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Assessing the Economic Impact and Health Effects of Bicycling in Minnesota

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December 2016

Research Project
Final Report 2016-36

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16. Abstract (Limit: 250 words)

This project estimated the economic impact of the bicycling industry and events in Minnesota, estimated bicycling infrastructure use across the state, and assessed the health effects of bicycling in the Twin Cities metropolitan area (TCMA). A survey of bicycling-related manufacturers, wholesalers, retailers, non-profit and advocacy groups found the industry produced a total of $779.9 million of economic activity in 2014. Using data from multiple sources, The number of bicycle trips in Minnesota was estimated to be between 75.2 and 96 million annually. The TCMA accounts for 69%-72% of the total number of trips and miles traveled in Minnesota. Bicycling events, including races, non-race rides, fundraising events, mountain bicycling events, high school races, and bicycle tours, produced a total of $14.3 million of economic activity in 2014. All six types of bicycling events mainly attract white, non-Hispanic male participants. “Riding my bicycle” was the most frequently identified reason to attend an event (except for fundraising event participants), and there is a variety of enjoyable attributes that differed across event types. Overall, respondents were satisfied with the events. Bicycle commuting prevents 12 to 61 deaths per year, saving $100 million to $500 million. Bicycle commuting three times per week is also linked to 46% lower odds of metabolic syndrome, 32% lower odds of obesity, and 28% lower odds of hypertension, all of which lower medical costs. Project findings tell a compelling story for the positive effects of bicycling and provide direct evidence that supports the efforts of promoting bicycling-related industry, infrastructure, events, and activities.

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Assessing the Economic Impact and Health Effects of Bicycling in Minnesota

Final Report

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EXECUTIVE SUMMARY

Research goals

For decades, MnDOT has identified bicycling as an integral part of Minnesota's transportation system. This is evidenced most recently with the adoption of the Complete Streets Policy, the 20-year Statewide Multimodal Transportation Plan and Statewide Bicycle System Plan. However, research on bicycling in Minnesota has been selective and does not provide a comprehensive understanding of the economic impact and health effects of bicycling (Transportation Research Synthesis#1309). Therefore, a concerted effort was needed to quantify the economic impact and assess the health effects of bicycling in Minnesota.

To address the need, this project has four goals:

- Estimate the economic impact of the bicycling industry in Minnesota by interviewing key industry informants and surveying manufacturers, parts suppliers, distributors, and retail establishments.
- Systematically review studies that estimated bicycling infrastructure use in various parts of Minnesota to provide a comprehensive estimate for the magnitude of bicycling infrastructure usage in the state.
- Estimate the economic impact of bicycling events in Minnesota by profiling attendees of selected bicycling events in Minnesota.
- Assess the health benefits of bicycling by performing secondary analysis of existing data and estimating the economic value of the health benefits associated with bicycle commuting in the Twin Cities Metropolitan Area (TCMA).

Research methods

Estimating the economic impact of the bicycling industry included developing a questionnaire to gather economic data from manufacturers, distributors, retail establishments and advocacy groups related to bicycling. Before distributing the questionnaire, in-person or telephone interviews were conducted to guide questionnaire design, sampling plan and data analysis. The data gathered from the questionnaire was used to estimate the economic impact of the bicycling industry in Minnesota using IMPLAN, an economic modeling tool using the input-output methodology to estimate the economic impact of an industry.

Estimating the magnitude of bicycle traffic in Minnesota involved review of multiple sources of information, including: (1) results of the MnDOT pilot field counts of bicycles undertaken in 2012 as part of the Minnesota Bicycle and Pedestrian Counting Initiative, (2) bicycle counts taken by local jurisdictions, including but not limited to the Minneapolis Department of Public Works, Transit for Livable Communities, the Minneapolis Park and Recreation Board, (3) counts of trail user visits taken by the Metropolitan Council, (4) trail user counts completed by the Minnesota Department of Natural Resources, (5) estimates of rates of bicycle commuting in the U.S. Census Bureau's American Community Survey (ACS), (6) estimates of frequency of bicycling from the Metropolitan Councils Travel Behavior Inventory (TBI), and (7) estimates of bicycling frequency from the MnDOT Omnibus Survey. The research team estimated the number of bicycle trips and bicycle miles traveled annually using two different methods. One

method involved extrapolation of ACS and TBI survey results, and the second involved extrapolation of Omnibus survey results. This component of the project did not estimate the economic impact of bicycling facilities (e.g., trails, bicycle lanes on streets).

Estimating the economic impact of bicycling events in Minnesota and profiling bicycling event attendees involved designing and using a two-page intercept questionnaire to collect information on visitor characteristics and their spending pattern at a selected sample of bicycling events in the state. The sample was developed with a list of bicycling events in the state compiled for this project. The sample aimed to cover a diverse array of events in terms of event type, size, location and season. The survey data was used to estimate the economic impact of bicycling events in Minnesota using IMPLAN and to profile bicycling event attendees.

To ***estimate the health benefits of bicycling***, secondary analysis was first performed with data from the Coronary Artery Risk Development in Young Adults Study (CARDIA). The CARDIA has been ongoing for the past 25 years and includes working adults in the Minneapolis/St Paul area. The study has excellent measures of cycling, other physical activities and a variety of health outcomes. Secondary data analysis informed the design of the Twin Cities Commuter Survey, which was developed and administered to a sample of commuters in TCMA. Information from the commuter survey was then used to estimate reduced morbidity due to bicycle commuting. Additionally, the economic value associated with reduced mortality due to bicycle commuting in TCMA was estimated using the Health Economic Assessment Tool (HEAT; Rutter, Cavill, Racioppi, Dinsdale, Oja, & Kahlmeier, 2013). This component of the project did not estimate the economic value associated with reduced mortality due to recreational bicycling. Nor did we estimate the economic value associated with reduced morbidity due to bicycling (commuting or recreational).

Research findings and significance

This is the first known attempt at estimating the economic impact of the bicycling industry and events in Minnesota, estimating the number of bicycle trips taken and the number of miles traveled by bicycle annually across the state, and assessing the health effects of bicycle commuting in the TCMA. Therefore, the project generated new knowledge related to bicycling in multiple aspects.

The economic impact of the bicycling industry in Minnesota

Key findings: The bicycling industry in Minnesota, including manufacturing, wholesaling, retail sales, and non-profits and advocacy groups, produced an estimated total of $780 million of economic activity in 2014. This includes $209 million of annual labor income and 5,519 jobs.

Significance: Minnesota has a strong bicycle-related manufacturing industry that drives the bicycle-related economy. Specialty bicycle retail stores, especially independent ones, are a critical component of the bicycle retail industry in Minnesota. Additionally, when asked about local suppliers, bicycling businesses often supplied names of other Minnesota companies, many of which are also bicycle-related businesses. Taken together, the findings provide evidence for the economic significance of the bicycling industry in Minnesota. Economic development

organizations can use the evidence to further seek support for bicycling businesses, non-profits and advocacy groups from private and public sectors.

The magnitude of bicycling infrastructure usage in Minnesota

Key findings: Using data from 2010 American Community Survey (ACS) and Metropolitan Council's regional Travel Behavior Inventory (TBI; 2010-2012), the number of bicycle trips in Minnesota is between 87 and 96 million annually. Using data from the 2013 MNDOT Omnibus Survey, the total estimated number of trips for the entire year is 75 million, which is somewhat lower than the estimates developed using ACS and TBI data but still in the same order of magnitude. Both of these estimates are conservative because bicycle trips on weekends for purposes of recreation are likely to be underestimated. Specifically, the ACS is designed to measure only commuting trips. The TBI is designed to measure all trips, including trips for recreation, but it is not administered on weekends when bicycle trips for recreation and fitness purposes are more likely to occur. Even though the ACS data were adjusted to account for recreational trips, underestimates from the lack of weekend data persist. Systematically estimating the use of trails and other bicycling infrastructure provided additional evidence of the spatial demand for bicycling. The TCMA accounts for 69 percent to 72 percent of the total number of trips and miles traveled in the state. At the same time, some counties in Greater Minnesota (e.g., Olmsted County, St. Louis County) have comparable numbers of annual bicycle trips as some of the counties in the TCMA.

Significance: The findings demonstrate people have an interest in bicycling across Minnesota, and there is (latent) demand and support for increased bicycle facilities and networks. The findings can help identify demand and support for bicycle facilities throughout the state that align with priorities identified in the Statewide Bicycle System Plan. The findings also indicate the importance of facilitating bicycling safety, as safer bicycling infrastructure and networks will likely lead to more people bicycling and more bicycling trips.

The economic impact of bicycling events in Minnesota and event attendee profile

Key findings: Bicycling events consist of races, non-race rides, fundraising events, mountain bicycling events, high school races and bicycle tours. An online survey of non-local participants (i.e., visitors) in 26 bicycling events found that an average bicycle event visitor spent a total of $121 per day in 2015. This spending translates into an estimated total of $14 million of annual economic activity, which includes $5 million in annual labor income and 150 jobs. Additionally, event participants, on average, brought an additional half person with them, which added up to more than 19,000 visitors who were travel companions but did not ride in any event.

The majority of participants in all six types of bicycling events were white, non-Hispanic males. There was some difference in participants' age, education and income levels. At least half of respondents had previously attended the surveyed event. Most respondents spent one or two nights on the entire trip, most commonly in a hotel/motel. The travel group size and type varied between different types of events. "Riding my bicycle" was the most frequently identified reason to attend an event (except for fundraising event participants), and there was a variety of enjoyable attributes that differed across event types. Overall, respondents were satisfied with the events.

Significance: Bicycling event attendees and their travel companions are a captive audience for shopping, recreation and amusement activities. Communities hosting events could explore opportunities to capture additional spending, for example, offering event-related specials for shopping, dining, and entertainment activities. The findings can bring together event organizers and officials of economic development, transportation, public health and tourism to orchestrate efforts of using bicycling events to promote: (1) the facilities on which the events take place, (2) the communities in which the facilities are located, and (3) bicycle tourism as a whole.

The health benefits of bicycle commuting in TCMA

Key findings: According to the results of Twin Cities Commuter Survey, bicycle commuting in the TCMA prevents 12 to 61 deaths per year, saving $100 million to $500 million annually. In the TCMA, bicycle commuting three times per week is also linked to 46 percent lower odds of metabolic syndrome, 32 percent lower odds of obesity, and 28 percent lower odds of hypertension, all of which lower medical costs.

Significance: The findings provide health and transportation officials and health care providers with multiple policy implications, including: (1) use the information to promote active transportation via bicycling as a type of physical activity that can be integrated into daily lives through policies and intervention programs, e.g., employers to incentivize bicycle commuting, (2) develop consistent safety education and encouragement messages statewide to increase bicycle commuting, and possibly, other utilitarian trips (e.g., running errands), and (3) continue to encourage and implement safe bicycling to school and access to bicycles for youth across the state.

Taken together, accessible and high-quality bicycling infrastructure, partnered with bicycle education, promotion, and planning, supports and encourages bicycle riding, which contributes to the bicycling industry and generates positive health benefits. Bicycle infrastructure also supports bicycle events, which contribute to the state economy and increase in ridership. A strong bicycling industry, vibrant bicycle events, and high ridership, in turn, demonstrate the need to maintain and increase accessible and high-quality bicycling infrastructure.

Recommendations for future research

To summarize, project findings tell a compelling story for the positive effects of bicycling and provide direct evidence that supports the efforts to promote bicycling-related industry, infrastructure, events, and activities. In light of project findings, we provide the following four recommendations for future research:

- estimate the economic impact of trails and other bicycling infrastructure throughout the state
- estimate the economic impact of bicycle tourism, not just bicycle events, in the state
- assess health effects associated with bicycling, both recreational and utilitarian, across the state
- include any negative or offsetting effects that may be associated with bicycling (utilitarian and recreational)

CHAPTER 1:
INTRODUCTION

1.1 **Research objective and goals**

In 2012, MnDOT identified bicycling as an integral part of Minnesota's transportation system in its 20-year Statewide Multimodal Transportation Plan. However, research on bicycling in Minnesota has been selective and does not provide a comprehensive understanding of the economic impact and health effects of bicycling (Transportation Research Synthesis #1309). Therefore, a concerted effort is needed to quantify the economic impact of and to assess the health effects of bicycling in Minnesota.

To address the need, this project has four goals:

- Estimate the economic impact of bicycling industry in Minnesota, by interviewing key industry informants and surveying manufacturers, parts suppliers, distributors, and retail establishments.
- Systematically review studies that estimated bicycling infrastructure use in various parts of Minnesota to provide a comprehensive estimate for the magnitude of bicycling infrastructure usage in the state.
- Estimate the economic impact of bicycling events in Minnesota, by profiling attendee s of selected bicycling events in Minnesota.
- Assess the health benefits of bicycling, by performing secondary analysis of existing data and estimating the economic value of the health benefits associated with bicycle commuting.

Together, the four goals demonstrate the impact of bicycling on economy, transportation, tourism, recreation and health, all of which, as shown in previous research (report No. MN/RC 2013-05), are integral to quality of life.

1.2 **Research problem and historical background**

A recent study of transportation and quality of life in Minnesota (Schneider, Guo, & Schroeder, 2013) found that Minnesota residents perceived the need for more bicycling facilities. To support the planning of such facilities and to determine future investment, it is critical to comprehensively understand the economic impact and health effects of bicycling. Previous research in various states in the U.S. demonstrated that the bicycling industry can be a strong economic driver that produces both direct and indirect economic return (BBC Research & Consulting, 2014; Lankford, Lankford, Grybovych, Bowles, Fleming, Fuller, et al., 2011; McClure Consulting LLC, Economic and Policy Resources, Inc., & Kimley-Horn and Associates, Inc., 2012; Simmons, Kay, Ingles, Khurana, Sulmont, & Lyons, 2015; Weigand, 2008). Minnesota, named the second most bicycle friendly state in the U.S. by American League of Bicyclists in 2014, has a significant presence in the bicycling industry. However, there has been no consistent effort to assess the economic impact of the bicycling industry in Minnesota.

Recreational bicycling, according to Venegas (2009), was the second most prevalent activity on Minnesota trails and made similar contributions to Gross State Product and job creation as walking/hiking, the most prevalent activity. There are multiple studies that estimated the

magnitude of bicycling infrastructure use in different areas of Minnesota. However, there has been no effort to systematically review the data produced by these studies to provide a comprehensive estimate for the use of trails and other bicycling infrastructure. Such an estimate will provide evidence of demand for bicycling throughout the state, which is important to state and local policy makers and transportation planners and engineers in at least two ways: (1) providing input into the evaluation of proposals for new facilities and rehabilitation of existing facilities, and (2) facilitating bicycling safety, which was expressed as a concern in the MnDOT-funded study on transportation and quality of life (report No. MN/RC 2013-05).

Bicycling events, from half-day road races to large-scale commercial tours, stimulate local economy and provide revenue by attracting participants and spectators (BBC Research & Consulting, 2014; Lankford, et al., 2011; McClure Consulting LLC, et al., 2013; Weigand, 2008). Minnesota has more than 100 bicycling events annually. Estimating the economic impact of these events is needed to understand their contributions to local economies.

Lastly, studies found that the health benefits of bicycling include increased fitness and reduced mortality and cardiovascular risk factors (Gordon-Larsen, Boon-Heinonen, Sidney, Sternfeld, Jacobs, & Lewis, 2009; Oja, Titze, Bauman, de Geus, Krenn, Reger-Nash, & Kohlberger, 2011; Simmons, et al., 2015). However, it remains unclear what, if any, health benefit is associated with bicycling in Minnesota.

1.3 **Scope and limits of the research**

The project consists four components: (1) estimating the economic impact of bicycling industry in Minnesota, (2) estimating volume of bicycling in Minnesota, (3) estimating the economic impact of bicycling events in Minnesota and profiling event attendees, and (4) assessing the health benefits associated with bicycling in Minnesota. The scope and limits of the four components are described below.

Estimating the economic impact of bicycling industry included developing and disseminating a questionnaire to gather economic data from manufacturers, distributors, retail establishments, and advocacy groups related to bicycling. Before distributing the questionnaire, in-person or telephone interviews were conducted to gather information that informed questionnaire design, sampling plan, and data analysis. The data gathered from the questionnaire was used to estimate the economic impact of bicycling industry in Minnesota using IMPLAN, an economic modeling tool using the input-output methodology to estimate the economic impact of an industry. See Appendix A for documentation of the input-output methodology.

Estimating the magnitude of bicycle traffic in Minnesota involved review of multiple sources of information, including: (1) results of the MnDOT pilot field counts of bicycles undertaken in 2012 as part of the Minnesota Bicycle and Pedestrian Counting Initiative, (2) bicycle counts taken by local jurisdictions, including but not limited to the Minneapolis Department of Public Works, Transit for Livable Communities, the Minneapolis Park and Recreation Board, (3) counts of trail user visits taken by the Metropolitan Council, (4) trail user counts completed by the Minnesota Department of Natural Resources, (5) estimates of rates of bicycle commuting in the U.S. Census Bureau's American Community Survey (ACS), (6) estimates of frequency of bicycling from the Metropolitan Councils Travel Behavior Inventory (TBI), and (7) estimates of

bicycling frequency from the MnDOT Omnibus Survey. The research team estimated the number of bicycle trips and bicycle miles traveled annually using two different methods. One method involved extrapolation of ACS and TBI survey results; the second involved extrapolation of Omnibus survey results. This component of the project did not estimate the economic impact of bicycling facilities (e.g., trails, bicycle lanes on streets).

Estimating the economic impact of bicycling events in Minnesota and profiling bicycling event attendees involved designing and using a two-page intercept questionnaire to collect information on visitor characteristics and their spending pattern at a selected sample of bicycling events in the state. The sample was developed with a list of bicycling events in the state compiled for this project. The sample aimed to cover a diverse array of events in terms of event type, size, location, and season. The survey data was used to estimate the economic impact of bicycling events in Minnesota using IMPLAN and to profile bicycling event attendees.

To estimate the health benefits of bicycling, secondary analysis was first performed with data from the Coronary Artery Risk Development in Young Adults Study (CARDIA). The CARDIA has been ongoing for the past 25 years and includes working adults in the Minneapolis/St Paul area. The study has excellent measures of cycling, other physical activities, and a variety of health outcomes. Secondary data analysis informed the design of the Twin Cities Commuter Survey, which was developed and administered to a sample of commuters in Twin Cities. Information from the commuter survey was then used to estimate reduced morbidity due to bicycle commuting. Additionally, the economic value associated with reduced mortality due to bicycle commuting was estimated using the Health Economic Assessment Tool (HEAT; Rutter, Cavill, Racioppi, Dinsdale, Oja, & Kahlmeier, 2013). This component of the project did not estimate the economic value associated with reduced mortality due to recreational bicycling. Nor did it estimate economic value associated with reduced morbidity due to bicycling (commuting or recreational).

It is worth noting that devising these four components helped avoid double-counting, extrapolating the results of non-Minnesota economic models to Minnesota, and comingling data related to users and non-users, as well as data related to visitors and non-visitors. All these were strongly advised against by an earlier synthesis of transportation literature (TRS 1309).

1.4 **Organization of the report**

This report is organized in eight chapters. Chapter 1 provides an introduction of the project. Chapter 2 documents the results from estimating the economic impact of bicycling industry in Minnesota. Chapter 3 documents the results from estimating the volume of bicycling infrastructure use in Minnesota. Chapter 4 documents the results from estimating the economic impact of bicycling events in Minnesota. Chapter 5 profiles attendees to a selected sample of bicycling events in Minnesota. Chapter 6 reports secondary analysis results using data from CARDIA. Chapter 7 reports on the economic value associated with reduced mortality due to bicycle commuting and estimates of reduced morbidity due to bicycle commuting. Chapter 8 provides a discussion of project findings, a conclusion and recommendations for future research.

CHAPTER 2:
ECONOMIC CONTRIBUTION OF BICYCLE INDUSTRY IN MINNESOTA

2.1 **Introduction**

This section focuses on the economic contribution of the bicycling industry. In this study, the bicycle industry in Minnesota included:

- Retailers
- Wholesalers
- Manufacturers
- Advocacy groups
- Service providers

Information about the bicycling industry is scattered, so we filled the information gaps by:

- Creating a list of bicycle-related businesses in Minnesota
- Interviewing bicycle related business leaders
- Surveying bicycle-related businesses
- Gathering additional information from relevant sources

We used this information to create an economic model that shows the economic contribution of the bicycling industry in Minnesota. In 2014, the bicycle industry in Minnesota supported an estimated $779.9 million of economic activity in the state. This includes an estimated $208.8 million in wages, salaries, and benefits paid to Minnesota workers. In 2014, the industry further supported an estimated 5,519 employees.

Our research design was modeled after similar work by the Arizona Department of Transportation. The remainder of this section describes our results and methods.

2.2 **Methods**

2.2.1 Methods Overview

We wanted to understand how the bicycling industry in Minnesota worked since understanding the industry helps create an accurate economic model. We found talking to people involved in the industry helped our understanding of it. We followed several steps to measure the impact of the bicycling industry, which included the following:

- Gathering a list of the bicycle related businesses in Minnesota. This information came from a variety of sources, including the ReferenceUSA database, Yellowpages.com, Bikeshop.us, and bicycle industry experts.
- Asking industry experts to review our list. Afterward, we added or deleted businesses that were either missing or closed. The list also included he business name, address, phone number, and business type. A total of 288 bicycle-related businesses were identified. (Appendix B-1)

- Conducting individual interviews with 15 bicycle industry leaders. The purpose was to provide context for the bicycle industry in Minnesota and improve the surveying strategy we used.
- Creating and distributing a survey to the 288 businesses.
- Using survey results, along with additional economic information, to create an economic model using IMPLAN software. The results provided an approximation of the economic contribution of bicycling in Minnesota. (Appendix A)

2.3 **Method: Creating a Bicycle Industry Business List**

It was important to have an accurate list of bicycle industry businesses. Many of the ones available were incomplete or out of date, so we overcame that challenge in two ways.

First, we gathered a list of the bicycle-related businesses in Minnesota. This information came from a variety of sources, including the ReferenceUSA database, Yellowpages.com, Bikeshop.us, and industry experts. We compiled the results to create a master list.

Second, we asked people involved in the bicycle industry to review our list. We added any businesses that were missing or removed those that had closed. The list included the business name, address, phone number and business type. A total of 288 bicycle related businesses were identified (Appendix B-1). The list was compiled from a variety of sources based on physical location, so a company could appear on the list multiple times if it had more than one location.

The list contained all businesses with links to the bicycle industry. To measure economic impact, it was critical to have more information on the number of businesses by category. Table 1 shows major business categories and the number of business locations on the list. The number of companies represented is also shown in Table 1. For example, there were 35 business locations for bicycle specialty stores with multiple locations, but the locations only represented eight individual companies.

Table 1 Business List by Category

Business Type	Number of Business Locations on List	Number of Individual Companies Represented
Bicycle Specialty Stores –One Location	105	105
Bicycle Specialty Stores –Multiple Locations	35	8
General Sporting Goods Stores, One Location	44	44
General Sporting Goods Stores, Multiple Locations	21	5
Other General Merchandise Stores	3	3
Bicycle Rentals	29	29
Online Bicycle Sales	2	2
Bicycle Advocacy Groups	3	3
Manufacturers and Wholesalers	31	31
Other (cycling studios, antiques, etc.)	9	9
Bicycling is not primary focus (motorcycle shops, etc.)	6	NA
Total	288	239

2.4 **Method: Industry Expert Interviews**

We conducted individual interviews with 15 industry leaders. The purpose was to provide context about the bicycle industry in Minnesota and to improve our surveying strategy. Engaging with experts in the bicycling industry was an effective way to gather information, contacts, and insights. We used what we learned to design a questionnaire and a survey approach to get the best results.

During the interviews, three major themes emerged about the bicycling industry. The interviews also provided five important survey-related insights.

2.4.1 Key Themes about the Bicycling Industry in Minnesota

Theme 1: Passion for Bicycling

People in the bicycling industry are passionate about bicycling, and the bicycling culture is important to them. People who make bicycle products are likely to buy them. This is an important aspect of the bicycle industry in Minnesota and appears to add value to those that participate.

Most important, however, is that people's passion for bicycling often leads to support for those who try to enhance the accessibility, safety and prevalence of bicycling in Minnesota. A theme among those interviewed was "I just want to see more people bicycling" or "I want to do things to help others catch the bicycling bug." Their passion for bicycling extended beyond simply liking a product and encompassed an entire lifestyle. Tapping into this passion will be important to the success of this project.

Theme 2: Retail Trends and Marketplace

The retail sector for bicycle products in Minnesota is competitive. Major retailers and sporting goods stores are dominant in offering lower prices. Competition at low price points is intense. One interviewee described the bicycling category among major retailers as "a race to the bottom," meaning that retailers are constrained by consumer demand and try to offer the lowest prices on bicycles. At the same time, these retailers must also live with the tradeoffs that low prices bring. One tradeoff is that lower priced bicycles mean a lower profit margin, making them less appealing to sell. Discount department stores and sporting goods stores would like to sell higher profit margin bicycles, but they are limited by consumer demand for lower prices. Another tradeoff is that lower quality bicycles do not always satisfy customers in the long run. Lower quality bicycles are constructed with lower quality components, and those components fail faster with use. When this happens, it is often less costly to purchase a new bicycle than to repair the broken one. Since discount department stores and sporting goods stores do not have the ability to repair broken bicycles, it leads to a poor situation for retailers, because they are unable to meet customer expectations. For consumers, it can lead to frustration.

Independent and multi-location bicycle shops, on the other hand, specialize in higher quality and higher priced bicycles. They offer specialized services, knowledgeable staff and repair services. Their bicycle product lines are driven by sales agreements with major bicycle manufacturers. Since product distributors and manufacturers offer discounts for larger orders, many small

bicycle shops are limited to carrying one to two product lines. This limits the number of independent products they can offer, as they might be competing with a core supplier. Some custom bicycles are available at independent retail shops, but most are purchased directly from custom bicycle builders.

Theme 3: Critical Firms

Minnesota is home to two global bicycle product and equipment firms. They are Quality Bicycle Products (QBP) and Park Tool. The importance of each firm to the Minnesota industry was mentioned often in interviews.

QBP was discussed most frequently as an important firm in Minnesota. QBP provides retailers with products, contacts, information and advice. The organization also distributes product for connected to component manufacturers.

Park Tool, on the other hand, produces bicycle repair tools. Their products are likely used by all bicycle shops that offer repair services.

2.4.2 Insights for Survey Questionnaire and Sampling Plan

Interviewees reviewed and provided feedback on the sample survey, survey methods and list of bicycle- related businesses. Below are several insights they offered and how those affected our surveying plans.

Insight #1: An online survey is preferred

All interviewees requested an online survey rather than a paper one, as it was easier to complete. Based on this feedback, we developed a sampling plan that used an online survey. It was designed and delivered using Qualtrics, an online survey tool available through the University of Minnesota.

Insight #2: People completed the survey because they wanted to support bicycling in Minnesota and provide decision makers with important information.

All communication about the survey and should highlight the value of the project and how it will impact bicycling in Minnesota. Monetary incentives, drawings and other methods are often used to increase a survey's response rate, but for this project that approach will likely be less effective than providing a compelling connection between the survey results and bicycling in Minnesota. The most important incentive for participating in our survey will be identifying with peoples' passion for bicycling.

Realizing this fact, we designed survey tools with this information in mind. We highlighted the importance of the project to bicycling in Minnesota at every opportunity possible. (See Appendix B-2 for examples.)

Insight #3: Importance of comfort, hybrid, and lifestyle bicycles as a retail segment

Comfort, hybrid and lifestyle bicycles are a larger part of the Midwest bicycle retail segment than in other regions. For independent retailers, this sales category is likely the largest. The Midwest is unique, because in other parts of the country a bicycle dealer's sales come primarily from racing and mountain bicycles. Knowing this information, the survey requested revenue information about this retail segment.

Insight #4: Willingness of industry contacts to assist with survey distribution

People in the Minnesota bicycling industry know each other and work together often. Relying on these social connections will be an effective strategy for encouraging participation and raising awareness of the project. Several respondents expressed a willingness to share the survey link and information with their networks via email and social media. This should be encouraged and supported, as it will likely lead to greater participation in the survey. This insight allowed us to provide a template email to key industry contacts who then shared it with their network. The email briefly explained the project, provided the core value about participation (see insight #2) and provided the link to the survey.

Insight #5: Fat bicycles are a small but quickly growing category

Fat tire bicycles are a small but growing retail category, but it might still be considered a niche product. This type of bicycle is primarily used for winter mountain bicycling and recreation and has a higher price point than traditional mountain bicycles. There is growing competition among fat bicycle manufacturers that may have an impact on the price and quality of the existing product mix. New entrants to this manufacturing sector (including at least one Minnesota-based company) are putting pressure on the profit margins that retailers and manufacturers get from each bicycle sale.

This insight enabled us to request revenue information about flat tire bicycles in the survey, although the overall revenue attributed to them will be a small percentage of overall sales for most retailers.

2.5 **Method: Bicycle Industry Survey**

Applying the insights from our expert interviews, we created and distributed a survey to bicycle-related businesses using the list of bicycle-related businesses as our mailing list.

The online survey was the main source of primary data for this study. A survey link was sent to all businesses identified as related to the bicycle industry and directed respondents to a specific subset of questions corresponding to their type of business. For example, retailers answered one set of questions, wholesalers and manufacturers answered a second set of questions, and advocacy groups answered a third set. The survey instrument gathered data on expenditures, labor income, and employment. Refer to Appendix B-2 for cover letter materials, B-3 for survey schedule, and B-4 for the survey questionnaire.

After the survey was sent, 25 were returned due to an incorrect address or a closed business. The business list was then modified based on these return notifications. The final list, compiled in 2015, contained a total of 282 business locations.

The survey information with a link to the online survey and a letter explaining the survey was distributed between June 16 and August 15 via mail and email.

The survey was also emailed to those who participated in expert interviews, as several people agreed to share it with their networks. Three rounds of reminder postcards were sent every two weeks.

In total, the survey received 52 responses, an overall response rate of 22 percent. Response rates varied significantly, however, based on the group surveyed.

Response rates were highest from the bicycle specialty and general sporting goods stores with multiple locations. Of the 13 companies represented, eight responded, for a response rate of 62 percent. Response rates were also relatively high for the manufacturers and wholesalers. Of the 31 companies represented in the list, 14 responded, for a response rate of 45 percent.

Response rates were lowest among the bicycle specialty, general sporting goods stores and bicycle rental stores with one location. The survey received 29 responses from this group, a 17 percent response rate. Since response rates were low in this category, the economic census product line data was used to verify the accuracy of responses.

No responses were received from other general merchandise stores, online stores, advocacy groups and the other category. General merchandise store data was supplemented with economic census product line data, as explained in section 2.5. Advocacy group data was supplemented with the GuideStar database, also explained below. Online stores and other were not included in the analysis.

All survey data was entered into a Microsoft Excel file and responses were segmented according to business category. The data was cleaned and outliers were removed. Outliers were defined as data points that were three times plus or minus the standard deviation for the set of data points. Average total expenditures, labor income expenditures and employment figures were then calculated for retailers and manufacturers/wholesalers. Average capital improvement expenditures were also calculated for manufacturers/wholesalers.

The responses from retailers were divided into two sub-groups based on the number of locations. Average expenditures (including payroll and labor costs) and employment were calculated for businesses with only one location and for those with multiple locations. Average expenditures and employment were then multiplied by the number of businesses on the list to arrive at total expenditures for each category. Since the survey asked about total expenditures at the business location, information from the Economic Census (see below) on the percent of total sales attributable to bicycles was used to adjust for bicycle-related sales.

The responses from manufacturers and wholesalers were also averaged and multiplied by the number of businesses on the list, with one exception. Minnesota is home to one major manufacturer, and this manufacturer responded to the survey. The response for this business was

not included in the averages, but rather added back at the end of the calculations. This was done to ensure the response did not overinflate the averages for all other businesses.

2.6 **Method: Economic Information from Additional Sources**

We used additional economic information from two other sources to enhance the information we gathered from the bicycle industry survey.

2.6.1 Economic Census Product Line

The bicycle industry survey provided a wealth of information about the retailers, manufacturers and wholesalers. There were a few gaps in the data, however, as detailed above. We used data from the Economic Census (U.S. Census Bureau) to fill these gaps. The Economic Census has sales data, called Product Line data, for retailers selling bicycles, parts and accessories. The latest available data for Minnesota is for 2012.

Output for retail categories that we didn't receive data for or were not adequately represented in the surey list (i.e., discount department stores, warehouse clubs and supercenters, and other general merchandise) was gathered from the Economic Census Product Line report. The data was then converted to 2014 dollars using the Consumer Price Index (CPI) from the United States Bureau of the Labor Statistics.

We also gathered output data for bicycle rentals from the Economic Census Product Line report. The report estimates sales for all recreational equipment rentals in 2012. To focus only on bicycle rentals, we adjusted the total figure by using the number of rental facilities on the bicycle industry list we created and adjusting by the percentage of bicycle-related sales.

We used the input-output model, IMPLAN, to generate employment and labor income figures associated with the output of these retail sectors because the Product Line data did not. The model contains a ratio that determines the number of employees and labor income generated per dollar of output. The ratio is specific to the particular industry being analyzed. In this case, we used the ratio for retail trade – sporting goods. The ratio is based on 2013 IMPLAN data.

The Product Line data was also used to verify results from the survey. The Economic Census reports 99 speciality bicycle stores; the list in this analysis contians 113. The Census reports 67 general sporting goods stores; the list in this analysis contains 49. Thus, in the analysis, 113 speciality stores were used and 67 general sporting goods. The Product Line data reports $82.4 million in sales from specialty bicycle stores and general sporting goods stores. Using the bicycle industry survey, our analysis shows total sales of $79.5 million, or 4 percent lower.

2.6.2 GuideStar Database

Non-profit groups in Minnesota can be tracked through GuideStar, an online storage place for data on non-profits. Using the keywords "bike" and "bicycling," we identified 16 non-profit organizations involved in promoting, advocating for or supporting bicycling in the state. The organizations are listed in Appendix B-5. GuideStar provides revenues and expenses for each of the organizations in the database; the data provided is from the United States Internal Revenue Service (IRS) Form 990, which is filed by the organization.

2.7 **Method: Input-Output Modeling**

We used the information we gathered to modify an economic model called an input-output model. IMPLAN (IMpact Analysis for PLANning, Minnesota IMPLAN Group) is one such model. Many economists use IMPLAN for economic contribution analysis because it can measure output and employment impacts, is available on a county-by-county basis, and is flexible for the user. IMPLAN has some limitations, but it is one of the best tools available to economists for input-output modeling. Understanding the IMPLAN tool, its capabilities and its limitations will help ensure the best results from the model. Appendix A provides a more detailed description of this methodology and a description of key terms. In this analysis, IMPLAN version 3.0 was used and the trade flows model with SAM multipliers was implemented.

2.8 **Method: Summary**

Figure 1 shows the overall research approach we used to estimate the economic contribution of the bicycling industry. At the center of the model is an input-output model. We used a variety of information sources to ensure the input-output model accurately represented the Minnesota bicycle-related industry.

The next section of this report discusses the results from our research process.

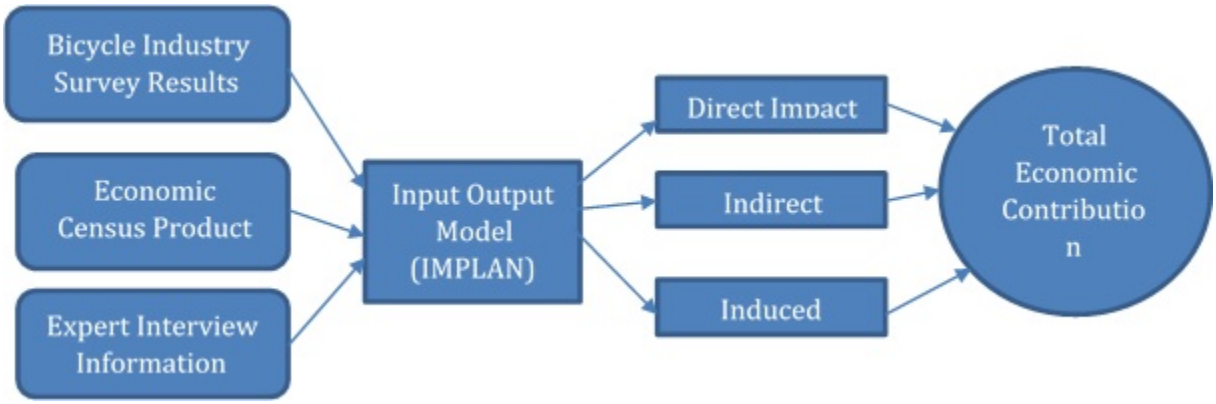

Figure 1 Summary of Research Approach

2.9 **Results - Economic Contribution of the Bicycle Industry in Minnesota**

Total economic contribution is measured by combining the direct, indirect and induced effects.

The bicycle industry in Minnesota has three main components – retailers, wholesalers and manufacturers and advocacy groups.

Retailers, in this study, include businesses selling new or used bicycles, parts and accessories, repair services, and bicycle rentals. Several types of retailers are involved in the bicycle industry,

including specialty retailers, general sporting goods retailers, discount department store retailers, warehouse and supercenter stores, and general merchandise stores.

Wholesalers and manufacturers included in this study make or sell bicycles, bicycle parts, and accessories related to bicycling (including clothing, trailers, and bicycle racks).

Advocacy groups are organizations that support and promote bicycling in the state.

2.9.1 Direct Effect of the Bicycle Industry

For the bicycle industry, direct effect is equal to bicycle-related operational and capital improvement spending by the businesses and organizations in each of the categories. Direct effect is measured in economic output, employment and labor income. The initial step of an economic contribution analysis is to quantify each of these direct effects for the industry.

2.9.2 Direct Effect of Bicycle-Related Retailers

In 2014, retailers in Minnesota generated an estimated $95.9 million of sales from bicycle parts and accessories, bicycle repairs, and bicycle-related rental activity (Table 2). The retailers employed an estimated 1,827 people and paid an estimated $34.3 million in labor income.

Table 2 Direct Effect of Bicycle-Related Retail Sales in Minnesota, 2014

	Output (millions)	Employment	Labor Income (millions)
Total	**$95.9**	**1,827**	**$34.3**
Sporting Goods Stores – Bicycle Specialty	$66.8	1,481	$27.2
Sporting Goods Stores - General	$12.7	279	$5.2
Department Stores, General Merchandise, and Warehouse/Supercenters	$15.8	61	$1.6
Bicycle Rentals	$0.6	6	$0.3

Sporting goods stores values derived from an industry survey. Other values derived from the Economic Census and IMPLAN.

2.9.3 Direct Effect of Bicycle-Related Manufacturers and Wholesalers

In addition to bicycle retailers, Minnesota is also home to several major manufacturers and wholesalers that specialize primarily in producing or selling bicycles, bicycle parts, bicycle accessories, and bicycle-related apparel. In 2014, bicycling-related manufacturers and wholesalers in Minnesota created an estimated $368.3 million in sales via their operations (Table 3). They also spent $14.8 million on capital investments (e.g., new buildings or equipment).

Table 3 Direct Effect of Bicycle-Related Manufacturing and Wholesale Activity in Minnesota, 2014

	Output	Employment	Labor Income

	(millions)		(millions)
Total	**$383.1**	**1,738**	**$66.3**
Operations	$368.3	1,684	$61.6
Capital Investments	$14.8	54	$4.7

Values derived from industry survey.

2.9.4 Direct Effect of Non-Profit and Advocacy Groups Related to Bicycling

Finally, in addition to retailers, wholesalers and manufacturers involved in the bicycle industry in Minnesota, there are also organizations that support and promote bicycling and healthy living in the state. These organizations also generate economic activity.

In total, the 16 organizations identified spent an estimated $7.0 million on operations in 2014. The estimate was based on the most recently reported fiscal year's data, which could be different from organization to organization. Only organizations with financials reported between 2013 and 2015 were included in the analysis. Based on the input-output model, IMPLAN, $7.0 million in operational expenditures by non-profit and advocacy groups translates into an estimated 85 direct jobs and an estimated $4.5 million of labor income paid to employees of the organizations (Table 4).

Table 4 Direct Effect of Bicycle-Related Non-Profit and Advocacy Groups in Minnesota, 2014

	Output (millions)	Employment	Labor Income (millions)
Non-Profits and Advocacy Groups	$7.0	85	$4.5

Values derived from GuideStar database and IMPLAN.

Fifteen of the organizations were categorized as social advocacy industries. One organization, Nice Ride, was categorized as a general consumer rental business in the model, due to its bicycle-rental function. This means Nice Ride has a different spending pattern than other non-profit and advocacy groups.

2.9.5 Total Direct Effect of the Bicycle Industry

In 2014, the Minnesota bicycling industry directly created $486.0 million of economic activity in the state (Table 5). This includes $105.1 million worth of income paid to those involved in the industry. Retailers, manufacturers, wholesalers and advocacy groups involved in the industry employed an estimated 3,650 workers.

Table 5 Direct Effect of the Bicycle Industry in Minnesota, 2014

	Output (millions)	Employment	Labor Income (millions)
Total	**$486.0**	**3,650**	**$105.1**
Retail	$95.9	1,827	$34.3
Manufacturing and Wholesale	$383.1	1,738	$66.3

Non-Profits and Advocacy Groups	$7.0	85	$4.5

Values derived from industry survey, United States Economic Census, GuideStar, and IMPLAN.

2.9.6 Indirect and Induced Effects

Using estimated direct effects, the data was entered into an input-output model.[1] Input-output models trace the flow of dollars throughout a local economy and can capture the indirect and induced, or ripple, effects of an economic activity. The input-output model IMPLAN was used in this analysis.[2]

Indirect effects are those associated with a change in economic activity due to spending for goods and services directly tied to the industry. In this case, these are the changes in the local economy occurring because bicycle manufacturers, for example, purchase goods (e.g., steel and aluminum) and related services (e.g., engineering and accounting). The bicycle manufacturers' purchases create an increase in purchases across the supply chain. Indirect effects are the sum of these changes across an economy.

Induced effects are those associated with a change in economic activity due to spending by the employees of businesses (labor) and by households. Primarily, in this study, these are economic changes related to spending by bicycle industry employees. It also includes household spending related to indirect effects. As employees of bicycle manufacturers make purchases locally, this triggers increases in purchases on that supply chain.

The indirect and induced effects of the bicycle industry are shown in the following tables, along with a discussion of the total impact. For more on the definitions of terms, please see Appendix A.

2.9.7 Total Economic Contribution of the Bicycle Industry in Minnesota

In 2014, the bicycle industry in Minnesota supported an estimated $779.9 million of economic activity in the state (Table 6). This includes an estimated $208.8 million of wages, salaries, and benefits paid to Minnesota workers. In 2014, the industry further supported an estimated 5,519 employees. For context, in 2014, total economic output in Minnesota topped $577.5 billion. There were 3.5 million jobs in the state.

[1] The retail sales data were margined when entered into the IMPLAN model. Margining is performed on retail sales data since all output in the IMPLAN model is in producer prices and retail sales are in purchaser prices. Margining appropriates a retail sale into the components of the sale. It measures the value of the sale minus the cost of the good sold, commonly known as the retail mark-up. The retail mark-up is the direct local impact used by the model to calculate the economic contribution.

[2] The analysis was conducted with the IMPLAN model version 3.0 and data from 2013. The type SAM multipliers were used. There are several types of multipliers – type I, type II, and type SAM. SAM multipliers are often preferred because they use the social accounting matrix (SAM) to calculate the indirect and induced effects. The social accounting matrix provides detailed data on household income expenditures, allowing for a more accurate measurement of induced effects. Type I multipliers do not include any household impacts. Type II multipliers assume all labor income payments are to local residents. The SAM multiplier allows for social insurance and in-commuters, thus more accurately reflecting complex economies.

Table 6 Total Economic Contribution of the Bicycling Industry in Minnesota, 2014 (Sum of Tables 7 through 9)

	Direct	Indirect	Induced	Total
Output (millions)	$486.0	$152.3	$141.6	$779.9
Employment	3,650	829	1,040	5,519
Labor Income (millions)	$105.1	$55.8	$47.9	$208.8

Estimates by University of Minnesota Extension

Of the total activity supported by the bicycling industry, $149.2 million was derived from the activity of bicycle-related retailers (Table 7). Retailers further supported $52.2 million in labor income and employment for an estimated 2,189 workers. In comparison, Minnesota's retail trade businesses had $25.1 billion of sales in 2014. Retail trade businesses employed 339,400 workers.

Table 7 Total Economic Contribution of Bicycle-Related Retail Sales in Minnesota, 2014

	Direct	Indirect	Induced	Total
Output (millions)	$95.9	$17.8	$35.5	$149.2
Employment	1,827	105	257	2,189
Labor Income (millions)	$34.3	$5.9	$12.0	$52.2

Estimates by University of Minnesota Extension

Manufacturers and wholesalers of bicycles, parts, and related-accessories also contributed to the industry's impact. In 2014, manufactures and wholesalers generated $616.6 million in economic activity (Table 8). Of this, $149.6 million was labor income. Manufacturers and wholesalers also helped create 3,198 jobs in the state. In comparison, Minnesota's manufacturers directly generated $139.3 billion of output and employed more than 317,600 people in 2014. Businesses in the transportation equipment manufacturing sector, the category of bicycle manufacturing, generated $6.4 billion of output and employed 11,100 workers.

Table 8 Total Economic Contribution of Bicycle-Related Manufacturing and Wholesale Activity in Minnesota, 2014

	Direct	Indirect	Induced	Total
Output (millions)	$383.1	$132.1	$101.4	$616.6
Employment	1,738	708	748	3,194
Labor Income (millions)	$66.3	$49.0	$34.3	$149.6

Estimates by University of Minnesota Extension

Finally, bicycling non-profits and advocacy groups contributed to the state's economy. In 2014, these organizations supported $14.1 million of economic activity, including $7.1 million of labor income and helped generate 135 jobs (Table 9).

Table 9 Total Economic Contribution of Bicycle-Related Non-Profits and Advocacy Groups in Minnesota, 2014

	Direct	Indirect	Induced	Total

Output	$7.0	$2.4	$4.7	$14.1
Employment	85	15	34	134
Labor Income	$4.5	$1.0	$1.6	$7.1

Estimates by University of Minnesota Extension

CHAPTER 3:
ESTIMATES OF TRIPS AND MILES TRAVELED

3.1 **Introduction**

How many people in Minnesota bicycle? How often do they ride? How far do they ride? Our inability to answer these types of basic questions has limited our ability to establish practical policies, set meaningful targets, plan effectively, and invest efficiently in bicycling infrastructure and programs that meet the needs of the state. Minnesota's policy-makers, planners and engineers need information about the use of bicycle infrastructure to build a safe, sustainable transportation system that meets the needs of Minnesota's residents in the 21st Century.

Developing a comprehensive estimate of the magnitude of bicycling in the state involved collecting and summarizing studies of the use of bicycle infrastructure in Minnesota and developing estimates of the magnitude of bicycling in Minnesota.

Bicycle commuter mode share is the most widely cited statistic used to compare rates of bicycling across states and municipalities. For example, Minneapolis routinely ranks high among peer cities in terms of this measure. Estimates of commuter mode share, however, have several limitations, particularly if the objective is to estimate total levels of bicycling. Estimates of commuter mode share are based on the U.S. Bureau of the Census, American Community Survey (ACS) journey-to-work question, summarize only the relative proportion of all commuters who primarily commute using a bicycle, and provide no information about the actual number of bicycling trips made for commuting or other purposes. Previous research has shown that the ACS measure of commuting in the Twin Cities Metropolitan Area (TCMA) underestimates bicycling mode share by a factor of 1.75 to 3.33 (Schoner & Lindsey, 2015). Policy-makers, transportation officials, and advocates have continued to use the journey-to-work measure because it is available, not because it summarizes the most important information needed to plan and develop efficient, safe bicycling infrastructure. Better measures for bicycling are needed.

This chapter presents two approaches to developing two statewide bicycling performance measures for policy-makers and analysts who want more complete measures of bicycling. These two measures, number of bicycle trips (NBT) and bicycle miles traveled (BMT), are estimates of quantities of bicycling, not simply shares of trips made for a single purpose, and they correspond better to analogs for motorized vehicles (e.g., vehicle miles traveled) commonly used to inform transportation policy-making and planning. Both approaches generate statewide estimates by applying simple factors derived from periodic regional and statewide transportation-related surveys. The first approach involves use of information from the Metropolitan Council's regional travel behavior inventory (TBI) to adjust and extrapolate results from the ACS journey-to-work question. The second involves extrapolation of results from questions about bicycling from a general transportation survey administered annually by the Minnesota Department of Transportation (MnDOT). Each approach has limitations, but allowing for known sources of error, the measures result in estimates of NBT and BMT of the same order of magnitude. Each approach also can be replicated over time given current commitments of agencies to survey administration and data collection

3.2 **Approach, Methods and Data**

Researchers and practitioners interested in measures of demand for or levels of bicycling typically work with two complementary types of data:

- Survey data, specifically self-reports of frequency and duration of bicycling and other bicycling-related behaviors; and
- Counts of bicyclists on transportation facilities.

Survey data and self-reports of bicycle-related behaviors are needed to understand how many people within a population bicycle, how often they bicycle, how far they bicycle, why they bicycle, whether they wear helmets when they bicycle, and other behaviors needed to plan public infrastructure and programs. Samples of populations are required to obtain this information because it typically is too costly to conduct censuses of entire populations. Sources of error in sample surveys that ask questions about behaviors include errors in self-reports, sample selection, and random error. Errors in self-reports occur when respondents provide inaccurate responses because their memories fail them or when they minimize negative behaviors or exaggerate positive behaviors (e.g., say they exercise more frequently than they actually do). Good surveys control for these sources of error, but they are present to some degree in virtually all surveys. Sample selection bias is a problem where people who are interested in a topic are more likely to "self-select" to participate in a survey, thereby reducing the sample's representativeness of the population. Random error occurs simply by chance, that is, results of well-designed sample surveys sometimes may yield results that are not representative of a general population simply by chance. All three sources of error are limitations that are useful to keep in mind in interpretation of results presented here.

Counts of bicyclists on public infrastructure are useful for understanding where and when people bicycle, but they cannot be used to determine how many people in a population bicycle, how far they go when they ride, how often they ride, why they ride, or anything else specific to an individual cyclist's behaviors. MnDOT has launched the Minnesota Bicycle and Pedestrian Counting Initiative and currently is establishing a network of automated sensors to count bicyclists and pedestrians on streets, sidewalks, and trails at a minimum of 25 permanent, index locations throughout the state. The purpose of the Counting Initiative is to generate information about traffic volumes and patterns that can be used to inform state, regional, and local planning and engineering initiatives, including project design. Among other applications, the monitoring results will enable MnDOT to track traffic trends over time, identify patterns in traffic that can be used to create annual traffic estimates, and develop performance measures. Although the Counting Initiative will provide useful information about bicycle traffic volumes at specific sites and additional information that can be used to generalize results, it will not produce estimates of total bicycle trips taken or total bicycle miles traveled for the entire state. Minnesota is not unique in this regard: no state has yet established monitoring networks sufficient for estimating BMT. The approach taken here, therefore, is to rely on survey-based approaches, specifically, re-analysis and extrapolation from existing, routinely administered surveys.

3.2.1 Survey-based Data about Bicycling in Minnesota

Our objective is to quantify levels of bicycling in Minnesota, specifically the NBT and BMT. Information about bicycling behaviors in Minnesota is available from three scientifically designed, randomized, population-based sample surveys:

The U.S. Bureau of the Census American Community Survey (ACS). As noted, a commonly reported performance measure related to bicycling is bicycle mode share based on the ACS journey-to-work question. The Census Bureau administers the ACS survey annually on a rolling basis throughout the year in every county in every state. Results are reported for multiple-year periods to increase the reliability of estimates. This question is phrased (McKenzie, 2014):

How did this person usually get to work LAST WEEK? If this person usually used more than one method of transportation during the trip, mark (X) the box of the one used for most of the distance

This question provides valid, reliable measures of the most frequent mode of commuting, but limitations of this measure are well known. Because it asks only about journey-to-work, it does not include bicycle trips for other purposes. Because it asks only about mode used "usually" for "most of the distance," it does not include part-time bicycle commuters or people who bicycle for part of their commutes. Because it does not ask about frequency of commuting trips, estimates of the number of trips cannot be made. Because of these limitations, it is inadequate by itself as a comprehensive measure of bicycling.

The Metropolitan Council's Travel Behavior Inventory (TBI; Metropolitan Council, 2013a, 2013b). The Metropolitan Council conducts its TBI for the 16-county TCMA (plus three counties in Wisconsin not analyzed here) approximately decennially. The TCMA accounts for 63.5 percent of the population over age five in Minnesota. The 2010 TBI, conducted between December 2010 and April 2012, obtained 24-hour, weekday travel diaries from 30,284 individuals in 14,055 randomly selected households. Each person recorded the origin, destination, mode, and purpose of each trip. The TBI provides information about all trips taken during weekdays, but because it was not administered on weekends, does not fully account for recreational bicycle trips that likely are taken disproportionately on weekends. The TBI classifies multimodal trips by dominant mode in which bicycling is, by definition, lower on the hierarchy than motorized vehicles or transit. Because of this analytic choice, the TBI also undercounts bicycling participation during weekdays. The TBI does not record length of trips explicitly, but a shortest-path length can be imputed from origin-destination pairs for individual trips using geographic information systems (GIS).

The MnDOT Omnibus 2013 Public Opinion Survey (Minnesota Department of Transportation, 2013). MnDOT annually administers its Omnibus Survey to a sample of individuals that is representative of the adult population in Minnesota. In 2013, Minnesota's population was approximately 5.42 million; the population of adults 18 and over was approximately 4.14 million. The sample size for the 2013 Omnibus Survey was 1,127. The survey, which asks people their opinions about all transportation modes and a wide range of issues, asks people about their frequency of bicycling, perceptions of safety, and other factors that affect their

propensity to bicycle. The survey question is worded (Minnesota Department of Transportation, 2013):

On average, how often did you ride a bicycle in the past bicycling season (April to October) for any reason?

The answer options included: *never; 1 time; once a month or a few times from April to October; at least once a week; and every day*.

Key information about each survey is summarized in Table 10. Relative to the objectives of this study:

Table 10 Travel and Trip Data Available in Surveys

Type of Information	U.S. Bureau of the Census, American Community Survey	Metropolitan Council Travel Behavior Inventory (2010-11)	MnDOT Omnibus Survey (2013)
Frequency	Annually	Decennially	Annually
Sample period	Year-round	Year-round	Partial year
Key data	Journey-to-work question	24-hour weekday travel diaries	Frequency of bicycling question (April – Oct.)
Characteristics	"Full-time" Commuting Only	Mode Share, all purposes	Frequency (times / year), no trip purpose data
Specificity of location data	County level	Trip origin and destination by city and county	Twin Cities Metropolitan and Greater Minnesota regions
Trip length	No	Can be imputed	No

The ACS data summarize participation in bicycle commuting consistently for the entire state, but do not include information about bicycling for other purposes or miles traveled.

The TBI data summarize bicycle trips made for all purposes, including data for approximating miles traveled, in the TCMA, but they do not include weekend trips when recreational bicycle trips disproportionately occur (Table 10). They include no data about bicycling by people in the state outside the 16-county TCMA metropolitan region, but they can be analyzed for different geographies (i.e., cities, suburban counties, and the exurban and rural "ring" counties that surround the suburban counties. The ring counties are characterized by low population densities, sparse development clustered in small towns, and agricultural/rural land uses, and they serve as a reasonable proxy for the Greater Minnesota counties.

The Omnibus survey includes information about frequency of cycling for the entire adult population in the state, but no information about trip purposes or lengths. The Omnibus Survey sample is too small to disaggregate accurately to the county level.

To estimate the number of bicycle trips and BMT in Minnesota, we combined information from these complementary surveys to produce two estimates of NBT and BMT. In Method 1, we adjusted county estimates of bicycle commuting from the ACS to account for the fact that people defined as bicycle commuters likely do not always bicycle to work, and we used results from the

TBI to augment ACS estimates of bicycle commuting mode and account for part-time bicycle commuting and non-commuting trips made by bicycle. We then extrapolated results for exurban, ring counties to Greater Minnesota. This procedure rests on the assumption that bicycling patterns in the ring counties are roughly characteristic of patterns in counties in greater Minnesota. In Method 2, we augmented measures of bicycling frequency for the "bicycling season" (April – October) from the MnDOT Omnibus Survey with measures of winter-time bicycling and miles traveled from the TBI.

Method 1: Estimating Number of Bicycle Trips from ACS and TBI

To estimate the total number of bicycle trips in Minnesota we:

1. Extracted variables from the US Census Bureau ACS 5-year estimates: Population (B01003), Number of workers (B08301), and Number of bicycle commuters (B08301) for the state and for each county. The number of workers was adjusted to exclude people who work from home.
2. Calculated bicycle mode share (number of bicycle commuters / number of workers) by county and for different geographies:
   a. TCMA: Minneapolis, St. Paul, Hennepin County minus Minneapolis, Ramsey County minus St. Paul, Suburban 5 counties, Exurban and Rural Ring 9 MN counties.
   b. Greater Minnesota: 71 MN counties outside TCMA
   c. State of MN (calculated as sum of aforementioned geographies)
3. Estimated the ratio of TBI bicycle commuting mode share to ACS commuting mode share for different geographies (to understand general magnitude of underestimation of bicycle commuting in ACS data).
4. Used TBI bicycle commuting mode share for the 9 ring (i.e., rural and exurban) counties to adjust ACS commuting mode estimates for 71 counties in Greater Minnesota.
5. Estimated the total number of bicycling trips in each county by multiplying adjusted number of bicycle commuters times 2 (for return trip home) x 235 (the number of work days in a year after accounting for holidays, vacation, sick, and personal days).
6. Accounted for non-bicycling commuter trips made by bicycle commuters because people classified by the ACS as bicycle commuters may not bicycle every day. The minimum number of days to be classified as a bicycle commuter would be three (of five); we multiplied the number of trips by 60 percent to obtain a lower, conservative range estimate.
7. Used the ratio of non-commute bicycle trips to commute bicycle trips from TBI to calculate non-work bicycle trips for TBI geographies and for Greater Minnesota and by assuming non-work trips may be made on 260 weekdays throughout the year.
8. Added estimated commuting and non-commuting bicycling trips in each county to obtain estimates of total bicycle trips made in each county during work week (because the TBI provides estimates for trips only on weekdays).
9. Scaled up the estimated number weekday commute and non-commute trips to account for weekend trips.
10. Aggregated estimates of county bicycle trips to obtain estimates of bicycle trips statewide.

As noted, the range of final estimates is believed to be conservative because some types of recreational trips are unlikely to be recorded in the TBI and because it assumes that weekend trips are proportional to weekday trips rather than trying to account for the fact that trips for

recreation, exercise, and non-commuting utilitarian purposes are disproportionately made on weekends.

Method 2: Estimating Number of Bicycle Trips from MnDOT Omnibus Survey

Participants in the Omnibus Survey were asked about their frequency of bicycling. An estimate of the number of bicycle trips made in Minnesota can be obtained by multiplying the number of individuals in each response category by an estimate of the ride count during the cycling season (i.e., April – October) for that category, and then summing across all response categories. We assigned the following number of rides for individuals in each response category:

- Never: 0
- 1 time: 1
- Once a month or a few times from April to October: 7
- At least once a week: 29
- Every day: 214

This approach includes no trips during the five months of late fall, winter, and early spring. To estimate the number of bicycling trips in these months, we use ratios of TBI mode share estimates for the seven month (April – October) and five month (November – March) seasons constructed from data for the entire TCMA region. The ratio of winter to summer mode shares is: 0.25/2.32 = 0.108.

3.2.2 Procedures for Estimating Annual BMT

Estimation of miles traveled annually by bicyclists in Minnesota required information about the length of trips taken by bicyclists. The TBI provides the best data available in Minnesota about the lengths of trips taken by bicycle for different purposes. To estimate miles traveled, we calculated the mean and median trip distances separately for commuting trips and trips taken for all other purposes. However, because outliers (e.g., a few cyclists with very long commutes) can influence mean values, we used median values for all estimates of miles traveled. Median values are not influenced by outliers and produce more stable estimates of a typical length.

To estimate BMT, we multiplied the median trip length for commute and non-commute bicycle trips times the number of trips taken during the year for each of the TBI geographies and for counties in greater Minnesota. Median trip lengths for trips in ring counties were used to estimate miles traveled for counties in greater Minnesota because it is assumed that travel patterns in these exurban counties are similar to those in counties in greater Minnesota. Mean and median bicycle trip distances for different geographies within the TBI are summarized in Table 11.

Table 11 Median and Mean Network Distance for Bicycle Trips

	Median Distance			
	HBW*(km)	Non-HBW* (km)	HBW* (mi)	Non-HBW*(mi)
Hennepin	9.21	1.88	5.72	1.17
MN-Ring	0.63	3.32	0.39	2.06
Minneapolis	4.90	2.63	3.05	1.64
Ramsey	4.01	2.49	2.49	1.55
St. Paul	8.14	2.37	5.06	1.47
Suburb-5	21.82	1.16	13.56	0.72
	Mean Distance			
Hennepin	10.15	3.61	6.31	2.24
MN-Ring	3.92	4.15	2.44	2.58
Minneapolis	6.68	3.76	4.15	2.34
Ramsey	5.36	3.28	3.33	2.04
St. Paul	8.52	4.50	5.29	2.79
Suburb-5	16.91	2.42	10.51	1.50
*HBW = home-based work trips. Non-HBW = all work trips that are not based in home and all non-work trips. HBW + Non-HBW = All trips.				

3.3 **Results: Bicycle Trips and Miles Traveled in Minnesota**

Estimates of the total annual NBT and BMT in the state of Minnesota and selected sub-geographies are presented in Tables 3 and 4 and in Figure 1. Using ACS and TBI data (Method 1), depending on whether it is assumed that regular bicycle commuters bicycle three or five days per week, the number of bicycle trips in Minnesota is between 87 and 96 million annually (Table 12).

A key assumption in this estimate is that the ratio of non-commuting to commuting trips in counties in greater Minnesota is similar to the ratio for the ring counties surrounding the suburban counties in the TCMA. Assuming that the median lengths of trips taken for commuting and non-commuting bicycle trips in the ring counties and counties in Greater Minnesota are similar, the annual BMT for bicyclists in Minnesota from Method 1 ranges from 165 million to 198 million. Because recreational trips may be longer than commuter trips on average, the underestimate of BMT is likely greater than the underestimate of number of trips.

As illustrated in Figure 2 (with estimates using Method 1), trips are higher in counties and regions in the state with larger populations in urban areas. The TCMA accounts for 69 percent to 72 percent of the total number of trips and miles traveled in the state even though it makes up only 54% percent of the state's population. This outcome is because the frequency of bicycling is much higher in the Twin Cities, particularly in Minneapolis. Minneapolis accounts for 29 percent of the number of trips taken annually and approximately 31 percent of the BMT. Appendix C includes estimates of bicycle trips and BMT for Minneapolis and St. Paul (Appendix C-1), the seven suburban counties in the TCMA (Appendix C-2), nine ring counties in the TCMA (Appendix C-3), and for all counties in Greater Minnesota (Appendix C-4).

The estimates of number of trips made using results from the Omnibus Survey (Method 2, Table 13) are the same order of magnitude, but somewhat lower (Table 12). The majority of respondents to the Omnibus Survey (55 percent) said they had bicycled at least once; 45 percent said they never cycled. Most adults (25 percent) are infrequent cyclists – about once per month during the cycling season. Only a small percentage (4 percent) said they ride every day. The percentage of frequent riders – cyclists who said they ride at least once a week or daily – varied little across the state, from 24 percent in the metro counties to 26 percent in Greater Minnesota. This result provides support for assumptions made in extrapolating TBI numbers to the rest of the state. Assuming the ride frequencies in Table 12, this approach yields an estimate of 67.8 million trips for the bicycling season. Adding trips for the off-season, the total estimated number of trips for the entire year is 75.2 million, which is somewhat lower than the estimates developed using Method 1. Using the median trip length for all trips in the 16 county TCMA (1.85 miles), Method 2 yields an estimate of 139,046, 956 BMT for 2013.

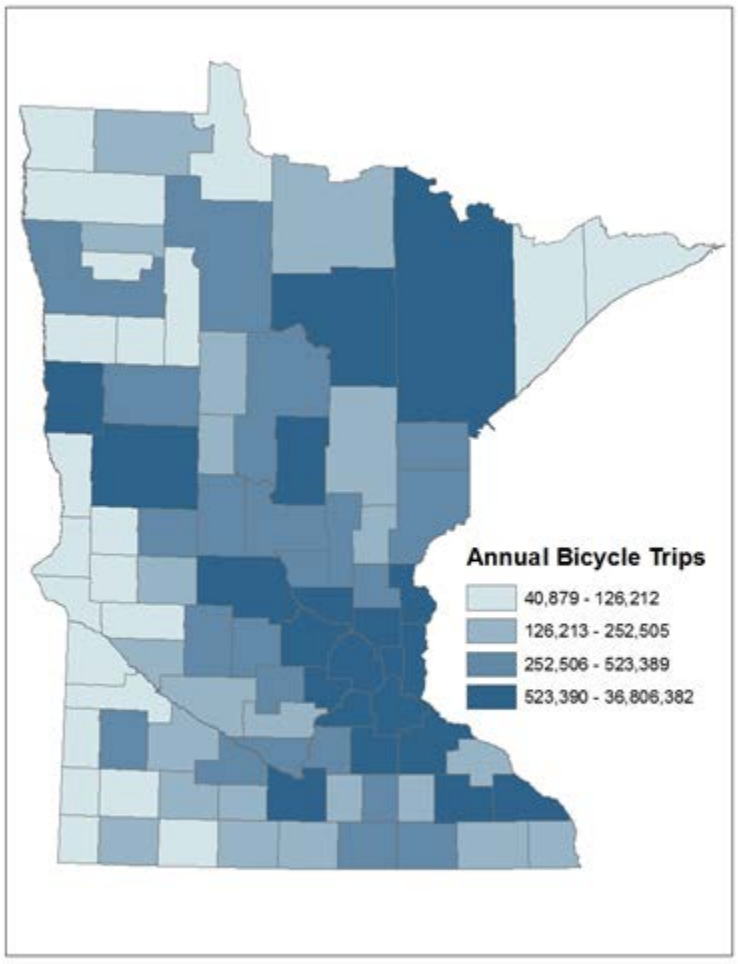

Figure 2 Estimated number of annual bicycle trips in Minnesota counties (Method 1)

Table 12 Method 1: Estimates of bicycle trips and BMT in Minnesota from ACS and TBI

Statewide	Population (Age ≥ 5)		Trips - Low Estimate		Trips - High Estimate		Miles - Low Estimate		Miles - High Estimate	
Core Cities	627,861	12.6%	31,568,455	36.3%	36,717,945	38.2%	64,330,319	39.0%	81,782,345	41.3%
Suburban TCMA (5 counties)	2,066,735	41.4%	28,487,560	32.7%	31,072,908	32.4%	47,997,399	29.1%	62,780,683	31.7%
7-County TCMA	2,694,596	53.9%	60,056,015	69.0%	67,790,852	70.6%	112,327,718	68.0%	144,563,029	73.1%
Exurban/Ring County TCMA (9	462,678	9.3%	5,439,864	6.2%	5,684,446	5.9%	10,608,246	6.4%	10,704,518	5.4%
Greater MN	1,839,126	36.8%	21,579,517	24.8%	22,522,578	23.5%	42,150,122	25.5%	42,521,326	21.5%

Table 13 Method 2: Estimated bicycle trips in Minnesota (2013) from MnDOT Omnibus Survey

Reported Riding Frequency (April – October)	Percentage of Respondents in Frequency Category	Estimated Adult Population in Frequency Category*	Estimated Rides During Cycling Season	Estimated Rides April – October	Estimated Rides - 2013
Never	45%	1,897,231	0	0	0
One Time	6%	255,072	1	255,072	282,558
Once / Month	25%	1,043,477	7	7,304,338	8,091,443
Once / Week	21%	881,158	29	25,553,588	28,307,208
Every Day	4%	162,319	214	34,736,184	38,479,308
Total	101%	4,239,256	--	67,849,182	75,160,517

3.4 **Discussion**

These analyses present the first-ever estimates of the annual number of bicycle trips and BMT in Minnesota. They also illustrate the variation in bicycle traffic across the state in urban, suburban, and exurban/rural areas in the TCMA. The fact that two different methods using different sources of data produce estimates of the same order of magnitude is an indication that the estimates are reasonable.

Different sources of error are present in each approach that at least partially account for these differences. The ACS survey and TBI diary methods have been validated over time and yield reliable results. However, because both the ACS and TBI are designed to measure commuting or weekday trips, they undercount bicycle trips made for purposes of recreation and fitness, which disproportionately occur on weekends. The estimates of bicycle trips based on the ACS and TBI data therefore are conservative. The estimates of trips from the MnDOT Omnibus survey are more likely to include more recreational trips but potentially have other limitations, including

undercounting winter trips and, as noted, the possibility that people may have overstated their frequency of cycling. The structure of the ACS journey-to-work question and the TBI diary minimize the type of response bias (i.e., yea-saying) that potentially affects the Omnibus Survey results. Because none of the three surveys was designed specifically for the purpose of creating bicycling measures of performance, these types of limitations are unavoidable.

The procedures used to develop these estimates are relatively straightforward and could be replicated periodically by MnDOT or other agencies as new results from the ACS or the MnDOT Omnibus survey become available. A limitation is that the TBI is administered only decennially. This means that median trip length and other data needed to estimate BMT could be updated only once a decade or so.

CHAPTER 4:
ECONOMIC CONTRIBUTION OF BICYCLE EVENT VISITORS IN MINNESOTA

4.1 **Introduction**

Minnesota communities host more than 100 bicycle events annually. Charity, community and trail rides plus mountain and road races are featured events. Event visitors create economic activity.

To date, no measure of this activity exists in Minnesota. Quantifying the activity is critical to understand bicycling's role in the economy. This report quantifies the economic activity of visitors. Activity is measured using input-output methodology.

The results show the value of Minnesota bicycle event visitors. In 2015, the average visitor spent $121.20 per day. There were an estimated 50,212 visitors in the state. Visitors supported an estimated $14.3 million of economic activity. This includes $4.6 million in labor income and 150 jobs.

4.2 **Methods**

Visitors are the focus of this analysis. Visitors meet one of two criteria. One, they travel further than 50 miles for an event. Or two, they stay overnight in the area. The focus on visitors follows input-output theory. Crompton, Lee, and Shuster (2001) authored a pioneering paper on the topic. They stated, "Only spending by visitors who reside outside the town and whose primary motivation for visiting is to attend the event, or who stay longer in the town, and spend more because of it, should be included." The argument is visitors bring new money into the area. Thus, only their spending should be included.

Visitor activity is measured in direct, indirect and induced effects. Visitor spending creates an initial change in the economy. This is the direct effect. That spending flowing through the economy creates indirect and induced effects. Direct effects are quantified via surveys. Indirect and induced effects are calculated with input-output models. The IMPLAN model is used here.

4.2.1 Direct Effect of Bicycle Event Visitors:

Four pieces of information are required to measure the direct effect:

- average daily spending
- number of event attendees
- ratio of visitors to attendees
- number of days per event.

Average Daily Spending of Bicycle Event Attendees:

University of Minnesota surveyed event attendees. The survey goal was to collect spending data. To survey, the University compiled a list of Minnesota bicycling events. A sample of these

events was then selected for surveying. The University developed an online survey form. The University also developed a plan for surveying visitors. The survey form factored in:

- event characteristics
- input from event organizers
- feedback from the project's Technical Assistance Panel
- Tourism Center's earlier survey work with other events.

Twenty-six events were surveyed. Surveyed events included:

- 10 non-races
- five high school races (parents completed the survey)
- four mountain bicycle events
- three bicycle races
- three bicycle tours
- one fundraiser.

Among the events, three were free. The rest had registration fees. One event took place in spring (March-May), 14 in summer (June-August), and 11 in fall (September-November). Events were also across MnDOT districts (Table 14).

Table 14 Surveyed Bicycling Events by MnDOT District

District	Number of Surveyed Events
1	4
2	1
3	7
6	3
7	2
Metro	5
Across multiple districts	4
Total	26

To survey participants, the PI contacted each event organizer. Each organizer reviewed and approved the survey form. The PI created a link. Each organizer distributed the link to participants. Links were sent immediately after the event. The survey was live for 14 days. The link was then closed to ensure recall accuracy.

Responses were saved into an Excel file. Of the 1,257 participants, 922 responded to the spending questions. These 922 responses were included in the analysis. Participants provided estimates of their travel party's spending for their entire stay. Responses were adjusted for the number of people in the party. Responses were also adjusted for length of stay. The responses were then averaged.

Number of Bicycle Event Attendees:

The number of attendees was quantified via online search and survey. Bicycle races post results online. A search yielded the number of participants for 30 events. A handful of events had media accounts with participant counts. Another 48 events were personally contacted to determine the count.

Participant numbers for 66 events were collected. This is 65 percent of all events. The total number of attendees was calculated by multiplying the average number of attendees per event by the number of events.

The bicycle event list determined the number of events held. The list was modified to include only events that occurred in 2015. The list was also modified to reflect surveyed event features. All events surveyed were organized rides or races. The list contained a few events without a ride or race. Those were dropped from the list.

Ratio of Bicycle Event Visitors to Attendees:

All event attendees received a survey invitation. The survey began with screening questions. Respondents were asked if they met the visitor definition. Participants saying "yes" were directed to complete the survey. Participants saying "no" were directed to the survey's end. Comparing these two numbers yielded the required ratio.

Number of Days per Event:

The number of days per event was collected with the event list.

4.2.2 Indirect and Induced Effects:

Indirect effects are associated with a change in the economy due to spending for goods and services. These are changes occurring because visitors make local purchases. These direct effects then spur related purchases. Visitors pay for hotel and other overnight stays. In turn, operators of hotels make purchases across their supply chain. Indirect effects are the sum of these changes.

Induced effects are associated with a change in the economy due to employee spending. Spending by employees of visited businesses trigger induced effects. Examples include restaurant and hotel employees. These employees spend their wages and tips. Induced effects are the sum of these changes.

Input-output models capture the flow of goods and services in an economy. They establish a pattern of purchases. With this pattern, models can calculate indirect and induced impacts of a change. This analysis used the input-output model IMPLAN.[3]

[3] The analysis was conducted with the IMPLAN model version 3.0 and data from 2013. The type SAM multipliers were used. There are several types of multipliers. They are type I, type II, and type SAM. SAM multipliers are preferred. They use the social accounting matrix

4.3 **Results of Economic Contribution of Bicycle Event Visitors in Minnesota**

In 2015, bicycle event visitors supported $14.3 million of economic activity. This includes $4.6 million in labor income and 150 jobs. The following section explains the calculations.

4.3.1 Direct Effect:

In 2015, the average bicycle event visitor spent $121.20 per day (Table 15). Major expenses include:

- event registration fees ($29.60)
- lodging ($25.50)
- dining out ($22.70)

Direct effects include visitor spending during the event. Lodging and dining out per person appear lower than expected. For some events, lodging and food are included in registration. Thus, registration fees reflect lodging and food.

Table 15 Average Daily Expenditures per Bicycle Event Visitor, Minnesota, 2015

Expenditure	Daily Value
Event registration	$29.60
Lodging	$25.50
Restaurants/bars	$22.70
Transportation (includes gas)	$11.90
Bicycling equipment	$11.20
Groceries	$6.90
Shopping	$4.90
Bicycle-event related	$4.50
Miscellaneous	$2.20
Recreation & entertainment (non-bicycling)	$1.10
Other bicycling-related	$0.70
Total	$121.20

University of Minnesota identified 101 active events in Minnesota. On average, each attracts approximately 610 participants. Thus, there were an estimated 61,610 participants in 2015. Of those, 50 percent were visitors. Minnesota events attracted an estimated 30,805 visitor participants (Table 16).

(SAM) to calculate the indirect and induced effects. The SAM provides detailed data on household income expenditures. This allows for a more accurate measurement of induced effects. Type I multipliers do not include any household impacts. Type II multipliers assume all labor income payments are to local residents. The SAM multiplier also allows for in-commuters. This more accurately reflects complex economies. Retail sales data were margined when entered into the model. Margining is performed since all output in the IMPLAN model is in producer prices and retail sales are in purchaser prices. Margining breaks down a retail sale into the components of the sale. It measures the value of the sale minus the cost of goods sold. This is known as the retail mark-up. The retail mark-up is the direct local impact used by the model.

Table 16 Total Estimated Number of Bicycle Event Visitor Participants in Minnesota, 2015

Total Number of Attendees	Percent of Visitors	Total Number of Visitors
61,610	50%	30,805

Event participants often have a travel friend. Survey results agree. Each participant brings an additional 0.6 person. This person is not active in the event. An estimated 19,407 visitors travel, but do not participate in the event. An estimated 50,212 visitors traveled for events (Table 17).

Table 17 Total Estimated Number of Visitors Associated with Bicycle Events in Minnesota, 2015

Total Number of Visitor Participants	Additional People Per Participant	Total Number of Visitor Non-Participants	Total Number of Visitors
30,805	0.6	19,407	50,212

In 2015, bicycle event visitors spent an estimated $8.5 million while attending events (Table 18). On average, each event lasted 1.4 days.

Table 18 Total Direct Effect of Bicycle Event Visitors in Minnesota, 2015

Daily Expenditure per Person	Average Number of Days	Total Number of Visitors	Total Visitor Spending
$121.20	1.4	50,212	$8,519,970

4.3.2 Total Economic Contribution of Bicycle Event Visitors in Minnesota

In 2015, bicycle event visitors in Minnesota supported $14.3 million of economic activity (Table 19). This includes $4.6 million in labor income and 150 jobs. For context, the leisure and hospitality industry in Minnesota directly created $19.1 billion of direct output in 2014. The industry employed 322,700 people.

Table 19 Total Economic Contribution of Bicycle Event Visitors in Minnesota, 2015

Impact Type	Output	Employment	Labor Income
Direct	$8,519,970	110	$2,641,430
Indirect	$2,601,660	17	$922,660
Induced	$3,131,510	23	$1,057,360
Total	$14,253,140	150	$4,621,450

4.4 **Discussion**

Bicycling events in Minnesota attract thousands of visitors annually. These visitors generate economic activity. Growth in events will lead to growth in economic activity. Events draw to an area not only participants, but family and friends. Host communities should consider options for engaging them. Special events on Main Street or activities for kids could draw larger attendance. There is also room to market other leisure options to visitors. Currently, non-bicycling recreation spending is low.

Multiple considerations merit mentioning here. This analysis focuses on event visitors. It is not a broad measure of bicycle tourism. This analysis does not measure spending by organizers of events. Visitor spending on registration fees is a fraction of total event spending. It does not account for registration fees paid by locals nor sponsorships. Some events also fundraise for causes. This analysis does not explore the value of fundraising.

Residents and quality of life are areas of future research. This analysis focuses on visitors. Bicycle events also affect residents. Tourism and bicycle events can increase quality of life in an area. This study does not explore quality of life.

CHAPTER 5:
PROFILING PARTICIPANTS OF MINNESOTA BICYCLING EVENTS

5.1 **Introduction**

From April to October 2015, the University of Minnesota Tourism Center surveyed participants of 26 bicycling events, as a part of a larger study that examines the economic impact and health effects of bicycling in Minnesota, funded by the Minnesota Department of Transportation (MnDOT). This chapter describes survey methodology and presents survey findings by bicycling event type.

5.2 **Methodology**

5.2.1 Questionnaire

An online questionnaire was developed based on bicycling event characteristics, input from bicycling event organizers, feedback from the project's Technical Assistance Panel, and the Tourism Center's earlier survey work with other events. Questionnaire sections included trip motivation, spending, activities, accommodations, transportation, group composition, planning and information sources and basic demographics. Qualtrics is the online survey platform used for questionnaire creation, distribution and collection. A copy of the questionnaire template can be found in Appendix A.

5.2.2 Sampling plan

Altogether, 26 bicycling events were surveyed in 2015, including 10 non-races, five high school races (parents completed the online questionnaire), four mountain bicycle events (three races and one non-race), three races, three bicycle tours, and one fundraiser (Table 1). Among the 26 events, three were free; the rest had registration fees. One event took place in spring (March-May), 14 in summer (June-August), and 11 in fall (September-November). Four events took place in MnDOT district 1, one in district 2, seven in district 3, three in district 6, two in district 7 and five in the metro district.

5.2.3 Survey process

To survey bicycle event participants, the author contacted the organizer of each event. Each organizer reviewed and approved the online questionnaire. For each event, the author created a survey link, which the event organizer distributed to participants immediately following the event. The online survey was closed after 15 or fewer days to ensure appropriate recall accuracy level.

Altogether, 1,172 eligible participants from the 26 events completed the online questionnaire. The number of responses these events provided ranged widely, from 1 to 154 (Table 20).

Table 20 Characteristics of the 26 Surveyed Events

Bicycle Event Name	Event Dates	Event type	Location	MnDOT district	#surveys received	#non-tourists screened out
Tour of Minnesota	6/12-19/2015	bicycle tour	Southern MN	--	65	--
Bicycling Around MN	8/13-16/2015	bicycle tour	Northern MN	--	154	--
Headwaters to Hills	8/26-9/2/2015	bicycle tour	Entire State	--	13	--
Red Ribbon Ride	7/16-19/2015	fundraiser	Twin Cities and Southeastern MN	--	43	--
High School race in Austin	9/20/2015	high school race	Austin	6	2	0
High School race in Cuyuna Lakes	10/11/2015	high school race	Cuyuna Lakes Trail	3	57	5
High School race in Mankato	10/25/2015	high school race	Mt. Kato	7	33	4
High School race in Rochester	10/4/2015	high school race	Game Haven	6	1	0
High School race in St. Cloud	9/13/2015	high school race	Jail Trail	3	1	0
Cuyuna Klunker Ride	8/8/2015	mountain bicycle non race	Cuyuna Lakes Crosby	3	10	11
Cuyuna Crusher	6/27-28/2015	mountain bicycle race	Cuyuna Lakes Crosby	3	74	40
The Great Hawk Chase	8/16/2015	mountain bicycle race	Duluth	1	80	31
Salsa Oremageddon	10/10/2015	mountain bicycle race	Cuyuna Lakes Crosby	3	61	12
Tour de Pepin	6/6/2015	non race	Lake City	6	46	30
MN Ironman	4/26/2015	non race	Southeastern MN	M	47	189
Bicycle Bemidji: Loop the Lake	6/20/2015	non race	Bemidji	2	41	101
Great River Energy Mesabi Trail Tour	8/1/2015	non race	Mesabi Trail	1	122	47
Gitchi Gami North Shore Ride	8/15/2015	non race	North Shore	1	23	13
Mankato River Ramble	10/11/2015	non race	Mankato	7	87	43
Minneapolis Bicycle Tour	9/20/2015	non race	Minneapolis	M	1	15
North Star Grand Prix	6/17-21/2015	non race	Twin Cities and Southeastern MN	M	21	--
St. Paul Classic	9/13/2015	non race	St. Paul	M	28	164
Tour of Saints	7/12/2015	non race	St. Joseph	3	123	28
Heck of the North	10/3/2015	race	Two Harbors	1	66	44
RAAM	7/18/2015	race	Twin Cities	M	2	2

5.2.4 Approaching and screening respondents

Three screening questions ensured each survey respondent was an adult tourist (Figure 3). For the purpose of this study, a tourist was anyone who traveled at least 50 miles from his or her primary residence to the event starting point or spent at least one night away from his or her primary residence. Table 20 documents the percentage of respondents who were screened out as non-tourists.

I. Are you 18 years old or older? ❑ Yes (Continue to question II) ❑ No (survey ends)
II. Do you live 50 miles or more to the [area name]? ❑ Yes (continue directly to Q1) ❑ No (continue to question III)
III. Did you spend at least one night in the [area name]? ❑ Yes (continue to Q1) ❑ No (survey ends)

Figure 3 Screening Questions for Potential Respondents to the Online Questionnaire

Participants of bicycle tours and the fundraiser were not asked the three screening questions, because these two types of events lasted for multiple days and traveled to multiple areas, making them tourists by default.

5.2.5 Analysis

Data from the online survey was downloaded from Qualtrics, then cleaned and checked in SPSS (version 23.0), a social science statistical analysis software. For each event that had at least 40 responses, a summary report specific to that event was developed and shared with the event organizer. Data from the 26 events was merged into one file for further analysis.

Analysis provided frequencies, means, medians and standard deviations to describe the sample and provide information on variables of interest. A comparison of attendees who participated in different types of bicycling events was conducted using chi-square tests to compare categorical variables and ANOVA (Analysis of Variance) to compare means.

5.3 **Results**

5.3.1 Respondents

5.3.1.1 *Demographics*

Different types of bicycling events tend to attract different types of people, although similarities also exist. All six types of events in this study mainly attract white, non-Hispanic participants. While bicycle tours tend to attract older, well-educated people from high income levels, fundraising events tend to attract participants from different ages, income ranges and educational levels. High school race participants are likely from families with higher income and well-educated parents. Mountain bicycling events tend to attract younger, high-income, well-educated males. Non-race rides tend to attract well-educated males from high-income levels but different age ranges. Lastly, races tend to attract young, higher-income and very highly educated males.

In terms of gender, there were more male than female participants across all event types (Table 21). There were also significant differences in gender composition across event types: while there were approximately 40 percent female participants in bicycle tours and the fundraising

event, there were no more than 20 percent female riders in mountain bicycling events, non-race rides, and races (χ^2=51.25, p<0.0005).

Table 21 Gender of survey respondents, by bicycling event type (n=1075)

	Percentage		Statistics	
	Male	Female	χ^2	Sig.
Bicycle tour (n=213)	59.6%	40.4%	51.25	<0.0005
Fundraiser (n=33)	60.6%	39.4%		
Mountain bicycling event (n=204)	79.4%	20.6%		
Non-race/Ride (n=479)	54.7%	15.3%		
Race (n=60)	85.0%	15.0%		
It is possible a family has more than one high school student participating in a race, so high school race participants were not included in this analysis.				

The average age of event participants ranged from 42 to 61 and differed significantly across event types (F=86.80, p<0.0005; Table 22). The oldest average age was among bicycle tour participants, and youngest was among participants in mountain bicycling events and races. Participants of the fundraising event and non-race rides were significantly younger than bicycle tour participants but significantly older than mountain bicycling event participants. Non-race ride participants were also significantly older than race participants.

In terms of age range, the two biggest age ranges for bicycle tours and non-race rides were 51-60 and 61-70 years old (Table 23). For the fundraising event, the two biggest age ranges were 41-50 and 51-60 years old. The highest percentages of participants in mountain bicycling events and races were in the 31-40 and 41-50 age ranges.

Table 22 Descriptive statistics of survey respondents' age, by bicycling event type (n=1087)

	Descriptive statistics			ANOVA	
	Mean	Median	Standard deviation	F	Sig.
Bicycle tour (n=212)	60.89_{abcd}	62	9.31	86.80	<0.0005
Fundraiser (n=43)	49.35_{ae}	52	13.66		
Mountain bicycling event (n=206)	41.96_{bef}	43	9.99		
Non-race/Ride (n=481)	53.40_{cfg}	56	12.15		
Race (n=59)	43.51_{dg}	44	10.12		
All high school race participants were high school students younger than 18 years old.					

Note: Means with pairing subscripts within rows are significantly different at the p<0.05 based on Bonferroni post hoc paired comparisons.

Table 23 Percentage of survey respondents in various age brackets, by bicycling event type (n=1087)

	Percentage					
	18-30	31-40	41-50	51-60	61-70	70+
Bicycle tour (n=212)	0%	2.8%	10.4%	30.7%	43.4%	12.7%
Fundraiser (n=43)	16.3%	9.3%	23.3%	30.2%	16.3%	4.7%
Mountain bicycling event (n=206)	15.5%	28.2%	39.3%	12.6%	4.4%	0%
Non-race/Ride (n=481)	7.3%	9.1%	15.6%	38.9%	24.9%	4.2%
Race (n=59)	6.8%	28.8%	40.7%	22.0%	0%	1.7%
All high school race participants were high school students younger than 18 years old.						

The household income of bicycling event participants tended to be high. The median household income in the U.S. is close to $53,000. According to survey results, no more than 25 percent of participants in any type of event had a household income lower than $50,000 (Table 24). Participants' household income also differed significantly by event type (χ^2=50.00, p<0.0005). The highest percentages of high school race participants came from households in the $150,000 or more and $100,000-$149,999 ranges. The highest percentages of participants in mountain bicycling events, non-race rides, and races were in the $150,000 or more and $50,000-$99,999 ranges. In terms of bicycle tours and the fundraising event, the two biggest income ranges were $50,000-$99,999 and $100,000-$149,999. Those with a household income lower than $50,000 were more likely to participate in bicycle tours, the fundraising event, and non-race rides.

Table 24 Percentage of survey respondents in pre-tax income groups, by bicycling event type (n=1025)

	Percentage					Statistics	
	Less than $25,000	$25,000-$49,999	$50,000-$99,999	$100,000-$149,999	$150,000 or more	χ^2	Sig.
Bicycle tour (n=195)	1.0%	14.9%	36.9%	25.6%	21.5%	50.00	<0.0005
Fundraiser (n=42)	7.1%	16.7%	35.7%	23.8%	16.7%		
High school race (n=83)	0.0%	2.4%	18.1%	30.1%	49.4%		
Mountain bicycling event (n=196)	4.1%	9.2%	31.1%	25.5%	30.1%		
Non-race/Ride (n=450)	3.8%	12.7%	30.7%	25.1%	27.8%		
Race (n=59)	1.7%	5.1%	28.8%	25.4%	39.0%		

Across all event types, at least two-thirds of respondents had a bachelor's degree or higher (Table 25). The education level of participants in the fundraising event was the most diverse (with 32.7% not having a bachelor's degree), while the education level of those participating in races was the least diverse (with only 11.7% not having a bachelor's degree) (χ^2=67.97, p<0.0005).

Table 25 Educational level of survey respondents, by bicycling event type (n=1102)

	Percentage						Statistics	
	Less than high school	High school	Some college	Associate degree	BA/BS	Graduate school	χ^2	Sig.
Bicycle tour (n=213)	0.0%	3.3%	8.0%	8.0%	33.8%	46.9%	67.97	<0.0005
Fundraiser (n=43)	0.0%	4.7%	14.0%	14.0%	34.9%	32.6%		
High school race (n=87)	4.6%	2.3%	4.6%	8.0%	39.1%	41.4%		
Mountain bicycling event (n=207)	0.0%	1.0%	11.6%	12.6%	48.8%	26.1%		
Non-race/Ride (n=492)	0.4%	3.7%	9.6%	7.5%	39.0%	39.8%		
Race (n=60)	0.0%	0.0%	6.7%	5.0%	48.3%	40.0%		

Ethnically, almost all of the respondents were of non-Hispanic and non-Latino background (Table 26). At least 87 percent of respondents are white for each event type (Table 27). While small sample sizes for non-white respondents prohibited statistical comparison, some nominal differences are noted. At least 1.7 percent of respondents from the fundraising event and races self-identified as Asians or African Americans. About 0.5 percent of respondents from bicycle tours and non-race rides self-identified as American Indian or Alaska Native. No event attracted any Native Hawaiian/Other Pacific Islander.

Table 26 Ethnic composition of survey respondents, by bicycling event type (n=1052)

	Percentage		Statistics[1]	
	Hispanic/Latino	Non-Hispanic/ Non-Latino	χ^2	Sig.
Bicycle tour (n=201)	0.5%	99.5%	--	--
Fundraiser (n=40)	2.5%	97.5%		
Mountain bicycling event (n=198)	0.5%	99.5%		
Non-race/Ride (n=473)	1.1%	98.9%		
Race (n=58)	3.4%	96.9%		
It is possible a family has more than one high school students participating in the race, so high school race participants were not included in this analysis.				

[1]No statistical comparison was performed as some cell sizes are too small.

Table 27 Racial composition of survey respondents, by bicycling event type (n=1068)

	Percentage						Statistics[1]	
	Native Hawaiian/Other Pacific islander	American Indian or Alaska Native	Asian	Black/African-American	White	Other	χ^2	Sig.
Bicycle tour (n=209)	0.0%	0.5%	0.0%	0.5%	98.6%	0.5%	--	--
Fundraiser (n=40)	0.0%	0.0%	2.5%	2.5%	87.5%	7.5%		
Mountain bicycling event (n=201)	0.0%	0.0%	0.0%	0.5%	95.5%	4.0%		
Non-race/Ride (n=475)	0.0%	0.6%	0.2%	0.2%	97.1%	1.9%		
Race (n=59)	0.0%	0.0%	3.4%	1.7%	94.9%	0.0%		
It is possible a family has more than one high school students participating in the race, so high school race participants were not included in this analysis.								

[1]No statistical comparison was performed as some cell sizes are too small.

5.3.1.2 *Primary residence*

Most bicycling event participants are Minnesotans (Table 28; Figures 4 through 9). More than 95 percent of participants in races (95.7 percent), the fundraising event (97.6 percent), and high school races (100 percent came from Minnesota. About 86 percent of participants in non-race rides (86.8 percent) and mountain bicycling events (86.3 percent) as well as 71.5 percent of bicycle tour participants came from Minnesota. Wisconsin was the second most frequently identified state of origin (except for high school races), particularly among participants in bicycle tours (15.1 percent) and mountain bicycling events (8.1percent). Bicycle tours, mountain bicycling events and non-race rides also attracted small percentages of participants from Iowa and North Dakota each. Bicycle tours also attracted a small percentage of participants from Illinois.

The Minneapolis-St. Paul-Bloomington (MSPB) Core Based Statistical Area (CBSA) was the most frequently identified place of origin (Table 28), although the percentages varied widely among different event types. All high school race participants, 97.6 percent of the fundraising event participants, and 80.9 percent of race participants came from MSPB. Meanwhile, 56.1 percent of non-race participants, 60.9 percent of bicycle tour participants and 67.5 percent of mountain bicycling event participants came from MSPB. Duluth was the second most frequently identified place of origin among participants of non-race rides (8.1 percent), races (6.4 percent), and mountain bicycling events (3.6 percent). The rest of participants came from a variety of CRSAs. Figures 2 through 7 showed the trade area for each of the six types of events.

Table 28 Primary place of residence of survey respondents, by bicycling event type (n=1058)

	Top states		Top Core Based Statistical Areas (CBSA)	
	State	Percent (%)	CBSA	Percent (%)
Bicycle tour (n=209)	Minnesota	71.5	Minneapolis-St. Paul-Bloomington, MN-WI (MSPB)	60.9
	Wisconsin	15.1	Chicago-Naperville-Elgin, IL-IN-WI	3.9
	Illinois	5.0	Bemidji, MN	2.8
	Iowa	4.5	Fargo, ND-MN	2.2
	North Dakota	1.7	La Crosse-Onalaska, WI-MN	2.2
Fundraiser (n=43)	Minnesota	97.6	MSPB	97.6
	Wisconsin	2.4	Green Bay, WI	2.4
High school race (n=65)	Minnesota	100	MSPB	100
Mountain bicycling events (n=198)	Minnesota	86.3	MSPB	67.5
	Wisconsin	8.1	Duluth, MN-WI	3.6
	Iowa	3.6	Des Moines-West Des Moines, IA	3.1
	North Dakota	1.5	Brainerd, MN	2.5
			Faribault-Northfield, MN	2.5
			Fargo, ND-MN	2.5
			Mankato-North Mankato, MN	2.0
Non-race (n=484)	Minnesota	86.8	MSPB	56.1
	Wisconsin	3.9	Duluth, MN-WI	8.1
	Iowa	2.9	Rochester, MN	2.9
	North Dakota	2.7	Grand Forks, ND-MN	1.7
			St. Cloud, MN	1.5
Race (n=59)	Minnesota	95.7	MSPB	80.9
	Wisconsin	2.1	Duluth, MN-WI	6.4
	North Dakota	2.1	Faribault-Northfield, MN	4.3

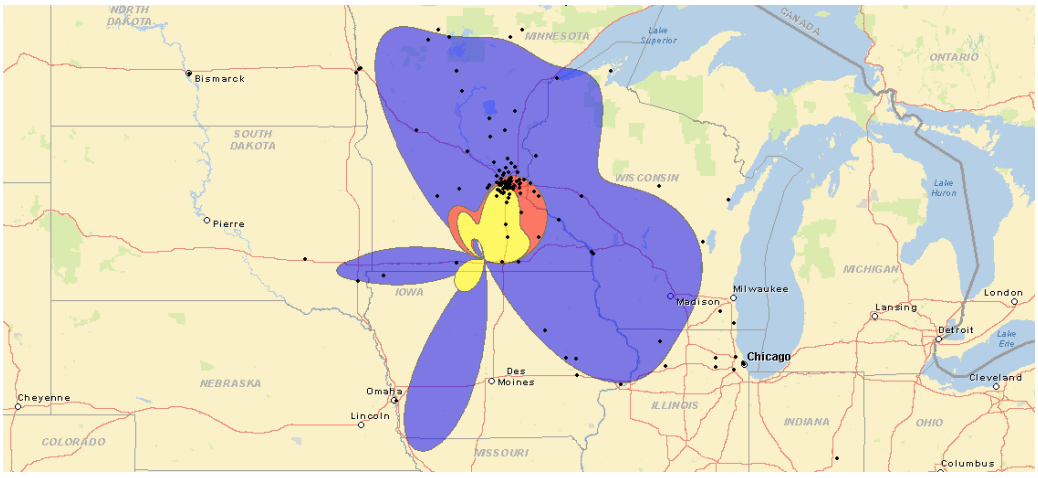

Figure 4 Trade Area of Surveyed Bicycle Tours (n=209)

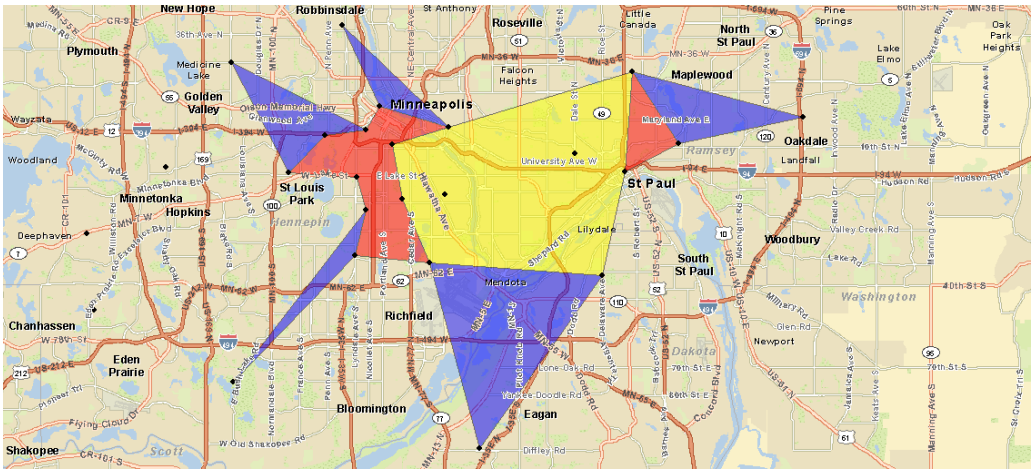

Figure 5 Trade area of the surveyed fundraising event (n=43)

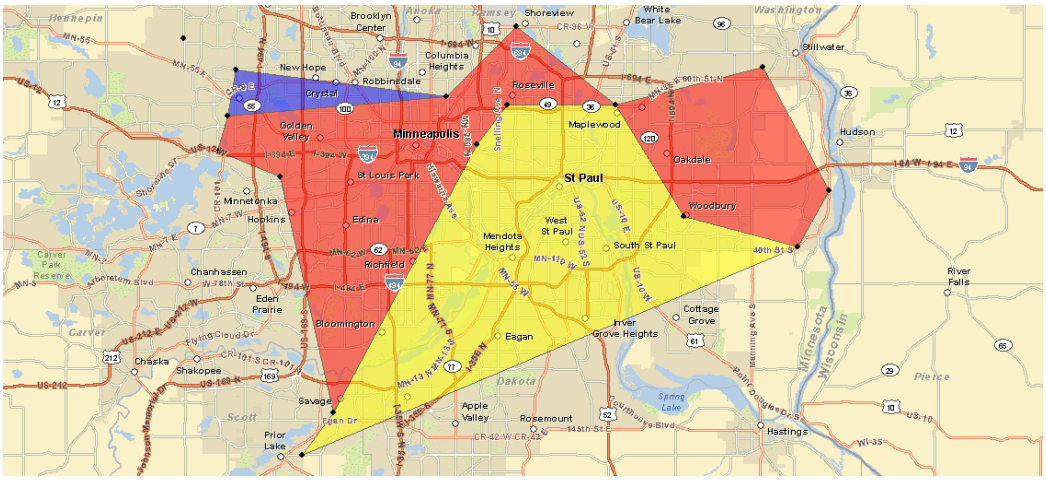

Figure 6 Trade area of surveyed high school races (n=65)

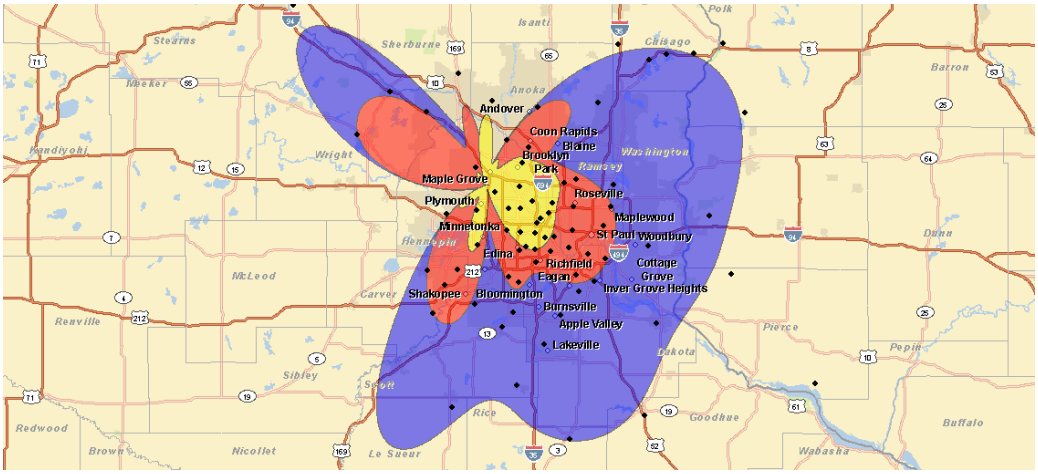

Figure 7 Trade area of surveyed mountain bicycling events (n=198)

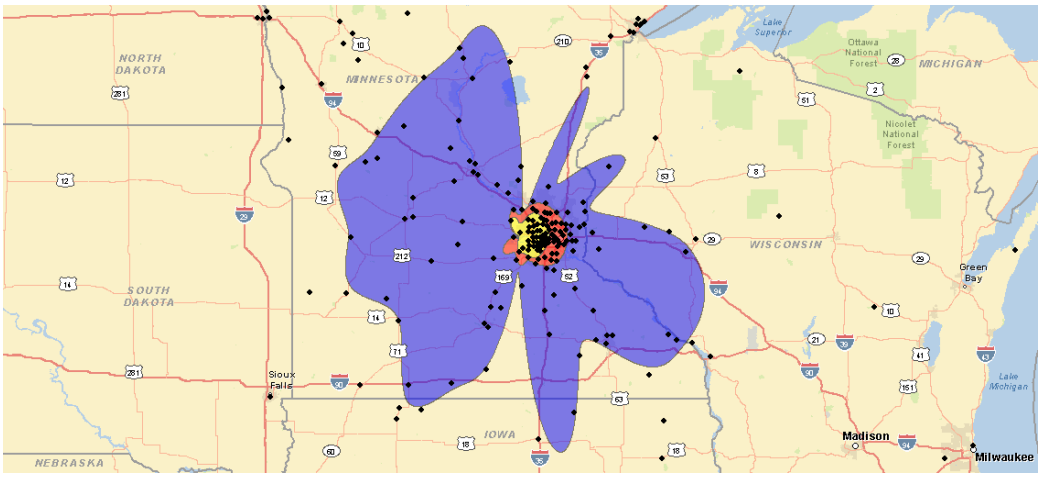

Figure 8 Trade area of surveyed non-race rides (n=484)

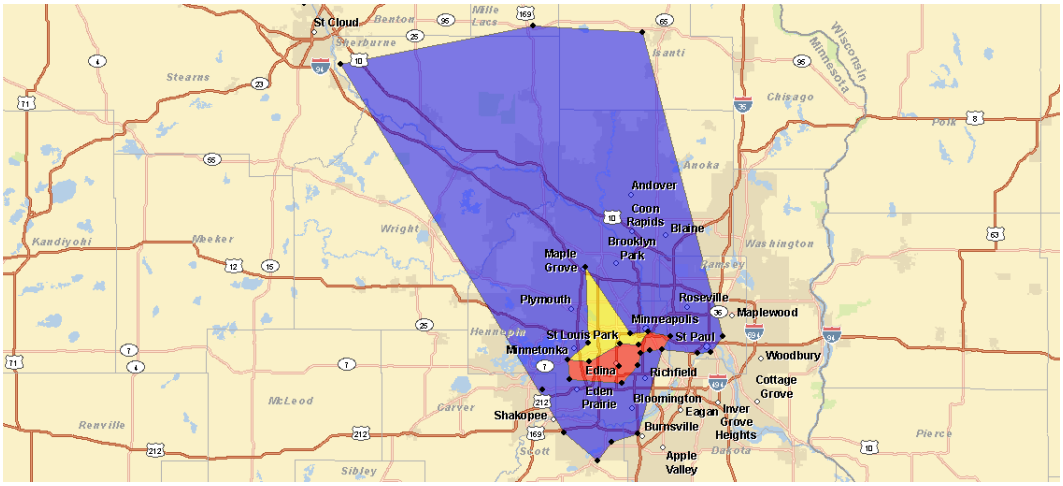

Figure 9 Trade area of surveyed races (n=59)

5.3.1.3 *Past attendance*

At least half of respondents had previously attended the surveyed bicycle event, although difference exists across event types (χ^2=26.82, p<0.0005; Table 29). About 75 percent of respondents from the fundraising event (74.4 percent) and high school races (76.6 percent) had attended the event previously. On the other hand, 53.2 percent of respondents from non-race rides and 59.7 percent from races had attended the event before.

Table 29 Percentage of respondents who had previously attended the surveyed event, by bicycling event type (n=1160)

	Percentage		Statistics	
	No	Yes	χ^2	Sig.
Bicycle tour (n=220)	36.8%	63.2%	26.82	<0.0005
Fundraiser (n=43)	25.6%	74.4%		
High school race (n=94)	23.4%	76.6%		
Mountain bicycling event (n=219)	37.0%	63.0%		
Non-race/Ride (n=519)	46.8%	53.2%		
Race (n=65)	40.3%	59.7%		

There are significant differences in the number of years respondents had attended an event (*F*=6.23, p<0.0005; Table 30). The average number of years that respondents had attended bicycle tours (5.55), the fundraising event (6.56), and non-race rides (5.26) was significantly more than that of respondents from high school races (2.21).

Table 30 Number of years respondents had attended the surveyed event, by bicycling event type (n=1087)

	Descriptive statistics			ANOVA	
	Mean	Median	Standard deviation	*F*	Sig.
Bicycle tour (n=212)	5.55_a	3	7.12	6.23	<0.0005
Fundraiser (n=43)	6.56_b	5	4.02		
High school race (n=86)	2.21_{abc}	2	1.19		
Mountain bicycling event (n=206)	4.21	3	3.35		
Non-race/Ride (n=481)	5.26_c	3	5.92		
Race (n=59)	3.06	3	1.29		

Note: Means with pairing subscripts within rows are significantly different at the *p*<0.05 based on Bonferroni post hoc paired comparisons.

5.3.2 Trip information

5.3.2.1 *Primary destination*

The event area was the primary destination for most survey respondents (Table 31). The event area was the primary destination for all high school race participants, while it was so for 87 percent of respondents from non-race rides and 89.4 percent respondents from races. Respondents from bicycle tours and the fundraising event was not asked whether the event area was the primary destination, as routes of these events included multiple towns/cities.

Table 31 Whether the event area was the primary destination for survey respondents, by bicycling event type (n=872)

	Percentage		Statistics[1]	
	Yes	No	χ^2	Sig.
Bicycle tour	Not applicable—route of bicycle tours and the fundraising event included multiple towns/cities.			
Fundraiser				
High school race (n=94)	100%	0%	--	--
Mountain bicycling event (n=219)	95.4%	4.6%		
Non-race/Ride (n=493)	87.0%	13.0%		
Race (n=66)	89.4%	10.6%		

[1]No statistical comparison was performed as some cell sizes are too small.

5.3.2.2 *Trip duration*

The three bicycle tours and the fundraising event all lasted for multiple days (Table 32). Specifically, two bicycle tours lasted for eight days. The other bicycle tour and the fundraising event lasted for four days.

Table 32 Number of days the surveyed bicycle tours and the fundraising event lasted

Bicycle event type	Bicycle event name	Number of days
Bicycle tours	Tour of Minnesota	8
	Bicycling Around Minnesota (BAM)	4
	Headwaters to Hills	8
Fundraiser	Red ribbon Ride	4

Most respondents spent one or two nights on the entire trip, although significant difference exists across event types (χ^2=24.25, p<0.0005; Table 33). Sixty-two% of high school race participants spent one night on the entire trip, while 61.7 percent of race participants spent two nights on the trip. Respondents from mountain bicycling events and non-race rides spread more evenly across spending one, two, three or more nights on the trip.

Table 33 Total number of nights spent on the trip by survey respondents, by bicycling event type (n=568)

	Percentage			Statistics	
	1 night	2 nights	3 or more nights	χ^2	Sig.
High school race (n=71)	62.0%	33.8%	4.2%	24.25	<0.0005
Mountain bicycling event (n=148)	39.0%	43.2%	17.8%		
Non-race/Ride (n=291)	46.0%	39.5%	14.4%		
Race (n=60)	31.7%	61.7%	6.7%		

As far as the event area is concerned, high school race participants were much more likely to spent one night in the event area (χ^2=14.78, p<0.05; Table 34). Respondents from mountain bicycling events, non-race rides, and races spread more evenly across were similarly likely to spend one or two nights in the event area.

Table 34 Number of nights spent in the event area by survey respondents, by bicycling event type (n=395)

	Percentage			Statistics	
	1 night	2 nights	3 or more nights	χ^2	Sig.
High school race (n=51)	72.5%	21.6%	5.9%	14.78	0.022
Mountain bicycling event (n=92)	41.3%	47.8%	10.9%		
Non-race/Ride (n=212)	49.1%	38.7%	12.3%		
Race (n=40)	47.5%	45.0%	7.5%		

5.3.2.3 *Lodging*

Hotel/motel was the most frequently chosen lodging facility by respondents from all event types except for bicycle tours (Table 35). For respondents from bicycle tours, tent was the most frequently used lodging type, while hotel/motel was the second most frequently used one. Tent was also the second mostly frequently used lodging type by respondents from the fundraising event, mountain bicycling events and races. For those participating in non-race rides, home of a friend/relative was the second most frequently chosen lodging type.

Table 35 Types of lodging facilities used by survey respondents, by bicycling event type (n=1172)

	Bicycle tour (n=229)	Fundraiser (n=43)	High school race (n=94)	Mountain bicycling events (n=219)	Non-race (n=520)	Race (n=67)
Hotel/motel	32.8%	58.1%	33.0%	10.5%	13.8%	19.4%
Resort/commercial cabin	1.3%	0.0%	1.1%	1.8%	0.8%	1.5%
Vacation rental by owner (VRBO)	0.4%	0.0%	1.1%	0.5%	1.0%	1.5%
Your own vacation home	2.6%	2.3%	1.1%	1.4%	1.2%	1.5%
RV	0.4%	2.3%	0.0%	4.1%	1.0%	6.0%
Vacation home of friend/relative	1.7%	0.0%	2.1%	0.9%	1.2%	3.0%
Bed & Breakfast	0.9%	0.0%	0.0%	0.0%	0.6%	0.0%
Home of friend/relative	10.5%	7.0%	2.1%	3.2%	5.0%	1.5%
Tent	73.8%	25.6%	1.1%	6.4%	1.5%	10.4%

5.3.2.4 *Transportation*

At least 80 percent of respondents from all event types arrived at the event area or starting point by a car, van, or truck (Table 36). While small sample sizes for those not using car/van/truck as the primary mode of transportation prohibited statistical comparison, some nominal differences are noted. Transportation mode for bicycle tour participants was more diverse, as 4.2 percent arrived in an RV or a camper, 6.3 percent arriving by bus, and 5.3 percent arriving by an airplane. Seven% of the fundraising event participants arrived by bicycle, while another seven% arrived by other means of transportation. On the other hand, all high school race participants arrived by a car, van, or truck.

Table 36 Primary mode of transportation among survey respondents, by bicycling event type (n=997)

	Percentage						Statistics[1]	
	Car/van /truck	RV/ camper	Bus	Airplane	Bicycle	Others (motorcycle, train, "other")	χ^2	Sig.
Bicycle tour (n=95)	82.1%	4.2%	6.3%	5.3%	0.0%	2.1%	--	--
Fundraiser (n=43)	86.0%	0.0%	0.0%	0.0%	7.0%	7.0%		
High school race (n=91)	100%	0.0%	0.0%	0.0%	0.0%	0.0%		
Mountain bicycling event (n=210)	98.1%	1.9%	0.0%	0.0%	0.0%	0.0%		
Non-race/Ride (n=498)	91.8%	1.0%	5.4%	0.4%	1.2%	0.2%		
Race (n=60)	92.8%	1.5%	0.0%	3.3%	0.0%	0.0%		

[1]No statistical comparison was performed as some cell sizes are too small.

5.3.2.5 *Group composition and size*

The average travel group size of survey respondents ranged from fewer than three people to more than five people (Table 37). Specifically, the average travel group size of participants of bicycle tours was significantly bigger than those of participants of non-race rides (F=2.36, p<0.05).

Participants of bicycle tours and the fundraising event were most likely to travel in either small groups (no more than two people) or large groups (six or more people) (Table 38). High school race participants were most likely to travel in groups of four or five people, while non-race ride participants were most likely to travel groups of two (χ^2=108.27, p<0.0005). The travel group size of participants in mountain bicycling events and races spread out more evenly.

Table 37 Group size in which survey respondents traveled, by bicycling event type (n=1143)

	Descriptive statistics			ANOVA	
	Mean	Median	Standard deviation	*F*	Sig.
Bicycle tour (n=221)	5.30_a	2	17.00	2.36	0.038
Fundraiser (n=43)	4.09	2	4.56		
High school race (n=93)	3.81	4	2.11		
Mountain bicycling event (n=214)	3.35	2	3.79		
Non-race/Ride (n=509)	3.28_a	2	3.28		
Race (n=63)	2.60	2	1.58		

Note: Means with pairing subscripts within rows are significantly different at the $p<0.05$ based on Bonferroni post hoc paired comparisons.

Table 38 Percentage of survey respondents traveling in different group sizes, by bicycling event type (n=1143)

	Statistics					Statistics	
	1 person	2 persons	3 persons	4-5 persons	6 or more persons	χ^2	Sig.
Bicycle tour (n=221)	26.6%	38.4%	5.2%	11.4%	18.3%	108.27	<0.0005
Fundraiser (n=43)	25.6%	30.2%	14.0%	9.3%	20.9%		
High school race (n=93)	4.3%	21.3%	21.3%	42.6%	10.6%		
Mountain bicycling event (n=214)	20.5%	30.1%	19.2%	19.6%	10.5%		
Non-race/Ride (n=509)	19.0%	40.0%	10.1%	16.6%	14.3%		
Race (n=63)	25.4%	28.4%	20.9%	14.9%	10.4%		

Note: Means with pairing subscripts within rows are significantly different at the $p<0.05$ based on Bonferroni post hoc paired comparisons.

The average number of people from one's travel group who participated in the event was significantly high among bicycle tour participants than those in high school races, mountain bicycling events and non-race rides ($F=4.21$, $p<0.005$; Table 39). Participants in high school races, mountain bicycling events and races were most likely to have one person in the travel group to participate in the event ($\chi^2=92.41$, $p<0.0005$; Table 40). For those riding in bicycle tours, the fundraising event, and non-race rides, the number of people from one's travel group who participated in the event spread out more evenly.

Table 39 Descriptive statistics of the number of people in the travel party who participated in the surveyed event, by bicycling event type (n=1167)

	Descriptive statistics			ANOVA	
	Mean	Median	Standard deviation	*F*	Sig.
Bicycle tour (n=218)	5.45_{abc}	2	18.48	4.26	0.001
Fundraiser (n=41)	5.21	2	8.59		
High school race (n=93)	2.12_{a}	1	5.06		
Mountain bicycling event (n=211)	2.46_{b}	2	3.54		
Non-race/Ride (n=504)	2.85_{c}	2	2.80		
Race (n=63)	2.10	2	1.46		

Note: Means with pairing subscripts within rows are significantly different at the $p<0.05$ based on Bonferroni post hoc paired comparisons.

Table 40 Number of people in the travel party who participated in the surveyed event, by bicycling event type (n=1167)

	Percentage				Statistics	
	1 person	2 persons	3 persons	4 or more persons	χ^2	Sig.
Bicycle tour (n=229)	27.9%	38.4%	5.2%	28.4%	92.41	<0.0005
Fundraiser (n=43)	30.2%	25.6%	11.6%	32.6%		
High school race (n=94)	64.9%	19.1%	5.3%	10.6%		
Mountain bicycling event (n=219)	42.9%	28.3%	11.9%	16.9%		
Non-race/Ride (n=515)	25.8%	35.9%	11.3%	27.0%		
Race (n=67)	41.8%	20.9%	19.4%	17.9%		

In terms of travel group type, although small cell sizes prohibited statistical comparison, some nominal differences are noted. Participants in bicycle tours and races were most likely to travel alone or with friends (Table 41). Participants in high school races and mountain bicycling events were most likely to travel with family. Participants in the fundraising event and non-race rides travel either alone, with family or with friends.

Table 41 Group type in which survey respondents traveled, by bicycling event type (n=994)

	Percentage						Statistics	
	Alone	Couple/ partner	Family	Friends	Family & friends	Other	χ^2	Sig.
Bicycle tour (n=94)	48.9%	11.7%	9.6%	27.7%	2.1%	0.0%	--	--
Fundraiser (n=43)	30.2%	4.7%	25.6%	23.3%	2.3%	14.0%		
High school race (n=87)	4.4%	0.0%	82.4%	0.0%	12.1%	1.1%		
Mountain bicycling event (n=91)	20.1%	12.0%	41.1%	17.7%	9.1%	0.0%		
Non-race/Ride (n=209)	18.9%	21.9%	25.4%	18.3%	13.7%	1.8%		
Race (n=60)	28.3%	11.7%	16.7%	31.7%	10.0%	1.7%		

Survey respondents had travel companions in different age groups, and there is significant difference in travel companions' age (Table 42). The fundraising event participants were most likely to have travel companions in the 18-25 age range, while bicycle tour participants were the least likely (χ^2=29.21, p<0.0005). Participants in the fundraising event, mountain bicycling events, and races were the most likely to travel with people in the 26-35 age range, but none of the high school race participants did so (χ^2=94.33, p<0.0005). The percentage of respondents traveling with people in the 36-50 age range was the highest among high school race participants and the lowest among bicycle tour participants did so (χ^2=202.78, p<0.0005). The percentage of respondents traveling with people in the 51-69 age range was the highest among non-race ride participants and the lowest among mountain bicycling event participants (χ^2=159.28, p<0.0005).

Table 42 Age groups included in survey respondents' travel party, by bicycling event type (n=1169)

	Percentage						Statistics	
	Bicycle tour (n=229)	Fundraiser (n=43)	High school race (n=94)	Mountain bicycling event (n=218)	Non-race/Ride (n=518)	Race (n=67)	χ^2	Sig.
Under 18	63.8%	0.0%	86.2%	30.3%	10.2%	10.4%	--	--
18-25 years old	0.9%	16.3%	2.1%	9.6%	5.8%	3.0%	29.21	<0.0005
26-35 years old	1.3%	27.9%	0.0%	29.4%	17.6%	26.9%	94.33	<0.0005
36-50 years old	10.5%	39.5%	75.5%	58.4%	26.8%	50.7%	202.78	<0.0005
51-69 years old	37.3%	51.2%	24.5%	21.1%	63.8%	23.9%	159.28	<0.0005
70 or older	56.8%	7.0%	7.4%	0.9%	6.8%	1.5%	--	--

Small cell sizes prohibited statistical comparison for the under 18 and 70 or older age groups, but nominal differences are noted. While 86.2 percent of high school race participants traveled with children under 18 years old, none of the fundraising event participants did so. Close to 57 percent of bicycle tour participants (56.8 percent) traveled with people at least 70 years only, but only 0.9% percent of mountain bicycling event participants did so.

5.3.3 Visitor spending

Bicycling event participants had spending in a variety of categories. Participants in the fundraising event spent significantly more on bicycling equipment than those participating in bicycle tours, high school races, mountain bicycling events and non-race rides (F=218.05, p<0.05; Table 43). In terms of bicycling event-related expense, non-race ride participants spent significantly less than bicycle tour and fundraising event participants, and high school race participants spent significantly less than the fundraising event participants (F=211.49, p<0.05).

Bicycle tour participants spent significantly more on registration than participants of all the other types of bicycling events (F=223.99, p<0.0005). Additionally, fundraising event participants spent more on registration than high school race participants.

When it comes to spending on lodging, bicycle tour participants spent more than participants in mountain bicycling events and non-race rides (F=207.78, p<0.0005). Participants in the fundraising event spent more than participants in high school races, mountain bicycling events, and non-race rides.

Bicycle tour participants spent significantly more on transportation (F=215.63, p<0.0005) and non-bicycling recreation/attractions (F=314.71, p<0.0005) than participants of all the other types of bicycling events. Bicycle tour participants spent significantly more on groceries than participants in the fundraising event, high school races and non-race rides (F=283.80, p<0.0005).

Bicycle tour participants also spent significantly more on restaurants/bars than participants in the fundraising event, high school races, mountain bicycling events and non-race rides (F=214.71, p<0.0005). Race participants spent more on restaurants/bars than the fundraising event participants.

Lastly, total spending by bicycle tour participants was significantly higher than that by participants in all other types of bicycling events (F=209.59, p<0.0005). The total spending by the fundraising event participants was significantly higher than that by participants in high school races, mountain bicycling events and non-race rides. Race participants had higher total spending than those participating in high school races, mountain bicycling events and non-race rides.

There is no significant difference in miscellaneous spending. Given that race participants did not spend money on other-bicycling related expense and shopping, it is not possible to perform statistical comparison for these two spending categories.

Table 43 Survey respondents' personal spending in various categories, by bicycling event type (n=1107)

	Mean ($)						ANOVA[1]	
	Bicycle tour (n=194)	Fundraiser (n=42)	High school race (n=93)	Mountain bicycling (n=214)	Non-race (n=501)	Race (n=63)	*Welch F*	Sig.
Bicycling equipment	32.08_{a}	125.89_{abcd}	2.45_{b}	6.35_{c}	4.29_{d}	65.32	218.05	0.028
Bicycling event-related expense	11.11_{a}	17.76_{bc}	3.12_{b}	6.01	3.12_{ac}	9.37	211.49	0.010
Other-bicycling related expense*	2.66	13.93	0.50	0.46	0.47	0.00	--	--
Event registration	260.15_{abcde}	53.46_{af}	8.60_{bf}	17.73_{c}	23.30_{d}	36.15_{e}	223.99	<0.0005
Lodging	57.95_{ab}	80.00_{cde}	32.06_{c}	19.90_{ad}	22.00_{be}	45.78	207.78	<0.0005
Transportation (incl. gas)	30.22_{abcde}	21.26_{a}	10.50_{b}	12.39_{c}	11.29_{d}	13.72_{e}	215.63	<0.0005
Groceries	12.88_{abc}	1.61_{a}	4.98_{b}	8.19	6.69_{c}	11.05	283.80	<0.0005
Restaurants/bars	49.05_{abcd}	4.90_{ae}	17.04_{b}	18.14_{c}	23.72_{d}	41.97_{e}	267.43	<0.0005
Recreation/attractions (non-bicycling)	7.67_{abcde}	0.06_{a}	0.18_{b}	1.22_{c}	0.94_{d}	1.88_{e}	314.71	<0.0005
Shopping*	13.55	0.00	5.20	1.76	5.94	4.83	--	--
Miscellaneous	19.74	6.68	5.23	1.26	0.96	2.51	201.75	0.290
Total	497.07_{abcde}	325.55_{afgh}	89.85_{bfi}	93.43_{cgj}	102.73_{dhk}	232.57_{eijk}	209.59	<0.0005

[1]Welch test results, rather than regular ANOVA, are reported here, due to non-homogeneity of variance.
*ANOVA cannot be performed, as at least one bicycling event type has zero variance.

5.3.4 Trip activities

Respondents participated in a variety of activities besides participating in the bicycling event (Table 44). More than 90 percent of bicycle tour participants (93.4 percent) dined out, while only 27.9% percent of the fundraising event participants did so (χ^2=116.56, p<0.0005). Sixty percent of bicycle tour participants drove on designated byways, but 17.7 percent of non-race ride participants did so (χ^2=147.67, p<0.0005). While 31 percent of participants in bicycle tours and races participated in sightseeing, 11.6 percent of the fundraising event participants did so (χ^2=26.60, p<0.0005). Close to 32 percent of non-race ride participants (31.7% percent visited friends/relatives, but only 11 percent of participants in bicycle tours, the fundraising event and high school races did so (χ^2=54.03, p<0.0005).

For the other activities, small cell sizes prohibited statistical comparison, but nominal differences are noted. Bicycle tour participants were mostly likely to participate in sporting events (62.9 percent), fishing (15.7 percent) and to visit historic sites (32.3%) and museums (51.1 percent). Few participants from the other event types participated in any of these activities. Bicycle tour participants were also most likely to participate in nightlife/evening entertainment (42.4 percent), camping (24.9 percent), to go shopping (43.7 percent), to visit state parks (49.3% percent and other attractions (25.8 percent), and to go bicycling (besides riding the event, 37.6 percent). Participants in the fundraising event were least likely to participate in nightlife/evening entertainment (2.3 percent), to go shopping (4.7 percent) to visit state parks (2.3 percent), and to go bicycling (besides riding the event, 4.7 percent) or hiking (0.0 percent). High school race

participants were the least likely to visit other attractions (4.3 percent) or to go camping (4.3 percent). Few participants in any event type attended shows/music concerts or a wedding/family reunion.

Table 44 Activities in which survey respondents participated, by bicycling event type (n=1172)

	Percentage						Statistics	
	Bicycle tour (n=229)	Fundraiser (n=43)	High school race (n=94)	Mountain bicycling (n=219)	Non-race (n=5020)	Race (n=67)	χ^2	Sig.
Dining out	93.4%	27.9%	76.6%	73.5%	63.7%	82.1%	116.56	<0.0005
Driving on designated byways	59.8%	32.6%	23.4%	25.1%	17.7%	46.3%	147.67	<0.0005
Sightseeing	31.0%	11.6%	18.1%	24.7%	16.9%	31.3%	26.60	<0.0005
Nightlife/evening entertainment*	42.4%	2.3%	9.6%	16.0%	9.4%	28.4%	--	--
Shopping*	43.7%	4.7%	23.4%	13.7%	18.5%	16.4%	--	--
Sporting event*	62.9%	0.0%	4.3%	5.9%	1.0%	0.0%	--	--
Shows/music concerts*	0.9%	0.0%	0.0%	5.5%	1.5%	0.0%	--	--
Wedding/family reunion*	3.1%	0.0%	0.0%	0.9%	1.0%	0.0%	--	--
Visiting friends/relatives	11.4%	11.6%	10.6%	21.0%	31.7%	16.4%	54.03	<0.0005
Visiting historic sites*	32.3%	0.0%	2.1%	5.5%	6.5%	13.4%	--	--
Visiting museums*	51.1%	2.3%	0.0%	2.7%	2.7%	1.5%	--	--
Visiting state parks*	49.3%	2.3%	17.0%	18.7%	16.5%	16.4%	--	--
Visiting other attractions*	25.8%	7.0%	4.3%	8.7%	8.7%	14.9%	--	--
Fishing*	15.7%	0.0%	1.1%	5.0%	4.4%	1.5%	--	--
Hiking*	3.9%	0.0%	9.6%	11.4%	8.5%	22.4%	--	--
Camping*	24.9%	9.3%	4.3%	11.4%	7.5%	16.4%	--	--
Bicycling (outside of attending the event)*	37.6%	4.7%	34.0%	38.4%	16.5%	13.4%	--	--

5.3.5 Satisfaction with bicycle events

As part of the survey, respondents were also asked to rate their level of satisfaction with the event, with 1=very dissatisfied and 5=very satisfied. Across all even types, respondents were more than satisfied with the events, with mean satisfaction level ranging between 4.38 and 4.72 (Table 45). There is no significant difference in mean satisfaction level across event types (F=2.13, p>0.05).

Table 45 Respondents' level of satisfaction with bicycling events, by event type (n=1131)

	Descriptive statistics[1]			ANOVA	
	Mean	Median	Standard deviation	*F*	Sig.
Bicycle tour (n=225)	4.49	5	0.88	2.13	0.059
Fundraiser (n=43)	4.53	5	0.73		
High school race (n=91)	4.43	5	0.96		
Mountain bicycling event (n=209)	4.38	5	0.96		
Non-race/Ride (n=503)	4.56	5	0.83		
Race (n=60)	4.72	5	0.90		

[1]All items rated on a scale where 1=Very dissatisfied, 2=Dissatisfied, 3=Unsure, 4=Satisfied, 5=Very satisfied.

There are multiple enjoyable attributes to the bicycle events, and participants in different types of bicycling events tended to enjoy different attributes of an event. The percentage of non-race ride participants who enjoyed the ride itself the most was the highest, while that of fundraising event participants was the lowest (χ^2=29.00, p<0.0005; Table 46). While more than 70 percent of non-race riders and race participants enjoyed the scenic route of the event, 31 percent of high school race participants and 32 percent of mountain bicycling event participants identified the scenic route as the most enjoyable attribute of the event (χ^2=172.65, p<0.0005). Participants in the fundraising event were most likely to enjoy social interaction, but only 25 percent of mountain bicycling event participants did so (χ^2=127.87, p<0.0005). The percentage of race participants who enjoyed the ride's challenge most was the highest, while that of bicycle tour participants was the lowest (χ^2=82.81, p<0.0005). About 45 percent of fundraising event participants (44.2 percent) and non-race riders (45.2 percent) enjoyed physical activity the most, but only 18.1 percent of high school race participants did so (χ^2=38.37, p<0.0005).

Table 46 The most enjoyable attributes of the event, by bicycling event type (n=1172)

	Percentage						Statistics	
	Bicycle tour (n=229)	Fundraiser (n=43)	High school race (n=94)	Mountain bicycling (n=219)	Non-race (n=502)	Race (n=67)	χ^2	Sig.
The ride	52.8%	44.2%	62.8%	67.6%	69.6%	58.2%	29.00	<0.0005
Competition*	3.1%	4.7%	40.4%	40.6%	2.5%	16.4%	--	--
The scenic route	48.0%	34.9%	30.9%	32.0%	75.2%	70.1%	172.65	<0.0005
Social interaction	59.8%	81.4%	42.6%	25.1%	26.3%	38.8%	127.87	<0.0005
Food & beverages**	40.2%	18.6%	2.1%	3.2%	17.1%	6.0%	--	--
The challenge	24.5%	55.8%	57.4%	43.4%	27.9%	64.2%	82.81	<0.0005
Physical activity	39.7%	44.2%	18.1%	31.1%	45.2%	23.9%	38.37	<0.0005
Other**	3.1%	23.3%	3.2%	2.3%	5.8%	0.0%	--	--

*Statistical comparison is not applicable as five events are races and the other 21 are non-races.
**No statistical comparison was performed as some cell sizes are too small.

Statistical comparison cannot be performed for three other enjoyable attributes due to small cell sizes, but nominal differences are noted. Forty percent of high school race and mountain bicycling event participants identified competition as the most enjoyable attributes. This is not

surprising, as all high school events are races, and three of the four mountain bicycling events are races. Interestingly, only 16.4 percent of race participants identified competition as the most enjoyable attribute. In terms of food and beverage, 40.2 percent of bicycle tour participants identified it as the most enjoyable attribute, but only 2.1 percent of high school race participants did so. Lastly, the most enjoyable attribute for 23.3 percent of fundraising event participants was "other," while no race participant had "other" most enjoyable attribute.

5.3.6 Trip purpose and planning

5.3.6.1 *Primary reasons for attending a bicycling event*

When asked why they chose to participate in the event, participants in different types of bicycling event identified a variety of reasons, and some differed significantly (Table 47). Mountain bicycling event participants, compared with the others, were the most likely to identify "to ride my bicycle" as a primary reason, while fundraising event participants were least likely to do (χ^2=19.70, p<0.005). The percentage of bicycle tour participants who identified social interaction as a primary reason was significantly higher than that of non-race ride participants (χ^2=103.64, p<0.0005). High school race participants were most likely to identify physical activity (χ^2=16.31, p<0.01) and "challenge myself" (χ^2=89.53, p<0.0005) as primary reasons, while in comparison, race participants were least likely to identify physical activity as a reason and bicycle tour participants were least likely to identify "challenge myself" as a reason. The percentage of race participants who identify "type of event" as a primary reason was significantly higher than that of bicycle tour participants (χ^2=25.50, p<0.0005). Meanwhile, there was no significant difference in the percentage of participants who identified "recommended by family/friend" as a primary reason across event types (χ^2=11.05, p>0.05).

Table 47 Primary reasons for survey respondents to attend the event, by bicycling event type (n=1172)

	Percentage						Statistics	
	Bicycle tour (n=229)	Fundraiser (n=43)	High school race (n=94)	Mountain bicycling (n=219)	Non-race (n=5020)	Race (n=67)	χ^2	Sig.
To ride my bicycle	68.6%	39.5%	66.0%	70.3%	67.1%	55.2%	19.70	0.001
Recommended by family/friend	14.0%	14.0%	6.4%	6.4%	12.5%	14.9%	11.05	0.060
Social interaction	55.9%	48.8%	28.7%	19.2%	23.5%	23.9%	103.64	<0.0005
The route*	27.5%	0.0%	6.4%	28.3%	41.2%	49.3%	--	--
Physical activity	31.0%	20.9%	36.2%	27.4%	35.8%	16.4%	16.31	0.006
Challenge myself	17.5%	37.2%	64.9%	43.8%	29.8%	50.7%	89.53	<0.0005
Prestige of event*	5.7%	4.7%	7.4%	3.2%	3.8%	10.4%	--	--
Location*	31.4%	2.3%	16.0%	42.9%	33.1%	26.9%	--	--
Type of event	10.9%	18.6%	25.5%	21.0%	16.5%	34.3%	25.50	<0.0005
Awards*	0.0%	0.0%	2.1%	0.9%	0.2%	0.0%	--	--
Prizes/give-aways*	0.4%	0.0%	0.0%	3.2%	0.6%	0.0%	--	--
Charity*	10.0%	74.4%	0.0%	2.3%	4.8%	0.0%	--	--
Other*	5.7%	11.6%	5.3%	2.3%	5.6%	0.0%	--	--

*No statistical comparison was performed as some cell sizes are too small.

Small cell sizes prohibited statistical comparison for the other reasons, but nominal differences are noted. Close to 50 percent of race participants (49.3 percent) identified the event route as a primary reason to participate in the event, but none of the fundraising event participants did so. While 10.4 percent of race participants identified prestige of event as a primary reason, only 3.2 percent of mountain bicycling event participants did. Forty-three percent of mountain bicycling event participants identified location as a primary reason, compared with 2.3 percent of the fundraising event participants. In terms of charity as a primary reason to attend a bicycling event, 74.4 percent of the fundraising event participants identified the reasons, which is not surprising given the nature of the event. No more than 4 percent of participants from any type of events identified either awards or prizes/give-aways as a primary reason to attend the event.

5.3.6.2 *Trip planning timeframe and information sources*

The planning timeframe of participants in different types of bicycling events differed significantly (χ^2=313.45, p<0.0005; Table 48). Participants in bicycle tours, the fundraising event and races were the most likely to plan their trip more than 13 weeks in advance. Non-race riders were the most likely to plan their trips five to eight weeks in advance. Between 25 and 30% of high school race participants planned their trips less than two weeks (25.3 percent), two to four weeks (29.9 percent), and five to eight weeks (27.6 percent) in advance. Mountain bicycling event participants tended to cluster on the two ends of the spectrum: 31.1 percent of them planned their trips less than two weeks in advance, while 27.8 percent did so more than 13 weeks in advance.

Table 48 Trip planning timeframe among survey respondents, by bicycling event type (n=1113)

	Percentage					Statistics	
	Less than 2 weeks	2-4 weeks	5-8 weeks	9-13 weeks	13+weeks	χ^2	Sig.
Bicycle tour (n=219)	2.7%	5.9%	6.4%	16.4%	68.5%	313.46	<0.0005
Fundraiser (n=43)	9.3%	4.7%	2.3%	18.6%	65.1%		
High school race (n=87)	25.3%	29.9%	27.6%	3.4%	13.8%		
Mountain bicycling event (n=209)	31.1%	16.7%	12.4%	12.0%	27.8%		
Non-race/Ride (n=496)	14.5%	22.0%	30.6%	14.3%	18.5%		
Race (n=59)	13.6%	11.9%	13.6%	13.6%	47.5%		

Survey respondents used a variety of information sources. More than 80 percent of participants in all bicycle event types used bicycle event websites to plan the trip (Table 49), although fundraising event participants were significantly more likely than high school race participants to do so (χ^2=14.99, p<0.05). The percentage of fundraising event and race participants who used word of mouth as information source were significantly higher than that of non-race and mountain bicycling event participants (χ^2=34.15, p<0.0005). Participants of the fundraising event were significantly more likely than high school race participants to use Facebook as an information source (χ^2=122.30, p<0.0005). Race participants, compared with bicycle tour and non-race ride participants, were significantly more likely to use other websites as information sources.

For the other information sources, small cell sizes prohibited statistical comparison, but nominal differences were noted. Thirty percent of fundraising event participants identified event committee as an information source, while 1.1 percent of high school race participants did so. Close to 20 percent of high school race participants (19.1 percent) used area/destination visitor guide as an information source, but only 2.3 percent of the fundraising event participants did so. In terms of Trip Advisor, 10.4 percent of race participants used it as an information source, but only 1.7 percent of non-race participants did so. Sixteen percent of race participants used "other" websites as information sources, while 6.1% of bicycle tour participants did so. No more than 10 percent of participants in any type of bicycle events used the following information sources: Twitter, Google+, magazine ad, PedalMN website, EMT website, Travelocity, Expedia, area/destination e-newsletter, newspaper, radio, information card and "other" information source.

Table 49 Information sources used by survey respondents, by bicycling event type (n=1172)

	Percentage						Statistics	
	Bicycle tour (n=229)	Fundraiser (n=43)	High school race (n=94)	Mountain bicycling (n=219)	Non-race (n=5020)	Race (n=67)	χ^2	Sig.
Bicycle event website	92.6%	97.7%	83.0%	93.6%	89.8%	85.1%	14.99	0.01
Word of mouth	31.9%	44.2%	36.2%	23.3%	20.8%	43.3%	34.15	<0.0005
Event committee*	14.0%	30.2%	1.1%	7.3%	4.4%	3.0%	--	--
Facebook	24.5%	58.1%	10.6%	46.6%	17.1%	50.7%	122.30	<0.0005
Twitter*	1.3%	0.0%	0.0%	8.2%	1.3%	3.0%	--	--
Google+*	4.4%	4.7%	9.6%	2.3%	4.0%	6.0%	--	--
Area/destination visitor guide*	11.8%	2.3%	19.1%	11.0%	8.5%	14.9%	--	--
Magazine ad*	0.0%	0.0%	0.0%	0.9%	1.5%	3.0%	--	--
PedalMN website*	1.7%	2.3%	4.3%	2.3%	6.0%	3.0%	--	--
EMT website*	7.0%	0.0%	6.4%	2.7%	6.3%	10.4%	--	--
Tavelocity*	0.4%	2.3%	3.2%	0.9%	0.8%	3.0%	--	--
Expedia*	2.6%	0.0%	5.3%	1.8%	0.4%	3.0%	--	--
Trip Advisor*	3.9%	2.3%	6.4%	2.7%	1.7%	10.4%	--	--
Other website	6.1%	7.0%	14.9%	7.8%	6.3%	16.4%	15.87	0.007
Area/destination e-newsletter*	0.9%	0.0%	1.1%	1.8%	2.1%	0.0%	--	--
Newspaper*	0.4%	0.0%	0.0%	0.5%	1.9%	0.0%	--	--
Radio*	0.0%	0.0%	0.0%	0.5%	1.5%	0.0%	--	--
Information card*	1.7%	4.7%	3.2%	0.5%	3.3%	0.0%	--	--
Other information source*	3.9%	7.0%	6.4%	4.1%	5.6%	3.0%	--	--

*No statistical comparison was performed as some cell sizes are too small.

5.4 **Discussion**

An online survey of participants in 26 bicycling events of six different types revealed similarities and differences among participants. The gender of participants in bicycle tours and the fundraising event were not as lopsided as those who participated in high school races, mountain

bicycling events, non-race rides and races. Bicycle tours are a fast growing part of bicycle tourism, while the main stated goal of fundraising events is for charitable reasons. As such, bicycle riding is more of a means to an end (to participate in tourism and to contribute to philanthropic causes) and may be similarly attractive to males and females. For the other four types of events, however, female participation is low. To increase the number of women who participate, it is important that event organizers reach out to female riders. It is possible that most of these events are, in fact, female-friendly, but female riders may not be aware of this fact. If so, better communication about the female-friendly atmosphere/features of the event is critical. Additionally, since high school races involve mountain bicycling, attracting more female students to participate in them can create a pipeline to increase female participation in adult mountain bicycling events in the future.

All six types of events would benefit from increasing participation by minority groups (Hispanic/Latino and non-white) and individuals from less wealthy households. It may be worthwhile for event organizers to contact bicycle clubs composed mainly of individuals from minority groups (for example, Major Taylor Bicycling Club, which is an African-American bicycling club in Minnesota). Establishing these relationships will create an inviting atmosphere for minority groups to participate in their events. In terms of attracting individuals from less wealthy households, is it possible, for example, that high school races offer a small number of scholarships so that interested students from less wealthy households also have a chance to participate? Event organizers could also work with organizations and programs (e.g., Rochester Community Bicycling Mentoring Program) that provide bicycles and bicycle repairs to people with lower incomes. This may help attract participants from more diverse income levels.

Geographically, bicycle tours, mountain bicycling events and non-race rides tended to attract participants from a wide range, in terms of state and core based statistical area (CBSA). On the other hand, participants in the fundraising event and high school races were more homogenous geographically, as nearly all came from the Minneapolis-St. Paul-Bloomington CBSA.

The average number of years that respondents had attended bicycle tours, the fundraising event, and non-race rides was significantly higher than those who had attended high school races. The maximum number of years a high school student is eligible to attend high school races is three or four (i.e., the number of years a student attends high school). Therefore, it is not surprising the average number of years participants had attended high school races is far less than other events. Another possible explanation is that high school races are relatively new while most bicycle tours, the fundraising event, and non-race rides have a longer history. Clearly, many bicycling events attract repeat attendees who may have developed an attachment to the event. Nevertheless, attracting new riders is just as important as maintaining repeat attendees to ensure an event's long-term success. This is especially important for the fundraising event, given 75 percent of its riders are repeat attendees.

In terms of spending, one reason for the higher total spending by bicycle tour and fundraising event participants is that these events lasted for multiple days, while 20 of the other 22 surveyed events lasted for one day. Registration fees for bicycle tours included lodging (tent) and most meal expenses, so it is not surprising the fees for bicycle tours are significantly higher than other types of events.

More than 60 percent of respondents from high school races, mountain bicycling events, non-race rides, and races stayed overnight to attend the events. This finding suggests the economic impact that bicycling events could have on the host community, particularly related to lodging. Additionally, a hotel/motel was the most frequently used lodging facility among participants across event types (except for bicycle tour participants who used a tent most frequently). It may be worthwhile for hotels/motels to market to bicycle event attendees and accommodate event-related needs (e.g., bicycle parking area).

Respondents participated in a variety of activities in addition to attending bicycling events. Event organizers can provide information on dining out, sightseeing, and shopping, as a moderate to high percentage of respondents participated in these activities. Event organizers can also list the state parks, scenic byways and bicycle trails close to the event route, as a moderate to high percentages of respondents also visited state parks, drove on scenic byways and went bicycling (outside of attending the event). For bicycle tours, it may be worthwhile to provide information on historic sites and museums along the tour route. For races, participants may appreciate information on hiking opportunities close to the race route.

Participants of all types of bicycling events attended the events for various reasons and identified different attributes of the events that they enjoyed. The primary reasons for attending and the most enjoyable attributes correspond on some occasions but differ on others, which has implications for event marketing and operations. For bicycle tours, more respondents identified riding one's bicycle as an enjoyable attribute than the ride itself. Similar percentages of respondents identified social interaction as a reason for attending the event, and an enjoyable attribute. Meanwhile, more respondents identified the route and physical activities as enjoyable attributes than as primary reasons, and 40 percent of respondents identified food and beverage as an enjoyable attribute. These findings suggest that bicycle tour organizers should highlight the opportunity of riding one's bicycle and social interaction when promoting their tours. At the same time, providing good food and designing a scenic route that also provides adequate physical activity will contribute to participant enjoyment.

For the fundraising event, the most frequently identified reason to attend was charity. A higher percentage of respondents identified social interaction, riding one's bicycle, and challenging oneself as enjoyable attributes rather than reasons to attend. Therefore, event organizers should highlight the opportunity to contribute to a charitable cause when promoting the event. At the same time, the event needs to be designed in a way that facilitates social interaction and allows participants to challenge themselves.

For high school races, event organizers should clearly communicate to parents about the benefits of mountain bicycle riding, such as physical activity and challenging oneself when promoting races. To ensure participants' enjoyment, the organizers need to promote social interaction.

For mountain bicycling events, a similar percentage of participants identified bicycle riding, the event route, physical activity, and the opportunity to challenge oneself as reasons to attend, as well as enjoyable attributes. As such, event organizers need to communicate these features as part of their event when marketing it. Additionally, 41 percent of participants identified competition as an enjoyable attribute, indicating the importance of organizing the events in a way that enables participants to relish the competition.

For non-race rides, a similar percentage of participants identified bicycle riding, challenging oneself, and social interaction as reasons to attend and enjoyable attributes. On the other hand, more participants identified the route and physical activity as enjoyable attributes rather than reasons to attend. Hence, non-race ride organizers should feature the opportunities of riding one's bicycle, social interaction, and challenging oneself when promoting events. Offering a scenic route will also contribute to ride enjoyment.

For races, a similar percentage of participants identified bicycle riding as a reason to attend and as an enjoyable attribute. Higher percentages of participants, however, identified the route and challenging oneself as enjoyable attributes rather than as reasons to attend. Race organizers, then, should highlight the challenging and scenic routes competitors will follow.

In addition to target communication, event organizers also need to pay attention to marketing mediums, outreach effort, and planning timeframes. Bicycle event websites, word of mouth, and Facebook were the three most frequently used information sources among event attendees. Event websites and Facebook pages provide digital content that event organizers have control over. While maintaining a website incurs financial cost, it is highly worthwhile, given 83percent to 98 percent of participants in different types of bicycling events identified the event website as an information source. Maintaining a Facebook page, however, incurs little financial cost but takes time. Given its frequent use among fundraising, mountain bicycling and race participants, a Facebook page can be a cost-effective marketing tool with a potentially wide reach. The popularity of word of mouth indicates the importance of repeat attendees acting as "ambassadors" to spread the word about an event. Since satisfaction level across all event types was very high, it is more likely repeat attendees will act as a word-of-mouth marketing medium.

Respondents planned their event trips within different timeframes. Participants of bicycle tours, the fundraising event and races tended to plan their trips 13 weeks or more in advance. As such, it is important for event organizers to provide essential information about the events well in advance, especially on the event's website and Facebook page. Non-race ride participants and parents of high school race participants spread out quite evenly in terms of planning timeframes. Mountain bicycling event participants, however, planned their trips either less than two weeks or more than 13 weeks in advance. These planning patterns could be challenging for event organizers, who need to provide information early and respond quickly to last minute registration and questions from participants.

Overall, bicycling events in Minnesota experienced a high level of satisfaction among participants, which is confirmed by the significant number who return year after year. The results of the survey identify opportunities to increase racial and economic diversity among attendees and specific marketing and operational initiatives that align with the interests of bicycle event tourists.

CHAPTER 6:
HEALTH EFFECTS OF BICYCLING: WHAT THE CORONARY ARTERY RISK DEVELOPMENT IN YOUNG ADULTS (CARDIA) STUDY TELLS US

6.1 **Introduction**

Physical activity or exercise has been shown to be protective against type 2 diabetes (Eriksson & Lindgarde, 1991; Group DPPR, 2011; tuomilehto, Indstrom, Eriksson, Valle, et al., 2001), obesity and heart disease (Katzmarzyk, Leon, Wilmore, et al., 2003; Lakka & Laaksonen, 2007). To improve specific exercise recommendations, it will be important to consider how different types of exercise impact these diseases. Exercise consists of four components: the duration, or how much time is spent in a single bout of activity; the frequency, or how often the activity is performed; the intensity, or how vigorously the activity is performed; and the mode, or which type of activity is performed. Recent interest in the mode of exercise has focused on the effects of combining aerobic exercise with resistance exercise (Chudyk & Petrella, 2011; Oliveira, Simoes, Carvalho, & Ribeiro, 2012; Pattyn, Cornelissen, Eshghi, & Vanhees, 2011), though these results have not been conclusive.

What has not been widely considered is whether specific modes of exercise (i.e. cycling, swimming, running) may have different effects on risk of diabetes and heart disease. We argue that different modes of exercise train different muscle groups, which in turn may serve as the basis for a 'mode effect' (e.g. cycling v. tennis) of activity on blood sugar and blood pressure. It will be important to also consider how total volume of activity, as well as the frequency, duration, and intensity of activity may relate to the 'mode effect'. Understanding how mode of exercise effects type 2 diabetes risk would help in the development of exercise interventions to prevent diabetes and in the construction of infrastructure that supports exercise of a certain type (e.g. sidewalk, greenways, separated bicycle facilities, etc.). For this reason, the purpose of this study is to examine the impact of mode of exercise (cycling, running, etc.) on the development of type 2 diabetes and heart disease risk. Because this study is funded by the Minnesota Department of Transportation to consider the effects of bicycling, we are specifically interested in how bicycling compares to other modes. To isolate the effect of each mode, we will use the method described by Gordon-Larsen et al (Gordon-Larsen, Boone-Heinonen, Sidney, Sternfeld, Jacobs, & Lewis, 2009). This method accounts for total exercise performed, to isolate the mode effect.

This study will provide relative risk estimates that can be used in future cost-benefit analyses for infrastructure for walking and cycling. Current methods of estimating cost-benefit for these projects only consider risk reductions related to death rates (Kahlmeier, Cavill, Dinsdale, et al., 2011). When cost-benefit analyses only consider reductions in death rates, the benefit of projects is underestimated because cost savings related to reduced health care costs from non-fatal concerns, like treatment of diabetes, are not considered. By providing an estimate of the risk reductions for diabetes and heart disease that are related to cycling and walking, we provide an input for cost-benefit analyses that will help project planners more accurately represent the benefits of these projects.

6.2 **Methods**

CARDIA: The CARDIA study is a longitudinal cohort study of Caucasians and African Americans designed to examine risk factors for heart disease. Participants in this study come from 4 centers: Birmingham, Alabama; Chicago, Illinois; Minneapolis, Minnesota; and Oakland, California. Participants were aged 18-30 when the study began in 1985. There have been 8 waves of data collection, most recently in 2010.

Outcome: The outcomes of interest for this analysis were type-2 diabetes and metabolic syndrome. Metabolic syndrome is defined as having three or more risk factors for diabetes and hear disease, including obesity, high blood pressure, low HDL cholesterol, high blood sugar, and high blood triglycerides. Diabetes was assessed at each wave of data collection using measured fasting glucose and self report of using diabetes medication. If measured fasting sugar was greater than 126 mg/dl or if the participant reported using diabetes medication they were considered diabetic. For incident diabetes, we excluded all participants who had diabetes at the first exam. A participant was considered diabetic if they met these criteria at any point in follow up, and their time to follow up was the time to the first exam where they met the criteria for diabetes.

Participants were considered to have metabolic syndrome if at any wave of data collection they met five of the following criteria:

1. High blood pressure: Systolic greater than 130mmhg, diastolic greater than 85mmhg.
2. Fasting High Density Lipoprotein (HDL) cholesterol less than 50 mg/dl in women or less than 40 mg/dl in men.
3. Fasting Triglycerides greater than 150 mg/dl.
4. Waist Circumference greater than 88 cm for women or greater than 102 cm for men
5. Fasting glucose (blood sugar) was greater than 100 mg/dl or a participant had diabetes

As with diabetes, for incident metabolic syndrome, we excluded all participants who had metabolic syndrome at the first exam. A participant was considered to have metabolic syndrome if they met these criteria at any point in follow up, and their time to follow up was the time to the first exam where they met the criteria for metabolic syndrome.

Exposure: The main exposure of interest was a score for 13 different modes of exercise. These modes were: Jog or Run, Vigorous Racket Sports, Bicycling more than 10mph, Swimming, Vigorous Exercise Class or Vigorous Dancing, Vigorous Job Activity, Home or Leisure Activities, Strenuous Sports, Non-strenuous Sports, Walk or Hike, Golf or Bowling, Home Exercise or Calisthenics, and Home Maintenance or Gardening. For each of these modes, the CARDIA Physical Activity Questionnaire asked: how many months did you do this activity for more than 1 hour, and for how many months did you do this activity more than *x* hours per week. The hours per week question varied from 2 (for bicycling for example) to 5 (for gardening for example). Essentially the second question asks how many months the participant frequently practiced the particular mode of physical activity. From these questions, a score was constructed for each mode. Each mode was assigned an intensity multiplier ranging from 3 for lower intensity activities like golf or bowling, to 8 for higher intensity activities like running or

jogging. This intensity multiplier was then multiplied by the sum of the months of more than 1 hour of the activity and two times the months with more than *x* hours per week of the activity. For example, for the bicycling variable, the intensity multiplier was 6. Each month that a respondent reported bicycling infrequently (more than one hour per month but less than two hours per week) represents a 6 point difference in the cycling score. Each month that a respondent reported bicycling frequently (more than 2 hours per week) represents an 18 point difference in cycling score. Because of the nature of the questions asked on the CARDIA physical activity survey, it is not possible to precisely estimate the frequency, intensity and duration of physical activity that participants achieved in each of the modes. For each mode, in reporting the hazard ratios, we used a unit that would correspond to one month of reporting frequent participation in that mode. This was done, because these questions were initially reported in months, to improve the understanding of the results and does not change the statistical significance of the results. The units used for each mode are shown in Table 50.

Table 50 Units, Means and Standard Deviations for each Physical Activity Mode

Mode of Physical Activity	Unit used for determining Hazard Ratios*	Mean [Standard Deviation] of Average Individual Activity over Follow Up before Incidence of Diabetes**	Mean (Standard Deviation) of Average Individual Activity over Follow Up before Incidence of Metabolic Syndrome**
Running or Jogging	24	44.4 [58.4]	44.8 [58.9]
Vigorous Racket Sports	24	11.2 [28.3]	11.5 [28.8]
Bicycling (Faster than 10 MPH)	18	29.8 [36.0]	29.9 [36.2]
Swimming	18	12.1 [23.6]	12.2 [23.8]
Vigorous Dancing or Exercise Class	18	28.0 [37.0]	28.4 [37.4]
Vigorous Job Activities (i.e. Digging)	18	45.3 [52.1]	45.5 [52.9]
Home or Leisure Activities (i.e. Snow Shoveling)	15	33.0 [35.6]	33 [36.0]
Strenuous Sports (i.e. Basketball)	24	32.6 [54.1]	33.5 [55.4]
Leisurely Sports (i.e. Ping Pong)	12	23.1 [24.8]	23.5 [25.4]
Walking or Hiking	12	50.1 [34.8]	50.1 [35.2]
Bowling or Golfing	9	7.2 [14.0]	7.2 [14.1]
Home Exercise or Calisthenics	12	24.1 [28.3]	24.2 [28.5]
Home Maintenance or Gardening	12	27.7 [27.9]	27.4 [28.1]

* These Units correspond to the change in activity score that would result if a respondent reported one additional month of the year of engaging in this activity frequently.

** This is the mean of the average for each individual of their level of this activity over the course of follow up, not counting any activity reported after the individual developed the outcome of interest.

Each participant in the study reported up to 8 follow-up surveys on exercise. The variables used in analysis were averages of these follow-up surveys reported before incidence of diabetes or

metabolic syndrome. If a participant developed diabetes or metabolic syndrome over the course of the study, we excluded their reported exercise from surveys completed after the developed the diseases.

Total Physical Activity Covariate: To isolate the effect of modes of exercise from the effect of total physical activity, we adjusted each model for the total physical activity outside of the mode of interest. This was the average over follow-up and before incidence of diabetes or metabolic syndrome of the sum of all mode scores except for the mode of interest for each individual.

Demographic Covariates: We adjusted for gender, race and age in all models.

Health Related Covariates: We adjusted for three health related covariates that may potentially confound the relationship between physical activity modes and diabetes and metabolic syndrome. We adjusted for self-reported amount of alcohol consumed per day at the baseline exam (1985). We adjusted for smoking status (current, former or never smoker) at the baseline exam. We adjusted for a healthy diet score constructed by Jacobs (personal communication) at the baseline exam.

The Model: We modeled both metabolic syndrome and diabetes using a Cox Proportional Hazards model, where survival time to incidence of metabolic syndrome or diabetes was the time to the first exam where these outcomes were reported. We excluded from analysis subjects who had the outcomes at baseline. The main effect for each model was a score for exercise for the various modes (Jacobs, personal communication). We adjusted for age, race, gender, smoking status, alcohol consumption and diet. We also added total exercise outside the mode of interest as a covariate; the purpose of this was to adjust for total exercise and determine whether a mode has an effect on diabetes or metabolic syndrome independent of total exercise.

6.3 **Results**

For these models, we examined the effect of average activity score over follow-up on diabetes and metabolic syndrome. The mean and standard deviations for each physical activity mode, and the units used to determine hazard ratios for each mode are shown in Table 50.

The hazard ratios for each mode of physical activity related to diabetes and metabolic syndrome are shown in Table 51. Running or jogging and vigorous bicycling (faster than 10 miles per hour) demonstrated protective correlations with diabetes and metabolic syndrome. Bowling or golfing demonstrated an adverse correlation with diabetes and metabolic syndrome. Vigorous dancing or exercise class, home or leisure activities, walking or hiking, home exercise or calisthenics, and home maintenance or gardening all show protective correlations with metabolic syndrome only, though these correlations are slightly weaker than the correlations with running or jogging and vigorous bicycling.

Table 51 Hazard Ratios for Diabetes and Metabolic Syndrome for each Physical Activity Mode

Mode of Physical Activity	Hazard Ratio [Confidence Interval] for Diabetes*	Hazard Ratio [Confidence Interval] for Metabolic Syndrome*
Running or Jogging	0.915 [0.868-0.964]**	0.887 [0.861-0.913]**
Vigorous Racket Sports	0.975 [0.888-1.071]	0.972 [0.923-1.023]
Bicycling (Faster than 10 MPH)	0.899 [0.842-0.959]**	0.916 [0.886-0.947]**
Swimming	1.049 [0.968-1.137]	0.99 [0.945-1.037]
Vigorous Dancing or Exercise Class	0.974 [0.922-1.029]	0.939 [0.909-0.97]**
Vigorous Job Activities (i.e. Digging)	0.995 [0.963-1.029]	0.996 [0.976-1.015]
Home or Leisure Activities (i.e. Snow Shoveling)	0.964 [0.914-1.017]	0.93 [0.904-0.956]**
Strenuous Sports (i.e. Basketball)	0.985 [0.933-1.041]	0.972 [0.943-1.002]
Leisurely Sports (i.e. Ping Pong)	1.055 [0.991-1.122]	1.01 [0.981-1.04]
Walking or Hiking	1.018 [0.984-1.054]	0.968 [0.949-0.989]**
Bowling or Golfing	1.076 [1.022-1.132]***	1.037 [1.004-1.072]***
Home Exercise or Calisthenics	1.023 [0.976-1.072]	0.952 [0.927-0.978]**
Home Maintenance or Gardening	1.013 [0.968-1.061]	0.953 [0.928-0.979]**

* All models are adjusted for race, sex, age, smoking status at baseline, diet, alcohol consumption at baseline and total physical activity excluding the mode of interest.

** These modes show a statistically significant ($p < 0.05$) protective effect against the outcome.

*** These modes show a statistically significant ($p < 0.05$) harmful effect against the outcome.

6.4 **Discussion**

The physical activity data from CARDIA has some limitations because it is self-reported and observational, and the wording of the questions rules out examining each physical activity mode at a fine level of frequency, duration and intensity. Since the questions are reported as months that the respondents engaged frequently or infrequently in each activity, we have reported the hazard ratios for each additional month of frequent participation reported. Because this is an observational study, the associations between each physical activity mode and diabetes or metabolic syndrome cannot be considered causal. Despite these limitations, the CARDIA physical activity data has unique strengths. Most importantly, these data were collected on very specific modes of physical activity that give us the opportunity to examine a possible mode effect of physical activity on diabetes and metabolic syndrome. The sample size is large and demographically diverse.

These results suggest that jogging and bicycling are associated with a decreased risk of metabolic syndrome and diabetes, and that golf and bowling are possibly associated with an increased risk of both metabolic syndrome and diabetes. Given the evidence that total physical activity is associated with a decreased risk of diabetes and metabolic syndrome (Eriksson & Lindgarde, 1991; Group DPPR, 2011; Katzmarzyk, et al., 2003; Lakka & Laaksonen, 2007; Tuomilehto, et al., 2001), it seems unlikely that there is something inherent in golf or bowling that would increase the risk of these diseases. Rather, a more likely explanation would be that golf and

bowling are associated with a range of other lifestyle variables that promote diabetes and metabolic syndrome. In a post-hoc analysis we found that golf and bowling are significantly related to poorer dietary habits. Residual confounding by diet may explain the weak harmful effect of golf and bowling on diabetes and metabolic syndrome.

Running or jogging and bicycling each demonstrated a protective association against diabetes and metabolic syndrome. The relative risks for cycling were 0.899 against diabetes and 0.916 against metabolic syndrome. We can use these relative risks as an input to a cost benefit analysis if they are combined with a reliable estimate of the health system costs of diabetes or metabolic syndrome.

CHAPTER 7:
ASSESSING THE HEALTH EFFECTS OF BICYCLE COMMUTING IN THE TWIN CITIES METROPOLITAN AREA

7.1 **Introduction**

This part of the project estimates the value of the health benefits of bicycling in the Twin Cities Metro Area. We measured the amount of bicycle commuting among Twin Cities adults and estimated the number of deaths prevented from that amount of bicycling. We also find links between bicycling and common chronic diseases. This can be combined with average treatment costs to estimate the medical savings from bicycling.

Chronic diseases need ongoing medical care. They lower quality of life and increase costs (Health Economics Program, 20116). 35% of Minnesotans had a chronic disease in 2012. This includes 33% of adults under age 65. In 2012, average spending for people with chronic conditions was $12,800. For persons without chronic conditions, it was $1,600. People with chronic disease accounted for 83% of medical spending that year[1]. In addition, 8.7% of Minnesota medical spending is due to obesity (Trogdon, Finkelstein, Feagan, & Cohen, 2012). See Table 52 for rates and costs for the chronic diseases included in this report.

Table 52 Prevalence and average per-patient spending for chronic diseases, 2012

Disease	Rate in Minnesota adults under 65 years	Medical costs per patient (all ages)*
Hypertension	17.1%	$12,900
High cholesterol	12.7%	$12,600
Diabetes	5.48%	$16,300
Ischemic Heart Disease	0.96%	$27,200

*Costs per patient includes all medical spending for persons with the disease.

Physical activity can prevent illness and death from chronic diseases. Exercise lowers risk of heart disease by lowering resting heart rate, blood pressure, and blood sugar, and increasing blood supply to the heart and HDL cholesterol (Labarthe, 2010). Studies have found that active people have lower risk of developing heart disease (Powell, 1987), metabolic syndrome (Lakka and Laaksonen, 2007) and diabetes (Group DPPR, 2002). Active transportation (bicycling or walking) is a key strategy for reducing chronic diseases (Kahlmeier et al., 2014). The World Health Organization, or WHO (2013), identified seven high-quality studies that followed people to link overall death rates to the person's amount of bicycling; combined results found a 10% lower death rate for every 100 minutes of bicycling per week.

Bicycling and walking are also linked to lower risk of chronic diseases. A survey of six middle-income countries found narrower waistlines, lower blood pressure and lower body mass index (BMI, or weight-for-height) for people who bicycle and walk (Lavergy, Palladino, Lee and Millett, 2015). Another study found that women, but not men, who bicycle or walk to work have less heart disease than scientists had predicted (Hu, Tuomilehto, Borodulin and Jousilahti, 2007). A Minnesota survey found that people who bicycle for more miles are more physically active

overall and have lower BMI. However, bicycling did not predict the way people perceive their own health (Forsyth and Oakes, 2015).

7.2 **HEAT Methods:**

The WHO developed the Health Economic Assessment Tool (HEAT) to estimate the number of deaths prevented by walking and cycling (Kahlmeier et al., 2014). HEAT can be applied to current levels of active transportation or to forecast the effects of a change. The tool gives an approximate value for working-age adult populations (ages 20 to 64).

To estimate the number of deaths prevented by cycling, HEAT requires:

- number of persons who bicycle;
- average time spent bicycling;
- population death rate;
- value of a statistical life (VSL);
- period of time for benefits to be calculated; and
- discount rate.

We estimated the value of deaths prevented by current bicycle commuting in the Twin Cities metropolitan area ("metro area"). This consists of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott and Washington Counties. Three questions were added to the 2014 Minnesota State Survey, or MSS (Armson, 2015). Metro area respondents were asked how many days they bicycle to work each week in warm weather (April to September) and cold weather months (October to March). People who bicycle to work were asked how many miles they ride each way. Questioning was completed from September to November, 2014.

We calculated annual bicycle commute miles with this formula:

$$\frac{\text{commute days}}{\text{year}} = \frac{\text{commute days}}{\text{cold weather week}} * 24 \frac{\text{cold weather weeks}}{\text{year}} + \frac{\text{commute days}}{\text{warm weather week}} * 24 \frac{\text{warm weather weeks}}{\text{year}}$$

$$\frac{\text{miles}}{\text{year}} = \frac{\text{commute days}}{\text{year}} * \frac{\text{one way distance}}{\text{commute day}} * 2$$

The responses were weighted using county, age group, sex and employment data from the 2014 American Community Survey, or ACS (Ruggles, Genadek, Goeken, Grover and Sobek, 2015). The death rate for metro area adults ages 20 to 64 was from the Minnesota Department of Health (2016). Values for VSL ($9.4 million) and discount rate (1.7% per year) are standard MnDOT values (2015). Our values were entered using online HEAT for cycling found at http://www.heatwalkingcycling.org/.

7.3 **HEAT results:**

The MSS interviewed 279 metro area adults ages 20 to 64 (Armson, 2015). We found that 13.4% of working age metro area residents (244,000 adults) bicycle to work at least occasionally. We have 95% confidence that the true number is between 171,000 and 318,000. The average bicycle commuter rides 366 miles per year. We have 95% confidence that the true number is between 218 and 613 miles.

Using these values, HEAT estimates that 12 to 61 deaths are prevented per year by bicycle commuting in the metro area. The current annual value of prevented deaths ranges from about $100 to $500 million as shown in Table 53. At current levels, roughly 1 death per year is prevented for every 10,000 cyclists.

Table 53 Results of HEAT under low, average, and high estimate of cycling prevalence and distance

Scenario	Number of cyclists	Miles per cyclist-year	Annual deaths prevented	Current annual value
Low	171,000	218	12	$108,805,000
Average	244,000	366	28	$ 260,657,000
High	318,000	613	61	$568,965,000

7.4 **Chronic disease methods:**

HEAT estimates savings from prevented deaths, but not from prevented disease (Kahlmeier et al., 2014). We conducted a survey to estimate the effect of bicycling on illness. The Twin Cities Cyclist Survey (TCCS) is an online survey of bicycling, other physical activities, and disease risk factors. We invited members of three commuter groups and one bicycle parts manufacturer to participate in the survey. Eligibility criteria for TCCS analysis are the same as for the MSS. Data collection occurred in August and September, 2015.

Outcome: The outcomes for this analysis were predicted risk of coronary heart disease (CHD) and self-reported metabolic syndrome, obesity, hypertension and high cholesterol. We chose CHD and metabolic syndrome because they have known links with physical activity (Labarthe, 2010). We chose hypertension and high cholesterol because they are the two most common chronic diseases for Minnesota adults under 65 (Health Economics Program 2016). We chose obesity because of the rise in obesity and obesity-related medical spending in Minnesota (Trogdon et al., 2012).

The gold standard for predicting 10-year risk of CHD is the Framingham Risk Score, or FRS (D'agostino et al., 2008). The standard FRS requires exact levels of total cholesterol, HDL cholesterol and blood pressure (National Institutes of Health [NIH]). Asking for exact values could bias results if knowing specific levels is linked to being sicker or healthier than average. We modified the FRS to use “yes” or “no” answers for whether the person has ever been told by a doctor that he or she has these risk factors.

To reduce bias and obtain accurate responses, TCCS asked if the person was ever told by a doctor that he or she had hypertension, high cholesterol, or low HDL cholesterol. We gave

participants who answered "No" the average of the Framingham Risk Score (FRS) points for persons with normal levels (NIH, 2001, 2015). We gave participants who answered "Yes" the average of the FRS points for persons with abnormal levels. Normal and abnormal levels were derived from National Heart, Lung and Blood Institute reports. See Table 54 for the modified FRS points used in this report.

Points for age and smoking status were not changed. Risk scores were used to predict 10-year CHD risk using a published FRS formula[16].

Table 54 Comparison of point assignments from standard versus modified Framingham Risk Score

Cholesterol, age 20 to 39

mg/dL	Validated FRS, male	Modified FRS, male	Validated FRS, female	Modified FRS, female
<160	0		0	
160-199	4	3.667	4	4
200-239	7		8	
240-279	9	10	11	12
280+	11		13	

HDL cholesterol (mg/dL)

mg/dL	Validated FRS	Modified FRS
60+	-1	
50-59	0	0
40-49	1	
<40	2	2

Systolic blood pressure, untreated

mmHg	Validated FRS, male	Modified FRS, male	Validated FRS, female	Modified FRS, female
<120	0		0	
120-129	0	0.333	1	1
130-139	1		2	
140-159	1	1.5	3	3.5
160+	2		4	

Metabolic syndrome is defined as having three or more of: large waistline, high triglycerides, low HDL cholesterol, high blood pressure, and high blood sugar (NIH, 2016). Because risk factors in TCCS are modified, we defined metabolic syndrome as having three or more of: self-reported obesity (BMI of at least 30 kg/m^2) and having ever been told by a doctor that the person had high triglycerides, low HDL cholesterol, high blood pressure, or diabetes.

Three self-reported conditions were examined for links with bicycling: obesity, high blood pressure and high total cholesterol.

Exposure: The main exposure was the number of bicycle trips to work and to other places each week. The number of trips per week was averaged over the year using self-reported trips per week in warm weather months and cold weather months.

Each model was adjusted for:

- total physical activity other than bicycling;
- demographic traits (sex, race, and age); and
- health behaviors (number of alcoholic drinks per week and smoking status).

The Model: We used a linear model for 10-year CHD risk. The effect is the percent difference in predicted risk. We used logistic models for all other outcomes. The effect for these models is the relative odds of having the illness.

Odds ratios can be interpreted this way: Imagine that odds of an illness without cycling are 0.2, and the relative odds for a person with three trips per week is 0.8. Then, odds of the illness for a person who bicycles three times per week are 0.2*0.8, or 0.16.

Models were fit in SAS 9.4 using a method that accounts for potential clustering of health risks and bicycling behavior by zip code.

7.5 **Chronic disease results:**

TCCS collected 1,771 complete surveys. We excluded surveys if the person did not report a metro area county (N = 47), valid zip code (N = 22), or age 20 to 64 years old (N = 80). We also excluded surveys missing any of the exposure or outcome data (N = 253). There were no significant differences between the full set of surveys and the surveys with complete data (Table 55).

Table 55 Characteristics of all eligible participants compared to participants with no missing data

	All eligible participants (*n* = 1,622)	Included in analyses (*n* = 1,369)
Age (years)	38.1 [37.5, 38.7][a]	37.6 [36.9, 38.2]
Male (%)	56.3 [53.9, 58.7]	54.8 [52.2, 57.4]
Non-Hispanic white (%)	89.1 [87.5, 90.6]	89.5 [87.9, 91.1]
Non-core counties (%)	5.56 [4.44, 6.67]	5.23 [4.05, 6.41]
Current smoker (%)	3.69 [2.77, 4.62]	3.19 [2.26, 4.12]
Alcoholic drinks/week	3.89 [3.72, 4.06]	3.85 [3.67, 4.04]
Cycling trips/week	4.57 [4.42, 4.71]	4.56 [4.41, 4.71]
Non-cycling PA (MET hours/week)	8.39 [8.10, 8.64]	8.42 [8.13, 8.71]
10-year CHD risk (%)	1.79 [1.61, 1.98]	1.69 [1.49, 1.89]
Metabolic syndrome (%)	2.34 [1.61, 3.08]	2.47 [1.65, 3.29]
Obese (%)	8.92 [7.52, 10.3]	8.77 [7.28, 10.3]
High blood pressure (%)	9.05 [7.64, 10.5]	8.41 [6.95, 9.88]
High cholesterol (%)	13.7 [12.0, 15.4]	12.2 [10.5, 13.9]

[a]Mean [95% CI]

The relative 10-year CHD risk and odds ratios for other outcomes are shown in Table 56. Effects less than 1 represent less risk; effects bigger than 1 represent greater risk. All estimates are for three bicycle trips per week. This amount was chosen to reflect the effect of being a cyclist compared to a non-cyclist.

Table 56 Effects on chronic disease for three bicycle trips per week increment

Chronic disease	Number of cases	Unadjusted estimate	Confounder-adjusted estimate[a]
10-year CHD risk - *Male*		**0.87 [0.82, 0.91]**	0.99 [0.97, 1.01]
Very low risk (< 6%)	602		
Low risk (6-9%)	74		
Intermediate risk (10-19%)	59		
High risk (≥20%)	15		
10-year CHD risk - *Female*		**0.96 [0.93, 0.99]**	0.99 [0.98, 1.01]
Very low risk (< 6%)	618		
Low risk (6-9%)	1		
Intermediate risk (10-19%)	--		
High risk (≥20%)	--		
Metabolic syndrome	34	**0.51 [0.33, 0.77]**	**0.54 [0.35, 0.83]**
Obesity	120	**0.65 [0.54, 0.77]**	**0.68 [0.57, 0.82]**
Hypertension	113	**0.77 [0.63, 0.93]**	**0.72 [0.58, 0.89]**
High cholesterol	165	**0.81 [0.70, 0.93]**	0.88 [0.74, 1.04]

[a]Estimate [95 percent CI] for 10-year CHD is relative risk. Estimates for all other models are odds ratios. Adjusted models control for age, sex, race, smoking status, alcohol consumption and non-cycling physical activity.
Bold estimates are significantly different from 1 ($p < 0.05$).

Bicycling is linked to lower risk of each disease. This is statistically significant for metabolic syndrome, obesity and hypertension. Taking three additional bicycle trips per week is associated with 46 percent lower odds of metabolic syndrome, 32 percent lower odds of obesity, and 28 percent lower odds of hypertension. In every case except for hypertension, the crude estimate shows a stronger link between bicycling and disease risk.

The lower odds of chronic disease can be interpreted this way. If a new project affects 10,000 citizens, causing an average increase of three bicycle trips per week, then the odds of hypertension in this population would be reduced by 28 percent. If we assume that the population experienced the statewide average rate of hypertension for adults under 64 (17%), then the expected number of hypertension cases without the project is 1,700. Risk can be converted to odds using the formula $\text{Odds} = \frac{\text{Risk}}{1-\text{Risk}}$, so risk of 0.17 translates to odds of $\frac{0.17}{0.83} = 0.21$. With lower odds from increased cycling, the population odds would become 0.21*0.72 = 0.15. This can be converted back to risk using the formula $\text{Risk} = \frac{\text{Odds}}{1+\text{Odds}}$, so odds of 0.15 translates to risk of $\frac{0.15}{1.15} = 0.13$. The expected number of cases after the project is 1,300, or 400 fewer cases of hypertension. If average medical spending for the prevented cases were the same as the statewide average ($12,900 in total medical spending[1]), preventing hypertension with this

project would save $5,200,000 per year. Please note that savings from multiple chronic conditions cannot be added together, as they include multiple overlapping diseases.

7.6 **Discussion**

This is the first attempt to link bicycling with risk of death and illness in the Twin Cities metro area. The MSS and TCCS are broad surveys of this population. We can generalize these to the greater working age population. Bicycling is a common form of regular physical activity in the metro area, with 171,000 to 318,000 adults bicycling to work at least a few times per year. This prevents 12 to 61 deaths per year, saving $100 to $500 million. Bicycling three times per week is also linked to 46% lower odds of metabolic syndrome, 32 percent lower odds of obesity, and 28 percent lower odds of hypertension, which also lowers medical costs.

Both surveys report the person's best guess of their true bicycling habits, not objectively measured bicycling. This limits the precision of our estimates. Given this limitation, we give the most conservative estimate possible for both the number of bicyclers and miles per person. We also matched the MSS survey to the true population as much as possible by using weights based on the ACS.

A bias that could affect the TCCS, but not the MSS, is the "healthy worker effect." Some members of the population are too sick to work. Because we recruited from commuter groups, we sampled a population that is healthier than average. Because the survey population is healthier than the full population, we did not capture non-bicyclers who are very sick. This means our estimate may be biased in a conservative direction.

Another possible bias in the TCCS is from the non-random sample. Anybody who wished to complete the survey was included. We tried to control for differences between more and less frequent bicyclists by adjusting for age, sex, race, smoking, drinking, and other physical activity. Some factors that we didn't measure but could affect results include education and diet.

Information about chronic diseases were simplified into yes or no answers for the online survey. Because we did not ask for the person's specific blood pressure, cholesterol, etc., the exact link between bicycling and CHD or metabolic syndrome risk is uncertain. We were not able to detect an effect on CHD risk. This is likely because the score we used is mainly controlled by age, sex, and smoking rather than physical activity.

To define metabolic syndrome, we used clinical rather than abdominal obesity and diabetes rather than high blood sugar. We do not know the true level of this disease in the sample but it is likely greater than the 2.5 percent we found. Because we found such a strong link between bicycling and metabolic syndrome, knowing the true level would likely affect the size but not the direction of the link.

Active transportation such as bicycling lets many people build regular physical activity into their daily routine. Bicycling is linked to a lower risk of death and illness among Twin Cities adults. Although the results provide only a general estimate of the cost savings from bicycling, it can be of value when making policy decisions.

CHAPTER 8:
DISCUSSION, CONCLUSION AND RECOMMENDATION

This is the first known attempt at estimating the economic impact of the bicycling industry and events in Minnesota, estimating the number of bicycle trips taken and the number of miles traveled by bicycle annually across the state, and assessing the health effects of bicycling in the Twin Cities Metropolitan Area (TCMA).

The project generated new knowledge related to bicycling in multiple aspects. An overarching benefit of the project is providing a comprehensive understanding of the economic impact of bicycling in Minnesota. Project findings can assist MnDOT staff, officials of transportation, economic development, tourism, health, and local economic development groups in at least two ways: (1) determining the appropriate level of future investment related to bicycling in Minnesota, and (2) informing policy and program decisions and strategies on bicycling, especially in the context of the Statewide Bicycle System Plan. Findings can also facilitate partnerships between officials of transportation planning and health, which has been identified as highly important by previous research on transportation and quality of life (report No. MN/RC 2013-05).

8.1 **The economic impact of bicycling industry**

The bicycling industry in this study includes manufacturing and wholesale activities, retail sales, and non-profits and advocacy groups. In 2014, the bicycling industry in Minnesota produced a total of $780 million of economic activity, which includes $209 million of labor income and 5,519 jobs. Minnesota has a strong bicycle-related manufacturing industry that drives the bicycle-related economy. Nearly 80 percent of the economic impact of the bicycling industry is derived from manufacturing and wholesale businesses. This strong manufacturing culture, in turn, drives a strong interest in bicycling across the state.

Specialty bicycle retail stores, especially independent ones, are a critical component of the bicycle retail industry in Minnesota. Slightly more than half of all retail locations selling bicycles are single-location bicycle shops. Furthermore, specialty bicycle stores account for 70% of total bicycle-related sales. Single-location bicycle shops are often small businesses. Therefore, policies that support small businesses in Minnesota would also likely support bicycle-related retail businesses.

Additionally, there are strong connections between manufacturers, wholesalers, and retailers. When asked about local suppliers, bicycling businesses often supplied names of other Minnesota companies, many of which are also bicycle-related businesses.

Taken together, the finding provides evidence for the economic significance of the bicycling industry in Minnesota. Economic development organizations can use the evidence to further seek support for bicycling businesses, non-profits and advocacy groups from private and public sectors.

8.2 **Bicycle infrastructure usage**

Decision makers in Minnesota historically have lacked basic information on demand for bicycling, which is needed to write policy, set meaningful planning goals, establish performance indicators, plan effectively, and invest efficiently in bicycling infrastructure and programs. By systematically estimating the use of trails, roads and other bicycling infrastructure, this part of the project provided evidence of demand for bicycling.

Using ACS and TBI data, the number of bicycle trips in Minnesota for commuting, other utilitarian purposes and recreation is conservatively estimated as between 87 and 96 million annually. This is an underestimate, because it did not include all home-based trips taken for recreational purposes, nor did it include trips at bicycle events. Using data from the MnDOT Omnibus Survey, the total estimated number of trips for the entire year is 75 million, which is somewhat lower than the estimates developed using ACS and TBI data but still in the same order of magnitude. In terms of bicycle miles traveled, Minnesotans traveled between 139 and 197 million miles annually by bicycle. This number is an underestimate because it did not include all trips, and the mileages estimates used to calculate miles per trip were median rather than mean (i.e., average) values.

The findings demonstrate people have an interest in bicycling across Minnesota, and there is (latent) demand and support for increased bicycle facilities and networks. Additionally, bicycling infrastructure in Minnesota is heavily used for recreation, fitness, health, running errands and commuting. The findings can help identify demand and support for bicycle facilities throughout the state that align with priorities identified in the Statewide Bicycle System Plan. Priorities in the plan include: increasing the connectivity of local networks, supporting development of state bicycle routes, increasing implementation of separated bicycle facilities statewide, and increasing the number of people bicycling. The findings also indicate the importance of facilitating bicycling safety. On one hand, bicycling safety was expressed as a concern in the study of transportation and quality of life funded by MnDOT (report No. MN/RC 2013-05), while on the other, safer bicycling infrastructure and networks will likely lead to more people bicycling and more bicycling trips.

8.3 **The economic impact of bicycling events**

Bicycling events consist of races, non-race rides, fundraising events, mountain bicycling events, high school races, and bicycle tours. An online survey of non-local participants (i.e., visitors) of 26 bicycling events found that an average bicycle event visitor spent a total of $121 per day in 2015. This spending translates into a total of $14.3 million of economic activity, which includes $4.6 million in labor income and 150 jobs. Additionally, event participants, on average, brought an additional half person with them, adding up to over 19,000 visitors who were travel companions but did not ride in any event. This is a captive audience for shopping, recreation and amusement activities. Communities that host events could explore opportunities to capture additional spending, for example, offering event related specials for shopping, dining, and entertainment activities.

All six types of bicycling events mainly attract white, non-Hispanic male participants. There is some difference in participants' age, education, and income levels. At least half of respondents

had previously attended the surveyed event. Most respondents spent one or two nights on the entire trip, most likely in a hotel/motel. The travel group size and type varied between different types of events. Riding my bicycle was the most frequently identified reason to attend an event (except for fundraising event participants), and there are a variety of enjoyable attributes that differed across event types. Overall, respondents were satisfied with the events. Taken together, these findings shed light on the characteristics and behavior of bicycling event participants as well as the market reach of these events. The findings can bring together event organizers and officials of economic development, transportation, public health and tourism to orchestrate efforts of using bicycling events to promote: (1) the facilities on which the events take place, (2) the communities in which the facilities are located, and (3) bicycle tourism as a whole.

8.4 **The health effects of bicycle commuting**

Bicycle commuting in the TCMA prevents 12 to 61 deaths per year, saving $100 million to $500 million. Bicycle commuting three times per week is also linked to 46 percent lower odds of metabolic syndrome, 32 percent lower odds of obesity, and 28 percent lower odds of hypertension, all of which lowers medical costs. Given the urgency of reducing mortality and morbidity rates associated with metabolic syndrome, obesity and hypertension, the findings clearly demonstrated the value of bicycle commuting to realizing these urgent health goals.

While the research was conducted in TCMA, residents in other parts of Minnesota can also reap health benefits from bicycling. As such, the findings provided state health and transportation officials and health care providers multiple policy implications:

- promote active transportation via bicycling as a type of physical activity that can be integrated into daily lives through policies and intervention programs, e.g., employers to incentivize bicycle commuting
- develop consistent safety education and encouragement messages statewide to increase bicycle commuting
- continue to encourage and implement safe bicycling to school and access to bicycles for youth across the state

8.5 **Recommendations for future research**

To summarize, project findings tell a compelling story for the positive effects of bicycling and provide direct evidence that supports the efforts to promote bicycling-related industry, infrastructure, events, and activities. In light of project findings, we provide the following four recommendations for future research:

- estimate the economic impact of trails and other bicycling infrastructure throughout the state
- estimate the economic impact of bicycle tourism, not just bicycle events, in the state
- assess health effects associated with bicycling, both recreational and utilitarian, across the state
- include any negative or offsetting effects that may be associated with bicycling (utilitarian and recreational)

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APPENDIX A

INPUT-OUTPUT METHODOLOGY

Special models, called input-output models, exist to conduct economic impact analysis. There are several input-output models available. IMPLAN (IMpact Analysis for PLANning, Minnesota IMPLAN Group)[4] is one such model. Many economists use IMPLAN for economic contribution analysis because it can measure output and employment impacts, is available on a county-by-county basis, and is flexible for the user. IMPLAN has some limitations and qualifications, but it is one of the best tools available to economists for input-output modeling. Understanding the IMPLAN tool, its capabilities, and its limitations will help ensure the best results from the model.

One of the most critical aspects of understanding economic impact analysis is the distinction between the "local" and "non-local" economy. The local economy is identified as part of the model-building process. Either the group requesting the study or the analyst defines the local area. Typically, the local economy studied is a county or a group of counties that share economic linkages. In this analysis, the local economy is Minnesota.

The local economy is an important designation as it sets the parameter for imports. Imports are critical in input-output analysis because imports represent a leakage from the economy and do not generate additional economic activity. If a bicycle manufacturer purchases a component from another business in the local area, this will trigger additional economy activity in the economy. If the bicycle manufacturer purchases a component from a business located outside the local economy, this represents a leakage, and no additional activity will be generated locally. Typically, a smaller the local economy will result in a higher level of leakage.

A few definitions are essential to properly read the results of an IMPLAN analysis. The terms and their definitions are provided below.

Output

Output is measured in dollars and is equivalent to total sales. The output measure can include significant "double counting", particularly when examining an industry and its supply chain. In this bicycling analysis, for example, when a bicycle is sold, the sale price of the bicycle includes the mark-up to the retailer, but also the value of the bicycle itself from the manufacturer and the value of all the component parts. If a bicycle component was manufactured in Minnesota and then sold to another Minnesota company, which in turn used the component to build a bicycle, the value of the component would be measured twice. First, it would be measured as a sale for the component manufacturer and second, it would be measured in the value of the sale by the company selling the bicycling. The sale could potentially be measured again if the bicycle was then sold by a Minnesota retailer.

Efforts were taken in this study to avoid double counting. First, as explained in the body of this report, retail sales were margined. Therefore, only the mark-up to the bicycle retailers were included in the economic contribution of the retailing.

[4] IMPLAN Version 3.0 was used in this analysis. The trade flows model with SAM multipliers was implemented.

Employment

Employment includes full- and part-time workers and is measured in annual average jobs, not full-time equivalents (FTEs). IMPLAN includes total wage and salaried employees, and the self-employed, in employment estimates. Because employment is measured in jobs and not in dollar values, it tends to be a very stable metric.

Labor Income

Labor income measures the value added to the product by the labor component. So, in the bicycle industry example above when the bicycle is sold from a Minnesota retailer, a certain percentage of the sale goes to the retailer for his/her labor. When the retailer buys the assembled bicycle, it includes some markup for labor costs from the manufacturer in the price. When the component manufacturer sells to bicycle manufacturer, they include a value for their labor. These individual value increments for labor can be measured, which amounts to labor income. Labor income does *not* include double counting.

Direct Impact

Direct impact is equivalent to the initial activity in the economy.

Indirect Impact

The indirect impact is the summation of changes in the local economy that occur due to **spending for inputs** (goods and services) by the industry or industries directly impacted. For instance, if employment in a bicycle manufacturing plant increases by 100 jobs, this implies a corresponding increase in output by the plant. As the plant increases output, it must also purchase more inputs, such as electricity, steel and equipment. As the plant increases purchases of these items, its suppliers must also increase production, and so forth. As these ripples move through the economy, they can be captured and measured. Ripples related to the purchase of goods and services are indirect impacts. As mentioned above, only expenditures within the local economy will create indirect impacts.

Induced Impact

The induced impact is the summation of changes in the local economy that occur due to **spending by labor**. For instance, if employment in a bicycle manufacturing plant increases by 100 jobs, the new employees will have more money to spend to purchase housing, buy groceries, and go out to dinner. As they spend their new income, more activity occurs in the local economy. Induced impacts also include spending by labor generated by indirect impacts. As with indirect impacts, only local spending will trigger induced impacts.

Total Impact

The total impact is the summation of the direct, indirect, and induced impacts.

Input-Output, Supply and Demand, and Size of Market

Care must be taken when using regional input-output models to ensure they are being used in the appropriate type of analysis. If input-output models are used to examine the impact or the contribution of an industry that is so large that its expansion or contraction results in such major shifts in supply and demand that prices of inputs and labor change, input-output can overstate the impacts or contributions. While the bicycling industry is an important component of the Minnesota economy, it is not likely that its existence has an impact on national prices. Hence, the model should estimate the contributions reliably.

APPENDIX B

BICYCLING INDUSTRY SURVEY MATERIALS

Name	Address	City	State Zip	City2	Phone	Type
A Train Custom Cycles	2718 E. 27th street	Minneapolis	MN 55408	Minneapolis	(651) 295-1525	Custom Bicycle Manufacturer
Acceleration Sports & Fitness	607 Laurel St	Brainerd	MN 56401	Brainerd	(218) 454-0100	Bicycle Shops
Adventure Cycle & Ski	178 Center St	Winona	MN 55987	Winona	(507) 452-4228	Bicycle Shops
Adventure Sports	9267 Raspberry Ct NE	Bemidji	MN 56601	Bemidji	(218) 556-0470	Bicycle Shops,Bicycle Rental
Alternative Bike & Board Shop	3013 Lyndale Ave S	Minneapolis	MN 55408	Minneapolis	(612) 374-3635	Bicycle Shops,Bicycle Repair
An Honest Bike Shop	44 4th St SE	Rochester	MN 55904	Rochester	(507) 288-8888	Bicycle Shops,Bicycle Repair
Anderson Custom	PO Box 16651	St Paul	MN 55116	Saint Paul	651-324-0095	Custom Bicycle Manufacturer
Angry Catfish Bicycle Shop	4208 28th Ave S	Minneapolis	MN 55406	Minneapolis	(612) 722-1538	Bicylce Shops
Appleman Bicycles	2718 E 27th St	Minneapolis	MN 55406	Minneapolis	(763) 232-9584	Custom Bicycle Manufacturer
Ardies Athletic	410 10th St E	Glencoe	MN 55336	Glencoe	(320) 864-5009	Bicycle Rental,Sporting Goods
B L Used Bike Shop	530 Cedar St	Monticello	MN 55362	Monticello	(763) 295-2055	Bicycle Shops
B L Used Bike Shop	112 E Broadway St	Monticello	MN 55362	Monticello	(763) 295-2055	Bicycle Shops,Bicycle Rental
B W's Bikes Sales-Svc & Rental	801 Fremont St E	Waterville	MN 56096	Waterville	(507) 362-4990	Bicycle Shops,Sporting Goods
Banjo Brothers Bike Bags	4832 Drew Ave. S	Minneapolis	MN 55410	Minneapolis		Apparel Manufacturing
Beachland Cottages	7111 County Road 13	Nisswa	MN 56468	Nisswa	(218) 963-2417	Bicycle Rental,Lodging,Fishing Piers
Behind Bars Bicycle Shop	208 13th Ave NE	Minneapolis	MN 55413	Minneapolis	(612) 436-0255	Bicycle Shop
Belchgear	P.O. Box 413	Bayport	MN 55003	Bayport	(651) 842-8478	Apparel Manufacturing
Bicycle Alliance Of Minnesota	214 Park Ave	Saint Paul	MN 55115	Saint Paul	(651) 387-2445	Training Consultants
Bicycle Bill's Pro-Shops	1260 Robert St S	Saint Paul	MN 55118	S Saint Paul	(651) 457-9111	Bicycle Shops
Bicycle Chain	1712 Lexington Ave N	Saint Paul	MN 55113	Paul	(651) 489-4513	Bicycle Shops,Bicycle Repair
Bicycle Express	1122 16th Ave SE	Minneapolis	MN 55414	Minneapolis	(612) 623-9999	Courier & Delivery Service,Trucking
Bicycle Mechanic	2545 Stark Rd	Harris	MN 55032	Harris	(763) 300-1646	Bicycle Shops,Bicycle Repair
Bicycle Service Center	419 Alex Moore St	Sauk Centre	MN 56378	Centre	(320) 352-5432	Bicycle Shops,Bicycle Repair
Bicycle Shop	24 W 1st St	Waconia	MN 55387	Waconia	(952) 442-1378	Bicycle Shops,Sporting Goods
Bicycle Shoppe	505 Lake Ave	Fairmont	MN 56031	Fairmont	(507) 238-1092	Bicycle Shops,Sporting Goods
Bicycle Sports	1400 5th Pl NW	Rochester	MN 55901	Rochester	(507) 218-0059	Bicycle Shops,Bicycle Repair
Bicycle Theory	15 Jackson St NE	Minneapolis	MN 55413	NEMinneapolis	(612) 229-7421	Bicycle Shops,Sporting Goods
Bicycle Theory Inc	705 Raymond Ave # 210	Saint Paul	MN 55114	Saint Paul	(612) 229-7421	Graphic Designers
Bike & Fitness Co	805 1st Ave E	Alexandria	MN 56308	Alexandria	(320) 762-8493	Bicycle Shops,Bicycle Rental
Bike Fixstation	2647 37th Ave S Unit 1	Minneapolis	MN 55406	Minneapolis	612-568-3494	Bicycle Repair
Bike Guy Ski & Bicycle Shop	423 Beltrami Ave NW	Bemidji	MN 56601	Bemidji	(218) 333-8891	Bicycle Shops,Bicycle Repair
Bike King	6489 Cahill Ave	Inver Grove Heights	MN 55076	Inver Grove Heights	(651) 457-7766	Bicycle Shops,Bicycle Repair
Bike Love	2219 31st Ave S	Minneapolis	MN 55406	Minneapolis	(612) 315-4051	Bicycle Shops,Sporting Goods
Bike Shop	219 W Main St	Marshall	MN 56258	Marshall	(507) 532-3633	Bicycle Shops,Bicycle Rental
Bike Shop Distributors Inc	809 Carleton St	Saint Paul	MN 55114	Saint Paul	(651) 646-9716	Bicycles-Wholesale & Manufacturers
Bikes and Pieces	4813 Chicago Avenue S	Minneapolis	MN 55417	Minneapolis	(612) 203-6077	Bicycle Shops
Bikes by Bob	61979 US Highway 12	Litchfield	MN 55355	Litchfield	(320) 593-1950	Bicycle Shops,Bicycle Rental
Bikes By Bob	621 1st St	Dassel	MN 55325	Dassel	(320) 593-1950	Bicycle Shops,Sporting Goods
Bikes On Howard	407 E Howard St	Hibbing	MN 55746	Hibbing	(218) 262-0899	Bicycle Shops,Bicycle Rental
Billet Bike Shop	1609 Mainstreet	Hopkins	MN 55343	Hopkins	(952) 933-2727	Bicycle Shops
Bl Bike and Boards	112 E Broadway St	Monticello	MN 55362	Monticello	(763) 295-2055	Bicycle Shops
Blue Bicycle Antiques	1818 Selby Ave	Saint Paul	MN 55104	Saint Paul	(612) 390-7099	Antiques
Bobber Shop Fishing	1630 N Riverfront Dr	Mankato	MN 56001	Mankato	(507) 625-8228	Bicycle Rental,Sporting Goods
Boehm's Cycling Fitness-Hockey	1592 Selby Ave	Saint Paul	MN 55104	Saint Paul	(651) 644-4990	Bicycle Shops,Bicycle Repair
Bokoo Bikes	550 Lake Dr	Chanhassen	MN 55317	Chanhassen	(952) 934-6468	Bicycle Shops
Braham Bicycle	103 Central Dr E	Braham	MN 55006	Braham	(320) 496-1133	Bicycle Shops,Sporting Goods

Name	Address	City	State Zip	City2	Phone	Type
Broken Spoke	19026 Rapidan Ave	Mankato	MN 56001	Mankato	(507) 278-4320	Bicycle Shops,Bicycle Repair
Broken Spoke Bicycle Repair	803 S Moore St	Blue Earth	MN 56013	Blue Earth	(507) 520-0875	Bicycle Shops
Buck's Bike	5962 Galant Rd	Saint Cloud	MN 56301	Saint Cloud	(320) 251-9150	Bicycle Shops
Bush Garden Products	107 3rd St S	Waterville	MN 56096	Waterville	(507) 362-8088	Bicycle Rental,Sporting Goods
Calhoun Cycle	3342 Hennepin Ave	Minneapolis	MN 55408	Minneapolis	(612) 827-8000	Bicycle Shops
Capital Deals	710 Smith Ave	S Saint Paul	MN 55107	S Saint Paul	(651) 222-8380	Bicycle Shops
Carlton Bike Rental & Repair Inc	106 Chestnut Ave	Carlton	MN 55718	Carlton	(218) 384-4696	Bicycle Rental
CARS Bike Shop	2661 County Road I	Saint Paul	MN 55112	Saint Paul	(763) 400-9055	Bicycles-Wholesale & Manufacturers
Central Lakes Cycle	2010 State Highway 210 E	Fergus Falls	MN 56537	Fergus Falls	(218) 739-5651	Bicycle Shops,Bicycle Repair
Chris Kvale Bicycles	2637 27th Avenue S.	Minneapolis	MN 55406	Minneapolis	612-724-8843	Custom Bicycle Manufacturer
Chuck's Ride Again Bikes	7447 Abbott Ave N	Minneapolis	MN 55443	Minneapolis	(763) 561-2228	Bicycle Shops,Sporting Goods
Cj's Bike Shop	2629 W 3rd St	Duluth	MN 55806	Duluth	(218) 940-8080	Bicycle Repair
Clockwork bike frame	4315 Douglas Ave.	Golden Valley	MN 55416	Golden Valley	612-483-8900	Custom Bicycle Manufacturer
Continental Ski & Bike	1305 E 1st St	Duluth	MN 55805	Duluth	(218) 728-4466	Bicycle Rental
County Cycles	2700 Lexington Ave N	Saint Paul	MN 55113	Saint Paul	(651) 482-9609	Bicycle Shops,Bicycle Repair
Craig's Bicycle Repair	806 S Union Ave	Fergus Falls	MN 56537	Fergus Falls	(218) 739-2754	Bicycle Shops
Craig's Bike Shop	9575 Sucker Creek Rd	Rice	MN 56367	Rice	(320) 393-3120	Bicycle Shops
Curt Goodrich Bycycles	2010 E Hennepin Ave	Minneapolis	MN 55413	Minneapolis	(612) 788-6812	Bicycles-Wholesale & Manufacturers
Cycle America	205 4th St N	Cannon Falls	MN 55009	Cannon Falls	(507) 263-2665	Bicycle Shops,Bicycle Rental
Cycle Path & Paddle	115 3rd Ave SW	Crosby	MN 56441	Crosby	(218) 545-4545	Bicycle Shops,Bicycle Rental
Cycle Pros	2040 Highway 14 E Ste A	Rochester	MN 55904	Rochester	(507) 287-1070	Bicycle Shops
Cyclequest Studio	6409 City West Pkwy	Eden Prairie	MN 55344	Eden Prairie	(952) 426-0169	Bicycle Shops,Gymnasiums
D L Bike Shop	1121 Highway 10 E	Detroit Lakes	MN 56501	Detroit Lakes	(218) 844-5320	Bicycle Shops,Sporting Goods
Dave's Bike Salvage & Service	13753 Echo Ave	Lonsdale	MN 55046	Lonsdale	(507) 334-9734	Bicycle Shops
Delaney's	1100 First St E	Park Rapids	MN 56470	Park Rapids	(218) 732-4281	Bicycle Rental,Sporting Goods
Denne Sport Sales	19050 Industrial Blvd NW	Elk River	MN 55330	Elk River	(763) 633-3366	Bicycle Rental,Sporting Goods
Dero Bike Racks	504 Malcolm Ave SE # 100	Minneapolis	MN 55414	Minneapolis	(612) 724-9217	Bicycle Rack Manufacturing
Donkey Label	2740 31st Ave S. Suite 300	Minneapolis	MN 55406	Minneapolis		Apparel Manufacturing
Dynacraft B S C Inc	825 Nicollet Mall	Minneapolis	MN 55402	Minneapolis	(612) 315-4963	Bicycle Shops
East Side Bicycle & Repair Shop	4753 University Ave NE	Minneapolis	MN 55421	Minneapolis	(763) 572-1970	Bicycle Shops,Sporting Goods
Easy Riders Bicycle & Sport	415 Washington St	Brainerd	MN 56401	Brainerd	(218) 829-5516	Bicycle Shops,Bicycle Rental
Edina Bike & Sport	4504 Valley View Rd	Minneapolis	MN 55424	Minneapolis	(952) 922-2453	Bicycle Shops,Sporting Goods
Ediscount Bike	21475 Holyoke Ave	Lakeville	MN 55044	Lakeville	(952) 985-5522	Bicycle Shops
Erik's Bike & Board Shop	1296 Town Centre Dr	Saint Paul	MN 55123	Saint Paul	(651) 209-6046	Bicycles-Wholesale & Manufacturers
Erik's Bike & Fitness	14613 County Road 11	Burnsville	MN 55337	Burnsville	(952) 891-6411	Bicycle Shops,Sporting Goods
Erik's Bike and Board Shop		Osseo	MN 55369	Osseo	(763) 391-7888	Bicycle Shops
Erik's Bike and Board Shop	2059 Snelling Ave N	Saint Paul	MN 55113	Saint Paul	(651) 209-1990	Bicycle Shops,Bicycle Repair
Eriks Bike Shop	501 County Road 42 E	Burnsville	MN 55306	Burnsville	(952) 898-5111	Bicycle Shops,Bicycle Repair
Erik's Bike Shop	1220 16th Street SW	Rochester	MN 55902	Rochester	(507) 292-0024	Bicycle Shops
Erik's Bike Shop	8006 Minnetonka Blvd	Minneapolis	MN 55426	Minneapolis	(952) 931-9322	Bicycle Shops,Bicycle Repair
Erik's Bike Shop	12500 Wayzata Blvd	Hopkins	MN 55305	Hopkins	(952) 345-0555	Bicycle Shops,Bicycle Repair
Erik's Bike Shop	6850 Hemlock Ln N	Maple Grove	MN 55369	Maple Grove	(763) 391-7888	Bicycle Shops,Bicycle Repair
Erik's Bike Shop	1312 4th St SE	Minneapolis	MN 55414	Minneapolis	(612) 617-8002	Bicycle Shops,Bicycle Repair
Erik's Bike Shop	2120 Northdale Blvd NW	Minneapolis	MN 55433	Minneapolis	(763) 862-0091	Bicycle Shops,Sporting Goods
Erik's Bike Shop	16570 Main St	Eden Prairie	MN 55346	Eden Prairie	(952) 934-7993	Bicycle Shops,Sporting Goods
Erik's Bike Shop	2115 W Division St	Saint Cloud	MN 56301	Saint Cloud	(320) 257-0111	Bicycle Shops,Sporting Goods

Name	Address	City	State Zip	City2	Phone	Type
Erik's Bike Shop	2191 Ford Pkwy	Saint Paul	MN 55116	Saint Paul	(651) 699-4679	Bicycle Shops,Sporting Goods
Erik's Bike Shop	7077 10th St N	Saint Paul	MN 55128	Saint Paul	(651) 730-0022	Bicycle Shops,Sporting Goods
Erik's Bike Shop-Bloomington	431 E 78th St	Minneapolis	MN 55420	Minneapolis	(952) 886-0800	Bicycle Shops,Sporting Goods
Erik's Bike Shop-Snowboards	1825 Radio Dr	Saint Paul	MN 55125	Saint Paul	(651) 259-4600	Bicycle Shops,Bicycle Repair
Excelcycle	18674 Lake Dr E	Chanhassen	MN 55317	Chanhassen	(952) 474-3180	Bicycle Shops,Bicycle Repair
Excelcycle	540 Lake St	Excelsior	MN 55331	Excelsior	(952) 474-3180	Bicycle Shops,Bicycle Repair
Express Bike Shop	1158 Selby Ave	Saint Paul	MN 55104	Saint Paul	(651) 644-9660	Bicycle Shops
Fast Bikes	1419 Rosewood St	Brainerd	MN 56401	Brainerd	(218) 829-0115	Bicycle Shops,Bicycle Rental
Fit To Be Tri'd	321 Division St S	Northfield	MN 55057	Northfield	(507) 786-9191	Bicycle Rental,Sporting Goods
Fitzharris Sports & Custom	105 7th Ave S	Saint Cloud	MN 56301	Saint Cloud	(320) 251-2844	Bicycle Shops,Bicycle Repair
Fix Studio	3725 Minnehaha Ave	Minneapolis	MN 55406	Minneapolis	(612) 220-0215	Bicycle Trainer
Flanders Bros Cycle & Sports	2707 Lyndale Ave S	Minneapolis	MN 55408	Minneapolis	(612) 872-6994	Bicycle Shops,Bicycle Repair
Flying Penguin Outdoor Sports	604 N Victory Dr	Mankato	MN 56001	Mankato	(507) 345-4754	Bicycle Shops,Bicycle Repair
Forest Lake Cycle & Skate	455 Lake St N	Forest Lake	MN 55025	Forest Lake	(651) 464-4035	Bicycle Shops
Framed Bikes	200 S. Owasso Blvd E	Saint Paul	MN 55117	Saint Paul	(612) 326-7841	Bicycle Manufacturer
Freewheel Bicycle Midtown Bike	2834 10th Ave S	Minneapolis	MN 55407	Minneapolis	(612) 238-4447	Bicycle Shops,Sporting Goods
Freewheel Bike	1812 S 6th St	Minneapolis	MN 55454	Minneapolis	(612) 339-2219	Bicycle Shops,Bicycle Repair
Fridley Heights Cyclery	4755 University Ave NE	Minneapolis	MN 55421	Minneapolis	(763) 572-1670	Bicycle Shops,Bicycle Repair
Full Cycle	3515 Chicago Ave	Minneapolis	MN 55407	Minneapolis	(612) 824-7581	Bicycle Shops,Bicycle Repair
Fun Time	4801 Minnehaha Ave	Minneapolis	MN 55417	Minneapolis	(612) 729-2660	Bicycle Shops,Sporting Goods
Galleria Sales	5225 Miller Trunk Hwy	Hermantown	MN 55811	Hermantown	(218) 729-9704	Bicycle Shops,Bicycle Repair
Gateway Cycle	6028 Highway 36 Blvd N	Saint Paul	MN 55128	Saint Paul	(651) 777-0188	Bicycle Shops,Bicycle Rental
Gear Doctors	4755 Hwy. 101	Minnetonka	MN 55345	Minnetonka	(612) 226-1704	Bicycle Repair,Camping Equipment
Gearwest Bicycle Shop	1786 W Wayzata Blvd	Long Lake	MN 55356	Long Lake	(952) 473-0093	Sporting Goods-Wholesale &...
Gene's Sport Shop	150 E Main St	Perham	MN 56573	Perham	(218) 346-3355	Bicycle Rental,Sporting Goods
Grand Performance	1938 Grand Ave	Saint Paul	MN 55105	Saint Paul	(651) 699-2640	Bicycle Shops
Greenstar Bikes				Maple Grove		Bicycle Manufacturer
H & D Eastside	4611 Birchbark Trl N	Lake Elmo	MN 55042	Lake Elmo	(651) 776-3412	Bicycle Shops,Sporting Goods
Halverson Bruce & Dianne	419 Alex Moore St	Sauk Centre	MN 56378	Sauk Centre	(320) 352-5432	Bicycle Shops,Bicycle Rental
Handsome Cycles	115 Washington Ave N	Minneapolis	MN 55401	Minneapolis	(612) 353-4035	Bicycle Shops,Sporting Goods
Hatcher Cycle	7780 State Highway 55	Rockford	MN 55373	Rockford	(763) 477-6959	Bicycle Shops
Hed Cycling Products	1025 Tomlyn Ave	Saint Paul	MN 55126	Saint Paul	(651) 797-4250	Bicycle Shops,Sporting Goods
Hed Cycling Products	4643 Chatsworth St N	Saint Paul	MN 55126	Saint Paul	(651) 653-0202	Bicycle Shops,Sporting Goods
Hiawatha Cyclery	4301 E 54th St	Minneapolis	MN 55417	Minneapolis	(612) 727-2565	Bicycle Shops,Bicycle Repair
Historic Crane Building	404 3rd Ave N	Minneapolis	MN 55401	Minneapolis	(612) 333-2581	Bicycles-Wholesale & Manufacturers
Hoigaard's	5425 Excelsior Blvd	Minneapolis	MN 55416	Minneapolis	(952) 929-1351	Bicycle Shops,Sporting Goods
Hollywood Cycles	3527 Dupont Ave S # 1	Minneapolis	MN 55408	Minneapolis	(952) 881-4707	Bicycle Shops
Home Place Bike & Ski Shop	524 Paul Bunyan Dr SE	Bemidji	MN 56601	Bemidji	(218) 751-3456	Bicycle Shops,Bicycle Repair
Hub Bike Co-Op	301 Cedar Ave S	Minneapolis	MN 55454	Minneapolis	(612) 238-3593	Bicycle Shops
Isanti Bicycle	24 Main St N	Cambridge	MN 55008	Cambridge	(763) 244-1284	Bicycle Repair
Isanti Bicycle	24 Main St	WIsanti	MN 55040	Isanti	(763) 645-0568	Bicycle Shops,Bicycle Repair
Island Cycle Supply Co.	425 Washington Ave N	Minneapolis	MN 55401	Minneapolis	(612) 333-7771	Bicycle Repair and Parts Distributor
Itasca Trail Sports	316 NE 4th St	Grand Rapids	MN 55744	Grand Rapids	(218) 326-1716	Bicycle Shops,Bicycle Repair
Jake's Bikes	611 3rd Ave E	Alexandria	MN 56308	Alexandria	(320) 219-7433	Bicycle Shops,Bicycle Repair
Janna's Hides & Rides	218 North Main Street	Stillwater	MN 55082	Stillwater	(651) 472-9218	Bicycle Rental,Leather Apparel,Souvenirs
Jonny Rock Bikes	9092 Excelsior Blvd	Hopkins	MN 55343	Hopkins	(952) 594-5333	Bicycle Shops

Name	Address	City	State Zip	City2	Phone	Type
Just Two Bikes	15449 FOREST BLVD N	Hugo MN		Hugo	(651) 426-1548	Custom Bicycle Manufacturer
Kolter Bicycle & Fitness Inc	400 Mankato Ave	Winona	MN 55987	Winona	(507) 452-5665	Bicycle Shops
Kvale Chris Cycles	2637 27th Ave S # 108	Minneapolis	MN 55406	Minneapolis	(612) 724-8843	Bicycle Shops,Sporting Goods
LaMere Cycles	2751 Hennepin Ave # 565	Minneapolis	MN 55408	Minneapolis	(877) 646-7186	Bicycle Shops,Bicycle Repair
Landfall Youth Bike Program	58 Aspen Way	Saint Paul	MN 55128	Saint Paul	(651) 578-1483	Bicycle Shops
Little River General Store	105 Coffee St E	Lanesboro	MN 55949	Lanesboro	(507) 467-2943	Bicycle Shop, Bicycle Rental
Lorties Cycle Shop	23918 500th St	Bemidji	MN 56601	Bemidji	(218) 333-3757	Bicycle Shops
Lowertown Bike	253 4th St E # 76	Saint Paul	MN 55101		(651) 222-0775	Bicycle Shops,Bicycle Repair
Maple Grove Cycling & Fitness	13950 Grove Dr	Osseo	MN 55311	Osseo	(763) 420-8878	Bicycle Shops,Sporting Goods
Martin's Cycling & Fitness	1137 S Broadway Ave	Albert Lea	MN 56007	Albert Lea	(507) 377-3704	Bicycle Shops,Bicycle Rental
Mbk Marketing	27420 Pine Bnd	Excelsior	MN 55331	Excelsior	(952) 474-7325	Bicycle Shops,Sporting Goods
mesabi recreation	720 9th st n.	virginia	MN 55792	Virginia	(218) 749-6719	Bicycle Shops,Sporting Goods
Michael's Cycles	16731 Highway 13 S	Prior Lake	MN 55372	Prior Lake	(952) 447-2453	Bicycle Shops,Sporting Goods
Midwest Bicycle Supply Inc	809 Carleton St	Saint Paul	MN 55114	Saint Paul	(651) 646-9716	Bicycle Shops
Mike's Bicycle Shop	416 Grastvedt Ln	Northfield	MN 55057	Northfield	(507) 645-9452	Bicycle Shops,Sporting Goods
Mikes Bikes MN	304 W Broadway	Elizabeth	MN 56533	Elizabeth	(218) 205-8494	Bicycle Shops,Bicycle Repair
Milltown Cycles	311 Central Ave N	Faribault	MN 55021	Faribault	(507) 331-2636	Bicycle Shops
Minneapolis Electric Bicycle Company				Minneapolis	612.770.8666	Bicycle Manufacturer
MM Bike Ped Alliance	712 University Ave W	Saint Paul	MN 55104	Saint Paul	(651) 222-2080	Bicycle Shops
Mountain Stream Apparel	1461 Pulaski Rd	Buffalo	MN 55313	Buffalo	(763) 682-2714	Bicycle Rental,Sporting Goods
Nicollet Bike Shop	607 N Riverfront Dr	Mankato	MN 56001	Mankato	(507) 388-9390	Bicycle Shops,Bicycle Repair
Nicollet South Bike Shop	50051 461st Ave	Nicollet	MN 56074	Nicollet	(507) 947-3264	Bicycle Shops,Bicycle Repair
Nokomis Cycle	4553 Bloomington Ave	Minneapolis	MN 55407	Minneapolis	(612) 721-2959	Bicycle Shops
Norski Bicycle Co	5776 Lake Ave S	Tower	MN 55790	Tower	(218) 753-1210	Bicycle Shops
North Suburban Schwinn	2661 County Road I	Saint Paul	MN 55112	Saint Paul	(763) 784-6704	Bicycle Shops,Sporting Goods
Northern Cycle	501 1st St E	Park Rapids	MN 56470	Park Rapids	(218) 732-5971	Bicycle Shops,Bicycle Repair
Northern Cycle	117 3rd St NW	Bemidji	MN 56601	Bemidji	(218) 751-2453	Bicycle Shops,Sporting Goods
Northern Lights Rental Shop	6331 Wynne Creek Dr	Biwabik	MN 55708	Biwabik	(218) 865-3002	Bicycle Repair,Bicycle Renta
Northern Surplus	325 3rd St NW	Bemidji	MN 56601	Bemidji	(218) 751-6866	Bicycle Rental,Sporting Goods
Northstar Cyclery	1574 154th Ave NW # 104B	Andover	MN 55304	Andover	(763) 434-3149	Bicycle Shops,Bicycle Rental
Now Bike & Fitness	1201 County Road E W	Saint Paul	MN 55112	Saint Paul	(651) 490-7709	Bicycle Shops,Sporting Goods
Now Bikes & Fitness	3673 Lexington Ave N Ste H	Saint Paul	MN 55126	Saint Paul	(651) 490-7709	Bicycle Shops,Bicycle Repair
Omnium Bike Shop	520 Selby Ave	Saint Paul	MN 55102	Saint Paul	(651) 224-2432	Bicycle Shops,Sporting Goods
One On One Bicycle StudioProducts	117 Washington Ave N	Minneapolis	MN 55401	Minneapolis	(612) 371-9565	Bicycle Shops
OneTen Cycles	1040 Dakota Dr	Saint Paul	MN 55120	Saint Paul	(651) 454-2066	Bicycle Shops
Otter Outdoors	411 Congress St W	Maple Lake	MN 55358	Maple Lake	(320) 963-6480	Bicycle Rental,Fishing Tackle
Outdoor Edge Inc	115 Adams St S	Cambridge	MN 55008	Cambridge	(763) 552-3343	Bicycle Shops,Bicycle Rental
Outdoor Motion Inc	141 Main St S	Hutchinson	MN 55350	Hutchinson	(320) 587-2453	Bicycle Shops,Bicycle Rental
Outdoor Store	323 Main St	Red Wing	MN 55066	Red Wing	(651) 388-5358	Bicycle Shops
Park Tool USA	5115 Hadley Ave N	Saint Paul	MN 55128	Saint Paul	(651) 777-6868	Tools,Hardware Stores
Patrol Bike Systems Inc	7051 47th St N	Saint Paul	MN 55128	Saint Paul	(651) 773-8763	Bicycle Shops
Paul's Bicycle Shop	120 Holmes Street South	Shakopee	MN 55379	Shakopee	(952) 688-6820	Bicycle Shops,Bicycle Repair
Paumco Products Inc	500 Congress St W	Maple Lake	MN 55358	Maple Lake	(320) 963-3868	Bicycle Rental,Sporting Goods
Peacock Groove Bike	2718 E 27th St	Minneapolis	MN 55406	Minneapolis	(651) 269-5295	Custom Bicycle Manufacturer
Penn Cycle	10611 Baltimore St NE Ste 140	Minneapolis	MN 55449	Minneapolis	(763) 432-9430	Bicycle Shops
Penn Cycle	6824 Penn Ave S	Minneapolis	MN 55423	Minneapolis	(612) 866-7540	Bicycle Shops,Bicycle Repair

Name	Address	City	State Zip	City2	Phone	Type
Penn Cycle	710 W Lake St	Minneapolis	MN 55408	Minneapolis	(612) 822-2228	Bicycle Shops,Bicycle Repair
Penn Cycle	10750 Cedar Bnd	Hopkins	MN 55305	Hopkins	(952) 593-5030	Bicycle Shops,Bicycle Repair
Penn Cycle	6415 Lake Road Ter	Saint Paul	MN 55125	Saint Paul	(877) 435-1019	Bicycle Shops,Bicycle Repair
Penn Cycle	6415 Lake Road Ter	Saint Paul	MN 55125	Saint Paul	(877) 435-1019	Bicycle Shops,Bicycle Repair
Penn Cycle & Fitness	2290 Cliff Rd	Saint Paul	MN 55122	Saint Paul	(877) 456-3208	Bicycle Shops,Bicycle Repair
Penn Cycle & Fitness	3916 W Old Shakopee Rd	Minneapolis	MN 55437	Minneapolis	(952) 314-8505	Bicycle Shops,Bicycle Repair
Penn Cycle & Fitness	2290 Cliff Rd	Saint Paul	MN 55122	Saint Paul	(877) 456-3208	Bicycle Shops,Bicycle Repair
Penn Cycle & Fitness	3916 W Old Shakopee Rd	Minneapolis	MN 55437	Minneapolis	(952) 314-8505	Bicycle Shops,Bicycle Repair
Pine Patch	34283 County Road 3	Crosslake	MN 56442	Crosslake	(218) 692-1180	Bicycle Shops,Sporting Goods
Pioneer Cycle	12741 Central Ave NE	Minneapolis	MN 55434	Minneapolis	(763) 755-8871	Bicycle Shops,Bicycle Repair
Piragis Northwoods Co	105 N Central Ave	Ely	MN 55731	Ely	(218) 365-6745	Bicycle Shops,Sporting Goods
Podium Wear	626 W Armstrong Ave	Saint Paul	MN 55102	Saint Paul	(651) 208-9391	Apparel Manufacturing
Poole's Bike Shop	402 Main Ct	Albert Lea	MN 56007	Albert Lea	(507) 373-8595	Bicycle Repair,Sporting Goods
PRF Bicycles	32349 230th St	Henderson	MN 56044	Henderson	(507) 248-3639	Bicycle Shops,Sporting Goods
Quality Bicycle Products	6400 W 105th St	Minneapolis	MN 55438	Minneapolis	(952) 829-7290	Bicycles-Wholesale & Manufacturers
Rackattack	4170 Excelsior Blvd	Minneapolis	MN 55416	Minneapolis	(952) 926-7225	Bicycle Equipment Manufacturer
Rain Shield Inc	5110 Cedar Lake Rd	Minneapolis	MN 55416	Minneapolis	(952) 543-1894	Apparel Manufacturing
Ramsey Bicycle	6825 Highway 10 NW	Anoka	MN 55303	Anoka	(763) 323-6666	Bicycle Shops
Recovery Bike Shop	2555 Central Ave NE	Minneapolis	MN 55418	Minneapolis	(612) 876-5356	Bicycle Shops,Sporting Goods
Red Wing Canoe & Bike Rental	1616 Old West Main St	Red Wing	MN 55066	Red Wing	(651) 327-2026	Bicycle Rental
Rei	1955 County Road I W B2	Saint Paul	MN 55126	Saint Paul	(651) 635-0211	Bicycle Shops,Sporting Goods
Rei	11581 Fountains Dr	Maple Grove	MN 55369	Maple Grove	(763) 493-7861	Bicycle Shops,Sporting Goods
Rei	750 American Blvd W	Minneapolis	MN 55420	Minneapolis	(952) 884-4315	Bicycle Shops,Sporting Goods
Revolution Cycle & Ski	160 29th Ave S	Saint Cloud	MN 56301	Saint Cloud	(320) 251-2453	Bicycle Shops,Bicycle Rental
Rice Street Bikes	2950 Rice St	Little Canada	MN 55113	Little Canada	(651) 766-5700	Bicycle Shops
Rick's Cycling & Sports Center	320 3rd St SW	Willmar	MN 56201	Willmar	(320) 235-0202	Bicycle Shops,Bicycle Repair
Rive Rider Cyle and Specialty	102 2 st East	Wabasha	MN 55981	Wabasha	(507) 396-3420	Bicycle Shop
Rochester Cycling	1211 7th St NW	Rochester	MN 55901	Rochester	(507) 289-7410	Bicycle Shops,Sporting Goods
Rod's Bike Shop	28 Lincoln Ave SE	Saint Cloud	MN 56304	Saint Cloud	(320) 259-1964	Bicycle Shops
Rydjor Bike Shop	219 N Main St	Austin	MN 55912	Austin	(507) 433-7571	Bicycle Shops
Sawtooth Outfitters	7213 W Highway 61	Tofte	MN 55615	Tofte	(218) 663-7643	Bicycle Shops,Sporting Goods
Schultzies Bike & Ski	618 5th St E	Northfield	MN 55057	Northfield	(507) 645-6842	Bicycle Shops,Sporting Goods
Shaw & Shaw	25350 Smiley Rd	Nisswa	MN 56468	Nisswa	(218) 963-0699	Bicycle Shops,Bicycle Rental
Shockspital	111 E 37th St	Minneapolis	MN 55409	Minneapolis	(612) 886-3834	Bicycle Shops
Short Stop Sports	220 Central St W	Bagley	MN 56621	Bagley	(218) 694-5095	Bicycle Rental,Sporting Goods
Sibley Bike Depot	712 University Ave W	Saint Paul	MN 55104	Saint Paul	(651) 222-2080	Bicycle Shops
Ski Hut	1032 E 4th St	Duluth	MN 55805	Duluth	(218) 724-8525	Bicycle Shops,Sporting Goods
Ski Hut	5607 Grand Ave	Duluth	MN 55807	Duluth	(218) 624-5889	Bicycle Shops,Sporting Goods
Skip's Brit Bikes Plus	27198 Verdin St NW	Isanti	MN 55040	Isanti	(763) 444-4823	Bicycle Shops
Speed Hound	4313 E 54th St	Minneapolis	MN 55417	Minneapolis	(612) 727-2565	Bicycle Component Manufacturing
Spokes Bike and Ice Cream Shop	8850 Glacier Rd	Saint Bonifacius	MN 55375	Saint bonifacius	(952) 446-1666	Bicycle Shops,Bicycle Repair
Sports Authority	8323 3rd St N	Saint Paul	MN 55128	Saint Paul	(651) 264-9522	Sporting Goods Store, Bicycle Shops
Sports Authority	1150 W 78th St Shops At Lyndale	Minneapolis	MN 55423	Minneapolis	(612) 861-1200	Sporting Goods Store, Bicycle Shops
Sports Authority	12530 Elm Creek Blvd N	Maple Grove	MN 55369	Maple Grove	(763) 420-2857	Sporting Goods Store, Bicycle Shops
Sports Authority	12595 Castlemoor Dr	Eden Prairie	MN 55344	Eden Prairie	(952) 941-8171	Sporting Goods Store, Bicycle Shops
Sports Authority	1750 Highway 36 W	Saint Paul	MN 55113	Saint Paul	(651) 638-3000	Sporting Goods Store, Bicycle Shops

Name	Address	City	State Zip	City2	Phone	Type
Sports Authority	12380 Wayzata Blvd	Hopkins	MN 55305	Hopkins	(952) 544-1700	Sporting Goods Store, Bicycle Shops
Sports Authority	10 Coon Rapids Blvd NW	Minneapolis	MN 55448	Minneapolis	(763) 786-2200	Sporting Goods Store, Bicycle Shops
Sports Authority	80 25th St SE	Rochester	MN 55904	Rochester	(507) 282-9400	Sporting Goods Store, Bicycle Shops
Sports Authority	3420 124th Ave NW	Minneapolis	MN 55433	Minneapolis	(763) 427-2669	Sporting Goods Store, Bicycle Shops
Sports Authority	60 E Broadway	Minneapolis	MN 55425	Minneapolis	(952) 854-9444	Sporting Goods Store, Bicycle Shops
Sports Authority	1300 County Road 42 W	Burnsville	MN 55337	Burnsville	(952) 435-3500	Sporting Goods Store, Bicycle Shops
Sports Authority	2028 Paul Bunyan Dr NW	Bemidji	MN 56601	Bemidji	(218) 751-2154	Sporting Goods Store, Bicycle Shops
Sports Hut	1175 Wayzata Blvd E	Wayzata	MN 55391	Wayzata	(952) 473-8843	Bicycle Shops,Sporting Goods
Sports Hut/The Hut	3355 Plymouth Blvd	Minneapolis	MN 55447	Minneapolis	(763) 354-7799	Bicycle Shops,Sporting Goods
Sports Shop	345 3rd St	International Falls	MN 56649	International Falls	(218) 283-6121	Bicycle Shops,Sporting Goods
Sportsmen Specialities Inc	1030 McKinley St	Anoka	MN 55303	Anoka	(763) 421-0368	Bicycle Rental,Sporting Goods
Stewart's Bikes & Sports	102 S 29th Ave W	Duluth	MN 55806	Duluth	(218) 625-5501	Bicycle Shops,Bicycle Repair
Stewart's Bikes & Sports	1502 E Superior St	Duluth	MN 55812	Duluth	(218) 724-5101	Bicycle Shops,Bicycle Repair
Straight River Sports Fitness	222 W Bridge St	Owatonna	MN 55060	Owatanna	(507) 451-1666	Bicycle Shops,Sporting Goods
Strauss Skates & Bicycles	1751 Cope Ave E	Saint Paul	MN 55109	Saint Paul	(651) 770-1344	Bicycle Shops,Bicycle Repair
Street Is Neat Custom Bike	200 Main StOslo	MN 56744		Olso	(218) 695-2082	Bicycle Shops
Sunrise Cyclery	3021 2nd Ave S	Minneapolis	MN 55408	Minneapolis	(612) 824-6144	Bicycle Shops,Sporting Goods
Sunset Cycle	10136 Sunset Ave	Circle Pines	MN 55014	Circle Pines	(763) 786-3205	Bicycle Shops
Superior North Outdoor Ctr	13 S Broadway Ave	Grand Marais	MN 55604	Grand Marais	(218) 387-2186	Bicycle Shops,Sporting Goods
Synergy Sports Store	113 Main St S	Cambridge	MN 55008	Cambridge	(763) 552-9521	Bicycle Rental
Tales & Trails Sports Shop	25355 Highway 169	Zimmerman	MN 55398	Zimmerman	(763) 856-3985	Bicycle Rental,Sporting Goods
Tangletown Bike Shop	322 W 48th St	Minneapolis	MN 55419	Minneapolis	(612) 259-8180	Bicycle Shops,Sporting Goods
The Bike Guy	19970 Lake Julia Dr NW	Bemidji	MN 56601	Bemidji	(218) 766-6310	Bicycle Shops
The Bike Shop	255 West Camp Street	Ely	MN 55731	Ely	(218) 365-2453	Bicycle Shops,Bicycle Rental
The Duluth Experience, LLC	132 W. 12th Street	Duluth	MN 55806	Duluth	(218) 464-6337	Bicycle Rental,Canoes & Kayaks
The Hub	3020 Minnehaha Ave	Minneapolis	MN 55406	Minneapolis	(612) 729-0437	Bicylce Shops
Tiger City Sports	101 S Broadway Ave	Albert Lea	MN 56007	Albert Lea	(507) 373-4366	Bicycle Rental,Sporting Goods
Toad Lake Store	17259 County Highway 39	Frazee	MN 56544	Frazee	(218) 334-8202	Bicycle Rental,Bars,Liquor Stores,Pizza
Tommy T Cyclery	3308 W 44th St	Minneapolis	MN 55410	Minneapolis	(612) 929-9202	Bicycle Shops
Tom's Bicycle Repair	2545 Stark Rd	Harris	MN 55032	Harris	(763) 300-1646	Bicycle Shops,Bicycle Repair
Tonka Cycle & Ski	16 Shady Oak Rd S	Hopkins	MN 55343	Hopkins	(952) 938-8336	Bicycle Shops,Bicycle Repair
TooleDesign	212 Third Avenue North Suite 405	Minneapolis	MN 55401	Minneapolis	(612) 584-4094	Architecture
Trail Cycle	92 Lake St S	Forest Lake	MN 55025	Forest Lake	(651) 464-5664	Bicycle Shops
Trailblazer Bikes	25336 Smiley Rd	Nisswa	MN 56468	Nisswa	(218) 963-0699	Bicycle Shops
Trailblazer Bikes	14843 Edgewood Dr	Baxter	MN 56425	Baxter	(218) 829-8542	Bicycle Shops,Bicycle Rental
Trailhead Cycling & Fitness	11350 Aquila Dr N # 505	Champlin	MN 55316	Champlin	(763) 712-0312	Bicycle Repair
Trike's Bike's & Auto's	2250 Highway 60 W	Faribault	MN 55021	Faribault	(507) 332-0970	Bicycle Shops
True Value Hardware & Paint	2250 Commerce Blvd	Mound	MN 55364	Mound	(952) 472-1819	Bicycle Repair,Garden Centers,Paint
Twin Ports Cyclery	2914 W 3rd St	Duluth	MN 55806	Duluth	(218) 624-4008	Bicycle Shops,Sporting Goods
Twin Six Cycling Apparel	5711 West 36th Street	Saint Louis Park	MN 55416	Saint Louis Park	612.208.1787	Apparel Manufacturing
Twin Town Pedicabs	917 5th Ave S	Minneapolis	MN 55404	Minneapolis	(612) 338-1128	Bicycle Rental
Two Wheels Bike Shop	1014 W 27th St	Minneapolis	MN 55408	Minneapolis	(612) 345-7389	Bicycle Shops,Sporting Goods
Ultimate Segway	2227 3rd St SW	Rochester	MN 55902	Rochester	(507) 206-0988	Bicycle Rental,Party Supply Renta
Universal Cycles	10740 Lyndale Ave S	Minneapolis	MN 55420	Minneapolis	(952) 888-1175	Bicycle Shops,Sporting Goods
Valley Bike & Ski Shops	7707 149th St W Ste 2	Apple Valley	MN 55124	Apple Valley	(952) 432-1666	Bicycle Shops
Valvoline Express CareServices	1112 Jackson Ave	Detroit Lakes	MN 56501	Detroit Lakes	(218) 844-2100	Bicycle Shops,Auto Repair & Service
Varsity Bike Shop	1316 4th St SE	Minneapolis	MN 55414	Minneapolis	(612) 623-0990	Bicycle Shops,Sporting Goods
Vigil Co Limited	550 Lake Dr	Chanhassen	MN 55317	Chanhassen	(952) 934-0111	Bicycle Shops,Sporting Goods
Vikeland Sales Inc	1172 Silverwood Bay	Saint Paul	MN 55125	Saint Paul	(651) 645-4647	Bicycle Shops,Sporting Goods
Vincent Dominguez Cycles	2718 East 27th Street	Minneapolis	MN 55414	Minneapolis	651.214.9903	Custom Bicycle Manufacturer
Wheel Fun Rentals	3000 Calhoun Parkway East	Minneapolis	MN 55408	Minneapolis	(612) 823-5765	Bicycle Rental,Canoes & Kayaks
Wheel Fun Rentals	5022 W Nokomis Pkwy	Minneapolis	MN 55417	Minneapolis	(612) 729-1127	Bicycle Rental,Canoes & Kayaks
Wheel Fun Rentals	1615 Phalen Drive	St. Paul	MN 55106	Saint Paul	(651) 776-0005	Bicycle Rental,Canoes & Kayaks
Wheelhouse Cycles	1932 Old West Main St	Red Wing	MN 55066	Red Wing	(651) 388-1082	Bicycle Shops
Whitewater Bike & Sport	237 W 6th St	Saint Charles	MN 55972	Saint Charles	(507) 932-8885	Bicycle Shops,Bicycle Rental
Willard Munger Inn	7408 Grand Ave	Duluth	MN 55807	Duluth	(218) 624-4814	Bicycle Rental,Sporting Goods
Wolf Tooth Components				Minneapolis		Component Manufacturing
Wyganowski Frames	30127 105TH ST	Princeton	MN 55371	Princeton	(763) 389-7811	Custom Bicycle Manufacturer

SURVEY PROMOTION EMAIL AND MAILING TEXT

LETTER TO BUSINESS OWNERS – ON UMN LETTERHEAD

ADDRESS BLOCK

Dear [INSERT OWNER NAME, IF AVAILABLE]

You can help us understand the economic contribution of the bicycle industry in Minnesota!

About the project

The Minnesota Department of Transportation (MnDOT) has contracted with the University of Minnesota to conduct a study on the Economic Impact of Bicycling in Minnesota. The purpose of this study is to inform MnDOT leaders, state and local decision makers, and other interested stakeholders on the economic contribution that bicycling makes to the state economy.

The results of this study will be used by MnDOT and other state decision makers to determine the appropriate levels of support to provide bicycling activities, so it's critical that you participate and provide the most accurate information possible.

Your assistance is critical to our understanding of the bicycling industry. You can help by taking our short survey about the ways your firm participates in the bicycling industry.

You can help by:

1.) Take the survey. As soon as possible. Even partially completed surveys are valuable, so don't hesitate to answer as much as possible. Without your information the scale and importance of the industry in Minnesota might be underrepresented.

Survey Link: http://z.umn.edu/BikeSurvey

2.) Share the survey link and a note on the importance of bicycling in Minnesota, with your business networks (suppliers, customers, and employee's). This will help us capture information about those small and little known businesses.

It's Confidential.

The information you provide on this survey will be kept confidential. Your individual responses will not be shared beyond the project team. The results of the survey will be reported in aggregate and included in an economic impact model. This means that it will not be possible to determine the individual responses from the summary report.

Please don't hesitate to go to the survey link (http://z.umn.edu/BikeSurvey) as soon possible.

Questions and Comments

You can contact me with any questions, comments, project inquires. I'm the leader of the bicycle industry analysis project at the University of Minnesota. I'm here to make providing this information to us as easy as possible. I'm also glad to share information about the project with you. So, please don't hesitate to contact me should you want to.

Thanks for your help in ensuring that we have the most accurate data about the bicycle industry in Minnesota.

Neil Linscheid – University of Minnesota

Lins0041@umn.edu, 507-337-2814

EMAIL LETTER TO PEOPLE HELPING SPREAD THE WORD – UMN EMAIL LETTERHEAD

Subject: You can help support biking in Minnesota – UMN Economic Impact of Bicycling Study

Attachment: Project Introduction Letter

Bicycling is important to the Minnesota economy. Help us provide the State of Minnesota with the best information possible to describe that contribution by taking this survey about your company: http://z.umn.edu/BikeSurvey

This survey is being conducted by researchers at the University of Minnesota, as part of an effort by MnDOT, to understand the economic impact of bicycling in the state. The researchers need your help because your part of the bicycling industry and can provide critical information.

You can help by:

1.) Take the survey. As soon as possible. Even partially completed surveys are valuable, so don't hesitate to answer as much as possible. Without your information the scale and importance of the industry in Minnesota might be underrepresented.

Survey Link: http://z.umn.edu/BikeSurvey

2.) Share the survey link and a note on the importance of bicycling in Minnesota, with your business networks (suppliers, customers, and employee's). Share it via email, facebook, twitter, or whatever you use. This will help us capture information about those small and little known businesses.

Attached is the letter the project leader provided to me about the project. This is an important thing for all of involved in supporting biking in Minnesota to complete, so please don't ignore this request.

Thanks for your Help!

SURVEY SCHEDULE

This document contains a sampling plan that will be used to gather information about the bicycling industry from bicycling industry related firms. An online questionnaire has been developed and is available for review. The questionnaire is hosted using the Qualtrics survey system and notifications will be sent via mail, email, and relevant social networks. The distribution would start upon final task approval, if possible.

The questionnaire is available at this website: http://z.umn.edu/BikeSurvey . It is also attached to this document, but please note that the printed version is more difficult to review.

Tentative Timeline

Upon final task approval	Survey distributed via mail and email
1 week from start	Reminder Postcard #1 sent + email reminder sent
2 weeks from start	Reminder Postcard #2 sent + email reminder sent
3 weeks from start	Final Reminder post card sent + email reminder sent
4 weeks from start	Survey closes
After 4th week from start	Analysis of results begins

Respondents & Goal

This survey will gather information from the firms listed in the Task 1 Deliverable. The goal of this sampling plan is to achieve a 70% response rate or better.

Components

1. Questionnaire
   (1) The draft questionnaire is available at this website: http://z.umn.edu/BikeSurvey . It is also attached to this document, but please note that the printed version is more difficult to review. This is intended to be an online survey and the looks best when viewed through a web browser.
   (2) The survey uses branching to allow the same survey link to be used for all involved in the industry. Respondents will be routed to either the Manufacturing/Wholesale, Retail, or Non-profit advocacy questionnaires based on their initial responses.
   (3) The survey is based on the Arizona Department of Transportation Bike Industry Survey, as well as past economic impact surveys conducted by the University of Minnesota team.
2. Mailed Materials
   (1) Introduction Letter
   (2) Follow-up reminder post cards

3. Emailed Materials
   (1) Email introduction letter when active email addresses are available

(2) Email to with instructions to those willing to help spread the word about the survey

Strategy

1. Utilize the Dillman Tailored Design survey method by:
   (1) Sending introduction letters with the survey link (increasing convenience)
   (2) Providing incentives in the form by tapping into desire to assist the biking industry (based on the insights gained from the expert interviews)
   (3) Sending three follow-up reminder postcards
   (4) Following best practices designing questionnaires, introduction letters, and reminders.
   (5) Appeal to group values such as supporting biking in Minnesota
2. Tap existing social networks and advocacy networks to raise awareness of the project and help distribute the link.
3. Utilize online survey tools to minimize the overall survey cost and make the survey easy to complete.

A COPY OF THE QUALITRICS ONLINE SURVEY

Economic Impact of Bicycling in Minnesota

INTRODUCTION
Thank you for your willingness to participate in this confidential survey. You are being asked to complete this survey as a part of a Minnesota Department of Transportation (MnDOT) study, being conducted by the University of Minnesota, to determine the economic impact of bicycling in Minnesota. The results of this study will inform MnDOT leaders, state and local decision makers, and other interested parties about the economic contribution that bicycling makes to the state economy.

Your participation is critical. Economic impact studies rely on credible information from people within an industry. Accurate estimates from you will result in a more accurate study.

GOALS
The goals of this survey are to: 1.) Quantify total expenditures for labor, operations, and capital investments by bicycle related firms and organizations in Minnesota; 2.) Determine which percentage of these expenditures are made in Minnesota.

ESTIMATED TIME TO COMPLETE
This survey should take no longer than 10 minutes to complete.

CONFIDENTIALITY AND REPORTING OF RESULTS
Here are a few things that are important to know before you get started.1.) Your information will be kept confidential. Individual responses and results will only be accessible to the primary researchers. In short, only 3 people will know who said what.2.) Survey results will be reported in aggregate. Your responses will be aggregated with similar businesses in the following three categories: manufacturers, retailers/dealers, and non-profit bicycle-related organizations.

QUESTIONS AND COMMENTS
If you have any questions or need additional information, please contact Neil Linscheid, University of Minnesota, via email at lins0041@umn.edu or by phone 507-337-2814.

YOUR ORGANIZATION TYPE

Please indicate the category which best describes your business type in relation to the bicycling industry.

- ❍ Retailer (1)
- ❍ Bicycle Manufacturer/ Wholesaler (2)
- ❍ Bicycling Related Non-Profit or Advocacy Group (3)

What NAICS code or codes match your business? NAICS stands for North American Industrial Classification System. If you do not know your NAICS code, you can find it here: http://www.naics.com/search/.

Are you reporting data for a:

- ❍ Single establishment (1)
- ❍ Multiple establishments (2)

Please tell us where your stores are located (if you have more than 10 locations please consider submitting a list as an attachment at the end of this survey).

	City	Number of Stores (2)
Location 1 (1)		
Location 2 (2)		
Location 3 (3)		
Location 4 (4)		
Location 5 (5)		
Location 6 (6)		
Location 7 (7)		
Location 8 (8)		
Location 9 (9)		
Location 10 (10)		

EMPLOYMENT

The following questions request information related your employment. Please provide your best estimates related to bicycle related employment.

How many employees did you have today? (This includes owners and family members)

	Number of Employees (1)	Average Hours per week (2)	Number of weeks employed (for seasonal/ temporary employees) (3)
Full Time Workers			
Part-time (2)			
Seasonal / Temporary (3)			

What is your total gross payroll (including benefits)?

If there are any comments you would like to make regarding the previous questions related to employment, please do so here.

REVENUE

The following questions request information related to your revenue in the most recently completed fiscal year. Please provide your best estimated related to bicycle related revenues.

Please estimate the percent of annual revenues that apply to each of the following product categories?

	New road bike sales (1)	New mountain bike sales (2)	New youth bike sales (3)	New Winter Bike Sales (Fat Tire Bikes) (4)	New comfort/ lifestyle/ hybrid bike sales (5)	New recumbent bike sales (6)	Used bicycles (all types) (7)	Bicycle servicing (8)	Bicycle Rental (9)	Bicycle Parts & Accessories (10)
Average % of annual revenues										

Please estimate the total percent of bicycle related revenue for each customer category:

	% of Bicycle Related Revenue (1)
Women (1) Men (2) Youth (3)	

Approximately, how many square feet in your establishment are dedicated to the following?

	New Bicycles (1)	Used Bicycles (2)	Bicycle Accessories (3)	Bicycle Service (4)	Non-bicycle products (5)
Approximate Square Feet (1)					

If there are any comments you would like to make regarding the previous questions related to revenue, please do so here.

OPERATIONS

The following questions request information about your operations. Please provide your best estimates related to bicycle related operations. Operations here are defined as expenditures for the day-to-day purchases of goods and services to run your business. This would include for example: rent, electricity, advertising, wholesale goods (bicycles), and accounting services. Do NOT include one-time purchases such as a new building.

What is your annual non-labor operating expense (in dollars)? Not including labor costs or capital investment expenditures.

Please name any businesses or industries in Minnesota from which you make major purchases:

Business/ Industry #1 (1)
Business / Industry #2 (2)
Business / Industry #3 (3)
Business / Industry #4 (4)
Any other businesses or industries: (5)

If there are any comments you would like to make regarding the previous questions related to operations, please do so here.

Establishment Type:

- ❍ Manufacturer (1)
- ❍ Wholesaler (2)

Which of the following best describes your Minnesota location?

- ❍ Sole location or headquarters (1)
- ❍ Branch operation of a parent company located IN Minnesota (2)
- ❍ Branch operation of a parent company located OUTSIDE of Minnesota (3)

IF your location is a branch operation, please provide the name and contact information of the parent company:

What year did you firm begin operating in Minnesota?

What percent of your total business at this establishment involves bicycle-related products?

EMPLOYMENT

The following questions request information related your employment. Please provide your best estimates related to bicycle related employment.

How many employees did you have & on average how many hours per week did they work? (This includes owners and family members)

	Number of Employees (1)	Average Hours per week (2)	Number of weeks employed (for seasonal and temporary) (3)
Full Time Workers			
Part-time (2)			
Seasonal / Temporary (3)			

What is your total gross payroll (including benefits)?

According to your best guess, what percent of your employees live in Minnesota?

If you need would like to share any additional comments related to the previous employment related questions, please do so here

OPERATIONS

The following questions request information about your operations. Please provide your best estimates related to bicycle related operations.

What is your annual non-labor operating expense (in dollars)? Not including labor costs or capital investment expenditures.

Please name any businesses or industries in Minnesota from which you make major purchases:

Business/ Industry #1 (1)
Business / Industry #2 (2)
Business / Industry #3 (3)
Business / Industry #4 (4)
Any other businesses or industries: (5)

If there are any comments you would like to make regarding the previous questions related to operations, please do so here.

CAPITAL EXPENDITURES

The following questions request information about capital expenditures in your most recently completed fiscal year. Please provide your best estimates related to bicycle related capital expenditures.

What were your capital expenditure outlays for each of the following over the last year? (in $'s)

Land (1)
Building/ Remodeling / Fixtures (2)
Machinery/ Vehicles / Equipment (3)

Thinking of your average expenditures on capital expenditures in the last five years, is this year's total expenditure: greater than, less than, or about the same as the five year average?

- ❍ greater than (1)
- ❍ about the same (2)
- ❍ less than (3)

OUTPUT

The following questions request information about revenues and output in your most recently completed fiscal year. Please provide your best estimates.

Please estimate the percent of your annual revenues, on average, that apply to each of the following product categories?

	Road bikes (1)	Mountain bikes (2)	Youth bikes (3)	Winter bikes (Fat Tire Bikes) (4)	Comfort/ lifestyle/ hybrid bikes (5)	Recumbent bikes (6)	Bicycle Components (7)	Bicycle Accessories (8)	Bicycle Apparel (9)
Estimated percent of total output (based on $) in all bicycle-related products									

Organization Type

- ❍ Bicycle Advocacy Group (1)
- ❍ Bicycle-related Nonprofit (2)

EMPLOYMENT

The following questions request information related your employment. Please provide your best estimates related to bicycle related employment.

How many employees did you have & on average how many hours per week did they work? (This includes owners and family members)

	Number of Employees (1)	Average Hours per week (2)	Number of weeks employed (For seasonal and temporary) (3)
Full Time Workers (1) Part-time (2) Seasonal / Temporary (3)			

What is your total gross payroll (including benefits)?

According to your best guess, what percent of your employees live in Minnesota?

If you need would like to share any additional comments related to the previous employment related questions, please do so here:

OPERATIONS

The following questions request information about your operations. Please provide your best estimates related to bicycle related operations. Operations here are defined as expenditures for the day-to-day purchases of goods and services to run your business. This would include for example: rent, electricity, advertising, wholesale goods (bicycles), and accounting services. Do NOT include one-time purchases such as a new building.

What is your annual non-labor operating expense (in dollars)? Not including labor costs or capital investment expenditures.

Please name any businesses or industries in Minnesota from which you make major purchases:

Business/ Industry #1 (1)
Business / Industry #2 (2)
Business / Industry #3 (3)
Business / Industry #4 (4)
Any other businesses or industries: (5)

If there are any comments you would like to make regarding the previous questions related to operations, please do so here.

VOLUNTEERS

The following questions request information about the volunteer contributions to your organization.

How many volunteers contributed to your organization in the most recent fiscal year?
On average, how many hours does your typical volunteer contribute to your organization?

If there are any comments you would like to make regarding the previous questions related to operations, please do so here.

MISCELLANEOUS COMMENTS

Occasionally, survey respondents would like to share additional information that is not contained in a survey. If you would like to share additional information or upload files that you think might aid this project, please do so in the space provide below.

Please share any additional comments about the spending, expenses, or other relevant information not requested previously:

File Upload: If you have a file you think might be helpful, in our effort to quantify the economic activity in the biking industry, that you would like to share, please do so using the button below. (This might be a financial statement, annual report, website, etc.)

File Upload #2: If you have a file you think might be helpful, in our effort to quantify the economic activity in the biking industry, that you would like to share, please do so using the button below. (This might be a financial statement, annual report, website, etc.)

File Upload #3: If you have a file you think might be helpful, in our effort to quantify the economic activity in the biking industry, that you would like to share, please do so using the button below. (This might be a financial statement, annual report, website, etc.)

Please tell us who filled out this survey. We are only requesting this information, so we don't continue to pester you to complete the survey. If you provide us with this information, we will remove your name from our reminder mailing list. We will not use this information to connect your name to survey responses.

Business

Business Name
Street Address
City
Zip
Phone #
Email
Website

Your Name and Title Name

Title
Email
Phone #

LIST OF BICYCLE-RELATED NON-PROFITS AND ADVOCACY GROUPS IN MINNESOTA

Using the GuideStar database and the keywords “bicycle” and “bicycling” the following non-profits and advocacy groups were identified in Minnesota.

Bicycle Alliance of Minnesota
Cuyuna Lakes Trail Association
Cycle Health
Cycles for Change
Midtown Greenway Coalition
Minneapolis Bicycle Coalition
Minnesota Bicycle Festivals Inc
Minnesota Fighting Aids on Bikes
Minnesota Off Road Cyclists
Mountain Bike Minnesota
Nice Ride MN
St Cloud Pineview Park BMX
St Paul Transportation Management Organization
Twin Cities Bicycling Club
ULLR Ski Bike Social Club

List Generated from GuideStar

APPENDIX C

ESTIMATES OF BICYCLE TRIPS AND MILES TRAVELED BY JURISDICTION

Table C-1. Estimates of bicycle trips and BMT in Minneapolis and St. Paul					
Core Cities	**Population 5+**	**Trips - Low Estimate**	**Trips - High Estimate**	**Miles - Low Estimate**	**Miles - High Estimate**
City of Minneapolis	361,874	25,120,781	29,389,925	50,105,346	63,105,824
City of St. Paul	265,987	6,447,674	7,328,020	14,224,973	18,676,521
Total	**627,861**	**31,568,455**	**36,717,945**	**64,330,319**	**81,782,345**

Table C-2. Estimates of bicycle trips and BMT in seven suburban counties.					
Suburban Metro	**Population**	**Trips - Low Estimate**	**Trips - High Estimate**	**Miles - Low Estimate**	**Miles - High Estimate**
Anoka	311,981	3,303,916	3,388,075	4,004,239	5,145,339
Carver	86,276	912,415	934,850	1,090,281	1,394,469
Dakota	374,949	3,973,355	4,076,234	4,847,694	6,242,617
Hennepin minus Minneapolis	731,488	9,767,335	11,312,405	21,973,659	30,818,831
Ramsey minus St. Paul	213,644	6,842,766	7,580,781	11,634,160	13,473,946
Scott	122,285	1,295,396	1,328,641	1,574,744	2,025,501
Washington	226,112	2,392,377	2,451,922	2,872,621	3,679,980
Total	**2,066,735**	**28,487,560**	**31,072,908**	**47,997,399**	**62,780,683**

Table C-3. Estimates of bicycle trips and BMT in nine ring counties.					
Ring County Metro	**Population**	**Trips - Low Estimate**	**Trips - High Estimate**	**Miles - Low Estimate**	**Miles - High Estimate**
Chisago	50,631	593,619	619,276	1,160,200	1,170,299
Goodhue	43,391	510,355	533,421	994,940	1,004,019
Isanti	35,451	415,749	433,785	812,393	819,493
Le Sueur	25,954	305,949	320,203	595,381	600,992
McLeod	34,033	400,905	419,409	780,604	787,887
Rice	60,645	709,548	739,286	1,389,101	1,400,807
Sherburne	82,614	972,585	1,017,098	1,894,669	1,912,190
Sibley	14,162	166,231	173,536	324,587	327,463
Wright	115,798	1,364,923	1,428,431	2,656,370	2,681,368
Total	**462,678**	**5,439,864**	**5,684,446**	**10,608,246**	**10,704,518**

Table C-4. Estimates of bicycle trips and BMT in Greater MN Counties					
Greater MN	**Population**	**Trips - Low Estimate**	**Trips - High Estimate**	**Miles - Low Estimate**	**Miles - High Estimate**
Aitkin	15,311	177,301	183,588	349,973	352,447
Becker	30,635	358,398	373,399	701,697	707,601
Beltrami	41,644	486,367	506,208	953,537	961,346
Benton	35,966	423,418	442,802	824,835	832,465
Big Stone	4,923	57,276	59,479	112,627	113,494
Blue Earth	60,763	719,578	755,145	1,395,199	1,409,198
Brown	24,104	283,594	296,463	552,739	557,804
Carlton	33,274	388,912	404,965	762,000	768,319
Cass	26,804	311,175	322,696	613,005	617,540
Chippewa	11,499	135,136	141,174	263,621	265,998
Clay	55,642	656,905	688,118	1,276,824	1,289,110
Clearwater	8,132	94,300	97,727	185,928	187,277
Cook	4,972	58,424	61,034	113,978	115,005
Cottonwood	10,970	128,296	133,639	251,254	253,357
Crow Wing	58,789	685,628	712,987	1,345,720	1,356,489
Dodge	18,728	220,756	231,034	429,611	433,657
Douglas	34,197	401,696	419,527	783,920	790,938
Faribault	13,636	159,645	166,398	312,385	315,043
Fillmore	19,493	228,515	238,376	446,662	450,544
Freeborn	29,261	343,402	358,449	670,651	676,573
Grant	5,625	65,982	68,856	128,902	130,033
Houston	17,894	210,605	220,212	410,351	414,133
Hubbard	19,193	223,296	231,865	439,128	442,502
Itasca	42,777	497,626	516,692	978,698	986,202
Jackson	9,657	113,434	118,464	221,382	223,362
Kanabec	15,263	177,863	184,875	349,318	352,078
Kandiyohi	39,391	463,935	485,292	903,469	911,875
Kittson	4,283	49,997	52,018	98,068	98,863
Koochiching	12,588	146,534	152,206	288,047	290,280
Lac qui Parle	6,796	79,380	82,623	155,613	156,890
Lake	10,230	119,685	124,701	234,313	236,287
Lake of the Woods	3,790	44,472	46,416	86,864	87,629
Lincoln	5,503	64,509	67,291	126,092	127,188
Lyon	23,878	282,031	295,512	547,982	553,288
Mahnomen	4,938	57,398	59,565	112,967	113,820
Marshall	8,915	104,511	109,020	204,284	206,059

Table C-4. Estimates of bicycle trips and BMT in Greater MN Counties					
Greater MN	**Population**	**Trips - Low Estimate**	**Trips - High Estimate**	**Miles - Low Estimate**	**Miles - High Estimate**
Martin	19,540	229,236	239,228	447,821	451,754
Meeker	21,643	253,619	264,499	495,893	500,175
Mille Lacs	24,164	282,316	293,898	553,326	557,885
Morrison	30,932	362,484	378,038	708,740	714,863
Mower	36,387	426,774	445,318	833,862	841,161
Murray	8,147	95,403	99,457	186,635	188,231
Nicollet	30,812	363,886	381,251	707,099	713,934
Nobles	19,771	232,391	242,801	453,279	457,377
Norman	6,368	74,277	77,247	145,773	146,942
Olmsted	135,400	1,599,475	1,676,068	3,107,412	3,137,560
Otter Tail	54,099	632,824	659,264	1,239,103	1,249,510
Pennington	13,111	154,705	162,003	300,835	303,708
Pine	27,800	323,526	336,004	636,083	640,995
Pipestone	8,864	103,914	108,398	203,112	204,877
Polk	29,473	346,163	361,501	675,614	681,651
Pope	10,332	121,060	126,241	236,736	238,775
Red Lake	3,821	44,946	46,977	87,622	88,422
Redwood	14,922	174,423	181,632	341,723	344,561
Renville	14,569	170,696	178,000	333,803	336,678
Rock	8,987	105,508	110,159	205,984	207,814
Roseau	14,605	172,452	180,663	335,152	338,384
St. Louis	189,710	2,218,569	2,310,913	4,344,959	4,381,307
Stearns	141,386	1,665,024	1,741,568	3,242,743	3,272,872
Steele	33,920	399,686	418,205	778,054	785,343
Stevens	9,149	107,273	111,910	209,658	211,483
Swift	9,126	107,015	111,647	209,135	210,959
Todd	23,042	269,031	279,955	527,570	531,870
Traverse	3,339	39,034	40,653	76,462	77,099
Wabasha	20,321	239,038	249,860	465,959	470,219
Wadena	12,863	149,256	154,736	294,144	296,301
Waseca	17,903	210,274	219,591	410,397	414,064
Watonwan	10,413	122,511	128,068	238,785	240,972
Wilkin	6,201	72,751	75,923	142,118	143,366
Winona	48,864	576,515	603,680	1,121,143	1,131,836
Yellow Medicine	9,676	113,485	118,411	221,747	223,686
Total	**1,839,126**	**21,579,517**	**22,522,578**	**42,150,122**	**42,521,326**

APPENDIX D

BICYCLING EVENT SURVEY QUESTIONNAIRE TEMPLATE

University of Minnesota Tourism Center
[bike event name] Questionnaire

Screening questions:

I. Are you 18 years old or older? ❑ Yes (Continue to question II) ❑ No (survey ends)

II. Do you live 50 miles or more to the [area name]? ❑ Yes (continue directly to Q1) ❑ No (continue to question III)

III. Did you spend at least one night in the [area name]? ❑ Yes (continue to Q1) ❑ No (survey ends)

---

1. Was [area name] your primary destination for this trip? ☐ Yes
☐ No, primary destination is _____

2. What was the **primary** reason that you made the trip to [area name]? (**Check only 1**)

☐ Attend [bike event name] ☐ Entertainment ☐ Convention/conference
☐ Outdoor recreation ☐ Casino gaming ☐ Business/work
☐ Visit family/friends ☐ Sporting events ☐ Passing through
☐ Attractions/family fun ☐ Museums/historic sites
☐ Other (Explain: _____) ☐ Event other than [bike event name] (which one: _____)

3. Have you attended [bike event name] before? (**Check only 1**) ___Yes ___No
If yes, how many years have you attended [bike event name]? ___ # of years
What was the last year you attended [bike event name]? _____

4. What did you enjoy the most about [bike event name]? (**Check no more than THREE**)

___ The ride ___ Competition ___The scenic route ___Social interaction ___Food & beverages
___ The challenge ___ Physical activity ___ Other (Explain: _____)

5. Please choose your main reason for attending [**bike event name**] (**Check no more than THREE**):

___ To ride my bike ___ Recommended by Family/Friend ___ Social interaction ___ The route ___ Physical activity
___ Challenge myself ___ Prestige of event ___ Location ___ Type of event
___ Awards ___ Prizes/Give-aways ___ Charity ___ Other (specify):_____

6. How many people (including you) were in your travel party on this trip? _____

7. How many people (including you) in your travel party participated in [bike event name]? _____

8. How many total nights did you spend away from home on this trip? ____ nights

9. How many of these nights were in [area name]? _____ nights (if 0, go to question 11)

10. If you stayed in [area name], how many nights did you stay in each of the following types of accommodations?

____ Hotel/motel ____ Resort/commercial cabin ____ Vacation rental by owner ____ Your own vacation home

____ RV ____ Vacation home of friend/relative ____ Bed & Breakfast ____ Home of friend/relative ____ Tent

11. Please estimate your travel group's spending in [area name] for your entire stay:

Biking equipment $ _____ Biking-event related expense $ _____ Other biking-related expense $ _____

Event registration $ _____ Lodging $ _____ Transportation (includes gas) $_____

Groceries $_____ Restaurants/Bars $ _____ Recreation/attractions (non-biking) $ _____

Shopping $ _____ Misc. $ _____

12. How many people are included in your spending estimate? _____

13. Overall, how satisfied are you with the [bike event name]? (**Check only 1**)

____Very Satisfied ____Satisfied ____Unsure ____Dissatisfied ____Very dissatisfied

14. How many of your travel party are:

____ Under 18 years old _____ 18 – 25 years old _____ 26 – 35 years old
____ 36 – 50 years old _____ 51 - 69 years old _____ 70 or older

15. What was the primary mode of transportation you used to get to [area name]? (**Check only 1**)

☐ Car/van/truck ☐ RV/Camper ☐ Motorcycle ☐ Bus
☐ Train (North Star or Amtrak) ☐ Plane ☐ Bike ☐ Other

16. While on this trip, which of the following activities did members of your travel party participate in? (**Check all that apply**)

General:	*Attending*:	*Visiting*:	*Participating in*:
☐ Dining out	☐ [bike event name]	☐ Friends/relatives	☐ Fishing
☐ Driving on designated byways	☐ Sporting events	☐ Historic sites	☐ Hiking
☐ Guided tour	☐ Shows/music concerts	☐ Museums	☐ Camping
☐ Sightseeing	☐ Wedding/family reunion	☐ State parks	☐ Biking (other than [bike event])
☐ Nightlife/evening entertainment		☐ Other attractions	
☐ Shopping			

17. Which one of the following best categorizes your travel party? (**Check only 1**)

☐ Alone ☐ Couple/partner ☐ Family ☐ Friends ☐ Family & friends ☐ Other (Explain: _____)

18. What information sources did you use to **plan** this trip? (**Check all that apply**)

☐ [bike event name] website
☐ Word of mouth
☐ Social media
Which ones?
☐ Facebook
☐ Twitter
☐ Google+

☐ Area/destination visitor guide
☐ Magazine ad
☐ Website
Which ones?
☐ www.PedalMN.com
☐ www.exploreminnesota.com
☐ Travelocity
☐ Expedia
☐ Trip Advisor
☐ Other _____

☐ Area/destination e-newsletter
☐ Newspaper
☐ Radio
☐ Other (Explain: _____)

19. How far in advance did you plan this trip? (**Check only 1**)

☐ Less than 2 weeks ☐ 2 to 4 weeks (1 month) ☐ 5 to 8 weeks (1 to 2 months)
☐ 9 to 13 weeks (2 to 3 months) ☐ 13+ weeks

Finally, a few questions about you.

22. In what year were you born? 19_____

23. What is the highest grade or year of school that you have completed?

☐ Less than High School ☐ Some college ☐ BA or BS degree
☐ High school graduate (or GED) ☐ Associate college degree ☐ Post graduate or professional school

24. You are: ☐ Male ☐ Female ☐ Prefer not to answer

25. What is the ZIPCODE of your primary residence? _____

26. Please give us an estimate of your annual household income (before taxes):
___Less than $25,000 ___$25,000-49,999 ___$50,000-99,999 ___$100,000-149,999 ___$150,000 or more

27. What is your ethnic origin? **(Check only 1)** ___Hispanic/Latino ___Non-Hispanic/Non-Latino

28. What is your race? **(Check all that apply)**
___American Indian or Alaska Native ___Asian ___Black or African-American ___White
___Native Hawaiian or Other Pacific Islander ___Other (specify: _____)

APPENDIX E

TWIN CITIES CYCLIST SURVEY

Q1.1 **RESEARCH STUDY:**

Assessing the Economic Impact and Health Benefits of Bicycling in Minnesota

You are invited to be in a research study of the health benefits of bicycling in Minnesota. You were selected as a possible participant because you are a member of a cycling organization. By providing information to the best of your ability you will help us understand the ways that cycling impacts the health of the population. We ask that you read this form, and ask any questions you may have, before agreeing to be in the study.

Procedures:

If you agree to be in this study, simply proceed with the following online questionnaire of cycling, health and demographics. If you wish to enter a drawing for one of three $100 Visa Gift Cards you may do so by entering a valid e-mail address upon completion of the survey.

Confidentiality:

The records of this study will be kept private. In our published reports, we will not include any information that will make it possible to identify you. Research records will be stored securely and only researchers will have access to the records.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota . If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

Contacts and Questions:

The researcher(s) conducting this study is (are): Mark Pereira, Ph.D., Xinyi (Lisa) Qian, Ph.D. and Aaron Berger. This study is sponsored by the Minnesota Department of Transportation. If you have questions later, you are encouraged to contact them at 1300 South 2nd Street, Minneapolis, MN 55455, 612-624-4173, or by e-mail at map@umn.edu. If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), you are encouraged to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.

You may print this information to keep for your records. Thank you for your time and interest!

The online questionnaire includes 29 questions and should take about 10 minutes of your time.

TO **BEGIN** THIS SURVEY: CLICK ON THE YELLOW ARROW ON THE LOWER RIGHT CORNER OF THIS PAGE.

Q2.1 These questions are about bicycling TO WORK at different times of year.

Q2.2 During the WARM WEATHER MONTHS, from April to September, how many days each week do you bicycle TO WORK?

- ❍ 0 days
- ❍ Less than one day per week
- ❍ 1 day
- ❍ 2 days
- ❍ 3 days
- ❍ 4 days
- ❍ 5 days
- ❍ 6 days
- ❍ 7 days
- ❍ Never ride a bike/don't know how to ride a bike
- ❍ I don't know

Q2.3 During the COLD WEATHER MONTHS, from October to March, how many days each week do you bicycle TO WORK?

- ❍ 0 days
- ❍ Less than one day per week
- ❍ 1 day
- ❍ 2 days
- ❍ 3 days
- ❍ 4 days
- ❍ 5 days
- ❍ 6 days
- ❍ 7 days
- ❍ Never ride a bike/don't know how to ride a bike
- ❍ I don't know

Q2.4 How far do you typically ride a bike ONE-WAY to your work?

- ❍ 0 to 0.9 miles
- ❍ 1 to 1.9 miles
- ❍ 2 to 2.9 miles
- ❍ 3 to 3.9 miles
- ❍ 4 to 4.9 miles
- ❍ 5 to 5.9 miles
- ❍ 6 to 6.9 miles
- ❍ 7 to 7.9 miles
- ❍ 8 to 8.9 miles
- ❍ 9 to 9.9 miles

- ❍ 10 or more miles
- ❍ I do not bike to work
- ❍ I don't know

Q3.1 These questions are about bicycling to DESTINATIONS OTHER THAN WORK at different times of year.

Q3.2 During the WARM WEATHER MONTHS, from April to September, how many days each week do you bicycle to a specific destination OTHER THAN WORK (e.g. grocery store, library, or restaurant) INSTEAD of driving to that destination?

- ❍ 0 days
- ❍ Less than one day per week
- ❍ 1 day
- ❍ 2 days
- ❍ 3 days
- ❍ 4 days
- ❍ 5 days
- ❍ 6 days
- ❍ 7 days
- ❍ Never ride a bike/don't know how to ride a bike
- ❍ I don't know

Q3.3 During the COLD WEATHER MONTHS, from October to March, how many days each week do you bicycle to a specific destination OTHER THAN WORK (e.g. grocery store, library, or restaurant) INSTEAD of driving to that destination?

- ❍ 0 days
- ❍ Less than one day per week
- ❍ 1 day
- ❍ 2 days
- ❍ 3 days
- ❍ 4 days
- ❍ 5 days
- ❍ 6 days
- ❍ 7 days
- ❍ Never ride a bike/don't know how to ride a bike
- ❍ I don't know

Q3.4 On a typical bike ride to a destination other than work, how far do you ride a bike ONE-WAY to your destination?

- ❍ 0 to 0.9 miles
- ❍ 1 to 1.9 miles
- ❍ 2 to 2.9 miles
- ❍ 3 to 3.9 miles
- ❍ 4 to 4.9 miles
- ❍ 5 to 5.9 miles
- ❍ 6 to 6.9 miles
- ❍ 7 to 7.9 miles
- ❍ 8 to 8.9 miles
- ❍ 9 to 9.9 miles
- ❍ 10 or more miles
- ❍ I do not ride to non-work destinations
- ❍ I don't know

Q4.1 These questions are about bicycling for LEISURE AND EXERCISE other than transportation or commuting.

Q4.2 Considering a 7-Day period (a week), how many times on average do you do the following kinds of exercise for more than 15 minutes during your free time?

	0	1	2	3	4	5	6	7	8+	I don't know
Strenuous exercise (heart beats rapidly) from vigorous long-distance bicycling?	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Strenuous exercise <u>other than bicycling</u> (e.g. running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming)?	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Moderate exercise (not exhausting) from easy bicycling?	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Moderate exercise <u>other than bicycling</u> (e.g. fast walking, baseball, tennis, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)?	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Mild exercise (minimal effort) (e.g. yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking)?	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q4.3 Considering a 7-Day period (a week), during your leisure time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?

- ❍ Often
- ❍ Sometimes
- ❍ Never/Rarely
- ❍ I don't know

Q5.1 These questions are about your current health and health history.

Q5.2 These two questions are about your height in feet and inches without shoes. Select the number of feet in your height (e.g. if your height is 5'8", select 5').

- ❍ 3'
- ❍ 4'
- ❍ 5'
- ❍ 6'
- ❍ 7'
- ❍ 8'
- ❍ Other
- ❍ I don't know

Q5.3 These two questions are about your height in feet and inches without shoes. Select the number of inches in your height (e.g. if your height is 5'8", select 8").

- ❍ 0"
- ❍ 1"
- ❍ 2"
- ❍ 3"
- ❍ 4"
- ❍ 5"
- ❍ 6"
- ❍ 7"
- ❍ 8"
- ❍ 9"
- ❍ 10"
- ❍ 11"
- ❍ I don't know

Q5.4 What is your weight in pounds?

- ❍ 75 or fewer
- ❍ 76
- ❍ 77
- ❍ 78…
- ❍ …399
- ❍ 400 or more
- ❍ I don't know

Q5.5 Do you NOW smoke cigarettes every day, some days or not at all?

- ❍ Every day
- ❍ Some days
- ❍ Not at all
- ❍ I don't know

Q5.6 In a TYPICAL WEEK, how many alcoholic beverages do you drink? An alcoholic beverage is 12 ounces of beer, 5 ounces of wine, or 1.5 ounces of liquor.

- ❍ 0
- ❍ 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5…
- ❍ …98
- ❍ 99 or more
- ❍ I don't know

Q6.1 Please answer the following questions regarding conditions and medications.

Q6.2 Have you ever been told by a doctor that you have high cholesterol (or are you taking medications to treat high cholesterol)?

- ❍ Yes
- ❍ No
- ❍ I don't know

Q6.3 Have you ever been told by a doctor that you have high blood pressure/hypertension (or are you taking medications to treat high blood pressure/hypertension)?

- ❍ Yes
- ❍ No
- ❍ I don't know

Q6.4 Have you ever been told by a doctor that you have high triglycerides in the blood (or are you taking medications to treat high triglycerides)?

- ❍ Yes
- ❍ No
- ❍ I don't know

Q6.5 Have you ever been told by a doctor that you have low HDL cholesterol (or are you taking medications to treat low HDL cholesterol)?

- ❍ Yes
- ❍ No
- ❍ I don't know

Q6.6 Other than during pregnancy, have you EVER been told by a doctor or other health professional that you have diabetes or sugar diabetes?

- ❍ Yes
- ❍ No
- ❍ I don't know

Q7.1 Before ending this survey we have a few remaining demographic questions.

Q7.2 In what year were you born?

- ❍ 1915 or earlier
- ❍ 1916
- ❍ 1917…
- ❍ …1998
- ❍ 1999
- ❍ 2000 or later
- ❍ I don't know

Q7.3 What is your gender?

- ❍ Female
- ❍ Male
- ❍ Other identification

Q7.4 What is your 5-digit zip code?

- ❍ Zip code _____
- ❍ I don't know

Q7.5 Please re-enter your 5-digit zip code for data validation.

- ❍ Zip code _____
- ❍ I don't know

Q7.6 In which county is your primary residence?

- ❍ Anoka
- ❍ Carver
- ❍ Dakota
- ❍ Hennepin
- ❍ Ramsey
- ❍ Scott
- ❍ Washington
- ❍ Other _____
- ❍ I don't know

Q7.7 What is your ethnicity? (Select one.)

- ❍ Hispanic or Latino
- ❍ Not Hispanic or Latino
- ❍ I don't know

Q7.8 What is your race? (Select all that apply.)

- ❑ White
- ❑ Black or African American
- ❑ American Indian/Alaska Native
- ❑ Asian
- ❑ Native Hawaiian or Other Pacific Islander
- ❑ Other; please specify: _____
- ❑ I don't know

Q8.1 Participants are eligible to participate in an optional drawing for a $100 Visa gift card. If you would like to be entered in the drawing, enter a valid e-mail address below. E-mail addresses will be removed from survey responses prior to analysis.

- ❍ Yes, I want to be entered in the drawing (Enter valid e-mail here): _____
- ❍ I do not wish to be entered in the drawing.

Q8.2 If you wish to participate please re-type your e-mail address for validation.

- ❍ Re-type e-mail address: _____
- ❍ I do not wish to be entered in the drawing.

APPENDIX F

GLOSSARY FOR CHAPTER 7

active transportation: bicycling or walking for transportation. TCCS respondents were asked how many days per week they bicycled to work and how many days per week they bicycled to a non-work destination instead of driving.

American Community Survey (ACS): an ongoing statistical survey by the U.S. census bureau that has replaced many functions of the decennial census.

body mass index (BMI): a measure of weight-for-height defined as kg/m^2.

chronic disease: ongoing illness or condition, often requiring medical treatment and/or medication.

coronary heart disease (CHD): disease characterized by blockage of arteries supplying blood to the heart muscle.

discount rate: the rate at which future payoffs are discounted compared to immediate payoffs. MnDOT discount rate is 1.7 percent per year.

Framingham Risk Score (FRS): a gender-specific prediction of 10-year coronary heart disease risk based on age, smoking status, systolic blood pressure, total cholesterol and HDL cholesterol.

Health Economic Assessment Tool (HEAT): a product of the World Health Organization allowing practical economic assessment of the reduced mortality attributable to bicycling and/or walking.

high-density lipoprotein (HDL) cholesterol: an essential fat that transports harmful low-density lipoprotein (LDL) cholesterol from the blood stream to the liver for processing.

metabolic syndrome: a group of risk factors that raises risk of heart disease, diabetes and stroke, and frequently referred to as "prediabetes."

Minnesota State Survey (MSS): an annual omnibus survey of Minnesota adults conducted via random digit dialing.

obesity: body mass index of at least 30 kg/m^2.

Twin Cities Cyclist Survey (TCCS): an online survey of a convenience sample of identified likely bicycle commuters.

Twin Cities metropolitan area: defined in this report as the seven-county metropolitan area, consisting of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott and Washington counties.

value of a statistical life (VSL): the marginal value of preventing a death, derived from hazard pay for high-risk occupations. MnDOT VSL is $9,400,000.