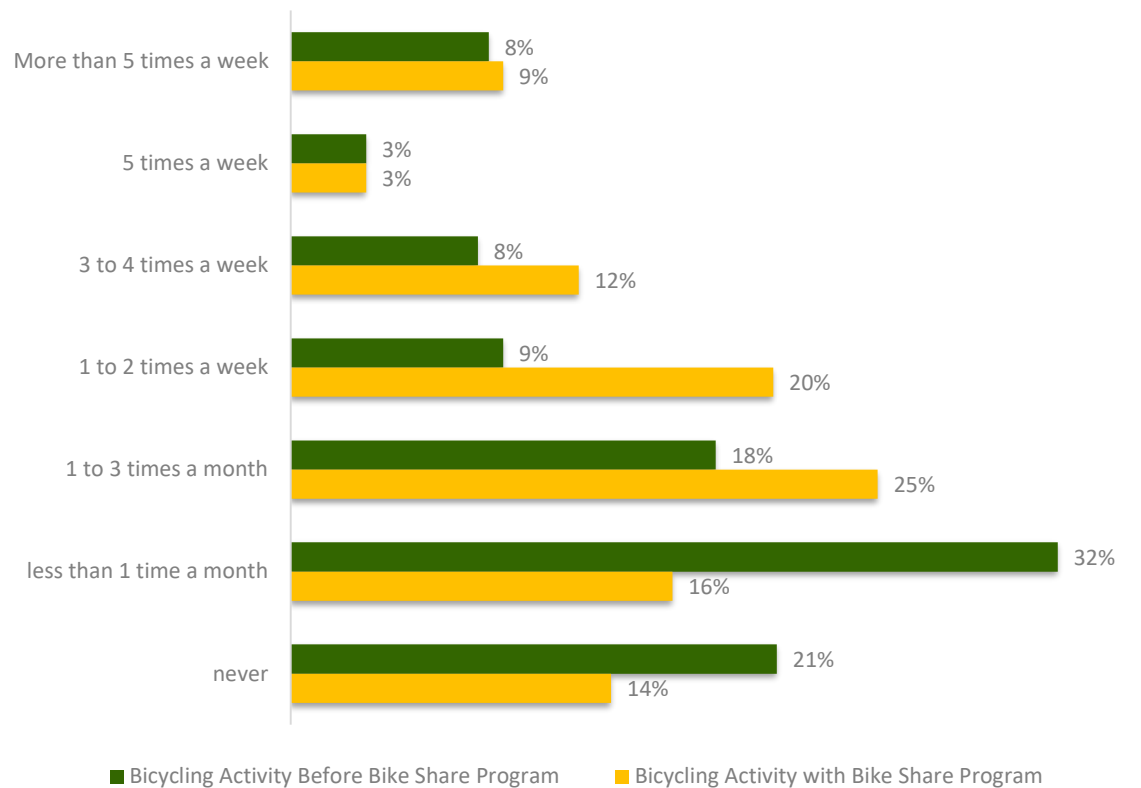


Figure 7.3 Bicycle Riding Activity of Great Rides Bike Share Users

Based on average previous bicycle trips (or bike share trips) made by each survey respondent, respondents were categorized as regular bicyclists – those who make an average of more than three trips per week; occasional bicyclists – those who make less than three trips per week and at least 1 trip per month; infrequent bicyclists – those who make less than 1 trip per month, and never bicyclists – those who have no bicycle activity. The distribution of survey 2 respondents before the launch was as follows: 20% regular bicyclists, 27% occasional bicyclists, 33% infrequent bicyclists, and 21% who never bicycled. These respondents then were asked how often they use the bike share program, and the results can be categorized as follows: 25% regular bike share users, 45% occasional bike share users, 16% infrequent bike share users, and 14% never use bike share. Results show that the percentage of regular and occasional bicycling increased, while the percentage of infrequent and never bicycling decreased.

Further analysis shows that most (87%) of the respondents who never bicycled before have become either regular bike share users (23%), occasional bike share users (44%), or infrequent bike share users (19%), showing that the Great Rides Bike Share program provided an opportunity to promote bicycling in Fargo (Figure 7.4). Similarly, almost all other categories of previous bicyclists have started using bike share regularly or occasionally.

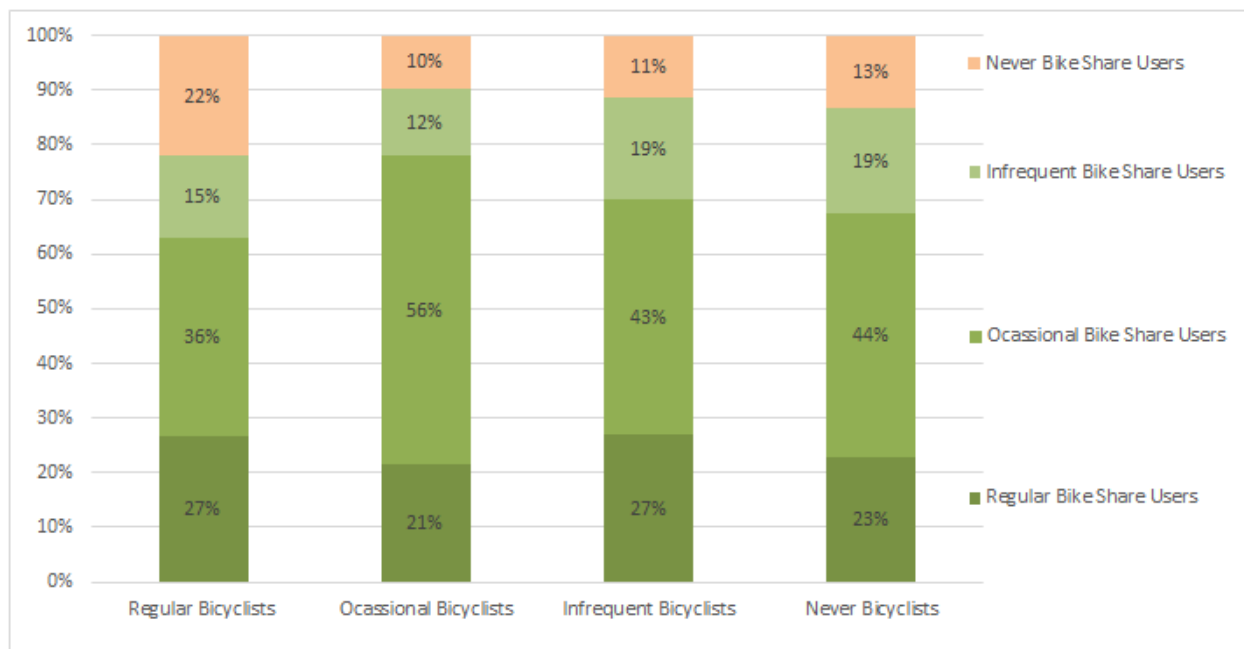


Figure 7.4 Previous Bicyclists who are Great Rides Bike Share Users

7.3 Analysis of MATBUS Ridership Data

The survey results suggest a possible negative impact on MATBUS ridership following the introduction of the bike share program. However, based solely on the survey data, it is difficult to determine if this effect is real or to estimate its magnitude. Therefore, to better analyze the possible impact of the bike share program on transit ridership, MATBUS ridership data for routes heavily used by NDSU students were obtained and analyzed. These routes overlap many of the bike share stations.

MATBUS routes 31, 32 (32E & 32W), 33, 34, and 35 were selected for studying the bike share program's impact on MATBUS ridership. These routes operate Monday-Friday during the NDSU academic year, including finals week. MATBUS routes 31, 32E, 32W, and 34 operate during the day in and around NDSU campus. Figure 7.5 illustrates each of these routes. MATBUS route 35 operates in and around NDSU campus in the evenings, as shown in Figure 7.6. MATBUS route 33 provides service between NDSU campus and downtown Fargo, specifically to the NDSU buildings downtown. Figure 7.7 illustrates route 33 among other MATBUS routes.

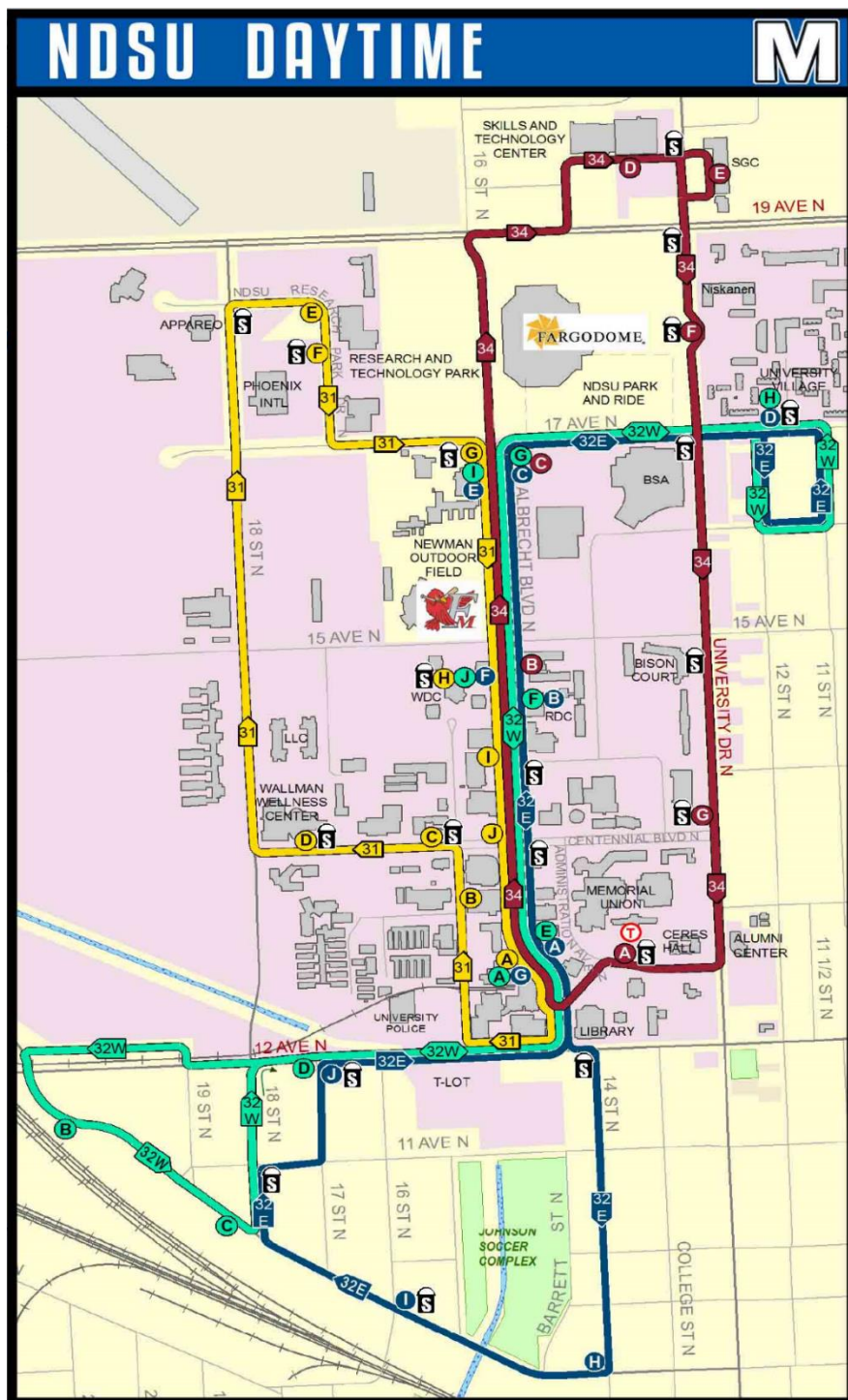


Figure 7.5 MATBUS Daytime Routes 31, 32E, 32W, and 34 in and around NDSU Campus
Source: <http://www.matbus.com/TimeTables/MATBUSMap.jpg>

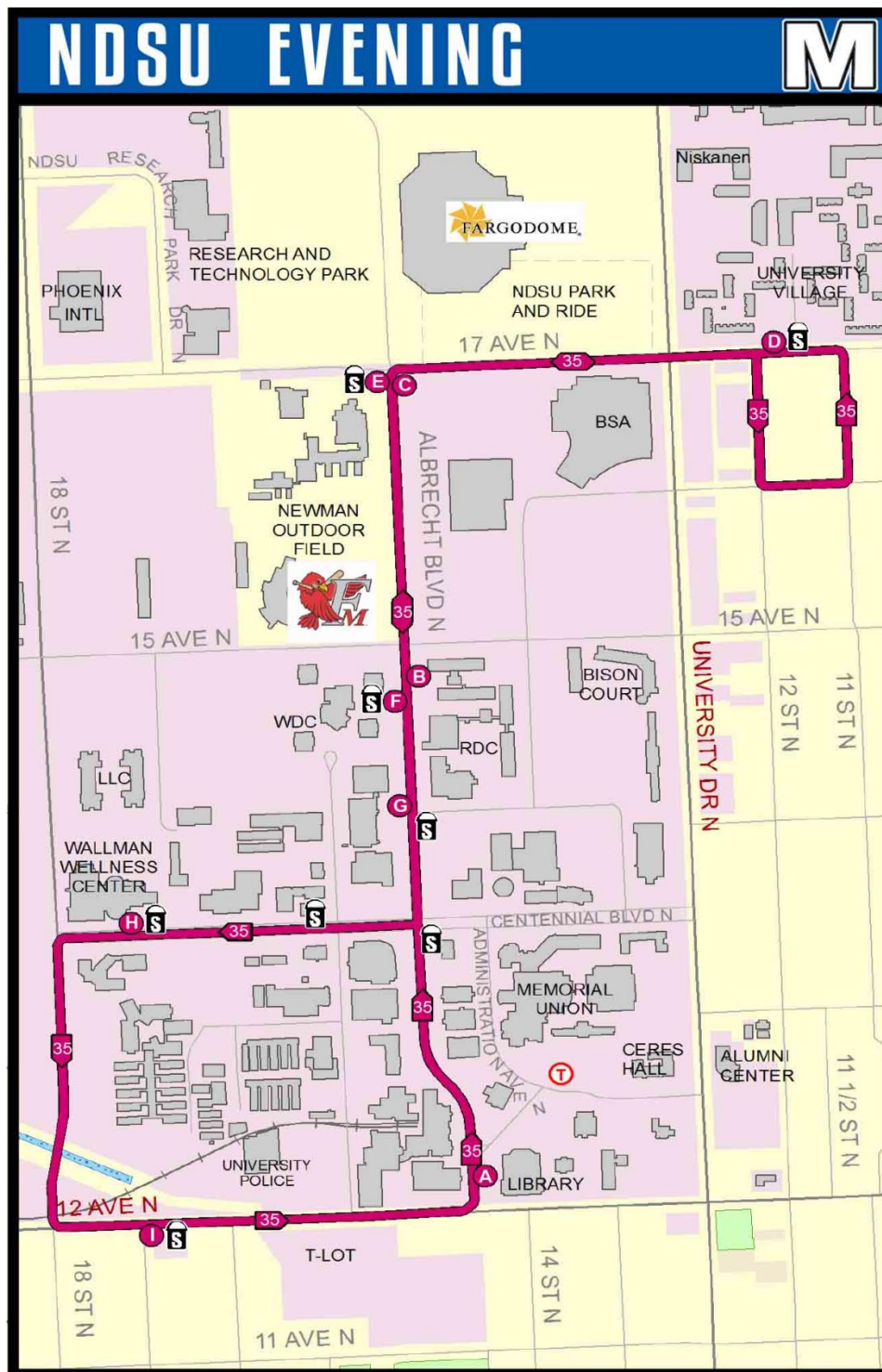


Figure 7.6 MATBUS Evening Route 35

Source: <http://www.matbus.com/TimeTables/MATBUSMap.jpg>

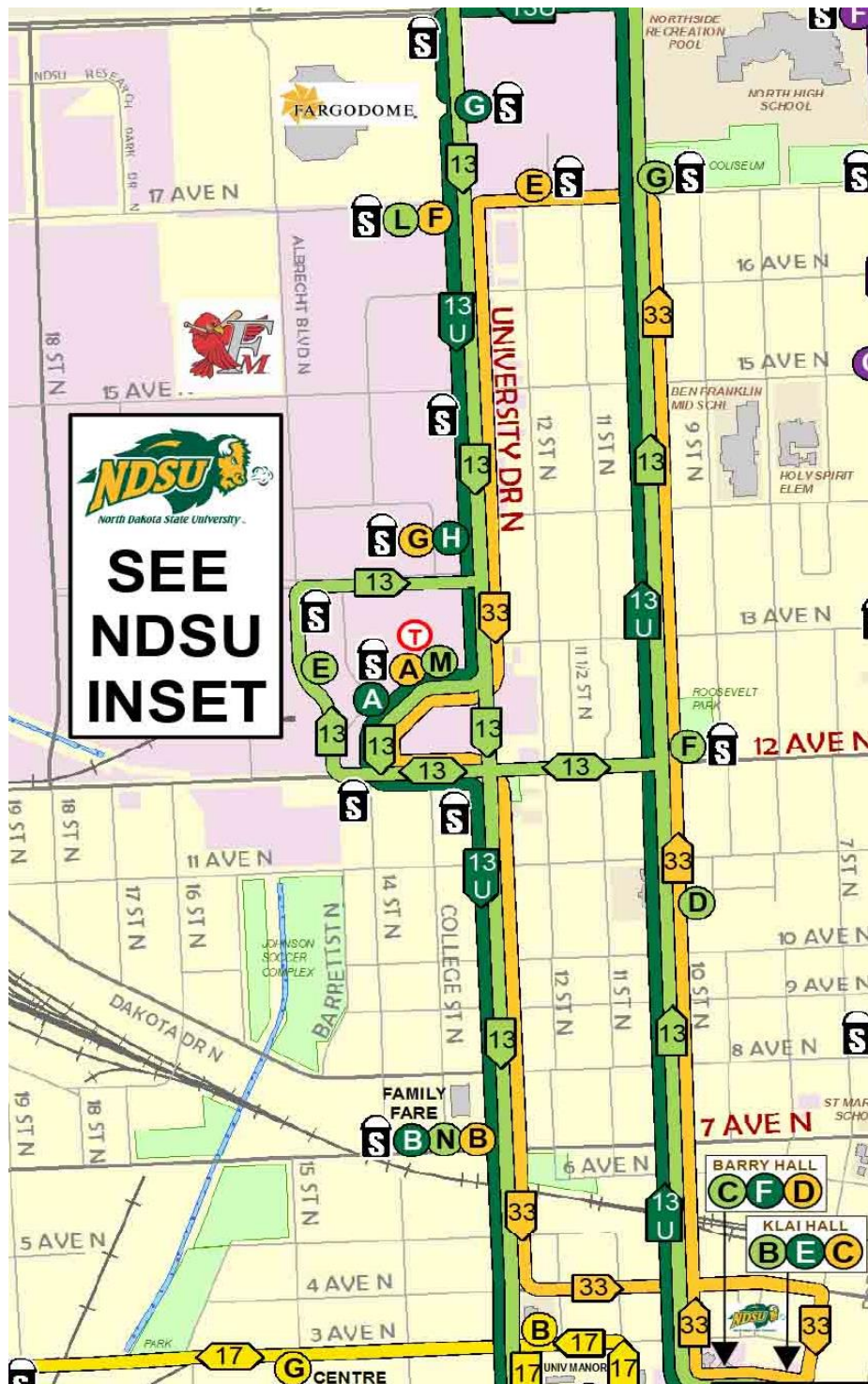


Figure 7.7 MATBUS Route 33 between NDSU Campus and Downtown Fargo
Source: <http://www.matbus.com/TimeTables/MATBUSMap.jpg>

7.3.1 Trends in NDSU MATBUS Ridership

MATBUS provided daily ridership data for these routes for 2014 through 2016. The 2014 data shows ridership before the bike share launch, while the 2015 and 2016 data represent MATBUS ridership during the first and second year of bike share operations.

Table 7.1 summarizes the service span, frequency, and ridership of all the routes selected for the study. All but route 34 experienced a reduction in ridership from 2014 to 2016.

Table 7.1 Selected MATBUS Routes: Operating Frequency, Span of Service, and Ridership Data for 2014, 2015, and 2016

Route	Service Days	Service Frequency	Total Trips			2015: Reduction in Total Trips when compared to 2014	2016: Reduction in Total Trips when compared to 2014
			2014	2015	2016		
31	M-F	7:25am-7:40pm, every 15 minutes.	62,536	52,809	41,273	-15.6%	-34.0%
32E	M-F	7:25am-5:55pm, every 30 minutes.					
32W	M-F	7:25am-9:55am & 3:25pm-5:55pm, every 30 minutes.	170,299	194,529	157,576	14.2%	-7.5%
33	M-F	6:55am-8:43am, every 12 minutes; 8:43am-10:27am, every 8 minutes; 10:27am-3:03pm, every 6 minutes; 3:03pm-6:03pm, every 12 minutes.	243,454	226,520	207,066	-7.0%	-14.9%
34	M-F	7:44am-4:44pm, every 20 minutes.	89,621	73,331	96,302	-18.2%	7.5%
35	M-F	8pm-10pm, every 20 minutes.	9,769	7,486	4,883	-23.4%	-50.0%
Total			575,679	554,675	507,100	-3.6%	-11.9%

Route 31, which operates from 7:25 a.m. to 7:40 p.m. with 15-minute headways, experienced a 16% reduction in ridership in 2015 and 22% reduction in 2016, resulting in a 34% reduction from 2014 to 2016.

Route 32 had a 14% increase in ridership in 2015, which was likely due to an increase in service provided. In August 2015, MATBUS added route 34W and renamed existing route 32 as 32E. Route 32E operates in and around the NDSU campus from 7:25 a.m. to 5:55 p.m. with 30-minute headways, and route 32W operates in and around campus from 7:25 a.m. to 9:55 a.m. and 3:25 p.m. to 5:55 p.m., with 30-minute headways. After the initial increase, ridership dropped 20% in 2016.

Route 33 operates between NDSU campus and downtown Fargo during the day with 12-minute headways from 6:55 a.m. to 8:43 a.m., 8-minute headways from 8:43 a.m. to 10:27 a.m., 6-minute headways from 10:27 a.m. to 3:03 p.m., and 12-minute headways from 3:03 p.m. to 6:03 p.m. Ridership on route 33 declined 7% in 2015 and 9% in 2016.

Route 34 is the only route that experienced an increase in ridership in 2016. This route, which operates from 7:44 a.m. to 4:44 p.m. with 20-minute headways, had a 31% increase in ridership in 2016, but this was preceded by an 18% decrease in 2015.

Route 35 operates during evenings in and around NDSU campus from 8:00 p.m. to 10:00 p.m. with 20-minute headways. Ridership on this route decreased by 50% from 2014 to 2016.

Figure 7.8 shows monthly ridership trends for the five routes for 2014-2016. Routes 32 and 33 are the most heavily used among the five NDSU routes, accounting for about 70-75% of ridership, so trends on these routes have the greatest impact on total ridership. Overall, ridership on the five routes decreased 4% in 2015 and 9% in 2016, and there was a 12% decrease from 2014 to 2016.

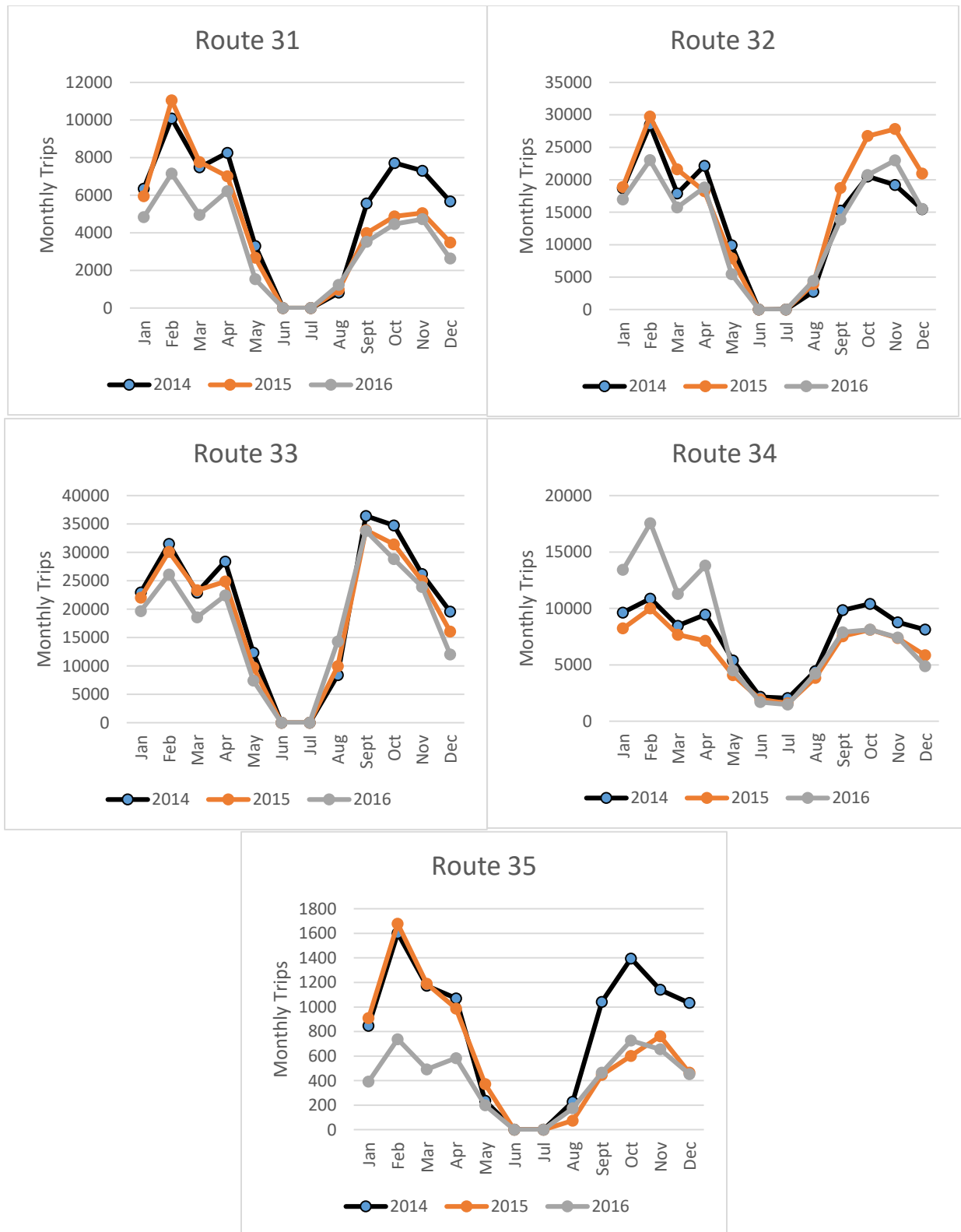


Figure 7.8 MATBUS Monthly Ridership for Routes 31, 32, 33, 34, and 35 for Years 2014, 2015, and 2016

Given that these routes operate only during the academic year and are closed on weekends, school holidays, and school breaks, there could be a slight variation from year to year in the number of days in which service was provided. Therefore, a proper analysis requires examining the average number of trips per day, excluding days that MATBUS did not provide service. Table 7.2 shows average daily ridership for each route and overall ridership for 2014-2016, excluding days with no service. Overall, ridership on the NDSU routes decreased 3% in 2015, 8% in 2016, and 11% from 2014 to 2016.

Table 7.2 Average Daily Ridership on NDSU MATBUS Routes, 2014-2016

Route	2014	2015	2016	Change 2014-15	Change 2015-16	Change 2014-16
31	391	328	253	-16%	-23%	-35%
32	1,064	1,201	967	13%	-19%	-9%
33	1,494	1,390	1,278	-7%	-8%	-14%
34	357	291	400	-19%	37%	12%
35	68	51	32	-26%	-36%	-53%
Five-route total	3,473	3,355	3,092	-3%	-8%	-11%

7.3.2 Potential Causes of MATBUS Ridership Decrease

In addition to the introduction of the bike share program, a number of other factors could also be contributing to the decline in bus ridership, such as a drop in gasoline prices, a small decline in student enrollment, and service cuts.

The Midwest regular conventional retail gasoline price averaged \$3.28 per gallon in 2014 (peaking at over \$3.60 before dropping at the end of the year), \$2.31 per gallon in 2015, and \$2.04 per gallon in 2016 (Energy Information Administration 2017). Previous research, including an analysis of MATBUS ridership, has shown that gasoline prices have an effect on bus ridership (Mattson 2008). However, gasoline prices might not affect the types of trips served by the NDSU MATBUS routes. Many of these are short-distance trips that might not otherwise be made by car. On the other hand, college students could be particularly sensitive to the price of gasoline, and lower prices could lead to a greater percentage of students having a vehicle on campus, which could then lead to a greater number of trips made by car. In fact, survey results and parking permit data show an increase in the number students with access to a vehicle.

NDSU enrollment has also declined slightly during this period, which could be a minor contributor. Fall enrollment decreased 1.6% in 2015, 0.6% in 2016, and 2.1% from 2014 (14,747 students) to 2016 (14,432 students).

Part of the ridership decrease in 2016 is likely due to MATBUS service cuts on these routes. Because of necessary budget cuts, MATBUS reduced total revenue hours of service on the NDSU routes by 17%, starting in August 2016.

Significant road construction throughout the metro area has also likely had a negative impact on ridership the last two years. This construction has led to route detours and increased congestion,

which has made it difficult for services to operate on time. Less reliable service results in a loss of some riders.

Part of the decrease in ridership numbers could actually be due to measurement error rather than reduced ridership. NDSU students ride MATBUS fare-free by swiping their student ID card on the farebox when they board. However, to speed up the boarding process on the five NDSU routes, drivers do not require students to swipe their cards. Drivers count the number of passengers boarding and manually enter the information, creating the potential for error. MATBUS has experienced significant turnover in drivers recently, resulting in less experienced drivers who could be more likely to incorrectly input, or fail to input, boarding numbers.

Note that the reduction in ridership has not been limited to the five NDSU routes (Figure 7.9). Total ridership on MATBUS routes in Fargo decreased 8% in 2015 (10% on the non-NDSU routes), 7% in 2016 (6% on the non-NDSU routes), and 15% from 2014 to 2016 (16% on the non-NDSU routes). The decrease in ridership on the NDSU routes was less than the system-wide decrease in 2015, due solely to the increased ridership on route 32, and the decrease in 2016 was slightly higher on the NDSU routes than system-wide.

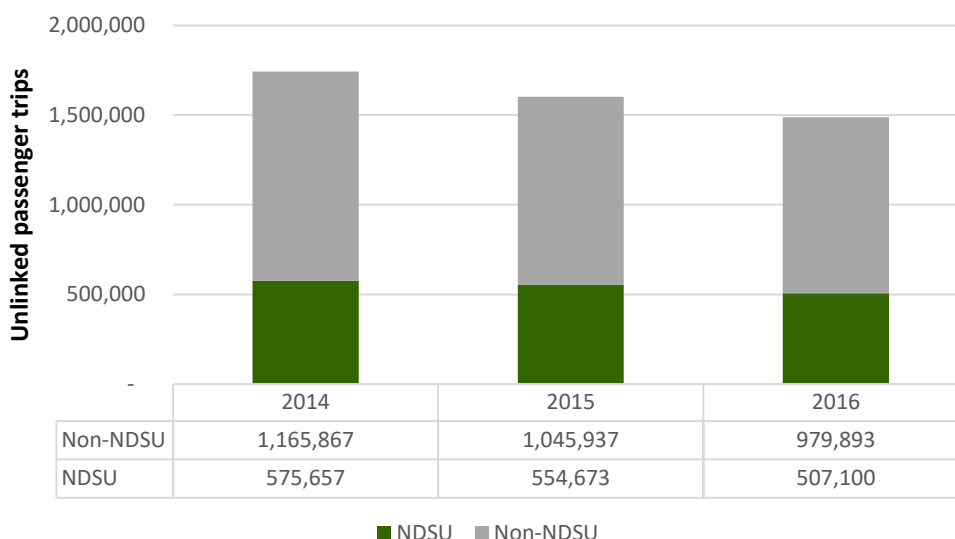


Figure 7.9 Fargo MATBUS Ridership, NDSU and Non-NDSU Routes, 2014-2016

All of these factors are important to consider when examining the impact of the bike share program on bus ridership. If the bike share program were to have any noticeable impact on bus ridership, it would be on the five NDSU routes, because this is where the large majority of bike share trips occur. (Route 13 could also be impacted since it provides service between NDSU and downtown, but it was not included in the analysis. There could also be minor impacts on some downtown routes, but they would likely be negligible.)

7.3.3 Possible Impacts of Great Rides Bike Share Use on MATBUS Ridership

Table 7.3 shows total average daily ridership on the five NDSU routes by month for 2014-2016. In 2015, the decrease in ridership was greatest during the months of April, May, and August, by a significant margin. During the other months, ridership either decreased slightly, stayed the

same, or increased. This suggests that the bike share program could have been a primary contributor to the decrease in bus ridership because students heavily use the bike share program these months. In 2016, however, ridership decreased throughout the year. Some of the largest decreases, in fact, were during the winter months when bike share is not available, suggesting bike share was not responsible for the decrease in 2016. Some of the decrease toward the end of the year could have been due to service cuts, but there were also significant declines in February and March, before the service cut.

Table 7.3 Average Daily Ridership on NDSU MATBUS Routes by Month, 2014-2016

	2014	2015	2016	Change 2014-15	Change 2015-16	Change 2014-16
January	4,100	3,952	3,913	-4%	-1%	-5%
February	4,343	4,346	3,729	0%	-14%	-14%
March	3,817	3,589	3,158	-6%	-12%	-17%
April	3,463	2,905	2,945	-16%	1%	-15%
May	2,514	2,167	1,826	-14%	-16%	-27%
June	NA	NA	NA	NA	NA	NA
July	NA	NA	NA	NA	NA	NA
August	2,962	2,475	2,905	-16%	17%	-2%
September	3,095	3,078	2,836	-1%	-8%	-8%
October	3,251	3,262	2,994	0%	-8%	-8%
November	3,680	3,664	3,143	0%	-14%	-15%
December	3,073	3,308	2,958	8%	-11%	-4%

Note: Excludes days in which service was provided only on route 34.

Bike share may have had some negative effect on bus ridership, especially in 2015 when the program first launched and experienced substantial success. However, other factors suggest it is only one of a number of possible contributors, such as:

- MATBUS ridership decreased at the greatest rate in 2016 even though bike share ridership decreased 29% in 2016.
- In 2016, bus ridership decreased during winter months when bike share was not available.
- Ridership decreased by similar rates citywide, including areas of the city that do not have bike share stations.
- Low gasoline prices and unreliable service caused by construction projects could have depressed ridership citywide.
- Decreased student enrollment and 2016 service cuts could have impacted ridership on NDSU routes.

A regression model was developed to attempt to isolate the impact of the bike share program on bus ridership. The model is described in the next section.

7.3.4 Modeling the Impact of Bike Share Use on MATBUS Ridership

To estimate the impact of bike share use on MATBUS ridership, a regression model was developed that estimated bus ridership on the five-NDSU routes as a function of bike share use, gasoline prices, and temporal variables, using daily ridership data for 2014-2016. The model used data only for days in which NDSU was in session. Therefore, weekends, holidays, school breaks, and the summer period were excluded.

Bus ridership may be greater during some days of the week due to differences in class schedules and student travel behavior, and there may also be seasonal variations in bus use. Therefore, the model includes dummy variables for day of the week and month of the year to account for these variations in ridership. Dummy variables were included for Monday, Tuesday, Wednesday, and Thursday. Friday was used as the base, and variables were excluded for Saturday and Sunday because no service was provided on those days, and therefore no weekend data were used. Monthly dummy variables were included for each month except June and July, because no service was provided during these months, and December, which was used as the base.

To capture year-to-variations caused by service changes, changes in student enrollment, or other factors, dummy variables were included for academic years. The model was based on academic years instead of calendar years because service changes were implemented at the beginning of the academic year. This includes the addition of service on route 32 at the beginning of the 2015/2016 academic year and the service cuts for 2016/17. The academic year could also capture changes in student enrollment. The variable for 2013/14 was excluded and used as the base. Since the data run through December 2016, the 2016/17 variable represents just the first half of the academic year.

Because the dependent variable is represented by count data, a Poisson regression was used. The dependent variable, bus trips, is therefore in log form. The number of bike trips per day was divided by 100 to simplify interpretation of results. Gasoline price data were also transformed. The gasoline price was represented in log form, and because there is often a lagged effect, as travelers do not necessarily response immediately to changes in price, the three-month moving average price was used.

Results show that bike share use does have a negative effect on ridership for the NDSU bus routes (Table 7.4). The estimated coefficient -0.0045 indicates that every 100 bike share trips reduce bus ridership by 0.45%. During this period, MATBUS averaged 3,327 trips per day on the five routes, so a 0.45% reduction equates to a loss of 15 bus trips for every 100 bike share trips. As shown in Section 6, bike share trips tended to average between 500 and 1,000 trips per day during the spring and fall months of 2015 and 2016, which would result in a 2%-5% reduction in bus trips during those months.

Table 7.4 Poisson Regression Results: Impacts of Bike Share Use on MATBUS Ridership for NDSU Routes

Variable	Parameter estimate	p value
Intercept	8.6363	<.0001**
Bike share trips	-0.0045	<.0001**
Ln(Gas price)	0.1180	<.0001**
Monday	0.2142	<.0001**
Tuesday	0.2753	<.0001**
Wednesday	0.2813	<.0001**
Thursday	0.2159	<.0001**
January	0.1784	<.0001**
February	0.2206	<.0001**
March	0.0618	<.0001**
April	-0.0462	<.0001**
May	-0.3871	<.0001**
August	-0.0568	<.0001**
September	-0.0201	0.0002**
October	0.0085	0.0553*
November	0.0747	<.0001**
Year 2014/15	-0.0487	<.0001**
Year 2015/16	-0.0501	0.0002**
Year 2016/17	-0.1154	<.0001**

n = 485

**significant at the 1% level, *significant at the 10% level

The results may vary between routes. Route 33 may be less impacted by the bike share program because it serves longer-distance trips that are not as frequently made by bike share, and the bus route provides convenient, high-frequency service. Other routes that have lower frequency and serve trips more easily made by bike share are more likely to be affected.

As discussed in the literature review, Martin and Shaheen (2014) found that bike-sharing may be more complementary to public transit in small- and mid-size communities and can be a substitute to public transit in larger cities, which might contradict our finding of a substitute relationship in a smaller city. However, their reasoning was that shifts away from transit were found to be most prominent in areas with high population density where bike-sharing offers faster, cheaper, and more direct connections for short trips that were previously made by transit, whereas complementary relationships were found in lower-density areas where bike share bridges a gap in the transportation network. In this sense, the bike share program on the NDSU campus is more similar to a system in a large urban core in that it offers fast, cheap (free for students), and more direct connections for trips that previously could have been made by transit.

The regression model accounts for seasonal and day-of-week variation in MATBUS ridership. The results show significant day-of-week variation, with ridership lowest on Fridays and highest on Tuesdays and Wednesdays. Seasonal variation also exists, with ridership tending to be greater in January and February and lowest in May, after accounting for bike share use. This result is consistent with survey results that show students consider the weather when choosing their mode of travel and are more likely to use the bus in winter months, preferring to ride the bus instead of walking or riding bike in cold weather.

While the results suggest that the bike share program has had some negative effect on bus ridership, it does not account for all, or even a majority, of the decline. It may account for a decrease in 2015 but not the larger decline in 2016. Part of the decrease could be attributed to lower gasoline prices. The estimated coefficient of 0.118 indicates that a 1% decrease in the price of gasoline results in a 0.118% decrease in bus ridership. The result is fairly inelastic, suggesting the response to gasoline prices is small. Gasoline prices decreased 38% from 2014 to 2016, which, according to these results, would account for a 4.5% reduction in bus ridership.

Beyond bike share use and gasoline prices, the results suggest a downward trend in ridership attributable to other factors. The dummy variables for 2014/15, 2015/16, and 2016/17 are all negative and significant and increasing in magnitude from year to year, indicating a downward trend. The differences between 2014/15 and 2015/16 were minor, suggesting that there was little change in overall ridership between these two academic years that could be attributable to factors other than bike share use and gasoline prices. However, there was a much larger decrease in 2016/17 that was likely due to the reduction in service levels. Overall, results for the yearly dummy variables indicate that, compared to 2013/14, ridership was 5% lower in 2014/15, 5% lower in 2015/16, and 11% lower in 2016/17 because of factors other than the bike share program or gasoline prices.

The results indicate that, while the bike share program does have a negative effect on bus ridership during the spring and fall months when the program is most heavily used, it appears to be a minor contributor to the overall decrease in bus ridership during the 2014-16 period.

8. EXPANSION OPPORTUNITIES

Given the success of Great Rides Bike Share during its first two years of operation, the system could potentially expand to serve a greater number of people. Hauf and Farnsworth (2016) conducted a study to examine the potential of expanding Great Rides Bike Share into Moorhead, Minnesota. Moorhead has the potential to support bike share, as its downtown is directly adjacent to downtown Fargo, and it has two higher education institutions, Minnesota State University Moorhead (MSUM) and Concordia College, that are also within bicycling distance of downtown. These locations are already within two miles of existing bike share stations in downtown Fargo.

Hauf and Farnsworth (2016) recommended two primary sites in downtown Moorhead (the Moorhead Center Mall and Dairy Queen) as top priorities for initial expansion. The study also recommended MSUM and Concordia College as secondary sites. Given that initial success of Great Rides has largely been driven by college students, expansion into Moorhead is most likely to be successful if it serves MSUM and Concordia College. The authors of the study noted that the long-term success of Great Rides in Moorhead will depend on cooperation with these two institutions and that it takes time to develop the relationships and systems necessary for success.

While expansion into Moorhead is a priority for Great Rides, there may also be opportunities to expand in Fargo. Survey 3 asked NDSU students where they would like to see new bike share stations added (Figure 8.1). Most responses tended to identify other locations on campus or near campus. Figure 8.2 maps locations of potential stations that were most frequently identified by survey respondents.

The most frequent response was the T-Lofts Apartments/T-Lot. The T-Lot is a large parking lot on the south edge of campus, and the T-Lofts is an adjacent apartment building. The area is also near a number of other apartment buildings and rental properties. A bike share station at this location could serve students living in this area just south of campus as well as those parking at the T-Lot. The location is close enough to existing stations on campus but far enough away so that it is not duplicative.

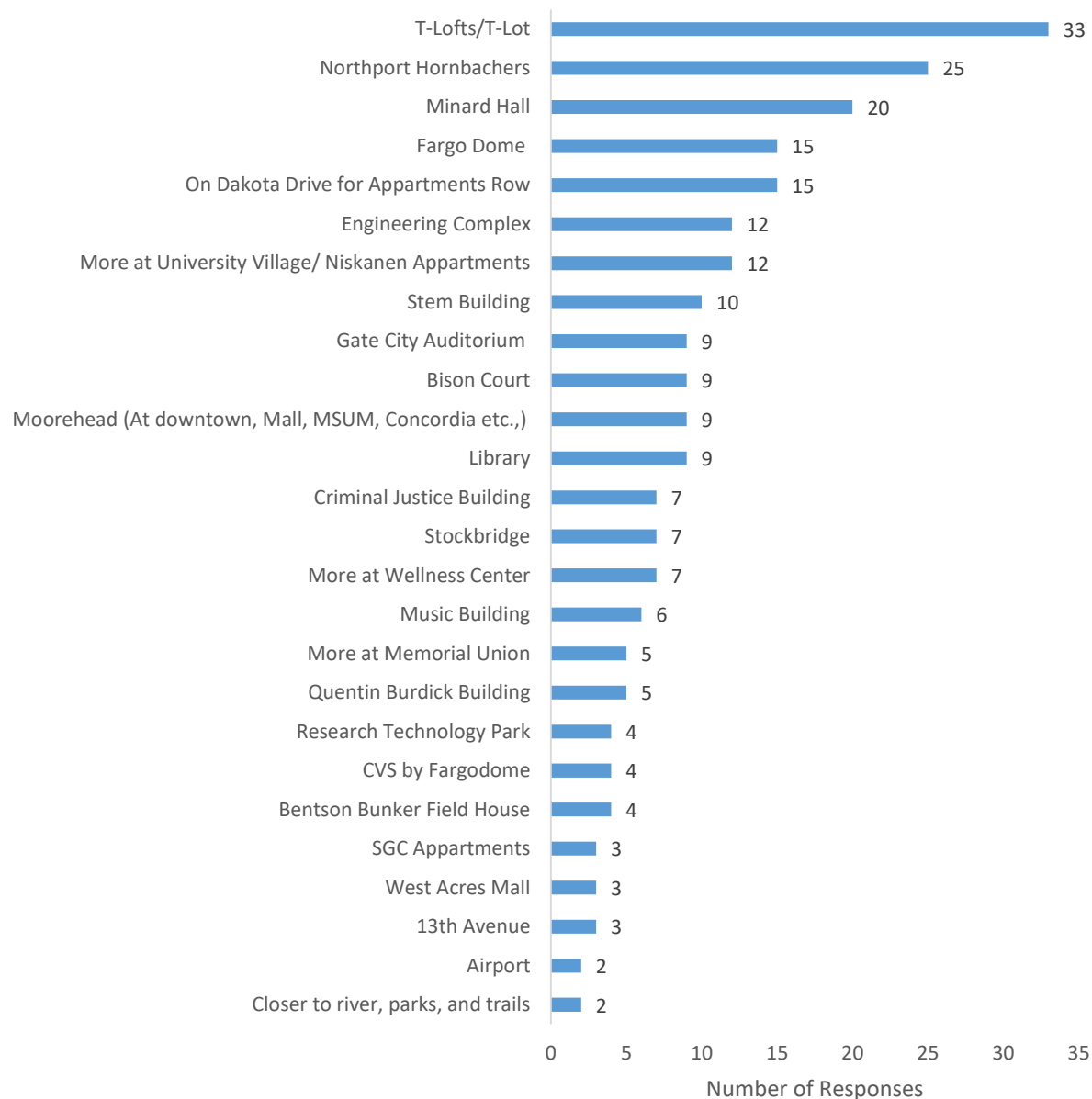


Figure 8.1 NDSU Student Responses Requesting Additional Bike Share Stations

The Northport Hornbachers grocery store was the second most cited location for an additional station. This is a grocery store in a shopping area northwest of campus. It is about one mile from the University Village bike share station, the closest existing station. Its distance from existing stations could cause it to be less successful. The National Association of City Transportation Officials (NACTO) (2015) concludes a high density of stations is needed to be successful. It recommends bike share stations should be placed no more than 1,000 feet apart across the entire program area. In reality, many bike share programs have a lower station density than what NACTO recommends, and the stations in Fargo are located more than 1,000 feet apart. However, the distance to the Northport Hornbachers site, without the addition of other stations in-between, would limit its usefulness.



Figure 8.2 NDSU Students Preferences for Additional Bike Share Station Locations

Popular choices on campus for additional stations were Minard Hall, the Engineering Complex, the STEM building, and Gate City Auditorium. These locations would all likely support a number of trips, but many are also near existing stations. For example, the distance from the existing Memorial Union station to proposed station at Minard Hall, the Library, the STEM building, and the Engineering Complex are about 550 feet, 530 feet, 400 feet, and 900 feet, respectively. All of these locations are within a 3-minute walking distance of the Memorial Union station, and only the Engineering Complex might be considered far away enough to be considered. A station at Minard Hall could possibly be considered because it is a popular destination, it is near a bus stop, and it could relieve pressure from the Memorial Union station. A station on the east side of campus near the Bison Court and Stockbridge residence halls could also be potentially justified, as they are about 0.3 miles from the High Rise Complex station.

Other popular locations near campus included the FargoDome and Dakota Drive. The FargoDome is adjacent to campus on the north side. A bike share station at this location could serve students or staff who park at the FargoDome and currently either walk or take the bus into campus. It could also potentially serve trips to the FargoDome or surrounding sporting venues for events. A bike share station on Dakota Drive could serve a number of students who live just south of campus. A number of apartment buildings are located on Dakota Drive and surrounding blocks. The area, just a few blocks south of campus, has a high density of college students who currently either walk or ride the bus for most trips to campus.

Some students also recommended adding stations in Moorhead. Only a small percentage of NDSU students live in Moorhead, so it is not surprising that they were most likely to suggest additional stations on NDSU campus or in other locations near campus. However, in addition to the locations mentioned, they were most likely to recommend expansion into Moorhead, either downtown or at the colleges and universities. No students recommended additional stations in downtown Fargo, and very few suggested stations elsewhere in the community.

9. LIVABILITY BENEFITS OF GREAT RIDES BIKE SHARE

The U.S. Department of Housing and Urban Development, U.S. Department of Transportation (DOT), and the U.S. Environmental Protection Agency (EPA) incorporated six principles of livability to help communities improve access to affordable housing, increase transportation options, and reduce transportation costs while protecting the environment (Livability 101: Six Principles of Livability, 2016). The six livability principles are: 1) provide more transportation choices, 2) expand location and energy efficient housing choices, 3) Improve economic competitiveness of neighborhoods, 4) target federal funding toward existing communities, 5) align federal policies and funding, and 6) enhance the unique characteristics of all communities (Livability 101: Six Principles of Livability, 2016).

The first livability principle relates directly towards transportation and how transportation can contribute to community livability. This principle is to “provide more transportation choices to decrease household transportation costs, reduce our dependence on oil, improve air quality, and promote public health” (Livability 101: Six Principles of Livability, 2016). This study examines if the new Great Rides Bike Share program in Fargo, ND, fulfills the first livability principle towards providing transportation choice for a sustainable and livable community.

In survey 3, conducted with NDSU students, 79% of the respondents mentioned that, with the availability of Great Rides Bike Share, they feel they have more available public transportation options for their travel needs. Further, 4% of respondents frequently use both MATBUS and bike share to complete a single trip, and 17% of respondents once in a while use both MATBUS and bike share to complete a single trip.

In survey 2, conducted with NDSU students and other bike share users, 30% of respondents mentioned that they use their personal car less often because of the availability of bike share, 10% mentioned that they walk more often, and 50% indicated that they are receiving more exercise. Further, 87% of the respondents who previously never bicycled became either regular, occasional, or infrequent bike share users. Also, research conducted by Alberts et al. (2012) and Woodcock et al. (2014) found that bike share programs have a positive effect on health. The survey results show that Great Rides Bike Share contributes towards providing more public transportation choices, reducing dependence on oil and improving air quality due to decreased car use, and promoting public health through increased bicycling and walking.

Access distances for public transportation varies across Fargo. According to the third edition of *Transit Capacity and Quality of Service Manual*, between 50 and 95% of transit passengers walk no farther than 0.25 mile to a local bus stop; and therefore, for planning purposes, the service coverage area of a local bus stop is defined as the distance within 0.25 mile (Kittelson and Associates, Inc. et al. 2013). Figure 9.1 shows areas within 0.25 miles of a bus stop, via the street network, in the north and central areas of Fargo-Moorhead. Residents within 0.25 mile of a bus stop can use MATBUS service to reach anywhere with the hashed area in Figure 9.1 using none, one, or two bus transfers.

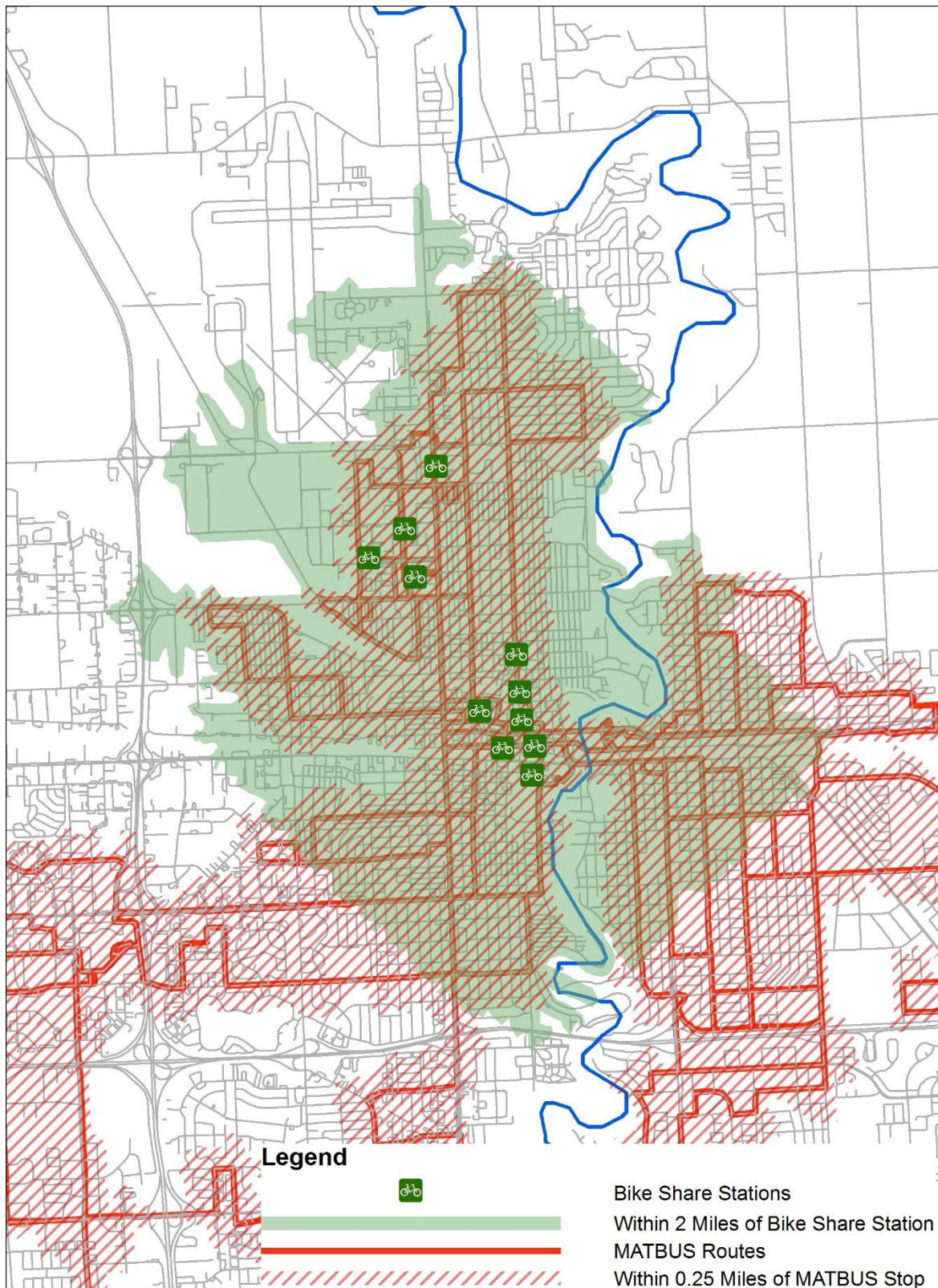


Figure 9.1 Great Rides Bike Share and MATBUS Coverage Area

Great Rides Bike Share users have free 30-minute trips and the flexibility to travel anywhere within the 30-minute time limit. This provides greater flexibility than MATBUS because bus routes are fixed and riders may have to wait for a ride (with most headways ranging from 8 minutes to 30 minutes and some being an hour) or transfer between routes. Bike share could allow riders to travel anywhere within a two-mile radius of any bike share station. The green-shaded area in Figure 9.1 shows areas within two miles of a bike share station. This bike share coverage area shows that bike share provides access to places and locations that are more than 0.25 miles from a MATBUS route. Also, note that this coverage area can be increased for riders who bicycle at a greater speed or for those willing to pay extra money for extending their trip times.

Having two different public transportation options for the public also provides an opportunity for users to use both modes for completing a single trip. Because all bike share stations are near a transit route, there is an opportunity for the two services to complement each other. Bike share can be used at the beginning or end of trips to extend the range of travel compared to using MATBUS alone.

Great Rides Bike Share provides an additional transportation option that can be used to access a greater coverage area than MATBUS alone, and it also allows the public to use multiple public transportation options, improving community livability.

10. CONCLUSIONS AND RECOMMENDATIONS

This study investigated the effectiveness of the Great Rides Bike Share program that was launched in Fargo, North Dakota, in March 2015. Eleven bike share stations were introduced in Fargo with 101 bikes. Bike share stations were primarily concentrated on the North Dakota State University (NDSU) campus and in downtown Fargo. The study presented an extensive literature review about bicycle use and the growth of bike share programs in the United States, factors impacting bike share and personal bicycle use, demographics of bike share users, and health impacts of bike share programs to give a better introduction and understanding about bike share programs in the United States and around the world.

The study conducted three online surveys. Two were sent exclusively to NDSU students, while the other was distributed to both NDSU students and others who use the bike share program. The first survey was conducted before the launch of Great Rides Bike Share and the other two after the launch. Surveys were conducted to understand the NDSU students' and bike share users' perceptions of the new bike share program in their community, before and after travel behavior, modal shifts, and preferences for additional bike share locations.

More than 95% of bike share trips in the first two years of operations were made by NDSU students. Therefore, the three surveys were primarily conducted with NDSU students, though survey 2 attempted to reach all possible users. Survey 1 was conducted in March 2015 and received 860 NDSU student responses; survey 2 was conducted in October 2015 and received 654 NDSU student and non-NDSU user responses, 92% of the respondents were again NDSU students; survey 3 was conducted in April 2016 and received 483 NDSU student responses. Surveys 1 and 3 included several of the same questions to understand changes in travel behavior, attitudes towards the bike share program, and use among NDSU students. Origin-destination trip data of Great Rides was analyzed for two years (2015 and 2016) to understand bike share station demands and user travel patterns.

Regression analyses were conducted to estimate the impacts of weather and other factors on bike share use and to estimate the impacts of bike share use on bus ridership. The study examined mode shifts and whether bike share has a substitute or complementary relationship with transit in Fargo.

10.1 Perception of Great Rides Bike Share Program and User Preference of Additional Locations

Before the launch of Great Rides Bike Share program, about 76% of the NDSU students knew about the concept of bike sharing and 14% had used a bike share program before in a different city. After one year of Great Rides operations, by the beginning of second year of operations, about 32% of NDSU students surveyed had used the bike share program. Students most commonly used bike share to make trips on NDSU campus, though some trips were also made between campus and downtown or between locations downtown. When asked where they would prefer to see new stations added, students most commonly mentioned the T-Lofts Apartments/T-Lot, which is located south of NDSU campus (primarily for commuting to campus and returning from campus); Northport Hornbachers (primarily for shopping purposes); Minard Hall (primarily for attending classes); FargoDome (primarily for students using park and ride services); and on

Dakota Drive for Apartments row (primarily for commuting to campus and returning from campus).

10.2 Travel Behavior and Modal Shift due to Bike Share Program

Travel behavior was analyzed for students living in NDSU housing (University Village/Niskanen Apartments), students living off-campus, students living on-campus, and students traveling between the main campus and downtown.

University Village/Niskanen Apartments (UV/NA) is an NDSU housing option located approximately 1 mile from the NDSU Memorial Union. A majority (>60%) of the UV/NA residents responding to the surveys make 1-2 one-way trips to and from campus each day, followed by 3-4 one-way trips (>25%). A majority of UV/NA residents use MATBUS as their primary mode of travel to campus, which was the case both before and after the launch of the bike share program. The most important factor influencing the mode of transportation used to travel to campus for UV/NA residents is the weather. Travel time and convenience are also important factors. After the bike share launch, 8% of UV/NA residents responding to the survey began using bike share as their most common mode of travel to campus, and 66% started using the program at least on occasion for traveling to campus. These observations show that bike share is being used as major mode of travel by UV/NA residents.

More than 55% of NDSU students responding to the survey live off-campus, and a majority of them live in North Fargo. A large percentage (>66%) of the off-campus students make 1-2 one-way trips to and from campus each day, followed by 3-4 one way trips (>17%). The most common mode of traveling to campus for these students is driving alone, but mode shares vary significantly depending on how far the students live from campus. Mode shares for walking, bicycling, and riding MATBUS are large for students closer to campus.

The number one factor influencing the mode of transportation used to travel to campus for off-campus students is travel time. Weather and convenience are also important factors. Survey results suggest there could have been a slight decrease in walking and using MATBUS to travel to campus after the bike share launch. Because bike share stations are primarily located on NDSU campus and downtown, there are no bike share stations near any major off-campus student housing locations other than downtown. Therefore, a small percentage of off-campus students use bike share to travel to campus. As mentioned in Section 9, students requested having additional bike share stations at T-Lofts Apartments/T-Lot and Dakota Drive, which would result in more off-campus students using bike share as a primary mode of travel to campus.

Regarding on-campus travel, students most commonly walk between locations, though MATBUS provides many trips on campus, and some students ride bicycle or drive occasionally. The survey found that 43% of respondents had used bike share at least occasionally for traveling on campus. The results show a slight modal shift towards more bicycling on campus. Walking and riding MATBUS may have decreased, but it is difficult to determine from the survey results.

Among a total of 11 bike share stations, 7 stations are located in downtown Fargo. Downtown stations are approximately 1-2 miles south of the NDSU main campus. Two of the downtown

stations are near the NDSU downtown campus. More than 63% of NDSU students responding to the surveys travel to downtown Fargo. Riding MATBUS and driving alone are the modes mostly used to travel between campus and downtown. Survey results showed that during non-winter months, 10% of respondents most commonly used bike share for traveling between campus and downtown and 7% most commonly used a personal bicycle. Responses indicate an overall increase in bicycling activity between campus and downtown, though its overall impact on bus ridership and automobile use is difficult to determine based solely on the survey results.

10.3 Ridership Data Analysis

The Great Rides Bike Share program has proven to be highly successful. Corbin (2016) noted that by averaging about six or seven rides per bike per day during its first year of operation, the system had more use per bike than in New York, Washington, DC, or Paris. Use was even greater during the spring and fall months when school was in session. For example, the system averaged 10.9 trips per bike per day in fall 2015 and 7.4 trips per bike per day in fall 2016. The success can be attributed to its presence on a college campus, as well as its innovative use of technology that reduced barriers to use (Cock 2016, Corbin 2016). By providing all NDSU students with a Great Rides pass as part of their student activity fee and by allowing students to check out bikes using student IDs that they already carry with them, Great Rides greatly reduced barriers to entry. Other factors that could have contributed to success include the city's flat topography and existing bicycle facilities.

The study analyzed Great Rides Bike Share ridership data for 2015 and 2016 to understand bike share trip patterns. A total of 138,463 bike share trips were made in 2015; 95.4% of the trips were made by NDSU students, 1.4% were made by bike share members, and 3.2% were made by guest users. A total of 98,767 trips were made in 2016, 96.1% by NDSU students, 1.0% by bike share members, and 2.9% by guests. Bike share trips declined 29% in the second year of operation, which could be due to the novelty wearing off. Overall use in 2016 was still good for a system of its size, and with just two years of data, it is not possible to determine if the decline is long-term trend or just a one-year drop to a more sustainable level of use.

Most users are NDSU students, so bike share ridership dropped substantially during the summer months (from mid-May until late August) because there are significantly fewer students on campus. Ridership also varies throughout the day. Bike share checkouts increase throughout the morning until reaching a midday peak; use drops after 2:00 p.m. before increasing again. Ridership is highest during the 4 p.m. to 9 p.m. period, accounting for 40% of all checkouts. By comparing the bike share ridership data with daily weather, results showed that users may be more likely to choose bike share mode if weather conditions are favorable.

A bike share ridership model was developed to predict ridership based on available variables. Results show that temperatures have a quadratic relationship with ridership. Bike share use increases with warmer temperatures, but the impacts of temperature changes on ridership diminish at higher temperatures, and ridership begins to decrease when temperatures exceed 81 degrees. The results also show that precipitation and wind have negative effects on bike share use. The amount of daylight hours in a day was found have an effect on use of downtown stations but not the stations on campus. Ridership was found to be substantially higher for stations located on campus.

Origin-destination trip analysis showed that about 86% of total bike share trips in 2015 and 90% in 2016 were made between the four stations on the NDSU campus. While the bike share stations located downtown do not generate as many trips, downtown stations cannot be compared to NDSU campus stations considering the fact that bike share membership for NDSU students is free. Also, bike share stations in downtown Fargo are important for the Fargo public and NDSU students for attending events or activities.

10.4 Impacts on MATBUS Use

About 83% of survey 1 respondents and 85% of survey 3 respondents had used MATBUS, and more than half of the students (~55%) are regular MATBUS riders. Students most commonly use MATBUS for traveling to school, but they also use it for a number of other purposes. Most of the students mentioned that the quality of MATBUS service was excellent, good, or satisfactory. Responses regarding the quality of service were nearly identical in the two surveys and also similar to results found in a survey conducted in 2010-11 (Mattson et al. 2012).

The survey results suggest a possible negative impact on MATBUS ridership following the introduction of the bike share program. However, based solely on the survey data, it is difficult to determine if this effect is real or to estimate its magnitude. Therefore, to better analyze the possible impact on transit ridership, daily MATBUS ridership data for the years 2014-2016 for routes heavily used by NDSU students were obtained and analyzed. The routes studied were those on or near campus and those providing service between downtown and campus.

The data revealed that MATBUS ridership decreased after the introduction of the bike share program. However, a number of factors could have contributed to this decline. In fact, bus ridership decreased throughout the city, including areas without access to the bike share system. A regression model was developed, using daily ridership data, to estimate the impact of bike share use on bus ridership. Results showed that the program did have some negative effect on bus ridership. The estimated coefficient -0.0045 indicates that every 100 bike share trips reduce bus ridership by 0.45%. During this period, MATBUS averaged 3,327 trips per day on the five routes, so a 0.45% reduction equates to a loss of 15 bus trips for every 100 bike share trips. However, this explained only a portion of the drop in bus use. The data analysis indicated that other factors played a larger role in the decrease.

10.5 Livability Benefits of Great Rides Bike Share Program

Great Rides Bike Share proved to improve livability in Fargo by providing multiple transportation choices and promoting public health with increased bicycling and walking activity. Also, the program provides transportation options that allow users to access a larger coverage area compared to using MATBUS service alone.

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APPENDIX A: US BIKE SHARE PROGRAMS AND BIKE SHARE STATIONS FOR EACH PROGRAM

Source: (Malouff, 2017)

S.No	City	Stations or Hubs as of January 2017	S.No	City	Stations or Hubs as of January 2017
1	New York	645	31	Chattanooga	37
2	Chicago	581	32	Hoboken	36
3	Washington	437	33	Boise	36
4	Minneapolis	197	34	Nashville	35
5	Boston	184	35	Kansas City	34
6	Miami	147	36	Omaha	33
7	Topeka	138	37	Houston	33
8	Philadelphia	105	38	Salt Lake City	32
9	Portland	100	39	Madison	31
10	San Diego	95	40	Indianapolis	30
11	Denver	88	41	Beverly Hills CA	28
12	Santa Monica	86	42	Ft Lauderdale/ Aventura	27
13	Los Angeles	66	43	Dayton	27
14	Phoenix	63	44	Cleveland	27
15	Buffalo	63	45	Atlanta	25
16	San Francisco	58	46	Charlotte	23
17	San Antonio	57	47	Las Vegas	21
18	Milwaukee	57	48	Charlottesville UVA	21
19	Cincinnati	57	49	Baltimore	21
20	Long Beach CA	54	50	Purdue Univ IN	20
21	Pittsburgh	50	51	Auburn Univ AL	19
22	Austin	50	52	Ohio State Univ	18
23	Columbus OH	46	53	USF-Tampa	17
24	Fort Worth	45	54	Fort Collins	17
25	Hailey ID	44	55	West Palm Beach FL	15
26	Boulder	43	56	Princeton Univ NJ	15
27	Aspen	43	57	El Paso	15
28	Tampa	42	58	College Park MD	15
29	Orlando	39	59	Albuquerque	15
30	Birmingham AL	39	60	Univ of Buffalo	14

S.No	City	Stations or Hubs as of January 2017	S.No	City	Stations or Hubs as of January 2017
61	San Mateo CA	14	91	Flint	4
62	Ann Arbor	13	92	Duke Univ NC	4
63	Stony Brook Univ	12	93	Cal Univ - Irvine	4
64	Long Beach NY	11	94	Battle Creek MI	4
65	Fargo	11	95	West Chester Univ PA	3
66	Carmel/ Westfield IN	11	96	Univ of New England ME	3
67	Yale Univ CT	10	97	Tulsa	3
68	St Petersburg FL	10	98	Santa Clara Univ, CA	3
69	Des Moines	10	99	Rome NY	3
70	Greenville	9	100	Northern Kentucky Univ	3
71	Oklahoma City	8	101	Macon GA	3
72	McAllen TX	8	102	Louisville	3
73	Kent State Univ OH	8	103	Key West FL	3
74	Dartmouth Coll NH	8	104	Kailua	3
75	Columbus IN	8	105	Jackson State Univ MS	3
76	Brownsville TX	8	106	Huntington IN	3
77	Lakeland FL	7	107	Columbia Univ NY	3
78	Evansville IN	7	108	Cobb Town Center GA	3
79	Corpus Christi TX	7	109	Bemidji MN	3
80	Tarleton State Univ TX	6	110	Aurora IL	3
81	Medford OR	6	111	Suwanee GA	2
82	Fort Wayne IN	6	112	Savannah	2
83	Corvallis OR	6	113	Roseburg VA Hospital	2
84	Westminster CO	5	114	Rapid City SD	2
85	Washington State Univ	5	115	Norristown PA	2
86	Univ of Texas - Dallas	5	116	Dallas	2
87	Spartanburg	5	117	Clarksville TN	2
88	Smyrna GA	5	118	Charleston SC	2
89	Alpharetta GA	5	119	Cal State East Bay	2
90	Gainesville FL	4			

APPENDIX B: BIKE SHARE STORY IN FARGO

NDSU

STUDENT GOVERNMENT

“Leaving the university better than when we arrived.”

THE STORY OF “BIKE SHARE”

- In the 2011-2012 academic year, the concept of Bike Share was explored by Student Government in collaboration with a member of the Fargo City Commission.
 - This year was dedicated to researching the vendor options, potential integration at NDSU and in the City of Fargo, budget/cost, and student feedback from multiple methods.
 - A reserve request to start the program failed in Senate due to the need for additional information.
- In the 2012-2013 academic year, Student Government took this information and developed more detailed program logistics and implementation programming.
 - Members of Student Government that were involved in the previous year and the current year continued with work on this program, and members that finished their terms also remained involved in the program development.
 - Initial explorations involving our weather, budgeting/costs, and the needs of the students were investigated in further detail.
 - A reserve request was discussed at length in the budgeting meeting in which resulted in a passing vote. This was for the amount of \$88,000 to be put toward capital costs in startup that needed to be spent by the end of the fiscal year (June 30, 2013).
 - At this same budgeting meeting, there was legislation to reallocate additional reserve funds. The final bill that was passed which allocated \$65,000 for the 2013-2014 fiscal year to be used toward the operations of the Bike Share program once it was started. This money was paid out to Campus Recreation and Intramurals and was placed in their budget under a line item specific to only the formation of a Bike Share program. This money was transferred in August 2013 (the beginning of the new fiscal year).
 - The planning team consisting of student government past and present that had been working on this project continued through the summer and found that the logistical details for startup required more time than was available given the fiscal year ended June 30, 2013 and reserve request money had to be spent by this date. This \$88,000 was not spent, and was then rolled back into the reserve account (which is where it came from).
 - Additional challenges with this date occurred as a result of a change by the primary sponsor at that time, a large regional company. This company made an internal decision to postpone sponsorship as they had some other priorities at that time. They did not exclude the opportunity to sponsor in the future as they expressed value in the program and saw opportunity in future partnership.
- In the 2013-2014 academic year was one in which the program budget had to be reevaluated and recalculated.
 - Given the withdrawal of the primary sponsor as well as the start of a new fiscal year, this became a process that took the fall semester.
 - The planning team solicited and secured multiple smaller sponsors in lieu of a primary sponsor. Such parties included: Dakota Medical Foundation, Xcel Energy, Sanford Health, Kilbourne Group, Swanson Health, Forum Communications, and Susan Mathison. There were additional station sponsors as well.
 - The planning team also prepared a Powerpoint presentation for the Student Senate as well as other members of Student Government. A series of four open forums were planned and each Student Senator received a call, email, and texts in order to inform them of the meetings. All senators attended meetings as well as had opportunity to contact and converse with the planning team in order to make an informed decision about the program and change in funding.
 - At the budgeting meeting, extensive discussion about the unspent \$65,000 allocation that was for Bike Share operational expenses in the 2013-2014 year. This was decided to be used for capital costs instead of operational costs in light of the sponsorship challenges.
 - Also at the budgeting meeting, the budget for 2014-2015 fiscal year was approved. Within this, there is a line item for \$65,000 for operational expenses for the Bike Share program.
 - At the close of this meeting, the target for startup of the program was understood to be fall 2014. The supplier was determined to be B-Cycle and a local biking non-profit (Great Rides Fargo Inc.) was aiding in the intended summer planning for the program. They solicited two members from Student Government to act as representatives of NDSU students in continued formation of the

- program over summer 2014. One position is to be held by the Executive Commissioner of Finance (Preston Gilderhus for the 2014-2015 year) and the other was to be determined by the Student Senate (Chris McEwen for the 2014-2015 year).
- No further decisions on the Bike Share program were made in this academic year.
- In the 2014-2015 academic year, a bulk of the planning logistics commenced in the summer of 2014. Nine in-person meetings as well as numerous conference calls and extensive email communication took place.
 - One provision that NDSU required of B-Cycle was the integration of the Bison card for use of the system. The intention is that all valid students can fill out a liability waiver, much like what is used at the NDSU Wellness Center. At this point the student would be immediately approved to be able to swipe their Bison card for access to checking out a bike for a determined time period. This is called multi-frequency, radio frequency identification or MF-RFID with real-time API approval.
 - This technology requirement of MF-RFID was ahead of B-cycle's current technological capabilities and required extensive research and development in order to get the Bison card to work in addition to the ability of credit cards to work for community members.
 - This dual reading process took additional time and research to get to an implementation date and was in the testing phase in Madison, WI by the end of August 2014.
 - Following testing, B-cycle needed ample time to assimilate data for proactive adjustments prior to launch in Fargo.
 - It should be noted that this system is the FIRST OF THIS KIND in which student cards are integrated which allows for bypass of credit card use by students of a sponsoring school. NDSU is innovating the industry by collaborating with B-cycle on this custom development.
 - The second provision that NDSU required of B-cycle was the custom color of the bikes to be Bison green. This custom order required a lead time of six months of which commenced in April resulting in an arrival target of October in Fargo, ND.
 - In light of the technological research and development stretching into the fall as well as the custom bikes arriving in October, the Board of Directors had to make the decision to ensure that all of these components are in place as intended for a full launch. This resulted in the unanimous vote of the Board to delay launch to Spring 2015. This delay of launch would allow for the following:
 - Completion of the MF-RFID development and testing as well as adjustments for launch
 - The fall semester to have B-cycle send a bike, kiosk, and dock to NDSU for Student Government to use to educate and engage students on the use of the system
 - Save in operational expenses since a portion of this year's expenses will not be needed due to a delayed launch. This money is currently in the discussion/pro-rating process as determined by Student Government and NDSU Administration (Finance and General Counsel).

If you have additional questions, please contact the following in Student Government:

Executive Commissioner of Finance, Preston Gilderhus

Vice-Chair of Senate, Chris McEwen

Executive Commissioner of Public Relations, Amy L. Nash

APPENDIX C: BIKE SHARE STATION DESCRIPTION AND POSSIBLE BIKE SHARE DEMAND AT SELECTED BIKE SHARE STATIONS

High Rise Complex: The High Rise Complex consists of four high rise halls (Pavek Hall, Seim Hall, Sevrinson Hall, and Thomson Hall) that primarily house on-campus freshman students and the West Dining Center. This bike share station is also near Bison Court East and West buildings, which provide more on-campus housing options for NDSU students. A bike share station at this location can be useful for students for traveling between their residence halls and other locations on campus or downtown.

Memorial Union: Memorial Union houses various student services and social activity centers such as: food court, Union Dining Center, NDSU Book Store, One Stop, Student Government, Administrative Offices, Games, Movie Theater, etc. This is the busiest building on campus with various students, faculty, and staff activities.

University Village: The station at University Village is close and accessible to University Village and Niskanen Apartment residents. Adjacent to the northeast corner of campus, these buildings are housing options primarily for undergraduate, graduate, married, and international students. This station is also close to the FargoDome, which is an indoor football stadium and arena frequently busy with various university and non-university events.

Wallman Wellness Center: Wallman Wellness Center houses a fitness center, student health services, child care services, disability services, and a pharmacy. Many NDSU students and non-students use the fitness center on a frequent basis.

Barry Hall and Renaissance Hall: These halls are a part of the NDSU downtown campus. A significant number of students, faculty, and staff commute between the NDSU main campus and the downtown buildings for attending classes, job responsibilities, meetings, etc.

US Bank Plaza: In the heart of downtown, this is a busy place near the US Bank downtown branch, surrounded by numerous businesses, restaurants, and other social and cultural activity centers.

Great Northern Bicycle Company: A downtown locations surrounded by numerous businesses, the Amtrak Station, and other social activity centers.

Sanford Medical Center: A major downtown activity generator and one of the main hospitals and medical centers in the city. This station is also midway between the NDSU campus and downtown Fargo in case riders need to check-in and checkout again to buy more time with their NDSU student or Great Rides membership.

Fercho YMCA: Location where Fargo public visit regularly for health and fitness purposes.

MATBUS Downtown Center: This location, also referred to as the Ground Transportation Center, is main transfer hub for MATBUS buses. The bike share station at this location can provide an opportunity for transit riders to use bike share to access the bus station or to travel to their final destination.

APPENDIX D: SURVEY 1 CONDUCTED WITH NDSU STUDENTS

NDSU Student Survey

Student Profile

What is your gender?

- ☐ Male
- ☐ Female

What is your age?

- ☐ 18-22
- ☐ 23-29
- ☐ 30-44
- ☐ 45-64
- ☐ 65+

Do you have regular access to a motor vehicle?

- ☐ Yes
- ☐ No

Do you have regular access to a bicycle?

- ☐ Yes
- ☐ No

What class are you?

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior
- ☐ Graduate

Where do you live?

- ☐ On-campus (Residence Hall / Bison Court)
- ☐ Off-campus
- ☐ University Village / Niskanen Apartments

Was transportation a factor when deciding where to live?

- ☐ Yes
- ☐ No

Travel to Campus for Students Living in University Village / Niskanen Apartments

What mode of transportation do you use most when travelling to campus?

- ☐ Walk
- ☐ Bicycle
- ☐ Automobile
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify) _____

What modes of transportation do you use, even occasionally, to travel to campus? (Check all that apply.)

- ☐ Walk
- ☐ Bicycle
- ☐ Automobile
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify) _____

What factors influence the mode of transportation used to travel to campus? (Check all that apply.)

- ☐ Travel time
- ☐ Weather
- ☐ Parking availability
- ☐ Cost of parking
- ☐ Vehicle cost
- ☐ Convenience
- ☐ Other (Please specify) _____

How many one-way trips do you usually make to and from campus each day?

- ☐ Less than daily
- ☐ 1-2
- ☐ 3-4
- ☐ 5+

Travel to Campus for Off-Campus Students

How far do you live off-campus?

- ☐ < 1/4 mile
- ☐ 1/4 to 1/2 mile
- ☐ 1/2 to 1 mile
- ☐ 1 to 5 miles
- ☐ 5 to 10 miles
- ☐ More than 10 miles

Where do you live?

- ☐ North Fargo
- ☐ Downtown Fargo
- ☐ Southwest Fargo
- ☐ South central Fargo
- ☐ West Fargo
- ☐ Moorhead
- ☐ Other

Where do your campus-bound trips usually originate?

- ☐ Home
- ☐ Work
- ☐ Childcare
- ☐ Shopping
- ☐ Live on-campus
- ☐ Other (Please specify) _____

What mode of transportation do you use most when travelling to campus?

- ☐ Walk
- ☐ Bicycle
- ☐ Automobile
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify) _____

How long does it take to travel to campus using this mode?

- ☐ 0 to 5 minutes
- ☐ 6 to 10 minutes
- ☐ 11 to 20 minutes
- ☐ 21 to 30 minutes
- ☐ 31 to 40 minutes
- ☐ 41 to 50 minutes
- ☐ 51 to 60 minutes
- ☐ More than 60 minutes

What modes of transportation do you use, even occasionally, to travel to campus? (Check all that apply.)

- ☐ Walk
- ☐ Bicycle
- ☐ Automobile
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify) _____

What is the longest acceptable travel time by MATBUS from your residence to campus?

- ☐ 0 to 5 minutes
- ☐ 6 to 10 minutes
- ☐ 11 to 20 minutes
- ☐ 21 to 30 minutes
- ☐ 31 to 40 minutes
- ☐ 41 to 50 minutes
- ☐ 51 to 60 minutes
- ☐ Would not ride

What factors influence the mode of transportation used to travel to campus? (Check all that apply.)

- ☐ Travel time
- ☐ Weather
- ☐ Parking availability
- ☐ Cost of parking
- ☐ Vehicle cost
- ☐ Convenience
- ☐ Other (Please specify) _____

How many one-way trips do you usually make to and from campus each day?

- ☐ 0
- ☐ 1-2
- ☐ 3-4
- ☐ 5+

Travel Behavior on Campus and between Campus and Downtown

How do you travel most often between locations on the NDSU campus?

- ☐ Walk
- ☐ Bicycle
- ☐ MATBUS
- ☐ Automobile
- ☐ Other (Please specify) _____

What mode/modes do you use even occasionally to travel between locations on the NDSU campus? (Check all that apply.)

- ☐ Walk
- ☐ Bicycle
- ☐ MATBUS
- ☐ Automobile
- ☐ Other (Please specify) _____

How often do you travel between NDSU campus and downtown?

- ☐ Never
- ☐ Less than Once a Month
- ☐ Once a Month
- ☐ 2-3 Times a Month
- ☐ Once a Week
- ☐ 2-3 Times a Week
- ☐ More than 3 times per week

What mode/modes do you use most often to travel between NDSU campus and downtown?

- ☐ Walk
- ☐ Bicycle
- ☐ Automobile
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify) _____

What mode/modes do you use even occasionally to travel between NDSU campus and downtown? (Check all that apply.)

- ☐ Walk
- ☐ Bicycle
- ☐ Automobile
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify) _____

Bike Share Program

Do you know what a bike share program is?

- ☐ Yes
- ☐ No

Have you ever used a bike share program before?

- ☐ Yes
- ☐ No

Bike Share Program Information: Bike share program is a service in which bicycles are made available for shared use to individuals on a very short term basis. This program allows people to borrow a bike from bike share station at point A and return at a bike share station at point B.

Did you know that the city of Fargo will be launching the bike share program (named as Great Rides Bike-share) which will be available for everyone starting March, 2015?

- ☐ Yes
- ☐ No

How did you know about the bike share program launch in Fargo? (Check all that apply.)

- ☐ Radio
- ☐ News Paper
- ☐ Facebook
- ☐ Friend
- ☐ Greatrides bikeshare website
- ☐ Other

Once the bike share program is launched in Fargo, did you know you can use it for free using a valid bison card?

- ☐ Yes
- ☐ No

Please find below the 11 locations of bike stations that will be in operation in Fargo starting March 15, 2015.



Information: The great rides bike-share program in Fargo will be in operation for the months March to November of every year and bike-share program will be closed for the months December to February for winter.

Will you use the bike share program when it launches in Fargo?

- ☐ Yes
- ☐ Maybe
- ☐ No

Among the 11 bike share stations locations that were proposed to be launched in Fargo, which station locations would you probably use for borrowing or returning a bicycle? Please select all that apply.

- ☐ University Village
- ☐ NDSU High Rises
- ☐ NDSU Wallman Wellness Center
- ☐ NDSU Memorial Union
- ☐ Sanford Health Broadway Medical Center
- ☐ Great Northern Bicycle Company
- ☐ NDSU Barry Hall
- ☐ NDSU Renaissance Hall
- ☐ U.S. Bank Plaza
- ☐ Ground Transportation Center (MATBUS)
- ☐ Fercho YMCA

How likely are you towards using a bike from the bike share facility for travelling within the NDSU campus?

- ☐ Very Unlikely
- ☐ Unlikely
- ☐ Somewhat Unlikely
- ☐ Undecided
- ☐ Somewhat Likely
- ☐ Likely
- ☐ Very Likely

How likely are you towards using a bike from the bike share facility for travelling between NDSU campus and downtown?

- ☐ Very Unlikely
- ☐ Unlikely
- ☐ Somewhat Unlikely
- ☐ Undecided
- ☐ Somewhat Likely
- ☐ Likely
- ☐ Very Likely

By what method would you prefer to receive information on bike share program in Fargo?
(Check all that apply.)

- ☐ Email
- ☐ Newspaper
- ☐ Radio
- ☐ Television
- ☐ Bikeshare Website
- ☐ Facebook
- ☐ Twitter
- ☐ Text Alert
- ☐ NDSU transit webpage
- ☐ Brochure
- ☐ Kiosk
- ☐ Other (Please specify) _____

Do you have any location that you can think of which can be a potential place for adding bike share station?

- ☐ Yes (please specify) _____
- ☐ No

MATBUS

Do you use MATBUS?

- ☐ Yes
- ☐ No

The rest of the questions in this section will be given to those indicating that they use MATBUS service.

How many one-way trips by bus do you make each week?

- ☐ Less than 1 per week
- ☐ 1 to 4
- ☐ 5 to 10
- ☐ 11 or more

What are normally the purposes of each bus trip? (Check all that apply.)

- ☐ School
- ☐ Grocery shopping
- ☐ General shopping
- ☐ Work
- ☐ Medical appointments
- ☐ Social/recreation
- ☐ Personal business
- ☐ Organization meetings
- ☐ Other (Please specify) _____

How do you rate the overall quality of MATBUS service?

- ☐ Excellent
- ☐ Good
- ☐ Satisfactory
- ☐ Poor
- ☐ Very poor

Have you ever been unable to board a bus because it was full?

- ☐ Yes
- ☐ No

Tri-College

Have you ever taken a Tri-College course?

- ☐ Yes
- ☐ No

If yes:

How did you travel to the other campuses? (check all that apply.)

- ☐ Walk
- ☐ Bicycle
- ☐ Automobile
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify) _____

Parking

Do you have an NDSU parking permit?

- ☐ Yes
- ☐ No

If yes:

How convenient is NDSU parking?

- ☐ Very convenient
- ☐ Somewhat convenient
- ☐ Inconvenient
- ☐ Very inconvenient

How affordable is NDSU parking?

- ☐ Very affordable
- ☐ Somewhat affordable
- ☐ Unaffordable
- ☐ Very unaffordable

Have you ever parked your vehicle on streets near campus?

- ☐ Yes
- ☐ No

APPENDIX E: SURVEY 2 CONDUCTED WITH NDSU STUDENTS, FACULTY, STAFF, NON-NDSU GREAT RIDES BIKE SHARE MEMBERS AND GUEST USERS

FARGO GREAT RIDES BIKE SHARE EXTENSION THROUGH THE WINTER: A FEASIBILITY STUDY

Current bike use

Currently, Great Rides Bike Share runs from April to November. The program will close for winter on Sunday, November 1st at 11:59 pm and resume in mid-April 2016.

As you may know, winter cycling is an emerging trend in cold-climate cities around the world. The practice was pioneered in the city of Oulu, in Finland. Here in the United States, Traverse City, Michigan and Chicago operate year-round bike share programs. The following survey is designed to assess the current operation of Fargo's program and gauge the potential demand for year-round bike sharing.

Please complete the survey and include an e-mail or phone number to be eligible for a drawing to win one of six \$ 25 gift cards. You are not required to answer any question that makes you feel uncomfortable. All answers are confidential, and responses will only be reported in aggregate.

Current bike use

1. Please indicate the type of membership that you currently have with Great Rides Bike Share

- ☐ NDSU Student
- ☐ NDSU faculty or staff
- ☐ Annual Membership
- ☐ Monthly Membership
- ☐ No longer a member
- ☐ Never held a membership

2. Before joining the Great Rides Bike Share, how often did you ride a bicycle?

- ☐ Never
- ☐ Less than 1 time a month
- ☐ 1 to 3 times a month
- ☐ 1 to 2 times a week
- ☐ 3 to 4 times a week
- ☐ 5 times a week
- ☐ More than 5 times a week

3. During the past month, I have used ...

- ☐ My own bicycle
- ☐ Great Rides bike share bicycle
- ☐ Both
- ☐ Neither

4. Reasons for choosing Great Rides Bike Share (please check all that apply)

- ☐ Convenience
- ☐ Fast mobility
- ☐ Fitness
- ☐ Eco-friendly (better for environment)
- ☐ Enjoy bicycling
- ☐ Curiosity
- ☐ Cost-effective
- ☐ Socially trendy
- ☐ Cheaper than taxi fare
- ☐ Cheaper than public transportation
- ☐ Easier than driving / finding a place to park
- ☐ Close to origin/destination
- ☐ Other (please specify)

5. Which factors prevent you from using bike share more often? (please check all that apply)

- ☐ Cold weather
- ☐ Rain or snow
- ☐ Long travel distance for some trips
- ☐ Stations not conveniently located for some trips
- ☐ Too expensive
- ☐ Lack of bicycle lanes or paths
- ☐ Would rather drive
- ☐ I use my own bicycle
- ☐ Other (please specify)

6. Bike-share systems typically support trips of 1-3 miles. What kind of trips do you mainly use the shared bicycles for? (Please check all that apply)

- ☐ Commuting to and from work
- ☐ Commuting to and from school
- ☐ Cycling to shopping
- ☐ Cycling to cultural activities
- ☐ Cycling for errands and appointments
- ☐ Cycling to visit friends
- ☐ Cycling for recreation
- ☐ Cycling for fitness or exercise
- ☐ Other (Please specify)

7. Currently, how often do you check out a Great Rides Bike Share bicycle?

- ☐ Never
- ☐ Less than 1 time a month
- ☐ 1 to 3 times a month
- ☐ 1 to 2 times a week
- ☐ 3 to 4 times a week
- ☐ 5 times a week
- ☐ More than 5 times a week

8. If you're using Great Rides Bike Share Program, identify the origin(A) and destination(B) of your three most likely trips?

Most frequent trip (From A _____ to B _____)	<input type="text"/>
Second most frequent trip (From A _____ to B _____)	<input type="text"/>
Third most likely trip (From A _____ to B _____)	<input type="text"/>

9. How would you have made these trips without Great Rides Bike Share?

- ☐ Personal vehicle (sole passenger)
- ☐ Personal bicycle
- ☐ Walking
- ☐ Carpool (2+ passengers)
- ☐ Public transportation
- ☐ Bike rental
- ☐ Taxi
- ☐ Would not make trip
- ☐ Other (please specify)

10. What other modes of transportation do you use in your day-to-day travel?

- ☐ Personal vehicle (sole passenger)
- ☐ Personal bicycle
- ☐ Walking
- ☐ Carpool (2+ passengers)
- ☐ Public transportation
- ☐ Bike rental
- ☐ Taxi
- ☐ Other (please specify)

11. How safe do you feel riding Great Rides Bike Share bikes?

- ☐ Very unsafe
- ☐ Unsafe
- ☐ Neither safe or unsafe
- ☐ Safe
- ☐ Very safe

12. Level of satisfaction

- ☐ Very unsatisfied
- ☐ Unsatisfied
- ☐ Neutral
- ☐ Satisfied
- ☐ Very satisfied

13. How many stops (where you get off the bike) do you typically make along the way when riding Great Rides Bike Share bikes?

- ☐ 0 stops (you only stopped at the docking stations)
- ☐ 1 stops
- ☐ 2 stops
- ☐ 3 stops
- ☐ 4 stops
- ☐ 5 stops
- ☐ 6 or more stops

14. As a result of my use of Great Rides Bike Share, I use the bus ...

- ☐ Much more often
- ☐ More often
- ☐ About the same (bike sharing has had no impact)
- ☐ Less often
- ☐ Much less often
- ☐ I did not ride the bus before, and I do not ride the bus now.
- ☐ I have changed how I use the bus but not because of Great Rides Bike Share.

15. As a result of my use of bike sharing, I drive a personal vehicle ...

- ☐ Much more often
- ☐ More often
- ☐ About the same (bike sharing has had no impact)
- ☐ Less often
- ☐ Much less often
- ☐ I did not drive a car before, and I do not drive a car now.
- ☐ I did change how much I drive a car but not because of Great Rides Bike Share.

16. As a result of my use of bike sharing, I walk...

- ☐ Much more often
- ☐ More often
- ☐ About the same (bike sharing has had no impact)
- ☐ Less often
- ☐ Much less often
- ☐ I did change how much I walk but not because of Great Rides Bike Share.

17. As a result of my use of Great Rides Bike Share, I have been getting ...

- ☐ Much more exercise
- ☐ More exercise
- ☐ About the same exercise as before
- ☐ Less exercise
- ☐ Much less exercise
- ☐ My exercise level has changed since joining Great Rides Bike Share but not because of Great Rides Bike Share.

18. How likely do you check the "B-cycle Now" app before using bike share?

- ☐ More than 75%
- ☐ 50% - 75%
- ☐ 25%-50%
- ☐ Less than 25%
- ☐ Never

Demographic Information

Age

- ☐ 18 to 19
- ☐ 20 to 24
- ☐ 25 to 29
- ☐ 30 to 34
- ☐ 35 to 39
- ☐ 40 to 44
- ☐ 45 to 49
- ☐ 50 to 54
- ☐ 55 to 59
- ☐ 60 to 64
- ☐ 65 to 69
- ☐ 70 to 74
- ☐ Prefer not to say

Gender

- ☐ Male
- ☐ Female
- ☐ Prefer not to say

Race

- ☐ Asian
- ☐ Black or African-American
- ☐ White or Caucasian
- ☐ Hispanic or Latino
- ☐ Native American or Alaska Native
- ☐ Native Hawaiian or Pacific Islander
- ☐ Prefer not to say
- ☐ Other, please specify


Education

- ☐ Some high school, no diploma
- ☐ Doctorate Degree
- ☐ High school or GED
- ☐ Some college
- ☐ 2-year college degree
- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ Professional degree
- ☐ Doctorate Degree
- ☐ Prefer not to answer
- ☐ Other, please specify...

Income

- ☐ Under \$15 K
- ☐ \$15k - 24.9K
- ☐ \$25K - 34.9K
- ☐ \$35K - \$49.9K
- ☐ \$50K - \$74.9K
- ☐ \$75K - \$99.9K
- ☐ Over \$100K
- ☐ Prefer not to answer

APPENDIX F: SURVEY 3 CONDUCTED WITH NDSU STUDENTS



Student/Staff Profile

Student Profile

What is your gender?

☐ Male

☐ Female

What is your age?

☐ 18-22

☐ 23-29

☐ 30-44

☐ 45-64

☐ 65+

Do you have regular access to a motor vehicle?

☐ Yes

☐ No

Do you have regular access to a bicycle you own?

☐ Yes

☐ No

Have you ever used Great Rides Bike Share program?

☐ Yes

☐ No

Student Information

Student Information

What class are you?

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior
- ☐ Graduate

Where do you live?

- ☐ On-campus (Residence Hall / Bison Court)
- ☐ Off-campus
- ☐ University Village / Niskanen Apartments

Was transportation a factor when deciding where to live?

- ☐ Yes
- ☐ No

University Village / Niskanen Apartments Residents

Travel to Campus for Students Living in University Village / Niskanen Apartments

During non-winter season, what mode of transportation do you use most when traveling to campus?

- ☐ Walk
- ☐ Personal Bicycle
- ☐ Bicycle - Great Rides Bike Share Program
- ☐ Automobile (drive alone)
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify)

During winter season, what mode of transportation do you use most when traveling to campus?

- ☐ Walk
- ☐ Personal Bicycle
- ☐ Automobile (drive alone)
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify)

What modes of transportation do you use, even occasionally, to travel to campus? (Check all that apply.)

- ☐ Walk
- ☐ Personal Bicycle
- ☐ Bicycle - Great Rides Bike Share Program
- ☐ Automobile (drive alone)
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify)

What factors influence the mode of transportation used to travel to campus? (Check all that apply.)

- ☐ Travel time
- ☐ Weather
- ☐ Parking availability
- ☐ Cost of parking
- ☐ Vehicle cost
- ☐ Convenience
- ☐ Other (Please specify)

How many one-way trips do you usually make to and from campus each day?

- ☐ Less than daily
- ☐ 1-2
- ☐ 3-4
- ☐ 5+

Off-Campus Residents

Travel to Campus for Off-Campus Students

How far do you live from campus?

- ☐ <1/4 miles
- ☐ 1/4 to 1/2 mile
- ☐ 1/2 to 1 mile
- ☐ 1 to 5 miles
- ☐ 5 to 10 miles
- ☐ More than 10 miles

Where do you live?

- ☐ North Fargo
- ☐ Downtown Fargo
- ☐ Southwest Fargo
- ☐ South central Fargo
- ☐ West Fargo
- ☐ Moorhead
- ☐ Other

Where do your campus-bound trips usually originate?

- ☐ Home
- ☐ Work
- ☐ Childcare
- ☐ Shopping
- ☐ Live on-campus
- ☐ Other

During non-winter season, what mode of transportation do you use most when traveling to campus?

- ☐ Walk
- ☐ Personal Bicycle
- ☐ Bicycle - Great Rides Bike Share Program
- ☐ Automobile (drive alone)
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify)

During winter season, what mode of transportation do you use most when traveling to campus?

- ☐ Walk
- ☐ Personal Bicycle
- ☐ Automobile (drive alone)
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify)

How long does it take to travel to campus using this mode?

- ☐ 0 to 5 minutes
- ☐ 6 to 10 minutes
- ☐ 11 to 20 minutes
- ☐ 21 to 30 minutes
- ☐ 31 to 40 minutes
- ☐ 41 to 50 minutes
- ☐ 51 to 60 minutes
- ☐ More than 60 minutes

What modes of transportation do you use, even occasionally, to travel to campus? (Check all that apply.)

- ☐ Walk
- ☐ Personal Bicycle
- ☐ Bicycle - Great Rides Bike Share Program
- ☐ Automobile (drive alone)
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify)

What is the longest acceptable travel time by MATBUS from your residence to campus?

- ☐ 0 to 5 minutes
- ☐ 6 to 10 minutes
- ☐ 11 to 20 minutes
- ☐ 21 to 30 minutes
- ☐ 31 to 40 minutes
- ☐ 41 to 50 minutes
- ☐ 51 to 60 minutes
- ☐ Would not ride

What factors influence the mode of transportation used to travel to campus?
(Check all that apply.)

- ☐ Travel time
- ☐ Weather
- ☐ Parking availability
- ☐ Cost of parking
- ☐ Vehicle cost
- ☐ Convenience
- ☐ Other (Please specify)

How many one-way trips do you usually make to and from campus each day?

- ☐ Less than daily
- ☐ 1-2
- ☐ 3-4
- ☐ 5+

Travel Behavior

Travel Behavior on Campus and Between Campus and Downtown

During non-winter season, how do you travel most often between locations on the NDSU campus?

- ☐ Walk
- ☐ Personal Bicycle
- ☐ Bicycle - Great Rides Bike Share Program
- ☐ MATBUS
- ☐ Automobile
- ☐ Other (Please specify)

During winter season, how do you travel most often between locations on the NDSU campus?

- ☐ Walk
- ☐ Personal Bicycle
- ☐ MATBUS
- ☐ Automobile
- ☐ Other (Please specify)

What modes of transportation do you use, even occasionally, when traveling between locations on the NDSU campus? (Check all that apply.)

- ☐ Walk
- ☐ Personal Bicycle
- ☐ Bicycle - Great Rides Bike Share Program
- ☐ MATBUS
- ☐ Automobile
- ☐ Other (Please specify)

How often do you travel between NDSU campus and downtown? (i.e., one end of the trip is downtown and other end is on campus.)

- ☐ Never
- ☐ Less than Once a Month
- ☐ Once a Month
- ☐ 2-3 Times a Month
- ☐ Once a Week
- ☐ 2-3 Times a Week
- ☐ More than 3 times per week

What mode of transportation do you use most often to travel between NDSU campus and downtown?

- ☐ Walk
- ☐ Personal Bicycle
- ☐ Bicycle - Great Rides Bike Share Program
- ☐ Automobile (drive alone)
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify)

What modes do you use, even occasionally, to travel between NDSU campus and downtown? (Check all that apply.)

- ☐ Walk
- ☐ Personal Bicycle
- ☐ Bicycle - Great Rides Bike Share Program
- ☐ Automobile (drive alone)
- ☐ Carpool
- ☐ MATBUS
- ☐ Motorcycle
- ☐ Other (Please specify)

Bike Share

Bike-Share Program

Are you familiar with the Great Rides Bike Share program in Fargo?

- ☐ Yes
- ☐ No

Have you ever used the Great Rides Bike Share program, or a bike-share program in another city?

- ☐ Yes
- ☐ No

Do you use the bike share program for making any of the following types of trips? (check all that apply)

- ☐ Trips on campus
- ☐ Trips between campus and downtown
- ☐ Trips between places downtown
- ☐ Other types of trips

During the spring and fall when the bike share is available, how many **one-way trips per week** do you make on average using the bike share program?

- ☐ None
- ☐ Less than 1
- ☐ 1-4
- ☐ 5-10
- ☐ 11 or more

With the availability of Great Rides Bike Share program in Fargo, ND, do you feel you have more available public transportation options for your travelling needs?

- ☐ Yes
- ☐ No

Have you ever used both MATBUS and bike-share system to complete a single one-way trip?

Example: If you need to get from downtown to wellness center, take a bus from downtown to memorial union, and then checkout a bike at memorial union bike-share station to go to wellness center.

- ☐ Yes, frequently
- ☐ Yes, once in a while
- ☐ Never

Is there a location where you would like to see a bike-share station added?

- ☐ Yes (please specify)

- ☐ No

Transit Users

MATBUS

Have you used MATBUS?

- ☐ Yes
- ☐ No

Transit Users

How many one-way trips by bus do you make each week?

- ☐ Less than 1 per week
- ☐ 1 to 4
- ☐ 5 to 10
- ☐ 11 or more

What are normally the purposes of each bus trip? (Check all that apply.)

- ☐ School
- ☐ Grocery shopping
- ☐ General shopping
- ☐ Work
- ☐ Medical appointments
- ☐ Social/recreation
- ☐ Personal business
- ☐ Organization meetings
- ☐ Other (Please specify)

How do you rate the overall quality of MATBUS service?

- ☐ Excellent
- ☐ Good
- ☐ Satisfactory
- ☐ Poor
- ☐ Very poor

Parking

Parking

Do you have an NDSU parking permit?

- ☐ Yes
- ☐ No

Please provide any other comments you have for improving the Great Rides Bike Share program or MATBUS service.