UNIVERSITY OF MINNESOTA

Nonmotorized Transportation Pilot Program Evaluation Study

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Active Communities / Transportation Research Group

CTS CENTER FOR TRANSPORTATION STUDIES

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Executive Summary

The 2005 federal transportation authorization bill, SAFETEA-LU (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users), provides more than $500 million to communities to construct nonmotorized transportation facilities and promote use of these facilities. The Nonmotorized Transportation Pilot Program (NTPP) specifically included $100 million for pilot programs in four communities (Columbia, Missouri; Marin County, California; Minneapolis, Minnesota; Sheboygan County, Wisconsin) to increase levels of walking and cycling. The NTPP also included funding to evaluate the efficacy of these programs, in 2006 and again in 2010. Toward this end, this report describes the efforts to establish baseline data that will be used for comparison purposes in 2010.

The baseline survey centers around two primary goals:

1. Understanding behavior as it relates to general notions of walking, cycling, and transit use in the communities, to be used to compare post-program results. There are a number of specific comparison criteria.
2. Developing a profile of behavior and attitudes in the individual communities that can aid in program decision making.

This report describes the key features of walking and bicycling behavior as they relate to the stated program objectives. It also provides additional information on walking and bicycling behavior that can serve as further reference points for future comparison. Finally, it furnishes information about attitudes toward nonmotorized transportation-related issues in the program communities. The research team strategically constructed a survey to glean reliable information on the following attributes of walking and cycling: frequencies, distances, purposes, attitudes, barriers, and other related information.

The data demands required the research team to develop innovative ways of collecting a broad array of information, employing a three-tiered data collection plan. The first step included a short survey sampling the general public to provide broad-based information, useful for estimating the overall prevalence and frequency of walking and cycling. The second step administered a longer survey to willing respondents from the initial short survey, focusing in particular on those who reported nonauto travel activities in order to collect as much detailed information as possible about these modes.

The third tier of data collection involved dividing the full survey respondents into four categories based on their use of the various travel modes: transit, bicycle, walk, and auto. While most of the full survey was the same for all respondents, one section was devoted to a more detailed exploration of a particular “reference trip” (e.g., distance, destination types, perceptions along the route), as well as some mode-specific attitudinal questions.

The research team contracted with NuStats, one of the nation’s leading travel behavior survey firms, to administer all parts of the survey, which took place between September 2006 and January 2007. An additional community, Spokane, Washington, was also surveyed as a control community. For Minneapolis and Columbia, the survey was administered within the boundaries of those cities. For Sheboygan and Spokane, the survey area comprised the entire

county in which they are located. For Marin, the survey focused on a specific list of census tracts in the eastern portion of the county.

In terms of participation, from the original 31,120 self-mailers sent out (through a combination of the pilot and full study), 1,826 were returned with bad addresses or were otherwise undeliverable by the U.S. Postal Service. A total of 4,457 completed self-mailers (by any method) yielded a 15 percent response rate, with 4,432 of those eligible for participation in the follow-up survey. From those eligible self-mailers, 1,514 resulted in a completed interview or web completion, for a 34 percent response rate. Certain adjustments to the data were used to account for three specific biases in the nature of the data collection: (1) the impact of weather conditions, (2) the sampling strategy, and (3) response biases.

The report identifies five different categories of outcome measures that are analyzed. Appendices A through D provide statistics for all of the questions from the survey. Specific questions about the behavior of walking and cycling can be analyzed along two parallel tracks: one for the recreational-related trips and another for the transportation-related trips. Only the latter type theoretically affects congestion, pollution, and energy use.

In this survey, the most reliable way to determine the impact of increased walking and cycling on auto use is through performing several iterations of analyses, in concert with knowledge of the characteristics of trips made by these modes. The sequence of logic is the following:

- Determine how many people cycle and walk each day.
- Of these, estimate how many are commuting, traveling to other destinations, or using the modes solely for recreation. This last group is not replacing auto travel and is dropped from subsequent calculations.
- For the first two groups, estimate total daily distance. Two methods are used: one is based on trip counts and calculated trip lengths, the other on reported daily travel times.
- Of this total daily distance, determine how much is replacing auto travel. This is different for commuting versus travel to other destinations.

Tables E.1 and E.2 summarize estimates of the amount of driving that is avoided by cycling and walking, respectively, based on the responses to the 2006 survey alone. The detailed methodology and assumptions leading to these results are described in detail in the report.

Table E.1: Estimated reduction in auto use due to bicycling
(miles of avoided auto use per adult resident per day)

Region	Lower bound	Upper bound	Average
Columbia	0.096	0.148	0.122
Marin	0.197	0.270	0.233
Minneapolis	0.203	0.242	0.222
Sheboygan	0.047	0.105	0.076
Spokane	0.059	0.120	0.089
Total	0.120	0.176	0.148

Table E.2: Estimated reduction in auto use due to walking
(miles of avoided auto use per adult resident per day)

Region	Lower bound	Upper bound	Average
Columbia	0.300	0.351	0.326
Marin	0.364	0.506	0.435
Minneapolis	0.488	0.699	0.593
Sheboygan	0.117	0.244	0.180
Spokane	0.163	0.278	0.221
Total	0.276	0.412	0.344

Tables E.3 and E.4 summarize the shares of total trips and total daily mileage by mode.

Table E.3: Share of total person trips by mode

Region	Vehicle	Rideshare	Transit	Walk	Bicycle	Sample size (respondents)
Columbia	86%	2.2%	2.2%	8.6%	1.5%	797
Marin	82%	1.4%	3.2%	11.8%	1.8%	891
Minneapolis	69%	2.2%	9.7%	17.6%	2.0%	837
Sheboygan	89%	2.4%	1.2%	6.6%	0.7%	972
Spokane	85%	2.0%	4.1%	8.5%	0.8%	960
Total	82%	2.1%	4.1%	10.7%	1.4%	4457

Table E.4: Total daily mileage per person by mode (based on all trips)

Region	Vehicle	Transit	Walk	Bicycle	Sample size (respondents)
Columbia	15.1	0.21	0.30	0.10	797
Marin	23.6	1.37	0.40	0.22	891
Minneapolis	20.7	2.23	0.55	0.23	837
Sheboygan	22.3	0.11	0.16	0.06	972
Spokane	25.9	0.88	0.25	0.08	960

Between the two modes, the total estimated reduction in auto travel is in the range of a quarter to three quarters of a mile per adult resident per day. This is in the context of average levels of auto travel in the range of 15 to 25 miles per day per person in these communities. Thus, the use of these modes probably reduces auto travel about 1% to 3% in these regions, representing a baseline from which post-program comparisons can be derived.

The survey of the five communities will be repeated in 2010. Data collected from the two surveys will be analyzed to identify changes in walking or cycling behavior or attitudes that resulted from the interventions. Such analysis will contribute to a better understanding of the factors that influence the choice to walk or cycle for both the communities under study and other communities waiting to rely on these results from this research.

1. Introduction

Traffic congestion, obesity, and environmental conservation are receiving increased attention both globally and in the United States. Interest is also growing in the role of walking and cycling in addressing such concerns, and many communities are looking to spur walking and cycling through planning activities. This enthusiasm has created a need for evidence on the degree to which different policies have succeeded in inducing nonmotorized travel and producing other benefits for the community. Did the sidewalk encourage more people to become physically active? Did showers and locker rooms at the worksite spur cycling to work? Did the improved intersection increase rates of walking? How much fuel was saved by constructing the bicycle trail? Answers to such questions could influence future policy decisions.

Evidence so far is sparse but may soon be growing. In the United States, the 2005 federal transportation authorization bill, SAFETEA-LU (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users), provides more than $500 million to communities to construct nonmotorized transportation facilities and promote use of these facilities. The Nonmotorized Transportation Pilot Program (NTPP) specifically included $100 million for pilot programs in four communities to increase levels of walking and cycling.

Such "interventions" provide a living laboratory often called for but rarely exploited in the transportation planning field. The NTPP also included funding to evaluate the efficacy of these programs—in 2006 and again in 2010—under the logic that documenting benefits in one community provides a basis for judging the potential benefits of proposed policies in other communities. Toward this end, this report describes the efforts to establish baseline data that will be used for comparison purposes in 2010.

1.1. Understanding the Effects of Interventions

Walking and cycling interventions generally fall under the umbrella of either "soft" measures (e.g., education, encouragement, or enforcement) or "hard" measures (e.g., infrastructure investments such as better street crossings or bike lanes). The former may bring about increased walking and cycling through psychological changes, such as increased desire or motivation to walk, or through complex social interactions, such as exchange of information with peer groups (a form of social learning). The interventions from the "hard" category require changes in the built environment. Behavioral changes theoretically result primarily from the increases in access, attractiveness, safety, comfort, and security that these infrastructure improvements offer. Additionally, they may stimulate changes in perceptions, attitudes, and other psychological factors similar to those anticipated by soft measures.

Regardless of the explanation, increased levels of cycling and walking could be observed from three factors:

- Trips previously made by motorized modes
- New nonmotorized trips
- Lengthened total time or distance of nonmotorized trips

Increased use of walking and cycling, in turn, leads to secondary effects at the individual level that may be longer term in nature, such as changes in auto ownership, increases in transit ridership, or improved health. In addition, a number of secondary benefits may accrue to the community. For example, a new bike path, if extensively used, may prompt or stimulate development and increased private investment. Thousands more people walking to work rather than driving would reduce pollution and traffic congestion for the community.

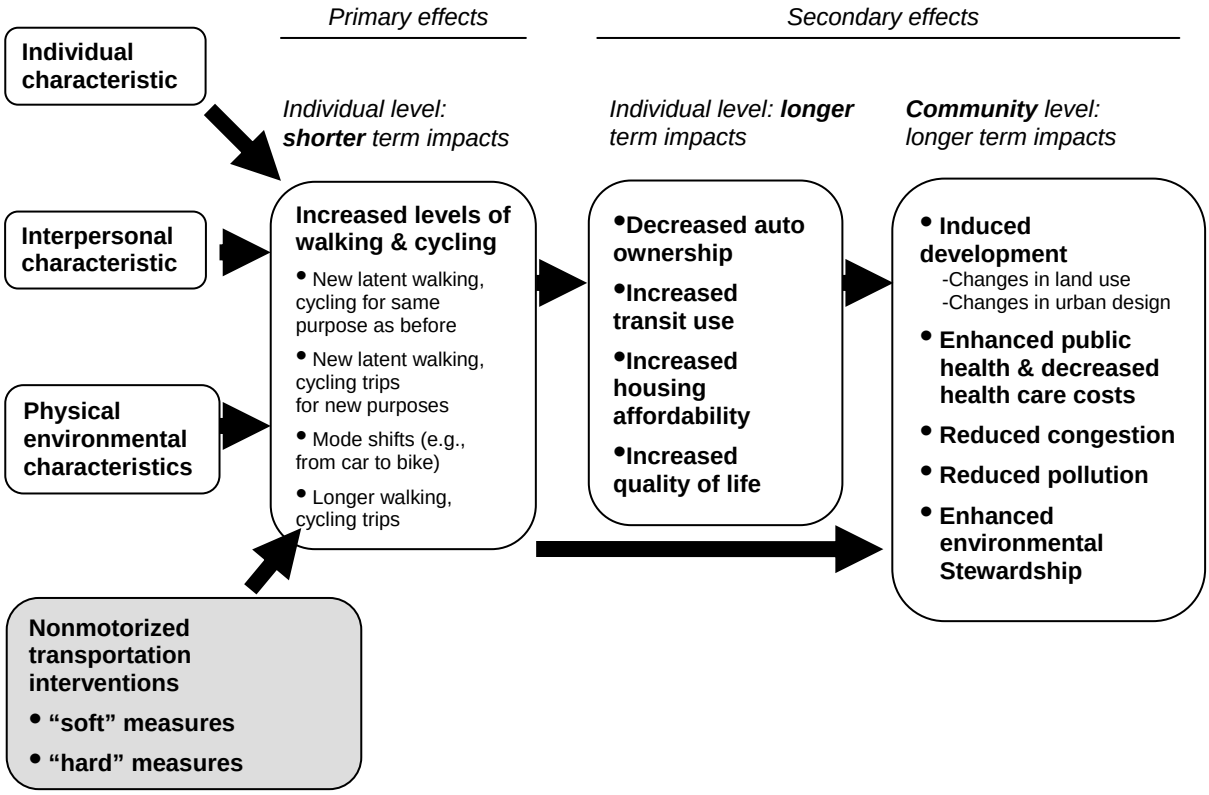

Figure 1.1: Conceptual framework

These secondary effects, at both the individual and community level, contribute to various desired policy outcomes, such as improved air quality, reduced health care costs, and increased livability (Figure 1.1). The broad range of possible policy outcomes from walking and cycling expands the justification for programs to promote such activity. At the same time, however, such oft-cited benefits generate other expectations that are more challenging to support because the benefits are more tenuously connected to levels of walking and cycling. Issues often mentioned at the forefront of nonmotorized policy initiatives—traffic congestion, obesity, and environmental conservation—have many different causes, and levels of walking and cycling may have a minor effect on the overall extent of the problem.

The endeavor documented in this report affords a living laboratory for research often called for, but rarely conducted, in policy circles: a before-and-after investigation to demonstrate to other communities across the country the specific merits of investing in walking and cycling

infrastructure. Namely, it reports the results of a baseline survey of rates of cycling and walking conducted in the four pilot communities in 2006. The survey of the four communities will be repeated in 2010. Data collected from the two surveys will be analyzed to identify changes in characteristics of walking or cycling behavior or attitudes that have taken place as a result of the interventions.

1.2. Survey Objectives and Report Organization

The baseline survey centers around two primary goals:

1. Understanding behavior as it relates to walking, cycling, and transit use in the communities, to be used to compare post-program results. A number of specific comparison criteria are discussed below.
2. Developing a profile of behavior and attitudes in the individual communities that can aid in program decision making.

This report consists of five chapters to describe the survey process and results. The introductory chapter outlines general issues and challenges of this type of study. The second chapter describes the survey design and methodology; the third chapter provides an overview of the sample that was obtained and how it can be used for the purposes of this research. The fourth chapter discusses the methodology and results of the primary analysis of the survey. The fifth chapter summarizes key conclusions.

The main body of the report describes a number of key features of walking and bicycling behavior as they relate to the stated program objectives. The primary focus of this analysis is estimating the amount of driving that is avoided due to walking and cycling in the survey communities; this represents a baseline for comparison at the conclusion of the program in 2010. Other key information includes transit access by nonmotorized modes, and the use of the various travel modes based on the number of trips and on total daily mileage.

A series of appendices contain additional survey results, maps, further discussion of methodology, and other reference materials. The first four appendices contain tables of results for all the survey questions that are not addressed in the main body of the report. Because the survey included a large number of questions (not all of which were asked of every respondent), these appendices contain a great deal of material of potential interest, both for planning investments and for evaluating changes in attitudes at the conclusion of the program.

Appendix A contains additional behavioral results that were not used in the primary analysis in the main body of the report. These fall into several broad categories:

- Most recent use of modes other than bicycle and walk to destination
- Mode to commute to work and school
- Days of walking and cycling per week and daily durations (see section 3.4.2)
- Frequency of walking and cycling to particular destinations
- Frequency of walking and cycling to destinations in general
- Facility types used for bicycling trips

Appendix B is the first of three appendices of attitudinal results. Again, there are several categories of questions covered:

- Satisfaction with infrastructure and service quality for various modes
- Approval of additional spending for various transportation purposes
- Safety concerns on walking and cycling trips
- Opinions of a variety of transit characteristics
- Modes of access to school for children
- Opinions about barriers to walking and cycling to school

Appendix C offers responses to 19 different questions about various characteristics of the respondent's home neighborhood in terms of suitability for walking and cycling. Appendix D provides responses to 27 questions regarding the factors that would motivate the respondent to use specific nonauto modes (walk, bicycle, transit) more frequently.

The rest of the appendices provide additional analyses, methodological discussions, and reference materials, in support of the primary report analysis. Their content is discussed in more detail at the appropriate point in the report text where they are referenced.

2. Research Design

The goal of research is typically is to be able to say with some certainty that an intervention of a certain type will have an impact of an estimated magnitude and/or character. Underlying this statement is evidence of a causal effect. Criteria for causality are: association, non-spuriousness, and time-order. Meeting these criteria is not easy in behavioral research, and it usually occurs in stages as knowledge accumulates and research designs evolve.

This research effort employs a pre-test/post-test quasi-experimental design. Good baseline data are critical to such a pursuit. The text below describes the process to ensure accurate baseline conditions of walking and cycling behavior and attitudes in 2006.

2.1. Behaviors to be Surveyed

Both walking and cycling have many different dimensions that might be relevant in understanding the primary and secondary effects of an intervention. Possibilities include whether or not individuals walk or cycle, the frequency with which they walk or cycle, the distances they walk or cycle, the time they spend walking or cycling, the purpose of trips for which they walk or cycle, and the routes they choose for walking or cycling. Intermediate effects might also be of interest, for example, changes in attitudes as a result of the intervention that do not necessarily translate into changes in behavior, at least in the short term. Different dimensions have different implications for policy outcomes and for data collection, as discussed below.

In addition to the direct effect of the intervention on walking and cycling levels, one or more secondary effects are of interest. Legislation from Section 1807 of SAFETEA-LU, for example, calls for the development of statistical information about whether pilot projects funded under the legislation have led to changes in motor vehicle usage, nonmotorized transportation usage, public transportation usage, congestion, energy consumption, frequency of bicycling and walking, connectivity to community activity centers, health, and environment. This is a challenging list of objectives for a single survey.

For example, estimating the prevalence and frequency of walking and biking among the general public requires a broad-based survey. However, the need to know specific characteristics of walk and bike activities, such as average distance per day, and how much of this distance is replacing driving, requires a large sample specifically of people who participate in these activities. Subsequently, the research team prepared the survey instrument in a manner that allowed them to collect data on a wide array of outcome measures to assess the program's impacts on issues called for in the legislation.

In addition to standard sociodemographic questions, the research team strategically constructed the survey to glean reliable information on the following attributes of walking and cycling: frequencies, distances, purposes, attitudes, barriers, and other related information. In sum, data was collected for a broad range of walking and cycling dimensions; at the same time, for select questions and behaviors, considerable detail was collected.

2.2. Survey Format

The data demands required the research team to develop innovative ways of collecting a broad array of information, employing a three-tiered data collection plan.

The first step included a short survey sampling the general public to provide broad-based information, useful for estimating the overall prevalence and frequency of walking and cycling (see Appendix J for a copy of the survey instrument).

The second step administered a longer survey (see Appendix K) to willing respondents from the initial short survey, focusing in particular on those who reported nonauto travel activities in order to collect as much detailed information as possible about use of these modes. This longer survey also included questions about attitudes, barriers to use, and socioeconomic characteristics.

The third tier of data collection involved dividing the full survey respondents into four categories based on their use of the various travel modes: transit, bicycle, walk, and auto. While most of the full survey was the same for all respondents, one section was devoted to a more detailed exploration of a particular "reference trip" (e.g., distance, destination types, perceptions along the route), as well as some mode-specific attitudinal questions.

2.3. Control Group

In efforts to better understand the impact of the intervention, it is important to control for any factors that apply to the entire experimental unit (the community). An effective strategy to do so uses control groups. Both treatment and control cases are required to be able to control for any element that is completed external to the communities (i.e., factors global in nature such as rising oil prices). Without proper control groups, it is impossible to detect "pure" changes that may have been influenced by the treatment. Instead, the research may be influenced by broader phenomena such as social changes or the pricing of alternative modes.

This research effort therefore employs a pre-test/post-test quasi-experimental design. We use the four communities identified in the legislation as treatment sites, plus an additional community (not subject to the intervention) to better control for factors—other than the intervention—that might influence walking and cycling.

To be most reliable, the control community should be as similar as possible to the program regions. Achieving this objective was challenging, as the treatment communities were originally identified in (and chosen for) the legislation because of their disparate nature. For example, Minneapolis has the largest population, lowest income, greatest number of minority residents, and highest rate of transit and nonmotorized transportation. Columbia is a geographically isolated, college-oriented town and consequently has the lowest median age.[1] Marin County is older, wealthier, warmer, and drier than the other three communities.

[1] The college atmosphere likely explains the high percentage of walking and bicycling, although transit ridership is nearly zero.

Sheboygan County has the largest percentage of white residents and lowest nonmotorized transportation rates. While Sheboygan and Marin Counties are naturally larger in area than the cities, most of their population lives in a few concentrated areas.

Given the variation in data and multiple measures, the research team decided it was important to match against four criteria: (1) geographical character (we did not want a large city or an overly small community), (2) average income and racial composition of residents, (3) a place where cycling and walking at least have "healthy" current rates of use and are not near zero (the theory being that the largest predictor of future levels of walking and cycling are current levels of walking and cycling), and (4) a community without a relatively progressive planning culture nor one with a high likelihood of pursuing walking and bicycling infrastructure improvements between 2006 and 2010. In consultation with project stakeholders, the research team identified Spokane, Washington, as the control community. (See comparison of sociodemographic characteristics and other selection criteria described in Appendix E.)

2.4. Survey Administration

The University of Minnesota contracted with NUSTATS to administer all parts of the survey, which took place between September 2006 and January 2007. An additional community, Spokane, Washington, was also surveyed as a control community. For Minneapolis and Columbia, the survey was administered within the boundaries of those cities. For Sheboygan and Spokane, the survey area comprised the entire county in which they are located. For Marin, the survey focused on specific census tracts in the eastern portion of the county.

A full account of the survey methodology, protocol, and response rates is provided in Appendix I.

Because one of the objectives of the survey was to acquire select information from walkers, cyclists, and transit users, it was necessary to oversample users of these modes relative to their prevalence in the population at large. To ensure that a sufficient number of these nonauto users would be surveyed, the project team used the Census Transportation Planning Package data and software to target the census tracts in each region in which households have the greatest propensity for walking, cycling, or transit use. These census tracts were targeted with a greater number of surveys per household than other tracts in the region.

The first part of the survey—the self-mailer—was sent to a randomly chosen set of 6,000 households in each region. This self-mailer contained a few questions and asked the respondent to agree to participate in the full survey. Based on the response to question #2 from the self-mailer (i.e., time that has passed since last transit, cycling, or walking trip), respondents were assigned one of four mode categories, only to be used to assign a specific reference trip for that respondent.

Our criterion for deciding if a respondent was a "user" of a mode was whether the person had used that mode in the past three months. Because many people had used more than one mode during this time, we placed each person in a single mode category using a hierarchy. The

research team, in consultation with NUSTATS, determined transit to be the rarest mode and therefore decided to fill this quota first. The hierarchical order then filled cycling and walking. As quotas for a given mode were filled, people were placed in the next lower mode in the hierarchy. Generally we aimed for not more than 100 in each mode, although in a couple of cases this was exceeded because totals were not calculated until the end of each day.

Those who agreed to participate in the full survey were telephoned at a later time, and an option of completing the survey (as well as the self-mailer itself) via Internet was also available. The full survey took approximately 18 minutes to complete by telephone.

In early December the research team decided to directly call nonrespondents in an effort to boost the number of completed surveys. Telephone numbers were available for a subset of the original sample. In these cases, respondents were first asked the questions from the self-mailer. They were assigned to a reference mode based on these answers, after which the full survey was administered immediately.

In terms of participation, from the original 31,120 self-mailers sent out (through a combination of the pilot and full study), 1,826 were returned with bad addresses or were otherwise undeliverable by the U.S. Postal Service. A total of 4,457 completed self-mailers (by any method) yielded a 15 percent response rate, with 4,432 of those eligible for participation in the follow-up survey. From those eligible self-mailers, 1,514 resulted in a completed interview or web completion, for a 34 percent response rate.

Because levels of walking and cycling have been shown to be affected by climate, an analysis of weather conditions during the sample period is provided in Appendix G (and discussed in Section 3.2.1).

3. Sample Characteristics

3.1. Sample Description

Administering the survey resulted in a total of 4,457 responses. Given the three tiers involved in the survey collection, results break down in the manner shown in Table 3.1. The last four columns describe the counts by reference mode; these sum to the total for the full survey for each region.

Table 3.1: Counts of survey responses by community

			Reference trip data collected for…			
Region	Self-mailer	Full survey	Transit	Bicycle	Walk	Auto
Columbia	797	313	50	73	104	86
Marin	891	272	70	52	100	50
Minneapolis	837	343	123	62	104	54
Sheboygan	972	297	26	70	101	100
Spokane	960	289	66	50	100	73
Total	4457	1514	335	307	509	363

Demographic and economic characteristics for the full sample and each community individually are shown in Appendix E. Comparatively, the sample populations in each community are similar in a number of ways. The number of female respondents is greater in each community except for Minneapolis. The greatest percentage of respondents are between 45 and 64 years old and white. Household income varies among communities, although Marin County respondents are of notably higher income. Roughly half the respondents are employed full time, and 60 to 70 percent of households have two to four residents. At least 70 percent of households have one or more vehicle per adult, with a high of 89 percent in Marin County. Roughly 50 percent of respondents report one or more bicycles per adult.

The next step is to compare the demographic and economic characteristics of the sample to the population at large. Appendix E contrasts the full sample and each community to Census 2000 demographics for each community. The survey respondents differ from the population for each community in select ways. Generally the sample is less employed, has more white residents, and has higher income than the general populations in each community. The differences highlight the need to exhibit care and consider these variations when generalizing about the population from the respondent sample. Among the community samples, similar demographic profiles allow more general behavioral comparisons, although observers should still show care when studying the results.

In order to demonstrate the spatial distribution of the surveys, the home location of each respondent is mapped in Appendix F. The maps show these locations in the context of bicycle facilities and the Census 2000 bicycle commute mode share. The distribution of respondents is well spread throughout the city or county in each community, except for instances of respondent clusters. Two factors explain these clusters: first, clusters represent areas of greater population, such as downtown Minneapolis or small cities in Sheboygan and

Marin Counties. Second, clusters in areas of high Census 2000 bicycle commute mode share reflect survey oversampling of those census tracts (see Section 2.4).

3.2. Sample Weighting

It is important to consider how well the sample represents the population at large, as survey responses were obtained from between 0.22% (Minneapolis) and 0.86% (Sheboygan) of the total residents living in each of the communities. Three factors influence the level of representation: (1) the impact of weather conditions (especially given the late time frame in which the survey was conducted), (2) the oversampling strategy, and (3) other biases among the respondents.

3.2.1. Weather

Weather conditions were relatively steady in all the communities through an unseasonably warm November in 2006; conditions turned decidedly colder in four of the five communities in late November (see Appendix G). As evidenced by responses to select questions, rates of bicycling, and to a lesser extent walking, declined significantly. For example, the percent of people who bicycled "yesterday" went from 3.2% to 1.1% overall, while Minneapolis specifically fell from 4.4% to 0.9%. Such a decline needs to be considered in the following light: only a small number of questions from the survey were temporally sensitive to the previous day or week (specifically, questions 1, 2, 7, and 8 from the self mailer, and A9, A10, and A11 from the full survey). Thus, the bulk of the survey questions were not dramatically affected by weather conditions. For those questions identified above, we used only surveys collected prior to December 1. There were already sufficient samples from this earlier period so that being unable to use the later surveys did not impact the analysis.

A possibly larger issue is that in a broader sense, the survey was administered during weather conditions that may or may not be similar for the 2010 survey. This is not related to the late autumn timing of this survey; no matter when the survey was administered, it would have been under a particular set of weather conditions that would probably not be duplicated later. In some sense, this survey took place under fortunate conditions. While it was perhaps not the optimal time of year for cycling and walking, the weather was relatively stable during the entire period of the survey, so responses to behavioral questions remained similarly stable until the late November cold snap. Thus, this survey represents behavior under a clear and fairly constant set of weather conditions.

3.2.2. Oversampling and response bias

To ensure an adequate number of respondents who cycle or use transit, the sampling method oversampled from targeted census tracts. To correct for this sampling method, it is necessary to calculate a weight variable to adjust for the differing probabilities that cases have of being selected in a sample. Using the weight variable permits making generalizations to the population from which the sample was drawn.

One possible method of weighting the surveys would be based on how they were mailed out; that is, the areas that were more densely blanketed with surveys would be overrepresented in the returns and thus would have lower weights assigned to each survey. A second method, and the one we use (described in the next section), is based on the characteristics of the surveys that are returned, and how they differ from known characteristics of the population.

That is, the research team made concerted effort to ensure that the survey represented all modes and did not appear to prize walking or cycling. However, most respondents could see the questions before deciding whether to respond; certain types of people may have been more likely to respond positively than others, given that the questions were clearly focused on nonauto modes.

One compelling piece of evidence for this is that the number of respondents who claimed to commute by bike was 5 to 10 times higher than the known percentage from the census, in every community (part, but not all of this, was because of the geographic oversampling). Among those who completed the longer survey, the discrepancy was even larger. Thus, to derive results that are representative of the broader public, it is necessary to weight the respondents to account for this overrepresentation of certain types of behavior. This issue also has to be considered carefully in case the post-program survey methodology is altered in a way that changes this self-selection bias.

3.2.3. Weighting calculations

We weight the surveys based on the overrepresentation of certain types of behaviors, in particular the use of walking and cycling. People who use these modes behave differently, and in some important cases, substantially differently, from people who do not use them. Thus, if these types of people are overrepresented among the survey respondents, the results fail to accurately represent the broader public. The issue was particularly pronounced for bicycling because, on a day-to-day basis, it is concentrated among a relatively small number of people. If individuals who bicycle frequently are more likely to respond to the survey than the general public, this can lead to a very large impact on the apparent level of cycling.

A few simple results can help to illustrate this. People who do not work have low bike rates, and they are similar everywhere (about 1.6% biked “yesterday”). Workers who do not commute by bike have slightly higher but still low rates; again, these are similar in all communities (2.1% “yesterday”). The difference across communities is in bike commuters, who have extremely high overall bicycling rates (63% “yesterday”). Thus the number of bike commuters in the sample significantly affects the overall rate of bicycling. And, as noted earlier, the number of self-mailer respondents who said they commuted by bike was 5 to 10 times higher than the known percentage from the census.

There is a similar but less pronounced overrepresentation of walk and transit commuters in the sample as well. To help the sample best represent the population at large, we employed a simple weighting based on the percent of each mode commuter in the sample, to the known percentage from the census. In other words, we used census mode commute share to amplify or reduce the impact of respondents in the sample.

We did not do any additional weighting to account for the oversampling. The oversampling of certain census tracts was aimed at reaching enough users of nonauto modes; since we are already addressing the excess of these respondents through the commute-mode-based weighting, it would be redundant to also weight based on the home location. Similarly, we do not weight based on the overrepresentation of certain demographic characteristics. Since the concern would be that certain demographics might be more likely to engage in certain behaviors, we believe we have already accounted for this through our behavior-based weighting.[2]

3.3. Reporting Accuracy

All surveys carry with them the problem of how well the sample represents the population at large as well has how well the respondents understood and accurately answered the questions. Apparent biases and inaccuracies in how the questions were answered becomes problematic when trying to construct behavioral profiles from information drawn from different parts of the survey, or when trying to use answers from one set of questions to check the reasonableness of the answers to a different set.

One example is that respondents are optimistic in their interpretation of a "usual" week.[3] The number who say they ride a bike in a typical week is about three times higher than the number who say they rode last week specifically. There is clearly some tendency to interpret the word "typical" in an optimistic way; the difficulties of answering this type of question are probably compounded by the fact that there is no such thing as a typical week for many people, particularly with regard to exercise habits.

A second example is that half the people who report a trip to a destination by bicycle report only one trip—in other words, they went there by bicycle but failed to report returning by bicycle. This seems almost certainly a case of misunderstanding the intent of the question. There is an inherent conflict between the need for simple questions that respondents can easily answer and the need to define terms precisely. Given that the first of these needs generally prevails, it is difficult to ascertain how well the data collected reflects actual behavior.

One strategy to counter the effects of this imprecision is to query about cycling and walking through a number of different but related questions—a strategy employed by the research team. The aim is to develop a broader picture of behavior drawn from the largest possible amount of information, rather than strictly relying on answers to select questions. In terms of evaluating changes in four years, the plan is to focus on the degree to which many or all of the behavioral indicators tend to move in the same direction.

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[2] We used these weights only for behavioral questions about walking, cycling, and transit use. For the more general attitudinal questions, we report direct counts. These are easier to understand, and in a sample of questions, the overall results did not vary based on whether the responses were weighted or not.

[3] This wording is taken, verbatim, from the well-tested BRFSS questions.

3.4. Comparison to Other Surveys

The overall quality of the data, and to some extent how well it represents the population, can be verified by comparing responses with other well-tested surveys. This can help to identify areas where extra caution may be needed in interpreting of the results or where adjustments are warranted to reduce selection biases.

3.4.1. Census

The U.S. Census provides the most reliable of the comparison surveys, as it has by far the largest sample size. Recognizing that the most recent Census data is from 2000, we compared sample results to key behavioral questions, specifically the mode used to commute to work. As shown by the below tables, walk and bike commuters in the Nonmotorized Transportation Pilot Program sample are overrepresented, sometimes substantially so.

Table 3.2: Commute to work mode: Bicycle

Region	Census	Self-mailer	Full survey
Columbia	1.2%	12.5%	17.0%
Marin	0.9%	5.2%	9.0%
Minneapolis	1.9%	10.5%	12.6%
Sheboygan	0.7%	3.1%	4.4%
Spokane	0.6%	5.5%	10.4%

Table 3.3: Commute to work mode: Walk

Region	Census	Self-mailer	Full survey
Columbia	5.7%	16.9%	16.1%
Marin	2.7%	7.5%	11.0%
Minneapolis	6.7%	20.3%	17.1%
Sheboygan	3.8%	5.0%	6.9%
Spokane	2.8%	12.1%	14.0%

Table 3.4: Commute to work mode: Transit

Region	Census	Self-mailer	Full survey
Columbia	0.9%	7.6%	14.1%
Marin	10.7%	10.4%	9.9%
Minneapolis	14.6%	21.1%	20.6%
Sheboygan	0.8%	4.0%	4.9%
Spokane	2.8%	10.3%	17.6%

Table 3.5: Commute to work mode: All auto modes

Region	Census	Self-mailer	Full survey
Columbia	92.3%	63.1%	52.8%
Marin	85.7%	76.9%	70.1%
Minneapolis	76.9%	48.1%	49.6%
Sheboygan	94.7%	87.8%	83.8%
Spokane	93.8%	72.1%	58.1%

The numbers in these tables form the basis for the sample weighting described in section 3.2.3.

3.4.2. Questions to compare to BRFSS

Several questions in the survey instrument mirror questions from the Behavioral Risk Factor Surveillance System (BRFSS). These questions allow comparison among the sample respondents to a larger population in each state, measuring self-reported levels of walking. The parallel questions ask respondents to consider the number of days engaged in an activity for at least 10 minutes at a time and report the duration of these activities. Generally our survey results, when weighted to reflect the overrepresentation of nonauto users, are consistent with the BRFSS results. (See Appendix A for tables comparing these parallel questions.)

3.4.3. Cycling frequency

A number of surveys have been conducted over the past 10 to 15 years in the United States addressing the frequency of bicycling among the general public. The results of these are summarized in Barnes and Krizek (2006) and are reproduced in Table 3.6 to provide context to the results of the present survey. Generally, as the time frame increases, the number of people who have cycled during that time increases; for example, the number of different people who ride over the course of a week is larger than the number that ride on a single day (but not seven times larger since it will not be all new people each day). There is a great deal of variation across geographic areas, as much as a factor of ten from the lowest to the highest. Generally we find that our weighted results are consistent with the ranges shown in this table. While we ultimately focus on the number of riders per day as our measure of cycling activity, our measures over other time frames provide additional points of reference with which to evaluate possible changes in activity at the conclusion of the program.

Table 3.6: Measures of adult bicycling frequencies

Source and Area	Measure	Average	Range
TBI, Twin Cities MSA	% per day	1.4%	-
NHTS, U.S. Total	% per day	0.9%	.56% winter .88% spring-fall 1.1% summer
NHTS, US MSAs		-	0.2% - 2.4%
NHTS, US States		-	0.0% - 2.2%
NHTS, U.S. Total	% per week	6.7%	-
NHTS, US MSAs		-	4.5% - 12.7%
NHTS, US States		-	3.5% - 12.4%
Rodale	% per month	-	16.6% - 21.2%
BTS	% per summer	27%	
Rodale	% per year		37% - 46%
NSGA	% who ride 6 or more times per year	10.7%	-
Mn/DOT	% that ever ride	50%	-
U.S. Census	Commute to work %	0.4%	
U.S. Census, MSAs			0.1 - 1.4%
U.S. Census, states			0.1 - 1.1%

Legend:
TBI: Minneapolis-St. Paul area Travel Behavior Inventory, 2001
MSA: Metropolitan Statistical Area (census-defined)
NHTS: National Household Travel Survey, 2001
Rodale: Surveys by Rodale Press, 1992 and 1995
BTS: Bureau of Transportation Statistics survey, 2002
NSGA: National Sporting Goods Association survey, 2002
Mn/DOT: Minnesota Department of Transportation survey, 2003
U.S. Census: Commute to work data, 2000.

4. Analysis and Key Results

The data can be analyzed to shed light on an array of outcomes. Some analysis is relatively straightforward, while other topics require combining information from a number of different sources. Various uncertainties associated with survey analysis necessitate the use of some care in interpreting results (see section 4.4).

Figure 4.1 identifies five different categories of outcome measures analyzed in the report. Appendices A through D, in concert with sections 4.1, 4.2, and 4.3 below, provide responses for all of the questions from the survey. For example, Appendix A presents the frequencies of responses from many of behavioral questions, which include the following broad categories:

- Most recent use of modes other than bicycle and walk to destination
- Mode to commute to work and school
- Days of walking and cycling per week and daily durations (see section 3.4.2)
- Frequency of walking and cycling to particular destinations
- Frequency of walking and cycling to destinations in general
- Facility types used for bicycling trips

Appendix B is the first of three appendices of attitudinal results, covering several categories of questions, including:

- Satisfaction with infrastructure and service quality for various modes
- Approval of additional spending for various transportation purposes
- Safety concerns on walking and cycling trips
- Opinions of a variety of transit characteristics
- Modes of access to school for children
- Opinions about barriers to walking and cycling to school

Appendix C offers responses to 19 different questions about various characteristics of the respondent's home neighborhood in terms of suitability for walking and cycling. Appendix D provides responses to 27 questions regarding the factors that would motivate the respondent to use specific non-auto modes (walk, bicycle, transit) more frequently. The reader is strongly encouraged to consult these Appendices when seeking information about baseline measures of interest.

	Counts or frequencies of walking/cycling and impact on **reduced driving**	**Behavior and characteristics** of walking/cycling trips	**Attitudes** toward walking/cycling & related infrastructure	**Neighborhood characteristics** and suitability for walking/cycling	**Factors to promote** increased walking/cycling
Examples of variables measured or questions surveyed	Number of walking trips	How many days in the past month did you walk or bike to the grocery store (and how far was that trip)	How satisfied are you with the opportunities for walking in your community?	The sidewalks in my neighborhood are well maintained	How likely are certain factors to get you to walk more often than you currently do?
	Percent of cycling trips that are replacing auto trips	Which of the following road types best describes the route you took on your most recent bicycle trip?	Were any of the following a cause for concern for your personal safety on your recent walking trip?	There are many places to go within easy walking distance of my home	
Location in the report	Chapter 4 of main report	Appendices A & F	Appendix B	Appendix C	Appendix D

Figure 4.1: Categories and locations of outcome measures in the report

The analysis in this chapter focuses on congestion, pollution, and energy use as the primary outcomes of interest. These are all functions of the amount of auto travel; specifically, the amount that doesn't take place because it is avoided by cycling and walking. The most reliable way to determine this is through the direct measurement of a sequence of component factors that are used to estimate this number based on the amount of cycling and walking, along with the characteristics of trips made by these modes (see section 4.4 for additional discussion). The basic sequence of logic is the following (see Figure 4.2):

- Determine how many people cycle and walk each day.
- Of these, estimate how many are commuting, traveling to other destinations, or using the modes solely for recreation. This last group is not replacing auto travel and is dropped from subsequent calculations.
- For the first two groups, estimate total daily distance. Two methods are used: one is based on trip counts and calculated trip lengths, the other on reported daily travel times.
- Of this total daily distance, determine how much is replacing auto travel. This is different for commuting versus travel to other destinations.

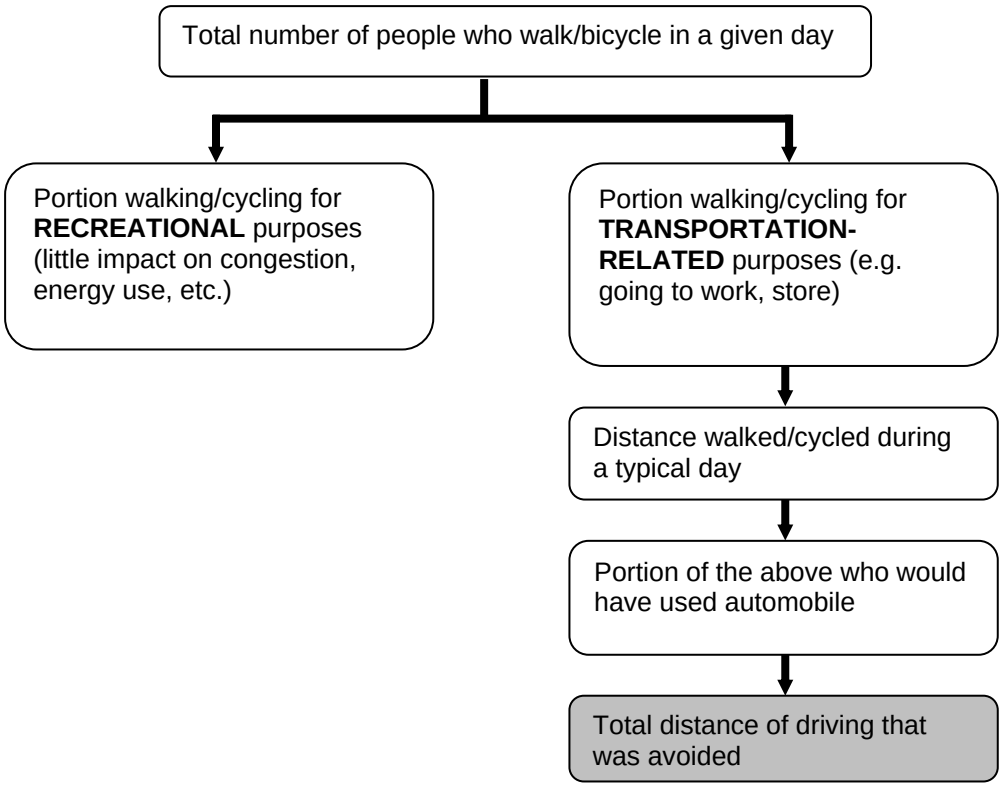

Figure 4.2: Methodology summary

The first two sections of this chapter address the amount of driving that is avoided by bicycling and walking, respectively. A third section summarizes these results, discusses the impact of transit, and provides information about mode splits based on number of trips and on total mileage by mode. A final section briefly discusses some other possible methods of analysis.

4.1. Bicycling Leading to Reduced Auto Use

The impact of bicycling on the key program measurement criteria is measured by estimating the reduction in auto use that can be attributed to the use of bicycling for transportation. This is calculated through a sequence of steps:

- How many adults ride a bike in an average day
- Of these, how many are riding for transportation, as opposed to purely recreation or exercise
- Of those riding for transportation, how many miles they ride
- Of these, how many would have made the trip by auto if not by bike

The following sections address each of these issues in turn.

4.1.1. Number of adults riding per day

Table 4.1 shows the frequency of bicycling from the large sample of the self-mailer. As discussed in the introduction, these are weighted to reduce the overrepresentation of

commuter cyclists, and include only responses prior to December 4, 2006, as this date marked the end of reasonable cycling weather in most of the communities. More than 3,400 self-mailers had been completed by this time.

Table 4.1: Please tell us the most recent time you used a bicycle (from self-mailer)

Region	Yesterday	Within Past Week*	Within Past Month	Within Past Year	Not in the Past Year	Weighted sample size
Columbia	2.6%	9.9%	18.6%	38.3%	61.7%	555
Marin	3.8%	14.3%	22.3%	37.6%	62.4%	727
Minneapolis	4.2%	11.4%	26.7%	47.6%	52.4%	740
Sheboygan	1.7%	6.3%	17.1%	37.3%	62.7%	737
Spokane	1.8%	5.5%	12.4%	27.7%	72.3%	785
Total	2.8%	9.4%	19.3%	37.5%	62.5%	3544

* Totals in the first four columns are cumulative, e.g., "within past week" includes the total from "yesterday."

The numbers for "yesterday" are quite high in all the communities relative to national averages. The results are more consistent with national averages as the time frame lengthens. For the past week and the past month, the averages are generally within the ranges observed in other surveys. For the past year, the numbers correspond closely to other surveys. All of the five communities have bicycle commuting rates well above the national average. Given this, the overall rates of daily bicycling are well within expected ranges.

4.1.2. Amount of bike travel for transportation purposes

Using the percent of respondents who reported riding a bike to a place yesterday (on the self-mailer), we weight to account for the intentional overrepresentation of bike commuters. We assume that all of these were riding for transportation and not recreation. One reason is that the question from which the "yesterday" counts are drawn asks specifically about travel to a place rather than simply whether the person rode a bike. In addition, of the subset who answered more detailed mode-specific questions about their cycling destinations, almost all of those who rode "yesterday" said they regularly ride to work or other destinations.

The rate of bicycle commuting in each community is known from U.S. Census numbers. We take this as the number of commuters, and the difference between this and the total self-mailer "yesterday" riders as the number of other destination riders[4]. This breakdown impacts how we assign average distance and extent of auto substitution.

Table 4.2 shows the results of these calculations for each community. The difference between the first two columns is because only 75% of all adults are employed, so there is a difference between the percent of workers who commute by bike and the percent of adults who do.

[4] Throughout this chapter, "transportation" refers to all non-recreational travel, which is divided into commuting and "other destination" travel.

Table 4.2: Estimated daily bicyclists by purpose

Region	% of workers who commute by bike (1)	% of all adults who commute by bike (2)	% of adults who bike to other destinations (3)	Total daily transportation cyclist % (4)
Columbia	1.2%	0.9%	1.75%	2.6%
Marin	0.9%	0.7%	3.18%	3.8%
Minneapolis	1.9%	1.4%	2.75%	4.2%
Sheboygan	0.7%	0.5%	1.22%	1.7%
Spokane	0.6%	0.4%	1.34%	1.8%
Total	1.2%	0.8%	2.05%	2.8%

1 From 2000 census for each community's survey area.
2 This number is smaller than the first column because only 75% of adults are employed.
3 This is the difference between columns 2 and 4.
4 This is from the "yesterday" column in table 4.1.

4.1.3. Total bicycle mileage per day

There are two sources of information in the survey to estimate total bicycle mileage per day. One method uses average trip lengths from those respondents with mapped bicycle reference trips, multiplied by the average number of trips per day by bicycle. The other method calculates averages from a question about total daily bicycle travel times, and uses an assumed average speed to estimate daily distance.

In estimating average bicycle trip lengths, we use only trips that are mapped as having lengths of less than nine miles. The small number of trips that are longer than this have an excessive impact on the averages, especially at the regional level or for specific trip types. While this does introduce some bias in that longer trips are being omitted, it has offsetting benefits in reducing the amount of variation in the answers. And, as long as the same method is used in four years, the bias will not affect the ability to compare results.

The sample sizes for specific trip types by region are relatively small; we therefore develop estimates for these numbers first by aggregating regions and developing averages by trip type, then by aggregating trip types and developing overall averages by region, then combining the two. The method for combination is to start with the average length for say, a commute trip, then adjust this average up or down based on the ratio of each region's average trip length (for all trip types) to the overall average. In this way the average distance for a specific trip type and region is based on two components—overall average for that trip type and for that region—that are both derived from samples of at least two dozen trips, rather than the handful that would be used if the number were calculated directly.

Table 4.3 shows the results of these calculations.

Table 4.3: Average trip length by trip type (miles)

Region	Average distance all bike trips	Estimated average bike commute trip distance	Estimated average bike other destination distance
Columbia	2.53	2.61	2.39
Marin	2.19	2.26	2.07
Minneapolis	1.91	1.97	1.80
Sheboygan	1.75	1.80	1.65
Spokane	1.48	1.53	1.40
Total	1.97	2.03	1.86

For those who are commuters or other destination cyclists, we then calculate the number of trips that they make per day on days when they cycle. This information comes from the self-mailer question about number of places visited. As in the text describing Table 4.3 above, we calculate an average number of bike trips by region, then an average by trip type, then combine the two as above. The results along with the calculated total daily distance are shown in table 4.4.

Table 4.4: Number of trips and total daily distance by bicycle, per day per adult

Region	Number of trips by commuters	Number of trips by other destination cyclists	Miles per trip by commuters	Miles per trip by other destination cyclists	Total daily miles by commuters	Total daily miles by other destination cyclists
Columbia	3.82	3.53	1.53	1.40	5.84	4.95
Marin	2.81	2.60	2.61	2.39	7.32	6.21
Minneapolis	3.56	3.29	2.26	2.07	8.02	6.80
Sheboygan	2.18	2.01	1.80	1.65	3.92	3.33
Spokane	2.45	2.27	1.97	1.80	4.81	4.08
Total	3.15	2.92	2.03	1.86	6.41	5.43

A noticeable feature of these results is the large range of daily mileage across communities. This result occurs because the communities with the fewest trips also have short distances per trip.

However, the other way of estimating distances gives a different result, in which the communities are more similar. This is based on a question that asks respondents how much time they spend cycling on a “typical” day that they ride. To simplify the presentation of results, the answers are grouped into three categories (Table 4.5)

Table 4.5: Reported daily cycling durations on days when cycling occurs

Region	10-29 min	30-59 min	1 Hour +	Average minutes	Distance @ 10mph
Columbia	15.2%	41.6%	43.2%	47.7	7.94
Marin	12.9%	23.7%	63.4%	51.3	8.55
Minneapolis	13.3%	31.4%	55.3%	50.0	8.33
Sheboygan	21.7%	33.1%	45.2%	46.3	7.72
Spokane	7.8%	37.4%	54.8%	51.3	8.55
Total	14.3%	33.0%	52.7%	49.3	8.22

In this table the average number of minutes is calculated using an assumption in which reported times longer than 60 minutes are capped at 60 minutes. As with capping trip distances at 10 miles, this biases the results downward, but with an offsetting advantage of reducing variability; again, this will not be a problem for future analysis if the same assumption is made for the end-of-program study. The total daily distance is estimated using an assumed average speed of 10 miles per hour.

Ultimately there is no objective basis for choosing between these two sets of numbers. Again, for purposes of evaluating the program at its conclusion, the most important thing is not having a single number as a baseline, but having the maximum possible amount of information from which comparisons can be drawn. Given this, we include both of these sets of numbers, presenting them as upper and lower bounds on distance per day per cyclist.

4.1.4. Substitution of cycling for auto use

Given an estimate of the total amount of commuting and other destination cycling per day, the final step in determining the reduction in auto travel due to cycling is to estimate the amount of each that is actually substituting for driving. There are three places in the surveys from which this information is taken.

For commuter cyclists, there are questions on both the self-mailer and the full survey that ask about all the modes used for commuting. In one case the question is about modes used in the previous week specifically; in the other case it is modes used in a “typical” week. For each of these, auto substitution is estimated by dividing the fraction of cyclists who say that they also drive, by the total number of cases of nonbike modes that are reported by bike commuters.

Because the answers come out differently depending on the time frame being considered, we use an average of the two estimates for commuter trips. For other bicycle destination trips, the sample size for the reference trip by community is large enough, and the answers are consistent enough, to derive answers using the stated alternative mode for those describing a bicycle reference trip. Table 4.6 shows the results of these calculations.

Table 4.6: Percent of cycling trips that are replacing auto trips

Region	Self mailer drive substitution*	Survey drive substitution*	Average of these* (commute)	Other destination trips
Columbia	28%	33%	31.0%	91.3%
Marin	33%	34%	33.8%	90.9%
Minneapolis	31%	26%	27.9%	91.7%
Sheboygan	28%	50%	41.7%	94.3%
Spokane	40%	30%	33.9%	95.2%
Total	32%	32%	32.0%	92.8%

* First three columns describe auto substitution for bicycle commute trips only

The finding that only about a third of bike commute trips would have been made by driving if not by bike may seem surprising, but it is consistent with results from other studies, such as the National Household Travel Survey. From a standpoint of convenience and travel time, cycling is in most cases more competitive with transit, or walking than it is with driving. Also, commute trips by these other modes are more likely to be of a distance that is compatible with cycling. For other types of destinations, though, almost all the cycling trips are replacing driving.

4.1.5. Summary of driving avoided by cycling

The first method, which can be taken as a lower bound, uses daily distances that are derived from average reference trip distances multiplied by the daily number of trips by bike, for those who make bike trips (Table 4.7).

Table 4.7: Summary of avoided driving due to cycling (low estimate)

Region	Bike commuter %	Daily total distance commuters	Commuter trips replacing auto	Other bike destination %	Daily total distance destination	Destination trips replacing auto	Total daily mileage per adult
Columbia	0.90%	5.84	31.0%	1.75%	4.95	91.3%	0.096
Marin	0.70%	7.32	33.8%	3.18%	6.21	90.9%	0.197
Minneapolis	1.40%	8.02	27.9%	2.75%	6.80	91.7%	0.203
Sheboygan	0.50%	3.92	41.7%	1.22%	3.33	94.3%	0.047
Spokane	0.40%	4.81	33.9%	1.34%	4.08	95.2%	0.059
Total	0.80%	6.41	32.0%	2.05%	5.43	92.8%	0.120

The second method, which can be taken as an upper bound, uses daily distances derived from reported daily durations. In this case the daily distance is taken to be the same for both commuters and other transportation cyclists (Table 4.8).

Table 4.8: Summary of avoided driving due to cycling (high estimate)

Region	Bike commuter %	Commuter trips replacing auto	Other bike destination %	Destination trips replacing auto	Average total daily distance	Total daily mileage per adult
Columbia	0.90%	31.00%	1.75%	91.30%	7.85	0.148
Marin	0.70%	33.80%	3.18%	90.91%	8.61	0.270
Minneapolis	1.40%	27.90%	2.75%	91.67%	8.3	0.242
Sheboygan	0.50%	41.70%	1.22%	94.29%	7.73	0.105
Spokane	0.40%	33.90%	1.34%	95.24%	8.5	0.120
Total	0.80%	32.00%	2.05%	92.80%	8.19	0.176

4.2. Walking Leading to Reduced Auto Use

A similar profile can be developed for walking. As the basic methodology is the same as for bicycling, we do not repeat all the details here, but simply provide a short summary.

4.2.1. Number of adults walking per day

The self-mailer asks about the most recent time a respondent walked to a destination (recreation is addressed separately). These results are shown in Table 4.9.

Table 4.9: Please tell us the most recent time you walked to get to a destination (from self-mailer)

Region	Yesterday	Within Past Week*	Within Past Month	Within Past Year	Not in the Past Year	Weighted sample size
Columbia	19.4%	34.1%	50.1%	66.0%	34.0%	553
Marin	23.5%	50.0%	67.4%	78.0%	22.0%	727
Minneapolis	36.6%	66.6%	81.6%	91.0%	9.0%	740
Sheboygan	12.9%	31.7%	50.3%	70.2%	29.8%	737
Spokane	15.0%	34.2%	51.2%	64.8%	35.2%	785
Total	21.5%	43.7%	60.5%	74.3%	25.7%	3542

* Totals in the first four columns are cumulative, e.g., “within past week” includes the total from “yesterday”.

These numbers seem very high. This could be in part because of the very open approach in this survey to defining a destination. That is, other surveys typically define a trip as being to a building, and as having a minimum duration (usually 5 to 10 minutes). Here there was no minimum duration and destinations were defined in a very open way. Thus many of these trips may in fact be recreational in nature (since places included parks and trails) or may be very short, such as walking to a transit stop.

4.2.2. Amount of walking for transportation purposes

The methodology used to estimate the amount of transportation walking was the same as described in the corresponding bicycling section. The number of destination walkers per day was taken as the total. This was divided into commute and other transportation by

using the number of commuter walkers from the census. Table 4.10 shows the results of these calculations.

Table 4.10: Number of walkers per day

Region	% of workers who commute by walking (1)	% of all adults who commute by walking (2)	% of adults who walk to other destinations (3)	Total daily transportation walk % (4)
Columbia	5.7%	4.3%	15.1%	19.4%
Marin	2.7%	2.0%	21.4%	23.5%
Minneapolis	6.7%	5.0%	31.6%	36.6%
Sheboygan	3.8%	2.8%	10.1%	12.9%
Spokane	2.8%	2.1%	12.9%	15.0%
Total	4.3%	3.2%	18.3%	21.5%

1 From 2000 census for each community's survey area
2 This number is smaller than the first column because only 75% of adults are employed
3 This is the difference between columns 2 and 4
4 This is from the "yesterday" column in table 4.1

4.2.3. Total walking mileage per day

Table 4.11 shows the average distances for walking trips of different types, the number of trips per day, and total daily distance. These were calculated using a maximum trip length of 2 miles in the raw data; the research team felt that the small number of distances calculated to be longer than this were likely geographic coding errors.

Table 4.11: Number of trips and total daily distance by walking

Region	Number of trips by commuters	Number of trips by other destination walkers	Miles per trip by commuters	Miles per trip by other destination walkers	Total daily miles by commuters	Total daily miles by other destination walkers
Columbia	2.33	2.75	0.83	0.65	1.95	1.80
Marin	2.23	2.63	0.80	0.63	1.79	1.66
Minneapolis	2.33	2.74	0.74	0.58	1.73	1.59
Sheboygan	1.99	2.34	0.57	0.45	1.14	1.05
Spokane	2.00	2.35	0.69	0.54	1.38	1.27
Total	2.20	2.59	0.73	0.57	1.61	1.48

As with bicycling, a separate question about walking daily durations can be used to provide an independent estimate of daily walking distance (Table 4.12).

Table 4.12: Reported daily walking durations

Region	10-29 min	30-59 min	1 Hour +	Average minutes	Distance @ 3 mph
Columbia	28.7%	40.8%	30.5%	42.4	2.12
Marin	18.1%	43.9%	38.0%	46.2	2.31
Minneapolis	21.4%	37.0%	41.6%	45.9	2.29
Sheboygan	24.5%	38.7%	36.7%	44.4	2.22
Spokane	26.4%	38.7%	34.9%	43.6	2.18
Total	23.9%	39.7%	36.4%	44.5	2.22

As with bicycling, the average daily distance from this method is somewhat longer than from trip lengths calculated directly, and again the reason seems to be because reported trip durations are heavily weighted toward the high end of the range.

4.2.4. Substitution of walking for auto use

The percentage of walk commute trips that would have been made by car is calculated using an average of other modes reported in separate and slightly different questions on the self-mailer and the full survey, as described in the corresponding section for bicycling. Car substitution for other walking transportation trips is again taken from the reported most common substitute mode from the reference trip, as there was a large sample of these trips and the answers were consistent across communities (Table 4.13).

Table 4.13: Degree of auto substitution by walk trips

Region	Self mailer drive substitution*	Survey drive substitution*	Average of these* (commute)	Other destination trips
Columbia	38%	40%	39.7%	98.2%
Marin	28%	45%	39.5%	98.5%
Minneapolis	28%	33%	31.9%	91.2%
Sheboygan	37%	47%	43.1%	97.4%
Spokane	30%	38%	34.3%	93.4%
Total	32%	39%	36.5%	95.1%

* First three columns describe auto substitution for bicycle commute trips only

4.2.5. Summary of driving avoided by walking

Tables 4.14 and 4.15 summarize the results of the above calculations to derive an average amount of avoided driving per day per adult resident of each community.

Table 4.14: Summary of avoided driving due to walking (low estimate)

Region	Walk commuter %	Daily total distance commuters	Commuter trips replacing auto	Other walk destination %	Daily total distance destination	Destination trips replacing auto	Total daily mileage per adult
Columbia	4.30%	1.95	39.7%	15.1%	1.80	98.2%	0.300
Marin	2.00%	1.79	39.5%	21.4%	1.66	98.5%	0.364
Minneapolis	5.00%	1.73	31.9%	31.6%	1.59	91.2%	0.488
Sheboygan	2.80%	1.14	43.1%	10.1%	1.05	97.4%	0.117
Spokane	2.10%	1.38	34.3%	12.9%	1.27	93.4%	0.163
Total	3.20%	1.61	36.5%	18.3%	1.48	95.1%	0.276

Table 4.15: Summary of avoided driving due to walking (high estimate)

Region	Walk commuter %	Commuter trips replacing auto	Other walk destination %	Destination trips replacing auto	Average total daily distance	Total daily mileage per adult
Columbia	4.30%	39.7%	15.1%	98.2%	2.12	0.351
Marin	2.00%	39.5%	21.4%	98.5%	2.31	0.506
Minneapolis	5.00%	31.9%	31.6%	91.2%	2.29	0.699
Sheboygan	2.80%	43.1%	10.1%	97.4%	2.22	0.244
Spokane	2.10%	34.3%	12.9%	93.4%	2.18	0.278
Total	3.20%	36.5%	18.3%	95.1%	2.22	0.412

4.3. Summary of Findings

Tables 4.16 through 4.18 summarize our estimates of the amount of driving that is avoided by cycling, walking, and the two modes combined.

Table 4.16: Estimated reduction in auto use due to bicycling
(miles of avoided auto use per adult resident per day)

Region	Lower bound	Upper bound	Average
Columbia	0.096	0.148	0.122
Marin	0.197	0.270	0.233
Minneapolis	0.203	0.242	0.222
Sheboygan	0.047	0.105	0.076
Spokane	0.059	0.120	0.089
Total	0.120	0.176	0.148

Table 4.17: Estimated reduction in auto use due to walking
(miles of avoided auto use per adult resident per day)

Region	Lower bound	Upper bound	Average
Columbia	0.300	0.351	0.326
Marin	0.364	0.506	0.435
Minneapolis	0.488	0.699	0.593
Sheboygan	0.117	0.244	0.180
Spokane	0.163	0.278	0.221
Total	0.276	0.412	0.344

Table 4.18: Total estimated reduction for both modes
(miles of avoided auto use per adult resident per day)

Region	Lower bound	Upper bound	Average
Columbia	0.396	0.499	0.447
Marin	0.561	0.775	0.668
Minneapolis	0.691	0.940	0.816
Sheboygan	0.163	0.350	0.256
Spokane	0.222	0.398	0.310
Total	0.396	0.589	0.492

Between the two modes, the total estimated reduction in auto travel is in the range of 0.5 mile per adult resident per day. This is in the context of average levels of auto travel in the range of 15 to 25 miles per day per person. Thus, the use of these modes probably reduces auto travel about 1% to 3% in these regions, representing a baseline from which post-program comparisons can be derived.

4.3.1. Walking and cycling to transit

A related question about mode substitution involves trips by transit. One possible high-leverage impact of improved walking and biking conditions might be in providing better access to long-haul transit. If, for example, a person chooses to drive 20 miles to work because it is too hard to find parking near transit boarding locations, then better nonmotorized access might help to eliminate a very long car trip, far in excess of the actual amount of walking or biking involved. Table 4.19 addresses this question.

Table 4.19: How did you get to the transit stop?

Region	Bike/walk	Drove/Rode	Drove/Rode to Transit trip >5 miles	Drove/Rode to Transit trip >10 miles	Sample size
Columbia	89%	11%			47
Marin	45%	55%	72% (28)	86% (22)	64
Minneapolis	88%	12%	21% (30)		116
Sheboygan	84%	16%			25
Spokane	78%	22%			65

(Blank entries indicate insufficient sample size for reliable calculation. Numbers in parentheses are sample sizes for restricted samples.)

This table does indicate that people are more likely to drive or ride with someone to the transit stop, the longer the transit trip is. This indicates that there may be some promise in a strategy of increasing bike and walk access to these types of transit routes. However, these results may also reflect differences in where different types of transit users live relative to the transit stop. A more targeted survey of transit users could help to resolve some of these questions.

4.3.2. Mode shares

The final point of reference is the overall share of trips by mode, and the overall distance by mode (Tables 4.20 and 4.21). Trip counts were slightly adjusted based on compelling

evidence that trips by all modes were being underreported (people apparently reported trips to other places, but not the corresponding trip back home). The degree of this adjustment was similar for all modes, so it does not affect the mode percentages, but does increase the total daily distance, to a level that is more in line with expectations. Trip counts are based on weighted responses to account for the overrepresentation of nonauto mode users.

Table 4.20: Share of total person trips by mode

Region	Vehicle	Rideshare	Walk	Bike	Transit	Sample size (respondents)
Columbia	86%	2.2%	8.6%	1.5%	2.2%	797
Marin	82%	1.4%	11.8%	1.8%	3.2%	891
Minneapolis	69%	2.2%	17.6%	2.0%	9.7%	837
Sheboygan	89%	2.4%	6.6%	0.7%	1.2%	972
Spokane	85%	2.0%	8.5%	0.8%	4.1%	960
Total	82%	2.1%	10.7%	1.4%	4.1%	4457

Table 4.21: Total daily mileage per person by mode

Region	Vehicle	Transit	Bike	Walk	Sample size (respondents)
Columbia	15.1	0.21	0.10	0.30	797
Marin	23.6	1.37	0.22	0.40	891
Minneapolis	20.7	2.23	0.23	0.55	837
Sheboygan	22.3	0.11	0.06	0.16	972
Spokane	25.9	0.88	0.08	0.25	960

4.4. Discussion

The data can be analyzed in a variety of ways. Some analysis is relatively straightforward. For example, one can sum responses to select questions, establish a mean, and assign confidence intervals describing the likely range of error in the estimated mean. This approach is appealing because it is relatively straightforward. However, it is appropriate to be cautious about these simple measures, for four reasons:

- There are high levels of reporting inaccuracy with data about walking and bicycle behavior because people tend to exaggerate "good" behavior, and because it is impossible to guarantee that respondents will interpret the questions in the way that was intended (see section 3.3).
- The phenomena in question are often more nuanced and complex than can be understood by responses to a single question. For example, increased rates of cycling may be a result of increased overall travel and not necessarily a reduction in automobile use.
- The size of any sample needs to be very large if the relationships of interest are weak, the number of cases of a given behavior are small, or the variance of the data is large. In this project, all these factors apply. Because of the limited sample size that was possible given the scope of this survey, confidence intervals around individual questions will likely be too broad to detect the magnitude of impacts that are likely to result from this program.

- Relying on a variety of different measures leads to a more robust and detailed understanding of the broader behavior being investigated.

Evidence on vehicle travel suggests that increased walking and biking does not necessarily reduce driving: not every walk or bike trip replaces a driving trip, and even when it does, the distances are relatively short. One study found that 73% of walking trips substituted for driving trips but estimated that this substitution saved only 2.1 miles of driving per person over a month (Handy and Clifton 2001). Furthermore, evidence points to a latent demand for auto travel in congested urban areas: any relief in congestion coming from some individuals substituting walking and biking for driving will be immediately consumed by additional driving from other individuals (Noland 2001; Cervero 2002).

Thus, simple measurements of walking and cycling cannot be assumed to have clear implications regarding the amount of driving. Furthermore, the amount of driving itself is influenced by a variety of external factors, and levels of walking and cycling may have a minor effect on the overall extent of the problem. This can be a difficult issue to untangle at both the regional level or even the neighborhood level.

For example, the most obvious approach to assess the impact on congestion would be to measure the amount of auto use at the beginning and end of the program, and see if it decreased. The survey includes relevant queries about auto use. However, the amount of auto use in a region is strongly affected by large-scale phenomena such as population growth, demographic changes, employment levels, and economic growth. At the scale of an urban region, the impact of walking and cycling is very small compared to these factors. Since there is no way to know the precise impact of these factors, there is no way to deduce the impact of walking and cycling from a direct measurement of auto use.

At small local scales, such as a neighborhood or a specific street, walking and cycling can play a more significant role compared with auto travel. However, even at this scale, there are major influences that can’t be controlled, most importantly, land use changes. A single new office building could generate more new auto traffic than all of the cycling and walking in the area reduces it. Again, since it is impossible to know the impact of these external factors, it is not possible to deduce the impact of walking and cycling on auto use by directly measuring auto use.

A second method of analysis could consider mode splits: what fraction of total trips, or of total miles of travel, are by walking and biking. If the fraction of total trips or mileage by these modes goes up, that would be a sign that there is relatively less auto use than before. In this method, walking and cycling are being evaluated relative to the overall level of travel (which might go up for other reasons) rather than against a fixed standard, which makes more sense.

However, while these numbers can provide a good general measure of changes in behavior patterns, they still do not exactly address the question of reduction in auto travel. One reason is that there could be a large increase in walking and cycling for

primarily recreational reasons; these types of trips would not, at least directly, be replacing auto travel; indeed, they could even increase it if people drive to specific locations where they walk or cycle. Another reason is that even trips that go to destinations might not be replacing auto travel; people might just be making more of these trips.

Even the measurements themselves are only valid within a range, because it is not possible to know if the sample was truly representative of the larger population. Confidence intervals can be assigned to each of the questions. The intervals reflect the population of the region, the size of the sample that is surveyed, and the percentage of people, among all those surveyed, who provide a particular answer to a question (e.g., "I walk four days per week").

Table 4.22 below illustrates the margin of error based on the region surveyed, showing confidence intervals and confidence levels for the expected 400 respondents in each region versus the actual number of respondents.[5] At a 95% confidence level, confidence intervals fall between 5.3 and 5.9.[6] Similarly, at the 90% confidence level, confidence intervals fall between 4.4 and 5.0. Thus, by region, and by confidence interval, difference in actual vs. expected does not significantly alter the ability to distinguish statistical differences in results, although the actual confidence intervals vary by specific question and the specific incident rate.[7]

Table 4.22: Actual vs. expected confidence intervals by region

	Number of Surveys		**Margin of Error at 95% Confidence Level**		**Margin of Error at 90% Confidence Level**	
Region	Target	Actual	Target	Actual	Target	Actual
City of Columbia	400	313	4.9	5.5	4.1	4.7
Marin County	400	272	4.9	5.9	4.1	5.0
Minneapolis	400	343	4.9	5.3	4.1	4.4
Sheboygan County	400	297	4.9	5.7	4.1	4.8
Spokane County	400	289	4.9	5.8	4.1	4.9
Total	**2,000**	**1,514**	**2.6**	**2.5**	**1.8**	**2.1**

[5] The *confidence interval* is the plus-or-minus figure usually reported in poll results. For example, if you use a confidence interval of 4 and 47% percent of your sample picks an answer, you can be "sure" that if you had asked the question of the entire relevant population, between 43% (47-4) and 51% (47+4) would have picked that answer. The *confidence level* tells you how sure you can be. It is expressed as a percentage and represents how often the true percentage of the population that would pick an answer lies within the confidence interval. The 95% confidence level means you can be 95% certain. Putting the confidence level and the confidence interval together allows an analyst to say they are 95% sure that the true percentage of the population is between 43% and 51%.

[6] Such confidence intervals are based on 50% of the sample giving one particular answer (the incidence rate). Behaviors with lower incidence rates usually have smaller confidence intervals.

[7] It is also important to mention, however, such confidence intervals also assume a genuinely random sample of the relevant population, which is not strictly true in this survey due to (a) the oversampling strategy, and (b) possibly biased response rates from participants who are not fully representative of the population.

5. Conclusions

Growing interest in the impacts of walking and cycling infrastructure has created a need to document the degree to which different policies induce nonmotorized travel and produce other benefits for the community. In addition to the direct effect of interventions on walking and cycling levels, one or more secondary effects are of interest. Legislation from Section 1807 of SAFETEA-LU, for example, calls for the development of statistical information about whether pilot projects funded under the legislation have led to changes in motor vehicle usage, nonmotorized transportation usage, public transportation usage, congestion, energy consumption, frequency of bicycling and walking, connectivity to community activity centers, health, and environment.

This report describes the results of a baseline survey of rates of cycling and walking conducted in the four pilot communities in 2006. While it is tempting to suppose that the objectives of a before-after comparison can be met by simply measuring one or two key variables at two points in time, the reality as it applies to complex phenomena such as levels of walking and cycling—and corresponding secondary impacts—is not so simple. Increases (or decreases) in walking and cycling are hard to discern for a variety of reasons. Walking and cycling take place in a broader context of transportation policy and investment more generally, as well as within economic and demographic changes. The influence exerted by these "external" factors can overwhelm the impacts created by walking and cycling investments, both at a regional scale and even within localized areas.

Several other challenges exist. First is measuring the variable of interest. It is generally acknowledged that survey responses are often inaccurate, both because people interpret questions differently than the researcher intended, and because there is a tendency to exaggerate "good" behavior. Ultimately it is often necessary to strike a balance between the information that would be ideal to collect, and what can realistically be collected with a reasonable degree of accuracy. Second is securing an adequate sample size given the rarity of some of the behaviors in question. The difficulty of these problems is reflected in the complexity of the methodologies used in this report, as well as in the range of estimated outcomes.

In addition to relatively straightforward measures, the research team arrived at a measure of avoided driving that could be attributed to levels of walking and cycling. While there was considerable variation across the communities, generally the two modes combined to avoid about a quarter to three quarters of a mile of driving per day, per adult resident. About two-thirds to three-fourths of this driving avoidance was due to walking; while walking trips are shorter, far more people walk than cycle on any given day.

The results presented in this report and in the appendices represent an overview; the 2010 analysis will have the original data available for comparison. Thus given what is known at that point, it may become apparent that different measurements or a different methodology for analyzing the data will lead to a more robust comparison. It may be that modifications to the survey or the data collection methodology might be appropriate to increase response rates, especially for key questions, or to reduce ambiguities or

subjectivities in the responses. However, any such changes must be carefully designed to reduce the possibility that they might introduce additional uncertainty into the comparison.

Despite escalating interest from varied groups, walking and cycling remain the most understudied—and subsequently least understood—modes of travel. Complicating the study of walking and cycling as modes of transportation is their frequent use for exercise and recreation rather than travel. The lack of research in this area contributes to and is hampered by a lack of a consistent effort to collect and distribute data on these behaviors and the environments in which they occur. The deficiency of secondary data sources focusing on walking/cycling travel is well documented. A growing appreciation of this deficit has led to a number of efforts to improve the quality and quantity of data on walking and cycling.

This project affords a living laboratory for research often called for, but rarely conducted, in policy circles: a before-and-after investigation to demonstrate to other communities across the country the specific merits of investing in walking and cycling infrastructure. The survey of the five communities will be repeated in 2010. Data collected from the two surveys will be analyzed to identify changes in walking or cycling behavior or attitudes that resulted from the interventions. Such analysis will contribute to a better understanding of the factors that influence the choice to walk or cycle for both the communities under study and other communities waiting to rely on these results from this research.

Appendix A

Additional Behavioral Results

All results in this appendix are based on weighted responses, except where noted.

Use of Different Modes

For the first three questions, answers are cumulative across time periods, i.e., the percent who drove in the past week includes those who drove yesterday. The "Not in past year" column is the remainder of those who did not report using the mode in the past year.

Results in this section are based on answers from self-mailers returned before December 1, 2006, as this represents a period of stable weather, conducive to use of nonauto modes. After this date the weather became much worse in several of the communities, and reported answers to these time-sensitive questions changed considerably.

Table A.1: Self-mailer Question 2

Indicate the last time you drove a vehicle to get to a destination (e.g., to work, shop, visit, or to catch a bus or train).

Region	Yesterday	Past Week*	Past Month	Past Year	Not Past Year	Weighted sample size
Columbia	86.9%	95.4%	96.8%	97.2%	2.8%	553
Marin	91.1%	97.6%	98.2%	98.3%	1.7%	727
Minneapolis	77.6%	90.1%	92.2%	94.7%	5.3%	740
Sheboygan	87.9%	96.8%	96.8%	97.8%	2.2%	737
Spokane	83.2%	90.2%	90.9%	91.7%	8.3%	785
Total	85.2%	93.9%	94.8%	95.8%	4.2%	3542

* Totals in the first four columns are cumulative, e.g., "past week" includes the total from "yesterday."

Table A.2: Self-mailer Question 2

Indicate the last time you walked for recreation or exercise.

Region	Yesterday	Past Week*	Past Month	Past Year	Not Past Year	Weighted sample size
Columbia	13.9%	50.1%	67.5%	80.1%	19.9%	553
Marin	21.6%	66.5%	77.3%	85.9%	14.1%	727
Minneapolis	27.6%	59.9%	78.8%	89.6%	10.4%	740
Sheboygan	10.7%	50.1%	67.2%	81.7%	18.3%	737
Spokane	13.7%	48.4%	64.3%	76.0%	24.0%	785
Total	17.6%	55.1%	71.1%	82.7%	17.3%	3542

* Totals in the first four columns are cumulative, e.g., "past week" includes the total from "yesterday."

Table A.3: Self-mailer Question 2

Indicate the last time you utilized public transit to get to a destination (e.g., to work, shop, visit, or to catch a bus or train).

Region	Yesterday	Past Week*	Past Month	Past Year	Not Past Year	Weighted sample size
Columbia	5.0%	8.7%	11.2%	27.5%	72.5%	553
Marin	7.1%	14.7%	27.1%	58.3%	41.7%	727
Minneapolis	19.2%	30.3%	48.5%	78.2%	21.8%	740
Sheboygan	2.4%	3.8%	6.7%	15.2%	84.8%	737
Spokane	7.6%	11.9%	17.4%	30.9%	69.1%	785
Total	8.4%	14.1%	22.7%	42.6%	57.4%	3542

* Totals in the first four columns are cumulative, e.g., “past week” includes the total from “yesterday.”

For the next two questions, answers sum to more than 100% because respondents were asked all modes that they used to get to work, not just the one they used the most.

Table A.4: Self-mailer Question 7

How did you get to work last week?

Region	Drive	Carpool	Transit	Walk	Bike	Sample Size
Columbia	62.4%	32.8%	1.6%	5.1%	1.1%	419
Marin	58.7%	28.0%	10.5%	2.7%	0.9%	493
Minneapolis	63.6%	26.9%	11.9%	5.9%	1.9%	575
Sheboygan	73.1%	21.9%	1.0%	4.1%	0.7%	509
Spokane	66.1%	24.2%	3.2%	2.7%	0.5%	510
Total	64.9%	26.5%	5.9%	4.1%	1.0%	2506

Multiple responses allowed; totals add to more than 100%

Table A.5: Self-mailer Question 8

How did you get to school last week?

Region	Drive	Carpool	Transit	Walk	Bike	Sample Size
Columbia	46.8%	25.1%	10.5%	15.0%	6.9%	143
Marin	34.5%	20.4%	5.9%	9.2%	3.5%	112
Minneapolis	31.6%	14.1%	31.0%	22.1%	10.8%	162
Sheboygan	28.2%	13.2%	1.7%	4.4%	2.4%	88
Spokane	28.8%	11.8%	9.0%	7.6%	1.9%	141
Total	34.4%	17.0%	13.3%	12.7%	5.6%	647

Multiple responses allowed; totals add to more than 100%

Comparison with BRFSS Study

The tables in this appendix compare several parallel questions between the survey instrument and the Behavioral Risk Factor Surveillance System (BRFSS) administered by the Centers for Disease Control and Prevention (CDC). Generally, the questions ask respondents to consider the number of days engaged in activities for at least 10 minutes at a time and report the duration of the activities. The structure and composition of the questions are highly similar; however, the questions get at slightly different behaviors. Specifically, the survey asks respondents to consider walking and bicycling individually, separate from other activities, while the BRFSS asks respondents to consider moderate and vigorous activity which include walking and bicycling as possible activities. While these differences do not allow for statistical comparisons, examining these results gleans information into how the sample population reports their activity patterns relative to the larger population.

Tables A.6 through A.11 contrast the sample and BRFSS health-related questions. Two notes concerning the results: first, the sample responses are weighted and the BRFSS results are raw counts from the publicly available data. Second, the geographic scale of the results is different. The BRFSS data reports at the national or state level while the sample results are at the community level.

Generally, the distribution of sample respondents engaging in walking activity resembles the moderate BRFSS results at both the full and individual community levels, although the sample respondents report engaging in the activity for shorter durations. Analyzing the results between the communities, respondents in Minneapolis and Marin County generally engage in walking and bicycling activities at greater frequencies and longer duration than the other communities.

Table A.6: Comparison of full sample and national BRFSS

	Sample		BRFSS	
	Walk	Bike	Moderate	Vigorous
Days per week engaging in activity for at least 10 minutes at a time				
Zero	16.5%	80.1%	18.5%	58.4%
One	3.7%	3.8%	3.3%	7.1%
Two	8.3%	4.5%	8.5%	9.0%
Three	16.5%	5.7%	16.4%	11.0%
Four	9.1%	2.0%	10.2%	4.8%
Five	17.4%	2.6%	13.4%	4.7%
Six	5.5%	0.3%	4.6%	1.5%
Seven	23.0%	1.0%	25.1%	3.5%
Minutes of activity per day				
0 minutes	18.0%	80.7%	19.1%	58.8%
10 to 29 minutes	19.4%	2.8%	16.6%	6.6%
30 to 59 minutes	32.8%	6.3%	29.7%	14.2%
1 Hour +	29.9%	10.3%	34.6%	20.4%
Sample Size	1377	1379	258473	255747

Table A.7: Comparison of Columbia sample and State of Missouri BRFSS

	Sample		BRFSS	
	Walk	Bike	Moderate	Vigorous
Days per week engaging in activity for at least 10 minutes at a time				
Zero	17.3%	85.8%	18.4%	60.3%
One	5.3%	3.9%	3.9%	8.6%
Two	8.4%	2.8%	8.1%	8.8%
Three	17.1%	3.1%	16.4%	10.1%
Four	10.0%	1.3%	10.9%	4.0%
Five	16.8%	1.9%	12.2%	3.5%
Six	5.0%	0.4%	3.7%	1.4%
Seven	20.2%	0.9%	26.5%	3.4%
Minutes of activity per day				
0 minutes	18.3%	86.4%	19.1%	60.9%
10 to 29 minutes	23.4%	2.1%	18.1%	7.1%
30 to 59 minutes	33.4%	5.7%	27.3%	12.2%
1 Hour +	24.9%	5.9%	35.4%	19.8%
Sample Size	232	232	4252	4252

Table A.8: Comparison of Marin County sample and State of California BRFSS

	Sample		BRFSS	
	Walk	Bike	Moderate	Vigorous
Days per week engaging in activity for at least 10 minutes at a time				
Zero	9.0	77.7	14.1	51.7
One	2.3	6.0	3.9	7.7
Two	9.0	6.4	9.6	10.9
Three	16.5	4.4	16.6	12.5
Four	8.7	1.8	12.5	6.2
Five	21.5	3.1	16.9	5.7
Six	7.8	0.1	5.3	2.0
Seven	25.3	0.5	21.1	3.2
Minutes of activity per day				
0 minutes	9.4	78.1	14.2	51.8
10 to 29 minutes	16.4	2.8	18.6	8.4
30 to 59 minutes	39.8	5.2	30.4	16.4
1 Hour +	34.4	13.9	36.8	23.4
Sample Size	232	232	4475	4475

Table A.9: Comparison of Minneapolis sample and State of Minnesota BRFSS

	Sample		BRFSS	
	Walk	Bike	Moderate	Vigorous
Days per week engaging in activity for at least 10 minutes at a time				
Zero	11.2	78.5	10.5	52.6
One	2.4	1.7	3.0	9.6
Two	7.9	5.9	10.0	11.2
Three	14.1	8.7	18.3	12.8
Four	9.2	1.6	12.1	4.6
Five	20.3	2.8	14.7	4.3
Six	6.7	0.4	4.8	1.4
Seven	28.2	0.3	26.8	3.5
Minutes of activity per day				
0 minutes	13.7	78.9	10.5	52.8
10 to 29 minutes	18.5	2.8	22.1	10.5
30 to 59 minutes	31.9	6.6	33.5	18.1
1 Hour +	35.9	11.6	33.8	18.5
Sample Size	340	342	3883	3883

Table A.10: Comparison of Sheboygan County sample and State of Wisconsin BRFSS

	Sample		BRFSS	
	Walk	Bike	Moderate	Vigorous
Days per week engaging in activity for at least 10 minutes at a time				
Zero	24.3%	77.0%	12.3%	52.5%
One	4.0%	3.9%	3.3%	7.5%
Two	7.3%	5.5%	7.4%	11.4%
Three	17.0%	4.8%	16.4%	12.0%
Four	9.7%	4.1%	10.8%	5.0%
Five	11.5%	1.9%	14.7%	5.4%
Six	4.7%	0.4%	4.9%	1.6%
Seven	21.6%	2.4%	30.2%	4.7%
Minutes of activity per day				
0 minutes	26.6%	77.8%	12.5%	52.8%
10 to 29 minutes	18.0%	4.8%	18.3%	8.3%
30 to 59 minutes	28.4%	7.4%	33.6%	17.8%
1 Hour +	27.0%	10.0%	35.7%	21.1%
Sample Size	296	296	4054	4054

Table A.11: Comparison of Spokane sample and State of Washington BRFSS

Days per week engaging in activity for at least 10 minutes at a time				
	Sample		BRFSS	
	Walk	Bike	Moderate	Vigorous
Zero	20.6%	81.6%	12.6%	51.7%
One	4.6%	3.6%	2.7%	8.0%
Two	8.8%	2.0%	7.7%	9.9%
Three	17.8%	7.3%	15.1%	13.4%
Four	8.1%	1.2%	11.0%	6.0%
Five	17.1%	3.2%	14.3%	5.4%
Six	3.4%	0.3%	5.2%	1.6%
Seven	19.6%	0.9%	31.3%	4.1%
Minutes of activity per day				
0 minutes	21.8%	82.1%	13.0%	52.1%
10 to 29 minutes	20.6%	1.4%	18.3%	8.7%
30 to 59 minutes	30.3%	6.7%	30.9%	16.9%
1 Hour +	27.3%	9.8%	37.9%	22.3%
Sample Size	277	277	18644	18644

Additional Walk and Bike Characteristics

In question A8, respondents were asked about their travel to specific types of destinations. Each person was asked about three of seven possible destinations, thus the sample size for each destination type is 3/7 of the total survey sample size for that region. In this question, "Don't know/refused" means the person could not think of a specific destination of that type to which he or she regularly traveled.

Table A.12: Question A8, Columbia

How many days in the past month did you walk or bike to [the following destinations]?

	Days					Weighted
Destination	0	1-2	3-5	5+	DK/Ref	sample size
Bank	70%	7%	5%	0%	18%	141
Entertainment	27%	5%	2%	3%	63%	146
Grocery	83%	8%	6%	1%	3%	158
Gym	22%	4%	3%	8%	62%	158
Park	39%	13%	5%	16%	28%	168
Post Office	66%	7%	2%	1%	24%	175
Restaurant	53%	11%	6%	4%	26%	148

Table A.13: Question A8, Marin

How many days in the past month did you walk or bike to [the following destinations]?

Region	0	1-2	Days 3-5	5+	DK/Ref	Weighted sample size
Bank	51%	13%	7%	3%	26%	117
Entertainment	21%	12%	4%	2%	61%	120
Grocery	71%	6%	9%	8%	6%	122
Gym	36%	1%	2%	8%	52%	129
Park	18%	12%	19%	21%	30%	115
Post Office	56%	13%	11%	6%	14%	102
Restaurant	40%	10%	12%	7%	30%	120

Table A.14: Question A8, Minneapolis

How many days in the past month did you walk or bike to [the following destinations]?

Destination	0	1-2	Days 3-5	5+	DK/Ref	Weighted sample size
Bank	48%	15%	10%	8%	19%	177
Entertainment	31%	11%	10%	4%	45%	144
Grocery	72%	8%	9%	8%	4%	167
Gym	22%	1%	5%	8%	64%	174
Park	18%	7%	16%	35%	23%	168
Post Office	48%	20%	5%	3%	22%	159
Restaurant	34%	14%	11%	14%	27%	159

Table A.15: Question A8, Sheboygan

How many days in the past month did you walk or bike to [the following destinations]?

Destination	0	1-2	Days 3-5	5+	DK/Ref	Weighted sample size
Bank	67%	6%	3%	1%	23%	134
Entertainment	17%	8%	3%	2%	70%	130
Grocery	85%	4%	4%	1%	5%	125
Gym	14%	5%	1%	4%	77%	117
Park	31%	14%	7%	13%	35%	126
Post Office	72%	4%	4%	3%	17%	127
Restaurant	55%	8%	4%	5%	27%	144

Table A.16: Question A8, Spokane

How many days in the past month did you walk or bike to [the following destinations]?

Destination	Days 0	1-2	3-5	5+	DK/Ref	Weighted sample size
Bank	62%	10%	5%	2%	20%	162
Entertainment	26%	8%	1%	4%	60%	138
Grocery	77%	5%	8%	6%	3%	155
Gym	22%	3%	1%	2%	73%	129
Park	34%	8%	15%	13%	30%	125
Post Office	72%	4%	6%	0%	18%	139
Restaurant	56%	8%	5%	2%	28%	146

Questions A9 and A10 below asked about travel to places in general, not just the specific destinations discussed in question A8.

Table A.17: Question A9

In the past 7 days, how many different places did you visit by walking?

Region	Places None	1-2	3-4	5+	Weighted sample size
Columbia	45%	22%	8%	25%	365
Marin	34%	18%	11%	37%	275
Minneapolis	20%	18%	13%	50%	383
Sheboygan	50%	24%	5%	20%	301
Spokane	48%	22%	6%	25%	331
Total	39%	21%	9%	32%	1655

Table A.18: Question A10

In the past 7 days, how many different places did you visit by bicycling?

Region	Places None	1-2	3-4	5+	Weighted sample size
Columbia	94%	3%	1%	3%	365
Marin	86%	7%	1%	6%	275
Minneapolis	89%	6%	1%	4%	383
Sheboygan	94%	4%	0%	2%	301
Spokane	96%	3%	0%	2%	331
Total	92%	4%	1%	3%	1655

Table A.19: Question B7

Which of the following road types best describes the route you took on [the bicycle reference trip] ride?

Road Types	Columbia	Marin	Minneapolis	Sheboygan	Spokane	Total
Bike Lane	11%	27%	18%	14%	14%	17%
Bike Path	13%	27%	32%	10%	18%	19%
Busy Street	28%	25%	28%	30%	26%	28%
Local Street	42%	49%	48%	41%	46%	45%
Other	8%	2%	0%	4%	10%	5%
Rural Road	4%	14%	0%	13%	10%	8%
Sidewalk	28%	16%	15%	10%	20%	18%
Sample size	72	51	60	70	50	303

Answers add to more than 100% as multiple responses were allowed. This is unweighted as it is derived from only bicycle reference trip respondents.

Appendix B

General Attitudinal Results

General Transportation Attitudes

The results in this section are based on unweighted counts from all self-mailers; the sample size ranges from 797 in Columbia to 972 in Sheboygan. The weighting based on commute mode used elsewhere does not impact the results of these questions.

Table B.1: Self-mailer Question 5

How satisfied are you with the highway/roadway system in your community?

Region	Very dissatisfied	Somewhat dissatisfied	Neutral	Somewhat satisfied	Very satisfied	No opinion
Columbia	9%	16%	22%	35%	13%	5%
Marin	18%	21%	26%	25%	8%	2%
Minneapolis	10%	21%	26%	31%	7%	5%
Sheboygan	5%	10%	25%	38%	18%	3%
Spokane	12%	20%	25%	30%	7%	6%
Total	11%	18%	25%	32%	11%	4%

Table B.2: Self-mailer Question 5

How satisfied are you with the opportunities for walking in your community?

Region	Very dissatisfied	Somewhat dissatisfied	Neutral	Somewhat satisfied	Very satisfied	No opinion
Columbia	5%	8%	14%	34%	34%	6%
Marin	4%	6%	11%	33%	42%	5%
Minneapolis	2%	6%	10%	35%	45%	3%
Sheboygan	4%	6%	18%	32%	31%	9%
Spokane	4%	11%	20%	32%	24%	9%
Total	4%	7%	15%	33%	35%	6%

Table B.3: Self-mailer Question 5

How satisfied are you with the opportunities for bicycling in your community?

Region	Very dissatisfied	Somewhat dissatisfied	Neutral	Somewhat satisfied	Very satisfied	No opinion
Columbia	7%	10%	16%	27%	22%	18%
Marin	6%	7%	16%	27%	24%	21%
Minneapolis	3%	5%	13%	30%	33%	16%
Sheboygan	5%	10%	16%	27%	23%	20%
Spokane	8%	13%	19%	21%	15%	25%
Total	6%	9%	16%	26%	23%	20%

Table B.4: Self-mailer Question 5

How satisfied are you with transit service in your community?

Region	Very dissatisfied	Somewhat dissatisfied	Neutral	Somewhat satisfied	Very satisfied	No opinion
Columbia	10%	11%	22%	15%	7%	34%
Marin	21%	21%	20%	16%	5%	17%
Minneapolis	8%	17%	20%	33%	14%	8%
Sheboygan	7%	5%	22%	13%	9%	45%
Spokane	10%	13%	23%	19%	12%	24%
Total	11%	13%	22%	19%	10%	26%

Table B.5: Self-mailer Question 6

Do you think more money should be spent improving road maintenance in your community?

Region	DK/Ref	No	Yes
Columbia	13%	17%	70%
Marin	11%	12%	77%
Minneapolis	13%	17%	70%
Sheboygan	8%	19%	73%
Spokane	9%	8%	83%
Total	11%	15%	75%

Table B.6: Self-mailer Question 6

Do you think more money should be spent on road expansion in your community?

Region	DK/Ref	No	Yes
Columbia	19%	28%	53%
Marin	16%	39%	45%
Minneapolis	16%	48%	36%
Sheboygan	23%	46%	31%
Spokane	25%	32%	43%
Total	20%	39%	41%

Table B.7: Self-mailer Question 6

Do you think more money should be spent improving walking and biking infrastructure, such as sidewalks, bike lanes, and trails in your community?

Region	DK/Ref	No	Yes
Columbia	12%	24%	63%
Marin	16%	22%	62%
Minneapolis	15%	21%	64%
Sheboygan	20%	29%	51%
Spokane	20%	20%	60%

Total	17%	23%	60%

Table B.8: Self-mailer Question 6

Do you think more money should be spent improving transit service in your community?

Region	DK/Ref	No	Yes
Columbia	33%	14%	52%
Marin	15%	8%	77%
Minneapolis	10%	10%	80%
Sheboygan	44%	34%	23%
Spokane	27%	22%	51%
Total	26%	18%	56%

Mode-Specific Attitudes

Answers are unweighted in this section as they are derived from specific mode respondents and are not intended to be generalized.

Table B.9: Question B8

Were any of the following a cause for concern for your personal safety on that [bicycling reference trip]? (Multiple answers allowed)

Region	Motorists	Traffic	Rough pavement	Intersections	Unsafe or unsightly	Other	Sample
Columbia	55%	44%	30%	33%	4%	19%	73
Marin	54%	58%	29%	31%	6%	10%	52
Minneapolis	48%	37%	16%	29%	11%	8%	62
Sheboygan	41%	37%	21%	24%	13%	10%	70
Spokane	48%	44%	26%	22%	22%	8%	50
Total	49%	43%	24%	28%	11%	11%	307

Table B.10: Question B9

Were any of the following a cause for concern for your personal safety on that [walking reference trip]? (Multiple answers allowed)

Region	Crosswalks	Sidewalks	Lighting	Drivers	Other	Sample
Columbia	22%	31%	18%	29%	13%	104
Marin	4%	15%	11%	14%	11%	100
Minneapolis	2%	3%	17%	22%	17%	104
Sheboygan	10%	17%	22%	27%	14%	101
Spokane	17%	18%	20%	29%	17%	100
Total	11%	17%	18%	24%	14%	509

Question B14 asked a subsample of transit users their opinions about various aspects of the transit service in their community. The sample size is the same for all these tables and

is shown once in the first table. The final two columns of percentages summarize the first four, by summing the two "disagree" columns and the two "agree" columns.

Table B.11: Question B14 A

Consider the following characteristics of transit in your area: For the most part, it is convenient for me to reach destinations by transit.

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree	Sample Size
Columbia	13%	18%	33%	36%	31%	69%	50
Marin	33%	24%	33%	10%	57%	43%	68
Minneapolis	8%	14%	43%	35%	22%	78%	123
Sheboygan	12%	0%	27%	62%	12%	88%	26
Spokane	5%	6%	41%	48%	11%	89%	66
Total	14%	14%	38%	35%	28%	72%	333

Table B.12: Question B14 B

Consider the following characteristics of transit in your area: I know where and how to connect to transit, even with a bike.

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	16%	13%	27%	44%	29%	71%
Marin	13%	13%	40%	34%	26%	74%
Minneapolis	5%	15%	24%	55%	20%	80%
Sheboygan	15%	12%	27%	46%	27%	73%
Spokane	11%	8%	35%	47%	18%	82%
Total	10%	13%	30%	47%	23%	77%

Table B.13: Question B14 C

Consider the following characteristics of transit in your area: The route to the transit stop I used is good for walking.

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	20%	7%	31%	42%	27%	73%
Marin	23%	14%	27%	36%	37%	63%
Minneapolis	6%	7%	26%	61%	13%	87%
Sheboygan	4%	0%	23%	73%	4%	96%
Spokane	5%	9%	23%	64%	14%	86%
Total	11%	8%	26%	55%	19%	81%

Table B.14: Question B14 D

Consider the following characteristics of transit in your area: The route to the transit stop I used is good for cycling.

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	24%	20%	24%	31%	44%	56%
Marin	23%	17%	27%	33%	40%	60%
Minneapolis	11%	17%	36%	37%	28%	72%
Sheboygan	19%	15%	27%	38%	35%	65%
Spokane	24%	15%	30%	30%	39%	61%
Total	18%	17%	31%	34%	35%	65%

Table B.15: Question B14 E

Consider the following characteristics of transit in your area: There is good bike parking at transit.

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	31%	22%	29%	18%	53%	47%
Marin	46%	19%	21%	14%	64%	36%
Minneapolis	37%	26%	25%	12%	63%	37%
Sheboygan	38%	35%	12%	15%	73%	27%
Spokane	33%	17%	30%	20%	50%	50%
Total	37%	23%	25%	15%	60%	40%

Table B.16: Question B14 F

Consider the following characteristics of transit in your area: It was convenient for me to bring my bike aboard the bus/train.

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	27%	13%	29%	31%	40%	60%
Marin	29%	19%	21%	31%	47%	53%
Minneapolis	13%	15%	41%	30%	28%	72%
Sheboygan	58%	31%	0%	12%	88%	12%
Spokane	23%	17%	27%	33%	39%	61%
Total	24%	17%	29%	30%	41%	59%

Table B.17: Question B15

Which of the following best describes what you would have done if you hadn't been able to drive or be driven on this [auto reference trip]?

Region	Bike	Stayed Home	Other	Ride with someone	Transit	Walk	Sample Size
Columbia	2%	34%	7%	45%	1%	11%	85
Marin	0%	45%	8%	43%	2%	2%	49
Minneapolis	2%	27%	19%	37%	4%	12%	52
Sheboygan	3%	36%	4%	45%	0%	11%	99
Spokane	0%	41%	16%	40%	1%	1%	73
Total	2%	37%	10%	42%	1%	8%	358

Access to School for Children

Table B.18: Question C1

For how many children are you the parent, foster parent, stepparent, or legal guardian?

	Number of Children			
Region	0	1	2	3+
Columbia	69%	11%	13%	7%
Marin	69%	15%	12%	4%
Minneapolis	77%	10%	9%	5%
Sheboygan	70%	9%	11%	10%
Spokane	77%	7%	11%	5%
Total	72%	10%	11%	6%

Table B.19: Question C2

How far is your child's school from your home?

	Miles			
Region	0	1	2	3+
Columbia	11%	19%	20%	51%
Marin	10%	19%	13%	58%
Minneapolis	17%	13%	18%	52%
Sheboygan	28%	25%	24%	24%
Spokane	25%	15%	28%	32%
Total	18%	19%	21%	43%

Table B.20: Question C3

How old is your child?

Region	Age 0	1	2	3+
Columbia	19%	30%	24%	27%
Marin	31%	38%	19%	12%
Minneapolis	14%	41%	17%	28%
Sheboygan	3%	41%	34%	21%
Spokane	11%	42%	19%	28%
Total	13%	39%	25%	23%

Table B.21: Question C4

How does your child usually get to school?

Region	Bike	Bus	Carpool	Dropped Off	Other	Walk
Columbia	0%	11%	3%	54%	22%	11%
Marin	12%	0%	4%	50%	8%	27%
Minneapolis	3%	31%	3%	38%	14%	10%
Sheboygan	7%	19%	3%	28%	12%	31%
Spokane	8%	19%	3%	42%	11%	17%
Total	6%	17%	3%	40%	13%	20%

Table B.22: Question C4

How does your child usually get to school? (All regions together, grouped by age of child)

Child Age	Bike	Bus	Carpool	Dropped Off	Other	Walk
4-5	0%	4%	0%	52%	32%	12%
6-10	7%	21%	1%	46%	0%	25%
11-14	4%	17%	7%	39%	4%	28%
15-17	9%	16%	5%	26%	35%	9%

Table B.23: Question C5A

With respect to your child walking or cycling to school, please tell me the extent each of the following conditions concerns you: Too much traffic in neighborhood

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	17%	20%	20%	43%	37%	63%
Marin	38%	21%	25%	17%	58%	42%
Minneapolis	46%	15%	12%	27%	62%	38%
Sheboygan	28%	26%	16%	31%	53%	47%
Spokane	17%	11%	11%	61%	28%	72%
Total	27%	20%	16%	37%	47%	53%

Table B.24: Question C5B

With respect to your child walking or cycling to school, please tell me the extent each of the following conditions concerns you: Too much traffic around

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	23%	9%	23%	46%	31%	69%
Marin	38%	13%	17%	33%	50%	50%
Minneapolis	32%	25%	18%	25%	57%	43%
Sheboygan	24%	12%	22%	41%	36%	64%
Spokane	17%	11%	17%	56%	28%	72%
Total	25%	13%	20%	41%	39%	61%

Table B.25: Question C5C

With respect to your child walking or cycling to school, please tell me the extent each of the following conditions concerns you: Cars drive too fast through the neighborhood

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	31%	11%	11%	46%	43%	57%
Marin	46%	8%	13%	33%	54%	46%
Minneapolis	64%	4%	18%	14%	68%	32%
Sheboygan	53%	19%	10%	17%	72%	28%
Spokane	47%	3%	19%	31%	50%	50%
Total	49%	10%	14%	27%	59%	41%

Table B.26: Question C5D

With respect to your child walking or cycling to school, please tell me the extent each of the following conditions concerns you: No (or inadequate) sidewalks/bikeways on the route to school

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	31%	11%	9%	49%	43%	57%
Marin	46%	17%	0%	38%	63%	38%
Minneapolis	37%	15%	30%	19%	52%	48%
Sheboygan	31%	19%	17%	33%	50%	50%
Spokane	19%	22%	22%	36%	42%	58%
Total	32%	17%	16%	35%	49%	51%

Table B.27: Question C5E

With respect to your child walking or cycling to school, please tell me the extent each of the following conditions concerns you: Crossing particularly problematic or dangerous intersections

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	74%	4%	0%	22%	78%	22%
Marin	56%	6%	0%	39%	61%	39%
Minneapolis	70%	4%	0%	26%	74%	26%
Sheboygan	92%	0%	2%	6%	92%	8%

Spokane	77%	0%	3%	19%	77%	23%
Total	78%	2%	1%	19%	80%	20%

Appendix C

Attitudes about Walking and Biking Conditions

In question C6, respondents were asked their opinions of a random selection of a long list of neighborhood characteristics. Because the selection of questions was random, the exact sample size varies slightly from one question to the next, but all are fairly close to the sample sizes shown in the first table.

Table C.1: Question C6A

Opinion of characteristics of your neighborhood for walking and bicycling: Stores are within easy walking distance of my home

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree	Sample Size
Columbia	43%	20%	25%	12%	63%	37%	98
Marin	20%	20%	26%	35%	40%	60%	83
Minneapolis	13%	22%	28%	36%	36%	64%	115
Sheboygan	29%	23%	27%	21%	52%	48%	109
Spokane	35%	14%	16%	35%	48%	52%	82
Total	28%	20%	24%	28%	47%	53%	487

Table C.2: Question C6B

Opinion of characteristics of your neighborhood for walking and bicycling: There are many places to go within easy walking distance of my home

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	25%	18%	27%	30%	43%	57%
Marin	13%	16%	24%	48%	29%	71%
Minneapolis	4%	11%	34%	51%	15%	85%
Sheboygan	26%	15%	28%	31%	41%	59%
Spokane	18%	14%	31%	37%	32%	68%
Total	17%	15%	29%	40%	31%	69%

Table C.3: Question C6C

Opinion of characteristics of your neighborhood for walking and bicycling: It is easy to walk to a transit stop (bus, train) from my home

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	27%	12%	25%	37%	39%	61%
Marin	13%	6%	29%	51%	19%	81%
Minneapolis	3%	2%	13%	82%	5%	95%
Sheboygan	30%	5%	15%	51%	35%	65%
Spokane	13%	4%	19%	65%	17%	83%
Total	16%	6%	20%	58%	22%	78%

Table C.4: Question C6D

Opinion of characteristics of your neighborhood for walking and bicycling: It is easy to bicycle to a transit stop (bus, train) from my home

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	27%	13%	22%	38%	40%	60%
Marin	11%	17%	25%	46%	28%	72%
Minneapolis	6%	10%	17%	67%	16%	84%
Sheboygan	30%	13%	24%	33%	43%	57%
Spokane	13%	15%	15%	58%	27%	73%
Total	17%	13%	20%	49%	31%	69%

Table C.5: Question C6E

Opinion of characteristics of your neighborhood for walking and bicycling: The streets in my neighborhood are hilly, making it difficult to walk

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	29%	33%	25%	13%	63%	38%
Marin	36%	14%	33%	18%	50%	50%
Minneapolis	74%	14%	7%	5%	87%	13%
Sheboygan	58%	14%	20%	8%	72%	28%
Spokane	50%	23%	12%	15%	73%	27%
Total	50%	20%	19%	11%	70%	30%

Table C.6: Question C6F

Opinion of characteristics of your neighborhood for walking and bicycling: There are sidewalks on most of the streets in my neighborhood

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	31%	10%	21%	38%	41%	59%
Marin	29%	12%	20%	39%	41%	59%
Minneapolis	1%	2%	12%	85%	3%	97%
Sheboygan	32%	5%	11%	52%	37%	63%
Spokane	32%	7%	13%	48%	39%	61%
Total	24%	7%	15%	54%	31%	69%

Table C.7: Question C6G

Opinion of characteristics of your neighborhood for walking and bicycling: There are sidewalks in my neighborhood are well maintained

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	41%	13%	24%	22%	54%	46%
Marin	33%	19%	26%	22%	52%	48%
Minneapolis	5%	11%	50%	34%	16%	84%
Sheboygan	26%	16%	24%	34%	42%	58%
Spokane	26%	21%	29%	24%	46%	54%
Total	25%	16%	32%	28%	40%	60%

Table C.8: Question C6H

Opinion of characteristics of your neighborhood for walking and bicycling: There are pedestrian trails in or near my neighborhood that are easy to get to

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	29%	15%	19%	37%	44%	56%
Marin	7%	21%	20%	51%	29%	71%
Minneapolis	8%	4%	34%	55%	12%	88%
Sheboygan	31%	14%	20%	34%	46%	54%
Spokane	34%	18%	30%	18%	52%	48%
Total	21%	14%	25%	40%	35%	65%

Table C.9: Question C6I

Opinion of characteristics of your neighborhood for walking and bicycling: There are crosswalks and pedestrian signals to help walkers cross busy streets in my neighborhood

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	34%	18%	19%	29%	52%	48%
Marin	12%	10%	26%	52%	22%	78%
Minneapolis	6%	9%	37%	49%	15%	85%
Sheboygan	34%	13%	19%	34%	47%	53%
Spokane	35%	23%	15%	27%	58%	42%
Total	25%	15%	23%	38%	39%	61%

Table C.10: Question C6J

Opinion of characteristics of your neighborhood for walking and bicycling: My neighborhood streets are well lit at night

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	23%	16%	39%	22%	39%	61%
Marin	30%	19%	34%	16%	49%	51%
Minneapolis	12%	22%	46%	20%	34%	66%
Sheboygan	31%	11%	27%	30%	42%	58%
Spokane	29%	23%	34%	15%	51%	49%
Total	25%	18%	36%	21%	42%	58%

Table C.11: Question C6K

Opinion of characteristics of your neighborhood for walking and bicycling: The crime rate in my neighborhood makes it unsafe to go on walks during the day

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	72%	16%	8%	4%	88%	12%
Marin	84%	10%	3%	3%	94%	6%
Minneapolis	70%	21%	6%	3%	91%	9%
Sheboygan	81%	7%	3%	8%	88%	12%
Spokane	63%	15%	14%	8%	78%	22%
Total	74%	14%	7%	5%	88%	12%

Table C.12: Question C6L

Opinion of characteristics of your neighborhood for walking and bicycling: Major streets have bike lanes

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	44%	25%	24%	6%	69%	31%
Marin	23%	18%	32%	27%	41%	59%
Minneapolis	21%	19%	33%	27%	40%	60%
Sheboygan	70%	14%	7%	9%	84%	16%
Spokane	56%	18%	16%	10%	73%	27%
Total	41%	19%	24%	17%	60%	40%

Table C.13: Question C6M

Opinion of characteristics of your neighborhood for walking and bicycling: The city has a network of off-street bicycle paths

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	22%	17%	34%	27%	39%	61%
Marin	21%	25%	27%	27%	45%	55%
Minneapolis	3%	11%	50%	35%	15%	85%
Sheboygan	30%	23%	25%	23%	53%	47%
Spokane	30%	25%	31%	14%	55%	45%
Total	20%	19%	35%	26%	39%	61%

Table C.14: Question C6N

Opinion of characteristics of your neighborhood for walking and bicycling: Streets without bike lanes are generally wide enough to bike on

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	35%	23%	27%	15%	58%	42%
Marin	27%	22%	37%	14%	49%	51%
Minneapolis	13%	29%	43%	15%	42%	58%
Sheboygan	28%	13%	23%	35%	41%	59%
Spokane	27%	18%	36%	18%	45%	55%
Total	26%	21%	33%	20%	47%	53%

Table C.15: Question C6O

Opinion of characteristics of your neighborhood for walking and bicycling: There are bike lanes, paths or routes that connect my home to places that I would like to ride to

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	51%	29%	12%	8%	80%	20%
Marin	27%	15%	35%	22%	42%	58%
Minneapolis	14%	18%	31%	37%	32%	68%
Sheboygan	49%	22%	16%	14%	71%	29%
Spokane	48%	21%	18%	13%	69%	31%
Total	36%	21%	23%	20%	57%	43%

Table C.16: Question C6P

Opinion of characteristics of your neighborhood for walking and bicycling: The bike route network has big gaps

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	14%	11%	30%	45%	25%	75%
Marin	13%	19%	33%	36%	31%	69%
Minneapolis	17%	36%	27%	20%	53%	47%
Sheboygan	29%	23%	23%	26%	52%	48%
Spokane	9%	18%	37%	35%	28%	72%
Total	16%	22%	30%	32%	38%	62%

Table C.17: Question C6Q

Opinion of characteristics of your neighborhood for walking and bicycling: Bike lanes and paths are free of obstacles

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	29%	22%	32%	17%	51%	49%
Marin	15%	8%	47%	30%	23%	77%
Minneapolis	4%	15%	41%	41%	19%	81%
Sheboygan	28%	10%	27%	35%	38%	62%
Spokane	32%	27%	26%	15%	59%	41%
Total	21%	17%	34%	28%	37%	63%

Table C.18: Question C6R

Opinion of characteristics of your neighborhood for walking and bicycling: Stores and other destinations have bike racks

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	30%	31%	33%	7%	60%	40%
Marin	18%	22%	48%	12%	40%	60%
Minneapolis	13%	28%	44%	15%	41%	59%
Sheboygan	37%	22%	24%	17%	59%	41%
Spokane	27%	26%	30%	17%	52%	48%
Total	25%	26%	36%	14%	51%	49%

Table C.19: Question C6S

Opinion of characteristics of your neighborhood for walking and bicycling: Intersections have push buttons or sensors for bicycles and pedestrians

Region	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Total disagree	Total agree
Columbia	45%	18%	22%	15%	63%	37%
Marin	20%	15%	34%	30%	35%	65%
Minneapolis	13%	18%	40%	28%	31%	69%
Sheboygan	50%	16%	19%	15%	66%	34%
Spokane	42%	13%	24%	21%	55%	45%
Total	33%	16%	29%	22%	49%	51%

Appendix D

Factors Motivating Use of Nonauto Modes

Factors Motivating Increased Walking

In question C7 each respondent was asked opinions of a randomly chosen subset of a longer list of questions. The sample size for all of these questions is close to that shown in the first table.

Table D.1: Question C7A

How likely are the following factors to get you to walk more often than you currently do? More sidewalks

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely	Sample Size
Columbia	30%	16%	27%	27%	46%	54%	183
Marin	53%	15%	16%	16%	68%	32%	137
Minneapolis	53%	17%	15%	15%	70%	30%	191
Sheboygan	58%	11%	14%	17%	69%	31%	171
Spokane	45%	16%	21%	18%	61%	39%	167
Total	47%	15%	19%	19%	63%	37%	849

Table D.2: Question C7B

How likely are the following factors to get you to walk more often than you currently do? Better condition of sidewalks

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	33%	23%	21%	23%	56%	44%
Marin	48%	21%	14%	17%	70%	30%
Minneapolis	46%	19%	22%	13%	65%	35%
Sheboygan	58%	12%	14%	17%	69%	31%
Spokane	35%	26%	18%	21%	61%	39%
Total	43%	20%	18%	18%	64%	36%

Table D.3: Question C7C

How likely are the following factors to get you to walk more often than you currently do? Safer intersections

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	33%	14%	28%	25%	47%	53%
Marin	46%	20%	17%	17%	66%	34%
Minneapolis	37%	21%	20%	22%	58%	42%
Sheboygan	44%	15%	21%	20%	59%	41%
Spokane	38%	21%	18%	24%	59%	41%
Total	39%	18%	21%	22%	57%	43%

Table D.4: Question C7D

How likely are the following factors to get you to walk more often than you currently do? Areas free from crime

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	34%	14%	21%	32%	47%	53%
Marin	47%	12%	14%	27%	59%	41%
Minneapolis	18%	14%	25%	43%	32%	68%
Sheboygan	41%	14%	15%	30%	55%	45%
Spokane	33%	15%	20%	33%	48%	52%
Total	33%	14%	19%	34%	47%	53%

Table D.5: Question C7E

How likely are the following factors to get you to walk more often than you currently do? More lights in walking areas

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	37%	17%	24%	22%	54%	46%
Marin	60%	15%	17%	7%	76%	24%
Minneapolis	35%	20%	21%	24%	55%	45%
Sheboygan	41%	17%	19%	23%	58%	42%
Spokane	35%	20%	25%	20%	55%	45%
Total	41%	18%	21%	20%	59%	41%

Table D.6: Question C7F

How likely are the following factors to get you to walk more often than you currently do? Areas free from fast moving traffic

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	30%	18%	25%	27%	48%	52%
Marin	31%	16%	26%	27%	47%	53%
Minneapolis	36%	17%	26%	21%	53%	47%
Sheboygan	35%	13%	24%	27%	49%	51%
Spokane	36%	15%	21%	28%	51%	49%
Total	34%	16%	24%	26%	50%	50%

Table D.7: Question C7G

How likely are the following factors to get you to walk more often than you currently do? The cost of parking and driving increased

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	52%	15%	14%	20%	67%	33%
Marin	53%	13%	16%	18%	66%	34%
Minneapolis	36%	22%	24%	18%	58%	42%
Sheboygan	55%	18%	13%	13%	73%	27%
Spokane	51%	20%	14%	15%	71%	29%
Total	49%	18%	16%	17%	67%	33%

Table D.8: Question C7H

How likely are the following factors to get you to walk more often than you currently do? More destinations close to home

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	31%	13%	23%	34%	44%	56%
Marin	29%	12%	26%	33%	41%	59%
Minneapolis	18%	16%	24%	42%	34%	66%
Sheboygan	33%	22%	21%	25%	55%	45%
Spokane	29%	21%	15%	35%	50%	50%
Total	27%	17%	22%	34%	44%	56%

Table D.9: Question C7I

How likely are the following factors to get you to walk more often than you currently do? More destinations close to work

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	33%	12%	32%	23%	45%	55%
Marin	42%	11%	22%	25%	53%	47%
Minneapolis	36%	15%	22%	27%	51%	49%
Sheboygan	47%	17%	17%	19%	64%	36%
Spokane	37%	19%	16%	28%	56%	44%
Total	39%	15%	22%	24%	54%	46%

Table D.10: Question C7J

How likely are the following factors to get you to walk more often than you currently do? If I had to pay to park my vehicle

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	57%	17%	13%	12%	74%	26%
Marin	50%	14%	19%	17%	64%	36%
Minneapolis	37%	16%	24%	23%	53%	47%
Sheboygan	61%	18%	12%	9%	79%	21%
Spokane	60%	20%	8%	13%	80%	20%
Total	53%	17%	15%	15%	70%	30%

Table D.11: Question C7K

How likely are the following factors to get you to walk more often than you currently do? If parking was hard to find

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	49%	18%	16%	16%	68%	32%
Marin	46%	16%	21%	17%	62%	38%
Minneapolis	33%	24%	24%	19%	57%	43%
Sheboygan	57%	19%	13%	10%	77%	23%
Spokane	53%	17%	13%	17%	71%	29%
Total	48%	19%	17%	16%	67%	33%

Factors Motivating Increased Cycling

In question C8 each respondent was asked opinions of a randomly chosen subset of a longer list of questions. The sample size for all of these questions is close to that shown in the first table.

Table D.12: Question C8A

How likely are the following factors to get you to bike more often than you currently do? More marked bike lanes on existing streets

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely	Sample Size
Columbia	41%	12%	16%	31%	53%	47%	213
Marin	37%	16%	22%	25%	53%	47%	147
Minneapolis	30%	16%	23%	32%	46%	54%	231
Sheboygan	39%	11%	21%	29%	50%	50%	204
Spokane	39%	10%	20%	31%	49%	51%	189
Total	37%	13%	20%	30%	50%	50%	984

Table D.13: Question C8B

How likely are the following factors to get you to bike more often than you currently do? More off-street bike paths

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	37%	13%	19%	32%	49%	51%
Marin	39%	9%	18%	33%	48%	52%
Minneapolis	26%	17%	18%	39%	43%	57%
Sheboygan	38%	11%	17%	33%	50%	50%
Spokane	38%	9%	21%	32%	47%	53%
Total	36%	12%	19%	34%	48%	52%

Table D.14: Question C8C

How likely are the following factors to get you to bike more often than you currently do? More lights on existing bicycle facilities

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	47%	17%	16%	20%	64%	36%
Marin	55%	15%	13%	17%	69%	31%
Minneapolis	34%	20%	22%	24%	54%	46%
Sheboygan	44%	16%	15%	25%	60%	40%
Spokane	44%	17%	21%	18%	61%	39%
Total	44%	17%	18%	21%	61%	39%

Table D.15: Question C8D

How likely are the following factors to get you to bike more often than you currently do? Safer intersections

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	33%	12%	24%	30%	45%	55%
Marin	40%	17%	15%	28%	56%	44%
Minneapolis	29%	16%	22%	33%	45%	55%
Sheboygan	45%	14%	18%	23%	59%	41%
Spokane	39%	14%	21%	26%	53%	47%
Total	37%	15%	20%	28%	51%	49%

Table D.16: Question C8E

How likely are the following factors to get you to bike more often than you currently do? Safer or better bike parking

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	46%	16%	23%	15%	62%	38%
Marin	44%	16%	19%	21%	60%	40%
Minneapolis	29%	21%	22%	28%	50%	50%
Sheboygan	52%	14%	17%	16%	67%	33%
Spokane	43%	9%	19%	29%	52%	48%
Total	42%	15%	20%	22%	58%	42%

Table D.17: Question C8F

How likely are the following factors to get you to bike more often than you currently do? Showers available at my destinations

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	68%	10%	11%	11%	77%	23%
Marin	68%	9%	12%	11%	77%	23%
Minneapolis	59%	12%	12%	17%	71%	29%
Sheboygan	79%	7%	9%	6%	86%	14%
Spokane	70%	8%	11%	11%	78%	22%
Total	69%	9%	11%	11%	78%	22%

Table D.18: Question C8G

How likely are the following factors to get you to bike more often than you currently do? Motorists who obey traffic laws

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	32%	15%	21%	33%	47%	53%
Marin	34%	13%	15%	38%	48%	52%
Minneapolis	30%	14%	20%	36%	44%	56%
Sheboygan	38%	11%	23%	27%	49%	51%
Spokane	33%	15%	16%	35%	48%	52%
Total	33%	14%	19%	34%	47%	53%

Table D.19: Question C8H

How likely are the following factors to get you to bike more often than you currently do?
Areas free from crime

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	44%	12%	22%	23%	55%	45%
Marin	57%	10%	13%	19%	67%	33%
Minneapolis	32%	16%	20%	32%	48%	52%
Sheboygan	50%	8%	12%	29%	59%	41%
Spokane	43%	9%	21%	26%	52%	48%
Total	44%	11%	18%	27%	55%	45%

Table D.20: Question C8I

How likely are the following factors to get you to bike more often than you currently do?
Areas free from fast moving traffic

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	34%	11%	20%	35%	45%	55%
Marin	31%	15%	18%	36%	46%	54%
Minneapolis	27%	21%	20%	32%	47%	53%
Sheboygan	38%	15%	20%	26%	54%	46%
Spokane	39%	11%	20%	30%	50%	50%
Total	34%	15%	20%	32%	49%	51%

Factors Motivating Increased Transit Use

In question C9 each respondent was asked opinions of a randomly chosen subset of a longer list of questions. The sample size for all of these questions is close to that shown in the first table.

Table D.21: Question C9A

How likely are the following factors to get you to use transit more often than you currently do?
A bus/rail stop closer to work or home

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely	Sample Size
Columbia	38%	12%	23%	27%	51%	49%	292
Marin	38%	12%	20%	30%	50%	50%	219
Minneapolis	31%	12%	22%	36%	42%	58%	333
Sheboygan	59%	14%	14%	13%	73%	27%	267
Spokane	44%	12%	22%	22%	56%	44%	266
Total	42%	13%	20%	26%	54%	46%	1377

Table D.22: Question C9B

How likely are the following factors to get you to use transit more often than you currently do?
More frequent or faster bus service

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	33%	15%	20%	33%	48%	52%
Marin	24%	9%	23%	45%	32%	68%
Minneapolis	21%	15%	26%	38%	36%	64%
Sheboygan	55%	13%	17%	15%	69%	31%
Spokane	35%	17%	19%	29%	52%	48%
Total	33%	14%	21%	32%	47%	53%

Table D.23: Question C9C

How likely are the following factors to get you to use transit more often than you currently do?
A more pleasurable route either to or from the closest bus/rail stop

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	51%	17%	16%	16%	68%	32%
Marin	53%	18%	13%	16%	71%	29%
Minneapolis	41%	20%	21%	18%	61%	39%
Sheboygan	69%	12%	11%	8%	81%	19%
Spokane	50%	12%	21%	17%	62%	38%
Total	52%	16%	17%	15%	68%	32%

Table D.24: Question C9D

How likely are the following factors to get you to use transit more often than you currently do?
A bus shelter

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	42%	18%	19%	22%	60%	40%
Marin	44%	19%	21%	16%	63%	37%
Minneapolis	35%	20%	23%	22%	55%	45%
Sheboygan	67%	11%	12%	10%	78%	22%
Spokane	40%	15%	25%	19%	55%	45%
Total	45%	17%	20%	18%	62%	38%

Table D.25: Question C9E

How likely are the following factors to get you to use transit more often than you currently do?
The ability to take my bike on the bus or the train

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	56%	13%	16%	15%	69%	31%
Marin	53%	11%	16%	20%	64%	36%
Minneapolis	47%	18%	17%	18%	66%	34%
Sheboygan	71%	8%	10%	12%	78%	22%
Spokane	57%	11%	15%	17%	69%	31%
Total	57%	13%	15%	16%	69%	31%

Table D.26: Question C9F

How likely are the following factors to get you to use transit more often than you currently do?
A free or subsidized transit pass

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	43%	11%	16%	29%	55%	45%
Marin	38%	13%	18%	31%	51%	49%
Minneapolis	27%	15%	16%	41%	42%	58%
Sheboygan	51%	17%	15%	17%	68%	32%
Spokane	35%	12%	21%	32%	47%	53%
Total	39%	14%	17%	31%	52%	48%

Table D.27: Question C9G

How likely are the following factors to get you to use transit more often than you currently do?
Other

Region	Not likely	Somewhat likely	Likely	Very likely	Total less likely	Total more likely
Columbia	69%	1%	3%	26%	71%	29%
Marin	61%	4%	4%	31%	65%	35%
Minneapolis	53%	3%	4%	40%	56%	44%
Sheboygan	81%	2%	2%	15%	83%	17%
Spokane	67%	1%	5%	26%	68%	32%
Total	66%	2%	4%	28%	69%	31%

Appendix E
Survey Demographics

Characteristics of Program Communities

This appendix displays various tables regarding sample demographics. The first table reports basic demographic and economic information for the full sample and each community. The percentages within categories may not add to 100 percent due to respondents' refusal to answer specific questions. The remaining tables compare the communities to Census 2000 demographics. The tables test whether the difference in means between the sample and Census is statistically significant. Among specific variables, certain categories are omitted from the statistical tests as either redundant or uninformative. For instance, testing the difference in percentage of people unemployed is not informative if already testing differences in full-time and part-time employment. If the difference in those employed is significant, the difference in those not employed will also be significant.

The basic demographic and economic characteristics for the full sample and each community individually are shown in Table E.1. Comparatively, the sample populations in each community are similar in a number of ways. The number of female respondents is greater in each community except for Minneapolis. The greatest percentage of the respondents are between 45 and 64 years old and describe themselves as white. Household income varies among communities, although Marin County respondents are of notably higher income. Roughly half the respondents are employed full-time, and 60 to 70 percent of households have two to four residents. At least 70 percent of households have one or more vehicle per adult, with a high of 89 percent in Marin County. Roughly 50 percent of respondents report one or more bicycles per adult.

The next step is to compare the demographic and economic characteristics of the sample to the population at large. Tables E.2 through E.7 contrast the full sample and each community to Census 2000 demographics. The survey respondents differ from the population at large in several variables. Generally, the sample tends to be less employed, more white, and of greater income. Variations from these trends occur in each community. The differences highlight the need to exhibit care and consider these variations when generalizing about the population from the respondent sample. Among the community samples, similar demographic profiles allow more general behavioral comparisons, although observers should still show care when studying the results.

Table E.1: Sample demographics

	Full Sample (%)	Columbia, MO (%)	Minneapolis, MN (%)	Marin County, CA (%)	Sheboygan County, WI (%)	Spokane, WA (%)
n	1514	313	343	272	297	289
Gender						
Female	52.5	55.0	49.9	51.1	51.5	55.4
Male	47.5	45.0	50.1	48.9	48.5	44.6
Age						
18 to 24 years	3.9	8.3	4.1	0.7	1.0	4.8
25 to 34 years	11.8	17.3	15.2	4.0	10.1	11.1
35 to 44 years	17.5	16.6	19.0	17.6	20.9	13.1
45 to 54 years	21.7	20.1	23.6	23.5	20.9	20.1
55 to 64 years	22.4	17.9	22.2	25.0	24.6	22.8
65 to 74 years	11.9	10.9	9.6	15.8	12.8	11.1
75 and over	9.0	8.9	6.1	12.1	9.4	9.3
Race						
White	91.3	88.8	88.0	92.6	97.0	91.0
African American	1.9	4.5	2.3	1.5		1.0
Asian	0.8	0.3	1.7	0.4	0.3	1.0
American Indian or Alaskan Native	0.7	1.0	1.5	0.0	0.0	1.0
Native Hawaiian or other Pacific Islander	0.2	0.0	0.3	0.0	0.3	0.3
Hispanic/Mexican	0.7	0.3	0.6	1.1	1.0	0.3
More the one race	1.3	1.3	1.5	1.5	0.7	1.4
Other	0.5	1.3	0.3	0.4	0.7	0.0
Household Income						
$0 - $14,999	9.0	13.1	9.0	2.2	6.7	13.5
$15,000 - $24,999	8.8	9.9	8.5	3.3	10.8	11.1
$25,000 - $34,999	7.3	10.2	5.2	2.6	8.4	9.7
$35,000 - $49,000	16.2	17.6	16.9	8.5	20.5	17.0
$50,000 - $74,999	16.2	13.4	18.4	11.8	19.9	17.0
$75,000 - $99,999	10.5	14.4	9.6	10.7	10.1	7.6
$100,000 or more	14.1	8.0	11.7	34.6	10.1	8.3
Refused	17.9	13.4	20.7	26.5	13.5	15.9
Employment Status						
Full-time	48.9	50.8	53.6	46.0	51.2	41.5
Part-time	15.3	15.0	15.5	16.5	11.4	18.0
Not employed	34.7	33.2	30.3	35.3	37.0	38.8
Household Size						
1	29.0	27.2	39.7	23.0	22.4	33.3
2	39.0	39.3	35.9	47.0	39.7	37.4
3 - 4	24.8	29.1	20.4	26.7	27.8	22.6
5 or more	5.6	4.5	4.1	3.3	10.2	6.7
Vehicles / Household						
None	8.0	9.0	14.0	2.0	5.0	11.0
Less than 1 per adult	12.0	12.0	16.0	8.0	10.0	12.0
1 or more per adult	80.0	79.0	70.0	89.0	85.0	77.0
Bicycles / Household						
None	36.0	39.0	32.0	34.0	33.0	42.0
Less than 1 per adult	11.0	12.0	9.0	14.0	10.0	12.0
1 or more per adult	53.0	49.0	59.0	53.0	56.0	46.0

Note: Percentages may not add to 100 due to refusal to answer

Table E.2: Comparison of full sample and Census 2000 demographics

	Survey Year				Comparison of Means
	Sample		Census		Statistic[ab]
	(%)	(n)	(%)	(n)	
Gender					
Male	47.5%	1514	49.5%	317	-1.498
Employment					
Full time	49.2%	1504	54.7%	317	-3.949**
Full or part time	64.6%	1504	73.3%	317	-6.458**
Race					
White	93.8%	1475	78.5%	317	10.888**
Black or African Am.	2.0%	1475	9.4%	317	-8.231**
Other	3.5%	1463	11.8%	317	-11.631**
	Average	(n)	Average	(n)	
Household Income	58964.2	1243	53954.3	317	2.806**
Household Size	2.3	1491	2.4	317	-3.508**

a T-statistic from Independent Samples t-test (2-tailed sig.)
b * Significant at 0.05 level, ** Significant at 0.01 level
c Census income adjusted for inflation using total CPI of 21.0%

Table E.3: Comparison of Columbia, MO, sample and Census 2000 demographics

	Survey Year				Comparison of Means
	Sample		Census		Statistic[ab]
	(%)	(n)	(%)	(n)	
Gender					
Male	45.0%	313	48.7%	23	-1.210
Employment					
Full time	51.0%	312	52.3%	23	-0.323
Full or part time	66.0%	312	80.3%	23	4.737**
Race					
White	91.1%	305	79.8%	23	1.901
Black or African Am.	4.6%	305	12.6%	23	0.070
Other	3.9%	304	7.6%	23	0.373
	Average	(n)	Average	(n)	
Household Income	51337.6	271	39794.7	23	2.469*
Household Size	2.3	313	2.3	23	0.208

a T-statistic from Independent Samples t-test (2-tailed sig.)
b * Significant at 0.05 level, ** Significant at 0.01 level
c Census income adjusted for inflation using total CPI of 21.0%

Table E.4: Comparison of Minneapolis, MN, sample and Census 2000 demographics

	Survey Year				Comparison of Means
	Sample		Census		Statistic[ab]
	(%)	(n)	(%)	(n)	
Gender					
Male	50.1%	343	50.6%	120	-0.156
Employment					
Full time	53.8%	342	58.0%	120	-1.448
Full or part time	69.3%	342	75.8%	120	-2.394*
Race					
White	91.5%	330	62.4%	120	-10.085**
Black or African Am.	2.4%	330	19.8%	120	-9.347**
Other	4.3%	324	17.8%	120	-8.910**
	Average	(n)	Average	(n)	
Household Income	57509.2	272	47192.1	120	3.665**
Household Size	2.0	343	2.4	120	-4.31**

a T-statistic from Independent Samples t-test (2-tailed sig.)
b * Significant at 0.05 level, ** Significant at 0.01 level
c Census income adjusted for inflation using total CPI of 21.0%

Table E.5: Comparison of Marin County, CA, sample and Census 2000 demographics

	Survey Year				Comparison of Means
	Sample		Census		Statistic[ab]
	(%)	(n)	(%)	(n)	
Gender					
Male	48.9%	272	47.9%	43	0.312
Employment					
Full time	46.8%	267	54.6%	43	-2.444*
Full or part time	63.7%	267	72.7%	43	2.913**
Race					
White	95.1%	265	85.6%	43	2.821**
Black or African Am.	1.5%	265	2.4%	43	-0.480
Other	3.0%	264	12.0%	43	-5.575**
	Average	(n)	Average	(n)	
Household Income	88500.0	200	94765.0	43	2.469*
Household Size	2.3	270	2.4	43	-1.290

a T-statistic from Independent Samples t-test (2-tailed sig.)
b * Significant at 0.05 level, ** Significant at 0.01 level
c Census income adjusted for inflation using total CPI of 21.0%

Table E.6: Comparison of Sheboygan County, WI, sample and Census 2000 demographics

	Survey Year				Comparison of Means
	Sample		Census		Statistic[ab]
	(%)	(n)	(%)	(n)	
Gender					
Male	48.5%	297	48.4%	25	-0.019
Employment					
Full time	51.2%	297	56.0%	25	-1.240
Full or part time	62.6%	297	72.8%	25	-2.353*
Race					
White	97.0%	297	89.0%	25	-2.201*
Black or African Am.	0.0%	297	1.2%	25	-1.770
Other	2.7%	296	5.8%	25	-0.950
	Average	(n)	Average	(n)	
Household Income	55233.5	257	54144.1	25	0.274**
Household Size	2.5	295	2.4	25	0.850

a T-statistic from Independent Samples t-test (2-tailed sig.)
b * Significant at 0.05 level, ** Significant at 0.01 level
c Census income adjusted for inflation using total CPI of 21.0%

Table E.7: Comparison of Spokane County, WA, sample and Census 2000 demographics

	Survey Year				Comparison of Means
	Sample		Census		Statistic[ab]
	(%)	(n)	(%)	(n)	
Gender					
Male	44.6%	289	49.2%	106	-1.555
Employment					
Full time	42.0%	286	51.4%	106	-3.159**
Full or part time	60.1%	286	69.4%	106	-3.139**
Race					
White	94.6%	278	91.2%	106	2.353*
Black or African Am.	1.1%	278	1.6%	106	-0.556
Other	3.3%	275	7.1%	106	-3.439**
	Average	(n)	Average	(n)	
Household Income	48734.6	243	48082.1	106	0.238**
Household Size	2.3	270	2.5	106	-2.641**

a T-statistic from Independent Samples t-test (2-tailed sig.)
b * Significant at 0.05 level, ** Significant at 0.01 level
c Census income adjusted for inflation using total CPI of 21.0%

Characteristics of Potential Control Communities

Since the pilot communities differ in multiple ways, choosing the control city demands careful consideration of variable effects. A relatively small and isolated geographic area might provide more even access to modes. A town with a large college population is undesirable as students are more prone to walking or bicycling. We also desired a control community with a low likelihood of pursuing walking and bicycling infrastructure improvements between 2006 and 2010. We narrow the cities to four candidates based largely on median household income, current commuting rates, and geographic area, and present them in Table E.8. Past this point, further discussion among the working group and the research team considering this information led to the selection of Spokane, Washington, as the control community.

Table E.8: Four control cities for consideration

	Measures city represents well	Measures city does not represent well
Des Moines, Iowa	Isolated area Median income October climate Racial composition	Walking/bicycling rate Low college percent
Lincoln, Nebraska	Isolated area Walking/bicycling rate	Low median income
Colorado Springs, Colorado	Racial composition Median income College percent Walking	Large geographic area Near zero transit climate
Spokane, Washington	Isolated area Walking/bicycling rate College percent	Low median income Colder climate

Table E.9 summarizes key demographic information for each pilot community and the four finalist control sites. It is important to consider each community has several deviations from average values. Minneapolis has the largest population, lowest income, greatest number of minority residents, and the highest rate of transit and nonmotorized transportation. Columbia is a geographically isolated, college-oriented town and consequently has the lowest median age. The college atmosphere likely explains the high percentage of walking and bicycling, although transit ridership is nearly zero. Marin County is older, wealthier, warmer, and drier. Sheboygan County has the largest white percentage and lowest nonmotorized transportation rates. While Sheboygan and Marin Counties are naturally larger in area than the cities, most of their population lives in a few concentrated areas.

Table E.9: Comparison of program communities and possible control sites

	Minneapolis	Columbia	Marin	Sheboygan	Average of Four	Des Moines Iowa	Lincoln Nebraska	Spokane Wash.	Co. Springs Colorado
		Treatment Communities					Selection Control Options		
GEOGRAPHIC AREA (sq mi)	55.0	53.0	520.0	514.0	285.5	76	75.0	1764.0	186
Persons per sq mi	6,970.3	1,592.8	475.7	219.3	2,314.5	2,621.3	3,022.2	3,387.0	1,942.9
POPULATION									
Total	382,618	84,531	247,552	112,646	206,837	198,682	225,591	425,684	360,890
% enrolled in college or grad	11.3	26.2	5.9	4.2	11.9	5.8	12.8	7.4	6.6
MEDIAN AGE	31.2	26.8	41.3	36.8	34.0	33.8	31.3	36.2	33.6
HHLD INCOME									
Total # of households	162,382	33,819	100,736	43,595	85,133	49,031	90,560	177,754	141,757
Less than $25,000	31.8	20.4	14.5	22.2	22.2	20.7	28.4	31.1	24.1
$25,000-49,999	31.0	26.8	19.4	19.5	24.2	33.4	32.4	27.8	31.4
$50,000-74,999	17.9	21.7	18.1	26.2	21.0	26.3	21.2	20.0	21.6
$75,000-99.999	9.0	14.9	12.9	11.2	12.0	11.2	9.2	9.2	11.4
$100,000 or more	9.3	16.2	35.1	7.7	17.1	8.3	8.9	11.9	11.6
Median hhld income ($)	37,974	52,288	71,306	46,237	51,951	46,590	40,605	41,667	45,081
RACE (one race)									
white	65.1	81.5	84.0	92.7	80.8	82.3	89.2	91.3	80.7
black	18.0	10.9	2.9	1.1	8.2	8.1	3.1	1.3	6.6
asian	6.1	4.3	4.5	3.3	4.6	3.5	3.1	2.2	2.8
WORK COMMUTE									
Total # workers 16 and over	203,951	44,919	126,646	58,546	108,516	99,490	124,882	199,542	183,806
Car truck or van - drive alone	61.6	75.2	65.5	81.0	70.8	78.9	80.7	79.3	79.6
Car truck or van - carpool	11.3	11.7	10.7	10.2	11.0	12.5	10.0	9.2	11.7
Public (includes taxi)	14.6	1.1	10.1	0.6	6.6	2.5	1.3	2.2	1.2
Walk	6.6	7.0	3.1	3.8	5.1	2.9	3.4	2.9	2.5
Other means	2.5	2.1	1.9	1.3	2.0	0.8	1.7	1.2	1.3
Worked at home	3.4	2.9	8.8	3.0	4.5	2.3	2.9	5.2	3.8
Mean travel time (minutes)	21.7	15.3	32.3	16.9	21.6	17.5	17.1	20.2	21
Bike commute (MSA)	0.44	0.95		0.25		0.18	0.89	0.57	0.42
HHLD CHARACTERISTICS									
Total # occupied units	162,352	33,689	100,652	43,545	85,060	80,504	90,485	177,754	141,516
owner-occupied	51.4	47.3	63.6	71.4	58.4	64.7	58.0	64.6	60.8
renter-occupied	48.6	52.7	36.4	28.6	41.6	35.3	42.0	35.4	39.2
average hhld size	2.3	2.3	2.3	2.5	2.3	2.39	2.4	2.3	2.5
hhlds with own child under 18	22.6	26.1	27.5	32.3	27.1	29.5	29.5	29.4	34
EDUCATION									
Total population 25 and older	243,409	46,650	183,694	74,561	137,079	128,664	136,440	276,887	228,576
Less than H.S.	15.1	8.9	8.7	15.6	12.1	17	9.8	8.9	9.1
H.S. or equivalence	20.1	17.8	12.4	39.9	22.6	33.5	24.5	25.8	22.1
Some college, no degree	21.2	18.5	21.3	19.7	20.2	21.5	24.1	27.3	26.2
Associate or bachelors	29.9	30.8	37.0	19.7	29.4	21.5	30.5	28.2	30.3
Grad or professional	13.1	24.0	20.5	5.1	15.7	6.5	11.2	9.9	12.2
OCTOBER CLIMATE	Intl AP	Col AP	San Rafae	in city		Intl AP	Munic AP	Intl AP	muni AP
Avg temp (max	58.6	67.5	75.0	59.4	65.1	64.2	66.6	58.5	63.5
Avg temp (min)	38.7	45.5	50.5	43.2	44.5	42.6	40.5	36.0	36.1
Inches of rain	1.9	3.1	1.7	2.5	2.3	2.3	2.1	1.2	0.8

Appendix F

Maps and Location-Based Analyses

Survey Respondent

The first series of reference maps displays the home location of survey respondents in each of the five communities in the context of bicycle facilities, major roads, city boundaries, and Census 2000 bicycle commute mode share.

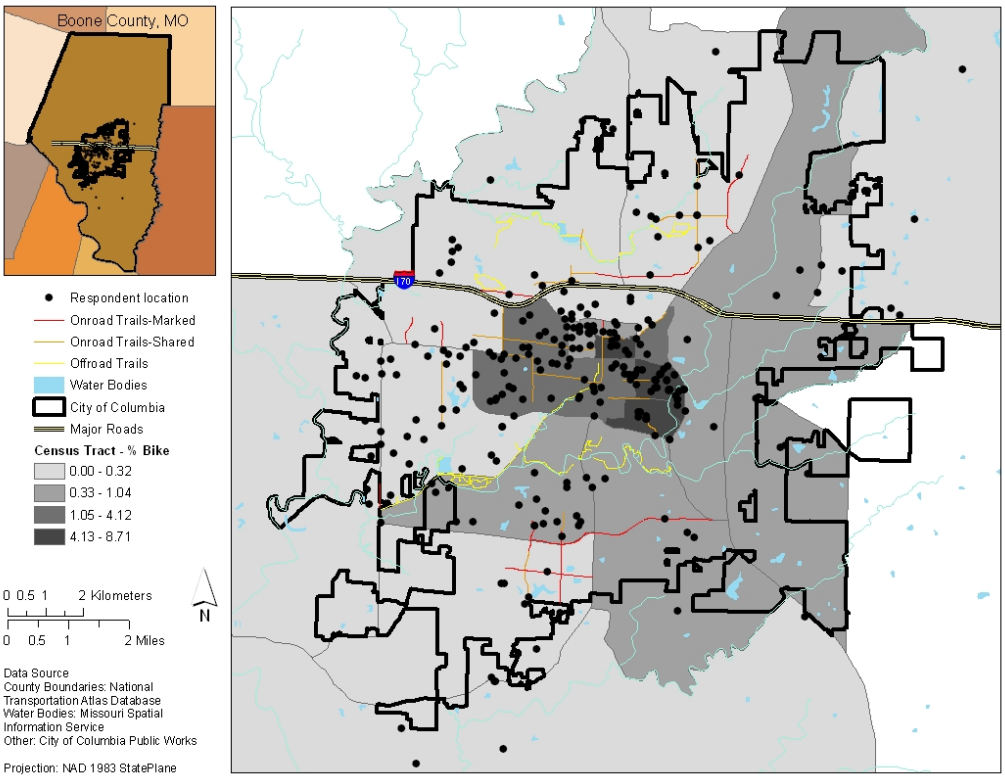

Figure F.1: Columbia, MO – Respondent home locations

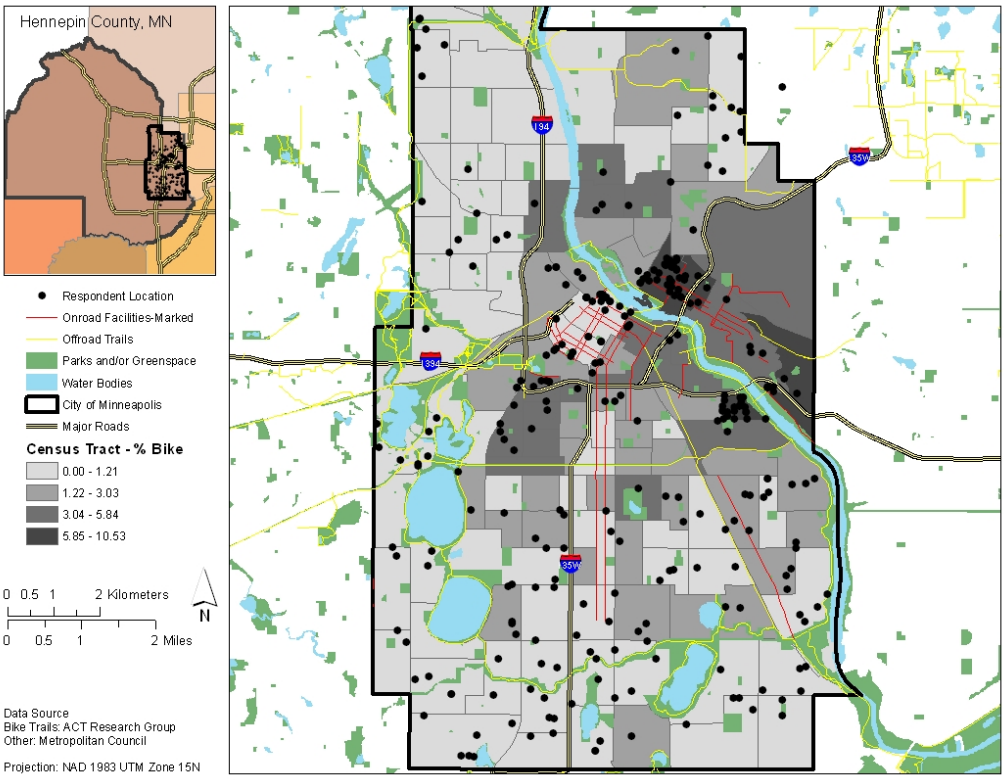

Figure F.2: Minneapolis, MN – Respondent home locations

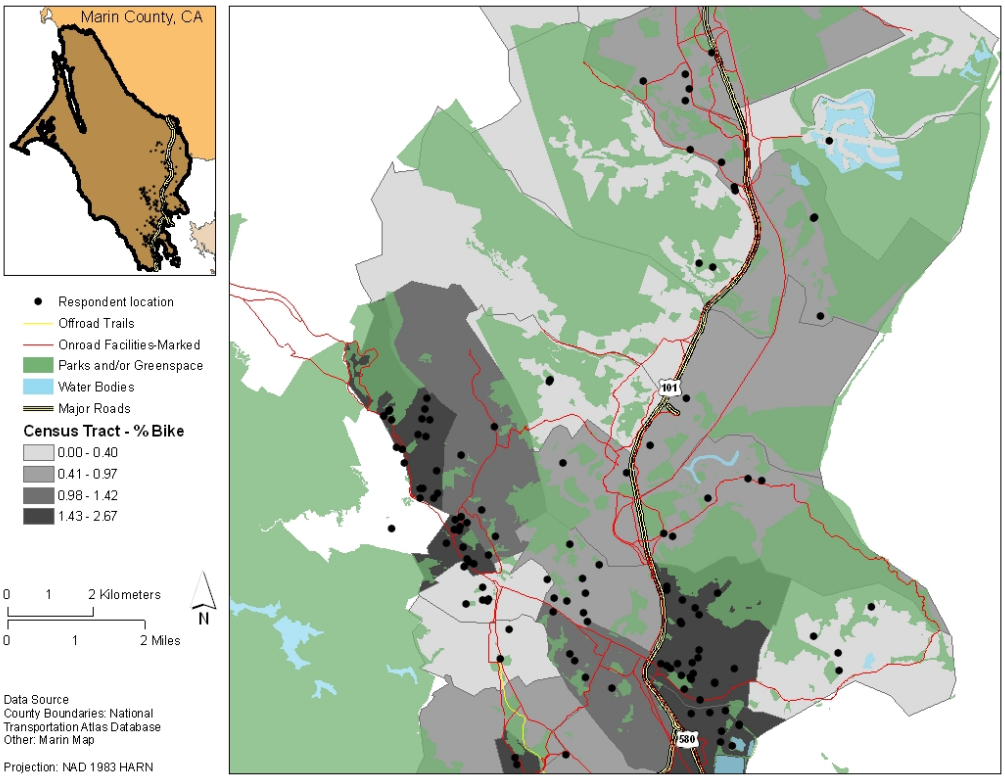

Figure F.3: Marin County, CA – Northeastern respondent home locations

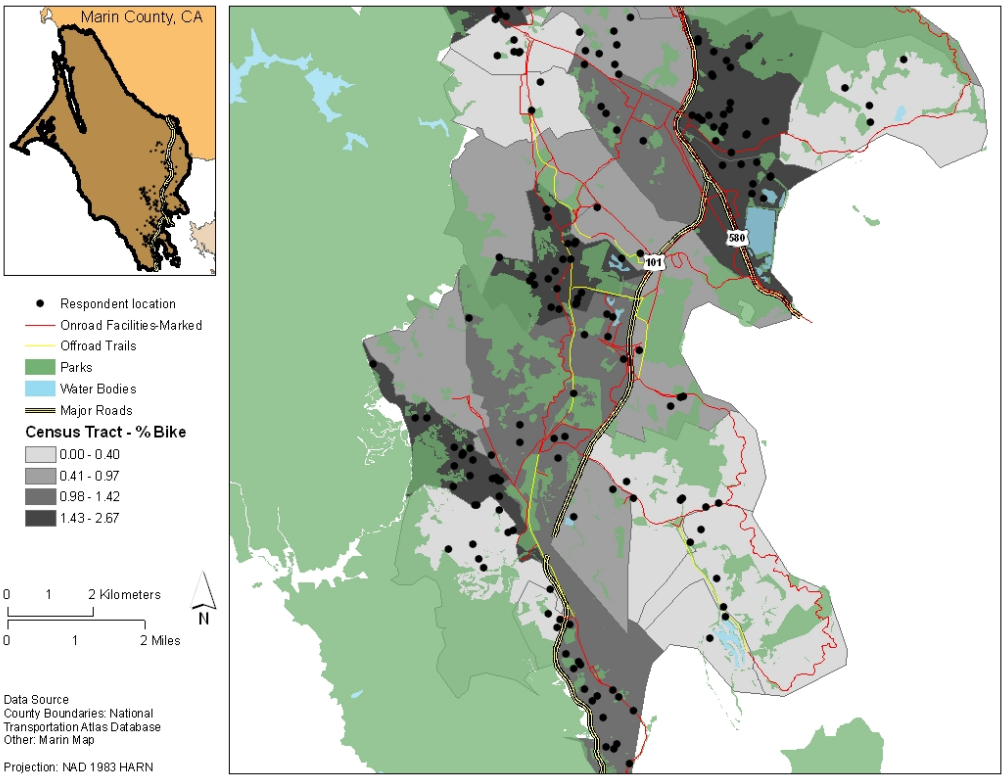

Figure F.4: Marin County, CA – Southeastern respondent home locations

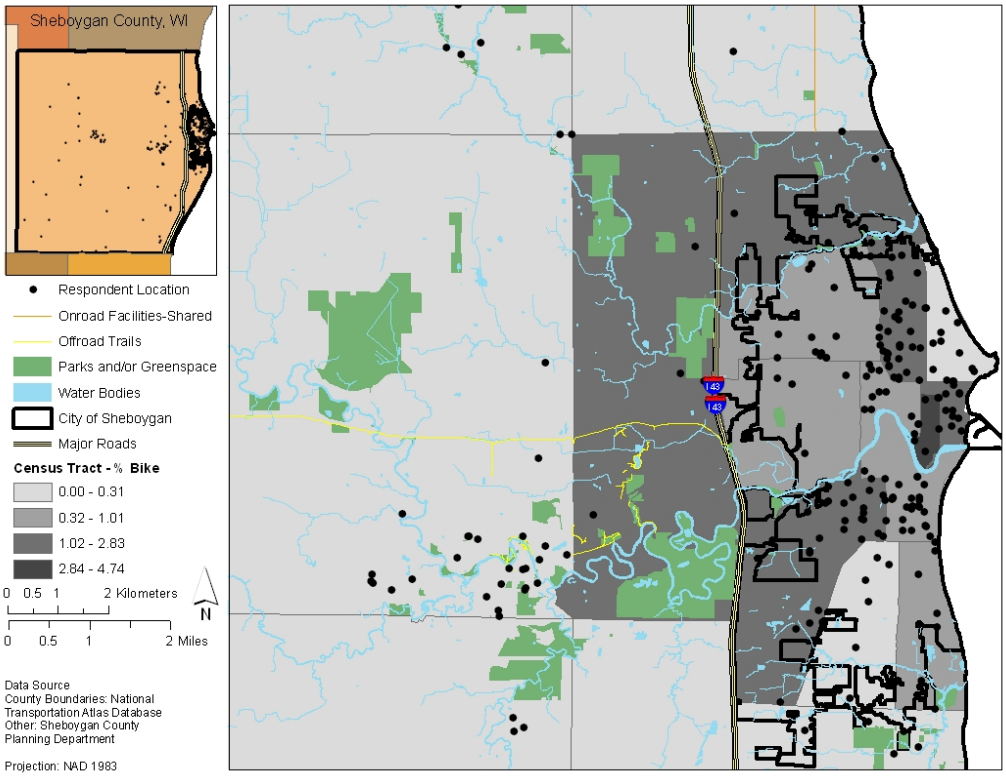

Figure F.5: Sheboygan County, WI – City-view respondent home locations

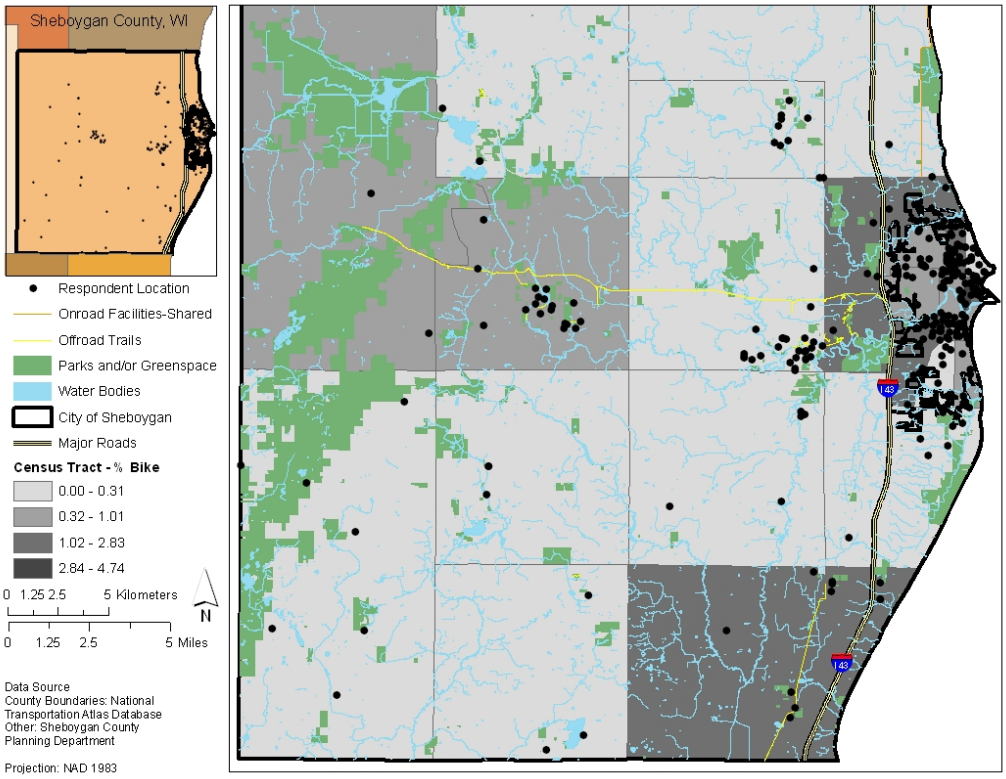

Figure F.6: Sheboygan County, WI – County-view respondent home locations

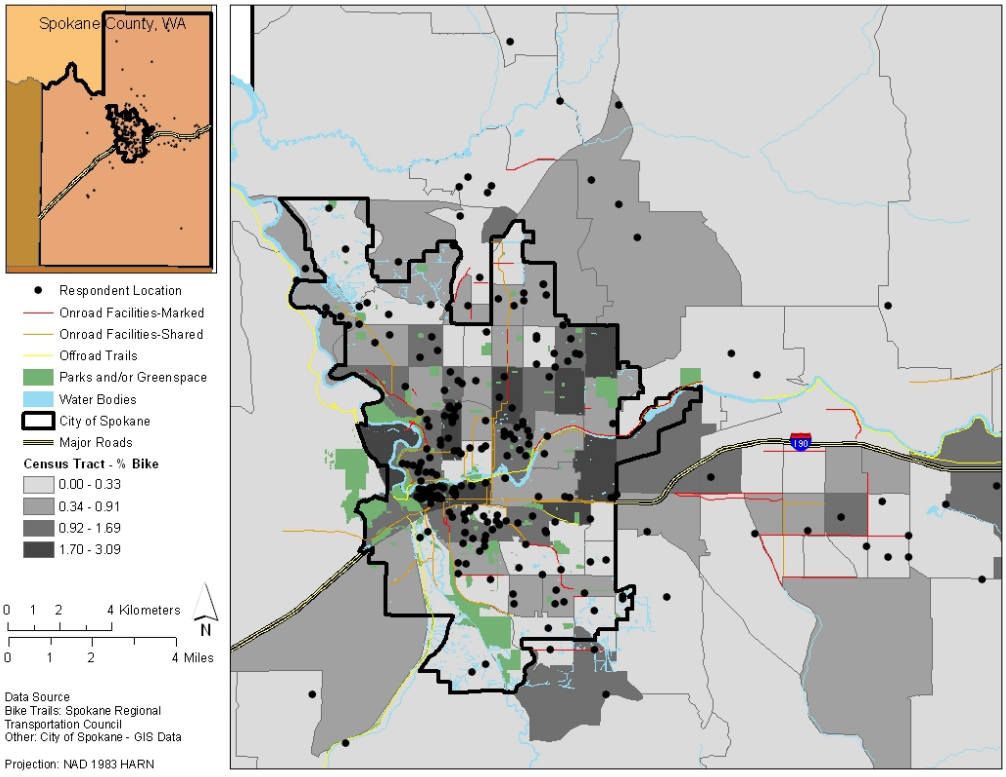

Figure F.7: Spokane County, WA – County-view respondent home locations

Reference Trips

The second series of maps displays sample route information in each of the five communities. Based on information collected as part of the reference trip, the maps display the origins, destinations, and routes for three walking and bicycling trips in the context of bicycle facilities, roads, and city boundaries.

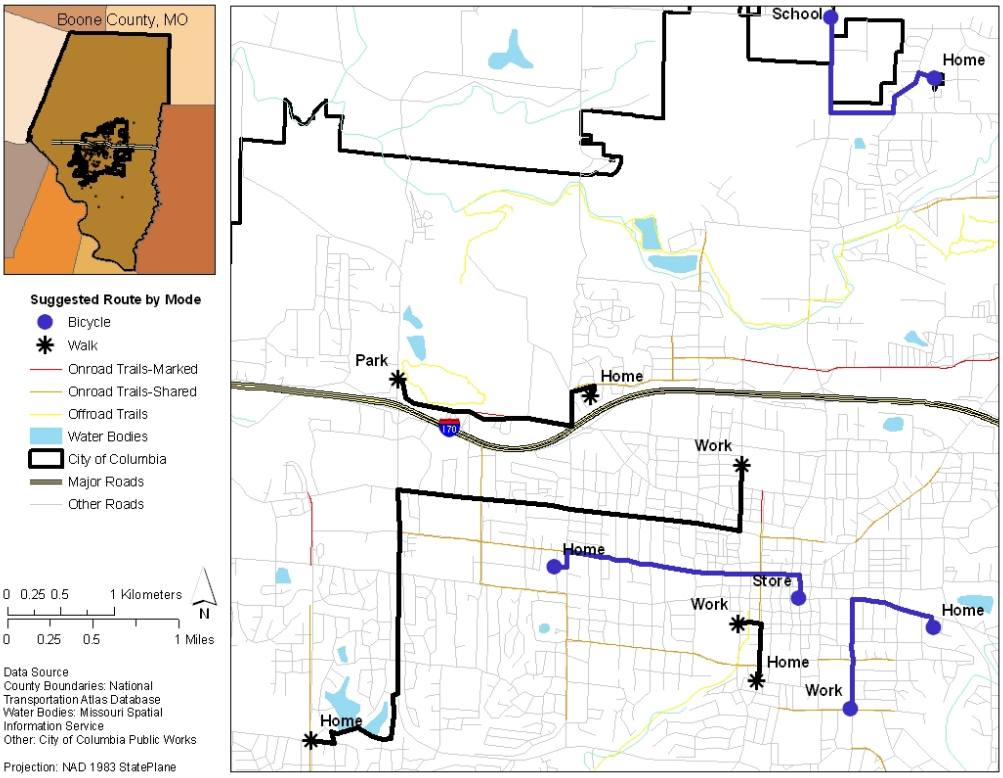

Figure F.8: Example reference trips from Columbia, MO

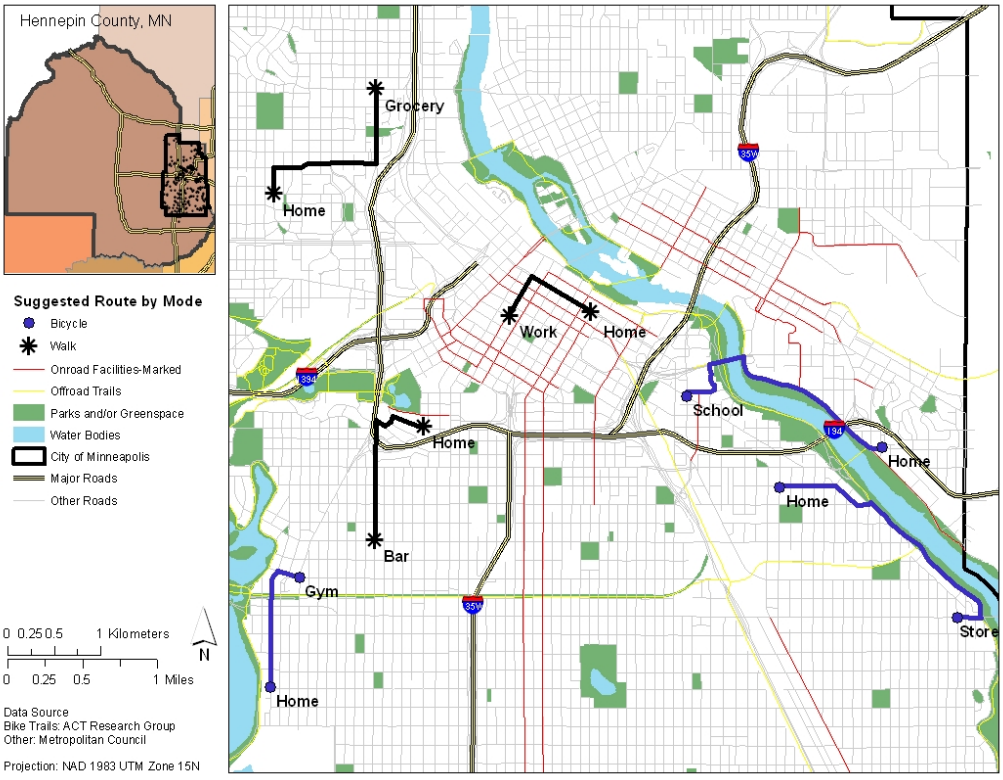

Figure F.9: E Example reference trips from Minneapolis, MN

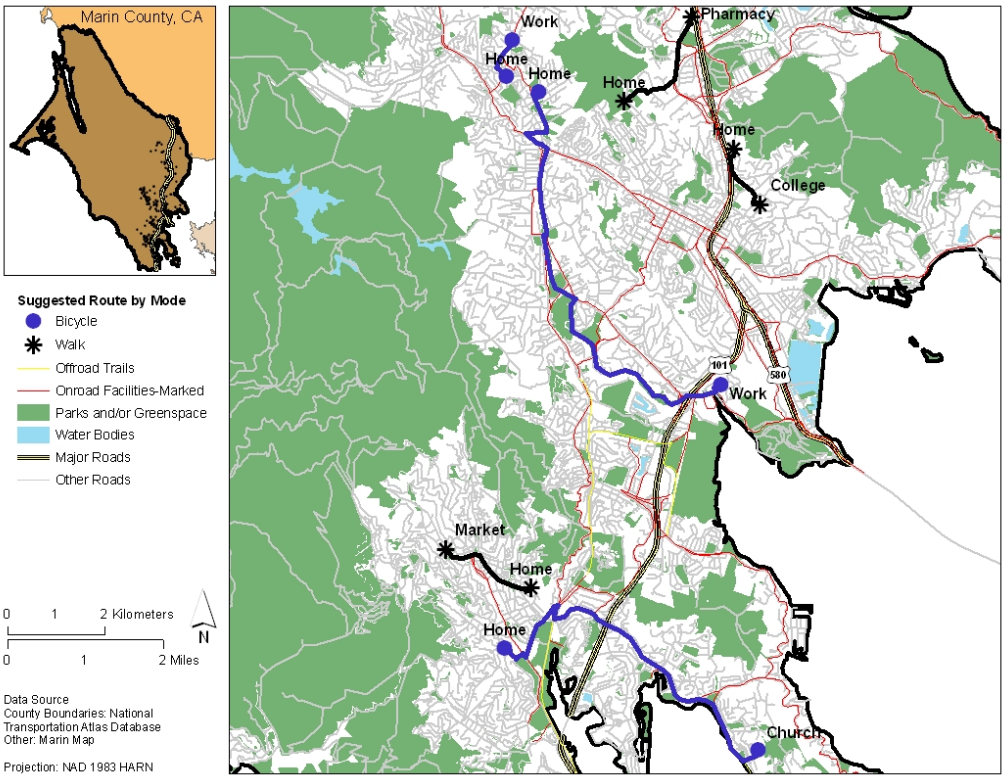

Figure F.10: Example reference trips from Marin County, CA

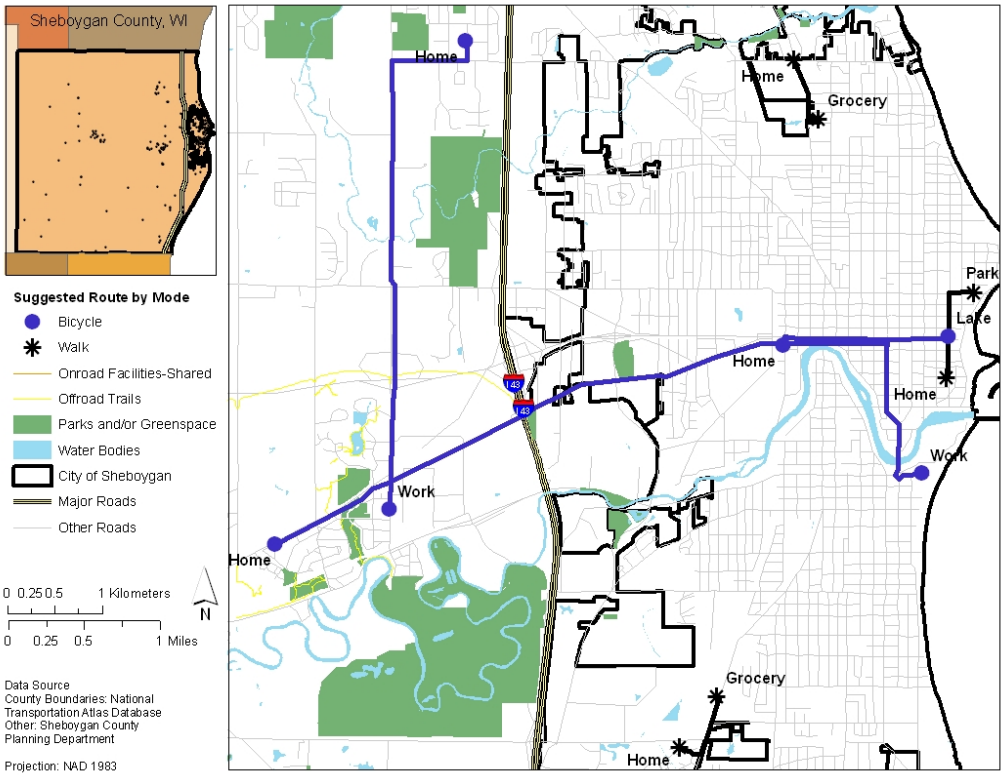

Figure F.11: Example reference trips from Sheboygan County, WI

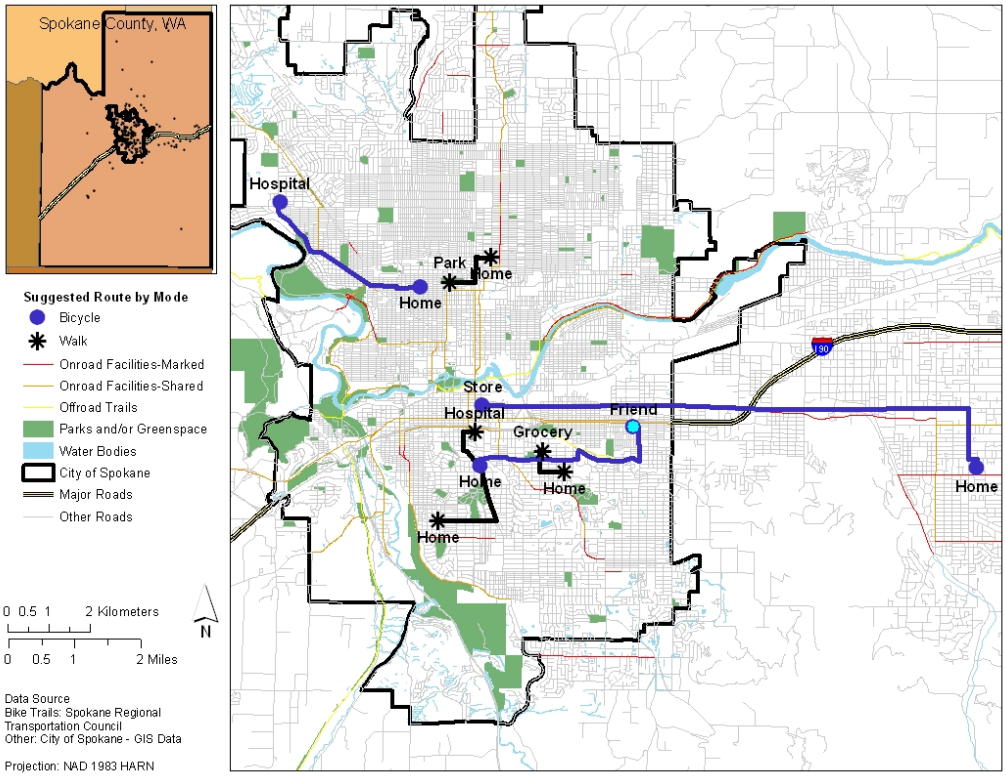

Figure F.12: Example reference trips from Spokane, WA

Distance-Decay Functions

Distance-decay functions are a relatively straightforward and simple concept to understand the spatial behavior of travelers for any mode in transportation planning. Decay functions specify the distribution of trip lengths as a function of a measure of impedance to travel (typically measured in the form of time or distance). As the name implies, distance has a *decaying* effect on the likelihood of travel between two locations.[1] The function is a general measure, incorporating large amounts of information about the structure of transportation networks, as well as surrounding land uses and urban form. Generally, improvements to transportation networks (such as the type being proposed by the pilot program) have an effect of reducing the overall impedance of travel, and so should appear in the form of lower impedance values. Lowering overall impedance levels (possibly by making travel between an origin and a destination more attractive) would then result in differently shaped functions. The following are examples of distance-decay functions to measure the current impedances of travel by walking and bicycling.

Data on walking and bicycling behavior used to estimate these decay functions were drawn from the survey question asking respondents to recall a recent trip they made by either of these modes. The computer-aided, interactive nature of the survey data collection allowed for the acquisition of location-specific information that could be used to identify origins and destinations for these trips. Network distances were then calculated for the trips, under the assumption that trip makers chose a minimum distance path between their origin and destination.

The first figure below (Figure F.13) shows curves for the fitted decay functions for recreation and exercise trips made by pedestrians and bicyclists. The data are aggregated across modes, and therefore lose some of the information associated with identifying the behavior of users of individual modes. However, the curves facilitate comparison of the five regions under study. As the curves indicate, there is little variation among cities in terms of the impedance associated with recreation or exercise trips, though the data for Minneapolis indicate a willingness to make slightly longer trips.

Figure F.14 also shows data on recreation and exercise trips by bicyclists and pedestrians. In this case, the data from all five study regions are pooled to produce samples large enough to estimate individual curves for bicyclists and pedestrians. As the curves demonstrate, impedance for pedestrians is considerably larger, owing to lower average travel speeds. The curve fitted using combined walking and bicycling data falls somewhere between the two individual curves for bicycling and walking data.

[1] These decay (or impedance) functions typically take the form of some uniformly declining mathematical function. Higher levels of impedance to travel are denoted by larger values of an impedance parameter, which is associated with the variable used to measure impedance.

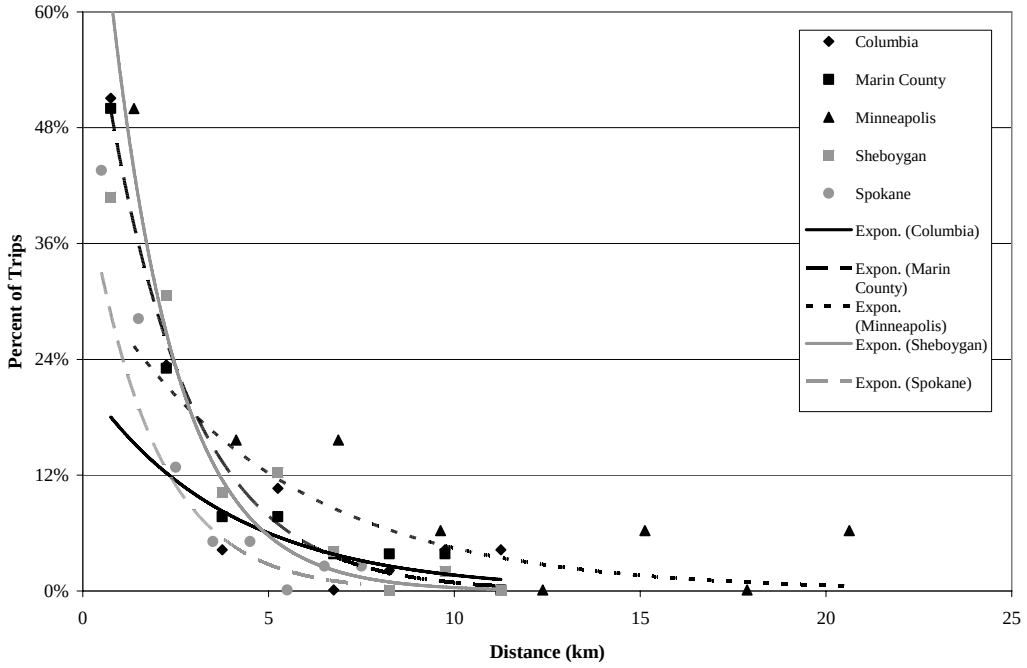

Figure F.13: Walk and bicycle trips for recreation or exercise purpose by study region

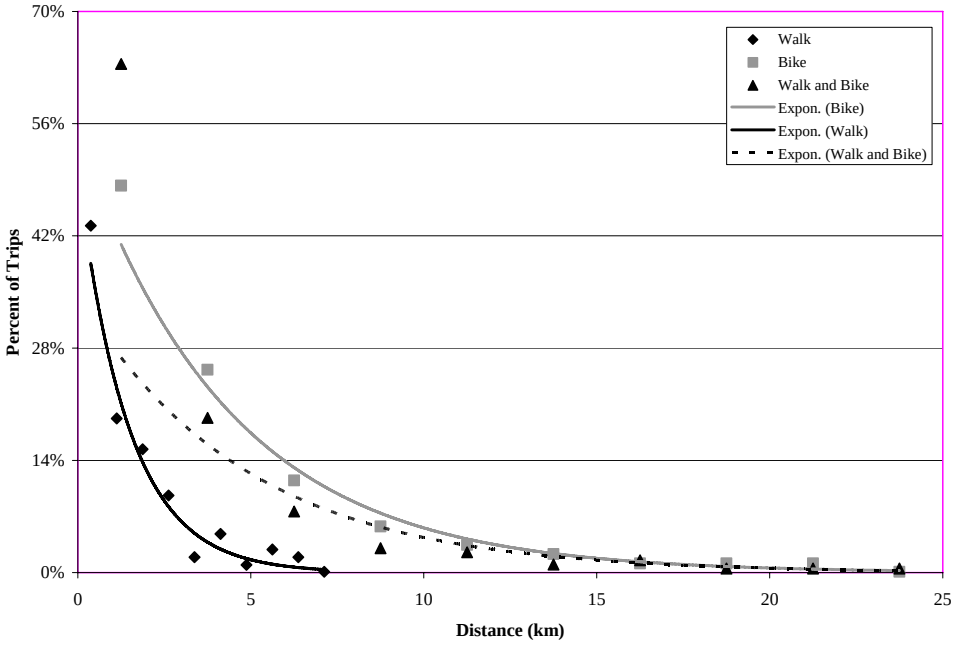

Figure F.14: Recreation and exercise trips by walking and bicycling (all regions)

Figure F.15 displays decay curves for shopping trips by bicyclists and pedestrians. Here, the sample of trips was somewhat smaller, and required the pooling of data across study regions to facilitate comparison. Curves are fitted with data for walking trips and pooled data for trips by walking and bicycling. Again, the influence of the bicycling trips is present, with the curve for the pooled bicycling and walking trips lying slightly above the trips by pedestrians only. The effect of bicycle trips on overall impedance is more muted here, due to the relatively small number of bicycle trips in the pooled bicycling and walking data for shopping trips.

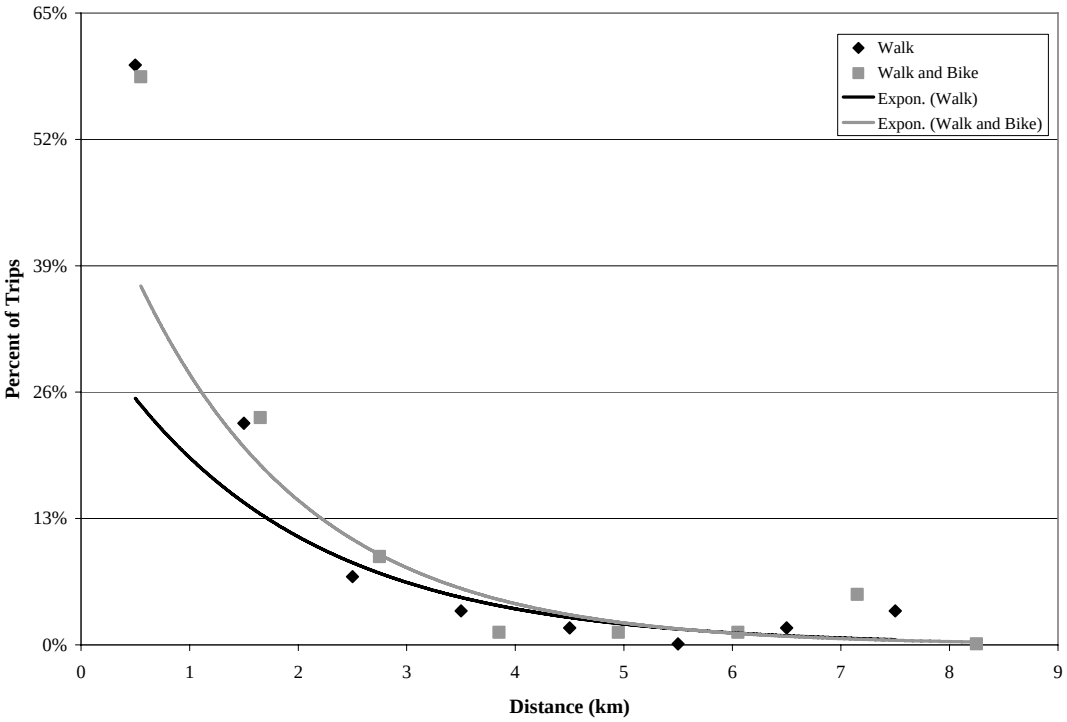

Figure F.15: Shopping trips by walking and bicycling (all regions)

In Figure F.16, decay curves are shown for work trips by bicyclists and pedestrians. Again, the data are combined across modes, but allow for comparisons between individual study regions. There is some variation in the effect of distance between locations, though most of the curves retain the same general shape. It appears that there is an upper distance threshold of roughly 20 KM beyond which few bicyclists (much less pedestrians) will travel to work.

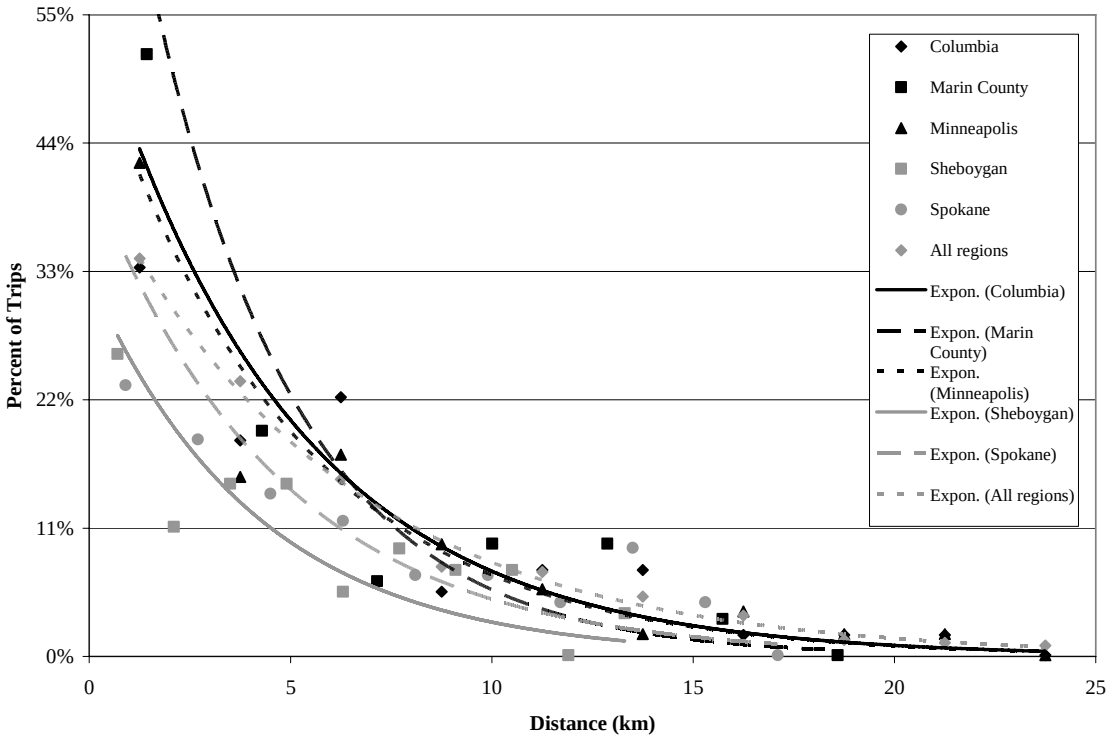

Figure F.16: Bicycling and walking work trips by study region

Finally, Figure F.17 shows trips to restaurant and bank or credit union destinations by walking or bicycling. These data are aggregated across study regions to allow for closer examination of nonmotorized trips to specific destinations. Bank or credit union trips appear to be limited to distances of approximately 8 KM or less, while restaurant trips cover somewhat greater distances. This may be because individuals walking or biking to a bank are doing so as part of a multi-stop trip (e.g., on the way to or from work), while restaurant trips may be made during leisure time with fewer time constraints.

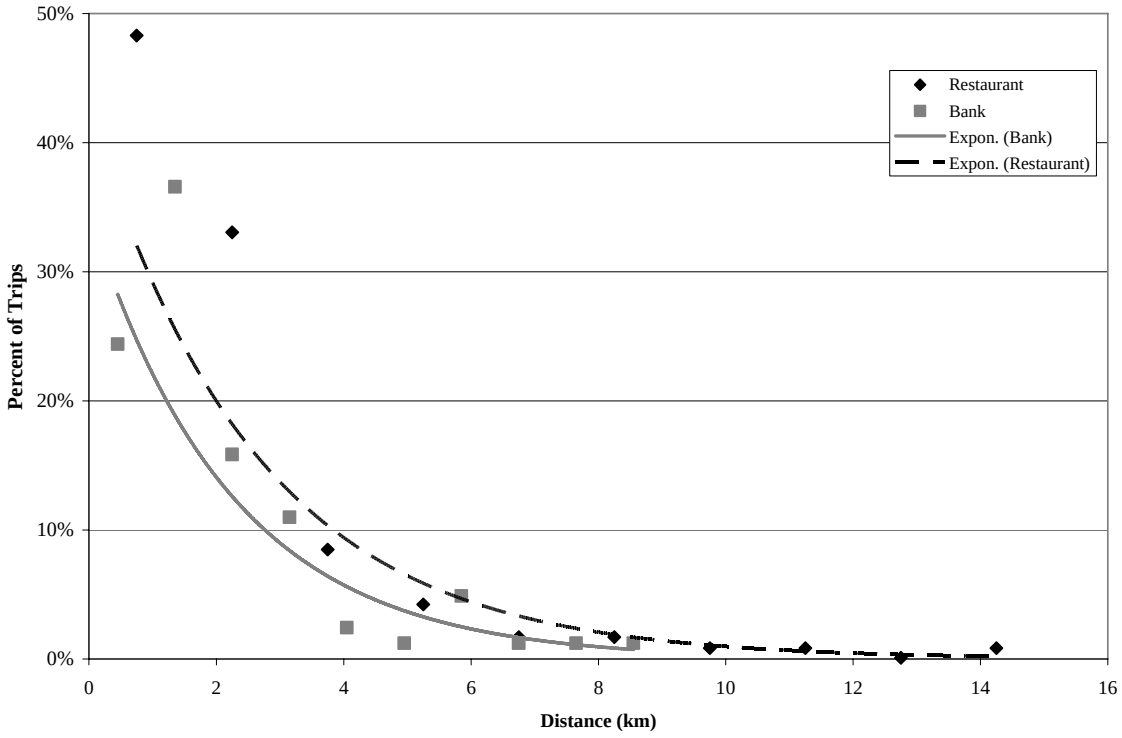

Figure F.17: Restaurant and bank or credit union trips by walking and bicycling (all regions)

Appendix G

Weather Conditions

Figures G.1 through G.5 display the weather patterns in each of the five communities during the sample period. Each figure plots the date against the temperature, measured in degrees Fahrenheit. The plots also mark days of precipitation greater than one-quarter inch, accounting for equivalent precipitation in any instance of snow. In addition to the summary provided in these figures, the research team has a considerable amount of additional data regarding specific weather conditions in the communities on the days during which the survey was conducted, which can be considered in greater detail during the 2010 comparison study.

The figures show similar weather patterns among four of the five communities. The changes in temperature reflect expected shifts between September and December. Beginning in early September, temperatures began to decline steadily and continued through October and November. At the end of November, nationwide cold temperatures affected four of the five communities, lowering temperatures to the teens, after which temperatures climbed back toward expected ranges. The notable exception to these patterns is Marin County, which experiences less variation in temperature than the other communities and didn't endure as severe cooling in the end of November.

Examination of the analysis should make note of these variations where necessary. Generally, each community experienced concurrent changes in weather, which will affect any results proportionally. With the exception of the ending cold period, the survey took place in favorable conditions, as the weather was stable until late November.

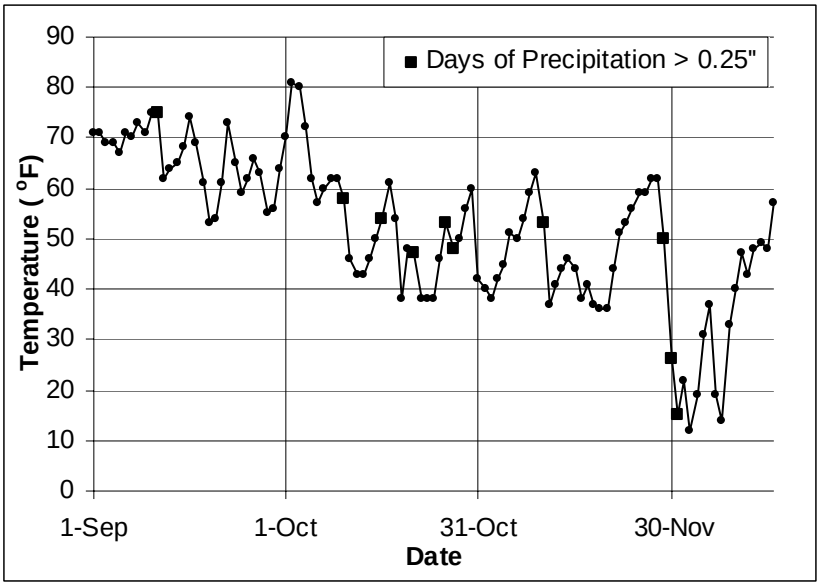

Figure G.1 Columbia, MO, weather pattern during survey period

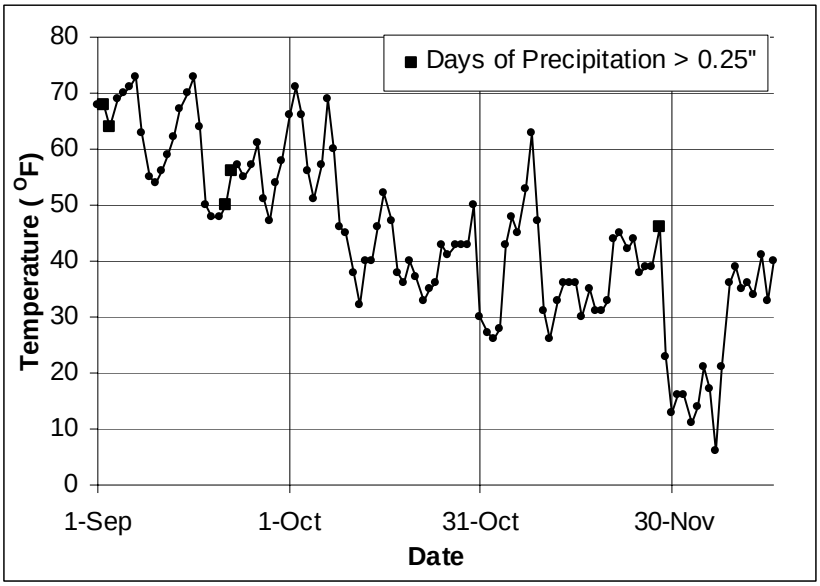

Figure G.2 Minneapolis, MN, weather pattern during survey period

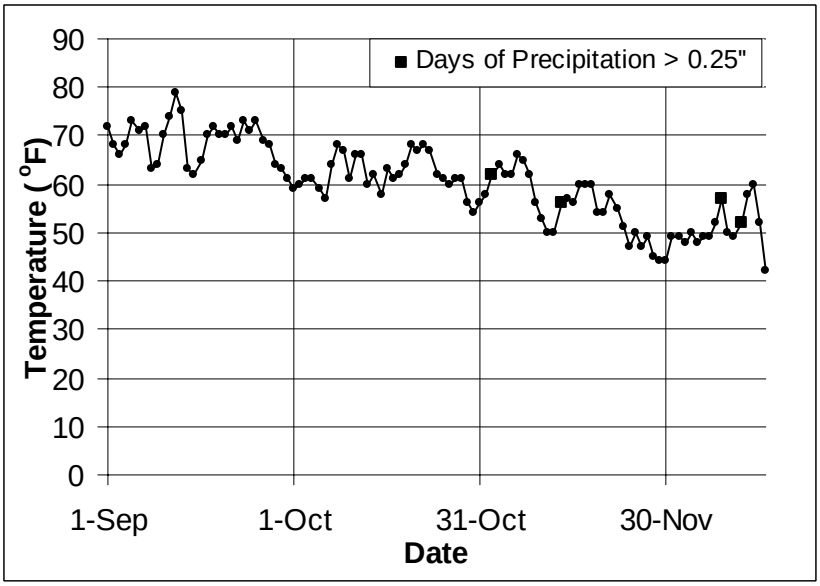

Figure G.3 Marin County, CA, weather pattern during survey period

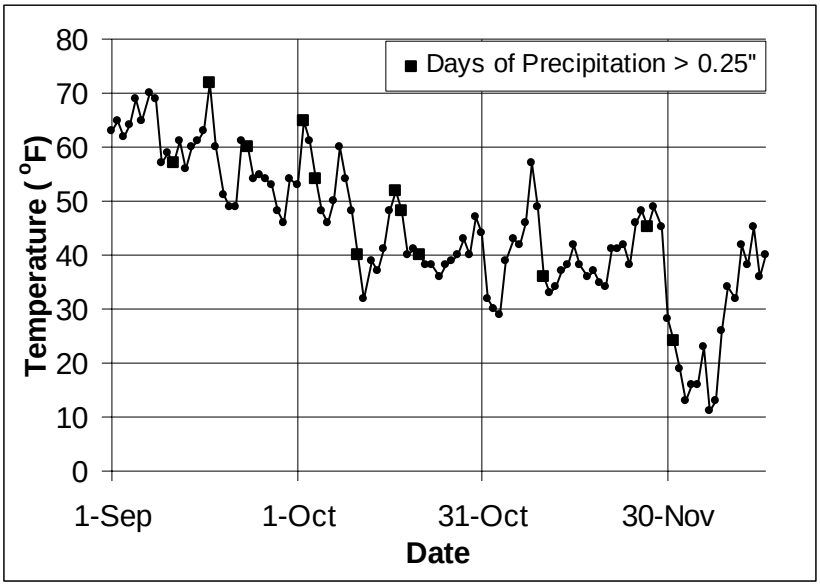

Figure G.4 Sheboygan County, WI, weather pattern during survey period

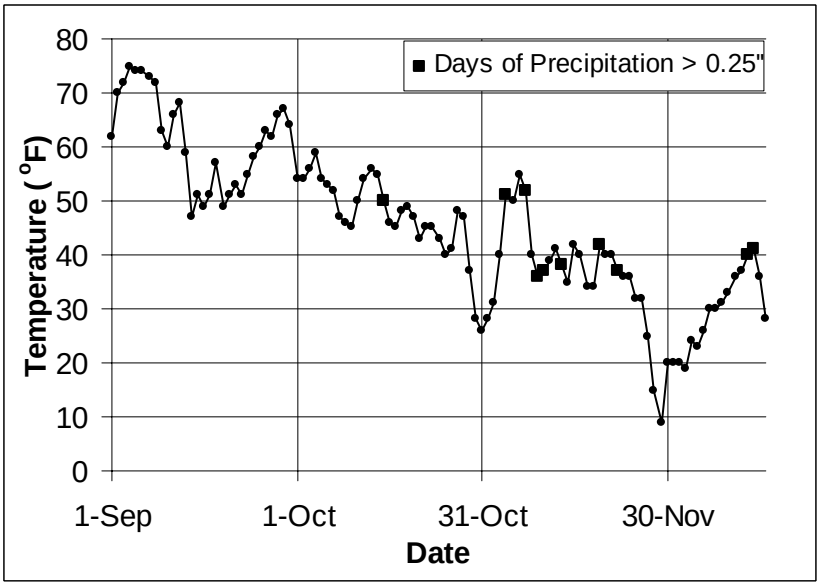

Figure G.5 Spokane, WA, weather pattern during survey period

Appendix H

Challenges of Measuring Walking and Cycling

The purpose of this appendix is to outline central challenges researchers face in evaluating the effectiveness of walking and bicycling interventions designed to increase walking and bicycling through infrastructure improvements and other programs. A central motivation of this work is to highlight difficult tradeoffs in this type of research and to help guard against unrealistic expectations. The intent is not to dispel any enthusiasm for engaging in such research. Rather, the aim is to build awareness among researchers engaged in such endeavor. We hope to advance dialogue between the research and policy communities and build a richer understanding of the perils and pitfalls researchers face in their attempts to produce credible evidence on walking and cycling interventions.

Research Design

The initial research on a behavioral question generally uses a cross-sectional design. The purpose of these early studies is to develop an initial understanding of the factors associated with the behavior of interest. Associations between variations in potential causal factors and variations in the behavior are examined for a sample of the population at one point in time. Statistically significant associations meet one of the criteria for establishing causality, and the evidence is stronger if the study statistically accounts for other potential causal factors. Most research on walking and cycling behavior falls into this category (see for example, (Nelson and Allen 1997; Cervero and Duncan 2003; Dill and Carr 2003; Rietveld and Daniel 2004; Krizek and Johnson 2006). These studies point to infrastructure design, street pattern, destinations, traffic, and densities as key factors associated with walking and cycling. They do not, however, prove that a change in any one of those factors will lead to a change in walking and cycling.

Cross-sectional studies provide the foundation for studies that use panel, experimental, or quasi-experimental designs to provide stronger evidence of causality. Researchers in the public health field commonly use evidence from cross-sectional studies to decide what factors to target in interventions designed to change behavior (Kahn, Ramsey et al. 2002; Rychetnik, Frommer et al. 2002). The intervention then serves as the "treatment" in the study. In a true experimental study, a sample of participants is randomly assigned to treatment and control groups, to ensure that the association is not spurious, and behavior is measured both before and after the treatment, to establish time-order for the cause and effect. A significantly greater change in behavior for the treatment group than the control group is evidence of a causal effect. Although a true experiment can be more easily used to study the effect of many soft walking/cycling interventions, most hard interventions do not allow for the random assignment of participants to treatment and control groups.

These cases employ a quasi-experimental design and the study must control for factors other than the intervention that might influence walking and cycling. One way to do this is to find control communities matched on key characteristics to the community where the intervention is taking place. See, example studies measuring the impact of street lighting (Painter 1996), bicycle lanes (McBeth 1999) or safe routes to school (Boarnet, Anderson et al. 2003). Another is to measure communities before and after an intervention (Barnes, Thompson et al. 2005). Several variations on this pre-test/post-test approach are possible, falling into a "hierarchy of robustness," depending on the constraints of the situation (Table 1). However, without proper control groups, it is impossible to detect "pure" changes that may have been influenced by the treatment. Instead, one may be detecting more general changes due to broader phenomena such as social changes or the pricing of alternative modes.

Thus, policy makers and advocates, as well as researchers themselves, must be careful not to overstate the strength of the available evidence; cross-sectional results are often cited as evidence of that an intervention will cause a certain outcome (Winship and Morgan 1999). The absence of

a body of intervention studies that provides strong evidence of the effects of an intervention does not mean that communities should not attempt walking/cycling interventions. After all, cross-sectional studies can provide solid evidence on potentially promising approaches. The body of intervention studies will only grow if communities are willing to try new approaches – and to work with researchers to rigorously evaluate them. In the meantime, interventions can be taken on with a realistic but not overly confident assessment, based on available evidence, of their potential.

Table 1. Research designs, advantages and disadvantages.

Label of research approach	*Representation 0=observe, T=treatment*	*Primary advantages*	*Primary disadvantages*
A. Cohort Designs (i.e., panel)	Same individuals: $O_{t, pre}$ T $O_{t, post}$ $O_{t, pre}$ $O_{t, post}$	Can sample exact same people in different settings (or after a treatment)	Difficult to account for attrition. Changes may be due to causes other than the treatment.
B. Two-Group Pretest-Posttest Design Using an Untreated Control Group	$O_{t, pre}$ T $O_{t, post}$ $O_{t, pre}$ $O_{t, post}$	Can isolate causal factors hypothesized to influence outcome variables	Sometimes difficult to find similar control group.
C. One-Group Pretest-Posttest Design	$O_{t, pre}$ T $O_{t, post}$	Cost effective	Difficult to rule out other explanatory factors.
D. One-Group Posttest-Only Design	T $O_{t, post}$	Cost effective	Lack of baseline data to compare against. Difficult to rule out other explanatory factors.

Which populations?

Different segments of the population also have different patterns of walking and cycling. Consider, for example, three distinct populations who are likely to be affected differently by walking and cycling investments: elementary school students, university students, and timid cyclists. Elementary students may need programmatic interventions that increase the perceived safety of their route to school, such as the walking school bus. University students may be sensitive to parking pricing on campus, and good sidewalk connections between more peripheral (cheaper) parking spaces and the campus may encourage walking. Timid cyclists may need off-street bicycle trails. As a result, bicycle planning documents differentiate between beginning cyclists, recreational cyclists, and serious cyclists, and often plan facilities according to the type of cyclists to be served (American Association of State Highway and Transportation Officials 1999); public health interventions designed to increase walking are also tailored to specific populations (e.g., (King, Marcus et al. 2006) Studies of the effectiveness of interventions must take into account the experience level and the attitudes, preferences, and perceptions of the population segment affected. As a further example, Table 2 presents the range and magnitude of effects that may be expected from different populations.

Table 2. Populations and different outcomes

Example Populations of Interest	**Example effects expected from improved walking or cycling facilities, by different populations** Further distance of walk/bike travel	Increased rates of walk/bike travel for varied trip purposes	Using walk/bike travel to substitute for select auto trips	Increased walk/bike for recreation use	Greater acceptance of walk/bike use for others	Increased choice and quality of life
Devoted Walkers & Cyclists	●	●	○	○		●
Periodic Walkers & Cyclists		○	◗	◗		●
Potential Walkers & Cyclists			○	●	◗	●
Non-Users					●	○

Magnitude of effect for the specific population: ● = first order effect, ◗ = second order, ○ = third order
Empty Cell = little effect for that population

Understanding the effect on different populations is important because it is often difficult to identify a specific treatment group. Although some programs are targeted at specific population segments (e.g. safety programs in elementary schools), others may affect the entire community to greater or lesser degrees. For example, a major new recreational trail may draw users from a wide area. Researchers testing the effect of the trail on walking and bicycling must identify a control group not affected by the trail opening, to compare to the treatment group. But how far from the trail does the treatment end? Another approach is to account for distance from the trail in analyzing its affect on behavior.

Similarly, surveying only walkers or cyclists is likely to yield a biased sample, therefore making it difficult to generalize to the general population. The effects on users of the walking/cycling system will differ from the effects on non-users of the system. Depending on the goals, it might be important to measure both.

Reporting Error

Measuring walking or cycling is another challenge for researchers. There are three general strategies to obtain information about walking/cycling behavior: (1) ask people to report for themselves the details of their behavior (self-reported) either through a survey or travel diary; (2) observe people's activity either manually or using sensing equipment; (3) employ instrumentation on bodies or bicycles to measure behavior (Troiano 2005). Self-report measures tend to be cheaper but less accurate than observational or instrumental approaches, but each has distinct advantages and disadvantages and is more or less appropriate for different dimensions of walking and cycling as shown in Table 3. Few efforts have compared measures across strategies (Troped 2001).

Table 3. Measurement strategies and how well the behavior is captured

	Phenomena / behavior to measure				
Measurement strategies	Who does and does not walk or cycle	Number of trips	Distance	Purpose or destination	Intensity
Self-Report	+	✓	-	+	-
Observation	-	+	-	-	✓
Instrumentation	+	✓	+	-	+ *

+ = is good at capturing this phenomenon / behavior
✓ = fair
- = poor
* the ability to measure intensity differs from accelerometers (good) to GPS units (poor)

The first strategy, self-report, generally has two problems. The first problem stems from issues of definition, particularly for walking trips. What constitutes a walking trip is not always clear to survey respondents; researchers themselves do not always adopt a clear definition. For example, surveys may or may not capture the following walking behaviors: (1) walking from one store in the mall to another, (2) walking five blocks from home to the bus, (3) walking the dog, (4) walking to the store when the visit to the store is simply an excuse for walking. Survey instruments must be carefully designed to capture all relevant walking and cycling. Discrepancies in definition make it difficult for differing surveys with different instruments and coding to be compared to one other.

Travel surveys tend to undercount walking and cycling because many people fail to think of walking or cycling as legitimate modes of travel; they may omit walking and cycling trips when asked to report their daily travel. For this reason, the recent version of the National Household Travel Survey (NHTS) made a special effort to prompt respondents about walking and bicycle trips using a follow-up telephone questionnaire. Interviewers asked, “Did [you] use any other type of transportation during [your] stay in [city here], including bicycling and walking?” So far, I have recorded [N] trip(s). Before we continue, did [you] take any other walks, bike rides, or drives on [trip date]? Please include any other trips where [you] started and ended in the same place.” Walking trips increased significantly between the 1995 NPTS and the 2001 NHTS, and survey administrators believe this increase is attributable to the improved prompts rather than a true increase. Also of concern is the period of time covered by the diary: a one-day diary may miss occasional use of walking and bicycling as a mode of transportation and as a form of exercise or recreation.

The second problem with the self-report approach is that walking and cycling are considered, by many, to be virtuous behaviors. Most people feel they should be doing more of it and therefore tend to overestimate the degree to which they engage in such activities. The magnitude of this “halo effect,” as it is often labeled, is uncertain.

Data collected using automated means, on the other hand, can sometimes be more accurate for certain behaviors (e.g., counts), but are often limited in geographic scope. Furthermore, they often obtain data for those who are walking and biking on a particular facility (Aultman-Hall and Hall 1998; Krizek and Harvey 2006) or in various contexts (Willis, Gjersoe et al. 2004). They therefore ignore those who are not walking or cycling. Instrument reported data—either located in a space (such as an infrared sensor) or worn on the person (such as various motion detectors) is largely considered superior.

However, observational and instrumental approaches present problems of their own. For example, an accelerometer, a device that measures motion of the hip, currently costs approximately $300-$400 per unit. Only in wide use since the late 1990s, such units measure weight-bearing activity (like walking) better than cycling. However, such instruments have the benefit of measuring intensity of activity. The less expensive pedometers, in the tens rather than the hundreds of dollars, have a different set of issues, only giving an overall count of movement with no information about type of activity or intensity; they provide reasonably good estimates of walking activity but they do not accurately measure bicycle use.

In addition, questions arise about how best to process the information—literally minute by minute readings of motion (Troiano 2005). For example, if there is little or no motion recorded, has the person taken off the accelerometer or are they merely being sedentary? The counts or values measured by the accelerometer have different meanings depending on the type of activity being measured, or a person's metabolic rate (Matthews 2005). Research is currently under way to standardize methods of cleaning and interpreting the data as well as validating it against other data collection strategies.

Some new technologies hold promise but until recently have been too expensive, bulky, or high-maintenance. For example, Global Positioning Systems are getting smaller and cheaper and memory is increasing, but they can be relatively bulky and require frequent battery changes or recharging. They are also a more indirect measure of activity intensity, and typically do not operate inside buildings limiting their use in examining overall physical activity. However, if mounted to a bicycle, they have some advantages. The bottom line is that using multiple measures can help triangulate findings but adds cost. In no way, is accurate measurement of walking/cycling transportation simple.

Measurement

Observational and instrumental approaches, however, present problems of their own. For example, an accelerometer, a device that measures motion of the hip, currently costs approximately $300 to $400 per unit. Only in wide use since the late 1990s, such units measure weight-bearing activity (like walking) better than cycling. However, such instruments have the benefit of measuring intensity of activity. The less expensive pedometers, in the tens rather than the hundreds of dollars, have a different set of issues, only giving an overall count of movement with no information about type of activity or intensity; they provide reasonably good estimates of walking activity but do not accurately measure bicycle use.

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Walking versus Cycling

Walking versus cycling?

Conventional transportation analysis (and policy) often groups walking and cycling together, implying such travel serves similar purposes and markets. Both activities are human powered and entail greater direct exposure to environmental conditions than transit or auto. While grouping them often suffices (combined they almost comprise 10 percent of all trips in the U.S.), walking and cycling are functionally different in that they fulfill different daily purposes for individuals and pose different problems for facility planning and community design:

- Walking: All trips start and end on foot, making walking essential to all travel. Requirements for sidewalks and other pedestrian infrastructure (e.g., crosswalks, public spaces) may be embedded within local zoning and subdivision codes. Pedestrian trips are usually short, often no more than a few city blocks. Finally, and most importantly, many factors influence the choice to walk for travel, including the attractiveness of the route (e.g., interesting facades, a variety of architecture, the absence of long, blank walls), route choices for variety and safety, and the number of destinations within a walkable distance (e.g., work places or close-by stores).

- Cycling: Bicycle trips generally traverse longer distances at higher speeds than pedestrian trips, requiring longer corridors (such as wide curb lanes and on-street or off-street bike paths), and are considered street-legal vehicles for most local roadways. The bulk of bicycle trips that are made are discretionary in nature, and whereas nearly everyone can walk, bicycling applies to a considerably smaller market of travelers, for a variety of reasons. Cycling requires equipment which then must be stored when not in use. Furthermore, not everyone owns or has access to a bicycle. During the summer months in most of the U.S., the cycling market includes just over a quarter of the American population, but there are far fewer year-round cyclists using this mode for travel rather than recreation (Bureau of Transportation Statistics 2003). Bicyclists who share the road also have unique safety concerns, dealing with the close proximity of autos speeding by, for example.

Grouping the modes together often suffices for the purposes of understanding the role of non-motorized travel within overall travel behavior. However, a more detailed understanding of the factors that spur pedestrian and bicycle use requires a separation of the two activities.

Which dimensions?

Both walking and cycling have many different dimensions that might be of relevance in understanding the primary and secondary effects of an intervention. An immediate example is the difference between traveling for utilitarian versus recreational purposes. Different survey instruments may be required to accurately glean such behavior; travel for utilitarian and recreational purposes often speak to different policy initiatives. Other dimensions to consider include whether or not individuals walk or cycle, the frequency with which they walk or cycle, the distances they walk or cycle, the time they spend walking or cycling, the purpose of trips for which they walk or cycle, and the routes they choose for walking or cycling. Intermediate effects might also be of interest, for example, changes in attitudes as a result of the intervention that do not necessarily translate into changes in behavior, at least in the short term. Different dimensions have different implications for policy outcomes and different implications for data collection, as discussed below.

Which secondary effects?

In addition to the direct effect of the intervention on walking and cycling levels, one or more secondary effects may be of interest. Legislation from Section 1807 of SAFETEA-LU, for example, calls for the development of statistical information about whether pilot projects funded under the legislation have led to changes in: motor vehicle usage, non-motorized transportation usage, public transportation usage, congestion, energy consumption, frequency of bicycling and walking, connectivity to community activity centers, health, and environment. Measuring any one of these outcomes may be challenging; measuring all of them could provide a career's worth of work for a transportation researcher. Narrowing the list to those that can be practically measured and that offer the greatest promise of substantive benefits will help to ensure the quality and usefulness of the research.

Several leading practitioners and academics suggest that several of the benefits often touted for walking and cycling facilities—decreased congestion, decreased consumption of natural resources, and even overall increases in physical activity—are *not* the benefits that ultimately come to fruition. A close review of research to date indicates that it getting people out of their cars does not necessarily mean that they get onto their feet (Forsyth in press). Other research finds that people do very little walking overall (Oakes under review). In addition, rates of bicycling are currently so low that even a quadrupling of the number of people in the United States who bike to work would lessen environmental and other harms from motorized vehicles to a miniscule degree—prompting some to term it a fringe mode (Gordon 1998). This is not to say that the individual benefits are insignificant, rather that their cumulative effect is limited.

Furthermore, making small interventions in the existing built environment (e.g., improving intersections, installing sidewalks) or other walking or cycling policies or programs (e.g., installing showers) will likely have only modest affects on one's propensity to drive less. There are larger and more powerful levers available such as altering the relative cost of auto travel, changing parking policies, and/or ensuring compact and mixed use development.

A few select benefits that are more related to the relatively ambiguous goal of "livability" appear to hold more hope for meeting expectations. A prominent transportation consultant after reviewing much of the literature on the benefits of non-motorized modes and interacting with policy officials about such matters argues, "from a policy perspective, the subject of non-motorized transportation presents a bit of a dilemma. Statistics are spotty and the literature appears to be heavily populated with advocacy. Thus, the overarching policy questions are whether non-motorized transportation, in fact, is a transportation services issue or a lifestyle issue, and is that distinction important" (Lockwood 2006). As Giuliano and Hansen (Giuliano and Hanson 2004)(p 398) suggest "building communities with abundant walking and biking opportunities may be more about livability than solving transportation problems." Of course, measuring livability presents its own challenges.

Estimating Secondary Effects

Secondary effects of an intervention depend not just on the increase in walking and biking that the intervention produces but also on the type of activity that the additional walking and bicycling replaces. With a fixed amount of time in a day, an individual who walks or bikes more must do less of something else; what that something else is determines whether the secondary effects are positive or negative. Physical activity outcomes are positive if additional walking and bicycling replaces inactivity; if it replaces other forms of physical activity, secondary effects may even be negative. Environmental outcomes are positive if additional walking and bicycling replaces driving; if it replaces other activities, the environmental benefits are likely to be limited. These possibilities mean that potentially replaceable activities must be measured as well.

Evidence on physical activity suggests that walking for transportation may simply replace walking for recreation. Many studies show that transportation walking is fostered by dense, mixed use areas and recreational walking is higher in other locations (Lee and Moudon 2006; Forsyth et al. 2007). However, a new round of research examining total walking shows that residents of the lower density make up for lower walking for transportation with greater leisure walking. In fact, rather like a travel budget, these studies seem to show the existence of a physical activity budget so that an increase in one form of physical activity leads to a decrease in another (Rodriguez 2006; Forsyth in press). Studies aiming to document the effects on total physical activity must include a measure of total physical activity. Options, as described above, include self-reports, pedometers, accelerometers, and emerging technologies such as GPS; in general, the more accurate options are the more costly and burdensome options.

Evidence on vehicle travel suggests that increased walking and biking does not necessarily reduce driving: not every walk or bike trip replaces a driving trip, and even when it does the distances are relatively short. One study found that 73% of walking trips substituted for driving trips but estimated that this substitution saved only 2.1 miles of driving per person over a month (Handy and Clifton 2001). Furthermore, evidence points to a latent demand for auto travel in congested urban areas: any relief in congestion coming from some individuals substituting walking and biking for driving will be immediately consumed by additional driving from other individuals (Noland 2001; Cervero 2002). Thus, studies aiming to document the effects on the environment must include a measure of vehicle miles traveled for both treatment and control groups. The standard approach is to use a travel diary survey of the type employed in the National Household Transportation Survey (NHTS). As noted earlier, these surveys have historically not given accurate measures of bicycling and walking trips. Their ability to accurately measure vehicle travel has now been established with the help of on-board GPS units (Doherty, Noël et al. 1999; Wolf, Guensler et al. 2001), though non-response bias is a continuing concern. These surveys are expensive and burdensome for the respondent, however.

Sample Size

Sampling is challenging in studies of the impact of bicycle and pedestrian interventions for two reasons: the relative infrequency of walking and cycling as modes of transportation, and the lack of a clear delineation of the "treatment group" experiencing the intervention.

Nationally, these modes represent a small portion of total travel when viewed in the context of conventional multimodal national transportation statistics (Pucher, Komanoff et al. 1999; Pucher and Dijkstra 2003). The rarity of walking and cycling means that it is hard to assemble a sufficiently large sample of people who cycle and/or walk or of walking/cycling trips. Walking comprises 8.7% of all trips, according to the National Household Transportation Study (NHTS). The recent Twin Cities Walking Study in the Twin Cities area (including St. Paul) included a seven-day travel and leisure walking/biking diary and only sampled individuals in the warmer months (Oakes under review). This study found that over the course of the seven days, 519 people out of 715 in the sample walked in trips or recreational loops that were not just getting to a form of motorized transportation and they walked a median distance of 0.74 miles per day or about seven and a half blocks – a small share of overall travel. Of course, as noted earlier, walking is likely undercounted in these surveys because most people walk as part of trips by other modes (e.g., walking to the car).

The challenges are even greater for bicycling. A 2003 survey from the Bureau of Transportation Statistics found that almost three-quarters of the American population never rode a bicycle or had not done so during a 30-day period over the summer of 2002 (Bureau of Transportation Statistics 2003). The NHTS reports that the percentage of adults who cycled on their survey day ranges

across cities from about 0.25 to about 2.35 percent. Previous work (Barnes and Krizek 2005)examined a variety of data sources to arrive at the percentage of Americans who bicycle over a given period of time. Results suggest 1% of adults bicycle on a given day, 5.3% bicycle on a given week, 16% bicycle on a given month, 29% bicycle in the summer, and 40% bicycle in a year(Barnes and Krizek 2005). Even in central cities deemed cycling friendly (e.g., Minneapolis and St. Paul), the regional travel survey for almost 2,000 households provided usable detailed travel behavior for only 86 cyclists (Krizek and Johnson 2006). In the Twin Cities Walking Study, a mere 73 individuals (10.2%) traveled by bike at all in a seven day period. For those 73 people the median distance bicycle per week was 9.6 miles. Nationally, cycling comes in at a mere 0.8% of all trips (Federal Highway Administration 2001). This means a very large sample of the population is needed to achieve a sufficiently large sample of bicyclists and bicycle trips for analysis purposes.

The relatively rarity walking or cycling becomes an issue—and sometimes costly to detect—when measuring changes among the general population that are statistically significant. As an illustration, assume travel diary information was collected for 1,000 (*n*) residents in a community from one year to the next; at an estimated $100 per travel diary interview (conservative estimate), this amounts to $100,000 of direct survey costs. Assume that the 1,000 individuals in each community complete the U.S. average of 4 trips per day, yielding information on about 4,000 trips. Assume the communities have cycling rates above the national average—say at 1 percent of all trips (*p=0.01)*—this would result in a mere 40 of the 4,000 trips for cycling (and most of these 40 trips would likely be from the same people). Now suppose data from the post-intervention survey shows the mode split of cycling doubles to 2%, or 80 cycling trips in the community. A statistical analysis at the 95% significance level would be able to confirm an increase in cycling (that is, such a change is outside the bounds of the confidence interval). Assuming the change in use was smaller than 2% (i.e., anything less than doubling) a statistical analysis would not be able to confidently detect such change, assuming this sample size. Put another way, the chance of detecting a *doubling* of the rate of cycling among the general population from 1% to 2% of all trips (*p=0.02*) is about 92%; however, an increase to a more likely outcome of 1.2% (*p=0.012*) will confidently be detected only about 44% of the time.

In general, the size of the sample needs to be exorbitantly large if one or more of the following applies: the weaker the relationships to be detected, the more control variables one will use, the smaller the number of cases in the smallest class of any variable, and the greater the variance of one's variables. One solution is to employ an approach referred to quota sampling where data about behaviors (e.g., walking or cycling) are recruited until a certain number of data points are obtained; although care must be taken to weight the sampled population to reflect the general population.

Bottom line

Despite escalating interest from varied groups, walking and cycling remain the most understudied—and subsequently least understood—modes of travel. Complicating the study of walking and cycling as modes of transportation is their frequent use for exercise and recreation rather than travel. The lack of research in this area contributes to and is hampered by a lack of a consistent effort to collect and distribute data on these behaviors and the environments in which they occur. The deficiency of secondary data sources focusing on nonmotorized travel is well documented. A growing appreciation of this deficit has led to a number of efforts to improve the quality and quantity of data on walking and cycling. Additional data will contribute to a better understanding of the factors that influence the choice to walk or cycle.

But what policymakers ultimately need to know is whether a particular policy, project, or program will lead to an increase in walking and bicycling. Such evidence comes from intervention studies—studies of the impact of the policy, project, or program on the behavior of those to whom the intervention applies. In documenting the impact of bicycle and pedestrian interventions, researchers should do the following:

1. Research Design: Before-and-after surveys of behavior, with treatment and control groups.
2. Conceptualization: Clear definition of the primary impacts of interest, combined with the selection of a limited set of promising secondary effects.
3. Measurement: Best possible measurement approaches for primary effects, given time and resources available, plus measures of potential substitutable behaviors to ensure accurate assessment of secondary effects.
4. Sampling: Careful delineation of treatment and control groups, with as large a sample as possible given resources available to ensure statistical power.

Adhering to all of these recommendations takes skill, time, resources, and patience, and may not be possible in every study. Researchers have a responsibility to employ sound methodologies and represent their results accurately. But consumers of research also have a responsibility to understand the limitations of the available evidence and not misuse that evidence in making the case for bicycle and pedestrian interventions. We hope that we have helped both researchers and research consumers better understand the challenges inherent in efforts to document the effects of bicycle and pedestrian interventions.

Appendix H References

Ajzen, I. (1991). "The Theory of Planned Behavior." Organizational Behavior and Human Decision Processes **50**: 179-211.

American Association of State Highway and Transportation Officials (1999). A Guide for the Development of Bicycle Facilities**:** 8.

Aultman-Hall, L. and F. Hall (1998). "Research Design Insights from a Survey of Urban Bicycle Commuters." Transportation Research Record: Journal of the Transportation Research Board **1636**: 21-28.

Bandura, A. (1986). Social Foundations of Thought and Action: A Social Cognitive Theory. Englewood Cliffs, N.J., Prentice-Hall, Inc.

Baranowski, T. and C. L. Perry, Eds. (2002). How Individuals, Environments, and Health Behavior Interact: Social Cognitive Theory. Health Behavior and Health Education: Theory, Research, and Practice. San Francisco, Calif., Jossey-Bass.

Barnes, G. and K. J. Krizek (2005). "Estimating Bicycling Demand." Transportation Research Record: Journal of the Transportation Research Board **1939**: 45-51.

Barnes, G., K. Thompson, et al. (2005). A Longitudinal Analysis of the Effect of Bicycle Facilities on Commute Mode Share. Minneapolis, MN, Active Communities / Transportation Research Group**:** 16.

Boarnet, M. G., C. L. Anderson, et al. (2003). "Evaluation of the California Safe Routes to School Legislation: urban form changes and children's active transportation to school." American Journal of Preventive Medicine **28**(134-140).

Bureau of Transportation Statistics (2003). National Survey of Pedestrian & Bicyclist Attitudes and Behaviors–Highlights Report.

Cervero, R. (2002). "Induced Travel Demand: Research Design, Empirical Evidence, and Normative Policies." Journal of Planning Literature **17**(1): 3-20.

Cervero, R. and M. Duncan (2003). "Walking, Bicycling, and Urban Landscapes: Evidence From the San Francisco Bay Area." American Journal of Public Health **93**(9): 1478-1483.
Dill, J. and T. Carr (2003). "Bicycle commuting and facilities in major U.S. cities: If you build them, commuters will use them-another look." Transportation Research Record(1828): 116-123.
Doherty, S. T., N. Noël, et al. (1999). "Moving Beyond Observed Outcomes: Integrating Global Positioning Systems and Interactive Computer-Based Travel Behaviour Surveys." Transportation Research Board, National Research Council, Washington, DC (in preparation).
Federal Highway Administration. (2001). "National Household Travel Survey 2001." Retrieved January 22, 2007, 2004, from http://nhts.ornl.gov/2001/index.shtml.
Forsyth, A., J.M. Oakes, K.H. Schmitz (in press). "Does residential density increase walking and other physical activity?" Urban Studies.
Giuliano, G. and S. Hanson (2004). Managing the Auto. The Geography of Urban Transportation. S. Hanson and G. Giuliano, The Guilford Press**:** 417.
Gordon, P., and Richardson, Harry W. (1998). "Bicycling in the United States: A Fringe Mode?" Transportation Quarterly **52**(1): 9-11.
Kahn, E., L. Ramsey, et al. (2002). "The effectiveness of interventions to increase physical activity: A systematic review." American Journal of Preventive Medicine **22**(4): 73-107.
King, A. C., B. Marcus, et al. (2006). "Identifying Subgroups that Succeed of Fail With Three Levels of Physical Activity Intervention: The Activity Counseling Trial." Health Psychology **25**(3): 336-347.
Krizek, K. J. and F. Harvey (2006). Surveying Cyclists' Behavior Using Global Positioning System Units, Active Communities / Transportation Research Group, University of Minnesota**:** 17 pages.
Krizek, K. J. and P. J. Johnson (2006). "Proximity to Trails and Retail: Effects on Urban Cycling and Walking." Journal of the American Planning Association **72**(1): 33-42.
Lockwood, S. (2006). The Current State of Non-motorized Transportation Planning and Research. Oberstar Forum, Minneapolis, MN, Center for Transportation Studies.
Matthews, C. (2005). "Calibration of accelerometer output for adults." Medicine and Science in Sports and Exercise **37**(11): 512-522.
McBeth, A. G. (1999). "Bicycle lanes in Toronto." Institute of Traffic Engineeers Journal **69**: 38-46.
McLeroy, K. R., D. Bibeau, et al. (1988). "An Ecological Perspective on Health Promotion Programs." Health Education Quarterly **15**(4): 351-377.
Nelson, A. C. and D. P. Allen (1997). "If you build them, commuters will use them." Transportation Research Record **1578**: 79-83.
Noland, R. (2001). "Relationships Between Highway Capacity and Induced Vehicle Travel." Transportation Research A **35**(1): 47-72.
Oakes, J. M., A. Forsyth, and K. H. Schmitz (under review). "The effect of neighborhood density and street connectivity on walking behavior: The Twin Cities Walking Study."
Painter, K. (1996). "The influence of street lighting improvements on crime, fear and pedestrian street use, after dark." Landscape and Urban Planning **35**(2-3): 193-201.
Pikora, T., B. Giles-Corti, et al. (2003). "Developing a framework for assessment of the environmental determinants of walking and cycling." Social Science and Medicine **56**: 1693-1703.
Pucher, J. and L. Dijkstra (2003). "Promoting Safe Walking and Cycling to Improve Public Health: Lessons from The Netherlands and Germany." American Journal of Public Health **93**(9).

Pucher, J., C. Komanoff, et al. (1999). "Bicycling renaissance in North America? Recent trends and alternative policies to promote bicycling." Transportation Research Part A **33**: 625-654.

Rietveld, P. and V. Daniel (2004). "Determinants of bicycle use: do municipal policies matter?" Transportation Research Part A **38**: 531-550.

Rodriguez, D., A.J.Khattak, and K. Evenson (2006). "Can new urbanism encourage physical activity?" Journal of the American Planning Association **72**(1): 43-54.

Rychetnik, L., M. Frommer, et al. (2002). "Criteria for evaluating evidence on public health interventions." Journal of Epidemiology and Community Health **56**.

Sallis, J. F. and N. Owen (1997). Ecological Models. Health Behavior and Health Education: Theory Research and Practice. K. Glanz, F. M. Lewis and B. K. Rimer. San Francisco, Jossey-Bass. **403-424**.

Singleton, R. A. J. and B. C. Straits (2005). Approaches to Social Research. New York, Oxford University Press.

Troiano, R. (2005). "A timely meeting: Objective measurement of physical activity." Medicine and Science in Sports and Exercise **37**(11): S487-489.

Troped, P. J., Saunders, R.P., Pate, R.R., Reininger, B., Ureda, J.R. and Thompson, S.J. (2001). "Associations between Self-Reported and Objective Physical Environmental Factors and Use of a Community Rail-Trail." Preventive Medicine **32**: 191-200.

Willis, A., N. Gjersoe, et al. (2004). "Human Movement Behaviour in Urban Spaces: Implications for the Design and Modelling of Effective Pedestrian Environments." Environment and Planning B: Planning and Design: 805-828.

Winship, C. and S. L. Morgan (1999). "The estimation of causal effects from observational data." Annual Review of Sociology **25**(1): 659-706.

Wolf, J., R. Guensler, et al. (2001). "Elimination of the travel diary: An experiment to derive trip purpose from GPS travel data." Notes from Transportation Research Board, 80th annual meeting.

Appendix I

NuStats Draft Methods Report

NATIONAL TRANSPORTATION PILOT PROGRAM: NONMOTORIZED STUDY

Draft Methods Report

February 2007

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Background

Under contract to the Center for Transportation Studies at the University of Minnesota, NuStats conducted Phase 1 of a two-phase research survey (baseline and tracking) on nonmotorized travel. This research affords a unique learning opportunity for researchers and other communities. The survey focuses on individual transportation habits and preferences, such as the frequency of travel modes and opinions about whether money should be spent to improve specific parts of the system. It is part of an overall program evaluation of the Nonmotorized Transportation Pilot Program (NTPP), funded by the transportation act passed by Congress in 2005.

Study Purpose

The study purpose is twofold: to provide a baseline measurement of nonmotorized travel within each region through a random survey of residents in the five regions in 2006, and to measure changes in travel modes following infrastructure investments to promote nonmotorized travel by administering the same survey in 2010. Spokane, WA, serves as the control group, and no nonmotorized travel infrastructure improvements will be made in this community as part of the NTPP.

Research Approach

The research entailed a two-pronged approach to the project: a mail-out/mail-back “self-mailer” survey and a computer-aided telephone interview (CATI) follow-up survey. The purpose of the self-mailer questionnaire was to measure incidence of mode usage and solicit participation in the telephone follow-up survey. The telephone follow-up survey was designed to measure attitudes and behavior regarding nonmotorized travel.

Sampling

NuStats, with consultation and approval from the University of Minnesota, employed two different but complementary strategies to ensure recruitment of adequate samples of individuals who walk, bike, and use transit. First, as part of a general mail-out survey, the project team used a self-mailer questionnaire to recruit participants who recently walked, cycled, or used transit – thus serving to allocate sample to a mode. Second, the sample plan called for a 50/50 split of random vs. targeted sample, which used the Census Transportation Planning Package data and software to target census tracts in which households have the greatest propensity for walking, cycling, or transit use. The sampling plan was not designed, however, to recruit from areas deemed to be “cycling-friendly.”

NuStats purchased address-based sample records from MSG, a sampling vendor in Virginia. NuStats mailed questionnaires to approximately 6,000 households (combined pilot and full study) in each of the five target communities. Approximately 30 percent of the addresses in the sample were also matched to a listed telephone number. The Phase 1 target was to obtain 2,000 telephone follow-up telephone interviews, with 400 interviews in each region, with 100 each representing walk, bike, transit, and auto travelers.

The Phase 1 final data set comprises 4,457 mail surveys (also called the short survey) and 1,514 follow-up telephone interviews (also called long surveys). Tables I.1 and I.2 below show the final distribution of mail and telephone surveys by region and by mode[1].

TABLE I.1: PHASE 1: DISTRIBUTION OF MAIL-OUT SURVEYS

STUDY AREA	TRANSIT	BIKE	WALK	AUTO
Columbia, MO	116	143	300	154
Minneapolis, MN	374	123	234	92
Marin, CA	231	130	397	118
Sheboygan, WI	73	163	453	258
Spokane, WA	207	109	408	179
Total	4,457			

TABLE I.2: PHASE 1: DISTRIBUTION OF FOLLOW-UP SURVEYS

STUDY AREA	TRANSIT	BIKE	WALK	AUTO
Columbia, MO	50	73	104	86
Minneapolis, MN	123	62	104	54
Marin, CA	70	52	100	50
Sheboygan, WI	26	70	101	100
Spokane, WA	66	50	100	73
Total	1,514			

SAMPLE DISPOSITION

The final number of completed and eligible[2] self-mailer questionnaires was 4,432 through a combination of mail-backs, Web, and outbound CATI calls. A total of 1,514 respondents participated in the follow-up interview, either by phone or Web. Table I.3 shows the final disposition of all the sample records dialed. Note: when NuStats changed the approach to outbound CATI calls, we had more than 9,000 records with a matched telephone number for households that had not yet participated in the survey; therefore, the available number of sample records attempted (9,698) is higher than the number of returned/completed and eligible self-mailers (4,432).

[1] The totals for each region include cases deemed "no mode" where a respondent most likely did not provide an answer or less likely, did not meet the required criteria to be categorized into one of the four travel modes. Only 4,262 cases with a clear mode from the 4,457 self-mailers were included in the follow-up survey.

[2] Indicated a clear mode and were included in the follow-up portion of the study.

TABLE I.3: CALL OUTCOMES

SAMPLE DISPOSITION	TOTAL	
	COUNT	PERCENT
Ineligible	1,207	15%
Not Qualified	268	3%
Disconnected Phone	973	10%
Business/ Fax/ Modem	192	2%
Unknown Eligibility, Non-Interview	5,474	56%
Answering Machine / Caller ID	2,854	29%
Hang Up / Refused (prior to screening)	843	9%
Ask for Callback (prior to screening)	280	3%
No Answer / Busy	1,239	13%
Wrong number	151	2%
Respondent moved/no one in HH ever heard of respondent	107	1%
Eligible	3,155	29%
Complete by CATI	1,143	12%
Complete by Web	371	4%
Partial Complete	21	<1%
Refusal	1,620	17%
Total Sample	9,698	100%

RESPONSE RATES

As with most other types of surveys, not all sampled households participate. Social Exchange Theory[3] states that when determining whether to participate in a survey, a respondent performs a cost-benefit analysis, comparing the costs of participating (typically in terms of time but also the disclosure of personal information) against the benefits. This is the point at which many people ask, 'If I participate in this survey, how does it benefit me today?' Declining response rates across the entire survey research industry suggest that, using social exchange terminology, respondents find the costs of participating outweigh the benefits.

Some respondents refuse to participate in surveys because of intrusiveness or the time commitment involved. Other respondents would possibly participate but are not included in the final sample due to non-contact, i.e., busy, no answer, answering machine. For this study, the non-contact rate was 42 percent. Fifteen percent of the sample was ineligible (not qualified, disconnected number, or number was for business/fax or modem). An additional 9 percent hung up the phone or refused to participate prior to when the screening began, and 3 percent requested a call back before any screening questions started. The refusal rate (once screening began) was 17 percent.

In terms of participation, from the original 31,120 self-mailers sent out (through a combination of the pilot and full study), 1,826 were returned with bad addresses or were otherwise undeliverable by the U.S. Postal Service. A total of 4,457 completed self-mailers (by any method) yielded a 15 percent response rate, with 4,432 of those eligible for participation in the follow-up survey. From those eligible self-mailers, 1,514 resulted in a completed interview or web completion, for a 34 percent response rate.

Of particular concern to the Working Group was, what impact, if any, the smaller sample size will have on the analysis of the data, i.e., the target was 2,000 long completes and the final number was 1,514 - is the data still

[3] See http://www.washington.edu/research/pathbreakers/1978a.html

valid and robust enough for analysis? As shown in Table I.4 below, the slight smaller sample size will not greatly reduce the statistical robustness of the data in the analysis.

A margin of error is calculated[4] to determine the level of precision in an existing sample, e.g., if a margin of error is 4.0%, then we can be sure that everyone in the population would have answered the same way within four percentage points either way, so the range would be 36% (-4%) to 44% (+4%). Confidence levels indicate the certainty with which we can say the data reflect the population of study – this level is expressed as a percentage and represents how often the true percentage of the population who would pick an answer lies within the margin of error. Most statistical research is conducted at the 95% confidence level, meaning, we can be 95% certain. For this study, we also calculated the margin of error at the 90% confidence level, meaning we can be 90% certain. The table below illustrates the differences in margin of error based on the region surveyed.

First consider the 95% confidence level. If all 400 surveys had been obtained for all 5 regions, the margin of error at the 95% confidence level would have been +/- 4.9%. The Phase 1 margins of error by region range instead from 5.3% to 5.9%, thus, only 1% larger at most. At the 90% confidence level, instead of a targeted 4.1% margin of error, the rates range instead from 4.4% to 5.0%, or a difference of .9% at most. Thus, by region, and by confidence interval, the difference between actual vs. target does not significantly alter the ability to distinguish statistical differences in results.

TABLE I.4: ACTUAL VS. TARGET MARGINS OF ERROR BY REGION AT 95% AND 90% CONFIDENCE LEVELS

	Number of Surveys		Margin of Error at 95% Confidence Level		Margin of Error at 90% Confidence Interval	
Region	Target	Actual	Target	Actual	Target	Actual
City of Columbia, Missouri	400	313	4.9	5.5	4.1	4.7
Marin County, California	400	272	4.9	5.9	4.1	5.0
City of Minneapolis, Minnesota	400	343	4.9	5.3	4.1	4.4
Sheboygan County, Wisconsin	400	297	4.9	5.7	4.1	4.8
Spokane County, Washington	400	289	4.9	5.8	4.1	4.9
Total	2000	1514	2.60%	2.52%	1.8	2.1

MEDIA / PUBLIC OUTREACH AND COMMUNICATION

It is important to consider public outreach in support of survey research efforts such as the NTPP study. The University of Minnesota / NuStats team encouraged each of the target communities on the Working Group to conduct public outreach and communication in the form of a news release. NuStats provided an example of a media release used in previous studies similar in nature to the nonmotor project, and also edited a draft released by the University of Minnesota. The target communities were given the option of working with the University of Minnesota to distribute the release to local media outlets.

DATA COLLECTION

Phase 1 Data Collection Methods

The data collection effort for Phase 1 included three main activities: mailings, telephone calls, and data management; we discuss each below.

[4] Margins of error (aka confidence intervals) are derived from standard statistical calculators. See http://www.surveysystem.com/sscalc.htm for an example of the calculator used for the 95% confidence level. These intervals assume the broadest possible margin of error, regardless of the variable under analysis.

Self-Administered Questionnaire

Design. NuStats designed a self-administered mail-out survey to capture mode usage. A copy of the self-mailer questionnaire is in Appendix J. In addition to mode usage questions, respondents indicated their interest in the follow-up survey either to receive a phone call or take the survey via web. Interested respondents provided the appropriate contact information, i.e., a phone number or e-mail address.

Mailing. On September 13 (pilot study) and October 13, 2006 (full study), NuStats printed and mailed more than 32,000 questionnaires via the Postal Service to households randomly sampled from throughout the five regions, averaging approximately 6,000 households in each of the five regions. All mail survey respondents had the option of participating by mail, web, or through a telephone interview (if contacted during the outbound calling effort).

Scanning. Respondents had the option either to complete and return the paper survey via Business Reply Mail or to participate via web. Upon receipt of completed self-mailer questionnaires, NuStats used Optical Character Recognition technology to scan the surveys into a database. The questionnaires were then verified and edited to ensure completeness and thoroughness of the data, i.e., logic checks, out of range numbers, correct skip patterns, among others.

Web option. For respondents who preferred participating in the self-mailer online, NuStats designed a survey web site with questions identical to those on the printed self-mailer instrument. Using mail merge technology, respondents received a Personal Identification Number (PIN) on their questionnaire to log on to the site and complete the survey. The web data was extracted then run through the same series of edit checks as described above.

Follow-up sample. Regardless of participation method, NuStats extracted contact information for all respondents who indicated willingness to take part in the follow-up survey and by his or her preferred method, phone or web. This information made up the sample of participants for the follow-up. The sample was then provided to DataSource to call, or NuStats e-mailed the web survey link and PIN to respondents.

Mode assignment. In addition to providing follow-up contact information, a primary goal of the self-mailer was to assign each respondent to a mode: transit, bike, walk, or auto. Respondents were eligible for more than one mode depending on their answers to Q2 in the self-mailer (*Please tell us the most recent time you used each of the following means of transportation*). Anyone who used any of the means of transportation in the past 7 days or past month was eligible.

Mode hierarchy. NuStats and the University of Minnesota agreed on the hierarchy of mode assignment so each quota would be filled in the same order, i.e., transit, then bike, then walk, then auto. Therefore, a respondent who qualified for more than one would be assigned a mode based on the established hierarchy (used a given mode either in the past 7 days or past month, and transit first, then bike, and so on).

Modified criteria for mode selection. Due to lagging response on the follow-up study, the project team decided to expand the allowable timeframe criteria from past 7 days or past month to past three months. The rationale was that with the time change and colder weather, particularly in regions like Spokane and Sheboygan, it was important to find people who used bike or walk as a means of transportation, which meant allowing respondents to include a time period of warmer temperatures and longer days.

Reminders. Throughout the project, NuStats sent reminder e-mails to respondents who chose to take the survey via the web. Lower than anticipated response rates led the University of Minnesota to request that NuStats send out a reminder postcard mailing, which was sent on November 8, 2006.

Strategic Change. After receipt of self-mailer questionnaires trickled to a halt in early December 2006, the University of Minnesota, with approval from the Working Group, directed NuStats to begin outbound calls to all sampled households that had not participated in the study to date. NuStats had more than 9,400 records

that were already matched to a phone number to use as sample for the alternate approach method. This shift in gears required a revamp of our internal procedures and processes (e.g., sample management, programming, data extraction and processing). On December 6, 2006, NuStats proceeded with an all CATI method (outbound "cold" calls) in an attempt to contact respondents who had not yet participated in the survey.

Expanded Hierarchy. In addition to beginning outbound calling, NuStats and the University of Minnesota again expanded the criteria for the mode assignment hierarchy to allow a wider range of recent usage, i.e., past year, past three months, past month, or past seven days were all acceptable.

Telephone Calls

Follow-up contact – phone. If a respondent selected to participate in the follow-up and provided contact information, NuStats' sister firm, DataSource, administered the follow-up CATI survey at its state-of-the-art data collection facility in San Marcos, Texas. Data collection took place from September 2006 to January 2007.

Follow-up contact – web. For those who indicated they preferred to participate in the follow-up via web, NuStats designed the follow-up web survey and respondents were e-mailed a PIN to log onto the survey (the PIN was the same for the self-mailer web program and the follow-up). A copy of the CATI survey instrument – which was identical for phone and the web – is in Appendix K.

Data / sample processing. As mail surveys were completed by mail and web, the data were scanned into electronic format and appended to a master database. The data and contact information for all mail survey respondents who were willing to participate in the follow-up survey were then processed and provided to the telephone facility. Interviewers at the telephone facility then contacted the households as close to receipt of the mail survey as possible (attempts to reach the households began within a few days of receipt of completed survey and continued through December).

Outbound calls. A second outbound calling effort (the first was during the pilot) was initiated after discussion among the research team members and with approval of the Working Group. In early December, NuStats began outbound calling of all sample for which mail surveys had not been received. Upon contact with the sampled household, the interviewer administered the mail survey over the telephone, then launched the follow-up CATI survey, thus completing both surveyed in one call. As noted earlier, NuStats completed more than 700 interviews between December 6 and 20, using this approach (yielding both mail and telephone surveys).

Data Management

CDF / Sample Management. With 31,120 randomly sampled households across five regions and a multi-stage/multi-mode data collection effort (mail and follow-up surveys administered by mail, web, and telephone), the survey effort required a comprehensive, complex, and labor-intense data management system to ensure that each sampled household received the requisite treatment at the appropriate time. For this project, NuStats Continuous Data Flow (CDF) system was tailored to the specific needs of the project. This included tracking web, mail, and telephone completion of the mail survey, and web and telephone completion of the follow-up survey, as well as communicating to the telephone facility regarding who needed to receive follow-up calls and for which modes.

The system also provided project management with detailed reports showing the progress of each household through the system, as well as flagging those cases that were not moving for whatever reason. The attention to the sample, as well as detailed reports, ensured that each respondent received the attention due them at the proper time, thereby maximizing participation rates through timely callbacks.

Completion Time Frame. Tables I.5 and I.6 show the distribution of mail-out versus completion date for the pilot and the full study; note that three methods of completion are applicable: mail-back, web or outbound

CATI call where an interviewer completed the web version of the self mailer for the respondent while on the phone. The gray shading indicates the cumulative number of completed self-mailers at approximately one-month intervals from the original mailing date. So, for example, NuStats received or respondents completed 165 self-mailers between September 13 and October 13 (this time period was during the pilot study).

TABLE I.5: PILOT STUDY MAIL OUT / RECEIVED DISTRIBUTION

DATE MAILED	COMPLETED	COUNT	CUMULATIVE RECEIVED	NUMBER OF DAYS
13-Sep-06	22-Sep-06	1	1	9
13-Sep-06	23-Sep-06	4	5	10
13-Sep-06	25-Sep-06	20	25	12
13-Sep-06	26-Sep-06	12	37	13
13-Sep-06	27-Sep-06	15	52	14
13-Sep-06	28-Sep-06	63	115	15
13-Sep-06	29-Sep-06	3	118	16
13-Sep-06	30-Sep-06	1	119	17
13-Sep-06	02-Oct-06	27	146	19
13-Sep-06	03-Oct-06	4	150	20
13-Sep-06	04-Oct-06	1	151	21
13-Sep-06	09-Oct-06	7	158	26
13-Sep-06	10-Oct-06	2	160	27
13-Sep-06	12-Oct-06	4	164	29
13-Sep-06	13-Oct-06	1	165	30
13-Sep-06	24-Oct-06	1	166	41
13-Sep-06	31-Oct-06	2	168	48
13-Sep-06	02-Nov-06	1	169	50
13-Sep-06	08-Nov-06	1	170	56
13-Sep-06	17-Nov-06	1	171	65
13-Sep-06	21-Nov-06	1	172	69
13-Sep-06	01-Dec-06	1	173	79
13-Sep-06	05-Dec-06	32	205	83
13-Sep-06	06-Dec-06	18	223	84
13-Sep-06	07-Dec-06	13	236	85
13-Sep-06	08-Dec-06	2	238	86
13-Sep-06	09-Dec-06	1	239	87
13-Sep-06	10-Dec-06	1	240	88
13-Sep-06	11-Dec-06	1	241	89
13-Sep-06	15-Dec-06	5	246	93
13-Sep-06	16-Dec-06	1	247	94
13-Sep-06	17-Dec-06	2	249	95
13-Sep-06	11-Jan-07	4	253	120
13-Sep-06	12-Jan-07	5	258	121
13-Sep-06	13-Jan-07	6	264	122
13-Sep-06	14-Jan-07	1	265	123

Note: Total self-mailers sent = 1,000

TABLE I.6: FULL STUDY MAIL-OUT / RECEIVED DISTRIBUTION

DATE MAILED	COMPLETED	COUNT	CUMULATIVE RECEIVED	NUMBER OF DAYS
13-Oct-06	18-Oct-06	20	285	5
13-Oct-06	19-Oct-06	74	359	6
13-Oct-06	20-Oct-06	62	421	7
13-Oct-06	21-Oct-06	27	448	8
13-Oct-06	22-Oct-06	16	464	9
13-Oct-06	23-Oct-06	22	486	10
13-Oct-06	24-Oct-06	170	656	11
13-Oct-06	25-Oct-06	12	668	12
13-Oct-06	26-Oct-06	11	679	13
13-Oct-06	27-Oct-06	3	682	14
13-Oct-06	28-Oct-06	6	688	15
13-Oct-06	29-Oct-06	5	693	16
13-Oct-06	30-Oct-06	6	699	17
13-Oct-06	31-Oct-06	483	1,182	18
13-Oct-06	01-Nov-06	382	1,564	19
13-Oct-06	02-Nov-06	282	1,846	20
13-Oct-06	03-Nov-06	4	1,850	21
13-Oct-06	04-Nov-06	4	1,854	22
13-Oct-06	05-Nov-06	5	1,859	23
13-Oct-06	06-Nov-06	4	1,863	24
13-Oct-06	07-Nov-06	130	1,993	25
13-Oct-06	08-Nov-06	71	2,064	26
13-Oct-06	09-Nov-06	228	2,292	27
13-Oct-06	10-Nov-06	407	2,699	28
13-Oct-06	11-Nov-06	7	2,706	29
13-Oct-06	12-Nov-06	7	2,713	30
13-Oct-06	13-Nov-06	224	2,937	31
13-Oct-06	14-Nov-06	48	2,985	32
13-Oct-06	15-Nov-06	41	3,026	33
13-Oct-06	16-Nov-06	26	3,052	34
13-Oct-06	17-Nov-06	156	3,208	35
13-Oct-06	18-Nov-06	12	3,220	36
13-Oct-06	19-Nov-06	12	3,232	37
13-Oct-06	20-Nov-06	20	3,252	38
13-Oct-06	21-Nov-06	87	3,339	39
13-Oct-06	22-Nov-06	1	3,340	40
13-Oct-06	24-Nov-06	1	3,341	42
13-Oct-06	27-Nov-06	4	3,345	45
13-Oct-06	28-Nov-06	1	3,346	46
13-Oct-06	01-Dec-06	62	3,408	49
13-Oct-06	04-Dec-06	2	3,410	52
13-Oct-06	05-Dec-06	17	3,427	53

DATE MAILED	COMPLETED	COUNT	CUMULATIVE RECEIVED	NUMBER OF DAYS
13-Oct-06	06-Dec-06	38	3,465	54
13-Oct-06	07-Dec-06	28	3,493	55
13-Oct-06	08-Dec-06	62	3,555	56
13-Oct-06	09-Dec-06	23	3,578	57
13-Oct-06	10-Dec-06	38	3,616	58
13-Oct-06	11-Dec-06	33	3,649	59
13-Oct-06	12-Dec-06	53	3,702	60
13-Oct-06	13-Dec-06	58	3,760	61
13-Oct-06	14-Dec-06	54	3,814	62
13-Oct-06	15-Dec-06	24	3,838	63
13-Oct-06	16-Dec-06	34	3,872	64
13-Oct-06	17-Dec-06	50	3,922	65
13-Oct-06	18-Dec-06	64	3,986	66
13-Oct-06	19-Dec-06	52	4,038	67
13-Oct-06	20-Dec-06	67	4,105	68
13-Oct-06	21-Dec-06	37	4,142	69
13-Oct-06	22-Dec-06	7	4,149	70
13-Oct-06	02-Jan-07	2	4,151	81
13-Oct-06	11-Jan-07	7	4,158	90
13-Oct-06	12-Jan-07	47	4,205	91
13-Oct-06	13-Jan-07	17	4,222	92
13-Oct-06	14-Jan-07	13	4,235	93
13-Oct-06	17-Jan-07	8	4,243	96
13-Oct-06	18-Jan-07	13	4,256	97
13-Oct-06	19-Jan-07	16	4,272	98
13-Oct-06	20-Jan-07	4	4,276	99
18-Oct-06	20-Oct-06	1	4,277	2
18-Oct-06	23-Oct-06	1	4,278	5
18-Oct-06	25-Oct-06	1	4,279	7
18-Oct-06	31-Oct-06	1	4,280	13
18-Oct-06	02-Nov-06	16	4,296	15
18-Oct-06	07-Nov-06	17	4,313	20
18-Oct-06	08-Nov-06	6	4,319	21
18-Oct-06	09-Nov-06	28	4,347	22
18-Oct-06	10-Nov-06	15	4,362	23
18-Oct-06	11-Nov-06	1	4,363	24
18-Oct-06	12-Nov-06	1	4,364	25
18-Oct-06	13-Nov-06	26	4,390	26
18-Oct-06	14-Nov-06	1	4,391	27
18-Oct-06	17-Nov-06	10	4,401	30
18-Oct-06	20-Nov-06	5	4,406	33
18-Oct-06	21-Nov-06	4	4,410	34
18-Oct-06	01-Dec-06	2	4,412	44
18-Oct-06	11-Dec-06	1	4,413	54

Date Mailed	Completed	Count	Cumulative Received	Number of Days
18-Oct-06	20-Dec-06	1	4,414	63
18-Oct-06	21-Dec-06	1	4,415	64
18-Oct-06	22-Dec-06	16	4,431	65
18-Oct-06	11-Jan-07	15	4,446	85
18-Oct-06	12-Jan-07	11	4,457	86

Note: Total self-mailers sent = 30,120

Pilot Study

In September 2006, NuStats conducted a pilot test of the nonmotorized study. A pilot test serves as a way to assess a research study on a small scale to work through issues and develop solutions to potential challenges. For the pilot, NuStats sent out 1,000 self-mailers to households in the five test communities (200 to each region) on September 13. By October 2, the response rate on the self-mailer was 10 percent, and by October 4, it was about 15 percent.

NuStats evaluated the pilot test results, which were summarized along with suggestions for revisions, edits, and changes in a memo to the University of Minnesota. In general, the overall process appeared to work during the pilot, though the time frame for receiving competed self-mailers back via the Postal Service was longer than anticipated (approximately three weeks from mail-out to receipt of a completed survey). Despite the delay, NuStats and the University of Minnesota agreed to continue with the same methodology as used in the pilot test with the understanding that the project schedule would likely shift due to the time required to receive back completed questionnaires.

Geocoding

The survey location data consisted of two location types: trip origin and trip destination (in many cases the respondent's home and work addresses were cross-referenced to these locations). A location master file was created that listed each address from each survey as a unique record. Data was then viewed and cleaned to allow for optimal geocoding conditions. The master file for geocoding, which included five regions, was split into five separate files to geocode specifically to a street centerline coverage file for each region. An automated batch run was first attempted in order to successfully geocode exact addresses. Addresses or cross-streets matching the coverage file were assigned an X/Y coordinate and a value of "M" for matched, and placed in the "AV_STATUS" field. Addresses or cross-streets not matched during the batch run were flagged with an "AV_STATUS" value of "U" for unmatched, and passed to the next stage of geocoding.

During the next stage, addresses were researched using a series of resources, including Switchboard.com, Google.com (Internet search engines), and DeLorme Street Atlas USA (mapping software). Addresses that were matched to an exact address or cross-streets during this stage were assigned an X/Y coordinate and an "AV_STATUS" of "M". Addresses that fell outside the defined study area have an "AV_STATUS" of "O". Addresses not geocoded were not assigned an X/Y coordinate, and were given the "AV_STATUS" of "U".

Geocoding Quality Control

The final data file, once geocoded, underwent a series of quality control checks. The checks included:

- All remaining unmatched records were further researched by using mode of travel as a potential determining factor to limit possibilities (such as walked five minutes to the nearest McDonald's would pinpoint the location that matches the criteria).

- Access queries were run to make certain that there were no inconsistencies, such as an address for Minnesota being labeled as California, and geocoded erroneously to the wrong region. Querying the file against itself to make sure that all respondent information was geocoded to proper area was also done.
- A comparison was made by city and zip code information given by the respondent and the information for where the location was geocoded to identify any possible errors.
- A random selection of 5% of the geocoded address file was reviewed in detail to ensure proper placement of the overall latitude/longitude points. This entails using ArcView and displaying the points on the street layer and comparing the points with DeLorme.
- Since a cross-street geocode does not reference a zone (zip code or city) in ArcView, all cross-street geocodes were queried and analyzed to ensure proper placement of the geocodes. (The ArcView default placement of a geocoded cross-street places the point in the southeast quadrant of that intersection.)
- Visual quality control check by city. Geocoding was verified by querying of geocoding matches related to each city. Then these points were displayed in the map view of ArcView and visually confirmed; outlying locations were selected and confirmed to be correct.

Global changes, such as correcting misspelled place names, misspelled city names, and any other global address problems, were made prior to the final data delivery.

CHALLENGES AND SOLUTIONS

In fielding the survey, several issues were continuously monitored, discussed, and addressed by the project team. These included:

- Schedule: The original schedule for the project called for the survey to be completed in September and October 2006. This was extended through January 2006, largely because it took three times as long for surveys to be returned by mail than originally anticipated. Another factor in continuing data collection into January was that the Working Group wanted to get a close to the 2,000 target as possible.
- Participation Rates: Based on available data about the survey objectives, anticipated questions, and survey environment, we anticipated receiving 6,000 completed mail surveys. Our target for agreeing to the follow-up was about 50 percent, and the actual rate was about 45 percent, so we ended up with fewer than expected sample records to dial for the follow-up CATI survey. However, an even more pressing issue was that the number of completed and returned self-mailer questionnaires was lower than anticipated. The final tally of self-mailers was 3,482 received or completed via web, with an additional 780 completed by telephone (during the outbound CATI calling) using the nonmotorized web program for the self-mailer questionnaire.

  As discussed earlier in this report, the survey research industry is experiencing continued declines across all mediums/methods of participation, and it gets more challenging each year to reach respondents. Reasons for nonresponse differ by respondent, but the following provides some possible rationale for why people did not participate in the self-mailer:
  - Lack of interest in subject matter
  - Do not bike or walk / use transit / have a car and thought they wouldn't qualify
  - Fear of scams
  - Concern about providing personal information / identity theft
  - Never received the mailer (never made it or was inadvertently tossed out because it wasn't from a known sender)
  - Meant to complete it but forgot / set it aside and it got lost in other household papers
  - Intended to complete it but spouse/friend/neighbor dissuaded them
  - No time / too busy

    - Opposed to or simply do not like taking surveys
    - Don't think tax dollars should be spent on surveys
    - No incentive
    - People did not see the value in participating, because it did not answer the "what's in it for me" question
    - Skimmed through questions and saw follow-up and decided they didn't want to be bothered
- Of those that returned the mail survey, almost half indicated they would participate in the follow-up survey. The team took many unbudgeted steps to counter the lower participation rate: including a web survey option for both the self-mailer survey and the CATI survey, sending reminder postcards and e-mails, and making outbound calls to the sampled households who had not yet returned the mail surveys. The result of these efforts is estimated at one-third the completed surveys (thus, had these unbudgeted steps not been taken, the final number of mail surveys would have been only about two-thirds the estimated return rate).
- Mailings: The original approach (as proposed) called for mailing more than 30,000 advance postcards that would capture a mode incidence. This was modified to a self-mailer, which is an 8.5 x 11-inch, one-page double-sided questionnaire, with questions on one side and mailing information on the other.
- Other Budgetary Issues: The study budget assumed a CATI interview length of 18 minutes; during the pilot, the interview length was 20+ minutes on average. Following the pilot, NuStats and the University of Minnesota made several edits to the CATI instrument, although the instrument was still long and the interview length was higher than budgeted.
- Low Incidence Rates: The longer interview was one factor that contributed to fewer completed surveys overall; another factor was the low incidence rate for several modes within a given region. For example, in Sheboygan, the incidence rate for transit users was very low (about 4 percent) and therefore, more telephone resources than planned were necessary to attempt to reach the transit goal for this region.

A question was raised during the 1/8/2007 conference call with the NTPP Working Group specific to the data collection efforts for Marin County. The week prior to the holidays, the Working Group and University of Minnesota directed NuStats and DataSource to target their efforts on boosting the overall completed interviews in the Marin, Sheboygan, and Spokane regions. During this time, the number of completed interviews in Marin increased by only three. The question during the call was the reason for such a small increase relative to the other two communities.

DataSource reviewed the sample disposition report and confirmed that “noncontact” was an issue in Marin. Noncontact refers to sample that is dialed but a respondent is never reached. These households are assigned one of the noncontact dispositions such as answering machine, busy signal, and no answer. The sample is put back into the pool and dialed at different times, but in the end, Marin had the highest rate of never contacted sample at 47 percent. This means that 47 percent of potential respondents were unable to be contacted even though DataSource dialed every sample record multiple times.

In addition, another factor that contributed to the Marin response rate was sample itself. The total number of sample available for Marin was considerably lower than in Spokane and Sheboygan. Yet DataSource had a higher level of effort in Marin, which is evidenced by the average number of call attempts to get 1 completed interview, which was 3.16 compared to an overall average of 2.73. In other words, it took 3.16 phone calls to reach a qualified respondent, whereas the average in other regions was 2.73 attempts.

Appendix J

Survey Instrument: Self-mailer

<REGION> TRANSPORTATION SURVEY

<sampno>

<REGION> is evaluating the quality and use of the transportation system in your community to make sure funding priorities reflect your needs. You can help us in this study by answering the questions below. Any information shared with us will be held in strict confidence, and your participation is strictly voluntary. *If you have any questions about the study, please contact Professor Kevin J. Krizek, the Principal Investigator at the University of Minnesota, (612) 626-2862, krizek@cts.umn.edu.*

PARTICIPATE IN ONE OF THE FOLLOWING WAYS:

Complete this survey on-line at: http://surveys.nustats.com/START/NONMOTOR.html

Login ID: <LOGIN> **Password:** <PSWD>

Fax your completed form to Stacey Bricka at: 800-###-####

Scan your completed form and email to Stacey Bricka at: sbricka@nustats.com

Fill out this form, fold with the business reply showing, seal with tape and drop in any public mailbox.

1a. How many total places did you visit YESTERDAY?
(A place is any specific destination. This includes all places with an address, parks/trails, transit stops, home, etc.)

☐ *Number of places*

1b. What day and month was YESTERDAY for you?

_____ / _____
(Month/Day)

1c. Of the places you visited YESTERDAY, how many did you visit by:

_____ Personal Vehicle
_____ Walking
_____ Bicycle
_____ Rideshare or other
_____ Public transit

2. Please tell us of the *most recent time* you used each of the following means of transportation by filling in one bubble in each row. *For walk, indicate the last time you walked to get to a destination (e.g., to work, shop, visit, or to catch a bus or train), and also the last time you walked for recreation or exercise.*

Transportation Used	Past 7 Days	Past Month	Past 3 Months	Past Year	Not Used in the Past Year
Vehicle	◯	◯	◯	◯	◯

Public transit	◯	◯	◯	◯	◯
Bicycle	◯	◯	◯	◯	◯
Walk to destination	◯	◯	◯	◯	◯
Walk for rec./exercise	◯	◯	◯	◯	◯

3. How many automobiles, vans, and trucks are kept at home for use by members of your household?

☐ *Number of vehicles*

4. How many adult-size bicycles, in working condition, does your household have?

☐ *Number of bicycles*

5. How satisfied are you with the following in <REGION>?

	Very Satisfied		Neutral		Very Dissatisfied	No Opinion
a. Highway/roadway system	5	4	3	2	1	9
b. Opportunities for walking	5	4	3	2	1	9
c. Opportunities for bicycling	5	4	3	2	1	9
d. Transit service	5	4	3	2	1	9

6. Do you think more money should be spent improving the following in <REGION>?

	Yes	No	No Opinion
a. Road maintenance	◯	◯	◯
b. Road expansion	◯	◯	◯
c. Walking and biking infrastructure, such as sidewalks, bike lanes, and trails	◯	◯	◯
d. Transit service	◯	◯	◯

7. How did you get to work last week? *(mark all that apply)*

◯ Not employed
◯ Drive alone
◯ Carpool
◯ Transit
◯ Walk
◯ Bicycle
◯ Other: *(specify)* _____

8. How did you get to school last week? *(mark all that apply)*

◯ Not a student
◯ Drive alone
◯ Carpool
◯ Transit
◯ Walk
◯ Bicycle
◯ Other: *(specify)* _____

9. Including yourself, how many people live in your household? *Please do not include anyone who usually lives somewhere else or is just visiting, such as a college student away at school.*

☐ *Number of people in household*

10. What is your age?

☐ *Years*

11. Are you: ⬭ Male ⬭ Female

12. This survey is the first step in our evaluation of the quality and use of the transportation system in <REGION>. Would you be willing to participate in a more detailed survey on this topic?

⬭ Yes, call me at: (_____) _____ - _____

The best time of day to reach me is: _____ am / pm

⬭ Yes, email me a password protected link to the Internet survey at:

_____ @ _____

⬭ No, I will not complete the follow-up survey

If yes, please provide your first name for contact purposes:

_____

THANK YOU!

PLEASE REPORT YOUR INFORMATION

BY ONE OF THE METHODS LISTED ABOVE.

Appendix K

Survey Instrument: Full Survey

<REGION> TRANSPORTATION SURVEY

CATI and Internet Survey

Survey will be tracked based on REGION (study area geography) as well as whether they walked, biked, used transit, or used auto to travel in the past 30 days. Sample is pre-identified based on reported non-motorized mode usage(s) from the self-mailer. The goals are 100 surveys in each mode category in each region (400 surveys in each region, 2000 surveys total).

NOTE TO SURVEY REVIEWERS: This questionnaire is designed for CATI programming. As such, you will note that some responses are in Upper and Lower case, while other text is IN ALL CAPS. This is a standard design feature that tells the interviewer whether to read the responses (if in upper and lower case) or the interviewer reads the question and just waits for a response (ALL IN CAPS). In addition, it also means that the numbering may skip about – typically the number "7" is used to designate an "other, specify" response while "8" is "don't know" and "9" is refused. Finally, programming notes are contained in [brackets] and merge information (that varies with each record) is shown with <TEXT>.

START of SURVEY

Hi, my name is _____ and I'm calling about the transportation survey being conducted in <REGION>. May I please speak with <NAME>? [If necessary: <NAME> mailed in a survey and asked that we contact <HIM/HER> at this number for this follow-up survey].

ONCE RESPONDENT ON PHONE: Hi, my name is _____ and I'm calling on behalf of <REGION> about the survey to evaluate the use and quality of the transportation system in your region. You indicated you could help us with more in-depth questions.

CONSENT: Your household was selected as part of a survey evaluation of transportation improvements in the <<REGION>> area, resulting from federal legislation in 2005. The questions are about travel patterns and your attitudes towards various aspects of current transportation options, as well as some demographic information. Your answers are completely confidentiality.

By participating in the study, you will help planners and elected officials prioritize transportation investments. Participation in this survey is voluntary, and, you may refuse to answer any question. I need your informed consent to participate.

S1. Do you understand the study and agree to be interviewed?
- 1 Yes,
- 2 No, thank and ask for another eligible person in the HH
- 9 Refused – thank and ask for another eligible person in the HH

PART 1. GENERAL LEVELS of WALKING and CYCLING

This first part of the survey helps us to understand the types of walk and bike trips you routinely make.

A1. Are you: [CODE BY OBSERVATION ONLY for CATI, ask question in web version but put at end of web survey with other demographics.

1 Female
2 Male
9 Refused

A2. In a usual week, do you walk for at least 10 minutes at a time for recreation, exercise, to get to and from places, or for any other reason?

1 YES
2 NO
8 DON'T KNOW
9 REFUSED

A3. [IF A2=1] How many days per week do you walk for at least 10 minutes at a time: ____ days per week (1-7)?
9=REFUSED

A4. [IF A2=1] On days when you walk for at least 10 minutes at a time, how much total time per day do you spend walking?

HOURS AND MINUTES PER DAY _____:_____
(IF RESPONDENT GIVES RANGE, CHOOSE LOWEST NUMBER).
99:99 =REFUSED

A5. In a usual week, do you bicycle for at least 10 minutes at a time for recreation, exercise, to get to and from places, or for any other reason?

1 YES
2 NO
8 DON'T KNOW
9 REFUSED

A6. [IF A5=1] How many days per week do you bicycle for at least 10 minutes at a time: ____ days per week (1-7)?
9=REFUSED

A7. [IF A5=1] On days when you bicycle for at least 10 minutes at a time, how much total time per day do you spend bicycling?

HOURS AND MINUTES PER DAY _____:_____
(IF RESPONDENT GIVES RANGE, CHOOSE LOWEST NUMBER).
99:99 =REFUSED

NOTE: MODE is imported with the sample and is associated with NAME. It is assigned based on how the respondent completed the self-mailer.

A8. [If MODE = WALK OR BIKE] Next, I am going to ask you about specific places you may frequently visit.

FOR EACH RESPONDENT, RANDOMLY OFFER 3 OF THE 7 PLACES AND ASK THE FOLLOWING TWO QUESTIONS

Places: A nearby city park, playground or trail
Your usual grocery store
The post office
A restaurant or a café you frequent
Your bank or credit union
Gym, health club, rec. center
An entertainment venue or bar

A8a Please tell me the location of: __ OBTAIN ADDRESS THEN MAP TO CONFIRM

Don't know

A8b How many days in the past MONTH have you either walked OR biked to this location?
__ TIMES

A9. In the past 7 days, how many different places did you visit by WALKING? (i.e., different places are any specific destination. This includes all places with an address, parks/trails, transit stops, home, etc)
___ PLACES

A10. In the past 7 days, how many different places did you visit by BICYCLING?
___ PLACES

A11. [IF A10=0] When do you estimate was last time you rode a bike in <REGION>?
a. More than one week ago but within the month
b. More than a month ago but within the year
c. More than a year ago
d. Within the past week
e. Don't know
f. REFUSED

PART 2. REFERENCE TRIP

In this next section, I am going to focus on trips you make by <MODE>.
NOTE: MODE is imported with the sample and is associated with NAME. It is assigned based on how the respondent completed the self-mailer.
NOTE: B1 through B7 are asked of all MODES

B1. How often do you <MODE> to get to work, either all the way or in combination with some other mode?
0 Not employed
1 Never
2 < once/month

3 > once/month but less than once/week
4 once/week or more often
9 REFUSED

B1A (If B1=3 or 4): How do you get to work on days when you don't use <MODE> to get to work?

1 Drive
2 Ride with someone else
3 Transit
4 Bike
5 Walk
6 Never use other mode
7 Other

IF B1=3 or 4, SKIP TO COMPUTE VARIABLE OTHERWISE CONTINUE TO B2

B2. How often do you <MODE> to get to other any other place besides work?

1 Never
2 < once/month
3 > once/month but less than once/week
4 once/week or more often
9 REFUSED

B2A How would you describe this place? VERBATIM

B2B (If B2=3 or 4): How do you usually get to other destinations that you don't visit by <MODE>?

1 Drive
2 Ride with someone else
3 Transit
4 Bike
5 Walk
6 Never use other mode
7 Other

COMPUTE TRIP PURPOSE FOR B3-B7: IF B1=3 OR 4, TRIP PURPOSE=WORK IF B1 <> 3 OR 4 AND B2=1 OR 2, TRIP PURPOSE=RECREATION/EXERCISE IF B1 <> 3 OR 4 AND B2=3 OR 4, TRIP PURPOSE=VERBATIM FROM B2A

B3. If you think about your most recent trip for [TRIP PURPOSE], where did this trip start? (address or intersection; map it on the screen – ALLOW INTERVIEWER TO SELECT HOME ADDRESS AS AN OPTION HERE)

B4. Where did this trip end? (address or intersection; map it on the software)

B5. When was this trip?

1 YESTERDAY
2 2-3 DAYS AGO

3 WITHIN THE PAST WEEK (3-7 DAYS AGO)
4 WITHIN THE PAST MONTH (8 TO 30 DAYS AGO)
5 MORE THAN A MONTH AGO (31+ DAYS AGO)
9 REFUSED

B6. The computer is showing me that a possible route for this trip was along _____. Is that correct? IF NOT, SELECT NEXT ROUTE
NOTE: INTERVIEWER READS DESIGNATED ROUTE FROM SCREEN

B7. [MODE=BIKE] Which of the following road types *best* describes the route you took on this ride? (select all that apply)
1 On neighborhood streets
2 On busy streets, in a bike lane
3 On busy streets, in the street itself
4 On sidewalks
5 On an urban bike path
6 In a rural area, but on paved roads
97 OTHER (SPECIFY)

B8. [IF MODE=BIKE] Were any of the following a cause for concern for your personal safety?
a. Motorist behavior (1=YES, 2=NO, 8=DON'T KNOW, 9=REFUSED)
b. Roads too narrow or too much traffic (1=YES, 2=NO, 8=DON'T KNOW, 9=REFUSED)
c. Roads or bike paths not well maintained (1=YES, 2=NO, 8=DON'T KNOW, 9=REFUSED)
d. Particularly problematic intersection (1=YES, 2=NO, 8=DON'T KNOW, 9=REFUSED)
d. Route through unsightly or unsafe area (1=YES, 2=NO, 8=DON'T KNOW, 9=REFUSED)
e. Or something else (specify) (1=YES, 2=NO, 8=DON'T KNOW, 9=REFUSED)

B9 [MODE=WALK] Were any of the following a cause for concern for your personal safety on that walking trip ?
a. Not enough crosswalks (1=YES, 2=NO, 8=DON'T KNOW, 9=REFUSED)
b. Not enough sidewalks or paths (1=YES, 2=NO, 8=DON'T KNOW, 9=REFUSED)
c. Not enough lighting (1=YES, 2=NO, 8=DON'T KNOW, 9=REFUSED)
d. Drivers not stopping for you to cross the street (1=YES, 2=NO, 8=DON'T KNOW, 9=REFUSED)
e. Or something else (SPECIFY) _____

B10. [IF MODE=TRANSIT] How did you get from your starting point to the transit (if MARIN, say transit or ferry) stop?
1 WALK
2 BIKE
3 I GOT DROPPED OFF
4 DROVE or USED PARK AND RIDE
8 DON'T KNOW
9 REFUSED

B11. [IF MODE=TRANSIT] And when you got off the bus (if MARIN, say bus or ferry), how did you reach your final destination?
1 WALK
2 BIKE

3 TRANSFERRED TO ANOTHER BUS
4 WAS PICKED UP
5 GOT IN PARKED CAR AND DROVE
8 DON'T KNOW
9 REFUSED

B14. [IF MODE=TRANSIT] Consider the following statements about the characteristics of transit in your area and tell me how strongly you agree with them, using a 4-point scale of 1=strongly disagree, 2=somewhat disagree, 3=somewhat agree, or 4=strongly agree.

a. For the most part, it is convenient for me to reach destinations by transit
b. I know where and how to connect to transit, even with a bike.
c. The route to the transit stop I used is good for walking
d. The route to the transit stop I used is good for cycling
e. There is good bike parking at transit.
f. It was convenient for me to bring my bike aboard the bus/train (if MARIN, bus, train or ferry, and possibly eliminate train for all but Minneapolis)

B15. [IF MODE=AUTO] Which of the following best describes what you would have done if you hadn't been able to drive or be driven on this trip? SELECT ONLY ONE

1 Stayed at home
2 Made the trip using transit (if Marin, say transit or ferry)
3 Made the trip by bicycle
4 Made the trip by walking
5 Get a ride with someone else
7 OTHER (SPECIFY)
9 REFUSED

PART 3. COMMUNITY PERCEPTIONS and BARRIERS to USE

C1. For how many children are you the parent, foster parent, step parent or legal guardian? [BY CHILD, WE ARE REFERRING TO ANYONE UNDER THE AGE OF 18] ENTER NUMBER (99=REFUSED) If C1=0, skip to C6

[IF C1<>0] Please think about just ONE of your children who attend school.

C2 How far is your child's school from your home? _____IN MILES.
[Then if more than 2 MILES (outside reasonable for walking or biking, skip to C6)

C3 How old is your child?

C4 How does your child usually get to school?
1 Walk
2 Bike
3 Dropped off by parent,
4 carpool,
5 school bus or transit,
6 other _____specify

C5. With respect to your child walking or cycling to school, please tell me the extent each of the following conditions concerns you using a four point scale of 1. not a concern, 2. concerning you a little, 3. concerning you somewhat, or 4. being a great concern.

ROTATE ORDER – MUST ALLOW 9=REFUSED
b. Too much traffic around the school location.
c. Too many cars or cars drive too fast through the neighborhood.
d. No (or inadequate) sidewalks/bikeways on the route to school.
f. Crossing particularly problematic or dangerous intersections.
j. Other (please explain)_____

Now I'd like to ask you some questions about bicycling and walking in your neighborhood.

C6. First, I'm going to read a series of statements about the characteristics of your neighborhood for walking and bicycling. Please answer by using a 4-point scale, where 1 is strongly disagree, 2 is somewhat disagree, 3 is somewhat agree, and 4 is strongly agree. MUST ALLOW 9=REFUSED

ROTATE – RANDOMLY ASK 7 OF THESE 19
a. Stores are within easy walking distance of my home.
b. There are many places to go within easy walking distance of my home.
c. It is easy to walk to a transit stop (bus, train) from my home
d. It is easy to bicycle to a transit stop (bus, train) from my home.
e. The streets in my neighborhood are hilly, making it difficult to walk.
f. There are sidewalks on most of the streets in my neighborhood.
g. The sidewalks in my neighborhood are well maintained (paved, even, and not a lot of cracks).
h. There are pedestrian trails in or near my neighborhood that are easy to get to.
i. There are crosswalks and pedestrian signals to help walkers cross busy streets in my neighborhood.
j. My neighborhood streets are well lit at night.
k. The crime rate in my neighborhood makes it unsafe to go on walks during the day.

l. Major streets have bike lanes
m. The city has a network of off-street bicycle paths
n. Streets without bike lanes are generally wide enough to bike on
o. There are bike lanes, paths or routes that connect my home to places that I would like to ride to
p. The bike route network has big gaps
q. Bike lanes and paths are free of obstacles
r. Stores and other destinations have bike racks
s. Intersections have push buttons or sensors for bicycles and pedestrians

C7. How likely are the following factors to get you to **walk** more often than you currently do? Please answer using a 4-point scale of 1 being not likely, 2 being somewhat likely, 3 being likely, and 4 being very likely. MUST ALLOW 9=REFUSED
ROTATE – RANDOMLY ASK 6 OF THESE 11
a. more sidewalks
b. better condition of sidewalks
c. safer intersections
d. areas free from crime
e. more lights in walking areas
f. areas free from fast moving traffic
g. the cost of parking and driving increased
h. more destinations close to home
i. more destinations close to work
j if I had to pay to park my vehicle
j. if parking was hard to find

C8. And again using the same 4-point scale please tell me how likely the following factors would get you to **bike** more often that you currently do? MUST ALLOW 9=REFUSED
ROTATE – RANDOMLY ASK 6 OF THESE 9
a.. more marked bike lanes on existing streets
b. more off-street bike paths
c. more lights on existing bicycle facilities
d. safer intersections (with regard to motorists)
e. safer or better bike parking
f. showers available at my destinations
g. motorists who obey traffic laws
h. areas free from crime
i. areas free from fast moving traffic

C9. Finally, how likely are the following factors to get you to use **transit** more often that you currently do? Again, please use the same scale. MUST ALLOW 9=REFUSED
ROTATE
a. a bus/rail stop closer to work or home
b. more frequent or faster bus service
c. a more pleasurable route either to or from the closest bus/rail stop
d. a bus shelter
e. the ability to take my bike on the bus or the train
f. a free or subsidized transit pass
g. other (specify)

PART 4. SOCIO-DEMOGRAPHICS

And in this final section, I have a few questions for statistical purposes:

D1. How long have you lived in < REGION>?
_____ Months
_____ Years
888=Don't Know
999=REFUSED

D2. Do you have a health condition that has lasted for 6 or more months which has made it difficult for you to travel outside the home?
1 YES
2 NO
8 DON'T KNOW
9 REFUSED

D3. Please tell me which best describes your race? Are you… [MULTIPLE RESPONSE]
1 White
2 African American (Black)
3 Asian
4 American Indian or Alaskan Native
5 Native Hawaiian, or other Pacific Islander?
6 HISPANIC/MEXICAN
7 MULTI-RACIAL
97 OTHER (SPECIFY)
99 REFUSED

D4. What is your current employment status?
1 Full-time
2 Part-time
3 Not employed
7 OTHER (SPECIFY)
8 DON'T KNOW
9 REFUSED

D5. [IF D4=full-time or part-time] During a typical week, does your commute include any of the following modes? ?
a. Walking (1=YES, 2=NO, 9=REFUSED)
b. Cycling (1=YES, 2=NO, 9=REFUSED)
c. Transit (1=YES, 2=NO, 9=REFUSED)
d. Auto driver (1=YES, 2=NO, 9=REFUSED)
e. Auto passenger (1=YES, 2=NO, 9=REFUSED)

D6. [IF D4=full-time or part-time] Do you feel your workplace accommodates cycling to work through the provision of showers, bicycle lockers, or other amenities?
1 YES
2 NO
8 DON'T KNOW
9 REFUSED

D7. [IF D4=full-time or part-time & work is not the reference trip in Section 2] For the purpose of acquiring a travel distance, where is your workplace located? (If you work at more than one location, use the most frequent location to which you report for work) OBTAIN NAME, ADDRESS, NEAREST CROSS STREET, CITY, STATE, AND ZIP

D8. And to ensure your household properly represents others in the region, can you tell me if your total household income for 2005 was above or below $35,000? INTERVIEWER NOTE: HOUSEHOLD INCOME NOT ONLY ALLOWS US TO VERIFY THAT WE ARE INCLUDING ALL TYPES OF HOUSEHOLDS FROM THE REGION, BUT ALSO HAS BEEN FOUND TO BE RELATED TO THE TYPES OF TRIPS HOUSEHOLDS MAKE.

[IF BELOW $35,000] Is it above or below $15,000?
If below $15,000, INCOME=1
[IF AT OR ABOVE $15,000] Is it above or below $25,000?
$15,000 - < $25,000, INCOME=2
$25,000 - < $35,000, INCOME=3

[IF$35,000 OR ABOVE] Is it above or below $50,000?
[IF BELOW $50,000, INCOME=4]
[IF $50,000 OR ABOVE] Is it above or below $75,000?
if $50,000 to $< $75,000, INCOME=5

if $75k or greater, Is it above or below $100,000?
If $75k to <$100k, INCOME=6
If $100k+, INCOME=7

IF REFUSED: I appreciate your concerns about providing this information, but I only need to properly identify your household as belonging to one of the following categories: READ INCOME LIST

1 $0 - $14,999
2 $15,000 - $24,999
3 $25,000 - $34,999
4 $35,000 - $49,999
5 $50,000 to $74,999
6 $75,000 to $99,999
7 $100,000 or more

9 REFUSED

Thank you for taking the time to answer our survey today!