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Developing ITS to Serve Diverse Populations

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In 2003, the State and Local Policy Program (SLPP) at the University of Minnesota's Humphrey Institute of Public Affairs began research into how Intelligent Transportation System (ITS) technologies can be used to deliver transportation services to an increasingly diverse population in Minnesota. The research objective was to identify the nature of the gap between the emerging needs and existing services, and to propose ways of using technology to bridge the gap, both in terms of providing better transportation options and in reducing the cost of these options.

Using the information obtained from emerging demographic data, the 2003 study focused on identifying transportation challenges and opportunities for several different populations, with a particular focus on those that do not or cannot drive. This project continues this general theme through a series of analyses of ITS applications that appear most promising to improve mobility and access for Minnesota's increasingly diverse population. These applications include technologically advanced Community-Based Transit, Car Sharing, use of ITS to implement Value Pricing through conversion of an HOV lane to a High-Occupancy/Toll (HOT) lane, and evaluation of web-based Advanced Traveler Information Systems (ATIS).

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Developing ITS to Serve Diverse Populations

Final Report

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Executive Summary

Under the sponsorship of the Minnesota Department of Transportation (Mn/DOT), with funding initiated by Congressman Martin Sabo, The State and Local Policy Program (SLPP) at the University of Minnesota's Humphrey Institute of Public Affairs, in cooperation with the University of Minnesota's Center for Transportation Studies (CTS), began research in 2003 into how intelligent transportation system (ITS) technologies can be used to deliver transportation services to an increasingly diverse population in Minnesota. The research objective was to identify the nature of the gap between the emerging needs and existing services and to propose ways of using technology to bridge the gap, both in terms of providing better transportation options and in reducing the cost of these options.

Using the information obtained from emerging demographic data, the 2003 study focused on identifying transportation challenges and opportunities for several different populations, with a particular focus on those who do not or cannot drive. This project continues this general theme through a series of analyses of ITS applications that appear most promising to improve mobility and access for Minnesota's increasingly diverse population. These applications include technologically advanced community-based transit (CBT), carsharing, use of ITS to implement value pricing through conversion of a high-occupancy vehicle (HOV) lane to a high-occupancy toll (HOT) lane, and evaluation of Web-based advanced traveler information systems (ATIS).

Task 1: Community Based Transit

Overview

Past research has shown that community-based transit services could be improved in terms of both operational and administrative efficiency. This task examined whether ITS and related innovations can help achieve these goals. The task had two parts: a large survey designed to develop a better understanding of specialized transportation resources and how they are being used, and a review of the regulatory and legal environment for community-based transit coordination, in particular looking, for barriers and best practices.

Survey Overview

The survey had two key characteristics. The first was to question both organizations that provide transportation and those that do not provide it but are actively involved in purchasing or arranging it on behalf of their clients. The second was to be comprehensive; that is, to survey any organization that might be involved either in providing or arranging transportation.

Survey Results

The results show that about 45% of the diverse organizations that were surveyed provide transportation in some form, and another 20% actively arrange transportation for their clients. This implies that there are more than 3,000 specialized transportation providers in Minnesota. The vast majority of these are social service agencies and housing providers. This confirms the common belief that the true size of the specialized transportation "system" is far larger than the formal network that is known to transportation funders and regulators. However, because the survey was intended to be broad and exploratory rather than focused and definitive, the findings

generally do not provide clear answers to specific questions. However, they provide considerable insight into the types of details that future surveys should address with respect to various issues.

Regulatory Overview

The review of regulations investigated findings that the rules, regulations, and reporting requirements for providing human service transportation were significant obstacles to coordination. A number of government agencies and researchers acknowledge that differing program requirements at various levels of government complicate coordinating efforts, but some researchers argue that some barriers are better categorized as "perceived barriers" rather than actual barriers. This effort reviewed both the nature of the barriers and best practice efforts to overcome them.

Regulatory Results

Regulatory barriers appear to be of two types: actual contradiction between regulations, preventing coordination; and prohibitive costs associated with understanding and complying with numerous regulation sources. This research found little to no direct evidence of actual conflict or per se prohibition of coordination between agencies in existing statutes. Rather, the barriers largely lie in the myriad rules that arise from the wide variety of funding sources for these types of programs. Providers basically find it easier to maintain a smaller operation that needs to follow the regulations of only a few sources, rather than attempting to be a larger operation that needs to remain in compliance with many different sets of rules, whether those rules are in conflict or not.

Perhaps not surprisingly, the attempts to overcome these barriers also have been regulatory in nature—either government incentives to get government agencies and providers to cooperatively work together to overcome these perceived barriers, or regulatory mandates to coordinate certain activities, or even consolidate entire operations. While the state examples reviewed here show the potential for significant cost savings or streamlined processes, they also require considerable restructuring, a process that has its own risks.

Recommendation

Both the survey and regulatory review demonstrate how widespread and diverse the providers of this service are and the significant hurdles that must be overcome to achieve any level of coordination. These hurdles are as basic as a lack of a common understanding of who the providers are and the regulatory environment in which they operate. Certainly, there is a role for government, and Minnesota is one of several states that has convened leaders of stakeholder agencies to improve this understanding. However, the providers are so diverse that top-down coordination or collaboration initiatives may not gain enough traction. Instead, *providers should consider creating their own interest group to better collect data, define problems, and articulate their needs.* Government resources may be needed to provide adequate start-up resources, but to ensure that the group can provide a consistent, independent message, it should be provider led, rather than government led.

Task 2: Carsharing

Overview

Carsharing, the sharing of one or more vehicles by many people in close proximity to one another, offers members access to a car without the burden of ownership. This report examined carsharing from a number of perspectives to assess whether and where it might succeed in the Twin Cities of Minneapolis and St. Paul, Minnesota, and how the conventional carsharing business model might be modified to bring the benefits of carsharing to low-income users.

For the assessment of the Twin Cities market, researchers interviewed carsharing organizations throughout the United States and conducted focus groups of members and non-members in neighborhoods with carsharing in Seattle and Chicago. The researchers then used these findings to model ideal carsharing neighborhoods in the Twin Cities.

For developing a business model that could make carsharing more accessible to low-income users, the researchers built a time-banking model where users "bank" transit trips that can be then used for carsharing time. They then assessed the factors that could lead to the success or failure of such a model in different neighborhoods and analyzed which of the neighborhoods in the Twin Cities would be most likely for such a model to succeed.

Results

During the time of this study, a local non-profit carsharing organization, HOURCAR, began operations, placing its first vehicles in Loring Park, Uptown (Lake Street and Hennepin Avenue area), and Lowertown in downtown St. Paul, which also were identified as likely areas in this analysis. HOURCAR considered both conversations with nonprofit carsharing organization (CSO) operators in other cities and Shaheen and Cervero's literature about the carsharing market. HOURCAR managers did not consider the detailed demographic and travel behavior data considered in this analysis, but relied on its extensive familiarity with the Twin Cities community and perceptions of CSOs elsewhere. HOURCAR looked at residential density, areas with significant numbers of young adults, and areas where it felt a large percentage of the population held a progressive ethic about environmental issues and would be responsive to the carsharing alternative.

The "timebanking" model took the earlier results one step further by analyzing the population, poverty rate, work locations, and transit shares of four neighborhoods: Uptown, Marcy-Holmes, Loring Park, and the University of Minnesota. The analysis found that such a model was most likely to succeed in Uptown and least likely to succeed at the University of Minnesota. However, more data is needed on how much of a subsidy per user would be necessary and the nature of the subsidy. Further, analysis is needed to determine whether there is an optimal mix of lower- and higher-income users—that is, whether the combination of increased vehicle use and lower-income per use results in a linear or parabolic return, and, if the latter, where the high points are.

In addition, the researchers acknowledge that the model scheme is not likely to improve mobility and access in the poorest neighborhoods, and it assumes that transit is most effective at serving commute trips, while creating a competing alternative to non-commute trips. As a result, any advocate of this program is likely to face criticism not only from anti-tax and anti-government groups, but also from transit advocates as well.

Recommendation

Carsharing is just beginning to get a foothold in the Twin Cities area, but it has shown considerable growth in similar neighborhoods in comparable metropolitan areas. However, whether these programs are bringing benefits to the "diverse" populations that are the focus of this study remains unclear. Consequently, *more research is needed to define the nature and travel behaviors of users of carsharing services in the Twin Cities and also to refine the timebanking model to the point that it can be tested operationally.*

Task 3: Evaluation of Attitudes Toward Road Pricing (HOT Lanes)

Overview

In 2005, Mn/DOT converted the HOV lane on Interstate Highway 394 (I-394) to a HOT lane, a change enabled in part through ITS technologies that allow for at-speed toll collection. Researchers in this study looked to analyze preferences and travel behavior for individuals in the I-394 travel shed before and after implementation of the HOT lane. A three-wave survey was conducted, with a focus on attitudes toward the HOT lane's impact on mode split, equity, enforcement, and technology.

Results

Findings from the attitudinal panel surveys show support for the HOV conversion across all income levels and gender. Most significantly, both users and non-users perceived that congestion went down after the lane was converted. Of panel members, 84% reported that they had used the MnPASS lanes in the past for free as a carpooler; 9% said they had used the lanes as a paying single-occupancy vehicle (SOV) driver; and 2% reported usage as a bus rider. MnPASS usage was reported across all income levels, with 55% of lower-income, 70% of middle-income, and 79% of higher-income respondents reporting that they have used the MnPASS lanes. Usage has remained stable among the lower-income group (54% in Wave 2 and 55% in Wave 3), while it has grown among the middle-income group (62% to 70%) and the higher-income group (66% to 79%). Users experienced high levels of satisfaction with the all-electronic toll operations. Other technology-related aspects of MnPASS also received high satisfaction levels both in Wave 2 and Wave 3.

Recommendation

The conversion from an HOV lane to a HOT lane appears to be fairly widely favored as a good idea. Most significantly, it did not appear to cause negative equity or mode split impacts, and the use of ITS was widely supported as positive part of the project. However, this facility is located in a relatively high-income corridor with relatively low transit usage. Consequently, the researchers would be interested in seeing the acceptance of *new efforts to use the HOT lane to increase transit usage in this corridor, and/or whether acceptance would be as high in a lower-income corridor or a corridor with a higher transit share.*

Task 4: Advanced Traveler Information Services (ATIS)

Overview

E-government initiatives are underway to enhance citizen access to government information and services. This research considers a method for end-user engagement in assessing a particular e-government initiative: ATIS. As the demographic and travel needs of various citizen groups become increasingly diverse, there is a need for data and analysis to help predict future travel behavior, identify suitable ITS technologies to meet these emerging travel needs, and plan transportation systems based on these emerging demographic patterns. As a result, this study specifically focuses on analyzing the availability and quality of, and providing recommendations for, the delivery of online ATIS trip information for use by service providers and end-users. The main goal of this study is to develop an evaluative model so that ATIS initiatives can be ranked to indicate how they better serve online trip planning needs. The model, although designed for ATIS-specific initiatives, can be generalized to other online initiatives.

This research study performed a series of analyses related to these study objectives. Research tasks associated with these objectives were: 1) analytical review of approaches for defining online quality, 2) analytical review of travel needs for diverse trips, 3) survey execution of an evaluation prototype for ITS in support of diverse trips, and 4) conducting focus group discussion in the cities where the online survey was executed.

Researchers designed an online survey comprising questions related to the EGOVSAT model, demographics, and experience with technologies. The survey was designed to inquire about the experience of users who accessed the ATIS Web sites based on performance and emotional dimensions and to understand the characteristics of those who use these Web sites. The survey was conducted in two cities: Los Angeles (LA) and Minneapolis/St. Paul (MN). In both the cities, Web sites provided by metropolitan authorities were considered for evaluation. For the city of Los Angeles, a Web-based initiative provided by Los Angeles County Metropolitan Transportation Authority (http://www.mta.net) was used. For the Minneapolis/St. Paul area, the MetroTransit Web site (http://www.metrotransit.org) was considered for evaluation.

Results

Respondents in both the cities indicated that the need for improved usability features was a relatively stronger determinant of emotional measures than efficiency or customizable options. The usability options include need for useful information, helpful features, consistent performance, and easy-to-use features. Further, need for better address location facilities also were found to be a determinant factor to a limited extent. Experienced MN users expect consistent useful information on the Web site, whereas LA respondents who use online public transportation information services in a relatively limited manner expect facilities for learning to use the system quickly. Second to "Utility," features for "Efficient" access were found to be a determinant of overall satisfaction in using online public transportation informational services. These features included better organization and integration of content as well as visual presentation. MN respondents ranked need for well-integrated functions higher than features, whereas LA respondents indicated need for appropriate Web site organization. "Customization" construct was found to be a limited determinant of emotional measures. MN respondents ranked

the need for saving their trips for future reference higher than other features, whereas LA respondents indicated need for receiving reminders and notifications. Among the dependent emotional measures, both LA respondents were most "Satisfied" with the Web site, whereas MN respondents ranked the "Pleasant" experience in planning a trip higher than other features. Respondents in both the cities were found to be fairly "Confident" in using the Web site. They were "Frustrated" to a very limited extent.

Recommendation

The online government initiative (ATIS) considered in this study represents but one type of the large number of available Web-based interactive services. However, it is an appropriate representative of types of experience that citizens undergo while using a government-led advanced digital service. The user groups observed in this research were found to be diverse. Additionally, the purposes of using online ATIS services by these user groups were found disparate, too. It will not be over-assuming to consider that similar interactions can be expected with other digital government services, and as such, *government agencies should recognize the possibility of using this tool to evaluate other systems such as those for public library, water works, and tax payment services.* Specific details of this recommendation are detailed in the report.

Chapter 1:
An Exploratory Survey of Potential Community Transportation Providers and Users & Discussion of Regulatory Barriers to Transportation Coordination

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Executive Summary

This chapter describes a large survey that was administered with the objective of better understanding specialized transportation resources and how they are being used. The survey had two key characteristics. The first was to question both organizations that provide transportation and those that do not provide it but are actively involved in purchasing or arranging it on behalf of their clients. The second was to be comprehensive; that is, to survey any organization that might be involved either in providing or arranging transportation.

The survey was motivated by two major objectives, the first of which was to develop a broad-based inventory of the specialized transportation resources in the state and how they are used, as well as an understanding of the needs of organizations that use transportation but do not provide it themselves. The second was to begin to explore the range circumstances in which transportation is provided and used as an initial step in the future development of more focused and revealing surveys of this type.

The survey was administered in two parts. A one-page pre-survey was sent to about 5,500 organizations in Minnesota; it generated about 1,500 responses. The pre-survey was used to estimate the total state numbers and types of transportation providers and organizations that arrange transportation for their clients. A longer survey was then sent to about 950 of the pre-survey respondents who had indicated some involvement in transportation. We received about 450 responses to this survey, which explored the characteristics of transportation providers and arrangers in much more detail.

The results fall into two broad categories. The first is the actual survey findings, which provide a broad and comprehensive overview of the types of transportation-related activities that organizations are engaged in. Most significantly, about 45% of the diverse organizations that were surveyed provide transportation in some form, and another 20% actively arrange transportation for their clients. This implies that there are more than 3,000 specialized transportation providers in Minnesota. The vast majority of these are social service agencies and

housing providers. This confirms the common belief that the true size of the specialized transportation "system" is far larger than the formal network that is known to transportation funders and regulators.

Because the survey was intended to be broad and exploratory rather than focused and definitive, the findings generally fall short of providing clear answers to specific questions. However, they often provide considerable insight into the types of details that future surveys should address with respect to various issues. Given this, perhaps the more important results are conclusions about how the findings of this survey, and the insights that they generate, can be used to develop more focused and definitive surveys of this type in the future.

Introduction

Many agencies at all levels of government, and a much larger number of local organizations, are involved in providing transportation services to individuals who, because of disability, poverty, or other reasons, are unable to routinely arrange for their own transportation. The belief that this "system" is both wasteful of resources and somewhat unsuccessful in accomplishing its objectives seems to be as old as the activity itself [1]. As a partial remedy to this situation, studies in recent years have provided examples of actions by governments or individual providers that can serve as examples of possible improvements [2, 3].

While improvements by particular organizations are one aspect of increasing efficiency, discussions with providers and funders inevitably turn to a more subtle aspect of the problem. This is the notion that a substantial fraction of the potentially available resources are in the hands of small organizations focused on non-transportation missions, which do not have either the demand or the expertise to use these transportation resources efficiently [4, 5].

This is not so much a criticism of those organizations as of the lack of a more general structure to the provision of transportation services. Because there is not a well-developed "market" for these services, the argument goes, small agencies are often forced to acquire their own vehicles and train drivers. The result is objectionable in two ways: from a system standpoint, valuable resources are being underused; while the agencies themselves are forced to maintain a transportation infrastructure that in many cases draws substantial resources away from their primary mission.

At a time of simultaneously tightening budgets and increasing need as the population ages, it is hard to ignore the possibility that there may in fact be plenty of resources available if only they were better organized and managed. The problem is that that while anecdotes of vehicles driven "500 miles a year" come up frequently in conversation, it is hard to find any objective and comprehensive study that describes the available inventory, who controls it, and how it is being used.

Thus, we administered this survey to get a sense of some of these issues. The primary objective was to develop a basic understanding of the types of organizations that provide or use transportation services and their inventories, operations, and attitudes. A second, and equally important objective given the exploratory nature of the project was to also use the results to develop insights into how to improve future surveys of this type.

Our approach to the survey had two key characteristics. The first was to question both organizations that provide transportation and those that do not provide it but are actively involved in purchasing or arranging it on behalf of their clients with an eye to better understanding the relationships between resources and needs. The second was to be comprehensive; that is, to try to survey any organization that might be involved in either providing or arranging transportation. The existing literature, as well as more informal discussions, tended to focus on the traditional transportation community known to government funders and regulators. We wanted not only to reach these organizations, but also to find the small social service agencies, housing service providers, and communities of worship for whom transportation is just an adjunct to a different mission.

Because we would be surveying agencies without a transportation focus, we did not have much idea of what we would find, either in terms of how many there would be or of what kinds of answers they would give. This affected our methodology in two important ways. First, we did a one-page pre-survey to get a general idea of the number of organizations falling into the categories of provider, arranger, or neither, and we used this to better target the mailing list for the full survey. Second, the questions on the full survey were very general. While this made it hard to develop definitive answers to specific questions, it seemed more important to focus first on understanding the general "lay of the land." We, and others, can use this understanding to develop more targeted and effective surveys in the future.

This chapter has three parts. The first outlines the general methodology of the survey, discusses the pre-survey results and how they were used, and gives an overview of the questions on the full survey. The second part discusses the results of the survey, broken out by whether the organization provides or arranges transportation. The third part, and an important one given the somewhat experimental nature of this survey, is a discussion of lessons learned.

General Methodology and Pre-survey Results

The survey (including the pre-survey) was conducted throughout the state of Minnesota between November 2004 and April 2005, with data entry continuing into the summer.

Because of our desire to reach any organization in the state that was involved in transportation, we constructed a very large mailing list from a variety of different sources. These fell into four broad categories, each of which was addressed with lists from one or more sources:

- Known transportation providers (Department of Transportation, Department of Health)
- Human service and other charity-based organizations (from several lists, primarily United Way)
- School districts and related programs (Department of Education)
- Churches and other religious organizations (Council of Churches, Lutheran Social Services, and Jewish and Islamic umbrella organizations)

This list, after removing duplicates, contained more than 11,000 names, mostly from the human services and religious categories. Our expectation was that a large fraction of organizations on our list would not be involved in transportation, so to save some expense and increase the eventual full-survey response rate, we decided to do a preliminary screening with a one-page pre-survey. It also seemed that our objectives could be realized with a much smaller sample than

we had available, so to help keep the project manageable given our labor resources, we randomly divided this list roughly in half. The division was based on the number of letters in the organization name being odd or even; we flipped a coin and sent the pre-survey to the roughly 5,500 names on the "odds" list. The pre-survey consisted of three questions:

- Type of client (from a list)
- Organization mission (open question)
- Transportation role: provider, arranger (could choose both), or neither.

If the respondent indicated that the organization was not involved in transportation, then a sub-question asked for reasons (from a list).

We received about 1,500 responses to the pre-survey; about a 30% response rate. The number of responses may have been somewhat limited by the fact that the pre-survey went out during the holiday season, and perhaps because a printing snafu omitted the postage-paid from the return envelopes.

Pre-survey Results

The primary objective of the pre-survey was to use a large sample to develop a general understanding of how organizations of different types relate to transportation issues, and in particular how many organizations actually have the capability of providing transportation. Because we did not know in advance how organizations would naturally group into categories, and especially how the very large social service category would break down, we asked an open question about the organization mission. We used the answers to group the respondents into five broad categories:

- School districts (7.5% of total)
- Transit and paratransit agencies (4.5%)
- General social service (41%)
- Housing services/assisted living (30%)
- Churches and worship-based (17%)

We classified some social service agencies as transit if providing transportation was the primary purpose of the organization. The "general social service" category could perhaps be broken down further, although no obvious divisions presented themselves, aside from housing services, which made up a very large fraction of the total.

A significant finding from this pre-survey was that more than 65% of the respondents are involved in transportation either as providers or arrangers. Excluding churches, which primarily either arrange transportation or are not involved, about 45% of the remainder actually provide transportation. Given our initial list, of which around 7,000 were not churches, this implies that there are about 4,500 organizations in Minnesota that are involved in transportation for their clients, and more than 3,000 of these actually provide transportation.

Breaking the results down by organization type shows that these general findings hold across the board (See Table 1.1). More than 50% of churches, 60% of social service agencies, and 70% of agencies providing housing services are involved in providing or arranging transportation for their clients. This is especially remarkable in light of the fact that there was no pre-screening; we

did not restrict the mailing to large organizations or those that seemed likely to have transportation involvement. This provides striking confirmation of the widely held belief that there is a large transportation market, both of providers and users that is largely outside the "formal" government-regulated system.

	School	Transit	Social	Housing	Church
Provide	47%	70%	12%	20%	11%
Arrange	24%	6%	26%	25%	36%
Both	28%	24%	22%	28%	4%
Not involved	0%	0%	40%	27%	49%

Table 1.1 Transportation Involvement by Organization Type

Considering the fraction of respondents that fall into each organization type, the implication of Table 1.1 is that 75% of the organizations that provide transportation (the sum of "provide" and "both") are not schools or agencies that specialize in providing transit, that is, the organizations that are typically thought of as transportation providers and formally included in policy discussions.

We were concerned that our response rate was relatively low and that perhaps organizations with transportation concerns might have been more likely to respond to the pre-survey, thus skewing the above results. To increase our confidence in these findings, we followed up with a smaller mailing to a new group of 200 recipients, and we focused on attaining a much higher response rate. In this effort, we received a 50% response rate but with identical results. In particular, the first 30% to respond were no different from the next 20%. This led us to conclude that willingness-to-respond was probably not a significant source of bias for these results.

For those organizations that were not involved in transportation, we asked for reasons why (from a list with non-exclusive choices):

- Clients arrange own transportation (50%)
- Beyond scope of organization (36%)
- No money available (35%)
- Too expensive (24%)
- No vehicles available (24%)
- No demand (16%)
- Too difficult to coordinate (15%)

We also asked a question of all respondents about the characteristics of their organization's clients. The responses to this were enlightening in that almost everyone checked several boxes:

- Age 65 and older: 79%
- Age 18 and younger: 56%
- Physical disability: 73%
- Mental disability: 76%
- Low income: 68%
- Homeless: 24%
- Other: 32%

It should be noted that this is not a measure of the number of clients that fall into each category; we simply asked the respondents to check any categories that they regularly encounter. Thus, a school would serve primarily young people, perhaps only a few of whom may have disabilities or low income. Nonetheless, this indicates that transportation-disadvantaged clients tend to be disadvantaged in multiple ways, and organizations must have the capability to deal with this. This hints at support for the common provider complaint that funding targeted to very specific client characteristics can be hard to accommodate within normal operations; providers do not distinguish between their clients in this way.

Full Survey Methodology

After analysis of the pre-survey, we sent the full survey to those that identified themselves as a provider, arranger, or both; we excluded those that were not involved in transportation as the full survey did not ask any additional questions of this type. Providers and arrangers from the pre-survey provided a full survey mailing size of about 950. We received about 450 responses to the full survey, an acceptable rate of nearly 50%.

The full survey was divided into two main parts, one for transportation providers and the other for organizations that arrange transportation from others. After a few initial descriptive questions, respondents characterized their organizations as providers and/or arrangers and were directed to the appropriate part of the survey. Those who were both filled in both parts.

The provider questions were focused on understanding issues of vehicle resources and use, and attitudes to coordination. The user questions were focused on client use of transportation services, and again, attitudes to coordination. Many of the questions were open-ended because we did not have a clear idea of what categories would be appropriate; this allowed us to develop categories after seeing the answers that were given. This did, however, create a coding and analysis challenge. The provider questions fell into three broad categories.

- Vehicles and their use (e.g., number of vehicles, passengers per week, schedule and hours of actual use)
- Passengers (e.g., transportation barriers, common destinations)
- Resources and Coordination (e.g., resource adequacy, funding sources, attitude to collaboration, known barriers)

Many of these questions were based on an implicit idea of a social service agency with clients to whom it would sometimes provide transportation. However, because we subsequently took a more inclusive approach to sending out the survey, some of the questions may not have been appropriate, or appropriately phrased, for other types of transportation providers such as transit agencies and school districts.

Transportation arrangers were defined as agencies with clients for whom they play some role in arranging or paying for transportation. Specific examples that we gave included purchasing transportation from another organization, reimbursing clients for costs such as bus fare or mileage, renting vehicles for events, and using employees or volunteers who drive their own vehicles. The types of questions included:

- Nature of arranged transportation
- Passengers
- Resources and Coordination

With the exception of questions about vehicles, which only applied to providers, many of the questions were the same or very similar between the two parts. Because many organizations filled out both parts, this may have led to some confusion on the part of respondents, or to the two activities being mingled together in the responses, when we intended the questions to be addressing different issues.

Full Survey Results: Providers

This group includes all organizations that answered yes to the descriptor "We provide transportation…" Some of these organizations also purchase or arrange transportation from other agencies, but the answers given by those organizations did not differ meaningfully from those who were providers only.

There were 262 organizations in this category; more than 170 were either general social service agencies or housing providers. As noted earlier, the generic nature of the survey questions meant that they might not apply to certain situations, and indeed the response rate for any given question was usually considerably less than the full number of survey respondents. In the tables below, the results are restricted to those respondents that actually answered that particular question; the only exceptions are a few questions that were yes/no, and we had to take the absence of a positive response to mean "no." These are noted where they occur. In other cases we provide counts of the total number of respondents to that question; sometimes the number that didn't answer is interesting information in its own right.

Vehicles and Usage

This part of the survey explored several issues:

- Vehicle inventory
- Vehicle occupancy
- Scheduled hours and actual use
- Busiest times
- Trip distances
- Service area restrictions

Vehicle Inventory

To better visualize the distribution of vehicle inventories, we grouped the reported number of vehicles into five categories. Table 1.2 shows the number of organizations of each type that fell into various categories of vehicle inventory. This table is based on the total count of vehicles of all types for a given organization.

	1	2 to 5	6 to 10	11 to 20	> 20	Unknown
Church	5	3	4	1		2
Housing	29	22	6	2	4	17
School		4	1	11	4	1
Social	16	31	13	13	13	11
Transit	5	12	3	9	6	3

(Entries show number of organizations in each category)

Table 1.2 Total Number of Vehicles

One interesting point here is that the majority of providers own five vehicles or fewer; between them they have a substantial inventory. Another observation is that a considerable number of social service agencies own a large number of vehicles. Some of this could be agencies that own vehicles that are primarily used for other purposes or agencies that have a social service mission but a strong transportation specialty.

We asked organizations to list the number of vehicles that they owned or leased by the type of vehicle. Table 1.3 shows the average number of each type of vehicle by organization type. Here, any organization with any type of vehicle is counted in the denominator for all vehicle types; for example, the average number of vans owned by churches is calculated based on all churches that own any kind of vehicle, not just those that own vans. These averages also are based only on

organizations that own 20 or fewer vehicles; the small number with more than this skew the results and obscure the characteristics of the vast majority of small providers.

	Cars	Mini-vans	Vans	Buses	Total Responses
Church	3.0	0.3	0.8	0.5	13
Housing	1.0	0.8	0.8	0.5	59
School	0.8	1.8	1.1	9.4	16
Social	1.1	1.4	1.9	1.0	73
Transit	2.4	0.7	0.5	3.8	29

Table 1.3 Average Number of Vehicles by Vehicle Type

There were two unexpected ambiguities in the answers to this seemingly straightforward question. The first was that some answers led us to wonder if some agencies were counting staff's personal vehicles in their counts; although we had tried to make clear that these were not to be counted. The second problem we had not anticipated at all. This was that some agencies appeared to own large numbers (or small numbers) of vehicles whose primary purpose was not to transport passengers. This particularly included agencies specializing in delivering goods or services to clients' homes, but who perhaps sometimes took the clients somewhere else. This led to implausibly low ridership per vehicle in these cases; a misleading statistic since the vehicles presumably are in fact being heavily used.

Vehicle Occupancy

We asked agencies about the average number of passengers that they transport each week. Again, we grouped the answers into categories to better visualize the distribution of answers (See Table 1.4).

	<20	21 to 100	101 to 1000	>1000	Unknown
Church	10	2	1		2
Housing	42	20	9		9
School	1	1	7	9	3
Social	24	31	26	7	9
Transit	4	6	15	10	3

(Entries show number of organizations in each category)

Table 1.4 Total Passengers per Week

Perhaps the most noticeable point in this table is the large number of organizations providing housing services that own vehicles but provide relatively little passenger transport. The average auto owned by a family carries more than 20 "passengers" per week.

We used this information combined with the number of vehicles by agency to calculate the average number of passengers per week by vehicle (See Table 1.5). Again, we grouped the results into categories so as to maintain information about the distribution of outcomes.

	<3	3 to 10	10 to 50	50 to 100	>100	Unknown
Church	3	5	4			3
Housing	12	24	16	1	2	25
School	1		7	4	6	3
Social	11	19	31	14	3	19
Transit	3	6	8	3	13	5

(Entries show number of organizations in each category)

Table 1.5 Passengers per Week per Vehicle

Vehicles carrying fewer than three passengers per week, we have to assume, belong to organizations that primarily use them for other purposes. Still, very few organizations, especially outside of the school and transit categories, carry more than 50 passengers per week per vehicle, which is roughly one per hour assuming a five-day week. And given that most organizations carry at least some group trips (discussed later in this chapter) it appears that most vehicles do in fact sit idle much of the time. This doesn't mean that these vehicles could be made available for other purposes, but it does at least indicate the theoretical possibility.

We also grouped the counts by passengers per week per vehicle based on the number of vehicles owned by the agency rather than by the agency type (See Table 1.6).

Number of Vehicles	<3	4 to 10	11 to 50	51 to 100	>100	Unknown
1	7	18	20	4	3	4
2 to 5	11	21	24	7	9	6
6 to 10	5	6	5	4	2	6
11 to 20	2	7	11	4	9	4
> 20	8	4	9	4	2	2

(Entries show number of organizations in each category)

Table 1.6 Passengers per Week per Vehicle by Number of Vehicles

As expected, most of the organizations with low average vehicle occupancy have a small number of vehicles. However, some organizations with a small number of vehicles have a very high occupancy rate, indicating that small size need not necessarily be inconsistent with high output. Conversely, some agencies with many vehicles carry few passengers per vehicle; again, some of these may be cases where some or all vehicles are used for purposes other than transporting passengers. Of course, this also could be the case for some of the smaller low-output agencies.

Scheduled Hours and Actual Use

One of our key questions asked organizations about the hours that their vehicles were scheduled to be available for use, either running a pre-set route or available for spontaneous requests. We categorized the answers based on whether they represented full or limited hours on weekdays, evenings, and weekends (See Table 1.7).

	Limited weekday	Full weekday	Limited evening	Full evening	Limited weekend	Full weekend
Church	45%	18%	27%	0%	82%	0%
Housing	33%	67%	11%	26%	21%	38%
School	68%	32%	5%	0%	5%	5%
Social	32%	67%	14%	18%	20%	24%
Transit	15%	85%	12%	15%	18%	21%

Table 1.7 Operating Schedules

The numbers within each time category (weekday, evening, weekend) add up to 100% or less; if they add to less it, means that some organizations do no offer service during that time frame at all. For example, almost no schools offer evening or weekend service. In general, relatively few organizations offer evening or weekend service, especially in the key categories of housing, social service, and transit. Many vehicles seemingly do sit entirely unused for substantial periods of time. Presumably some of this has to do with lack of demand, yet anecdotally at least, there is demand (elsewhere) for evening and weekend service that cannot find supply to accommodate it.

Another critical question in this vein asked agencies how many hours their vehicles were actually in use in a given day. That is, a nursing home vehicle might be available for its residents to use 14 hours a day, but might only be used for one or two hours. This sort of situation is common in anecdotes, but we knew nothing about its prevalence in reality.

The notion of a vehicle being underused in this context is a function of the number of hours it is scheduled to be in service. Thus, we considered two categories of organizations: those that reported no evening service and those that reported full weekday and at least some evening service (See Table 1.8).

	Full daytime service only		Full daytime and any evening service	
	Average hours of use	Number of orgs	Average hours of use	Number of orgs
Housing	3.6	19	4.6	32
School	4.2	5	5.3	6
Social	5.4	27	6.2	43
Transit	7.2	13	8.2	21

Table 1.8 Hours of Vehicle Use Compared to Scheduled Hours

Even organizations providing housing, who might be expected to have the most limited demand for transportation and hence the lowest level of vehicle use, still report that their vehicles are in use nearly half the available hours on weekdays. Other types of organizations use their vehicles even more intensively. This indicates that focusing on periods when vehicles are not used at all, such as evenings and weekends, might be a more promising tactic for increasing transportation supply, if demand exists during these times. During the day, while vehicles are not always in use, there do not appear in most cases to be large periods of time when the vehicles might be available for other purposes, even in theory.

It is notable, however, that those organizations that offer evening service use their vehicles only about an hour more per day on average. This may indicate that there is not in fact much demand for services during this time.

There also may be a significant number of exceptions to the general rule that vehicles are well used. About a quarter of the agencies offering full weekday service reported that they actually used their vehicles less than three hours per day on average.

We also examined the subset of organizations that offer full-day and some evening service and that own only one vehicle. The premise was that small organizations with one vehicle might have lower or less consistent demand and hence less efficient usage. Only housing had a usable number of organizations that fell into this category, and for them, the average of 3.9 hours was slightly lower than the full sample, but not strikingly lower. Again, this indicates that small organizations are not necessarily less efficient than larger ones.

Busiest Times

We asked respondents to describe their busiest time of the day, of the week, and of the year. These were open-ended questions; we grouped the answers into categories based on natural grouping in the answers (See Tables 1.9, 1.10, and 1.11). In all of these tables, percentages for a

given organization type can add up to more than 100%. In some cases, an organization's answers overlapped categories, and in other cases, they claimed to be equally busy at all times.

	Commute	Other Daytime	Evening
Church	0%	100%	8%
Housing	10%	91%	19%
School	81%	24%	5%
Social	51%	52%	15%
Transit	34%	71%	0%

Table 1.9 Busiest Time of Day

There are a couple of interesting results in Table 1.9. The first is that housing organizations are rarely busy during the commute hours; this raises the possibility that these resources could complement the needs of low-income workers. Another striking point is that most transit agencies report that they are most busy outside of commuting hours. This could be because many of our transit agencies are paratransit or social service agencies with a transportation specialty, rather than traditional fixed-route transit, which tends to be far more heavily used for commuting in most places. Again, this could suggest some possible complementarities.

	Weekday	Weekend
Church	21%	86%
Housing	94%	12%
School	100%	0%
Social	95%	10%
Transit	96%	4%

Table 1.10 Busiest Time of Week

The interesting point in Table 1.10 is that with the obvious exception of churches, very few organizations report that they are busy on weekends. People who are self-sufficient in transportation tend to make about as many trips on weekends as on weekdays, but the same does not seem to be true of transportation-dependent people. This raises a question of whether the services being offered are well matched to the needs or desires of the target population. Obviously the expense of offering weekend service plays a role in this too, but there does seem to be a question that is worth considering in terms perhaps of how funding is allocated.

	Winter	Spring	Summer	Fall
Church	78%	78%	78%	78%
Housing	61%	57%	83%	56%
School	80%	100%	0%	85%
Social	90%	69%	64%	67%
Transit	82%	61%	14%	50%

Table 1.11 Busiest Time of Year

Again here in Table 1.11, there appear to be possible complementarities in that the busiest seasons for housing organizations are the opposite of those for social service and transit agencies. It is not clear why so few transit agencies report summer as a busy time.

Trip Distances

We asked providers about the average length of a one-way trip (See Table 1.12). Because we thought that some organizations might not know an exact average, we asked for an average or a range of trip lengths. Unfortunately, this led to ambiguity in the answers, since if someone wrote "15 miles," we could not know if this was meant to signify an average or the upper bound of a range. Another problem was that for organizations that run a route rather than transporting specific trips, this question had little meaning. Some schools, for example, simply wrote the average length of the entire route, and we wondered if some social service agencies did something similar, given the large number that reported an average trip length in excess of 20 miles.

	<5 miles	5 to 10 miles	10 to 20 miles	>20 miles	Unknown
Church	12	2		1	
Housing	43	18	10	6	3
School	5	1	2	10	3
Social	26	25	20	19	7
Transit	12	6	5	9	6

(Entries show number of organizations in each category)

Table 1.12 Average Trip Length

Generally the average trip length is fairly short, as it is for non-transit-dependent people. However, a surprisingly large number of agencies, especially in the social service and housing categories, report average trip lengths in excess of 10 or even 20 miles. Again, we are not sure if this reflects a real phenomenon or simply misunderstanding of the question.

Service Area Restrictions

One problem frequently cited by providers is that legal or administrative restrictions in the areas to which they can provide service prevent them from serving certain customers or create a need for time-consuming coordination to transfer the passenger to another provider. We asked a question to determine the prevalence of this situation (See Table 1.13).

	Percent with service area restrictions
Church	60%
Housing	71%
School	90%
Social	77%
Transit	82%

Table 1.13 Presence of Service Area Restrictions

A substantial majority of all provider types indicate that their service area is restricted. Unfortunately, we did not probe this theme by asking if the restrictions were legally- or self-imposed, or merely guidelines, or about the extent to which the restrictions actually interfere with operations.

Client Characteristics

This explored three aspects of the clients of transportation providers:

- Characteristics and barriers
- Destinations
- Group trips

Characteristics and Barriers

We asked providers about the specific transportation challenges faced by their passengers (See Table 1.14).

	Elderly	Youth	Mental disabilities	Low Income	Immigrants Refugees	Wheelchair use	Other physical disabilities
Church	100%	53%	40%	47%	27%	33%	40%
Housing	76%	15%	69%	58%	15%	61%	58%
School	0%	95%	67%	38%	10%	33%	38%
Social	75%	36%	80%	56%	25%	53%	62%
Transit	95%	76%	92%	74%	55%	74%	84%

Table 1.14 Passenger Characteristics

Again, with a few obvious exceptions (schools don't carry many elderly, nursing homes don't carry many youth), most types of transportation challenges appear at least occasionally to a considerable fraction of providers.

Destinations

We asked providers to rank the most common destinations for their clients. Here we provided seven choices, which the respondent ranked in order. Thus, a lower number indicates a higher rank, or a more common destination (See Table 1.15).

	To and from organization	Work	School	Medical	Shopping	Social & recreational	Personal & other
Church	1.4	6.1	5.3	3.6	5.4	3.1	3.0
Housing	3.8	5.6	5.7	2.0	3.4	2.9	4.6
Social	2.5	4.1	5.3	3.4	4.1	3.7	4.9
Transit	6.7	3.3	3.7	2.2	3.6	4.2	4.4

(Entries show average rank for that destination, given the organization type)

Table 1.15 Most Common Destinations

Schools are not shown in this table, because they don't serve most of these destination types; they all ranked "school" or "to organization" first, and many did not even rank the others.

There does not appear to be a clear hierarchy of destinations. In most cases, there are certain destinations that clearly are at the top or bottom for a given organization type, for obvious reasons, and most of the other destinations are about equally ranked. Medical destinations are ranked above average by all organization types, perhaps because there often is specific money available to reimburse these trips. However, personal activities also seem to be well served.

Group Trips

To better understand how vehicles were being used, we asked providers about the typical number of passengers on vehicle trips (See Table 1.16). Specifically, we asked them to indicate the percentage of their vehicle trips that served large groups (five or more people) and individuals or small groups (four or fewer people).

	Four or fewer people	Five or more people
Church	42.5%	57.5%
Housing	70.5%	29.5%
School	14.1%	86.0%
Social	55.2%	44.8%
Transit	64.6%	35.4%

Table 1.16 Percent of Trips Serving Groups

There appear to be a surprising number of group trips for all organization types. Because we expected this number to be small, we did not ask follow-on questions about the nature and frequency of the group trips. This would be an interesting area for further exploration.

Resources and Collaboration

This part of the survey queried providers about various aspects of their available transportation resources and their interactions with other agencies:

- Resource adequacy
- Funding sources and types
- Existing collaboration
- Clients arranging own transportation
- Collaboration interest and barriers

Resource Adequacy

We asked providers an attitudinal question about the adequacy of their available resources to meet demand (See Table 1.17). The possibility of using excess capacity to meet other demands hinges in part on whether the agency perceives itself to have excess capacity.

	Not enough vehicles	Just enough vehicles	More than enough vehicles	Enough vehicles, not enough money
Church	8%	58%	25%	8%
Housing	25%	39%	22%	14%
School	19%	67%	5%	10%
Social	27%	45%	9%	21%
Transit	18%	41%	12%	32%

Table 1.17 Resource Adequacy

Most organizations believe that they have just enough vehicles. Only in the church and housing categories does a significant fraction believe that they have more than enough. The more transportation-focused types are far more likely to believe that their resources are inadequate, especially with regard to funding.

We analyzed this question further by breaking the results down the number of agency vehicles rather than by the organization type (See Table 1.18). The idea here was that smaller agencies might have less flexibility or sophistication in terms of managing their vehicle fleet, and thus might be more likely to have excess capacity.

Number of vehicles	Not enough vehicles	Just enough vehicles	More than enough vehicles	Enough vehicles, not enough money
1	16%	47%	20%	18%
2 to 5	18%	43%	16%	24%
6 to 10	18%	50%	23%	9%
11 to 20	18%	68%	3%	12%
> 20	41%	22%	7%	33%

Table 1.18 Resource Adequacy by Number of Vehicles

Three points stand out in this table. First, assessing oneself as having "not enough vehicles" was strongly associated with agencies having more than 20 vehicles; perhaps a counterintuitive result. Second, agencies with more vehicles were much less likely to believe themselves to have "more than enough." Finally, in comparing this chart to the breakdown by organization type, attitudes toward money seem to be more a function of the organization type than of the number of vehicles. In terms of our original hypothesis, the smallest agencies did not appear more likely to consider themselves to have excess capacity.

We also analyzed the results by passengers per vehicle, our measure of operational efficiency (See Table 1.19). Again, the hypothesis was that those agencies with light passenger loads might be more likely to perceive themselves as having excess capacity.

Passengers per vehicle	Not enough vehicles	Just enough vehicles	More than enough vehicles	Enough vehicles, not enough money
<3	15%	42%	23%	23%
3 to 10	20%	41%	18%	22%
10 to 50	22%	44%	13%	21%
50 to 100	24%	52%	10%	19%
>100	22%	61%	4%	13%

Table 1.19 Resource Adequacy by Passengers per Vehicle

Here, finally, the expected trend was observed: the probability that an agency would consider itself to have "more than enough" vehicles was strongly and inversely related to the passenger load per vehicle. A similar relationship also held in terms of attitudes toward funding. Those with the lightest loads were more likely to consider their funding to be inadequate. It is not obvious how to interpret this.

Funding Sources and Types

We asked providers about the sources of the funding that they used to pay for their operations (See Table 1.20). An interesting point in this regard is that only 12 (of roughly 90) housing organizations answered this question.

	Federal	State	County	City	Private	Medical	Other	Count
Housing	33%	42%	42%	0%	33%	8%	33%	12
School	25%	100%	6%	0%	0%	0%	0%	16
Social	42%	75%	69%	5%	31%	7%	18%	55
Transit	77%	83%	73%	23%	40%	43%	27%	30

Table 1.20 Funding Sources

Generally, it appears that many or most agencies use a mix of funding sources, especially in the transit category. This could be healthy in that organizations don't become overly dependent on any one source. However, it also supports the common provider complaints that they have to spend excessive amounts of time applying for large numbers of small grants from a multitude of sources, and that all of these have their own distinct reporting and regulatory requirements.

We asked about the nature of the funding received (See Table 1.21). A relatively large fraction of agencies are reimbursed for specific rides, most likely from medical sources. A substantial number, especially of housing and transit, receive vehicles and materials, while cash grants seem surprisingly uncommon. We have heard providers complain in the past that funders are eager to provide vehicles but reluctant to provide money to operate them, and these findings support that to some degree.

	Cash grants	Vehicles and materials	Ride reimbursement	Other	Count
Housing	17%	42%	58%	17%	12
School	20%	0%	20%	60%	15
Social	31%	22%	63%	30%	54
Transit	53%	43%	73%	20%	30

Table 1.21 Funding Types

We also asked about fees that organizations charge their riders (See Table 1.22). Except for transit agencies, most charge nothing; the transportation is being provided as part of another service.

	Mandatory Fee	Specified Donation	General Donation	Nothing	Count
Church	7%	0%	7%	93%	15
Housing	19%	1%	3%	83%	77
School	0%	0%	0%	100%	19
Social	25%	3%	7%	73%	95
Transit	78%	14%	11%	14%	36

Table 1.22 Fees Charged to Riders

Percentages in Table 1.22 can add to more than 100% because some agencies may have different types of trips or passengers, and thus might charge a fee in some cases and not in others.

Existing Collaboration

We asked agencies about whether they provide rides to other customers outside of their primary clients (See Table 1.23). This question didn't necessarily make sense in the context of transit agencies, where anyone that gets a ride is, by definition, a client. However, for the other organization types, where transportation is secondary to some other organizational purpose, the notion of an outside customer has more meaning.

	Percent providing transportation for other organizations
Church	33%
Housing	21%
School	29%
Social	29%
Transit	71%

Table 1.23 Organizations Providing Transportation to Others

In every case except transit, more than two-thirds of providers serve only their own specific clientele. For those that do serve others, the majority cited a specific organization or situation for which they provide trips. Although we did not ask directly, in most cases these appeared to be informal, voluntary relationships. A more in-depth study of how these relationships arose and are maintained might provide some insight.

A follow-up question asked about the frequency of providing transportation to outside customers (See Table 1.24). Even given the small number of organizations that do this, relatively few of these answered this question.

	Less than once per month	Less than once per week	More than once per week	Daily	Count
Church	25%	25%	25%	25%	4
Housing	64%	18%	9%	9%	11
School	50%	50%	0%	0%	4
Social	35%	25%	5%	35%	20
Transit	17%	6%	33%	44%	18

Table 1.24 Frequency of Providing Transportation to Others

The relatively high frequency of provision outside the organization among social service providers is interesting, in that these organizations are not more likely to provide outside transportation in general. Some of this may be social service organizations that have a specific transportation component.

The converse question asked providers about the frequency with which they refer their own clients to other transportation providers (See Table 1.25). This appears to be quite common among housing and social service organizations.

	Less than once per month	Less than once per week	More than once per week	Daily	Count
Church	50%	17%	33%	0%	6
Housing	20%	37%	28%	15%	46
School	100%	0%	0%	0%	3
Social	40%	22%	18%	21%	68
Transit	38%	31%	15%	15%	26

Table 1.25 Referring Clients to Other Providers

In the majority of cases, outside referrals were to specialty transportation providers, either fixed route transit, or more commonly, wheelchair-equipped providers. Specialized medical transport services also were frequently cited. This indicates that many providers may be equipped only to serve a limited range of trips and degree of disability.

An interesting footnote to this question is that our initial survey categorization was between providers and "arrangers," whom we tried to define to include anyone who arranges or purchases transportation for their clients with other agencies. But in this question, more than 50% of those who identified themselves initially as providers but not arrangers answered yes to this question of whether they refer their clients to other agencies. Conversely, 20% of those that said they did both in the initial question then said they didn't arrange at this point in the survey. In other words, a minority of the survey provider respondents answered these two questions consistently. We are not sure of the reasons for this, except that perhaps respondents detected a difference in the wording of the two questions. The initial question implied more of an active role in arranging or paying for transportation, while the later question only asked if they "refer" their clients to other transportation providers. These referrals may be fairly passive in many cases.

<u>Clients Arranging Own Transportation</u>

We also asked providers if their clients also arrange transportation on their own, without the organization's involvement (See Table 1.26).

	Percent whose clients use other transportation without referral
Church	20%
Housing	39%
School	14%
Social	44%
Transit	11%

Table 1.26 Clients' Own Transportation Activities

The low numbers here may just indicate that many organizations don't know or take any role in what their clients do outside of their relationship with the agency. Unfortunately, we did not offer "don't know" as an option.

Collaboration Interest and Barriers

We asked providers their attitudes about "improving your transportation services through collaboration with other organizations" (See Table 1.27). A follow-up question asked if they were aware of restrictions that would hinder or prevent such collaboration.

	Not interested	Somewhat interested	Very interested	Aware of restrictions	Count
Church	50%	33%	17%	42%	12
Housing	43%	38%	12%	33%	69
School	57%	24%	19%	67%	21
Social	22%	41%	36%	47%	85
Transit	15%	35%	41%	24%	34

Table 1.27 Interest in Collaboration

An important ambiguity in this question was that we did not specify that we intended that collaboration be interpreted as sharing their vehicles and drivers with other organizations. The

comments from many respondents indicate they might have interpreted collaboration to mean getting more rides from others, rather than giving more rides to others. Also, those that both arrange and provide transportation were much more interested in collaboration, by a difference of 42% to 19%, compared to those that only provide, further supporting this interpretation. We should have asked the two questions separately.

There was no particular pattern in terms of awareness of restrictions being related to interest in collaboration. That is, people seemed to separate their theoretical interest in collaboration from their practical feelings about its implementation; those who were very interested seemed as aware of restrictions as those that weren't.

The cited restrictions were interesting. In a number of cases, they reflected organization-specific restrictions based on special client needs or confidentiality issues. However, many of the cited barriers had to do with real or perceived administrative or procedural restrictions, which are in principle open to reform:

- Providing transportation services to those outside our agency makes us a transportation company requiring special transportation service (STS) certification
- Rules and regulations that limit use of vehicles by other groups (i.e., driver requirements, insurance coverage)
- Mn/DOT grant requires vehicle be used for senior and transportation of seniors with disabilities
- Motor carrier regulations, liability insurance
- State funding of public transit limits service area (destinations)
- Our liability insurance. We are covered only for our clients. Other providers have a wide range of coverage
- Our buses are licensed with tax-exempt plates, and that restricts us to school-related transportation only
- Funding restrictions and amount of funding available
- Motor Carrier Regulations that will increase our costs, insurance concerns
- County buses don't cross lines, and we are on the edge of the county
- Regulations that prohibit public transit for working with schools or private transit
- Licensing—insurance coverage limits us to transport only our residents using our vehicles to be covered
- State law prohibits non-school bus for route pick up. We tried!
- Certain laws prevent us from using our buses to collaborate with schools
- X (city) goes only from their border—we are X… zip code but in the city of Y…
- Funding restrictions
- Our mission and insurance coverage
- Service limits to city limits
- This becomes an insurance issue, and much higher rates are charged if we get into a "livery" category
- Statutes limiting who we can transport

Many of these can be grouped into three broad categories: insurance restrictions, legal constraints, and the desire to avoid being subjected to new regulatory structures. These are the same kinds of issues that are always raised when coordination is discussed; this survey indicates

that these problems are indeed widespread and not just the defense mechanisms of organizations trying to avoid change, as funders sometimes implicitly assert. In principle, these are all things that the governments that fund these systems could influence at least to a degree.

Regulations are created by governments, and while they may be promulgated by many different sources, this is not necessarily an insuperable barrier to clarification and simplification. Similarly, operating rules, such as those often cited by transit agencies and schools, are created by the governments that operate these systems. The reason for the rule needs to be weighed against the possible benefits of bending it. Again, this may be a matter of government agencies communicating their respective objectives with each other, rather than putting the burden on the transportation provider to do this. Finally, while insurance is generally privately provided and purchased, there is no reason in principle why the government couldn't be involved either in negotiating rates or conditions, or subsidizing higher insurance rates in cases where an expanded operation could yield substantial public benefits.

Full Survey: Arrangers

This group includes all organizations that answered yes to the descriptor "We purchase or arrange transportation…" Some of these also provide transportation themselves, but the answers given by those organizations did not differ meaningfully from those who did not provide transportation.

There were 264 organizations in this category; more than 200 were either general social service agencies or housing providers. As in the provider section, the response rate for any given question was usually considerably less than the full number of survey respondents. In the tables below, the results are restricted to those respondents that actually answered that particular question; the only exceptions are a few questions that were yes/no, and we had to take the absence of a positive response to mean "no."

Arranged Transportation
This part of the survey explored the nature of the transportation that is arranged with external providers:

- Types of arranged transportation
- Types of providers used
- Trips per week and costs
- Busiest times
- Service area restrictions

Types of Arranged Transportation

Organizations that purchase or arrange transportation for their clients use a variety of methods (See Table 1.28). No one tactic is particularly widespread, nor is any method rare. This could reflect differing transportation needs across organizations, budget constraints, or opportunities.

	Purchase transportation directly	Reimburse expenses	Use own drivers with other vehicles	Short term rentals	Employee or volunteer drivers and vehicles	Assist with public transit use
Church	31%	27%	27%	31%	58%	31%
Housing	32%	9%	23%	8%	44%	41%
School	81%	25%	13%	13%	13%	0%
Social	53%	27%	25%	11%	49%	49%
Transit	33%	17%	8%	8%	50%	50%

Table 1.28 Types of Arranged Transportation

Types of Providers Used

A question about the types of providers that organizations use met with similar results (See Table 1.29). No particular type of provider is very widely used.

	Medical transport	Senior or ADA services	Church	Social service agency	Public transit	Taxi
Church	12%	42%	23%	15%	19%	31%
Housing	38%	30%	6%	11%	14%	19%
School	0%	0%	0%	0%	6%	6%
Social	32%	34%	3%	14%	36%	22%
Transit	25%	17%	8%	17%	8%	17%

Table 1.29 Types of Providers Used

Trips Per Week and Cost

We asked organizations about the average number of trips that they purchase or arrange each month (See Table 1.30). We also asked about the number of different passengers, to get at the question of whether they are many trips for a few people, or a few trips for many different people. However, we did not make sufficiently clear what we meant, so the answers tended to just be the same as for the total number of trips.

	<20	20 to 100	100 to 1000	>1000	Unknown
Church	17	1	2		6
Housing	68	8	2		10
School	1	3	5	5	2
Social	59	26	7	1	21
Transit	2	3	2	3	2

(Entries show number of organizations in each category)

Table 1.30 Average Trips Arranged per Month

We also asked about the total monthly expense for arranged trips (See Table 1.31). We group them into categories for ease of display. Comparison of the "unknown" category between these two tables shows that agencies are much more likely to know the number of trips they arrange than they are to know how much these trips are costing them.

	< $100	$100 to $1000	$1000 to $10000	>$10000	Unknown
Church	9	5	1		11
Housing	28	13	3		44
School		1	3	9	3
Social	28	24	14	5	43
Transit	1	1	2	1	7

(Entries show number of organizations in each category)

Table 1.31 Average Total Cost per Month for Arranged Trips

From these two questions, we calculated the average cost of trips that organizations arrange on behalf of their clients (See Tables 1.32 and 1.33). It is important to note here that many of the arranged trips involve little or no monetary outlay, for example, using volunteer drivers and vehicles or referring to public transit.

	Average trip cost	Number of respondents
Church	$3.74	10
Housing	$8.09	20
School	$15.69	12
Social	$14.84	49
Transit	$11.67	4

Table 1.32 Average Cost of Arranged Trips

	<$5	$5 to $15	$15 to $25	$25 to $50	> $50	Unknown
Church	8	2				16
Housing	10	7	2	1		68
School	3	5	3		1	4
Social	23	17	4	1	4	65
Transit	1	1	2			8

(Entries show number of organizations in each category)

Table 1.33 Cost per Trip by Category

This information on cost per trip seemed less useful the more we thought about it. As just noted, we did not ask respondents to distinguish between trips that were done for "free" and those for which they actually paid money. This immediately makes any calculation of averages very suspect. An equally important problem is that we did not seek information on the characteristics of the trips that were purchased. It could be that the purchased trips are precisely the most difficult ones, which organizations were not capable of providing on their own (since many arrangers are also providers). In other cases the most expensive trips might be paid for by someone else, such as medical sources. So we present these results primarily to encourage ideas on how this question might be more effectively probed in future surveys.

Busiest Times

As with the provider section of the survey, we asked arrangers about their busiest times for transportation needs (See Tables 1.34, 1.35, 1.36). Part of our thought with this was that we could identify times when transportation needs were high (in this group) and unused resources were available (in the provider group). However, because we asked "when is your busiest time" as opposed to "when do you have unmet needs," or, "are your clients able to travel at the times they want," the answers were not very enlightening in this regard. The busiest times are, almost by definition, those times when transportation is being provided by someone; people know that this is when they should seek rides.

	Commute	Other daytime	Evening
Church	0%	86%	14%
Housing	15%	83%	5%
School	69%	31%	0%
Social	31%	67%	5%
Transit	44%	56%	0%

Table 1.34 Busiest Time of Day

	Weekday	Weekend
Church	42%	74%
Housing	100%	8%
School	100%	8%
Social	98%	14%
Transit	100%	0%

Table 1.35 Busiest Time of Week

	Winter	Spring	Summer	Fall
Church	91%	73%	27%	64%
Housing	83%	64%	62%	55%
School	91%	91%	9%	91%
Social	80%	64%	66%	80%
Transit	88%	75%	25%	75%

Table 1.36 Busiest Time of Year

Generally, these tables are not substantially different from those for providers. Evening and weekend trips are even less common for arrangers, which may reflect the difficulty of arranging transportation at these times of day.

Service Area Restrictions

We asked arrangers if there were any geographic restrictions on where they would arrange trips, or a limit on what they would pay (See Table 1.37).

	Percent with service area restrictions
Church	42%
Housing	43%
School	50%
Social	46%
Transit	83%

Table 1.37 Presence of Service Area Restrictions

It is interesting that, with the exception of transit, all of the numbers are far lower here than they were for providers. Organizations arranging transportation, who are not as bound by legally- or administratively-defined service areas, are more open about the types of trips that they will consider funding.

Client Characteristics

We asked about characteristics of the clients for whom trips are arranged:

- Characteristics and barriers
- Destinations
- Group trips

Characteristics and Barriers

At the beginning of the survey, all respondents were asked about the characteristics of their organization's clients. Then later in the survey, providers and arrangers separately were asked about the barriers faced by those clients with whom they have a transportation relationship. For providers, the two responses were quite similar. For arrangers, they differed somewhat (See Tables 1.38 and 1.39).

	Elderly	Youth	Physical disabilities	Immigrants Refugees	Mental disabilities	Low income
Church	96%	81%	88%	35%	69%	77%
Housing	90%	16%	83%	14%	68%	70%
School	0%	100%	69%	13%	63%	31%
Social	84%	47%	80%	32%	75%	77%
Transit	50%	58%	67%	50%	67%	58%

Table 1.38 Characteristics of Organization Clients

	Elderly	Youth	Wheelchair use	Other physical disabilities	Mental disabilities	Low income
Church	92%	31%	38%	46%	23%	42%
Housing	82%	8%	69%	69%	51%	64%
School	6%	75%	19%	31%	25%	19%
Social	74%	22%	52%	59%	58%	64%
Transit	58%	50%	58%	67%	75%	75%

Table 1.39 Transportation Barriers

Although the categories are not exactly the same, it appears that efforts to arrange or purchase transportation for clients might focus on those with physical disabilities, while those with other barriers are less likely to be served in this way. This could reflect a couple of possible explanations. One is that many arrangers are also providers, and they may seek outside providers for those trips that they are not equipped to serve themselves, i.e., those requiring wheelchair or other disability accommodation. Conversely, the lower likelihood of arranging transportation for other groups may in some cases reflect that those groups are better able to arrange their own transportation and thus do not have this kind of relationship with the organization, e.g., youth and low income.

Destinations

As with providers, we asked arrangers about the most common destinations for which they arrange or purchase trips for their clients (See Table 1.40). Again here, the numbers represent average rankings, thus a lower number represents a more common destination.

	To and from organization	Work	School	Medical	Shopping	Social & recreational	Personal & other
Church	2.2	6.0	5.3	2.0	4.3	4.2	4.0
Housing	4.7	4.8	5.7	1.7	3.1	4.1	4.0
Social	3.8	4.9	5.2	1.9	3.7	3.9	4.6
Transit	5.5	3.5	4.5	2.0	3.7	3.7	5.2

(Entries show average rank for that destination, given the organization type)

Table 1.40 Most Common Destinations

As with providers, medical trips dominate, perhaps because there often is outside funding available to pay for these. Other destinations are also well represented though.

Group Trips

We asked arrangers about the typical number of passengers on the trips that they purchase or arrange (See Table 1.41).

	Four or fewer people	Five or more people
Church	59%	41%
Housing	90%	10%
School	21%	79%
Social	80%	20%
Transit	84%	16%

Table 1.41 Percent of Trips Serving Groups

We were surprised to see that in every type, arranged trips tended to serve smaller groups than did trips provided by the organization itself (See Table 1.16). We had expected that organizations might be more likely to use outside providers to serve large group trips that they couldn't handle with their own vehicles. A couple of possible explanations come to mind. One is that organizations with frequent group trips may come to feel that it is worth buying their own vehicle to serve them, and thus are not in this category at all. Another possibility is that large vehicles are difficult and costly to arrange and so these types of trips just aren't served as often. In other words, we cannot know if the discrepancy is a benign difference in needs or a real problem with the system.

Resources and Collaboration

Finally, we asked transportation arrangers about the resources they use to support transportation and their relationships with other organizations.

- Resource adequacy
- Funding sources
- Clients arranging own transportation
- Attitudes to collaboration, known barriers

Resource Adequacy

We asked arrangers about the adequacy of their transportation resources. The options that we gave differed for those for providers, representing the different nature of the resources used here (See Table 1.42).

	Adequate	Not enough money	Not enough staff	Not enough volunteers	Not enough drivers	Not enough collaborative relationships
Church	56%	20%	4%	40%	0%	8%
Housing	45%	38%	26%	34%	21%	9%
School	57%	43%	14%	7%	14%	0%
Social	38%	48%	26%	30%	10%	12%
Transit	73%	36%	18%	36%	9%	9%

Table 1.42 Resource Adequacy

For all organization types, a substantial fraction felt that their resources were inadequate, and the nature of this problem was similar across types.

Funding Sources

As with providers, we asked arrangers about the sources of the funding that they use for transportation (See Table 1.43). And, as with providers, relatively few answered the question.

	Federal	State	County	City	Private	Medical	Count
Housing	21%	43%	43%	0%	18%	18%	28
School	25%	92%	17%	8%	17%	8%	12
Social	42%	60%	48%	6%	31%	24%	67
Transit	56%	78%	78%	11%	44%	44%	9

Table 1.43 Funding Sources

Generally, the answers do no differ dramatically from those given by providers.

Clients Arranging Own Transportation

We asked arrangers about the types of transportation that their clients used on their own (See Table 1.44).

	Other agencies	Public transit	Taxi	Family	Count
Church	53%	63%	26%	68%	19
Housing	48%	54%	41%	89%	63
School	0%	30%	10%	90%	10
Social	48%	71%	40%	84%	97
Transit	36%	45%	45%	73%	11

Table 1.44 Clients Arranging Own Transportation

For the arranger organizations, about 80% have clients that arrange transportation on their own, as opposed to the 10–40% observed among providers. This may simply reflect that the lack of transportation provision within the agency forces clients to seek other alternatives more actively.

Attitudes to Collaboration, Known Barriers

Finally, we asked arrangers about their attitudes toward additional collaboration and their knowledge of barriers that would make this difficult (See Table 1.45).

	Not interested	Somewhat interested	Very interested	Aware of restriction	Count
Church	29%	63%	8%	0%	24
Housing	18%	53%	30%	22%	80
School	40%	47%	13%	25%	15
Social	12%	39%	49%	34%	106
Transit	36%	18%	45%	58%	11

Table 1.45 Attitudes Toward Collaboration/Knowledge of Barriers

Arrangers of transportation are somewhat more interested in collaboration than are providers. They may be more likely to see themselves as the beneficiaries of any such arrangements. This may also just reflect the fact that providers to some extent have their own resources and see less to gain from working with others, while arrangers need others to provide transportation for them and would benefit from having this done more cheaply or efficiently.

Lessons

Our objective in this survey was not really to develop definitive answers to specific questions about the specialized transit community. Because we did not know much about the types of organizations that we were likely to encounter, the types of models that they would operate under, or the relative frequencies of the various activities and attitudes in the field, it seemed premature to try to focus on specific knowledge until we had a better sense of the "lay of the land."

Thus, our primary objective was to develop this general description of the field. With a better knowledge of the range of activities being pursued, a sense of what issues and activities are common enough to justify further study, and a clearer idea of the complexities inherent in how different types of organizations approach the transportation problem, we could approach more detailed surveys with much more confidence. Our secondary objective, deriving from this, was to learn about how to conduct future surveys of this type.

Our primary lesson was that future surveys should be more specialized to different types of organizations. School districts, for example, operate under a fundamentally different model than do nursing homes, and so asking them all the same questions is not effective at exploring the subtleties of the different models. While this seems somewhat obvious in retrospect, it was not necessarily so going in. For one thing, we didn't know what the appropriate categories would be; this was something that we wanted to let the data tell us rather than imposing on it. Second, asking everyone the same questions and then observing where differences or ambiguities arise in the answers actually has helped us to understand more about how the operational models differ from each other. If we had assumed these differences from the beginning, we could not have known if they were real or simply a reflection of our own preconceptions.

One example of this approach would be surveys specialized to the type of organization, for example, school, social service, etc. This also could address whether the organization has a major focus on transportation. Many of the questions in this survey were based on an implicit idea of a social service agency with clients to whom it would sometimes provide transportation. Because of this, some of the questions may not have been appropriate, or appropriately phrased, for other types of transportation providers such as transit agencies and school districts, or even for social service agencies with a transportation specialty. For these organizations, their clients *are* their transportation customers; questions aimed at understanding which clients receive transportation services are meaningless in this context.

It also would be useful to have separate surveys for providers and arrangers of transportation, with clearer criteria for distinguishing between the two. There is really a continuum of both of these activities, as a function of the frequency with which they are done; there needs to be an explicit threshold for membership in each category. Having separate surveys would make it feasible to go into more depth in each one. More importantly, it would add clarity for those organizations that do both, in terms of keeping the different activities separate when they answer questions. Because we asked many of the same questions in both parts of our survey, we were not always completely confident that respondents were not mixing the two activities together in their answers.

We also learned a number of smaller lessons about how to organize future surveys in a general sense.

We wished that we had asked about the organization size, in terms of number of employees, volunteers, clients, parishioners, and so on. Again, this question would be easier to define in the context of a survey that is geared to a specific type of organization. However, it also might be another dimension around which surveys could be specialized.

Similarly, the geographical setting of the organization (urban, suburban, small city, etc.) would have been good to know. Again, this could be a dimension along which to organize surveys or specific questions within them.

We asked a fair number of yes/no questions. In future surveys, we would avoid these. One point is simply that there are other relevant possibilities, such as "don't know" or "don't want to say." Another, more significant issue, is again that there is a continuum of behaviors and attitudes. It would be more useful to have a sense of frequency or perceived importance, rather than simply whether something is done.

Pre-survey Lessons

In our survey, the primary purpose of the pre-survey was simply to reduce our sample size. We had found ourselves with a very large database of more than 11,000 organizations. We expected that a large fraction of these would have no involvement with transportation, and we did not want to waste the expense of printing and mailing a full 20-page survey if most of the recipients would have no reason to respond. So, we used the one-page pre-survey as a way of filtering out organizations with no transportation interests.

However, in doing this, we encountered a couple of important accidental benefits that would justify the use of a similar pre-survey in future efforts as well. First, we got a very large sample from which to draw conclusions about the number and types of organizations involved in transportation and the nature of their involvement. This was the one key question of our study, and the short survey made it possible to maximize the response rate to this specific topic.

We also observed that the pre-survey could be an effective way to filter responses, in order to more effectively target the full survey. In our case, we used it only to filter out those organizations that were not involved in transportation. However, in the future, we would use it to focus specifically on categorizing possible respondents in order to send more specialized surveys, based on organization type, provider or arranger, geographic location, or other criteria of interest. Given our conclusion that the full survey should be specialized to different organizational criteria, the pre-survey is almost a necessary component of this.

In addition to creating provider surveys that are specialized to different types of organizations, so that for example schools will be asked different questions than nursing homes, we also learned a number of other lessons about how to better define the issues of interest in order to reduce ambiguity and eliminate irrelevant situations.

The first point would be to create much clearer criteria for defining what a provider is. We simply asked whether the organization provides transportation, but we did not place any formal

constraints on how to interpret this. In part, this was again because we did not want to impose our own preconceptions on the definition of the concept, but we wanted to let the data inform us on how to best define it. From this we learned a couple of important lessons.

First, vehicles that are owned by staff and perhaps occasionally used to give rides are an important phenomenon, but one that needs to be considered separately from true agency-controlled vehicles. We did not specifically exclude these situations or include them as a separate category, so in the end, we did not have a sense of the prevalence of this activity.

Second, some organizations have vehicles that are owned by the organization and sometimes used to transport clients, but which have some other primary purpose. For example, a church might have a car for the pastor to use for visits, or some social service agencies might have vehicles that they use to bring meals or other services to their clients at home. As with staff-owned vehicles, these situations need to be explored, but kept separate from vehicles that are actually intended primarily for transporting passengers. In both cases, the major problem is that it becomes very hard to determine how efficiently vehicles are being used for passenger transport when multi-use vehicles are lumped in to the total count.

In general, from the perspective of efficient resource usage that underlies much of the concern about community transportation, it might make more sense to define "provider" in terms of resources rather than activities. That is, a provider might be defined as an organization that owns or leases a vehicle whose primary purpose is transporting passengers. Survey questions could then focus much more directly on how these vehicles are being used. By contrast, organizations that occasionally provide passenger transport in vehicles that are mostly used for other purposes, or which sometimes borrow or rent vehicles, perhaps really should be considered transportation "arrangers" from the perspective of their degree of involvement in how transportation resources are used.

Another major category of information from providers was the nature of the transportation that they provide and the clients that they serve. One distinction is between pre-set routes versus on-demand service; another is the focus on individual versus group trips. Both of these could significantly affect the cost per trip and the average trip length. A better understanding of service-area restrictions would be helpful; many organizations did indicate that they were subject to these. It would be useful to probe the extent to which these restrictions are legally or self imposed, or merely guidelines, and about the extent to which the restrictions actually interfere with operations. Finally, there also are organizations that provide specialty services, such as long-distance rides to particular destinations, and distinguishing these from ordinary local-area providers is important to maintaining the integrity of the data.

Another aspect of specialty services is the type of client. In our survey, we listed a number of characteristics and asked the respondent to check all that applied. This was not that helpful in that most organizations checked most of the boxes. We really wanted to know something more about the frequency with which they encounter particular characteristics, and providing frequency categories rather than a simple yes/no choice would be one way to get at this. But beyond frequency, we also want to know if some passenger characteristics are primary, while others are merely incidental. For example, schools primarily serve youth; some of them may be disabled or low income, but these are not factors by which they decide whom to transport. Other

organizations may focus on disabled or low-income passengers, and age may be a secondary characteristic. Transit agencies carry whoever pays the fare; their customers have all the characteristics, but none of them are primary in the sense of being a focus of the agency.

The real issues of interest here are: 1) To what extent does dealing with secondary characteristics draw resources away from the primary mission, and could these situations be better handled by specialty providers. For example, do agencies have to invest in expensive vehicles to serve disabled passengers when this is 1% of their ridership and when others are already equipped to do this? 2) To what extent do funding restrictions that may be directed to specific passenger characteristics make it hard to serve their client base, which may be much more general?

A final important aspect of understanding transportation providers and resource usage is their relationships with other organizations and attitudes toward working with others. A fair number of providers did indicate that they provide transportation on behalf of other organizations at least occasionally, and understanding the circumstances of these relationships would be valuable in identifying opportunities for additional collaboration. Conversely, it also would be useful to know more about the reasons and constraints that motivate the large number of providers that do not ever provide rides outside their own organization.

Many organizations indicated an interest in more collaboration with others, but indicated the presence of barriers that make this difficult or impossible. Our write-in option on this question provided a good list of possible barriers, and further exploration of the prevalence of these would be very helpful in better understanding this often-cited problem. Another interesting possibility would be to probe further into the details of what kind of collaboration organizations are interested in or what constraints they might want to impose upon any such collaboration. As a general point of possible improvement, we asked a lot of questions about what providers do, but none about what they would like to be able to do but can't, i.e., how the system is not working and how coordination might make it better.

Arranger Survey Lessons

We were somewhat disappointed with the results of the arranger part of the survey. Our thinking going in was that we would ask questions that would basically parallel the appropriate provider questions, and then use differences in the answers to develop an understanding of why some organizations arrange transportation rather than provide it. We also imagined that differences in the answers might make it possible to identify opportunities where provider resources and arranger needs might be brought together in a productive way.

While this approach did point to a few intriguing differences between providers and arrangers, in general the two groups seemed fairly similar. Whatever motivates some organizations to provide their own transportation and others to arrange it was not apparent in the answers to the questions that we asked. Neither were possible complementarities identified. By focusing our questions on what arrangers do, rather than on what they would like to do but can't, we merely developed a description of the status quo, rather than an agenda of unmet needs.

Part of the problem was the sheer variety of activities that constituted "arranging" transportation by our survey definition. As noted for providers, there would be considerable value added by explicitly defining the different activities and treating them as separate issues in terms of the

survey questions. There is a big difference in resource usage between an agency that sometimes helps a client figure out how to get somewhere on the bus, versus one that regularly pays for taxi rides or arranges medical transportation.

Another important distinction is between those organizations whose involvement in transportation is occasional and as-needed, versus those that have an ongoing and formal involvement. Both situations are important and worthy of study, but they represent fundamentally different business models that require different lines of questioning to understand.

Yet another point is that some organizations only arrange transportation, while others both provide and arrange. Our survey did not really help us to understand the differences between these types, because we asked only descriptive questions about operations rather than asking organizations directly about why they fall in one category or the other. For those that do both, the important follow-on is to understand why some rides are provided internally, while others are arranged from outside. Our survey did provide some possible insight here, but more explicit examination would be valuable. For those that only arrange transportation, understanding why they do not own their own vehicle and what constraints this creates are the important details.

In general, the first lesson here is the same as for providers. That is, to identify the different possible operational models and develop specific surveys or sets of questions to examine each one separately. The second key lesson is complementary to that for providers. That is, while the focus for providers is on identifying underused resources, the focus for arrangers should be on identifying unmet needs; these are a possible application of underused resources. While it is important to understand what arrangers do and why, it also is important to know if this is due to preference or constraint.

Survey Conclusions

The primary objective of the survey was to develop a basic understanding of the types of organizations that provide or use transportation services and their inventories, operations, and attitudes. A second, and equally important objective given the exploratory nature of the project, was to also use the results to develop insights into how to improve future surveys of this type.

Our approach to the survey had two key characteristics. The first was to question both organizations that provide transportation and those that do not provide it but are actively involved in purchasing or arranging it on behalf of their clients with an eye to better understanding the relationships between resources and needs. The second was to be comprehensive; that is, to try to survey any organization that might be involved in either in providing or arranging transportation. The existing literature, as well as more informal discussions, tended to focus on the traditional transportation community known to government funders and regulators. We wanted not only to reach these organizations, but also to find the small social service agencies, housing service providers, and communities of worship for whom transportation is just an adjunct to a different mission.

Our purpose in this survey was not really to develop definitive answers to specific questions about the specialized transit community. Because we did not know much about the types of organizations that we were likely to encounter, the types of models that they would operate

under, or the relative frequencies of the various activities and attitudes in the field, it seemed premature to try to focus on specific knowledge until we had a better sense of the "lay of the land."

Thus our focus was on developing this general description of the field. With a better knowledge of the range of activities being pursued, a sense of what issues and activities are common enough to justify further study, and a clearer idea of the complexities inherent in how different types of organizations approach the transportation problem, we could approach more detailed surveys with much more confidence. Our secondary objective, deriving from this, was to learn about how to conduct future surveys of this type.

We arrived at a few important findings about the current state of the specialized transportation system. Primary among these was that involvement in providing or arranging transportation for disadvantaged clients is indeed as widespread as has been believed. Among the very large sample in our pre-survey, which included a wide range of different types of organizations, about 65% were involved in their clients' transportation, and excluding churches, about 45% actually provided transportation themselves. Given our initial sample size of 7,000 non-church organizations, this implies that there are more than 3,000 specialized transportation providers in the state of Minnesota, and 75% of these are not schools or government transit agencies that are formally regulated by the state, but are churches, nursing homes, and social service agencies.

Another important finding was the types of organizations that are involved in transportation. We did not impose any structure on this, allowing organizations to describe their missions directly. The descriptions, however, did fall into five broad types, which could serve as the basis for more specialized surveys in the future. Churches and other worship-based organizations generally are focused on their own parishioners, although some go beyond this. Agencies that provide housing services, again, generally focus on their own clients. These are of special interest, because they were far more common than we expected and seemed in general to use their vehicles less intensively than other organization types. Schools, also, mostly carry their own students, and seem especially constrained on how they are allowed to operate. General social service agencies were the largest category (although not much larger than housing services) and provided the broadest range of operating models. Finally, transit agencies, while they are the main focus of discussions of improving community transit, are a small minority of the transit providers in operation.

With regard to questions of the efficiency or lack thereof in vehicle usage, our findings were mixed. Passenger loads per vehicle varied widely; part of this may have been due to a lack of precision on our part in defining which vehicles we wanted to be counted. In looking at vehicle schedules, we found that while weekdays are well served, evenings and weekends are much less so, although it was not clear how much this simply reflected realities about demand. We also learned that in many cases, vehicles are used only about half or less of the hours that they are scheduled to be available, indicating that there may be significant blocks of time when they could in theory be used for other purposes.

Finally, in examining how organizations interact with each other and their interest in additional collaboration to improve their transportation services, our results were mixed. Most organizations serve only their own clients or provide transportation to other organizations very

rarely. Many organizations also were uninterested in collaboration in principle as well. While a reasonable number of organizations were interested in more collaboration, many of them cited barriers that make such interaction difficult. Significant among these, from the standpoint that policy could address them, were insurance restrictions, legal constraints on how particular organizations (e.g., schools or transit agencies) can operate their transportation services, and the desire to avoid becoming subject to additional regulatory structures.

Our second main class of conclusions was an improved understanding of how to do better surveys of this type in the future. Chief among these was that future surveys should be more specialized to different types of organizations. Important criteria for this type of specialization are the organization type (school, social service, etc.), the degree of involvement in transportation (occasional, as needed, or formal and ongoing), and whether the organization provides or arranges transportation. We also would provide more explicit criteria for distinguishing between providers and arrangers.

Another key finding was the value of the pre-survey in filtering respondents, in order to more effectively target these specialized full surveys. The pre-survey also proved to be an effective tool for reaching a very large sample on one important question. In our survey, this issue was developing an estimate of the total number of providers and arrangers in the state. In future surveys, we might focus on variations of this theme, but with more tightly defined categories, or measurement of the frequency of specific activities or problems.

Finally, while this survey was very focused on what organizations actually do with regard to transportation, future surveys also should explore in more depth what they would like to do and why they are not able to do it. While it is important to understand what organizations do, and why, it is also important to know if this is due to preference or constraint. This is where the possibilities for policy improvements lie.

Regulatory Barriers to Coordination

Community Based Transit (CBT) providers and researchers have suggested that there are significant regulatory barriers to coordinating transportation efforts for organizations providing human services. Providers report that the rules, regulations, and reporting requirements for providing human service transportation are particularly burdensome [5]. A number of government agencies and researchers acknowledge that coordinating programs at various levels of government and providers is complicated by differing program requirements [6]. However, some researchers argue that some barriers are better categorized as “perceived barriers” rather than actual barriers [7]. Whether the barriers are perceived or actual, they currently hinder coordination efforts.

Regulatory barriers appear to be of two types: actual contradiction between regulations, preventing coordination; and prohibitive costs associated with understanding and complying with numerous sources of regulation [5]. Researchers have found little to no direct evidence of actual conflict or per se prohibition of coordination between agencies in existing statutes [7]. A review of applicable statutes and regulations in Minnesota (See Appendix A), provides a similar lack of evidence for this proposition. However, such a review is a good demonstration of the

complexity, variation, and extent of regulation subjected to when providing community-based transportation.

CBT providers believe that considerable resources go into determination of eligibility for funding and into compliance with reporting requirements [5]. Part of the issue stems from the fact that CBT providers can acquire funding from voluminous sources. The federal government alone provides funding through more than 62 programs originating in 20 different sources of authorizing legislation [6]. Funding is available through departments of social services, departments of health, Area Agencies on Aging, vocational or developmental disabilities departments, departments of employment, departments of education, public transportation agencies, private non-profit organizations, and numerous other federal, state, and local sources [8]. Because community-based transportation funding usually is targeted to clients of particular agencies, and the federal government prohibits commingling of funds, separate transportation systems develop [9]. Funding streams differ among sources, for example, some federal programs give money directly to providers, while others pass it through the state [6]. Each funding source usually has its own reporting requirements and restrictions on use of funds, based on the type of client or type of trip [6, 9].

Also relevant is the fact the funding sources differ on the extent to which funding is directly targeted to transportation activities. Because Department of Transportation programs are directly targeted to transportation, those agencies receiving funding have specific, comprehensive, and relatively uniform requirements for planning [8]. In contrast, Health and Human Services-funded programs meet varied planning and performance monitoring requirements, reflecting their range of legislative origins [8].

Providers also face multiple sources of regulations for motor carrier safety, which each source having potentially different standards [6]. Federal, state, and local governments all may have specific compliance standards depending on the type of client, the type of trip, and the service area [6]. Further, liability insurance companies may impose their own requirements and restrictions as a condition of coverage [5, 6]. For example, because of these differences, a non-emergency medical transportation provider may have to comply with harsher restrictions when seeking to capitalize on unused capacity by coordinating with local Head Start to provide transportation for toddler attendees [6].

Part of the challenge exists in the fact that different regulators, funding sources, agencies, and providers have different missions, different objectives, and use different terminology [8]. Particularly relevant is the different language used for the same processes, clients, and tools used by different agencies [5, 8, 9]. Providers may be deterred from coordination because of the difficulty in reconciling these differences and not because of contradictory regulations or regulations prohibiting coordination. Regardless of whether the barriers are perceived or actual, researchers and providers tend to agree that regulatory barriers impede coordination efforts by agencies, and efforts should be made to counteract this effect.

Efforts to Diffuse Regulatory Barriers

States that have passed significant legislation supporting coordination and/or consolidation of programming have seen significant cost savings returns [7]. Areas with some of the largest

reported cost savings associated with coordination of community-based transportation also have significant legislation regarding coordination and consolidation of funding, reporting, and monitoring [10].

Researchers and government agencies have made many recommendations for dealing with regulatory barriers to coordination between agencies providing, supervising, and funding community-based transit. The most cited need is for standardization of reporting procedures [6, 9, 11]; although, given the vast number of programs, this activity could be among the most costly [6]. Other studies call for the government to streamline funding processes and coordinate the chain of command [7, 9]. These works also note the need for additional research about the existence of actual regulatory inconsistencies and their impacts on coordination. Finally, some agencies argue that one of the biggest needs is for a general clearinghouse of information for states, funders, and providers seeking to coordinate [8, 11].

Current approaches used by the federal government and state government can be differentiated by type of approach and level of coordination. Strategic approaches tend to lie in three general categories: independent agency action; executive orders; and legislation [12]. Independent actions by states include informal inter-agency coalitions, agency regulations, and development of online resource databases [12]. Executive orders to coordinate activities, standardize reporting requirements, and establish inter-agency communication also have been used by states but are less favored as the orders generally expire before all activities become complete [12]. One of the most popular and widely-implemented strategies is the use of legislation to create inter-agency coordination councils, consolidate offices, and standardize reporting requirements [12].

These efforts vary in level of coordination. Efforts that signify *cooperation* include working together in loose association with informal rules and little specification [8]. Examples of *cooperative* efforts to deter regulatory barriers include most legislative broad mandates for coordination, which may provide for comprehensive planning or technical assistance [12]. *Coordinative* efforts are characterized by joint decision-making with formal structures and authority [8]. Coordination councils and information clearinghouses are examples of coordinative activities. Possible benefits of coordinative activities include increased inter-agency communication, reliable technical assistance for regulatory issues, and clarification of standards. Coordination councils often are established as a mechanism for monitoring and supporting coordination activities. Finally, *consolidation* entails investing all authority in one agency [8]. Some states have consolidated authority into one office for community-based transportation, have centralized all funding disbursement (state and federal), have created uniform reporting databases, and have established uniform standards and procedures [12]. Benefits of consolidation activities include standardization of reporting and centralized authority to provide clarity on regulatory questions.

Examples

Federal Initiatives

Efforts on a federal level have remained in the general, cooperative level. Federal regulations do require effort to coordinate services in statewide planning processes [13]. Further, the Coordination Council on Access and Mobility (CCAM) has been working to improve communication between the Department of Transportation, the Department of Health and

Human Services, and state and local agencies and providers [8]. CCAM also is working to "institutionalize coordination of transportation planning and resources" and "provide an ongoing forum for raising state and local impacts of regulatory inconsistencies" [8]. Attempts to create formal legislation regarding the elimination of regulatory barriers or consolidation of activities into a central office have yet to come to fruition.

State Initiatives

Cooperation and coordination. Many states have provisions for development of a plan to coordinate services. At least 17 states require a plan through broad, general legislation [12]. Fewer states have coordination councils, which vary in power, in membership, and in the frequency that they meet. Some are legislatively authorized or created by executive order, while a number have been informally instituted. Other states attempt to diffuse misunderstandings by legislatively standardizing the language used to describe processes and technology.

ARKANSAS

- "Arkansas Public Transportation Coordination Council" [14]
- Includes at least the following members:
    - The Director of the Department of Human Services or his or her designee
    - The Director of State Highways and Transportation or his or her designee
    - The Director of the Department of Health or his or her designee
    - The Director of the Arkansas Economic Development Commission or his or her designee
    - The Director of the Department of Rural Services or his or her designee
    - The Director of the University of Arkansas Cooperative Extension Service or his or her designee
    - The Chair of the Transitional Employment Assistance Program Advisory Council or his or her successor or designee
- Meets at "call of the chair"
- Serves as a clearinghouse; develops policies and procedures. It must "assure that all procedures, guidelines, and directives issued by state agencies are conducive to the coordination of public transportation services and facilities"

IOWA

- Coordination Council, consisting of the heads of the Departments of Transportation, Elder Affairs
- The Council is required by legislation to meet regularly and to make reports to the legislature
- The Council reviews eligibility for funding for human service transportation and supervises compliance with coordination requirements
- Also acts as a information resource and gives technical advice

KENTUCKY

- "Coordinated Transportation Advisory Committee" [15]
- Meets monthly
    - The executive director of the Office of Transportation Delivery shall set the agenda for meetings of the CTAC. The Office of Transportation Delivery may

promulgate administrative regulations under KRS Chapter 13A governing the human service transportation delivery program on behalf of the CTAC.
    - The program coordinator shall investigate issues of eligibility that result in a person being denied transportation, determine the status of the person's case, and attempt to immediately resolve the matter in order for the person to continue to receive transportation services.
- *Pending 2005 legislation may change or eliminate this committee*

LOUISIANA

- Executive order for "Intra-agency Coordination Council" (expired) [12]
- Purpose: "Review and evaluate the transportation provision policies of each agency to determine the most efficient methods for facilitating the coordination"

NORTH CAROLINA

- "North Carolina Act to Remove Barriers to Coordinating Human Service and Volunteer Transportation" [16]
- Purpose: "In order to promote improved transportation for the elderly, handicapped and residents of rural areas and small towns through an expanded and coordinated transportation network, it is the intent of the General Assembly to recognize human service transportation and volunteer transportation as separate but contributing components of the North Carolina transportation system. Further, it is the intent of the General Assembly to remove barriers to low cost human service transportation."
- Makes distinctions between for hire transportation, commercial motor carriers, and human services transportation, and clarifies which regulations apply

TEXAS

- Permits creation of advisory committee of agencies [17]

VIRGINIA

- Created a "Specialized Transportation Incentive Fund" to assist participating planning districts in the development of coordination specialized transportation plans and projects [18]
- Allows local communities to set up coordination advisory committees, but no explicit requirement for statewide advisory committee

Consolidation. Few states have taken steps, legislatively or otherwise, that could be considered consolidation. Some states have mandated that receipt of funding (federal and state) be monitored by state agencies to ensure that recipient agencies comply with regulations and work to coordinate. Other states have required that state agencies create a "memorandum of understanding" to clarify any existing conflicts of law. A number of states have consolidated all regulation of human services transportation through a single office. Finally, some states have standardized reporting requirements and created online reporting tools to lessen administrative burdens on providers.

ARKANSAS

- The Coordination Council reviews, monitors, and coordinates all funding requests for state and federal grants transportation services. Recipients must be participating in approved coordination transportation systems [14].

IOWA

- Requires that funding for state agencies be consolidated through a central clearinghouse. Providers apply for and receive federal and state funds through central authority [19].
- Other organizations must comply with coordination mandates to continue eligibility for funding. The department will receive and disburse all funds unless prohibited by federal law.

TEXAS

- Texas law requires a "memorandum of understanding" between state agencies, including provisions to ensure that agencies do not have duplicative authority, responsibilities, or activities in human transportation services [17]
- Creates central office: "Health and Human Services Office of Community Transportation Services." *Although the statute has not been repealed, State of Texas internet sites suggest that control has now been shifted to the Department of Transportation.*
- The agencies are further required to create standardized reporting and to explore the feasibility of use of online reporting and consolidating the distribution of federal and state funding

Minnesota Initiatives

Minnesota state initiatives have yet to reach past coordinative and cooperative stages. Minnesota has a broad statute requiring state agencies to "promote, support and facilitate coordination of those services with other special services and with regular transportation" [20]. The same statute authorized the creation of an inter-agency task force on coordination. This section of the statute has been repealed, although the task force has been meeting informally, intermittently since repeal. Recent legislation seeking to coordinate services for disabled individuals leaving institutions for living in the community has yet to pass through Minnesota's legislature. Although not wholly focused on transportation, the legislation will create an inter-agency task force to work toward coordination.

Conclusion

Significant work remains to be done if Minnesota providers are to realize the gains that are apparently available from consolidation of funding and regulatory mechanisms. Arkansas, Iowa, and Texas all provide templates for how this may be done, but efforts to move in this direction have not gained significant momentum in the legislature. The Texas example, in particular, may be useful as it applies in a state with providers in both large metropolitan areas and rural areas. Further, the steps involved are based on similar efforts already made, such as Minnesota's inter-agency task force on coordination. Administratively, the greatest challenge will lie in reconciling the applicable statutes and rules to allow for standardized and streamlined reporting processes. However, that effort could fall into place should the political will be found to require this to happen.

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Chapter 2: Carsharing & Timebanking

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Introduction

"If you live in a city, you don't need to own a car," said William Clay Ford, CEO of the Ford Motor Company in 2000 [1]. Carsharing organizations and their supporters commonly repeat this quote from the heir to the pioneer in car ownership for the masses to demonstrate the viability of this transportation innovation. Carsharing, the sharing of one or more vehicles by many people in close proximity to one another, offers members of a carsharing organization access to a car without the burden of ownership. Proponents of carsharing insist that it is the missing link towards an ecologically sustainable transportation system, giving transit users the flexibility and mobility that transit is increasingly unable to provide in the polycentric metropolises of the 21st century. Certainly, carsharing has seen remarkable success in Europe where it began and is showing degrees of success in a few American cities where it has been introduced since 1998. Skeptics may report that the impact of carsharing appears to be minimal and that it only attracts a narrow demographic, yet carsharing is new in the United States and improvements in technology over the last decade have transformed its potential. Furthermore, carsharing organizations continue to see steady increases in their memberships, and it may be too early to predict this alternative's long-term impact on transportation choices in the cities of the 21st century.

The purpose of this paper is to first understand the current state of the carsharing business in the United States, and second to determine appropriate criteria for choosing carsharing hub locations in a new carsharing market. The first section draws heavily from the current literature on carsharing as well as depth interviews with managers of carsharing organizations (CSOs). The second section includes a market analysis for carsharing in the Twin Cities. The market analysis draws on information gathered at focus groups of carsharing users and demographics analysis of neighborhoods as well as information from the literature and depth interviews. This analysis uses the Twin Cities as a case study to suggest locations where carsharing is most likely to succeed. The Twin Cities start-up operation, HOURCAR, may find this analysis most useful, but the criteria used in this analysis can be applied to locations outside of the Twin Cities market.

The first section of this chapter details the history of carsharing in the United States and provides an overview of significant findings in the current research on best practices in the industry. Data and conclusions from this section were gleaned from academic and industry research on the subject and from interviews with CSO managers in San Francisco, Madison, Washington, Portland, Seattle, and Boston. Because the carsharing industry is a competitive business, details of conversations with these managers are treated as proprietary information. Therefore,

individuals are not cited in this report so as to preserve anonymity. The CSO manager interviews were conducted in spring 2004, the focus groups were held in August and October 2004, and the Geographic Information System (GIS) analysis was performed in January and February 2005.

The second section discusses the findings from carsharing user focus group sessions that the State and Local Policy Program conducted in Seattle and Chicago in summer and fall of 2004. Data and conclusions drawn from the focus groups are then compared to the previous and current research on carsharing and are explored in greater detail to reach more firm conclusions.

The third section is a GIS analysis of Seattle neighborhoods with a strong presence of carsharing. All demographic and travel behavior factors that appear substantial in either the literature review, CSO manager interviews, or focus groups are examined using census 2000 travel behavior and demographic data. Those factors of these neighborhoods that are significantly different from the rest of Seattle were then applied to Minneapolis and St. Paul neighborhoods to determine neighborhoods where carsharing should have the most potential based on the experience of existing CSOs in other cities.

The final section discusses those neighborhoods in Minneapolis and St. Paul that look promising for implementing a carsharing program and provides recommendations about implementation and marketing in these neighborhoods. This concluding section also includes limitations of the study and opportunities for further research once carsharing service is launched in the Twin Cities.

The analysis and conclusions in this chapter are based on the following overriding assumptions. A CSO in the Twin Cities will operate under similar conditions as they have in other cities in the United States, and the early market for carsharing in the Twin Cities will be similar to the market where carsharing is currently established. This study relies on both quantitative and qualitative analysis. In the absence of detailed comprehensive studies of the carsharing business and the relatively small number of carsharing operations from which to sample, qualitative analysis provides the bulk of the data used in this study. These come in the form of interviews with managers, focus groups of users in Seattle and Chicago, and a summary of conclusions from the previous literature on the topic. The selection of neighborhoods in the Twin Cities for carsharing implementation is informed by a quantitative evaluation of demographic and travel behavior data.

This methodology is not without limitations that must be considered when using it as an implementation tool. The first is the relatively small sample size with which to work. Carsharing is still new in the United States, and the cities where it has been introduced are few and varied. It is therefore difficult to make generalizations about carsharing. Those characteristics of the carsharing market that appear to be persistent across cities are considered in this study. This study focuses primarily on Seattle for comparison because, of the cities where carsharing has achieved a significant presence, it is most similar to the Twin Cities in terms of travel behavior and demographics [2]. The assumption that the Twin Cities should be similar to Seattle in the applicability of carsharing must be treated with some caution as HOURCAR introduces itself to the Twin Cities market. There may be some overriding difference between the two cities that were missed that is a significant factor in the success of carsharing.

At the time this chapter was written, HOURCAR had received start-up funding and was planning to launch service in June 2005, in three locations in Minneapolis and St. Paul using a fleet of gasoline-electric hybrid Toyota Prius vehicles. HOURCAR is employing a non-profit model aimed at becoming financially self-sufficient within one year.

History and Current Research on Carsharing in the United States

Introduction to Carsharing

Carsharing began in 1987 simultaneously but independently in Germany and Switzerland. The first carsharing business was only one car shared by a few friends and quickly spread through word-of-mouth until the organization was able to buy a second car. More sophisticated models were developed in Europe soon after. Today, the largest organization, Mobility Carsharing of Switzerland, boasts a membership of more than 60,000 people and 1,700 cars (www.mobility.ch). Using the European experience as a model, some entrepreneurs began the first carsharing operation in the United States in Portland, Oregon. Initially called CarSharing Portland, it has since joined the Seattle-based for-profit company, Flexcar, which had subsequently initiated service the following year. Flexcar has a large operation with substantial operations in Seattle, Portland, and the Washington D.C. metropolitan area (www.flexcar.com). It is now beginning to see growth in San Diego and Los Angeles and has recently collaborated with the non-profit startup I-Go in Chicago by offering the use of its technology and consolidating some other administrative operations. Zipcar is another for-profit enterprise based on the East Coast, and it has experienced fast growth in Boston, New York City, Washington, D.C., and New Jersey (www.zipcar.com).The non-profit organization, City CarShare, (www.citycarshare.org) began operations in San Francisco in 2001 and has since grown to an operation with more than 100 cars. It has collaborated with Philly CarShare (www.phillycarshare.org) in Philadelphia, which operates under a similar model.

While a carsharing program can be as simple as a few friends or community members owning a vehicle together and reserving it by signing up for the car on an accessible registration sheet, carsharing operations of any size use a great degree of technology to function. In fact, it is precisely internet and wireless technology that has led to the rapid proliferation of carsharing in the last five years both in the United States and Europe.

A typical process for joining and using a neighborhood carsharing program is as follows. A new member registers on the organization's Web site and pays an application fee and a refundable deposit that can range from $75 to $400. The organization performs a credit and driving history check. Upon acceptance into the program, the new user can use the service immediately. The fees vary by organization, but there are typically two rate plans to accommodate both heavy-use and occasional-use requirements. Most organizations combine distance and time factors into the rate structure (usually $4–$12 per hour plus $0.40–$0.80 per mile, although at least one organization offers 10 free miles for each trip) [3]. Some organizations are now instituting pre-paid plans, where members can use the cars for a certain number of hours without incurring any extra costs. A member can reserve a car on the phone or on the Web site for a particular time and duration. Because the car is equipped with a cellular communication system connected to the

reservation and billing system for the organization, the user is identified, and the car can be opened or started. The car continues to communicate with the reservation and billing system and tracks mileage and time until the member returns the car. The member is then billed a monthly fee that varies depending on the member's rate plan plus all fees for use of vehicles during the month. For some organizations, members are allowed to change their rate structure each month if they suddenly expect to drive less or more than they had originally anticipated.

Current Trends

Carsharing programs have seen steady growth in the United States since 1998. Shaheen's survey of carsharing operations shows that the growth is almost exponential. In 2003, the United States claimed more than 25,000 carsharing members and almost 700 cars in carsharing programs [4]; by the end of 2004, that number had more than doubled to over 60,000 members and cars [5]. This should not be entirely surprising considering how new the technology is in the United States. Most of the growth in carsharing since 1998 has been the result of the aggressive expansion of Zipcar and Flexcar as well as the increasingly popular City CarShare in San Francisco. Flexcar claims to be making a profit in Seattle, as does Zipcar throughout its system. The latter has announced a plan to take its program nationally and introduce the service to a host of new cities. City CarShare also has expanded rapidly with low rates and generous support from non-profit and government funding sources [6].

Where is Carsharing Effective?

According to CSO managers, neighborhood carsharing programs typically locate their cars in areas that have been previously favorable to carsharing. Businesses look for densely populated mixed-use areas well served by public transit. They are usually in areas of predominantly middle-income residents or areas of mixed income. As a carsharing business expands its membership, most carsharing organizations place additional cars in areas nearby its existing cars. This practice, known as clustering, allows users to choose from among a number of available cars within reasonable distance, thereby increasing the geographic coverage of the program within high performance neighborhoods. It also serves to increase the visibility of the program in a particular area. In interviews, managers of all three of the major carsharing operators in the United States reported that they began by placing their first vehicles in areas where they anticipated that they would find a market instantaneously. These are areas:

- with a high number of residents who are in the middle-income range and are well educated
- where parking is difficult or expensive
- with excellent transit service
- and have a high residential density and some mixed uses

Who Uses the Service?

Both the literature on the topic and CSO managers report that carsharing users typically have some common characteristics:

- middle-income
- between the ages of 21–55, with the bulk in the 21–39 range
- live in households with no more than one car
- exercise more than the general population

- walked, biked, or rode transit to work
- high level of education

This last characteristic appears to be a key one. Flexcar reported that more than 85% of its users have bachelor's degrees, 30% have master's degrees, and 10% have doctoral degrees [7]. This characteristic of carsharing members is reported for all of the carsharing organizations in the United States. Most CSO operators attributed this to the novelty of the idea in the United States; it is conventional wisdom in marketing that new products are usually adopted by people with more education before finally being accepted by a larger spread of the population. One would anticipate that this is beginning to happen, and a study by Cervero on City CarShare in San Francisco confirms that the diversity of membership has indeed begun to increase as the program matures [8]. In addition to the characteristics identified on the previous page, Cervero's study found that most early adopting City CarShare members

- lived in "non-family" households (more than 70% of users did not live in a household with children)
- were disproportionately employed in a professional occupation, with many of these professionals affiliated with the urban planning or architecture professions [9]

The most recent study on initial adopters of carsharing confirmed many of these conclusions. In his study of Philly CarShare, Lane found that early adopters universally had a high level of education and were frequent transit users. They also are most likely to not own a car. The largest percentages of early adopters in his study walked (43%), took transit (36%), or biked (21%) to work. Lane found all demographic data from Philadelphia to closely match Cervero's findings from San Francisco in terms of the use of alternative commute modes, living in non-traditional households, and being aged in the late 20s and 30s. While many once perceived income to be a strong predictor of carsharing participation, Lane found no significant relationship in his study of Philadelphia or in previous studies in San Francisco and Portland [10].

Another possible reason for the lack of diversity among the membership of carsharing programs is the way in which the organizations market the service. According to CSO managers, CSOs all employ "guerrilla marketing" approaches to getting the word out about their service. Few have the resources to mount aggressive advertising campaigns. Word-of-mouth, press coverage, tabling at neighborhood street festivals, dropping off literature in apartment buildings and coffee shops, and some advertising in free weekly papers provides the bulk of marketing. This approach attracts new members who are similar to existing members. However, partnerships with existing institutions can help to bring in a new audience to pitch the service. All but one carsharing operator uses the transit agency's resources to market to new members. These agencies usually provide free advertising on buses and bus shelters, include information on their Web sites, and sometimes facilitate membership in the carsharing program through their commuter pass programs.

Trip Purposes

Certain travel behavior characteristics appear to be persistent across all cities. Most individual members of carsharing organizations commute to work by walking, public transit, or bicycling. Carsharing rarely is used for this purpose. If it were, it would fast become more expensive than owning a car. According to CSO managers, most members use the service to run errands, haul things within a neighborhood, and visit friends in a less accessible neighborhood. Few individual

members use the cars to go out of town for a significant amount of time and instead use discounted rental cars that the organization has arranged with a rental car company. However, one manager of a large carsharing operation reports that members take the cars out of town frequently, which poses a few problems for it since this organization already has so many cars in its system. Perhaps as carsharing services grow, the need to collaborate with rental car companies will disappear, as the impact of removing a car from the system for a few days would be minimal. About 50% of one for-profit organization's membership signs up for the service as a form of mobility insurance and rarely accesses the vehicles. These members typically pay a lower monthly rate (in some cases there is a no monthly fee option) that comes with a higher per-use rate. Some of these people might live in very dense neighborhoods with excellent transit accessibility and rarely need a car or are in a household with a car and sign up with the carsharing organization as a backup second vehicle.

Of Flexcar members, 40% do not own a single car [7], and almost 70% of City CarShare members are car-free [9]. Almost 70% of Philly CarShare members are also car-less [10]. According to Cervero's study, more than 90% of City CarShare members lived in 0–1 car households, a significantly higher proportion than the average for the Bay Area [11].

Business Members

Most CSOs like to locate their cars in areas with a mix of high-density residential uses and employment. Managers report that this is due to the low car-ownership needs of individuals in such neighborhoods, and also because businesses can use the cars during the middle of the day when there is little demand from individual members. In these arrangements, businesses, typically in central business districts (CBDs), often sign up with a CSO to replace a fleet of vehicles or to offer their employees an additional benefit and encourage them to take transit to work. This works particularly well for downtown businesses that already have a commute trip reduction program in place to encourage alternative transportation for their employees like commuter checks, free bus passes, vanpooling, etc. Others simply market the service by becoming non-paying business members. In this case, employees are given information on the carsharing program and their initial membership fees are waived by the carsharing provider because of their association with a business member. A number of carsharing organizations are also developing relationships with universities and other public agencies that are interested in reducing fleet costs. Zipcar is most aggressively marketing its services to universities. In one partnership, at the University of North Carolina Chapel Hill, the university simply uses the Zipcar technology and Web site and manages the fleet itself [12]. While in the case of Madison's Community Car, the University of Wisconsin offers trial memberships to employees and eligible students and provides marketing assistance to Community Car but does not manage the fleet. When a business signs up with a CSO, it enrolls all or some of its employees who must go through the same background check and application process as an individual member. Managers report that participation varies within business establishments; some employees rarely use the vehicles, while others use them considerably.

Impact on Travel Behavior

Cervero has undertaken the only substantial study on the impact of carsharing on travel behavior and the environment. His study of City CarShare members determined that vehicle miles traveled and per capita gasoline consumption initially increased and then later decreased, while mobility

for transit users increased as the program matured. In the one or two years since new members joined City CarShare, they used the vehicles less and carpooled and trip-chained more as time passed as they adjusted their travel behavior to account for the new option [13]. Cervero attributes this to an increased awareness of the cost of various modes of transportation. The induced vehicle travel that carsharing programs may produce for previously car-free households is far outweighed by the reduction in use by users who forgo the purchase of a vehicle or sell a vehicle.

Focus Groups

Methodology

In August 2004, the State and Local Policy Program conducted focus group interviews of Flexcar members in Seattle and interviewed I-Go members in Chicago in August and October 2004. Participants in the Seattle interviews were solicited from a list of Flexcar members who lived in areas where Flexcar had a substantial presence. These are areas of the city in which a significant proportion of households are within walking distance of a Flexcar location. A control group of individuals who were not members of Flexcar but who lived within walking distance of a Flexcar location was also solicited, but the study suffered from a low response rate from this group. While there were differences between the conversation of the control group and the Flexcar group, the small size of the control group prohibit its consideration in this analysis. Similarly, Chicago participants were solicited with the cooperation of I-Go, who emailed its membership about the opportunity to participate. A control group was solicited using the same criteria as in the Flexcar case. The Chicago control group also suffered from a low response rate, although it was slightly better than for Seattle.

Some significant differences exist between members from the two locations. Whereas Flexcar had close to 130 cars in its Seattle network and had been in that market for six years, I-Go had only recently launched full service in 2003. Therefore, all members interviewed in Chicago were early adopters, whereas some members interviewed in Seattle were early adopters, and others had joined once the service had gained a significant market presence in Seattle.

Seattle and Chicago are interesting markets to analyze when considering the Twin Cities market. While Chicago is in the same geographic region as the Twin Cities, Seattle is more similar in size, density, and demographic composition [14]. Public transportation has a much greater presence in Chicago than it does in Seattle, and Seattle is more like the Twin Cities in that its public transportation system is made up almost entirely of buses (The Twin Cities only recently added light rail transit to its system), while the “L” and Metra commuter trains both carry a relatively large amount of passengers in Chicago. But Chicago is interesting in that the I-Go service is relatively new, and so the Chicago responses revealed more about the decision-making and travel behavior of early adopters.

In both locations, participants were asked a series of questions about their travel behavior before and after becoming members and their reasons for joining, as well as questions about their neighborhoods and how they perceived that the character of their neighborhoods affected their travel. Participants also were provided an opportunity to comment on the service of their

respective carsharing organization. A summary of discoveries from the focus group participants follows.

Focus Group Observations

Among focus group participants, more than half joined for convenience, followed by environmental reasons and affordability. Still others joined because of a temporary need for a vehicle, often a truck to haul personal items. Indeed many members wished the program offered a wider variety of cars such as pickup trucks.

Focus group participants typically used the service for appointments to transit-inaccessible places; common trip purposes included shopping, volunteering, picking people up from the airport, emergencies, and to visit family in the suburbs. Members almost universally used the service to save up for "one big errand trip" to big box stores and supermarkets. One young lower-income user used the service to help friends who did not have access to a car with emergencies or errands. Some users enjoyed the opportunity to try out driving the new hybrid vehicles that had recently been introduced. To go out of town, some participants said that they used the partnership with Enterprise and Dollar rental car companies, but knowledge of this program was not universal among all participants. A number of participants in Seattle acknowledged that they frequently took the cars if they were going to be out late and would return them in the early morning since use of the cars late at night does not incur hourly charges.

Members accomplished these types of trips before joining the carsharing organization in different ways that depended on the kind of transportation access they possessed before joining. Those who did not previously have a car would have borrowed a friend's car, taken a cab (which many noted is more convenient and cheaper for one-way trips than taking the Flexcar or I-Go), or not made the trip at all. Most would not have bused for these types of trips, although a few did ride the bus to go grocery shopping. For out-of-town trips and for hauling things, most participants stated that they would have rented a car. Those who had a car previously would have driven their cars. One individual who rarely used the service but was a member said that he felt Flexcar to be too expensive for many of the trips he needs to make: "I don't use it much, why would I use Flexcar for $9/hour when a cab is cheaper?" I-Go's standard rate, in contrast, is $6/hour. Such statements and the statements of others in the focus groups indicate that carsharing replaces planned utilitarian trips more than spontaneous or recreational trips.

Members who previously owned a car either immediately before joining the service, or at some point recently, believed that they had become much more economical in the way that they travel. Instead of spontaneously making trips to do one thing, they would now plan ahead and think about all of the errands that they needed to make and trip chained more. These members said that they are much more likely to take the bus or walk instead of using the vehicles. Indeed, walking became the preferred mode of travel for most daily activities.

Although not a characteristic of all members, a significant number of focus group participants were attracted to the predictable nature of the costs associated with membership in the carsharing program. These members of Flexcar in Seattle take advantage of the pre-paid options where members pay a set amount per month and are allowed a certain amount of car use without incurring extra charges. These members contrasted this with the unpredictable costs associated with car ownership. According to one Flexcar member, "I was getting tired of trying to park

downtown, getting tickets, so I sold it…I haven't regretted it, no insurance, no tickets, it's much cheaper and predictable, I can budget out exactly how much I need to spend on transportation, and it never changes."

Among those individuals who did not regularly use the vehicles and only occasionally rented them out for a large shopping trip or an emergency were satisfied with the program's ability to enable them to continue to live without a car; "I don't panic about not having a car, I hope, for the rest of my life." These individuals typically walked or rode transit both before joining and after joining and lived in neighborhoods where driving was unnecessary. The spread out character of the metropolitan areas of both Seattle and (to an extent) Chicago made it difficult, however, to never require the use of a car. Carsharing gave these people the availability of a car in the few instances that one was necessary.

Members described their neighborhoods in ways that reflected the available transportation opportunities and constraints. The most common discussion centered on the lack of parking for themselves or for guests. It became clear that all of these members lived in areas where parking was expensive or difficult, indicating that this may be a key "push" factor in discouraging car ownership. Among those who had access to a free parking space with their condominium or apartment, at least two rented out their space or gave it to friends when they visited; even if an individual does not own a car, the lack of parking in the neighborhood can be a significant frustration for visitors.

Besides parking problems, most participants stated that they could walk to most things that they needed. Their neighborhoods included many restaurants, coffee shops, and small stores. Indeed, walking was probably the most common form of transportation among those in the Seattle groups. This was less clear in Chicago where people were much more likely to talk about using transit. But all of these individuals were aware of the effect that their neighborhood had on their transportation behavior; "I walk everywhere, the neighborhood reminds me that I can walk," said one Seattle member.

Indeed, the accessibility of their neighborhood to most services by foot or transit was the prime motivator for members' residential location decisions. Almost all focus group participants stated that they chose their current residence because of its location and not because of other qualities. In this way, members appear to be a self-selecting group of individuals who care deeply about the nature of their community environment and their location. Almost all members also acknowledged that living where they do was the reason that the carsharing service worked for them; "living downtown is conducive to not having a car because of the parking issue; if I lived further out I would probably purchase a car." Still others in the Seattle groups stated that the availability of Flexcar is one of the reasons they are able to stay in their neighborhood, since buying a car would add so much to their expenses that they would be forced to relocate to a less expensive neighborhood.

In addition to those discussed above, the following observations from the focus group sessions in Chicago and Seattle also should be considered by a carsharing startup in the Twin Cities or any area without an existing CSO:

- Many of the members interviewed in both Seattle and Chicago joined Flexcar or I-Go when they either moved to the city or moved to a new neighborhood. The move played a big factor in evaluating their transportation/location options.
- While environmental/political reasons were not a driving factor for most to join in the first place, many mentioned it later on as something they felt good about in using the program. Participants also were enthusiastic about the new hybrid cars.
- Focus group participants preferred walking to any other form of transportation and lived in neighborhoods where they could walk to most things, and when walking was impractical, they generally used public transit.
- Most focus group participants matched other data on carsharing users in that few mentioned living with children. Most lived alone or lived in small households with a partner or roommates.
- Chicago participants (all "early adopters") were likely to mention knowledge of carsharing from other cities prior to joining I-Go, and many had joined I-Go upon moving to Chicago from neighborhoods where carsharing existed in other cities on the East Coast.
- Members generally lived and worked in transit- and pedestrian-accessible areas and used the cars to go to transit-inaccessible areas like the suburbs.
- Seattle residents were more likely to have owned a car prior to joining, while Chicago residents were largely transit-dependent. This may be attributable to the quality of transit in Chicago as opposed to Seattle, but Cervero and Lane both also demonstrated that "early adopters" were more likely to be car-less.

Responses from the focus group sessions in Seattle and Chicago did not reveal anything entirely new about the carsharing market that had not been discussed in previous studies such as those by Lane, Cervero, and Shaheen. But they highlighted a few factors that appear persistent in the literature or significant from a perspective of transportation choices. The main conclusions about neighborhoods and individuals attracted to carsharing include lack of parking in the neighborhood, a preference for walking or bicycling over other forms of transportation, high familiarity with the transit system, and the value of the convenience of using the carsharing service over other motivations. One previously unexplored finding was that the decision to join the program appeared to be frequently associated with a move to the city or a move within the city.

While demographic data was not collected from the focus group participants, and their small numbers would make most measurements insignificant, they did predominantly appear to match the profile described by Lane and Cervero and by CSO managers as likely to be highly educated and living in small or non-traditional households. There would be some bias in this result since individuals with children may be less likely to participate in a focus group than those living alone or with other adults.

Evaluating Neighborhoods

Methodology

The academic literature, interviews with CSO managers and staff, and the focus groups provided a foundation for evaluating neighborhoods for their amenability to carsharing in the Twin Cities. In doing so, the evaluation considered only those factors that were mentioned as significant in at least two of the manager interviews, the focus groups, or the academic literature. These factors from the 2000 U.S. Census were:

- Percentage of individuals with a bachelor's degree or higher
- Median household income
- Average household size
- Percentage of total in non-family households
- Population density of individuals aged 22–39;
- Percentage of workers who commuted by car, transit, walking, and bicycling
- Percentage of households renting and owning their homes

For the purposes of discovering how neighborhoods that supported a great deal of carsharing service were distinct from average urban neighborhoods, this study looked at those block groups in Seattle where at least half of the block group was within one-eighth of a mile from a Flexcar location (See Figure 2.1). These factors in the Flexcar block groups were assessed against the average for the city of Seattle. The factors that were significantly different from the citywide average were applied to the evaluation of neighborhoods in the Twin Cities. (See Table 2.1)

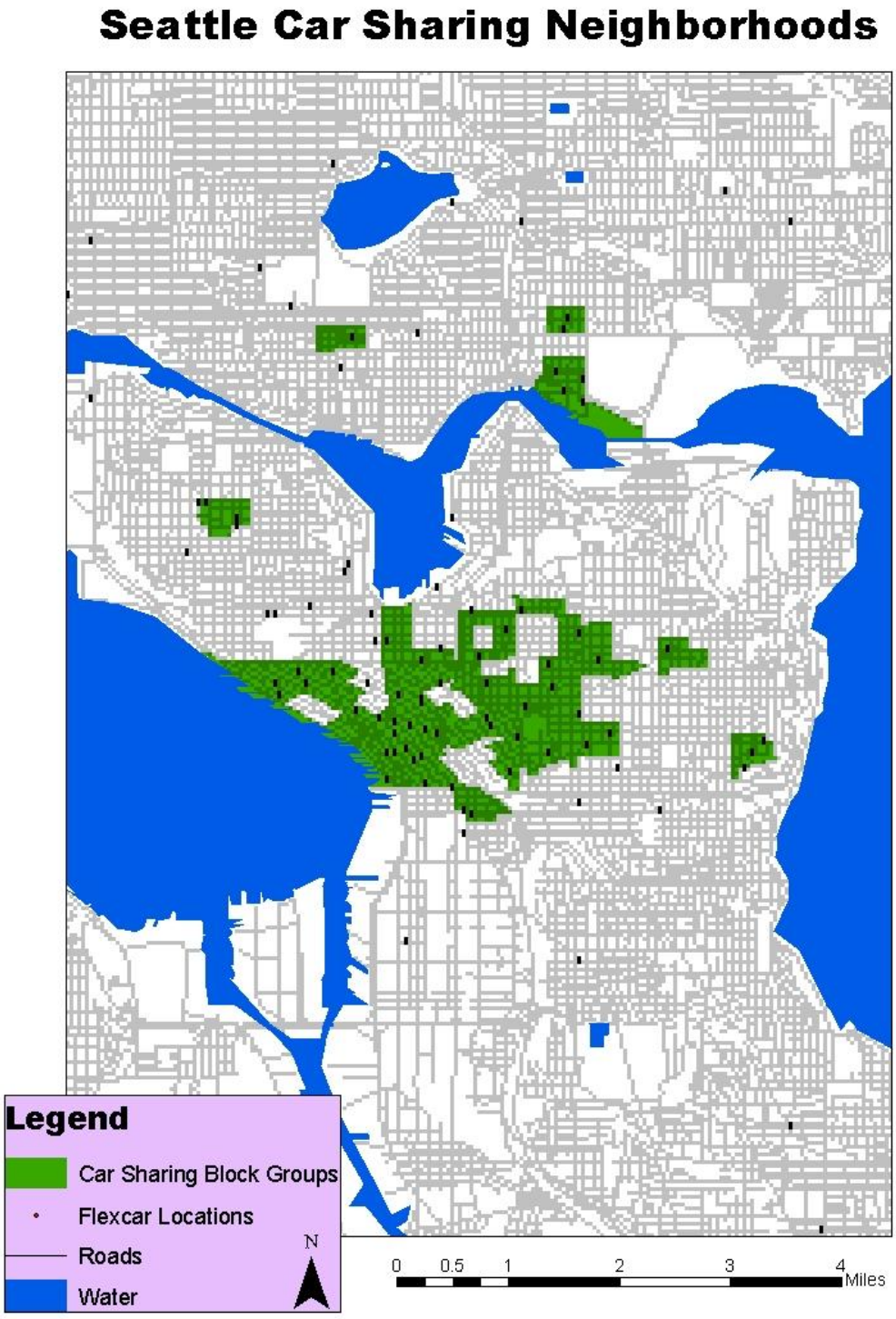

Figure 2.1 Carsharing Neighborhoods in Seattle

Characteristic	Carsharing Block Groups		City of Seattle	City of Seattle Deviation from Carsharing Block Groups (in STD units)
	Median	Standard Deviation		
% renter occupied	89.01%	18.60%	45.31%	-2.3493
% of hh with 1-person	62.52%	14.21%	40.77%	-1.5306
% who walked	30.50%	16.11%	7.40%	-1.4345
Density of Population Aged 21-39	10511	7431	1566	-1.2037
% income $150,000 to $199,999	1.10%	1.74%	2.90%	1.0356
% income $100,000 to $124,999	2.20%	3.69%	6.20%	1.0841
% income $60,000 to $74,999	5.80%	4.03%	10.30%	1.1185
Median household income in 1999	$27,505	$15,639	$45,736	1.1657
% with a Master's Degree	9.99%	6.13%	17.30%	1.1915
% income $75,000 to $99,999	4.96%	4.74%	11.40%	1.3595
% who carpooled	4.43%	4.68%	11.20%	1.4467
% of hh with 2 or more people	37.48%	14.21%	59.23%	1.5306
% drove alone	29.75%	13.42%	56.50%	1.9928
% with car, truck, or van:	36.53%	14.32%	67.70%	2.1764
Average household size	1.45	0.29	2.08	2.1897
% owner occupied	10.99%	18.60%	54.69%	2.3493
% of households that are families	15.94%	11.25%	44.66%	2.5526

Table 2.1 Flexcar Neighborhoods Compared to City of Seattle Totals

Those factors that appeared to be distinct were:

- a higher population density of individuals aged 22–39
- higher proportions of individuals commuting by walking
- lower proportions of individuals commuting by driving alone
- a higher proportion of non-family households
- smaller average household size
- a higher proportion of renters

In addition to those above, median income was significant in that there was a lower proportion of high-income households in the Flexcar neighborhoods than in the city as a whole, contradicting early claims that carsharing works better in higher and middle income neighborhoods. The percentage of those with a master's degree was also significantly higher in the city as a whole than in the Flexcar neighborhoods, despite the fact that the majority of carsharing users are highly educated. While Flexcar is most likely attracting highly educated (and perhaps middle-income) individuals to its program, these individuals are likely to live in mixed neighborhoods [15]. Because the characteristics of Flexcar neighborhoods contradict much of what is known about carsharing users, they are not considered in this analysis.

The Role of Parking

Since no previous literature had examined the role of parking availability in carsharing use, and this factor appeared to be so important in the focus groups and in some of the manager interviews, this study examined the peak and average parking use on street blocks near or containing a Flexcar location in Seattle using a 1999 residential parking study conducted for the City of Seattle [16]. That study recorded the average and peak parking use rate (the amount of available on- and off-street parking space in use) for selected street blocks in neighborhoods throughout the city. Each block that lay within one block of a Flexcar location was considered. Not all Flexcar locations in Seattle were considered, because the study included only a sample of street blocks in its study and so left out some areas with a Flexcar presence. A total of 187 records representing average parking use near Flexcar locations were considered in calculating average daily parking use on street blocks, and a total of 51 records were considered in calculating peak parking use on city blocks. The lower number of peak use records is because the study considered whole city blocks instead of breaking them into four segments as was done for average parking use. (See Table 2.2)

Flexcar Neighborhoods	**Total Use**	**Public**	**Private**
Average Peak Use (51 records)	84%	85%	81%
Average Use (187 records)	75%	N/A	N/A

Table 2.2 Parking Use Near Flexcar Locations in Seattle

On average, Flexcar locations were in areas with an average parking use rate of 75% and a peak-hour use rate of 84%. To put that in perspective, the Institute for Transportation Engineers

Transportation Planning Handbook defines a parking use rate of 85% or more as an acute parking shortage; a driver likely would have to circle around the block numerous times before finding a parking space, causing significant frustration [17]. This study confirms that Flexcar locates cars predominantly in areas with low parking availability. Of course, some of these locations do not have such a high parking shortage, while others have a particularly extreme shortage, but the high average rate of use demonstrates that these neighborhoods discourage car travel because of the barriers due to lack of parking. It must be taken into account, however, that high-density neighborhoods and mixed-use neighborhoods often have parking shortages.

No such study of residential parking use has been undertaken in the Twin Cities, so a precise comparison of the Twin Cities to Seattle is not feasible. A carsharing operator in the Twin Cities should consider the critical parking areas of Minneapolis when picking car locations. It should also look at the parking availability in other neighborhoods that appear promising for other reasons. If a street has a large supply of on-street parking, it is probably an indication that owning and operating a vehicle is relatively, easy and a new carsharing startup may have difficulty competing in this environment. However, many of the neighborhoods that look promising for carsharing development also will likely have parking shortages because of their high residential densities and mix of uses.

Most Promising Neighborhoods for Carsharing in the Twin Cities

For the purpose of starting up a carsharing operation in the Twin Cities, the primary demographic and travel behavior factors were examined for block groups in Minneapolis and St. Paul using a GIS with census data. Parking considerations were not considered, because parking data does not exist for Minneapolis/St. Paul. This analysis resulted in a ranking system by which block groups were evaluated by how much they deviated from the average for Minneapolis/St. Paul in all of these characteristics. Table 2.3 shows the thresholds for the ranking system using the averages and standard deviation for each of these characteristics.

Data Type	Description	Twin Cities Block Group Mean	1 Standard Deviation from Mean
Density	Density of population aged 22-39	3,058/square mile	5,582/square mile
Transportation	Walk commute	5%	13%
	Did not commute driving alone	35%	50%
	Transit commute	12%	20%
Household	Non-family households	27%	40%
	1-person households	35%	50%
	Renters	38%	66%

Table 2.3 Thresholds for Choosing Carsharing Neighborhoods in the Twin Cities

Source: U.S. Census Bureau. Census 2000, Summary File 3 – Sample Data

Density of the young adult population is the most important factor, since that should be the essential driver of the market for a new carsharing program; a carsharing startup needs a critical mass of this demographic group in order to gain significant traction. Transportation characteristics are the next most important, followed by household characteristics. Those block groups that were above the 68th percentile (one standard deviation above the Minneapolis/St. Paul mean) for all the previously described characteristics are considered the ripest for carsharing in the Twin Cities. Those block groups for which only all transportation characteristics and density of young adults were above the 68th percentile are considered the next most promising. Those block groups for which only all household characteristics and density of young adults were above the 68th percentile are considered the third most promising. Finally, carsharing might have potential in other neighborhoods with a high density of young adults without necessarily satisfying all of the previously mentioned criteria or in areas that are above average in all characteristics but not one full standard deviation above average. These should be considered later.

#1: Top Neighborhoods in All Categories

There are five block groups that fall above the 68th percentile in all categories. Four of these are located along the southern edge of downtown Minneapolis (around Loring Park, Stevens Square, and Elliot Park), and one is located in downtown St. Paul.

#2: Top Neighborhoods in Transportation Categories

There are five neighborhoods that fall above the 68th percentile in transportation categories and in the density of young adults category but not in all of the household categories. These

neighborhoods are located in Ventura Village, around Loring Park, the West Bank of the University of Minnesota, and Whittier neighborhoods in Minneapolis.

#3: Top Neighborhoods in Household Categories

There are 16 block groups that fall above the 68th percentile in the household characteristics and in the density of young adults category but not in the all of the transportation categories. These are located primarily in the Uptown, Seward, Whittier, Loring Heights, and Marcy-Holmes neighborhoods of Minneapolis, and the Cathedral Hill neighborhood of Saint Paul.

#4 and #5: Top Neighborhoods in Density of Young Adults (4), and Other Neighborhoods Above Average in all Categories (5).

These categories fill out the rest of the potential carsharing neighborhoods for the Twin Cities. These are located primarily close to block groups that fall within the first three rankings with a few notable exceptions near Hamline University and Highland Park in Saint Paul. (See Figures 2.2, 2.3, and 2.4)

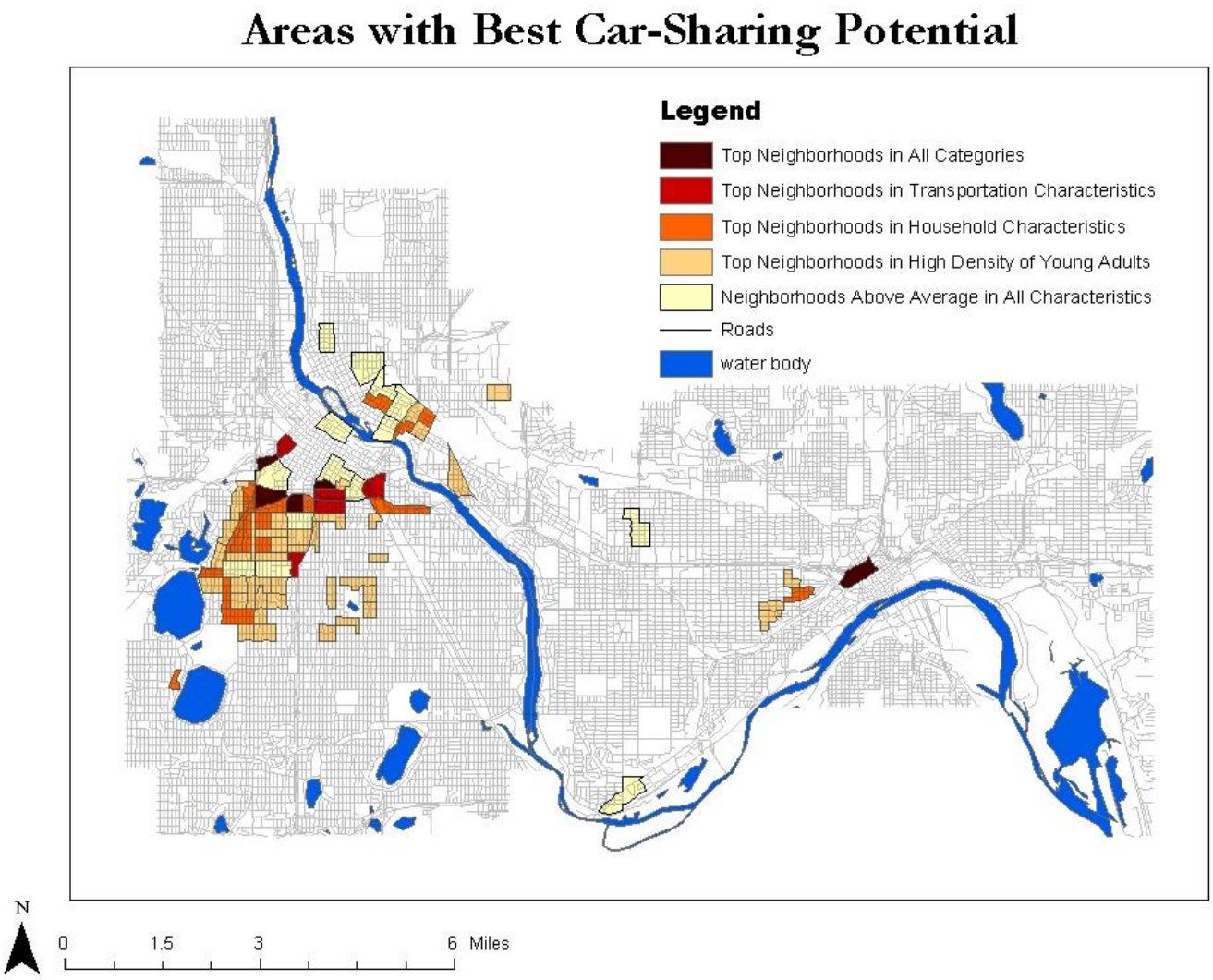

Figure 2.2 Minneapolis and St. Paul Neighborhoods

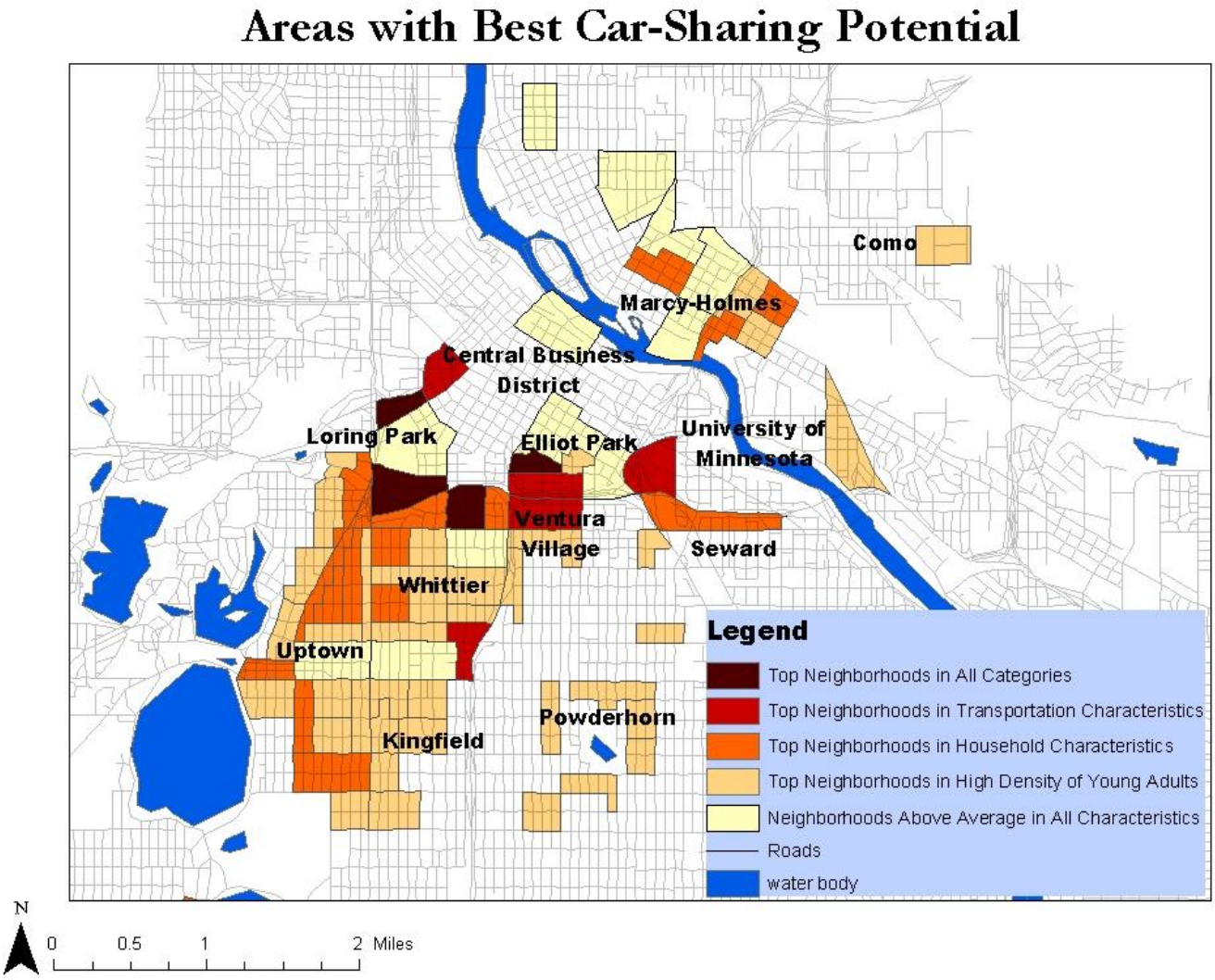

Figure 2.3 Minneapolis Neighborhoods

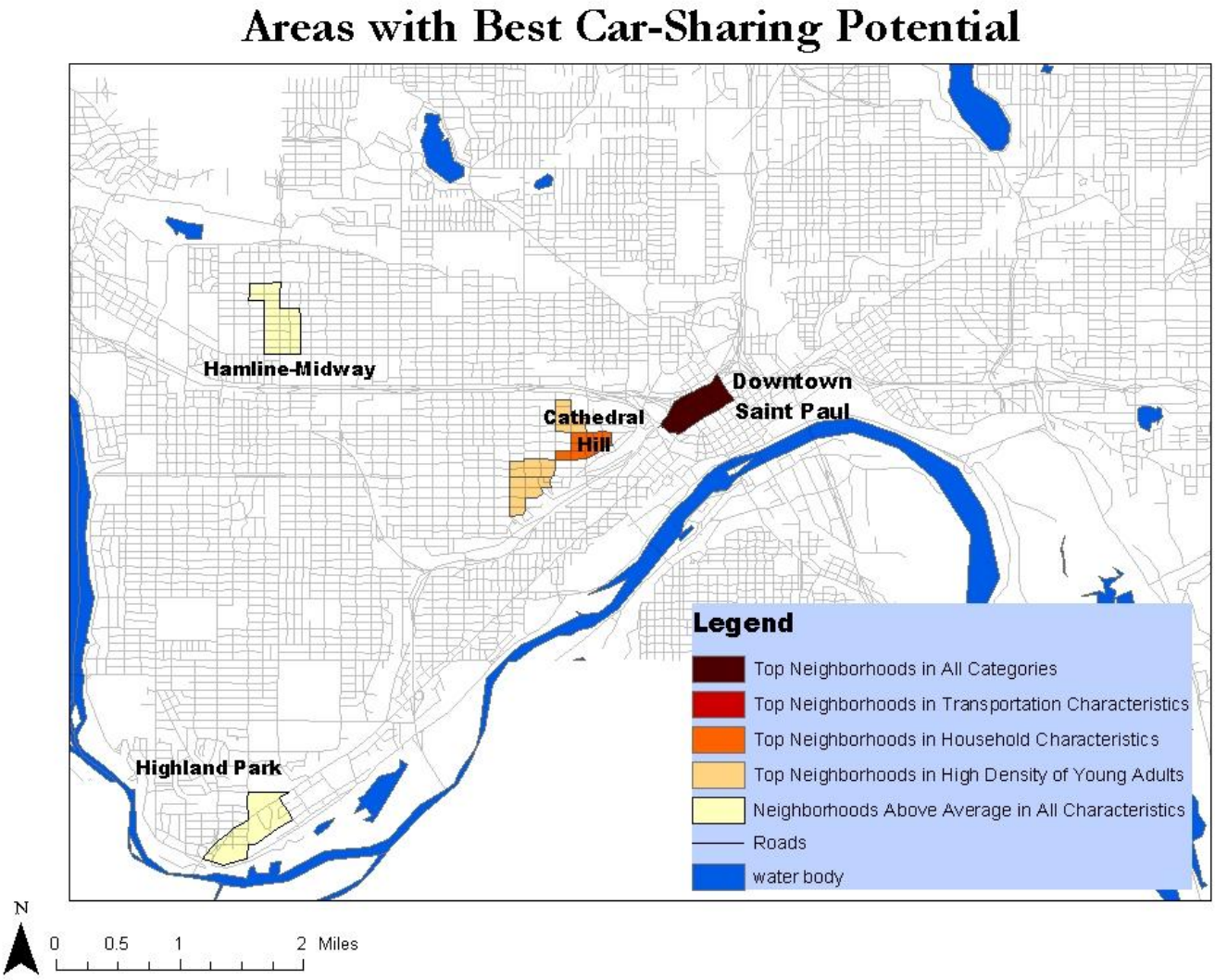

Figure 2.4 St. Paul Neighborhoods

HOURCAR already has committed to placing its first vehicles in Loring Park, Uptown (in the Lake Street and Hennepin Avenue area), and Lowertown in downtown St. Paul. HOURCAR considered conversations with non-profit CSO operators in other cities and Shaheen and Cervero's literature about the carsharing market. While HOURCAR's managers were confident in the potential in these initial locations, they requested this market analysis to confirm their choices and to determine other areas of the Twin Cities with carsharing market potential. HOURCAR managers did not consider the detailed demographic and travel behavior data considered in this analysis, but relied on its extensive familiarity with the Twin Cities community and perceptions of CSOs elsewhere. HOURCAR looked at residential density, areas with significant numbers of young adults, and areas where it felt a large percentage of the population held a progressive ethic about environmental issues and would be responsive to the carsharing alternative. In addition, HOURCAR chose the Saint Paul location, because the organization received funding from a St. Paul-based foundation for start-up service in St. Paul [18].

The results of this analysis confirm that the HOURCAR made good choices regarding its initial car placement. The Loring Park neighborhood appears to be the most promising for carsharing, as does a small area of downtown Saint Paul. The Uptown neighborhood also contains most of the characteristics that make carsharing successful, particularly in the household demographic categories. As HOURCAR expands, it should consider the other areas in this analysis that look promising when deciding where to launch new service. It should also conduct surveys of its membership and analysis of the revenue performance of each car to determine which factors appear most important: demographic household factors or transportation factors. Knowing what factors are particularly influential in the Twin Cities market will add utility to the previously-described ranking system, since this system is based on the experience of CSOs in other cities.

Additional Considerations

HOURCAR may gain special knowledge of the carsharing market as it proceeds with its program and should use that knowledge to inform its decisions about where to place cars. One strategy that many CSOs use to determine future locations is an online form where individuals interested in the program can enter their addresses; this information is then entered into a database. Once the database has a critical mass of interested parties in a particular area, the CSO will consider placing a vehicle in it. The availability of business members also should play a role in determining appropriate locations. The most obvious market for business members would be the CBDs of Minneapolis and St. Paul. These are areas well served by public transportation (37% of downtown commuters take transit according to the City of Minneapolis [19]) and where there are large concentrations of public agencies and large corporate offices. The University of Minnesota also should be a prime target for a business partnership both for its staff fleet and for possible use by students. Indeed, areas where a synergy exists between business and individual memberships would be ideal. In this way, the residential areas near downtown Minneapolis and St. Paul and the University of Minnesota may end up being quite successful if enough business partnerships are forged.

Besides employer memberships, HOURCAR also can forge partnerships with property managers who could similarly offer reduced-fee membership to their tenants. All of these neighborhoods that appear promising for early HOURCAR implementation contain large quantities of rental

housing. The Como neighborhood also has a large concentration of graduate student housing that contain many married international students. These housing cooperatives also may provide an interested market for HOURCAR. Partnerships like these could provide the necessary "anchor" that would allow carsharing to become sustainable in these neighborhoods. As membership grows in each neighborhood, additional cars should be spread throughout the neighborhood to cover as large a market area as possible but not so far as to make it difficult for members in one area to walk to a vehicle if the one nearest their home is rented.

Study Conclusions

This analysis provides a guide for initial program development in terms of picking geographic markets for service expansion. While we can reasonably expect the carsharing business in the Twin Cities to operate under similar conditions as it has elsewhere, HOURCAR likely will learn a great deal about the behavior of its membership and the expanse of its potential market that are not apparent in a generalized cross-sectional study such as this one. The market factors that HOURCAR discovers to be significant in its early stages of operation can alter or add to the assumptions presented in this analysis for use in places other than the Twin Cities. However, any conclusions based on the experience of HOURCAR should consider that its business plan is unique among CSOs in that it is designed to be a non-profit self-sufficient operation within a year after its launch; by comparison, most non-profits have relied heavily on outside funding for a longer period of time. This characteristic of HOURCAR's business plan will make it particularly sensitive to the market response to its service.

The market identified in this analysis certainly is not the only market that may benefit or be attracted to carsharing. Many factors, including the type of marketing that existing carsharing providers use, have made carsharing attractive to this limited demographic, but evidence from the growth of carsharing on the East and West Coasts is finding potential for carsharing in more diverse neighborhoods. Once HOURCAR can become self-sustaining through growing a membership in these high-potential neighborhoods, it can use other approaches to further develop and diversify its membership. This can be done through altering its rate structure, partnering with public and non-profit entities to offer membership to low-income individuals and organizations, and pursuing targeted marketing strategies to gain members in less conventional districts of the metropolitan area that do not fit the profile described in this study.

It is this expansion of the service model that provides the greatest opportunities for further study. Low-income individuals have not adopted carsharing to a great extent, although some CSOs have received funding to subsidize targeting this population. Another aspect of this business that should receive more attention is the role of partnerships in service delivery. The carsharing reservation/billing/management technology may have potential beyond its current use, and creative partnerships may expand this potential to previously unexplored market segments. This study has used the experience only of existing CSOs to inform the development of a new service in the Twin Cities; it says little about the long-term market potential of this kind of transportation option. As carsharing grows throughout the United States and becomes more visible to a larger section of the population, new partnerships and markets certainly will be explored by CSOs and will demand scrutiny in further evaluating the costs and benefits of carsharing.

"Timebanking" Transit and Carsharing: Can it Bring Additional Users to Carsharing Originations and Increased Mobility and Access to Low-Income Populations?

Study Introduction and Overview

Carsharing has been most attractive to those in middle-income brackets, with most users being those who could afford to buy an additional car but instead choose to live in areas where it is more convenient to join a CSO. However, the structure of carsharing, which moves the fixed costs of car ownership to variable costs, seems to create an opportunity for providing access to the benefits of private automobile use to those that could not otherwise afford it. As Giuliano and others have pointed out, a highly disproportionate number of low-income households have limited access to private vehicles [20]. The lack of access to private vehicles appears to result in reduced trip-making and increased use of alternative modes [20]. While one should attribute some of the reduced trips to lower amounts of money available for discretionary travel, low-income people may not be making other trips simply because they are unable to access some auto-oriented destinations. Further, Giuliano shows that the use of alternative modes is by necessity, not choice—that is, people would rather use a private vehicle, if they could afford it [20]. Consequently, it appears that developing a scheme that allows carsharing use by lower-income people could be a "win-win:" CSO's could expand their customer base, while the low-income population would gain a means to access new areas. Note that a related effect is that the quality of the automobile fleet also would improve, as CSO's usually operate with new cars in good repair, while most cars purchased by low-income people tend to be older cars in poor repair. One area directly improved by this change would be air quality, as the worst emitting vehicles also are older cars in poor repair.

Financial considerations are the major obstacle towards making such a seemingly logical connection a reality. While carsharing has much lower fixed costs than owning a car, application fees, membership fees, and monthly fees may be part of paying for a CSO membership, all of which are greater fixed costs than paying transit fares or walking, and, over time, can add up to more than the fixed costs of owning a bicycle. For example, a Zipcar member in Minneapolis would pay a $25 application fee plus a $50 annual fee in addition to the $8 per hour use charge [21]. Similarly, HOURCAR, the other CSO in the Twin Cities, requires a $50 application fee and monthly fees that vary depending upon the plan the user chooses in addition to use charges. Note that the use charges and monthly fees to vary inversely [22]. Since low-income populations already pay a greater share of their income for transportation costs than people with higher incomes [20], adding these costs to their budget is a significant consideration. On the other hand, reducing carsharing fees to affordable levels for low-income people would be financial suicide for CSO's that struggle to make a profit operating in neighborhoods populated by users that can afford higher rates.

Consequently, this service would need some type of subsidy. A potential model for this subsidy would be a timebanking model where users "bank" transit trips that can be then used for carsharing time. An obvious partner for providing this subsidy would be transit providers. While these organizations are often strapped for resources themselves, collaborating with CSO's to offer carsharing to some of the low-income populations they serve could provide benefits in return. The subsidy could be a mechanism that at least retains and possibly increases ridership: if the hub is located in an area that provides good commute service, a program where the transit

service pays for an hour or two of carsharing use by riders that build up 8 to 10 transit trips per week (basically using transit for the work trip) preserves the transit commute. This idea is inspired by the "time-banking" model developed by Katherine Freund of ITNAmerica [23]. In the alternative, if low-income individuals buy their own car, the transit commute is likely lost, due to incentives for the new auto owners to maximize use of their new purchase. Giuliano points out that low-income people would rather own cars than take transit [20]. Additionally, such a program could attract new, higher-income riders, as the addition of carsharing would serve as incentive for higher-income residents to become regular transit users. In other words, the carsharing connection would provide them with "mobility insurance."

An option for reducing this subsidy is locating carsharing hubs in locations accessible to both low-income and higher-income users. Given the finding that most carsharing members choose to live in mixed-income neighborhoods, this happy circumstance is not completely impossible to find. Since financial success of a CSO is based upon increasing the hours each car is in use, the greatest benefit arises if additional users can be brought to existing cars, rather than expanding the fleet. Locating a hub in neighborhoods with high concentrations of low-income people actually exacerbates the latter situation, as the limits on charges previously discussed greatly increase the number of hours required for use before the hub breaks even. In other words, locating in an exclusively low-income neighborhood would likely require a continual subsidy to the CSO, exposing it to the same critiques and potential cuts endured by existing government-subsidized transit services. Instead, location in mixed-income neighborhoods creates the opportunity for creative pricing structures, internal cross-subsidizations, and other mechanisms that reduce the overall additional assistance needed.

Obviously, this is a "niche." The program would work only in mixed-income neighborhoods that have a high level of transit service. Fortunately, the discussion in earlier tasks shows these are the same neighborhood characteristics that indicate a higher likelihood of carsharing success. The remaining obstacles are identifying the neighborhoods most favorable to adding low-income users and working with a transit provider to develop a method for financing the subsidies.

Methodology

The research team examined whether such a model could work in the Twin Cities. To determine the likelihood for a time-banking model to work, the team looked at the following factors:

- population
- poverty rate
- work location
- transit use

The team then set up a working hypothesis that the neighborhood needed a high population density to support carsharing and discourage parking (thus creating demand for carsharing), commutes long enough that transit made more sense than walking or biking, a relatively high transit commute share, and, most importantly for this analysis, a poverty rate that is high enough for a significant number of low-income people to benefit from the program, but not so high as to overwhelm demand for the carsharing car.

For this analysis, we looked at four neighborhoods identified in earlier tasks as being most favorable to carsharing: the Loring Park, University of Minnesota, Marcy-Holmes, and Uptown areas (See Figure 2.5). Then, using the census tracts identified in the neighborhood analysis from earlier subtasks, we used census data to identify the population and poverty rates in each neighborhood. We calculated poverty rates for the neighborhood as an average of the tracts [24] (See Table 2.4). Finally, we created maps and tables describing where people in these neighborhoods work [25]. The results of this data, and analysis of whether the model could succeed in each neighborhood, are presented on the following pages, with neighborhoods listed from most likely to least likely.

Uptown Area

This is the most populous of the four areas, with a 2000 population of 30,447. However, it also had the lowest amount of poverty, with 15.2% of individuals in poverty (4,639, also the lowest actual number of the four areas) and 12.7% of families. Figures 2.6 and 2.7 show that while the greatest concentration of workers have relatively short commutes (less than 10 miles), these trips are to the transit-friendly destinations of downtown Minneapolis and the University of Minnesota. Transit share in 2000 for zip code 55408 was 20.5% [26]. Additional workers are concentrated in St. Paul, Bloomington, and Edina (See Table 2.5), which are 10 to 15 miles away, and more likely to be taken by a motorized mode of transportation, rather than biking or walking; these areas are also accessible by transit. Consequently, this area appears to be a likely candidate where a timebanking program could serve the low-income residents and sustain itself.

Marcy-Holmes Area

This area has a population of 21,168 and a high poverty rate of just less than 1 in 3 people, or, 28.1%. However, the family poverty rate is a much lower 14.2%, possibly creating a situation where low-income families could benefit from carsharing providing a "second" car, if the program could be structured to cater to families only. Obviously, the feasibility and wisdom of further restricting membership is questionable. Further, and similar to the Loring Park area, workers are very likely to work close to home, as shown in Figures 2.8 and 2.9. Consequently, walking and biking would be as attractive as transit as an alternative commute mode. The percentage of workers in Minneapolis (See Table 2.6) is not as high as Loring Park, however, and Figure 2.8 does indicate some concentrations of workers near downtown St. Paul, Bloomington, and Edina, which are relatively accessible by transit. Transit share for work commutes in zip code 55414 is only 12%, while 21.6% walked [27]. Thus, while not as obvious a fit as Uptown, a timebanking model might work in this area if sufficiently customized and given a lot of attention during its first years of operation.

Loring Park Area

This area is almost as populous as Uptown, with a 2000 population of 29,652. However, its poverty rates were higher, with nearly 20% of individuals and families in poverty. In addition, this area is located closer to downtown Minneapolis (within four miles), and 49% of its workers, the highest of the four neighborhoods, work within the city limits (See Table 2.7). Figures 2.10 and 2.11 further demonstrate the concentration of workers with their jobs located quite close to where they live. Consequently, a timebanking model might not be as effective here. The higher poverty rates indicate a possible higher demand by low-income users, thus reducing the number of trips available to paying users and reducing the likelihood of the hub sustaining itself

financially. On the other hand, the transit share for work commutes is the highest of the four neighborhoods, so, if sufficient funding exists to subsidize the likely operating loss, low-income users could accumulate the transit trips necessary to obtain use of a carsharing car. Despite the close proximity of downtown, the transit share of work commutes in zip code 55403 is 21.3% with 18% walking [28].

University of Minnesota Area

This area is least likely to sustain a timebanking model. The area has the smallest population (14,281) and the highest poverty rate, leaving a dearth of paying users. Further, a significant portion of the individuals below the poverty rate are probably students, who are unlikely to use transit for regular commute trips, thus making their demand for carsharing vehicles less predictable and possibly at times when paying users also would be likely to demand use of the vehicles. Finally, as shown in Figures 2.12 and 2.13, jobs are concentrated within a very small area. Two zip codes are referenced in this area: 55455 and 55454. The transit share of work commutes in 55455 (which includes the U of M campus), is only 10%, with 50% walking. The transit share is higher in the adjacent 55454, at 19%, but that is still not as high as the walking share, which is 25% [29].

However, despite all these negatives, a timebanking model might even work here. Since the University has two campuses, one in Minneapolis and one in St. Paul, students and staff who live in the area could accumulate a significant number of transit trips between each of these. Further, Figure 2.12 and Table 2.8 show a concentration of jobs in downtown St. Paul and in Bloomington, near the airport and Mall of America, which are easily accessed by transit. Consequently, if further research demonstrated sufficient demand by paying customers to cross-subsidize use by those truly in poverty, a timebanking model could sustain itself.

Need for Additional information

Obviously, this review is only a first cut. More data is needed on how much of a subsidy per user would be necessary, how much of that subsidy could be covered though contributions from a transit agency, and how much could be covered through cross-subsidy from paying users. Further, analysis is needed to determine whether there is an optimal mix of lower- and higher-income users—that is, whether the combination of increased vehicle use and lower income per use results in a linear or parabolic return, and, if the latter, where the high point(s) are.

In addition, the scheme itself is not perfect. It is not likely to improve mobility and access in the poorest neighborhoods, and it assumes that transit is most effective at serving commute trips, while creating a competing alternative to non-commute trips. As a result, any advocate of this program is likely to face criticism not only from anti-tax and anti-government groups, but also from transit advocates as well.

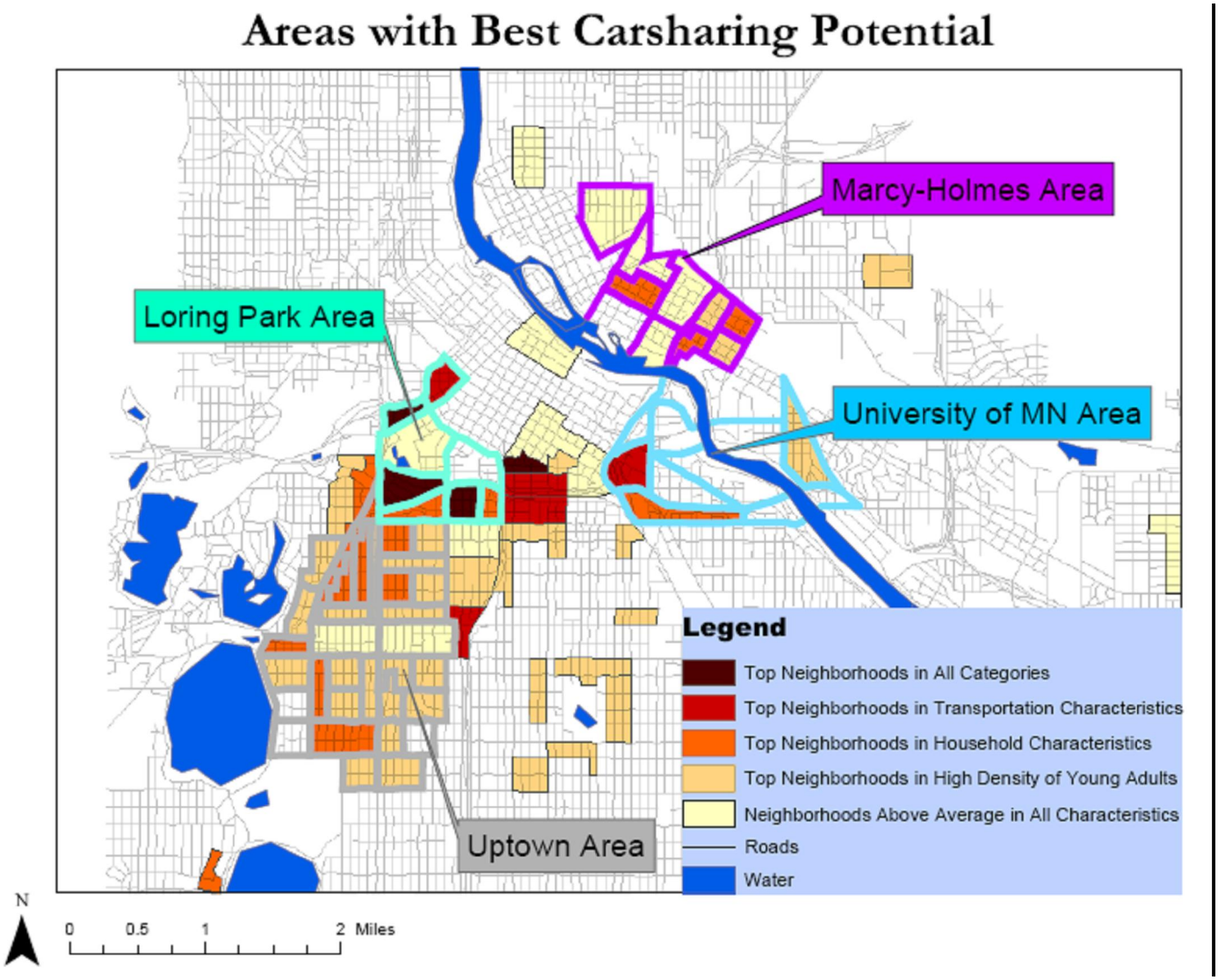

Figure 2.5 Areas with Best Carsharing Potential

Table 1: Uptown Area

Population	30,447	Families	5,109
Individuals in Poverty	4,639	Families in Poverty	649
Poverty Rate	15.2%	Poverty Rate	12.7%

Table 2: Marcy-Holmes Area

Population	21,168	Families	3,176
Individuals in Poverty	5,953	Families in Poverty	451
Poverty Rate	28.1%	Poverty Rate	14.2%

Table 3: Loring Park Area

Population	29,652	Families	3,354
Individuals in Poverty	5,863	Families in Poverty	636
Poverty Rate	19.8%	Poverty Rate	19.0%

Table 4: University of Minnesota Area

Population	14,281	Families	2,665
Individuals in Poverty	5,104	Families in Poverty	713
Poverty Rate	35.7%	Poverty Rate	26.8%

Table 2.4 Poverty Rates by Neighborhood

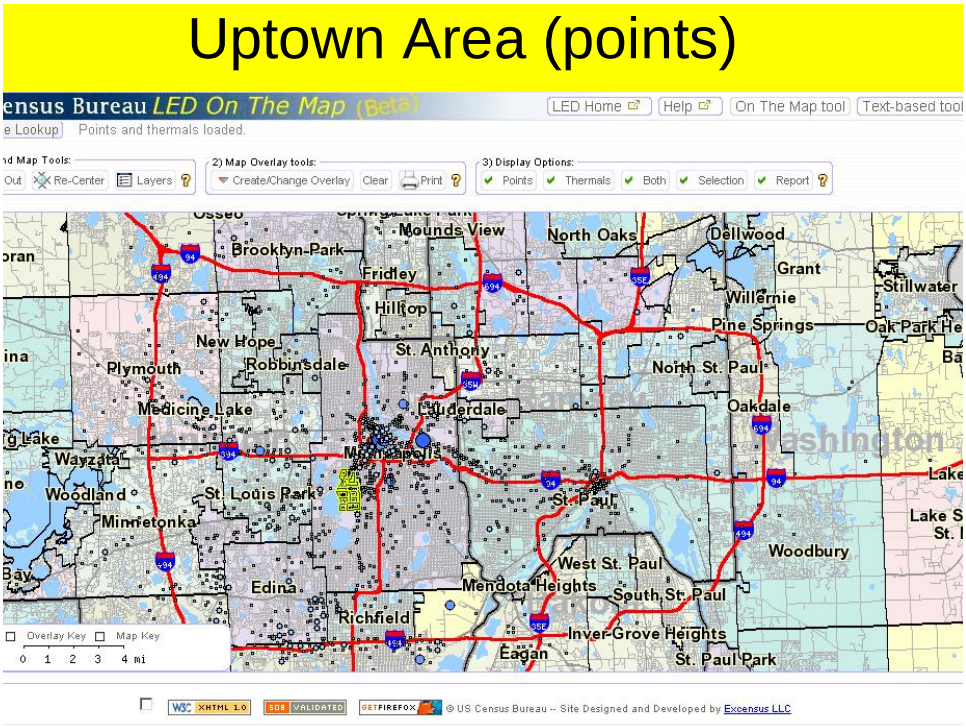

Figure 2.6 Uptown Area (points)

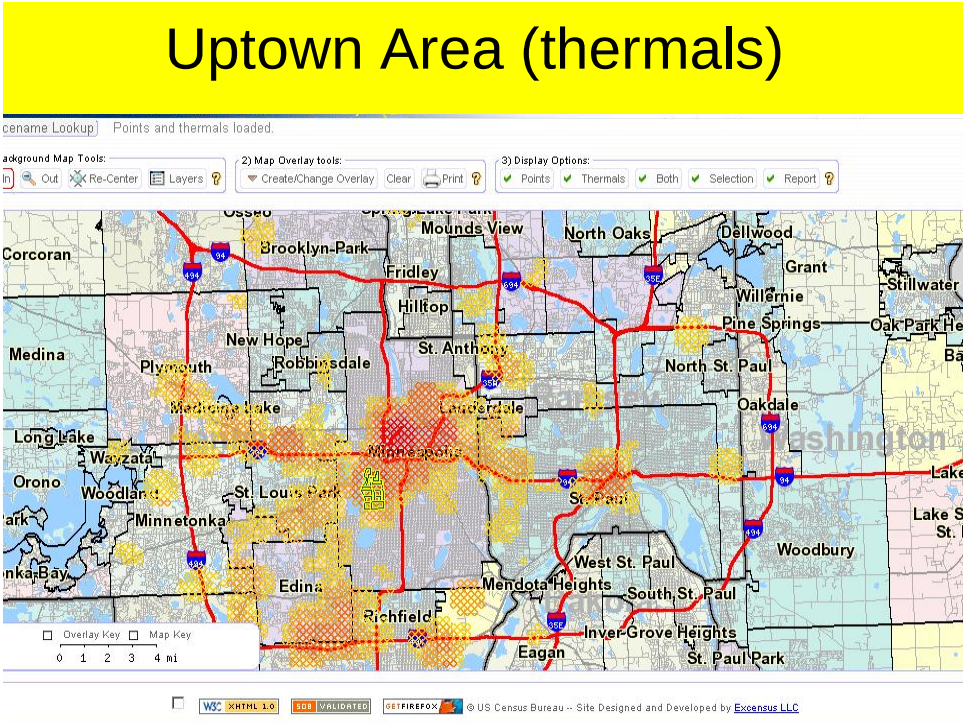

Figure 2.7 Uptown Area (thermals)

Commute Shed Report-Where Residents are Employed: Minneapolis' Uptown Area

NUMBER OF JOBS HELD BY RESIDENTS

	2003		2002	
	Count	Share	Count	Share
*All Jobs	7,823	100.0%	8,572	100.0%
*All Jobs (Private Sector Only)	6,870	87.8%	7,605	88.7%
*All Primary Jobs (Worker's highest paying job)	7,202	92.1%	7,923	92.4%
*All Primary Jobs (Private Sector Only)	6,298	80.5%	6,991	81.6%

WHERE AREA WORKERS ARE EMPLOYED

	2003		2002	
	Count	Share	Count	Share
Total Workers (Primary Jobs-Private Sector)	6,298	100.0%	6,991	100.0%
Cities/Towns Where Residents are Employed				
*Minneapolis	2,770	44.0%	3,017	43.2%
*St. Paul	451	7.2%	498	7.1%
*Bloomington	451	7.2%	504	7.2%
*Edina	311	4.9%	422	6.0%
*Golden Valley	237	3.8%	233	3.3%
*All Other Locations	2,078	33.0%	2,317	33.1%
Counties Where Residents are Employed				
*Hennepin	4,879	77.5%	5,427	77.6%
*Ramsey	751	11.9%	791	11.3%
*Dakota	196	3.1%	207	3.0%
*Anoka	121	1.9%	175	2.5%
*Washington	57	0.9%	42	0.6%
*All Other Locations	294	4.7%	334	4.8%

Table 2.5 Commute Shed Report—Where Residents Are Employed: Minneapolis' Uptown Area

Source: LED Worker Origin/Destination Database (2nd Quarter 2002 and 2003)

Marcy-Holmes Area (points)

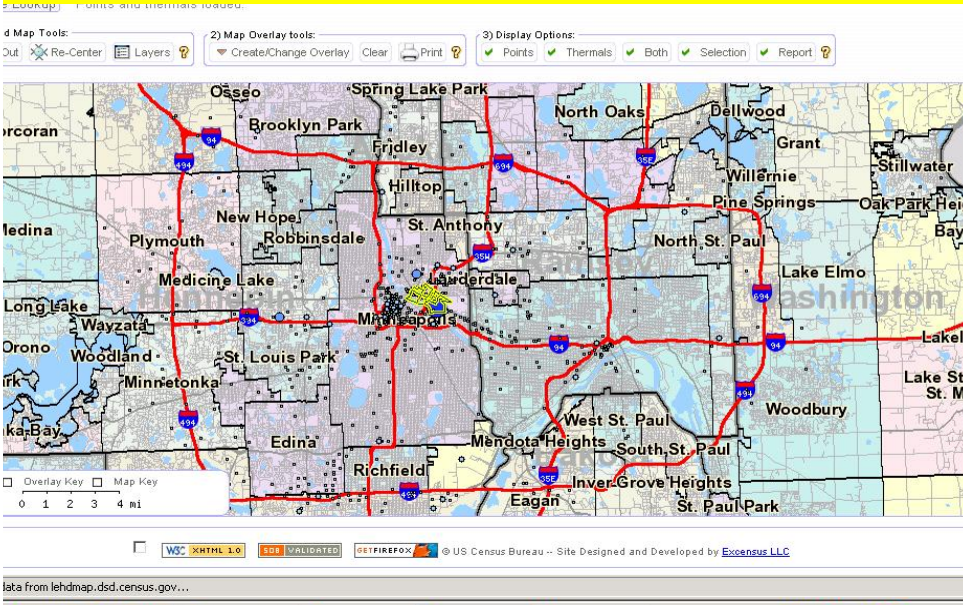

Figure 2.8 Marcy-Holmes Area (points)

Marcy-Holmes Area (thermals)

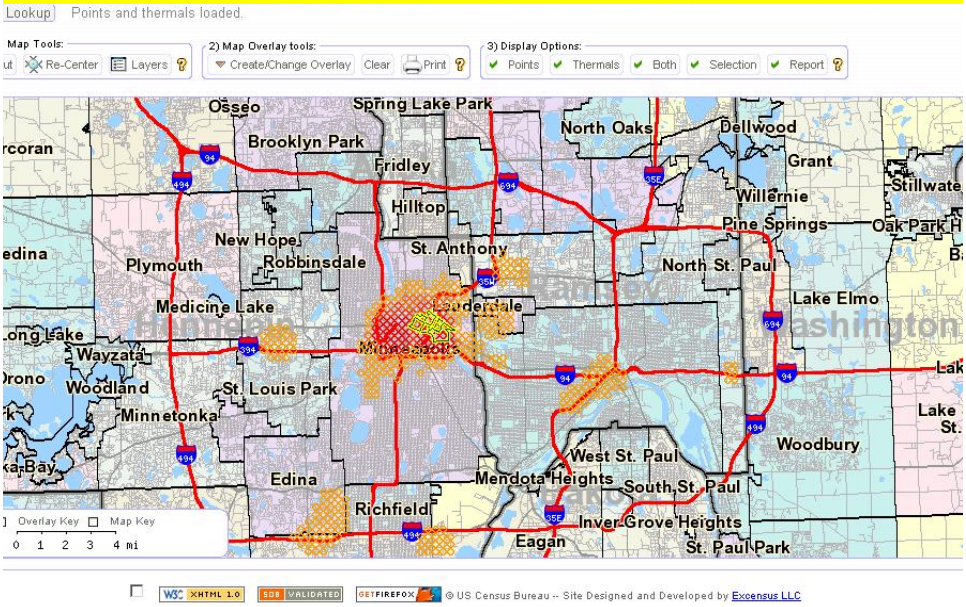

Figure 2.9 Marcy-Holmes Area (thermals)

Commute Shed Report-Where Residents are Employed: Minneapolis' Marcy-Holmes Area

NUMBER OF JOBS HELD BY RESIDENTS

	2003		2002	
	Count	Share	Count	Share
*All Jobs	2,488	100.0%	2,712	100.0%
*All Jobs (Private Sector Only)	1,974	79.3%	2,214	81.6%
*All Primary Jobs (Worker's highest paying job)	2,246	90.3%	2,413	89.0%
*All Primary Jobs (Private Sector Only)	1,761	70.8%	1,941	71.6%

WHERE AREA WORKERS ARE EMPLOYED

	2003		2002	
	Count	Share	Count	Share
Total Workers (Primary Jobs-Private Sector)	1,761	100.0%	1,941	100.0%
Cities/Towns Where Residents are Employed				
*Minneapolis	821	46.6%	940	48.4%
*Bloomington	120	6.8%	115	5.9%
*St. Paul	119	6.8%	147	7.6%
*Edina	64	3.6%	58	3.0%
*Roseville	52	3.0%	60	3.1%
*All Other Locations	585	33.2%	621	32.0%
Counties Where Residents are Employed				
*Hennepin	1,272	72.2%	1,399	72.1%
*Ramsey	243	13.8%	279	14.4%
*Dakota	82	4.7%	61	3.1%
*Anoka	58	3.3%	74	3.8%
*Washington	17	1.0%	25	1.3%
*All Other Locations	89	5.1%	88	4.5%

Table 2.6 Commute Shed Report—Where Residents Are Employed: Minneapolis' Marcy-Holmes Area

Source: LED Worker Origin/Destination Database (2nd Quarter 2002 and 2003)

Loring Park Area (points)

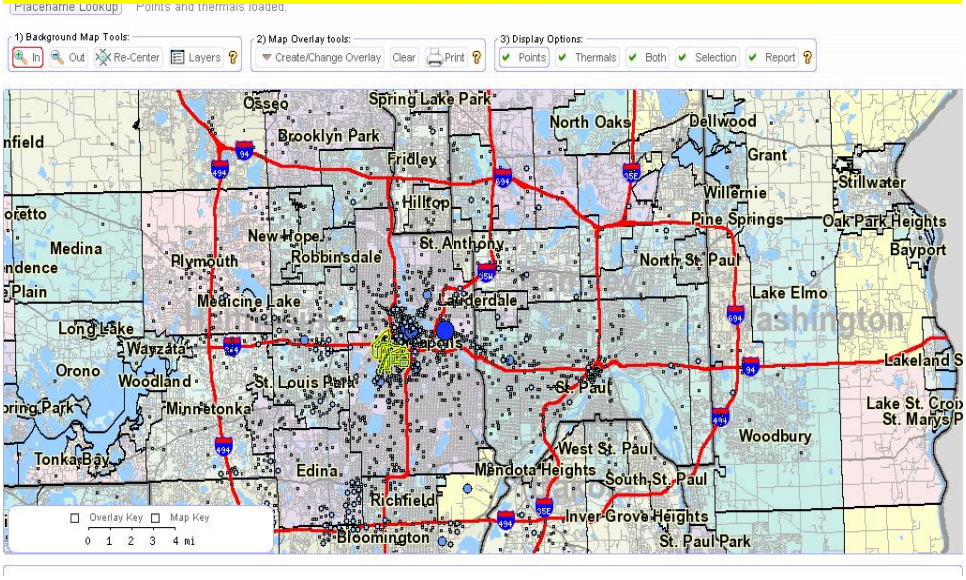

Figure 2.10 Loring Park Area (points)

Loring Park Area (thermals)

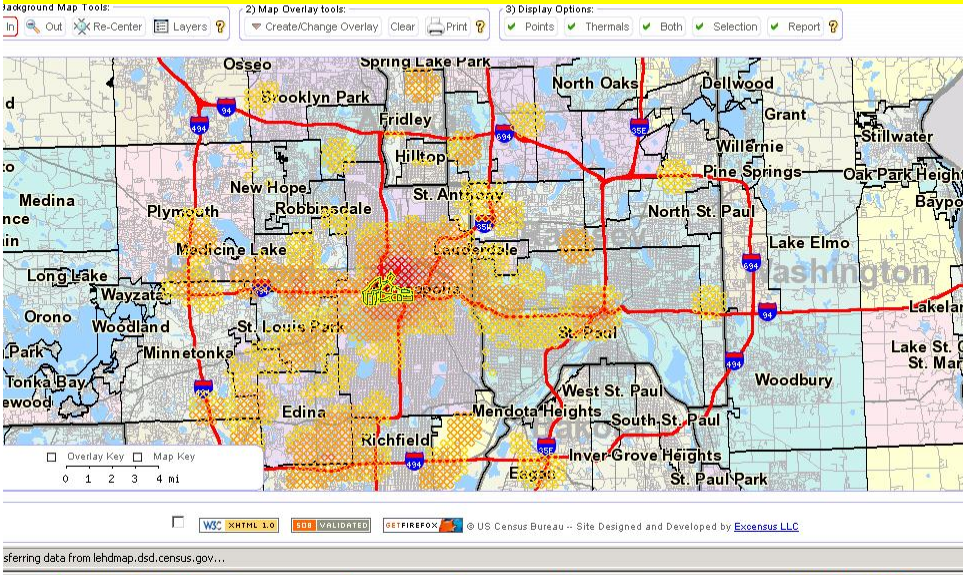

Figure 2.11 Loring Park Area (thermals)

Commute Shed Report-Where Residents are Employed: Minneapolis' Loring Park Area

NUMBER OF JOBS HELD BY RESIDENTS

	2003		2002	
	Count	Share	Count	Share
*All Jobs	11,390	100.0%	12,237	100.0%
*All Jobs (Private Sector Only)	10,221	89.7%	10,977	89.7%
*All Primary Jobs (Worker's highest paying job)	10,339	90.8%	11,073	90.5%
*All Primary Jobs (Private Sector Only)	9,229	81.0%	9,890	80.8%

WHERE AREA WORKERS ARE EMPLOYED

	2003		2002	
	Count	Share	Count	Share
Total Workers (Primary Jobs-Private Sector)	9,229	100.0%	9,890	100.0%
Cities/Towns Where Residents are Employed				
*Minneapolis	4,551	49.3%	4,864	49.2%
*St. Paul	632	6.8%	656	6.6%
*Bloomington	540	5.9%	541	5.5%
*Edina	443	4.8%	522	5.3%
*St. Louis Park	306	3.3%	320	3.2%
*All Other Locations	2,757	29.9%	2,987	30.2%
Counties Where Residents are Employed				
*Hennepin	7,185	77.9%	7,800	78.9%
*Ramsey	1,053	11.4%	1,047	10.6%
*Dakota	321	3.5%	246	2.5%
*Anoka	200	2.2%	236	2.4%
*Washington	78	0.8%	59	0.6%
*All Other Locations	392	4.2%	482	4.9%

Table 2.7 Commute Shed Report—Where Residents Are Employed: Minneapolis' Loring Park Area

Source: LED Worker Origin/Destination Database (2nd Quarter 2002 and 2003)

University Area (points)

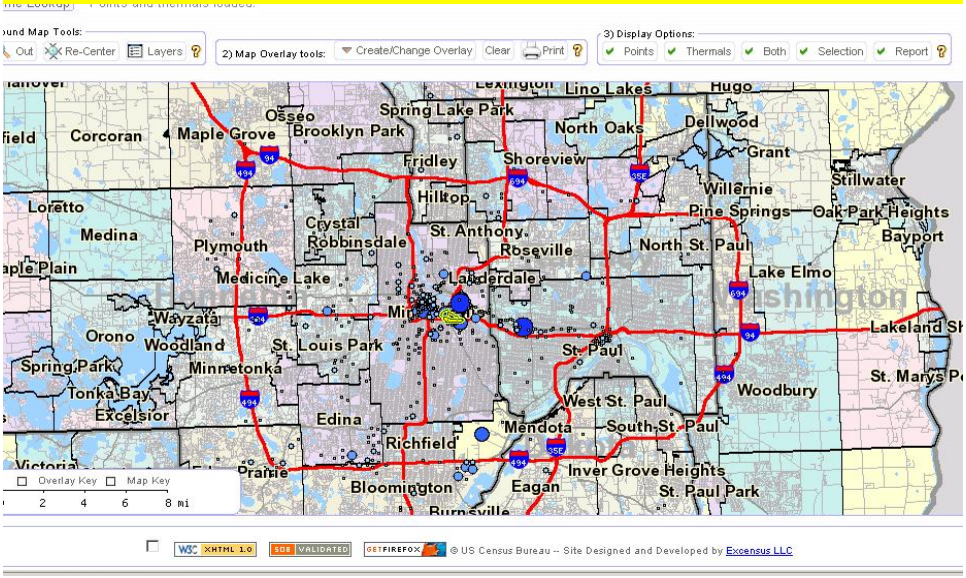

Figure 2.12 University Area (points)

University Area (thermals)

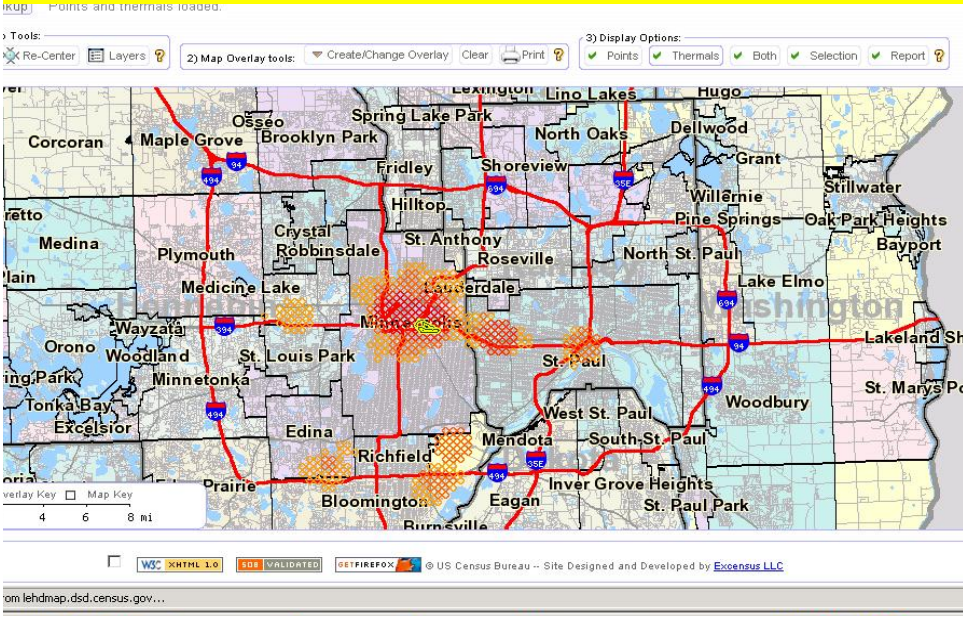

Figure 2.13 University Area (thermals)

Commute Shed Report-Where Residents are Employed: Minneapolis' University of Minnesota Area

NUMBER OF JOBS HELD BY RESIDENTS

	2003		2002	
	Count	Share	Count	Share
*All Jobs	2,407	100.0%	2,565	100.0%
*All Jobs (Private Sector Only)	2,126	88.3%	2,267	88.4%
*All Primary Jobs (Worker's highest paying job)	2,087	86.7%	2,277	88.8%
*All Primary Jobs (Private Sector Only)	1,817	75.5%	2,004	78.1%

WHERE AREA WORKERS ARE EMPLOYED

	2003		2002	
	Count	Share	Count	Share
Total Workers (Primary Jobs-Private Sector)	1,817	100.0%	2,004	100.0%
Cities/Towns Where Residents are Employed				
*Minneapolis	833	45.8%	952	47.5%
*St. Paul	259	14.3%	173	8.6%
*Bloomington	109	6.0%	155	7.7%
*Unincorporated Area	72	4.0%	68	3.4%
*Edina	57	3.1%	73	3.6%
*All Other Locations	487	26.8%	583	29.1%
Counties Where Residents are Employed				
*Hennepin	1,264	69.6%	1,428	71.3%
*Ramsey	326	17.9%	287	14.3%
*Dakota	50	2.8%	46	2.3%
*Anoka	47	2.6%	48	2.4%
*Steele	18	1.0%	25	1.2%
*All Other Locations	112	6.2%	162	8.1%

Table 2.8 Commute Shed Report—Where Residents Are Employed: Minneapolis' University of Minnesota Area

Source: LED Worker Origin/Destination Database (2nd Quarter 2002 and 2003)

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Chapter 3:
I-394 MnPASS Attitudinal Evaluation Summary

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Introduction

Overview

This chapter reviews the results of the I-394 Attitudinal Panel Survey (See Appendix B for the complete Wave 3 report). The purpose of this study was to analyze preferences and travel behavior for individuals using the I-394 corridor before and after the implementation of a high-occupancy toll (HOT) lane. Data, figures, and tables used in this report are from the Wave 3 report unless otherwise stated. After the survey methods are described, the HOT lane's impact on mode split, equity, enforcement, and technology are analyzed.

Purpose of the Attitudinal Panel Survey

The I-394 MnPASS Express Lane project created Minnesota's first HOT lane. This project began allowing solo drivers to pay a fee to use an 11-mile stretch of carpool lanes between downtown Minneapolis and the western suburbs in May 2005. While solo drivers pay to use the MnPASS lanes, carpoolers, bus riders, and motorcyclists may use the lanes free of charge. Dynamic pricing ensures continued free flow in the lanes at about 50 to 55 miles per hour by adjusting the toll up or down depending upon the amount of traffic in the lanes. The per-trip fee depends on where users enter and exit the MnPASS Express Lanes. The variable, per-trip fee is always charged for single-occupancy vehicle (SOV) use in the reversible section, while fees are charged only in the peak direction during rush hours in the diamond lane section. The fee is posted on changeable message signs, which can be adjusted as often as every three minutes, located just before entrances to MnPASS lanes. The tolls range from 25 cents to $8 and average $1 to $4 during rush hour. Solo drivers who subscribe to the MnPASS program (identified in this chapter as subscribers or transponder owners) are issued windshield-mounted transponders for automatic vehicle identification. Each time subscribers use the lanes; their accounts are automatically debited the per-trip fee. MnPASS subscribers also pay a $1.50 monthly fee for leasing the MnPASS transponder.

MnPASS is a new and significant change in highway management in Minnesota. To evaluate public acceptance and use, the Minnesota Department of Transportation (Mn/DOT) commissioned the University of Minnesota's Humphrey Institute of Public Affairs to conduct

before-and-after project implementation surveys. The Attitudinal Panel Survey used a longitudinal panel design to collect opinion, travel behavior, and willingness to pay information from users and potential users of the MnPASS Express Lanes.

Attitudinal Panel Survey Methods and Design

The 2004 Baseline Attitudinal Panel Survey established a foundation for the conduct of future waves of data collection. The design included the use of a treatment sample and control sample. The treatment sample consisted of households selected from the I-394 corridor, and the control sample consisted of households in the I-35W corridor. I-35W was selected as the control, because it was the only other facility with carpool lanes in the immediate area. Segments of each corridor were designated as follows:

- I-394 Travel Shed: Between Hwy 101 (West) and I-94 (East); alternate segment within this stratum was Minnesota Highway 55
- I-35W Travel Shed: Between Hwy 62 (North) and Hwy 13 (South); alternate segment within this stratum was Minnesota Highway 77

The population of inference (or population under study) consisted of those individuals 18 years of age or older, residing within the target travel sheds, that had traveled the target segments of I-394, Hwy 55, I-35W, or Hwy 77 between 6 a.m. and 9 p.m. at least once in the five weekdays prior to the day of interview. To efficiently sample this population, specific areas within the I-394 and I-35W travel sheds were pre-identified as being the likely residential locations for I-394 or I-35W users based on origin and destination data from the Household Travel Diary Survey, conducted as one element of the Twin Cities Metropolitan Area Travel Behavior Inventory (TBI). These data were used to identify the areas that generated the highest proportions of target trips. Random digit dial (RDD) sample was then proportionally allocated to those areas.

The Attitudinal Panel Survey measured the attitudes, perceptions, and reported travel behaviors of a scientific sample of residents of the study area. It covered issues of acceptance, equity, and effectiveness in congestion management, toll system performance, as well as changes in travel behavior, mode choice, route choice, and willingness to pay for the priced lane before and after the project implementation. As depicted in Figure 3.1, the survey waves took place in fall 2004, fall 2005, and spring 2006.

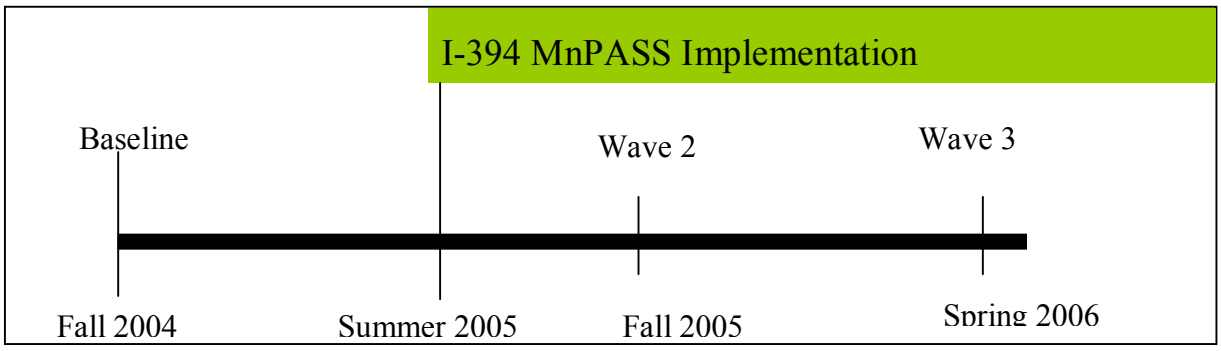


Figure 3.1 Attitudinal Panel Survey Timeline

The first wave (i.e., Baseline) of the Attitudinal Panel Survey was conducted prior to I-394 MnPASS Express Lane implementation in November/December 2004. In it, 1,000 respondents completed a 20-minute telephone survey, and 980 of these respondents agreed to continue as panel members. The second panel survey wave was conducted in November/December 2005, about six months after MnPASS implementation. Of the 980 baseline respondents who had agreed to be interviewed in Wave 2, 549 panel members were actually located, contacted, and interviewed. In addition, the Wave 2 sample included 400 choice-based respondents (i.e., 151 MnPASS subscribers and 250 transit users who were sampled from lists). All Wave 2 respondents recorded information about their travel in a travel log and also completed a modified version of the Baseline telephone survey.

The third wave of the Attitudinal Panel Survey was conducted in May/June 2006. A total of 1,228 respondents completed Wave 3 interviews. Of these, 343 were interviews with panel members (i.e., interviewed in the Baseline and Wave 2 Surveys). Additionally, 106 were with MnPASS subscribers and 178 were with transit users who were interviewed in Wave 2. In total, two-thirds (66%) of Wave 2 participants were re-surveyed in Wave 3. About one-third of the original panel members were successfully interviewed in all three waves of the Attitudinal Panel Survey (See Table 3.1).

PANEL TYPE	BASELINE		WAVE 2		WAVE 3
	Interviewed	Continued (Panel)	Interviewed	Continued (Panel)	Interviewed
I-394	750	736	413	364	266
I-35W	250	244	136	118	77
	1000	980	549	482	343

Table 3.1 Panel Attrition Overview

In addition to these participants in the previous survey waves, a new probability-based sample was introduced in Wave 3. These were 601 randomly-sampled residents of the I-394 or I-35W travel sheds. The Wave 3 Survey used slightly modified versions of the Wave 2 materials including a pre-notification letter, travel log, and a telephone survey instrument.

Mode Split

Travel Mode

Usual mode was calculated by determining the most commonly used travel mode for all trips taken in the previous Monday–Friday five-day period. For about four out of five panelists, drive alone (SOV) was the most commonly used travel mode. Carpooling was slightly higher among I-394 panelists (19%) than among I-35W panelists (17%), but the difference was not statistically significant.

Comparing all three I-394 Waves by their usual modes of travel, there is only minimal difference between the three waves within the modes of travel. Overall, carpooling share increased from Wave 1 to Wave 2 and then roughly returned to its previous percentage in Wave 3. I-35W respondents showed a steadier pattern throughout all three waves (See Table 3.2). Respondents

driving alone increased from 77% in Wave 1 to 81% in Wave 2 to 82% in Wave 3. Carpooling showed a corresponding decrease in percentages from Wave 1 to Wave 3. Given the slight decline in carpooling in both corridors, the data does not support the theory that a reduction in carpooling is linked to the MnPASS Lane.

Now consider all trips you made in both directions. On how many of those trips did you:

I-394	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Drive alone	212	80%	177	76%	214	81%
Carpool	52	19%	54	23%	50	19%
Ride bus	2	1%	3	1%	1	0%
Total	266	100%	234	100%	265	100%
I-35W						
Drive alone	59	77%	55	81%	62	82%
Carpool	18	23%	13	19%	13	17%
Ride bus	0	0%	0	0%	1	1%
Total	77	100%	68	100%	76	100%

Table 3.2 Usual Travel Mode

I-394 panelists were less likely to switch from SOV to carpool than were those in the I-35W control corridor (7% versus 10%), whereas those in the control corridor were more likely to switch from carpool to SOV (8% versus 20%) (See Figure 3.2).

Now consider all trips you made in both directions. On how many of those trips did you:

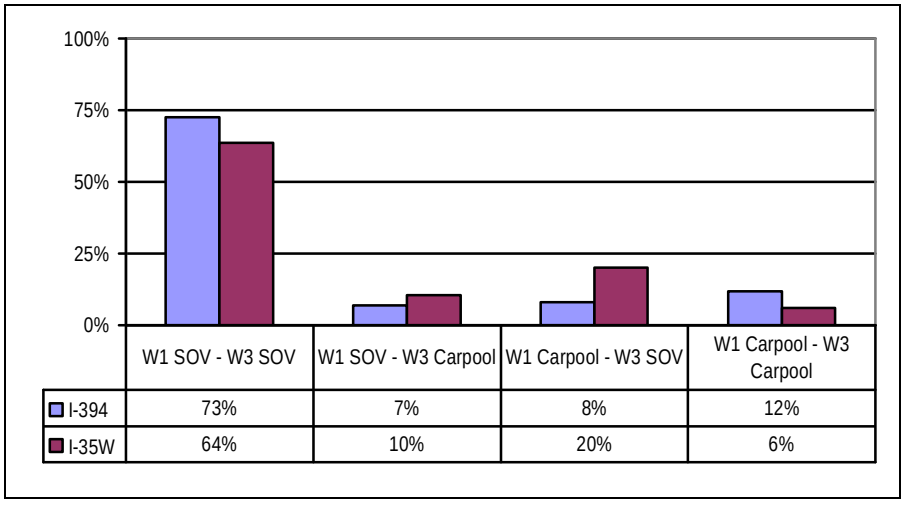


Figure 3.2 Mode Switching Behavior by Corridor (Wave 1 to Wave 3) Among Non-Transit Panel Members

Equity

Background

There is extensive academic literature on the subject of social equity, but it is best expressed in everyday language in terms of "fairness." In the case of HOT lanes, this translates to questions of whether the tolling operation is regarded as having a disproportionate impact (both in terms of benefits and costs) on some groups relative to others.

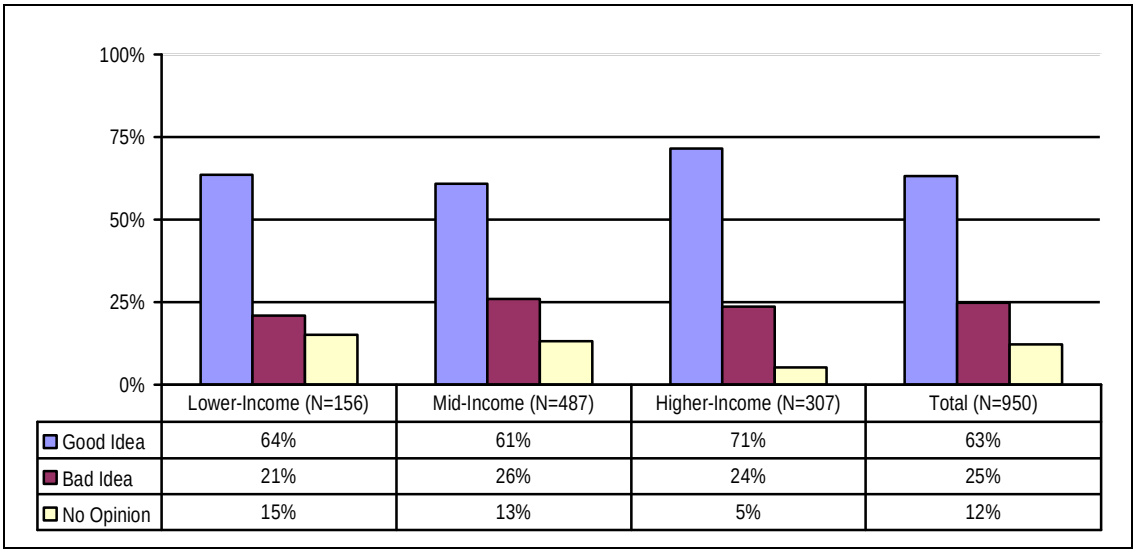
Recent studies, including this study on the MnPASS lane, conclude that there is wide support for HOT lanes across socio-economic levels. For instance, a survey of San Diego's I-15 Express Lanes found high support among users and nonusers regardless of their socio-economic status. This consistent support extends to pricing, use of program revenues, and lengthening of the lane. Further, 88% of Express Lane users approved the program, while two-thirds of non-users gave their support in the survey. Users of the lane tend to come from higher-income households with two vehicles, are homeowners, and are more highly educated than general lane users. Equity is addressed in I-15 by dedicating revenues from the Express Lane to express bus service in the corridor [1]

Similar approval across income groups was documented in surveys done on Orange County, California's, SR-91. The survey found large numbers of individuals from each socio-economic group actually used the lane, although use tended to be proportional to income level [2].

MnPASS Acceptance

A majority of respondents in all income groups responded positively to the idea of allowing SOV drivers to use carpool lanes by paying a toll, as illustrated in Figure 3.3. At the same time, acceptance was greater among the higher-income respondents (71%) than among lower-income (64%) or mid-income (61%) respondents. The lower-income group represents respondents reporting total household income less than $50,000, mid-income $50,000 to $124,999, and higher-income greater than $125,000. These breaks were determined based on the income category breaks used in the survey instrument combined with the 1999 median household income levels for the 170 sampled census tracts for the I-394 corridor. Median incomes for these 170 sampled census tracts for the I-394 corridor ranged from $14,000 to $114,000 [3]. There were no significant differences across the income groups in terms of negative response to the concept. About one-fourth of each income group thought this concept was a bad idea (26% of mid-income, 24% of lower-income, and 21% of higher-income).

What do you think of allowing single drivers to use the carpool lanes by paying a toll? Is it…



	Lower-Income (N=156)	Mid-Income (N=487)	Higher-Income (N=307)	Total (N=950)
Good Idea	64%	61%	71%	63%
Bad Idea	21%	26%	24%	25%
No Opinion	15%	13%	5%	12%

Figure 3.3 Opinion on Allowing Single Drivers to Use Carpool Lanes by Household Income

Table 3.3 shows there were slight differences by income in the reasons given by respondents for their positive responses on questions pertaining to MnPASS tolling operations. Mid- and higher-income respondents were more likely to say that MnPASS provides a better use for the carpool lane than were lower-income respondents. That MnPASS eases congestion and receives payment only from users, not everyone, were slightly more salient factors for lower and mid-income households than those in the higher-income group. Otherwise, the resulting rank order of reasons for supporting MnPASS was consistent across income groups.

Why do you feel this way? ***(Multiple response table based on percent of responses.)***

	LOWER-INCOME	MID-INCOME	HIGHER-INCOME	TOTAL
It provides a better use for carpool lanes	14%	18%	21%	18%
Adds capacity to roadway	4%	7%	6%	6%
Saves time for busy people	11%	11%	14%	11%
Only users pay, not everyone	16%	16%	10%	15%
Time is money for some people	12%	10%	16%	12%
Eases congestion	28%	26%	21%	25%
Tolls are used during peak hours only	1%	1%	1%	1%
Use of carpool lanes not encouraged enough	4%	2%	3%	2%
Creates revenue	5%	6%	5%	5%
Provides another transportation option	0%	1%	1%	1%
Increases safety	1%	0%	1%	0%
Conserves fuel	1%	1%	0%	1%
Other	3%	1%	1%	3%
Total %	100%	100%	100%	100%
Total Number	172	689	215	1076

Table 3.3 Reasons "Good Idea" by Household Income (Among Respondents who Thought Allowing Single Drivers to Pay a Toll to Use the Carpool Lane Was a Good Idea)

There also were slight differences among household income groups in opinions about why the MnPASS concept was a bad idea, as shown in Table 3.4. Interestingly, all income groups held a relatively similar level of agreement that the MnPASS concept only benefits the rich. This pattern was similar among those who thought MnPASS should be free to all. A much higher percentage of respondents in the higher-income group felt carpool lanes were not encouraged enough compared with those in lower-income groups. Conversely, a much higher percent of lower-income groups thought the MnPASS concept was unfair when compared with the percentage of those in the higher-income group who held the same opinion.

Why do you feel this way?

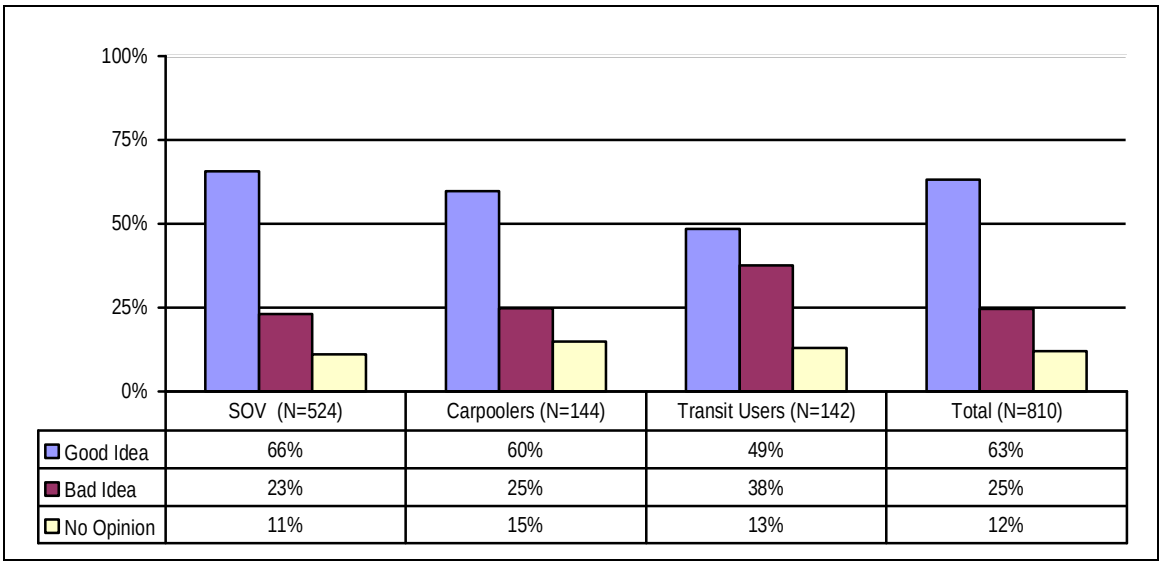
(Multiple response table based on percent of responses. Percents do not total 100 due to rounding.)

	LOWER-INCOME	MID-INCOME	HIGHER-INCOME	TOTAL
Only benefits the rich	11%	12%	13%	12%
Carpool lanes should be free to all	11%	10%	12%	10%
Inefficient	5%	7%	10%	7%
Carpool lanes should only be open to carpoolers	11%	10%	12%	10%
Use of carpool lanes not encouraged enough	8%	16%	21%	16%
Gives too much money to Mn/DOT	8%	4%	1%	4%
Bad for environment	0%	3%	5%	3%
Will not work	5%	4%	0%	4%
Roads are already paid for	11%	8%	10%	9%
Delays roadway improvements for all	2%	2%	1%	2%
Makes level of service worse in carpool lane	2%	4%	3%	4%
Increases bureaucracy	3%	3%	3%	3%
Unfair	16%	7%	1%	7.4%
Too confusing for people	3%	0%	0%	1%
Adds capacity to the roads	2%	1%	0%	1%
Better use of carpool lanes	2%	2%	3%	2%
Did not improve congestion	0%	1%	1%	1%
Would prefer public transportation	0%	0%	1%	0%
Opposes tolls	0%	1%	0%	0%
Other	6%	5%	3%	4%
Total%	100%	100%	100%	100%
Total Number	64	331	77	472

Table 3.4 Reasons "Bad Idea" by Household Income
(Among Respondents who Thought Allowing Single Drivers to Pay a Toll to Use the Carpool Lane Was a Bad Idea)

When MnPASS acceptance was examined by respondents' usual commute mode, significant differences were observed. MnPASS acceptance is highest among SOV drivers (66%) and lowest among transit users (49%). Yet, acceptance among carpoolers was also high (60%). Roughly two in five transit users (38%) thought allowing paying single drivers to use carpool lanes was a bad idea compared to 25% of carpoolers and 23% of SOV drivers. At the same time, a larger percentage of carpoolers had no opinion on this issue than other groups (See Figure 3.4).

What do you think of allowing single drivers to use the carpool lanes by paying a toll? Is it…



	SOV (N=524)	Carpoolers (N=144)	Transit Users (N=142)	Total (N=810)
Good Idea	66%	60%	49%	63%
Bad Idea	23%	25%	38%	25%
No Opinion	11%	15%	13%	12%

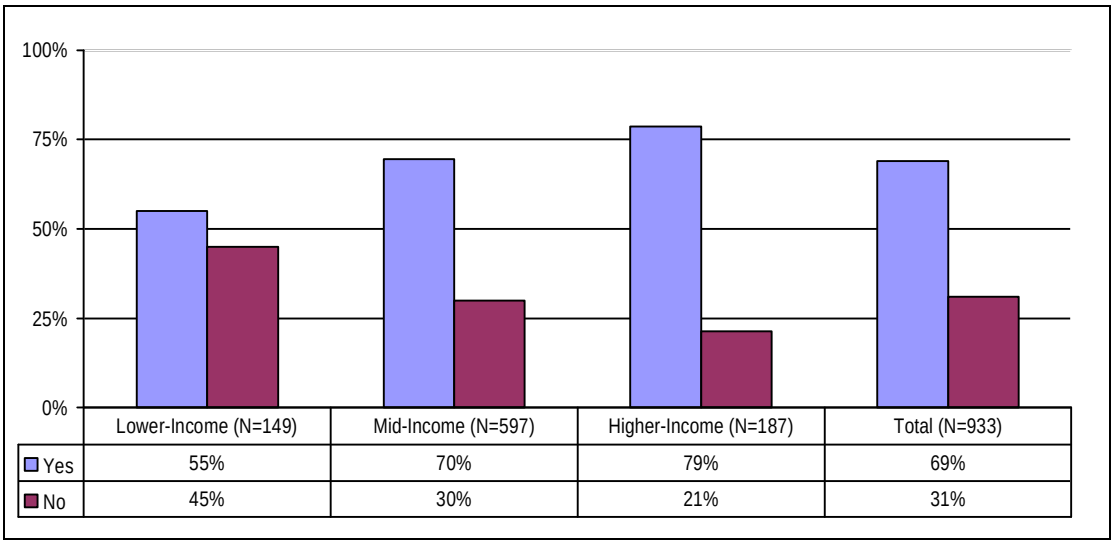
Figure 3.4 Opinion on Allowing Single Drivers to Use Carpool Lanes by Usual Travel Mode

Travelers at all income levels made a distinction between their travel experience with MnPASS and the general traffic lanes. Travelers found the general traffic lanes to be more congested than the MnPASS lanes. However, by pulling drivers off of the general purpose lane and onto the MnPASS Lane, there was better use of the roadway resulting in benefits to drivers in both lanes.

MnPASS Lane Usage

Respondents from all income levels use MnPASS. Among I-394 respondents, 69% of all income groups reported using the MnPASS lanes. While this is true, those in higher-income households are using MnPASS at a higher rate than those in lower-income households. Figure 3.5 includes users who use the MnPASS for free or pay, regardless of mode (SOV, HOV, or transit).

Have you ever used the MnPASS lanes?

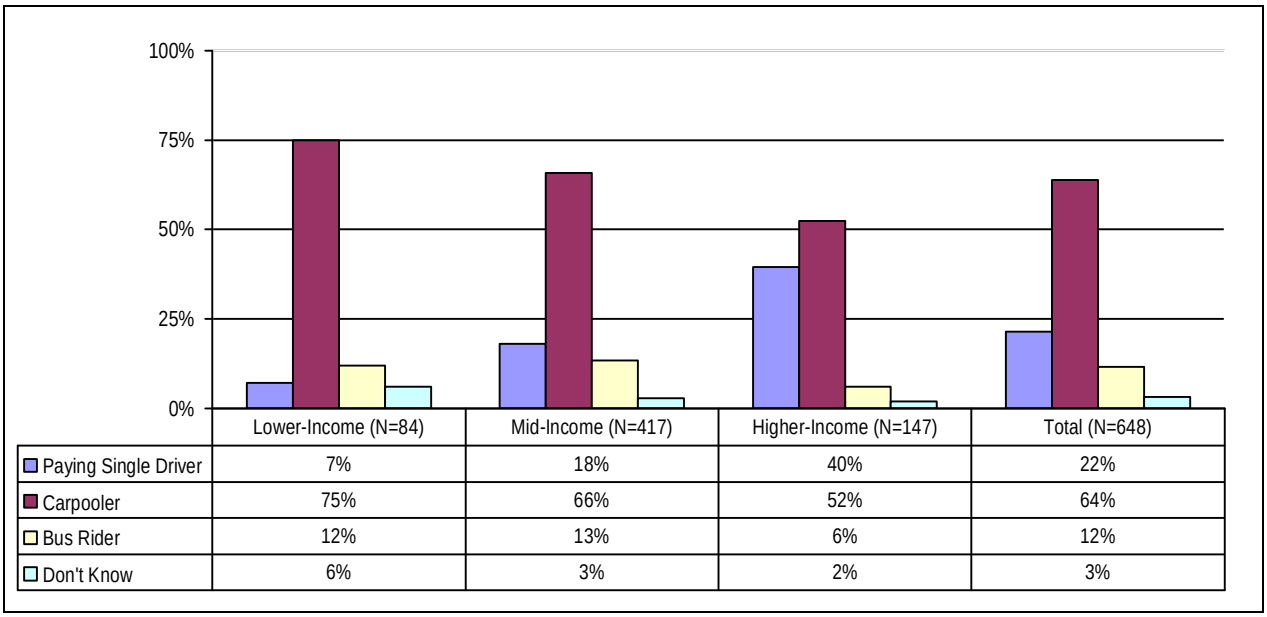


	Lower-Income (N=149)	Mid-Income (N=597)	Higher-Income (N=187)	Total (N=933)
Yes	55%	70%	79%	69%
No	45%	30%	21%	31%

Figure 3.5 Use of MnPASS Lanes by Household Income (Among I-394 Respondents Only)

Respondents who used the MnPASS lanes were asked if they were a single driver, carpooler, or bus rider when they used the lanes. Significant differences were found, as illustrated in Figure 3.6. Whereas 40% of higher-income responses were paying single drivers, only 18% of mid-income and 7% of lower-income responses were paying SOVs. The majority of lower-income responses (75%) were carpoolers.

When you have used the MnPASS lanes in the past, were you…



	Lower-Income (N=84)	Mid-Income (N=417)	Higher-Income (N=147)	Total (N=648)
Paying Single Driver	7%	18%	40%	22%
Carpooler	75%	66%	52%	64%
Bus Rider	12%	13%	6%	12%
Don't Know	6%	3%	2%	3%

Figure 3.6 Mode of MnPASS Use by Income
(Among I-394 Respondents Reporting MnPASS Use)

Demographic Profiles of Transponder Owners

Transponder owners were more strongly represented among respondents with a higher educational attainment and those who were employed full time. Transponder owners were between 35 and 54 years of age. The sample included very few people representing racial or ethnic minorities. Still, it appears that transponder owners were more likely to be White than Non-White. About the same percentages of males as females reported owning transponders. In terms of household characteristics, transponder owners resided in higher-income households, as well larger households and those with multiple vehicles (See Tables 3.5 and 3.6).

PERSON CHARACTERISTIC	TRANSPONDER OWNERSHIP		TOTAL
	YES	NO	
Educational Attainment			
High School or Less	5%	95%	74 (100%)
Some College / Trade	9%	91%	171 (100%)
Graduated College	15%	85%	385 (100%)
Graduate Work	21%	79%	303 (100%)
Employment Status			
Full-time	19%	81%	664 (100%)
Part-time	8%	92%	109 (100%)
Retired	4%	96%	117 (100%)
Other / Disabled / Unemployed	5%	95%	43 (100%)
Type of Employment			
Part-Time	8%	92%	109 (100%)
Full-time	19%	81%	664 (100%)
Age			
18-34	10%	90%	10 (100%)
25-34	11%	89%	100 (100%)
35-44	21%	79%	205 (100%)
45-54	19%	81%	287 (100%)
55-64	15%	85%	201 (100%)
65+	4%	96%	129(100%)
Race / Ethnicity			
White / Caucasian	16%	84%	871 (100%)
Non-White / Minority	11%	89%	62 (100%)
Gender			
Male	16%	84%	533 (100%)
Female	15%	85%	400 (100%)

Table 3.5 Transponder Ownership by Person Characteristics (Among I-394 Respondents Only)

Household Characteristic	Transponder Ownership		Total
	Yes	No	
Household Income			
Lower-Income	4%	96%	149 (100%)
Mid-Income	12%	88%	597 (100%)
Higher-Income	34%	66%	187 (100%)
Household Size			
One-person	9%	91%	161 (100%)
Two-person	15%	85%	344 (100%)
Three-person	20%	80%	145 (100%)
Four+ person	17%	83%	282 (100%)
Vehicles Available			
Zero	0%	100%	6 (100%)
One	6%	94%	198 (100%)
Two	17%	83%	485 (100%)
Three+	20%	80%	244 (100%)

Table 3.6 Transponder Ownership by Household Characteristics (Among I-394 Respondents Only)

Enforcement

As seen in Table 3.7, there was a difference between satisfaction levels for enforcement between subscribers and non-subscribers (64% satisfaction with subscribers and 48% satisfaction with non-subscribers). Of subscribers, 19% were dissatisfied, while 15% of non-subscribers were dissatisfied. Slightly less than one-fifth of subscribers (17%) and more than one-third of non-subscribers (37%) either had no opinion or refused to provide an answer.

Level of Satisfaction	Transponder Owner			
	Yes		No	
	Frequency	Percent	Frequency	Percent
Satisfied	91	64%	243	48%
Very satisfied	48	34%	106	21%
Somewhat satisfied	43	30%	137	27%
Dissatisfied	27	19%	72	15%
Very dissatisfied	9	6%	23	5%
Somewhat dissatisfied	18	13%	49	10%
No opinion	16	11%	113	22%
Don't Know / Refuse	9	6%	77	15%
Total	143	100%	505	100%

Table 3.7 Satisfaction with the Enforcement of MnPASS Usage

Technology

Satisfaction with MnPASS Operations Among All Paying MnPASS Users

Overall satisfaction levels with MnPASS electronic operations were high among respondents who used the MnPASS lanes as a paying single driver (SOV, N=163). About 9 of 10 (87%) reported being very satisfied. Paying users had the highest levels of satisfaction with the all-electronic operation of the tolls and the lowest with the staff at the customer service center. Due to the high percentage of respondents that answered "Don't Know" to this question, it is expected that not many respondents have actually visited the customer service center. Only 2% said they were dissatisfied. Furthermore, it should be noted that the customer service center manages almost all accounts and inquiries online. There are very few walk-ins, which may explain the high levels of respondents that report "Don't Know" or "Refuse."

Paying MnPASS users also were satisfied with the ability to use their credit card to automatically replenish their account, with 70% very satisfied and 17% somewhat satisfied. Only 2% expressed dissatisfaction (See Figure 3.7). Further, there was relatively high satisfaction with the ease of opening a pre-paid MnPASS account; 83% were satisfied. In addition, more than 80% of respondents expressed satisfaction with the ease of installing the MnPASS transponder, with approximately two-thirds (65%) being very satisfied and only 4% dissatisfied.

Eight of ten paying MnPASS users were satisfied with the clarity of prices on overhead signs, with more than half (57%) being very satisfied; 16% were dissatisfied. Further, two-thirds (65%) of paying MnPASS users were satisfied with the varying toll amounts that fluctuate with traffic levels, nearly 30% were dissatisfied, and 6% did not know or refused to provide an answer. In addition, nearly two-thirds (62%) of paying MnPASS users were satisfied with the MnPASS Web site, while 5% were dissatisfied. One-third did not know or refused to provide an answer, suggesting they had not accessed the Web site. Finally, the majority (64%) of paying MnPASS users were not familiar with or did not provide their opinion about the customer service center staff, expressing lack of knowledge about the center. Of those with an opinion acknowledging contact with the center, virtually all were satisfied.

Compared with Wave 2, there was a slight increase in the satisfaction level with the all-electronic-operations aspect of MnPASS. Many of the other technology issues (ease of opening a transponder account, using a credit card to replenish the account, the ease of installing the MnPASS transponder, the clarity of prices on overhead signs, and with the toll amounts that vary with traffic levels) experienced a slight drop in satisfaction from Wave 2 to Wave 3 (although Wave 3 satisfaction levels still remain overwhelmingly positive). This may be a result of the modification of the dynamic pricing formula in 2006 that led to higher tolling prices.

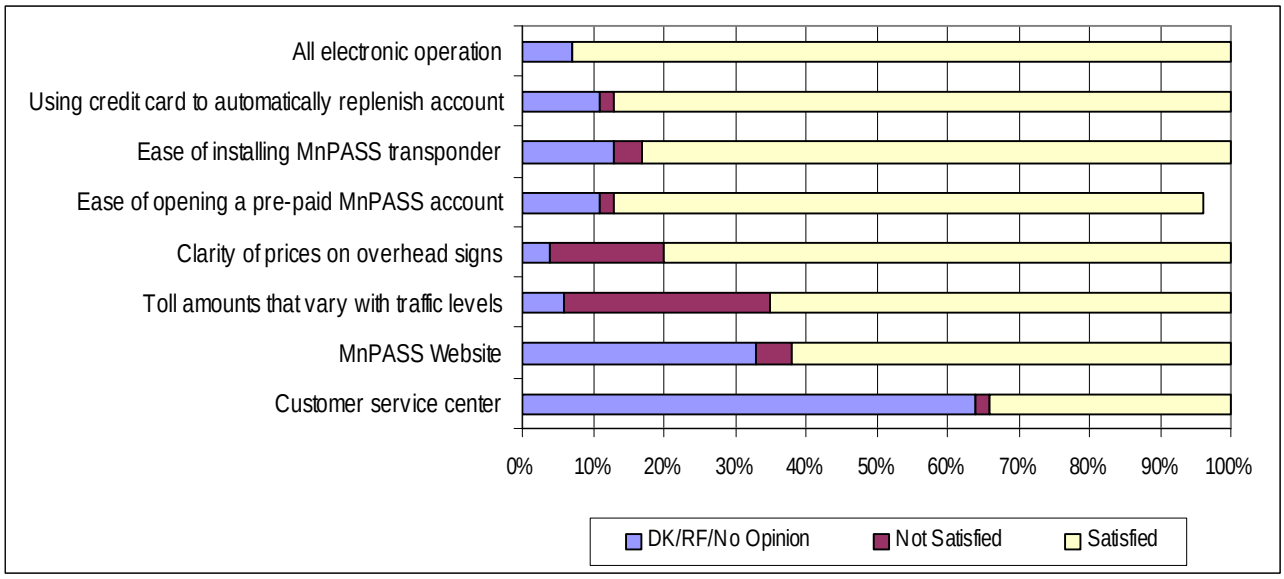


Figure 3.7 Comparison of Satisfaction Levels for Various MnPASS Aspects Among Paying MnPASS Users

Summary Statements

Key Findings

Travel Behavior and Experience among I-394 Users

The implementation of MnPASS has not had a negative impact on carpooling on I-394 nor on traveling experiences in the corridor. The current mode share of I-394 panelists is comparable to that captured in the Wave 1 survey: 81% drive alone and 19% carpool.

I-394 MnPASS Acceptance across Income Groups and Mode

Approval was consistent across all income groups. Higher-income respondents were the most supportive (71%). Lower-income respondents also were quite supportive by a three-to-one margin (64% "good idea" versus 21% "bad idea"). The majority of carpoolers were supportive (60% "good idea"). About half of transit users surveyed (49%) expressed support for the MnPASS concept. The most common reason for supporting MnPASS was that it "eases congestion." There was ample evidence in the Wave 3 data that the MnPASS lanes did have a positive impact on perceived congestion levels on I-394.

I-394 MnPASS Use and Satisfaction

The Wave 3 panel captured a 6% incidence of MnPASS subscribers. However, use of the MnPASS lanes represented a much broader market. The 6% represented just those who leased a transponder to pay for the use of the MnPASS lane as an SOV; however, beneficiaries of the MnPASS project included non-paying users as well. Of panel members, 84% reported that they had used the MnPASS lanes in the past for free as a carpooler; 9% said they had used the lanes

as a paying SOV driver; and 2% reported usage as a bus rider. MnPASS usage was reported across all income levels, with 55% of lower-income, 70% of middle-income, and 79% of higher-income respondents reporting that they had used the MnPASS lanes. Usage has remained stable among the lower-income group (54% in Wave 2 and 55% in Wave 3), while it has grown among the middle-income group (62% to 70%) and the higher income group (66% to 79%).

Users experienced high levels of satisfaction with the all-electronic toll operations. Other technology-related aspects of MnPASS also received high satisfaction levels both in Wave 2 and Wave 3.

Chapter 3 References

1. Mowday, M. “Equity and High Occupancy Toll Lanes: A Literature Review and Minnesotans’ Perceptions About the I-394 High Occupancy Toll Lanes.” *Transportation Research Board Compendium of Papers*, January 2006. Report No. 06-1502. Washington, D.C., pp. 1.

2. Ibid, pp. 6.

3. Ibid.

Chapter 4:
Toward a New Evaluation Model of E-Government Satisfaction—In Situ Satisfaction with ATIS Trip Planning

By:
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Tarun Abhichandani, Research Assistant

Claremont Graduate University

Executive Summary

E-Government initiatives are underway to enhance citizen access to government information and services. This research study extends this enterprise to consider a method for end-user engagement in assessing e-government initiatives, advanced traveler information systems (ATIS) in particular. As the demographic and travel needs of various citizen groups become increasingly diverse, there is a need for data and analysis to help predict future travel behavior, identify suitable intelligent transportation systems (ITS) technologies to meet these emerging travel needs, and plan transportation systems based on these emerging demographic patterns. As a result, this study specifically focuses on analyzing the availability and quality of, and providing recommendations for, the delivery of online ATIS trip information for use by service providers and end-users. The main goal of this study is to develop an evaluative model so that ATIS initiatives can be ranked to indicate how they better serve online trip planning needs. The model, although designed for ATIS-specific initiatives, can be generalized to other online initiatives. Specifically, the objectives in this study are to:

1. Identify key metrics from the literature for use in evaluating the quality of online services

2. Identify key metrics from the transportation and related ITS literature for use identifying diverse trips and evaluating an internet-based ATIS

3. Based on these metrics, develop an exhaustive satisfaction model (*EGOVSAT*) and validate its applicability through various research methods

4. Examine whether these metrics can be generalized to evaluate other e-government initiatives

This research study performed a series of analyses related to these study objectives. Research tasks associated with these objectives were: 1) analytical review of approaches for defining online quality, 2) analytical review of travel needs for diverse trips, 3) survey execution of an evaluation prototype for ITS in support of diverse trips, and 4) conducting focus group discussion in the cities where the online survey was executed.

Research Methodology

An online survey comprising questions related to the *EGOVSAT* model, demographics, and experience with technologies was designed. The survey was designed to inquire about the

experience of individuals using the ATIS Web sites based on performance and emotional dimensions and understand the characteristics of users who use these Web sites. The survey was conducted in two cities: Los Angeles (LA) and Minneapolis/St. Paul (MN). In both cities, Web sites provided by metropolitan authorities were considered for evaluation. For the city of Los Angeles, a Web-based initiative provided by the Los Angeles County Metropolitan Transportation Authority (http://www.mta.net) was used. For the Minneapolis/St. Paul area, the MetroTransit Web site (http://www.metrotransit.org) was considered for evaluation. The survey protocol was designed to collect reactions of respondents just after they had used the Web site for trip planning purposes. The respondents, in addition, were randomly provided with certain scenarios so that the trip planning is performed in "realistic" situations. For research purposes, certain control was exercised in presenting these scenarios.

The sample for the survey respondents was gathered in various ways. Initially, a databank provided by a commercial organization was used. Subsequently, a URL for the online survey was provided through the MetroTransit Web site. This resulted in collection of 401 survey responses: LA (n=155) and MN (n=246). Although the data collection was conducted using different avenues, a common online survey was presented. In addition to the online survey, focus group discussions with the survey respondents were conducted in the two cities (LA and MN). There were eight respondents from LA and 22 from MN who participated in the focus group discussions.

Research Model

EGOVSAT metric was formed based on a statistically evaluated model. This model is based on published research centered on customer satisfaction, ATIS, and e-Government. The initial model was exhaustive in including all the major constructs of performance dimensions. Subsequent to data collection, the model was statistically evaluated to ensure that the responses collected through the online survey adequately explained various performance and emotional constructs. In the study, it was ensured that various statistically indices were kept at acceptable levels. Figure 4.1 illustrates the model used in this study.

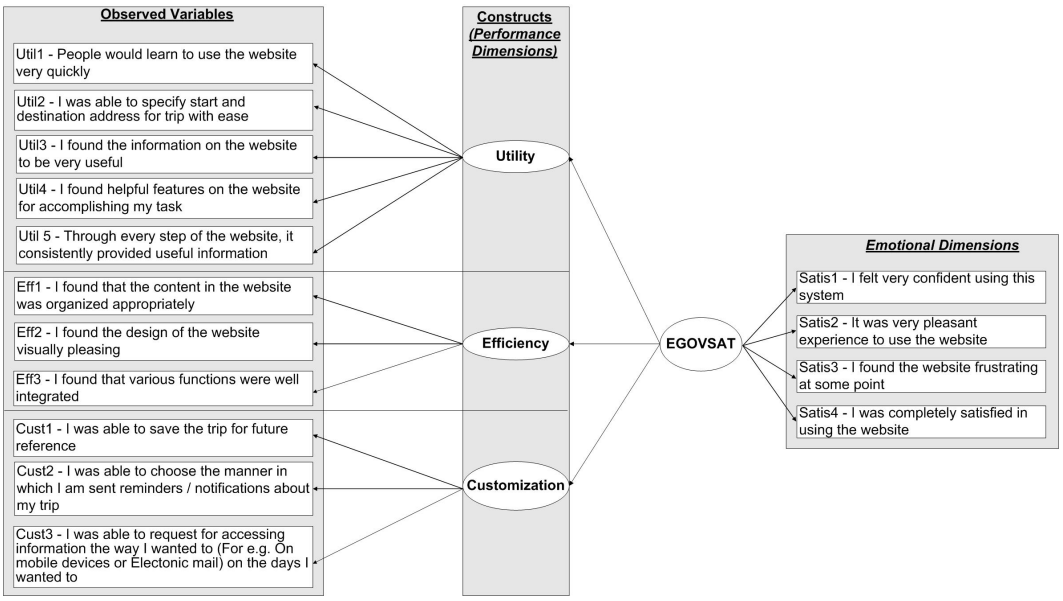

Figure 4.1 EGOVSAT Model

Summarized Findings

Respondents in both cities indicated that the need for improved usability features was a relatively stronger determinant of emotional measures than efficiency or customizable options. The usability options include need for useful information, helpful features, consistent performance, and easy to use features. Further, need for better address location facilities also were found to be a determinant factor to a limited extent. Experienced MN users expect consistent useful information on the Web site, whereas LA respondents who relatively use online public transportation information services in a limited manner expect facilities for learning to use the system quickly. Second to "Utility," features for "Efficient" access were found to be a determinant of overall satisfaction in using an online public transportation informational service. These features included better organization and integration of content as well as visual presentation. MN respondents ranked need for well-integrated functions higher than features, whereas LA respondents indicated need for appropriate organization of the Web site.

"Customization" construct was found to be a limited determinant of emotional measures. MN Respondents ranked the need for saving their trips for future reference higher than other features, whereas LA respondents indicated need for receiving reminders and notifications. Among the dependent emotional measures, LA respondents were most "Satisfied" with the Web site, whereas MN respondents ranked the "Pleasant" experience in planning a trip higher than other features. Respondents in both the cities were found to be fairly "Confident" in using the Web site. They were "Frustrated" to a very limited extent.

Study Introduction

Electronic Government (e-Government) refers to the facility of delivering government-related information and services online through the Internet or other digital means [1]. Public agencies, using this facility, provide a range of services to various interest groups [2]. A major domain in these services considers effective information delivery to citizens (i.e., government-to-citizen services). Use of such services has been growing over the years, and citizens are increasingly interacting with online government services. A survey conducted by Norris and Moon indicates that nearly 90% of American local governments with population of 10,000 or more had official sites on the Web through which they delivered various services [3]. Further, Pew Internet reports that 77% of internet users, or 97 million adult Americans, took advantage of e-government facility in the year 2003 using various methods [4]. Apparently, there is an overall realization of importance of e-government initiatives—by citizens and by government agencies at various levels. Such realizations have ensured that e-government initiatives are continuously developed and constantly used.

As these sets of interaction spread wide across citizen groups, expectations from online e-government initiatives increase accordingly. West notes that the particular characteristic of such initiatives that makes it so special is that it allows citizens to seek public services at their own convenience and not just when the government office is open [1]. As a result, citizens are increasingly expecting government units to perform like commercial entities [5]. Need for addressing these expectations has been widely recognized in order to improve relations between public agencies and citizens. Grönlund has identified the importance of serving civil society by delivering services to a wide array of citizens [6]. Traunmüller and Wimmer have extended the vision of citizen-centric provisions so that active participation in government and democracy is promoted [7]. They further note that although citizen-centric interactive Web sites have been produced, users—internal or external—seem to be dissatisfied as complicated issues fall short of heightened expectations. Consequently, online e-government initiatives need to be user-centric or citizen-centric in nature [8, 9, 10]. There is an apparent need to identify theoretical constructs and measures that are formed to evaluate citizen reactions in using e-government information services, so that empirical evaluation can be carried out. Detailed evaluation programs can present insights for better delivery towards citizen interaction.

ATIS

In delivering different kinds of information, West [9] illustrates, as shown in Figure 4.2, various stages of development and technological change with which a particular government agency is involved. Different stages indicate the level of interaction and integration offered by a government agency. In the first stage (*Billboards*), a particular government agency reports static information through its Web site in the form of reports and publications and offers no interactive service to its customers. In the second stage (*Partial Service Delivery*), an agency provides its users a limited number of interactive online services but no form of personalization and security. In the third stage (*Portal Stage with Fully Executable and Integrated Services*), the government agency Web site provides integrated service and personalization and certain forms of delivering dynamic information. In the final stage (*Interactive Democracy*), the agency's Web site provides a range of online integrated services and offers options for the public to provide continuous feedback. In the current study, ATIS represents the stage of Partial Service Delivery. To progress

towards higher stages, the agency needs to include certain determinative constructs identified in this study.

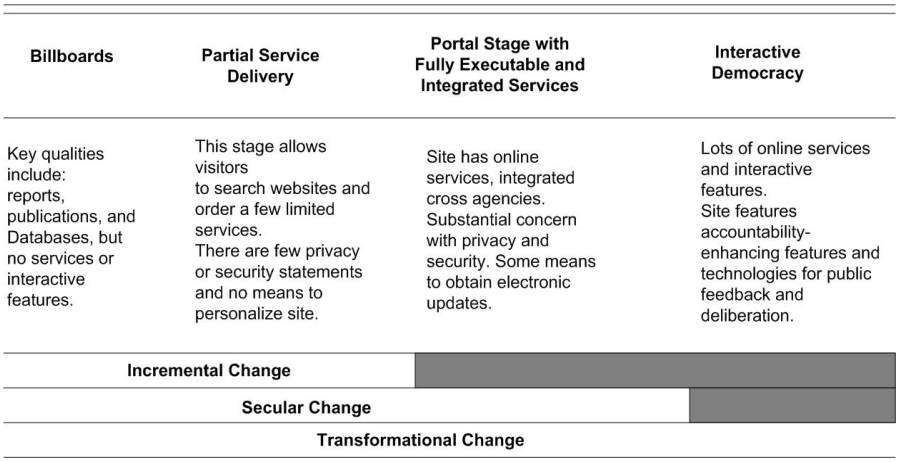

Figure 4.2 E-Government Stages and Models of Technological Change

Use of ITS can help ease the strain created by increasing demand for travel on highways and public transit systems in the United States through application of modern information technology and communications [11]. ATIS is a part of the overall activity of creating an ITS infrastructure, and seeks to inquire, analyze, communicate, and present information to assist surface transportation travelers in moving from a starting location to their desired destination. It is expected that ATIS will provide assistance in a manner that best satisfies the traveler's need for safety, efficiency, and comfort. As an example of government-to-citizen services, ATIS provides 1) real-time network information, traffic or transit, and 2) traveler information, such as route guidance or destination information using advanced technologies such as the Internet [12, 13]. According to the Intelligent Transportation Society of America [14], ATIS delivers data directly to travelers or citizens, empowering them to make better choices about alternate routes or modes of transportation. ATIS represents a part of ITS responsible for providing an assortment of traveler information services. Advanced public transportation systems (APTS), a related set of services, focuses on providing information to travelers, assisting in transit management, and addressing the use of electronic payments [15]. These services often involve delivering information through internet-based systems. From a broader e-government perspective, ATIS/APTS (henceforth, referred as ATIS) represents but one type of "Web-enabled" service that is offered to a community of users resulting in better government-to-citizen relationships.

Characteristics of travelers and trips, in addition to other factors, determine customer demand for ATIS [12]. Studies and surveys have identified these characteristics to be diverse in nature [16, 17]. While it is common to believe that work trips are the predominate purpose of travel, the situation is actually more diverse [18]. In a National Household Travel Survey (NHTS) of 2001 by the Bureau of Transportation Statistics (BTS), results indicate that a large portion of trips were taken for family and personal reasons such as shopping and running errands (45 %). Social and recreational trips, such as vacations and visiting friends, accounted for 27% of the trips. Despite the strong focus on work and commuting trips by researchers and urban planners, commute and related trips accounted for about 18% of all trips taken. Trips to school and church

accounted for about 10% of all trips. Alternatives in the mode of transportation such as fixed-route and non-fixed-route services exist for various trips. Fixed-route travel includes services provided such as bus, rail, or other conveyances, either publicly or privately owned, on a regular and continuing basis [19]. Non-fixed-route trips include demand response trip planning as well as alternative modes such as walking. By far the most common form of transit for all trips is the fixed-route bus system, with significant use of fixed rail in selected metropolitan areas [20]. Focusing in on transit usage, recent studies have identified different transit patterns across different socio-economic groups [18, 21]. These socio-economic groups can be based on household income, race or ethnicity, gender, age, and disability. Further, various purposes for making a trip form an important part of building the overall context. These purposes range from using transit for going to work to visiting a doctor to making a social or recreational trip.

ATIS delivery through e-government Web sites is just one of the various methods by which transit-related information can be disseminated. Although, in a broader sense, expectations towards the information delivery need to be examined irrespective of such methods. Widespread expectations towards ATIS delivery have been examined by various studies. Lappin has identified various user groups that use ATIS and their attitudes that could determine disparate expectations, thereof [12]. The results of the study indicated need for accuracy, timeliness, reliability, cost, personalization, convenience, and safety. Further determinative features such as maps, route guidance, coverage, and related findings also were identified. A much broader evaluation program is continuously being run by the U.S. Department of Transportation [22]. The results of these programs are meant to be used mainly by administrators of ATIS initiatives. In these results, specific infrastructural expectations are noted; however, a citizen-centric evaluative perspective seems to be absent.

Inclusion of end-user needs in providing infrastructural facilities lately has been prescribed to be an important aspect. A 10-year ITS plan developed by U.S. Department of Transportation recognizes the importance of end-user explicitly [23]. The plan recommends that ITS programs need to focus on providing improved choice of modes to diverse user groups—irrespective of their age or disability—who use transit for various purposes. The goal, as purported by the plan, is "universally available information that supports seamless, end-to-end travel choices for all users of the transportation system" [23]. Further, Horan and Reany [24] recommend that planners, policy makers, engineers, and service providers associated with ITS infrastructure should consider how well they can serve the needs of diverse users. A much more functional vision was provided by Horan [25], wherein, it was noted that ITS projects need to adopt a user-centric perspective and research on various aspects of end-users of the system. Through providing an analogy of recent e-commerce initiatives, Horan [25] recommends "dedication to a customer focus, alternatively termed mass customization (e.g., Dell), personalization (e.g., Amazon), or, more generally, customer relationship management (CRM)."

This research suggests that transportation services are quite diversified in both type of service offered and the range of citizens using such services. The challenge is to devise a dynamic evaluation method that can evaluate online ATIS systems and provide deterministic recommendation that could ensure that the citizens using the services are satisfied with the delivered information.

Objectives

This research builds upon e-government and transportation studies to provide a citizen-centric evaluative measurement index. The broad context of the study centers on e-government expectations and delivery. ATIS, however, is considered as one specific instance in e-government functions. This study evaluates how well ATIS initiatives are serving a diverse set of users in using Web sites to plan their trips meant for various purposes. Specifically, the objectives of the study are as follows:

1. To identify and formulate emotional and determinative aspects towards forming an evaluative index by which Web-based e-government initiatives can be ranked

2. To examine whether the emotional assessment comprised of "Satisfaction," "Frustration," "Confidence," and "Pleasantness" vary as a function of a Web site's perceived "Utility," "Reliability," "Efficiency," "Customization," and "Flexibility"

3. Based on the above aspects, examine assessments of various citizen groups in evaluating online trip planning ATIS Web sites. The results of these assessments will provide validity in generalizing the evaluative model created by the study.

4. To use different methods (qualitative and quantitative) in conducting the research study so that in addition to objective assessments, the context surrounding the study is well recognized.

Research Model

Research studies with varying contexts have considered a variety of measures in evaluating performance of an artifact in subject. The most predominant performance measure has been the evaluation of usability. Doll and Torkzadeh [26] have identified the content, format, and timeliness of the information delivered and the ease of use facilitated by a system. Zeithaml, et al., identify the importance of responsiveness and ease of navigation in using a service offered through Web sites [27]. Similar usability measures have been identified in various studies [28, 29, 30, 31]. Further, Brooke has formulated a usability index: System Usability Scale (SUS) [32]. These contributions have been formulated as "Utility" construct in this study that examines whether the Web site is usable or not. "Reliability" construct examines whether the Web site functions appropriately in terms of technology and content accuracy [27]. Similar measures are considered in [28, 29, 31, 33]. While the importance of usable and reliable information is largely acknowledged, it also is pertinent that the information can be accessed efficiently with minimal effort by the end-user. "Efficiency" construct examines the accessibility and organization of the features and information available in the Web site [29, 31, 34]. In addition to these aspects, it is important that the Web site delivers facility of providing dynamic information, provides various options of accessing the information, and offers the facility of customizing the information contained in the Web site. Personalization and customization refers to the ability of an internet Web site or service to be shaped to reshaped so as to better meet the individual needs or wants of a user [35]. Performance constructs—"Flexibility" and "Customization"—are formed to evaluate these aspects of digital delivery.

"Consumer Satisfaction" has not been clearly defined by researchers. A consensual definition of satisfaction that can be readily applied to research studies does not exist [36]. As a result, formulation of emotional perspectives of satisfaction for this study has been adopted from various research. While satisfaction has been identified as a single summary concept, it is comprised of certain affective responses with varying intensity. Giese and Cote identify alternative terms that were offered by various consumers in their research [36]. These alternative connotations may indicate the variations of emotional response that comprise the overall emotional construct. Westbrook and Oliver confirm such variations, while identifying the dimensionality of emotion space in satisfaction [37]. Emotional composition of satisfaction, in this study, has been extended to include not only "Satisfaction," but also "Frustration," "Pleasantness," and "Confidence." Affective dimensions of satisfaction depend on certain determinative process constructs [36]. This evaluative dimension is agreed to originate in a comparison of the level of product or service performance, quality, or other outcomes perceived by the consumer [37]. Giese and Cote [36] posit that while determining emotional response to satisfaction, the researcher should focus on a broad or narrow range of consumption issues depending on the context of the study. Consequently, this study considers performance measures that have been identified in information systems (IS) literature. Figure 4.3 presents the causal relationship between emotional and performance dimensions.

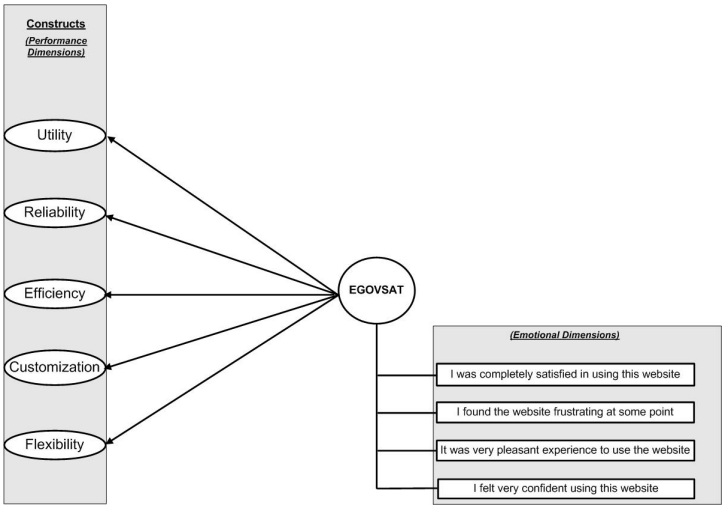

Figure 4.3 Study Model

As mentioned before, satisfaction measures are extensions of performance and quality measures. While the latter are user-centric approaches, true citizen-centric evaluation of systems needs to examine attitudes of the user towards e-government systems as a public service. Satisfaction in using these systems warrants inclusion of the components previously mentioned as well as the integrity in the delivery method and its content. The previously identified constructs are further broken down into measures based on these components as illustrated in Figure C.1 in Appendix C. One or more measures determine perspectives in constructs. A measure can be a

process or a content measure. Process measures depict various activities that a user indulges to obtain information. Content measures determine the quality of information that a user receives from the Web site. Process and content measures are identified differently in IS literature. Loiacono, et al., [30] groups them as interactional quality, usability, and informational quality. Delone and McLean [38] classify them as information and system quality. Huizingh [34] identifies them as content and design measures in a Web site. Observable items or survey questions are classified based on these measures. Table C.1 in Appendix C enumerates the sources and description of various constructs. Table C.2 presents the survey questions that were designed based on these constructs to be presented to the respondents.

Research Design and Methods

The overall study consisted of two phases, as shown in Figure 4.4. Phase I considered usability as its main construct. Usability—System Usability Scale (SUS) [32] and Transitweb [39]—qualities were identified as key measures for this phase. In Phase II, a more elaborative construct was considered—Satisfaction. In this phase, "Utility," "Reliability," "Efficiency," "Customization," and "Flexibility" were considered as its key constructs.

	First Phase	Second Phase
Overall Construct	Usability	Satisfaction
Key Measures	System Usability Scale (SUS) Transitweb recommended features	Utility (including SUS) Reliability Efficiency Customization Flexibility

Figure 4.4 Two Phases of the Study

Phase I

In the survey, one group of participants was presented with a basic set of questions for a specified (origin and destination pre-determined) trip. The second group of participants was presented with a more complex set of questions for both an unspecified (origin and destination not pre-determined) and a specified trip.

Minnesota participants were provided with a Web site address or a Uniform Resource Locator (URL) for the survey. Upon accessing this Web site, participants were presented with a description and purpose and directions for completing the survey. Participants also were provided with a scenario that involved planning a recreational trip from O'Hare Airport to the Navy Pier in downtown Chicago. Participants were asked to use the Chicago Regional Transportation Authority's Web site (http://rtachicago.com). Upon completing the scenario, participants were asked a series of questions for evaluating the usability of the Web site. Appendix D, Figure D.2 presents snapshot of the trip planner available through the Chicago Regional Transportation Authority's Web site. Tables E.1–E.4 in Appendix E illustrate the survey questions.

The online survey presented to California participants was dynamic, unlike that for the Minnesota participants. Upon accessing their Web site, California participants also were presented with a description and purpose and directions for completing the survey. Participants also were provided with a scenario that involved planning a recreational trip. However, here the survey system would randomly present either a "specified" or an "unspecified" trip scenario to the participant. The specified trip involved planning a trip for a family from Claremont, California, to Pasadena City College to attend an art exhibition. The unspecified trip involved planning a general recreational family trip with the starting point and destination determined by the participants. In both cases, the participants were asked to use the Los Angeles Metropolitan Transportation Authority's Web site (http://mta.net); a snapshot of this Web site is shown in Appendix D, Figure D.3. Upon completing the scenario, participants were asked a series of questions evaluating the Web site. Participants also were presented with specific trip planning questions. In addition to these questions, California respondents were asked to choose a feature from a list that they believed was most important in the trip planning process; this list is presented in Appendix E, Table E.4.

The questionnaire consisted of both open-ended and Likert-scale questions. The open-ended questions (See Table E.1 in Appendix E) were designed to collect responses that were related to the general behavior of the Web site and the trip planned. There were two sets of Likert-scale questions. The first set included 10 system usability questions. The second set consisted of seven questions related to trip planning.

The first set of Likert-scale questions (See Table E.2 in Appendix E) was based on the System Usability Scale (SUS), a simple, 10-item scale giving a global view of subjective assessments of usability [32]. Originally developed by the Digital Equipment Corporation, the SUS is a Likert scale, where a statement is made and the respondent then indicates the degree of agreement or disagreement with the statement on a five-point scale. The selected statements cover a variety of aspects of system usability, such as the need for support, training, and complexity, and thus have a high level of validity for measuring the usability of a system. SUS is used after the respondents have had an opportunity to use the system being evaluated but before any debriefing or discussion takes place. Respondents are asked to record their immediate response to each item, rather than thinking about items for a long time. It provides a single number, which is a composite measure of the overall usability of the system being studied. SUS scores range from 0 to 100. The score has proven to be a valuable evaluation tool, being robust and reliable, correlating well with other subjective measures of usability (e.g., the general usability subscale of the SUMI) [32]. The score is freely available for use in usability assessment and has been used for a variety of research projects and industrial evaluations [40, 41].

The second set of Likert-scale questions (See Table E.3 in Appendix E) related to trip planning were adopted from Transitweb [42]. Transitweb prescribes principles and guidelines for which Web site developers can implement an effective artifact for trip planning. Seven trip planning questions related to user interface attributes were asked of the users regarding their trip planning from its origin to destination.

One group of participants was asked to evaluate the Los Angeles Metropolitan Transportation Authority's Web site (http://www.mta.net). The specified (origin and destination pre-determined) trip scenario in this case was a trip from Claremont, California to Pasadena City College for an

art exhibition. The unspecified (origin and destination not pre-determined) trip scenario was a trip in which the users themselves would decide the origin and destination. One group of participants was asked to evaluate the Chicago Regional Transportation Authority's Web site (http://www.rtachicago.com). The specified trip scenario in this case was a trip from O'Hare Airport to the Navy Pier in downtown Chicago.

Phase II

As previously noted, in the second phase, a more elaborative satisfaction construct was used for the study. In this phase, Minnesota respondents were asked to evaluate the Minneapolis/St. Paul Metro Area MetroTransit Web site (http://www.metrotransit.org/); a snapshot is shown in Appendix D, Figure D.1. In this phase, the model detailed in the Research Model section of this chapter was used. In addition to the model, there were certain specific MetroTransit-related questions also presented. This is because in the second phase, the Minneapolis/St. Paul MetroTransit agency was a significant stakeholder in the project. The agency provided a sizeable respondent base for the survey and focus group discussions.

Figure G.1 in Appendix G illustrates various aspects of the online survey. At the start of the survey, the respondents were presented with the description of the survey, instructions that needed to be followed, and a consent form. Upon agreeing to participate in the survey, the databank respondents were presented with a "Specified" or "Unspecified" trip scenario, and MetroTransit Web site link respondents were asked specific questions related to the MetroTransit Web site. Figure G.2 in Appendix G illustrates the questions presented to the MetroTransit survey link users. Table G.1 in Appendix G illustrates the "Specified" and "Unspecified" trip scenarios for both the cities—MN and LA.

The survey questions were divided into different groups. Figure G.3 in Appendix G illustrates these groups—Likert-scale, open-ended, demographics, public transportation usage, and experience with informational technologies. Table C.1 in Appendix C enumerates the Likert-scale questions that were asked. It also enumerates the sources from where they were adopted. Open-ended questions are illustrated in Appendix H, Table H.1. These questions required respondents to provide detailed responses of their experiences with the ATIS Web sites. Appendix H, Table H.2, shows the demographic information asked, such as "Age," "Gender," "Level of Education," "Employment Status," "Household Income," and "Ethnicity." Table H.3 in Appendix H presents questions related to frequency and purpose of using public transportation and frequency of planning a trip on the ATIS Web site. Respondents also were asked about their experience with and access to information technology devices as illustrated in Appendix H, Table H.4.

MetroTransit survey link users were asked certain specific questions. The main objective of asking these questions was to collect past experiences of users that frequently use information services provided by the MetroTransit Web site. As shown in Figure G.2 in Appendix G, a "Repeat" user of the MetroTransit Web site was asked whether the transit information was found to be adequate or not. If the information, in the past, was not found to be adequate, respondents was asked to share their past unsatisfying experience. Subsequently, respondents were asked if they had planned a trip in the past two days. If they had not planned a trip in past two days, they were presented with a "Specified" or an "Unspecified" scenario. If they had planned an online trip recently, they were presented with the online survey without the scenarios.

Results

Phase I

The respondents consisted of two groups: 200 older citizens (over 55) were identified through an outreach effort in Minneapolis, Minnesota (MN), and 125 graduate students were canvassed in graduate level courses at Claremont Graduate University (CGU) in greater Los Angeles, California (CA). From these samples, 71 complete responses were obtained: 48 valid responses from CGU and 23 from MN. While this sample does not represent the gamut of users, it is considered suitable for the study's objective to conduct a preliminary test of an online evaluation system with at least two distinct user groups. Further, for similar purposes, the systematic difference in selecting the sites was deliberate. Minnesota participants were provided a Web site address for the online evaluation system. Upon accessing this Web site, participants were presented with a description and purpose and instructions for completing a survey. They also were provided with a scenario that involved planning a recreational trip from O'Hare Airport to the Navy Pier in downtown Chicago. Participants were asked to use the Chicago Regional Transportation Authority's Web site (http://www.rtachicago.com).

California participants also were presented with a description and purpose and instructions for completing a survey. They were provided with a scenario that involved planning a recreational trip. In addition, however, here the survey system would randomly present either a specified or an unspecified trip scenario to a participant. The specified trip involved planning a trip for a family from Claremont, California to Pasadena City College to attend an art exhibition. The unspecified trip involved planning a general recreational family trip to a location of their choice. In both cases, the participants were asked to use the Los Angeles Metropolitan Transportation Authority's Web site (http://mta.net). Upon completion of the above scenarios, participants were asked a series of questions for evaluating the Web site. California participants were further presented with trip planning questions and were asked to choose a feature from a list that they believed was most important in the trip planning process.

General usability with an ATIS Web site was measured using the SUS scores. The overall usability ratings between the Specified Origin/Destination groups (MN and CGU) were reasonably high, and there was an insignificant difference in the SUS scores (X_{avg} = 70.3, X_{avg} =74.7), as illustrated in Appendix F, Table F.1. Large variation was observed, however, among the MN respondents and could be due, in part, to the wide range of computer proficiency within the MN group, which consisted of older citizens. However, the satisfaction dropped when the (CGU) respondents were asked to plan their own trip. It was found that the average SUS score for the Unspecified Origin/Destination group (X_{avg} = 57.1) was significantly lower (p<. 05) than that for either Specified Origin/Destination group (X_{avg} = 70.3, X_{avg} =74.7). This difference could be due to greater difficulty in using the Web site to plan a trip where the location was decided upon by the user.

Questions about trip planning functions were asked only from CGU respondents. There was a difference between the mean score of trip planning questions between the Specified Origin/Destination and Unspecified Origin/Destination groups (X_{avg} = 3.59, versus X_{avg} =3.28), as illustrated in Appendix F, Table F.1. However, this difference was not statistically significant (p<.05 level). One possible explanation for why respondents did not differentiate among trip planning items is that the overall functioning of the Web site (as assessed by the trip planning

measures) was relatively similar across the two groups, but the experience of using it under the two specified/unspecified exercises differed significantly (as measured by the SUS score). Distribution of SUS score is presented in Figures F.1–F.3 in Appendix F.

Similar to Trip Planning, feature-based questions were asked only of the two CGU groups. Table F.1 in Appendix F presents the frequency distributions of the features selected. As illustrated, the most important feature was "Schedules and Routes" in every distribution. Other features that ranked lower in the scale were "Maps," "Transit Modes," and "Navigation." While features such as "Lists," "Menu," "Home Page," "Demand Response Services," "Web Page," and "Search Features" were far lower in the scale.

CGU respondents, who were assigned a specified trip scenario, found the site simple and easy to use. The orientation and information provided by maps were found useful for trip planning. Respondents were pleased with details of fares, time duration, timings of transit modes, and directions provided. Many respondents found dropdown lists particularly helpful for indicating the origin and destination. However, a need for improved features for schedules and routes related to transfer information, cost of trip, and various trip specifications was observed. The response time of maps was found to be too slow, and the site was difficult to navigate with respect to the use of hyperlinks. Among CGU respondents, who were assigned an unspecified trip scenario, there were numerous references to the need for selecting an origin and/or destination using a dropdown list based on landmarks. However, a need for better information in dropdown lists was observed. Similar to observations in the specified trip scenario, ease of use and response time were problematic. Some respondents were unable to fully plan their trip, specify the time of travel, or find fare information for children. Maps displayed by the Web site provided minimal details. There was a need for transfer information and a better display of landmarks along the route. MN respondents indicated various transit modes, including walking, that were available for trip planning on the Web site were helpful. Dropdown lists, which were based on landmarks, and options for schedules and route planning, assisted the respondents in planning their trip. Some respondents did indicate need for providing various transit modes and improved ease of Web site navigation.

To summarize the Phase I findings, overall usability varied depending on whether the trip was "typical" (e.g., specified) or "non-typical" (e.g., unspecified). However, the dimensions were limited to SUS, Transitweb, and certain open-ended questions. While these dimensions provide a designer with measures of usability, a more holistic view of "User Satisfaction" is needed that encompasses usability and as well as other constructs that drive satisfaction. This was substantiated by the myriad open-ended responses that addressed broader issues than usability and facilitated development of our more comprehensive measure of satisfaction.

Phase II

An online survey, comprising questions illustrated in Appendix C, was implemented in summer 2005 by RSG. Part of the samples was provided by RSG and part was provided by the Minneapolis/St. Paul MetroTransit agency. RSG maintains a databank of users who are interested in participating in various survey initiatives like the present study. Within this databank, RSG stores demographic information for respondents and the areas of interest in which they would like to participate. For the purpose of this study, respondents that were located in the area of Los Angeles and Minneapolis/St. Paul and had expressed interest in participating in a

public transportation survey were selected. These respondents (henceforth referred as RSG databank respondents) were provided with a survey link they had to navigate to respond to the survey. All of the RSG databank respondents were asked to plan a "Specified" or "Unspecified" trip and provide their responses to the online survey. MetroTransit, a public organization that provides public transportation in the Minneapolis/St. Paul metropolitan area, agreed to place a link to our online survey on its Web site. The users of the MetroTransit Web site would voluntarily navigate to the survey link to provide their responses.

A total of 401 individuals responded to the survey. RSG databank respondents provided 155 responses towards LA ATIS services by evaluating the Metropolitan Transportation Authority (MTA) Web site (http://www.mta.net) and 52 responses towards MN ATIS services by evaluating the MetroTransit Web site (http://www.metrotransit.org). The link placed on the MetroTransit Web site yielded 194 responses (See Table 4.1).

Providers	LA	MN	Total
RSG databank	155	52	**207**
MetroTransit survey link	-	194	**194**
Total	**155**	**246**	**401**

Table 4.1 Number of Responses Collected Through Different Providers

Demographics

Referring to Table I.1 in Appendix I, the average age of a MN respondent was markedly lower compared to an LA respondent. Of the MN respondents, 50% were under 35 years of age. However, of the LA respondents, only 30% were under age 35. A larger part of LA respondents (approximately 72%) were within the age group of 25 to 54 years. Further, 20% of LA respondents were over 55 years old as compared to 7.3% in the case of MN respondents.

Table I.2 in Appendix I illustrates the gender distribution in the two cities. Nearly 58% of MN respondents were female. The gender distribution for LA was equitable compared with MN.

Most of the respondents in both the cities were "White/Caucasian," as shown in Table I.3 in Appendix I. However, MN respondents seemed much more biased than LA: 85% compared to 72.3%. The major difference was noted in the contribution of "Asian/Pacific Islander" and "Hispanic/Latino" responses. In case of LA, nearly 18% of respondents belong to these ethnic groups compared with 2% for MN.

As shown in Table I.4 in Appendix I, in both cities, more than 30% of respondents had a bachelor's degree. There was a marginally higher number of respondents who had not graduated with a bachelor's degree, 38% in the case of MN and 33% in the case of LA, indicating there could be more student participation in the survey. Table I.5 in Appendix I confirms this observation. Nearly 21% of MN respondents were "Student—Working or Not Working." This percentage was much lower (6%) in LA. However, in both the cities, a majority of respondents, 70% in case of LA and 66% in case of MN, were "Employed Full-Time or Part-Time."

As shown in Table I.6 in Appendix I, the average household income for respondents from MN was lower compared to LA. Of the MN respondents, 70% had a household income less than $75,000 compared to 52% of LA respondents. Further, 40% of LA respondents had a household income of more than $75,000 compared to 20% of MN respondents.

Based on all of this data, it was observed that MN respondents were younger in the age group, were mostly female, were "Employed Full-time" or "Students," had a household income of below $75,000, and were "White/Caucasian." On the other hand, LA respondents were older, enjoyed a far higher household income, were mostly "Employed Full-time" or "Employed Part-time," and similar to MN respondents, were "White/Caucasian."

Public Transit Usage

As shown in Table I.7 in Appendix I, nearly 50% of MN respondents use the public transportation "5 or more times a week." This is in extreme contrast with LA respondents, wherein only 6.5% respondents use public transportation for as many times in a week. Of the LA respondents, 80% used public transportation "3 times a month" or even less. In the case of MN, 65.5% respondents use public transportation "2 times a week" or more. Further, as illustrated in Table I.8 of Appendix I, 62% of MN respondents use public transportation for "Work" and "School" purposes. Of the LA respondents, 41% use public transportation for purposes of "Recreation," "Vacation," or "Visiting Family or Friends" and 27% used public transportation for "Other" purposes. These purposes were mostly emergency in nature, such as "Car not available," "if my car is in the shop."

Referring to Table I.9 in Appendix I, 44% of MN respondents planned their trip using the MetroTransit Web site at least "Once a Week" or more. This is in sharp contrast to LA respondents, where 72% of respondents planned their trip using Metropolitan Transportation Authority Web site "Less than once a month." Further, 86.5% of LA respondents have access to a personal vehicle "Always" or "Most of the Time" compared to 57.3% of MN respondents, as shown in Table I.10 in Appendix I.

It seemed certain that MN respondents would use the public transportation more than the LA respondents, as nearly 43% of MN respondents said they have access to a personal vehicle "Sometimes," "Rarely," or "Never" compared to 13.6% in case of LA.

Based on these observations, MN respondents appear to be frequent users of the public transportation and consequently frequent planners of their transit planning using the public information systems compared to LA respondents. MN respondents use public transportation for their day-to-day activities: "Work" or "School." LA respondents, unlike MN respondents, use public transportation merely for emergency purposes or for "Recreation" at best.

Experience with Information Technologies

As shown in Table I.11 of Appendix I, MN respondents have more experience in using computers than LA respondents. Of MN respondents, 72% have more than 10 years of experience using computers compared to 59% of LA respondents. Similarly, MN respondents indicated a marginally higher experience in internet usage than LA respondents according to Table I.12 of Appendix I.

Nearly 85% of MN respondents had internet usage experience of 6–15 years compared to 77% of LA respondents. In both the cities, the majority of the respondents have "Regular cell phones" at their disposal, as shown in Table I.13 of Appendix I. However, a marginally higher number of MN respondents have access to "Portable computer with wireless communications"—63 for MN compared to 39 for LA respondents. MN respondents had higher experience and access to information technology devices than their LA counterparts.

Metro Transit-Specific Questions

Out of 194 respondents, 185 were "Repeat" users of the MetroTransit Web site. And, of the 185, 135 had planned a trip on the Web site within last two days. There were 50 respondents who were asked to plan a specified/unspecified trip, so that they could evaluate the Web site. Out of 185 respondents, 180 had taken a bus trip based on information provided on the Web site sometime in the past. Of these respondents, 155 found the information to be adequate, whereas 25 of these respondents found the information inadequate for their use. Table I.15 of Appendix I illustrates the valid responses of respondents who thought the information provided by the Web site was inadequate. Most of the responses were related to the inability of the trip planner to provide exact schedules, fares, or bus routes. Few responses alluded to inefficient planning provided by the Web site or absence of complete transfer information.

Of 194 MetroTransit Web site users, 44.3% use "Public bus" as their mode of transportation for commuting to "Work," whereas 13% use private automobile for commuting to work. This finding was confirmed when 59% of MN respondents indicated that they "Often" used "Public bus" as their mode of transit to work. Other means such as "Public rail," "Biking," and "Carpool" are "Rarely" used for transit to work.

Statistical Overview

Based on the constructs illustrated in the model shown in the Phase Two section of this chapter, descriptive analyses are illustrated in Figure 4.5. Mean values for overall "Utility" of the MetroTransit Web site was found to be marginally higher compared to the Los Angeles MTA. The MetroTransit Web site was found to be much easier to use and navigate than the MTA site. The MTA Web site was found to deliver marginally more complete information and better geographical coverage.

The mean values in various aspects in "Efficiency" and "Reliability" were not found to be different for both the Web sites. However, there was a sizeable difference found in the mean score for "Customization" construct between the two Web sites. The MetroTransit Web site had relatively lower mean values for customized access and content compared to the MTA site. The MetroTransit Web site was found extremely flexible in providing trip-planning features compared to the MTA site. However, the nature of content provided by MetroTransit was not found to be dynamic in nature. In evaluating emotional constructs, the users of the MetroTransit Web site had more confidence in using the Web site compared to users of the MTA Web site. Other aspects of "Satisfaction," "Frustration," and "Pleasant" were not found to be different.

	MN	LA		MN	LA
UTILITY	3.8	3.7	**CUSTOMIZATION**	3.3	3.5
Ease of Use	4.0	3.6	Customized Access	2.9	3.2
Ease of Navigation	3.9	3.7	Customized Content	3.6	3.8
Completeness	3.7	3.9	**FLEXIBILITY**	3.5	3.4
Usefulness	4.0	3.9	Flexible Planning	3.9	3.3
Coverage	3.1	3.4	Dynamic Content	3.0	3.4
RELIABILITY	4.3	4.3	**EMOTIONAL DIMENSIONS**		
Uptime	4.6	4.6	Satisfaction	3.5	3.5
Accuracy	3.9	3.9	Confident	4.0	3.7
EFFICIENCY	3.7	3.7	Pleasant	3.5	3.4
Ease of Access	3.7	3.7	Frustration	3.0	3.0
Presentation	3.7	3.6			

Figure 4.5 Mean Values of Constructs

EGOVSAT

The model previously described was analyzed further to formulate a statistically significant satisfaction index—EGOVSAT—which could be used for evaluating other e-government initiatives. An advanced statistical technique, structural equation modeling (SEM) was used to evaluate the model, as shown in Figure 4.6.

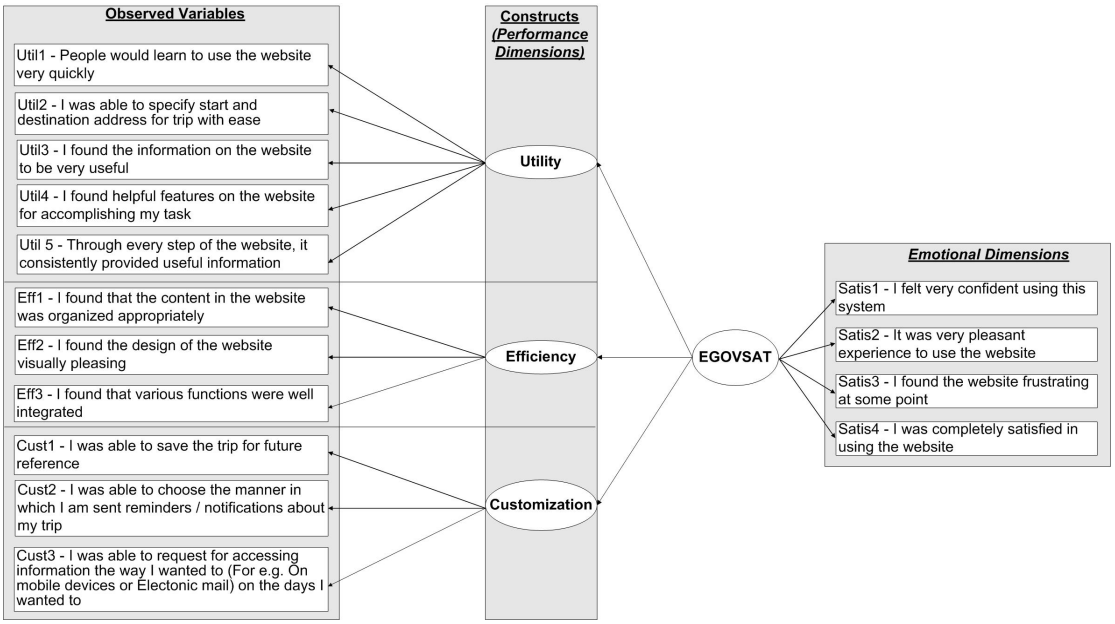

Figure 4.6 Evaluated Model

During the analyses, to maintain a high level of statistical significance, two major constructs ("Flexibility" and "Reliability") failed to explain the relationship of the underlying data. Additionally, few observed variables had similar behavior. As a result, the model was reduced to 15 observed variables and 3 constructs, of which, 11 were performance-related determinative questions and 4 were emotional questions. The analyses following this section comprise different indices that were formulated using the statistically tested model.

In evaluating the overall model, the probability level was kept at 0.001 or lower. Further, significant indices were 0.87 or above. Table 4.2 lists significant parameters of the statistical findings and their values.

Fit Indices	LA	MN
Probability Level (p)	= 0.001	< 0.001
CMIN (Minimal Discrepancy)	134.42	197.46
Degrees of Freedom (df)	88	88
CMIN/df	1.53	2.24
Goodness-of-fit (GFI)	0.90	0.91
Adjusted Goodness-of-Fit (AGFI)	0.87	0.87
Parsimonous Goodness-of-Fit (PGFI)	0.66	0.66
Normed Fit Index (NFI)	0.92	0.92
Comparative Fit Index (CFI)	0.97	0.95
Root Mean Squared Error of Approximation (RMSEA)	0.05	0.07
Root Mean Squared Residual (RMR)	0.06	0.05

Table 4.2 Statistical Indices (EGOVSAT Model)

Emotional Index

The emotional index (Minimum 0, Maximum 100) was formed based on four different observed variables in emotional dimensions, as illustrated in Figure 4.6. In evaluating emotional dimensions, the MetroTransit index was higher than the MTA Web site, as illustrated in Appendix J (63 as against 60.85). This could be because the confidence level in MN respondents was found much higher than LA respondents.

Performance Index

Performance index (Minimum 0, Maximum 100) was formed based on 11 determinative variables. As illustrated in Appendix K, the index for LA respondents was higher than the MN respondents (65.73 compared to 64).

EGOVSAT and SUS

The performance and emotional index was combined to form the EGOVSAT index (Minimum 0, Maximum 100). This index comprises 15 questions (11 determinative and 4 emotional). It was found that LA Web site scored marginally higher than the MetroTransit Web site. Further, an established usability scale also was calculated so that comparison can be made with the EGOVSAT. Compared to SUS, the EGOVSAT index was found to be a little more stringent. As illustrated in Appendix L, EGOVSAT index for MN was 63.89 and for LA was 64.61. Contrary to this, SUS index for MN was 65.50 and 72.60 for LA, as shown in Appendix M.

Focus Group Responses

Los Angeles

Focus group participants were chosen from a group of survey respondents who had agreed to participate in the follow-up study. In Los Angeles, 131 survey respondents chose to volunteer for the focus group. These participants were offered compensation in the form of in-store gift cards for their contribution. Eight respondents participated in these discussions; four male and four female. All participants had used the Internet for planning some kind of trip for surface travel. Further, all users had experience using some form of e-government Web sites that were informative in nature as well as those that offered transactional services.

Usability Measures

The focus group discussion began with a query about the participants' overall view of the Web site as "a good way to plan trips." In comparing trip planning, participants compared it with MapQuest or Yahoo! Maps. Consequently, these services implicitly set a benchmark for comparison. Participants found the Web site "really" useful, "simple to use," and "encyclopedic." However, participants noted that the information was appropriate for "shorter" and "point-to-point" trips. The planning information was found useful as it displayed landmarks for the route. The respondents viewed the Web site as quite accessible for first-time users with moderate computer and Internet experience. Frequent ("heavy") users did not find the information to be of appropriate value. Recent transit users found the Web site to be appropriate and a good way to plan trip. However, users who were aware of the actual transit service had opposing responses. Regular transit service users commented on the inability of the Web site to plan complex trips and inadequacy to offer complete information.

Emotional Dimensions

The focus group discussion then proceeded to examining emotional elements (i.e., what was more satisfying or frustrating about using the site"). Respondents identified need for specific features that could result in a satisfying or frustrating experience in using the Web site. The information provided by the system was identified to be "incomplete," "inefficient in providing decision-making capabilities," and "lacking in integrated services." Participants alluded to lack

of sophistication of detailed information such as "stop-wise listing" and "alternate routes." For advanced services such as "visual representation," "customization," and "integrated services," participants made comparisons with MapQuest. They noted that it helps to plan a trip when visual representation of the destination is provided. Further, they noted that MapQuest services provide the option of changing trip metrics, which the ATIS Web sites do not. A lack of integrated information services via the trip planning Web site was a major concern for all participants. They noted that integration of information services was important to present a comprehensive picture of the overall trip plan. It was found that the emotional indicators, "satisfaction" and "frustration," varied based on different usage patterns of the actual transit service users. These indicators were varied in nature for "heavy" or "light" users.

Suggested Improvements

The participants felt that the services offered by the site could be improved by providing sufficient information related to destination, routes, and schedules as well as dynamic information such as real-time changes in the actual route being planned. Participants felt that the site does not provide choices to frequent ("heavy") users. Participants responded that the trip planning Web site was incomplete at times and even incorrect based on their personal knowledge of the area. They stated that some transit users are aware of alternate routes and that the trip planning Web site does not account for those. Frequent users of public transportation felt that there is unquestionable need for detailed information related to maps and destinations. In terms of dynamic information, participants stated that the Web site did not reflect the real-time information related to the transit route.

Likely Use of E-Services

Participants desired specific features that could be included in the Web site—customization and certain special needs. Participants noted also the need for saving frequent trips for future reference. This observation also was echoed by other participants who felt that similar customization would help them better plan their trips. Participants who were homemakers with young children noted the issue of special needs. Some of the participants seemed interested in the trip planner being able to differentiate between local and express bus services, as their trips were local and recreational in nature. There was some degree of consensus among the participants that the Web site was better than other e-government Web sites. This trip planning facility was observed to be sophisticated and "easy to use" compared with other e-government information systems. There was consensus among all participants that e-government services should be available free of charge.

Minneapolis/St. Paul

Focus group participants were chosen from a group of survey respondents who had agreed to participate in the follow-up study. In MN, 176 survey respondents chose to volunteer for the focus group. Focus group participants were offered compensation in the form of in-store gift cards. After few rounds of telephonic conversations, a total of 25 respondents agreed to participate; 22 respondents appeared in person for the discussion.

Usability Measures

Participants thought that the option of planning trips on the Web site is a good improvement over other informational services such as telephones. (MetroTransit provides telephonic services, wherein the operators assist callers by detailing various options that are available for taking public transit for their specific transit route.) Participants also felt that the online system is far better than the paper route maps that they collect from various transit stations or from the bus. Extending this thought, they contributed that the Web site is available 24 hours a day, and it does not depend on certain office hours. Further, a high level of trust was identified with the Web site by various respondents.

Participants noted that the Web site was very useful for planning trips as it gave them different options in various aspects of planning: bus timing schedules, walking distance, and different options for transfer. Participants proposed that the trip plans provided by the Web site can be used by a commuter who is unfamiliar with the area. The instructions, they indicated, should be a "no-brainer" for an unfamiliar commuter. For first time users, the Web site assists them in getting acquainted with the area. However, an experienced commuter might know better routes than those being offered. It was further pointed out that an unfamiliar commuter might need more explanation than the Web site provided.

The Web site was found very easy to use. Diverse user groups use the Web site, and they seem to be comfortable using it. The Web site was found easiest at the front page. However, there were other responses that indicated certain specific features that might present hindrances in using the Web site. The Web site seemed unforgiving for users who used the "Back" button of the browser. Other related responses indicated the failure of the Web site in identifying certain addresses. The Web site was found to be a little unreliable and inaccurate when different modes, such as light rail, are involved. Some of the respondents did point out the inability of the Web site to plan a suburban trip. These doubts were further supported by other respondents indicating that the issue was fairly general in nature.

Emotional Dimensions

Some of the respondents felt really satisfied because of the "impromptu" usage the Web site supports. An advanced feature of impromptu usage is the use of a mobile device to plan a trip. Some of the respondents identified specific features that gave them satisfaction, such as maps in PDF format, choice of route, and schedule and trip planning. Some of the respondents indicated certain peculiar workings of the trip planning Web site, which led to a bit of frustration. One of these aspects was related to providing origin and destination addresses for the transit. Another peculiarity was failure of the Web site in identifying bus stops, which respondents knew to exist. During the discussions, frustration due to lack of certain advanced features needed for trip planning was identified.

Suggested Improvements

Some of the respondents indicated that the Web site could be improved by including customization features. Certain extensions of such customized features also included provision of different transfer times, waiting duration, walking distance, and real-time information such as the presence of shelters along the bus route. Further, the need for including bike-related information was also identified by respondents. Certain responses also indicated a need for including road-specific information, while the trip is being planned. A fair number of responses indicated need for delivering information regarding the bus service as well as the geographic location around the bus service. The respondents indicated that the need for information about the geographic location is important, especially in the case when transfers need to be made on other bus route or when the area is unfamiliar. To counter this lack of geographical information, respondents use other accompanying tools provided by private or public initiatives such as Yahoo! Maps, MapQuest, or Google Earth. Providing better map facilities seemed to be a topical need for trip planning Web sites. The maps are being used by the commuters as a backup and for areas that are unfamiliar to them. Related to these issues, respondents point to the fact that there should be a high coordination of what is being shown on the trip planning and what is actually happening. This was identified to be a cause a great deal of confusion.

Likely Use of E-Services

The participants indicated varied expectations from the Web site based on different trip purposes commuters plan for. It seemed quite apparent that the pattern of trips taken by commuters included work, recreational, or school trips. There were some respondents who seemed entirely dependent on public transit for all their travel purposes. The MetroTransit Web site, accordingly, should accommodate these various expectations. Regular users of the trip planning information requested more real-time information about the services and the geographic location around the service. The real-time information, regular users purported, would make the information handy as most of the time, they indicated they knew more about the routes than the trip planning Web site offered. For recreational commuters, on the other hand, there was a greater requirement for supplemental information such as links and maps. Regular commuters also expressed the need for various options that saved trip time. These included a need for bandwidth time within which the service is being delivered or certain additional supplemental information. The Web site seemed an invaluable help to commuters who solely depend on public transit for all of their trips. The Web site provided these commuters an immediate sense of confidence.

Comparison with other Online Government Services

The respondents seemed to have experience with various interactive digital government services such as driver's license renewal, public libraries, student loan information, and the Social Security and Internal Revenue Service Web sites. Most of the respondents found the trip planner compared favourably to other online government services. Participants agreed that the Web site is a good use of taxpayer's money. They reiterated that due to the Web site they have made public transportation their first choice of travel. Participants also indicated that the Web site provides them "on-demand" service in answering their questions regarding public transit. They feel a sense of confidence about the service being available all the time and the Web site being an important information delivery system related to the public transit.

General Observations

Participants noted that special facilities are required so that the public transit usage is much more equitable and satisfying. These facilities include provisions for discounted fares for children in rush hours, limited-stop bus line on heavily-used routes, and reduced bus size for routes that have few commuters or are lightly used. Participants also indicated that they have increased their day-to-day usage in interactive trip planning over the past few years.

Findings and Implications

Citizen-based evaluation of governmental systems has been the focus of a number of studies. However, there have not been many studies that focus on satisfaction as a major construct. This study attempts to fill this gap by formulating a model that can be extended to other e-government online citizen-based interactive systems. The EGVOSAT model is expected to reflect on specific design parameters that have been demonstrated in this study. These parameters might prove critical in ensuring a more satisfying or less frustrating experience when users are in the process of using e-government initiatives. The long-term vision of this research is to provide a scale based on which different e-government systems can be assessed to measure the level of satisfying user experience it offers. This scale will provide the designer of such systems an evaluation tool, which can be used to predict behavior of various citizen groups. The central theme of this study is to develop a means for e-government success as seen by users, while they are using the electronic services. The idea is to integrate both the online means for assessment and the subsequent findings into the design processes of an online government-to-citizen system. While this study has focused on travel planning information, it could perhaps be generally applicable to other similar initiatives, wherein a diverse set of citizens use services for various reasons.

Based on these objectives, the research was conducted in two different cities (LA and MN). MN respondents were younger compared to LA respondents. In MN, female respondents were more represented in the survey compared to LA. The income distribution for MN respondents was lower compared to LA. No major differences were found in education and employment status. Further, citizen groups in LA and MN were equally experienced with advanced technological developments. However, vast differences were noted in the purpose and frequency of using public transportation. MN respondents used public transportation much more compared to LA respondents. Further, their usage was found to be much more regular. The findings also reveal that LA respondents were more incidental users than active users of public transportation.

Although the citizen groups were different, similar expectations were found to be viable based on the model designed in the study. Both the citizen groups ranked “Utility” (ease of use, ease of navigation, ease in learning, and delivery of useful information) to be the most important performance aspect in using a Web site. Similar importance was given to the efficiency (organization as well as integration of the information and a visually pleasing design) construct. Both groups ranked “Customization” to be a marginally important performance aspect of the Web site. Other performance constructs, “Flexibility” and “Reliability,” were not found to be effective. Both the groups noted the importance of satisfaction, confidence, pleasantness, and frustration to be important determinants of emotional aspects in evaluating the Web sites.

The model (EGVOSAT) developed in the study was compared with established measures. It was found that the EGOVSAT index was a little more stringent than usability index (SUS). The MN respondents were less satisfied with the performance aspect of the Web site. However, they did note that they were much more emotionally satisfied with the Web site. On the other hand, LA respondents did rate the MTA Web site higher in usability index but lower in emotional dimensions. Based on this finding, it can be concluded that the emotional constructs do not depend on various performance aspects of the Web site.

During the focus group discussions, MN respondents exuded a high level of confidence in using the Web site. They were satisfied with the features that were available for planning a public transit trip on the Web site. They found the Web site to be useful and the information to be organized and integrated in its delivery. They found the ATIS delivery to be much more customer-centric than other e-government initiatives. However, they did note the lack of customized delivery by the MetroTransit Web site. On the other hand, LA respondents found the Web site to be useful to a limited extent as it did not provide visual representation of trip information. The respondents compared the Web sites with other private online mapping initiatives such as Yahoo! Maps and MapQuest. Similar to MN respondents, LA respondents noted the need for customized features in the MTA Web site. Need for certain advanced features were noted by both LA and MN respondents.

Recommendations

The online government initiative (ATIS) considered in this study represents but one type of the large number of Web-based interactive services. However, it is an appropriate representative of types of experience that citizens undergo while using a government-led advanced digital service. The user groups observed in this research were found to be diverse. Further, the purpose of using online ATIS services by these user groups was found disparate, too. It will not be over-assuming to consider that similar interactions can be expected with other digital government services. Recommendations drafted from this study, detailed below, do promise the possibility of generalizations to other systems such as those for public library, water works, and tax payment services.

1. It was found that the trip planning is not designed to be delivered to disparate user groups. Different user groups expect different features in trip planning information. The dynamism of various constructs, emotional and performance, depends on the type of the individual using the Web site to access trip planning information. The trip planning sites need to provide equal importance to the specific attributes as well as the context of usage such as the personal attributes of the user. For example, it was found that a non-native-English-speaking novice user found the LA trip planning feature not as easy to use as compared to a native-English-speaking user. The Web site did not seem to be designed for users who are unaware of the regional areas where they reside, even though language was not a barrier.

2. Digital information delivery is readily being compared irrespective of who is providing the facility. In focus group discussions, the respondents frequently compared ATIS Web

sites with other established private initiatives such as Google Maps, Yahoo! Maps, and MapQuest and comparison shopping sites such as Amazon and eBay. For end-users, such comparisons seem to be a matter of fact. However, the underpinnings are quite complex. There is much more innovation in private initiatives than the ones led by government. To ensure better delivery, public-private partnerships might help in such cases.

3. There is a distinct need for advanced features in information delivery such as customization, visual representation, and integration. In online survey responses and focus group discussions, it was evident that ATIS Web sites need to tailor their information based on who is actually using the services, and these provisions need to be personalized. For example, ATIS Web sites need to store frequently-used destinations for every user. One frequent user of the MN Web site (MetroTransit) suggested the need for providing a "My MetroTransit" option. This essentially means customizing and personalizing the Web site based on the specific user needs.

4. Due to advanced visual features available in private initiatives such as Google Earth, users expect similar features in ATIS trip planning Web sites. It was observed that presently, trip planning is performed by combining information from government as well private initiatives. In both the cities, it was observed that ATIS users complete their trip by combining information from disparate public and private sources. The main reason for this, as cited by the respondents, was the lack of visual representation of information such as maps. Visual information delivered by ATIS Web sites is inadequate at present. For example, maps are supplied in static formats such as images and PDF files. It would be better if the maps were interactive.

5. The main purpose of this study was to highlight the need for certain subjective assessments (emotional constructs, described in the study). There have been attempts to highlight the need for specific attributes to be included in ATIS Web sites, such as usability guidelines provided by the ITS Joint Program Office (http://www.transitweb.its.dot.gov/guidelines/main.asp). The eventual effects of such attributes, however, remain to be examined. This research, on the other hand, considers features that might prove more effective than specific attributes of ATIS Web sites in determining satisfaction derived in using interactive digital services. The designers of ATIS Web sites need to consider the importance of subjective or emotional assessments in their implementation as well.

6. During detailed statistical evaluation of the EGOVSAT model and focus group discussions, it was evident that the importance of ease of use, ease of navigation, delivery of complete information, organized presentation, and customized features ranked much higher than other qualities. ATIS Web site designers need to be aware that these qualities ensure utmost satisfaction and the least frustration among users.

7. As observed, digital information delivery is not considered as a part of overall government services. As a result, information delivered through online e-government Web sites appear to be distinct and disconnected with traditional deliveries such as printed maps, in-vehicle announcements, and the like. For example, in the case of MetroTransit, the Web site does not mention the location of snow shelters near the bus

stops. As a result, bus travelers have to bear the extreme weather until the bus arrives at their stops. It would be much more beneficial if such information is included in ATIS Web sites. For this, the designers need to be aware of the importance of delivering different kinds of information on their Web sites than what is being currently provided using traditional methods.

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Appendix A
Potential Sources of Funding and Regulation

Appendix A
Non-exhaustive Listing of Potential Sources of Funding and Regulation for Minnesota Providers

Federal Statutes

- Statewide Transportation Improvement Program (23 U.S.C. Section 135)
  - General Provisions
- Social Security Act (42 U.S.C. 401)
  - Federal Old-Age, Survivors and Disability Insurance
- Americans with Disabilities Act (42 U.S.C. 126)
  - Paratransit (§12143)
  - Public entity operating a demand responsive system (§12144)
  - Other (§§12141-12150)
- Transportation (49 USC 5300)
  - Subtitle III (subsections 1-7, 9-11, 13, 18, 20, 24, 27-38)
- Older Americans Act (42 USC 3001)
  - Grants for State & Community Programs on Aging (Title III)
  - Grants for Native Americans (Title VI)
- Transportation Equity Act-21 (P.L. 105-178)
  - Over-the-Road Bus Accessibility: Rural Transportation Accessibility Incentive Program (§ 3038)

Federal Regulations

- Statewide Planning Processes
  - General requirements (23 CFR 450.206)
  - Coordination (23 CFR 450.210)
- Education
  - Rehabilitative services (34 CFR 300)
- Health
  - Programs of All-inclusive Care for the Elderly (PACE) (42 CFR 460.70 – 460.76)
- Public Welfare
  - Rehabilitation Act (45 CFR 84)
  - Head Start (45 CFR 1308-1310)
- Transportation
  - Transportation/ADA (49 CFR 37-40)
  - Insurance (49 CFR 378.33)
  - Commercial driver's license standards (49 CFR 383.51)
  - Driver qualifications (49 CFR 391)
  - Motor carrier safety (49 CFR 39; 49 CFR 395)
  - Repair/inspection (49 CFR 396)
  - Motor vehicle safety/General (49 CFR 571)
  - School bus operations (49 CFR 605)
  - Transportation for the elderly and handicapped (49 CFR 609)

- Major capital investment plans/5309 (49 CFR 611)
- Planning regulations (49 CFR 613)
- Capital leases (49 CFR 639)
- Prevention of alcohol misuse and drug abuse (49 CFR 655)
- Bus testing (49 CFR 665)

Minnesota Statutes

- Funding
  - Financial aid, application, disbursement (§174.04)
- Motor Carriers
  - Intrastate carriers, operating requirements, exemptions (§221.031)
  - Passenger, registration, exemptions (§221.0252)
  - Exemptions for certification (§221.025)
  - Commuter vans (§221.011)
  - Insurance (§221.141)
- School Transportation
  - School transportation inspection (§§169.451, 169.4501-.4504)
  - Head Start (§169.451)
- Special Transportation Services
  - Ambulance service prohibited (§174.315)
  - Paratransit (§174.255)
  - Coordination (§174.29)
  - Eligibility (§174.295)
  - Operations (§174.30)
- Vehicle registration
  - Definitions of vehicles (§168.011)
- Medical Assistance
  - Definition of special transit (§256B.04)
  - Covered services (§256B.0625)
- General Assistance
  - Exclusion (§256D.03)
- Human Rights
  - Non-discrimination (§363.03)
- Health Care Cost Containment
  - Special transportation in emergency situations (§62J.48)
- Wheelchair Transportation
  - Safety precautions (§299A.11-299A.17)

Minnesota Rules

- Transportation
  - Public transportation (§8835)
  - Transportation for the elderly & disabled (§§8840.51-8840.6)
  - Motor carrier safety (§8850)

- Human Services
  - Health care programs in general (§9505)
    - Medical Assistance (§§9505.0170-9505.0475)
    - Covered services (§9505.020)
    - Medical transportation (§9505.0315)
    - Payment rates (§9505.0445)
    - Billing (§§9505.0450-05.0470)

Appendix B
MnPASS Evaluation: Final Report

HUMPHREY INSTITUTE OF PUBLIC AFFAIRS,
UNIVERSITY OF MINNESOTA

MNPASS EVALUATION ATTITUDINAL PANEL SURVEY WAVE 3

Final Report

August 2006

NuStats

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1. EXECUTIVE SUMMARY

This report documents the methods and results of the third and final wave of data collection for the I-394 MnPASS Evaluation Attitudinal Panel Survey (hereafter referred to as the Attitudinal Panel Survey). The Wave 3 Survey, conducted during May and June 2006, occurred six months after the second wave and about one year after the implementation of the I-394 MnPASS Express Lane project. NuStats conducted 1,228 interviews, of which 343 were with panel members (i.e., interviewed in the Baseline, Wave 2, and Wave 3). These data were collected to evaluate the attitudinal and behavioral impacts of allowing solo drivers to pay to use carpool lanes. NuStats conducted the survey under subcontract to the State and Local Policy Program at the Humphrey Institute of Public Affairs at the University of Minnesota for the Minnesota Department of Transportation.

1.1 PURPOSE OF THE ATTITUDINAL PANEL SURVEY

The I-394 MnPASS Express Lane project created Minnesota's first High Occupancy Toll (HOT) lanes. This project began allowing solo drivers to pay a fee to use an 11-mile stretch of carpool lanes between downtown Minneapolis and the western suburbs in May 2005. While solo drivers pay to use the MnPASS lanes, carpoolers, bus riders, and motorcyclists may use the lanes free of charge. Dynamic pricing ensures continued free flow in the lanes at about 50 to 55 miles per hour by adjusting the toll up or down depending upon the amount of traffic in the lanes. The per-trip fee depends on where users enter and exit the MnPASS Express Lanes. The variable, per-trip fee is always charged for single-occupancy vehicle (SOV) use in the reversible section, while fees are only charged in the peak direction during rush hours in the diamond lane section. The fee is posted on changeable message signs, which can be adjusted as often as every three minutes, located just before entrances to MnPASS lanes. The tolls range from 25 cents to $8 and average $1 to $4 during rush hour. Solo drivers who subscribe to the MnPASS program (identified in this report as subscribers or transponder owners) are issued windshield-mounted transponders for automatic vehicle identification. Each time subscribers use the lanes; their accounts are automatically debited the per-trip fee. MnPASS subscribers also pay a $1.50 monthly fee for leasing the MnPASS transponder.

MnPASS is a new and significant change in highway management in Minnesota. To evaluate public acceptance and use, the Minnesota Department of Transportation (MnDOT) commissioned the University of Minnesota's Humphrey Institute of Public Affair to conduct before-and-after project implementation surveys. The Attitudinal Panel Survey used a longitudinal panel design to collect opinion, travel behavior, and willingness to pay information from users and potential users of the MnPASS Express Lanes.

1.2 ATTITUDINAL PANEL SURVEY METHODS

Survey panels are comprised of individuals who are pre-recruited to participate on a more or less predictable basis in surveys over a period of time. The MnPASS Attitudinal Panel Survey respondents were interviewed in fall 2004, fall 2005, and spring 2006. The first wave (i.e., Baseline) of the Attitudinal Panel Survey was conducted prior to I-394 MnPASS Express Lane implementation in November/ December 2004. In it, 1,000 respondents were sampled through a probability-based approach and completed a 20-minute telephone survey. Of these respondents, 980 agreed to continue as panel members. The second panel survey wave was conducted in November/ December 2005, about six months after MnPASS implementation. Of the 980 baseline respondents who had agreed to be interviewed in Wave 2, 549 panel members were actually located, contacted, and interviewed. In addition, the Wave 2 sample included 400 choice-based respondents (i.e., 151 MnPASS subscribers and 250 transit users who were sampled from lists). All Wave 2 respondents recorded information about their travel in a travel log and also completed a modified version of the Baseline telephone survey.

The third wave of the Attitudinal Panel Survey was conducted in May / June 2006. A total of 1,228 respondents completed Wave 3 interviews. Of these, 343 were interviews with panel members (i.e., interviewed in the Baseline and Wave 2 Surveys). Additionally 106 were with MnPASS subscribers and 178 were with transit users who were interviewed in Wave 2. In addition to these participants in the previous survey waves, a new probability-based sample was introduced in Wave 3. These were 601 randomly sampled residents of the I-394 or I-35W travel sheds. The Wave 3 Survey used slightly modified versions of the Wave 2 materials including a pre-notification letter, travel log, and a telephone survey instrument.

1.3 KEY FINDINGS

1) Support for the idea of allowing single drivers to use carpool lanes by paying a fee remained high one year after MnPASS implementation (65% "good idea" versus 22% "bad idea").
   a) Support was consistent across all three waves of data collection: (Wave 1) 60% "good idea", (Wave 2) 58% "good idea", and (Wave 3) 65% "good idea."
   b) Approval was consistent across all income groups – 71% higher income, 61% middle income, and 64% lower income.
   c) Support remained strong among carpoolers (60% "good idea") and stable among transit users (49% "good idea").
   d) Opposition diminished across the three waves of data collection: (Wave 1) 30% "bad idea", (Wave 2) 29% "bad idea", and (Wave 3) 22% "bad idea."
   e) Opposition to the 24-hour operation of the toll lane program decreased between fall 2005 and spring 2006: (Wave 2) 61% "bad idea" and (Wave 3) 54% "bad idea"; conversely support increased nine percentage points from 23% (Wave 2) to 32% (Wave 3).
2) Beneficiaries of the MnPASS Express Lane project include a diverse population – across all income, age, race/ethnicity, employment, and mode usage groups.
   a) By spring 2006, penetration in the transponder market for the I-394 travel shed has reached 6%.
   b) All MnPASS lane users include those who pay to use the lanes as well as those who do not -- 84% have used the MnPASS lanes as a carpooler, 9% as a single driver, and 2% as a bus rider.
   c) MnPASS usage was reported across all income levels – 79% higher income, 70% middle income, and 55% lower income.
3) Satisfaction with toll operations is strong, with minimal levels of dissatisfaction voiced by all MnPASS lane users.
   a) The highest measures of satisfaction were with the all electric operation (93% satisfied) and speed of traffic flow in the MnPASS lane (88% satisfied).
   b) Satisfaction with operations related to "safety" has increased relative to Wave 2 for ease of identifying the MnPASS entry points (83% satisfied) and safety of merging into the MnPASS lanes (72% satisfied).
4) Traveling experiences of I-394 users have improved since fall 2004 – 71% reported no congestion delays on their reference trip compared to 62% in Wave 1 and 61% of I-35W respondents.
   a) Decrease in the percent of respondents reporting a congestion delay held steady at 29% (Wave 2 and Wave 3) compared with 37% in Wave 1.
   b) Nearly half (49%) of I-394 respondents were 100% satisfied with the quality of travel on that roadway compared with 48% in Wave 2 and 37% in Wave 1.
   c) 68% described their reference trip travel as "enjoyable" compared with 63% in Wave 2 and 47% in Wave 1.

d) All MnPASS lane users perceived a significant difference in levels of congestion in the general traffic lanes relative to the MnPASS lane on their reference trip – 48% described the general traffic lanes as "very or extremely congested" compared to 2% for the MnPASS lane.

5) The dynamic pricing formula was adjusted in January 2006, and resulted in a higher average price for peak period users. The formula adjustment also resulted in less price fluctuations and more predictability. However, as a result of this policy, there was a slight decrease in the percent of MnPASS subscribers who considered the MnPASS toll a good value – decreased from 71% just right to 61% just right.

   a) Among MnPASS subscribers, fewer reported satisfaction with toll amounts that vary with traffic levels (65% versus 76% in Wave 2).

   b) Willingness to pay to use the MnPASS lanes was higher for AM commute than the PM commute trips and for trips of more than 20 miles.

   c) Positive association between experience with MnPASS and willingness to pay for it. MnPASS subscribers and users show a willingness to pay at least 3 times higher than non-subscribers/ non-users.

6) The implementation of MnPASS has not had a negative impact on carpooling on I-394, nor on traveling experiences in the corridor. The current mode share of I-394 panelists is comparable to that captured in the Wave 1 survey: 81% drive alone and 19% carpool.

1.4 CONCLUSIONS AND NEXT STEPS

Overall approval and satisfaction with the I-394 MnPASS Express Lane project remained strong and broad one year after project implementation. Six-to-seven out of ten believed that allowing single drivers to use carpool lanes by paying a toll was a good idea. Support remained strong among lower-income households and carpoolers, as well as stable among transit users. Users of the MnPASS lane perceive it as having a positive impact on their traveling experiences on I-394 and are highly satisfied with its operations. The price increase in January 2006 did have a mitigating effect on users perception of the MnPASS toll as a good value, and in tandem to this, satisfaction with toll amounts that vary with traffic levels experienced a slight decrease from fall 2005.

Next steps for the I-394 MnPASS Express Lane project are to continue evaluating its behavior impacts and monitoring public acceptance. New customers will be marketed, along with the continuation of proactive public outreach and education. Study of I-394 MnPASS Phase 2 options, funded by a Value Pricing Grant of the Federal Highway Administration, began in the Summer of 2006 and will continue throughout 2007.

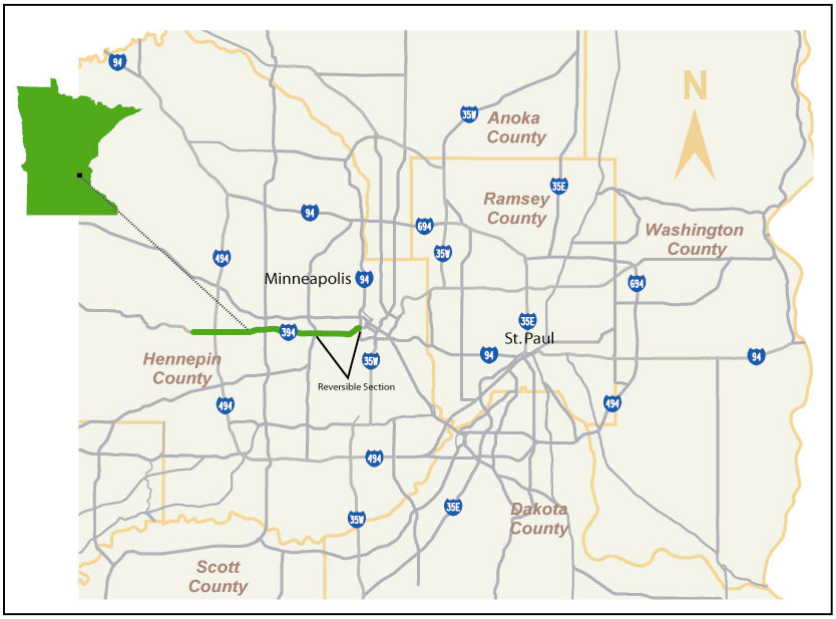
2. SURVEY METHODS

This chapter begins with a brief description of the MnPASS project, including its significance and goals. It then goes on to review the objectives and outcomes of the baseline and Wave 2 survey, followed by a more detailed description of the Wave 3 survey, including objectives, methods, outcomes and panel attrition.

2.1 MNPASS ATTITUDINAL PANEL EVALUATION: SIGNIFICANCE, DESCRIPTION AND GOALS

The I-394 MnPASS Express Lane project created Minnesota's first High Occupancy Toll (HOT) lanes. This project began allowing solo drivers to pay a fee to use an 11-mile stretch of carpool lanes between downtown Minneapolis and the western suburbs in May 2005 (see Figure 2.1). While solo drivers pay to use the MnPASS lanes, carpoolers, bus riders, and motorcyclists may use the lanes free of charge.

FIGURE 2.1: MAP OF STUDY AREA AND I-394 CORRIDOR



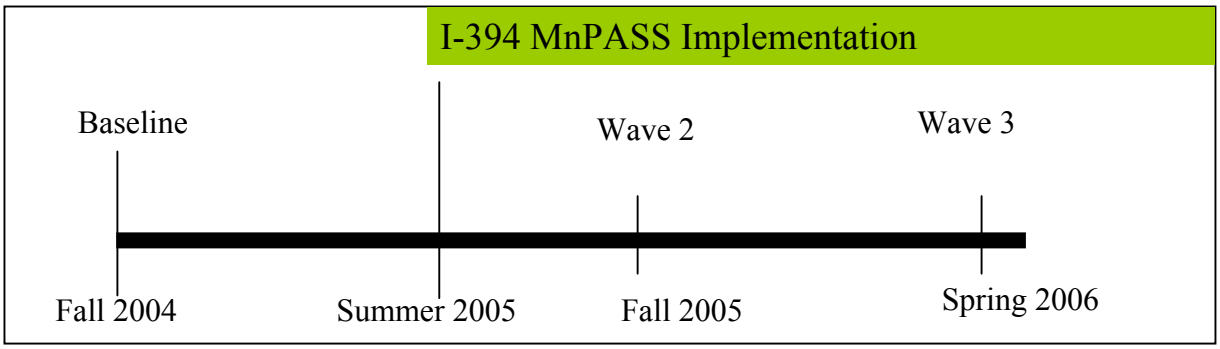
The I-394 MnPASS Express Lanes are divided into two segments for operations and pricing: (1) a barrier-separated, reversible section east of Highway 100 to downtown Minneapolis and (2) a "diamond lane" from west of Highway 100 to Highway 101, where two solid lines white lines separate the MnPASS lanes. Dynamic pricing ensures continued free flow in the lanes at about 50 to 55 miles per hour by adjusting the toll up or down depending upon the amount of traffic in the lanes. The variable, per-trip fee is always charged for single-occupancy vehicle (SOV) use in the reversible section, while fees are only charged in the peak direction during rush hours in the diamond lane section. The per-trip fee depends on where users enter and exit the MnPASS Express Lanes. Separate tolls are charged for use of each section. The fee is posted on changeable message signs, which can be adjusted as often as every three minutes, located just before entrances to MnPASS lanes. The tolls range from 25 cents to $8 and average $1 to $4 during rush hour.

Solo drivers who subscribe to the MnPASS program are issued windshield-mounted transponders for automatic vehicle identification. Each time subscribers use the lanes; their accounts are automatically debited the per-trip fee. MnPASS subscribers also pay a $1.50 monthly fee for leasing the MnPASS transponder. The transponders are read by antennae stationed at the access points in the lanes.

Enforcement is carried out by local law enforcement that patrols the MnPASS lane. Readers in their vehicles can determine whether a vehicle has a "working" transponder or not. This technology, plus visual determination of vehicle occupancy, is used for enforcement.

The Attitudinal Panel Survey measured the attitudes, perceptions, and reported travel behaviors of a scientific sample of residents of the study area. It covered issues of acceptance, equity, effectiveness in congestion management, toll system performance, as well as changes in travel behavior, mode choice, route choice and willingness to pay for the priced lane before-and-after the project implementation. As depicted in Figure 2.2, the survey waves took place in fall 2004, fall 2005, and spring 2006.

FIGURE 2.2: ATTITUDINAL PANEL SURVEY TIMELINE



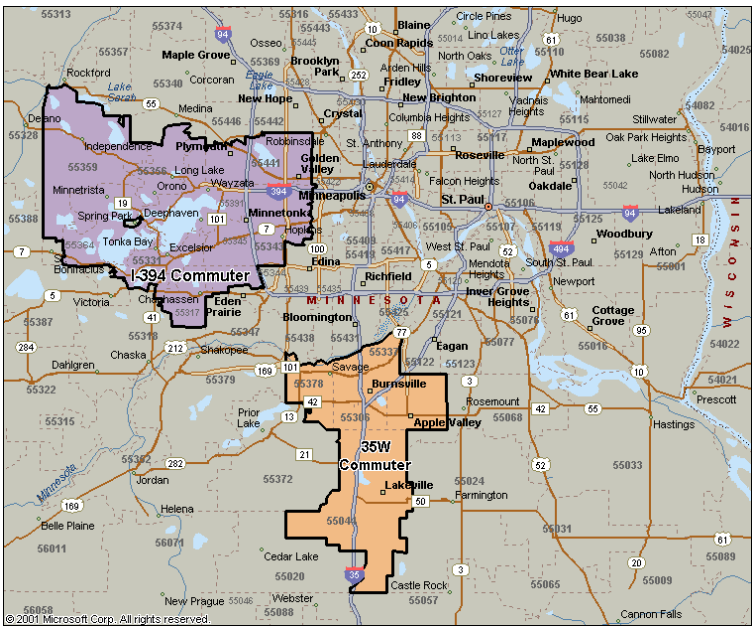
2.2 BASELINE (WAVE 1) SURVEY 2004

The Baseline Attitudinal Panel Survey established a foundation for the conduct of future waves of data collection. Full documentation of its methods and results can be found in a separate report, *I-394 MnPASS Project Evaluation Attitudinal Panel Survey, Final Report, March 2005*. Methods and outcomes are summarized here. Data collection for the Baseline Survey was completed in November / December 2004, prior to the opening of the I-394 MnPASS Express Lane. The design included the use of a treatment sample and control sample. The treatment sample consisted of households selected from the I-394 corridor, and the control sample consisted of households in the I-35W corridor. I-35W was selected as the control because it was the only other facility with carpool lanes in the study area (see Figure 2.3). Segments of each corridor were designated as follows:

- I-394 Travel Shed: Between Hwy 101 (West) and I-94 (East); alternate segment within this stratum was Minnesota Highway 55.
- I-35W Travel Shed: Between Hwy 62 (North) and Hwy 13 (South); alternate segment within this stratum was Minnesota Highway 77.

The population of inference (or population under study) consisted of those individuals 18 years of age or older, residing within the target travel sheds, that had traveled the target segments of I-394, Hwy 55, I-35W, or Hwy 77 between 6am and 9pm at least once in the five weekdays prior to the day of interview. To efficiently sample this population, specific areas within the I-394 and I-35W travel sheds were pre-identified as being the likely residential locations for I-394 or I-35W users based on origin and destination data from the Household Travel Diary Survey, conducted as one element of the Twin Cities Metropolitan Area Travel Behavior Inventory (TBI). These data were used to identify the areas that generated the highest proportions of target trips. Random digit dial (RDD) sample was then proportionally allocated to those areas.

FIGURE 2.3: MAP OF I-394 (PURPLE) AND I-35W (ORANGE) TRAVEL SHEDS



The survey materials consisted of an advance letter and a computer-assisted telephone interview (CATI) questionnaire. The questionnaire was developed based upon the objectives and research questions identified by a team that included MnDOT and other representatives from the I-394 MnPASS team. In addition, the Baseline Survey questionnaire drew from instruments used to evaluate predecessor projects, SR91 and I-15 in California. The Baseline Survey questionnaire contained six sections: (1) eligibility screening, (2) attitude/ opinion, (3) information about travel during the assigned travel week, (4) reference trip information, (5) stated preference questions, and (6) demographics. The questionnaire also contained a script to recruit respondents into the panel. Approval from the Institutional Review Board (IRB) of the University of Minnesota was obtained prior to administering these materials.

A total of 750 users of the I-394 corridor and 250 users of the control corridor (I-35W) were interviewed. An overall response rate of 66% was achieved. Nearly all of the 1,000 respondents (980) agreed to participate in future waves, thus forming the base panel sample for Wave 2 of the Attitudinal Panel Survey. In March 2005, postcards were sent to these persons reminding them of their prior consent to be interviewed in the Wave 2 Survey.

2.3 WAVE 2 SURVEY

Full documentation of its methods and results can be found in a separate report, *MnPASS Evaluation Attitudinal Panel Survey Wave 2, Final Report, March 2006*. Methods and outcomes are summarized here. In addition to the 980 Baseline Survey respondents who agreed to participate in the panel, NuStats targeted two supplementary sample types for inclusion in the Wave 2 Survey – transit users and MnPASS subscribers (e.g., transponder owners). Both of these sub-groups were targeted to ensure a sufficient sample size for analytical purposes. Transit users were sampled from a list of individuals known to use the local public transportation system supplied by Metro Transit in Minneapolis. The list contained name, address and contact information for 8,600 regional transit users. NuStats randomly selected 1,076 individuals from this list for inclusion in the survey. MnPASS subscribers were sampled from a list of 650 transponder owners supplied by MnDOT. The list contained name, address, contact information and date of account opening.

The survey materials included an advance packet that contained a letter and travel log. The travel log was used by respondents to record general travel information for an assigned travel week as well as information about a specific reference trip. The reference trip characteristics were pulled from the Baseline data and attached to the Travel Log via a mail-merge label. The CATI instrument was a slightly modified version of the Baseline questionnaire.

Data collection for the Wave 2 Survey was completed between November 2005 and January 2006. The data collection period was longer than the Baseline because of the level of effort required to re-contact Baseline Survey (i.e., panel) respondents. Wave 2 data collection was originally scheduled to take place in September / October 2005. However, it was re-scheduled to begin in November as a result of construction taking place on I-394 during the early Fall time period. In order to keep panel members abreast of the situation, another postcard was sent to panel members in early Fall reminding them of their consent to be interviewed, as well as providing them with the new schedule established for Wave 2 data collection. Of the 980 postcards sent, 70 (7%) were returned for failed delivery.

A total of 950 respondents completed the Wave 2 Survey. Of these, 549 were panel members (interviewed in both the Baseline and Wave 2), 151 were MnPASS subscribers, and 250 were transit users. The overall response rate was 65%.[1] Table 2.1 provides additional detail on the panel sample. We were able to contact and complete interviews with 56% of the Baseline respondents. No differences were observed in the completion rates between the treatment (I-394) and control (I-35W) panel samples.

TABLE 2.1: COMPLETION RATES BY SAMPLE TYPE – WAVE 2

SAMPLE TYPE	SAMPLE	COMPLETED INTERVIEWS	COMPLETION RATE
I-394 Baseline	736	413	56%
I-35W Baseline	244	136	56%
MnPASS Subscribers	583	151	26%
Transit Users	1,001	250	25%
Total	**2,564**	**950**	**37%**

The Wave 2 Survey experienced an attrition rate of 44% of the Baseline respondents. While this rate of attrition was higher than expected, it is comparable to that experienced in other recent transportation panels.[2] Reasons for the attrition in Wave 2 included: unable to locate or contact target person, target person no longer willing to participate, or target person no longer using corridor. Because of the panel attrition, an analysis was conducted in which the demographic characteristics of respondents completing both Waves 1 and 2 were compared to respondents who only completed the Baseline Survey. The analysis revealed that persons "lost" to the panel tended to be persons who rented rather than owned their residences and who were age 34 or younger. This outcome was not surprising given the fact that such persons tend to be more mobile. They would be more likely to change residences, jobs or their travel patterns making them difficult to locate and /or otherwise non-qualified to participate in the Wave 2 survey. For other demographic characteristics measured, no significant differences were found.[3] The attrition did reduce the effective sample size for longitudinal analysis – particularly those analyses of specific sub-samples, such as those used in the Stated Preference (SP) analysis. Eighty-nine percent of the total 950 Wave 2 respondents (or 847 persons) agreed to be re-contacted in the Wave 3 Survey. Of the 549 panel members, 88% (or 482 persons) agreed to be re-contacted in the Wave 3 Survey.

[1] Response rate takes into consideration eligibility criteria such as disconnected phone numbers and use of the target corridor so that it is higher than the completion rate presented in Table 1.

[2] Panel attrition was about 33% per six-month wave in the I-15 panel survey. The German Mobility Panel experienced a 43% attrition rate in the second wave (i.e., 1-year interval). The London Panel Survey had an attrition rate of 38% per year.

[3] Other demographic variables were: household size, household vehicles, education, employment status, licensed driver, household income, and gender.

2.4 WAVE 3 SURVEY 2006

This report serves as the documentation of methods for Wave 3 of the Attitudinal Panel Survey. For this reason, it contains greater details on survey design and implementation than that provided for the Baseline and Wave 2.

Objectives

The objectives of the Wave 3 Attitudinal Panel Survey focused on the following:

- Trends in attitudes toward MnPASS,
- Characteristics of MnPASS customers (transponder owners), including willingness to pay, changes in willingness to pay since the Baseline, and demand,
- Equity issues including MnPASS acceptance, usage, and satisfaction,
- Impacts on travel behavior as a result of MnPASS, and
- Mode choice.

The Wave 3 Attitudinal Panel Survey was the final wave in the Attitudinal Evaluation.

Sampling Approach

Wave 3 of the MnPASS Attitudinal Panel Survey had four (4) unique sample types: (1) Panel, (2) subscribers, (3) transit users, and (4) a new random cross-sectional sample.

- The panel sample consisted of the 549 respondents who participated in both the Baseline and Wave 2 Surveys. Of these 549 respondents, 413 reported using I-394/Hwy 55, while the remaining 136 reported trips taken on I-35W/Hwy 77.
- The subscriber sample consisted of the 151 MnPASS subscribers selected from the MnPASS database who participated in Wave 2.
- The transit sample consisted of the 250 transit users sampled from a list provided by Metro Transit who participated in Wave 2.
- The new random cross-sectional sample consisted of households residing within targeted census tracts within the I-394/Hwy 55 and I-35W/Hwy 77 corridors.

The CATI instrument was programmed with quotas in order to complete a minimum of 450 interviews in the I-394/Hwy 55 corridor[4] and 150 interviews in the I-35W/Hwy 77 corridor, for a total of 600 completed surveys from the new random cross sectional sample. To maximize dialing efficiency, the entire sample was processed by partitioning it into 34 replicates, or subsamples, which on average included 240 sample records.

Survey Materials

The Wave 3 survey materials included a pre-notification packet and a telephone survey instrument (see samples in Appendices A - C). The pre-notification packet included a letter prepared on letterhead of the Hubert Humphrey Institute of Public Affairs. The purpose of this letter was to inform respondents of the survey purpose, benefits, sponsors, and the obligations entailed in survey participation. The voluntary nature of participation was fully explained, and contact information was provided in the event that more information was desired or needed.

[4] A total of 101 interviews were completed in tracts within the I-394 corridor (West of Interstate 494) not sampled during Waves 1 and 2, and the remaining 350 interviews were completed in tracts that were sampled in previous Waves.

The packet also included a Travel Log to be used by respondents to record travel information during the assigned travel week (Monday through Friday) as well as information about a specific reference trip. The reference trip characteristics were pulled from the Baseline data and attached to the Travel Log via a mail-merge label.[5]

The telephone instrument was a slightly modified version of the Wave 2 telephone instrument. It contained the same six sections as the Baseline questionnaire: (1) eligibility screening, (2) attitude / opinion, (3) information about travel during the assigned travel week, (4) reference trip information, (5) stated preference questions, and (6) demographics.[6] The Wave 3 instrument differed from the Baseline instrument in the following aspects:

- Relaxation of reference trip requirements. During Wave 2 each panel respondent was asked to report on a trip that was identical to their Wave 1 reference trip in the following characteristics: travel corridor, time of day, trip purpose, day of week, time of day and direction of travel. Due to the specificity of the requirements, 137 respondents were not able to provide reference trip details. For this reason, during Wave 3, the reference trip requirements were relaxed to include only travel corridor and trip purpose.
- Transition from "assigned week" for reference trip to "most recent trip" that satisfied reference trip requirements. During Wave 2 respondents were assigned a specific trip week during which they were asked to record information about a trip that matched the trip they reported during Wave 1. However, due to this level of specificity, 137 respondents were not able to provide reference trip details. For this reason, during Wave 3, respondents were asked to report on the most recent trip they took that matched the assigned reference trip details.
- Addition of a follow-up question on asking for transponder cost for those respondents who commented that they did not purchase a transponder because it was too expensive. This question was added to assess whether the perceived cost of a transponder was a barrier to acquisition.
- Addition of a question to identify the most significant factor in terms of mode choice. This question was added to identify why respondents chose the specific reference trip mode they reported for their Wave 3 reference trip.
- Deletion of qualifying questions *(Do you plan on moving anytime next year? Do you plan on moving outside of the Twin Cities? Do you plan on changing jobs next year?).* These questions were originally included to disqualify respondents from being included in the panel and interviewed in future waves. As Wave 3 was the final wave of the Attitudinal Panel Survey, these questions were no longer needed.

Stated Preference Questions

Stated preference (SP) questions were developed to measure willingness to pay for use of the HOT lane. The same SP measurement design was used in all three waves of data collection, in order to be able to compare SP results across the waves of data collection. SP tradeoff questions were asked of all respondents who reported making a reference trip as a solo driver on the I-394. A quota was designed based on the questionnaire items about the reference trip, to ensure a distribution of 75% peak period and 25% non-peak period trips.

The tradeoff questions were introduced with the following wording:

[5] During wave 3, the reference trip requirements were relaxed to include only corridor (I-394 / HWY55 or I-35W / HWY77), time of day (peak/non-peak) and trip purpose (commute/non-commute).

[6] Demographic items were asked of the new random panel sample only. Panel respondents were asked if there had been any changes in the following demographic variables since their last interview: household size, household vehicles, household workers and household income. If so, they were once again asked these specific questions. If not, they were not asked the demographic module of the survey.

Now assume you're making the same trip in the future that you just told me about. It's a trip on the same day of the week, at the same time of day, for the same purpose, and you're under the same time pressures. You enter the freeway, I-394, and find out that you can make this trip using a toll lane and paying via electronic toll collection if you want to.

To avoid bias due to ordering effects, the questions were asked in two different ways. Versions 1 and 2 below differ only in the order in which the toll and non-toll options are described to the respondent. Each respondent was assigned one of the two orderings at random, and that same ordering was used for all of the SP scenarios presented to that respondent:

VERSON 1: If you were to use the general traffic lanes on I-394, your trip would take [reported travel time without congestion + Y minutes] and be free. If you were to use the toll lane you would $X and your trip would take [reported travel time without congestion] saving Y minutes. Now under these conditions, which would you choose to do?

- *Use the toll lane, pay $X and save Y minutes*
- *Use the general lane for free.*

VERSION 2: If you were to use the toll lane on I-394, you would pay $X and your trip would take [reported travel time without congestion]. If you were to use the general lanes, your trip would take [reported travel time without congestion +Y minutes], Y minutes longer than the toll lane, but it would be free. Now under these conditions, which would you choose to do?

- *Use the general lane for free.*
- *Use the toll lane, pay $X and save Y minutes*

The SP experimental design included two different methods for setting the toll and time savings levels (X and Y above). The reasons for the two methods were: (1) to add confirmatory credibility to the SP results, assuming similar estimates of demand resulted, and (2) to include a method that could provide individual-level estimates of willingness to pay, to facilitate a wider variety of analyses.

In Method A, each person received four different HOT lane scenarios, each with a different amount of time saving (Y = 5, 10, 15 or 20 minutes) and toll (X = 50 cents, $1, $2, $3, $4, $5, $6 or $7). The time for the MnPASS lane was set to be the travel time with no congestion, based on a response to a prior question about a specific reference trip that each respondent had recently made. Nine different sets of four scenarios were used across the sample, with each respondent assigned one of the nine sets at random. So, in total, 36 (9 x 4) different scenarios were used, each identifying a different time savings/toll level tradeoff point, with the identified values of time ranging from $1.50/hour (50 cents for 20 minutes saved) up to $84.hour ($7 for 5 minutes saved).

In Method B, the same type of scenario was presented again, but this time using the "price meter" adaptive approach to set the time and toll levels. Each respondent was assigned a level of time savings (S = 5, 10 or 15 minutes) at random. Then a random toll price point was chosen (P = 50 cents, $1, $2, $3, $4, $5, $6 or $7) and the same question wording as in Method A was used to present the choice options. If the person said that he/ she would pay the toll, a higher price point was chosen at random, and if he/she said they would not pay the toll, a lower price point was chosen at random, and the question was asked again at the new toll level. This procedure was continued until the "switching point" was identified – e.g. the respondent would be willing to pay a toll of $2, but not $3 – or if the respondent would not pay even the lowest toll level, or would pay even the highest toll level. In this way, the price meter approach provides an individual-level estimate of the willingness to pay (monetary value of time savings) for each respondent. Note that the transition from the Method A design questions to the Method B design question was designed to be transparent to the respondent, since the same question wording was used for both.

Fieldwork Process

Wave 3 data collection took place between May 5, 2005 and June 22, 2006. In order to remind panel members of their agreement to be interviewed, a postcard was sent to panel members in early April. Of the 950 postcards sent, 13 (1%) were returned for failed delivery. If a new address was provided by the postal service, the information was updated and the pre-notification packet was sent to the correct address. If a new address was not provided, the respondent was contacted as a "cold call."

Prior to starting the interviewing for the Wave 3 Survey, an interviewer training session was conducted in which the goals and objectives of the survey were outlined for the interviewers. Interviewer supervisors and survey coordinators presented different aspect of the program to all interviewers, until they felt comfortable with the program, including terms, concepts and definitions within the program, as well as the skip logic and progression of data collection tasks. The training session culminated with the conduct of mock interviews, during which time the interviewers were encouraged to ask questions regarding any aspect of the program that was unclear to them.

A total of 22 interviewers participated in data collection, many of whom also participated in the Baseline and Wave 2 Attitudinal Panel Surveys; dialing times ran from 4 pm – 9 pm during weekdays and 11 am – 7 pm on Saturdays and Sundays. No interviews were conducted on May 7 and May 21. The interviewing process was organized to ensure that respondents would receive the pre-notification packet a few days prior to receiving their phone call. In cases where respondents reported not recalling a recent trip that matched their assigned trip characteristics, they were asked if they ever take trips that matched these characteristics. If so, a call back was scheduled 10 to 14 days in the future, in hopes of capturing an eligible trip. If not, NuStats flagged the respondent as ineligible.

Data Collection Outcomes

A total of 1,228 respondents completed Wave 3 interviews. Of these, 343 were panel members (interviewed in the Baseline, Wave 2 and Wave 3), 106 were MnPASS subscribers, 178 were transit users and 601 were new cross-sectional sample. Table 2.2 suggests that Wave 3 completion rates were significantly higher among respondents, who had also participated in Wave 2. The completion rates of the new cross-sectional sample are much lower than previously interviewed respondents because the rates do not control for "eligibility" criteria. If one were to restrict the completion rate calculation for the new cross-sectional sample to only eligible respondents, it would be much higher. The completion rate among new cross-sectional sample was 10%, and the overall completion rate for Wave 3 was 17%.

TABLE 2.2: COMPLETION RATES BY SAMPLE TYPE– WAVE 3

SAMPLE TYPE	DIALED SAMPLE PIECES	COMPLETED INTERVIEWS	WAVE 3 COMPLETION RATE
I-394 Panel	413	266	64%
I-35W Panel	136	77	57%
MnPASS Subscribers	151	106	70%
Transit Users	250	178	71%
New Cross-sectional Sample	6,108	601	10%
Total	7,058	1,228	17%

In total, two-thirds (66%) of Wave 2 participants were re-surveyed in Wave 3. About one-third of the original panel members were successfully interviewed in all three waves of the Attitudinal Panel Survey (see Table 2.3).

TABLE 2.3: PANEL ATTRITION OVERVIEW

PANEL TYPE	BASELINE		WAVE 2		WAVE 3
	Interviewed	Continued (Panel)	Interviewed	Continued (Panel)	Interviewed
I-394	750	736	413	364	266
I-35W	250	244	136	118	77
	1000	**980**	**549**	**482**	**343**

A slight difference was observed in the completion rates between the treatment (I-394) and control (I-35W) Wave 3 panel samples, with more I-394 Wave 3 panel members completing the survey (see Table 2.4). So 38% of the Wave 2 panel respondents were not interviewed in Wave 3. This 38% breaks down as follows. Seven percent of the I-394 panel and 10% of the I-35W panel refused to be interviewed in Wave 3. Two-tenths (20%) were no longer qualified to be interviewed (i.e., original panel member was no longer available, indicated they no longer used their assigned corridor or could not recall making any trips on their assigned corridor). Six percent (6%) were "call backs" for which the follow-up contact was never achieved. For about 4%, the sampled telephone numbers were no longer working residential numbers.

TABLE 2.4: DETAILED PANEL SAMPLE OUTCOMES – WAVE 2 TO WAVE 3

DISPOSITION	PANEL			
	I-394		I-35W	
				Interviewed
Complete	266	64%	77	57%
Subtotal	266	64%	77	57%
				Not Interviewed
Refuse	28	7%	14	10%
Not Qualified	79	19%	31	23%
Contact made – no interview[7]	24	6%	7	5%
Disconnect / Business / Fax[8]	16	4%	7	5%
Subtotal	147	36%	59	43%
Total	413	100%	136	100%

Because of the panel attrition, an analysis was conducted in which the demographic characteristics of respondents participating in all three waves of the Attitudinal panel survey were compared to respondents who agreed to participate in all three waves, but did not do so. These comparative tables are included as Appendix D to this report. An analysis of the attrition revealed no systematic bias was introduced into the Wave 3 sample. However, the attrition did reduce the effective sample size for longitudinal analysis – particularly those analyses of specific sub-samples, such as those used in the SP analysis.

[7] These were call-backs for which the follow-up contact was not achieved.
[8] These sample numbers were called multiple times to verify outcome.

According to Table 2.5 below panel members were contacted an average of five times before an interview was completed, whereas a non-panel member was contacted an average of two times. If one excludes sample records that resulted in a completed interview for this analysis, the number of attempts per record increases to 10 for panel records.

TABLE 2.5: MAJOR FIELDWORK INDICATORS

SAMPLE TYPE	AVERAGE INTERVIEW LENGTH	AVERAGE ATTEMPTS PER COMPLETE
I-394 Returning Random Panel	15.6	4.5
I-35W Returning Random Panel	13.2	5.8
MnPASS Subscriber Panel	16.8	6.8
Transit User Panel	13.7	5.2
New Random Panel	17.0	2.0

Table 2.6 presents the final sample dispositions for all 7,058 pieces of sample (i.e., panel, MnPASS subscribers, transit lists and new random panel) dialed for the Wave 3 Survey. Survey outcome rates were calculated using the percentage of respondents who completed interviews relative to the total numbers dialed in which an eligible respondent was contacted. This method also takes into account households of unknown eligibility by estimating what percentage of these may have been eligible for participation. Based on this calculation, the overall response rate was 45%.

TABLE 2.6: FINAL SAMPLE DISPOSITIONS

SAMPLE DISPOSITION	TOTAL	
	COUNT	PERCENT
Ineligible	1,813	26%
Not Qualified (no trips, moving, does not use corridor, language barrier)	896	13%
Disconnected Phone	795	11%
Business/ Fax/ Modem	122	2%
Unknown Eligibility, Non-Interview	3,988	56%
Answering Machine / Caller ID	2,017	29%
Hang Up / Refused (prior to screening)	993	14%
Ask for Callback (prior to screening)	401	5%
No Answer / Busy	577	8%
Eligible	1,257	18%
Complete	1,228	17%
Partial Complete	29	1%
Total Sample	**7,058**	**100%**

3. PANEL TRENDS: ATTITUDES ABOUT MNPASS

This section examines trends in attitudes about MnPASS by comparing responses to attitude, opinion, and knowledge questions among the 343 panel members who answered these questions in fall 2004 (Wave 1), fall 2005 (Wave 2) and spring 2006 (Wave 3). It should be noted that opinions expressed by panel members might be different from those expressed by non-panel members, because panel members are more familiar with the interview process.

3.1 MNPASS ACCEPTANCE

Acceptance of the MnPASS concept among panel members reached a high during Wave 3, when two-thirds (65%) commented that allowing SOVs to use the carpool lane was a good idea (relative to 60% in Wave 1 and 58% in Wave 2. Of those panel members who thought it was good idea, most thought so because it eases congestion (representing 29% of responses).[9] Other frequently mentioned reasons included better use of carpool lanes (19% of responses), only users pay not everyone (15% of responses), time is money (11% of responses), saves time for busy people (9% of responses), adds capacity to roadway (7% of responses) and creates revenue (4% of responses). See Table 3.1 for further detail.

Of those respondents that thought it was a bad idea, most thought so because it only benefits the rich (representing 16% of responses). Other frequently mentioned reasons included carpools are not encouraged (12% of responses) carpool lanes should be free for all (11% of responses), roads are already paid for (10% of responses), it's unfair (9% of responses), carpool lanes should only be used for carpools (6% of responses), gives too much money to the road agency (5% of responses), and it's inefficient (5% of responses).

The data in Table 3.1 suggests some shifting of opinions within the panel that is most easily observed from Wave 2 to Wave 3. During this time, there was an increase of 7 percentage points in the percentage of panel respondents who changed their opinion from bad idea to good idea, while there was no change between Waves 2 and 3 regarding panel respondents who had no opinion. Since Wave 1, there has been a net increase (5%) in the percentage of respondents that perceive allowing SOVs to use the carpool lane by paying a toll is a good idea.

TABLE 3.1: PERCEPTION OF ALLOWING SOV TO USE CARPOOL LANES BY PAYING TOLL

What do you think of allowing single drivers to use the carpool lanes by paying a toll?

	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Good Idea	205	60%	200	58%	224	65%
Bad Idea	104	30%	100	29%	75	22%
No Opinion	34	10%	43	13%	44	13%
Total	**343**	**100%**	**343**	**100%**	**343**	**100%**

[9] Survey respondents were asked for the reasons behind their opinions on these MnPASS acceptance questions in an unprompted (or open-ended) manner.

Acceptance of a 24-hour operation of MnPASS declined significantly from Wave 1 to Wave 2 (53% versus 23%, respectively), but then increased from Wave 2 to Wave 3 (from 23% to 32%). From Wave 1 to Wave 3, we see a significant difference in the percentage of panel respondents that thought this was a good idea. The percentage of panel members who thought this was a bad idea increased significantly from 33% in Wave 1 to 61% in Wave 2, but then decreased from Wave 2 to Wave 3 from 61% to 54%. See Table 3.2 for further detail.

From Wave 1 to Wave 3, we see a significant difference in the percentage of respondents that thought this was a bad idea. Of the 180 panel members who thought this would be a good idea in Wave 1, 43% still felt that way in Wave 3, but 45% switched their opinion to bad idea and 12% reported no opinion. See Table 3.2 for further detail.

When the 185 people who thought the 24-hour operation was a bad idea in Wave 3 were asked, "why," their most frequent response was tolls should only be charged during peak hours (representing 31% of responses). Other frequently mentioned reasons were: it causes congestion (11% of responses), it's inefficient (10% of responses), and it's too restrictive (9% of responses). The most frequent reasons provided by respondents who thought it was a good idea were: better use of carpool lanes and adds capacity to roadway (representing 19% of responses), encourages carpooling (11% of responses), only users pay not everyone and provides a good alternative (11% of responses each), generates revenue for the state (6% of responses) and helps users save money and time (5% of responses).

TABLE 3.2: PERCEPTION OF OPERATING MNPASS 24-HOURS PER DAY

When MnPASS opened, the toll lane program on I-394 operated 24-hours per day. Was this a . . .

	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Good Idea	180	53%	80	23%	110	32%
Bad Idea	113	33%	208	61%	185	54%
No Opinion	50	14%	55	16%	48	14%
Total	**343**	**100%**	**343**	**100%**	**343**	**100%**

Between Waves 1 and 2, there was a slight increase in the percentage of panel respondents (from 62% to 64%) who thought it was a good idea that there are no tolls outbound from MN100 from 5:30 am to 2:00 pm weekdays and inbound to MN 100 from 1:00 pm to 5:30 am weekdays. This was coupled with a decrease in the percentage of panel respondents (from 15% to 7%) who thought this was a bad idea, and an increase in the percentage of panel respondents (from 23% to 29%) who had no opinion. No changes from Wave 2 to Wave 3 were significant. See Table 3.3 for further detail.

Those 110 people who thought this revised operational plan was a good idea thought so because only peak hours are now tolled (33% of all responses), it eases congestion (25% of responses), it adds capacity to the roadway (8% of responses), it increases efficiency and encourages use of the lane (5% of responses each). Seven percent of panel members who answered "good idea" to the 24-hour operation of MnPASS answered "bad" to the new tolling operational hours, with 50% of those panel members who answered "good idea" to the 24-hour operation of MnPASS saying the new tolling hours were a good idea. Only 8% of panel members answered "bad idea" to both questions.

Those 185 people who thought this revised operational plan was a bad idea felt that it would be too confusing for people (15% of responses) and that tolls are not needed/tolls are not the answer (11% of responses), only peak hours were now tolled, too restrictive, and increased congestion (7% of responses each), lanes could be used better, should have open lanes in both directions, carpool lanes not encouraged and only users pay not everyone (4% of responses each).

More than three fourths (77%) of panel members who answered "bad idea" to the 24-hour operation of MnPASS answered "good idea" to the new tolling operational hours. Of those who answered "good idea" to the 24-hour operation, about 7% thought the new tolling operational hours was a "bad idea."

TABLE 3.3: PERCEPTION OF PEAK / OFF PEAK TOLL HOURS

Now there are no tolls outbound from MN 100 from 5:30 am to 2 pm weekdays and inbound to MN100 from 1 pm to 5:30 am weekdays. Is this a . . .

	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Good Idea	213	62%	219	64%
Bad Idea	50	15%	23	7%
No Opinion	80	23%	101	29%
Total	**343**	**100%**	**343**	**100%**

3.2 MNPASS AWARENESS

Virtually all of the panel members (97%) were aware of MnPASS during the Wave 3 interview, suggesting a steady increase from Wave 1, when 73% of panel members had heard of MnPASS. Overall, the increase in the percentage of respondents who were aware of MnPASS from between Wave 1 and Wave 2 and between Wave 1 and Wave 3 are significant. The nine panel members who had not heard of the MnPASS project were almost equally split among those in the I-35W panel sample and those in the I-394 panel sample. See Table 3.4 for further detail.

TABLE 3.4: MNPASS PROJECT AWARENESS

Have you heard of the MnPASS project on I-394?

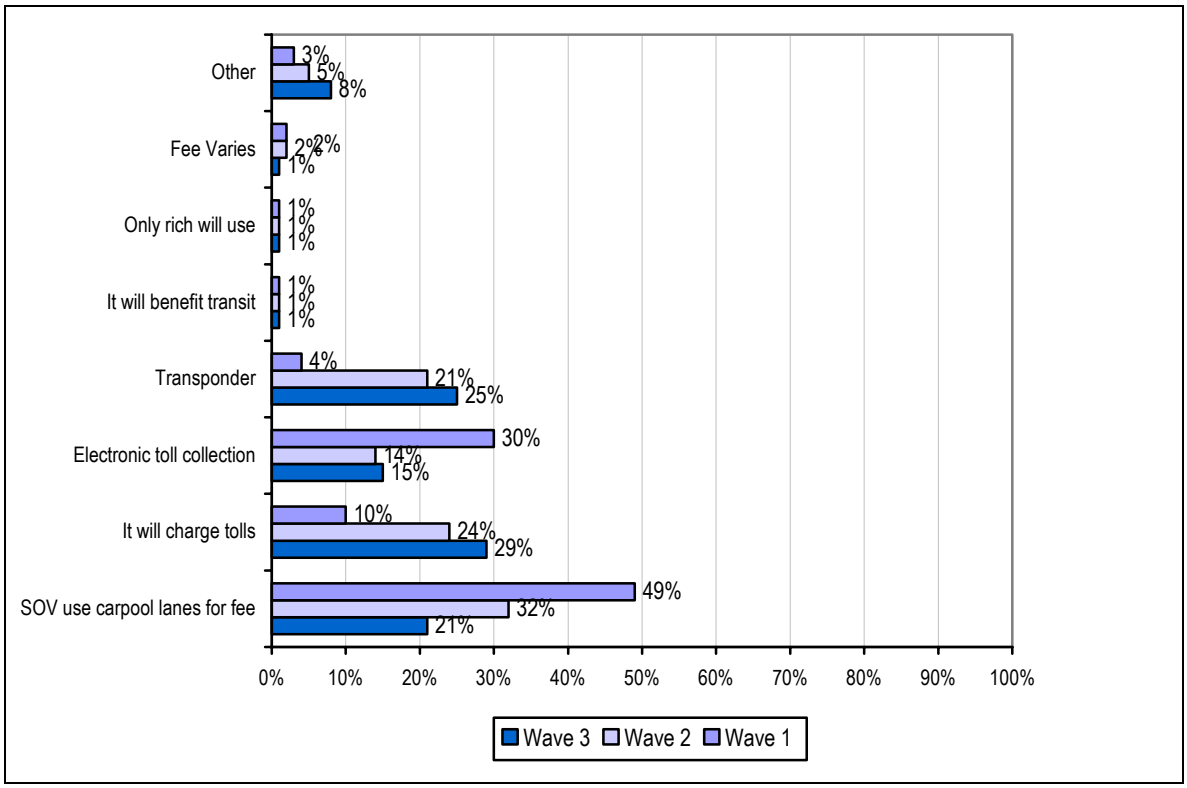
	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Yes	249	73%	322	94%	332	97%
No	86	25%	20	6%	9	3%
Unsure	8	2%	1	<1%	2	<1%
Total	**343**	**100%**	**343**	**100%**	**343**	**100%**

Panel members reported a wider variety of MnPASS knowledge during Wave 3 than in any other Wave, as evidenced in the greater number of responses collected during Wave 3 (616) than in either Wave 1 (341) or Wave 2 (555). In Wave 3, more panel members were aware of a transponder[10] and the fact that tolls would be collected. A much smaller percentage of respondents reported that SOVs would be able to use the carpool lane for a fee. See Figure 3.1 on the following page for further detail.

[10] Respondents that were familiar with transponders during Wave 3, may have, in previous waves, not been familiar and reported only knowledge of electronic toll collection.

FIGURE 3.1: WHAT RESPONDENTS KNEW ABOUT I-394 MNPASS PROJECT [OPEN-ENDED]

(Unprompted Multiple Response Question)
Wave 1 = 341 valid responses, Wave 2 = 555 valid responses, Wave 3 = 616 valid responses



3.3 OPINIONS ABOUT TRAFFIC CONGESTION, SAFETY, AND NOISE

About six of ten respondents (62%) considered traffic congestion a major problem in Wave 1. A similar percentage (59%) expressed that same opinion during Wave 2. This percentage dropped significantly during Wave 3, when 50% of respondents reported that traffic congestion is a major problem in the Twin Cities. Interestingly, the percentage of respondents that viewed traffic congestion as a moderate problem increased from both Waves 1 (35%) and 2 (33%) to Wave 3 (43%) When comparing Wave 1 to Wave 3 responses, 24% of panel respondents reported congestion increased, 9% reported congestion decreased and 67% reported no change in congestion. See Table 3.5 for further detail.

TABLE 3.5: OPINIONS ABOUT TRAFFIC CONGESTION IN THE TWIN CITIES

In general, do you think traffic congestion the Twin Cities is…

	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Major Problem	214	62%	203	59%	171	50%
Moderate Problem	120	35%	112	33%	147	43%
Minor Problem	7	2%	20	6%	17	5%
No Problem at All	2	1%	6	2%	6	2%
Unsure / Refused	0	0%	2	<1%	2	<1%
Total	**343**	**100%**	**343**	**100%**	**343**	**100%**

During Wave 1, 71% of panel respondents thought MnPASS would have a positive impact on I-394 traffic congestion. This number decreased significantly during Wave 2 to 45%. However, during Wave 3, the percentage rebounded slightly to 51% of panel respondents. The percent of panel respondents who thought MnPASS had a negative effect on I-394 congestion increased from Wave 1 to Wave 2, but remained fairly steady from Wave 2 to Wave 3. In both Wave 1 and Wave 3, approximately 2 of 10 panel respondents thought MnPASS would not impact I-394 congestion (relative to Wave 2 when nearly 3 of 10 felt the same way). See Table 3.6 for further detail.

Of Wave 1 respondents who answered MnPASS would have a "positive impact" on traffic congestion, more than half (60%) responded similarly in Wave 3. Of the remaining, 18% responded "no impact," 15% "don't know," and 7% "negative impact." The increase in those answering "negative impact" from 6% to 11% was not statistically significant.

TABLE 3.6: OPINIONS ABOUT IMPACT OF MNPASS ON TRAFFIC CONGESTION

What impact do you think MnPASS has on traffic congestion on I-394?

	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Positive	244	71%	155	45%	175	51%
Negative	18	5%	38	11%	30	9%
No Impact	66	19%	91	27%	75	22%
Don't Know	15	5%	59	17%	63	18%
Total	**343**	**100%**	**343**	**100%**	**343**	**100%**

During Wave 1, 43% of panel respondents thought MnPASS would have a positive impact on I-394 traffic safety. This number decreased significantly during Wave 2 to 27%. During Wave 3, this percentage increased to a third (32%) of panel respondents. This is not a significant difference from either Wave 1 or Wave 2. The percent of panel respondents who thought MnPASS would have a negative effect on I-394 congestion fluctuated from 6% to 14% to 10% from Wave 1 to Wave 3, respectively. The data also suggest a steady decrease in the percentage of respondents that believe MnPASS has no impact on I-394 traffic safety (43% for Wave 1, 40% for Wave 2 and 36% for Wave 3). This is coupled with a steady increase in the percentage of respondents that don't know if MnPASS has had an impact on I-394 traffic safety (8% for Wave 1, 19% for Wave 2 and 23% for Wave 3). See Table 3.7 for further detail.

TABLE 3.7: OPINIONS ABOUT IMPACT OF MNPASS ON TRAFFIC SAFETY

What impact do you think MnPASS has on traffic safety on I-394?

	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Positive	148	43%	93	27%	109	32%
Negative	20	6%	47	14%	33	10%
No Impact	146	43%	138	40%	122	36%
Don't Know	29	8%	65	19%	79	23%
Total	**343**	**100%**	**343**	**100%**	**343**	**100%**

Similar to results on the preceding attitudinal item, panel members tended to shift from a specific pre-MnPASS implementation opinion on the impact of MnPASS on noise levels to a "don't know" response in the post-implementation interviews. There are significant differences between Wave 1 and Wave 2 AND between Wave 1 and Wave 3 in the percentage of respondents that reported "No Impact", suggesting that respondents have no consensus on this issue yet. This is further supported by the data suggesting a significant difference in the percentage of respondents who reported "don't know" between Wave 1 and Wave 3 and between Wave 2 and Wave 3. See Table 3.8 for further detail.

TABLE 3.8: OPINIONS ABOUT IMPACT OF MNPASS ON NOISE LEVELS

What impact do you think MnPASS has on noise levels along I-394?

	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Positive	28	8%	29	8%	23	7%
Negative	25	7%	16	5%	13	4%
No Impact	261	76%	187	55%	200	58%
Don't Know	29	9%	111	32%	107	31%
Total	**343**	**100%**	**343**	**100%**	**343**	**100%**

4. IMPACT OF MNPASS ON TRAVEL BEHAVIOR

The opening of the MnPASS toll lanes altered the congestion patterns on I-394, which in turn influenced travel behavior in the corridor. This chapter examines the impact of MnPASS implementation on the traveling experience and travel behavior of panel members. It also presents information about the traveling experience of MnPASS users specifically on their reference trip.

4.1 TRAVELING EXPERIENCE

The reported traveling experiences of I-394 panelists have improved since Wave 1. The percentage of I-394 panelists reporting a delay was lower in both Wave 2 and Wave 3 (29% each) than in Wave 1 (37%). I-394 respondents who did not use the MnPASS lanes for their reference trip were more likely to experience congestion than those who did use MnPASS for their entire trip (31% versus 22%, respectively). However, the percentages of respondents who reported leaving at a particular time to avoid congestion were similar, with about one-fourth in all three waves using this congestion avoidance tactic. Among I-35W panelists, the percentage reporting a congestion delay steadily increased, beginning with 33% in Wave 1 and increasing to 39% in Wave 3. See Table 4.1 for further detail.

TABLE 4.1: CONGESTION DELAY ON REFERENCE TRIP

(Among All Panel Members)

Were you delayed by congestion on this trip?

I-394	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Yes	100	37%	62	29%	78	29%
No	164	62%	153	71%	188	71%
Don't Know	2	1%	0	0%	0	0%
Total	**266**	**100%**	**215**	**100%**	**266**	**100%**
I-35W						
Yes	25	33%	23	37%	30	39%
No	52	67%	39	63%	47	61%
Don't Know	0	0%	0	0%	0	0%
Total	**77**	**100%**	**62**	**100%**	**77**	**100%**

Note: Table does not include responses from MnPASS subscriber sample or transit sample.

I-394 panelists reported higher levels of satisfaction as the study progressed with 37%, 48% and 49% of respondents reporting 100% satisfaction in Wave 1, Wave 2 and Wave 3, respectively (see Table 4.2). Satisfaction was highest among panelists who used the MnPASS lanes for their entire reference trip – 57% reported 100% satisfaction, compared with 51% who did not use the MnPASS lanes. Approximately one of ten I-394 panelists reported 30% satisfaction with the overall quality of their trip across all three waves. Across all three waves, no more than one of twenty I-394 panelists reported dissatisfaction. We found virtually no differences in the reported satisfaction levels among I-35W panelists with an average of 45% of respondents in all three waves reporting 100% satisfaction. See Table 4.2 for further detail.

TABLE 4.2: SATISFACTION WITH TRAVEL ON REFERENCE TRIP

(Among All Panel Members)

Based on this trip, how satisfied were you with the overall quality of your travel on this roadway?

I-394	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
100% Satisfied	96	37%	103	48%	130	49%
60% Satisfied	131	49%	86	40%	104	39%
30% Satisfied	25	9%	21	10%	24	9%
Not Satisfied	13	5%	5	2%	7	3%
Don't Know	1	0%	0	0%	1	0%
Total	**266**	**100%**	**215**	**100%**	**266**	**100%**
I-35W						
100% Satisfied	35	45%	28	45%	35	46%
60% Satisfied	29	38%	23	37%	31	40%
30% Satisfied	10	13%	8	13%	10	13%
Not Satisfied	3	4%	3	5%	1	1%
Don't Know	0	0%	0	0%	0	0%
Total	**77**	**100%**	**62**	**100%**	**77**	**100%**

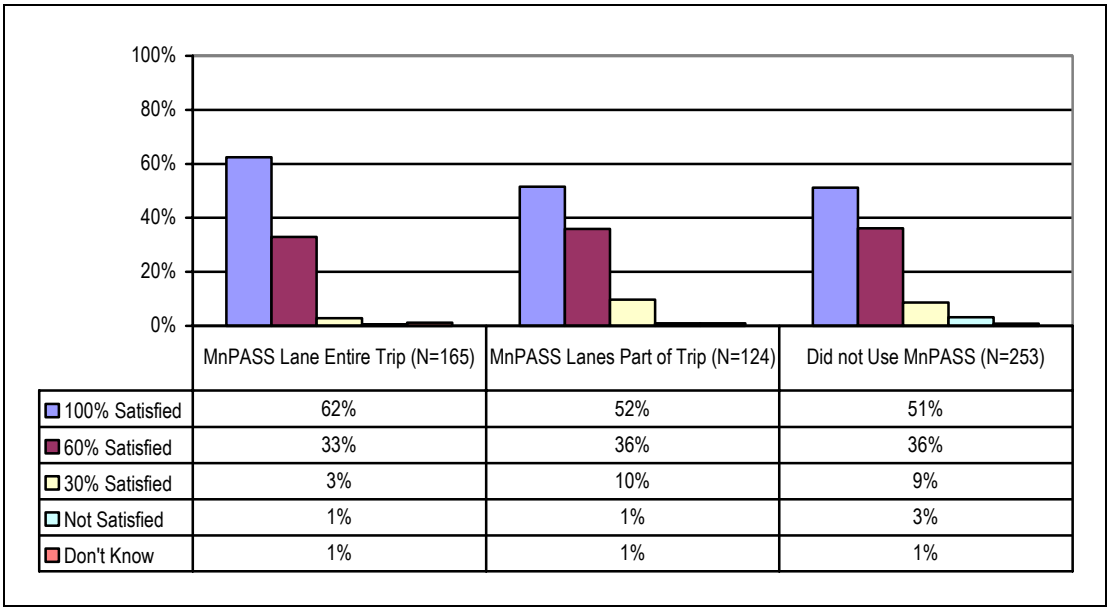
Note: Table does not include responses from MnPASS subscriber sample or transit sample.

Among all I-394 respondents (which provides a larger, more reliable sample), we find that 62% of those who used the MnPASS lanes for their entire trip were 100% satisfied, compared with 52% who used the MnPASS lanes for part of their trip, and 51% of those who did not use the MnPASS lanes at all. See Figure 4.1 for further detail.

FIGURE 4.1: SATISFACTION WITH TRAVEL ON REFERENCE TRIP BY USE OF MNPASS LANES

(Among All I-394 Respondents)

Based on this trip, how satisfied were you with the overall quality of your travel on this roadway?



	MnPASS Lane Entire Trip (N=165)	MnPASS Lanes Part of Trip (N=124)	Did not Use MnPASS (N=253)
100% Satisfied	62%	52%	51%
60% Satisfied	33%	36%	36%
30% Satisfied	3%	10%	9%
Not Satisfied	1%	1%	3%
Don't Know	1%	1%	1%

Throughout Waves 2 and 3, panelists in both corridors (I-394 and I-35W) reported their travel as enjoyable and less stressful – a marked difference from the Wave 1 findings. Sixty-eight percent of the I-394 Wave 3 panelists reported an enjoyable travel experience, compared with 63% of Wave 2 panelists and 47% of Wave 1 panelists. This represents a significant increase (from Wave 1 to Wave 2 and from Wave 1 to Wave 3). Comparatively, 50% of I-394 Wave 1 panelists reported a stressful travel experience, compared to 35% and 29% of Wave 2 and 3 panelists, respectively. This represents a significant decrease (from Wave 1 to Wave 2 and from Wave 1 to Wave 3). See Table 4.3 for further detail.

Among I-35W panelists, 56% reported their travel as enjoyable in Wave 3 compared with 52% of Wave 2 and 47% of Wave 1 respondents. The percentage characterizing their travel as stressful also decreased from Wave 1 to Wave 3, going from 53% to 41%. No significant differences were noted among I-35W responses. See Table 4.3 for further detail.

TABLE 4.3: TRAVEL EXPERIENCE ON I-394 DURING REFERENCE TRIP
(Among All Panel Members)

Which of the following descriptors best captures your travel experience on I-394 [I-35W] at that time?

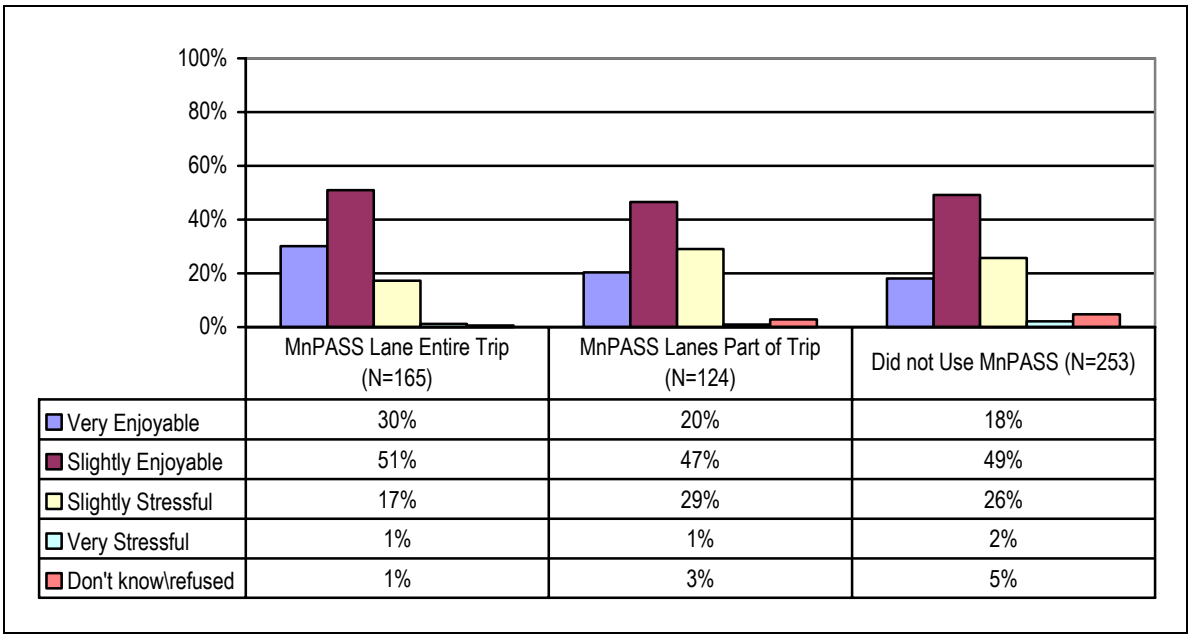
I-394	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Enjoyable	127	47%	134	63%	181	68%
Very Enjoyable	27	10%	31	15%	42	16%
Slightly Enjoyable	100	37%	103	48%	139	52%
Stressful	132	50%	76	35%	77	29%
Slightly Stressful	114	43%	69	32%	70	26%
Very Stressful	18	7%	7	3%	7	3%
Don't Know	7	3%	5	2%	8	3%
Total	**266**	**100%**	**215**	**100%**	**266**	**100%**
I-35W						
Enjoyable	36	47%	32	52%	43	56%
Very Enjoyable	11	14%	9	15%	7	9%
Slightly Enjoyable	25	33%	23	37%	36	47%
Stressful	41	53%	28	45%	32	41%
Slightly Stressful	37	48%	27	43%	31	40%
Very Stressful	4	5%	1	2%	1	1%
Don't Know	0	0%	2	3%	2	3%
Total	**77**	**100%**	**62**	**100%**	**77**	**100%**

Among all I-394 respondents – which provides a larger, more reliable sample – we found 81% of those who used the MnPASS lanes for their entire trip characterized their travel as very or slightly enjoyable, compared with 67% each of those who used the MnPASS lanes for part of their trip or did not use the MnPASS lanes at all (see Figure 4.2 on the following page). See Figure 4.2 for further detail.

FIGURE 4.2: TRAVEL EXPERIENCE ON REFERENCE TRIP BY USE OF MNPASS LANES

(Among All I-394 Respondents)

Which of the following descriptors best captures your travel experience on I-394 at that time?



	MnPASS Lane Entire Trip (N=165)	MnPASS Lanes Part of Trip (N=124)	Did not Use MnPASS (N=253)
Very Enjoyable	30%	20%	18%
Slightly Enjoyable	51%	47%	49%
Slightly Stressful	17%	29%	26%
Very Stressful	1%	1%	2%
Don't know\refused	1%	3%	5%

4.2 TRAVEL MODE

The survey captured information about travel mode in two ways: (1) "usual" mode and (2) "reference trip" mode. While these two measures were identical for all three waves, Wave 2 and Wave 3 respondents used a Travel Log to record their information for an assigned travel week (see Appendix B: Travel Log).

Usual mode was calculated by determining the most commonly used travel mode for all trips taken in the previous Monday-Friday 5-day period. For about four out of five panelists, drive alone (SOV) was the most commonly used travel mode. Carpooling was slightly higher among I-394 panelists (19%) than among I-35W panelists (17%), but the difference was not statistically significant. See Table 4.4.

TABLE 4.4: CURRENT "USUAL" TRAVEL MODE
(Among All Panel Members)

Now consider all trips you made in both directions. On how many of those trips did you:

	FREQUENCY I-394	PERCENT I-394	FREQUENCY I-35W	PERCENT I-35W
Drive alone	215	81%	63	82%
Carpool	50	19%	13	17%
Ride bus	1	0%	1	1%
Total	**266**	**100%**	**77**	**100%**

The travel mode of the respondents' reference trip was also measured. However, during Wave 2, reference trip was not collected for people who were interviewed as a "short" complete (see Wave 2 Attitudinal Panel Survey Final Report Methods chapter). All panel members interviewed in Wave 3 were asked to report on the same type of trip as they reported in either Wave 1 or Wave 2 (subscribers and transit users who were not sampled until Wave 2 were asked to report on a trip similar to the Wave 2 reference trip). For most panel members (97%), reporting on a similar trip (i.e., same trip type) was possible. Three percent of all panel members provided a reference trip that did not match the details provided in their travel log. The reference trips for those respondents who reported a similar trip were distributed as: subsistence (77%), discretionary (15%) and maintenance (8%)[11]. The reference trips for those respondents who reported a similar trip and used MnPASS for either all or part of their reference trip were distributed as: subsistence (82%), discretionary (13%) and maintenance (5%). See Table 4.5 for further detail.

TABLE 4.5: COMPARABILITY OF REPORTED WAVE 3 TRIP TO ASSIGNED WAVE 3 TRIP
(Among All Wave 3 Respondents-excluding new random panel members-who reported a Wave 1 or Wave 2 Reference Trip)

	FREQUENCY I-394	PERCENT I-394	FREQUENCY I-35W	PERCENT I-35W
Reported Similar Trip	469	97%	134	92%
Reported Different Trip	13	3%	11	8%
Total	**482**	**100%**	**145**	**100%**

Very similar travel mode patterns were observed for the reference trip as for "usual" mode – about three-quarters of panelists drove alone, about one-fourth carpooled, and 1% rode the bus. It appears that I-35W panelists were slightly more likely to carpool (26%) than were panelists on I-394 (23%), but the differences are not statistically significant due to the small size of the I-35W sample. See Table 4.6 for further detail.

TABLE 4.6: CURRENT "REFERENCE TRIP" TRAVEL MODE
(Among All Panel Members Reporting Similar Trips)

Now I have questions about the trip you recorded in your travel log. Were you…

	FREQUENCY I-394	PERCENT I-394	FREQUENCY I-35W	PERCENT I-35W
Drive alone	199	76%	53	73%
Carpool	59	23%	19	26%
Ride bus	2	1%	1	1%
Total	**260**	**100%**	**73**	**100%**

[11] Subsistence trips are those that are for commuting to or from work/school *or* work related. Discretionary trips are those that are for visiting friends or family *or* recreational or entertainment *or* something else. Maintenance trips are those for shopping *or* medical *or* personal appointments.

Comparing all three I-394 Waves by their usual modes of travel, there is only minimal difference between the 3 waves within the modes of travel. Overall, carpooling share increased from Wave 1 to Wave 2 and then roughly returned to its previous percentage in Wave 3. I-35W respondents showed a steadier pattern throughout all three waves. Respondents driving alone increased from 77% in Wave 1 to 81% in Wave 2 to 82% in Wave 3. Carpooling showed a corresponding decrease in percentages from Wave 1 to Wave 3. See Table 4.7 for further detail.

TABLE 4.7: USUAL TRAVEL MODE

Now consider all trips you made in both directions. On how many of those trips did you:

I-394	FREQUENCY WAVE 1 (2004)	PERCENT WAVE 1 (2004)	FREQUENCY WAVE 2 (2005)	PERCENT WAVE 2 (2005)	FREQUENCY WAVE 3 (2006)	PERCENT WAVE 3 (2006)
Drive alone	212	80%	177	76%	214	81%
Carpool	52	19%	54	23%	50	19%
Ride bus	2	1%	3	1%	1	0%
Total	**266**	**100%**	**234**	**100%**	**265**	**100%**
I-35W						
Drive alone	59	77%	55	81%	62	82%
Carpool	18	23%	13	19%	13	17%
Ride bus	0	0%	0	0%	1	1%
Total	**77**	**100%**	**68**	**100%**	**76**	**100%**

When the responses of individual panelists are explored, less than one-fifth of I-394 panelist reported different usual modes of travel from Wave 1 to Wave 3. A higher percentage of I-35W panelist reported different usual modes of travel from Wave 1 to Wave 3, with 3 in 10 stating the use of different modes. See Table 4.8 for further detail.

TABLE 4.8: CHANGE IN USUAL MODE OF TRAVEL (WAVE 1 TO WAVE 3)
(Among All Panel Members)

Now consider all trips you made in both directions. On how many of those trips did you:

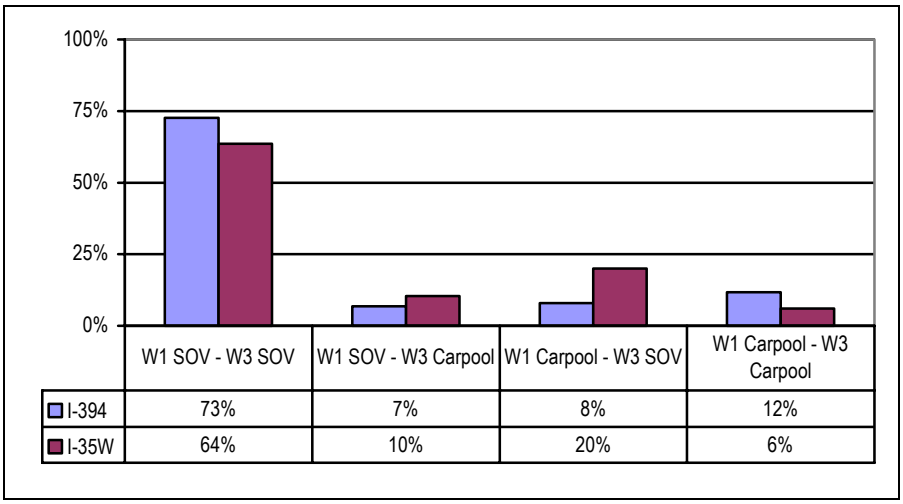
	FREQUENCY I-394	PERCENT I-394	FREQUENCY I-35W	PERCENT I-35W
Same Mode	225	85%	54	70%
Different Mode	41	15%	23	30%
Total	**266**	**100%**	**77**	**100%**

Consistent with the information presented in Table 4.8, I-394 panelists were less likely to switch from SOV to carpool than were those in the I-35W control corridor (7% versus 10%), whereas those in the control corridor were more likely to switch from carpool to SOV (8% versus 20%). See Figure 4.3 for further detail.

FIGURE 4.3: MODE SWITCHING BEHAVIOR BY CORRIDOR (WAVE 1 TO WAVE 3)

(Among Non-Transit Panel Members)[12]

Now consider all trips you made in both directions. On how many of those trips did you:



	W1 SOV - W3 SOV	W1 SOV - W3 Carpool	W1 Carpool - W3 SOV	W1 Carpool - W3 Carpool
I-394	73%	7%	8%	12%
I-35W	64%	10%	20%	6%

4.3 ROADWAY USED

Dissimilar methods were used to capture information about roadways used in the past five weekdays in Wave 1 versus Waves 2 and 3. In Wave 1, respondents were asked, "On which of the following freeways have you traveled in the past 5 weekdays between the hours of 6 am and 9 pm?" (i.e., I-394, I-35W, Hwy 55, and Hwy 77). Responses were captured in a yes / no format and in Wave 1, all respondents were asked about all four roadways.

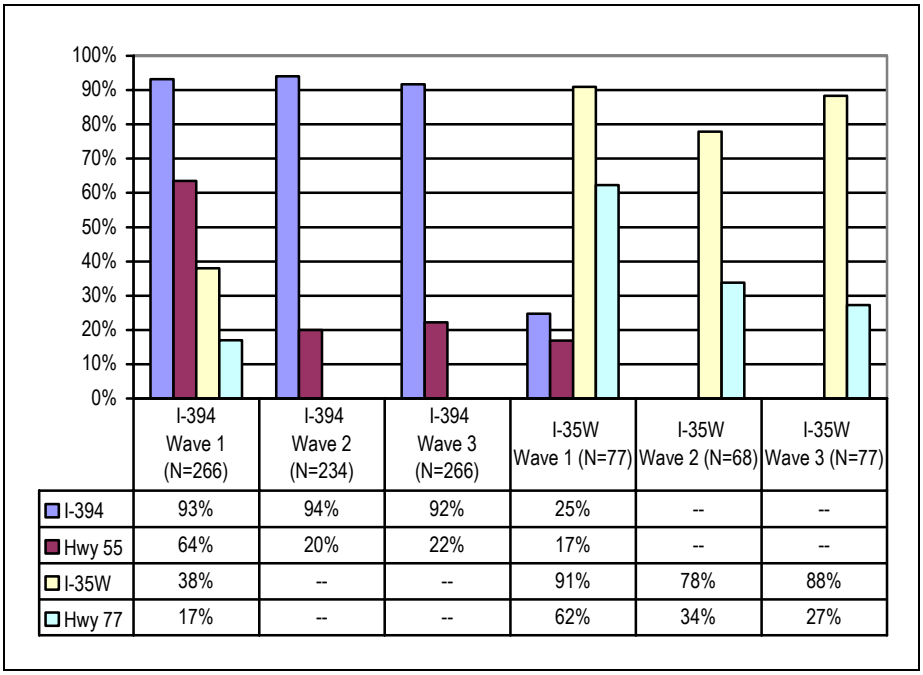
In Waves 2 and 3, respondents were asked, "On how many [of those total] trips did you mostly…" I-394 respondents were provided the response categories "use the MnPASS lanes, use the general traffic lanes on I-394, and use Hwy 55." I-35W respondents were provided the categories "use the carpool lanes on I-35W, use the general traffic lanes on I-35W, and use Hwy 77." So in Waves 2 and 3, respondents were asked only about the roadways in their specific corridor. The intent of this question wording was to simplify Travel Log completion by respondents in Waves 2 and 3. See Figure 4.4 on the following page for further detail.

The differences in question wording between Wave 1 and Waves 2 and 3 make us cautious in drawing inferences about trends in roadway use. However, it does appear that I-394 respondents in Waves 2 and 3 were less likely to use the alternative roadway (Hwy 55) as another option for travel; about one in five chose that option. Meanwhile, I-35W respondents were more likely to try different routes and more readily used the Hwy 77 alternative (34% of Wave 2 respondents and 27% of Wave 3 respondents). See Figure 4.4 below.

[12] Transit sample size is too small to report.

FIGURE 4.4: ROADWAYS USED MONDAY - FRIDAY, 6AM - 9PM, ASSIGNED WEEK

(Among Panel Members)



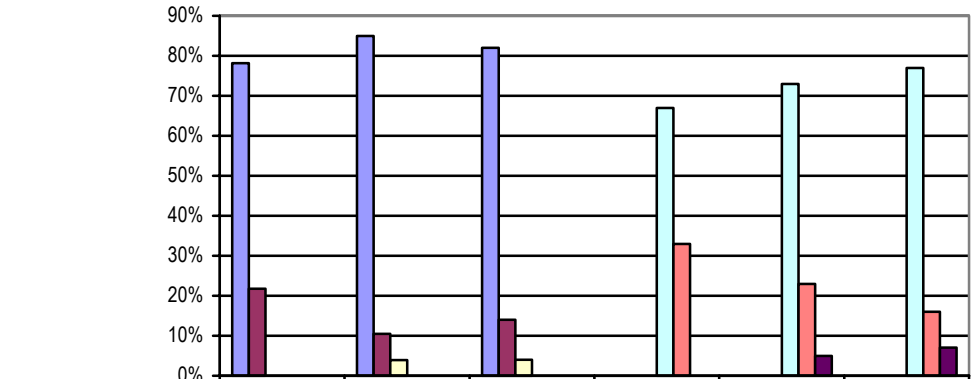
	I-394 Wave 1 (N=266)	I-394 Wave 2 (N=234)	I-394 Wave 3 (N=266)	I-35W Wave 1 (N=77)	I-35W Wave 2 (N=68)	I-35W Wave 3 (N=77)
I-394	93%	94%	92%	25%	--	--
Hwy 55	64%	20%	22%	17%	--	--
I-35W	38%	--	--	91%	78%	88%
Hwy 77	17%	--	--	62%	34%	27%

Another way to compare wave responses on roadway used is in terms of the "most frequently used" roadway. In Wave 1, subsequent to being asked whether respondents used a particular roadway or not, those respondents who reported using more than roadway were asked "which one do you use most frequently?" For Waves 2 and 3, the most frequently used roadway was statistically computed from the trip data so that there were respondents for whom both the interstate and the alternative were used for an equal number of trips.

Different patterns of the most frequently used roadway were observed for I-394 panel member versus I-35W panel members. In Wave 2, more I-394 panelists (85%) seemed to use I-394 as opposed to the alternative highway (Hwy 55) than did the I-35W panelists (73%) use the interstate versus the alternative. Also, there appeared to be differences between Wave 1 and Wave 2 in the percentages of I-394 panelists reporting most frequent use of I-394 (78% versus 85%). From Wave 1 to Wave 3, the data suggest a steady increase in the percentage of I-35W panelists that mostly use I-35W (from 67% in Wave 1 to 73% in Wave 2 to 77% in Wave 3). See Figure 4.5 for further detail.

FIGURE 4.5: ROADWAY USED MOST FREQUENTLY MONDAY - FRIDAY, 6 AM – 9 PM, ASSIGNED WEEK

(Among Panel Members)

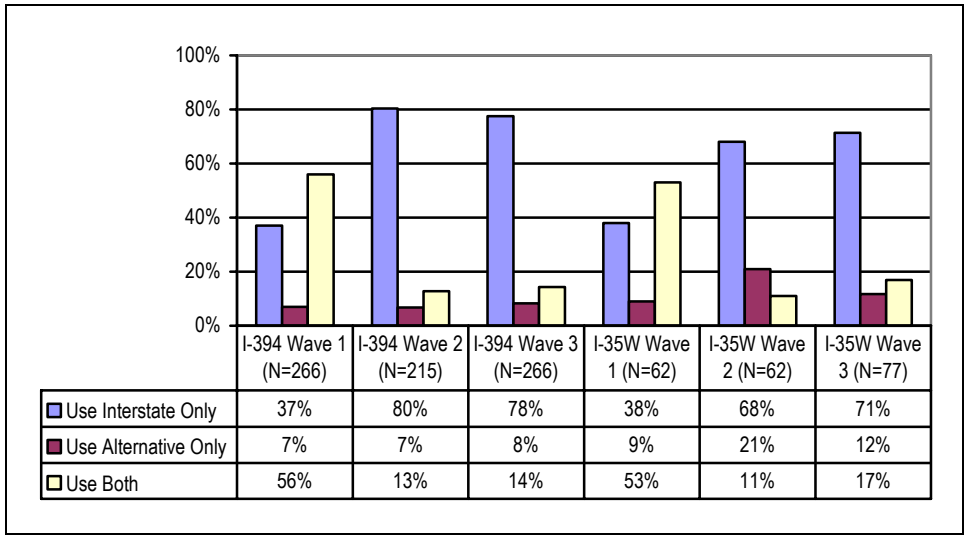


	I-394 Wave 1 (N=266)	I-394 Wave 2 (N=228)	I-394 Wave 3 (N=266)	I-35W Wave 1 (N=77)	I-35W Wave 2 (N=62)	I-35W Wave 3 (N=77)
I-394	78%	85%	82%	--	--	--
Hwy 55	22%	11%	14%	--	--	--
I-394 / Hwy 55 equally	0%	4%	4%	--	--	--
I-35W	--	--	--	67%	73%	77%
Hwy 77	--	--	--	33%	23%	16%
I-35W / Hwy 77 equally	--	--	--	0%	5%	7%

Due to differences in the manner in which the data was collected, the data suggest significant differences between the Wave 1 estimates and the estimates for Waves 2 and 3. However, due to these differences in methodology, one cannot conclude if the differences in these can be attributed to methodology or true travel behavior. I-394 and I-35W panelists reported similar types of roadways used in Waves 2 and 3. The most noticeable difference is seen in the Wave 2 and Wave 3 I-35W panelists. During Wave 2, 21% of I-35W panelists used the alternative only, whereas in Wave 3, this number decreases to 12%. Conversely, during Wave 2, 11% of I-35W panelists reported using both the interstate and the alternative, whereas in Wave 3, this number increased to 17%. See Figure 4.6 for further detail.

FIGURE 4.6: TYPE OF ROADWAY USED MONDAY - FRIDAY, 6 AM – 9 PM, WAVE 2 ASSIGNED WEEK

(Among Panel Members)



	I-394 Wave 1 (N=266)	I-394 Wave 2 (N=215)	I-394 Wave 3 (N=266)	I-35W Wave 1 (N=62)	I-35W Wave 2 (N=62)	I-35W Wave 3 (N=77)
Use Interstate Only	37%	80%	78%	38%	68%	71%
Use Alternative Only	7%	7%	8%	9%	21%	12%
Use Both	56%	13%	14%	53%	11%	17%

4.4 VOLUME OF TRAVEL

There were moderate differences between the mean number of trips recorded among the I-394 panel during Wave 1 (7.75), Wave 2 (8.03) and Wave 3 (7.40). See Table 4.9 for further detail.

TABLE 4.9: MEAN VOLUME OF TRIPS MONDAY - FRIDAY, 6AM - 9PM, WAVE 2 ASSIGNED WEEK

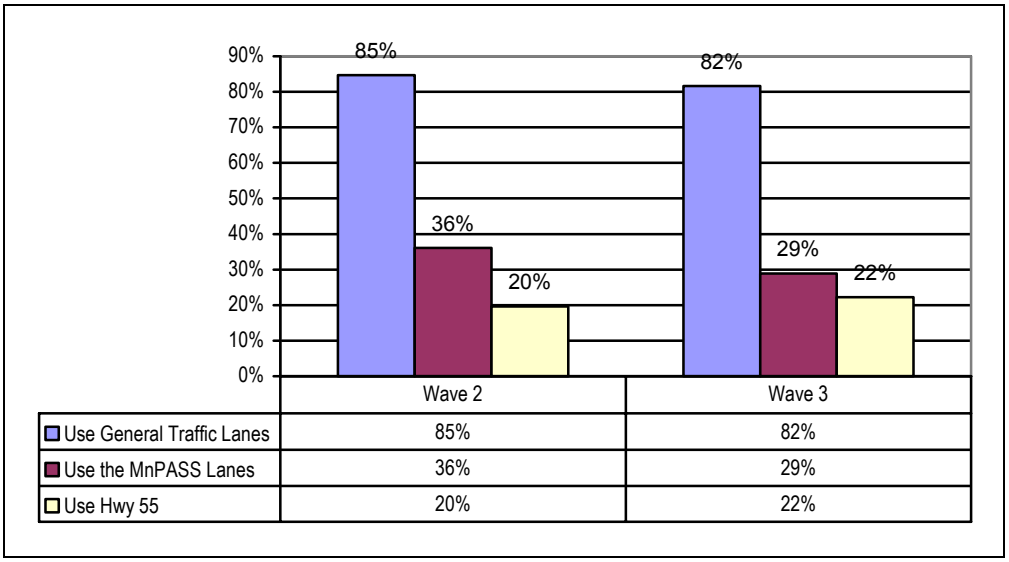
How many trips did you make in total?

TYPE OF TRIP	I-394			I-35W		
	WAVE 1	WAVE 2	WAVE 3	WAVE 1	WAVE 2	WAVE 3
	(N=266)	(N=215)	(N=266)	(N=136)	(N=111)	(N=77)
Total Number of Trips	7.75	8.03	7.40	6.51	6.59	6.60
By Direction						
Total Eastbound Trips	3.72	3.99	3.61	--	--	--
Total Westbound Trips	4.03	4.04	3.79	--	--	--
Total Northbound Trips	--	--	--	3.18	3.23	3.36
Total Southbound Trips	--	--	--	3.32	3.32	3.23
By Mode						
Total Number of Drive Alone Trips	5.95	6.14	5.82	5.21	5.27	4.90
Total Number of Carpool Trips	1.74	1.85	1.42	1.30	1.27	1.36
Total Number of Transit Trips	.06	.08	.08	.00	.00	.13
By Roadway or Lane						
Total Number of MnPASS Trips	--	1.61	1.33	--	--	--
Total Number of Hwy 55 Trips	--	1.12	.92	--	--	--
Total Number of General Traffic Lane Trips	--	5.38	5.06	--	4.42	4.69
Total Number of Carpool Lane Trips	--	--	--	--	.37	.39
Total Number of Hwy 77 Trips	--	--	--	--	1.76	1.31

MnPASS lane usage appears to have diminished as a proportion of all trips on the I-394 corridor. In Wave 2, 36% of trips used the MnPASS lanes whereas in Wave 3, 29% of trips used the MnPASS lane. A reason for this reduction may be the increase in cost for using the MnPASS lanes that occurred in January 2006. At the same time the proportion of trips that used the general traffic lanes and those that used Highway 55 remained stable between Wave 2 and Wave 3. See Figure 4.7 for further detail.

FIGURE 4.7: I-394 ROADWAY / LANES USED MONDAY - FRIDAY, 6 AM – 9 PM, WAVE 2 AND 3 ASSIGNED WEEK

Now consider all trips you made in both directions. On how many of those trips did you use…



5. STATED PREFERENCE ANALYSIS

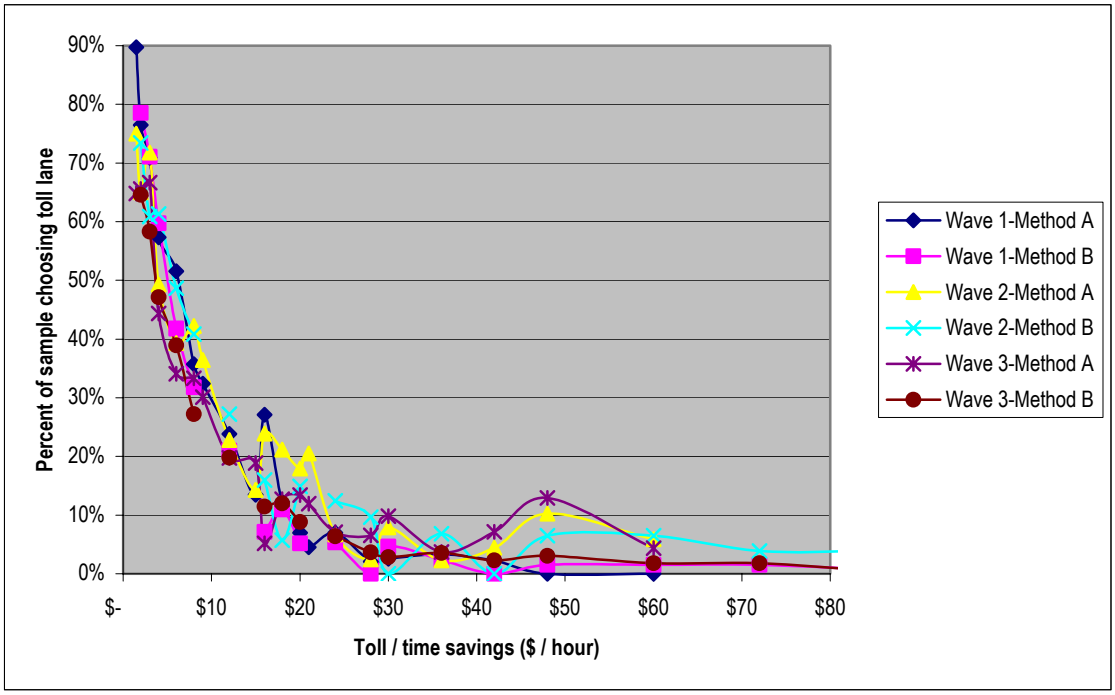
Stated preference (SP) questions were used to measure respondents' likelihood of using the MnPASS lane as a function of the toll level and time savings. The questions were asked of all respondents whose reference trip was made as a solo driver on the I-394. The structure and wording of the SP questions is shown in Chapter 2. The same experimental design and wording was used in all three waves to allow comparisons of SP results across the waves.

5.1 STATED PREFERENCE RESPONSES

The first analysis of the Wave 3 SP responses was a comparison to Waves 1 and 2 SP responses and results. In this analysis, there was no explicit linkage between responses from the same panel member in different waves—the data was analyzed as repeated cross-sections, allowing us to use the full samples from both waves, rather than just panel members.

There were 1,313 SP respondents: 412 in Wave 1, 366 in Wave 2, and 535 in Wave 3. Nearly all of those respondents completed both Methods A and B, with the exception of Wave 2 where Method B was skipped for a substantial number of respondents.[13] Figure 5.1 shows the percent of respondents choosing the MnPASS lane at different levels of time savings/toll tradeoff ratios. Although there is inevitably some random noise in such a plot due to fairly small sample sizes at each tradeoff point, the overall patterns look quite smooth and similar between the two SP methods and three waves of data.

FIGURE 5.1: PERCENT OF STATED PREFERENCE CHOICES PAYING TOLL VS. TIME/COST TRADEOFF

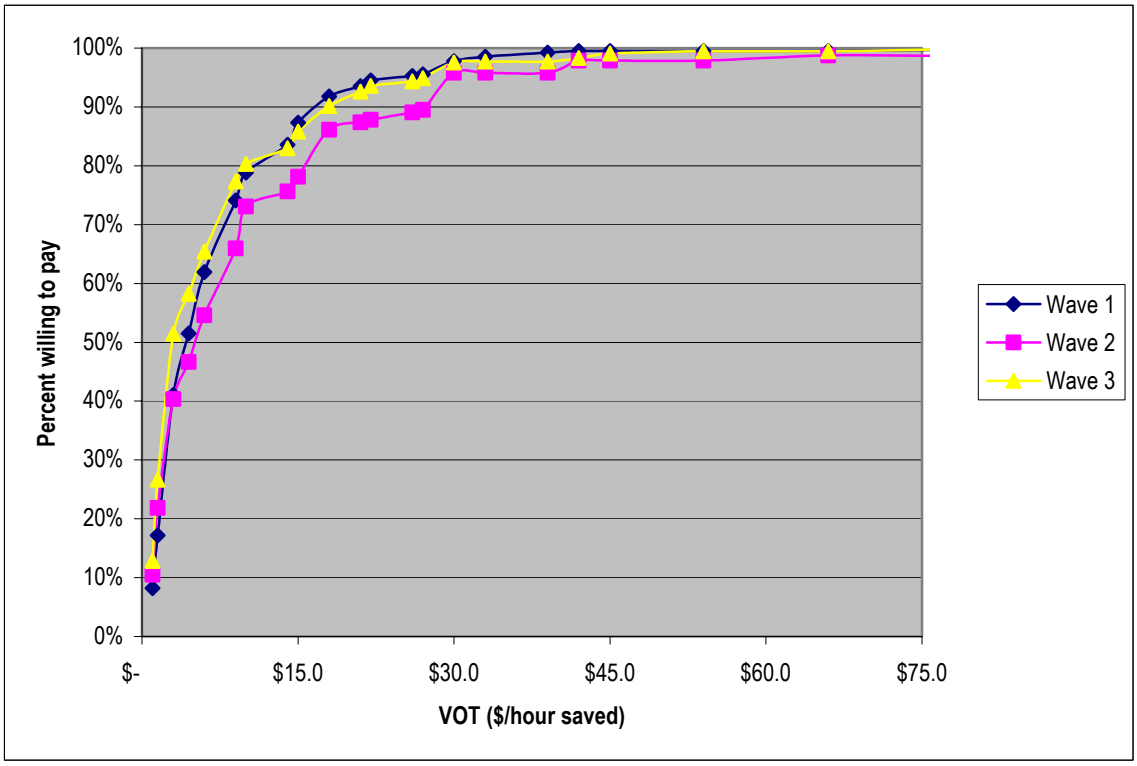


[13] During Wave 2, the CATI program was modified to collect "short completes" from respondents who reported not taking a trip that matched their assigned trip during their assigned travel week. As a result of this programming change, several respondents that should have been asked the Method B questions were not.

Individual Level VOT Distributions

An advantage of the Method B price meter data is that it provides an individual level estimate of Value of Time (VOT) for each respondent. Figure 5.2 is a plot of the cumulative distribution of those values from each of the three waves of data. While the Wave 2 curve looks somewhat different than Wave 1, with somewhat higher values of time, the Wave 3 curve looks almost identical to Wave 1.

FIGURE 5.2 CUMULATIVE VOT DISTRIBUTIONS FROM METHOD B DATA



Individual Level VOT Correlations

Another interesting analysis was to measure the correlation between the individual-level VOT estimates for the same respondents between waves. The overall results are:

TABLE 5.1: INDIVIDUAL LEVEL VOT CORRELATIONS – WAVES 1 THROUGH 3

WAVE RELATIONSHIP	FREQUENCY	CORRELATION
Wave 1 with Wave 2	101	-0.017
Wave 2 with Wave 3	86	+0.095
Wave 1 with Wave 3	126	+0.367

The correlation between Wave 1 and Wave 3 VOTs for the 126 respondents who provided price meter data in both waves is +0.367, which is highly statistically significant. The Wave 2 VOTs are not significantly correlated with either the Wave 1 or Wave 3 values for the same people. This result, combined with the findings in Table 5.1 above, suggests the Wave 1 and Wave 3 data may be more useful for predictive analyses. For that reason, all further analysis is carried out using only Waves 1 and 3, the first and last waves.

5.2 MULTIVARIATE ANALYSIS

The Wave 1 and Wave 2 reports contain descriptive tables of how willingness to pay to use the toll lane is related to various socio-demographic characteristics, as well as attitudes and opinions. The relationships with attitudes and opinions, while interesting, are fairly obvious, so that analysis is not repeated here. The emphasis is now on observable variables. In this analysis, the Method A and Method B data from Waves 1 and 3 was pooled in order to estimate a logistic multivariate model of VOT that can sort out the effects of several variables that may be correlated with one another. The results of two interesting models are shown in Table 5.2 below. [Note: these models are intended for explanatory purposes, and not for direct use in demand forecasting. Before the data could be used for forecasting, it would need to be weighted to adjust for the non-random methods of recruitment for the panel, MnPASS and transit samples.]

Binary logit models with error scaling were used to estimate models with the time coefficients directly in units of VOT ($/hour). In Model 1, the "base" value of time is $9.63, but there are several additional "modifier" variables that are related to either lower or higher willingness to pay:

Income: No significant difference in VOT is found between the income groups below $50K and between $50K and $100K (the base group). However, it appears that willingness to pay rises sharply with income above the $100K level, and is $6.45 (about 70%) higher than the base level for those with income above $125K.

Age: Relative to the base age group of 45-65, younger people have higher VOT and older people have lower VOT, on average. This is presumably due to a busier lifestyle for younger people – particularly those with children. Note that the age effect is additive to the income effect, and that many younger people have lower than average income, so that the net effect of the age and income modifiers may be negative. This fact underlines the importance of analyzing correlated variables simultaneously to avoid spurious results as much as possible.

Trip purpose/time of day: The willingness to pay for time savings in the AM commute and for work-related non-commute trips is about $3/hour higher than the base, while the VOT for the PM commute is less than $1 higher than the base. The value for non-work trips in the PM peak is about $2/hour lower than the base group. (The "base" group includes any purpose for which there is no modifier variable, in this case mainly off-peak social and recreation trips.)

Trip distance: Relative to medium-distance trips, trips of less than 10 miles are related to a significantly lower value of time, while trips of more than 20 miles have significantly higher value. One might expect the opposite effect because each minute saved is a higher percentage of travel time on short trips. On the other hand, it is often found that peoples' marginal disutility of in-vehicle time increases as more time is spent in the vehicle, and these results confirm that finding.

Time saved: The willingness to pay for each marginal minute of time saved may also depend on the total amount saved. The marginal willingness to pay for 15 and 20-minute time savings is about $2/hour (about 3.5 cents/minute) lower than for the base levels of 5 and 10 minutes. Perhaps respondents think saving 5 or 10 minutes would already get congestion down to bearable levels, or else some people may not believe that 15 or 20-minute savings are realistic.

Price meter (method B): When compared to the base Method A data, the price meter SP choices do not give significantly higher or lower values of time. This result is very encouraging for analyses such as this that pool the data together.

Wave/sample: Among the SP panel members (the 126 individuals that completed all SP questions in both Waves 1 and 3), the average VOT in Wave 1 was very similar to that of the other Wave 1 respondents (63 cents difference). In Wave 3, however, the mean value of time for the SP panel members is $3.71 lower (-$3.08 - 0.63) than it was for the same individuals in Wave 1. That means the willingness to pay for those individuals dropped by almost 40% between the two waves, after any other differences are taken into account. The VOT for the non-panel SP respondents in Wave 3 is $1.77 lower than for the non-panel in Wave 1. So, the willingness to pay for other respondents also decreased between the two waves, but not by as much as for SP panel members. (The non-panel SP sample in Wave 3 is non-random and includes a proportion of MnPASS subscribers that is higher than in the general population, so any comparison with Wave 1 must be interpreted with caution.) Further analysis described below was done in an attempt to sort out some possible reasons for the decrease in willingness to pay between waves.

Toll lane constant: Aside from time and cost differences, there is a negative constant on the toll lane equivalent to about $1.60. This result suggests that some people have resistance to using the toll lane, regardless of the toll or time saving levels. This may be related to the perceived difficulty of subscribing, of getting into and out of the lane, or simply an aversion to the concept of tolls.

TABLE 5.2: LOGISTIC MULTIVARIATE MODEL

	MODEL 1		MODEL 2		MODEL 3	
	COEFFICIENT	T-STAT	COEFFICIENT	T-STAT	COEFFICIENT	T-STAT
Base value of time ($/hour)	9.63	6.9	10.33	7.7	9.97	7.5
Differences from the base VOT						
HH income under $50K	+0.02	0.0	+0.04	0.1	-0.02	0.0
HH income $100K-$125K	+2.07	4.0	+1.84	3.7	+2.11	4.2
HH income over $125K	+6.21	15.0	+5.12	12.7	+5.28	13.1
Age under 35	+2.44	4.5	+2.62	4.9	+2.22	4.2
Age 35 to 45	+1.38	3.3	+1.42	3.5	+0.92	2.2
Age over 65	-2.87	-4.2	-2.87	-4.3	-2.53	-3.8
AM commute trips	+3.46	6.1	+0.86	1.5	+1.86	3.4
PM commute trips	+0.85	1.2	-0.17	-0.3	+0.53	0.8
Other AM peak trips	-0.02	0.0	-0.55	-1.1	+0.03	0.1
Other PM peak trips	-2.10	-3.2	-2.53	-4.0	-1.99	-3.1
Work-related trips	+3.82	6.4	+3.21	5.5	+3.09	5.3
Shopping/personal business trips	+1.51	2.2	+1.51	2.3	+1.42	2.2
Trip distance under 10 miles	-1.90	-4.6	-1.28	-3.2	-1.55	-3.9
Trip distance over 20 miles	+2.28	5.6	+1.11	2.7	+1.28	3.1
Time saved = 15 minutes	-2.03	-3.1	-1.84	-3.0	-1.74	-2.8
Time saved = 20 minutes	-2.21	-2.5	-1.82	-2.2	-1.77	-2.1
Price meter (B) data	-0.16	-0.4	-0.22	-0.5	-0.24	-0.6
Wave 1- SP Panel	+0.63	1.2				
Is a MnPASS subscriber			+2.65	1.8		
Is not a MnPASS subscriber			+0.70	1.3		
Used the MnPASS lane					+0.79	0.6
Did not use MnPASS lane					+0.75	1.4

Table 5.2: Logistic Multivariate Model (Continued)

Wave 3 – SP Panel	-3.08	-5.3				
Is a MnPASS subscriber			+2.48	1.8		
Is not a MnPASS subscriber			-3.09	-5.4		
Used the MnPASS lane					-2.67	-2.1
Did not use MnPASS lane					-2.70	-4.7
Wave 3 – New SP	-1.77	-4.3				
Is a MnPASS subscriber			+5.95	10.3		
Is not a MnPASS subscriber			-4.68	-10.6		
Used the MnPASS lane					+5.90	10.0
Did not use MnPass lane					-4.33	10.0
Additional variables						
Toll cost ($/$)	-1.00	fixed	-1.00	fixed	-1.00	fixed
Constant for MnPASS lane ($)	-1.61	-8.7	-1.41	-8.1	-1.42	-8.1
Scale on the error term	0.8014	38.4	0.8490	38.4	0.8457	38.4
Model fit statistics						
Observations	11250		11250		11250	
Final log-likelihood	-3880		-3705.3		-3726.3	
Rho-squared (0)	0.502		0.525		0.522	
Rho-squared (const)	0.31		0.341		0.338	

5.3 DIFFERENCES BETWEEN MNPASS SUBSCRIBERS AND NON-SUBSCRIBERS

In Model 2, instead of the three VOT **modifiers** for Wave 1 SP panel, Wave 3 SP panel and Wave 3 new respondents, each of those groups is further divided by whether or not the respondent was a MnPASS subscriber at the time of Wave 3. The results are:

- **SP panel members who subscribed to MnPASS**: In Wave 1 (before they actually subscribed), this group had a $2.65 higher willingness to pay than the other Wave 1 respondents (the base group). In Wave 3, the same group had an average willingness to pay that was virtually unchanged since Wave 1 ($2.48 higher than the base group). Note: this group is quite small, as only about 10% of the 126 Wave 1 SP panel members had subscribed to MnPASS by the time of Wave 3.
- **SP panel members who have NOT subscribed to MnPASS**: In Wave 1, this group has an average VOT that was not significantly different ($0.70 higher) than the other Wave 1 respondents. In Wave 3, however, the average VOT for this group is over $3.00 lower than the base group. Thus, the drop in willingness to pay among panel members occurs entirely among those who have not subscribed to MnPASS.
- **New Wave 3 SP respondents who have subscribed to MnPASS**: This group has the highest VOT, about $6/hour higher than the non-panel Wave 1 SP.
- **New Wave 3 SP respondents who have NOT subscribed to MnPass**: This group has the lowest VOT, almost $5/hour lower than the non-panel Wave 1 SP.

Even though these variables are very significant, most of the other variables related to income, age, etc., also remain significant and similar to Model 1. If other variables are highly correlated with whether or not a person is a subscriber or not, and if those variables had become insignificant in Model 2, then the original results in Model 1 would have been spurious. This is generally not the case, meaning that income, age, etc. are important determinants of value of willingness to pay in the SP responses regardless of whether or not a person is a current subscriber. (The biggest changes between Models 1 and 2 are the

AM commute and trip distance>20 miles effects, suggesting that many of the MnPASS subscribers with high willingness to pay were in those trip segments.)

It is interesting that the difference in willingness to pay between subscribers and non-subscribers is much larger for the new Wave 3 respondents than for the panel respondents. It may be the case that people who agree to participate in the survey now that the system is in place tend to be those who have strong feelings one way or the other, with fewer in the middle. It may also be the case that people who have completed the survey before respond somewhat differently than the new respondents, either because they want to respond in a way that is consistent with past responses, or because they are more "educated" about the tradeoffs involved.

The analysis in Model 2 was repeated, this time including the Wave 2 SP responses as well as those from Waves 1 and 3. Although the exact estimation results are not shown here, the findings for Wave 2 were very similar to those for Wave 3: non-subscribers had much lower willingness to pay than subscribers, both in the SP panel and in the non-panel sample. There was virtually no difference between the Wave 2 and Wave 3 values, so, while there is evidence that there has been a "split" in willingness to pay related to actual behavior, there is no evidence that the split is growing over time. Note, however, that the time gap between waves 2 and 3 was quite short, so more data would need to be collected in the future to test whether there is any longer term trend in attitudes or willingness to pay.

5.4 Differences Between MnPASS Lane Users and Non-Users

Model 3 is identical to Model 2, except that instead of segmenting by whether or not the person was a MnPASS subscriber, it is segmented by whether or not the person actually used the MnPASS lane during their SOV reference trip. In general, the MnPASS user segment is the same as the subscriber segment, but there are some differences, e.g., many subscribers did not use the MnPASS lane for that particular trip, and a few non-subscribers who reported using the toll lane.

For new Wave 3 SP respondents, the results confirm those of Model 2, with actual MnPASS lane users reporting much higher willingness to pay than non-users. For the SP panel respondents, however, the value of time for Wave 3 reference trip toll lane users in both the Wave 1 and Wave 3 choices is virtually the same as for those who did not use the toll lane. This is a curious result that suggests that some SP respondents may be answering the questions based more on their typical willingness to pay than on their willingness for that specific reference trip. (Again the caveat that this result is based on a very small sample—only 16 of the 126 SP panel members reported using the MnPASS lane.)

5.5 Overall Conclusions from the SP Analysis

- The distribution of SP responses and willingness to pay looks quite similar across all waves.
- Within the SP panel, a significant correlation was found between the individual-level willingness to pay measures from Waves 1 and 3.
- The willingness to pay is found to be significantly related to several observable factors of the traveling population, including income, age, trip purpose, time of day, trip distance, and amount of time saved.
- After those factors are taken into account, there appears to be a significant drop in willingness to pay between Waves 1 and 3, particularly in the SP panel.
- Relative to the pre-introduction SP, the measured value of time in the post-introduction SP is strongly bifurcated, with MnPASS subscribers and users showing willingness to pay at least 3 times as high as non-subscribers/non-users. Because the majority of the population are non-users, this

will tend to skew the distribution even further to the left, with a lower median VOT but with a higher variance.

- The Wave 3 SP sample is a choice-based sample, oversampling MnPASS subscribers. Before using these results to forecast or to represent the general population, reweighting would be necessary.

It is also recommended to compile the data to perform RP analysis to the extent possible. This would mean relating the reference trips used in the SP analysis to the actual toll level and time savings available on that day at that time.

6. MnPASS Customers

6.1 Transponder Interest

The question, "Are you a MnPASS subscriber?" was asked of all respondents not coming from the original subscriber list.[14] Table 6.1 provides the responses of the I-394 panel members only. Six percent confirmed they were MnPASS subscribers. When combined with the respondents sampled from the MnPASS subscriber list and the non I-394 panel members, the total MnPASS subscriber sample for analysis was 145 people. See Table 6.1 for further detail.

Table 6.1: MnPASS Subscribers

Are you a MnPASS Subscriber?

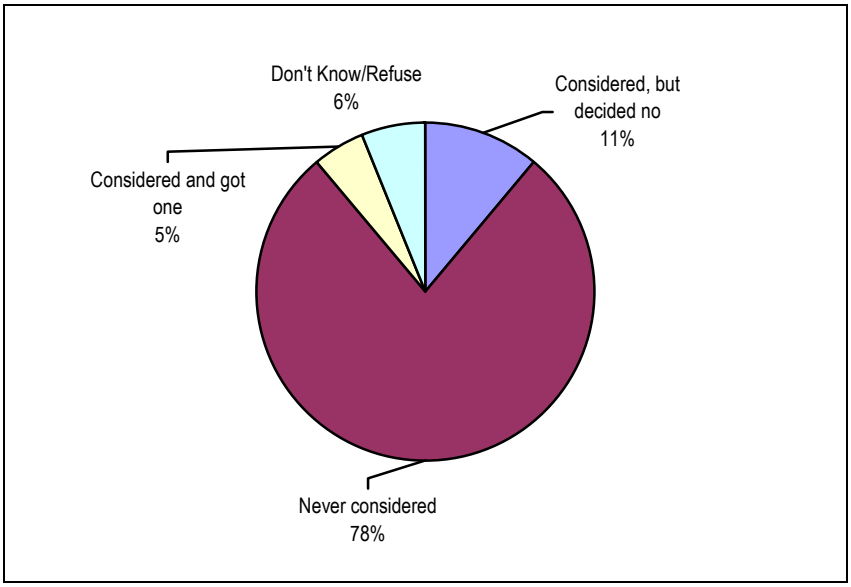
Response	Frequency	Percent
Yes	15	6%
No	251	94%
Total	**266**	**100%**

The 251 I-394 panel respondents who said "no" to the question above (Table 6.1) were asked if they had ever considered purchasing a transponder. Of these, 11% had considered it but decided against it. Seventy-eight percent had never considered it, and 6% did not know or refused to provide an answer. See Figure 6.1 for further detail.

Figure 6.1: MnPASS Purchase Consideration Among Non-Subscribers

N=251

Have you Considered Purchasing a Transponder?



[14] Survey respondents sampled from the original subscriber list were not asked if they were still MnPASS subscribers. It was assumed that they were.

Three of ten I-394 panel respondents that said they considered purchasing a transponder, decided against it because they generally don't drive the I-394 route. Approximately three of ten felt they would not use the MnPASS lane enough to justify the purchase. One of ten panel respondents carpool and one of ten did not want to pay for MnPASS. Less than one of ten reported transit use as the reason for not purchasing a transponder. Less than one of ten were unaware of MnPASS and less than two of ten (but more than one of ten) commented that the transponder was too expensive to lease.

TABLE 6.2: REASONS FOR NON-PURCHASE OF TRANSPONDERS

Why?

REASONS TRANSPONDER NOT PURCHASED	CONSIDERED PURCHASE AND DECIDED AGAINST IT N=30	DID NOT CONSIDER PURCHASE N=207
Would not use MnPASS lane enough	33%	28%
Transponder is too expensive to lease	17%	5%
Have not gotten around to it	17%	1%
Generally don't drive I-394	10%	27%
Traffic is not that bad	7%	6%
I use carpools	3%	14%
Don't want to pay to use MnPASS	3%	14%
I use transit	3%	0%
Drive in the opposite direction	3%	1%
Unaware of MnPASS	0%	1%
Don't know how to purchase	0%	0%
Don't support the idea of MnPASS	0%	2%
Other, specify	3%	1%
Don't Know / Refuse	1%	0%
Total	**100%**	**100%**

Those I-394 panel respondents who indicated not purchasing a transponder because it was too costly were asked to identify the price of the transponder. Of these respondents, nearly four of ten did not know. Two of ten thought it was $5, and more than four of ten thought it was $20 or more.

TABLE 6.3 KNOWLEDGE OF COST OF TRANSPONDER AMOUNT

N=251

How much did you anticipate the cost to be?

PURCHASE COST	PERCENT N=14
5.00	21%
20.00	14%
25.00	7%
30.00	14%
40.00	7%
Don't Know / Refuse	37%
Total	**100%**

6.2 CUSTOMER ACCOUNTS

As shown in Table 6.4 below, most respondents did not know, or chose not to share, when they purchased their transponder. Of respondents who knew the month, 23% reported making their purchase in May. Nearly 40 percent of transponder owners purchased a unit between April and June. The fewest number of transponders was purchased in December.

TABLE 6.4: MONTH OF TRANSPONDER PURCHASE

In what month did you acquire a transponder?

MONTH	FREQUENCY	PERCENT
January	3	2%
February	3	2%
March	2	1%
April	10	7%
May	33	23%
June	11	8%
July	4	3%
August	3	2%
September	5	3%
October	2	1%
November	5	3%
December	1	1%
Don't Know / Refuse	62	44%
Total	**140**	**100%**

Slightly less than two-thirds of subscribers purchased only one transponder. Of the 60% of subscriber households that purchased only one transponder, half (52%) were in one or two person households, and 72% owned two or fewer vehicles. Of the 40% of subscriber households that purchased more than one transponder, nearly half (42%) were in 4+ person households and over half (56%) were in 2-vehicle households. Table 6.5 provides further detail.

TABLE 6.5: TRANSPONDERS PER HOUSEHOLD

How many transponders does your household have?

TRANSPONDERS	FREQUENCY	PERCENT
One	87	60%
Two	44	30%
Three	6	4%
Don't know / refused	8	6%
Total	**145**	**100%**

Eight of 10 (79%) subscribers opened an account online, while more than 1 of 10 (12%) went to the customer service center and opened an account in-person. Only 4% opened an account over the phone. See Table 6.6 for further detail.

TABLE 6.6: METHOD OF OPENING MNPASS ACCOUNT

How did you open your MnPASS Account?

METHOD USED TO OPEN ACCOUNT	FREQUENCY	PERCENT
Online	115	79%
In-person at customer service center	17	12%
Telephone	6	4%
Don't know / refused	7	5%
Total	**138**	**100%**

Most (87%) transponder owners paid for their own MnPASS account. See Table 6.7 for more detail.

TABLE 6.7: HOW IS YOUR MNPASS ACCOUNT PAID?

WHO PAYS FOR ACCOUNT	FREQUENCY	PERCENT
Paid by you	126	87%
Paid directly by employer	7	5%
Paid by you but reimbursed by employer	5	3%
Don't know / refused	7	5%
Total	**145**	**100%**

6.3 SATISFACTION WITH MNPASS OPERATIONS BY TRANSIT USE

Satisfaction questions were also compared among respondents known to be transit users (sampled from the MnPASS-provided transit list) and non-transit users. Table 6.8 shows that transit users and non-users alike were most satisfied with the speed of traffic flow in the MnPASS lanes (92% satisfaction with transit users and 89% satisfaction with non-users). Less than 1 of 10 users and non-users were dissatisfied with this aspect of MnPASS.

TABLE 6.8: SATISFACTION WITH THE SPEED OF TRAFFIC FLOW IN THE MNPASS LANES

LEVEL OF SATISFACTION	TRANSIT USER			
	YES		NO	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT
Satisfied	91	92%	489	89%
Very satisfied	55	56%	310	56%
Somewhat satisfied	36	36%	179	33%
Dissatisfied	4	4%	46	9%
Very dissatisfied	1	1%	15	3%
Somewhat dissatisfied	3	3%	31	6%
No opinion	3	3%	7	1%
Don't Know / Refuse	1	1%	7	1%
Total	**99**	**100%**	**549**	**100%**

Table 6.9 shows that ease of identifying the MnPASS entry points was satisfying to transit users and non-users alike (80% and 85%, respectively, were very or somewhat satisfied). Less than one of twenty (4%) of transit users had no opinion or did not know.

TABLE 6.9 SATISFACTION WITH EASE OF IDENTIFYING THE MNPASS ENTRY POINTS

LEVEL OF SATISFACTION	TRANSIT USER			
	YES		NO	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT
Satisfied	79	80%	464	85%
Very satisfied	41	41%	269	49%
Somewhat satisfied	39	39%	195	36%
Dissatisfied	16	16%	72	13%
Very dissatisfied	4	4%	26	5%
Somewhat dissatisfied	12	12%	46	8%
No opinion	3	3%	5	1%
Don't Know / Refuse	1	1%	8	2%
Total	**99**	**100%**	**549**	**100%**

Just over two-thirds of transit users (68%) and slightly less than three quarters of non-users (74%) were satisfied with the safety of merging into the MnPASS lanes. About one-fourth of both groups were dissatisfied with this aspect of MnPASS (27% dissatisfaction among users and 23% of non-users). Less than one-tenth of users and non-users alike were indifferent or refused to provide and answer. See Table 6.10 for further detail.

TABLE 6.10: SATISFACTION WITH THE SAFETY OF MERGING INTO THE MNPASS LANES

LEVEL OF SATISFACTION	TRANSIT USER			
	YES		NO	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT
Satisfied	67	68%	403	74%
Very satisfied	22	22%	175	32%
Somewhat satisfied	45	46%	228	42%
Dissatisfied	27	27%	123	23%
Very dissatisfied	12	12%	48	9%
Somewhat dissatisfied	15	15%	75	14%
No opinion	4	4%	14	3%
Don't Know / Refuse	1	1%	9	2%
Total	**99**	**100%**	**549**	**100%**

Transit users and non-users alike were least satisfied with the enforcement of MnPASS usage (63% satisfaction among users and 50% satisfaction among non users). However, it should be noted that the percent of dissatisfied users and non-users was also low (9% and 17%, for each group, respectively). This may be attributed to the high percentage of users and non-users that had no opinion or refused to provide an answer; more than one quarter (28%) of transit users and one-third (33%) of non-users had no opinion or refused to provide an answer. See Table 6.11 below for additional detail.

TABLE 6.11: SATISFACTION WITH THE ENFORCEMENT OF MNPASS USAGE

LEVEL OF SATISFACTION	TRANSIT USER			
	YES		NO	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT
Satisfied	62	63%	272	50%
Very satisfied	33	33%	121	22%
Somewhat satisfied	29	29%	151	28%
Dissatisfied	9	9%	90	17%
Very dissatisfied	1	1%	31	6%
Somewhat dissatisfied	8	8%	59	11%
No opinion	18	18%	111	20%
Don't Know / Refuse	10	10%	76	13%
Total	**99**	**100%**	**549**	**100%**

6.4 MNPASS LANE USAGE

All respondents were asked about their travel during an assigned travel week (Monday through Friday). Almost 6 of ten trips on I-394 in both directions were reported by SOV drivers that did not use the MnPASS lanes (i.e., used the general lane for free). Twelve percent of trips were taken by SOVs in the MnPASS lanes – 10% who chose to pay a toll and 2% who reported using the MnPASS lanes for free. Carpoolers reported 18% of I-394 trips, and bus riders reported 10% of I-394 trips. See Table 6.12.

When examined by sample type, the data suggest that more than three-fourths (76%) of I-394 trips taken by panel members (N=266) were taken while driving alone and not using the MnPASS lanes (i.e., used the general lane for free). Nearly two-third (61%) of subscriber trips were taken while driving alone and paying to use the MnPASS lane. Finally, more than half (54%) of all trips taken by transit users were taken while riding a bus. See Table 6.12 for further detail.

TABLE 6.12: PRIMARY MODE FOR I-394 TRAVEL DURING ASSIGNED WEEK

Now consider all trips you made in both directions. On how many of those trips did you…

TYPE OF TRAVEL ON I-394 DURING ASSIGNED	PANEL (N=266)		SUBSCRIBERS (N=106)		TRANSIT (N=110)		NEW I-394 SAMPLE (N=350)		NEW I-394 SAMPLE WEST OF 494 (N=101)		ALL (N=933)	
	TRIPS	% TOTAL TRIPS	TRIPS	% TOTAL TRIPS	TRIPS	% TOTAL TRIPS	TRIPS	% TOTAL TRIPS	TRIPS	% TOTAL TRIPS	TRIPS	% TOTAL TRIPS
Drive alone and not use MnPASS lanes	1,468	76%	267	29%	261	26%	1612	69%	445	68%	4053	59%
Drive alone and pay a toll to use the MnPASS lanes	41	2%	552	61%	10	1%	72	3%	13	2%	688	10%
Drive alone, use MnPASS lanes and not pay a toll	39	2%	7	1%	10	1%	61	3%	36	5%	153	2%
Carpool	379	19%	67	7%	181	18%	497	22%	131	20%	1255	18%
Ride a bus	20	1%	18	2%	533	54%	62	3%	60	5%	693	10%
Total	**1,947**	**100%**	**911**	**100%**	**995**	**100%**	**2304**	**100%**	**655**	**100%**	**6,842**	**100%**

When the window for reporting MnPASS usage was expanded to "ever used the MnPASS lanes," the percent of users increased from 12% to 66%. Of course, this percent includes those sampled from the MnPASS subscriber list. But 59% of panel members and 61% of people sampled from the transit list had used the MnPASS lanes at least once since their implementation. See Table 6.13 for further detail.

TABLE 6.13: MNPASS LANE USAGE (BY SAMPLE TYPE)

Have you ever used the MnPASS Lanes?

RESPONSE	PANEL		SUBSCRIBER		TRANSIT	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT	FREQUENCY	PERCENT
Yes	202	59%	105	99%	108	61%
No	141	41%	1	1%	70	39%
Total	**343**	**100%**	**106**	**100%**	**178**	**100%**

Among panel respondents who reported having used MnPASS in the past, carpooling was the most frequently mentioned mode (84%). Subscribers reported using the MnPASS lane most often as a paying SOV (91%), and transit users reported using the MnPASS lane most frequently as a bus rider (53%). See Table 6.14 below.

TABLE 6.14: MOST FREQUENTLY MENTIONED MODE OF MNPASS USE (BY SAMPLE TYPE)

When you have used the MnPASS lanes in the past, were you: (all that apply) How did you travel on the MnPASS lanes most frequently?

MODE	PANEL		SUBSCRIBER		TRANSIT	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT	FREQUENCY	PERCENT
Paying SOV	19	9%	95	91%	3	3%
Carpooler	171	84%	8	8%	48	44%
Bus Rider	4	2%	2	2%	58	53%
Don't Know / Refuse	10	5%	0	0%	1	1%
Total	**204**	**100%**	**105**	**100%**	**110**	**100%**

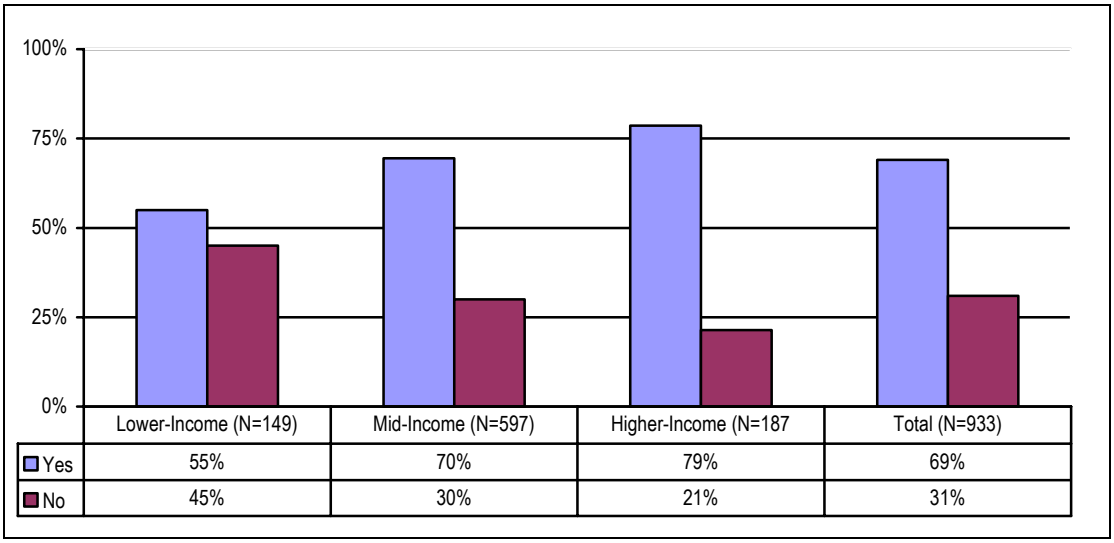
6.5 MNPASS LANE USAGE

Respondents from all income levels use MnPASS. Sixty-nine percent of all income groups among I-394 respondents reported using the MnPASS lanes. While this is true, those in higher-income households are using MnPASS at a higher rate than those in lower-income households. Figure 6.2 includes users who use the MnPASS for free or pay, regardless of mode (SOV, HOV or transit).

FIGURE 6.2: USE OF MNPASS LANES BY HOUSEHOLD INCOME

(Among I-394 Respondents Only)

Have you ever used the MnPASS lanes?



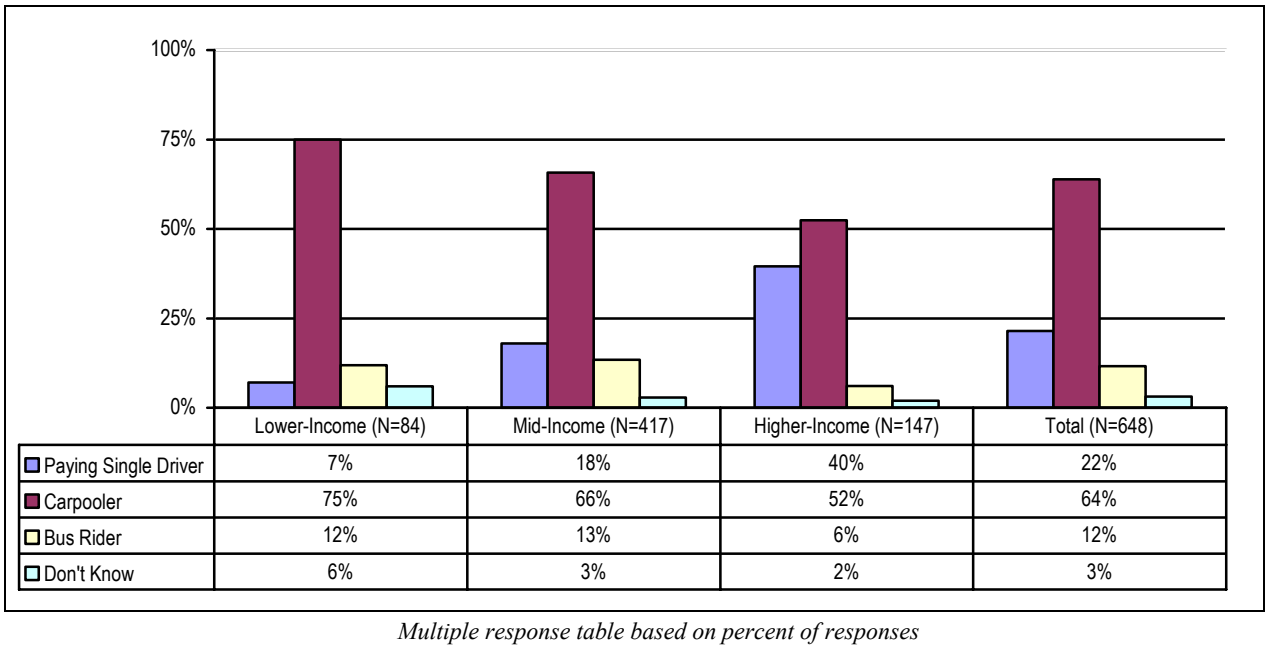
	Lower-Income (N=149)	Mid-Income (N=597)	Higher-Income (N=187	Total (N=933)
Yes	55%	70%	79%	69%
No	45%	30%	21%	31%

Respondents who used the MnPASS lanes were asked if they were a single driver, carpooler, or bus rider when they used the lanes. Significant differences were found as illustrated in Figure 6.3. Whereas 40% of higher-income responses were paying single drivers, only 18% of mid-income and 7% of lower-income responses were paying SOVs. The majority of lower-income responses (75%) were carpoolers.

FIGURE 6.3: MODE OF MNPASS USE BY INCOME

(Among I-394 Respondents Reporting MnPASS use)

When you have used the MnPASS lanes in the past, were you…



	Lower-Income (N=84)	Mid-Income (N=417)	Higher-Income (N=147)	Total (N=648)
Paying Single Driver	7%	18%	40%	22%
Carpooler	75%	66%	52%	64%
Bus Rider	12%	13%	6%	12%
Don't Know	6%	3%	2%	3%

Multiple response table based on percent of responses

6.6 TRAVEL EXPERIENCES OF MNPASS USERS VERSUS NON-USERS

MnPASS lane users reported significantly more trips than non-users (7.88 versus 6.04 trips). Transponder owners averaged 8.66 trips, with a minimum of 1 trip and a maximum of 20. MnPASS lane users actually reported shorter trips, on average, than non-users (14.81 miles versus 15.27 miles). However, travel time in minutes of the reference trip was slightly less for MnPass users, which means that speeds for MnPASS lane users were close to the same as for non-users. Table 6.15 provides further detail.

TABLE 6.15: TRIP CHARACTERISTICS OF MNPASS USERS AND NON-USERS
(All I-394 Respondents)

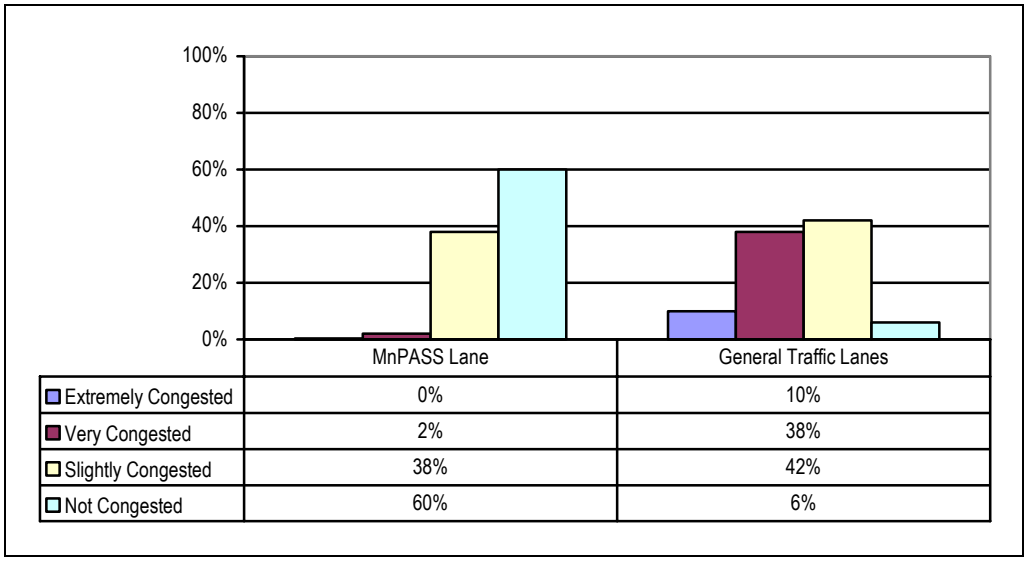
TRIP STATISTIC	MNPASS LANE USER (N=644)	MNPASS LANE NON-USER (N=289)
Total Trips Assigned Week (mean)	7.88	6.04
Total Trips Assigned Week (median)	8.00	5.00
Reference Trip in Miles (mean)	14.81	15.27
Reference Trip in Miles (median)	14.00	13.00
Reference Trip Travel Time (mean)	35.24	36.15
Reference Trip Travel Time (median)	30.00	30.00

At the time of their reference trip travel, almost half of MnPASS lane users (48%) characterized the level of congestion in the general traffic lanes as very congested or extremely congested. About 42% said congestion in the general traffic lanes was slightly congested. About all (98%) described the MnPASS lane as not congested at all, indicating that there were free flow conditions. See Figure 6.4.

FIGURE 6.4: CONGESTION IN MNPASS LANE AND GENERAL TRAFFIC LANES

(I-394 Respondents who Used MnPASS Lane for reference trip, N=276)

How would you describe the level of congestion in the MnPASS / general traffic lanes at the time of your travel?



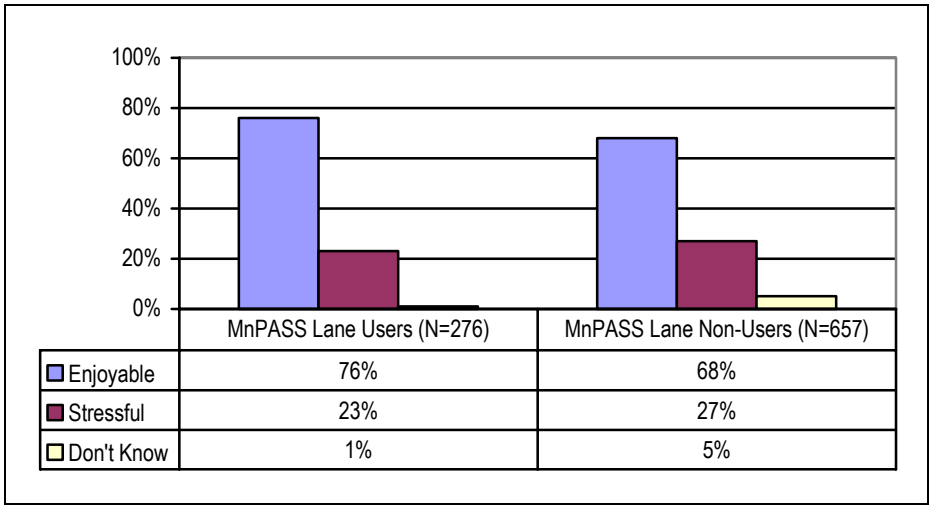
	MnPASS Lane	General Traffic Lanes
Extremely Congested	0%	10%
Very Congested	2%	38%
Slightly Congested	38%	42%
Not Congested	60%	6%

MnPASS lane users were much more likely than non-users to describe their reference trip as "enjoyable" (76% versus 68%, respectively).

FIGURE 6.5: TRAVEL EXPERIENCE FOR REFERENCE TRIP OF MNPASS LANE USERS AND NON-USERS

(All I-394 Respondents)

Which of the following descriptors best captures your travel experience on I-394 at that time?



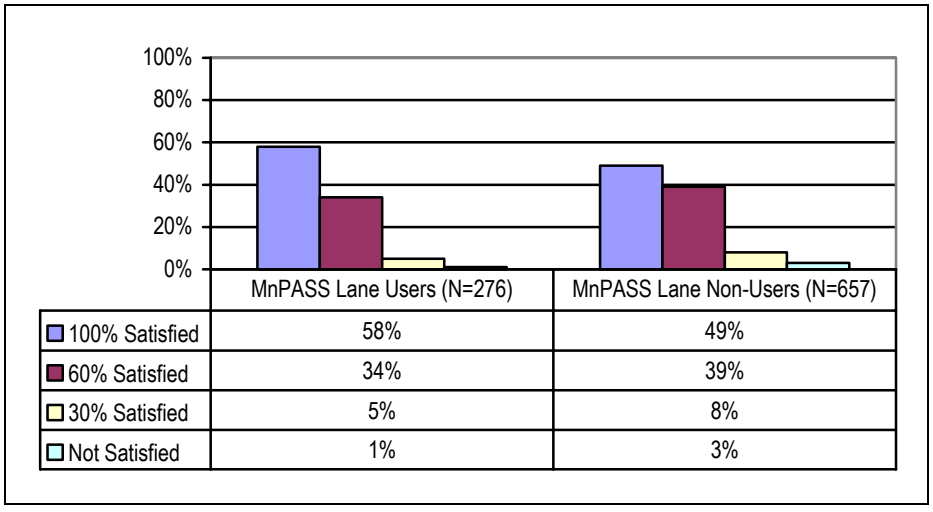
	MnPASS Lane Users (N=276)	MnPASS Lane Non-Users (N=657)
Enjoyable	76%	68%
Stressful	23%	27%
Don't Know	1%	5%

MnPASS lane users were also more satisfied with their trip than were non-users (58% were "100% satisfied" versus 49%, respectively).

FIGURE 6.6: SATISFACTION WITH REFERENCE TRIP

(All I-394 Respondents)

Based on this trip, how satisfied were you with the overall quality of your travel on this roadway?



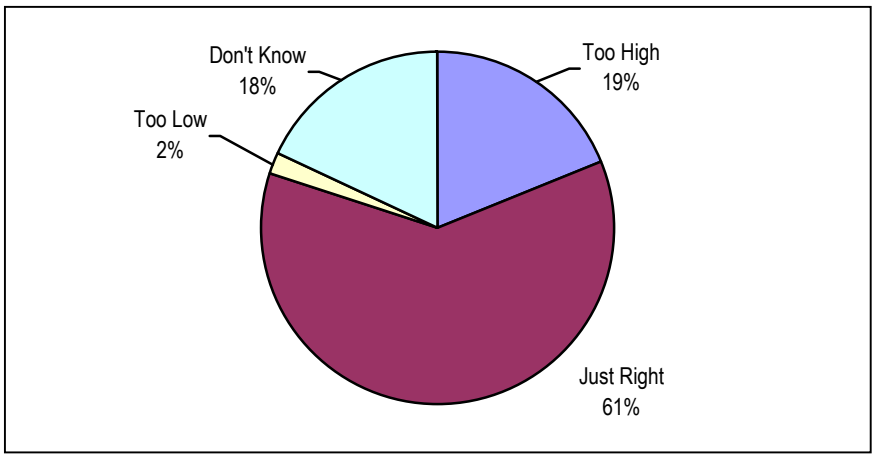
	MnPASS Lane Users (N=276)	MnPASS Lane Non-Users (N=657)
100% Satisfied	58%	49%
60% Satisfied	34%	39%
30% Satisfied	5%	8%
Not Satisfied	1%	3%

As Figure 6.7 shows, some MnPASS lane users considered the MnPASS toll a good value; 61% said the toll paid for their reference trip was just right – neither too high nor too low. Less than 20% perceived the toll as too high.

FIGURE 6.7: PERCEIVED VALUE OF MNPASS TOLL

(I-394 Respondents who Used All or Part of MnPASS Lane for Reference Trip (not as bus rider), N=218)

Given the time saved using the MnPASS lane for this trip, do you think the toll paid was…

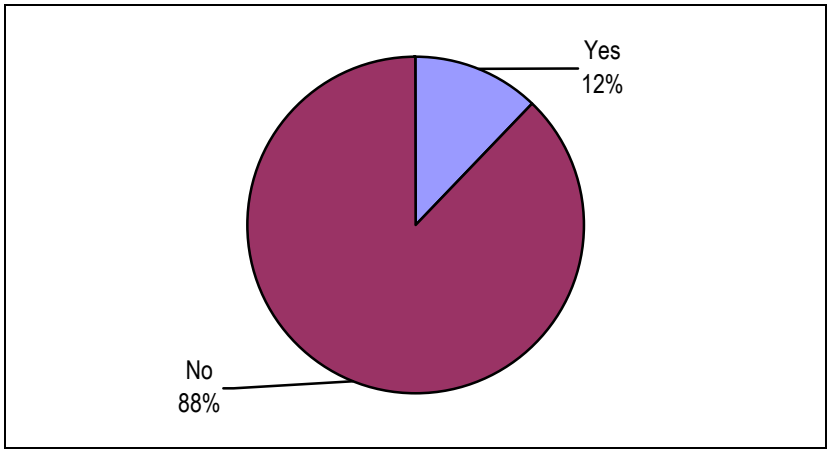


The vast majority of MnPASS lane users (88%) did not experience any problems merging into the MnPASS from the general traffic lane on their reference trip, while 12% experienced problems, as illustrated in Figure 6.8. Of the total sample, 6% identified the problem as congestion; 4% as lanes were confusing; and 3% said they experienced rude drivers.

FIGURE 6.8: MERGING PROBLEMS ON REFERENCE TRIPS

(I-394 Respondents who Used MnPASS Lanes, N=276)

Did you experience any problems in merging into the MnPASS lane from the general traffic lane?



6.7 TRAVEL PROFILES OF TRANSPONDER OWNERS AND TRANSPONDER NON-OWNERS

Does being a transponder owner influence travel behavior? There was a significant difference between transponder owners and non-owners in their trip volumes during the assigned travel week (Monday through Friday). Transponder owners averaged 8.55 trips, with a minimum of 1 trip and a maximum of 20 trips. Transponder non-owners averaged 7.08 trips, with a minimum of 1 trip and a maximum of 20 trips. There is also a significant difference in the number of miles traveled, which was measured in terms of the reference trip. Transponder owners reported a mean distance of 18.90 miles and median distance of 18.00 miles, whereas non-owners reported a mean distance of 14.21 miles and a median distance of 12 miles. Travel time in minutes of the reference trip was virtually the same, which means speeds for transponder owners were 16 mph faster for the mean trip, even though their trip lengths were 33% longer.

TABLE 6.16: MEAN VOLUME OF TRIPS MONDAY - FRIDAY, 6 AM – 9 PM, WAVE 2 ASSIGNED WEEK
(All I-394 Respondents)

How many trips did you make in total?

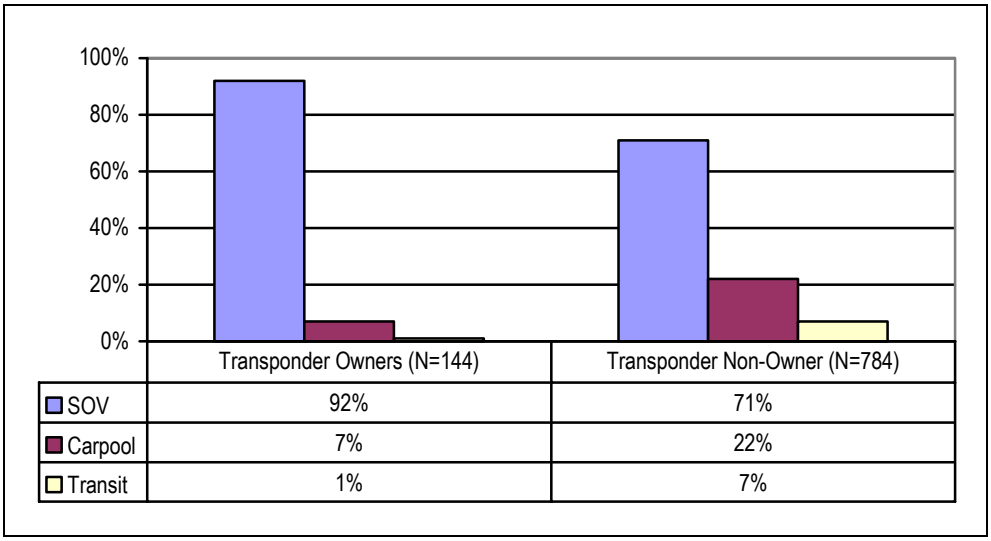
TRIP STATISTIC	TRANSPONDER OWNERS	TRANSPONDER NON-OWNERS
	(N=144)	(N=789)
Total Trips Assigned Week (mean)	8.55	7.08
Total Trips Assigned Week (median)	10.00	6.00
Reference Trip in Miles (mean)	18.90	14.21
Reference Trip in Miles (median)	18.00	12.00
Reference Trip Travel Time (mean)	34.32	35.74
Reference Trip Travel Time (median)	30.00	30.00

Since only SOV users of the MnPASS lane are required to have transponders, the overwhelming majority of transponder owners (92%) were SOV drivers. It is interesting to note, however, that 7% of transponder owners also carpooled, and probably own the transponder for occasions when they need to drive alone.

FIGURE 6.9: USUAL MODE OF TRAVEL MONDAY - FRIDAY, 6 AM – 9 PM, WAVE 2 ASSIGNED WEEK

(All I-394 Respondents reporting reference trips Monday through Friday between 6 AM and 9 PM, N=928)

Now consider all trips you made in both directions. On how many of those trips did you:

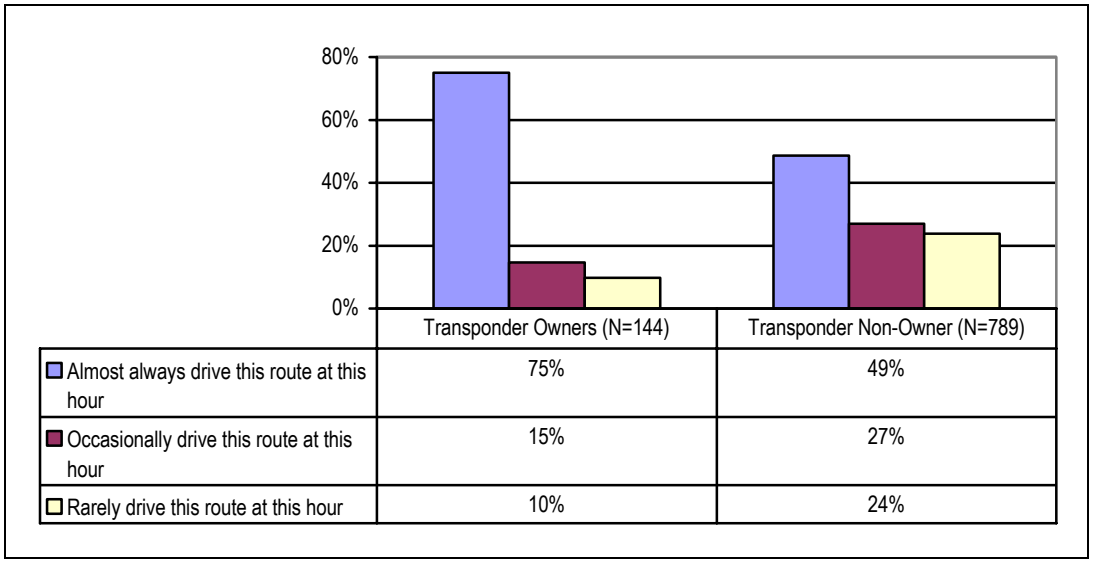


There were significant differences between the two ownership segments in terms of how familiar they were with the traffic conditions at the time of their reference trip. Transponder owners are frequent, regular users of the I-394 corridor. Three-fourths of transponder owners (75%) said they almost always drive this route at this hour (3 or 4 times per week) compared to only 49% of non-owners (see Figure 6.10). There were no differences in the flexibility that transponder owners versus non-owners have in their scheduled arrival times at destinations.

FIGURE 6.10: FAMILIARITY WITH TRAFFIC CONDITIONS RELATED TO REFERENCE TRIP

(All I-394 Respondents, N=933)

How familiar are you with the traffic conditions on the freeway at this time? Would you say you…

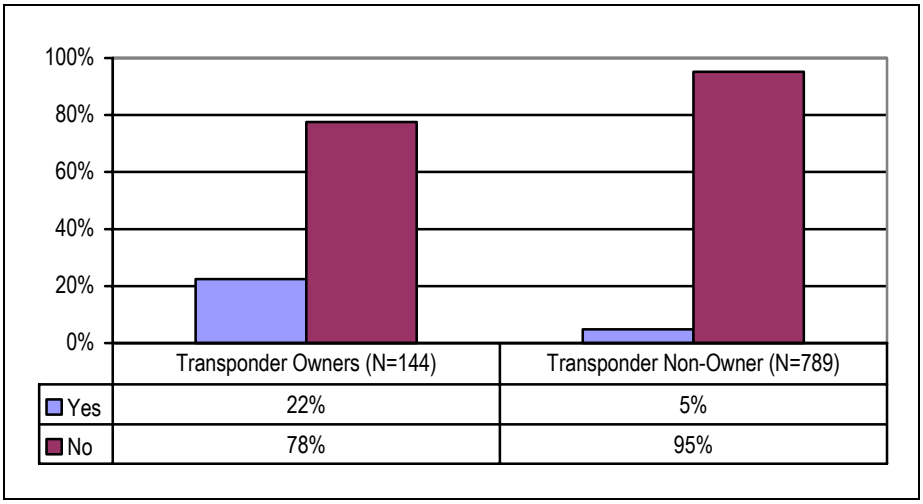


A larger percent of transponder owners reported changes in their typical departure time for their reference trip because of MnPASS (22% versus 5%). This difference is statistically significant. Of those transponder owners who changed their departure time, 81% are leaving later and 19% are leaving earlier. The fact that 78% of transponder owners did not change the time of their trip, compared to 95% for non-owners is an indication that MnPASS affords greater departure flexibility / choice. See Figure 6.11 below.

FIGURE 6.11: CHANGE IN TYPICAL DEPARTURE TIME RELATED TO REFERENCE TRIP

(All I-394 Respondents, N=933)

Have you changed your typical departure time for this trip because of MnPASS?

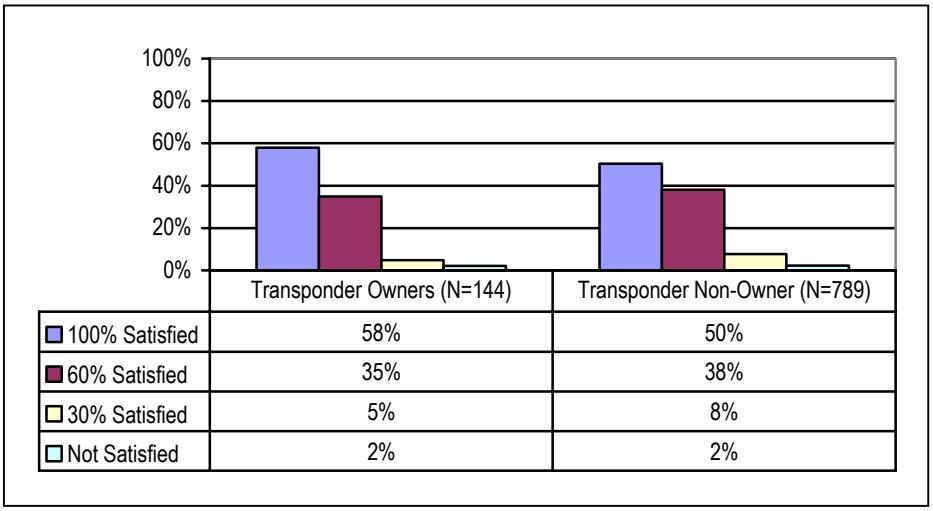


Transponder owners were more likely to report 100% satisfaction with the overall quality of their reference trip than were non-owners (58% versus 50%). Beyond that, there seems to be little difference between owners and non-owners that are 60% and 30% satisfied. Only 2% of transponder owners and transponder non-owners were not satisfied. See Figure 6.12 for further detail.

FIGURE 6.12: SATISFACTION WITH REFERENCE TRIP

(All I-394 Respondents)

Based on this trip, how satisfied were you with the overall quality of your travel on this roadway?



	Transponder Owners (N=144)	Transponder Non-Owner (N=789)
100% Satisfied	58%	50%
60% Satisfied	35%	38%
30% Satisfied	5%	8%
Not Satisfied	2%	2%

7. MnPASS Customer Satisfaction

This chapter examines satisfaction with several different aspects of MnPASS operation among both paying and non-paying MnPASS lane users.

7.1 Demographic Profiles of Transponder Owners

The MnPASS lanes can be used for free by carpoolers and transit riders. Drivers of single occupancy vehicles (SOVs) can use the MnPASS lanes by paying a fee. The fee is assessed through a transponder placed on the windshield of the vehicle. The following two tables (7.1 and 7.2) present demographic profiles (person and household) of transponder owners[15], and the table row percentages sum up to 100%.

Transponder owners were more strongly represented among respondents with a higher educational attainment and those who were employed full-time. Transponder owners were between 35 and 54 years of age. The sample included very few people representing racial or ethnic minorities. Still, it appears that transponder owners were more likely to be White than Non-White. About the same percentages of males as females reported owning transponders. In terms of household characteristics, transponder owners resided in higher-income households, as well larger households and those with multiple vehicles.

Table 7.1: Transponder Ownership[16] by Person Characteristics

(Among I-394 Respondents Only)

Person Characteristic	Transponder Ownership		Total
	Yes	No	
Educational Attainment			
High School or Less	5%	95%	74 (100%)
Some College / Trade	9%	91%	171 (100%)
Graduated College	15%	85%	385 (100%)
Graduate Work	21%	79%	303 (100%)
Employment Status			
Full-time	19%	81%	664 (100%)
Part-time	8%	92%	109 (100%)
Retired	4%	96%	117 (100%)
Other / Disabled / Unemployed	5%	95%	43 (100%)
Type of Employment			
Part-Time	8%	92%	109 (100%)
Full-time	19%	81%	664 (100%)
Age			
18-34	10%	90%	10 (100%)
25-34	11%	89%	100 (100%)

[15] The tables in this section include all I-394 respondents (i.e., panel members, MnPASS subscribers, transit users and new I-394 sample). This base was chosen to ensure robust numbers for the analysis. Six percent of panel members were transponder owners.

[16] Transponder ownership was defined as "yes" to the question, "Are you a MnPASS subscriber?" or "yes, and decided to purchase one" to the question "Have you considered purchasing a transponder?" or respondents sampled from the MnPASS subscriber list.

PERSON CHARACTERISTIC	TRANSPONDER OWNERSHIP		TOTAL
35-44	21%	79%	205 (100%)
45-54	19%	81%	287 (100%)
55-64	15%	85%	201 (100%)
65+	4%	96%	129(100%)
Race / Ethnicity			
White / Caucasian	16%	84%	871 (100%)
Non-White / Minority	11%	89%	62 (100%)
Gender			
Male	16%	84%	533 (100%)
Female	15%	85%	400 (100%)

TABLE 7.2: TRANSPONDER OWNERSHIP BY HOUSEHOLD CHARACTERISTICS

(Among I-394 Respondents Only)

HOUSEHOLD CHARACTERISTIC	TRANSPONDER OWNERSHIP		TOTAL
	YES	NO	
Household Income			
Lower-Income	4%	96%	149 (100%)
Mid-Income	12%	88%	597 (100%)
Higher-Income	34%	66%	187 (100%)
Household Size			
One-person	9%	91%	161 (100%)
Two-person	15%	85%	344 (100%)
Three-person	20%	80%	145 (100%)
Four+ person	17%	83%	282 (100%)
Vehicles Available			
Zero	0%	100%	6 (100%)
One	6%	94%	198 (100%)
Two	17%	83%	485 (100%)
Three+	20%	80%	244 (100%)

7.2 SATISFACTION WITH MNPASS OPERATIONS BY TRANSPONDER OWNERSHIP

Levels of satisfaction regarding certain aspects of MnPASS operation were compared for respondents who own transponders and respondents that do not own transponders. As shown in Table 7.3, overall, MnPASS subscribers were most satisfied with the speed of traffic flow in the MnPASS lanes (94% satisfied). Almost 90% of non-subscribers were also satisfied with this aspect of MnPASS. Less than 1 of 10 subscribers or non-subscribers were dissatisfied.

TABLE 7.3: SATISFACTION WITH THE SPEED OF TRAFFIC FLOW IN THE MNPASS LANES

LEVEL OF SATISFACTION	TRANSPONDER OWNER			
	YES		NO	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT
Satisfied	134	94%	446	89%
Very satisfied	86	60%	279	56%
Somewhat satisfied	48	34%	167	33%
Dissatisfied	9	6%	41	8%
Very dissatisfied	2	1%	14	3%
Somewhat dissatisfied	7	5%	27	5%
No opinion	0	0%	10	2%
Don't Know / Refuse	0	0%	8	1%
Total	**143**	**100%**	**505**	**100%**

MnPASS subscribers were also satisfied with the ease of identifying the MnPASS entry points (91% of subscribers satisfied), with more than two thirds (67%) very satisfied, as shown in Table 7.4. Eighty two percent of non-subscribers were satisfied. Less than one of ten subscribers and two of ten non-subscribers were dissatisfied with this aspect of MnPASS operations.

TABLE 7.4: SATISFACTION WITH EASE OF IDENTIFYING THE MNPASS ENTRY POINTS

LEVEL OF SATISFACTION	TRANSPONDER OWNER			
	YES		NO	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT
Satisfied	130	91%	413	82%
Very satisfied	96	67%	213	42%
Somewhat satisfied	34	24%	200	40%
Dissatisfied	13	9%	75	15%
Very dissatisfied	5	4%	25	5%
Somewhat dissatisfied	8	6%	50	10%
No opinion	0	0%	8	2%
Don't Know / Refuse	0	0%	9	2%
Total	**143**	**100%**	**505**	**100%**

More than three-fourths (78%) of subscribers were satisfied with the safety of merging into the MnPASS lanes. Seven of ten non-subscribers were satisfied with this aspect of MnPASS, with slightly less than one-fourth (24%) dissatisfied. Table 7.5 provides further detail.

TABLE 7.5: SATISFACTION WITH THE SAFETY OF MERGING INTO THE MNPASS LANES

LEVEL OF SATISFACTION	TRANSPONDER OWNER			
	YES		NO	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT
Satisfied	112	78%	358	71%
Very satisfied	54	37%	143	29%
Somewhat satisfied	58	41%	215	43%
Dissatisfied	31	22%	119	24%
Very dissatisfied	12	9%	48	10%
Somewhat dissatisfied	19	13%	71	14%
No opinion	0	0%	18	4%
Don't Know / Refuse	0	0%	10	2%
Total	**143**	**100%**	**505**	**100%**

As seen in Table 7.6 below, the enforcement of MnPASS usage was least satisfying to subscribers and non-subscribers alike (64% satisfaction with subscribers and 48% satisfaction with non-subscribers). Nineteen percent of subscribers and 15% of non-subscribers were dissatisfied. Slightly less than one fifth of subscribers (17%) and more than one third of non-subscribers (37%) either had no opinion or refused to provide an answer.

TABLE 7.6: SATISFACTION WITH THE ENFORCEMENT OF MNPASS USAGE

LEVEL OF SATISFACTION	TRANSPONDER OWNER			
	YES		NO	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT
Satisfied	91	64%	243	48%
Very satisfied	48	34%	106	21%
Somewhat satisfied	43	30%	137	27%
Dissatisfied	27	19%	72	15%
Very dissatisfied	9	6%	23	5%
Somewhat dissatisfied	18	13%	49	10%
No opinion	16	11%	113	22%
Don't Know / Refuse	9	6%	77	15%
Total	**143**	**100%**	**505**	**100%**

7.3 SATISFACTION WITH MNPASS OPERATIONS AMONG ALL PAYING MNPASS USERS

As indicated in Table 7.7, overall satisfaction levels with MnPASS electronic operations were high among respondents who used the MnPASS lanes as a paying single driver (SOV, N=163). About 9 of 10 (87%) reported being very satisfied. Paying users had the highest levels of satisfaction with the all-electronic operation of the tolls and the lowest with the staff at the customer service center.[17]

TABLE 7.7: SATISFACTION WITH ALL ELECTRONIC OPERATIONS

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	151	93%
Very satisfied	141	87%
Somewhat satisfied	10	6%
Dissatisfied	0	0%
Very dissatisfied	0	0%
Somewhat dissatisfied	0	0%
Don't Know / Refuse	12	7%
Total	**163**	**100%**

Paying MnPASS users were also satisfied with the ability to use their credit card to automatically replenish their account, with 70% very satisfied and 17% somewhat satisfied. Only 2% expressed dissatisfaction. See Table 7.8 for further detail.

TABLE 7.8: SATISFACTION WITH USING CREDIT CARD TO AUTOMATICALLY REPLENISH ACCOUNT

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	142	87%
Very satisfied	115	70%
Somewhat satisfied	27	17%
Dissatisfied	3	2%
Very dissatisfied	1	1%
Somewhat dissatisfied	2	1%
Don't Know / Refuse	18	11%
Total	**163**	**100%**

[17] Due to the high percentage of respondents that answered "Don't Know" to this question, it is expected that not many respondents have actually visited the customer service center. Only 2% said they were dissatisfied. Furthermore, it should be noted that the customer service center manages almost all accounts and inquiries online. There are very few walk-ins, which may explain the high levels of respondents that report Don't Know or Refuse.

Among paying MnPASS users, there was relatively high satisfaction with the ease of opening a pre-paid MnPASS account; 70% were very satisfied and 13% somewhat satisfied. See Table 7.9 for further detail.

TABLE 7.9: SATISFACTION WITH THE EASE OF OPENING A PRE-PAID MNPASS ACCOUNT

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	135	83%
Very satisfied	114	70%
Somewhat satisfied	21	13%
Dissatisfied	3	2%
Very dissatisfied	2	1%
Somewhat dissatisfied	1	1%
Don't Know / Refuse	25	15%
Total	**163**	**100%**

As shown in Table 7.10, more than 80% of respondents expressed satisfaction with the ease of installing the MnPASS transponder, with approximately two-thirds (65%) being very satisfied. Four percent were dissatisfied, and 13% did not know or refused to provide an answer.

TABLE 7.10: SATISFACTION WITH THE EASE OF INSTALLING THE MNPASS TRANSPONDER

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	135	83%
Very satisfied	106	65%
Somewhat satisfied	29	18%
Dissatisfied	6	4%
Very dissatisfied	4	3%
Somewhat dissatisfied	2	1%
Don't Know / Refuse	22	13%
Total	**163**	**100%**

Eight of 10 paying MnPASS users were satisfied with the clarity of prices on overhead signs, with more than half (57%) being very satisfied. Sixteen percent were dissatisfied. See Table 7.11.

TABLE 7.11: SATISFACTION WITH THE CLARITY OF PRICES ON OVERHEAD SIGNS

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	131	80%
Very satisfied	93	57%
Somewhat satisfied	38	23%
Dissatisfied	26	16%
Very dissatisfied	9	6%
Somewhat dissatisfied	17	10%
Don't Know / Refuse	6	4%
Total	**163**	**100%**

Table 7.12 shows that two-thirds (65%) of paying MnPASS users were satisfied with the varying toll amounts that fluctuate with traffic levels, with slightly less than one quarter (23%) being very satisfied. Nearly 30% were dissatisfied and 6% did not know or refused to provide an answer.

TABLE 7.12: SATISFACTION WITH THE TOLL AMOUNTS THAT VARY WITH TRAFFIC LEVELS

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	107	65%
Very satisfied	38	23%
Somewhat satisfied	69	42%
Dissatisfied	47	29%
Very dissatisfied	17	10%
Somewhat dissatisfied	30	19%
Don't Know / Refuse	9	6%
Total	**163**	**100%**

Nearly two-thirds (62%) of paying MnPASS users were satisfied with the MnPASS website, with 37% being very satisfied. Five percent were dissatisfied. One-third did not know or refused to provide an answer, suggesting they had not accessed the website. Table 7.13 shows additional detail.

TABLE 7.13: SATISFACTION WITH THE MNPASS WEBSITE

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	102	62%
Very satisfied	61	37%
Somewhat satisfied	41	25%
Dissatisfied	8	5%
Very dissatisfied	1	1%
Somewhat dissatisfied	7	4%
Don't Know / Refuse	53	33%
Total	**163**	**100%**

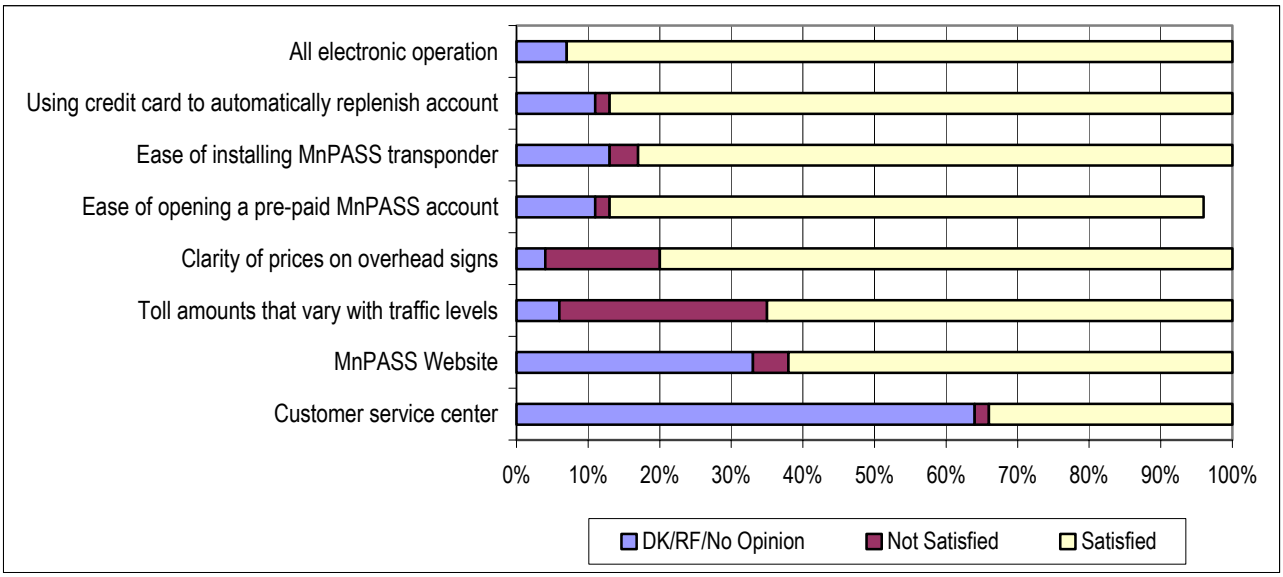
The majority (64%) of paying MnPASS users were not familiar with or did not provide their opinion about the customer service center staff, expressing lack of knowledge about the center. Of those with an opinion acknowledging contact with the center, virtually all were satisfied. See Table 7.14.

TABLE 7.14: SATISFACTION WITH THE STAFF AT THE CUSTOMER SERVICE CENTER

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	57	34%
Very satisfied	43	25%
Somewhat satisfied	14	9%
Dissatisfied	2	2%
Very dissatisfied	1	1%
Somewhat dissatisfied	1	1%
Don't Know / Refuse	104	64%
Total	**163**	**100%**

Figure 7.1 below provides a summary of tables 7.7 through 7.14.

FIGURE 7.1: COMPARISON OF SATISFACTION LEVELS FOR VARIOUS MNPASS ASPECTS AMONG PAYING MNPASS USERS



7.4 SATISFACTION WITH MNPASS OPERATIONS AMONG ALL MNPASS LANE USERS

MnPASS users[18], regardless of whether they were paying users or not, were satisfied with MnPASS operations. Of all MnPASS aspects about which they were asked to provide their level of satisfaction, the speed of traffic flow in the MnPASS lane gained the highest satisfaction rating (88% satisfaction). The enforcement of MnPASS usage had the lowest satisfaction (50%; refer to Table 4.12).

Nearly 9 of 10 (88%) respondents were satisfied with the speed of traffic flow in the MnPASS lanes, with half (55%) being very satisfied a seen in Table 7.15 below. Less than one-tenth (8%) were dissatisfied, 2% had no opinion, and 2% did not know or refused to provide an answer.

TABLE 7.15: SATISFACTION WITH THE SPEED OF TRAFFIC FLOW IN THE MNPASS

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	623	88%
Very satisfied	390	55%
Somewhat satisfied	233	33%
Dissatisfied	55	8%
Very dissatisfied	17	2%
Somewhat dissatisfied	38	5%
No opinion	17	2%
Don't Know / Refuse	9	2%
Total	**704**	**100%**

[18] These 704 MnPASS users reported trips in the MnPASS lane during their reference trip week (N=359) or users who reported using MnPASS sometime in the past, but not during their reference trip week (N=345).

More than 8 of 10 (83%) respondents were satisfied with the ease of identifying the MnPASS entry points, with (46%) very satisfied. Less than one-fifth (14%) were dissatisfied, 2% had no opinion, and 1% did not know or refused to provide an answer. See Table 7.16 for further detail.

TABLE 7.16: SATISFACTION WITH EASE OF IDENTIFYING THE MNPASS ENTRY POINTS

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	581	83%
Very satisfied	324	46%
Somewhat satisfied	257	37%
Dissatisfied	97	14%
Very dissatisfied	30	4%
Somewhat dissatisfied	67	10%
No opinion	14	2%
Don't Know / Refuse	12	1%
Total	**704**	**100%**

Most respondents (72%) were satisfied with the safety of merging into the MnPASS lanes, with almost one-third (30%) being very satisfied. But slightly more than one fifth (22%) were dissatisfied. Four percent had no opinion and 2% refused to provide an answer. See Table 7.17 for further detail.

TABLE 7.17: SATISFACTION WITH THE SAFETY OF MERGING INTO THE MNPASS LANES

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	510	72%
Very satisfied	214	30%
Somewhat satisfied	296	42%
Dissatisfied	154	22%
Very dissatisfied	61	9%
Somewhat dissatisfied	93	13%
No opinion	27	4%
Don't Know / Refuse	13	2%
Total	**704**	**100%**

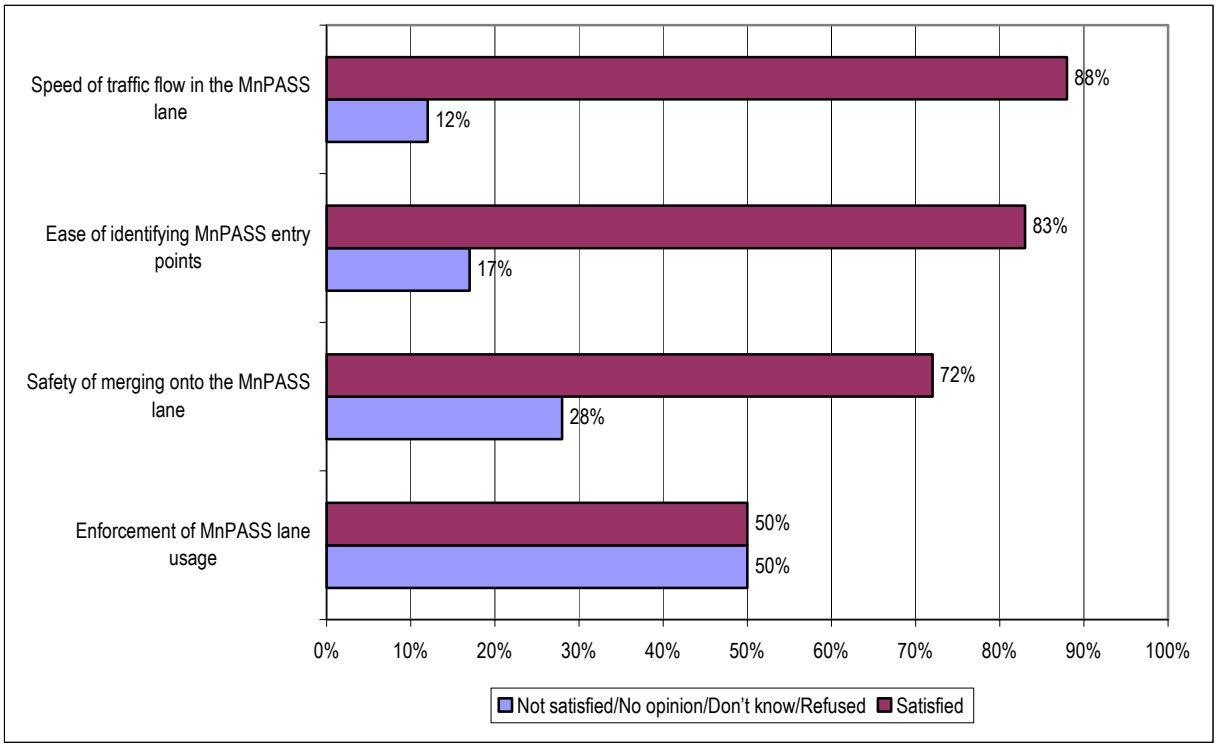
Half of respondents were somewhat (27%) or very (23%) satisfied with the enforcement of MnPASS usage. Fifteen percent were dissatisfied. A large percentage either had no opinion (21%) or did not know or refused to provide an answer (14%). See Table 7.18 for further detail.

TABLE 7.18: SATISFACTION WITH THE ENFORCEMENT OF MNPASS USAGE

LEVEL OF SATISFACTION	FREQUENCY	PERCENT
Satisfied	348	50%
Very satisfied	161	23%
Somewhat satisfied	187	27%
Dissatisfied	109	15%
Very dissatisfied	37	5%
Somewhat dissatisfied	72	10%
No opinion	145	21%
Don't Know / Refuse	102	14%
Total	**704**	**100%**

Figure 7.2 below provides summary of tables 7.15 through 7.18.

FIGURE 7.2: COMPARISON OF SATISFACTION LEVELS FOR VARIOUS MNPASS ASPECTS AMONG ALL MNPASS USERS



8. SOCIAL EQUITY ISSUES

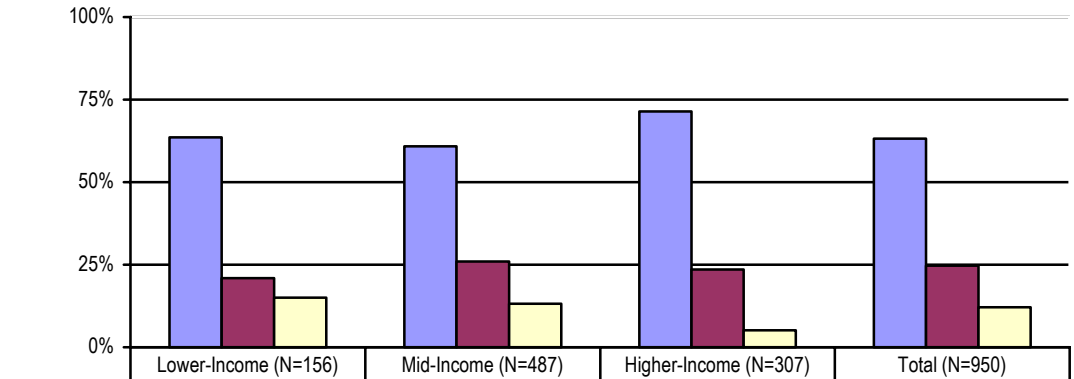
There is extensive academic literature on the subject of social equity, but it is best expressed in everyday language in terms of 'fairness.' In the case of road user charging, this translates to questions of whether the tolling operation is regarded as having a disproportionate impact on some groups relative to others. This section examines social equity issues relative to opinions about current traveling experiences, attitudes about MnPASS tolling operations, and use of MnPASS lanes relative to differences in income, education, employment status, gender, age, and ethnicity.[19]

8.1 MNPASS ACCEPTANCE

A majority of respondents in all income groups responded positively to the idea of allowing SOV drivers to use carpool lanes by paying a toll, as illustrated in Figure 8.1. At the same time, acceptance was greater among the higher-income respondents (71%), than among lower-income (64%) or mid-income (61%) respondents. [20] There were no significant differences across the income groups in terms of negative response to the concept. About one-fourth of each income group thought this concept was a bad idea (26% of mid-income, 24% of lower-income, and 21% of higher-income).

FIGURE 8.1: OPINION ON ALLOWING SINGLE DRIVERS TO USE CARPOOL LANES BY HOUSEHOLD INCOME

What do you think of allowing single drivers to use the carpool lanes by paying a toll? Is it…



	Lower-Income (N=156)	Mid-Income (N=487)	Higher-Income (N=307)	Total (N=950)
Good Idea	64%	61%	71%	63%
Bad Idea	21%	26%	24%	25%
No Opinion	15%	13%	5%	12%

[19] Many of the tables presented in this section report results by income. About 16% of respondents did not report their household income. For this reason, we have imputed income for missing records using the hot deck approach. For an explanation of hot deck imputation, refer to http://stats.oecd.org/glossary/detail.asp?ID=3379.

[20] The lower-income group represents respondents reporting total household income less than $50,000, mid-income $50,000 to $124,999, and higher-income greater than $125,000. These breaks were determined based on the income category breaks used in the survey instrument (see Appendix C) combined with the 1999 median household income levels for the 170 sampled census tracts for the I-394 corridor. Median incomes for these 170 sampled census tracts for the I-394 corridor ranged from $14,000 to $114,000.

Table 8.1 shows there were slight differences by income in the reasons given by respondents for their positive responses on questions pertaining to MnPASS tolling operations. Mid and higher-income respondents were more likely to say that MnPASS provides a better use for the carpool lane than were lower-income respondents. That MnPASS eases congestion and receives payment only from users, not everyone, were slightly more salient factors for lower and mid-income households than those in the higher-income group. Otherwise, the resulting rank order of reasons for supporting MnPASS were consistent across income groups.

TABLE 8.1: REASONS "GOOD IDEA" BY HOUSEHOLD INCOME

(Among Respondents who Thought Allowing Single Drivers to Pay a Toll to Use the Carpool Lane Was a Good Idea)

Why do you feel this way? ***(Multiple response table based on percent of responses.)***

	LOWER-INCOME	MID-INCOME	HIGHER-INCOME	TOTAL
It provides a better use for carpool lanes	14%	18%	21%	18%
Adds capacity to roadway	4%	7%	6%	6%
Saves time for busy people	11%	11%	14%	11%
Only users pay, not everyone	16%	16%	10%	15%
Time is money for some people	12%	10%	16%	12%
Eases congestion	28%	26%	21%	25%
Tolls are used during peak hours only	1%	1%	1%	1%
Use of carpool lanes not encouraged enough	4%	2%	3%	2%
Creates revenue	5%	6%	5%	5%
Provides another transportation option	0%	1%	1%	1%
Increases safety	1%	0%	1%	0%
Conserves fuel	1%	1%	0%	1%
Other	3%	1%	1%	3%
Total %	**100%**	**100%**	**100%**	**100%**
Total Number	**172**	**689**	**215**	**1076**

There were also slight differences among household income groups in opinions about why the MnPASS concept was a bad idea, as shown in Table 8.2. Interestingly, all income groups held a relatively similar level of agreement that the MnPASS concept only benefits the rich. This pattern was similar among those who thought MnPASS should be free to all. A much higher percentage of respondents in the higher-income group felt carpool lanes were not encouraged enough compared with those in lower-income groups. Conversely, a much higher percent of lower-income groups thought the MnPASS concept was unfair when compared with the percent of those in the higher-income group who held the same opinion.

TABLE 8.2: REASONS "BAD IDEA" BY HOUSEHOLD INCOME

(Among Respondents who Thought Allowing Single Drivers to Pay a Toll to Use the Carpool Lane Was a Bad Idea)

Why do you feel this way?

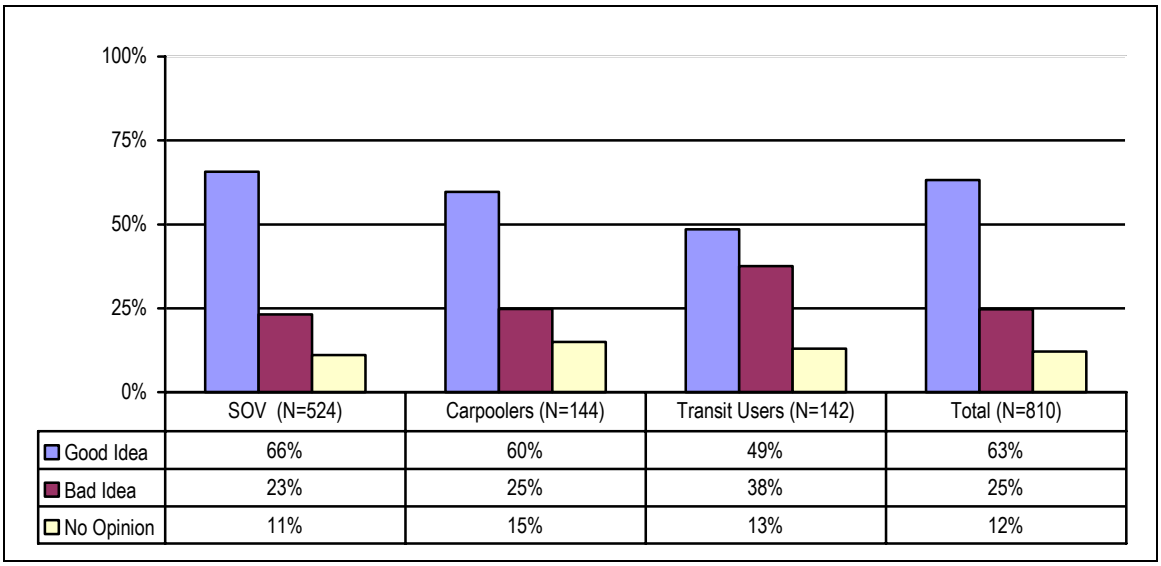
(Multiple response table based on percent of responses. Percents do not total 100 due to rounding.)

	LOWER-INCOME	MID-INCOME	HIGHER-INCOME	TOTAL
Only benefits the rich	11%	12%	13%	12%
Carpool lanes should be free to all	11%	10%	12%	10%
Inefficient	5%	7%	10%	7%
Carpool lanes should only be open to carpoolers	11%	10%	12%	10%
Use of carpool lanes not encouraged enough	8%	16%	21%	16%
Gives too much money to MnDOT	8%	4%	1%	4%
Bad for environment	0%	3%	5%	3%
Will not work	5%	4%	0%	4%
Roads are already paid for	11%	8%	10%	9%
Delays roadway improvements for all	2%	2%	1%	2%
Makes level of service worse in carpool lane	2%	4%	3%	4%
Increases bureaucracy	3%	3%	3%	3%
Unfair	16%	7%	1%	7.4%
Too confusing for people	3%	0%	0%	1%
Adds capacity to the roads	2%	1%	0%	1%
Better use of carpool lanes	2%	2%	3%	2%
Did not improve congestion	0%	1%	1%	1%
Would prefer public transportation	0%	0%	1%	0%
Opposes tolls	0%	1%	0%	0%
Other	6%	5%	3%	4%
Total%	**100%**	**100%**	**100%**	**100%**
Total Number	**64**	**331**	**77**	**472**

When MnPASS acceptance was examined by respondents' usual commute mode, significant differences were observed. MnPASS acceptance is highest among SOV drivers (66%) and lowest among transit users (49%). Yet, acceptance among carpoolers was also high (60%). Roughly two in five transit users (38%) thought allowing paying single drivers to use carpool lanes was a bad idea compared to 25% of carpoolers and 23% of SOV drivers. At the same time, a larger percent of carpoolers had no opinion on this issue than other groups. See Figure 8.2 for further detail.

FIGURE 8.2: OPINION ON ALLOWING SINGLE DRIVERS TO USE CARPOOL LANES BY USUAL TRAVEL MODE

What do you think of allowing single drivers to use the carpool lanes by paying a toll? Is it…



	SOV (N=524)	Carpoolers (N=144)	Transit Users (N=142)	Total (N=810)
Good Idea	66%	60%	49%	63%
Bad Idea	23%	25%	38%	25%
No Opinion	11%	15%	13%	12%

Opinions about why the single paying driver concept was a good idea did not differ significantly by usual travel mode. Transit users' most frequent response, like users of other modes, was that MnPASS eases congestion. Transit users were slightly more likely to respond that MnPASS would create more revenue. On the other hand, carpoolers were more likely than users of other modes to respond that only users pay, not everyone. Both carpoolers and SOV drivers seemed supportive of the idea that the MnPASS concept would provide a better use of the carpool lane. See Table 8.3 for further detail.

TABLE 8.3: REASONS "GOOD IDEA" BY USUAL TRAVEL MODE

(Among Respondents who Thought Allowing Single Drivers to Pay a Toll to Use the Carpool Lane Was a Good Idea)

Why do you feel this way? ***(Multiple response table based on percent of responses.)***

	SOV	CARPOOLERS	TRANSIT	TOTAL
It provides a better use for carpool lanes	18%	19%	15%	18%
Adds capacity to roadway	6%	4%	10%	6%
Saves time for busy people	12%	9%	5%	11%
Only users pay, not everyone	15%	16%	13%	15%
Time is money for some people	12%	10%	5%	12%
Eases congestion	25%	28%	27%	25%
Tolls only during peak hours	2%	3%	3%	2%
Use of carpool lanes not encouraged enough	2%	2%	2%	2%
Creates Revenue	5%	6%	13%	5%
Provides another transportation option	1%	0%	2%	1%
Increases safety	0%	0%	0%	0%
Conserves fuel	1%	0%	0%	1%
Other	1%	3%	5%	2%
Total %	**100%**	**100%**	**100%**	**100%**
Total Number	**829**	**187**	**60**	**1076**

There were significant differences by usual travel mode in the reasons cited by respondents who thought the MnPASS concept was a bad idea. SOV drivers and carpoolers were much more likely than transit users to respond that carpool lanes should be free to all, whereas transit users were more likely to suggest that the use of carpool lanes was not encouraged enough. They were also more likely to suggest that the MnPASS concept only benefited the rich. SOV drivers and carpoolers were more likely than transit users to respond that roads were already paid for. See Table 8.4 for further detail.

TABLE 8.4: REASONS "BAD IDEA" BY USUAL TRAVEL MODE

(Among Respondents who Thought Allowing Single Drivers to Pay a Toll to Use the Carpool Lane Was a Bad Idea)

Why do you feel this way? ***(Multiple response table based on percent of responses.)***

	SOV	CARPOOLERS	TRANSIT	TOTAL
Only benefits the rich	11%	11%	17%	12%
Carpool lanes should be free to all	15%	7%	2%	11%
Inefficient	8%	6%	7%	7%
Carpool lanes should only be for carpools	8%	12%	14%	9%
Use of carpool lanes not encouraged enough	13%	16%	31%	16%
Gives too much money to MnDOT	5%	3%	2%	4%
Bad for environment	3%	4%	3%	3%
Roads are already paid for	10%	8%	2%	9%
Will not work	2%	7%	2%	3%
Delays roadway improvements for all	2%	3%	2%	2%
Makes level of service worse in carpool lane	3%	6%	3%	4%
Increases bureaucracy	3%	5%	2%	3%
Unfair	7%	8%	9%	7%
Too confusing for people	1%	0%	2%	1%
Better use of carpool lanes	2%	3%	0%	2%
Adds capacity to roadways	1%	1%	0%	1%
Did not improve congestion	1%	0%	0%	0%
Would prefer public transportation	0%	1%	0%	0%
Opposes tolls	1%	0%	0%	0%
Other	4%	2%	2%	6%
Total%	**100%**	**100%**	**100%**	**100%**
Total Number	**310**	**104**	**58**	**472**

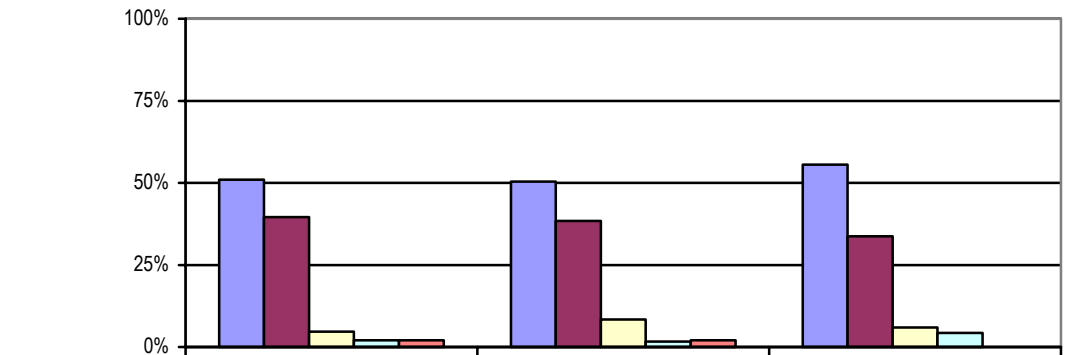
8.2 SATISFACTION WITH CURRENT TRAVEL EXPERIENCES

The majority of respondents, regardless of their income level, were satisfied with the quality of travel on the roadway used for their reference trip.[21] See Figure 8.3 for further detail.

FIGURE 8.3: SATISFACTION WITH QUALITY OF REFERENCE TRIP BY HOUSEHOLD INCOME

(Among I-394 Respondents Only)

Based on this trip, how satisfied were you with the overall quality of your travel on this roadway?



	Lower-Income (N=83)	Mid-Income (N=294)	Higher-Income (N=236)
100% Satisfied	51%	50%	56%
60% Satisfied	40%	38%	34%
30% Satisfied	5%	8%	6%
Not Satisfied at All	2%	2%	4%
Don't Know	2%	2%	0%

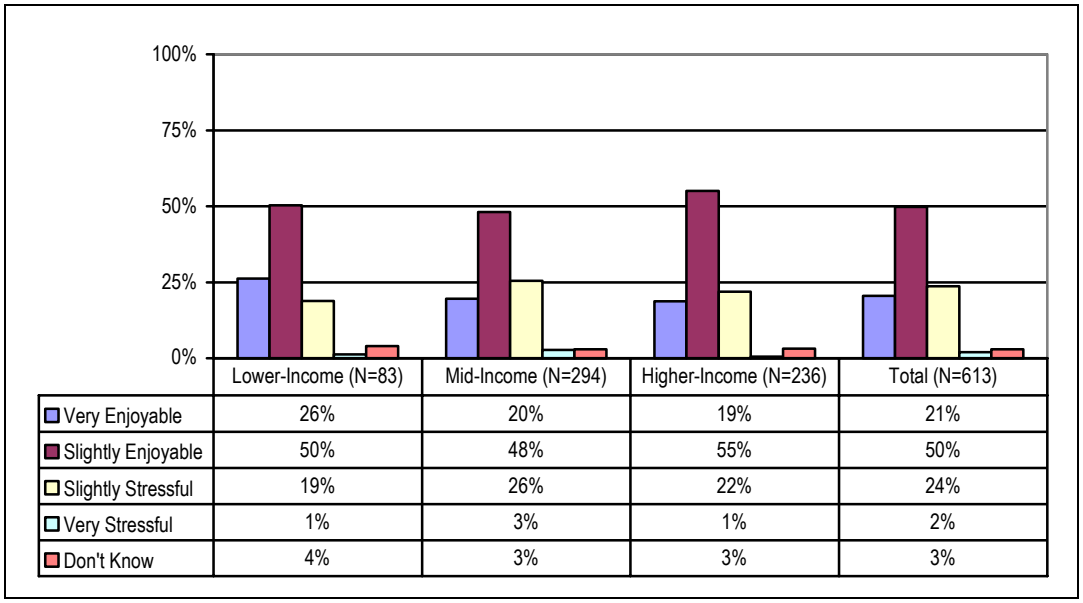
Across all income levels, the majority of respondents reported that their reference trip was more enjoyable than stressful. Overall, lower-income respondents reported the least stressful trips. Only a small percentage of I-394 respondents (ranging from 1% to 3%) found the trip very stressful. See Figure 8.4 on the following page for further detail.

[21] Reference trip was defined as the most recent trip on I-394 that either matched their Wave 1 trip (in the case of the panel sample) or was a commute trip in the case of respondents sampled from the transit user or MnPASS subscriber lists. These trips were recorded in Travel Logs and subsequently reported to the telephone interviewers.

FIGURE 8.4: OPINION ON REFERENCE TRIP EXPERIENCE BY HOUSEHOLD INCOME

(Among I-394 Respondents Only)

Which of the following descriptors best captures your travel experience on this trip?



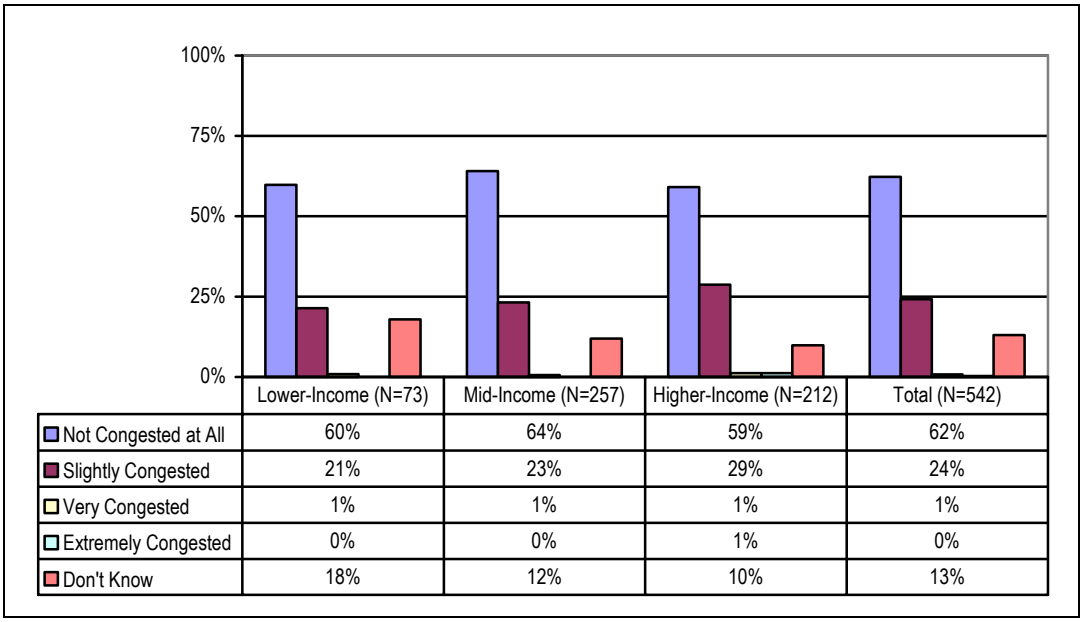
	Lower-Income (N=83)	Mid-Income (N=294)	Higher-Income (N=236)	Total (N=613)
Very Enjoyable	26%	20%	19%	21%
Slightly Enjoyable	50%	48%	55%	50%
Slightly Stressful	19%	26%	22%	24%
Very Stressful	1%	3%	1%	2%
Don't Know	4%	3%	3%	3%

Travelers at all income levels made a distinction between their travel experience with MnPASS and the general traffic lanes. Travelers found the general traffic lanes to be more congested than MnPASS lanes, as indicated in the following two figures - 8.5 and 8.6.

FIGURE 8.5: OPINION ON CONGESTION IN MNPASS LANES DURING REFERENCE TRIP BY HOUSEHOLD INCOME

(Among I-394 Respondents Only)

How would you describe the level of congestion in the MnPASS lane at the time of your travel?

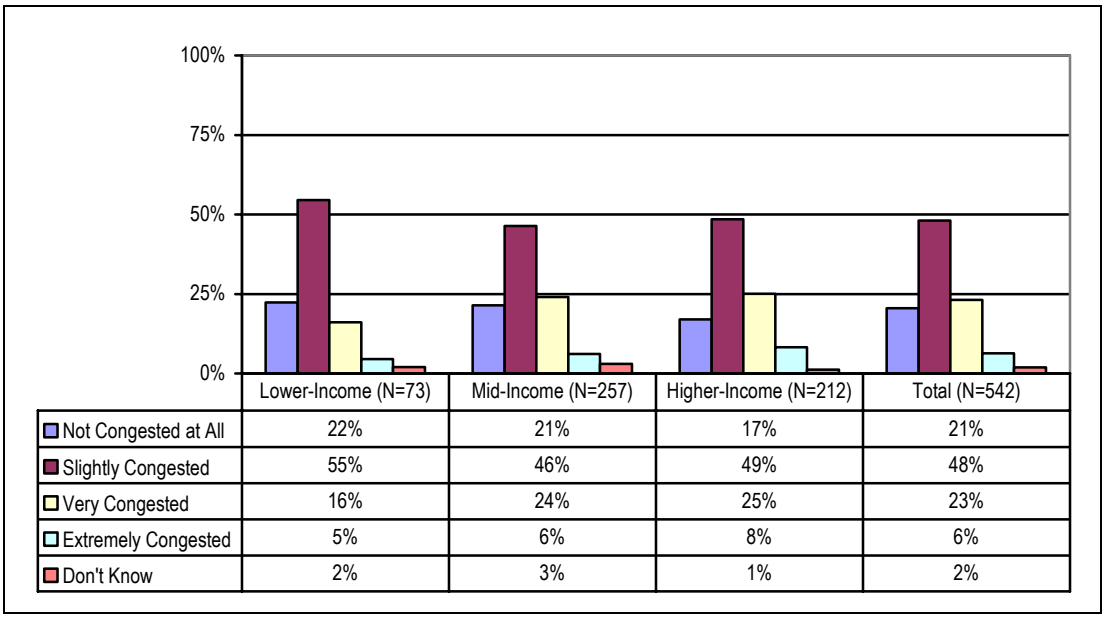


	Lower-Income (N=73)	Mid-Income (N=257)	Higher-Income (N=212)	Total (N=542)
Not Congested at All	60%	64%	59%	62%
Slightly Congested	21%	23%	29%	24%
Very Congested	1%	1%	1%	1%
Extremely Congested	0%	0%	1%	0%
Don't Know	18%	12%	10%	13%

FIGURE 8.6: OPINION ON CONGESTION IN GENERAL TRAFFIC LANES DURING REFERENCE TRIP BY HOUSEHOLD INCOME

(Among I-394 Respondents Only)

What about the general traffic lanes at that time, would you say the lanes were…



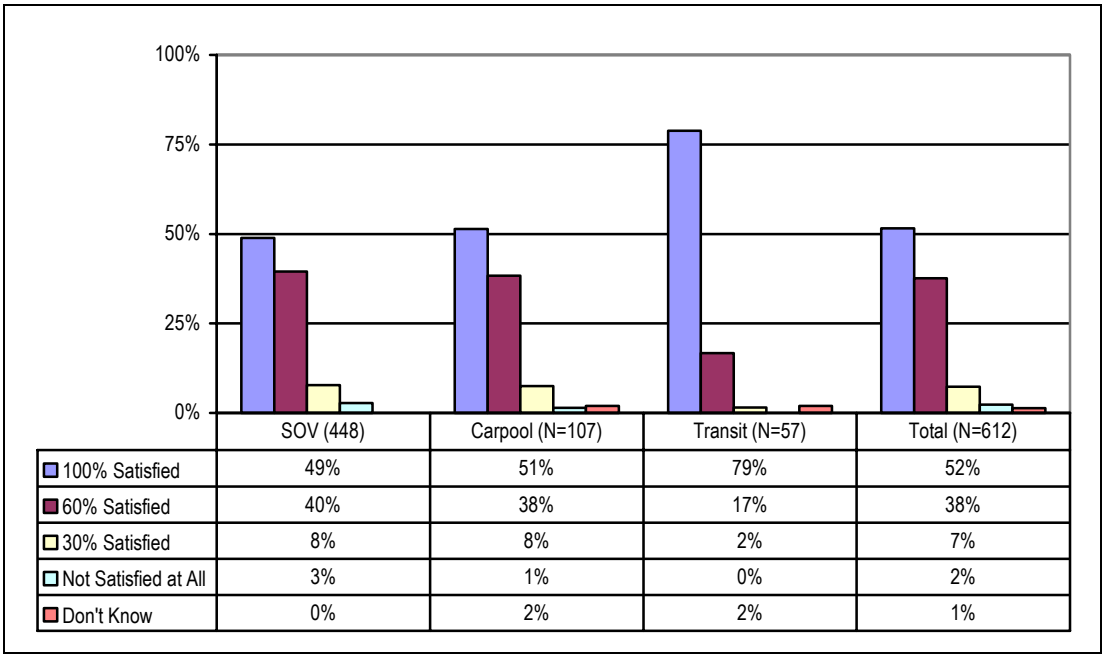
	Lower-Income (N=73)	Mid-Income (N=257)	Higher-Income (N=212)	Total (N=542)
Not Congested at All	22%	21%	17%	21%
Slightly Congested	55%	46%	49%	48%
Very Congested	16%	24%	25%	23%
Extremely Congested	5%	6%	8%	6%
Don't Know	2%	3%	1%	2%

Most respondents, regardless of travel mode, were satisfied with the quality of travel on their reference trip. Transit users had the highest level of satisfaction with the quality of travel on their reference trip; 79% reported being "100% satisfied", compared with 51% of carpoolers and 49% of SOV drivers. See Figure 8.7 for further detail.

FIGURE 8.7: SATISFACTION WITH QUALITY OF REFERENCE TRIP BY REFERENCE TRIP MODE

(Among I-394 Respondents Only)

Based on this trip, how satisfied were you with the overall quality of your travel on this roadway?



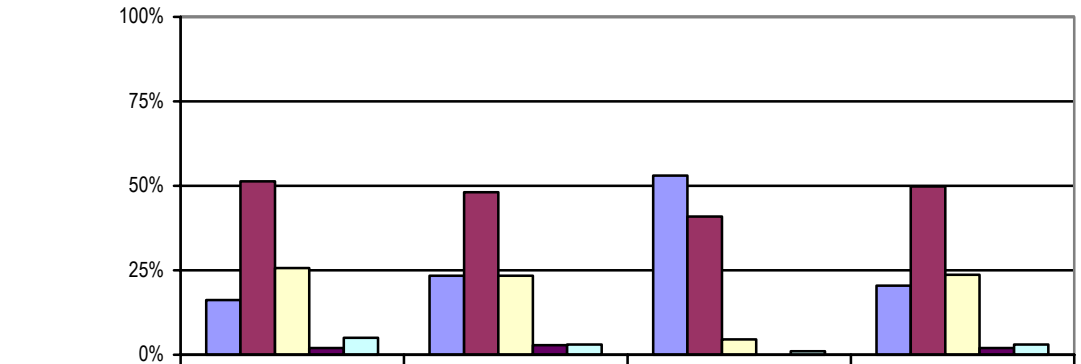
	SOV (448)	Carpool (N=107)	Transit (N=57)	Total (N=612)
100% Satisfied	49%	51%	79%	52%
60% Satisfied	40%	38%	17%	38%
30% Satisfied	8%	8%	2%	7%
Not Satisfied at All	3%	1%	0%	2%
Don't Know	0%	2%	2%	1%

The travel experience was most enjoyable for transit users, though respondents in all travel mode categories were more likely to find the trip enjoyable than stressful. More than half (53%) of transit users rated the target trip as very enjoyable compared to 16% of SOV drivers and 23% of carpoolers. Similarly, a quarter of HOV or SOV users found the trip slightly stressful, compared to only 5% of transit users. See Figure 8.8 for further detail.

FIGURE 8.8: OPINION ON REFERENCE TRIP EXPERIENCE BY REFERENCE TRIP MODE

(Among I-394 Respondents Only)

Which of the following descriptors best captures your travel experience on this trip?



	SOV (N=448)	Carpool (N=107)	Transit (N=57)	Total (N=612)
Very Enjoyable	16%	23%	53%	21%
Slightly Enjoyable	51%	48%	41%	50%
Slightly Stressful	26%	23%	5%	24%
Very Stressful	2%	3%	0%	2%
Don't Know	5%	3%	1%	3%

9. CONCLUSIONS

This chapter contains the key findings of the Attitudinal Panel Survey. The survey materials (advance letter, travel log and survey instrument) are in the Appendices section of this report. That chapter concludes with data tables that present panel attrition and panel demographics.

9.1 KEY FINDINGS

I-394 MnPASS Acceptance

Acceptance of the MnPASS concept reached its highest levels of support during the third wave of surveying (65% "good idea" versus 22% bad idea). The 43 percentage point spread between support and opposition was also the widest among the waves (i.e., 30 point spread in Wave 1 and 29 point spread in Wave 2). Experience with the High Occupancy Vehicle (HOT) lanes in operation was positively associated with acceptance of allowing single drivers to use carpool lanes by paying a toll. Approval was consistent across all income groups. Higher-income respondents were the most supportive (71%). Lower-income respondents were also quite supportive, and by a three-to-one margin (64% "good idea" versus 21% "bad idea"). The majority of carpoolers were supportive (60% "good idea"). About half of transit users surveyed (49%) expressed support for the MnPASS concept. The most common reason for supporting MnPASS was that it "eases congestion." There was ample evidence in the Wave 3 data that the MnPASS lanes did have a positive impact on perceived congestion levels on I-394. The percent of panel members who believed traffic congestion was a major problem decreased from 62% in Wave 1 to 50% in Wave 3. The percent that was delayed by congestion on their reference trip decreased from 37% in Wave 1 to 29% in Wave 3.

The level of opposition to the MnPASS concept decreased from 30% in Wave 1 to 22% in Wave 3. The shrinking size of the group in opposition created greater agreement among them as to the reasons why MnPASS was a "bad idea." About one-fourth believed either it "only benefits the rich" (16%) or that it is "unfair" (9%). About one in five (21%) were opposed to tolling the lanes in general -- 11% saying "carpool lanes should be free for all", and 10% saying "roads are already paid for." About 18% cited a reason that was associated with carpooling – 12% said "carpools are not encouraged", and 6% said "carpool lanes should be used only for carpools." These three categories of reasons accounted for nearly two-thirds of the reasons cited for why MnPASS was a "bad idea."

Soon after MnPASS implementation, a contra-peak congestion issues arose and, to deal with it, pricing was eliminated in the off peak direction. Shortly thereafter, the construction of a previously planned outbound auxiliary lane on a section of the MnPASS lanes (i.e., MN100 to US169) was accelerated. With the congestion issue that arose, support for a 24-hour operation of the MnPASS Express Lane project fell from 53% in Wave 1 to 23% in Wave 2. However, with longer experience with the MnPASS project in operation as well as greater elapse of time since the contra-peak congestion event, support for the 24-hour operation had grown to 32% in Wave 3. The percent that think the 24-hour operation is a "bad idea" decreased from 61% in Wave 2 to 54 % in Wave 3.

I-394 MnPASS Use and Satisfaction

The Wave 3 panel captured a 6% incidence of MnPASS subscribers. However, use of the MnPASS lanes represented a much broader market. The 6% represented just those who leased a transponder to pay for the use of the MnPASS lane as a Single Occupancy Vehicle (SOV); however, beneficiaries of the MnPASS project included non-paying users as well. Of panel members, 84% reported that they had used the MnPASS lanes in the past for free as a carpooler; 9% said they have used the lanes as a paying SOV driver; and 2% reported usage as a bus rider. MnPASS usage was reported across all income levels, with

55% of lower-income, 70% of middle-income, and 79% of higher-income respondents reporting that they have used the MnPASS lanes. Usage has remained stable among the lower-income group (54% in Wave 2 and 55% in Wave 3), while it has grown among middle-income group (62% to 70%) and the higher income (66% to 79%) group.

MnPASS users, regardless of whether they were paying users or not, were satisfied with MnPASS operations. Users had the highest levels of satisfaction with the all-electronic toll operations (93% satisfied) and with the speed of traffic flow in the MnPASS lane (88% satisfied). The absence of "safety" concerns related to the non-barrier separated MnPASS lane or the five access points was evidenced by that fact 83% were satisfied with the ease of identifying the MnPASS entry points and 72% were satisfied with the safety of merging into the MnPASS lanes. These levels of satisfaction were higher than those reported in Wave 2.

There was a slight decrease in the percent of MnPASS lane users who considered the MnPASS toll a good value from Wave 2 to Wave 3. During Wave 2, 71% stated the toll they paid was just right, whereas, during Wave 3, 61% felt that the toll they paid was just right. This may be a result of the modification of the dynamic pricing formula in 2006. This may also have impacted the overall satisfaction reported by paying customers (reducing these) such as the ease of opening a transponder account (83%); using a credit card to replenish the account (87%), and the ease of installing the MnPASS transponder (83%); the clarity of prices on overhead signs (80%) or with the toll amounts that vary with traffic levels (65%).

Travel Behavior and Experience among I-394 Users

I-394 panelists reported higher levels of satisfaction as the Attitudinal Panel survey progressed with 37%, 48% and 49% of respondents reporting 100% satisfaction in Wave 1, Wave 2 and Wave 3, respectively. Satisfaction was highest among panelists who used the MnPASS lanes for their entire reference trip. In the same way, panelists reported their travel as enjoyable and less stressful from Wave 1 to Wave 3 of the panel. Sixty-eight percent of the Wave 3 panelists reported an enjoyable travel experience, compared with 63% of Wave 2 panelists, and 47% of Wave 1 panelists. The implementation of MnPASS has not had a negative impact on carpooling on I-394, nor on traveling experiences in the corridor. The current mode share of I-394 panelists is comparable to that captured in the Wave 1 survey: 81% drive alone and 19% carpool.

Willingness to Pay the MnPASS Toll

There was a positive association between experience with MnPASS and willingness to pay the MnPASS toll. The willingness to pay is found to be significantly related to several observable factors of the traveling population, including income, age, trip purpose, time of day, trip distance, and amount of time saved. After those factors are taken into account, there appears to be a significant drop in willingness to pay between waves 1 and 3, particularly in the Stated Preference (SP) panel. Relative to the pre-introduction SP, the measured value of time in the post-introduction SP is strongly bifurcated, with MnPASS subscribers and users showing willingness to pay at least 3 times as high as non-subscribers/non-users. Because the majority of the population is non-users, this will tend to skew the distribution even further to the left, with a lower median Value of Time (VOT) but with a higher variance. It seems that when an SP survey is done before respondents have any experience with the actual HOT lane context, their responses may tend to "homogenize" to some extent. On the other hand, after the actual HOT lane system is introduced, respondents may have a much better idea of whether or not they would be willing to pay the toll in specific situations, so their responses will tend to show a wider variance.

In the longer term, as more HOT lane systems open, it would be best to build up revealed preference (RP) evidence on willingness to pay and value of time. This would require linking the types of trips that were intercepted in the MnPASS surveys to actual operating data on the toll levels charged and the time

savings offered at the times that the reported trips were made. We hope to be able to complete such analyses in the future.

9.2 DESIGN AND FIELDWORK

The Attitudinal Panel Survey was successfully implemented for three panel waves. There was the cost advantage for the panel of being able to spread out the recruitment cost over multiple waves of data collection. However, this study also required the analyses of specific subgroups, such as subscribers and transit users that were not present in sufficient numbers in the pure random sample. The cost of recruiting these new sample members diminished the full cost advantage of the panel.

In addition, the Attitudinal Panel Survey experienced a substantial rate of attrition. About one-third of the Wave 1 respondents were also interviewed in Wave 3. The attrition level experienced was comparable to that of other panel surveys. However, panel attrition limited the samples sizes available for longitudinal analyses, particularly within specific subgroups, such as for the SP analyses. This fact limited the statistical advantage of the panel design. That said, the panel data was shown to be extremely useful for disentangling the longitudinal effects of the MnPASS Express Lane project.

APPENDICES

APPENDIX A: ADVANCE LETTERS

UNIVERSITY OF MINNESOTA

Twin Cities Campus

State and Local Policy Program
Hubert H. Humphrey Institute of Public Affairs

Humphrey Center
301-19th Avenue South
Minneapolis, MN 55455-0429

612-626-0347
Fax: 612-626-9833
E-mail: slpp@hhh.umn.edu
http://www.hhh.umn.edu/Centers/SLP/

August 11, 2006

«FNAME» «LNAME»
«HADDR»
«HCITY», «HSTAT» «HZIP1»

«SAMPN»-«REP»-«STYPE»

Dear «FNAME» «LNAME»,

Thank you for continuing to participate in the **Attitudinal Panel Survey**. Your participation will ensure that our regional transportation system truly meets citizens' needs. A representative of NuStats, a professional survey research firm, will telephone you in about a week to remind you to complete the enclosed travel log. If you would like to participate in the survey at that time you may do so. We ask that you record information about your travel during a recent week that you make a trip that matches the trip described in the in the **enclosed travel log**.

What are we asking of you?

- **First, summarize the number of trips you make during a week that you made a trip that matches the trip described in the in Part A of the enclosed travel log.** Use the enclosed travel log to record the volume of *one-way* trips you made Monday through Friday during the week by direction of travel and also by your mode of travel.
- **Second, record specific information about a one-way trip you made during the week that matches the information provided in Part B of the enclosed travel log**. Record information about a trip you make during the week that resembles the one that you detailed for us in your previous interview. To assist you, we have indicated the time of day and purpose of your last trip in Part B of the enclosed travel log.
- **Third, provide us this information in a telephone interview.** An interviewer from NuStats will call to collect your information and also to ask some additional opinion questions. At the start of this call, the interviewer will ask if any of the Household Profile information provided in the box below has changed. If so, please report the changes.

Household Profile	
Household size, including you:<<xx>>	No. of Workers, including you? <<xx>>
No. of vehicles available: <<xx>>	Total Household Income: <<xx>>

Remember, all information will be held in strict confidence. ***It is very important that this survey is conducted with the individual from your household who was originally surveyed in late 2004.*** If you have any questions or concerns about this study, please contact Frank Douma, the principal investigator 612-626-9946, fdouma@hhh.umn.edu). If you have questions about the interview, contact Chris Simek of NuStats (1-800-447-8287, csimek@nustats.com).

Sincerely,

Lee Munnich
Director, State and Local Policy Program
Hubert H. Humphrey Institute

UNIVERSITY OF MINNESOTA

Twin Cities Campus

State and Local Policy Program
Hubert H. Humphrey Institute of Public Affairs

Humphrey Center
301-19th Avenue South
Minneapolis, MN 55455-0429

612-626-0347
Fax: 612-626-9833
E-mail: slpp@hhh.umn.edu
http://www.hhh.umn.edu/Centers/SLP/

August 11, 2006

«FNAME» «LNAME»
«HADDR»
«HCITY», «HSTAT» «HZIP1»

«SAMPN»-«REP»-«STYPE»

Dear «FNAME» «LNAME»,

We need your help. You have been selected to participate in a panel survey to evaluate travel conditions in our region. Your participation will ensure that our transportation system truly meets citizens' needs. The study's sponsors are the State and Local Policy Program of the Hubert H. Humphrey Institute of Public Affairs at the University of Minnesota and the Minnesota Department of Transportation. A representative of NuStats, a professional survey research firm, will telephone you in about a week to remind you to complete the enclosed travel log. If you would like to participate in the survey at that time you may do so. We ask that you record information about your travel during a recent week that you make a trip that matches the trip described in the in the **enclosed travel log**.

What are we asking you to do?

- **First, summarize the number of trips you make during a week that you made a trip that matches the trip described in the in Part A of the enclosed travel log.** Use the enclosed travel log to record the volume of *one-way* trips you made Monday through Friday during the week by direction of travel and also by your mode of travel.
- **Second, record specific information about a one-way trip you made during the week that matches the information provided in Part B of the enclosed travel log**. Record information about a trip you make during the week that resembles the one described in Part B of the enclosed travel log.
- **Third, provide us this information in a telephone interview.** An interviewer from NuStats will call to collect your information and also to ask some additional opinion questions. The interview will only last about 15 minutes.

Confidentiality is critical to the success of our study. We want you to feel secure in providing candid responses to our questions. So, your name and other identifying information will be stored separately from the data files containing your responses. Your decision to participate is voluntary. And, you may refuse to answer any question without risk. Such actions will not affect relations with any survey sponsors. If you have any questions or concerns about the study, please contact Frank Douma, principal investigator, at 612-626-9946, fdouma@hhh.umn.edu). If you have questions about the interview, contact Chris Simek of NuStats (1-800-447-8287, csimek@nustats.com). If you want to talk to someone other than the researchers, contact Research Subjects Advocate line (612) 625-1650.

Sincerely,

Lee Munnich
Director, State and Local Policy Program
Hubert H. Humphrey Institute

APPENDIX B: TRAVEL LOG

Attitudinal Panel Surveys

TRAVEL LOG
(I-35W/Hwy 77)

Part A: Travel Week

Record information about ALL trips you make on I-35W or Hwy 77, each day during your travel week between 6 a.m. and 9 p.m.

Your travel week is the week during which you make a trip that matches the characteristics described in Part B: Assigned Trip, below.

1 **For each day during your travel week, please record how many trips you make:**

a. Northbound on I-35W or Hwy 77
b. Southbound on I-35W or Hwy 77

Direction of Travel	Mon	Tue	Wed	Thu	Fri	Total
a. Northbound on I-35W or Hwy 77						
b. Southbound on I-35W or Hwy 77						

Total Trips North & South bound

2 **For the total trips in question 1, please tell us how many of them you:**

a. Drive alone
b. Carpool (2 or more persons, regardless of age)
c. Ride a bus

Total Number of Trips should be the same

How Traveled	Mon	Tue	Wed	Thu	Fri	Total
a. Drive alone						
b. Carpool (2 or more persons, regardless of age)						
c. Ride a bus						

Total Trips by all travel modes

Part B: Assigned Trip

Record information about a ONE-WAY TRIP you make on I-35W or Hwy 77, during your travel week, that matches your assigned trip below.

3 **On what day of the week was the first trip you took matching your Assigned Trip above?**

○ Monday ○ Tuesday ○ Wednesday ○ Thursday ○ Friday

4 **How many TOTAL CAR TRIPS (number of times you turned on the ignition) did you make that day?**
(include ALL car trips, not just those on I-35W and Hwy 77)

_____ *# car trips (# times you turned on the ignition)*

Continue on back

5 **What was the purpose of your trip?**

- ◯ Work
- ◯ Work-related
- ◯ School
- ◯ Shop
- ◯ Medical/Personal Appointment
- ◯ Visit friends/relatives
- ◯ Recreation
- ◯ Other: _____

6 **Which PRIMARY ROADWAY did you use?** ◯ I-35W only ◯ Hwy 77 only ◯ Both I-35W & Hwy 77

7 **In what DIRECTION were you travelling?** ◯ North ◯ South

8 **What was your START LOCATION?** ◯ Home ◯ Work ◯ Other: _____

9 **What time did you DEPART?** _____ : _____ ◯ am ◯ pm

10 **What was your DESTINATION LOCATION?** ◯ Home ◯ Work ◯ Other: _____

11 **What time did you PLAN TO ARRIVE at your destination?** _____ : _____ ◯ am ◯ pm

12 **What time did you ACTUALLY ARRIVE at your destination?** _____ : _____ ◯ am ◯ pm

13 **What was your TOTAL TRAVEL TIME** *(from your start location to your destination location)***?** _____ *# minutes*

14 **What was your PRIMARY MODE OF TRAVEL?** ◯ Drive alone ◯ Carpool ◯ Bus

Total number of people in vehicle, including yourself:

_____ *# people*

15 **How many SIDE TRIPS (or stops) did you make on the way to your destination location?**

_____ *# side trips or stops*

THANK YOU! DO NOT MAIL. You will receive a call to collect your information. For questions about how to complete your log, call the **toll-free hotline at 877-261-4621**.

Attitudinal Panel Surveys

TRAVEL LOG
(I-394/Hwy 55)

Part A: Travel Week

Record information about ALL trips you make on I-394 or Hwy 55, each day during your travel week between 6 a.m. and 9 p.m.

Your travel week is the week during which you make a trip that matches the characteristics described in Part B: Assigned Trip, below.

1 **For each day during your travel week, please record how many trips you make:**

a. Eastbound on I-394 or Hwy 55
b. Westbound on I-394 or Hwy 55

Direction of Travel	Mon	Tue	Wed	Thu	Fri	Total
a. Eastbound on I-394 or Hwy 55						
b. Westbound on I-394 or Hwy 55						

Total Trips East & West bound

2 **For the total trips in question 1, please tell us how many of them you:**

a. Drive alone and do not use the MnPass lanes
b. Drive alone and pay a toll to use the MnPass lanes
c. Drive alone, use the MnPass lanes and not pay a toll
d. Carpool (2 or more persons, regardless of age)
e. Ride a bus

Total Number of Trips should be the same

How Traveled	Mon	Tue	Wed	Thu	Fri	Total
a. Drive alone and do not use MnPass lanes						
b. Drive alone and pay toll to use MnPass lanes						
c. Drive alone, use MnPass lanes and not pay a toll						
d. Carpool (2 or more persons, regardless of age)						
e. Ride a bus						

Total Trips by all travel modes

Part B: Assigned Trip

Record information about a ONE-WAY TRIP you make on I-394 or Hwy 55, during your travel week, that matches your assigned trip below.

3 **On what day of the week was the first trip you took matching your Assigned Trip above?**

○ Monday ○ Tuesday ○ Wednesday ○ Thursday ○ Friday

4 **How many TOTAL CAR TRIPS (number of times you turned on the ignition) did you make that day?**
(include ALL car trips, not just those on I-394 and Hwy 55)

_____ *# car trips (# times you turned on the ignition)*

Continue on back

5 **What was the purpose of your trip?**

- ◯ Work
- ◯ Work-related
- ◯ School
- ◯ Shop
- ◯ Medical/Personal Appointment
- ◯ Visit friends/relatives
- ◯ Recreation
- ◯ Other: _____

6 **Which PRIMARY ROADWAY did you use?** ◯ I-394 only ◯ Hwy 55 only ◯ Both I-394 & Hwy 55

7 **IF I-394: At what RAMP or INTERCHANGE did you enter the roadway?** _____

8 **In what DIRECTION were you travelling?** ◯ East ◯ West

9 **What was your START LOCATION?** ◯ Home ◯ Work ◯ Other: _____

10 **What time did you DEPART?** _____ : _____ ◯ am ◯ pm

11 **What was your DESTINATION LOCATION?** ◯ Home ◯ Work ◯ Other: _____

12 **What time did you PLAN TO ARRIVE at your destination?** _____ : _____ ◯ am ◯ pm

13 **What time did you ACTUALLY ARRIVE at your destination?** _____ : _____ ◯ am ◯ pm

14 **What was your TOTAL TRAVEL TIME** *(from your start location to your destination location)***?** _____ *# minutes*

15 **What was your PRIMARY MODE OF TRAVEL?** ◯ Drive alone ◯ Carpool ◯ Bus

→ Total number of people in vehicle, including yourself:
_____ *# people*

16 **How many SIDE TRIPS (or stops) did you make on the way to your destination location?**

_____ *# side trips or stops*

17 **Did you use the MnPASS Lane?**

◯ **YES**

a Toll paid *(one-way)* $ _____ . _____

b What do you think your travel time would be if you **had not** used the MnPASS lane? _____ *# minutes*

c Did you **plan to use** the MnPASS lane **before** you left your start location?

◯ Yes ◯ No

d Why did you decide to use the MnPASS lane? *(mark all that apply)*

- ◯ To avoid an unexpected delay.
- ◯ To travel more safely.
- ◯ To avoid an unexpected level of congestion.
- ◯ I travelled by carpool or bus.
- ◯ Other: _____

◯ **NO**

a What do you think your travel time would be if you **had** used the MnPASS lane? _____ *# minutes*

b Why didn't you use the MnPASS lane? *(mark all that apply)*

- ◯ I am not a MnPASS subscriber.
- ◯ Traffic levels were lighter than usual.
- ◯ Price was too high.

→ How much would the one-way toll have been?
$ _____ . _____

- ◯ MnPASS lanes were not available in my direction of travel.
- ◯ Other: _____

THANK YOU! DO NOT MAIL. You will receive a call to collect your information. For questions about how to complete your log, call the **toll-free hotline at 877-261-4621**.

APPENDIX C: SURVEY INSTRUMENT

MnPASS Wave 3

NOTE: For the I-394 corridor, we will add 450 respondents from the I-394 corridor and 150 respondents from the I-35W corridor.

SAMPLE TYPE (From sample databases):

RETURNING PANEL – I-394	1
SUBSCRIBER PANEL – I-394	2
TRANSIT PANEL – I-394	3
RETURNING PANEL – I-35	4
TRANSIT PANEL – I-35W	5
NEW SAMPLE - I-394	6
NEW SAMPLE - I-35W	7
NEW SAMPLE - I-394 WEST OF 494	8
Final Refusal ---→ TERM	999

INTRO_A: Hello, my name is _____, and I'm calling on behalf of the Minnesota DOT and the Hubert Humphrey Institute of the University of Minnesota.

PANEL MEMBERS – SAMPLE TYPE < 6

S1. May I speak with _____(respondent)? He/ she is participating in our Attitudinal Panel Survey.

Continue	1
Callback	2
First Refusal	3
Final Refusal ---→ TERM	4

CB1. What would be a good time to call back? Enter date and time.

CONT: Thank you for participating in our Attitudinal Panel Survey. In order to make sure we're speaking to the correct HH member, can you confirm that you participated in a survey about travel conditions and traffic congestion in the Fall/Winter of 2004?

YES (go to I1)	1
NO (continue)	2
UNSURE (continue)	998
RF (terminate)	999

Our records indicate that a [import gender] member of your household participated in the 2004 survey? Do you have any idea what member of your household that might be?

YES (ask to speak to that person and re-start interview with that person)	1

NO (terminate)	2
UNSURE (terminate)	998
RF (terminate)	999

I1: Did any of the information in your demographic profile change? IF SO: MAKE CHANGES.
HH Size:
No. Vehicles:
No. Workers:
HH Income:

PANEL_LTR_Did you receive an advance letter describing the survey and a travel log?

YES (go to TRIP)
NO (go to TRIP)
UNSURE (go to TRIP)
RF (terminate)

NEW SAMPLE – SAMPLE TYPE 6 - 8

I1. May I speak with _____? We're conducting a survey on travel conditions in the Twin Cities. This is not a sales call.

Continue	1
Callback	2
First Refusal	3
Final Refusal ---→ TERM	4

CB1. What would be a good time to call back? Enter date and time.

INFORMED CONSENT CONTINUE – NEW SAMPLE ONLY (STPYPE 6-8)

I2**.** Your household has been randomly selected to be surveyed as part of an evaluation of a new roadway project in the Twin Cities area, resulting from statewide legislation in 2003. This interview should take about 15 minutes. I'll ask questions on congestion, carpool (diamond) lanes, and other transportation issues. I'll also collect travel information relating to your use of the I-394 and I-35W corridors and some demographic questions. Confidentiality is critical to the success of our study. Your name and other identifying information will be stored separately from the data files containing your responses.

We sent a letter about this survey to your home address. You should have received it within the past week. Do you remember receiving and reading this letter?

YES (GOTO I4A)	1
NO (GOTO I3)	2
DK/RF (GO TO I3)	3

I3. Can I confirm your name [and mailing address – IF ANSWERED NO]? READ AND CONFIRM.

MAILING CORRECT—GO TO CONSENT	1
MAILING INCORRECT – COLLECT ADDRESS THEN GO TO CONSENT	2

ENTER NEW MAILING ADDRESS:
l3a. NAME
l3b. ADDRESS
l3c. CITY
13d. ZIP

CONSENT. The benefits of participation in the study are truly helping our community identify new ways of dealing with the congestion problem. Your decision to participate is voluntary. And, you may refuse to answer any question without risk. Such actions will not affect any relations with study sponsors GO TO l4a.

l4a. Do you understand the study??

YES	1
NO (THANK AND ASK FOR OTHER ELIGIBLE PERSON IN HH)	2
DK/RF (THANK AND ASK FOR OTHER ELIGIBLE PERSON IN HH)	3

l4b. Do you agree to be interviewed?

YES (GO TO TRIP)	1
NO (THANK AND ASK FOR OTHER ELIGIBLE PERSON IN HH)	2
DK/RF (THANK AND ASK FOR OTHER ELIGIBLE PERSON IN HH)	3

NEW SCREENER PORTION THAT IS ASKED OF EVERYONE

TRIP: PANEL: Have you taken a trip in the last few months on [ROAD} that was [TRIP PURPOSE] during [TIME OF DAY]

TRIP: NON PANEL: Have you taken a trip in the last few months on [ROAD} during [TIME OF DAY]

YES (GO TO LOG)	1
NO (SKIP TO WHEN)	2
UNSURE (SKIP TO WHEN)	998
RF (terminate)	999

LOG: Did you use your travel log to record information about this trip and all trips taken on [road] during the week you took your assigned trip?

YES (GO TO S1)	1
NO (GO TO S1)	2
UNSURE (GO TO S1)	998
RF (GO TO S1)	999

WHEN: Do you think you'll be taking a trip like the one described in your travel log in the near future?

YES (SCHEDULE CALLBACK IN 5 DAYS)	1
NO (FIND OUT WHY AND MAKE NQ)	2
UNSURE (SCHEDULE CALLBACK IN 5 DAYS)	998
RF (TERMINATE)	999

General Attitude, MnPASS Awareness , Knowledge - Everyone

S1. In general, do you think traffic congestion in the Twin Cities is ...? (ROTATE)

A major problem	1
A moderate problem	2
A minor problem,	3
No problem at all	4
UNSURE	998
REFUSED	999

PANEL MEMBERS (SAMPLE TYPE < 6) SKIP S2-S3

S2. How many people, including yourself, are currently living in your household?
_____# valid range 1-10

UNSURE	998
REFUSED	999

S3. How many motor vehicles in working condition does your household have available for use?
____#

valid range 0-10

UNSURE	998
REFUSED	999

S4. Do you plan on moving anytime in the next year?

YES (GOTO S5)	1
NO	2
UNSURE	998
RF	999

S5. And, do you plan on moving outside of the Twin Cities area?

YES (GOTO TERM - NOT ELIGIBLE FOR PANEL)	1

NO	2
UNSURE	998
REFUSED	999

S6. Do you plan on changing jobs in the next year?

YES (GOTO TERM - NOT ELIGIBLE)	1
NO	2
UNSURE	998
RF	999

Now, I'd like to ask you a few questions about a new transportation project in the Twin Cities area.

MNPASS SUBSCRIBERS (STYPE 2) SKIP A1-A4A

A1. Have you heard of the MnPASS lanes on I-394?

YES	1
NO	2
UNSURE	998
REFUSED	999

A2. Are you an MnPASS subscriber?

YES (GO TO A5)	1
NO	2
UNSURE	998
REFUSED	999

A3. Have you considered getting a transponder?

YES – AND DID GET ONE (GOTO A5)	1
YES – AND DECIDED AGAINST IT	2
NO	3
UNSURE	998
REFUSED	999

A4. Why? **THEN SKIP TO A9**

TRANSPONDER IS TOO EXPENSIVE TO LEASE	1
DON'T WANT TO PAY TO USE MNPASS	2
TRAFFIC IS NOT THAT BAD	3
GENERALLY DON'T DRIVE THE I-394 ROUTE	4
I USE CARPOOLS	5
I USE TRANSIT	6

UNAWARE OF MNPASS	7
WOULDN'T USE MNPASS LANE ENOUGH TO JUSTIFY LEASING TRANSPONDER	8
UNLIKELY TO USE IT: SPECIFY	9
OTHER: SPECIFY	997
UNSURE-→READ DESC	998
REFUSED-→READ DESC	999

A4A. IF RESPONDENT A4=1 ASK How much do you think it costs to lease a transponder?

Enter number in dollar format.

WE NEED TO ASK A5-A9 OF MNPASS SUBSCRIBERS (SAMPLE TYPE 2 AND THOSE THAT RESPOND YES (1) TO A2.

A5. In what month did you acquire a transponder?

MONTH: SPECIFY	1
DON'T HAVE ONE	2
UNSURE	998
REFUSED	999

A6. How many transponders does your household have?

1	1
2	2
3	3
4+	4
UNSURE	998
REFUSED	999

A7. How did you open your MnPASS account?

Online	1
Telephone	2
In-Person at Customer Service Center	3
UNSURE	998
REFUSED	999

A8. Is your MnPASS account…

Paid by you	1
Paid directly by your employer	2
Paid by you but reimbursed by your employer	3
UNSURE	998
REFUSED	999

A9. What do you know about MnPASS?
[ALLOW MORE THAN ONE ANSWER]

SINGLE DRIVERS USE CARPOOL LANES FOR FEE	1
ELECTRONIC TOLL COLLECTION	2
TRANSPONDER	3
IT WILL CHARGE TOLLS	4
IT MAY BENEFIT TRANSIT	5
ONLY RICH WILL USE	6
OTHER: SPECIFY	7
NOTHING	8
UNSURE	998
REFUSED	999

READ TO EVERYONE : The MnPASS program permits single drivers on I-394 to pay a fee to use the MnPASS lanes. Drivers who pay the fee can use the carpool lanes without being in a carpool. The fee varies based on how congested the roadway is.

A9. What do you think of allowing single drivers to use the carpool lanes by paying a toll? Is it [rotate]

Good idea	1
Bad idea	2
No opinion	3

A10. Why do you feel this way? (Not asked of those who state "No opinion") ADD ALL CODES

SAVES TIME FOR BUSY PEOPLE	1
USERS PAY NOT EVERYONE	2
TIME IS MONEY FOR SOME PEOPLE	3
BETTER USE OF CARPOOL LANES	4
ADDS CAPACITY TO ROADWAY	5
UNFAIR, SPECIFY	6
DELAYS ROADWAY IMPROVEMENT FOR ALL	7
LEVEL OF SERVICE WORSE IN CARPOOL LANE	8
INCREASES BUREAUCRACY	9
WILL NOT WORK	10
INEFFICIENT	11
ONLY BENEFITS THE RICH	12
BAD FOR ENVIRONMENT	13
TOO CONFUSING FOR PEOPLE	14
GIVES TOO MUCH MONEY TO ROAD AGENCY	15
OTHER: SPECIFY	16
CARPOOL LANES SHOULD BE FREE TO ALL	17
DON'T KNOW	998
REFUSED	999

A11 When MnPASS opened, the toll lane program on I-394 operated 24 hours per day, meaning that the only persons who could travel in the MnPASS lanes at any time were carpoolers, bus riders, motorcyclists, and those who opt to pay the toll. Was this a…[rotate]

Good idea	1
Bad idea	2
No opinion	3

A12. Why do you feel this way? (Not asked of those who state "No opinion") ADD ALL CODES

USERS PAY NOT EVERYONE	2
TIME IS MONEY FOR SOME PEOPLE	3
BETTER USE OF CARPOOL LANES	4
ADDS CAPACITY TO ROADWAY	5
UNFAIR, SPECIFY	6
INCREASES BUREAUCRACY	9
WILL NOT WORK	10
INEFFICIENT	11
ONLY BENEFITS THE RICH	12
BAD FOR ENVIRONMENT	13
TOO CONFUSING FOR PEOPLE	14
GIVES TOO MUCH MONEY TO ROAD AGENCY	15
NOW CARPOOL LANES ARE FREE TO ALL IN NON-PEAK	17
OTHER: SPECIFY	16
DON'T KNOW	998
REFUSED	999

A13 Now there are no tolls outbound from MN100 from 5:30am to 2pm weekdays and inbound to MN100 from1pm to 5:30am weekdays. Is this a…[rotate]

Good idea	1
Bad idea	2
No opinion	3

A14. Why is that? ADD ALL CODES

A15. For the next few items, please tell me if you think MnPASS has a positive impact, a negative impact, or no impact at all. What impact do you think MnPASS has on…

	Positive	**Negative**	**No Impact**	**DK**
a. Traffic congestion on I-394?	1	2	3	998
b. Traffic safety on I-394?	1	2	3	998
c. Noise levels along I-394?	1	2	3	998

General Trip Making Characteristics

Now I'd like to collect the information that you recorded in your travel log about total one-way trips made Monday through Friday during your assigned travel week.

TM1. IF I-394: For this next question, you can refer to #1 on your travel log. How many eastbound trips [TOWARD DOWNTOWN] did you make? And how many westbound trips?

a. EASTBOUND _____ valid range = 1-10
b. WESTBOUND _____ valid range = 1-10

IF I-35W: For this next question, you can refer to #1 on your travel log. How many northbound trips [TOWARD DOWNTOWN] did you make? And how many southbound trips?

c. NORTHBOUND _____ valid range = 1-10
d. SOUTHBOUND _____ valid range = 1-10

TM2 IF I-394: For this next question, you can refer to #2 on your travel log. Now consider all [TOTAL TM1] trips you made in both directions. On how many of those trips did you mostly:

Use the MnPASS Lanes (#)
Use the general traffic lanes on I-394 (#)
Use Hwy 55 (#)

IF I-I35W: For this next question, you can refer to #2 on your travel log. Now consider all [TOTAL TM1] trips you made in both directions. On how many of those trips did you mostly:

Use the carpool lanes on I-35W (#)
Use the general traffic lanes on I-35W (#)
Use Hwy 77 (#)

TM3 For this next question, you can refer to #2 on your travel log. Now consider all [TOTAL TM1] trips you made in both directions. On how many of those trips did you:

Drive alone (and not use MnPASS lanes) (#)

NOT OPTION FOR I-35W TRAVEL SHED<-----Drive alone and pay a toll to use the MnPASS lanes
Drive alone, use MnPASS and not pay a toll (#)
Carpool (#) (IF > 0, ASK TM10)
Ride a bus (#)
Total (calculated)
CHECK AGAINST TM3RESPONSE

COMPUTE NEW VARIABLE = USUAL MODE
SOV = mostly drive alone trips in TM3
HOV = mostly drive with other passengers or ride as passenger in person vehicle in TM3
TRANSIT= mostly ride as passenger in a bus in TM3

IF TM2 OR TM3 IDENTIFY MNPASS LANE USE SKIP TO TM5.

TM4. Have you ever used the MnPASS lanes?

YES	1
NO	2
DON'T KNOW	998
REFUSED	999

TM5. IF TM2, TM3 = MnPASS OR TM4=YES: When you have used the MnPASS lanes in the past were you: CHECK ALL APPLY.

A paying single driver	1
carpooler	2
Bus rider	3
DON'T KNOW	998
REFUSED	999

TM6: IF MORE THAN ONE ANSWER TO TM5: How did you travel on the MnPASS lanes most frequently?

A paying single driver	1
carpooler	2
Bus rider	3

TM7. IF TM2, TM3 = MnPASS OR TM4=YES: Now I'd like to ask how satisfied you have been with certain aspects of the MnPASS program. For each item I mention, please tell me if you are very satisfied, somewhat satisfied, very dissatisfied, or somewhat dissatisfied. First, how satisfied are you with ….

	Very Satisfied	Somewhat Satisfied	Somewhat Disatisfied	Very Disatisfied	DK	RF
a. Ease of identifying the MnPASS entry points along I-394	4	3	2	1	998	999
b. Safety of merging into the MnPASS lane at designated entry points	4	3	2	1	998	999
c. The speed of traffic flow in the MnPASS lanes	4	3	2	1	998	999
d. Enforcement of MnPASS usage	4	3	2	1	998	999

TM8. IF TM5 OR TM6 = 1: Which of the following factors was the most important reason that you use the MnPASS lane?

To reduce overall travel time	1
To reduce amount of time you spend in heavy traffic	2
Too increase reliability of your travel time	3
To increase personal safety while driving in traffic,	4
Or something else: SPECIFY	5
RF	999

TM9. IF TM5 OR TM6 = 1: Now I have a few more of the satisfaction questions. For each item I mention, please tell me if you are very satisfied, somewhat satisfied, very dissatisfied, or somewhat dissatisfied. First, how satisfied are you with ….

	Very Satisfied	Somewhat Satisfied	Somewhat Disatisfied	Very Disatisfied	DK	RF
a. The clarity of prices on overhead signs located before MnPASS entrances	4	3	2	1	998	999
b. The MnPASS website	4	3	2	1	998	999
c. The staff at customer service center	4	3	2	1	998	999
d. The ease of opening a pre-paid MnPASS account	4	3	2	1	998	999
e. The ease of installing the MnPASS transponder	4	3	2	1	998	999
f. All electronic operation – no tollbooths, gates, dropping in coins	4	3	2	1	998	999
g. The toll amounts that vary with traffic levels	4	3	2	1	998	999
h. Using your credit card or debit card to automatically replenish your account	4	3	2	1	998	999

TM10. IF TM3= TRANSIT: Revenues from the MnPASS program will be used to make transit system improvements. I'd like to know which of the following transit service improvements

would be most important to you. For each item I mention, please tell me if the improvement is very important, somewhat important, or not important at all to you. First, how important is….USE SCALE WHERE 1=NOT IMPORTANT AT ALL, 2=SOMEWHAT IMPORTANT AND 3=VERY IMPORTANT.

More Park and Ride Lots	
More frequent service	
Greater enforcement in the MnPASS lane	
Service routed differently	
Security at Park and Ride Lots	
Light Rail	

Detailed Trip Making Characteristics

Now, I have some questions about the trip that you recorded in your travel log. So use the reference trip information that you provided in the travel log to assist you in answering the next few questions.

DT1. For this next question, you can refer to #3 on your travel log. On what day of the week was your trip? (ALLOW ONLY ONE ANSWER)

MONDAY	1
TUESDAY	2
WEDNESDAY	3
THURSDAY	4
FRIDAY	5

DT1A. For this next question, you can refer to #4 on your travel log. How many total one-way trips (on any roadway) did you make on this day?

DT2. For this next question, you can refer to #5 on your travel log. What was the main reason for the trip you recorded in your travel log?

COMMUTE TO OR FROM WORK	1
WORK-RELATED	2
SCHOOL	3
SHOP	4
MEDICAL OR OTHER PERSONAL APPT	5
VISIT FRIENDS OR FAMILY	6
RECREATIONAL OR ENTERTAINMENT ACTIVITY	7
OR SOMETHING ELSE (DO NOT SPECIFY)?	998
REFUSED	999

COMPUTE NEW VARIABLE BASED ON DT3 = TARGET TRIP TYPE
MAINTENANCE = 4, 5,
SUBSISTENCE = 1, 2 3,
DISCRETIONARY = 6, 7, 998

DT3: For this next question, you can refer to #6 on your travel log. On what roadway were you traveling?

I-394	1
Hwy 55	2
I-35W	3
Hwy 77	4

DT4: For this next question, you can refer to #8 on your travel log. And, in what direction?

East	1
West	2
North	3
South	4

DT5: IF A2 = YES and DT3 = I-394: For this next question, you can refer to #17 on your travel log. Did you use the MnPASS lane for all or part of your trip?

ALL	1
PART	2
DID NOT USE (GO TO DT7]	3

DT6: If DT5 = 1, 2: For this next question, you can refer to #17a on your travel log. What toll amount did you pay?

DT7. IF A2 = YES and DT3 = I-394: For this next question, you can refer to #17c on your travel log. Did you plan to use the MnPASS lane before you left your start location?

YES	1
NO	2
UNSURE	998
RF	999

DT8. IF DT5 = 1, 2: For this next question, you can refer to #17d on your travel log. Why did you decide to use the MnPASS lane?

To avoid unexpected delay	1
To travel more safely	2
To avoid unexpected levels of congestion	3
I traveled by carpool or bus	4
Or some other reason: SPECIFY	997
UNSURE	998
RF	999

DT9. IF DT5 = 3: For this next question, you can refer to #17b on your travel log, under the "no" option. Why didn't you use the MnPASS lane?

I am not an MnPASS subscriber	1
Traffic levels were lighter than usual	2
Price was too high	3
MnPASS lanes were not available in my direction of travel	4
Or some other reason: SPECIFY	997
UNSURE	998
RF	999

DT10 What time did you start this trip? For this next question, you can refer to #10 on your travel log. [military time]

COMPUTE TIME PERIOD VARIABLE:
6AM-9AM = 1
9AM-1PM =2
1PM-3PM =3
3PM-6PM =4
6PM-9PM =5

DT11. How familiar are you with the traffic conditions on the freeway at this time? Would you say you ….

Almost always drive this route at this hour (3 or 4 times / wk)	1
Occasionally drive this route at this hour (1 or 2 time/ wk)	2
Rarely drive this route at this hour (less than 1/ wk)	3
RF	999

DT12 Did you leave at this particular time to avoid traffic congestion?

YES	1
NO (GO TO DT14)	2
RF	999

DT13. What time would you have preferred to leave if there was no traffic congestion to avoid? [military time]

DT14 IF DT3 = I-394 or Hwy 55: Have you changed your typical departure time for this trip because of MnPASS?

YES	1
NO (GO TO DT17)	2
RF	999

DT15: Are you leaving earlier or later?

EARLIER	1
LATER	2
RF	999

DT16. By how much? #
minutes____

DT17. For this next question, you can refer to #9 on your travel log. Where did you start this trip? Was it at home, work, or someplace else?

HOME (GOTO DT19)	1
WORK (GOTO DT19)	2
SOMEPLACE ELSE	3
RF	999

DT18. ***IF SOMEPLACE ELSE***: Can you give me a street address or the names of two nearby intersecting streets?

Address (GOTO DT18A)	1
Intersection (GOTO DT18B)	2
DK	998
RF	999

DT18a. Collect address information

DT18b. Collect xstreet information

DT18c. What city was that in? _____

DT19. IF I-394: For this next question, you can refer to #7 on your travel log. At which ramp did you get I-394?
[DROP DOWN LIST OF RAMPS]

DT20. IF DT5 = 1, 2: And, where did you enter the MnPASS lane? DROP DOWN LIST OF ENTRY POINTS (need points)

DT21. IF DT5 = 1, 2: Did you experience any problems in merging into the MnPASS lane from the general traffic lane?

YES	1
NO	2
REFUSE	999

DT22. IF DT21 = YES: What type of problem did you encounter? Open-ended

DT23. And where did you exit the MnPASS lane? DROP DOWN LIST OF EXIT POINTS (need points)

DT24. For this next question, you can refer to #15 on your travel log. And were you …

Driving alone (GOTO DT23)	1
Carpooling	2
Riding a bus	3
DK	998
RF	999

COMPUTE NEW VARIABLE BASED ON DT24 RESPONSE = TARGET TRIP MODE
SOV =1
HOV = 2
TRANSIT = 3

DT25. IF TARGET TRIP MODE = HOV: How many adults, 18 or older, traveled with you on this trip, [not including yourself]? #_____ Valid range = 1-6

DK	998

DT26. IF TARGET TRIP MODE = HOV: And, how many children? #_____ Valid range = 1-6

DK	999

DT27 IF TAGET TRIP MODE = HOV/TRANSIT: When you made this trip, did you park at a park and ride facility?

YES	1
NO	2
DK	998
RF	999

DT27a. Why did you choose [IMPORT ANSNWER FROM DT24] for this trip?

RECORD OPEN TEXT RESPONSE.

DT28. For this next question, you can refer to #11 on your travel log. Now, I want to know where you ended this trip? Was it at home, work or someplace else? [THEY STARTED FROM DT12 CAN'T BE SAME]

HOME (GOTO DT30)	1
WORK (GOTO DT30)	2
SOMEPLACE ELSE	3
DK	999

DT29. IF SOMEPLACE ELSE: Can you give me a street address or the names of two nearby intersecting streets?

Address (GOTO DT29A)	1
Intersection (GOTO DT29B)	2
DK	998
RF	999

DT29A. Collect address information

DT29B. Collect xstreet information

DT29C. IF SOMEPLACE ELSE: What city was that in? _____

DT30. About how many miles is this trip from door-to-door?Miles (#) valid range = 1-50

DT31. For this next question, you can refer to #12 on your travel log. At what time did you plan to arrive at your destination? [military time]

DT32. For this next question, you can refer to #13 on your travel log. What time did you actually arrive? [military time]

COMPUTE NEW VARIABLE, TRAVEL TIME = DT32-DT10

DT33 For this next question, you can refer to #14 on your travel log. This means your trip took about [TRAVEL TIME] minutes from door-to-door. Is this about right?

YES	1

NO→TRY TO CLARIFY START (DT10) and END (DT32) times	2
DK	998
RF	999

DT34. How much flexibility did you have in the time you had to arrive at your destination? Did you

Have to be there at a specific time	1
Have to be there at a specific time plus or minus 10 minutes	2
Plus or minus 30 minutes	3
Or did you have more flexibility in the arrival time than that?	4
DK	998
RF	999

DT35. For this next question, you can refer to #16 on your travel log. Did you make any stops or side trips as any part of this trip?

YES	1
NO (GOTO DT37)	2
DK (GOTO DT37)	998
REFUSED (GOTO DT37)	999

DT36. Which of the following best describes the type of stops you made? Was it to… [ALLOW MORE THAN ONE ANSWER]

Dropping child off at day care	6
Drop someone else off	1
Pick people up	2
Take care of personal business, like shopping	3
Do a work-related activity	4
Or, did you make multiple detours for many different purposes?	5
DK	998
RF	999

DT37. Were you delayed by congestion on this trip?

YES	1
NO (GOTO DT33DT39)	2
DK (GOTO DT39)	998
REFUSED (GOTO DT39)	999

DT38 Your trip took about [TRAVEL TIME] minutes door-to-door. If you had not been delayed by congestion, about how long do you think this trip would have taken? # minutes valid range = 5-120

DT39: IF DT5 = 1, 2: For this next question, you can refer to #17b on your travel log, under the "yes" option. If you had not used MnPASS for this trip, how long do you think this trip would have taken?

DT40: IF DT5=3: For this next question, you can refer to #17a on your travel log, under the "no" option. If you had used MnPASS, how long do you think this trip would have taken?

DT41. Which of the following experience best captures your travel experience on this trip? [ROTATE]

Very enjoyable	1
Slightly enjoyable	2
Slightly stressful	3
Very stressful	4
DK	998
RF	999

DT42. Based on this trip, how satisfied were you with the overall quality of your travel on this roadway?

100% satisfied	1
60% satisfied	2
30% satisfied	3
Not satisfied at all?	4
DK	998

DT43. IF DT3 = I-394: How would you describe the general level of congestion in the MnPASS lane at the time of your travel? Would you say the MnPASS lane was…[ROTATE]

Not congested at all	1
Slightly congested	2
Very congested	3
Extremely congested	4
DK	998
RF	999

DT44. IF DT3 = 1-394: What about the general traffic lanes at that time, would you say the lanes were…

Not congested at all	1
Slightly congested	2
Very congested	3
Extremely congested	4
DK	998

DT45. IF DT5 = 1, 2: Given the time saved using the MnPASS lane for this trip, do you think the toll you paid was…

Too high	1
Just right	2
Too low	3
DK	998

Stated Preference Questions -- only asked of TARGET TRIP MODE = SOV and TM2 = I-394

Now assume you're making the same trip in the future that you recorded in your travel log. It's a trip on the same day, at the same time of day, for the same purpose, and you're under the same time pressures. You enter the freeway, I-394, and have the option of making this trip using MnPASS if you want to. RANDOMLY ASSIGN [$] AND [#] BELOW

SP1-2. If you were to use the general traffic lanes on I-394, your trip would take TOLLTIME+[#] and be free. If you used the MnPASS lane you would pay [$] and your trip would take TOLLTIME, saving [#] minutes. Now under these conditions, which would you choose to: [ROTATE]

Use the MnPASS lane, pay [$] and save [#] minutes	1
Use the general lane for free	2
DK	998

SP1-2. If you were to use the MnPASS lane on I-394, you would pay [$] and your trip would take TOLLTIME. If you were to use the general traffic lanes, your trip would take TOLLTIME+[#], [#] minutes longer than in the toll lane, but it would be free, Now under these conditions, which would you choose to: [ROTATE]

Use the MnPASS lane, pay [$] and save [#] minutes	1
Use the general lane for free	2
DK	998

SP3. Now imagine a different scenario. If you were to use the MnPASS lane on I-394, you would pay [$] and you would save [#] minutes. Under these conditions what would you do?

Use the MnPASS lane, pay [$] and save [#] minutes	1
Use the general lane for free	2
DK	998

Respondent Characteristics

So we can make sure this survey represents all persons in the Twin Cities area. I need to ask some questions about you.

PANEL SAMPLE SKIP TO R12

R1. What is the highest grade or year of school that you have completed?

HIGH SCHOOL OR LESS	1
SOME COLLEGE, TRADE OR VOCATIONAL SCHOOL	2

GRADUATED COLLECTED WITH A BA DEGREE	3
GRADUATE WORK BEYOND BA DEGREE	4
DK	998
RF	999

R2. And what is your age, are you between...

18-24	1
25-34	2
35-44	3
45-54	4
55-64	5
65+	6
RF	999

R3. Currently are you…[ALLOW MORE THAN ONE RESPONSE]

Employed full or part time (GOTO R4)	1
Homemaker	2
A Student full or part time	3
Retired	4
Disabled	5
Unemployed	6
DK	998
RF	999

R4. Do you work…

Part-time, less than 30 hours	1
Full-time, 30 hours or more	2
DK	998
RF	999

R5. Are you self-employed?

YES	1
NO	2
DK	998
RF	999

R6A. IF S4>1: How many of the other people in your household work outside the home, either full- or part-time? _____ # valid range 1-9

COMPUTE NEW VARIABLE, NUMBER OF WORKERS IN HH = R3 (1) + R5

R6. How many years have you lived at your current residence?
_____ YEARS valid range = 1 - 99

R7. Do you own or rent this residence?

OWN	1
RENT	2
OTHER	3

DK	998
RF	999

R8. Are you a licensed driver?

YES	1
NO	2
DK	998
RF	999

R9. IF S4>1: How many of the other people in your household are licensed to drive?
_____ # valid range = 1-9

COMPUTE NEW VARIABLE, NUMBER OF LICENSED DRIVERS IN HH = R8 + R9

R10. What is the total annual income for your household, when you consider the income of all employed individuals? Was it above or below $75,000?

BELOW $75,000 (GOTO R11A)	1
ABOVE $75,000 (GOTO R11B)	2
RF (GOTO R14)	999

R11A. Please stop me when I state the range that best describes your household's total annual income…

$30,000 or less	1
$30,000 to $49,999	2
$50,000 to $74,999	3
RF	999

R11B. Please stop me when I state the range that best describes your household's total annual income…

$75,000 to $99,999	4
$100,000 to $124,999	5
$125,000 to $149,999	6
$150,000 or above	7
RF	999

R12. Which of the following categories best describes your race or ethnic background?

White or Caucasian	1
Black/ African American	2
Hispanic	3
Asian	4
RF	999

R13.GENDER (DO NOT ASK)

MALE	1
FEMALE	2

Thank you/ Wrap Up

Thank you so much for answering my questions today. Your participation in this survey will make a difference in our evaluation of the MnPASS Project. Would you be willing to participate in future research activities on this topic?

YES	1
NO	2
UNSURE	998
RF	999

IF NO or UNSURE: PROVIDE MORE INFORMATION ABOUT USES OF RESULTS AND BENEFITS OF PARTICIPATION.

P1: IF AGREE TO PARTICIPATE IN FUTURE SURVEYS We will need to contact you to let you know about next survey. Which of the following ways would be the best ways to contact you?

Home phone	1
Cell phone	2
Email	3

P2: COLLECT CONTACT INFORMATION

Confirm home number
Collect cell phone
Collect email

APPENDIX D: PANEL ATTRITION ANALYSIS

TABLE D1: PANEL MEMBERS AND PANEL ATTRITION BY HOUSEHOLD SIZE

WAVE 1		HOUSEHOLD SIZE				TOTAL
		1	2	3	4+	
PANEL	*Count*	64	129	49	101	343
	Row %	18.7	37.6	14.3	29.4	100.0
ATTRITORS	*Count*	124	255	126	152	657
	Row %	18.9	38.8	19.2	23.1	100.0
Total	*Count*	188	384	175	253	1,000
	Row	18.8	38.4	17.5	25.3	100.0

Note: Asked of Wave 1 respondents that agreed to participate in Wave 2.

TABLE D2: PANEL MEMBERS AND PANEL ATTRITION BY HOUSEHOLD VEHICLES

WAVE 1		COLLAPSED HOUSEHOLD VEHICLES				TOTAL
		0	1	2	3+	
PANEL	*Count*	0	82	185	76	343
	Row %	0.0	23.9	53.9	22.2	100.0
ATTRITORS	*Count*	4	143	347	163	657
	Row %	0.6	21.8	52.8	24.8	100.0
Total	*Count*	4	225	532	239	1,000
	Row %	0.4	22.5	53.2	23.9	100.0

Note: Asked of Wave 1 respondents that agreed to participate in Wave 2.

TABLE D3: PANEL MEMBERS AND PANEL ATTRITION BY EDUCATION

WAVE 1		EDUCATION					TOTAL
		High School or less	Some college, trade / voc.	Graduated with a BA / BS	Graduated beyond BA / BS	Refused	
PANEL	*Count*	31	72	126	114	0	343
	Row %	9.0	21.0	36.7	33.2	0.0	100.0
ATTRITORS	*Count*	69	148	273	165	2	657
	Row %	10.5	22.5	41.6	25.1	0.3	100.0
Total	*Count*	100	220	399	279	2	1,000
	Row %	10.0	22.0	39.9	27.9	0.2	100.0

Note: Asked of Wave 1 respondents that agreed to participate in Wave 2.

TABLE D4: PANEL MEMBERS AND PANEL ATTRITION BY AGE

WAVE 1		AGE						TOTAL
		18-34	35-44	45-54	55-64	65+	Refused	
PANEL	*Count*	34	73	104	72	60	0	343
	Row %	9.9	21.3	30.3	21.0	17.5	0.0	100.0
ATTRITORS	*Count*	145	136	154	127	93	2	657
	Row %	22.1	20.7	23.4	19.3	14.2	0.3	0.0
Total	*Count*	179	209	258	199	153	2	1,000
	Row %	17.9	20.9	25.8	19.9	15.3	0.2	100.0

Note: Asked of Wave 1 respondents that agreed to participate in Wave 2.

TABLE D5: PANEL MEMBERS AND PANEL ATTRITION BY EMPLOYMENT

WAVE 1		EMPLOYMENT						TOTAL
		Employed full or part time	Homemaker	Student full or part time	Retired	Disabled	Unemployed	
PANEL	*Count*	276	50	8	59	5	7	405
	Row %	68.2	12.3	2.0	14.6	1.2	1.7	100.0
ATTRITORS	*Count*	537	103	32	102	9	11	794
	Row %	67.7	13.0	4.0	12.8	1.1	1.4	100.0
Total	*Count*	813	153	40	161	14	18	1,199
	Row %	67.8	12.8	3.3	13.4	1.2	1.5	100.0

Note: Multiple response questions based on % responses

TABLE D6: PANEL MEMBERS AND PANEL ATTRITION BY FULL OR PART TIME EMPLOYMENT STATUS

WAVE 1		FULL OR PART TIME EMPLOYMENT			TOTAL
		Part time, less than 30-hours	Full time, 30-hours or more	Don't Know	
PANEL	*Count*	40	236	0	276
	Row %	14.5	85.5	0.0	100.0
ATTRITORS	*Count*	79	456	2	537
	Row %	14.7	84.9	0.4	100.0
Total	*Count*	119	692	2	813
	Row %	14.7	85.1	0.2	100.0

Note: Asked of Wave 1 respondents that agreed to participate in Wave 2.

TABLE D7: PANEL MEMBERS AND PANEL ATTRITION BY HH WORKERS

WAVE 1		COLLAPSED HOUSEHOLD WORKERS				TOTAL
		0	1	2	3+	
PANEL	*Count*	52	117	145	29	343
	Row %	16.0	34.1	42.3	7.6	100.0
ATTRITORS	*Count*	76	233	289	59	657
	Row %	11.6	35.5	44.0	8.9	100.0
Total	*Count*	128	350	434	88	1,000
	Row %	13.1	35.0	43.4	8.5	100.0

Note: Asked of Wave 1 respondents that agreed to participate in Wave 2.

TABLE D8: PANEL MEMBERS AND PANEL ATTRITION BY HOUSING TENURE

WAVE 1		HOUSING TENURE				TOTAL
		Own	Rent	Other	Refused	
PANEL	*Count*	313	29	1	0	343
	Row %	91.3	8.5	0.2	0.0	100.0
ATTRITORS	*Count*	538	105	11	3	657
	Row %	81.9	16.0	1.6	0.5	100.0
Total	*Count*	851	134	12	3	1,000
	Row %	85.1	13.4	1.2	0.3	100.0

Note: Asked of Wave 1 respondents that agreed to participate in Wave 2.

TABLE D9: PANEL MEMBERS AND PANEL ATTRITION BY LICENSED DRIVERS

WAVE 1		LICENSED DRIVERS IN HOUSEHOLD				TOTAL
		0	1	2	3+	
PANEL	*Count*	0	80	209	54	343
	Row %	0.0	23.3	60.9	15.8	100.0
ATTRITORS	*Count*	3	152	397	105	657
	Row %	0.5	23.1	60.4	16.0	100.0
Total	*Count*	3	232	606	159	1,000
	Row %	0.3	23.2	60.6	15.9	100.0

Note: Asked of Wave 1 respondents that agreed to participate in Wave 2.

TABLE D10: PANEL MEMBERS AND PANEL ATTRITION BY HOUSEHOLD INCOME

WAVE 1		COLLAPSED HOUSEHOLD INCOME			TOTAL
		Less than $50k	$50k or greater	Refused	
PANEL	*Count*	69	274	0	343
	Row %	20.1	79.9	0.0	100.0
ATTRITORS	*Count*	109	478	0	587
	Row %	18.6	81.4	0.0	100.0[1]
Total	*Count*	178	752	0	930
	Row %	19.1	80.9	0	100.0

Note: Asked of Wave 1 respondents that agreed to participate in Wave 2.

TABLE D11: PANEL MEMBERS AND PANEL ATTRITION BY GENDER

WAVE 1		GENDER		TOTAL
		Male	Female	
PANEL	*Count*	197	146	343
	Row %	57.4	42.6	100.0
ATTRITORS	*Count*	338	319	657
	Row %	51.4	48.6	100.0
Total	*Count*	535	465	1,000
	Row %	53.5	46.5	100.0

Note: Asked of Wave 1 respondents that agreed to participate in Wave 2.

[1] Income was not imputed for Wave 1 and was for Waves 2 and 3. As such, the comparison shown here compares the income distribution of the panel for which income has been imputed (if refused) to the attritors for which income has been omitted (if refused).

APPENDIX E: PANEL DEMOGRAPHICS

TABLE E1: PANEL MEMBERS AND PANEL ATTRITION BY HOUSEHOLD SIZE

WAVE 1		HOUSEHOLD SIZE				TOTAL
		0	1	2	3+	
BASELINE PANEL	*Count*	188	384	175	253	1,000
	Row %	18.8	38.4	17.5	25.3	100.0
WAVE 3 PANEL	*Count*	64	129	49	101	343
	Row %	18.7	37.6	14.3	29.4	100.0

TABLE E2: PANEL MEMBERS AND PANEL ATTRITION BY HOUSEHOLD VEHICLES

WAVE 1		HOUSEHOLD VEHICLES				TOTAL
		0	1	2	3+	
BASELINE PANEL	*Count*	4	225	532	239	1,000
	Row %	0.4	22.5	53.2	23.9	100.0
WAVE 3 PANEL	*Count*	0	82	185	76	343
	Row %	0.0	23.9	53.9	22.2	100.0

TABLE E3: PANEL MEMBERS AND PANEL ATTRITION BY EDUCATION

WAVE 1		EDUCATION					TOTAL
		High School or less	Some college, trade / voc.	Graduated with a BA / BS	Graduated beyond BA / BS	Refused	
BASELINE PANEL	*Count*	100	220	399	279	2	1,000
	Row %	10.0	22.0	39.9	27.9	0.2	100.0
WAVE 3 PANEL	*Count*	31	72	126	114	0	343
	Row %	9.0	21.0	36.7	33.2	0.0	100.0

TABLE E4: PANEL MEMBERS AND PANEL ATTRITION BY AGE

WAVE 1		AGE						TOTAL
		18-34	35-44	45-54	55-64	65+	Refused	
BASELINE PANEL	*Count*	179	209	258	199	153	2	1,000
	Row %	17.9	20.9	25.8	19.9	15.3	0.2	100.0
WAVE 3 PANEL	*Count*	34	73	104	72	60	0	343
	Row %	9.9	21.3	30.3	21.0	17.5	0.0	100.0

TABLE E5: PANEL MEMBERS AND PANEL ATTRITION BY EMPLOYMENT

WAVE 1		EMPLOYMENT						TOTAL
		Employed full or part time	Homemaker	student full or part time	Retired	Disabled	Unemployed	
BASELINE PANEL	*Count*	813	153	40	161	14	18	1,199
	Row %	67.8	12.8	3.3	13.4	1.2	1.5	100.0
WAVE 3 PANEL	*Count*	276	50	8	59	5	7	405
	Row %	68.1	12.4	2.0	14.6	1.2	1.7	100.0

Multiple response table base on percent responses

TABLE E6: PANEL MEMBERS AND PANEL ATTRITION BY FULL OR PART TIME EMPLOYMENT STATUS

WAVE 1		FULL OR PART TIME EMPLOYMENT			TOTAL
		Part time, less than 30-hours	Full time, 30-hours or more	Don't Know	
BASELINE PANEL	*Count*	119	692	2	813
	Row %	14.6	85.2	0.2	100.0
WAVE 3 PANEL	*Count*	40	236	0	276
	Row %	14.4	85.6	0.0	100.0

TABLE E7: PANEL MEMBERS AND PANEL ATTRITION BY HH WORKERS

WAVE 1		COLLAPSED HOUSEHOLD WORKERS				TOTAL
		0	1	2	3+	
BASELINE PANEL	*Count*	128	350	434	88	1,000
	Row %	13.1	35.0	43.4	8.5	100.0
WAVE 3 PANEL	*Count*	52	117	145	29	343
	Row %	16.0	34.1	42.3	7.6	100.0

TABLE E8: PANEL MEMBERS AND PANEL ATTRITION BY HOUSING TENURE

WAVE 1		HOUSING TENURE				TOTAL
		Own	Rent	Other	Refused	
BASELINE PANEL	*Count*	851	134	12	3	1,000
	Row %	85.1	13.4	1.2	0.3	100.0
WAVE 3 PANEL	*Count*	313	29	1	0	343
	Row %	91.3	8.5	0.2	0.0	100.0

TABLE E9: PANEL MEMBERS AND PANEL ATTRITION BY LICENSED DRIVERS

WAVE 1		LICENSED DRIVERS IN HOUSEHOLD				TOTAL
		0	1	2	3+	
BASELINE PANEL	*Count*	3	232	606	159	1,000
	Row %	0.3	23.2	60.6	15.9	100.0
WAVE 3 PANEL	*Count*	0	80	209	54	343
	Row %	0.0	23.3	60.9	15.8	100.0

TABLE E10: PANEL MEMBERS AND PANEL ATTRITION BY HOUSEHOLD INCOME

WAVE 1		HOUSEHOLD INCOME								TOTAL
		Less than $30k	$30k to Less than $50k	$50k to Less than $75k	$75k to Less than $100k	$100k to Less than $125k	$125k to Less than $150k	$150k or More	Refused	
BASELINE PANEL	*Count*	56	111	161	212	132	76	130	122	1,000
	Row %	5.6	11.1	16.1	21.2	13.2	7.6	13.0	12.2	100.0
WAVE 3 PANEL	*Count*	19	50	61	77	60	28	48	0	343
	Row %	5.5	14.6	17.8	22.4	17.5	8.2	14.0	0.0	100.0

TABLE E11: PANEL MEMBERS AND PANEL ATTRITION BY GENDER

WAVE 1		GENDER		TOTAL
		Male	Female	
BASELINE PANEL	*Count*	535	465	1,000
	Row %	53.5	46.5	100.0
WAVE 3 PANEL	*Count*	197	146	343
	Row %	57.4	42.6	100.0

Appendix C
Detailed Model, Measures, and Constructs

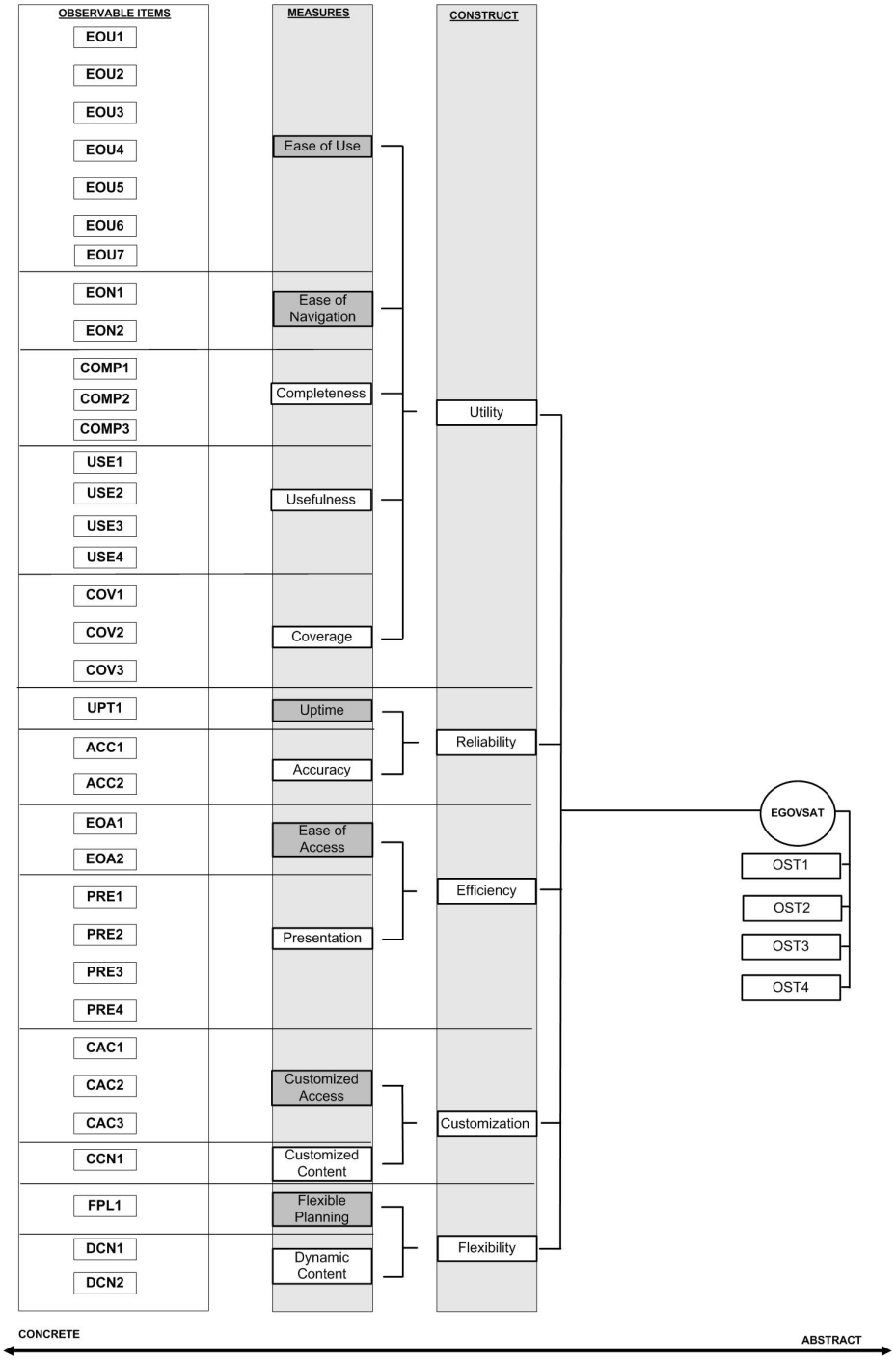


Figure C.1 Detailed Model

		Description	Sources
1. Utility		**Examines whether the Web site is usable or not**	
Process	1.1 Ease of Use	Whether the Web site is easy to use	[1, 2, 3]
	1.2 Ease of Navigation	Whether the Web site provides features for navigating with ease	[3, 4, 5, 6]
Content	1.3 Completeness	Whether the Web site provides complete information regarding a planned trip	[4]
	1.4 Usefulness	Whether features and information provided by the Web site are found useful by the users	[4]
	1.5 Coverage	Whether the Web site appropriately covers geographical area	[3]
2. Reliability		Whether the Web site provides appropriate technical functioning and the content provided is accurate	[5]
Process	2.1 Uptime	Whether the site is available for planning a trip	[5]
Content	2.2 Accuracy	Whether the content provided by the Web site is accurate relative to its image	[5]

Table C.1 Description and Sources for the Measures and Constructs Shown in Figure C.1

		Description	Sources
3. Efficiency		Whether the features available in the Web site are easily accessible and the information is organized appropriately	[5]
Process	3.1 Ease of Access	Whether the information and features are easily accessible	[3]
Content	3.2 Presentation	Whether the information is organized appropriately	[6, 7]
4. Customization		Whether the information and access to information can be tailored to individual customers' preferences.	[5]
Process	4.1 Customized Access	Whether the information in the Web site can be accessed to suite individual customer's preferences.	[6]
Content	4.2 Customized Content	Whether the information in the Web site can be customized to suite individual customer's preferences	[6]
5. Flexibility		Whether the Web site provides choice of ways to state the need and delivers dynamic information	[5]
Process	5.1 Flexible Planning	Whether the trips can be planned based on users' preferences for route and transfers	
Content	5.2 Dynamic Content	Whether the content is close to real-time information	

Table C.1 Description and sources for the measures and constructs shown in Figure C.1 (continued)

(1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree Nor Disagree, 4 = Agree, 5 = Strongly Agree)		
Code	**Questions**	**Source**
EOU1	I thought the system was easy to use	[1, 2, 8, 9]
EOU2	I found the system complex	[2, 8]
EOU3	I would need technical support to use the system	[8]
EOU4	I needed to learn a lot of things before I could get going with this system	[8]
EOU5	I would like to use this system frequently	[8]
EOU6	I found the system cumbersome to use	[8]
EOU7	People would learn to use this system quickly.	[8]
EON1	I was able to get to various features on the Web site with ease.	[5, 7]
EON2*	I was lost while planning for the trip.	
COM1*	I found detailed fare, transfer and route information for the trip that I planned	[6]
COM2*	I was able to specify start and destination address for trip with ease	
COM3*	I found relevant maps for the trip that I planned for.	[2]

Table C.2 Survey Questions

(1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree Nor Disagree, 4 = Agree, 5 = Strongly Agree)		
Code	**Questions**	**Source**
USE1	I found the information on the Web site to be very useful	[2]
USE2	I found helpful features on the Web site for accomplishing my task.	[1, 2]
USE3*	I was able to print my itinerary so that I can take it along.	
USE4	Through every step of the Web site, it consistently provided useful information	[1, 8]
COV1*	I found the Web site to be appropriate in its geographical coverage	[3, 9]
COV2*	I found various information such as road conditions, weather, maps, route and destinations provided by the Web site adequate for my trip planning	[9]
COV3*	I found that the Web site displayed landmarks for the route which could be useful for trip planning.	
UPT1	I was able to access the Web site for trip planning	[5]
ACC1*	I found that the Web site planned the trip for the route that I had asked for	
ACC2	I believe that the information provided by the Web site was accurate	[1, 2, 6, 9]
EOA1*	I found all the essential trip planning features with ease	[2]

Table C.2 Survey Questions (continued)

(1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree Nor Disagree, 4 = Agree, 5 = Strongly Agree)		
Code	**Questions**	**Source**
EOA2	I found that various functions were well integrated	[2, 8]
PRE1	I found that the content in the Web site was organized appropriately	[1, 2, 6, 7, 9]
PRE2	I was confused because the Web site provided too much information.	[1, 2, 7]
PRE3*	The Web site was able to combine different information such as road conditions, alternate routes and time estimate for travel	
PRE4	I found the design of the Web site visually pleasing.	[6, 7]
CAC1	I was able to request for accessing information the way I wanted to (For e.g. On mobile devices or Electronic mail) on the days I wanted to	[5]
CAC2	I was able to choose the manner in which I am sent reminders / notifications about my trip	[5]
CAC3	I was able to store the trip for future reference	
CCN1	The Web site provided the facility of delivering information to me on particular routes on specific days	
FPL1*	I was able to request for an itinerary based on certain conditions such as shortest route, least transfers, etc	[10]

Table C.2 Survey Questions (continued)

(1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree Nor Disagree, 4 = Agree, 5 = Strongly Agree)		
Code	**Questions**	**Source**
DCN1*	I was able to request for multiple modes of transportation (e.g. walking, buses or trains) for my trip	[10]
DCN2*	I found that real-time information such as weather, road conditions, etc conveyed the latest happenings on the road	
OST1	I felt very confident using this system	[2, 4, 8]
OST2	It was very pleasant experience to use the Web site	[4]
OST3	I found the Web site frustrating at some point	[4]
OST4	I was completely satisfied in using the Web site	[4, 9]

Table C.2 Survey Questions (continued)

Appendix C References

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7. Huizingh, E.K.R.E. "The Content and Design of Web Site: An Empirical Study," *Information and Management* (27:3), pp. 123–134, 2000.

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9. Wang, Y., Tang, T., and Tang, J.E. "An Instrument for Measuring Customer Satisfaction Toward Websites that Market Digital Products and Services," *Journal of Electronic Commerce Research* (2:3), pp. 89–102, 2001.

10. Federal Transit Authority, *Usability Guidelines for Transit Web Sites*, 2004. Available at http://www.transitweb.its.dot.gov/guidelines/main.asp (last accessed June 8, 2005).

Appendix D
Snapshots

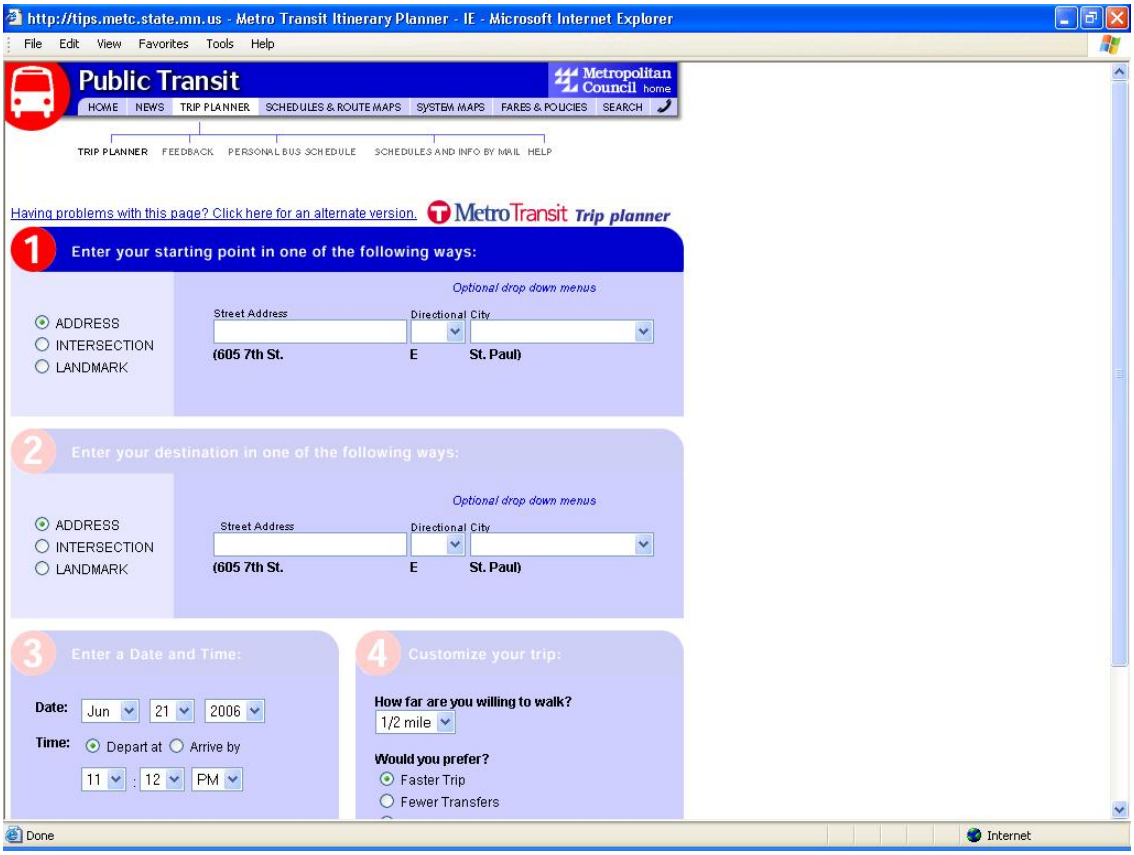

Figure D.1 MetroTransit Trip Planner (Minneapolis/St. Paul)

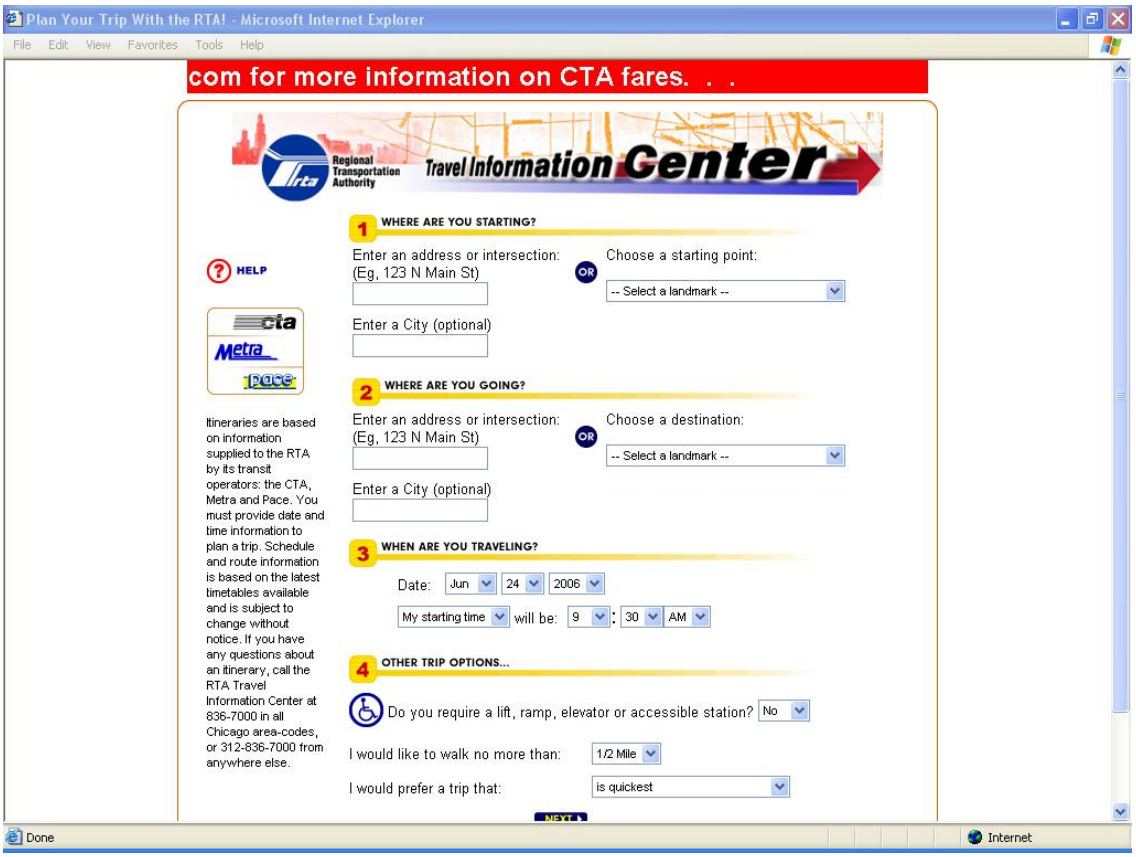

Figure D.2 RTA Chicago Trip Planner

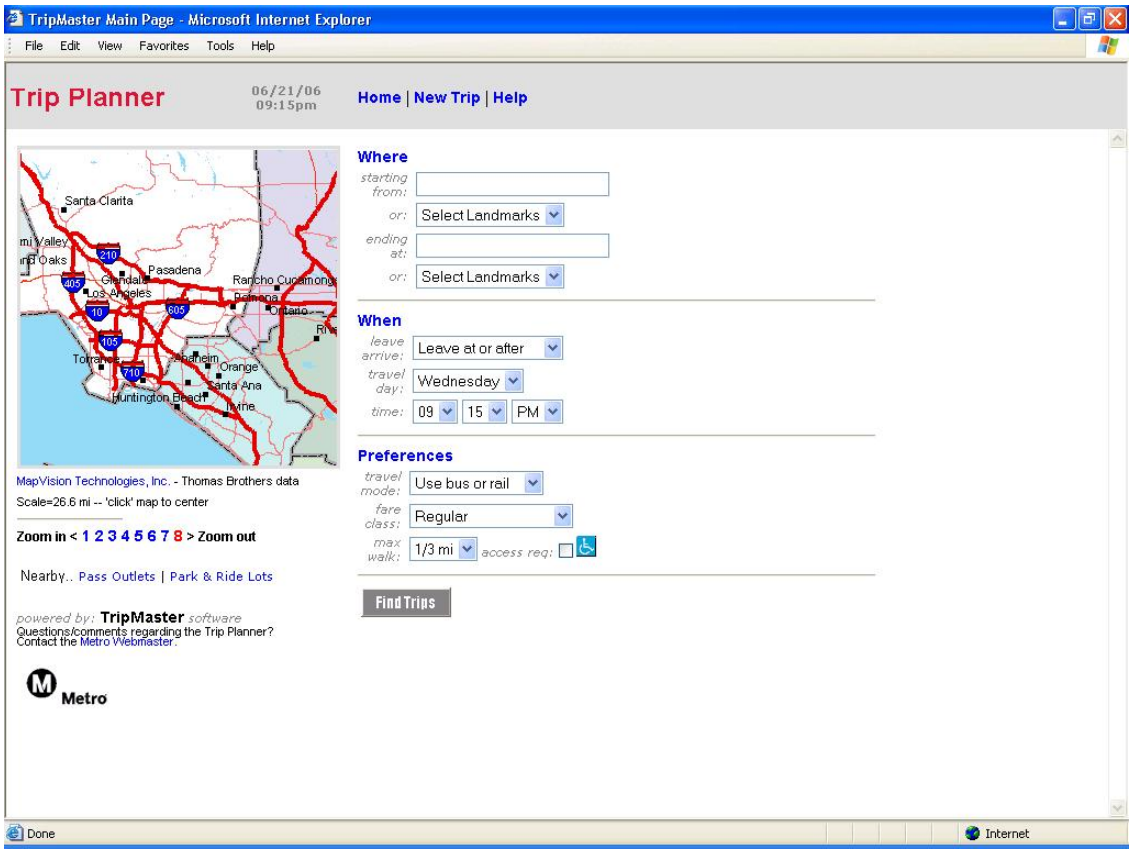

Figure D.3 MetroTransit Trip Planner (Los Angeles)

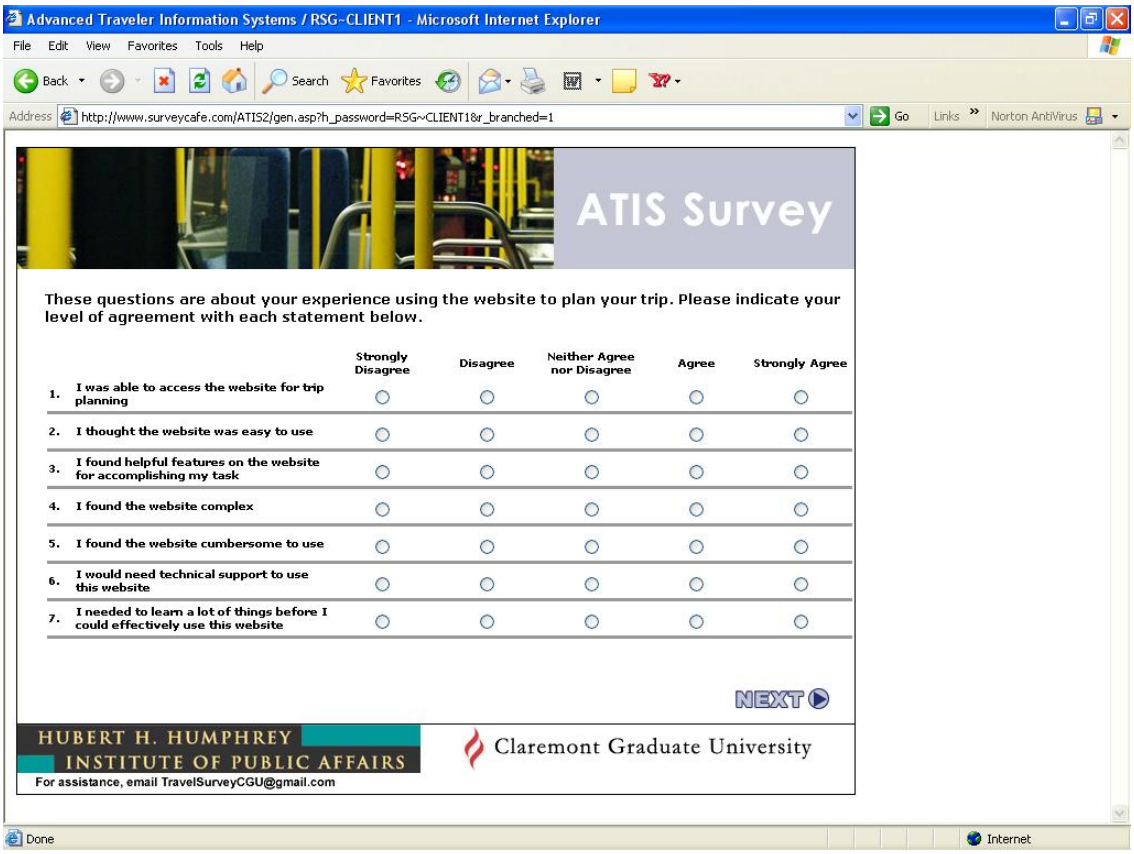

Figure D.4 Online Survey

Appendix E
Survey Questions

No.	Question
1	Where did you start
2	Where did you end
3	Were you successful in planning trip? If ‘no’, why?
4	Aspects of the site you disliked
5	Aspects of the site you liked

Table E.1 Open-Ended Questions

No.	Question
1	I would like to use this system frequently
2	I found the system complex
3	I thought the system was easy to use
4	I would need technical support to use this system
5	I found the various functions were well integrated
6	I thought there was too much inconsistency
7	People would learn to use this system very quickly
8	I found the system cumbersome to use
9	I felt very confident using the system
10	I needed to learn a lot of things before I could get going with this system

Table E.2 Likert-Scale: System Usability Scale (SUS)

No.	Question
1	The itinerary maker was easily accessible
2	The input controls were labeled appropriately
3	The results returned were displayed in sufficient detail
4	The results were annotated to indicate various options regarding my inputs.
5	When an error occurred (or no results were returned) I got the help I needed.
6	The maps and schedules were provided depending on the travel mode that I selected.
7	The lists generated by itinerary maker were arranged in chronological order.

Table E.3 Likert-Scale: Trip Planning

Which one of the following do you think is an important feature?
Schedules and Routes
Maps
Transit Modes
Navigation
Menu
Web Page
Search Features
Lists
Home Page
Demand Response Services
Web Page
Search Features

Table E.4 Important Feature (for LA Respondents)

Appendix F
Phase I: Results

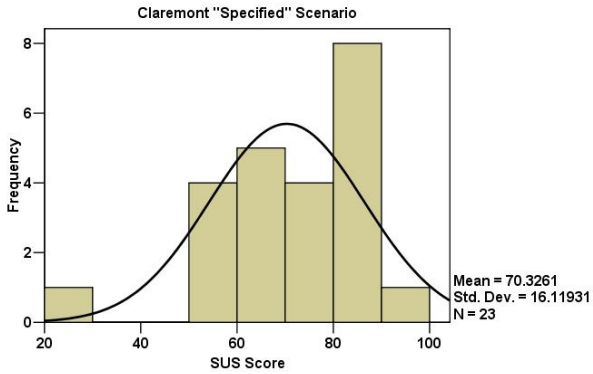

Figure F.1 SUS Score for Claremont "Specified" Scenario

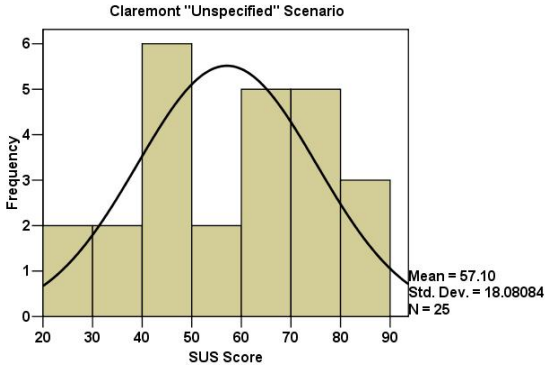

Figure F.2 SUS Score for Claremont "Unspecified" Scenario

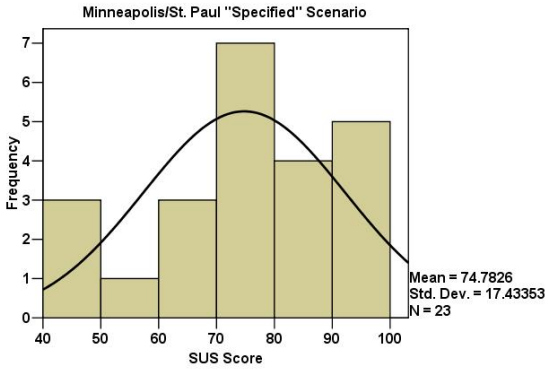

Figure F.3 SUS Score for MN/St. Paul Scenario

SUS Score – California and Minnesota Groups			
Group	**No. of Responses**	**Mean**	**Std. Deviation**
CGU Group1 (Specified)	23	70.3	16.12
CGU Group2 (Unspecified)	25	57.1	18.08
MN Group (Specified)	23	74.7	17.4
Mean Trip Plan Score – California Group			
Group	**No. of Responses**	**Mean (Max-5)**	**Std. Deviation**
CGU GROUP1 (Specified)	23	3.59	0.63
CGU Group2 (Unspecified)	25	3.28	0.65

Table F.1 SUS: Trip Planning Score and Features

Most Important Feature – California Group		
	Frequency	**Percent**
Schedules and Routes	22	45.8
Maps	7	14.6
Transit Modes	5	10.4
Navigation	4	8.3
Menu	3	6.3
Web Page	2	4.2
Search Features	2	4.2
Lists	1	2.1
Home Page	1	2.1
Demand Response Services	1	2.1
Web Page	2	4.2
Search Features	2	4.2
Total	**48**	**100**

Table F.1 SUS, Trip Planning Score and Features (continued)

Appendix G
Phase II: Survey Protocol

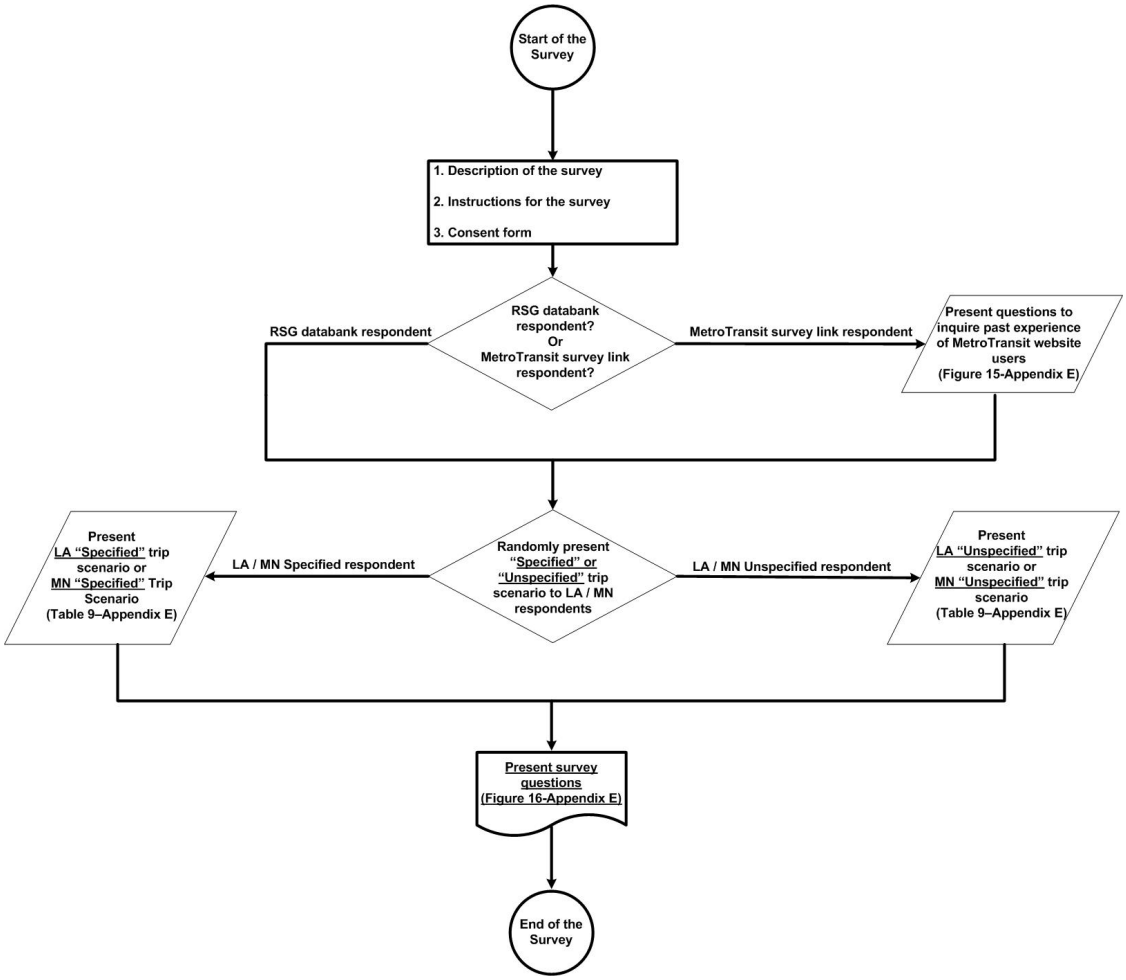

Figure G.1 Survey Outline

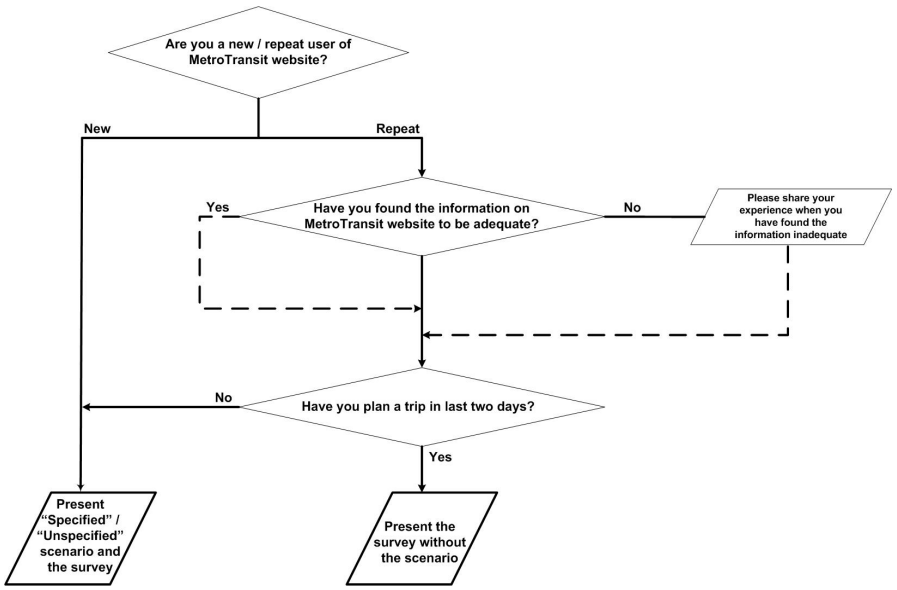

Figure G.2 MetroTransit Specific Questions

LA "Specified" Trip Scenario
You have decided to make the following work, commute and recreational trips using public transportation this Friday and Saturday. Pre-plan these trips using the Los Angeles City Metropolitan Transportation Authority Web site, http://www.mta.net. Friday: Step 1: Plan a trip from your home, which is near the intersection of Orange Grove Ave. and Kenneth Rd. in Burbank, to your workplace at Pershing Square, arriving at 8:30 a.m. on Friday. Step 2: Plan a trip from your workplace at Pershing Square to the Pasadena Playhouse (located at 39 S. El Molino Ave.), to see a play that starts at 8:00 p.m. Assume you will spend the night at a friend's house close to the Playhouse. Saturday: Step 3: Plan a trip from your friend's house which is near the Pasadena Playhouse (39 S. El Molino Ave.) to Santa Monica Beach. Plan to reach the beach around 11:00 a.m. Step 4: Plan your trip from Santa Monica Beach back to your home, which is near the intersection of Orange Grove Ave. and Kenneth Rd in Blaine. Plan to reach your home by 6:30 p.m.

Table G.1 Survey Scenarios

LA "Unspecified" Trip Scenario
Imagine that you have decided that this Friday and Saturday you will make recreational trips in the greater Los Angeles area using public transportation. Pre-plan these trips using the Los Angeles County Metropolitan Transportation Authority Web site, http://www.mta.net. Friday: Step 1: Plan a recreational trip from your workplace to an amusement park, a movie theater, or a museum. You will be making this trip in the evening after your day's work. Step 2: Plan your trip back home. Saturday: Step 3: Plan a recreational trip for this Saturday from your home to a different amusement park, movie theater, museum or other recreational location. Step 4: Plan your trip back home from that location.

Table G.1 Survey Scenarios (continued)

MN "Specified" Trip Scenario
You have decided to make the following work, commute and recreational trips using public transportation this Friday and Saturday. Pre-plan these trips using the MetroTransit Web site, http://www.metrotransit.org. Friday: Step 1: Plan a trip from your home near the intersection of Polk Street and 89th Avenue to your workplace at the Target Center in downtown, arriving at 8:30 a.m. on Friday. Step 2: Plan a trip from the Target Center to the Mall of America, arriving at the mall to meet friends by 7:00 p.m. Assume that you will spend the night at a friend's house nearby and that you will be dropped off at the 82nd Street Transit center on Saturday. Saturday: Step 3: Plan a trip on Saturday from the 82nd Street Transit Center to the Metrodome to see a game that starts at noon. Step 4: Plan a trip leaving the Metrodome at 4:30 p.m. on Saturday to return to your home at Polk Street and 89th Avenue.

Table G.1 Survey Scenarios (continued)

MN "Unspecified" Trip Scenario
Imagine that you have decided that this Friday and Saturday you will make recreational trips in the greater Minneapolis area using public transportation. Pre-plan these trips using the MetroTransit Web site, http://www.metrotransit.org. Friday: Step 1: Plan a recreational trip for this Friday from your workplace to an amusement park, a movie theater, or a museum. You will be making this trip in the evening after your day's work. Step 2: Plan your trip back home. Saturday: Step 3: Plan a recreational trip for this Saturday from your home to a different amusement park, movie theater, museum or other recreational location. Step 4: Plan your trip back home from that location.

Table G.1 Survey Scenarios (continued)

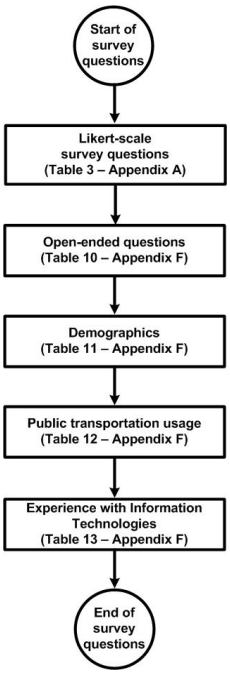

Figure G.3 Survey Structure

Appendix H
Phase II: Survey Questions

Questions
Were you successful in planning the trip?
(Yes, No – Please explain why)
What were the features you liked?
What were the features you disliked?

Table H.1 Open-Ended Questions

Questions
What is your gender?
(Male, Female, Prefer not to answer)
What is your age?
(18 to 24,25 to 34,35 to 44,45 to 54,55 to 64,65 or older, Prefer not to answer)
What is the highest level of education that you have completed?
(Less than high school graduate, Graduated from high school or received equivalent degree, Attended college but did not graduate, Bachelor's degree, Associate degree, Master's degree, Doctoral degree, Other professional degree, Prefer not to answer)
What is your employment status?
(Employed Full-Time, Employed Part-Time, Unemployed, Student – Working or Part-Time, Student - Not Working, Homemaker, Retired, Prefer not to answer)
What is your approximate household income?
(Less than $25,000, $25,000 - $49,999, $50,000 - $74,999, $75,000 - $99,999, $100,000 - $149,999, $150,000 or more, Prefer not to answer)
Which of the following best describes your ethnicity?
(White / Caucasian, Black / African-American, Asian/Pacific-Islander, Hispanic/Latino, Other-Please Specify, Prefer not to answer)

Table H.2 Demographics

Questions
How often do you utilize public transportation?
(5 or more Times a week, 2 to 4 times a week, Once a week, 1 to 3 times a month, Less than once a month – Please specify # of times per year _____, I don't use public transportation)
What is the primary purpose for which you use public transportation?
(Work, School, Shopping, Medical, Recreation, Visit family or friends, Vacation, Other_____ , I don't use public transportation)
How often do you use public transportation Web sites to plan trips?
(5 or more Times a week, 2 to 4 times a week, Once a week, 1 to 3 times a month, Less than once a month – Please specify # of times per year _____)
Do you have a personal vehicle available for transportation when you want?
(Always, Most of the Time, Sometimes, Rarely, Never)

Table H.3 Public Transportation Usage

How long have you been using computers?
_____Year(s)
How long have you been using Internet?
_____Year(s)
Which of the following devices do you have available to use when you want?
(Regular Cell Phone, Cell Phone with Internet Access, Personal Digital Assistants (PDA) with Wireless Communications, Portable Computer with Wireless Communications, Pager, None of These)

Table H.4 Experience with Advanced Technologies

Appendix I
Phase II: Results

Survey Response Code		Los Angeles (%)	Minneapolis/ St. Paul (%)
	N (Number of Respondents)	**155**	**246**
1	**18-24**	8.4	21.5
2	**25-34**	21.9	29.3
3	**35-44**	27.1	19.1
4	**45-54**	22.6	18.7
5	**55-64**	13.5	6.9
6	**65 or older**	6.5	0.4
7	**Prefer not to answer**	0.0	4.1
	Mean	3.30	2.78

Table I.1 Age

Survey Response Code		Los Angeles (%)	Minneapolis/ St. Paul (%)
	N (Number of Respondents)	**155**	**246**
1	**Female**	44.5	57.7
2	**Male**	55.5	37.8
3	**Prefer not to answer**	0.0	4.5
	Mean	1.55	1.47

Table I.2 Gender

Survey Response Code		Los Angeles (%)	Minneapolis/ St. Paul (%)
	N (Number of Respondents)	**155**	**246**
1	**White/Caucasian**	72.3	85
2	**Black/African-American**	5.8	4.9
3	**Asian/Pacific-Islander**	10.3	2.0
4	**Hispanic/Latino**	7.7	0.4
5	**Other**	1.9	3.3
6	**Prefer not to answer**	1.9	4.5
	Mean	1.67	1.46

Table I.3 Ethnicity

Survey Response Code		Los Angeles (%)	Minneapolis/ St. Paul (%)
	N (Number of Respondents)	**155**	**246**
1	**Less than high school graduate**	0.6	1.6
2	**Graduated from high school or received equivalent degree**	10.3	11.0
3	**Attended college but did not graduate**	21.9	25.2
4	**Bachelor's Degree**	36.8	33.3
5	**Associate's Degree**	9.7	9.3
6	**Master's degree**	14.8	11.4
7	**Doctoral degree**	2.6	1.6
8	**Other professional degree (MD, LLB, etc.)**	1.9	2.4
9	**Prefer not to answer**	1.3	4.1
	Mean	4.17	4.15

Table I.4 Education

Survey Response Code		Los Angeles (%)	Minneapolis/ St. Paul (%)
	N (Number of Respondents)	**155**	**246**
1	**Employed Full-Time**	54.8	56.9
2	**Employed Part-Time**	14.2	9.8
3	**Unemployed**	5.2	6.5
4	**Student-Working or Part-time**	2.6	12.2
5	**Student-Not Working**	3.2	8.1
6	**Homemaker**	9.7	3.3
7	**Retired**	9.0	2.0
8	**Prefer not to answer**	1.3	1.2
	Mean	2.57	2.29

Table I.5 Employment Status

Survey Response Code		Los Angeles (%)	Minneapolis/ St. Paul (%)
	N (Number of Respondents)	**155**	**246**
1	**Less than $25,000**	6.5	19.1
2	**$25,000 - $49,999**	25.8	27.2
3	**$50,000 - $74,999**	20.0	24.0
4	**$75,000 - $99,999**	18.1	10.6
5	**$100,000 - $149,999**	16.1	6.1
6	**$150,000 – More**	6.5	2.8
7	**Prefer not to answer**	7.1	10.2
	Mean	3.59	3.07

Table I.6 Annual Income

Survey Response Code		Los Angeles (%)	Minneapolis/ St. Paul (%)
	N (Number of Respondents)	**155**	**246**
1	**5 or more times a week**	6.5	48.0
2	**2 to 4 times a week**	7.1	17.5
3	**Once a week**	6.5	4.1
4	**1 to 3 times a month**	14.8	10.2
5	**Less than once a month**	65.2	18.3
6	**I don't use public transportation**	0.0	2.0
	Mean	4.25	2.39

Table I.7 Use of Public Transportation

Survey Response Code		Los Angeles (%)	Minneapolis/ St. Paul (%)
	N (Number of Respondents)	**155**	**246**
1	**Work**	13.5	49.2
2	**School**	4.5	13.0
3	**Shopping**	8.4	5.7
4	**Medical**	5.8	1.6
5	**Recreation**	22.6	12.6
6	**Visit family or friends**	4.5	1.2
7	**Vacation**	13.5	0.8
8	**Others**	27.1	13.8
9	**I don't use public transportation**	0.0	2.0
	Mean	5.23	2.83

Table I.8 Primary Purpose of Public Transportation

Survey Response Code		Los Angeles (%)	Minneapolis/ St. Paul (%)
	N (Number of Respondents)	**155**	**246**
1	**5 or more times a week**	1.9	5.3
2	**2 to 4 times a week**	2.6	20.7
3	**Once a week**	4.5	17.9
4	**1 to 3 times a month**	19.4	30.1
5	**Less than once a month**	71.6	26.0
	Mean	4.56	3.51

Table I.9 Frequency of Planning a Trip Using the Web site

Survey Response Code		Los Angeles (%)	Minneapolis / St. Paul (%)
	N (Number of Respondents)	**155**	**246**
1	**Always**	71.0	42.7
2	**Most of the time**	15.5	14.6
3	**Sometimes**	5.2	13.8
4	**Rarely**	3.9	13.0
5	**Never**	4.5	15.9
	Mean	1.55	2.45

Table I.10 Personal Vehicle Available for Transportation

	Los Angeles (%)	Minneapolis/ St. Paul (%)
N (Number of Respondents)	**155**	**246**
1 – 5 years	11.6	5.3
6 – 10 years	29.7	22.8
11 – 15 years	27.7	27.6
16 - 20 years	17.4	26.4
21 – Above	13.6	17.9

Table I.11 Experience Using Computers

	Los Angeles (%)	Minneapolis/ St. Paul (%)
N (Number of Respondents)	**155**	**246**
1 – 5 years	18.0	10.6
6 – 10 years	56.1	59.3
11 – 15 years	20.7	25.3
16 - 20 years	3.2	3.2
21 – Above	2.0	1.6

Table I.12 Experience Using the Internet

	Los Angeles	Minneapolis/ St. Paul
N (Number of Respondents)	**155**	**246**
Regular cell phone	134	160
Cell phone with Internet access	50	50
PDA with wireless communications	30	28
Portable computer with wireless communications	39	63
Pager	20	4
None of the above	12	62

Table I.13 Available Devices at Disposal

N - Number of Respondents	246
New (%)	3.7 (9)
Repeat (%)	75.2 (185)
Missing (%)	21.1 (52)

Table I.14 New/Repeat Web site User

N - Number of Respondents	246
New Users - Plan a Specified/Unspecified Trip	61
Repeat Users	185
- Planned a trip in last two days	135
- Plan a Specified/Unspecified Trip if not planned in last two days	50
Taken a trip based on information provided by MetroTransit Web site	180
Respondents found information to be adequate	155
Respondents found information not to be adequate	25

Table I.15 Treatment to New/Repeat Users

	Minneapolis/St. Paul
N (Number of Respondents)	**246**
Missing	**52**
Effective N	**194**
Private automobile	13.0
Carpool	2.8
Public bus	44.3
Light rail	3.3
Walking	4.9
Biking	5.7
Other	4.9

Table I.16 Usual Transit for Work Purposes

	Often (%)	Seldom (%)	Never (%)
N (Number of Respondents)	**246**		
Missing	**52**		
Effective N	**194**		
Private automobile	36.2	27.6	15.0
Carpool	6.9	14.2	57.7
Public bus	59.3	13.8	5.7
Light rail	14.6	26.0	38.2
Walking	51.6	17.5	9.8
Biking	14.2	17.1	47.6

Table I.17 Transit Use in the Last 30 Days (Minneapolis/St. Paul)

Appendix J
Emotional Index

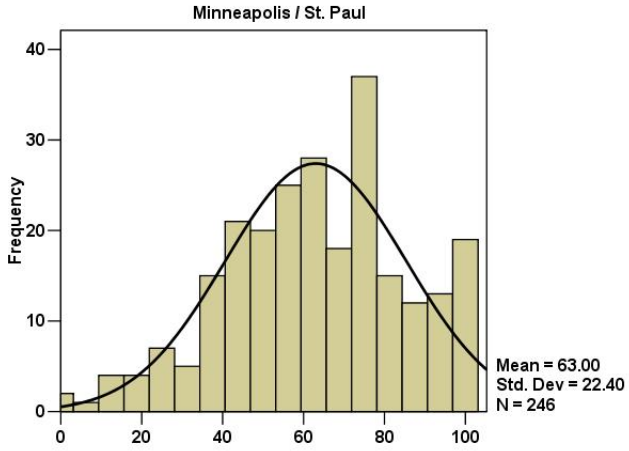

Figure J.1 Emotional Index for MN Respondents

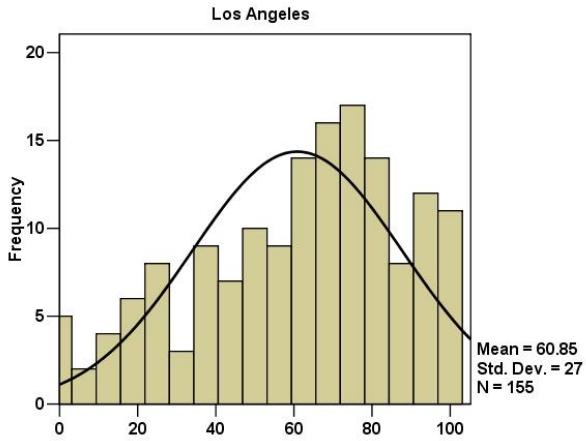

Figure J.2 Emotional Index for LA Respondents

Appendix K
Performance Index

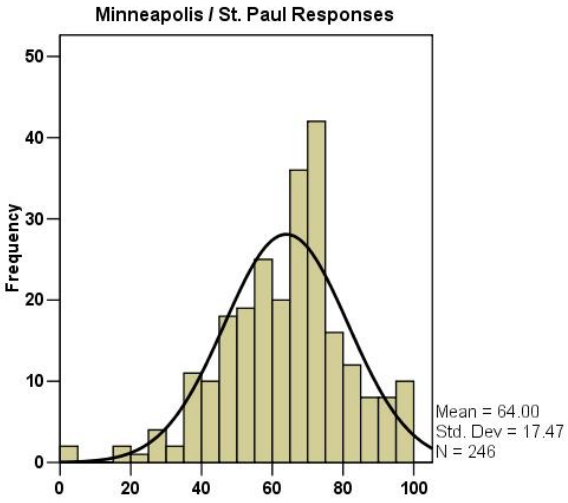

Figure K.1 Performance Index for MN Respondents

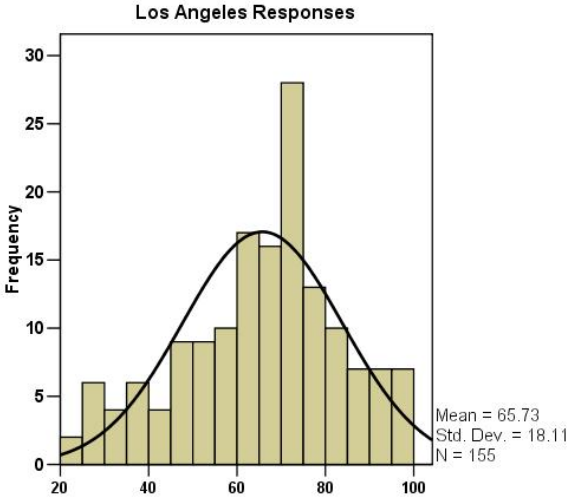

Figure K.2 Performance Index for LA Respondents

Appendix L
EGOVSAT Index

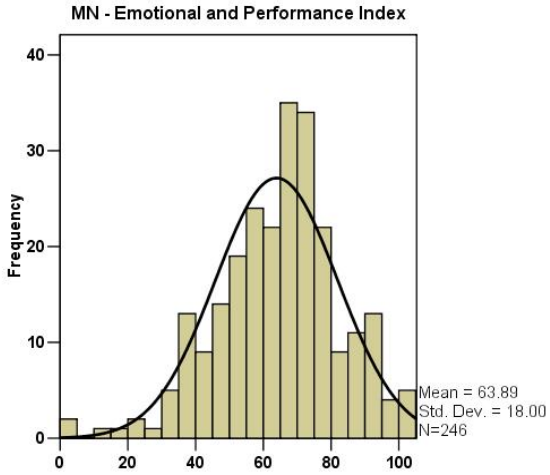

Figure L.1 EGOVSAT Index for MN Respondents

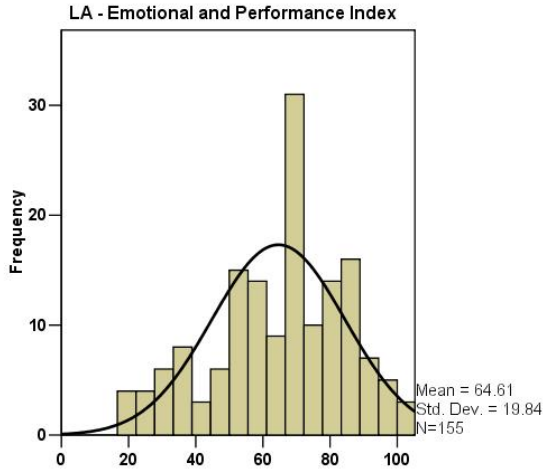

Figure L.2 EGOVSAT Index for LA Respondents

Appendix M
System Usability Scale (SUS) Score

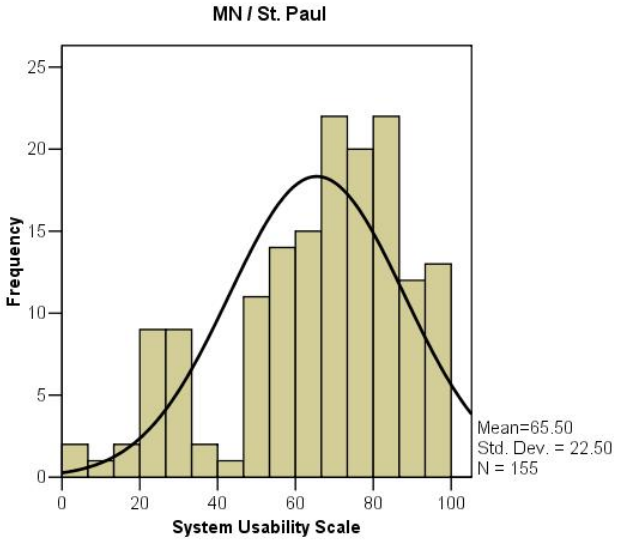

Figure M.1 SUS Scale for MN Respondents

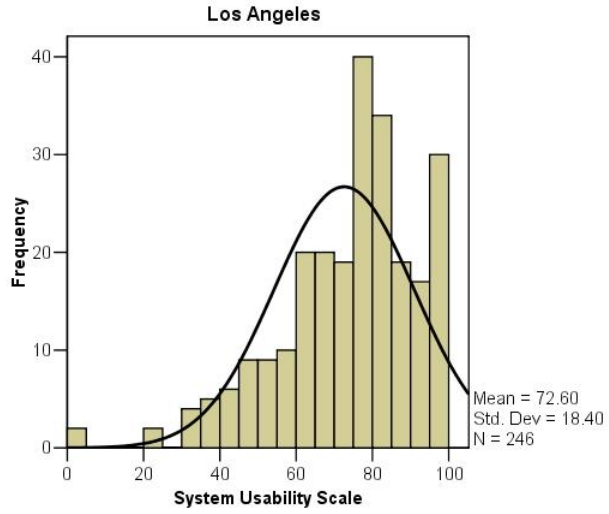

Figure M.2 SUS for LA Respondents

Appendix N
Paper Published at the
2006 Americas Conference on Information Systems (AMCIS)

Toward A New Evaluation Model of E-Government Satisfaction: Results of Structural Equation Modeling

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ABSTRACT

A major domain of e-government research considers effective delivery of information to citizens (i.e. government-to-citizens services). These services involve all sets of communication and transaction between government, at various levels, and citizens. Research indicates that due to the expectations that people hold while utilizing public services available through digital means, there needs to be a *citizen-centric* or *customer-centric delivery* of information related to such services. The study extends this premise by evaluating citizens' satisfaction with online governmental information services and formulating a model for satisfaction: *EGOVSAT*. This model includes various performance and emotional measures. To demonstrate the applicability and its generalization, the model is being applied to online Advanced Transportation Information Services (ATIS), a form of government-to-citizen online service delivery. This paper presents results of statistical analysis of online survey conducted in evaluating ATIS initiatives in Los Angeles (n = 155) and Minneapolis/St. Paul (n = 246). It presents an evaluated set of 15 questions based on the formulated model that can be extended for evaluating citizen interaction with e-government initiatives.

Keywords

E-Government, Citizen-centric delivery, Satisfaction, Structural Equation Modeling.

INTRODUCTION

Electronic Government (e-Government) refers to the facility of delivering government-related information and services online through the Internet or other digital means [1]. Public agencies, utilizing this facility, provide range of services to various interest groups [2]. A major domain, in these services, considers effective delivery of information to citizens (i.e. government-to-citizen services). Usage of such services has been growing over the years and citizens are increasingly interacting with online government services. A survey conducted by Norris and Moon [3] indicates that nearly 90% of American local governments with population of 10,000 or more had official sites on the Web through which they delivered various services. Further, Pew Internet reports that 77% of Internet users or 97 million adult Americans took advantage of e-government facility in the year 2003 using various methods[4]. Apparently, there is an overall realization of importance of e-government initiatives by citizens and by government agencies at various levels. Such realizations have ensured that e-government initiatives are continuously developed and constantly used.

As these sets of interaction spread wide, expectations from online e-government initiatives increase accordingly. West notes that the particular characteristic of such initiatives that makes it so special is that it allows citizens to seek public services at their own convenience and not just when the government office is open [1]. As a result, citizens are increasingly expecting government units to perform like commercial entities [5]. Need for addressing these expectations have been widely recognized in order to improve relations between public agencies and citizens. Grönlund has identified the importance of serving civil society by delivering services to wide array of citizens [6]. Traunmüller and Wimmer have extended the vision of citizen-centric provisions so that active participation in government and democracy is promoted [7]. They further note that although citizen-centric interactive Web sites have been produced users – intern or extern seem to be dissatisfied as complicated issues fall short of heightened expectations. Consequently, online e-government initiatives need to be user-centric or citizen-centric in nature [8, 9, 10]. There is an apparent need to identify theoretical constructs and measures that are formed to evaluate citizen reactions in using e-government information services so that empirical evaluation can be carried out. Detailed evaluation programs can present insights for better delivery towards citizen interaction.

This study attempts to cover the gap in understanding e-governmental impacts with citizen interaction. The study extends the premise of evaluating user or citizen satisfaction with governmental information services by developing a generalized theoretical model that can be applied for evaluating e-governmental information systems. It aims to demonstrate the formulated model by applying citizen-centric approach in the domain of Advanced Travel Information Systems (ATIS), a form of government-to-citizen information service. ATIS provides (1) real-time network information, whether traffic or transit, and (2) traveler information such as route guidance or destination information, provided on advanced technologies [11, 12]. An online survey comprising questions related to the model was designed. Users from two different cities—Los Angeles (LA) and Minneapolis/St. Paul (MN) were asked to evaluate ATIS Web sites provided by respective metropolitan authorities. The paper focuses on presenting the statistical analyses of the data collected.

The next section summarizes various literature related to customer and user satisfaction and presents a satisfaction model formulated for citizen-centric evaluation. Subsequently, process of data collection is described. Thereafter, demographics of users from different cities and multivariate analysis based on the model are presented. The paper concludes with detailed discussions based on the results.

RESEARCH MODEL

As citizens increasingly interact with online digital governmental services, there are widespread expectations for effective service delivery from such initiatives. The overall objective, in these initiatives, seems to be impersonal delivery of services than an efficient package of effective value-added service offerings. Such an improvement is important, as utilization of e-government initiatives is more of a voluntary in nature. Varied effects of such effective delivery have been identified by different studies. West has identified importance of such service delivery to raise the levels of trust and confidence among citizens towards government [1]. Eschenfelder and Miller propose a socio-technical toolkit for evaluation of e-government Web sites that address issues of openness and trust in e-government systems [13]. Citizen-based evaluation of governmental systems has been the focus of a number of studies. Wang, et al. propose a model of evaluating the performance of a Web-enabled e-government system with a citizen centric approach [14]. Carter and Belanger [15] present results of their study on citizen adoption of e-government initiatives based on an approach supported by the Technology Acceptance Model (TAM) [16]. Reddick analyzes the demand side of e-government, which relates to aspects of citizen interaction with e-government systems [17]. The satisfaction model, presented in Figure 1, formulated by this study considers these broad perspectives and presents a causal construct comprising features that promote confidence, trust, openness and citizen-centric delivery in utilizing online government initiatives. This model considers emotional response of the users to be a dependent factor on performance features of the digital government service delivery. Although, this measurement has been utilized for the domain of ATIS, it is designed to evaluate other government-to-citizen Web-based initiatives.

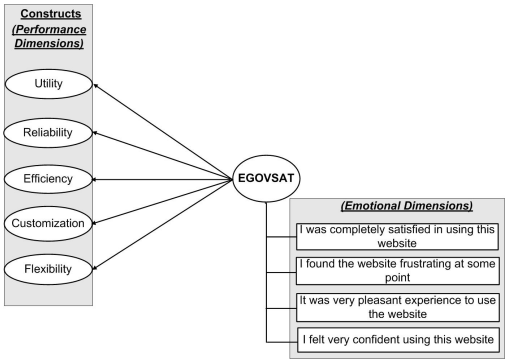

Figure 1: EGOVSAT Model

EGOVSAT has been formulated with an aim to provide a scale using which government-to-citizen Web-based initiatives can be evaluated - in terms of satisfaction derived by citizens [18]. To operationalize emotional aspects of satisfaction experienced by users, various attempts have been reported. While satisfaction has been identified as a single summary concept, it is comprised of certain affective responses with varying intensity. Giese and Cote identify alternative terms that were offered by various consumers in their research [19]. These alternative connotations may indicate the variations of emotional response that comprise the overall emotional construct. Westbrook and Oliver confirm such variations while identifying the

dimensionality of emotion space in satisfaction [20]. Emotional composition of satisfaction, in this study, has been extended to include not just "Satisfaction," but also "Frustration," "Pleasantness," and "Confidence."

Research studies with varying contexts have considered variety of measures in evaluating performance of an artifact in subject; most predominant being usability. Doll and Torkzadeh [21], in identifying End-User Computing Satisfaction (EUCS) instrument, have identified content, format and timeliness of the information delivered and the ease of use facilitated by a system. Effectiveness of information delivered by a system is measured through User Information Satisfaction (UIS) model [22]. Brooke has formulated a usability index—System Usability Scale (SUS) [23]. Extensions of similar measures have been recommended for Web-based initiatives and services. Zeithaml, et al. identify the importance of responsiveness and ease of navigation in utilizing a service offered through Web sites [24]. Loiacono, et al. have included usability measures in devising a quality instrument for Web sites: Webqual [25]. Similar aspects, or extensions thereof, have been used in other studies [26, 27, 28]. These contributions have been formulated as "Utility" construct in this study that examines whether the Web site is usable or not. "Reliability" construct examines whether the Web site functions appropriately in terms of technology as well as accuracy of the content [24, 26, 27, 28, 29]. While the importance of usable and reliable information is largely acknowledged, it is also pertinent that the information can be accessed efficiently with minimal effort by the end-user. "Efficiency" construct examines the accessibility and organization of the features and information available in the Web site [26, 28, 30]. In addition to these aspects, it is important that the Web site delivers facility of providing dynamic information, provides various options of accessing the information and offers the facility of customizing the information contained in the Web site. Personalization and customization refers to the ability of an Internet Web site or service to be shaped or reshaped so as to better meet the individual needs or wants of a user [31]. Performance constructs - "Flexibility" and "Customization," in this study, are formed to evaluate these aspects of digital delivery. These influences focus on determinative performance measures that need to be included so that a Web site is designed to be user-centric, citizen-centric in this case.

In addition to the above constructs, further enhancements have been included to formulate the survey questions based on certain measures. Satisfaction measures are extensions of performance and quality measures. While the latter are user centric approaches, true citizen-centric evaluation of systems need to examine attitudes of the user towards e-government systems as a public service. Satisfaction in using these systems warrants inclusion of the aforementioned components as well as the integrity in the method of delivery and its content. Accordingly, the constructs, described before, are further broken down into process and content measures. Process measures depict various activities that a user indulges in to obtain information. Content measures determine the quality of information that a user receives from the Web site. These measures have been identified differently in the past literature. Loiacono et al [25] groups them as interactional quality, usability and informational quality. Delone and McLean [32] classify them as information and system quality. Huizingh [30] identifies them as content and design measures in Web sites.

Based on these measures and overall construct, 39 survey questions were identified. 35, of them, were based on five performance constructs and four were identified as constituents of overall satisfaction measure. These questions were presented as a five-point Likert-scale questions [33],

designed to collect responses with varying degrees of agreement or disagreement. Due to space constraints an exhaustive list of on-line survey questions has not been provided. The questions are provided in Abhichandani, et al. [34].

DATA COLLECTION

An online survey comprising questions related to *EGOVSAT* model, demographics and experience with technologies was designed. The survey was designed to inquire experiences of users utilizing the ATIS Web sites based on performance and emotional dimensions and understand the characteristics of users utilizing these Web sites. The survey was conducted in two cities – Los Angeles (LA), Minneapolis / St. Paul (MN). In both the cities, Web sites provided by metropolitan authorities were considered for evaluation. For the city of Los Angeles, Web-based initiative provided by Los Angeles County Metropolitan Transportation Authority (http://www.mta.net) was utilized. For the Minneapolis/St. Paul area, MetroTransit Web site (http://www.metrotransit.org) was considered for evaluation. The survey protocol was designed to collect reactions of respondents just after they had used the Web site for trip planning purposes. The respondents, in addition, were randomly provided with certain scenarios so that the trip planning is performed in "realistic" situations. For research purposes, certain control was exercised in presenting these scenarios. Details of the survey protocol are available in Abhichandani, et al. [34].

The sample for the survey respondents was gathered in various ways. Initially, a databank provided by a commercial organization was utilized. (Resources Systems Group, Inc based in Vermont provided their databank for both the locations. For LA, all the respondents were arranged through this databank. For MN, 54 responses were collected using this databank.) Subsequently, a URL for the online survey was provided through the MetroTransit Web site (http://www.metrotransit.org). These avenues resulted in LA (n=155) and MN (n=246). Although the data collection was conducted using different avenues a common online survey was presented. Detailed findings of this survey follow.

STATISTICAL RESULTS

Descriptive data collected in the study can be divided into three different groups: demographics, public transportation usage and experience with Information Technologies. Demographics related to information such as "Age," "Gender," "Level of Education," "Employment Status," "Household Income," and "Ethnicity." Respondents were asked about their patterns of public transportation usage - "Frequency of using public transportation," "Primary purpose of using public transportation," "Frequency of planning a trip on the Web site," and "Access to personal vehicle." Further, it was important to collect data regarding the experience of respondents in using various information technology devices. Respondents were asked about their experience in using "Computers," "Internet," and "Accessibility to various devices."

The average age of an MN respondent was markedly lower compared to an LA respondent. 50% of MN respondents were below 35 years of age. This was far higher compared to LA respondents wherein only 30% of respondents were below that age. A larger part of LA respondents (approximately 72%) were within the age group of 25–54 years. Further, 20% of LA respondents were above 55 years as compared to 7.3% in the case of MN respondents. Nearly 58% of MN respondents were female. The gender distribution for LA was more equitable

compared to MN. Most of the respondents in both the cities were mostly "White/Caucasian." However, MN respondents seemed much more biased than LA - 85% compared to 72.3%. The major difference was noted in the contribution of "Asian/Pacific Islander" and "Hispanic/Latino" responses. In case of LA, nearly 18% of respondents belonged to these ethnic groups compared to 2% for MN. In both the cities more than 30% of respondents had a Bachelor's degree. Nearly 21% of MN respondents were "Student – Working or Not Working." This percentage was much lower (6%) in LA. However, in both the cities majority of respondents were either "Employed Full-Time or Part-Time" – 70% in case of LA and 66% in case of MN. The average household income for respondents from MN was lower compared to LA. 70% of MN respondents had household income less than $75,000 compared to 52% of LA respondents. Further, 40% of LA respondents had household income of more than $75,000 compared to 20% of MN respondents.

Nearly 50% of MN respondents utilize the public transportation "5 or more times a week." This is in extreme contrast with LA respondents, wherein only 6.5% respondents utilize public transportation for as many times in a week. 80% of LA respondents used public transportation "3 times a month" or even less. In the case of MN, 65.5% respondents utilize public transportation "2 times a week" or more. 62% of MN respondents utilize public transportation for "Work" and "School" purposes. 41% of LA respondents use public transportation for purposes of "Recreation," "Vacation," or "Visiting Family or Friends." Of the LA respondents, 27% used public transportation for "Other" purposes. These purposes were mostly emergent in nature - such as "Car not available," "if my car is in the shop." Of the Minnesota respondents, 44% planned their trip using MetroTransit Web site (http://www.metrotransit.org) at least "Once a Week" or more. This was in sharp contrast to LA respondents, where 72% of respondents planned their trip using Metropolitan Transportation Authority Web site (http://ww.mta.net) "Less than once a month." Further, 86.5% of LA respondents have access to a personal vehicle "Always" or "Most of the Time" compared to 57.3% of MN respondents. It seemed certain that MN respondents used the public transportation more than the LA respondents as nearly 43% of MN respondents have access to personal vehicle "Sometimes," "Rarely," or "Never" compared to 13.6% in the case of LA.

MN respondents had more experience in using computers than LA respondents. Of the Minnesota respondents, 72% had more than 10 years of experience in using computers compared to 59% of LA respondents. Similarly, MN respondents indicated a marginally higher experience in Internet usage than LA respondents. Nearly 85% of MN respondents had Internet usage experience of 6–15 years compared to 77% of LA respondents. In both the cities, majority of the respondents had "Regular cell phones" at their disposal. However, a marginally higher number of MN respondents indicated access to "Portable computer with wireless communications"—63 for MN compared to 39 for LA respondents.

Model Evaluation

The model, presented in Figure 1, was evaluated using confirmatory factor analysis (CFA) [35]. SPSS v12.0 was used to calculate item reliability and Cronbach alpha [36] for various constructs. Average Variance Extracted (AVE) and construct reliability was calculated based on standardized regression weights and measurement errors [37]. Table 1 illustrates the parameter and reliability estimates obtained for LA and MN.

Table 1: Parameter and Reliability Estimates (LA: n=155 with p = 0.001, MN: n=246 with p < 0.001)[a]

Observed Variables			Constructs			
Item	**Factor Loading**	**Reliability[c]**	**Construct**	**Structural Coefficient**	**R^2**	**Reliability[d]**
Util1	0.84[b]	0.74	Utility	0.95[b]	0.91	0.88
	0.74	*0.65*		*0.98*	*0.96*	*0.85*
Util2	0.66 (9.57)	0.63				0.62
	0.63 (10.99)	*0.59*				*0.55*
Util3	0.80 (13.23)	0.72				0.89
	0.74 (13.60)	*0.68*				*0.86*
Util4	0.80 (13.55)	0.78				
	0.75 (13.92)	*0.70*				
Util5	0.83 (14.25)	0.75				
	0.84 (16.81)	*0.75*				
Eff1	0.84[b]	0.67	Efficiency	0.95 (13.33)	0.90	0.83
	0.81	*0.69*		*0.96 (14.85)*	*0.93*	*0.80*
Eff2	0.76 (10.63)	0.69				0.61
	0.68 (11.28)	*0.61*				*0.59*
Eff3	0.75 (10.56)	0.69				0.82
	0.82 (14.42)	*0.68*				*0.81*
Cust1	0.85[b]	0.74	Customization	0.42 (4.94)	0.18	0.84

Table 1: Parameter and Reliability Estimates [LA: n=155 with p = 0.001, MN: n=246 with p < 0.001][a] (continued)

Observed Variables			Constructs			
Item	**Factor Loading**	**Reliability[c]**	**Construct**	**Structural Coefficient**	**R^2**	**Reliability[d]**
	0.91	*0.69*		*0.46 (5.91)*	*0.17*	*0.83*
	0.90 (11.28)	0.80				0.67
Cust2	*0.83 (13.24)*	*0.80*				*0.59*
	0.69 (9.11)	0.62				0.86
Cust3	*0.52 (10.51)*	*0.58*				*0.81*
	0.86[b]	0.81				0.91
Satis1	*0.77*	*0.68*	EGOVSAT			*0.85*
	0.84 (15.15)	0.79				0.66
Satis2	*0.82 (15.96)*	*0.69*				*0.70*
	-0.77 (-12.4)	0.73				0.84
Satis3	*-0.65 (-11.37)*	*0.63*				*0.86*
	0.91 (18.3)	0.86				
Satis4	*0.81 (15.64)*	*0.77*				

a - Figures in italics and shaded cells are for MN, non-italics and unshaded cells are for LA
b - Parameter fixed to 1 to set the scale of construct
c - Corrected item-to-total correlations for individual items
d - Construct reliability is presented as Cronbach alpha, average variance extracted and construct reliability, respectively
( ) - indicates the t-values

Overall model was evaluated using AMOS v6.0 statistical software using Maximum Likelihood Estimation (MLE) as the variables were found to be multivariate normal and the sample size was moderate [37]. Initially, to filter out the variables that failed to explain the cohesiveness of a construct, corrected item-to-total correlations and Cronbach alphas were examined per construct. Variables with low corrected item-to-total correlations (i.e. < 0.50) and pairwise correlations (i.e. < 0.50) were removed. Constructs with Cronbach alphas less than 0.70 were removed from further analysis. Subsequently, additional analyses involved examining squared multiple correlation (R^2), regression weights (i.e. factor loadings for observed variable and structural coefficient for constructs), AVE and construct reliability. R^2 indicates the amount of variance explained, predicted or accounted for by a set of variables [38].

Various recommendations have been proposed for fit-indices illustrated in Table 2. One of the preliminary fit indices is the value obtained by dividing Chi-Square with degrees of freedom (CMIN/df). Although there is no clear-cut guideline about what value of CMIN/df is acceptable, a frequent suggestion is that this ratio should be less than 3 [39]. In both cases, value of less than 3 was obtained. Other indices have been recommended as they are less sensitive to sample sizes, such as GFI and AGFI. Both the indexes range from 0 to 1 with values close to 1 being indicative of good fit. However, no absolute threshold levels for acceptability have been established [37]. Based on the values obtained in this study, it can be concluded that the model fits the sample data in moderation. PGFI is indication of parismony in the model. Values greater than 0.5 are indicative of better parsimony. NFI and CFI have been proposed to be practical criterion of choice. CFI with values of 0.95 and greater have been recommended for well-fitting model [40]. Similar values (>= 0.95) have been obtained in this analyses. Values of 0.05 or less have been proposed for error approximation and residuals [35]. Values not far from 0.05 have been obtained. Alternative analyses included combining the two locations and evaluating the model. Comparatively, higher level of indices were obtained. This analysis yielded following results: GFI - 0.93, AGFI - 0.90,NFI – 0.94, CFI – 0.95, RMSEA – 0.06, RMR – 0.05.

Table 2: Fit Indices, Errors and Residuals for LA and MN

Fit-Indices	LA	MN
Probability Level (p)	= 0.001	< 0.001
CMIN (Minimal Discrepancy) or χ^2 (Chi-Square)	134.42	197.46
Degrees of Freedom (df)	88	88
CMIN/df	1.53	2.24
Goodness-of-Fit Index (GFI)	0.90	0.91
Adjusted Goodness-of-Fit Index (AGFI)	0.87	0.87
Parsimonous Goodness-of-Fit Index (PGFI)	0.66	0.66
Normed Fit Index (NFI)	0.92	0.92
Comparative Fit Index (CFI)	0.97	0.95
Root Mean Squared Error of Approximation (RMSEA)	0.05	0.07
Root Mean Square Residual (RMR)	0.06	0.05

DISCUSSION

Figure 2, comprising of 15 questions, is the resultant model that has been formulated after performing detailed statistical analysis described in previous sections. The remaining questions in “Reliability” and “Flexibility” constructs were discarded as they were not found to be statistically significant.

The statistical fit of the model with the data collected is moderate and the data collection has a fair bit of bias. The entire LA respondents were collected from the RSG databank. This databank has a mix of individuals that may or may not use public transportation. However, majority of MN respondents accessed online survey through the MetroTransit Web site and are regular users. The conclusions, nonetheless, are important to evaluate the overall expectations of a seasoned or a non-regular user of public transportation and the online information services. Respondents in both the cities indicated that the need for improved usability features was relatively stronger determinant of emotional measures than efficiency or customizable options. The usability options include need for useful information, helpful features, consistent performance and easy to use features. Further, need for better address location facilities also was found to be a

determinant factor to a limited extent. Experienced MN users expect consistent useful information on the Web site whereas LA respondents who relatively use online public transportation information services in a limited manner expect facilities for learning to use the system quickly. Second to "Utility," features for "Efficient" access were found to be a determinant of overall satisfaction in using online public transportation informational service. These features included better organization and integration of content as well as visual presentation. MN respondents ranked need for well-integrated functions higher than features whereas LA respondents indicated need for appropriate organization of Web site. "Customization" construct was found to be a limited determinant of emotional measures. MN Respondents ranked the need for saving their trips for future reference higher than other features whereas LA respondents indicated need for receiving reminders and notifications. Among the dependent emotional measures, both LA respondents were most "Satisfied" with the Web site whereas MN respondent ranked the "Pleasant" experience in planning a trip higher than other features. Respondents in both the cities were found to be fairly "Confident" in using the Web site. They were "Frustrated" to a very limited extent.

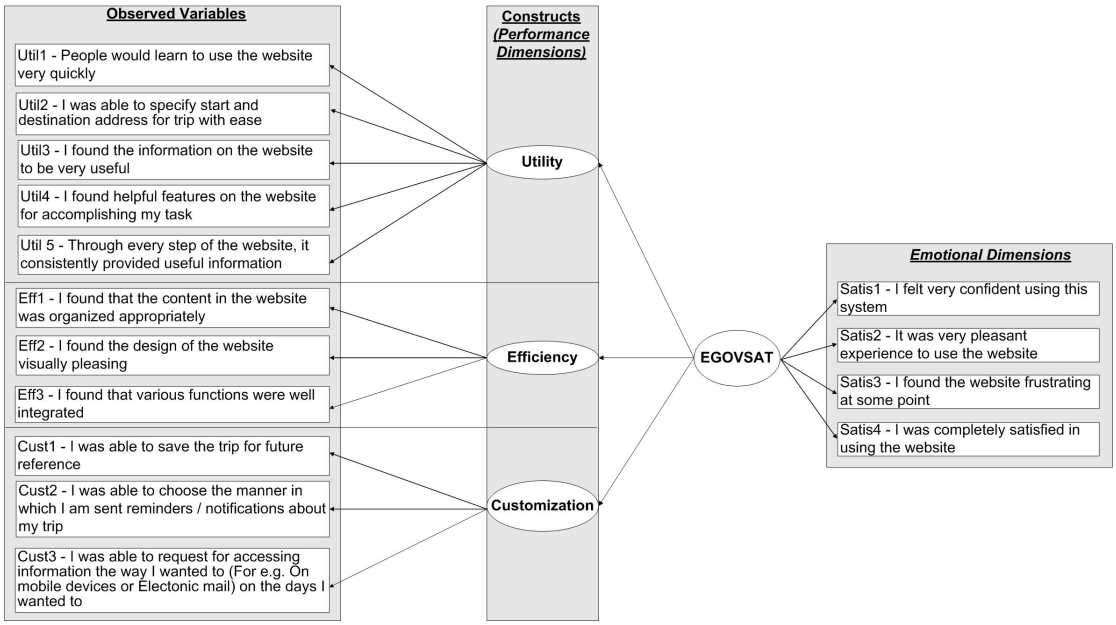

Figure 2: Questions and Constructs in Statistically-tested EGOVSAT Model

Citizen-based evaluation of governmental systems has been the focus of a number of studies. However, there have not been many studies that focus on satisfaction as a major construct. Stowers reports that among existing e-government performance measures, customer satisfaction is the least used metric [41]. This study attempts to fill this gap by formulating a model that can be extended to other e-government online citizen-based interactive systems. The model is expected to reflect on certain specific design parameters that have been demonstrated in this study. These parameters might prove critical in ensuring a more satisfying or less frustrating experience when users are in the process of utilizing e-government initiatives. The long-term vision of this research is to provide a scale based on which different e-government systems can be assessed to measure the level of satisfying user experience it offers. This scale will provide

the designer of such systems an evaluation tool which can be used to predict behavior of various citizen groups. Future research undertakings include conducting focus group discussions in both the cities.

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