Improving Bikeability & the Perception of Safety

An Evaluation of the Nonmotorized Transportation Pilot Program

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Dedicated to my grandparents and the
Washington University Environmental Studies Program.
Thank you for indulging me.

The bicycle is the most civilized conveyance known to man. Other forms of transport grow daily more nightmarish. Only the bicycle remains pure in heart.

~Iris Murdoch, *The Red and the Green*

Abstract

In the United States, the bicycle has rarely been regarded as a legitimate form of transportation. As gas prices rise, and concerns about climate change and congestion become more severe, however, many American cities are looking to the bike as part of the solution to transportation issues. In 2005, The Nonmotorized Transportation Pilot Program (NMTPP), as part of the Safe, Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), awarded $25 million dollars each to four communities for the purpose of improving their nonmotorized transit networks. These four communities: Columbia, MO; Sheboygan County, WI; Minneapolis, MN; and Marin County, CA, aim to use this funding to develop their bike and pedestrian infrastructures in an effort to demonstrate the extent to which bicycling and walking can carry a significant portion of the transportation load. If proven successful, the NMTPP will provide an example to other cities on how to expand their own nonmotorized transit systems and funding will be awarded to an additional ten communities.

The greatest challenge facing the four pilot communities is the perception that cycling is unsafe. In the United States, risk averse riders have not been historically drawn to biking as a form of transportation because the existing cycling infrastructure is considered too dangerous and fragmented. The question this thesis intends to answer is this: how should a community develop its bicycling infrastructure to achieve the best perception of safety thus encouraging more people to bike? In order to address this issue, all four pilot communities have developed infrastructure projects and educational programs designed to improve safety and connectivity, as well as to create more confident cyclists. The efficacy of these initiatives are measured by ridership counts, surveys, shifts in the demographics of cyclists using bike facilities, as well as changes in the number of bike-related accidents experienced.

Though the NMTPP originally planned to have the majority of its programs and projects finished by the end of 2009, delays caused by the Federal approval process for allocating funding has hindered the progress of many of the infrastructure projects. This means that much of the available data is inconclusive regarding the pilot programs' ability to improve safety and the perception of safety. Initial figures may indicate that progress has been made, and this thesis evaluates and forecasts the success of the four pilot programs based on available results, proposed plans, and precedents set by other communities.

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Chapter 1: Introduction

The Nonmotorized Transportation Pilot Program, part of the 2005 Transportation Bill (SAFETEA-LU) allotted $25 million dollars to four pilot communities for the purpose of improving their nonmotorized transit system. Nonmotorized transportation focuses on providing facilities that encourage pedestrian and bike use. The NMTPP provides an unprecedented chance to learn more about bike use from a quantitative point of view, rather than subjective and anecdotal information, upon which the modern bike movement has historically been based. In this thesis, I will discuss what makes the perception of nonmotorized transit safer than the present model and evaluate the success of what the four pilot communities have accomplished with the goal of safety in mind. I will specifically focus on increased safety for cyclists and "bikeability," a term which encompasses the extent to which a community is safely and easily navigated by bike. I will also look at a number of initiatives targeted toward increasing the mode share of pedestrians when they are combined with initiatives targeted toward increasing bike use. Furthermore, while I will examine data on accidents and fatalities experienced in each community, as well as individual survey results, I will largely base my evaluation on each program's success at increasing the mode share of cyclists, as an increase or decrease will be an indication of how safe the system is perceived to be. The NMTPP is an ongoing project and is scheduled to be completed September of 2010, at which point the program will submit its final report to Congress. This thesis will take into account data and reports released prior to March of 2010.

1:1 A Brief History of American Bike Use

When seeking the answers to problems associated with congestion, pollution, gas prices, and Global Climate Change, it is hard to find a solution more elegant in its simplicity than the bicycle. Bicycles are an efficient and inexpensive mode of transportation which, with increased use, could reduce dependency on foreign oil supplies, improve air quality, reduce roadway congestion, and improve the health and livability of a community. In the United States, however, the bicycle has traditionally been marginalized as a form of transportation as cities develop and sprawl outward. As a result, most American cities are decidedly unfriendly to bike use.

There is poetic irony to this because bicycles themselves are responsible for literally paving the way to their own near extinction as a viable mode of transportation in the United States. In the 1880s, Albert Pope, the first American manufacturer of bicycles, formed the League of American Wheelmen, an organization which fought efforts to ban the bicycle from the roads. The League, in conjunction with the Good Roads Movement—another organization led by Pope—lobbied to have roads paved in an attempt to make cycling safer and more comfortable. Pope's efforts eventually financed the first ever modern asphalt road in Boston, Massachusetts. At the turn of the century, these roads made long distance "touring" possible for the Automobile, and America's love affair with the car was cemented, so to speak.

The bicycle persisted in the United States and around the world as an affordable way to get around, but it wasn't until the 1970's that cyclists began to fight to regain a larger share of the American transportation network. In his book, *Pedaling Revolution*, Jeff Mapes discusses the rise of the modern Bike Movement.

> [In the 1970s] Bicycle advocacy groups formed in several cities and government agencies turned their attention to such issues as bike safety and the construction of bike paths. 'We were all dreamers,' recalled Dan Burden, one of the early bike advocates. 'We assumed that some time maybe 10 percent of all Americans would ride their bikes to work, to shop, to school, you know, things like that'(Mapes 2009: 28).

In reality, bike use has rarely climbed above 5 percent in any American city, though there are a few exceptions. Davis, California, boasted 22 percent per capita bike use according to the 1990 Census. That number has since dropped to around 14 percent in 2000 due to increases in population and number of residents who commute to work in Sacramento 40 minutes away. According to Mapes, the bike movement in the 1970s was a born out of a response to "…the kind of sprawling, auto-oriented development that was remaking America," as well as spikes in the price of foreign oil and the nascent environmental movement (p.29).

Nearly forty years later, the same problems endure on top of the previously unforeseen threat of global climate change. Unfortunately, the progress of the bicycle movement slowed through the 80s and early 90s when oil prices dropped and families moved farther away from city centers (p.30). At times, the fight has been like trying to bike uphill in San Francisco as cars become more numerous and cycling becomes less safe. As a result, American cyclists have developed into a cycling subculture largely made up of risk-taking, white, middle-class males, who thrive on the danger of dodging in and out of traffic on feather-light road bikes, and along intermittent bike lanes (p.33). In the mainstream, the bicycle has all but vanished as a method of transport, and instead serves as an instrument for exercise in the U.S. This decline in widespread bike use has led to decline in motorist's ability to safely share the road with cyclists, as well as the cyclist's knowledge of proper bike etiquette and safety.

But what if anyone could get around safely on a bike? What has to change in the United States for the bicycle to be regarded as a legitimate form of transportation?

If a lesson is to be learned from Amsterdam and Copenhagen, the undisputed bike capitals of the world, it is that the bicycle can easily be used as an integral part of a city's transportation network without drastically changing our standard of living. In Amsterdam, a city of approximately 1.36 million people, between 40 and 50 percent of the population commutes to work via bike. This is due in large part to an intricate bike infrastructure that so heavily favors bike use that it is considered the preferred method of transport over any other method. Additionally, the government and a number of private organizations have designed programs to educate truck drivers on how to watch out for cyclists when making turns across bike lanes or cycletracks—bike lanes which are physically separated from automobile traffic by a concrete barrier—as well as programs to help teach immigrants how ride bikes and about proper bike etiquette. Copenhagen, which also has an extensive network of bike lanes and cycletracks, has placed a 180% import tax on all foreign autos (Keates 2007). This market incentive has made car use incredibly unattractive and funded one of the best public transportation systems in the world as well as moved people to bike whenever possible.

American city planners have looked closely at Amsterdam and Copenhagen for cues on how to improve their cycling infrastructures, and while many lessons have been learned, American cities face a number of challenges to which these European cities are not subject. Automobile use is so pervasive and the typical commute for an American worker can exceed 30 minutes per day (U.S. Census 2005), making it easy to doubt the bicycle's ability to carry a significant portion of the transportation mode share. It is, perhaps, unreasonable to expect similar

results to those experienced by Amsterdam and Copenhagen, but many city and local governments have optimistically begun developing comprehensive bike plans in an effort to encourage higher bike usage.

If any of these programs are to be successful, they must address concerns regarding the safety of cycling, which is cited as one of the most common factors impeding potential cyclists (FHWA 1995: 13). Currently, bike infrastructure in American cities consists of intermittent on-street bike lanes, which are favored by male cyclists. Men tend to be less risk averse than women, so an indication of a safe bike network is an increase in female cyclists. Women tend to favor off-road bikeways which can lower the risk of bikes colliding with automobiles (Baker 2009).

Success is also contingent on where these bikeways lead. Since women are predominately responsible for childcare, bikeways must connect with residential areas, schools, and shopping districts. In an October 2009 article published in *Scientific American*, John Pucher, a professor of urban planning at Rutgers University and longtime bike scholar asserted that off-street bikeways are almost always built along rivers and parks rather than along routes leading "to the supermarket, the school [or] the daycare center" which, while appealing to recreational riders, is not likely to entice more women to ride for utilitarian purposes (Baker 2009).

In the past decade, the cycling movement has gained ground as well as allies in local and national government. Many cities are working to improve their cycling infrastructure by increasing miles of bikeways and other actions aimed at increasing bicycle use. These programs have been moderately to extremely successful, but are cities truly moving toward improving bikeability, or are they simply catering to the same cycling subculture that has stubbornly persisted since the 1970s? Will these programs increase ridership for both women and children, the true indicators of a city's bikeability?

In the 2005 federal transportation bill (SAFETEA-LU) Congress funded the Nonmotorized Transportation Pilot Program, a demonstration effort to promote active transportation for urban mobility. The basic premise of the pilot program is that focused community investments in active transportation infrastructure — such as rail-trails, bikeways, and other multiuse paths— with supporting educational programs will increase the share of trips taken by biking or walking. Interconnected active transportation systems will decrease congestion and improve the health and environment of communities by providing new choices to people for everyday travel decisions.

Four pilot communities (Marin County, California, Minneapolis, Minnesota, Sheboygan County, Wisconsin, and Columbia, Missouri) were awarded $25 million each through this Pilot Program. These communities are currently engaged in planning infrastructure and programmatic efforts to shift short trips to bicycling and walking. In this thesis, I will explore these four case studies and their success in improving bikeability in their respective communities. In order to evaluate them, I will look at improvements made to their cycling infrastructures, programs targeted toward educating the public about bicycle safety and etiquette, and finally, whether these steps have actually increased ridership. In doing so, I will be able to identify which programs should be used as models for other cities that endeavor to improve their own cycling infrastructures.

Chapter 2: Background

2:1 The Nonmotorized Transportation Pilot Program (NMTPP)

The Nonmotorized Transportation Pilot Program is part of the 2005 Safe, Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). Overseen by the Federal Highway Administration (FHWA), the NMTPP has provided $25 million to four pilot programs over the span of four years to construct a network of Nonmotorized transportation infrastructure facilities, including sidewalks, bicycle lanes, and multiuse paths that "connect directly with transit stations, schools, residences, businesses, recreation areas, and other community activity centers." The purpose of the NMTPP is to "demonstrate the extent to which bicycling and walking can carry a significant part of the transportation load, and represent a major portion of the transportation solution, within selected communities" (NMTPP Interim Report to Congress 2007: 1). The four pilot communities are:

- Columbia, Missouri- Administered under the name, GetAbout Columbia, by PedNet (Non-profit)
- Sheboygan County, Wisconsin- Administered by Sheboygan County Joint Resources and Transportation Committee (Government)
- Minneapolis, Minnesota- Administered under the name, Bike Walk Twin Cities, by Transit for Livable Communities (Non-profit)
- Marin County, California- Administered under the name Walk Bike Marin, by Marin County Department of Public Works (Government)

These four pilot communities were selected for their variety of size, population, climate, and, perhaps most importantly, their varying degrees of existing nonmotorized transit. A fifth community, Spokane, Washington, was selected to serve as a control community by which the four pilot communities will be measured. This serves to identify external factors that may affect nonmotorized transit use, like gas prices. Theoretically, by September of 2010, enough data will have been collected by these four communities to provide sufficient evidence and recommendations for other communities who wish to successfully expand their nonmotorized mode share. If the Nonmotorized Transportation Pilot Program proves to be a success at that time, then it will be expanded to cover 10 different communities around the country and each will be allocated 50 million dollars.

There are four phases to this project.

- The first phase—conducted by the University of Minnesota research team—was to collect baseline data for each community as well as the control community, Spokane, Washington.
- The second phase was to collect before-and-after data for at least five specific projects in each community. This was done in an effort to gather information on the infrastructure projects and educational programs the four communities have undertaken and to conduct a detailed analysis of a limited number of significant and innovative projects to identify increases in bicycling and walking, along with related safety, environmental, and health benefits.

- The third phase—to be conducted by the University of Minnesota research team—is to apply the same survey given in the first phase to collect data on travel changes after the projects were implemented.
- The fourth phase will be to synthesize and analyze the data collected and develop results to be provided in a final report to Congress in 2010.

The Program is currently between the second and third phase.

2:2 Significance of the NMTPP

Traditionally, Americans do not view nonmotorized transit as a legitimate form of transportation. Bikes are reserved for recreation, and walking is increasingly perceived to be inconvenient and unsafe. In view of this perception, city planning has largely revolved around accommodating cars, and cities sprawl outward, thus requiring people to drive, adding more traffic, and marginalizing those who might have chosen to walk or bike instead. As a result, local governments have been reluctant to provide accommodations for the marginalized minority at the risk of inconveniencing the motorized majority.

The NMTPP "offers the opportunity to learn more about the extent to which a suite of coordinated, integrated infrastructure projects and educational promotional programs can yield shifts in travel behaviors and use of different modes of transportation" (NMTPP Interim Report to congress 2007: 3). Most importantly, knowledge about successful projects and programs, as well as information on those that are not as successful, will be invaluable to other communities implementing programs designed to increase bicycling and walking to improve the safety of pedestrians and cyclists.

2:3 Historical Problems with Collecting Data on Bicycle Use

The University of Minnesota research team, which was selected to conduct the community-wide travel behavior surveys for all four pilot communities, issued a report in 2007 which evaluated the existing studies on the economic benefits of bike use. In this report, The University of Minnesota Research team discussed the problems associated with collecting accurate data on bike use. The Nonmotorized Transportation Pilot Program aims to address many of these issues in Phase 2, when it collects before and after data from five different infrastructure projects in each community, but it is important to note the challenges to creating an accurate portrayal of the effects of bike use when we evaluate the success of the program. Also, in this section, I acknowledge the complications of combining bike use and pedestrian travel under the aggregate of "nonmotorized transportation."

2:3:1 Bike Use vs. Nonmotorized Transit Use

Historically, transportation research has lumped bike and pedestrian facilities under the umbrella of nonmotorized transit. The University of Minnesota research team enumerates the differences between bike and pedestrian use:

1. All trips—whether by car, rail transit, or bus—require pedestrian travel because they begin and end with a walking trip.

2. Sidewalks and other pedestrian related amenities are now often required under zoning codes.
3. Pedestrian concerns typically relate to relatively confined travel-sheds or geographic scales (e.g., city blocks). Bicycle travel and facilities, on the other hand, apply to longer corridors, fail to be used as frequently as walking facilities, and are considered more discretionary in nature.
4. Pedestrian planning applies to a clear majority of the population, whereas bicycle planning applies to a considerably smaller market of travelers (Krizek, 2007: 3).

This thesis intends to focus primarily on bike use, and will use bike-specific data where available. However, the NMTPP plans to improve both the bike and pedestrian transportation mode shares, and the before and after data collected in Phase 2 will typically be taken from combined bike/pedestrian facilities. With this in mind, we may expect the influence of new bicycle facilities on bike use to be understated because cyclists may prefer facilities which decrease pedestrian/cyclist interaction.

2:3:2 Inconclusive Data and Disparate Methodologies

The University of Minnesota Report analyzes and discusses more than 25 existing studies on evaluating bike use and describes poor data as being "the black cloud looming over all analysis of nonmotorized transportation." Part of this can be attributed to the variety of sources from which bicycle behavior can be gleaned. These sources include: the census, metropolitan/nationwide travel surveys, facility specific surveys or counts, or national surveys like those administered by the Bureau of Transportation Statistics. The University of Minnesota research team concludes that existing behavioral bicycle data "…lacks both the breadth and quality necessary for reliable analysis" (Krizek 2007: 3). Furthermore, analysis of cycling use has been especially marginalized because of its relatively low levels of use.

According to the NMTPP's Interim Report to Congress, The NMTPP has designed a comprehensive plan to standardize the evaluation and analysis of data across all four pilot programs. This plan will look at the Program's effect on increases in the nonmotorized transportation mode share, improvements to safety, environmental and health benefits, and has been developed by the Federal Highway Administration (p.3). Unfortunately, as of March of 2010, this plan has not been released to the public.

2:3:3 Ridership Counts

The University of Minnesota research team asserts that relying solely on ridership counts as a measure of the effectiveness of a bicycle facility may lead to inaccurate conclusions. It is therefore important to use surveys which evaluate stated preferences to uncover situations that "are qualitatively different from the actual ones seen in practice" (Krizek 2007: 8). For example, a facility may see increased use overall, but ridership counts alone may not accurately reflect whether those riders are new riders who would not have biked without the facility, or whether those riders are riders who would have used another route in the facility's absence.

2:3:4 Challenges to Evaluating and Measuring Safety

The effects that different bike facilities have on bike safety have previously been measured in terms of the number of fatalities or accidents experienced, and the perceived levels of comfort for the cyclist at each facility. The University of Minnesota report explains that the

variables that influence these outcomes are difficult to identify. Regarding accident statistics, the report explains:

> [T]he overwhelming majority of bicycle accidents resulting in fatalities are caused by collisions with motor vehicles. Less severe accidents tend to occur at intersections or at locations where motor vehicles and bicycles come in contact with each other; it is further suggested that accidents are caused by differing expectations between auto drivers and bicyclists. However, there is also evidence to suggest that some bicycle accidents do not involve any other party; this is especially true for children (p,12).

The report suggests that it may be impossible to identify a common factor that can be attributed the cause of bike accidents. This is particularly important to remember when trying to assess what type of bike facility may be the safest. In light of this, city planners have to pay attention to how safe the public perceives a bike facility to be. Risk averse riders will not use a facility that they view to be unsafe, regardless of what studies with collision data may actually reveal. Furthermore, it is widely suspected that many accidents involving bikes go unreported and collision statistics are too low (FHWA 1995: 26, 29).

Chapter 3: What Makes a Community Bike Friendly?

As defined by The League of American Bicyclists, a bike friendly community is a community that provides bike facilities, infrastructure, and education in an effort to promote high levels of bike use. In the following section, we will discuss a few strategies to help make a community bike friendly.

3:1 Infrastructure: Bikeways and Bike Facilities

Bikeways are routes that have been designed to accommodate bicycle use. These accommodations can be as simple as signage asking motorists to "Share the Road," or widened and paved shoulders. Conversely, they can be as intricate as European-style cycletracks which limit automobile access by way of concrete barriers and can be wide enough to allow cyclists to ride two abreast. In this section, I will define different types of bikeways in terms of proximity to motorists, safety, and convenience.

Class I: Bikeways that seek to minimize automobile/cyclist interaction (See Appendix E- Figures E-2 thru E-6).

- Cycletracks- Paved bikeways which limit both pedestrian and automobile interference by way of a physical barrier. Cycletracks are one-way and follow busy arterials allowing for ease of flow and access. These bikeways require a lot of space because they are separate from both motorways and walkways.
- Greenways- Multiuse paths usually through parks or along waterways. Tend to restrict automobile access entirely and are wide enough to ride in two directions or to ride two abreast. Limited access to major roads or residential areas.
- Rail trails- Multiuse trails along former railroad corridors. Share many of the same characteristics as Greenways.
- Overpasses and underpasses- Allow cyclists and pedestrians to cross busy motorways without interrupting the flow of traffic.

Class II: Bikeways that are integrated with motorways and have an increased chance of automobile/cyclist interaction (See Appendix E- Figures E-7 thru E-10).

- Paved Shoulders- Allow cyclists to ride along busier motorways and main arterials. Provide more space for cyclists to ride but are not explicitly for bike use.
- Bike Lanes- One-way marked sections along streets and motorways. Usually positioned between automobile traffic and parked cars. Can be considered dangerous due to the chance of being "doored" (hit by an open door from a parked car) or due to cars drifting into bike lanes when making a right turn.
- Sharrows- Striped sections of streets or motorways where the road narrows and cyclists and motorists must share space. These are common in city centers where cars are parked parallel to the sidewalk and where the possibility of being hit by an opening door is high. Additionally, sharrows are meant to alert drivers to the cyclists that may be sharing their lane.
- Bike Boulevards- Discourage cut-through motor vehicle traffic. They are designed to give priority to cyclists as through-going traffic. Bicycle boulevards use a variety of traffic calming elements to achieve a safe environment. For instance, diverters with

bicycle cut-outs at mid-block allow motorists to enter the block in order to park or otherwise access a property, and allow cyclists to continue to the next block as well, but do not allow motorists to continue.

Additional facilities and infrastructure designed to increase bike use include:

- Parking for bikes.
- Traffic signals for bicycles.
- Showers and changing rooms in office buildings.
- Lower speed limits.
- Closing off certain streets or city centers to automobile access permanently or temporarily.

3:2 The Question of Convenience: Overcoming the Challenge of the "First and Last Mile"

It is not enough to build all of these facilities and hope that people will use them. If we are to shift bike use from mere recreation to a more utilitarian form of transportation, we need to design this new infrastructure to allow cycling to be as convenient as getting around by car. This means we have to construct bikeways that get people to where they need to go. We need to connect residential areas with grocery stores, schools, and business districts. As important as it is to promote recreation and healthy lifestyles, it is necessary to build bikeways that get people to where they need to go if we wish to see an increase in utilitarian cycling.

For longer trips, the bicycle network must be linked to the public transit network. When addressing larger issues associated with congestion, oil prices and carbon emissions, many cities are developing multimodal public transportation systems where commuters utilize a variety of interconnected forms of transport to get where they need to go. But mass transit will not succeed unless we can overcome the challenge of the "first and last mile." Mass transportation does not have the same door-to-door convenience that the car has, so as appealing as it may be to have everyone take the train or the bus to work, many commuters still have to drive to a park-and-ride facility before they can go anywhere. Once in the car, a commuter may be more inclined to drive the entire way. If bikeways were planned to connect residential areas to transportation hubs, then commuters might be enticed to forgo the car completely.

Chapter 4: The Perception of Safety: The Primary Concern

4:1 Overview

One of the biggest hurdles facing the modern bike movement is the perception that riding a bike is unsafe. Comparatively, riding a bike is safer than traveling by car but the opinion that biking is too dangerous persists, and if we wish to see our bicycle infrastructure succeed in encouraging more people to choose alternative forms of transport, then we must address this perception. There are two schools of thought on how to do this:

The first is that there is safety in numbers. This theory, avidly promoted by longtime bike activist and public health consultant, Peter Jacobsen, asserts that the only way to make cycling safer is to put more cyclists on the road. Their increased numbers will make motorists more alert and safer drivers. In his 2003 study on incidences of injury in relation to number of cyclists on the road, Jacobsen concluded that "Policies that increase the numbers of people walking and bicycling appear to be an effective route to improving the safety of people walking and bicycling." He credits the increased visibility of cyclists to making motorists more aware and cautious (Jacobsen 2003: 205). A 2006 study conducted in Portland, Oregon, the American city with the highest rate of bicycle use according to the U.S. Department of Transportation, reported that bike-related accidents are inversely proportional to the number of cyclists on the road. The study went on to conclude that improvements to the bike infrastructure in Portland led to increased bike traffic and decreased the crash rate by 69 percent (see Appendix E; Figure E-1). This theory requires that bike traffic be as integrated with automobile traffic as possible and favors Class II bikeways.

The second school of thought, widely promoted by bicycle advocacy groups, insists that the best way to make cycling safer is to limit interaction with cars as much as possible. Women and children tend to support this approach which favors Class I bikeways. The percentage of cyclists who are women and children is a good indicator of how bike friendly a network is. Specifically, women can show how safe a network is perceived to be, because women have proven to be more risk averse and less likely to use bikeways that are integrated with the street. Our current infrastructure is heavily favored by men, and in the U.S., male riders outnumber female riders 3:1. In The Netherlands, however, women make up 55 percent of all bike commuters (Baker 2009). Since women are more likely to be responsible for childcare and shopping, bikeways and cycletracks must be planned accordingly to connect schools, markets and residential areas and to restrict auto access.

Furthermore, our current system is not suitable for children and requires more paths that limit interaction with cars if we are to expect parents to be comfortable letting their children use them. A healthy bike network would have to have separated bikeways that link residential areas with schools to encourage children to use them, thus allowing children to become accustomed to using bikes as transport at an early age.

There are pros and cons to both theories. Studies have shown that accidents and fatalities do not increase as the number of cyclists on the roads increases (University of New South Wales 2008) which would support the first theory. Overtime, motorists become more aware and safer drivers when there are more bikes around, but how do you entice people to ride on the roads in the meantime? Paradoxically, if we limit interactions between automobiles and cyclists almost entirely, then motorists will never grow accustomed to dealing with cyclists, which may lead to accidents should a cyclist ever find its way onto a motorway. Additionally, Class I bikeways

require more space and money to install and maintain, and our existing greenways and rail trails do not always successfully integrate residential areas with schools and business districts. Moreover, a segregated system amounts to creating a second road system and would require more resources than an integrated system which can require little more than a few lines of reflective paint to install.

A sustainable system needs both types of infrastructure if it is to be successful in accommodating a variety of riders with varying degrees of skill and risk aversion. As we evaluate bike networks, we must bear in mind two goals: safety and convenience. Cycletracks are, perhaps, the middle ground because they physically separate cyclists from motorists without hiding them visually and they do have the capacity to follow busy arterials. They may eventually serve this purpose, but currently cycletracks are rare in the United States, and are not always appropriate due to the space requirements. It is important, therefore, to provide a variety of modes to accommodate a variety of riders.

4:2 Beyond Infrastructure: How Can We Make the System Safe?

Beyond infrastructure, two vital components to promoting the safety and convenience of cycling are educational programs and traffic laws. Educational programming falls into two categories: programs for cyclists and programs for motorists. In Amsterdam, this has manifested in programs that help immigrant women learn how to ride a bike, and classes geared toward teaching truck drivers to watch for cyclists, especially when turning right (Wilson 2009). In the United States, these programs can be designed to make both riders and drivers aware of proper cycling etiquette in an effort to avoid accidents. Traffic laws have the power to improve safety for cyclists and motorists as well. Once everyone is made aware of the laws, then law enforcement is responsible for making sure those rules are followed. Something as simple as observing speed limits and stop signs has the potential to cut down on cycling fatalities significantly.

One specific program that aims to increase safety and awareness for both pedestrians and cyclists is the Safe Routes to Schools Program, which is a federally funded program that assists communities in enabling and encouraging children to safely walk and bike to school. This program was also developed under SAFETEA-LU, and its funding is separate from the NMTPP, but all four of the pilot programs are leveraging SRTS and NMTPP funding to increase the impact of some of their projects. According to a report published by Safe Routes to School in 2009, less than 15 percent of American children walk or bike to school as opposed to nearly 100 percent of children in 1969. Furthermore, as much as 21 percent of morning traffic is generated by parents driving their children to school (SRTS Guide 2006). Programs like these promote and educate the public on the virtues of alternative transportation and coordinate “walking and biking school buses” where groups of parents and children travel to school together in highly visible clusters. Safe Routes to Schools has expanded rapidly in its first three years to include programs in all 50 states, signaling that the public is ready and willing to step outside their cars for short trips.

4:3 Summary

The Nonmotorized Transportation Pilot Program aims to address the issues of safety and convenience in all four of its pilot programs. In the following chapters we will explore how each of these programs intends to solve these problems based on each program's unique requirements. We will measure their success by evaluating ridership counts, surveys, shifts in the demographics of cyclists using bike facilities, as well as changes in the number of bike-related accidents experienced. Following that, we will compare the four communities in terms of common approaches and results. When results and data are unavailable, we will look at proposed programs and evaluate their potential based outcomes reported by comparable projects in other communities. In closing, we will identify projects that should be considered by other communities that are looking to develop their own bicycle network.

Chapter 5: Columbia, Missouri

5:1 Overview of Columbia Prior to the Nonmotorized Transportation Pilot Program

Columbia, Missouri is the smallest of the four pilot communities with fewer than 100,000 residents. The city is home to the University of Missouri-Columbia, and has the youngest median age of all the pilot communities at 27 years old. Prior to the NMTPP, Columbia experienced below average pedestrian use and the mode share made up by mass transit was half of the average among pilots at 2.2 percent.

Table 5-1: Share of Total Person Trips by Mode

Community	Vehicle %	Rideshare %	Walk %	Bicycle %	Transit %
Columbia	86	2.2	8.6	1.5	2.2
Avg. for Pilots	82	2.1	11.2	1.5	4.1
Spokane, WA (Control)	86	2.0	8.5	0.8	4.1

* Nonmotorized Transportation Pilot Program Report to Congress, November 2007, p.2

In spite of being the smallest of the four communities, Columbia has the second highest ratio of bikeways and paths per square mile behind Minneapolis. Columbia had 25 miles of off-road lanes or pathways, as well as 28 miles of marked or striped bike lanes. Furthermore, 61 percent of the roadways in Columbia have sidewalks on at least one side of the street. In spite of having the smallest fleet of buses (24) among the four pilot communities, Columbia experiences 89 percent of trips to and from public transit made by walking or biking which is 13 percent above the average for all four pilot communities (Appendix A; Tables A-1 thru A-3).

5:2 Plan and Identified System Needs

Columbia, Missouri already had a small nonmotorized transportation infrastructure, so its pilot program's aim is less focused on creating an entirely new network but more improving connections between existing bikeways and on getting a larger share of the population to use the system. Projects geared toward improving the existing infrastructure have been paired with educational and promotional programs that look to spark a behavior change amongst individuals to motivate them to move away from automobile use towards walking and bicycling for recreation and eventually towards walking and biking for utilitarian travel. Utilitarian travel includes trips to school, work, and for grocery runs, specifically trips with a destination and not trips done for exercise or recreation. Educational programs have been designed to "enhance skills and competency," and improvements to infrastructure have been designed to provide safe facilities on and off the road (NMTPP Interim Report to Congress 2007: 17).

Columbia named its pilot program GetAbout Columbia which is facilitated by PedNet, an existing bicycling and pedestrian advocacy group. GetAbout Columbia originally evaluated its infrastructure projects and determined three priority levels. Projects listed as Priority 1 have been outlined in Table A-4 in Appendix A. Of the Priority Projects, two are for Class II bikeways and

four are for Class I bikeways and paths. The first projects implemented were the construction of Class II bicycle lanes which began in the summer of 2007. Columbia plans to complete 100 miles of new bikeways and sidewalks in addition to its existing 403 miles of bikeways and sidewalks. These projects include:

- 19 miles of new Class I paths and trails in addition to an existing 25 miles.
- 66 miles of Class II on street bike lanes in addition to an existing 52 miles.
- Several bike boulevard demonstration projects.

Additionally, GetAbout Columbia has divided its programming into three categories: Community, Education, and Training. These programs are described in Table A-5.

5:3 Projects Specifically Targeted Toward Increasing Safety for Cyclists

5:3:1 Infrastructure

Columbia has one of the least developed nonmotorized networks among the pilots, so the city has allocated much of its funding toward expanding its system of bikeways and sidewalks. Columbia has also elected to implement a series of demonstration projects, in addition to the two signature projects, which aim to improve the safety of cyclists in Columbia, Missouri. These demonstration projects include:

Back-In Angle Parking Spaces on Ash Street between Seventh and Ninth Streets- This project is designed to make motorists more aware of cyclists using bike lanes on the street with the aim to increase safety. Similar Back-In parking projects have been implemented in 26 North American cities and Motorists can easily make eye contact with passing bicyclists or other motorists before exiting a parking space (see Figure 5-1).

Figure 5-1: GetAbout Columbia's Back in Angle Parking Plan for Ash Street between 7th and 9th Streets

Green Merge Areas- The city will paint green sharrows to indicate areas where cyclists have to merge with automobile traffic. It is safer for cyclists at intersections to move into the traffic lane to be more visible to motorists. The project will also include signage notifying motorists and cyclists about when it is appropriate to merge (See Figure 2 in the Analysis).

Intersection Improvement projects- The City is installing wedge-shaped islands to help facilitate right turns for both motorists and cyclists. See Appendix A, Figure A-8.

5:3:2 Education

Like the other three pilots, GetAbout Columbia has budgeted for a variety of educational programs, and the City has arguably designed the most comprehensive and diverse curriculum of classes and workshops targeted at every demographic. These programs began in April of 2007 and are scheduled to go on indefinitely. A list of these programs can be found in Table A-3. Of particular note are the seven educational programs which range from classes geared toward children and classes geared toward adults. Each course is taught by an instructor who is certified by the League of American Bicyclists to teach bicycle education and safety. Columbia's educational programs are designed to accommodate a variety of riders with a variety of objectives, but the overarching goal is clear: Get more people to bike safely and frequently.

In order to accomplish this goal, GetAbout Columbia's programs are cumulative, yet individually comprehensive. For younger riders, there is the WalkSafe BikeSafe program, which teaches students K-3rd grade basic bike and walking safety during P.E. class, as well as the Earn-a-Bike program which gives local children the opportunity to earn a bike after they demonstrate their knowledge of the fundamentals of road safety and bike maintenance. For children aged 10-14, GetAbout Columbia developed the Bike Pro course which covers balance and control, scanning and signaling, road positioning and turning, hazard avoidance and emergency stops, with the intention of preparing younger cyclists to be comfortable riding on the street. Four programs are geared toward increasing the rate of adult cyclists, all of which teach basic safety and maintenance, but the Commuting and Bike Buddy Courses instruct cyclists on strategies which make commuting by bike convenient and easy, including tips on selecting a route, riding with cargo, and riding in foul weather. All of these programs build upon each other to make it easier for cyclists to navigate city traffic.

5:4 Progress

As of November of 2009, Columbia has spent only $5.6 million of its allotted $25 million in NMTPP funding. With it, GetAbout Columbia has redesigned three intersections, striped seven miles of bike lanes and painted "sharrows" to mark where cyclists should ride. GetAbout Columbia has outspent the other three pilot communities on promotion and education. To date, Columbia has spent $2.16 million on these programs and the goal of getting people out of their cars has seeped into the public discourse (Berger 2009).

Infrastructure-wise, the city has yet to build any trails or sidewalks. Columbia originally planned to complete 100 miles of new bikeways and sidewalks in addition to 19 miles of new paths and trails that would be added to an existing 25 miles. GetAbout Columbia expected the majority of these projects to have been finished by the end of 2009, but many projects have been delayed and some have been dropped completely.

Ted Curtis, the Director of the GetAbout Columbia Project, attributes the delay to the engineering process and a lengthier-than-anticipated federal approval process (Berger 2009). Marianne Fowler, Senior Vice-president of Federal Relations for the Rails-to-Trails Conservancy, is quoted in an article that ran in *The Columbia Missourian* in November of 2009, as saying that she "thinks the approval process that pilot communities must go through is geared more toward major highway projects than trails and other such infrastructure."

"There's a disconnect between big projects and small-scale projects. The Conservancy lobbied for the four pilot cities to receive the initial funding and will now try to change the process such projects must go through with upcoming legislation," Fowler said (Berger 2009).

According to Ted Curtis, GetAbout Columbia has spent $350,000 designing projects which have subsequently been cut. Although these projects will not be funded by the NMTPP, the plans still exist and may be built in the future should funding become available.

So far, the infrastructure projects that have been completed are three intersection improvements[1] over 7 miles of striped bike lanes, painted sharrows, and the two-block back in angle parking demonstration project (Figures A-9 & A-10).

In spite of the slow start, GetAbout Columbia estimates that the majority of the budgeted projects will be complete by the end of 2010, at which point the final report to Congress is due. The budget for these projects can be found in Table A-6. All of these planned projects must go through several stages of approval from the City Council, including preliminary design and engineering, land acquisition, and, in some instances, project revisions. Federal approval also creates a speed bump for project planning.

5:5 Results

Since Columbia has yet to implement the majority of its infrastructure projects, most of the data available is anecdotal or based on completed surveys. Columbia has released a number of counts done in 2007 before any of the projects were built, so the numbers provided are inconclusive regarding the effects of new infrastructure. These numbers do offer insight into the effects of the educational programs which began in the spring of 2007. In light of this, many of the problems associated with gathering objective data on bike use remain unchanged.

Columbia has noted a positive response to its educational programs an overall increase in bike use and awareness throughout the city. In its 2009 Progress Report, GetAbout Columbia reported that a follow-up survey of the 125 adults taking the 9-hour "Confident City Cycling" course showed 75 percent riding their bikes more and reporting that they have replaced on the average 24 percent of automobile trips with bicycle trips. On the pedestrian side, concentrating on the Walking School Bus program, part of the Safe Routes to Schools program (Table A-4) resulted in increasing daily participation from 60 to 435 children between 2007 and 2008.

Furthermore, GetAbout Columbia reports that while it is still "early in the implementation process, there are solid indicators that Columbia has been able to 'jump start' the mode shift process" (GetAbout Columbia 2008: 1). Transit ridership has tripled, and the number of bikes on buses increased from 4,577 in 2005, to 8,363 in 2008. Other than transit use, counts and surveys both showed a much larger impact on bicycle use than on walking. Columbia's 2007-2008 Attitude and Awareness Surveys of 400 residents showed the percentage of those who bused/walked/biked to work or school nearly doubling, from 11.7 percent in 2007, to 21.2 percent in 2008, with by far the largest change seen in bicycling, reports GetAbout Columbia. The "Snapshot" counts during the same years showed a 71 percent increase in weekday peak hour bicycle use.

[1] Eight intersection improvements were originally planned. Two are in the process of being completed, but three have been scrapped altogether. "We wanted to do a good job on five rather then a mediocre job on eight," Curtis said.

5:5:1 Surveys and Measured Results

Phillips Program Surveys in 2007 and 2008

GetAbout Columbia commissioned Philips and Associates, Inc. of St. Louis, MO to conduct more than 400 phone surveys in 2007 and 2008. In December of 2008, the firm issued the report: "Consumer Awareness and Attitude Research Results of Survey" which is a mid-project follow-up to the survey this firm conducted in 2007. Key findings include:

- The number of respondents who occasionally bike to work or school in a typical week rose from 3.4 percent to 8.7 percent.
- 75 percent of Columbia residents are aware of the GetAbout Columbia program in 2008, up from 66 percent in 2007.
- In 2007 two out of three respondents expected at least some increase in nonmotorized transit and in 2008 over half said it has already resulted in at least some mode shift.
- The number of respondents walking to work or school increased from 6 percent to nearly 10 percent, while those who drive alone dropped from 77.5 percent to 62 percent (GetAbout Columbia Executive Summary 2009: 4).

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Alta Data "Counts" in 2007 and 2008

GetAbout Columbia has been working with Alta Planning and Design, a Los Angeles-based firm which specializes in planning bikeways. Alta has helped to develop standards for documenting bike use in order to improve the quality of data across the United States. In December of 2008, Alta compiled the "Summary of 2008 Bicycle and Pedestrian Counts and Surveys" which provides a "snapshot in walking and bicycling in Columbia." This data tracks annual counts of pedestrians and bicyclists at seven locations in Columbia in 2007 and 2008. Key findings include:

- Average weekday pedestrian peak hour volumes increased 33 percent with a marginal 8 percent increase in utilitarian trips: 28 percent in 2007 to 36 percent in 2008.
- Average weekday peak hour bicycling volumes increased 71 percent, from 31 to 52 at the seven measured locations. Per spot surveys, 54 percent were utilitarian trips, up from 31 percent last year, and reported frequency of bicycling doubled to 16 times a month (GetAbout Columbia Executive Summary 2009: 5).

LeMaster Qualitative Study: Semi-structured Interviews

Dr. J.W. LeMaster and other researchers at the University of Missouri interviewed forty-eight persons in the area where one of GetAbout Columbia's educational programs was implemented in 2008. Key findings include:

- Of all the people surveyed, safety was the major concern.
- Of people in the area who did not participate, the perceived inconvenience and length of time needed were concerns.
- Places that were difficult to get through, such as choke points (narrow bridges) or busy roads (to be crossed) were concerns.
- There was strong support for the bike course among all who took it.
- Older individuals participating listed health benefits as the primary reason while younger participants listed community and social aspects (GetAbout Columbia Executive Summary 2009: 5).

4. Columbia Transit data

As part of its plan to modify behavior and create a mode shift away from automobile use, GetAbout has allocated funding to promote bike use – this includes walking and biking to bus stops – as part of the NMTPP program. GetAbout reports increase in usage in all areas since the program was initiated. Surveys conducted concluded that overall ridership is up significantly and that a portion of those who ride the bus also walk to the bus stop which accomplishes GetAbout Columbia's goal of a mixed use modal shift. In addition, there has been a significant increase in the number of cyclist who use the bike racks on the front of the buses. The counts from this survey are found in the Table below.

Table 5-2: Ridership and Bike-on-Bus Counts 2005-2008

Year	Ridership	Bikes-on-Bus Racks
2005	549,236	4577
2006	617,270	6635
2007	1,659,647	5411
2008	1,854,029	8363

The above reflects a tripling in ridership and an 83 percent increase in the use of the bike racks on the busses (GetAbout Columbia Executive Summary 2009: 5).

5:5:2 Safety and Accidents

The Columbia Police Department reports 37 bicyclist-involved accidents between October of 2006 and October of 2008. Twenty-six individuals were injured and one was killed (Alonzo 2008). The lone fatality occurred in 2007, but Columbia has not experienced another cyclist death over the past ten years. This contradicts a report issued by the U.S. Department Transportation which stated that Columbia did not experience a single bike death between 2004 and 2008 (USDOT Traffic Safety Facts for Missouri 2009). More information is required to understand the context of either of these facts, as I was unable to track down information on the number of accidents per year in Columbia prior to 2006.

According to surveys conducted by LeMaster Qualitative Study, safety was still listed as the dominate concern among those surveyed. However, since the overall rate of cycling increased over all surveys, it is reasonable to guess that more people view cycling to be safer than it has been historically.

Behavior change is the overall goal of the GetAbout Columbia project, though safety is often a consideration. Ted Curtis still maintains that cycling will be safer as the number of cyclists increase and motorists become more aware.

5:6 Summary

Columbia has certainly seen a positive response to what it has accomplished thus far, but the City's slow momentum is an indication of how difficult it is to plan and build what amounts to a second road system. As a result, Columbia's success may largely be attributed to the attention paid to developing and implementing its educational programs. It may be too early to

tell whether or not new infrastructure projects will make people feel safer commuting by bike, and GetAbout Columbia has not released any specific reports regarding ridership in areas where infrastructure improvements have been made. In light of this, I will compare Columbia's proposed projects to similar projects implemented in other cities and evaluate their success based on those comparisons in Chapter 9.

Chapter 6: Sheboygan County, WI

6:1 Overview of Sheboygan County prior to the Nonmotorized Transportation Pilot Program

Sheboygan County, Wisconsin is located on the western shores of Lake Michigan and is the second largest of the four pilot communities, covering more than 500 square miles. With a 2000 Census population of 110,000, Sheboygan County is composed of 15 townships, 10 villages, and 3 cities. It is also the least densely populated and has the smallest mode share of commuters who utilize nonmotorized transportation at less than 8 percent. The percentage of people who commute to work by bicycle is less than half the average of the four pilots at 0.7 percent.

Sheboygan County is the blankest slate as far as nonmotorized infrastructure is concerned, with only 1.75 miles of marked or striped bike lanes prior to the NMTPP, compared to the average across the pilots of 25.89 miles. Sheboygan County has historically focused on promoting bike use as recreation and has more than 35 miles of Class I off-road trails or pathways which are typically through parks or along waterways, though not usually linked to business districts, schools, or residential areas. Moreover, Sheboygan County has the least extensive public transportation network of all four pilot communities and the lowest percentage of commuters who travel via public transportation at 1.2 percent.

Table 6-1: Share of Total Person Trips by Mode Prior to NMTPP

Community	Vehicle %	Rideshare %	Walk %	Bicycle %	Transit %
Sheboygan County	89	2.4	6.6	0.7	1.2
Avg. for Pilots	82	2.1	11.2	1.5	4.1
Spokane, WA (Control)	86	2.0	8.5	0.8	4.1

Like the other four pilot communities, Sheboygan County aims to use NMTPP funds to "change attitudes and behaviors" through a complementary set of infrastructure projects and public education projects in order to realize a mode shift from motor vehicle transport to higher levels of bike use (NMTPP Interim Report to Congress 2007: 29).

After Sheboygan County was awarded the NMTPP grant, it created the Joint Resources and Transportation Committee which immediately set to work developing the county's first-ever comprehensive pedestrian and bicycle plan. The goals of the Sheboygan County Pedestrian and Bicycle Comprehensive Plan are:

- The establishment of pedestrian and bicycle travel as a viable, convenient, and safe transportation choice for Sheboygan County Residents and visitors.
- The creation of an efficient, connecting systems of bicycle routes and facilities that provides a safe, convenient, and viable transportation choice for Sheboygan County residents and visitors.
- Make a positive impact on the transportation options available for Sheboygan County residents.

- Work to establish countywide policies that establish long-term meaningful improvements to the non-motorized transportation infrastructure of Sheboygan County.
- Provide a safe non-motorized transportation network that establishes year-round use of non-motorized networks.
- Increase the mode share of bicyclists and pedestrians.
- Achieve a positive impact on the health of Sheboygan County residents by encouraging safe and active lifestyles through non-motorized means of transportation.
- Provide integrated non-motorized transportation alternatives to automobile travel, including the construction of an interconnected network of sidewalks, bicycle lanes and other on-street facilities, and shared-use trails that connect residents to locations where they live, work, shop, go to school, and play (2010 Campaign for Active Transportation Case Statement, 2008: 2).

In order to achieve these objectives, the JRTC has worked to incorporate pedestrian and bicycle planning into every transportation project undertaken in the County.

6:2 Plan and Identified System Needs

At the beginning of the NMTPP, Sheboygan County had the lowest mode share of cyclists at 0.7 percent which is well below the national average and below the average of the other three pilot communities. Residents of Sheboygan County, however, tend to live closer to where they work, shop, and play as compared to the other pilot communities. The relative lack of nonmotorized infrastructure accounts for this disparity, so the County has the greatest potential to increase its mode share of cyclists and pedestrians than do the other communities.

Prior to receiving NMTPP funds, Sheboygan County already featured a number of recreational multiuse trails. Among these are the Old Plank Road Trail, which runs for 17 miles adjacent to the four-lane State Highway 23, and the Interurban Trail which connects downtown Milwaukee to municipalities, parks, and businesses for a stretch of 35 miles. The interurban trail traverses through three counties and the last eight miles to be completed will link downtown Sheboygan to downtown Milwaukee. Both of these trails were initially designed with recreation and tourism in mind, and their utilitarian uses have been largely ignored until now. These trails, along with an additional 5 miles of trails throughout the County, serve as a backbone off of which to build other bikeways and multiuse paths. Initial efforts have been to provide critical connections to these facilities through the use of simple projects like bike lane striping and a three mile multi-use pathway. The majority of the original NMTPP funding has been allocated to provide the basic infrastructure for this new bicycle and pedestrian network.

6:3 Specific Programs Targeted Toward Improving Safety

6:3:1 Educational Programs

Prior to the Nonmotorized Transportation Pilot Program, Sheboygan had the least extensive nonmotorized infrastructure of the four pilot programs. Sheboygan, therefore, has the most potential to increase its biking mode share by adding bikeways where none existed before. Unfortunately, Sheboygan cannot rely on the “if you build it they will come” mentality to entice

novice riders to forsake their cars for their bicycles because perceptions regarding the risks of cycling dissuade potential cyclists. As a result, while the vast majority of Sheboygan's NMTPP funds have been allocated to infrastructure projects, Sheboygan has developed a number of educational programs to teach bike etiquette and road safety. Because construction and planning efforts take time (the majority of infrastructure improvements did not break ground until the spring of 2008) these educational efforts were started before most of the infrastructure could be put in place. Safety is the greatest concern and one of the largest hurdles impeding many cyclists from making the switch from recreational cycling to utilitarian cycling. In light of this, Sheboygan County has used NMTPP funds to implement the programs found in Table B-4 to address many of these safety concerns.

Unlike Columbia's programs, Sheboygan County has elected to use much of its educational funding to target administrators and law enforcement officials, rather than citizen cyclists. The wisdom behind this is that because utilitarian bike use in Sheboygan County has not historically been very high, law enforcement and city planners, therefore, have a limited understanding of how to accommodate cyclists on the road. However, funding these projects has an indirect effect on how the public behaves. Three of the four programs initially funded have focused on training and utilizing the police to enforce and educate the public about bike laws and safe cycling. I will discuss these programs further in the Analysis section.

Nationally, between 74 and 92 percent of all bicycle fatalities involve motor vehicles.[2] Sheboygan County experienced zero motor vehicle-related bike deaths between 2004 and 2008, but the perception of the risk is enough to deter many potential cyclists (USDOT Traffic Safety Facts for Wisconsin 2009). In response to this fear, several of Sheboygan County's programs focus on changing motorists' behavior as well as the behavior of cyclists. The two programs involving law enforcement aim to elevate the understanding of bike-related traffic laws for officers, cyclists, and motorists alike by enforcing speed limits and conducting seminars. Laws regarding cyclists vary from state to state, so Sheboygan County's Planning Department lists Wisconsin's State bike laws on its home page for those who cannot attend a seminar (See Section B-8 of the Appendix for these laws as they appear on Sheboygan County's Homepage).

6:3:2 Infrastructure: Class II On-road Bikeways

Sheboygan County is the least densely populated of the four pilot programs and most of the community consists of rural developments surrounding several denser, suburban pockets. As a result, the majority of the County's roads do not have roadside parking or paved shoulders meaning that cyclists do not generally run the risk of being hit by opening car doors at the side of the road, nor do they typically have much space between the side of the road and the cars traveling in the same direction. Beyond the extensive bike lane striping, Sheboygan has allocated funds to pave the shoulders of more than 70 miles of roads throughout the county. Specific projects are outlined in Table B-5.

Sheboygan County is currently in the process of completing its county-wide bicycle lane plan which will paint and stripe nearly 80 miles of new on-road bike lanes. All infrastructure improvements are scheduled to be finished by the fall of 2012, excluding many of them from the NMTPP final report to Congress, due in September of 2010.

[2] Statistics for motor vehicle-related bicycle deaths vary significantly year to year. Some sources take the average over ten years resulting in the lower numbers, whereas other sources report the years with the highest percentage of motor vehicle-related deaths. The highest percentage reported by the Dept of Transportation-NHTSA in the last decade was 92 percent in 2005.

6:4 Progress

Before the Nonmotorized Transportation Pilot Program, Sheboygan County had the least extensive nonmotorized transportation network. Four years later, and the status quo remains unchanged. Some progress has been made, however. Unlike the three other pilot programs, Sheboygan County had no historic bike culture from which it could leverage support and to which is could delegate the project. Instead, the County itself is responsible for running every aspect of the program, and progress has been slow as a result. Like the other pilots, Sheboygan has struggled with having to get federal approval for all of its infrastructure projects, but its lack of experience with nonmotorized infrastructure has compounded its challenges. As of the summer of 2009, Sheboygan County had allocated all of its funding to 35 projects and completed only 9. Of those 9, only 3 were infrastructure projects. The remaining projects have been scheduled to be completed between 2010 and 2012, but the dates are tentative at best.

A number of non-infrastructure educational and outreach projects have been implemented and a number of educational projects requiring little if any funds have successfully moved forward. In May of 2008, with the help of the Bicycle Federation of Wisconsin, Sheboygan County residents, employers, and employees participated in their first-ever Bike and Walk to Work Week. The event was hosted again in 2009, with increased participation (see section 6:5).

In spite of struggles with getting projects approved at the federal level, local governments in Sheboygan County have been very supportive. Sheboygan County's 2010 Case Statement for Active Transportation, reports that the Town of Sheboygan passed an ordinance in 2008 that mandates nonmotorized facilities to be included in all new development. The ordinance further requires these facilities to be connected to the existing nonmotorized system (2008: 10). Through the education and promotion efforts of the NMTPP (specifically the APBP Bicycle Friendly Workshops outlined in Table B-4), "Town officials realized that not planning for these types of facilities actually costs the Town taxpayers more in increased school busing expenses, increased maintenance on their infrastructure, and increased time spent in congestion on their roadways" (Sheboygan County Case Statement 2008: 10).

6:5 Results

In spite of not being able to complete most of its plans, Sheboygan County has dutifully attempted to compile data. The preliminary counts have indicated an overall upward trend in nonmotorized transit use. Between 2007 and 2008, Sheboygan County recorded the number of cyclists and pedestrians found at eight different locations (Table B-7). All eight of these locations were selected because they would be the sites of future infrastructure improvement projects. The first counts were meant to show nonmotorized transit use before the improvements were made, while later counts would show the effects the improvements had on behavior. Though only one of the eight projects has been completed, Sheboygan County has still witnessed an increase in nonmotorized trips in many areas. The County attributes these increases to planning, educational, and outreach efforts. In the project that has been constructed, Location #7 a sidewalk facility, the average increase in pedestrian traffic is an impressive 88 percent. Overall, among all eight projects the County reports that the average increase in use between 2007 and 2008 is roughly 54 percent (Sheboygan County Case Statement 2008: 14).

Sheboygan County has also gathered participation data on some of its outreach and educational efforts such as Bike Corrals and Bike & Walk to Work Week, two programs which were not budgeted for in the initial allocation of funding. The bike corrals, which consist of free monitored bike parking at public events (e.g., festivals and outdoor concerts) were particularly popular. Sheboygan County describes the program as "a small and uncomplicated effort, [which] kept 400 automobile trips from happening in the summer of 2007" (p.14). People who used the corrals were surveyed and asked three questions:

- How far [sic] did it take you to get here?
- Would you have driven if the corrals were not here?
- Do you bike/walk for other utilitarian trips?

The survey results revealed that:

- 340 miles were traveled by bicycling,
- 74 percent said they would have driven if the corrals were not available
- 75 percent stated they bike for other utilitarian purposes (p.14)

Sheboygan County also developed Bike & Walk to Work Week—another program not budgeted for in the initial allocation of funding—which has been similarly successful. The program is a week of community events like scavenger hunts and demonstrations on how to use the bike racks on buses, as well as free tune ups and bike maintenance lessons. In its first year, Bike & Walk to Work Week reported over 2,500 miles traveled by bicycling or walking rather than by driving. Sheboygan County reports that when comparing five count sites during Bike & Walk to Work Week '09[3] with the same sites the previous month, the program saw a 45 percent increase in nonmotorized traffic. When comparing the '09 event to the 2008 Bike & Walk to Work Week, Sheboygan County reported a 47 percent increase in nonmotorized at those same five sites (Sheboygan County Bike Walk to Work Week Event Results 2009: 1). Overall, Sheboygan County considers these programs a success and plans to continue them in the future.

6:5:1 Safety and Accidents

According to a report issued by the US Department of Transportation, Sheboygan has not experienced a bicycle death since before 2004 (USDOT *Traffic Safety Facts for Wisconsin,* 2008). It is, therefore, impossible to draw any conclusions about the effect of the NMTPP on accidents. There are, however, some anecdotal conclusions that can be drawn. In its 2010 Case Statement for Active Transportation, The County included letters and quotes given by NMTPP users, most of which indicate public support for the steps taken by the County thus far as well as support for future projects. For example, a quote given by one user demonstrates his faith that future "changes will make it safer and more convenient for those who don't use motorized transportation" (p.56). Another user wrote in a letter that when trying to ride eight miles to work, she found the route to be dangerous and unpleasant at times. She recognized that her route had not yet been addressed by the NMTPP, but she expressed her willingness to continue riding should the shoulders of the road be paved or if sidewalks were to be installed (p.48).

[3] Bike & Walk to Work Week took place during mid-May in both 2008 and 2009.

6:6 Summary

Progress in Sheboygan County has been slow, but public support for the project has been high. As the program gains visibility, it is reasonable to expect that it will result in an even greater increase in the mode share of cyclists. However, delays in the completion of important infrastructure projects have stalled surveys and the release of pertinent data regarding how the public responds to those projects. At this point, I can offer only speculation on the potential success of these projects based on similar projects in other cities. This occurs later in Chapter 9.

Chapter 7: Minneapolis, Minnesota

7:1 Overview of Minneapolis prior to the Nonmotorized Transportation Pilot Program

The city of Minneapolis is the most densely populated of the four pilot communities, with nearly 400,000 residents occupying 55 square miles. The majority of NMTPP projects will be implemented within the city limits, though some will extend into 14 adjacent urban and suburban municipalities along corridors, and the combined population of those communities is 550,000. Of the four pilot communities, Minneapolis experiences the highest share of non-vehicular commuting, with 17 percent of trips made on foot, and 2 percent by bicycle. Public transit claims another 9.7 percent, leaving only 71.2 percent of trips to be made by car (Table 1).

There are several reasons for this. Minneapolis has 57 miles of off-road lanes and pathways, combined with 38 miles of on-road painted bike lanes as compared to the average among the pilots of 37.8 and 27.8 miles respectively. 91 percent of the roadways in Minneapolis have sidewalks on at least one side of the street making walking more attractive and biking safer for younger riders. The only other pilot to report the percentage of roads with adjacent sidewalks was Columbia, which has only 61%. Moreover, Minneapolis has a fleet of 843 buses and more than 24 track miles of Light Rail. Prior to the NMTPP, none of the other pilot programs had a light rail system and Marin County, a community which is twice the size of Minneapolis, reported a fleet of only 263 busses. Because Minneapolis has below average vehicles per household (1.6; the average is 1.9), 88 percent of trips made to public transit stops are made by walking or biking (Table C-2).

Minneapolis' head start on integrating non-motorized transportation with its transit infrastructure gives it a unique opportunity to figure out ways to entice non-riders and walkers to use the nonmotorized system that is already in place. With this in mind, the City of Minneapolis appointed the Twin Cities-based non-profit, Transit for Livable Communities to manage the pilot program. The program, christened Bike/Walk Twin Cities, aims to promote walking and biking through improvements in infrastructure, combined with planning, public education, and promotion.

Table 7-1: Share of Total Person Trips by Mode

Community	Vehicle %	Rideshare %	Walk %	Bicycle %	Transit %
Minneapolis	69	2.2	17.6	2.0	9.7
Avg. for Pilots	82	2.1	11.2	1.5	4.1
Spokane, WA (Control)	86	2.0	8.5	0.8	4.1

7:2 Plan and Identified System Needs

Transit for Livable Communities divided its funding amongst three categories: planning, operations, and infrastructure. The largest share was allocated to infrastructure and the first projects to be funded can be found in Table C-4. Central to Bike Walk Twin Cities plan is the completion of two central spines which would connect to transit hubs and several smaller Class I

and Class II bikeways which would link users to residential areas, schools and business districts. Bike Walk Twin Cities refers to this multimode system as an effort to gain users throughout the system (Bike Walk Twin Cities 2008: 4).

Signature facilities and projects identified by Bike Walk Twin Cities include the 5.5 mile Midtown Greenway (Class I bikeway) which stretches across south Minneapolis to various recreational, residential, and commercial destinations. Minneapolis also allocated funding to complete the new Martin Sabo Bicycle Bridge which was completed in November of 2007. According to Bike Walk Twin Cities, this bike and pedestrian bridge "provides greater safety, access to new Greenway development, and connects… to downtown" (p.4). Other infrastructure projects include Class II bike lanes and bike boulevards.

Minneapolis has elected to spend a large portion of its NMTPP funding on studying its non-motorized transit network, and has issued grants to eight different studies to help identify flaws in the network. Flaws include barriers, gaps in infrastructure, traffic, and areas that are prone to accidents.

Education and outreach programs are targeted toward getting more people to utilize the existing infrastructure as well as toward promoting safety and proper bike etiquette. One such program is the Bike Walk Ambassadors program. Bike Walk Ambassadors serve as liaisons to the community and help disseminate information about non-motorized transportation. Ambassadors teach safety and promote bicycle usage for short trips. Additional educational opportunities include consulting resources provided to local communities, design seminars, major exhibits on bicycling and walking, a safety and awareness campaign, as well as ongoing measurement and data collection (p.11).

7:3 Specific Programs Targeted Toward Improving Safety

Of the four pilots, Minneapolis had the highest mode share of bike use and the most extensive nonmotorized transit network prior to the NMTPP so the City chose to use much of its funding to target areas that have traditionally been regarded as unsafe for biking and to identify ways to get more people to use the existing system. Like the other three pilot programs, Minneapolis has also designed and begun implementing an educational campaign which includes classes and a signage campaign targeted toward informing cyclists and motorists of ways to share the road safely. Table 2 lists these projects.

Table 7-2: Programs Designed to Address Safety Concerns

Project	Description	Scheduled Date of Completion
Bike Walk Ambassadors	Ambassadors serve as liaisons to the community and help spread the word about non-motorized transportation. Ambassadors play a part in teaching bicycle safety and promoting bicycle usage for short trips.	Ongoing
Livable Streets Campaign	Major exhibits on bicycling and walking, a safety and awareness campaign, as well as ongoing measurement and data collection.	Ongoing

As mentioned in the previous section, the Bike Walk Ambassadors program seeks to raise the profile of the nonmotorized transportation movement as well as disseminate information about bike safety.

The Livable Streets movement targets busy streets[4] in an effort to make them safer for bike use and pedestrians. These efforts include Class II bike lanes and traffic calming elements like lower speed limits and speed bumps. The Livable Streets Campaign focuses predominately on promoting awareness and educational programs, rather than on the infrastructural aspect of the movement.

7:4 Progress

Beginning in 2007, the Bike Walk Twin Cities allocated $2.2 million of its $25 million toward planning and constructing infrastructure projects, and $3.3 million in educational projects and campaigns. In 2008, the program focused investments on two innovative infrastructure programs: $2 million was invested in Livable Streets Campaign in addition $1 million was invested in Bike Walk Streets for corridors with average daily traffic less than 3,000 (p.10).

Like the other pilot communities, Minneapolis has been slow to begin construction on the majority of its infrastructure projects. So far, 37 Capital Projects have been funded. These projects are in various stages of planning, but Bike Walk Twin Cities reports that several will be constructed in 2010. A few of the projects that have already been completed and are in the process of being evaluated are listed in Table C-5. These projects include the extension of two Class I multiuse trails and newly striped Class II bike lanes. All three of these projects were paired with monthly counts, as well as individual surveys. The results of those counts and surveys have not yet been released.

Non-infrastructural programs were quicker to get off the ground. One of the first projects to be funded and begin operations was the Bicycle and Pedestrian Ambassadors Program, which was run by the City of Minneapolis. Bike Walk Twin Cities reports that since 2008, the education and outreach program has sent staff and volunteer bike and walk educators to work places, community events, organizations, schools, places of worship and cafes.

Though this is not directly related to NMTPP funding, it is worth noting that in 2008, the state legislature authorized metro counties to levy a ¼ cent sales tax for additional transit development, and also authorized counties to use up to 2.5 percent of this funding to develop bicycle and pedestrian facilities (Bike Walk Twin Cities 2008: 3). Unfortunately, I was unable to find any information on how much revenue this tax is likely to generate, but this indicates state-wide support for nonmotorized transit.

7:5 Results

In May 2008, Minneapolis received the League of American Bicyclists' silver level award as a Bike Friendly Community. The League awarded Minneapolis this distinction because of its extensive network of Class I & II bikeways, along with the city's policy of plowing all multi-use paths within a day of snowfall. Furthermore, Bike Walk Twin Cities reported in February of 2010 that Minneapolis boasts the second highest share of bike commuters in the country behind Portland, Oregon, with a 68 percent increase in biking from 2006-2008.

[4] Streets which experience average daily traffic of greater than 3,000 cars

While Minneapolis has yet to construct the majority of its new infrastructure projects, it had the most extensive nonmotorized transit network of the four pilot communities prior to the NMTPP, and has been able to allocate a significant amount of resources toward conducting monthly and annual counts at a number of locations. As a result, Minneapolis has a larger cache of data which offers a more complete view of bike use in a variety of conditions. Beginning in the spring of 2010, Bike Walk Twin Cities will incorporate automated 24-hour counting at several locations, for even more complete data collection.

The most recent report released by Bike Walk Twin Cities reveals:

- 10 percent of workers in Minneapolis commute by biking (4.3 percent) or walking (6.1 percent), compared to the National average of 3.3 percent.
- Overall, there has been a 13 percent increase in biking between 2007 and 2009 (Bike Walk Twin Cities 2010: 3).

Bike Walk Twin Cities also reported that, surprisingly, Minnesotans are year round bicyclists and walkers. New monthly count data indicates that "even on the worst winter day 68 percent of walkers continue to walk and 20 percent of bicyclists bike." The report goes on to say that on a clear winter day, 81 percent of pedestrians will walk and that 36 percent of bicyclists will ride (p.3). This indicates that, while the cold temperatures do discourage some nonmotorized transit users, many will choose to walk or bike rather than drive on icy and dangerous roads. This makes it an imperative that city maintenance does not forget to watch conditions on trails and bikeways when the weather gets bad, thus enforcing nonmotorized transit as a reliable way to commute (p.4).

Unlike the other pilot programs, Minneapolis chose to conduct monthly counts rather than annual counts and Table C-6 shows the results of counts taken during the Fall of 2007 and 2008 at 17 different locations. The general trend at all locations is that bike use has increased year to year. The only exception is the Midtown Greenway crossing Highway 55. Bike Walk Twin Cities accounts for this decrease by pointing out that the Martin Sabo Bridge was completed and opened during this time, providing an additional place to cross the highway (Bike Walk Twin Cities 2009: 4). Bike Walk Twin Cities also mentions that it is "worthy to note that a significant number of bicyclists still use the at-grade crossing, an indication that some bicyclists prefer the direct route…over the extra distance and climb associated with using the Sabo Bridge" (p.5).

7:5:1 Safety and Accidents

Overall, the gender breakdown of all nonmotorized transit users in Minneapolis is consistent with national trends. 72 percent of cyclists are male and the other 28 percent consist of women and children.[5] The national average is a 3:1 male to female ratio (Bike Walk Twin Cities 2010: 4). This indicates that more work needs to be done in Minneapolis to improve the perception of safety for its nonmotorized transit network, since women and children tend to be more risk averse (Baker 2009).

On a more positive note, Bike Walk Twin Cities reports that cyclists are using lights and wearing helmets. In winter, 74 percent of cyclists used lights after dark. During the rest of the

[5] Gender was not observed for children.

year, when daylight hours allowed for better observation, 64 percent of cyclists were seen wearing helmets (Bike Walk Twin Cities 2010: 3).[6]

Unlike the other three pilot communities, Bike Walk Twin Cities and the City of Minneapolis have placed special focus on observing bicyclists on sidewalks (Table C-7). This data is collected in conjunction with the counts. Bike Walk Twin Cities highlights sidewalk riding for several reasons related to the safety of bicyclists and pedestrians which I will discuss in Chapter 9. General trends to note from this study are:

- The locations with the lowest percentages (7.2-9 percent) of bikes ridden on the sidewalks were locations that featured at least one on-street Class II bike lane.
- Locations with moderate percentages (26-36 percent) of bikes ridden on the sidewalk were locations with four lanes of traffic with either no on-street parking or with on-street parking and a wide outside travel lane (i.e. paved shoulder).
- The location with the highest recorded rate of bikes on the sidewalk (74.5 percent) was a four-lane road with on-street parking indicating that cyclists are less inclined to ride on a busier street where the risk of being hit by an opening car door is higher.

While it is difficult to make a direct comparison of these locations without understanding more detailed environmental factors, there is a good indication that bike lanes will reduce the likelihood of bicyclists using the sidewalk.

Statistically, between 2004 and 2008, Minneapolis and greater Hennepin County have experienced an average of two bicyclist deaths annually according to a report issued by the US Department of Transportation. This average is higher than the other three pilot communities combined, but the average only accounts for 0.18 fatalities per 100,000 people (USDOT Traffic Safety Facts for Minnesota 2009). This is unsurprising since Minneapolis boasts the highest mode share of cyclists over all the other pilot communities. However, no direct relationship can be gleaned from this comparison since the other three communities have the same percentage of bike fatalities per/number of cyclists (0 percent) but they do not all have comparable numbers or cyclists on the road.

7:6 Summary

Minneapolis has experienced an overall increase in the mode share of cyclists and its progress has been impressive. Its silver rating by the League of American Bicyclists is particularly important to note because it recognizes the steps Minneapolis has taken to improve safety and its status as a bike friendly community. As of 2009, 22 other communities shared silver status with Minneapolis, but only three had populations larger than 300,000. The League of American Bicyclists ranks cities up to Gold and Platinum standards, but only four cities with populations greater than 300,000 achieved those rankings (League of American Bicyclists 2009). The only Platinum-ranked large city is Portland, Oregon, which, incidentally, is the only large city with a higher rate of bike commuters than Minneapolis.

[6] It should be noted that TLC chooses to observe helmet use (Mar-Oct) and light use (Nov-Feb, when it is dark during the count period) for the monthly counts.

Unfortunately, what makes Minneapolis unique among the four communities as far as NMTPP funding is concerned—i.e. the results of the studies that were funded to identify solutions to flaws in the nonmotorized transit structure—is not yet available for analysis. Additionally, the only data available are the 2007 and 2008 ridership counts, while the results of individual surveys are still forthcoming. As mentioned previously in the background section on historical problems with gathering data on bike use, ridership counts alone are not sufficient enough evidence to explain whether or not there are more individual cyclists on the road rather than simply a greater reoccurrence of cyclists who were previously inclined to bike. Further information is required before we can judge the overall success of the Minneapolis pilot program at improving safety and the perception thereof.

Chapter 8: Marin County, California

8:1 Overview of Marin County prior to the Nonmotorized Transportation Pilot Program

Marin County, in the northern part of the San Francisco Bay Area, is the largest of the four pilot communities at 520 square miles and is home to almost 250,000 residents according to the 2000 Census. However, most of the population lives in a 121 square mile urbanized area in the eastern portion of the County, and NMTPP funds have been allocated almost exclusively to that area, making the actual program the second largest of the four communities. For this reason, most of the numbers and statistics represented in this paper are for the eastern urbanized portion of the County, rather than the county as a whole.

Of the four pilot communities, Marin County has the second most extensive non-motorized transportation network, as well as an intricate public transit network. The County boasts 33.7 miles of off-road trails and pathways, which is slightly below the average for all four pilot communities, but its on-road infrastructure is nearly 10 miles above the average at 35.8 miles. Marin County's public transit network, which includes regular buses and ferries, accounts for 3.2 percent of all commutes while cyclists and pedestrians account for a combined 13.6 percent of the mode share. Despite having a strong public transit network, prior to NMTPP, public transit was underused due in large part to high levels of auto ownership and problems associated with "the first and last mile." Marin County is largely suburban, and its residential areas are not well situated around transportation hubs, and require users to commute over longer distances to get to a bus stop or a port than in the other communities. As a result, only 45 percent of trips to and from transit are made via bicycling or walking as compared with the average among the pilot communities which is 76.5 percent.

In light of this, Marin County has chosen to simultaneously promote non-motorized transportation as well as mass transportation by leveraging NMTPP funds to improve connectivity between transportation hubs and residential areas. In order to accomplish this, Marin County has incorporated its eleven member communities under the umbrella of the "Walk Bike Marin" initiative which is managed by the Marin County Department of Public Works and is designed to manage the non-motorized transportation pilot program.

Table 8-1: Share of Total Person Trips by Mode

Community	Vehicle %	Rideshare %	Walk %	Bicycle %	Transit %
Marin County	82	1.4	11.8	1.8	3.2
Avg. for Pilots	82	2.1	11.2	1.5	4.1
Spokane, WA (Control)	86	2.0	8.5	0.8	4.1

8:2 Plan and Identified System Needs

Marin County has chosen to focus on connecting residential areas and transportation hubs, thereby boosting ridership on buses and ferries as well as bike and pedestrian use. Plans

include new bicycle facilities and infrastructure development along with educational programs to promote walking and biking as a transportation alternative. Walk Bike Marin originally anticipated that all infrastructure projects would be constructed by the end of 2009 and that all educational programs would be initiated beginning in 2007.

Marin County has divided its infrastructural projects into "primary network" infrastructure projects, "countywide" infrastructure projects, and "local network/feeder" projects. Primary network projects include transit corridors that align north-south and east-west. These include Class I bikeways along old railroad grades, major waterways, and paths or Class II bike lanes on key arterial streets. Countywide projects include bicycle racks and lockers, striping and signage projects, intersection improvement, lanes and paths that can be effectively implemented at a variety of locations. Local/Feeder projects tie into the primary network, but serve smaller neighborhoods or business districts. These projects are particularly important in integrating the non-motorized networks with the public transit network (NMTPP Interim Report to Congress 2007).

In April of 2007, Marin County divided its NMTPP funds to cover the following projects seen in Table D-4. The signature project of the Walk Bike Marin Initiative is the North-South Greenway, a "long envisioned corridor running the length of the county along the railroad right-of-way, parallel to Highway 101, creating a safe, flat and direct pathway that will be separated from cars except for a few at grade crossings" (NMTPP interim Report to Congress 2007: 24) The North-South Greenway will provide access to all major transit centers, including bus stops, the two ferry terminals, and the planned stops for SMART, Sonoma Marin Rail Transit.

8:3 Specific Programs Targeted Toward Improving Safety

Like the other pilot programs, Marin County has designed a complementary set of infrastructural improvements and educational programs aimed at making cycling safer. Prior to the NMTPP, however, Marin already had above average bike use with 1.8 percent of the mode share, only behind Minneapolis at 2.1 percent, and has already had time to develop a robust bike culture of cyclists who are already familiar with bike etiquette and elements common to bikeways and nonmotorized infrastructure. In light of this, Marin has elected to spend less of its funding on education than the other pilot communities, and more on identifying and addressing areas where cyclists are at the highest risk of getting in accidents or collisions. With this goal in mind, Marin has allocated much of its funding toward improving safety at intersections, with the intention of making on-road bike use significantly safer. Specifically, Marin County is in the process of installing special cameras to detect cyclists at traffic signals, at 31 different intersections in 10 separate communities (Walk Bike Marin Project 802 2009: 1).

Beyond making intersections safer, Marin County has allocated the majority of its funding to building new Class I and Class II bikeways and multiuse paths in an effort to fill in the gaps in its current nonmotorized network. A list of infrastructural improvements can be found in Table D-5. Many of these projects include planes to utilize a combination of Class I and II bikeways, thus accommodating a wider variety of cyclists with a variety of skill levels.

8:4 Progress

Marin County has arguably been the most successful at allocating funding and constructing its infrastructure projects. The Nonmotorized Transportation Pilot Program in Marin has enabled the construction of over $41 million in bicycle and pedestrian facilities, $19 million of which are from NMTPP funds with the balance leveraged from other sources including local, regional and state funds. An additional $1 million in NMTPP education and outreach programming is under way to encourage increased walking and bicycling for everyday trips in the community.

Beyond bicycle and pedestrian plans, Marin has adopted the ambitious goal in its Countywide Plan for 20 percent of utilitarian trips countywide to be made by bicycle or walking by 2020. Targeted programs, such as Safe Routes to Schools, have also been implemented throughout the county. Safe Routes to Schools is currently operating in more than 40 schools, representing more approximately 60 percent of the schools in Marin. As stated before, SRTS was part of the same transportation bill as NMTPP, but its funding is technically separate. However, the NMTPP's goals often align with SRTS and many of Marin's programs have utilized funding from both sources (Marin County Department of Public Works 2008).

8:5 Results

Marin has an edge over all of the other pilot programs when collecting and synthesizing data on nonmotorized transit use. Since 1999, Marin County has been conducting counts and surveys in order to get an accurate idea of what its bike culture looks like and what it would require in order to continue to grow and thrive. These counts and surveys were performed as part of the NMTPP and the National Bicycle & Pedestrian Documentation Project (NBPDP). As a result, Marin has a decade of data to look at when deciding how to expand its nonmotorized transit system, and, more importantly, increase its nonmotorized mode share. Tables D-7 through D-12 show bicycle and pedestrian counts taken in 2007, 2008, and 2009 at a variety of locations. Key findings include:

- During weekdays bicycling rates increased an average of 118 percent between 1999 and 2009, 23 percent between 2007 and 2009, and 6 percent between 2008 and 2009.
- During weekends, bicycling increased an average of 25 percent between 1999 and 2009, 60 percent between 2007 and 2009, and 10 percent between 2008 and 2009.

While both weekend and weekday counts increased, the increase was far more significant on weekends rather than weekdays. Walk Bike Marin suggests that this accounts for a greater number of cyclists who bike for recreation rather than for utility. One factor which would support this finding is the fact that the location which saw the greatest increase in use was a multiuse path through a large park that overlooks the San Francisco Bay and offers a panoramic view of San Francisco. In 1999, this location counted 188 peak hour weekend cyclists and 502 in 2009, an increase of 314 cyclists. At the same location, there was an increase of 76 bicyclists during the weekday period. The path is largely utilized by recreational cyclists.

In Marin County, however, the 2007 baseline surveys conducted by the University of Minnesota research team revealed that about 44 percent of pedestrian trips and 38 percent of bicycle trips were transportation-related (school, work, shopping), and likely replacing vehicle trips (NMTPP Interim Report to Congress 2007: 13). In support of this, the increase in weekday trips indicates a large increase in bicycling to work and school trips.

8:5:1 Surveys and Measured Results

A report released by Walk Bike Marin in October of 2009, revealed that walking and biking on weekdays has increased throughout the county. Over a period of 2 hours, the 22 locations surveyed experienced an average of 80 cyclists. Walk Bike Marin also reported that average weekend bicycling is 125 percent higher than average weekday volumes, and average weekend walking is 53 percent higher than average weekdays, indicating the popularity of bicycling and walking as recreational activities (Walk Bike Marin Count Report 2009: 5). According to Walk Bike Marin, the most popular weekend bicycling locations are all Class I off-road, multiuse paths (p. 6).

Demographically, Walk Bike Marin was able to survey and provide data on the breakdown of bicyclist attributes, including gender and age for the year 2007. These figures can be found in Table D-10. According to this survey, men make up 72 percent of the 2007 bicyclists, which is consistent with the National Average of 3:1 males to female cyclists. Walk Bike Marin suggests that concerns about safety and security could be reasons why fewer females bicycle than males. This 2007 survey also observed that children 18 years or under, based on visual observation, make up about 13 percent of 2007 bicyclists. This figure indicates that proportionally fewer children bike on average than adults since children make up 24.6 percent of the national population (p. 6). From this, we can infer that Marin's nonmotorized system still appeals disproportionately to men and could therefore be viewed as too risky or unsafe by women and children.

In 2009, Walk Bike Marin published the results of face-to-face surveys conducted at selected count locations. The surveys were taken during or immediately before or after count periods. Walk Bike Marin reported the following trends (pp.6-7):

- 20 percent of bicycling trips were part of school or work commutes. Together with shopping/errand trips (14 percent), about 34 percent of trips are utilitarian and transportation related.
- The average bicycling frequency was 11 days/month, with 16 percent of the respondents bicycling daily.
- If respondents were not able to bicycle, 37 percent would have driven. 19 percent would have walked, indicating the exercise/recreational nature of their trip.
- Respondents identified better roadway and pathway maintenance, bike lanes, less traffic, and signs/stencils as their top four (4) improvements.
- Respondents stated that directness, accessibility/proximity, separation from traffic, and lower traffic volumes were the top reasons they selected the route to bike.

8:5:2 Safety and Accidents

Helmet Use and Improper Utilization of Facilities

Table D-10 indicates that a significant number of the 2007 bicyclists (29 percent) were reported not to be wearing helmets. Whether or not helmet use actually improves safety is the subject of many debates and studies and I will explore the topic in my Analysis. Table D-7 also indicates that 29 percent of cyclists were observed riding the wrong direction which leads to questions regarding proper use and safety which will also be explored in the Analysis.

Mill Valley Corte Madera Study

Walk Bike Marin allocated NMTPP funding to the Mill Valley to Corte Madera Bike and Pedestrian Corridor Study. This corridor meanders for 3.7 miles through neighborhoods, along busy roads, and offers a variety of types of infrastructure to accommodate nonmotorized transportation. Most of the route, however, consists of a widened paved shoulder along a busy two-lane road. The corridor was constructed prior to the NMTPP and offers an opportunity to better understand how existing infrastructure may be improved to address safety concerns. In a December 2009 report, the Study acknowledged that the corridor is heavily used by bicyclists, and "that many have stated that they would use the route even if there were other options because they enjoy its scenic and challenging qualities" (Walk Bike Marin 2009: 6). However, bicycles traveling slowly uphill frequently impede vehicle traffic on this busy road and this route exposes bicyclists to steep hills and sharp curves, often with little or no shoulder.

Figure D-13 shows where accidents have occurred along this corridor between 2004 and 2008. The majority of all collisions involving bicycles happened along the steep and curvy Camino Alto/Corte Madera Avenue, and in 2009, the Study published its recommendations for how to improve safety along this route. Improvements include Class II bike lanes and a widened bicycle climbing lane. Though none of these improvements would be funded with NMTPP funds, the study still provides insight into how bike accidents occur and what types of solutions exist to address them.

Fatalities

The U.S. Department of Transportation reports no bike-related deaths between 2004 and 2008, which is consistent with the other NMTPP pilot programs. I will explore this further in Chapter 9.

8:6 Summary

At first glance, Marin County appears to have successfully allocated its funding to projects which will increase ridership throughout the community. Ridership counts would suggest that the mode share has gone up as well, but as discussed in previous sections, ridership counts alone are not an entirely accurate reflection of overall bike use. The fact that male riders still outnumber female cyclists 3:1 would suggest that the overall perception of safety has not improved based on ridership alone. It is possible, however, that the increase in ridership counts would indicate an increase in the number of individual cyclists using a facility, but it is also likely that the same cyclists who would have biked had the facility not existed make up a large share of the riders counted.

Chapter 9: Analysis

9:1 Impediments to Progress

Progress for all four Nonmotorized Transportation Pilot Programs has been considerably slower than originally expected. All four pilots have experienced problems throughout the planning and engineering process, but two of the largest hurdles impeding progress have been problems obtaining land use and a lengthier than anticipated federal approval process.

These issues have been most apparent in Columbia and Sheboygan County, where the largest infrastructure projects have been dropped or delayed. In Columbia, GetAbout has spent $350,000 on conceptual engineering of projects which have subsequently been dismissed (Berger 2009). Sheboygan has completed only one of its planned infrastructure projects and has suffered problems obtaining land use for several of its projects. Two of Sheboygan's signature projects, The Random Lake Project and the Cedar Grove Project, which were expected to have been completed by the spring of 2009 and then used as models from which to gather before and after data for further development, were stalled for this reason. According to a joint report issued by the Sheboygan County Nonmotorized Transportation Pilot Project and the Center for Disease Control (*Focused Evaluation Project- Baseline Report* 2009: 7), the main reason the Random Lake project was delayed was because adjacent neighbors to the proposed projects refused to allow contractors access to private property. This problem was unforeseen and after 90 percent of the engineering was done, three neighbors stated that they would not be willing to provide the temporary easement at the last public open house. An alternative was found but required that a portion of the project be reengineered, resulting in unforeseen delays and expenditures not budgeted for in the original project. Because of this unexpected expense, the project will end after construction is finished and no additional surveys or counts will be conducted (p.7). The Cedar Grove Project, which was originally scheduled to be completed in April of 2009, was finished in November of 2009. This delay was due primarily to the County's inexperience planning and contracting the project which was further complicated by its struggles to obtain federal approval (p.8).

Walk Bike Marin issued this statement addressing the frustration caused by the federal approval process.

> [F]urther delay of both projects is the process by which federal transportation dollars are administered and allocated for the NMTPP. The process is structured to handle large construction projects. Smaller projects are still treated as if they are large projects which results in a disproportionate level of review and analysis, and thus time and cost beyond what would be anticipated if the same project were funded with nonfederal dollars. Once funds are transferred to the implementing agency, a series of approvals are required by the state's Department of Transportation at multiple steps along the way. Receiving authorization to proceed at each step can take several months and the various steps cannot generally be undertaken concurrently. This has affected the delivery timeline of all of the NMTPP infrastructure projects (2009: 8).

As evidenced by Sheboygan and Columbia pilot programs, these delays often waste money and, in many cases, end projects before ground can be broken. Ted Curtis, of GetAbout Columbia

suggests that money spent on plans never implemented is not money wasted. Although there may not be any immediate plans to pursue dropped projects, they could still be built eventually (Berger 2009).

9:2 In Spite of Many Setbacks, Results Have Been Positive

Each of the four pilot programs has experienced increases in their nonmotorized mode shares. Counts began in 2007 and Table 1 summarizes these increases from year to year based on data collected at selected locations.

Table 9-1: Annual Change in Bicycle Use among Pilot Communities

	2008	2009	Overall
Columbia			
Weekday	71%	Not reported	71%
Sheboygan County			
Overall	54%	Not reported	54%
Minneapolis			
Overall	29.2%	Not Reported	29.2%
Marin County			
Weekday	22.9%	6.2%	29.1%
Weekend	28.4%	0.5%	28.9%

In spite of having completed few of their proposed infrastructure projects, Columbia and Sheboygan County have experienced the highest rates of increase in their bicycle mode shares. This is to be expected because cities with the least amount of infrastructure in place see the most benefit from new infrastructure (Krizek 2007: Table 1 p. 22). This would help to explain why Columbia has experienced a greater increase than Sheboygan since Columbia has managed to implement more of its infrastructural projects, including 7 miles of painted bike lanes, sharrows, and three intersection improvements.

Columbia's edge may also be attributed to its educational efforts. Columbia has designed the most extensive education campaign of all four pilot programs. Since 2007, Columbia has spent $2.26 million of its funding on these programs and has offered classes geared toward all levels of cyclists every week since then. 75 percent of survey respondents said that they were aware of GetAbout Columbia's programs in 2008, which would suggest that increased awareness contributes to increase in mode shift.

Unfortunately, since recent Census data for the percentage of commuters who commute by bike regularly is not yet available, it is impossible to know whether more people are forgoing their cars in favor of their bikes, or if the increase can be attributed to the existing cycling population riding more frequently. Additionally, since data has not yet been released for Spokane, WA, the control community, the effects that changes in gas prices and other external factors have on the mode shift are difficult to measure. This lack of information does not altogether negate the positive results that the counts have shown thus far. The increase in mode shift indicated by the selected count locations demonstrate that more people are taking advantage of the nonmotorized transit system on a regular basis and would suggest that improvements lead to positive results.

9:3 Overall Improvements in Safety

Quantitative data on the safety of cycling has been historically difficult to gather. The Federal Highway Administration measures traffic safety by the number of fatalities per 100 million miles (FHWA 1995: 25). This means determining progress, which, while useful in reporting the safety of driving, is woefully inadequate when applied to bicycling. We simply do not have adequate information on the amount of cycling being done. For the four pilot programs, the only data currently available indicates that there was no increase in bike-related fatalities for all four pilot programs between 2004 and 2008. Three of the pilot programs experienced zero bike-related deaths during this time, indicating that cycling is safer than driving, comparatively. The exception, Minneapolis, experienced 2 deaths per year between 2004 and 2008, which amounts to 0.18 deaths per 100,000 people, which is still below the national average for motor vehicle deaths at 0.41 deaths per 100,000 people (Bureau of Transportation Statistics 2009). It is reasonable to infer that Minneapolis has the highest rate of bike deaths over the other three communities because it is the densest pilot with the highest percentage of cyclists. More people driving more cars plus more bikes on the road will yield more collisions and fatalities. The fact that this number hasn't risen as ridership counts have gone up might be an indication that the chance that a cyclist would get in an accident goes down as the number of riders increases. Unfortunately, more information is needed to substantiate this claim.

Marin County and Minneapolis have leveraged their existing nonmotorized infrastructures and funded studies intended to explore and address areas that have historically experienced accidents. In June 2007, Bike Walk Twin Cities awarded $50,000 of NMTPP funds to study a four lane road that currently has a high pedestrian and bicycle crash rate. This study is not yet complete and the results have not been published. Marin County has funded the Mill Valley to Corte Madera Bike and Pedestrian Corridor Study which looks at a 3.7 mile stretch of road which is heavily used by cyclists. This study has identified the locations which pose the highest risk for bike-related accidents and has created a proposal for how to make these locations safer.

9:3:1 Infrastructure as a Method of Influencing Safety and the Perception of Safety

In the following section I will explore the different planned and implemented infrastructure projects in terms of their expected influence on improving safety and their perceived influence on safety. Specifically, I will focus on the public response to proposed infrastructure and bikeways, as well as public preference.

Bike Lanes (Class 1 Bikeway)

Bike lanes are ubiquitous in all four pilot communities and tend to be popular among nonmotorized transit users. Walk Bike Marin reported that respondents of face-to-face surveys at selected locations listed bike lanes amongst their top 4 improvements to the nonmotorized transit system. This trend is consistent with a report issued by the Federal Highway Administration in 1995 which found that 49.3 percent of respondents to a survey on incentives influencing bike use said they would commute to work by bike if safe bike lanes were available on roads and highways. 44.8 percent of respondents said that bike lanes would not be enough to entice them to bike to work (FHWA 1995: 12). Data from the Bureau of Transportation Statistics from 2002 reveals that 11 percent of bike commuters ride primarily on bike lanes as compared with 5.6

percent of recreational cyclists. Another study found that regular bicycle commuters in Phoenix, AZ, adjusted their routes to use bicycle facilities indicating that providing facilities impacts behavior (Howard & Burns 2001: 39-46). Research conducted by Portland State University's School of Urban Studies and Planning revealed that the top four cities that experienced the highest percentage of bike commuters also had the highest number of bike lanes and paths per square mile. Among those four cities is Minneapolis with 1.44 miles of bike lanes and paths per square mile (Dill & Carr 2003: Table 2, p. 199). This study further showed that for typical U.S. cities with a population of more than 250,000, each additional mile of Class II bike lanes per square mile is associated with roughly one percentage point increase in the share of workers commuting by bike.

Beyond stated preference, bike lanes can influence a cyclist's behavior on the road and generally leads to safer conditions for both cyclists and motorists (p. 120). Some advocates have expressed concerns that bicycle lanes might increase the risk of being "doored" (Van Houten 2005: 4). Bicyclists, however, generally travel on streets between parked cars and moving vehicles whether or not bike lanes are present, and the risk of colliding with a car door is always present in these circumstances. Furthermore, a study conducted in Cambridge, MA, found that cyclists were more likely to ride farther away from parked cars if a bike lane is present (p.3). Several studies have shown that drivers make fewer wide swerves or close passes when they are passing cyclists on streets with bike lanes (Kroll 1977; McHenry 1985). In a 1985 study on shared lanes, McHenry and Wallace determined that motorists swerved less when passing cyclists if there was a marked bike lane as compared with when there was none. Surveys conducted after bike lanes were installed in Cambridge, found that drivers were more alert and on the lookout for cyclists when the lanes were provided than they were on a street with a widened curb. Additionally, designated bike lanes give cyclists a sense that they belong on the road and are therefore more likely to behave like a vehicle and observe signs and signals than they would if they were riding along a street with a wide curb. A 1997 study designed to evaluate on road bike facilities, and conducted by the National Research Council, found that there were fewer incidents of cyclists riding the wrong way down the street or on the sidewalk if bike lanes were present (Van Houten 2005: 3).

Multiuse Trails and Separated Bike Paths (Class I Bikeways)

Class I bikeways are of particular interest because they are widely perceived to be safer than Class II bikeways. There are several reasons for this. First, Class I bikeways limit the likelihood of cyclist/car interactions. Injuries suffered in bicycle-motor vehicle crashes tend to be more severe than those suffered in all other kinds of bicycle crashes. This is most clearly shown in the National Highway Safety Administration's Fatality Analysis Reporting System (FARS) statistics from 1995; over 90 percent of all bicycling deaths involved collisions with motor vehicles. Second, Class I bikeways are located away from residential streets and roadways. 50-60% of bicyclist crashes resulting in injuries occur at either roadway or driveway/alley intersections (FHWA 1995: 28).

The locations that typically experience the highest traffic in Marin County are all multiuse, off-road bikeways, while the newly constructed, immensely popular Martin Sabo Bridge in Minneapolis rises high above all auto traffic. All four pilot programs have long-term plans to build their nonmotorized infrastructures around longer greenways and rail trails utilizing these Class I multiuse paths as spines connected to residential areas and business districts through a network of Class II bikeways. As previously mentioned, Class I bikeways do not tend

to run through city centers and can be inconvenient for commuting. However, with a well planned network of feeder paths and bikeways, these off-road, multiuse greenways can serve as nonmotorized interstates. At present, however, Class I bikeways are not as strongly associated with commuting as Class II bikeways are (Dill 2003: 121).

Back In Angle Parking (In Conjunction with a Class II Bike Path)

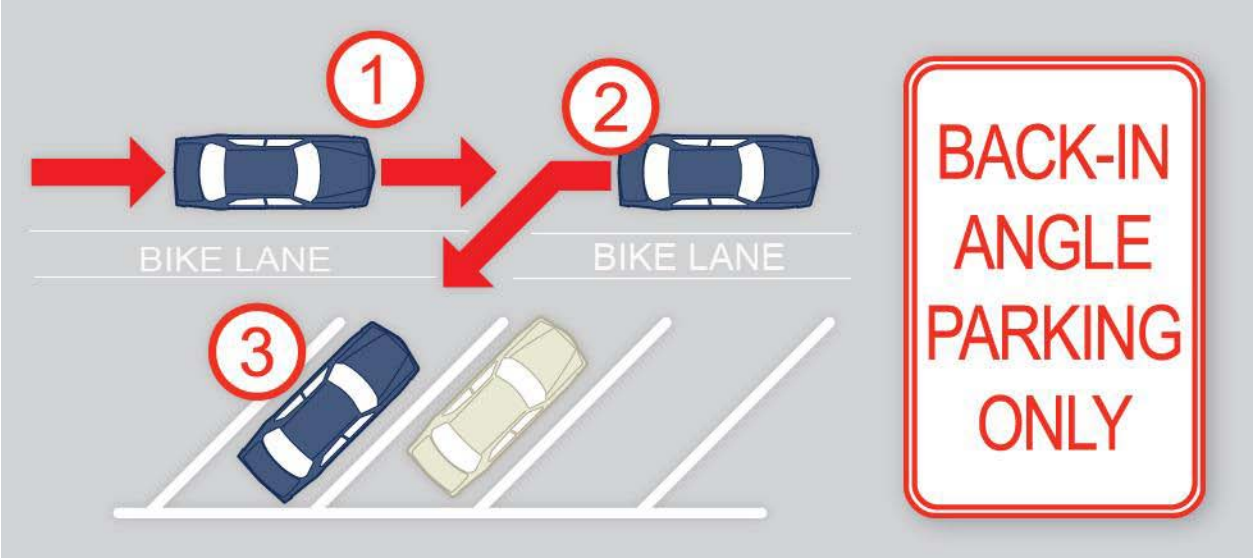


Figure 9-1 Back In Angle Parking. *Source: GetAbout Columbia, Modified by Addison Green*

Back in angle parking is a relatively rare program in the U.S. which has been growing in popularity in recent years. The demonstration project on Ash Street in Columbia, MO, is unique among the pilot programs, and the intention is to help address concerns about cyclists getting hit by opening car doors. Additionally, cars driving out of their parking spots have a better view of oncoming cars and cyclists as they reenter traffic. Figure 1 demonstrates how the system works.

Before and after data on Columbia's program is not available, but back in angle parking projects have been installed sparingly in a variety of cities, including Washington D.C., Tucson, Arizona, Seattle and Vancouver, Washington. A study conducted by the City of Vancouver in 2005 found that the program increased bike traffic in the area by 235% after bike lanes and back in angle parking spaces were added, but that the number of collisions between cyclists and cars was low before the program and remained low. The project's effect on safety was, therefore, inconclusive, and the inclusion of bike lanes rather than the parking spaces is most likely to have contributed to the rise in bike traffic. Unexpectedly, Vancouver's back in program did not serve as a traffic calming element. The street is posted as a 25 mph zone, and prior to the project, traffic averaged between 35 and 36 mph. After the project was installed, average speed rose to 38.5 mph (Boulanger 2005). However, a similar program in Tucson, AZ, had much more conclusive results regarding the program's potential to improve safety. Prior to installing back in angle parking along a stretch of road in downtown Tucson, the city reported an average of 3-4 bike/car collisions per month. After the project was installed, the area has not experienced a single accident in the subsequent 5 years (Losch).

Intersection Improvements

Accidents occur most often at intersections, though the bulk of existing literature on perceived levels of bicycle safety focuses primarily on mid-block roadway segments (Krizek 2007: 7). But intersections tend to be confusing for cyclists. In some cities, cyclists are not required to make complete stops at stop signs if there are no cars approaching the intersection (Mapes 2009: 201) because it requires a significant amount of energy for cyclists to get moving again. Stalled cyclists can cause impatient motorists to move into oncoming traffic in order to overtake them. Additionally, bike lanes tend to disappear when approaching intersections so that cars can make right turns, further confusing cyclists.

Columbia and Marin have both invested in tackling issues at intersections. The two approaches are very different and have been met with mixed reactions. Marin has allocated funding to install special cameras that recognize cyclists and trigger the stop light at intersections. Ordinarily, a cyclist would have to wait at a light until a car came along to trigger the light or else the cyclist would run the light. This makes riding on the road more convenient, and decreases the chance that a car will get caught behind a cyclist. Columbia originally designed eight intersection improvements composed of wedge-shaped concrete islands where pedestrians and cyclists can wait for cars to pass (An example of this type of intersection improvement can be found in Figure A-7 of the Appendix). Of those eight, three have been constructed and three have been dropped. Reactions to the new intersection islands border between positive and indifferent. In fact, many users were unsure how to use the new islands causing GetAbout Columbia to paint a portion of the bike lanes green (sharrows) leading into the islands so that cyclists would know where to ride (Berger 2009).

Bike Climb Lanes (Class II Bikeways)

Bike climb lanes are designated lanes along roads with a steep grade. As mentioned previously in the intersection discussion, bicycles traveling slowly uphill impede vehicle traffic enticing motorists to attempt to overtake the cyclist, or else to force the cyclist to the edge or the road where debris often collects. The only NMTPP community to suggest building a bike climb lane is Marin, since the majority of the county is coastal and hilly. This type of infrastructure is particularly relevant in hilly communities that wish to maintain the connectivity of its nonmotorized transit system but cannot spare extra space for a separated route.

Sharrows (Class II Bikeways)

Sharrows were originally designed to address problems with connectivity between bike lanes and paths. Sharrows are used along routes that are too narrow to accommodate a full bike lane so chevrons are painted on the roads to signal to motorists that they are supposed to share the lane with cyclists and not to try and overtake them. The only pilot program to use sharrows is Columbia, and they used them as a part of their intersection improvement projects. Figure 2 demonstrates how GetAbout has planned to do this.

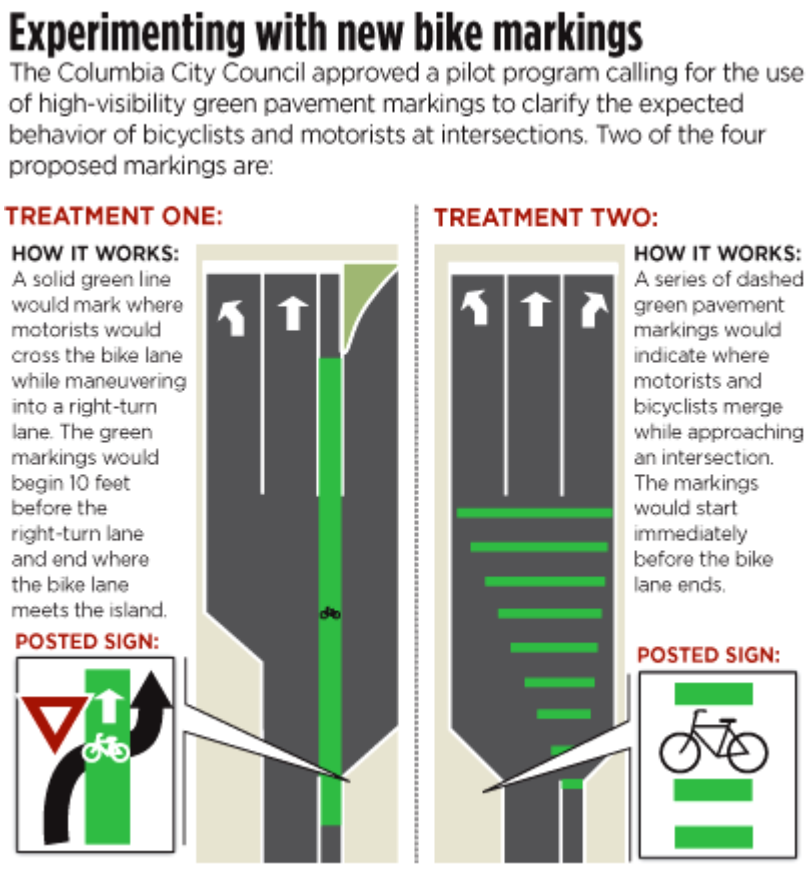


Figure 9-2 Sharrows approaching intersections in Columbia, MO. *Source: GetAbout Columbia*

GetAbout Columbia refers to these green intersections as sharrows, but the only real characteristic that they share with traditional sharrows is the signage painted directly on the asphalt. GetAbout Columbia has not released any information on how these new markings have been received by the community.

Bike Boulevards

Both Columbia and Minneapolis have made plans to develop bike boulevards, though neither has yet completed one. Bike boulevards are Class II bikeways which seek to limit automobile access without hindering cyclists. Several cities have experimented with bike boulevards and a number of studies have shown that the presence of bike boulevards does not necessarily increase the number of cyclists on the road, but they can influence where people choose to live (VanZerr 2008: 2). Someone who may not have been inclined to bike where they formerly lived may choose to move to a bike boulevard so that they may be able to bike safely and conveniently. Another factor which drew some residents to bike boulevards was that quieter streets with less traffic is perceived to be safer for children, therefore bike boulevards can be particularly appealing to families.

In a survey done in Portland, OR, on residents who live on a bike boulevard 18.4 percent of respondents said that the bike boulevard designation factored positively into their decision to move to that street. 0 percent said that it was a negative factor while the remainder was either indifferent, unaware of the designation, or had been living on the street prior to its designation as

a bike boulevard (p.14). The survey also found that 42 percent of respondents said that the boulevard made them more likely to ride a bike while 54 percent said it wasn't a factor at all indicating that the boulevard is likely to encourage more people to ride than it would discourage considering only 4 percent of respondents said that the boulevard negatively affected their decision to bike (p.15). Interestingly, the study found that while the majority of respondents look favorably on the bike boulevard, the study reported that "the majority of respondents said the Bicycle Boulevard designation has had no impact on Safety for Children, Convenience for Pedestrians, or the Number of Traffic Collisions on the street" (p.16). In this case, at least, it would appear that bike boulevards do not influence respondents' perception of safety though it does not negatively affect their willingness to bike. This may be because cycling is not generally perceived to be unsafe in Portland, so bike boulevards may not impact that perception. This is based off of the assumption that Portland experiences high rates of cycling because cyclists view the system to be safe. The Portland State study, however, does not address this assumption, as such, but it does note that a significantly higher share of non-cyclists (67.7 percent) than cyclists (33.3 percent) felt that the Bicycle Boulevard designation has no impact on traffic collisions (p.20) indicating that cyclists do consider bike boulevards safer.

The study did ask respondents what improvements they would like to see made to their bicycle boulevard. 51.3 percent of respondents wanted more signals at "problem intersections" while 39.5 percent wanted to see traffic laws enforced more frequently (see *The Importance of Law Enforcement* section). 34.2 percent wanted bike traffic and vehicle traffic to be separated entirely (p.18), though this figure may be due to the assumption that this would be safe for cyclists or more convenient for motorists.

9:3:2 Infrastructure to Modify Behavior

Whether on or off-road bikeways, it is important to develop bicycle infrastructure as a tool to modify cyclists' behavior. Improvements to Class II bikeways have the highest potential to improve overall safety of cycling, since fewer accidents occur on off-road bike ways than do along roads and intersections. Furthermore, Class II bikeways allow cyclists to claim their own space on the road and to perform as vehicles. When cyclists view themselves as vehicles, they are more likely to observe traffic laws and signals (Van Houten 2005: 7). The likelihood for bicyclist behavior to cause a crash is contingent on good and bad behavior. A Canadian study observed 900 bicyclists' actions and compared them to 2,300 crashes over 13 years. The study concluded that bicyclists generally tended to stop or yield at signals, but when they did fail to stop, they were responsible for causing 11 percent of crashes. When a cyclist decides to forego the road entirely, and choose to ride on the sidewalk, the same Canadian study found that it was 14 percent likely to be a factor should a collision occur (FHWA 1995: 31). FHWA reported that bicyclist errors may have contributed to 64.6 percent of bicycle-motor vehicle related fatalities in 1991. The most common errors were:

- Failure to yield (21.8 percent),
- Improper crossing of a roadway or intersection (12.6 percent)
- Failure to obey traffic signs, signals, or a police officer (8.6 percent collectively) (p.31).

The FHWA warns not to take these statistics at face value because they "may mask the failure of motorists to search for and yield to bicycle traffic, as well as the low level of police training in investigating bicycle-motor vehicle crashes" (p.31). What they do suggest, however, is that safety could be greatly improved by designing bikeways that would cause cyclists to obey and

observe traffic laws. Their increased visibility on the road will also help to alleviate any failure that motorists might have in observing cyclists on the road.

As mentioned before in the discussion about cyclists riding on the sidewalk in Minneapolis, cyclists who choose not to ride in the street run a higher risk of getting into a collision with a car than they might on the street. This may seem counterintuitive, but Bike Walk Twin Cities cites a study which found that it is 5.3 times more dangerous to cycle on the sidewalk because drivers at intersections or driveways do not always anticipate cyclists on sidewalks, and are therefore, unprepared to encounter anyone moving at the speed a cyclist does. (Bike Walk Twin Cities 2009: 7). While it is not illegal in many places, and it may be advisable for children, riding at low speeds, to utilize the sidewalk, high rates of sidewalk riding is an indication that cyclists do not feel safe on the road. Class II bikeways (i.e. bike lanes and paved shoulders) are required to encourage cyclists to use the street, thereby improving safety.

9:3:3 The Importance of Law Enforcement

Unfortunately, law enforcement is typically underutilized when it comes to walking and biking safety. Due to the fact that most law enforcement officers did not receive much, if any, bike/pedestrian training, the laws tend to not be enforced or fully understood. This is especially true in cities where bikes make up a smaller segment of the transportation mode share. In light of this, both Columbia and Sheboygan have designed special programs to help law enforcement understand and uphold bike laws, as well as City ordinances prohibiting the harassment of bicyclists. In June of 2009, the Columbia City Council enacted an ordinance which seeks to punish anyone who endangers a cyclist. It addresses specific, prohibited acts such as throwing objects at a cyclist, honking to frighten and other threatening behaviors. It gives Columbia Police explicit powers to investigate reports of harassment and to bring charges, if appropriate. The ordinance, not only helps to define what constitutes as harassment, but also determines what sort of legal action may result from violations. Credible complaints are followed up in the same way as other allegations against individuals, including motorists. If appropriate, misdemeanor charges may be brought against the driver of the vehicle or other person involved in the complaint (Columbia City Code Sec. 16-141).

Sheboygan County invested $35,256 of its NMTPP funding on courses designed to provide safety training specific to bike/pedestrian policies for all law enforcement agencies within the county (Table B-4). Better law enforcement not only targets motorists, but also targets bad behavior by cyclists. This has the dual mission of improving safety and predictability as well as public perception of cyclists.

All four pilot programs have implemented "Share the Road" campaigns. Share the Road campaigns are based on the recognition that cyclists and motorists are equally responsible for road safety. The primary goal of the campaign is to enforce city ordinances and state statutes regarding rights and duties of bicycle and motor vehicle operators. These duties include:

- Cyclists' use of a white, front facing light and red, rear facing reflector in low light situations.
- The need to obey all traffic devices including stop signs and red lights.
- Riding upon sidewalks in business districts is illegal.
- Cyclists must ride in same direction of traffic.
- Motorists should not harass bicyclists by honking or shouting at them.

- Motorists should have the responsibility to pass bicyclists only when it is safe to do so (GetAbout Columbia Operation Share the Road 2008).

Share the Road campaigns are common across the country, though data on the effectiveness of the campaign is unavailable.

Speed limit enforcement is a crucial element in attracting more users to on-street bike facilities. Decreasing traffic speed has the potential to increase bike use among children, specifically. With this in mind, Sheboygan has increased its police presence in school zones with the goal of obtaining 90 percent speed limit compliance (Table B-4).

Bike Helmet Use: Improvement or Hindrance to Safety?

Helmet use has been the subject of much debate amongst bike advocates. That they can save lives and decrease the severity of bike injuries is undeniable. About two-thirds of the deaths and one-third of the injuries involve the head and face. Wearing a helmet can reduce the risk of head injury to bicyclists by as much as 85 percent (Cleveland Clinic 2010). What is heavily contested is whether or not helmet-use decreases the number of accidents, or whether it increases them. Several studies have concluded that helmet-use results in risk compensation and causes cyclists to become less cautious (Mapes 2009: 224). The same can be true of motorists, who may be less cautious around a helmet-wearing cyclist. A study out of Cambridge, England, electronically measured how close drivers came to a cyclist when he rode with and without a helmet. The study found that drivers gave the cyclist more leeway when he wasn't wearing a helmet (Walker 2007: 420).

Helmet laws also have to potential to discourage bike use. Studies out of Australia, New Zealand and Canada revealed that bike use fell after bike helmet laws were enacted. Helmet use in Copenhagen and Amsterdam is rare, but in the U.S., helmet use is almost always included in any bike safety campaign, though cyclists are three-times more likely to die in bike-related accident in the U.S than they are in Amsterdam (Mapes 2009: 225).

In spite of this, many states still consider helmet-use to be one of the most important factors in improving bike safety. The first bicycle helmet law was passed in California in 1986 and became effective in 1987. This law was amended in 1994 to cover anyone under age 18. As of October 2002, 20 States (including the District of Columbia) have enacted age-specific bicycle helmet laws. Most of these laws cover bicyclists under age 16. As of 2009, Marin County, California remains the only pilot program with a mandatory helmet law for minors (Cleveland Clinic 2010).

Chapter 10: Recommendations and Conclusion

This thesis set out to identify how best to build a bicycle infrastructure which is perceived to be both safe and convenient, thereby encouraging larger numbers of people to ride their bikes for transportation rather than just recreation. The Nonmotorized Transportation Pilot Program seeks to accomplish these goals, and unfortunately, due to unforeseen difficulties getting projects approved at the federal level, the program has not completed the majority of its projects, which has delayed the data collection phase. As a result, this thesis suffers from the same problems that have historically faced synthesizing evidence on bike use. Since all four pilot programs are at such different stages of data collection, it is difficult to compare the success of one against the success of the others. Furthermore, my analysis relies mostly on ridership counts, which without the results of more face-to-face surveys and information on the number of new cyclists on the road, offers an incomplete picture of what the NMTPP has actually achieved. More time is required, therefore, to gather more data from which to definitively assess the NMTPP. Instead, this thesis provides a look at different strategies for creating a bikable community and their potential for improving the perception of safety. The objective, overall, is to promote cycling as a legitimate form of transportation, in an effort to provide an alternative to the automobile.

10:1 Recommendations

In the following section, I offer my recommendations for what programs other communities might consider including in their own bicycle networks. My conclusions pull from what the NMTPP has demonstrated thus far as well as comparable projects in other cities. I divide my recommendations into communities with little to moderate, and moderate to extensive existing bike networks.

Communities with Little to Moderate Existing Infrastructure

Communities with little to moderate existing bicycle infrastructure need to focus on creating a comprehensive network of both Class I & II bikeways to accommodate a variety of cyclists with varying skill levels. The ideal network would provide access to places where people want to go, rather than just through parks and other recreational areas. With the availability of safe and convenient infrastructure, many drivers will shift some of their trips to bicycling and walking. It is important to label or use on-street signage to denote where these bikeways exist, and when possible, communities should try and build bikeways which are explicitly for bike use (e.g. bike lanes and bike trails rather than sharrows and paved shoulders) in an effort to limit interaction between bikes and motor vehicles. However, where gaps in the network exist, communities might consider sharrows and paved shoulders to link disconnected routes. Specifically, sharrows should be used on narrow streets with roadside parking for cars. This may serve as a signal to cyclists and motorists that bikes deserve space on the road as well as to discourage cyclists who might be inclined to move onto the sidewalk. Paved shoulders can be used where there is no roadside parking and in rural areas where traffic is lower. These have been used to great affect in Sheboygan County, the least densely populated of the four pilots, between urban areas where bike lanes are not necessary. Paved shoulders, however, must be accompanied with signage denoting the road as a bike route because their use as a bikeway may not be apparent to either motorists or potential cyclists.

Education is particularly important in communities with new bike networks. Not only might users be unfamiliar with how to use these new facilities, but they may not have previously considered the bicycle as a convenient mode of transport. Furthermore, educational programs may help overcome some of the gaps in the network by providing cyclists with the skills and confidence to safely ride in the streets. Even though neither Columbia nor Sheboygan managed to complete many of their infrastructure projects, both saw a large increase in the mode share of bike use based on early counts and surveys because they were able to implement a variety of educational programs. The Columbia, MO pilot project is a strong example of a program that offers several classes year-round that are targeted at different age groups and skill levels. These programs cover the basics of bike safety and etiquette, but they all build upon each other to encourage students to take each successive level.

Finally, law enforcement is particularly important in accommodating higher numbers of cyclists in communities that are unaccustomed to high bike use. Sheboygan County has demonstrated sensitivity to this issue by creating courses for law enforcement officials throughout the County who had never been trained to deal with cyclists or who had previously been unaware of bicycle laws. City ordinances can also serve to provide a safe environment for cyclists. Columbia created a city ordinance to discourage harassment of cyclists, further promoting cyclists' right to use the road.

Communities with Moderate to Extensive Existing Infrastructure

Beyond identifying gaps in the current network, communities with moderate to extensive existing bike networks have the opportunity to entice more people to bike over longer distances by linking their networks to public transportation. To be efficient, public transportation requires effective bicycle and pedestrian networks because bicycling and walking provide the most convenient ways to access public transportation. Improvements that make the route to public transportation more pleasant and safe will also draw more people to public transportation. A good example of this is Marin County, which has planned many of its bikeways to link transit hubs with residential areas, while simultaneously expanding its railway system. Smaller steps to also consider are bike parking at transit stops or bike-on-bus racks which are featured in Sheboygan County and Columbia and have been demonstrated to increase ridership on buses in both communities.

While comprehensive classes similar to the Columbia pilot program might still be offered, more developed communities might consider wide-spread advertising campaigns to target specific issues that might make biking unsafe (see figure E-11 for an example). Important issues to address include:

- The hazards of biking on the sidewalk
- How to make a turn across a bike lane
- Looking out for cyclists when opening a car door

By inserting these images into the landscape of the community, motorists and cyclists alike will be more aware and alert, thus making cycling safer in the long run.

10:2 Conclusion

Transportation has become a one-dimensional affair. Half of all trips we take are only three miles or less—yet we drive almost everywhere we need to go, even to the closest destinations. Rates of car ownership in the United States are the highest in the world, and the number of cars per household now exceeds the number of drivers (Rails-to-Trails Conservancy 2008: 7). For most Americans, the predominance of the car and the lack of adequate infrastructure for bicycling and walking have basically eliminated all transportation options except for one—driving. If we wish to solve problems associated with congestion, pollution, and public health issues caused by the over-use of the automobile, then we have to provide other options that are safe and equally convenient. By improving our cycling infrastructure and encouraging more people to ride bikes, we can assert the cyclists' right to use the roads as well as provide segregated bikeways for more cautious cyclists. In the United States, utilitarian cycling has become visible but it's still not mainstream, and support from the government and political will may be the catalyst to making the bike a viable mode of transportation in American cities.

Appendices A, B, C, D, & E

Appendix A: Columbia, Missouri

Table A-1: Demographic and Economic Characteristics and Travel Behavior within Columbia, MO

	Columbia	Avg. Among Pilots	Spokane (Control)
Geographic Area (sq mi)	53.0	185.9	1764
Persons per sq mi	1,592.8	2,675.6	241.3
Population			
Total	84,531	203,232	425,684
Total Population 25+	46,650	137,079	276,887
Median Age	26.8	34.0	35.4
Household Income			
Total # of Households	33,819	85,113	163,611
Less than $25,000	20.4	22.2	32.2
$25,000-49,999	26.8	24.2	32.1
$50,000-75,999	21.7	21.0	19.3
$75,000-99,999	14.9	12.0	8.5
$100,000 or More	16.2	17.2	7.9
Median Household Income (2006 $)	$63,273	$62,865	$45,145
Race (includes Hispanic and non-Hispanic)			
White	81.5	80.8	88.4
Black	10.9	8.2	2.3
Asian	4.3	4.6	2.1
Other Race or Multiracial	3.2	6.5	4.1
Hispanic (any race)	2.1	7.8	3.1
Work Commute			
Total # of Workers 16 and over	44,919	108,516	191,195
Car, Truck or Van- drive alone	75.2	70.8	76.5
Car, Truck or Van- Carpool	11.7	11.0	12.3
Public (includes taxi)	1.1	6.6	2.8
Walk	7.0	5.1	32.8
Other Means	2.1	2.0	1.2
Work at Home	2.9	4.5	4.1
Mean Travel Time (minutes)	15.3	21.6	21.2
Bike Commute	0.95		0.57
Household Characteristics			
Total # Occupied Units	33.689	85,060	175,005
Average Number of Vehicles per Household (owner occupied units)	1.9	1.9	1.6
Average Number of Vehicles per Household (renter occupied units)	1.5	1.3	1.3
October Climate (degrees Fahrenheit)	Columbia Airport	Avg. Among Pilots	Spokane Int'l Airport
Average Temp (max)	67.5	65.1	58.5
Average Temp (min)	45.5	44.5	36.0
Inches of Rain	3.1	2.3	1.2

1: Source for all Demographic data: 2000 U.S. Decennial Census; Source for Meteorological Data: University of Minnesota Research Team

Table A-2: Existing Transportation Network Prior to Pilot Program

	City of Columbia	Avg. Among Programs	Spokane (Control)
Transportation Network			
Public transit buses[7]	24	885.25	288
Number of track miles of Light Rail[8]			
Number of ferryboat vessels[9]			
Annual Vehicle Revenue Miles[10]	540,281	8,125,608.5	7,855,371
Bicycle and Pedestrian Network			
Miles of off-road lanes or pathways	25 miles	37.8	Unavailable
Miles of marked or striped bike lanes	28 miles	25.89	Unavailable
Miles of sidewalks	350 miles		Unavailable
Percent of roadways with sidewalks on at least one side of the street	61%		Unavailable
Total Fare Revenues[11]	$196,190	$22,544,980.25	$5,847,503

[7] "Vehicles Available for Maximum Service" from Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.
[8] From Federal Transit Administration's National Transit Data Tables (Table 23)
[9] Number of Ferryboat vehicles operated in maximum service by Golden Gate Bridge, Highway and Transportation District from Federal Transit Administration's National Transit Database 2005 Data Tables (Table 24)
[10] "Annual Vehicle Revenue Miles" from Federal Transit Administration's National Transit Database 2004 Transit Agency Profiles. This figure represents the number of miles that vehicles travel while in revenue service. Vehicle revenue miles (VRM) include layover/recovery time, but exclude deadhead, operator training and maintenance testing, as well as school bus and charter services.
[11] "Total Fare Revenues Earned" from Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.

Table A-3: Transportation Usage and Travel Behaviors Prior to Pilot Program

	City of Columbia	Avg. Among Pilots	Spokane (Control)
Transportation Usage			
Total annual "unlinked" public transit trips[12]	540,181	20,062,317.5	8,280,757
Total annual passenger miles[13]	2,092,610	102,381,021	40,931,915
Average weekday "unlinked" public transit[14] trips	1,898	65,736	28,634
Bicycle			
Average daily trips[15]	3.82	3.09	2.45
Average trip distance[16]	7.94 miles	8.19 miles	8.55
Average trip duration[17]	47.7 minutes	46.05 minutes	51.3
Pedestrian			
Average daily trips[18]	2.54	2.42	2.18
Average trip distance[19]	2.12 miles	2.24 miles	2.18 miles
Average trip duration[20]	42.4 minutes	44.73 minutes	43.6 minutes
Percent of trips to/from transit via bicycling/walking	89%	76.5%	78%
Percent of trips to/from transit via driving	11%	23.5%	22%
Reduced auto use due to bicycling and walking (miles per adult per day)[21]	0.447 miles	0.547 miles	0.310 miles
Total annual estimated reduction in auto travel due to bicycling and walking (in miles)	11,044,959 miles	39,769,395.5 miles	17,708,337 miles
Automobile Vehicle Miles Traveled[22]	6,565,000	4,844,955,345	Unavailable

[12] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles; public transit boardings.
[13] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles; One passenger riding one mile is one passenger mile.
[14] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.
[15] University of Minnesota Study. Data represent average number of trips by commuters, per day, and excludes other destinations. Data are measured in miles, and refer to total daily miles for commuters only, not destinations. The total daily mileage has been calculated by UMN, and is a function of average daily bicycling duration multiplied by distance covered at a typical speed of 10 miles per hour.
[16] University of Minnesota Study. UMN calculated this figure based on the percentage of trips that fall into each of the three categories of trip duration. Actual duration in minutes was not solicited from UMN survey respondents; rather, respondents categorized their trip duration according to three ranges (10-29 min., 30-59 min., and 60+ min.). An average total daily bicycling duration was derived from this information.
[17] University of Minnesota Study. The data points in this row represent the average daily number of pedestrian trips taken by commuters, not destination walkers.
[18] University of Minnesota Study. Data are measured in miles, and refer to total daily miles for commuters only, not destinations. The total daily mileage has been calculated by UMN, and is a function of average daily walking duration multiplied by distance covered at a typical walking speed of 3 mi/hr.
[19] University of Minnesota Study. Actual duration of daily walking (in minutes) was not solicited from UMN survey respondents; rather, respondents categorized their total daily walking duration according to three ranges see footnote x, above). An average daily walking duration was derived from this information.
[20] University of Minnesota Study. These data represent total number of miles of avoided auto use per adult resident per day, and represent the average of upper and lower bound estimates.
[21] Marin County: Metropolitan Transportation Commission (2007). Minneapolis data are from MnDOT (2001), and include all VMT in Anoka, Hennepin, and Ramsey Counties. Sheboygan County: WIDOT (2005). Columbia data are from the City of Columbia, MO.
[22] University of Minnesota Study.

Table A-4: Infrastructure

Project Type	Name
Infrastructure (Priority 1)	Missouri-Kansas-Texas Rail Trail (MKT) Hinson Creek and Bear Creek Trail Projects: Class I
	Acquisition of additional trail Right of Way for four trails[23]
	Downtown and University of MO-Columbia hub/spoke bicycle lanes[24]: Class II
	Demonstration bicycle route Project in Downtown Class II
	Three Intersection Projects
	Five Bridge Overpass Projects Class I
	Demonstration Grate Replacement Project
	Downtown Bicycle Racks
	University Projects (including shelters, racks, striping, and trail extensions)
	Neighborhood and school-area sidewalks Class I
	Three Pedestrian Walkways Class I

Source: NMTPP Interim Report to Congress 2007: 19

[23] Right of Way- Gives trails the right to cut through private property, thus connecting previously fragmented segments.
[24] Hub/spoke- A model where bikeways are planned to intersect at a central hub from which they radiate outward.

Table A-5: Non-infrastructural Programming

Program Type	Name	Description
Community	Errand Bikes	Local Businesses may sign up to be part of a free bike share program aimed at providing convenient, nonmotorized transportation for errands, personal or business-related. These bikes are available to employees who wish to use the bikes to commute to work and may be checked out for 30 to 60 days. Includes an optional one hour safety course.
	Guided Rides	A series of bike rides around the Columbia Area led by trained bike experts. Some rides are geared towards families and others are focused on recreational tours of the city and the surrounding countryside. Free bike rental is available for some rides.
	No Car, Low Car and Whoa! Car Challenge	Urges citizens to cut down or eliminate their use of a car for a full month. There are three commitment levels: • No Car- Individuals must go entirely without the use of any motorized transportation for the length of the challenge. Public transit modes are acceptable, but no private motorized transportation is allowed. • Low Car- Individuals are allowed the use of a car for one weekend. • Whoa! Car- Allows individuals to use a car one day a week for grocery shopping, errands and appointments.
	Cycle Recycle	Recycles and restores used bikes and gives them away to those who need them. Since the program began in 2001, it has given away 950 bicycles to Columbia residents.
Educational	WalkSafe BikeSafe	Teaches Columbia Public School children in grades K to 3 some basic bike and walking safety in PE class. The curriculum includes: • WalkSafe: Where to walk, who to walk with, which side of the road to walk on, where to cross the road, and how to cross at an intersection. • BikeSafe: Who to bike with, what to wear when biking, correct bike size, where to ride, and how to cross sidewalks and driveways.
	Bike Pro	Teaches Bike Safety Education for children ages 10 to 14. Sessions include four two-hour lessons and cover: balance and control, scanning and signaling, road positioning and turning, hazard avoidance and emergency stopping, and the rules of the road. The course is taught by a League of American Bicyclists certified instructor and are specifically arranged for target groups like scout groups, youth groups, neighborhoods, etc.
	Confident City Cycling	Teaches people (age 14 and up) how to ride safely and confidently on city streets. Classes are taught in three sessions over three hours each and covers: bicycle safety checks, fixing a flat tire, on-bike skills, and crash avoidance techniques. Course is taught by a League of American Bicyclists certified instructor for a fee though financial assistance is available.
	Bike Skills 101	A three-hour crash course geared toward adult cyclists who cannot take the full Confident City Cycling course.
	Commuting	A one session, three-hour course geared toward the adult cyclist who wants to learn more about commuting to work or school by bike. The course covers: route selection, bike choice, dealing with cargo and clothing, bike parking, lighting, reflection, as well as foul weather riding.
	Bike Buddy	Work with a certified bike expert to learn basic skills that make bike commuting easy and convenient. Includes tutorials on how to get your bike on the bus and how to spot bike maintenance problems as well as instruction on which routes to take to any destination. Program is open to anyone over the age of 18 and strives to give riders more confidence when navigating city traffic.

	Earn A Bike	In partnership with Walt's Bike Shop, allows local kids to earn a bike by learning the fundamentals of bike safety and maintenance. In order to get a free bike, kids have to complete two two-hour sessions in which they learn how to fix minor bike problems and about road safety.
Training	Walking School Bus Program Workshops	Groups of parents and children walk to school together in highly visible clusters.

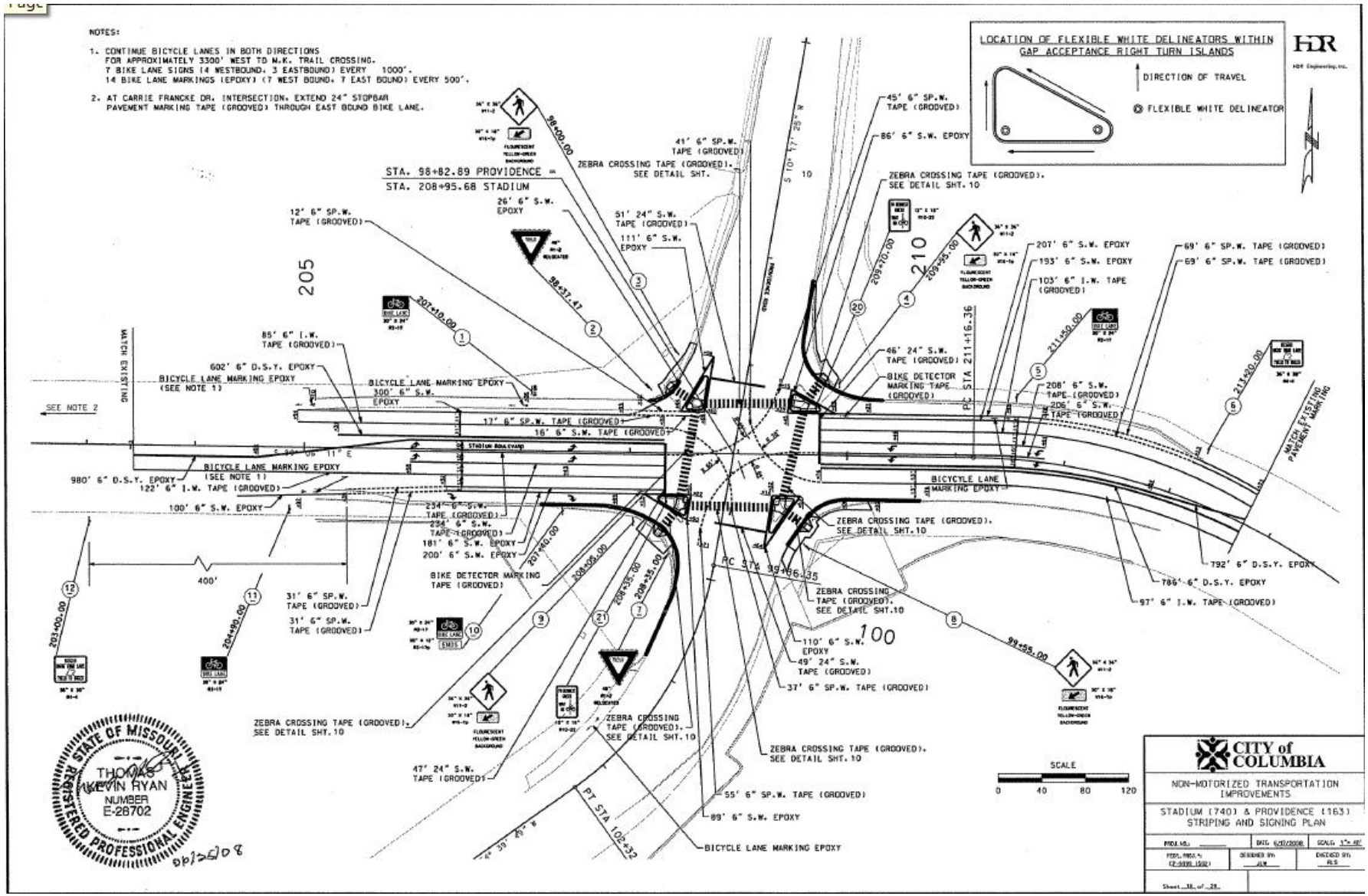
Source: PedNet.org 2009

Table A-6: GetAbout Columbia Budget as of November 2009

Category	**Estimated Budget**
Payroll and Supplies	$1,212,130
Promotion and Education	$3,475,080
Studies	$350,000
Street Markings, Bike Racks, Bike Boulevards, Wayfindings and Evaluation	$1,679,824
Construction 2009-10	
Intersections	$2,625,397
Repairing Sidewalk Gaps	$2,810,994
Trails	$5,323,032
Construction 2011	
Trails	$3,322,000
Pedestrian Improvements	$1,042,606
MKT Connection	$790,612
Total	**$22,631,675**
Federal Funds Available	**$22,530,000**
Difference	**-$101,675**

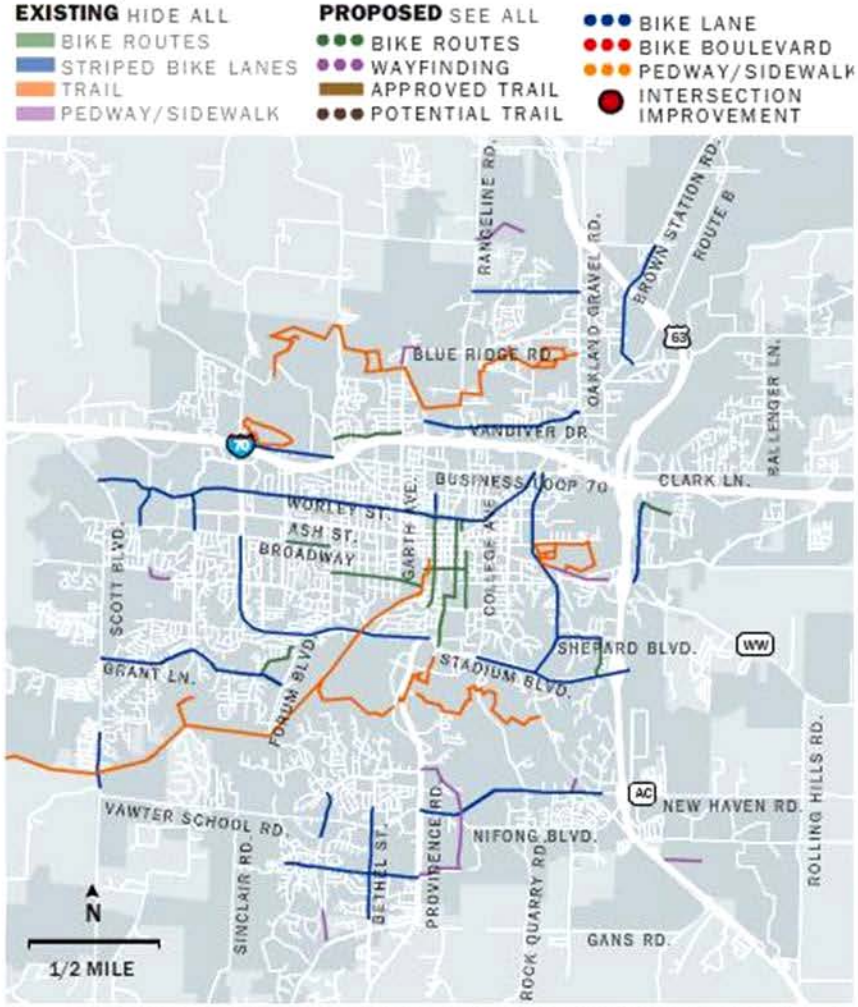
Source: Berger, Eric. "GetAbout Update: What's Finished, What's Been Dropped and What's Pending?" *The Columbia Missourian*. 18 Nov. 2009. Web. 7 Feb. 2010.

Figure A-7: Intersection Improvement Plan. Source: Getabout Columbia

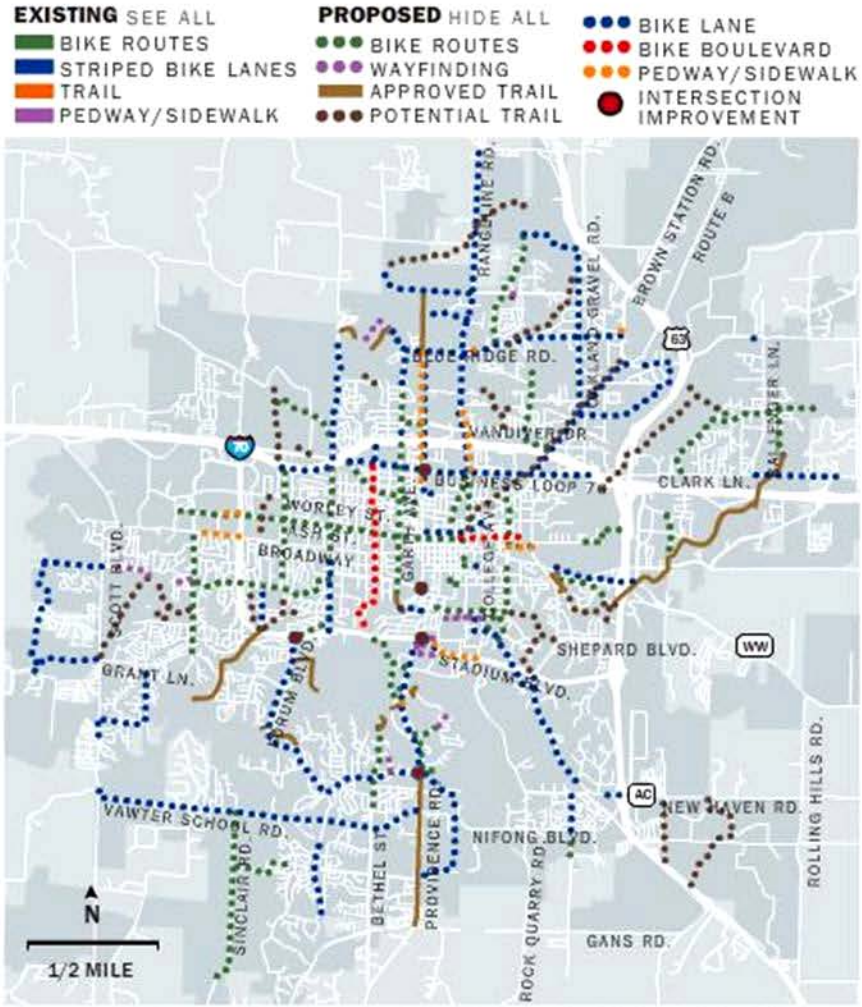


Columbia's Progress as of November 2009

Existing Infrastructure



Planned Infrastructure



SOURCE: http://www.columbiamissourian.com/multimedia/graphic/2009/11/18/getabout-columbia-map/popup/

Figure A-9: Back in Angle parking Along Ash Street between 7th & 9th Streets

Source: GetAbout Columbia 2009

Figure A-10 Back in Angle Parking Prior to Bike Lane- Source: GetAbout Columbia 2009

Appendix B: Sheboygan County, Wisconsin

Table B-1: Demographic and Economic Characteristics and Travel Behavior within Sheboygan County, WI

	Sheboygan	**Avg. Among Pilots**	**Spokane (Control)**
Geographic Area (sq mi)	514.0	185.9	1764
Persons per sq mi	219.3	2,675.6	241.3
Population			
Total	112,646	203,232	425,684
Total Population 25+	74,561	137,079	276,887
Median Age	36.8	34.0	35.4
Household Income			
Total # of Households	43,595	85,113	163,611
Less than $25,000	22.2	22.2	32.2
$25,000-49,999	19.5	24.2	32.1
$50,000-75,999	26.2	21.0	19.3
$75,000-99,999	11.2	12.0	8.5
$100,000 or More	7.7	17.2	7.9
Median Household Income (2006 $)	$55.951	$62,865	$45,145
Race (includes Hispanic and non-Hispanic)			
White	92.7	80.8	88.4
Black	1.1	8.2	2.3
Asian	3.3	4.6	2.1
Other Race or Multiracial	3.1	6.5	4.1
Hispanic (any race)	3.3	7.8	3.1
Work Commute			
Total # of Workers 16 and over	58,546	108,516	191,195
Car, Truck or Van- drive alone	81.0	70.8	76.5
Car, Truck or Van- Carpool	10.2	11.0	12.3
Public (includes taxi)	0.6	6.6	2.8
Walk	3.8	5.1	32.8
Other Means	1.3	2.0	1.2
Work at Home	3.0	4.5	4.1
Mean Travel Time (minutes)	16.9	21.6	21.2
Bike Commute	0.25		0.57
Household Characteristics			
Total # Occupied Units	43.545	85,060	175,005
Average Number of Vehicles per Household (owner occupied units)	2.0	1.9	1.6
Average Number of Vehicles per Household (renter occupied units)	1.2	1.3	1.3
October Climate (degrees Fahrenheit)	In City	Avg. Among Pilots	Spokane Int'l Airport
Average Temp (max)	59.4	65.1	58.5
Average Temp (min)	43.2	44.5	36.0
Inches of Rain	2.5	2.3	1.2

2 Source for all Demographic data: 2002 U.S. Decennial Census; Source for Meteorological Data: University of Minnesota Research Team

Table B-2: Existing Transportation Network Prior to Pilot Program

	Sheboygan County	Avg. Among Programs	Spokane (Control)
Transportation Network			
Public transit buses[25]	41	885.25	288
Number of track miles of Light Rail[26]			
Number of ferryboat vessels[27]			
Annual Vehicle Revenue Miles[28]	716,854	8,125,608.5	7,855,371
Bicycle and Pedestrian Network			
Miles of off-road lanes or pathways	35.5 miles	37.8	Unavailable
Miles of marked or striped bike lanes	1.75 miles	25.89	Unavailable
Miles of sidewalks	414 miles		Unavailable
Percent of roadways with sidewalks on at least one side of the street	Unavailable		Unavailable
Total Fare Revenues[29]	$490,035	$22,544,980.25	$5,847,503

[25] "Vehicles Available for Maximum Service" from Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.
[26] From Federal Transit Administration's National Transit Data Tables (Table 23)
[27] Number of Ferryboat vehicles operated in maximum service by Golden Gate Bridge, Highway and Transportation District from Federal Transit Administration's National Transit Database 2005 Data Tables (Table 24)
[28] "Annual Vehicle Revenue Miles" from Federal Transit Administration's National Transit Database 2004 Transit Agency Profiles. This figure represents the number of miles that vehicles travel while in revenue service. Vehicle revenue miles (VRM) include layover/recovery time, but exclude deadhead, operator training and maintenance testing, as well as school bus and charter services.
[29] "Total Fare Revenues Earned" from Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.

Table B-3: Transportation Usage and Travel Behaviors Prior to Pilot Program

	Sheboygan County	Avg. Among Pilots	Spokane (Control)
Transportation Usage			
Total annual "unlinked" public transit trips[30]	544,904	20,062,317.5	8,280,757
Total annual passenger miles[31]	1,926,024	102,381,021	40,931,915
Average weekday "unlinked" public transit[32] trips	2,000	65,736	28,634
Bicycle			
Average daily trips[33]	2.18	3.09	2.45
Average trip distance[34]	7.72 miles	8.19 miles	8.55
Average trip duration[35]	46.3 minutes	46.05 minutes	51.3
Pedestrian			
Average daily trips[36]	2.17	2.42	2.18
Average trip distance[37]	2.22 miles	2.24 miles	2.18 miles
Average trip duration[38]	44.4 minutes	44.73 minutes	43.6 minutes
Percent of trips to/from transit via bicycling/walking	84%	76.5%	78%
Percent of trips to/from transit via driving	16%	23.5%	22%
Reduced auto use due to bicycling and walking (miles per adult per day)[39]	0.256 miles	0.547 miles	0.310 miles
Total annual estimated reduction in auto travel due to bicycling and walking (in miles)	8,433,901	39,769,395.5 miles	17,708,337 miles
Automobile Vehicle Miles Traveled[40]	1,045,719,000	4,844,955,345	Unavailable

[30] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles; public transit boardings.
[31] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles; One passenger riding one mile is one passenger mile.
[32] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.
[33] University of Minnesota Study. Data represent average number of trips by commuters, per day, and excludes other destinations. Data are measured in miles, and refer to total daily miles for commuters only, not destinations. The total daily mileage has been calculated by UMN, and is a function of average daily bicycling duration multiplied by distance covered at a typical speed of 10 miles per hour.
[34] University of Minnesota Study. UMN calculated this figure based on the percentage of trips that fall into each of the three categories of trip duration. Actual duration in minutes was not solicited from UMN survey respondents; rather, respondents categorized their trip duration according to three ranges (10-29 min., 30-59 min., and 60+ min.). An average total daily bicycling duration was derived from this information.
[35] University of Minnesota Study. The data points in this row represent the average daily number of pedestrian trips taken by commuters, not destination walkers.
[36] University of Minnesota Study. Data are measured in miles, and refer to total daily miles for commuters only, not destinations. The total daily mileage has been calculated by UMN, and is a function of average daily walking duration multiplied by distance covered at a typical walking speed of 3 mi/hr.
[37] University of Minnesota Study. Actual duration of daily walking (in minutes) was not solicited from UMN survey respondents; rather, respondents categorized their total daily walking duration according to three ranges see footnote x, above). An average daily walking duration was derived from this information.
[38] University of Minnesota Study. These data represent total number of miles of avoided auto use per adult resident per day, and represent the average of upper and lower bound estimates.
[39] Marin County: Metropolitan Transportation Commission (2007). Minneapolis data are from MnDOT (2001), and include all VMT in Anoka, Hennepin, and Ramsey Counties. Sheboygan County: WIDOT (2005). Columbia data are from the City of Columbia, MO.

Table B-4: Educational Programs Focused on Promoting Bike Safety

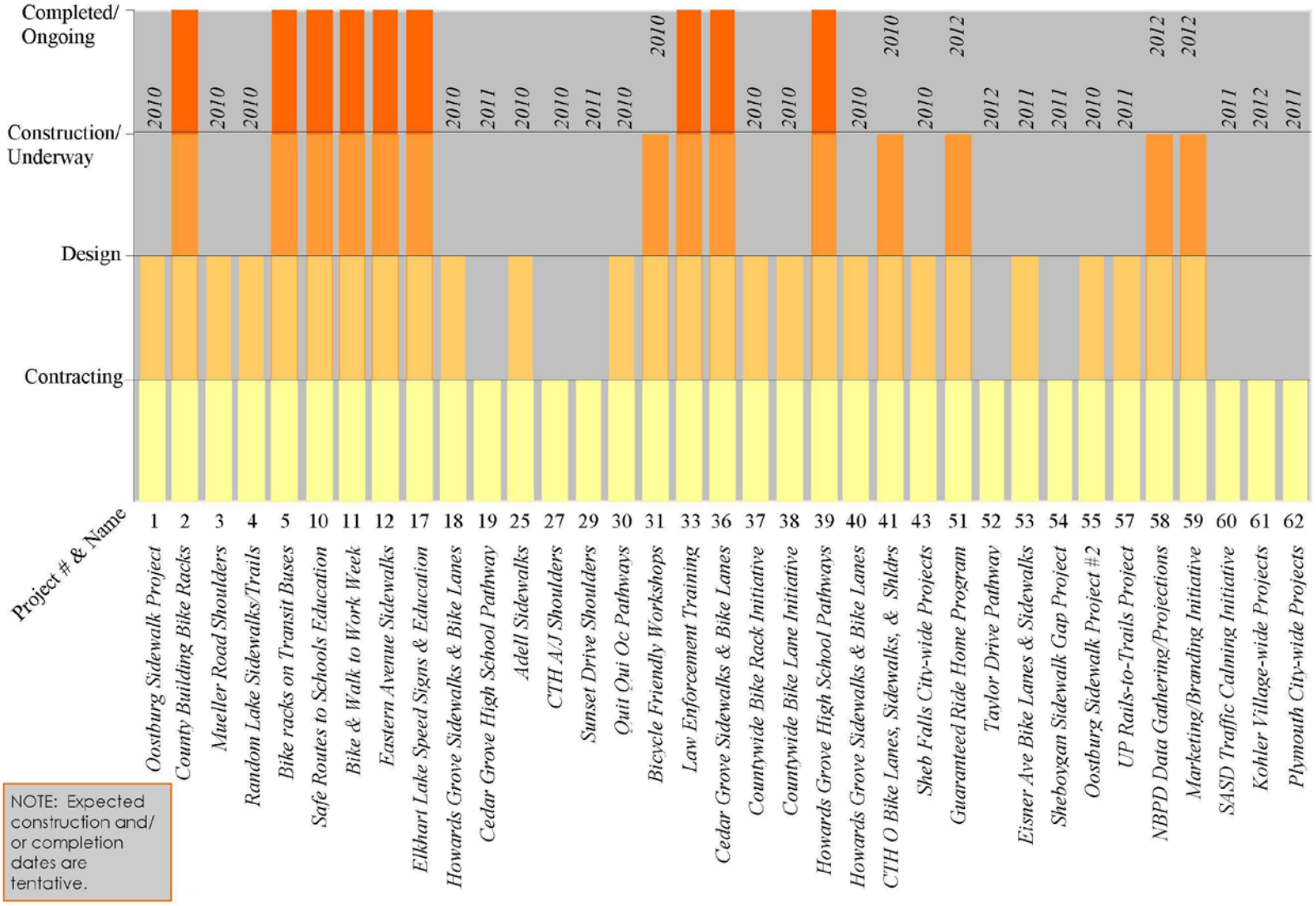
Program	Description	Cost
APBP Bicycle Friendly Communities Workshops (Association of Pedestrian & Bicycle Professionals)	**Scope** Three classes taught by APBP Executive Director and League of American Cyclists instructors. **Project Purpose** Educates community decision-makers by offering hands on training in bicycling safety around the respective community. Helps decision makers realize the challenges bicyclists face and educates them on the benefits of making their community more bikeable.	$10,400
WE Bike, etc. Law Enforcement Training	**Scope -** Provide bicycle and pedestrian training to law enforcement officers throughout the County. **Project Purpose -** The enforcement of laws is critical to improving pedestrian and bicycle safety and enjoyment. Unfortunately, law enforcement is typically underutilized when it comes to walking and biking safety. Due to the fact that most law enforcement officers did not receive much, if any, bike/ped training, the laws tend to not be enforced or fully understood.	$35,256
Safe Routes to Schools-Bike Federation of Wisconsin	**Scope -** Complete a SRTS plan for Sheboygan County schools by organizing volunteer committees and evaluating conditions within two miles of each school for on-sight bicycle/pedestrian facilities and hazardous conditions. The project will also include bike training classes for children at no less than four county schools. **Project Purpose -** Incorporating an educational/awareness/safety program as this enables and encourages children to walk and bike to school and thus, encourages a healthier, more active lifestyle from an early age. The community not only benefits from a healthier, safer citizenry, but also from the reduction in traffic congestion and the consequent reduction in auto emissions.	$64,480 One year
Village of Elkhart Lake Police Department	**Scope -** Project includes educational events such as bicycle rodeos, incorporating bicycle, pedestrian and active lifestyles materials into the school curriculum, hold a SRTS poster contest, provide prizes and other incentives for students who participate, coordinate event dates with the national SRTS program, and increase the enforcement of speed limits throughout the school zones with the use of speed boards and a police presence. **Project Purpose -** The goal for this project is a 45% increase in the number of students who walk and ride bikes to school. The project hopes to gain motorists compliance with school-zone speed limits by 90%. With the increased police presence and the introduction of speed boards, motorists will be more aware of their speed, thus making walking and biking safer for students and residents.	$9,350

Table B-5: Sheboygan County On-road Projects

Project	Description	Length	Cost	Scheduled Date of Completion
Eisner Avenue Sidewalks and Bike Lanes	5' sidewalks on both sides of the road and 5' bike lanes on both sides of the road	~1 mile	$861,300	Fall 2009
City of Plymouth Comprehensive Plan	Road widening to accommodate bicyclists	Entire City of Plymouth	$408,100	2010 thru 2012
Village of Cedar Grove Sidewalks & Bicycle Lanes	The addition of sidewalks and extra pavement width on a stretch of S Main Street where currently no bike/ped facilities exist. This project is part of a larger road reconstruction project.	2,100 feet	$439,513	Fall 2008
Cedar Grove-Belgium Schools Pathway	Install 10' multi-use pathway	800 feet	$27,050	Fall 2009
City of Sheboygan Falls Comprehensive Plan	5' Bike lanes, 5' sidewalks, 5' paved shoulders, 10' multi-use pathways, road diets and signage	Entire City of Sheboygan Falls	$2,641,617	Fall 2009
CTH O Bike Lanes, Sidewalks, & Paved Shoulders	Phase I of the project calls for a 10' multi-use facility. Phase II of the project calls for 5' bike lanes on both sides of the roadway and sidewalks on the south side of the roadway. Phase III calls for 5' paved shoulders on both sides of the roadway.	12.78 miles of bike lanes, 6.34 miles of sidewalk 11.82 miles of paved shoulder	$673,050	Fall 2009
Village of Howards Grove Sidewalks & Bike Lane Striping for Millersville Road	Five foot wide, bike lanes and ADA compliant sidewalks.	0.5 miles of sidewalks, 1.5 miles of bike lanes	$154,030	Summer 2008
Howards Grove Bike Lanes & Sidewalks	Close gaps in the existing sidewalk network and strips bike lanes to create a highly visible network.	3,020 feet of sidewalks, 4.5 miles of bike lanes	$82,414	Spring 2009
Mueller Road Paved Shoulders	Pave 5' shoulders on both sides of the roadway.	2.5 miles	$805,640	Spring 2009
CTH PP Shoulder Paving	A 5' paved asphalt shoulder	~1 mile	$57,960	Spring 2008
CTH A/J Paved Shoulders	Install 5 foot paved shoulders on each side of CTH A/J.	1,614 feet of paved shoulders and	$70,293	Spring 2009

		30 feet of crosswalk striping.		
Town of Sherman & Random Lake sidewalks and paved shoulders	The plan includes lane and crosswalk striping, solar flashing lights, paths, 5' sidewalks, ADA handicap ramps, and a retaining wall	1,590 feet of sidewalks, 1,992 feet of paved shoulders, 1,100 feet of pathways	$149,103	Spring 2009
Sheboygan Area School District Traffic Calming	Various traffic calming solutions.	Sheboygan Area School District Schools	$451,950	2010 thru 2012
Sunset Drive Paved Shoulders	5' wide paved shoulders	1 mile	$217,120	Fall 2008
Taylor Drive Multi-use Facility	10'-16' multi-use pathway with the width depending on the surrounding slopes	3.3 miles	$6,994,444	Fall 2010
Village of Kohler Comprehensive Plan	Updated crossing, road diets, road widening, sidewalks, & multi-use pathways.	Entire Village of Kohler	$926,651	2010 thru 2012
CTH A Shoulder Paving	A 5' paved asphalt shoulder	3 miles	$249,422	Fall 2008

Nonmotorized Transportation Pilot Program Project Status, Sept. 09



NOTE: Expected construction and/ or completion dates are tentative.

Table B-7: Bicyclist and Pedestrian Counts 2007 & 2008

	2007		2008	
	Bicyclists	Pedestrians	Bicyclists	Pedestrians
Location #	Total	Total	Total	Total
1	13	2	13	5
2	13	15	54	73
3	8	12	8	12
4	9	3	19	12
5	5	1	3	7
6	6	24	9	5
7	1	2	10	54
8	11	20	10	12
	76	**80**	**126**	**180**
Total Nonmotorized Users	**146**		**306**	

Source Sheboygan County 2009

Section B-8: Wisconsin Bike Laws

[adapted from the bracketed Wisconsin State Statutes]

Vehicular Status – The bicycle is defined as a vehicle. [340.01(5)] The operator of a vehicle is granted the same rights and subject to the same duties as the driver of any other vehicle. [346.02(4)(a)]

Lane Positioning – Always ride on the right, in the same direction as other traffic. [346.80(2)(a)] Ride as far to the right as practicable (not as far as possible). [346.80(2)(a)] Practicable generally means safe and reasonable. [346.80(2)(a)] lists a few situations where it is not practicable to ride far to the right:

- When overtaking and passing another vehicle traveling in the same direction;
- When preparing for a left turn at an intersection or driveway, and;
- When reasonably necessary to avoid unsafe conditions.

One Way Streets – Bicycles on a one-way street with 2 or more lanes of traffic may ride as near the left or right-hand edge of the roadway as practicable (in the same direction as other traffic). [346.80(2)(b)]

Use of Shoulders – Bicycles may be ridden on the shoulder of a highway unless prohibited by local authorities. [346.05(1m)]

Riding 2-Abreast – Riding 2-abreast is permitted on any street as long as other traffic is not impeded. When riding 2-abreast on a 2 or more lane road, bicycles must be in a single lane. [346.80(3)(a)]

Hand Signals – Bicyclists are required to use the same hand signals as motorists. [346.35]

Passing – A motorist passing a bicyclist in the same lane is required to give the bicyclist at least 3 feet of clearance until safely past. [346.075] A bicyclist must provide the same clearance to a stopped or moving vehicle. [346.80(2)(c)]

Use of Sidewalks – State Statutes allow local units of government to permit vehicles on sidewalks. [346.94(1)] When bicycles are allowed on sidewalks they must yield to pedestrians and give audible warning when passing pedestrians traveling in the same direction. [346.804] At intersections or other crossings, bicyclists have the same rights and duties as pedestrians. [346.23; 346.24; 346.25; 346.37; 346.38]

Bicycling at Night – Bicycling at night requires at least a white front headlight and a red rear reflector. These are required whether the bicyclists are on a street, a sidewalk, or a path. [347.489(1)]

Duty to Report a Crash (accident) – [346.70] The operator of a vehicle involved in a crash resulting in injury to or death of any person or damage to property of any individual totaling $1000 or more shall immediately report the crash to police.

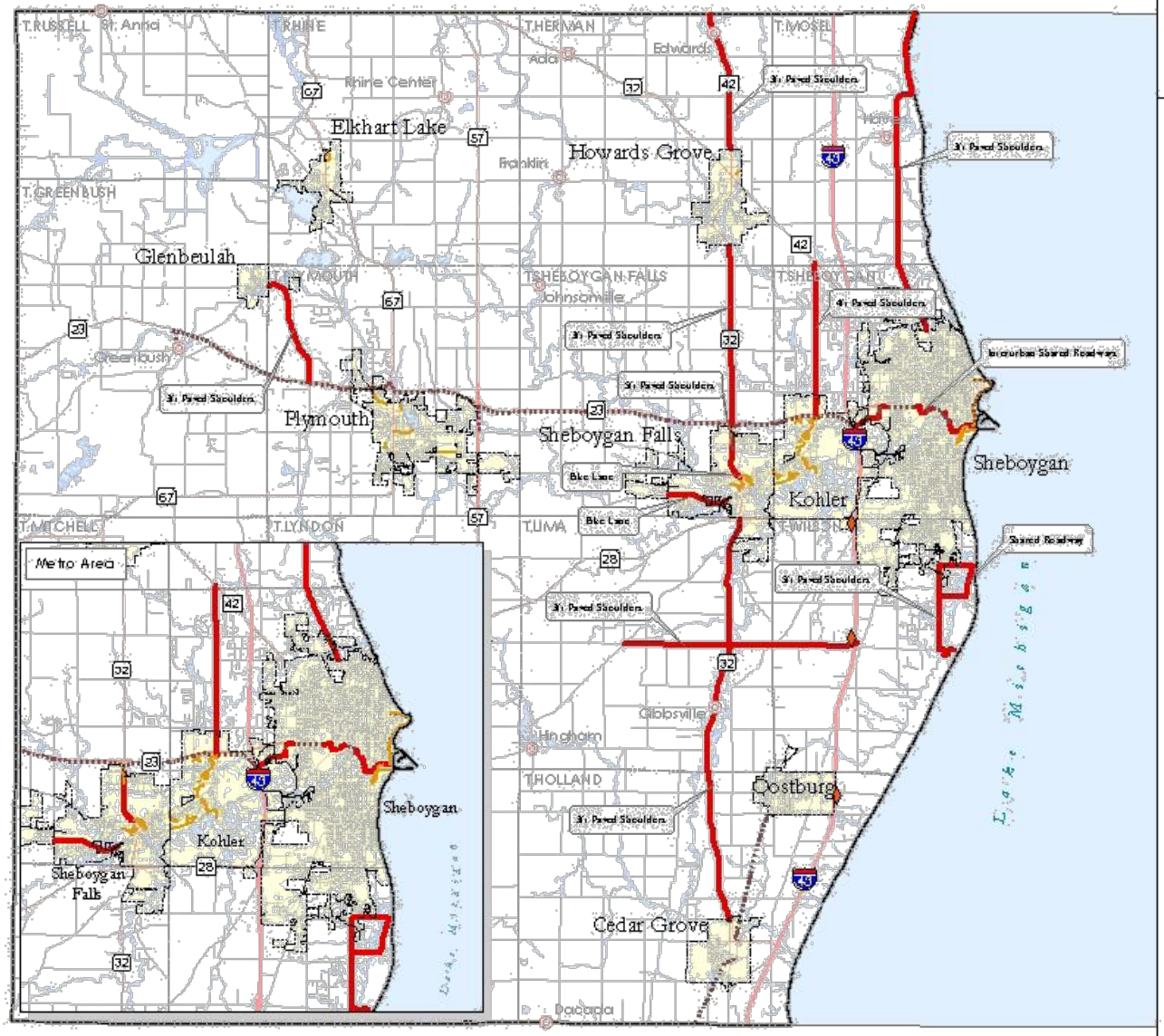
Red Traffic Signal: [346.37(1)(c)4] allows a bicyclist facing a red signal at an intersection, after stopping as required, for not less than 45 seconds, to proceed cautiously through the intersection before the signal turns green if no other vehicles are present at the intersection to actuate the signal and the operator believes the signal is vehicle actuated. The bicyclist shall yield the right-of-way to any vehicular traffic when proceeding through the green signal at the intersection.

*Source: "Wisconsin Bike Laws." *Welcome to the Sheboygan County Government Web site*. Web. 01 Mar. 2010.

Sheboygan County Pedestrian/Bicycle Plan

Map 6

Existing Bicycle Facilities



Existing Facilities

- Shared Roadways*
- Shared Use Paths
- Municipal Trails
- Interstate
- State Highway
- County Road
- Local Road
- Park & Rides
- Hamlets
- Municipal Boundaries
- County Boundary

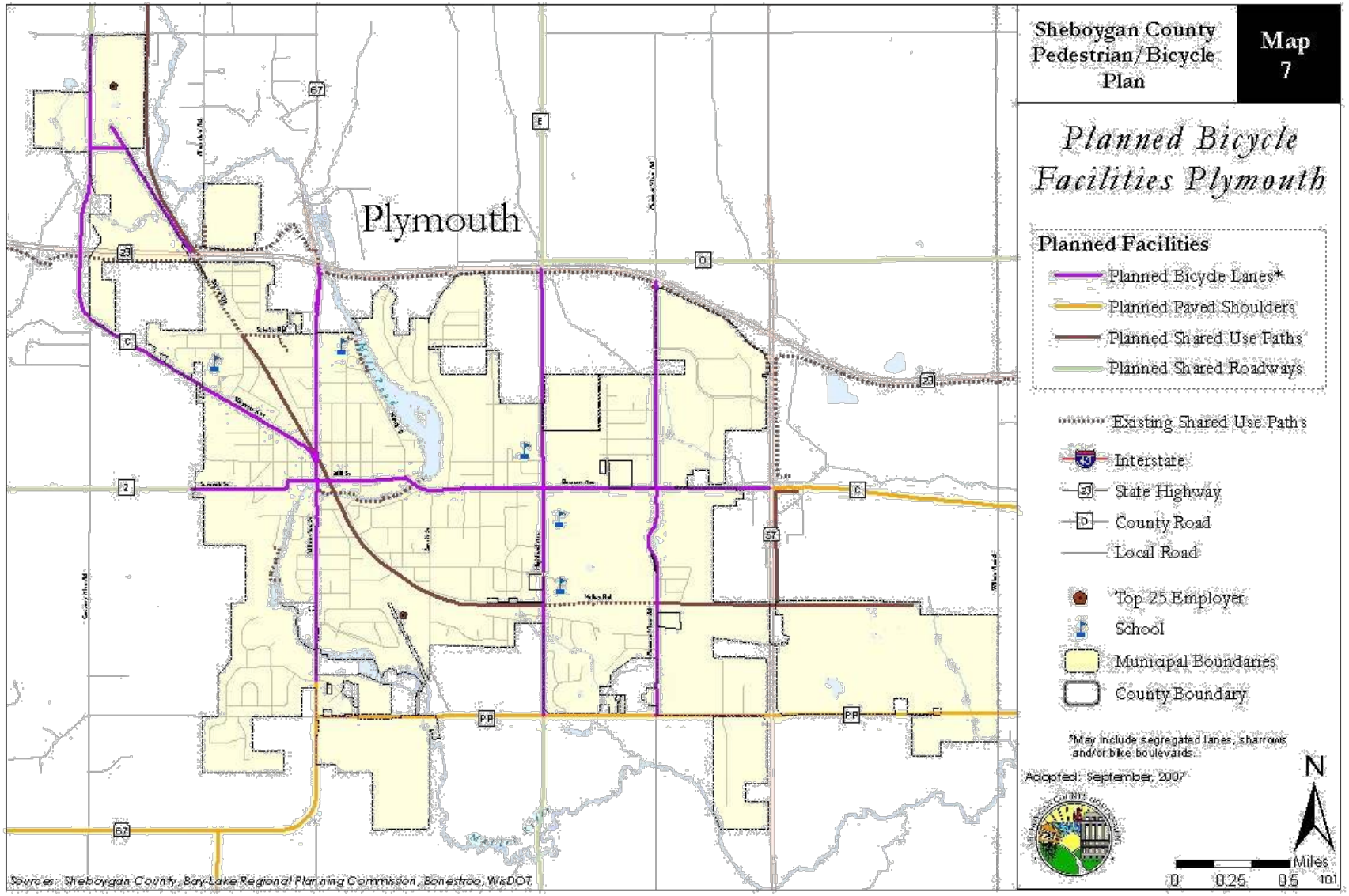
*Note: For the purposes of this map "Shared Roadways" include designated bicycle lanes, paved shoulders and other on-street shared facilities.

Adopted: September, 2007

N

0 1 2 4 100 Miles

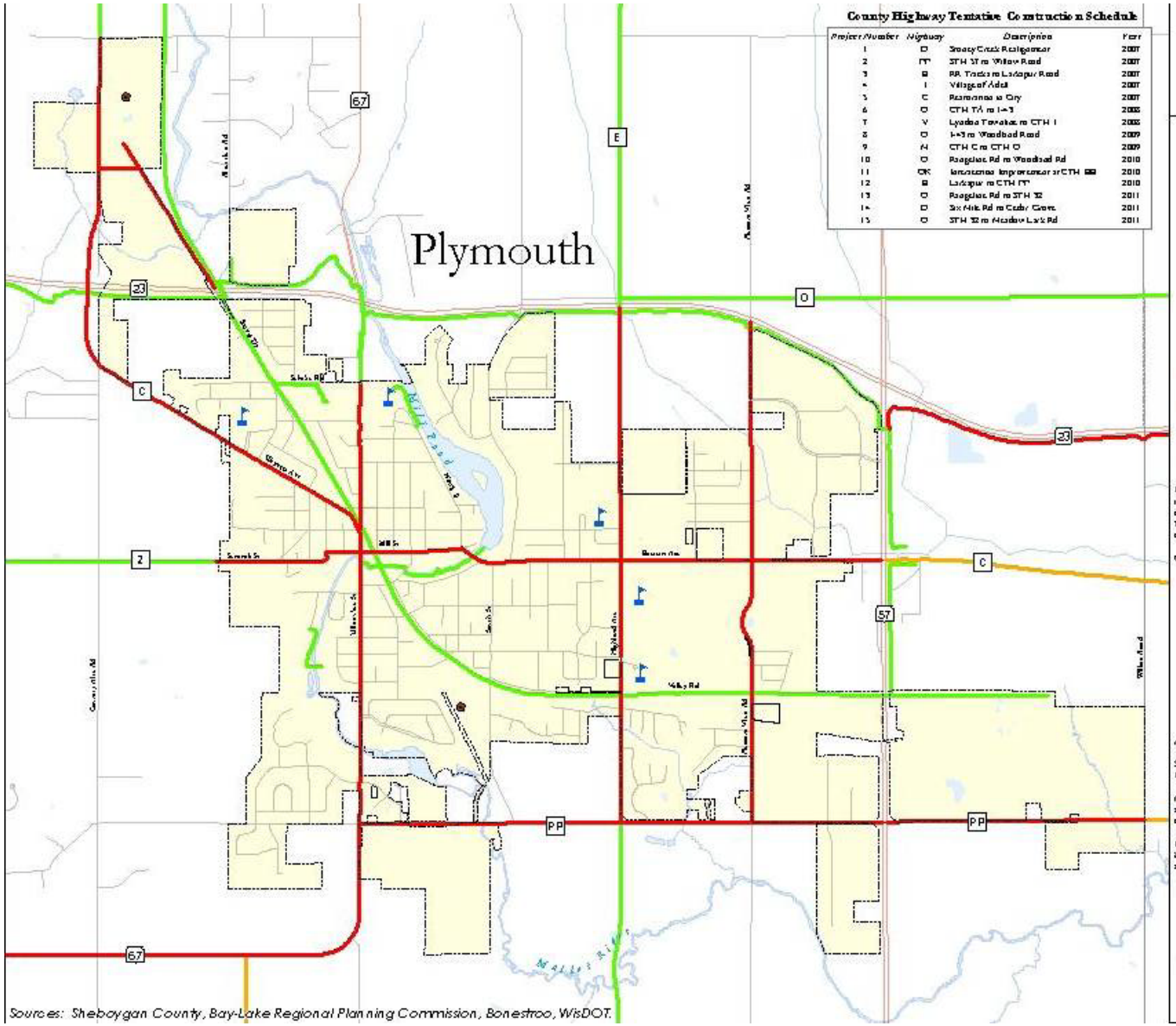
Sources: Sheboygan County.


Sheboygan County Pedestrian/Bicycle Plan
Map 7
Planned Bicycle Facilities Plymouth
Plymouth
Planned Facilities
Planned Bicycle Lanes*
Planned Paved Shoulders
Planned Shared Use Paths
Planned Shared Roadways
Existing Shared Use Paths
Interstate
State Highway
County Road
Local Road
Top 25 Employer
School
Municipal Boundaries
County Boundary
*May include segregated lanes, sharrows and/or bike boulevards.
Adopted: September, 2007
N
Miles
0 0.25 0.5 1
Sources: Sheboygan County, Bay-Lake Regional Planning Commission, Bonestroo, WisDOT.

Sheboygan County Pedestrian/Bicycle Plan

Map 8

Planned Bicycle Priorities Plymouth



County Highway Tentative Construction Schedule

Project Number	Highway	Description	Year
1	D	Stoney Creek Realignment	2007
2	PP	STH 57 to Willow Road	2007
3	B	RR Tracks to Larkspur Road	2007
4	I	Village of Adell	2007
5	C	Plymouth to City	2007
6	O	CTH TA to I-43	2008
7	V	Lyndon Township to CTH I	2008
8	O	I-43 to Woodland Road	2009
9	N	CTH C to CTH O	2009
10	O	Rangeline Rd to Woodland Rd	2010
11	OK	Intersection Improvement at CTH BB	2010
12	B	Larkspur to CTH PP	2010
13	O	Rangeline Rd to STH 32	2011
14	D	Six Mile Rd to Cedar Grove	2011
15	O	STH 32 to Meadow Lark Rd	2011

Planned Priorities

- Short Term Projects (0 - 5 yrs)
- Mid Term Projects (6 - 10 yrs)
- Long Term Projects (11 - 20 yrs)

- Interstate
- State Highway
- County Road
- Local Road
- Hamlets
- Municipal Boundaries
- County Boundary
- Top 25 Employer

In defining pedestrian and bicycle priorities, the County drew upon numerous sources of information. The pedestrian and bicycle network priorities focus on connectivity between communities, schools, cultural destinations, and businesses and consider Average Daily Traffic (ADT), truck traffic, sight distances, and roadway auxiliary. Many individuals and organizations contributed to defining the priorities.

Criteria to consider when ranking highway improvements include:

- Improve system connectivity by providing direct and convenient access to origins and destinations;
- Has support of participating jurisdictions, with an agreement in place for sustainable operations and maintenance;
- Demonstrates high cost benefit for number of existing and potential users;
- Improves modal shift opportunities;
- Takes advantage of opportunities associated with road reconstruction, and;
- Improves safety.

A ranked-based system offers a simple method to prioritize proposed projects:

Short-term (0-5 years) – Includes the Non-Motorized Transportation Grant, Capital Improvement Program and Transportation Improvement Program schedules.

Mid-term (6-10 years) – These projects will increase opportunities for modal shift, but only after there is existing infrastructure in place to build on; or environmental or other complicating factors are cleared.

Long-term (11-20 years) – These projects increase opportunities for biking and walking but require environmental, long-term reconstruction schedules or other complicating factors and/or are already existing and will need future maintenance.

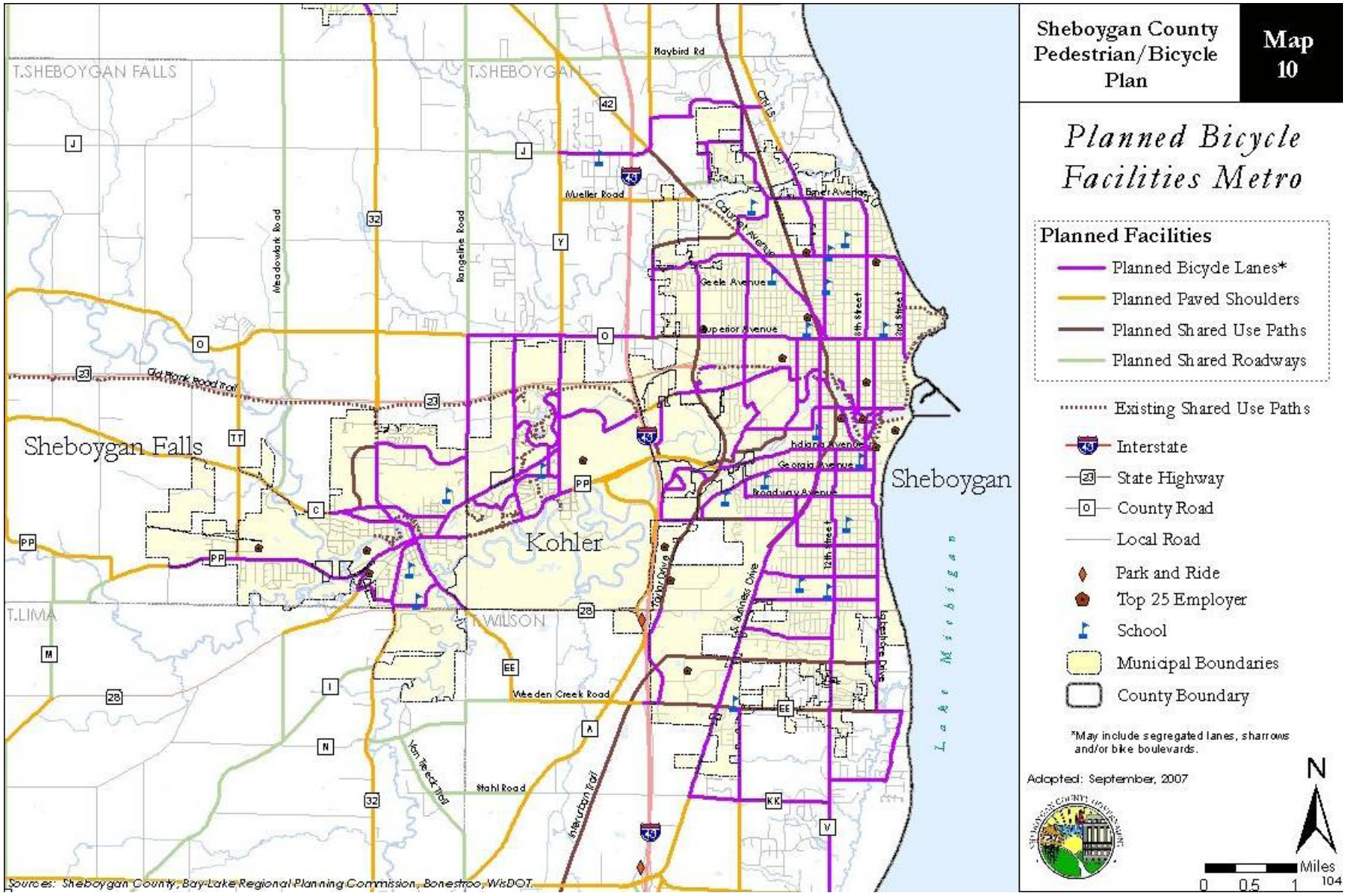
Adopted: September, 2007

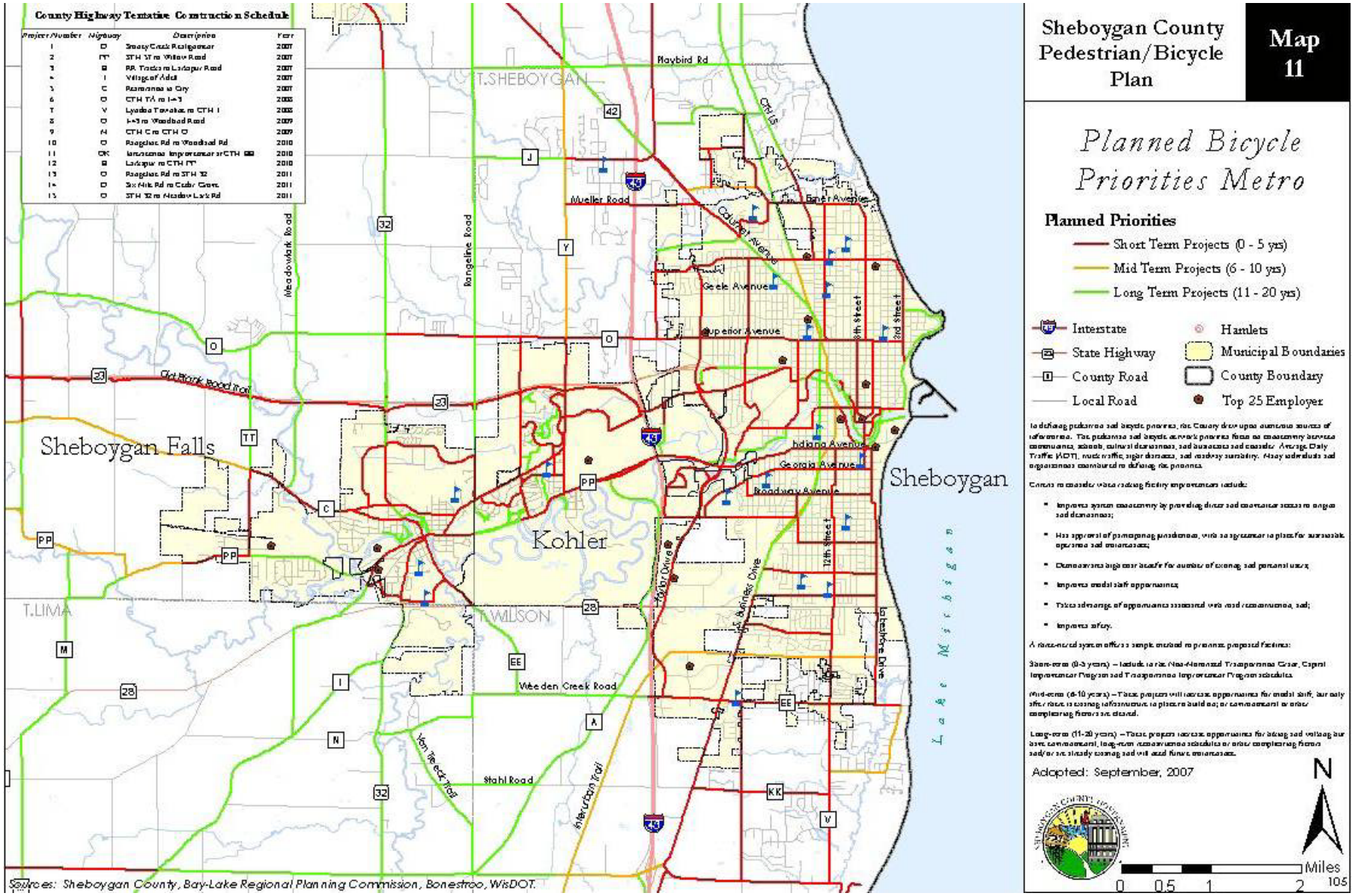
N

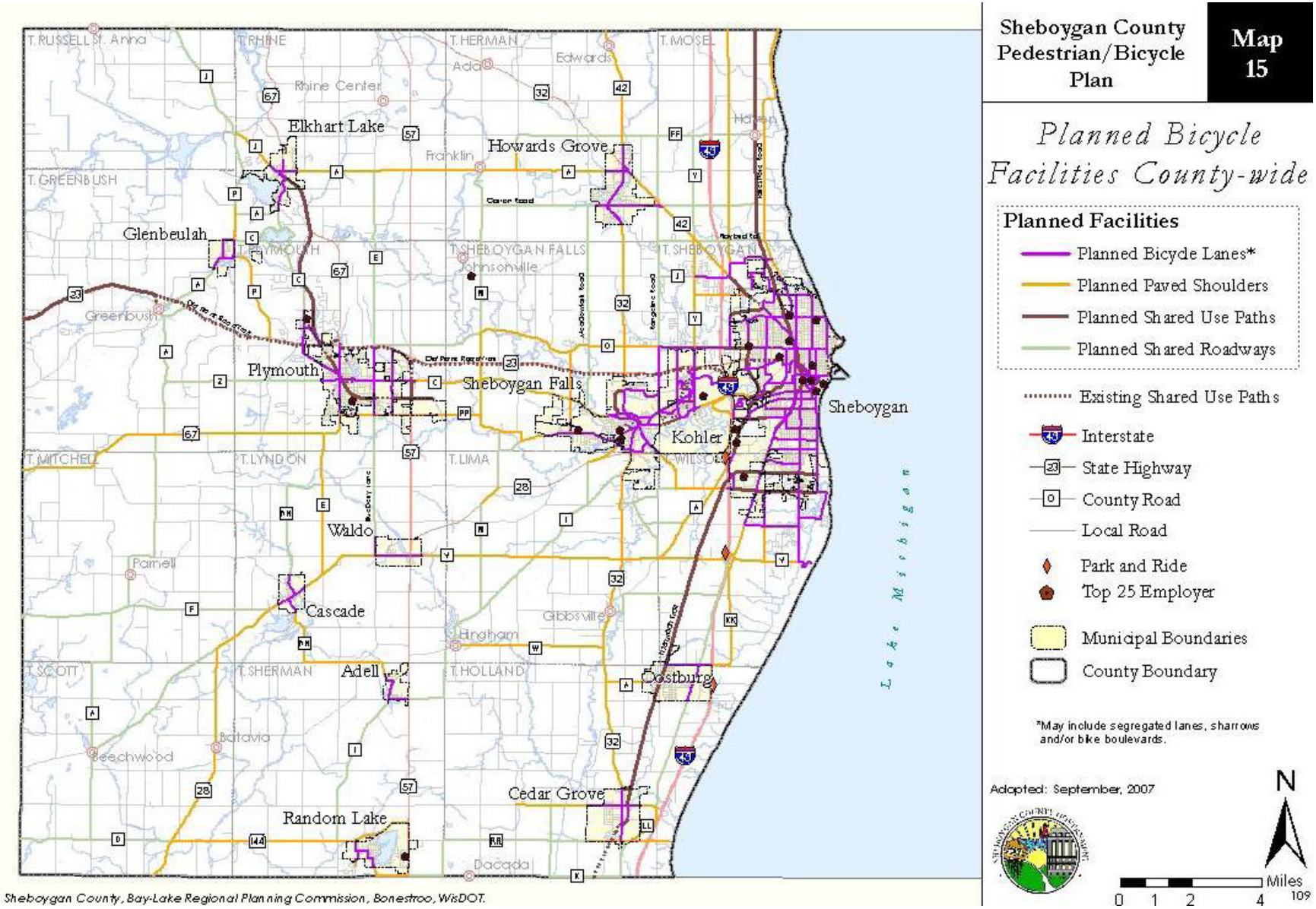
Miles

0 0.25 0.5 1 2

Sources: Sheboygan County, Bay-Lake Regional Planning Commission, Bonestroo, WisDOT.


Sheboygan County Pedestrian/Bicycle Plan
Map 10
Planned Bicycle Facilities Metro
Planned Facilities
Planned Bicycle Lanes*
Planned Paved Shoulders
Planned Shared Use Paths
Planned Shared Roadways
Existing Shared Use Paths
Interstate
State Highway
County Road
Local Road
Park and Ride
Top 25 Employer
School
Municipal Boundaries
County Boundary
*May include segregated lanes, sharrows and/or bike boulevards.
Adopted: September, 2007
N
Miles
0 0.5 1
T.SHEBOYGAN FALLS
T.SHEBOYGAN
Sheboygan Falls
Kohler
Sheboygan
T.LIMA
T.WILSON
Lake Michigan
Meadowlark Road
Rangeline Road
Mueller Road
Maybird Rd
Geele Avenue
Superior Avenue
Indiana Avenue
Georgia Avenue
Broadway Avenue
Weeden Creek Road
Stahl Road
Old Plank Road Trail
Interurban Trail
Van Buren Trail
Taylor Drive
Ft. Atkinson Drive
Lakeshore Drive
Sources: Sheboygan County, Bay-Lake Regional Planning Commission, Bonestroo, WisDOT.


Sheboygan County Pedestrian/Bicycle Plan
Map 11
Planned Bicycle Priorities Metro
Planned Priorities
Short Term Projects (0 - 5 yrs)
Mid Term Projects (6 - 10 yrs)
Long Term Projects (11 - 20 yrs)
Interstate
State Highway
County Road
Local Road
Hamlets
Municipal Boundaries
County Boundary
Top 25 Employer
Adopted: September, 2007
N
Miles
0 0.5 1 2 10.5
County Highway Tentative Construction Schedule
Sheboygan Falls
Kohler
Sheboygan
T.SHEBOYGAN
T.LIMA
T.WILSON
Lake Michigan
Playbird Rd
Mueller Road
Meadowlark Road
Rangeline Road
Geele Avenue
Superior Avenue
Indiana Avenue
Georgia Avenue
Broadway Avenue
Weeden Creek Road
Stahl Road
Interurban Trail
Taylor Drive
N. Business Drive
Lakeshore Drive
12th Street
9th Street
3rd Street
Sources: Sheboygan County, Bay-Lake Regional Planning Commission, Bonestroo, WisDOT.


Sheboygan County Pedestrian/Bicycle Plan
Map 15
Planned Bicycle Facilities County-wide
Planned Facilities
Planned Bicycle Lanes*
Planned Paved Shoulders
Planned Shared Use Paths
Planned Shared Roadways
Existing Shared Use Paths
Interstate
State Highway
County Road
Local Road
Park and Ride
Top 25 Employer
Municipal Boundaries
County Boundary
*May include segregated lanes, sharrows and/or bike boulevards.
Adopted: September, 2007
N
Miles
0 1 2 4
Elkhart Lake
Howards Grove
Glenbeulah
Plymouth
Sheboygan Falls
Sheboygan
Kohler
Waldo
Cascade
Adell
Costburg
Cedar Grove
Random Lake
Lake Michigan
T. RUSSELL
T. RHINE
T. HERMAN
T. MOSEL
T. GREENBUSH
T. PLYMOUTH
T. SHEBOYGAN FALLS
T. SHEBOYGAN
T. MITCHELL
T. LYNDON
T. LIMA
T. SCOTT
T. SHERMAN
T. HOLLAND
Rhine Center
Franklin
Johnsonville
Greenbush
Parnell
Gibbsville
Hingham
Batavia
Beechwood
Dacada
Sheboygan County, Bay-Lake Regional Planning Commission, Bonestroo, WisDOT.

Sheboygan County Pedestrian/Bicycle Plan

Map 16

Planned Bicycle Priorities County-wide

Planned Priorities

- Short Term Projects (0 - 5 yrs)
- Mid Term Projects (6 - 10 yrs)
- Long Term Projects (11 - 20 yrs)

- Interstate
- State Highway
- County Road
- Local Road
- Hamlets
- Municipal Boundaries
- County Boundary

In defining pedestrian and bicycle priorities, the County drew upon numerous sources of information. The pedestrian and bicycle network priorities focus on connecting service communities, schools, cultural destinations, and businesses and consider Average Daily Traffic (ADT), truck traffic, sight distances, and roadway suitability. Many individuals and organizations commented on defining the priorities.

Criteria to consider when defining facility improvements include:

- Improve system connectivity by providing direct and convenient access to origins and destinations;
- Has support of participating jurisdictions, with an agreement in place for sustainable operations and maintenance;
- Demonstrates high cost benefit for number of existing and potential users;
- Improves modal shift opportunities;
- Takes advantage of opportunities associated with road reconstruction; and
- Improves safety.

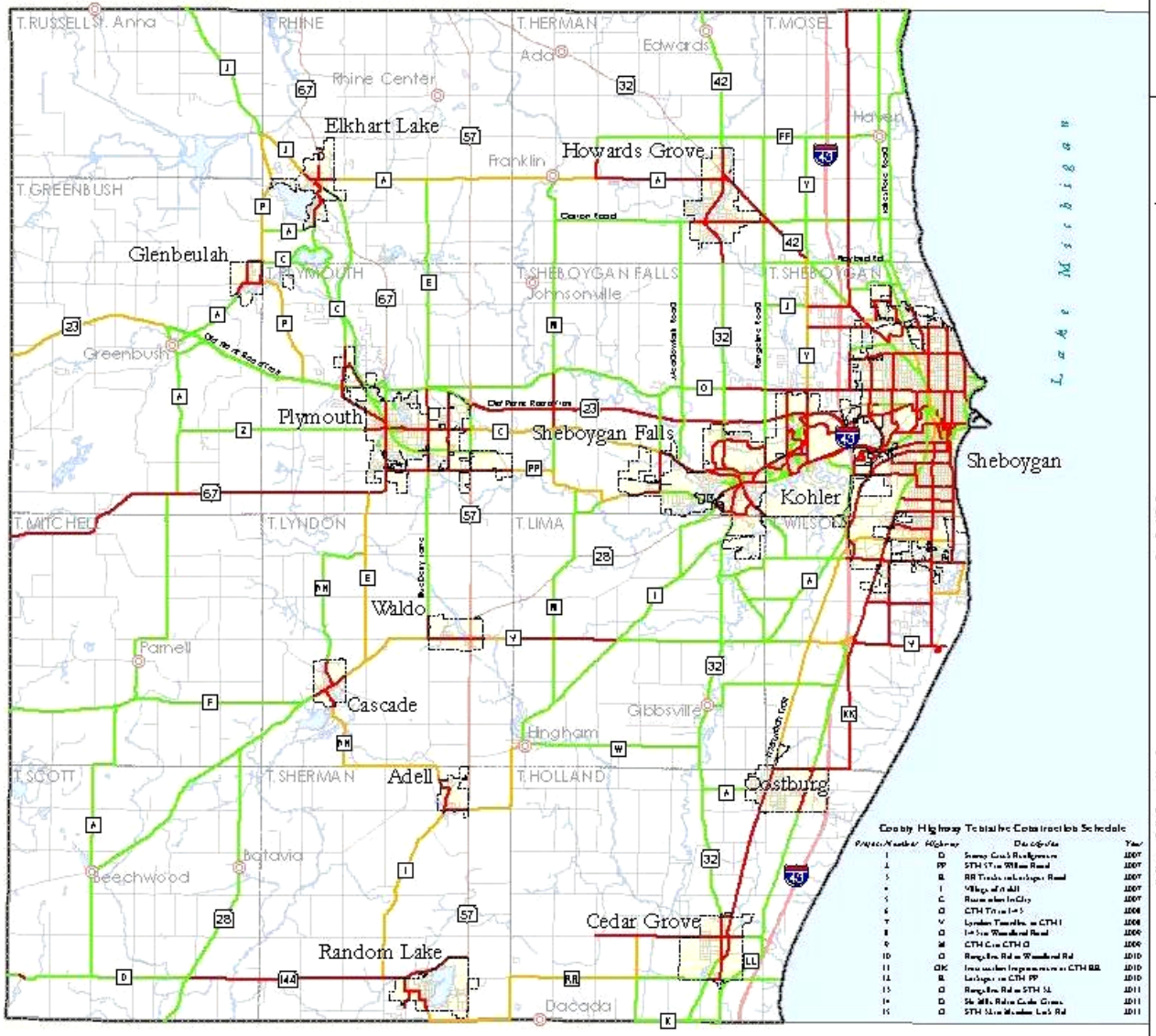
A three-tiered system of five criteria evaluated the priorities proposed facilities.

Short-term (0-5 years) – Includes the Non-Motorized Transportation Grant, Capital Improvement Program and Transportation Improvement Program schedules.

Mid-term (6-10 years) – These projects will increase opportunities for modal shift, but only after there is existing information in place to build on; or commitment or other complementing factors are created.

Long-term (11-20 years) – These projects increase opportunities for biking and walking but require commitment, long-term commitments schedules or other complementing factors and/or are already existing and will need future enhancements.

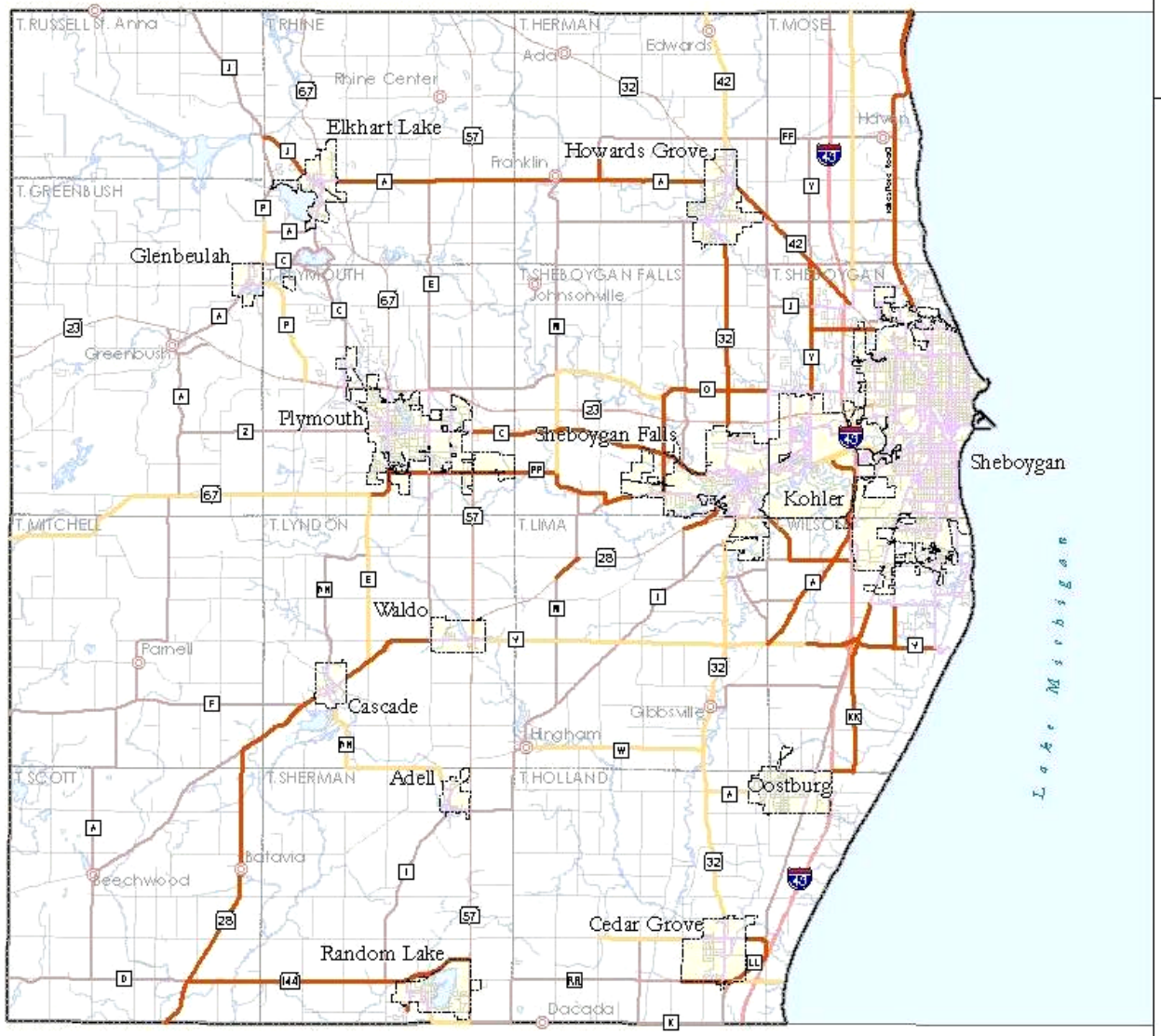
Adopted: September, 2007



County Highway Tentative Construction Schedule

Project Number	Highway	Description	Year
1	D	Sunny Creek Realignment	2007
2	PP	STH 57 to Willow Road	2007
3	B	RR Tracks in Sheboygan Falls	2007
4	I	Village of Adell	2007
5	C	Roundabout in City	2007
6	O	CTH T to I-43	2008
7	V	Lyndon Township to CTH I	2008
8	O	I-43 to Woodland Road	2009
9	M	CTH C to CTH O	2009
10	O	Range Line Rd to Woodland Rd	2010
11	OK	Intersection Improvements on CTH OK	2010
12	B	Lutkemeyer to CTH PP	2010
13	O	Range Line Rd to STH 32	2011
14	D	Sheridan Road to Cedar Grove	2011
15	O	STH 32 to Mueller Lake Rd	2011

Sources: Sheboygan County, Bay-Lake Regional Planning Commission, Bonestroo, WisDOT.



Sources: Sheboygan County, Bay-Lake Regional Planning Commission, Bonestroo, WisDOT.

Sheboygan County Pedestrian/Bicycle Plan

Map 27

Planned Paved Shoulders County-wide

Planned Paved Shoulders

- 3ft Planned Paved Shoulders
- 4ft+ Planned Paved Shoulders

- Planned Bicycle Lanes*
- Planned Shared Roadways
- Interstate
- State Highway
- County Road
- Local Road
- Hamlets
- Municipal Boundaries
- County Boundary

Note: Size of the Planned Paved Shoulders are based on WisDOT's Bicycle Facility Handbook Table 2.1 which takes into account Average Daily Traffic Counts (ADT's) in determining the type of the desired facility. Local citizen input and/or knowledge was also utilized in determining desired size. ADT's used for this map were provided by Bonestroo's 2028 Projected ADT counts (see Map 2).

*May include segregated lanes, sharrows and/or bike boulevards.

Adopted: September, 2007

N

0 1 2 4 Miles

121

Appendix C: Minneapolis, Minnesota

Table C-1: Demographic and Economic Characteristics and Travel Behavior within the Minneapolis, MN

	Minneapolis	**Avg. Among Pilots**	**Spokane (Control)**
Geographic Area (sq mi)	55.0	185.9	1764
Persons per sq mi	6,970.3	2,675.6	241.3
Population			
Total	382,618	203,232	425,684
Total Population 25+	243,409	137,079	276,887
Median Age	31.2	34.0	35.4
Household Income			
Total # of Households	162,382	85,113	163,611
Less than $25,000	31.8	22.2	32.2
$25,000-49,999	31.0	24.2	32.1
$50,000-75,999	17.9	21.0	19.3
$75,000-99,999	9.0	12.0	8.5
$100,000 or More	9.3	17.2	7.9
Median Household Income (2006 $)	$45,952	$62,865	$45,145
Race (includes Hispanic and non-Hispanic)			
White	65.1	80.8	88.4
Black	18.0	8.2	2.3
Asian	6.1	4.6	2.1
Other Race or Multiracial	10.9	6.5	4.1
Hispanic (any race)	7.6	7.8	3.1
Work Commute			
Total # of Workers 16 and over	203,951	108,516	191,195
Car, Truck or Van- drive alone	61.6	70.8	76.5
Car, Truck or Van- Carpool	11.3	11.0	12.3
Public (includes taxi)	14.6	6.6	2.8
Walk	6.6	5.1	32.8
Other Means	2.5	2.0	1.2
Work at Home	3.4	4.5	4.1
Mean Travel Time (minutes)	21.7	21.6	21.2
Bike Commute	0.44		0.57
Household Characteristics			
Total # Occupied Units	162,352	85,060	175,005
Average Number of Vehicles per Household (owner occupied units)	1.6	1.9	1.6
Average Number of Vehicles per Household (renter occupied units)	1.0	1.3	1.3
October Climate (degrees Fahrenheit)	Minneapolis Int'l Airport	Avg. Among Pilots	Spokane Int'l Airport
Average Temp (max)	58.6	65.1	58.5
Average Temp (min)	43.2	44.5	36.0
Inches of Rain	1.9	2.3	1.2

Source for all Demographic data: 2002 U.S. Decennial Census; Source for Meteorological Data: University of Minnesota Research Team

Table C-2: Existing Transportation Network Prior to Pilot Program

	City of Minneapolis	Avg. Among Programs	Spokane (Control)
Transportation Network			
Public transit buses[41]	843	885.25	288
Number of track miles of Light Rail[42]	24.2		
Number of ferryboat vessels[43]			
Annual Vehicle Revenue Miles[44]	25,884,056	8,125,608.5	7,855,371
Bicycle and Pedestrian Network			
Miles of off-road lanes or pathways	57 miles	37.8	Unavailable
Miles of marked or striped bike lanes	38 miles	25.89	Unavailable
Miles of sidewalks	1841 miles		Unavailable
Percent of roadways with sidewalks on at least one side of the street	91%		Unavailable
Total Fare Revenues[45]	$66,073,401	$22,544,980.25	$5,847,503

[41] "Vehicles Available for Maximum Service" from Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.
[42] From Federal Transit Administration's National Transit Data Tables (Table 23)
[43] Number of Ferryboat vehicles operated in maximum service by Golden Gate Bridge, Highway and Transportation District from Federal Transit Administration's National Transit Database 2005 Data Tables (Table 24)
[44] "Annual Vehicle Revenue Miles" from Federal Transit Administration's National Transit Database 2004 Transit Agency Profiles. This figure represents the number of miles that vehicles travel while in revenue service. Vehicle revenue miles (VRM) include layover/recovery time, but exclude deadhead, operator training and maintenance testing, as well as school bus and charter services.
[45] "Total Fare Revenues Earned" from Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.

Table C-3: Transportation Usage and Travel Behaviors Prior to Pilot Program

	City of Minneapolis	Avg. Among Pilots	Spokane (Control)
Transportation Usage			
Total annual "unlinked" public transit trips[46]	69,698,813	20,062,317.5	8,280,757
Total annual passenger miles[47]	309,667,298	102,381,021	40,931,915
Average weekday "unlinked" public transit[48] trips	227,373	65,736	28,634
Bicycle			
Average daily trips[49]	3.56	3.09	2.45
Average trip distance[50]	8.33 miles	8.19 miles	8.55
Average trip duration[51]	50.0 minutes	46.05 minutes	51.3
Pedestrian			
Average daily trips[52]	2.54	2.42	2.18
Average trip distance[53]	2.29 miles	2.24 miles	2.18 miles
Average trip duration[54]	45.9 minutes	44.73 minutes	43.6 minutes
Percent of trips to/from transit via bicycling/walking	88%	76.5%	78%
Percent of trips to/from transit via driving	12%	23.5%	22%
Reduced auto use due to bicycling and walking (miles per adult per day)[55]	0.816 miles	0.547 miles	0.310 miles
Total annual estimated reduction in auto travel due to bicycling and walking (in miles)	91,125, 498 miles	39,769,395.5 miles	17,708,337 miles
Automobile Vehicle Miles Traveled[56]	1,045,719,000	4,844,955,345	Unavailable

[46] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles; public transit boardings.
[47] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles; One passenger riding one mile is one passenger mile.
[48] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.
[49] University of Minnesota Study. Data represent average number of trips by commuters, per day, and excludes other destinations. Data are measured in miles, and refer to total daily miles for commuters only, not destinations. The total daily mileage has been calculated by UMN, and is a function of average daily bicycling duration multiplied by distance covered at a typical speed of 10 miles per hour.
[50] University of Minnesota Study. UMN calculated this figure based on the percentage of trips that fall into each of the three categories of trip duration. Actual duration in minutes was not solicited from UMN survey respondents; rather, respondents categorized their trip duration according to three ranges (10-29 min., 30-59 min., and 60+ min.). An average total daily bicycling duration was derived from this information.
[51] University of Minnesota Study. The data points in this row represent the average daily number of pedestrian trips taken by commuters, not destination walkers.
[52] University of Minnesota Study. Data are measured in miles, and refer to total daily miles for commuters only, not destinations. The total daily mileage has been calculated by UMN, and is a function of average daily walking duration multiplied by distance covered at a typical walking speed of 3 mi/hr.
[53] University of Minnesota Study. Actual duration of daily walking (in minutes) was not solicited from UMN survey respondents; rather, respondents categorized their total daily walking duration according to three ranges see footnote x, above). An average daily walking duration was derived from this information.
[54] University of Minnesota Study. These data represent total number of miles of avoided auto use per adult resident per day, and represent the average of upper and lower bound estimates.
[55] Marin County: Metropolitan Transportation Commission (2007). Minneapolis data are from MnDOT (2001), and include all VMT in Anoka, Hennepin, and Ramsey Counties. Sheboygan County: WIDOT (2005). Columbia data are from the City of Columbia, MO.
[56] University of Minnesota Study.

Table C-4: Minneapolis' Projects

Project Type	Project	Status
Infrastructure	• Bicycle parking in Minneapolis (at various locations, including schools, employment centers, recreation facilities, transit stops, and other community activity centers). • A construction project which will provide a significant travel connection between high-traffic destinations of the University of Minnesota main campus, downtown Minneapolis, and the University of Minnesota St. Paul campus. • A 3.23 mile project in South Minneapolis that will include a bicycle boulevard treatment, providing an alternative for bicyclists to the heavy arterials between several neighborhoods and downtown Minneapolis.	Funded
Planning	• Pedestrian Plan for the City of Minneapolis. • A study to develop a Central Corridor Bicycle and Pedestrian Plan. The Study will build upon the Central Corridor Development Strategy, to determine where bicycle and pedestrian connections can be created or improved to the anticipated light rail line between downtown Minneapolis and downtown St. Paul. • The Douglas Drive Corridor Enhancement and Connection to Luce Line Trail study seeks to provide a safe non-motorized connection to Minneapolis. This will focus on land use issues and trail and sidewalk improvements, enhancing an important suburban travel route to Minneapolis.	Funded

Source: NMTPP Interim Report to Congress 2007: Table 2.4 p. 27

Table C-5: Completed Infrastructure Projects

Project	Description
Franklin/Riverside Avenue bike lanes	New striped bike lanes made possible by conversion of the existing roadway from 4 lanes to 3 lanes. Counts took place at this location in September of 2007 and 2008 and monthly since February of 2009. Approximately 80 intercept surveys were also conducted on the Riverside Ave. overpass over 1-94 and Franklin Avenue Bridge over the Mississippi River during the fall of 2007. Surveys will be repeated in 2010.
Hiawatha LRT bike/ped trail extension into downtown Minneapolis	Counts took place just south of the location of the proposed trail extension during September of 2006, May of 2007 and September of 2007 and 2008. Additional counts are being conducted monthly since February 2009.
University of Minnesota bike/ped trail extension	Counts took place on Bridge #9 which will connect to the new trail during September of 2006, May of 2007, and September 2007 & 2008. Additional counts are being conducted monthly since February 2009.
Marshall Avenue "Livable Streets" project	Counts of bicyclists and pedestrians took place on the Marshall Avenue/Lake Street Bridge in September of 2006, May of 2007, and September of 2007 & 2008. Additional counts are being conducted monthly since February 2009. This project is also within the boundaries of the St Paul Smart Trips Union Park Project that will begin in the summer/fall of 2009.

Source Bike Walk Twin Cities 2010

Table C-6: Bike Counts at Individual Locations- 2007-2008

Count Location	Fall 2007	Fall 2008	Change	Percent Change
Midtown Greenway, West of Hennepin Ave	306	597	291	95.1%
Hiawatha Trail (So of 11th)	230	333	103	44.8%
15th Ave SE north of University Ave SE	514	598	84	16.3%
Franklin Bridge Ave	203	287	84	41.1%
Cedar Lake Trail west of I-394	201	244	43	21.4%
Hennepin Ave, North of 28th St.	71	104	33	46.5%
Lyndale Ave S, north of Franklin Ave S	113	142	29	26.0%
42nd St, east of Minnehaha Ave. S	14	36	23	166.7%
20th Ave over I-94	200	221	21	10.5%
2nd St. S, South of Plymouth Ave	45	65	20	43.3%
Riverside Ave over I-94	60	77	17	28.3%
Central Ave NE, North of Lowry Ave	40	55	15	36.5%
Plymouth Ave Bridge	57	69	12	21.1%
University Ave, west of Prior Ave	58	70	12	19.8%
Lake/Marshall St. Bridge	280	290	10	3.6%
7th St. N over I-94	21	23	3	12.2%
Greenway crossing Highway 55 (at grade)	237	212	-25	-10.5%
Totals	**2,650**	**3,422**	**772**	**29.2%**

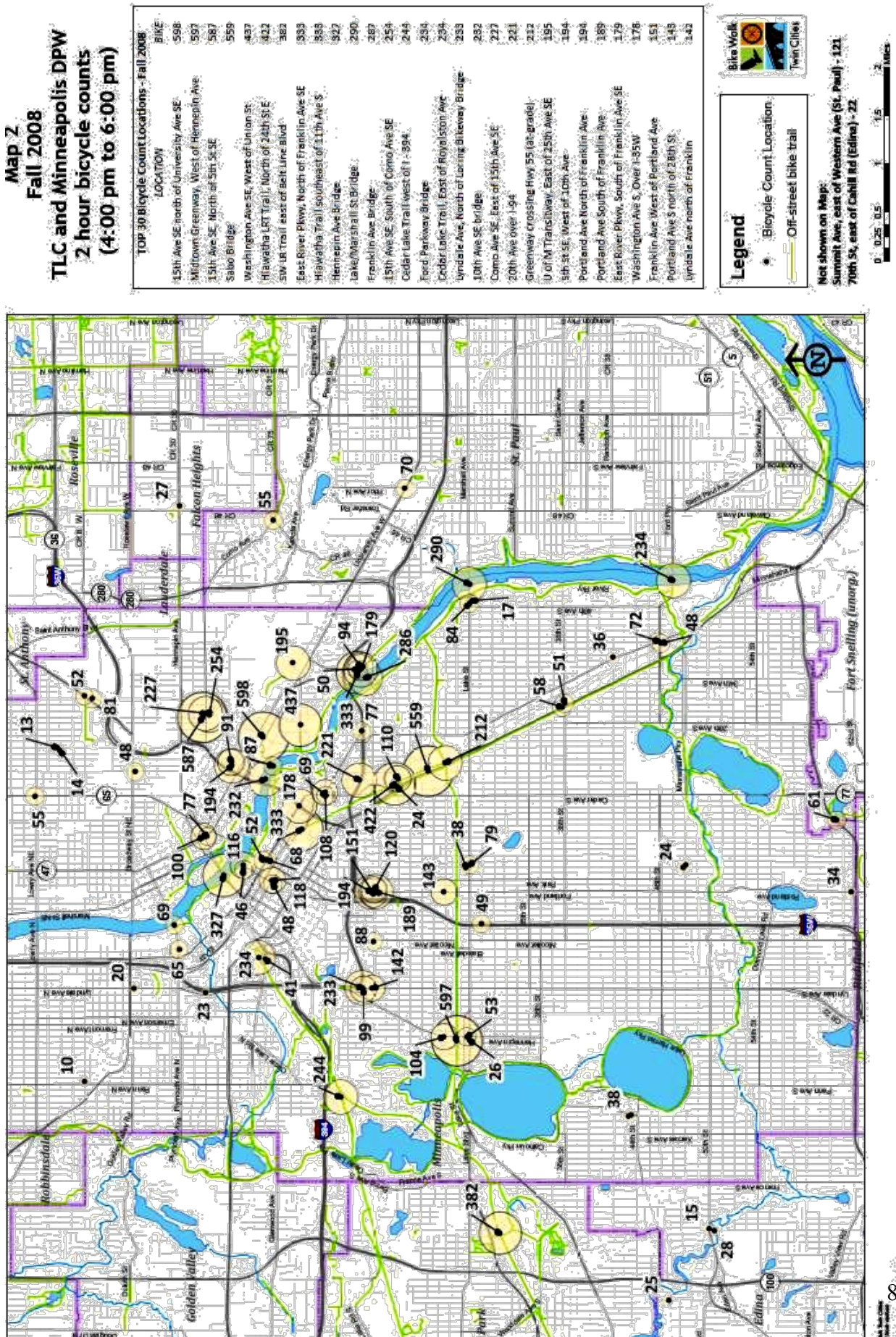
Source: Bike Walk Twin Cities 2009

Table C-7: Instances of Bikes Riding on Sidewalks

Count Location	Street Description	Bike	Bike on Sidewalk	Percent Bike on Sidewalk
20th Ave over I-94	Bridge with 4 Lanes of Traffic and Bike Lanes	221	16	7.2 %
Portland Ave S north of 28th St.	3 lanes of traffic (1-way) with on-street parking and a left side bike lane (1-way)	143	12	8.4%
15th Ave SE, north of 5 St. SE	3 lanes of traffic (2-way center turn lane) with bike lanes	587	53	9.0%
Riverside Ave over I-94	Bridge with 4 lanes of traffic	77	20	26.0%
University Ave west of Prior Ave	4 lanes of traffic with on-street parking and wide outside travel lane	70	26	36.7%
Central Ave NE of Lowry Ave	4 lanes of Traffic with	55	41	74.5%

Source Bike Walk Twin Cities 2009

Figure C-7: Minneapolis Count Locations



Appendix D: Marin County, California

Table D-1: Demographic & Economic Characteristics and Travel Behavior within Marin County, CA

	Marin	**Avg. Among Pilots**	**Spokane (Control)**
Geographic Area (sq mi)	121.4**57**	185.9	1764
Persons per sq mi	1,920**58**	2,675.6	241.3
Population			
Total	233,132**59**	203,232	425,684
Total Population 25+	183694	137,079	276,887
Median Age	41.3	34.0	35.4
Household Income			
Total # of Households	100,736	85,113	163,611
Less than $25,000	14.5	22.2	32.2
$25,000-49,999	19.4	24.2	32.1
$50,000-75,999	18.1	21.0	19.3
$75,000-99,999	12.9	12.0	8.5
$100,000 or More	35.1	17.2	7.9
Median Household Income (2006 $)	$86,286	$62,865	$45,145
Race (includes Hispanic and non-Hispanic)			
White	84.0	80.8	88.4
Black	2.9	8.2	2.3
Asian	4.5	4.6	2.1
Other Race or Multiracial	8.7	6.5	4.1
Hispanic (any race)	11.1	7.8	3.1
Work Commute			
Total # of Workers 16 and over	126,646	108,516	191,195
Car, Truck or Van- drive alone	65.5	70.8	76.5
Car, Truck or Van- Carpool	10.7	11.0	12.3
Public (includes taxi)	10.1	6.6	2.8
Walk	3.1	5.1	32.8
Other Means	1,9	2.0	1.2
Work at Home	8.8	4.5	4.1
Mean Travel Time (minutes)	32.3	21.6	21.2
Bike Commute			0.57
Household Characteristics			
Total # Occupied Units	100,652	85,060	175,005
Average Number of Vehicles per Household (owner occupied units)	2.0	1.9	1.6
Average Number of Vehicles per Household (renter occupied units)	1.4	1.3	1.3
October Climate (degrees Fahrenheit)	San Rafael	Avg. Among Pilots	Spokane Int'l Airport
Average Temp (max)	75.0	65.1	58.5
Average Temp (min)	50.5	44.5	36.0
Inches of Rain	1.7	2.3	1.2

Source for all Demographic data: 2002 U.S. Decennial Census; Source for Meteorological Data: University of Minnesota Research Team

57 The land area represents Marin's City-Centered Corridor, the eastern urbanized portion of the County.
58 Refers only to the population density in the City-Centered Corridor
59 Population in all Census tracts lying wholly or partially in the City-Centered Corridor

Table D-2: Existing Transportation Network Prior to Pilot Program

	Marin County	Avg. Among Programs	Spokane (Control)
Transportation Network			
Public transit buses[60]	263	885.25	288
Number of track miles of Light Rail[61]			
Number of ferryboat vessels[62]	4		
Annual Vehicle Revenue Miles[63]	6,361,243	8,125,608.5	7,855,371
Bicycle and Pedestrian Network			
Miles of off-road lanes or pathways	33.7 miles	37.8	Unavailable
Miles of marked or striped bike lanes	35.8 miles	25.89	Unavailable
Miles of sidewalks	Unavailable		Unavailable
Percent of roadways with sidewalks on at least one side of the street	Unavailable		Unavailable
Total Fare Revenues[64]	$23,420,295	$22,544,980.25	$5,847,503

[60] "Vehicles Available for Maximum Service" from Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.
[61] From Federal Transit Administration's National Transit Data Tables (Table 23)
[62] Number of Ferryboat vehicles operated in maximum service by Golden Gate Bridge, Highway and Transportation District from Federal Transit Administration's National Transit Database 2005 Data Tables (Table 24)
[63] "Annual Vehicle Revenue Miles" from Federal Transit Administration's National Transit Database 2004 Transit Agency Profiles. This figure represents the number of miles that vehicles travel while in revenue service. Vehicle revenue miles (VRM) include layover/recovery time, but exclude deadhead, operator training and maintenance testing, as well as school bus and charter services.
[64] "Total Fare Revenues Earned" from Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.

Table D-3: Transportation Usage and Travel Behaviors Prior to Pilot Program

	Marin County	Avg. Among Pilots	Spokane (Control)
Transportation Usage			
Total annual "unlinked" public transit trips[65]	9,465,372	20,062,317.5	8,280,757
Total annual passenger miles[66]	95,828,152	102,381,021	40,931,915
Average weekday "unlinked" public transit[67] trips	31,673	65,736	28,634
Bicycle			
Average daily trips[68]	2.81	3.09	2.45
Average trip distance[69]	8.55 miles	8.19 miles	8.55
Average trip duration[70]	51.3 minutes	46.05 minutes	51.3
Pedestrian			
Average daily trips[71]	2.43	2.42	2.18
Average trip distance[72]	2.31 miles	2.24 miles	2.18 miles
Average trip duration[73]	46.1 minutes	44.73 minutes	43.6 minutes
Percent of trips to/from transit via bicycling/walking	45%	76.5%	78%
Percent of trips to/from transit via driving	55%	23.5%	22%
Reduced auto use due to bicycling and walking (miles per adult per day)[74]	0.668 miles	0.547 miles	0.310 miles
Total annual estimated reduction in auto travel due to bicycling and walking (in miles)	48,281,361	39,769,395.5 miles	17,708,337 miles
Automobile Vehicle Miles Traveled[75]	6,701,100	4,844,955,345	Unavailable

[65] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles; public transit boardings.
[66] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles; One passenger riding one mile is one passenger mile.
[67] Federal Transit Administration's National Transit Database 2005 Transit Agency Profiles.
[68] University of Minnesota Study. Data represent average number of trips by commuters, per day, and excludes other destinations. Data are measured in miles, and refer to total daily miles for commuters only, not destinations. The total daily mileage has been calculated by UMN, and is a function of average daily bicycling duration multiplied by distance covered at a typical speed of 10 miles per hour.
[69] University of Minnesota Study. UMN calculated this figure based on the percentage of trips that fall into each of the three categories of trip duration. Actual duration in minutes was not solicited from UMN survey respondents; rather, respondents categorized their trip duration according to three ranges (10-29 min., 30-59 min., and 60+ min.). An average total daily bicycling duration was derived from this information.
[70] University of Minnesota Study. The data points in this row represent the average daily number of pedestrian trips taken by commuters, not destination walkers.
[71] University of Minnesota Study. Data are measured in miles, and refer to total daily miles for commuters only, not destinations. The total daily mileage has been calculated by UMN, and is a function of average daily walking duration multiplied by distance covered at a typical walking speed of 3 mi/hr.
[72] University of Minnesota Study. Actual duration of daily walking (in minutes) was not solicited from UMN survey respondents; rather, respondents categorized their total daily walking duration according to three ranges see footnote x, above). An average daily walking duration was derived from this information.
[73] University of Minnesota Study. These data represent total number of miles of avoided auto use per adult resident per day, and represent the average of upper and lower bound estimates.
[74] Marin County: Metropolitan Transportation Commission (2007). Minneapolis data are from MnDOT (2001), and include all VMT in Anoka, Hennepin, and Ramsey Counties. Sheboygan County: WIDOT (2005). Columbia data are from the City of Columbia, MO.
[75] University of Minnesota Study.

Table D-4: Marin's Projects and Programs

Project Type	Project	Status
Infrastructure	• Gate Six Rd/Bridgeway Intersection Improvements • San Rafael Transit Center Improvements • Enfrente Road Connector Class I* • Bridgeway to Ferry Path • Puerto Suello to Transit Center Connection • Northgate Class II Gap Closure • Lost Ranchitos Class II** • Reserve Funding for Cal Park Tunnel Pathway and Puerto Suello Pathway • Alameda del Prado Class II • Sir Francis Drake Sidewalk and Crosswalk improvements in Ross, Fairfax, and San Anselmo • Tennessee Valley Path Class I • Doherty Drive Class I • Manzanita Connector Class I • Medway Road Improvements • Terra Linda/Freitas Parkway Class II • Multiple-site, countywide projects including bicycle Racks and lockers, signing/striping, minor intersection improvements, and stops, lanes, and pathways.	All projects are funded
Planning	• Central Marin Ferry Connection • Alto Tunnel/Mill Valley-Corte Madera Divide Access Study • San Rafael to Fairfax Corridor Study • Bridgeway Path • Francisco Blvd. East Improvements • Miller Creek-Las Gallinas Improvements	All studies are funded
Education	• Bicycle education/streetskills • Riding with Youth Workshops • Facility Design Seminars for Engineers • Safety Campaign Development	All programs are funded
Public Awareness	• Street Smarts Program • Health promotion, co-sponsored with County Health Dept. • Share the Road/Share the Path Program • Informational booths at community events	All programs are funded
Resources	• Bicycle repair classes or programs • Maps for directional signage • Community pathway/walking maps	All programs are funded
Incentives	• Personal Travel Planning	All Programs are funded

Source: NMTPP Interim Report to Congress 2007: Table 2.3 p. 23

Table D-5: Marin County Infrastructure Improvements

Project	**Description**	**Cost**	**Scheduled Date of Completion**
Intersection Improvements	Improved detection of bicycles at traffic signals. (**Focus on this in discussion as being particularly innovative)**	$922,000	Spring 2010
Alameda del Prado Class II Lanes	New Class II bike lanes on the unincorporated section of Alameda del Prado between Alameda de la Loma and Posada del Sol.	$950,000 ($850,000 NMTPP)	Winter, 2010
Terra Linda – North San Rafael Improvements	New Class II bicycle lanes, sidewalk improvements, and enhancements at selected intersections to improve cyclist and pedestrian circulation.	$400,000	June 2010
Northgate Gap Closure	Class II lanes will be installed on Las Gallinas Avenue between the end of the existing Class II lanes at Las Colindas Road and Nova Albion Way and then from Merrydale Road to Ranchitos Road, to connect with the new Ranchitos Road Class II lanes (Project 2008). Class II lanes will also be installed on Northgate Drive.	$360,000	June 2010
Puerto Suello – Transit Center Connector	A combination of Class I multi-use path and Class III bike route between the San Rafael Transit Center and the Puerto Suello Hill Pathway	$1,200,000 ($600,000 NMTPP)	June 2010
Los Ranchitos Connector	The project will construct new Class II bike lanes on Ranchitos Road from North San Pedro Road to the Puerto Suello summit, connecting with the Puerto Suello Hill Pathway ***Important- will also improve the grade of the road making it easier for cyclists to maintain the same speeds as motorists)**	$1,160,000 ($1,000,000 NMTPP)	Summer 2009
Medway Improvements	New bike lanes, widened sidewalks, improved bus stops, and new street furniture will be installed while overhead utilities will be buried underground at the same time.	$1,665,300 ($500,000 NMTPP)	Fall 2008
Mahon Creek Path – Transit Center Connector	Class I path between the San Rafael Transit Center and the existing Mahon Creek Pathway and improvements to the Second Street/Tamalpais intersection for pedestrians and cyclists.	$350,000	June 2010
Bridgeway to Ferry Path	A new pedestrian and cycling path to connect Bridgeway to the Sausalito Ferry Terminal,	$200,000	Fall 2010
Puerto Suello Hill Pathway	As part of the final phase of the Highway 101 Gap Closure project, a separated Class I pathway is being constructed on the west side of the freeway. The path will begin at Mission Avenue in San Rafael at Hetherton Street and end at the Puerto Suello Hill summit, just east of Fair Drive.	$43,000,000 ($0 NMTPP)	Spring 2010

Tennessee Valley/Manzanita Pathway	Class I pathway along Coyote Creek from the Mill Valley/Sausalito path to a signalized crossing of Shoreline Highway at Tennessee Valley Road. A portion of the improved path will be a raised boardwalk to ensure the path is not submerged during high tides. Once across Shoreline Highway, the path will continue along Coyote Creek to the Tennessee Valley Road/Marin Avenue intersection. A new bicycle/pedestrian bridge will be constructed on the west side of Shoreline Highway over Coyote Creek.	$3,400,000 ($2,800,000 NMTPP)	Winter 2011
Cal Park Tunnel Pathway Project	A single track tunnel for future SMART rail service and an 11.5-foot wide path in the other half of the tunnel, with an approach path on either side, connecting Larkspur with San Rafael through the Cal Park hill.	$25,116,000 ($2,000,000)	Spring 2010

Table D-6: Sites of Highest Combined Pedestrian/Bike Counts

Location	**Description**	**# Pedestrians/Bicyclists**
Bridgeway Boulevard/Princess Street	Multiuse path thru a park that overlooks the Bay and has a view of San Francisco.	4,766
4th/B Streets, San Rafael	On street bike lanes thru a Business district with shops and restaurants.	1,563
Medway Road/Belvedere Street	(No description available)	1,142

Table D-7: Weekend Peak-Hour Pedestrian Counts and Percent Change, 1999-2009

		Counts				Percent Change Between Previous Counts and 2009		
Location	**Streets**	**1999**	**2007**	**2008**	**2009**	**1999**	**2007**	**2008**
1	Tiburon Blvd at Main Street, Tiburon	770	564	187	238	(69.1)	(57.8)	27.3
2	Miller Ave. at Throckmorton, Mill Valley	552	253	328	270	(51.1)	4.7	(17.7)
3	4th and B St	510	770	762	385	(24.5)	(50.0)	(49.5)
4	Bridgeway at Princess St, Sauselito	490	303	1388	1782	263.7	488.1	28.4
5	San Anselmo Ave at Tunstead, Ave, San Anselmo	450	222	60	194	(56.9)	(12.6)	223.3
6	Broadway at Bolinas Rd., Fairfax	146	125	276	124	(15.1)	(0.8)	(55.1)
7	Grant Ave., at Redwood Hwy., Novato	133	111	61	96	(27.8)	(13.5)	57.4
8	Magnolia Ave. at Ward St., Larkspur	120	102	114	133	10.8	30.4	16.7
9	Mill Valley-Sausalito Path at E. Blithedale, Mill Valley	*	19	39	28	*	47.4	(28.2)
10	Mill Valley-Sausalito Path at Tennessee Valley Path Junction, Tam Junction	14	48	40	55	292.9	14.6	37.5
11	Tiburon Bike Path at Blackie's Pasture, Tiburon	50	75	97	92	84.0	22.7	(5.2)
12	Larkspur-Corte Madera Path at Baltimore Wye	10	33	44	59	490.0	78.8	34.1
13	Corte Madera Creek Path at Bon Air Rd., Greenbrae	75	26	37	47	(37.3)	(80.8)	27.0
14	Medway Rd. at Belvedere St., San Rafael	*	198	279	258	*	30.3	(7.5)
15	Camino Alto at E. Blithedale, Mill Valley	*	15	12	6	*	(60.0)	(50.0)
16	Alameda Del Prado at Nave Drive, Novato	*	11	8	11	*	0.0	37.5
17	Ranchitos Rd at Puerto Suello Summit, San Rafael	*	20	1	4	*	(80.0)	300.0
18	Doherty Dr. at Hall Middle School, Larkspur	*	30	26	13	*	(56.7)	(50.0)
19	Sir Francis Drake at Wolfe Grade, Kentfield	*	15	8	5	*	(66.7)	(37.5)
20	Andersen Drive at Cal Park Tunnel Path, San Rafael	*	21	24	10	*	(52.4)	(58.3)
21	South Novato Blvd. at Rowland; Novato	*	13	*	6	*	(53.8)	*
22	Bellam at Andersen, San Rafael	*	20	*	34	*	70.0	*
Average count per location/Average Percent Change		276.7	136.3	189.6	175.0	4.7	28.4	0.5

Source: Walk Bike Marin 2009: Table B-4

Table D-8: Weekday Peak-Hour Pedestrian Counts and Percent Change, 1999-2009

		Counts				Percent Change Between Previous Counts and 2009		
Location	**Streets**	**1999**	**2007**	**2008**	**2009**	**1999**	**2007**	**2008**
1	Tiburon Blvd at Main Street, Tiburon	*	64	54	84	*	31.3	55.6
2	Miller Ave. at Throckmorton, Mill Valley	*	23	37	36	*	56.5	(2.7)
3	4th and B St	*	31	19	35	*	12.9	84.2
4	Bridgeway at Princess St, Sauselito	45	129	184	121	168.9	(6.2)	(34.2)
5	San Anselmo Ave at Tunstead, Ave, San Anselmo	34	41	40	69	102.9	68.3	72.5
6	Broadway at Bolinas Rd., Fairfax	20	61	67	80	300.0	31.1	19.4
7	Grant Ave., at Redwood Hwy., Novato	12	21	17	14	16.7	(33.3)	(17.6)
8	Magnolia Ave. at Ward St., Larkspur	*	25	33	45	*	8-.0	36.4
9	Mill Valley-Sausalito Path at E. Blithedale, Mill Valley	88	84	98	93	5.7	10.7	(5.1)
10	Mill Valley-Sausalito Path at Tennessee Valley Path Junction, Tam Junction	42	101	156	116	176.2	14.9	(25.6)
11	Tiburon Bike Path at Blackie's Pasture, Tiburon	32	77	58	93	190.6	20.8	60.3
12	Larkspur-Corte Madera Path at Baltimore Wye	42	28	44	141	235.7	403.6	220.5
13	Corte Madera Creek Path at Bon Air Rd., Greenbrae	4	27	38	35	775.0	29.6	(7.9)
14	Medway Rd. at Belvedere St., San Rafael	*	55	80	51	*	(7.3)	(36.3)
15	Camino Alto at E. Blithedale, Mill Valley	*	36	33	18	*	(50.0)	(45.5)
16	Alameda Del Prado at Nave Drive, Novato	*	6	11	4	*	(33.3)	(63.6)
17	Ranchitos Rd at Puerto Suello Summit, San Rafael	16	22	11	15	(6.3)	(31.8)	36.4
18	Doherty Dr. at Hall Middle School, Larkspur	*	28	26	28	*	0.0	7.7
19	Sir Francis Drake at Wolfe Grade, Kentfield	22	9	12	10	(54.5)	11.1	(16.7)
20	Andersen Drive at Cal Park Tunnel Path, San Rafael	*	37	39	35	*	(5.4)	(10.3)
21	South Novato Blvd. at Rowland; Novato	*	18	*	12	*	(33.3)	*
22	Bellam at Andersen, San Rafael	16	21	*	25	56.3	19.0	*
Average count per location/Average Percent Change		31.1	42.9	52.9	52.7	117.7	22.9	6.2

Source: Walk Bike Marin 2009: Table B-3

Table D-9: 2007 Walking and Bicycling 2-Hour Count Volumes for Weekdays and Weekends

		Week Day (Peak Hr between 4-6)			Weekend Day (Peak Hr between 12-2 pm)		
Location	**Streets**	**Bicyclists**	**Pedestrians**	**Total**	**Bicyclists**	**Pedestrians**	**Total**
1	Tiburon Blvd at Main Street, Tiburon	102	426	528	278	983	1261
2	Miller Ave. at Throckmorton, Mill Valley	41	167	208	86	503	588
3	4th and B St	52	1141	1193	47	1492	1539
4	Bridgeway at Princess St, Sauselito	246	614	860	150	515	665
5	San Anselmo Ave at Tunstead, Ave, San Anselmo	67	203	270	176	388	564
6	Broadway at Bolinas Rd., Fairfax	100	139	239	267	187	454
7	Grant Ave., at Redwood Hwy., Novato	26	100	126	14	209	223
8	Magnolia Ave. at Ward St., Larkspur	38	160	198	129	123	252
9	Mill Valley-Sausalito Path at E. Blithedale, Mill Valley	137	68	205	194	32	226
10	Mill Valley-Sausalito Path at Tennessee Valley Path Junction, Tam Junction	157	28	185	516	60	576
11	Tiburon Bike Path at Blackie's Pasture, Tiburon	112	133	245	133	132	265
12	Larkspur-Corte Madera Path at Baltimore Wye	45	110	155	105	55	160
13	Corte Madera Creek Path at Bon Air Rd., Greenbrae	45	60	105	56	42	98
14	Medway Rd. at Belvedere St., San Rafael	94	420	514	56	395	451
15	Camino Alto at E. Blithedale, Mill Valley	64	61	125	49	21	70
16	Alameda Del Prado at Nave Drive, Novato	6	11	17	7	15	22
17	Ranchitos Rd at Puerto Suello Summit, San Rafael	30	16	46	84	31	115
18	Doherty Dr. at Hall Middle School, Larkspur	34	53	87	35	51	86
19	Sir Francis Drake at Wolfe Grade, Kentfield	17	37	54	25	22	47
20	Andersen Drive at Cal Park Tunnel Path, San Rafael	52	17	69	30	39	69
21	South Novato Blvd. at Rowland; Novato	35	69	104	23	16	39
22	Bellam at Andersen, San Rafael	33	61	94	14	35	49
Average count per location/Average Percent Change		70	186	256	112	243	555

Source: Walk Bike Marin 2009: Table B-5

Table D-10: Weekday 2007 Two-Hour Bicyclist Volumes & Attributes: Gender, Age and Helmet Use

	Bicyclists						
Loc #	**Streets**	**Male**	**Female**	**Total**	**Children**	**No Helmet**	**Wrong Way**
1	Tiburon Blvd at Main Street, Tiburon	251	129	380	30	63	27
2	Miller Ave. at Throckmorton, Mill Valley	96	31	127	25	28	28
3	4th and B St	86	22	108	10	0	0
4	Bridgeway at Princess St, Sauselito	247	149	396	12	135	0
5	San Anselmo Ave at Tunstead, Ave, San Anselmo	186	57	243	`5	22	0
6	Broadway at Bolinas Rd., Fairfax	*	*	367	*	*	*
7	Grant Ave., at Redwood Hwy., Novato	35	5	40	20	25	12
8	Magnolia Ave. at Ward St., Larkspur	31	7	38	14	26	4
9	Mill Valley-Sausalito Path at E. Blithedale, Mill Valley	*	*	331	*	*	*
10	Mill Valley-Sausalito Path at Tennessee Valley Path Junction, Tam Junction	*	*	673	*	*	*
11	Tiburon Bike Path at Blackie's Pasture, Tiburon	135	110	245	66	55	*
12	Larkspur-Corte Madera Path at Baltimore Wye	*	*	150	*	*	*
13	Corte Madera Creek Path at Bon Air Rd., Greenbrae	58	33	101	14	15	*
14	Medway Rd. at Belvedere St., San Rafael	147	3	150	22	151	46
15	Camino Alto at E. Blithedale, Mill Valley	*	*	113	*	*	*
16	Alameda Del Prado at Nave Drive, Novato	*	*	13	*	*	*
17	Ranchitos Rd at Puerto Suello Summit, San Rafael	*	*	114	*	*	*
18	Doherty Dr. at Hall Middle School, Larkspur	63	17	80	22	5	5
19	Sir Francis Drake at Wolfe Grade, Kentfield	38	4	42	12	4	0
20	Andersen Drive at Cal Park Tunnel Path, San Rafael	75	7	82	0	61	16
21	South Novato Blvd. at Rowland; Novato	*	*	58	*	*	*
22	Bellam at Andersen, San Rafael	*	*	47	*	*	*
Total (of locations reporting attributes)		1458	574	2032	262	590	590
Percent		72%	38%	100%	13%	29%	29%

Source: Walk Bike Marin 2009: Table B-6

Table D-11: 2008 Two-Hour Weekday and Weekend Total Bicyclist and Pedestrian Volumes

		Bicyclists	**Pedestrians**
Loc #	**Streets**	**Total**	**Total**
1	Tiburon Blvd at Main Street, Tiburon	339	352
2	Miller Ave. at Throckmorton, Mill Valley	157	932
3	4th and B St	99	1588
4	Bridgeway at Princess St, Sauselito	1147	2760
5	San Anselmo Ave at Tunstead, Ave, San Anselmo	132	216
6	Broadway at Bolinas Rd., Fairfax	263	814
7	Grant Ave., at Redwood Hwy., Novato	72	210
8	Magnolia Ave. at Ward St., Larkspur	234	382
9	Mill Valley-Sausalito Path at E. Blithedale, Mill Valley	767	125
10	Mill Valley-Sausalito Path at Tennessee Valley Path Junction, Tam Junction	901	154
11	Tiburon Bike Path at Blackie's Pasture, Tiburon	359	487
12	Larkspur-Corte Madera Path at Baltimore Wye	160	140
13	Corte Madera Creek Path at Bon Air Rd., Greenbrae	59	89
14	Medway Rd. at Belvedere St., San Rafael	217	1095
15	Camino Alto at E. Blithedale, Mill Valley	261	38
16	Alameda Del Prado at Nave Drive, Novato	38	34
17	Ranchitos Rd at Puerto Suello Summit, San Rafael	22	3
18	Doherty Dr. at Hall Middle School, Larkspur	96	125
19	Sir Francis Drake at Wolfe Grade, Kentfield	28	30
20	Andersen Drive at Cal Park Tunnel Path, San Rafael	103	69
21	South Novato Blvd. at Rowland; Novato	*	*
22	Bellam at Andersen, San Rafael	*	*
Total (of locations reporting attributes) Percent		5454	9643

Source: Walk Bike Marin 2009: Table B-6

Table D-12: 2009 Two-Hour Weekday and Weekend Total Bicyclist and Pedestrian Volumes

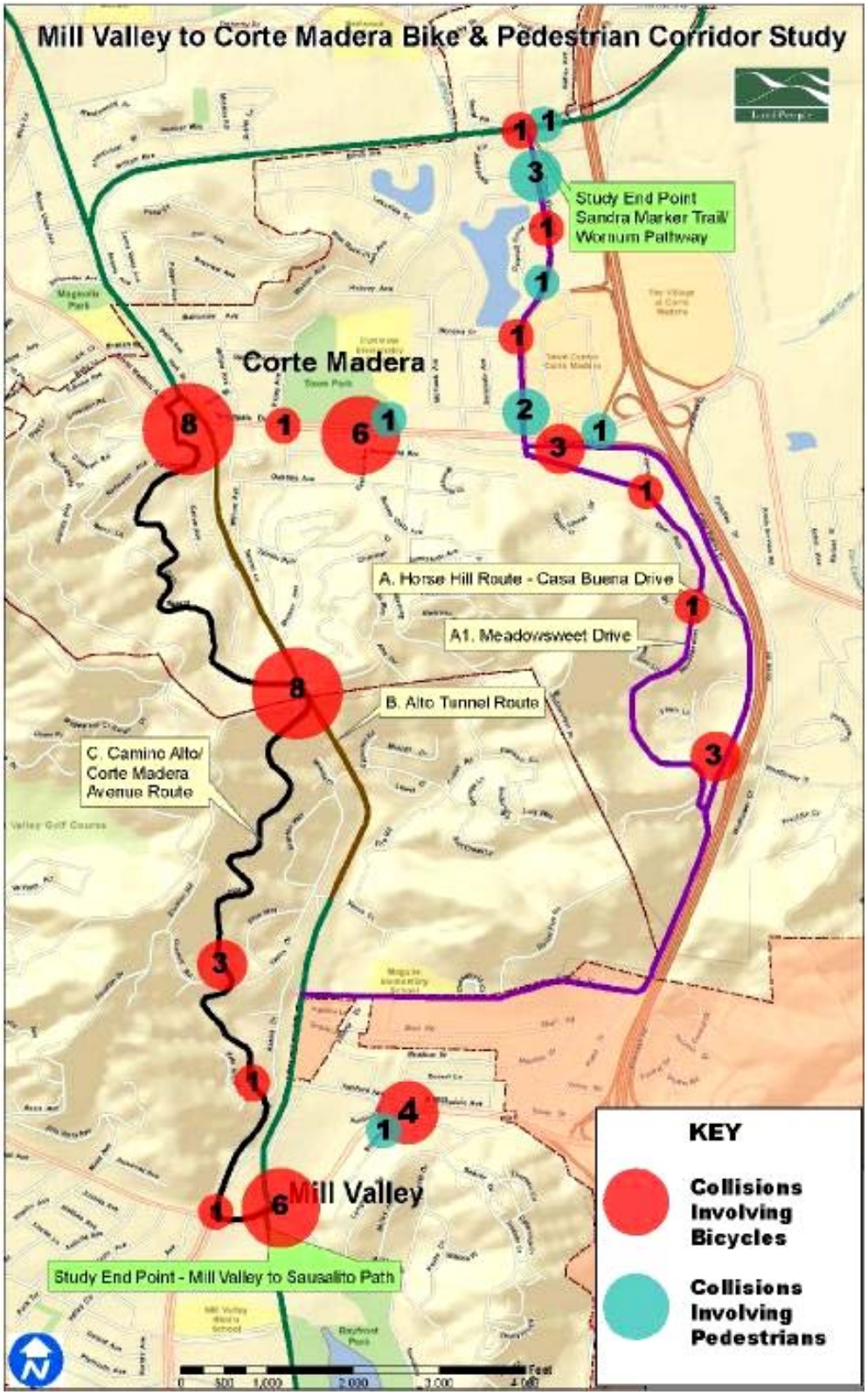
		Bicyclists			Pedestrians		
Loc #	**Streets**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
1	Tiburon Blvd at Main Street, Tiburon	172	57	229	433	420	853
2	Miller Ave. at Throckmorton, Mill Valley	86	17	103	369	431	800
3	4th and B St	91	18	109	778	676	1454
4	Bridgeway at Princess St, Sauselito	804	406	1210	1682	1874	3556
5	San Anselmo Ave at Tunstead, Ave, San Anselmo	264	72	336	263	324	387
6	Broadway at Bolinas Rd., Fairfax	471	139	610	229	193	422
7	Grant Ave., at Redwood Hwy., Novato	50	8	58	268	241	509
8	Magnolia Ave. at Ward St., Larkspur	162	45	207	206	249	455
9	Mill Valley-Sausalito Path at E. Blithedale, Mill Valley	520	179	699	65	38	103
10	Mill Valley-Sausalito Path at Tennessee Valley Path Junction, Tam Junction	658	255	913	80	83	163
11	Tiburon Bike Path at Blackie's Pasture, Tiburon	190	119	309	122	163	173
12	Larkspur-Corte Madera Path at Baltimore Wye	110	55	165	74	109	183
13	Corte Madera Creek Path at Bon Air Rd., Greenbrae	84	51	135	57	74	131
14	Medway Rd. at Belvedere St., San Rafael	168	6	174	616	352	968
15	Camino Alto at E. Blithedale, Mill Valley	49	25	74	23	12	35
16	Alameda Del Prado at Nave Drive, Novato	26	9	35	10	16	26
17	Ranchitos Rd at Puerto Suello Summit, San Rafael	26	9	35	11	3	14
18	Doherty Dr. at Hall Middle School, Larkspur	66	51	117	176	152	328
19	Sir Francis Drake at Wolfe Grade, Kentfield	18	6	24	18	32	50
20	Andersen Drive at Cal Park Tunnel Path, San Rafael	85	3	88	32	21	53
21	South Novato Blvd. at Rowland; Novato	30	2	31	11	10	21
22	Bellam at Andersen, San Rafael	51	9	60	58	9	67
23	Nacasio Valley Road near Nicasio School, Nicasio	73	53	126	-	-	-
Total (of locations reporting attributes) Percent		4181 73%	1541 27%	5721 100%	5581 50%	5482 50%	10951 100%

* = PM Counts are four hours, from 2:00 to 6:00 PM

** = Bicycle counts at Location 23 - Nicasio Valley Road near Nicasio School are weekend only. During the same weekend period as shown in the table, there were 431 passing vehicles at the same location.

Source: Walk Bike Marin 2009: Table B-7

Figure 1 Mill Valley to Corte Madera Bike & Pedestrian Study: Bicycle and Pedestrian Collision Data, 2004-2008



Source: Mill Valley to Corte Madera Bike and Pedestrian Corridor Study 2009

Appendix E: Background and Analysis

Figure E-1: Safety in Numbers

Safety in Numbers

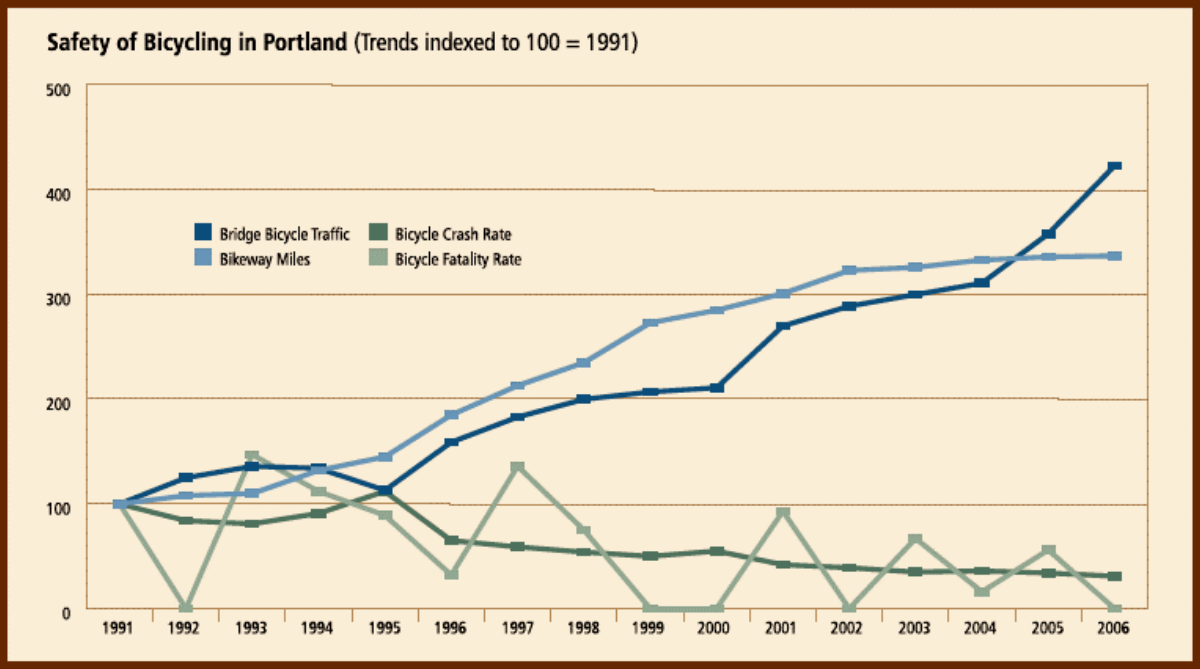
Infrastructure Improvements Lower Fatality Rates

Designing communities to foster active transportation improves the safety of bicyclists and pedestrians. In 2006, more than 4,784 pedestrians and 771 bicyclists were killed on U.S. roads. Despite this disproportionate share of fatalities, federal funding to address bicycle and pedestrian safety has been sorely lacking.

In European countries that have invested considerably in bicycle and pedestrian infrastructure, such as Germany or the Netherlands, fatality rates for non-motorists are about 10 times lower than in the United States.[4, 25] Australian cities also report increased safety for bicyclists as a result of infrastructure investments and increased bicycling.[5]

Portland, Ore., is a prime example of how investment in bicycle infrastructure results in increased safety. Since 1991, Portland has steadily expanded its network of bicycle facilities, and observed a constant growth in bicycling, while crash and fatality rates among cyclists significantly decreased. Between 1991 and 2006, Portland was able to reduce the crash rate by more than 69 percent. In that time period, the number of bicyclists grew more than four fold, while the number of fatalities remained low, between zero and five per year.

Infrastructure investments are clearly an effective and necessary measure to increase the safety of cyclists and pedestrians. Additional measures, such as education of motorized and non-motorized traffic participants, and various forms of traffic regulations can further improve safety.



From *Active Transportation for America: The Case for Increased Federal Investment in Bicycling and Walking* © 2008 Rails-to-Trails Conservancy

* Source: Rails-to-Trails Conservancy. *Active Transportation for America: The Case for Increased Federal Investment in Bicycling and Walking*. Rep. Rails-to-Trails Conservancy, 15 Oct. 2008. Web. 27 Feb. 2010.

Class I Bikeways Figures E-2 thru E-6:

Figure E-2 Cycletrack

Source: Altaplanning.com

Figure E-3 Greenway through Vondelpark, Amsterdam

Source: Addison Green

Figure E-4 Rail Trail along an abandoned railroad corridor

Source: Bike-Walk Alliance New Hampshire, www.bwanh.org

Figure E-5 Overpass. Martin Sabo Bike and Pedestrian Bridge, Minneapolis, MN

Source: Bike Walk Twin Cities

Figure E-6 Underpass in New Zealand

Source: nzta.govt.nz

Class II Bikeways Figures E-7 thru E-10:

Figure E-7 Paved Shoulder in Ontario, Canada

Source: www.thecyclistwebhouse.com

Figure E-8 Bike lane in New York City

Source: www.nycbikemaps.com

Figure E-9 Sharrows along both sides of a street in Seattle, WA

Source: sdotblog.seattle.gov

Figure E-10 Bike Boulevard in Berkeley.CA

Source: svn.openplans.org

Figure E-11 Example Advertising Campaign

Source: LookNYC.org

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