The Socio-Economic Benefits of Transit in Wisconsin

HLB Decision Economics Inc.

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WISCONSIN DOT

PUTTING RESEARCH TO WORK

Wisconsin Department of Transportation Research, Development & Technology Transfer

NOTICE:

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16. Abstract

The primary objective of this study was to identify and measure the benefits of transit to other economic sectors in Wisconsin. This study specifically focuses upon the benefits of public transit service to the healthcare, work, education, and retail, recreation and tourism sectors. A secondary objective was to measure the impact of public transportation on congestion management in large urban areas of the state. The analysis relies upon a methodology previously developed by the author that identifies user preferences and actions as well as modeling the impact of such decisions on the appropriate sectors.

Various sources of information and data were employed to conduct the study. These included a comprehensive literature search, and on-board rider survey, information from several transit agencies in Wisconsin, panel opinions from a group of experts, as well as reports and publications from earlier studies.

The study confirmed the important role public transportation plays in maintaining the viability of the state's economy. The research found the existence of public transit service in Wisconsin saves various sectors within the state a total of $730.17 million, while providing 98.96 million transit trips annually. Without transit services 15.10 million transit rides would convert to forgone trips that individuals would not make by means of other higher cost transportation modes.

In evaluating future cost-benefit criterion for new or expanded services, it is estimated that the average sector benefit from each trip is $7.38. For those areas that are fully served by transit, there are significant benefits to both riders and state programs. However, in areas that remain without service and those that are underserved, the potential remains for greater benefits to be cultivated through additional transit service programs.

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EXECUTIVE SUMMARY

Introduction and Background

This study represents a collaborative effort between the Wisconsin Department of Transportation (WisDOT) and the Wisconsin Urban and Rural Transit Association (WURTA). The objective of this study is to identify the social and economic benefits of public transportation services to the main economic sectors in Wisconsin; specifically, the healthcare, work, education, and retail, recreation and tourism sectors. This study was developed to produce information and data that demonstrates both the quantitative and qualitative benefits of transit services.

The principal uses to be derived from this research are the following:

- Providing a credible benefit/cost analysis for transportation alternatives
- Allowing a more efficient comparison and analysis of transportation solutions
- Developing a better understanding of the impact of public transportation to Wisconsin's socioeconomic structure
- Building a methodology that allows for additional research and analysis in this field.

The need for such research has become increasingly apparent over the past decades as the Federal Transit Administration as well as national, state and local organizations have begun to explore methods for assessing the benefits of public transportation. Despite these efforts, much remains to be done in order to ascertain the actual benefits of transit to regions throughout the United States.

Data Collection and Analysis

There are three components that were used in measuring the benefits of public transportation from the trips made in each sector. The first is a measure of the cost savings (consumer surplus) realized from individuals using public transportation in place of a higher cost alternative transportation mode. The second component is a qualitative measure of access to each studied sector within the community. Without access to public transit there is a portion of trips within each sector that would be forgone, decreasing the quality of life standards in the region. The third component is the cross-sector benefit found within the work and healthcare sectors.

Individuals that are unable to access work and medical centers would turn to assistance programs such as welfare-to-work or home healthcare services. Although a few patients might be able to pay for their own home healthcare, a large proportion of the healthcare costs of transit riders would be bore by society as a whole through increased insurance costs. Similarly, the cost of providing social services to persons unable to work would be bore through higher taxes.

In order to determine the extent and impact of these three components, it was necessary to apportion the total Wisconsin ridership into appropriate segments. As trip purpose and riders actions will vary by community size, the total Wisconsin ridership was first divided into three community size categories: large populations of 50,000+, medium sized with populations of

10,000 to 50,000, and small communities with populations less than 10,000. The percentage of trips by purpose within each category was then determined through the use of an extensive ridership survey in six Wisconsin communities, representing a sample of each community category. These communities include: Milwaukee, Madison, Green Bay, Stevens Point, River Falls, and Neillsville.

In addition to the statistical survey, an in depth series of interviews were conducted with selected transit riders identified from the rider survey. Over 100 interviews were used to identify and assess the specific purpose and circumstances surrounding an individual's decision to used transit service in Wisconsin.

Study Findings

Transit services within the State of Wisconsin provide 98,961,000 trips annually to riders for various purposes. The responses from the rider survey indicated that the largest proportion of transit trips in Wisconsin are for work purposes, which account for 48.4 percent of all trips. Slightly fewer than thirty percent of trips (22.9 percent) were for education purposes; 10.5 percent were for medical purposes; and 18.2 percent for shopping, tourism, or recreation.

As stated earlier, for each trip purpose, there is a measure of cost savings that benefits transit riders themselves (consumer surplus). Additionally, there is a measure of trips that would not be made if transit did not exist. Besides these measures, there are two other cross sectional benefits that reflect the expenditure savings in public assistance programs as well as home healthcare savings.

Benefits to Healthcare

There are 10.4 million annual trips on public transit in the State of Wisconsin that are for healthcare purposes. As a result, a total of $193 million is saved in costs. Of this amount, transit riders save $134 million in transportation costs, while $59 million is saved in home healthcare costs that would have been paid by the riders themselves or by the public through increased insurance premiums or government subsidy. Although large population areas with more extensive transit systems enjoy the majority of all transit benefits, the proportion of rides for healthcare trips was highest in small communities. Approximately 56 percent of all benefits from transit to small communities can be attributed to healthcare trip purposes.

Benefits to Employment

Wisconsin riders make 47.9 transit trips per year for the purpose of reaching places of employment within the State of Wisconsin. The total savings generated from these work related trips is $333 million, resulting in a per trip savings for work purpose travel of $6.96.

There are two components to this cost savings. The first is the reduction in transportation cost for transit users, amounting to $259 million annually. The second component is savings due to the reduction in public assistance spending for Wisconsin's W-2 and other work support programs. It is estimated that without transit there would be a 12 percent increase in Wisconsin's public assistance cases (a 13,800 increase in the average caseload). At current per case spending levels, an additional $74 million would be required to cover these additional costs.

Benefits to Education

Riders in the State of Wisconsin save $91.3 million in education purpose travel annually due to the existence of transit service in Wisconsin. Each year, 22.6 million education related trips are made via transit services. The per trip savings from transit services for education purposes is $4.03.

Benefits to Service

Besides commutes for work, education, and healthcare, there are a considerable number of trips made for entertainment, recreation, shopping or tourism purposes. Many of the trips within this category are discretionary trips that are sensitive to changes in the cost of transportation. Each year there are 18 million trips made for such purposes on Wisconsin's transit systems. The total annual savings from these trips is $112.8 million. Therefore, the resulting per trip cost savings is $6.27.

Congestion Management

Congestion management benefits accrue not to transit riders, but to the users who remain on the roadway. Because transit riders choose not to travel via personal vehicles, the remaining roadway users enjoy faster travel times with the added benefits of fewer accidents and lower tailgate emissions as fewer miles are traveled on the roadways each day.

Congestion management benefits were measured by determining the added vehicle miles traveled (VMT) that would take place without the presence of transit. In Milwaukee, 84.9 million additional VMT would be added per year if transit riders switched to an alternative motor mode of travel. In Madison, congestion would increase by 20.2 million VMT annually.

Conclusions

Many of the benefits of public transportation are economic, both direct and indirect, with a real dollar value, and they are also directly related to the availability of public funds. Investment in public transportation translates into significant increases in business revenues, profits, and employment. The relationship between funding and benefits for the U.S. as a whole can be summarized as follows:

- Every dollar invested in public transportation provides $6 in economic returns.
- Every $10 million invested in transit capital projects yields $30 million in business sales and 300 jobs, and the same investment in transit operations generates $32 million and 600 jobs.
- Americans who live in transit-intensive areas save $22 billion each year by using public transportation.
- Every $10 million invested in public transportation saves more than $15 million.
- Transit availability can reduce the need for additional cars.
- Savings to social programs from transit use may be as high as $1.3 billion to $2 billion per year.

Similarly, the residents of Wisconsin can greatly benefit from increased funding to maintain and enhance the transit systems within the state. In order to generate the wide-ranging benefits of public transportation, transit agencies in Wisconsin need to provide ever-increasing amounts of funding to provide quality public transportation services.

STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION

THE SOCIO-ECONOMIC BENEFITS OF TRANSIT IN WISCONSIN

CHAPTER 1: OVERVIEW

Prepared By:

HLB DECISION ECONOMICS INC.
8403 Colesville Road, Suite 910
Silver Spring, MD 20910

December 1, 2003

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1. STUDY APPROACH

1.1 Objective

The objective of this study is to identify the social and economic benefits of public transportation services to the main economic sectors in Wisconsin. This study was developed to produce information and data that demonstrates both the quantitative and qualitative benefits of transit services.

The principal uses to be derived from this research are the following:

- Providing a credible benefit/cost analysis for transportation alternatives
- Allowing a more efficient comparison and analysis of transportation solutions
- Developing a better understanding of the impact of public transportation to Wisconsin's socioeconomic structure
- Building a methodology that allows for additional research and analysis in this field.

The need for such research has become increasingly apparent over the past decades as the Federal Transit Administration as well as national, state and local organizations have begun to explore methods for assessing the benefits of public transportation. Despite these efforts, much remains to be done in order to ascertain the actual benefits of transit to regions throughout the United States.

1.1.1 Purpose and Extent of the Study

This study specifically focuses upon the benefits of public transit service to the healthcare, work, education, and retail, recreation and tourism sectors. The following report has been prepared as a summary of findings from a series of individual reports of the various sector benefits of public transit in Wisconsin. The analysis relies on methodology developed by HLB Decision Economics Inc. (HLB) over the past decade on behalf of the Federal Transit Administration and other state agencies. The approach to such a study involves the application of acceptable economic theory by identifying user preferences and actions as well as modeling the impact of such decisions on the appropriate sectors.

Various sources of information and data were employed to conduct this study. These included a comprehensive literature search, an on-board rider survey, information from several transit agencies in Wisconsin, panel opinions from a group of experts, as well as reports and publications from earlier studies.

There are about 70 transit agencies serving communities in the State of Wisconsin. The services range from commuter rail, serving large metropolitan areas, to shared-ride taxi service in small communities. As a part of the Transit Sectors Socioeconomic Analysis Study, transit user surveys were conducted in six Wisconsin cities served by these agencies. The cities of Milwaukee, Madison, Green Bay, Stevens Point, Neillsville and River Falls were selected to reflect a wide variety of communities that benefit from transit services. The survey was conducted to capture variances due to geographical locations, climate conditions, culture, proximity to large metropolitan areas, etc. Surveys included questions regarding the purpose of the trip, mode choice in the absence of transit, and consequences of being unable to reach healthcare facilities, school, work, and shopping or recreational centers.

After the survey had been conducted and results tabulated, a group of experts from Wisconsin met to discuss the survey findings and offer their professional opinion on the assumptions being used to build the model. By defining ranges of the input variables the results of the model account for risk by defining probability distributions of the effects to each of the sectors.

Taking into consideration the expert opinions, survey results, literature findings, and transit information specific to the State of Wisconsin, analysis methods were applied to measure the value of the benefit of transit services to sectors of Wisconsin's economy.

1.2 Methodology

Over the past decade HLB has worked extensively with federal, state and local agencies in developing cost/benefit methodologies to accurately measure the socioeconomic benefits of transit. By bringing its expertise in transportation economics to the particular circumstances found in the State of Wisconsin, HLB has provided the methodological framework to measure the impacts of public transportation to various sectors of the economy.

The methodology used to measure the socioeconomic benefits, as well as the resulting benefits within the State of Wisconsin are presented for the following four sectors: education, work, healthcare and retail, recreation and tourism. While the principle results from the analysis are presented in this executive summary, the detailed description of the methodology and impacts for each of the four sectors is most comprehensively presented in a series of four reports, one for each sector.

1.2.1 Literature Review

The review of the literature available on the topic of transit benefits found a wide variety of benefit measurements used in estimating the effects of transit. The studies available can be classified into three larger segments of reports including research in low-cost mobility, congestion management, and economic development.

Low-cost Mobility

Low-cost mobility studies highlight the benefits of providing low-cost mobility to "transit-dependent" as well as "choice" riders[1]. The benefits include income from employment, which is made possible or more convenient by transit; the economic value of access to services, such as healthcare, education, shopping, and attractions; and budget savings for welfare and social services due to the presence of transit.

Congestion Management

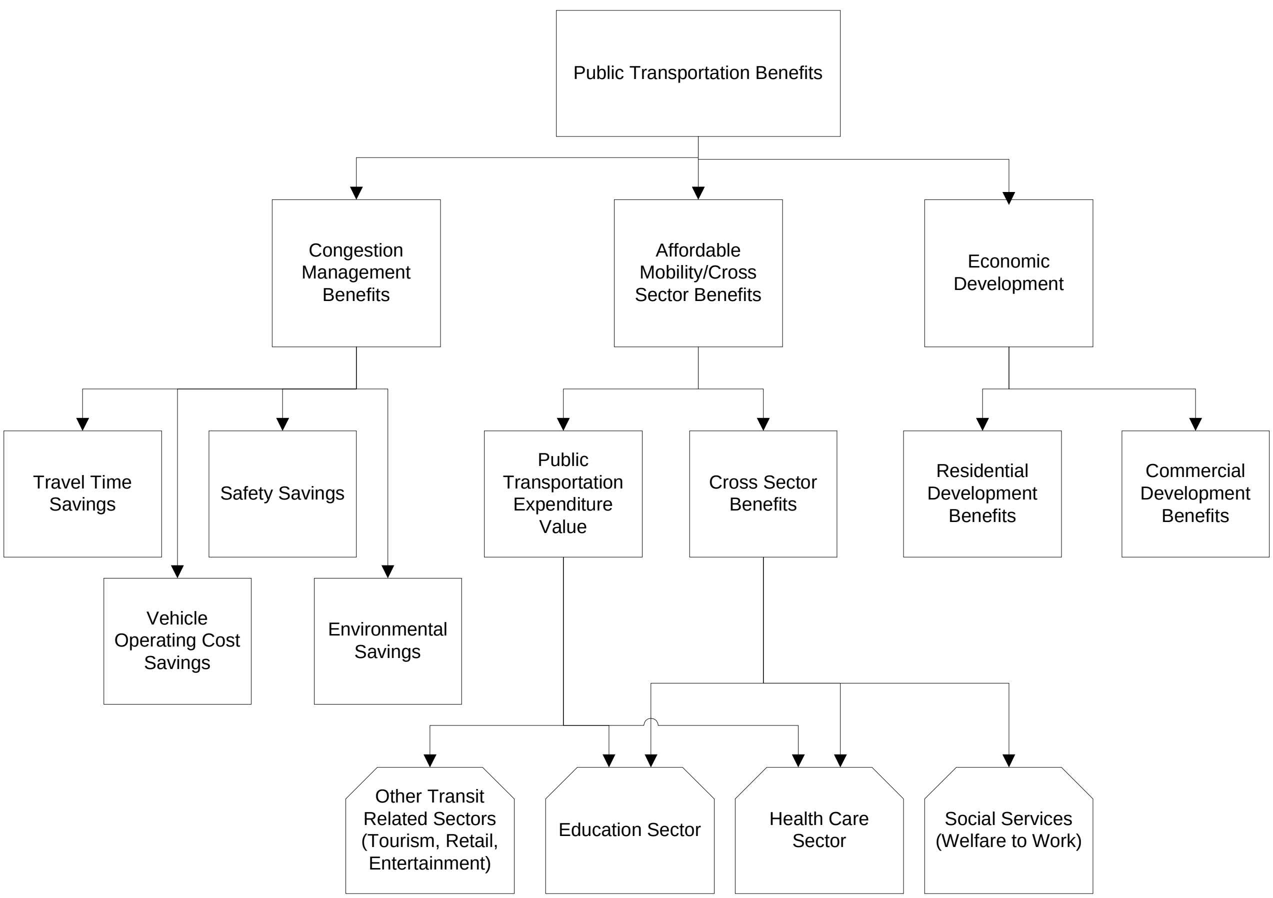
1 "Transit-dependent riders" are people who either cannot drive due to age, physical condition, etc. or do not have access to or cannot afford to use an automobile. "Choice- riders" have access to an automobile and ability to use it.

The study of congestion management evaluates how the existence of transit services causes a decrease in the costs of owning and operating a personal vehicle. With increased reliance on transit services there is an improvement in travel time, fewer accidents, and lower pollution emissions as fewer miles are traveled via personal vehicles. The two principal benefits attributed to congestion management are the reduction in travel by personal vehicles and the less congested traveling conditions for the vehicles that remain on the roadway.

Economic Development

The study of economic development and transportation considers the relationship that exists between the economic activities of an area and the proximity of transportation services. Greater access via transit presents the opportunity for increased commercial activity, as travel to the location is more readily available for both patrons and employees. As commercial opportunities expand, secondary effects appear. With an increase in commercial activity, a higher demand for real estate emerges along with increasing property values.

Figure 1: Overview of Transit Benefits



Some transit benefit studies attempt to identify or measure the benefits of factors listed in all three groups, while other studies focus on one or a few of the issues within a category. Each of these issues plays an important role in magnitude, location, and timing of the transit sector investments. Different types of benefits, however, require different evaluation methods. Some of the most pronounced benefits are relatively difficult to measure. As a result, conventional planning practices might undervalue public transit, by considering just a portion of total potential benefits. A diagrammatic representation of these benefits is presented in Figure 1.

The existing literature indicates that investments in public transportation would have an immediate positive impact on lower-income households while bringing many social and economic benefits to society as a whole. Transit provides low-cost travel opportunities to many lower-income households. Individuals with access to transit can enjoy the benefits of social interaction, healthcare access, entertainment and education, which in turn influence their contribution to the economy. Also, low-cost mobility extends the opportunities for employment to individuals who may otherwise be unemployed. Low-cost mobility additionally reduces the need for costly social services, thus resulting in a direct reduction in welfare and social service budgets.

The distribution of transit benefits to the different segments of society is, however, not uniform. Only a few of the studies examined in this literature review used quantitative methods. Although there are methods, tools, and techniques to rigorously estimate the probable socioeconomic effects or the impact on other industries of building or upgrading transportation systems, these methods are mainly used for highway systems, and their application to the transit system is very limited.

1.2.2 Development of the Model

1.2.2.1 The Conceptual Approach to Affordable Mobility and Cross Sector Benefits

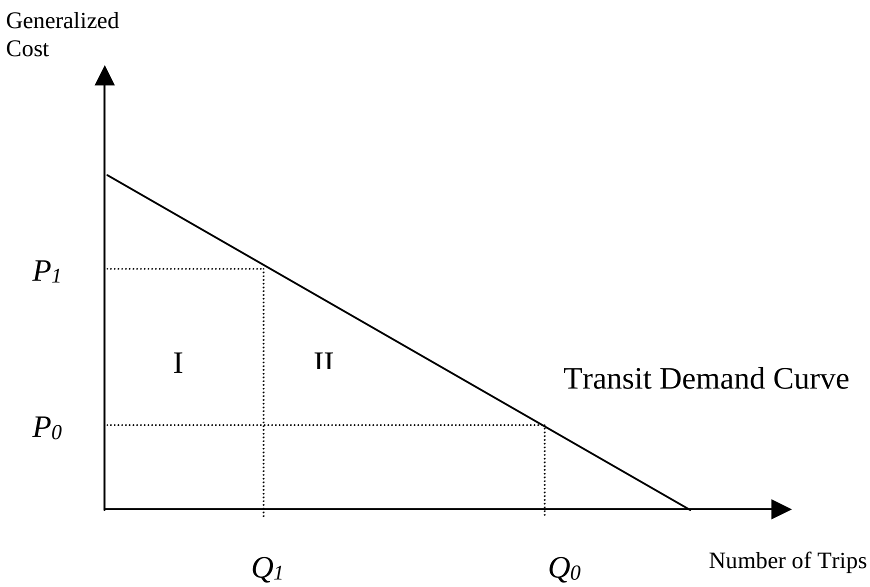
The affordable mobility benefits of public transit include providing an affordable and high quality alternative to automobile for commuting to work and accessing medical, educational, entertainment and shopping facilities. The benefits under this category also include the impacts associated with a reduction of public transportation service on key mobility vulnerable sectors.

A change in transit service translates into a change in the number of trips. This must be translated into trips by purpose to estimate the overall impacts. For example, a portion of lost medical trips leads to an increase in home healthcare services, while a segment of lost work trips leads to unemployment. The incremental Medicare-Medicaid program costs for each added home health care visit is multiplied by the number of added visits to estimate the monetary value of these trips. Likewise, the added food stamp costs and unemployment compensation benefits per lost job are multiplied by the number of lost jobs to arrive at estimates of the monetary cost of lost jobs. In summary, under HLB's affordable mobility/cross sector benefit assessment methodology, the benefits are assessed as follows:

1. Estimate the economic value of public transportation trips for each of the transit dependent sectors (healthcare, education, retail, tourism, and entertainment). To quantify the economic value of transit trips for each of the sectors listed above, two situations are considered: (1) transit services are available; (2) transit services are not available, and some riders have to switch to other higher-cost transportation modes, while others will forego their trips. The difference between the two situations is the economic value of transit trips.

Figure 2 illustrates the approach pursued to estimate the economic value of transit trips. Initially, riders pay P_0 and demand Q_0 number of trips. When transit services are eliminated, some riders shift to more costly transportation modes while others have no choice but to forego their trips. P_1 is the new (weighted average) generalized cost per trip using alternative transportation modes and Q_1 is the corresponding trip demand. The difference between Q_1 and Q_0 is the number of foregone trips. The expenditure value to be estimated is the area between P_1 and P_0 under the demand curve (that is, areas I and II).

Figure 2: The Concept of Consumer Surplus



It is clear from Figure 2 that low-income people are better off (in financial and mobility terms) in the presence of transit system ($P_0 < P_1$ and $Q_0 > Q_1$). Economists call the difference between the amount people actually pay for a product or a service and the amount they would pay for the next most costly alternative, "consumer surplus." Consumer surplus is a monetary quantity that equates to the expenditure value of the mobility afforded to people by the availability of transit. The released household expenditures (savings) then serve as the base for the economic impact calculations using multipliers from Input/Output models such as REMI or IMPLAN.

2. Estimate the *cross sector* benefits in terms of cost avoided by other programs and services due to the availability of public transportation, which include welfare services, and home healthcare services. These benefits can be defined as the additional costs to be generated in *other* sectors of the economy in the absence of transit services. The analysis will reveal the expected benefits of a budgetary reduction in transit provision on the most mobility vulnerable programs and services such as Welfare to Work support programs, Medicare/Medicaid, Unemployment Compensation, etc.

1.2.2.2 The Methodological Approach within Each Sector

Within each of the four sectors a specific methodology is used to evaluate benefits described in the above conceptual approach. Figure 3 gives a graphic representation of the structural logic used within each sector to calculate the affordable mobility and cross sector benefits.

There are three components that are considered in measuring the benefits of public transportation from the trips made in each sector. The first is a measure of the cost savings and consumer surplus of affordable mobility, which benefits consumers directly by allowing them to avoid higher cost transit modes.

The second component is a qualitative measure of access to the respective sectors within the community. Without access to public transit there is a portion of trips within each sector that would be forgone, decreasing the quality of life standards in the region.

The third component is the cross-sector benefit found within the work and healthcare sectors. Some individuals, unable to access work or medical centers, would turn to assistance programs such as welfare to work, or home healthcare. Although a few patients might be able to pay for their own home healthcare, a large proportion of the healthcare costs of transit riders are bore by society as a whole. To cover the additional home healthcare, the population will see increased insurance costs, whether private or public (Medicare and Medicaid.) For welfare to work programs such costs are obviously a burden on taxpayers.

Segmenting Ridership by System and Purpose

In order to arrive at these three components it is first necessary to apportion the total Wisconsin ridership into its appropriate segments. As trip purpose and riders' actions will vary by community size, the total Wisconsin ridership is first divided into three community size categories: large with populations of 50,000+, medium with populations of 10,000-50,000 and small with populations less than 10,000. By establishing the total ridership within each community size category, as well as the percentage of trips for each purpose within the category, the number of trips for each purpose is determined within each system.

Users' Actions in the Absence of Transit

The next stage in the process is to define what actions transit users would take in the absence of transit service. Each of the possible alternatives is established, including alternative transit modes: walking, personal vehicle, taxi, etc. as well as the percentage of trips that would not be made in the absence of transit. For each of the trips that would be made on an alternative transit mode, the generalized cost difference between transit and the given alternative is estimated to arrive at a cost savings for that specific trip. The sum of these differences times the respective number of trips differed to each mode is the total cost savings in the given sector due to transit.

Effects of Forgone Trips

The number of trips that would not be made in the absence of transit is then used for two purposes. The first is a measure of lost trips that would result in cross sector programs (home healthcare or welfare to work services). By multiplying this figure by the average incremental cost associated with the service, the additional expenditure in personal, insurance, or government subsidy is determined. The additional cost required for such service is a savings that occurs due to the existence of transit.

The second use of the measure of trips that would be foregone in the absence of transit is a qualitative measure of access within the community, an important measure of the area's quality of life. Access to medical services, shopping centers, educational institutions as well recreational and entertainment facilities all contribute to a community's livability standards that suffer when individuals fail to reach their destinations. While lost trips are harmful to individuals that are directly impacted, it should be noted that the community at large also has an interest in maintaining a mobile population. Transportation access to medical facilities prevents the spread of contagion within communities. Having youth engaged in productive recreational programs has been shown to reduce criminal mischief. Access to higher levels of education improves the quality of jobs and standard of living in an area. By providing access to medical facilities, recreation programs, educational institutions and work, transit holds the potential to cause benefits that accrue not only to transit riders but the community as a whole. The number of lost trips prevented serves as a measure of how transit is affecting the quality of life in each of these areas.

The structure and logic diagram in Figure 3 illustrates the methodology used to estimate the expenditure value and the public transportation impact on healthcare. The figure illustrates the model followed to calculate the corresponding savings by identifying all the inputs and the relationships between these inputs.

Risk Analysis

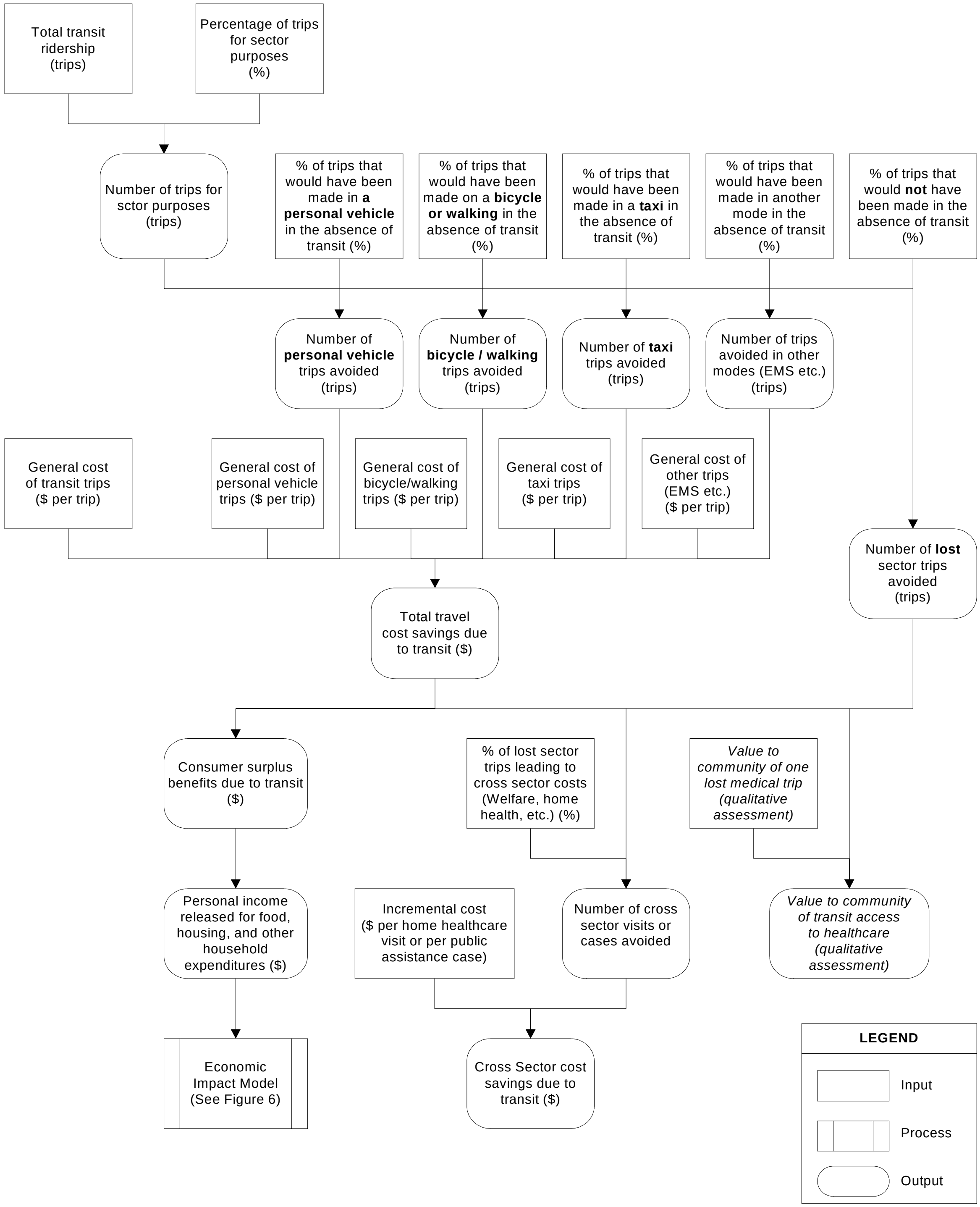
For the statistical assumptions used to build the model, distributions were defined to describe the uncertainty associated with the knowledge of each particular variable. While point estimates could have been used in the modeling assumptions to arrive at a single value of the benefit of transit to the sectors, there would be no measure of confidence in this resulting point value. There is a very significant difference between a mean expected value of $100 million with an 80% confidence interval of ($90 million, $110 million), and the same mean expected value with an 80% confidence interval of ($40 million, $160 million). The certainty of the first is much greater than the second. Therefore, in addition to the mean expected values presented throughout the report, probability distributions have been generated to express the certainty in the resulting benefit values.

Economic Impact Model

In addition to the direct effect of out-of-pocket savings by transit riders avoiding more costly transportation modes, there are multiplier effects that need to be considered on the cost savings. The expenditure that is saved in transportation cost is redirected toward purchases in housing, food, and other household expenditures. As this dollar amount is re-spent the benefit multiplies within other sectors of the economy. HLB utilizes the IMPLAN© model which is an economic impact assessment modeling system (structured as an input-output model) originally developed by the U.S. Forest Service (and now maintained by the Minnesota IMPLAN Group, Inc.).[2] By analyzing the change in spending patterns across the 528 industrial sectors that IMPLAN tracks within Wisconsin, the model is able to establish the resulting direct, indirect and induced changes in employment, output and tax revenue as result of the out of pocket savings from transit trips.

[2] An input-output ("I/O") approach was followed in this study, drawing on an extensive body of research and experience with successful applications to transportation project analysis. An I/O model calculates impact multipliers, which are then used to compute direct, indirect, and induced effects – output, employment, personal income, and local tax revenue generated per dollar of direct spending for labor, goods, and services.

Figure 3: Estimating Public Transportation Benefits Within Each Sector (Structure and Logic)



2. SURVEY RESULTS AND OTHER DATA SOURCES

A variety of data sources were used in building the analysis model. An on board survey of Wisconsin transit users was conducted to obtain information on riders' motivation, purpose and available alternatives. A panel of transportation experts from Wisconsin then offered their opinions on the survey statistics and methodology. Supplementary statistics were also obtained from sources such as the National Transit Database, the Wisconsin Department of Transportation, information provided by local transit providers, the Federal Transportation Administration, as well as previous research conducted in the field of transit benefit analysis.

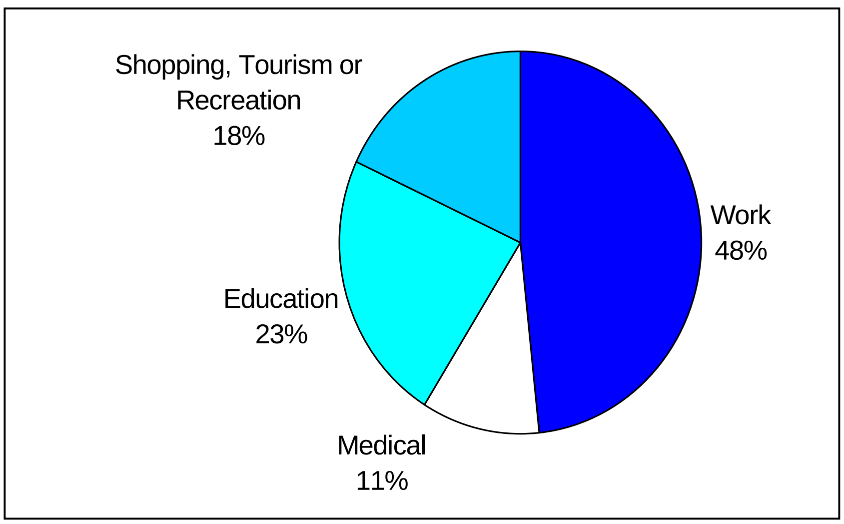
2.1 Rider Survey

Transit services within the State of Wisconsin provide 98,961,000 trips annually to riders for various purposes. The rider survey sampled 3,035 transit users across Wisconsin to establish the purposes for which riders use Wisconsin's public transit services. In addition to trip purpose, the survey also established the alternative transportation forms that are available to users, as well as the choices that would be made if transit services were unavailable.

2.1.1 Trip Purpose

The responses from the rider survey indicated that the largest proportion of transit trips in Wisconsin are for work purposes, which account for 48.4% of all trips. 22.9% of trips were for education purposes; 10.5% for medical purposes, and 18.2% for shopping, tourism or recreation.[3]

Figure 4: Wisconsin Transit by Purpose



[3] The original survey methodology allowed for a segment of trips purposed "other." However, when users specified their exact purposes when marking "other" it was noted that they were over specifying a trip that would be more appropriately classified in one of the preexisting categories. Appropriate corrections were made to arrive at the statistics presented here.

> ***User Perspective***
> "I don't know what we would do without the local share ride service. It is a necessity. Many of the people here in the Senior Well Haven Apartments are handicapped or older individuals that simply cannot drive. There are so many of us that have regular doctors appointments to keep."
>
> -Anna Keeney, River Falls

2.1.2 Transit Riders Choices in the Absence of Service

The survey also attempted to capture the choices transit riders would make in the absence of public transportation service, depending on their trip purpose. Each individual surveyed was asked to indicate how their actions would differ if they did not have access to transit.

2.1.2.1 Work Purpose Riders

Of the individuals who responded that they were using public transport for the purpose of commuting to or from work, 48.0% said that they would have made the same trip in the absence of public transit, but via an alternative transportation mode. The remaining individuals responded that they would alter their work patterns. 18.5% indicated that they would be unable to work; 22.2% would look for another job closer to home; 4.9% would attempt to adjust their working hours; and 3.4% would try to work at home.

Table 1: Work Purpose Riders' Choices in the Absence of Transit

Not be able to work	18.5%
Look for another job (closer to home)	22.2%
Adjust working hours	4.9%
Work at home	3.4%
Use another means of transportation	48.0%
Other	3.0%

2.1.2.2 Education Purpose Riders

Of the individuals who responded that they were using public transport for the purpose of commuting to or from educational institutions, 48.0% indicated that they would have made the same trip, but via an alternative transportation mode. The remaining individuals responded that they would alter their educational activities. 12.6% indicated that they would not be able to attend school or college; 21.6% would miss more classes or school activities; while 14.9% would choose another school that is closer to their place of residence.

Table 2: Education Purpose Riders' Choices in the Absence of Transit

Not be able to attend school / college	12.6%
Miss more classes or school activities	21.6%
Choose another school (closer to home)	14.9%
Use another means of transportation	48.0%
Other	3.0%

2.1.2.3 Healthcare Purpose Riders

Of the individuals who responded that they were using public transport for the purpose of commuting to or from medical appointments, 47.5% indicated that in the absence of public transit they would have made the same trip, but via an alternative transportation mode. 24.3% indicated that they would not seek medical assistance as often; 17.2% would select another physician or care provider; while 5.8% would attempt to receive homecare.

Table 3: Healthcare Purpose Riders' Choices in the Absence of Transit

Not seek medical assistance as often	24.3%
Select another physician / care provider	17.2%
Receive home care	5.8%
Use another means of transportation	47.5%
Other	5.3%

2.1.2.4 Shopping, Recreation and Tourism Purpose Riders

Of the individuals who responded that they were using public transport for the purpose of commuting for retail, recreation or tourism purposes, 32.7% indicated that without transit they would have made the same trip, but via an alternative transportation mode. 36.8% would make less shopping trips; 18.7% would patronize another shopping center; while 9.1% would choose to shop online or by catalogue.

Table 4: Shopping, Recreation or Tourism Purpose Riders' Choices in the Absence of Transit

Make less shopping trips	36.9%
Go to a different shopping center	18.8%
Shop online or by catalog	9.1%
Use another means of transportation	32.7%
Other	2.7%

User Perspective

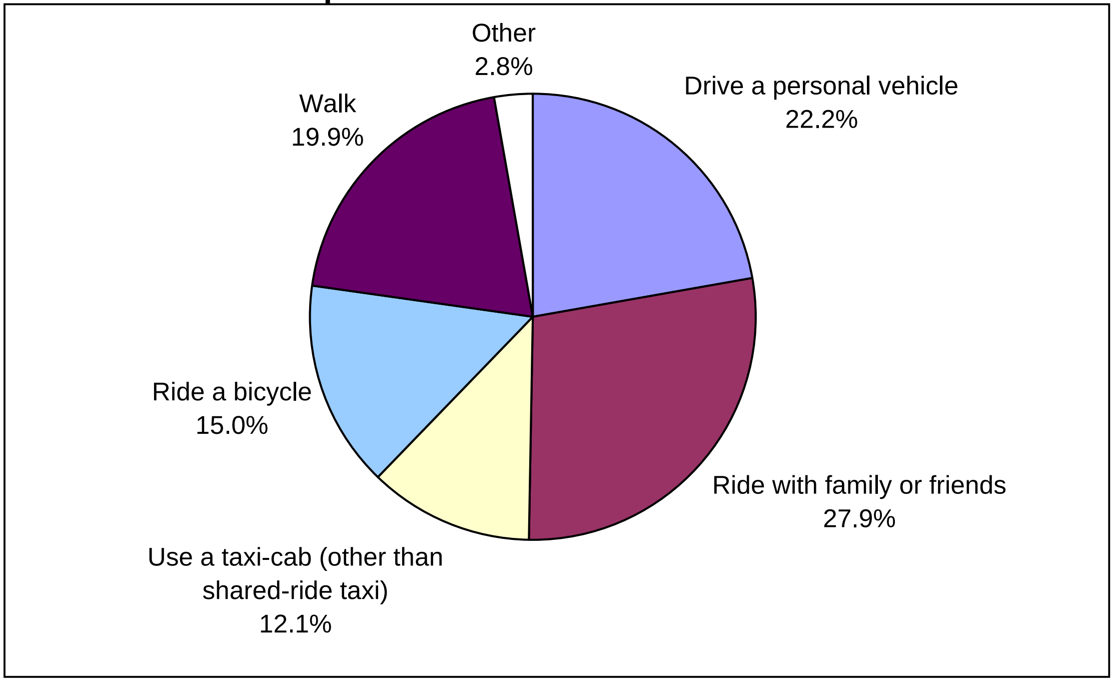
"I really appreciated the student bus pass for a semester worth of rides. It was easy to carry with me and use whenever I needed it. I didn't have to carry change, plus the deal was what really convinced me to ride the bus."

-Laura, UW Stevens Point Student

2.1.3 Alternative Transportation Modes

For those individuals who responded that they would make the same trip via an alternative transportation mode, the survey asked what mode they would most likely choose to replace the transit trip. Figure 2 shows the average response for all community sizes and trip purposes across the State of Wisconsin.

Figure 5: Alternative Transportation Modes



2.1.4 Follow up Interviews

In addition to the statistical survey, an in depth series of interviews were conducted via telephone with selected transit riders identified from the rider survey. Over 100 interviews were used to identify and assess the specific purposes and circumstances surrounding an individual's decision to use transit service in Wisconsin.

2.2 Panel of Experts

After compiling preliminary results from the survey, HLB sought input from local transportation and academic experts familiar with the particular circumstances of Wisconsin. The group provided valuable feedback to the study on a variety of levels. Not only were the survey statistics discussed at length, but conceptual concerns and improvements on the benefit model were also considered.

3. STUDY FINDINGS

The ultimate purpose of the Wisconsin Transit Sector Socioeconomic Study was to evaluate the socioeconomic benefits to transit riders and the community from the existence of transit service. However, before reaching a total value, the benefits were first segmented by trip purpose. Within each purpose there is a measure of cost savings that benefits transit riders themselves. Additionally, there is a measure of lost trips, trips that would not be made if transit did not exit. Besides these measures, there are also two other cross sectional benefits of importance to Wisconsin: expenditure savings in public assistance programs as well as home healthcare savings.

Transit services provide a means for those without other transportation access to reach places of employment. Without transit service a proportion of these trips would lead to increased dependence on Wisconsin's assistance programs such as W-2 for individuals who need support in reentering the workforce. Thus, the study measured the savings in public expenditure due to the existence of public transit. The final impact considered is a cost savings in home healthcare services. There is a portion of trips that, in the absence of transit, would lead to increased dependence on home healthcare. Thus the study also measured this savings in home healthcare costs.

3.1 Benefits to Healthcare

There are 10.4 million annual trips on public transit in the State of Wisconsin that are for healthcare purposes. As a result, a total of $193 million is saved in costs. Of this amount transit riders save $134 million in transportation costs, while $59 million is saved in home healthcare costs that would have been paid by the riders themselves, or by the public through increased insurance premiums or government subsidy. Although large population areas with more extensive transit systems enjoy the majority of all transit benefits, it was particularly noteworthy that the proportion of rides for healthcare trips was highest in small communities. Approximately 56% of all benefits from transit to small communities can be attributed to healthcare purpose trips. (See Table 5.)

Table 5: Healthcare Cost Savings by Community Size (Millions of Dollars)

Savings	Regions			Total
	Small	Medium	Large	
Consumer Surplus	$2.21	$5.84	$125.86	$133.92
Home Healthcare Savings	$1.28	$3.85	$53.76	$58.89
Total Savings	**$3.48**	**$9.69**	**$179.63**	**$192.80**

(small – populations less than 10,000; medium – populations 10,000-50,000; large – populations 50,000+)

With a total of $192.8 million in healthcare sector savings and a ridership of 10.41 million for healthcare purposes, it is estimated that the average healthcare purpose trip on transit service saves $18.52.

In addition to the cost savings there is a measure of trips that would not be made without transit service. Without access to tranist1.39 million trips for medical purposes would not be made. Of these foregone medical trips it is estimated that 552,000 would result in home healthcare visits, while the others would simply result in forgone treatment.

3.2 Benefits to Employment

Wisconsin riders make 47.9 million transit trips per year for the purpose of reaching places of employment within the State of Wisconsin. The total savings generated from these work related trips is $333 million. The per trip savings from transit service for work purpose travel is thus $6.96.

There are two components to this cost savings. The first is a reduction in transportation cost for transit users amounting to $259 million annually. The second component is savings do to the reduction in public assistance spending for Wisconsin's W-2 and other work support programs. It is estimated that without transit there would be a 12% increase in Wisconsin's public assistance cases, or a 13,800 increase in the average caseload. At current per case spending levels an additional $74.26 million would be required to cover these additional cases. (See Table 6).

Of the 47.9 million annual work related trips, transit service allows for 8.8 million trips annually that would not be made otherwise.

Table 6: Work Cost Savings (Millions of Dollars)

Savings	Regions			Total
	Small	Medium	Large	
Consumer Surplus	$1.31	$5.86	$251.87	$259.05
Public Assistance	$0.60	$2.23	$71.42	$74.26
Total Savings	**$1.92**	**$8.10**	**$323.30**	**$333.31**

3.3 Benefits to Education

Riders in the State of Wisconsin save $91.3 million in education purpose travel annually due to the existence of transit service in Wisconsin. Each year 22.6 million education related trips are made via transit services. The per trip savings from transit services for education purposes is thus $4.03.

Of the 22.6 million trips, 2.8 million would not have occurred if it were not for the existence of transit services. The majority of these trips are accounted for by individuals seeking post secondary education at colleges and universities distant from their place of residence. Educational purpose trips also vary by community size. Very few transit trips in smaller communities, only 8% of total transit trips, are for educational purposes. In larger communities, however, transit use to reach educational destinations accounts for a much larger proportion, nearly 23%. (See Table 7).

Table 7: Education Cost Savings (Millions of Dollars)

Savings	System Size		
	Small	Medium	Large
Consumer Surplus	$0.17	$0.65	90.48
Total Savings Across Systems			**$91.30**

3.4 Benefits to Retail, Recreation and Tourism

Besides commutes for work, education and healthcare, there are a considerable number of trips made for entertainment, recreation, shopping or tourism purposes. Many of the trips within this category are discretionary trips that are sensitive to changes in the cost of transportation. Each year there are 18 million trips made for such purposes on Wisconsin transit. The total annual savings from these trips is $113 million. The resulting per trip cost savings is thus $6.27. (See Table 8).

In addition to the cost savings, public transit allows for 2.1 million retail, recreation or tourism trips that would otherwise be forgone.

Table 8: Retail Recreation and Tourism Cost Savings (Millions of Dollars)

Savings	Regions		
	Small	Medium	Large
Consumer Surplus	$0.60	$5.74	$106.42
Total Savings Across Systems			**$112.76**

User Perspective

"The transportation system here in Green Bay really can be a way of life. When we live in a world where consumption is often out of bounds with our resources, it is refreshing to know that there is a convenient alternative that meets our needs."

-Betty Bennett, Green Bay

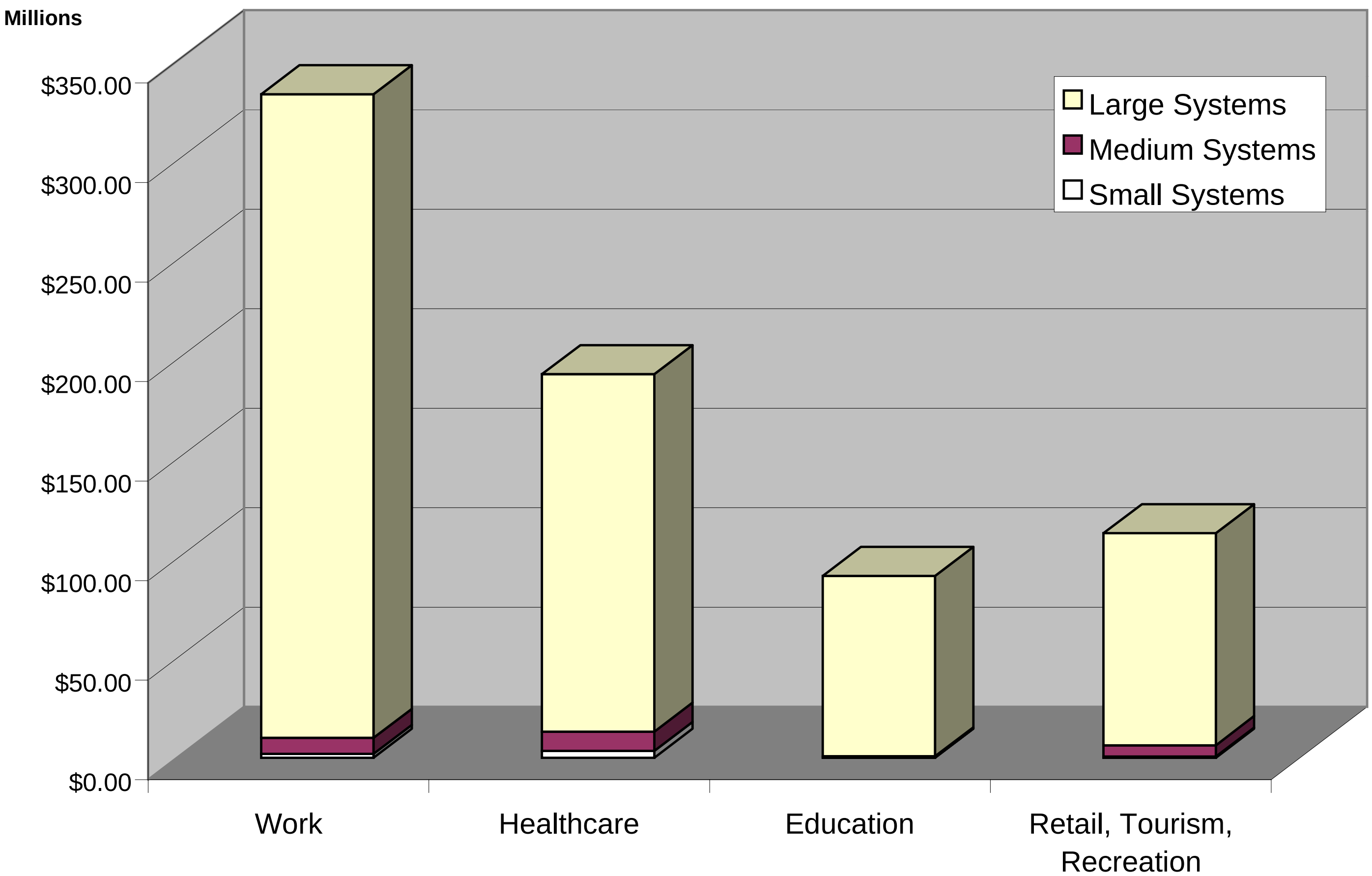
3.5 Total Resulting Socioeconomic Benefits

The total calculated benefit to Wisconsin from the existence of public transit is $730 million with a total ridership of 98.96 million. The resulting per trip benefit on Wisconsin public transit is $7.38.

Work purpose trips generate the largest proportion of the benefit due to public transit - 45.6% of the total benefit. Healthcare purpose trips generate 26.4% of the benefit; retail, recreation and tourism 15.4%; and education trips 12.5%.

The vast majority of benefits from public transit in Wisconsin are generated within cities with populations of 50,000 or more. 95.8% of the total benefit of transit comes from these larger urban areas. 3.3% of the savings is generated in medium sized communities with populations of 10,000 to 50,000, while only 0.9% originates in small communities with populations less than 10,000.

Figure 6: Total Wisconsin Transit Benefits by Purpose and Community Size



As illustrated in Figure 4 and Table 9, the vast majority of benefits are generated in large population centers having a population over 50,000, while work is the purpose that generates the largest proportion of the benefits.

Table 9: Benefits of Wisconsin Transit by Purpose and Community Size (Millions of Dollars)

	Community Size			
Purpose	**Small**	**Medium**	**Large**	**Total**
Work	$1.92	$8.11	$323.26	$333.30
Healthcare	$3.48	$9.69	$179.54	$192.72
Education	$0.17	$0.66	$90.50	$91.32
Retail, Tourism and Recreation	$0.60	$5.74	$106.47	$112.82
Total	**$6.17**	**$24.21**	**$699.78**	**$730.16**

3.6 Total Benefits of Transit

The resulting values presented in section 4.2 are *only* the affordable mobility and cross-sectional benefits of transit in Wisconsin. These benefits are 1) to transit users and 2) societal savings in program spending that would have to be made to support transit users if the transportation service were unavailable. This is only one component of the total benefit of transit in Wisconsin (see Figure 1). In addition the affordable mobility and cross sector benefits described above, congestion management and economic development benefits described in section 2.1 must also be considered when performing cost/benefit analysis of any transportation project.

3.6.1 Congestion Management

Congestion management benefits accrue not to transit riders, but to the users who remain on the roadway. Because transit riders choose not to travel via personal vehicles, the remaining roadway users enjoy faster travel times with the added benefits of fewer accidents and lower total pollution emissions as fewer miles are traveled on the roadways each day.

In a supplementary report, HLB has preformed congestion management benefit studies for two selected cities of Wisconsin: Madison and Milwaukee. Perhaps the best measure of the added congestion that would take place without the presence of transit is the additional vehicle miles traveled (VMT) on the roadways in each city annually. In Milwaukee 84.9 million additional VMT would be added per year if transit riders switched to taxis, carpooling, or personal vehicle travel. In Madison congestion would increase by 20.2 million VMT annually. (See Table 10).

Table 10: Added Congestion in Madison and Milwaukee without Transit

	Additional Annual VMT	Additional Annual Trips	Average Daily Increase in Congestion (Trips)
Madison	20,168,282	6,272,783	17,186
Milwaukee	84,891,213	29,440,980	80,660

Alternatively, the added congestion can be expressed by the additional vehicle trips made each year: 6.3 million vehicle trips in Madison, and 28.7 million in Milwaukee. Using a rough daily average implies that there would be at least 17,200 additional vehicles trips in Madison daily, and 80,700 additional vehicles trips in Milwaukee daily.[4]

3.6.2 Economic Development Benefits

Although not a component of this study, the economic development benefits of transit are the last benefits that should be included in cost benefit analysis of transit projects. This includes the increase in commercial and residential property values caused by the construction of transit lines in a region. Furthermore, the economic development benefits would include the economic impact of any investment that originates outside of the study area. For instance, if funds from outside the state were used in construction efforts, the multiplier effects of such spending should also be considered, and can be measured via input/output modeling techniques.

[4] These daily averages do not account for variation in travel. Added workday congestion would be larger.

4. FUNDING AND BENEFITS OF PUBLIC TRANSIT

4.1 Transit Funding

Federal, state and local agencies provide varying amounts of funding for public transportation. As the availability of these funds increases, local authorities are likely to invest more in improving their transportation system and this will, in turn, impact Wisconsin's socioeconomic structure.

In the U.S., public funding for transit grew rapidly during the 1970s. Federal funding increased by 38.9 percent and State and local funding by 11.9 percent per year throughout the decade. Federal funding experienced a small growth during the 1980s, increasing at an average annual rate of 0.4 percent, while funding at the State and local levels continued to grow steadily at an average annual rate of 7.8 percent. Since 1990, Federal funding has increased at an average annual rate of 4.3 percent, while State and local funding increased at an average annual rate of 4.8 percent. In 2000, a total funding of $30.8 billion was available from all sources to finance public transit investment and operations in the U.S. (Table 1)

Table 1: Sources of Funding for Transit (1960-2000)

	Average Annual Growth Rate		
YEAR	**FEDERAL**	**STATE AND LOCAL**	**TOTAL**
1960-1970	N/A	8.18%	9.04%
1970-1980	38.87%	11.91%	17.18%
1980-1990	0.45%	7.84%	5.30%
1990-2000	4.28%	4.83%	4.69%

Source: Congressional Budget Office/National Transit Database.

Annual federal funding for the federal transit program has increased significantly under the Transportation Equity Act for the 21st Century (TEA 21). Federal funding increased from $4.4 billion in Fiscal Year 1997 to $7.2 billion in Fiscal Year 2003, a 65 percent increase.[5]

Annual transit investment requirements are estimated to be $14.8 billion for the next twenty years to maintain the conditions and performance of the Nation's transit systems at their year 2000 level, assuming an average annual increase in transit ridership of 1.6 percent. To improve performance of the transit systems by 2020 would require an additional $5.8 billion per year for a total average annual capital investment of $20.6 billion.[6]

[5] http://www.apta.com/government_affairs/positions/aptatest/senate030515.cfm
[6] Status of the Nation's Highways, Bridges, and Transit: 2002 Conditions and Performance Report Chapter 6. FHWA, The Department of Transportation.

Following the national trends, transit agencies in Wisconsin are trying to maintain the high level of service provided by the current transit systems in the state while staying within the budgets that are provided by the federal, state and local governments.

Wisconsin ranks 10th in the nation in the level of transit operating aids funded with state revenues, but receives only about 1% of the national appropriation for transit funding. Although federal funding is less than one-third of the amount needed, Wisconsin's operating aids are above the national average.[7]

Four major revenue sources (federal, state, and local funds and fare box revenues) allow the continued operation and maintenance of transit systems in Wisconsin. Transit agencies in Wisconsin received about 55 percent of their operating funding from federal and state funds in 2003. The Bureau of Transit at the Wisconsin Department of Transportation estimates that state funding for operations will be stable around $98.6 million for 2003 and 2004 and decline slightly in 2005 to $96.7 million. Federal funding is estimated to increase to $38.5 million in 2004, but decline to $34.7 million in 2005. Local funds are estimated to increase significantly from $46.6 million in 2003 to $75.1 million in 2005. The fare-box revenues are estimated to be around $63.2 million for both 2003 and 2004 and will slightly increase to $66.5 million for 2005.

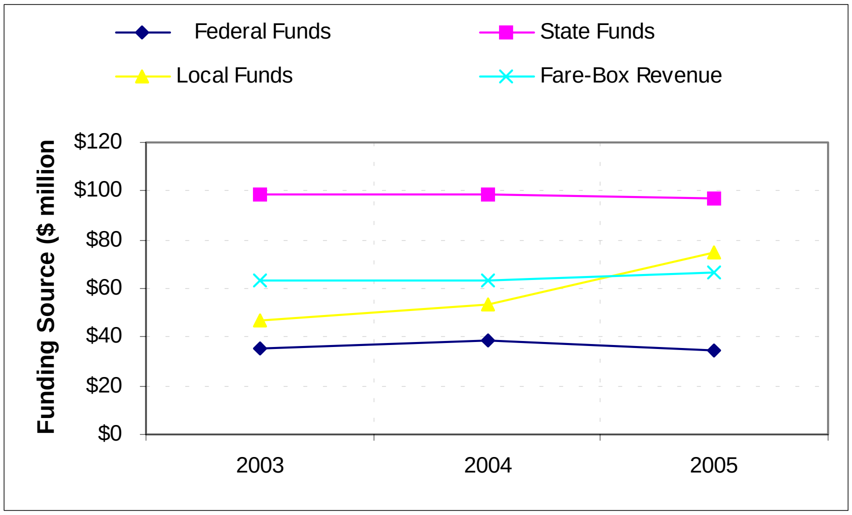
Total operating expenses (and funding requirements) are estimated to be around $244 million in 2003. These expenses are expected to grow about 4 percent in 2004 and 7.5 percent in 2005. The shares of federal and state funding are expected to decline as they are sustained at their current levels.

Although communities of all sizes will require growth in local funds, the need for local funds is greater in smaller communities. Local fund requirements for shared taxi in small communities are expected to grow five fold from their currents levels: $608,217 in 2003 to about $3.5 million in 2005. Funding for small bus service is also expected to grow from $827,666 in 2003 to $2.1 million in 2005.

Figure 1 presents the funding requirements for the operating expenses. Overall operating expenses are expected to grow at a steady pace. Local funds are expected to drive the overall growth, while federal and state funds are expected to experience a small decline.

[7] ASCE 2003 Wisconsin Report Card. Issue Brief, Transit Report Card (http://www.asce.org/reportcard/pdf/wisconsin6.pdf)

Figure 7: Funding Sources for Transit Operating Expenses in the State of Wisconsin



Source: Wisconsin Department of Transportation, The Bureau of Transit

4.2 Transit Benefits

Public transportation plays a vital role in enhancing productivity and quality of life. It promotes access to employment, community resources, medical care, and entertainment. Both those who choose to ride, and those who have no other choice benefit from its presence. By reducing congestion, air pollution, and travel times, public transit also benefits those who choose not to use the public transit systems. In a recent five-year period, transit ridership grew 22 percent, greater than the growth rate of highways and domestic air travel during the same time frame.

Many communities are improving and expanding public transportation systems and constructing new ones. More than 550 local public transportation operators currently provide services in 319 urbanized areas; 1,260 organizations provide public transportation in rural areas; and 3,660 organizations provide services to the aging population and disabled individuals.[8]

The tangible benefits are apparent in higher property values, increased retail sales and communities' ability to attract employers, as well as cultural, recreational and business events. Without sufficient funding to sustain and expand transit, those advantages will disappear and new transportation and construction jobs will be lost.

An investment in public transportation translates into significant increases in business revenues and profits. The Public Transportation Partnership for Tomorrow argues that every $10 million invested in transit capital projects yields $30 million in business sales, and the same investment in transit operations generates $32 million.[9]

[8] http://www.apta.com/government_affairs/positions/aptatest/senate030515.cfm
[9] http://www.publictransportation.org/reports/

Savings with public transportation are substantial. Residents living in transit-intensive metropolitan areas save $22 billion annually in transportation costs. It was estimated that every $10 million invested in public transportation saves more than $15 million, for both highway and transit users. This includes savings of about $1,500 in reduction of 200 gallons of gas per person per year. Transit availability also reduces the need for additional cars, a yearly expense of between $4,800 and $9,700.

Communities that invest in public transportation realize enhanced development and wealth in the form of more jobs, revitalized business and activity centers, and an expanded tax base. The $27 billion U.S. public transportation industry generates up to a 6-to-1 net return on investment — which translates into higher revenues for cities and states.

A capital investment in public transportation generates into thousands of private-sector jobs in the design, construction, and manufacturing industries and in the retail and wholesale trade sectors, extending beyond the local economies. Every $10 million invested in public transportation capital projects generates 300 jobs, and the same amount invested in transit operations generates about 600 jobs.

Social service-oriented programs benefit extensively from the transit services. Savings to social programs from transit use are estimated to be as high as $1.3 billion to $2 billion per year.

The benefits of public transportation are more evident in metropolitan areas. Public transportation, however, is equally important to the nation's small urban communities and rural areas. In the last three years, funding for small urban and rural public transportation systems in all 50 states has nearly doubled and ridership has increased about 15%.

Transit investment leads to improved transit access, an increase in transit ridership, a reduction in the number of cars on the road, improved air quality, and improved accessibility to jobs and other local resources. For example, transit investment of $10.5 billion in 21 New Starts projects, as authorized by TEA-21 for Full Funding Grant Agreements, is expected to:[10]

- Add over 550,000 average weekday boarding and carry an additional 162 million riders, of which about 75.5 million would formerly have driven to work.
- Remove 62.5 million cars from the road annually;
- Improve air quality by a reduction of 60 billion tons of carbon dioxide emissions annually;
- Save over 76 million hours of travel-time annually by removing 62,500 million cars from the road; and
- Provide transit access to an additional 920 thousand households, of which 87 thousand are low income.

HLB estimated the benefits in four different sectors for the Transit Sectors Socio Economic Analysis Study for the state of Wisconsin. For the sectors under study, the benefits would exceed the variable costs with a large margin. The operating costs are estimated to be around $230

[10] http://www.fhwa.dot.gov/policy/2002cpr/ch9c.htm

million for all transit agencies in Wisconsin. Public transit in Wisconsin is estimated to generate $730 million in benefits for the four sectors. A summary of operating costs and the associated benefits from transit services within the State of Wisconsin for four sectors is presented in Table 3.

Table 11: Summary of Operating Expenses and Associated Benefits of Wisconsin Transit

***Operating Expense**	**(Millions of dollars)**
Federal Share	$30.1
State Share	$91.2
Local Share	$42.9
Fare Box Revenue	$63.2
Total Operating Expense	**$229.3**
Affordable Mobility Benefits	
Work Sector	$333.3
Healthcare Sector	$192.7
Education Sector	$91.3
Retail, Recreation, and Tourism	$112.8
TOTAL AFFORDABLE MOBILITY BENEFITS	**$730.2**

* Wisconsin Urban Transit Systems Public Funding Distribution (2002), American Society of Civil Engineers 2003 Wisconsin Report Card-Transit

Healthcare sector savings are estimated to be $192.8 million with a ridership of 10.41 million for healthcare purposes. It is estimated that the average healthcare purpose trip on transit service saves about $18.52.

Residents make 47.9 million transit trips per year in commuting to and from work within the State of Wisconsin. The total savings generated from these work related trips is estimated to be $333 million. The per trip savings from transit service for work purpose travel is about $6.96.

Riders in the State of Wisconsin save $91.3 million in education purpose travel annually due to the existence of transit service in Wisconsin. Each year 22.6 million education related trips are made by transit. Per trip savings from transit services for education purposes is about $4.03.

The trips made for entertainment, recreation, shopping, or tourism purposes are discretionary trips that are sensitive to changes in the cost of transportation. Each year 18 million trips are made for such purposes on Wisconsin transit. The total annual savings from these trips is $113 million. The resulting per trip cost savings is about $6.27.

The per trip benefit of using Wisconsin public transit is estimated to range of \$4.03 to \$18.52, averaging about \$7.38 per trip. Overall benefits of transit are far larger than the total estimated benefits for these four sectors.

Conclusions

Many of the benefits of public transportation are economic, both direct and indirect, with a real dollar value, and they are directly related to the availability of public funds. Investment in public transportation translates into significant increases in business revenues, profits, and employment. The relationship between funding and benefits for the U.S. as a whole can be summarized as follows:

- Every dollar invested in public transportation provides \$6 in economic returns (a 6-to-1 net return on investment).
- Every \$10 million invested in transit capital projects yields \$30 million in business sales, and the same investment in transit operations generates \$32 million.
- Americans who live in transit-intensive areas save \$22 billion each year by using public transportation.
- Every \$10 million invested in public transportation saves more than \$15 million, for both highway and transit users.
- Transit availability can reduce the need for additional cars, a yearly expense of between \$4,800 and \$9,700.
- Every \$10 million invested in public transportation capital projects generates 300 jobs, and the same amount invested in transit operations generates 600 jobs.
- Savings to social programs from transit use may be as high as \$1.3 billion to \$2 billion per year.

Similarly, the residents of Wisconsin can greatly benefit from increased funding to maintain and enhance the transit systems within the state. Benefits of transit investments clearly outweigh the funding requirements associated with building and maintaining transit systems. HLB study shows that the selected industries alone yield a 3-to-1 the return on investment in Wisconsin.

In order to generate the wide-ranging benefits of public transportation, transit agencies in Wisconsin need to come up with ever-increasing amounts of funding to provide quality public transportation services. Local authorities are like to invest more in improving their transportation systems if the availability of the funds increases.

5. CONCLUSION AND PUBLIC POLICY IMPLICATIONS

The existence of public transit service in Wisconsin saves various sectors within the state a total of $730.17 million, while providing 98.961 million transit trips annually. Thus, the average savings per transit trip provided is $7.38.

Without transit services 15.10 million transit rides would convert to forgone trips that individuals would not make via higher cost transportation modes. Of these trips, 8.82 million work trips, 2.82 million education trips, 1.39 million healthcare trips, and 2.07 million retail, recreation or tourism trips would be lost in the absence of transit service.

The sector that benefits most from transit service is work. However, the most valuable trips on a per trip basis are those for healthcare purposes. From a public policy standpoint, an incremental change in medical purpose trips will benefit the state more than an incremental change in any other category. Thus, it is important that the state strive to maximize the availability of transit for medical purposes. For every transit trip that is provided for medical purposes there is an associated saving of $18.52.

In evaluating future cost-benefit criterion for new or expanded services it can be estimated that the average sector benefit from each transit trip is $7.38. However, this is but one component of the full analysis of benefits that would be required for evaluating new projects. Benefits from congestion management and economic development must also be determined in order to understand the full benefit that would result from a specific project.

For those areas that are fully served by transit, there are significant benefits to both riders and state programs. However, in areas that remain without service and those that are underserved, the potential remains for greater benefits to be cultivated through additional transit service programs.

User Perspective

"I would love to see more extensive service both in area and time coverage. It is next to impossible to get to outlying areas of this city and it's surrounding communities. Late night service, early morning service, and weekend service is quite frankly lousy, especially if they are combined as in a late night on a weekend. I might add that holiday service is so bad that it may as well not exist at all; *if* a destination is reachable at all the return is usually not possible."

-Carolyn Rose, Madison

Table 11 provides a summary of operating costs and the associated benefits from transit services within the State of Wisconsin. The benefits presented include a full assessment of low-cost mobility benefits, the specified purpose of this report, as well as the congestion management benefits in two of Wisconsin's cities. To fully account for the benefits of transit in Wisconsin, the economic development benefits should also be considered. (See section 2.1 for definitions of each type of benefit). Although only a portion of the total benefits are presented in this report it is clear that the benefits of transit within the State well exceed the annual operating costs. The benefits being generated more than exceed the variable costs, thereby justifying a measure of transit capital investment within the state.

Table 12: Summary of Operating Expenses and Associated Benefits of Wisconsin Transit

***Operating Expense (millions of dollars)**	**$229.3**
Federal Share	$30.1
State Share	$91.2
Local Share	$42.9
Fare box Revenue	$63.2
Affordable Mobility Benefits (millions of dollars)	**$730.2**
Work Sector	$333.3
Healthcare Sector	$192.7
Education Sector	$91.3
Retail, Recreation, Tourism	$112.8
Congestion Management (millions of VMT)	
Milwaukee	84.9
Madison	20.2

* Wisconsin Urban Transit Systems Public Funding Distribution (2002), American Society of Civil Engineers 2003 Wisconsin Report Card - Transit

5.1 Economic Implications of Budgetary Changes

Government bodies, in their search for cost savings during budget crisis, often threaten across the board cuts in program funding. In the direst of cases transportation services themselves have been the target of cost cutting efforts. In economic terms these actions violate two central tenants of the field – efficiency and equity. Because of the capital expenditure required and the complex planning involved in mass transportation services, private firms are very hesitant to take on large transportation projects. Instead, many smaller, less efficient transportation services appear, such as taxi services. Thus, the individuals who continue to travel do so in a manner more costly than would have been possible if mass transit services were available. However, only a portion of the transit trips would be made via private transportation services, which are often many times more expensive. As the average price of making a trip increases, fewer individuals commute, resulting in a less mobile population. Low-income families, who already spend a disproportionately large portion of their income on transportation, are those who bear the largest burden when transportation services are threatened. In equity terms such policies are regressive, causing those with the least resources to contribute the most for the provision of services.

The implications of a more mobile population, however, are not restricted to the direct effects to the riders themselves. There are advantages and benefits that accrue to the community at large from having increased transit. As mobility and access to community centers are improved, the community as a whole stands to gain. With reduced search costs individual firms are required to be more competitive. If transport services for low-income populations are unavailable, many families have little choice but to shop at the closest of stores. These stores then charge higher prices than could be obtained elsewhere, because customers cannot reach competitors' locations. Additionally, such isolated and inefficient businesses are rarely able to offer the same scope of products – variety that consumers cherish. Transit service allows for community centers to be built that are more attractive for the establishment of businesses. Instead of serving individual neighborhoods, businesses are able to enjoy the networking effects associated with locating in central business districts made accessible to clients by the existence of public transportation.

5.2 Directing Economic Growth

Transit systems, however, should not simply be built in response to the current economic and geographic features of a region. The ability to organize transportation systems allows urban planners a distinct opportunity to design directed economic growth rather than the chaotic urban sprawl that is so common in growing communities across the nation. A well-planned transit system not only provides transit to and from central business districts, but also establishes terminal and intermediary points that hold the opportunity to become neighborhood or commercial centers in their own right. By directing growth, rather than simply responding to it, well-designed communities are possible, allowing for a more efficient provision of public services and greater accessibility for residents.

One of the consequences commonly recognized as the process of urban sprawl overtakes a community, is the fragmentation of the area into isolated sub-regions. As the different regions become more inwardly focused, labor conditions suffer. Instead of having access to the larger labor pool of the city to find the most appropriate worker for a given position, employers are often restricted to workers living in the immediate area, thus causing labor market inefficiencies.

A wealth of recent literature exists on what has become known as *spatial mismatch* wherein workers and the jobs for which they are most appropriately suited are isolated from one another. Perhaps the most studied case is the generalized condition of lesser-educated populations congregating in urban centers, while the labor markets in the suburbs cannot fill their service sector needs. Once such conditions exist, it is a great challenge to provide efficient transportation services to the many fragmented enclaves. Although some employers, those experiencing the greatest difficulty in finding appropriate employees, have themselves devised solutions for transporting workers, it is generally done at a high cost, which most firms are simply unable or unwilling to bear. Community leaders would be well advised to direct the growth of their cities before such fragmentation occurs. Although distinct community centers may arise, they should be seamlessly connected and accessible so that the most appropriate individual fills each position in the regional labor market.

5.3 Government Service Agencies

In addition to the burdens placed up on the business sector, lack of affordable forms of transportation poses a distinct challenge for government service agencies. The intended purpose of many government programs is to service the sectors of society most disadvantaged -those in need of support in reentering the workforce, children living in low-income households, etc. In order for such service programs to fulfill their mandate, individuals must be able to access government centers or be serviced in their local neighborhood. In most instances the added costs and bureaucracy of servicing individual households or even neighborhoods would be prohibitive, leaving agencies ineffective in their purpose. When considering the strong correlation between transit ridership and families targeted by such agencies it is clear that affordable transit service can provide the means for such individuals to reach service centers that may not be located in their immediate vicinity.

One notable instance of transit reducing the harm and expense to society occurs in the medical sector. Without transit services, medical centers become more difficult to access causing patients to delay preventative and diagnostic visits until conditions advance to more critical stages, when treatment is more lengthy and expensive. Many of the individuals who are transit dependent often lack health insurance policies, thus increasing the social burden of providing Medicare and Medicaid coverage to such patients.

It should be noted, however, that even in instances when businesses, community organizations, or individual government services programs do have the capacity and willingness to provide transport service, it is not provided in the most efficient manner. Such micro-level solutions do not have the same access to the scale provided by transit services, which because of their mass capacity are able to provide mobility at the lowest average cost.

5.4 Quality of Life Effects

Other than implications in employment and government services, there are other detriments to the quality of life and efficiency within the community when transportation services are lacking. With the increased traffic that could have been diverted to transit, travel times between destinations increase dramatically. Even with a relatively small percentage increase in the number of vehicles on a given corridor, time efficiency is lost. Working parents are required to spend more in daycare expenditures as their trip time increases. This is in addition to the social cost of spending less time with their children. For the same reason, just-in-time deliveries arrive late causing chaos in inventory management and an overall slowing of the economic activities in industries that depend on the shipping of intermediary and final goods. Besides worsening road conditions, higher automobile ownership rates complicate parking and space requirements in densely populated areas, causing further inefficiencies.

Furthermore, many of the drivers who would choose to drive in the absence of transit, do so at a risk to themselves as well as other drivers on the roadways. As the elderly population of the US continues to expand, the risks associated with elderly and handicapped drivers are becoming increasingly apparent. Slow reaction times and physical impairments in eyesight, hearing, etc. have been to blame for traffic accidents across the country. The existence of transit services allows such individuals the ability to move within the community without the potential to harm others.

Thus, a number of decisions face policy makers in regards to how community transportation systems are designed. The first is where transit lines are to be built. While attention does need to be given to where transit is currently needed, urban planners also need to identify where they hope to promote future growth. Transportation access can be one important component in influencing where future development occurs, moving chaotic urban sprawl into well organized development patterns. Thus, appropriate timing can be just as crucial in launching transit lines as where they are placed. Lastly, planning must remember who comprises transit ridership and ensure that the appropriate incentives are in place to make transit an attractive alternative. Discount and multi-use passes have shown to be successful methods of attracting target groups of riders including students, welfare to work participants and the elderly. With prudent planning, transit service holds the potential to solve current mobility problems, as well as reduce future impediments to integrated and mobile communities.

STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION

THE SOCIO-ECONOMIC BENEFITS OF TRANSIT IN WISCONSIN

Chapter 2: Healthcare

Prepared By:

HLB DECISION ECONOMICS INC.
8403 Colesville Road, Suite 910
Silver Spring, MD 20910

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EXECUTIVE SUMMARY

TRANSIT BENEFITS

Public transit plays an important role in ensuring access to healthcare services in Wisconsin; some 10.41 million transit trips annually are for medical purposes. If transit services were not available, an estimated 1.39 million of these trips would be forgone. Such consequences would have a detrimental impact not only upon patients requiring care, but also the community at large which benefits from an improved quality of life by having the population receiving appropriate medical attention. In instances where healthcare services have become more difficult to reach inefficiencies arise; patients no longer receive the best care via the most cost effective means. Such inefficiencies result in increased budgets for healthcare spending, despite the deterioration in the community's overall quality of life.

Describing the benefits of transit service has historically been completed through qualitative analysis. In conducting literature reviews in transit cost benefit analysis, HLB has found that even today the vast majority of studies fall into the category of qualitative reports. Anecdotal evidence and theoretical postulating are relied upon to describe the interactions taking place as a result of the existence of transit services. Such studies, conducted from federal agencies to community organizations, each attempt to describe the costs and benefits of transit without the thorough scrutiny of empirical case data. While the studies have played an important role in developing the areas of interest for measurement, such as low-cost mobility and reduced traffic congestion, they have done so primarily in the absence of sound quantitative analysis. What remains to be explained and accounted for are the actual benefits being generated by transit within specific regions.

In recent years, however, the development of transportation research has begun to focus upon the quantification of transit benefits as a valuable tool in describing the return on expenditure, as well as for comparing alternative capital investment options. More specifically the benefits of transit fall into three main categories that can be defined as follows: congestion management, economic development, and affordable mobility. Measuring each type of benefit requires a different methodology, which if conducted inappropriately can undervalue public transit by considering just a portion of the total potential benefits.

Congestion Management

The study of congestion management evaluates how the existence of transit services causes a decrease in the costs of owning and operating a personal vehicle. With increased reliance on transit services there is an improvement in travel time, fewer accidents, and lower pollution emissions as fewer miles are traveled via personal vehicles. The two principal benefits attributed to congestion management are the reduction in travel by personal vehicles and the less congested traveling conditions for the vehicles that remain on the roadway.

Economic Development

The study of development and transportation considers the relationship that exists between the economic activities of an area and the proximity of transportation services. Greater access via transit presents the opportunity for increased commercial activity, as travel to the location is more readily available for both patrons and employees. As commercial opportunities expand, secondary effects appear. With an increase in commercial activity, a higher demand for real estate emerges along with increasing property values.

Affordable Mobility

Studies of affordable mobility attempt to define the benefits to riders who are transit dependent as well as choice riders. Transit dependent riders are those who cannot drive due to physical factors or monetary restraints, while choice riders have access and the ability to use an automobile, but make the choice to use transit. The benefits to riders can be measured by their expenditure savings in accessing different sector services via public transit instead of a more costly alternative. In addition to the expenditure savings measure, certain cross sector benefits also exist. By providing access to employment sites, transit helps decrease spending on welfare to work programs. Similarly, by providing a means of transit to medical services, transit helps prevent cases that might otherwise become dependent upon home healthcare.

BENEFITS OF TRANSIT TO ACCESS HEALTHCARE SERVICES

Sector studies in affordable mobility, such as the Wisconsin Transit Sectors Socioeconomic Analysis Study, attempt to show not simply a total benefit figure for a given region, but the how each of the various sectors within the regional economy benefit from transit service. As transit riders' purposes for using public transportation will differ depending upon the geographical, cultural and socioeconomic characteristics of a region, it is necessary to define how users act with transit versus the actions they would take in the absence of transit. The sectors of analysis are divided into: work purposed trips, educational purpose trips, healthcare purpose trips, as well as retail, tourism and recreation trips. Such a list is not, of course, exhaustive. Each of the four sectors could be further divided to type of employment, place of education, etc. for studies on a micro or community level basis.

The Wisconsin Transit Sectors Socioeconomic Analysis is a sector benefits study of transit to the State of Wisconsin. This report specifically focuses upon the benefits of public transit service to the healthcare sector of Wisconsin's economy. HLB Decision Economics has prepared the following report as one component of a larger study of the various sector benefits of public transit in Wisconsin. The analysis relies on methodology developed by HLB Decision Economics over the past decade on behalf of the Federal Transit Administration and other state agencies. The approach to such a study involves application of acceptable economic theory by identifying user preferences and actions as well as modeling the impact of such decisions on the healthcare sector.

STUDY APPROACH

HLB employed various sources of information and data to conduct this quantitative study. These included an extensive literature search, an HLB conducted survey, information from several transit agencies in Wisconsin, panel opinions from a group of experts, as well as reports and publications from earlier studies conducted by HLB.

STUDY FINDINGS

The results of the healthcare sector study indicate that Wisconsin's transit riders who use the public transit service for medical purposes save $133.92 million annually in choosing public transit over more costly modes of transportation. Such savings accounts for the total generalized cost differences including changes in out of pocket costs, and time costs to transit riders.

In addition to the increased transportation costs, some individuals would begin receiving home healthcare services if they were unable to commute to the appropriate medical facilities. Without transit services there would be a 552,000 increase in annual home healthcare visits generating $58.89 million in extra costs that would have to be paid by patients, or via increased insurance premiums and government subsidy programs.

Thus, the total benefit from medical purpose transit trips is $192.80 million, which translates into an average benefit of $18.52 for each healthcare trip made in the State of Wisconsin. Summart Table 1 provides a summary of the study findings.

SUMMARY TABLE 1: SUMMARY OF TRANSIT BENEFITS TO THE HEALTHCARE SECTOR

Percent of Transit Trips for Healthcare Purposes	10.5%
Number of Trips for Healthcare Purposes (annual)	10,410,000
Survey Response, User Actions Without Transit	
Use Alternative Transport Mode for the Same Trip	47.50%
Not Seek Medical Assistance as Often	24.30%
Select Another Physician / Healthcare Provider	17.20%
Receive Homecare	5.80%
Other	5.20%
Consequences if Transit were not Available	
Number of Forgone Work Trips	1.39 million
Number of New Home Healthcare Visits	552,000
Benefits of Transit to Healthcare	
Consumer Surplus (Travel Cost Savings)	$133.92 million
Home Healthcare Cost Savings	$58.89 million
Total Benefit from Transit to the Healthcare Sector	$192.8 million
Per Trip Benefit from Transit Service	$18.52

In addition to the above, IMPLAN© input/output modeling calculated that as the out of pocket cost savings to transit riders is spent in other sectors of Wisconsin's economy 2500 jobs are generated, total output increases by $235.01 million and $35 million more is collected in total tax revenues (See Summary Table 2).

The following report details the process of determining each of the statistics presented here. All statistics were calculated after careful consideration of survey statistics, literature findings, panel opinions, data from Wisconsin transit systems, as well as sound and accepted economic modeling methods conducted by HLB Decision Economics.

SUMMARY TABLE 2: ECONOMIC IMPACT DUE TO HEALTHCARE TRANSPORTATION SAVINGS

	Direct	Indirect	Induced	Total
Employment	1,315	540	647	**2,502**
Output	$123,770,000	$52,900,000	$58,340,000	**$235,010,000**
Tax Revenue	$18,390,000	$7,550,000	$9,050,000	**$34,990,000**

1. INTRODUCTION

Research within the healthcare industry has indicated that there are a number of closely linked issues in healthcare and transportation. Not only does transit service provide a segment of the population with access to medical service centers, but it also provides mobility for individuals lacking the ability to operate a motor vehicle. Recent research has also indicated that there is a strong link between distance to grocery stores, transportation, and the consumption of healthy foods. Some of the more significant findings in current research are detailed below.

1.1 Healthcare and Transportation

For people with a car, getting to a doctor is fairly easy. So is getting to a grocery store on a frequent basis to buy fresh fruits and vegetables, or a park where they can exercise. For transit-dependent communities of low income, elderly, and people with disabilities, lack of transit can put these basic activities out of reach. In fact, more and more research[1] indicates that poor public transportation systems act as barriers to health care and healthy activities. On the other hand, to lower the health care costs, it is preferable that non-driving outpatients travel to health care facilities by the cheapest means possible, which is usually transit. The alternative may be expensive taxi, or extremely costly ambulance service. For instance, throughout the State of Wisconsin, Shared Ride Taxi and Dial-a-Ride small buses carry thousands of residents to and from dialysis and other treatments, saving their families and communities thousands of dollars.

1.2 Mobility for the Increasing Elderly Population

The National Institute on Aging estimates that 600,000 drivers, 70 years and older, go through the process of losing their drivers license every year.[2] Many of them stop driving voluntarily because of poor vision and memory impairment. Others, unwilling to admit they have failing eyesight and slower response times, have to be forced away from the steering wheel after angry confrontations with concerned family members. The problem of older drivers who should not be behind the wheel is likely to get worse as the population ages. The National Highway Traffic Safety Administration reports that from 1990 to 2000, the group of Americans 70 years and older grew nearly twice as fast as the total population. For this group of aging Americans the options are few: become dependant on family members, move from the comfort of their own homes to a retirement community, or have access to public transit.

1.3 Access to Healthy Foods

Recent research conducted at the University of North Carolina has also indicated that living farther from supermarkets may be bad for one's health. The study showed that poor eating habits among residents in low-income neighborhoods stemmed partially from a lack of easy access to fresh, nutritious foods. "We're expecting the lowest-income people to go the farthest to get reasonable prices, so it has implications on the quality of food they can get and the

[1]Nationwide Personal Transportation Study", July 1972. Current statistics from S. Ham, "Calculations from the 1995 Nationwide Personal Transportation Survey", unpublished data, Centers for Disease Control and Prevention, 2000. Centers for Disease Control and Prevention, "Increasing Physical Activity: a Report on Recommendations of the Task Force on Community Preventive Services", *Morbidity and Mortality Weekly Report* 2001; 50 (No. RR-18).
[2] "Older Drivers." Health Information. The National Institute on Aging, The US Department of Health and Human Services. 1999.

purchasing power of food stamps," said Diane Gibson, a New York City College professor who studied access to Chicago's supermarkets while at the University of Chicago.[3] Unlike their suburban neighbors, many who live in low-income neighborhoods don't own cars and are dependent on public transportation for their shopping errands. The corner markets that are in walking distance tend to charge higher prices because they generally lack the economies of scale available to chain stores. Limited shelf space also keeps them from carrying as many items, including a wide selection of produce. The study published by Kimberly Morland in *The American Journal of Public Health* found that the greater the access to supermarkets in a given neighborhood, the more likely residents are to meet dietary recommendations for fruits and vegetables. The effect was found to be strongest in predominantly black neighborhoods, where fruit and vegetable intake increased by 32 percent for each additional supermarket in the neighborhood, compared with an 11 percent increase in mostly white neighborhoods, where residents also had three times the access to private transportation.[4] One might hope for a supermarket with a large selection of produce in every neighborhood. However, for many, access to healthy foods is restricted to locations served via public transit.

1.4 Access to Healthcare

Perhaps the most troubling report comes from a 2001 report commissioned by the Children's Health Fund and conducted by Zogby International.[5] Inadequate transportation resources constitute a hidden barrier to access to medical care. The result is that children with manageable, chronic medical conditions get sick more often and children who need critical follow-up care after surgery or a major illness cannot get it. Asthma was the most frequently cited chronic child health condition, according to the survey. However the study also found circumstances where serious follow-up care, such as chemotherapy, has been a problem for children without access to transportation.

The survey indicated that nine percent or between 3.5 and 4 million U.S. children in families with incomes of up to $50,000 miss essential doctors appointments due to a lack of transportation, regardless of whether they are insured or not. Three million of these children come from families classified as low-income. Within this group, families below the poverty line are three times more likely to be affected. The study concluded rural families living as far as 50 miles away from the nearest medical facility are hardest hit, although transportation is also a problem in urban centers.

[3] McCormick, John. "South, West Sides of Chicago Hungry for Grocery Stores." Knight Ridder Tribune Business News. 29 June 2003.
[4] Morland, Kimberly (2002). "The contextual effect of the local food environment on residents' diets: The atherosclerosis risk in communities study." American Journal of Public Health. 92(11):1761-1767.
[5] "Survey Reveals Millions of US Children Unable to Access Healthcare Due to Lack of Transportation." The Children's Health Fund, 2001.

Wisconsin's Seniors Access Health Services

Independence is a valued treasure for Wisconsin's seniors. As the aging process makes driving dangerous or impossible, many seniors are forced to look elsewhere for the means to travel to their destinations, including healthcare services. While some have family that may be willing to oblige, others do not. Local transportation services provide seniors with the prospect of being self-sufficient in reaching their needs.

Anna Keeney of River Falls comments, "I don't know what we would do without the local share ride service. It is a necessity. Many of the people here in the Senior Well Haven Apartments are handicapped or older individuals that simply cannot drive. There are so many of us that have regular doctors appointments to keep."

Mrs. Keeney relies on the River Falls share ride to make 2 or 3 trips per week to travel to the health clinic, make optical and dental appointments, as well as do her shopping and take care of the necessities that she needs to perform in order to remain self-reliant. While she does observe that the seniors would welcome service beyond the immediate area, she speaks only words of gratitude for the men and women who allow her the freedom to perform her necessary travels.

1.5 Plan of the Report

The following chapters of the report will present a quantification of the benefits of transit to the healthcare sector. An overview of the methodology used by HLB Decision Economics in Chapter 2 will indicate how the modeling process proceeded. Chapter 3 presents the data and sources used to build the modeling assumptions including results from a survey of Wisconsin transit riders, opinions from a panel of experts, as well as transit statistics from service providers and government agencies. The results of the modeling process are presented in Chapter 4, followed by a discussion of the implications and concluding observations from the study in Chapter 5.

2. METHODOLOGY

There are three components that are evaluated in measuring the benefits of public transportation from healthcare related trips. The first is a measure of the cost savings from affordable mobility, which benefits consumers directly by allowing them to avoid higher cost transit modes. The second component is an increase in healthcare costs as some individuals, being unable to easily reach medical centers, turn to home healthcare. Such costs are bore by either the consumer directly or by the population who will face increased insurance costs, whether public or private. The third component is a qualitative measure of medical access to the community. Without access to public transit there is a class of medical trips that would be forgone, decreasing the quality of life standards of the region.

Segmenting Ridership by System and Purpose

In order to arrive at these three components it is first necessary to apportion the total Wisconsin ridership into its appropriate segments. As trip purpose and riders' actions will vary by community size, the total Wisconsin ridership is first divided into three community size categories: large with populations of 50,000+, medium with populations of 10,000-50,000 and small with populations less than 10,000. By establishing the total ridership within each community size category, as well as the percentage of trips for healthcare purposes within the category, the number of healthcare trips within each system is determined.

Users' Actions in the Absence of Transit

The next stage in the process is to define what actions transit users would take in the absence of transit service. Each of the possible alternatives is established, including alternative transit modes: walking, personal vehicle, taxi, etc. as well as the percentage of trips that would not be made in the absence of transit. For each of the trips that would be made on an alternative transit mode, the generalized cost difference between transit and the given alternative is estimated to arrive at a cost savings for that specific trip. The sum of these differences is the total cost savings in the healthcare sector due to transit.

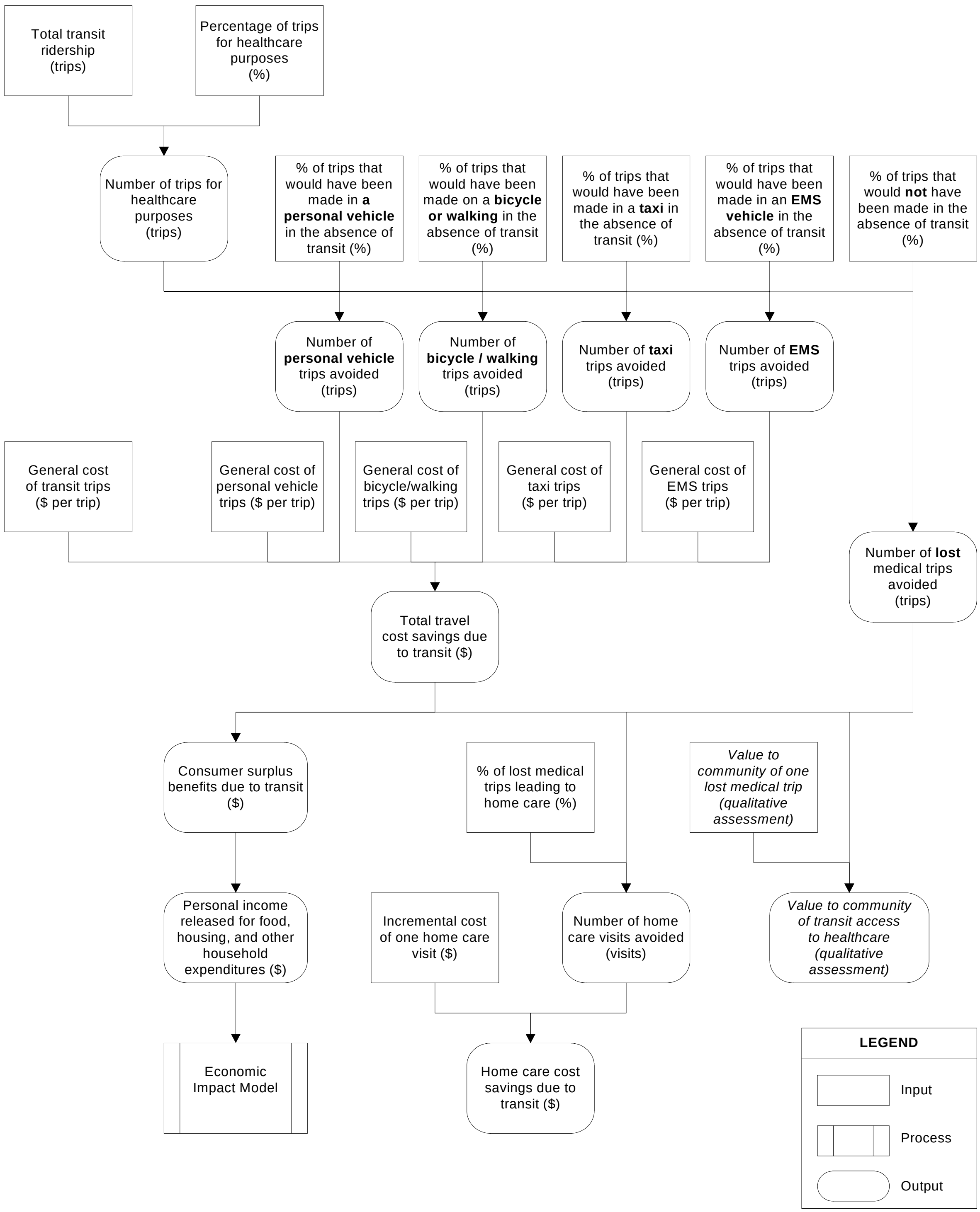
Effects of Forgone Health Trips

The number of trips that would not be made in the absence of transit is then used for two purposes. The first is a measure of lost trips that would result in home healthcare services. By multiplying this figure by the average incremental cost associated with home healthcare, the additional expenditure in personal, insurance, or government subsidy is determined. The additional cost required for such service is a savings that occurs due to the existence of transit.

Only a portion of forgone healthcare trips, however, will result in home healthcare. The remaining trips will result in the individuals not making the healthcare purpose trip. Access to medical services, and living in a healthy community setting are both quality of life indicators that suffer when individuals fail to seek medical services. While lost medical trips are harmful to individuals that would have directly received the medical care, it should be noted that the community at large also has an interest in maintaining a healthy population. As contagion and other community health issues depend on many other factors that will vary by region, it would be inappropriate to attempt generalize the epidemiological effects. However, the number of lost medical trips prevented will be used as a measure of the benefit received as a community good.

The structure and logic diagram below illustrates the methodology used by HLB to estimate the expenditure value and the public transportation impact on healthcare. The figure illustrates the model followed to calculate the corresponding savings by identifying all the inputs and the relationships between these inputs.

Figure 1: Estimating Public Transportation Benefits to Healthcare



Risk Analysis

For the statistical assumptions used to build the model, distributions were defined to describe the uncertainty associated with the knowledge of each particular variable. While point estimates could have been used in the modeling assumptions to arrive at a single value of the benefit of transit to the healthcare sector, there would be no measure of confidence in this resulting point value. There is a very significant difference between a mean expected value of $100 million with an 80% confidence interval of ($90 million, $110 million), and the same mean expected value with an 80% confidence interval of ($40 million, $160 million). The certainty of the first is much greater than that for the second. Therefore, in addition to the mean expected values presented throughout the report, probability distributions have been generated to express the certainty in the resulting benefit values. The probability distributions are presented in section 4.5. For a detailed discussion on how the risk analysis process is conducted see Appendix B.

Economic Impact Model

In addition to the direct effect of out-of-pocket savings by transit riders avoiding more costly transportation modes, there are multiplier effects that need to be considered on the cost savings. The expenditure that is saved in transportation cost is redirected toward purchases in housing, food, and other household expenditures. As this dollar amount is re-spent the benefit multiplies within other sectors of the economy. HLB utilizes the IMPLAN© model which is an economic impact assessment modeling system (structured as an input-output model) originally developed by the U.S. Forest Service (and now maintained by the Minnesota IMPLAN Group, Inc.).[6] By analyzing the change in spending patterns across the 528 industrial sectors that IMPLAN tracks within Wisconsin, the model is able to establish the resulting direct, indirect and induced changes in employment, output and tax revenue as result of the out of pocket savings for healthcare purpose trips.

[6] An input-output ("I/O") approach was followed in this study, drawing on an extensive body of research and experience with successful applications to transportation project analysis. An I/O model calculates impact multipliers, which are then used to compute direct, indirect, and induced effects – output, employment, personal income, and local tax revenue generated per dollar of direct spending for labor, goods, and services.

3. DATA SOURCES

A variety of data sources were used in building the analysis model. An on board survey of Wisconsin transit users was conducted to obtain information on riders' motivation, purpose and available alternatives. A panel of transportation experts from Wisconsin then offered their opinions on the survey statistics and methodology. Supplementary statistics were also obtained from sources such as the National Transit Database, the Wisconsin Department of Transportation, information provided by local transit providers, the Federal Transportation Administration, as well as previous research conducted in the field of transit benefit analysis.

3.1 Survey Results

The on board survey was an essential component in the data collection process. Survey responses were critical in determining rider purpose, alternative transportation options and actions that would be taken in the absence of transit service. The following survey results were generated from an on board survey conducted in six Wisconsin transit districts of varying sizes. A total of 3,035 riders were sampled in the survey.

3.1.1 Community Type Weighting

The final survey results were taken as a weighted average of survey statistics by community size. Rather than simply using raw percentages from the survey, the sample areas were divided into three community sizes. As trip purpose and available alternatives are likely to differ among the given areas, the best manner in which to make the survey reflect the Wisconsin population as a whole is to take the results from the three area types and weight these results by the percentage of Wisconsin population served by public transport within each size category (ridership). The size categories were chosen as Large (population 50,000+), Medium (population 10,000-50,000) and Small (population 0-10,000). The classification used for each area served by public transport is shown in Appendix A. The weights were derived from the percentage of ridership found in each size category. For further discussion on ridership see section 3.3. Table 1 shows the weights used within the HLB modeling process, which can also be used to combine the survey results from each area to representative figures for the State of Wisconsin. The survey results presented below include either the results by community size or, where estimated for the entire state, the weighted result.

Table 1: Survey Weights for Community Size by Ridership

Community Surveyed	**Transit System**	**Region**	**Population**	**Population Percentage**	**Population Group**	**Ridership Weight**
Milwaukee County	Large Bus	East	940,164	72.86%	Large	96.11%
Green Bay	Large Bus	East	102,313	7.93%	Large	
Madison	Large Bus	Center	208,054	16.12%	Large	
Stevens Point	Small Bus	Center	24,551	1.90%	Medium	3.22%
River Falls	Shared-Ride Taxi	West	12,560	0.97%	Medium	
Neillsville	Shared-Ride Taxi	West	2,731	0.21%	Small	0.67%

3.1.2 Trip Purpose

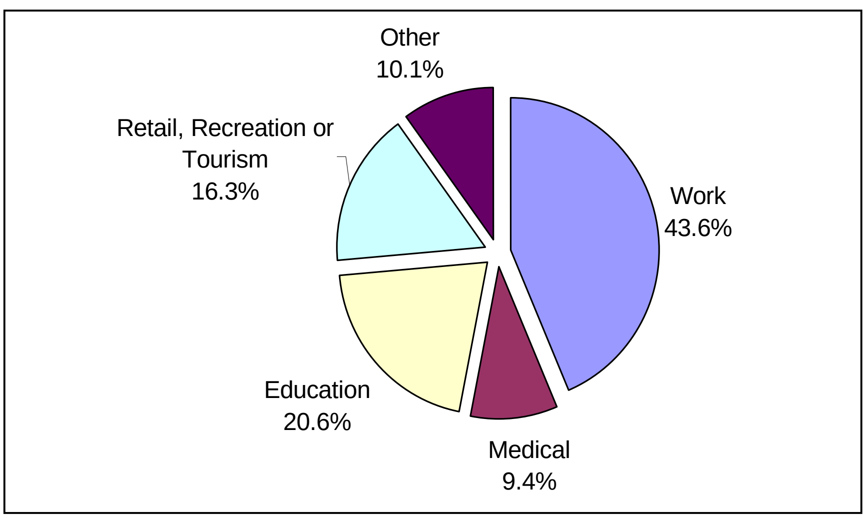
The results of the survey indicated that 9.4% of trips on public transportation in Wisconsin are for the purposes of traveling to or from medical appointments.[7] The percentage of trips for medical purposes is highest in small communities with populations of 10,000 or less, with some 31.6% of trips for healthcare. Transit in the medium and large communities is less intensively used for medical purposes, 16.7% and 9.1% respectively (see Table 2).

Table 2: Medical Trips – Survey Results

Survey Results: Percent of Trips for Healthcare Purposes		
Region	**Percentage**	**Standard Error**
Wisconsin	9.4%	0.53%
Small	31.6%	3.38%
Neillsville	*31.6%*	3.38%
Medium	16.7%	2.53%
River Falls	*19.9%*	3.12%
Stevens Point	*7.7%*	3.66%
Large	9.0%	0.56%
Green Bay	*14.0%*	1.60%
Madison	*6.9%*	0.76%
Milwaukee	*8.7%*	0.88%

On the statewide level, medical purpose trips account for the smallest proportion of the transit ridership. Despite the relatively small percentage of ridership (Figure 2), this segment will prove to be very significant in calculation of the benefits of public transit. Its importance is particularly felt in smaller communities, in which medical trips can account for one-third of the ridership.

Figure 2: Wisconsin Transit by Purpose

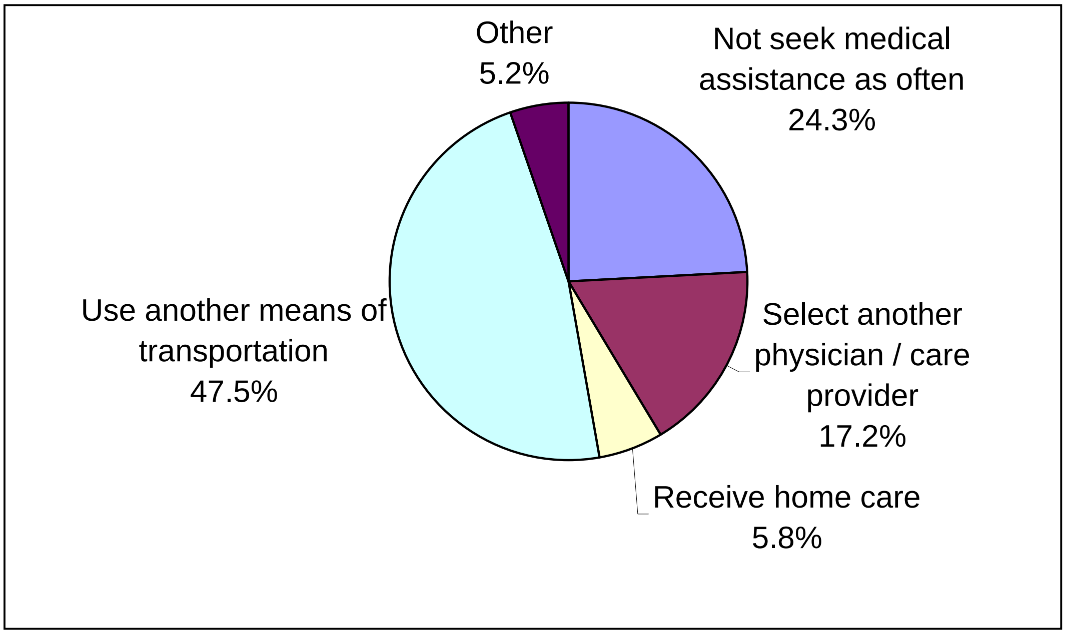


[7] For details on how the purpose statistics were applied to the modeling process see section 3.4

3.1.3 Medically related activity in the absence of Public Transit

Of the individuals who responded that they were using public transport for the purpose of commuting to or from medical appointments, 47.5% indicated that in the absence of public transit they would have made the same trip, but via an alternative transportation mode. The remaining individuals responded that they would alter their medical activities. 24.3% indicated that they would not seek medical assistance as often; 17.2% would select another physician or care provider; while 5.8% would attempt to receive homecare. Figure 3 shows a summary of the active choice responses.

Figure 3: Activity choice in the absence of Public Transit



3.1.4 Alternative Transportation choice in the absence of Public Transit

Individuals who responded that they would use an alternative transportation mode for medical purposes indicated that they would switch to the forms of transportation showing in the table below.

Table 3: Alternate Transportation choice if public transit were unavailable

Transportation Alternative Chosen	Small Systems	Medium Systems	Large Systems	Weighted Average
Drive your personal vehicle	8.3%	6.1%	10.1%	10.0%
Ride with family or friends	60.4%	48.5%	30.3%	31.1%
Use a taxi-cab (other than shared-ride taxi)	25.0%	9.1%	24.2%	23.8%
Ride a bicycle	0.0%	9.1%	10.6%	10.5%
Walk	4.2%	27.3%	20.7%	20.8%
Other	2.1%	0.0%	4.0%	3.9%

3.1.5 Follow up Interviews

In addition to the statistical survey, an in depth series of interviews were conducted via telephone with selected transit riders identified from the rider survey. Over 100 interviews were used to identify and assess the specific purposes and circumstances surrounding an individual's decision to use transit service in Wisconsin.

3.2 Risk Analysis Panel Of Experts

After compiling preliminary results from the survey, HLB sought input from local transportation and academic experts familiar with the particular circumstances of Wisconsin. The group provided valuable feedback to the study on a variety of levels. Not only were the survey statistics and values for model population discussed at length, but conceptual concerns and improvements on the theoretical framework were also addressed. See Panel list in Appendix C.

3.2.1 Weighting the Survey Results by Sampling Areas

The original survey methodology called for sampling in each of the selected communities to be conducted in approximate proportion to the transit population that is represented by not only the geographic portion of Wisconsin, but also type of transportation systems present. The panel indicated that they felt community size was the most important factor influencing the riders' survey responses, and thus recommended the weighting of survey results by ridership according to community size. The weights used are further detailed in section 3.1. With the use of such weights HLB calculated not only total benefit figures for each of the sectors under study, but also the origin of the benefits, by community size. Although the weights were used directly in the modeling process, they can also be used to summarize the survey statistics to reach values that provide the most representative depiction of the average Wisconsin transit user. Although some adjustments were noted from the preliminary survey analysis, the values were not greatly changed as the survey was originally applied in close proportion to the ratios represented by the weights. Nonetheless, all state-level survey results are interpreted from the community level data using the specified weights.

3.2.2 Adjustments to Survey Data for Modeling

The purpose of the Wisconsin ridership survey was to gain not only an understanding of the purpose of transit trips, but also the alternatives that transit riders would turn to should access be unavailable. While sample subjects can be relied upon to indicate their present or past actions with a high degree of accuracy, there is some question as to the reliability of their responses to a conditional statement. In short, when asked what action or transit form they would take in the absence of public transportation, respondents indicated the action they thought they would perform. The choice that they would ultimately take under such circumstances could very well be different. After conferring with the panel assembled, HLB adjusted some of the statistics for application in the benefit model. One area that seemed particularly problematic from the survey data was the number of individuals who claimed they would walk or bike in the absence of transit. For any system size that reported above 5% walking/biking use as the alternative choice for medical purpose trips, an upper bound was established at 5% with the remaining distributed proportionally to the alternative options.

The Move to Assisted Living Doesn't Mean Separation.

In our increasingly fast-paced world, time with family often becomes a scarcity. Children are moving further away from home, and families are constantly relocated to new areas. However, the process of separation is not simply a concern of younger families. As the process of aging, accidents, or illness take their toll, loved ones often find that they require increasingly more aid. Frequently, they must look outside of their own homes for the aid they require.

However, the move to assisted living doesn't mean separation from family and friends. Individuals are increasingly finding that public transport service Medi-Vans allow those once confined to a nursing home the ability to return to the comfort of their own homes for a few hours each day. One couple in Eau Claire reported that the Medi-Van service has assisted them in dealing with their situation.

"He simply couldn't go out for short trips," noted Pudge Lamoureux of her husband's condition. "As he is in a wheelchair, he would not be able to go home regularly if public transportation were not available. The Medi-Van service allows him to return home for a few hours. We really do appreciate all that they do." While such adjustments are never easy, the Medi-Van service is helping individuals gain some measure of the freedom that we often take for granted.

3.3 Ridership

Ridership is a pivotal assumption in the model. Under or overestimation of the ridership figures will cause the ultimate model results to be inaccurate in similar proportion. In order to reach a base figure for annual public transportation ridership in Wisconsin, HLB began with the revenue generating rides recorded by the Wisconsin Department of Transportation. The total revenue generating ridership for the 2002 year was 73,133,315. This, however, does not represent the total number of public transit trips provided in the state. There are additional trips, which are not revenue generating, that must be included in the final ridership figure to accurately describe the benefits of public transit to the state. The National Transit Database provides records of total ridership figures, revenue and non-revenue generating, for the largest transportation systems across the nation. The eighteen largest transportation systems in Wisconsin are included in the database (2001). The selected areas were thus adjusted to include the non-revenue generating trips. These areas alone account for the vast majority of transit trips in Wisconsin, some 97% of ridership. For the smaller transportation systems across the state, Wisconsin DOT revenue generating counts were used as a best conservative estimation. The final ridership value used in the modeling process was thus 98,961,000.

3.4 Healthcare Purpose Trips

The HLB model first analyzed the benefits according to community size (small, medium, large, as described in 3.1.1) Thus, the distribution of healthcare purpose trips was defined separately for each area. It should be noted that the values chosen differ from the raw statistics of the rider survey. After an analysis of the surveys it was discovered that many of the 10.1% of individuals who chose the purpose "other" were actually over specifying a trip that would be more appropriately categorized into one of the existing categories. Examples given such as: library, school, church, counseling, welfare, and physical therapy could all be easily categorized into one of the other purposes. The "other" category was thus eliminated with the 10.1% proportionally distributed among the other areas. The ultimate modeling distributions chosen for medical purposes for each area type are as follows.

Table 4: Transit Trips for Medical Purposes

System	Median	Low 10%	High 10%
Large	10.05%	9.29%	10.80%
Medium	19.34%	15.90%	22.78%
Small	35.87%	31.40%	40.34%

The risk analysis panel indicated some hesitation in the use of the above proportions for modeling medical purpose trips. Some felt that the percentage of medical purpose trips should be reduced across the systems to approximately two-thirds of the values shown above, with the proportion of trips for educational purposes increased by a corresponding amount. These values were also tested in the model to check for the sensitivity of such values in the final results.

3.5 Foregone Healthcare Trips

The on board survey indicated that 23.7% of individuals would not make medical trips as often if public transit were unavailable. It is estimated that such individuals would make only two-thirds of their current health related trips. There is additionally a class of individuals who indicated they would use home healthcare instead of traveling to a medical institution. About 5.8% of the medical purpose transit trips statewide would be replaced by home healthcare. Correspondingly the estimate of total forgone healthcare trips is 13.7% of the trips currently made on public transit for healthcare purposes.

3.6 Alternative Modes Used in Absence of Transit for Healthcare Trips

Although table 4 gives an indication of the alternative transit modes that would be substituted for transit, both HLB and the risk analysis panel agreed that the percentage of people who reported that they would use a bike or walk to medically related trips was unrealistic. Thus an upper bounds of 5% was placed on the use of these modes combined. The chosen modeling distributions are presented in table 5.

Table 5: Alternative Modes in the Absence of Transit

Alternative	System Size		
	Small	Medium	Large
Personal Vehicle	69.51%	80.61%	58.79%
Bicycle or Walking	4.22%	4.95%	4.95%
Taxi	25.27%	13.44%	35.26%

3.7 Transportation Costs

Transportation Costs for each mode of transportation were based upon three generalized costs: out of pocket costs, time costs and accident costs. Out of pocket cost were defined as the out of pocket costs per trip. Time costs were calculated by using the average trip length, average speed for the given mode and a valuation of the time expenditure. Accident costs were derived from published accident statistics, and the estimated losses from such incidents per mile traveled. The total estimated transportation costs per trip are given in table 7 for the various modes.

Table 6: Generalized Costs of Trip by Mode and System

	System Size		
Mode	**Small**		**Large**
Transit	$ 5.74	$ 5.50	$ 5.61
Personal Car	$ 11.11	$ 11.17	$ 12.55
Bicycle or Walking	$ 3.33	$ 3.33	$ 3.33
Taxi	$ 16.14	$ 19.42	$ 21.39
School Bus or Shuttle	$ 5.70	$ 5.70	$ 5.70
EMS	$ 294.33	$ 319.81	$ 332.89

3.8 Alternative Scenarios

In addition to the distributions and assumptions defined above through a consideration of all input sources, HLB developed a model that also allowed for the testing of the values as given directly by individual sources, such as the panel opinions. The values defined above are the most appropriate values, as they consider input from all sources. The alternative cases were used simply to test the results for robustness, in making sure that the results were not overly sensitive to any one variable on which there were conflicting distributions from the various input sources.

4. TRANSIT BENEFITS RESULTING FROM ACCESS TO HEALTHCARE

The following results were determined using HLB's benefit measurement methodology given the assumption distributions that were presented in Chapter 3.

4.1 Ridership by System

There are approximately 10.41 million annual trips on public transit in the State of Wisconsin that are for healthcare purposes (Table 7).

Table 7: Healthcare Purpose Ridership

Healthcare Purpose Trips		
System	**Percent in System**	**Number of Trips**
Small	35.9%	235,000
Medium	19.3%	615,000
Large	10.1%	9,560,000
Total	**10.5%**	**10,410,000**

The survey and the model results indicate that public transportation provides 1.39 million trips for medical purposes that would not have been made if the transit system did not exist.

4.2 Home Healthcare Cases Prevented

In allowing individuals the mobility to reach medical facilities, public transit prevents a 552,000 increase in the number of home healthcare visits. The increase in medical costs associated with such healthcare visits would pay for by the patient or the larger population via insurance premiums. It is estimated that the increase in costs for home healthcare in the absence of public transit would amount to $58.89 million (See Table 8 below).

Table 8: Prevented Loss in Medical Trips and Increase in Home Healthcare Visits

	Without Transit		
System	**Number of Lost Trips**	**New Home Healthcare Visits**	**Prevented Home Healthcare Costs***
Small	27,595	15,238	$ 1.28
Medium	86,620	39,263	$ 3.85
Large	1,274,085	497,738	$ 53.76
Total	**1,388,299**	**552,239**	**$ 58.89**

*Millions of dollars

4.3 Consumer Surplus

The benefit of public transit to medical purpose transit users amounts to a savings of some $133.92 million. This is the generalized increase in costs that users would have to pay by switching to an alternative mode in the absence of transit service.

4.4 Total Cost Savings

The total cost savings includes both the consumer surplus measured by transport cost savings enjoyed by the consumer, as well as the savings in home healthcare costs. Table 9 shows that the total savings from the healthcare sector amounts to a sum of $192.80 million.

Table 9: Total Cost Savings to the Healthcare Sector by System (Millions of dollars)

Savings	Regions			Total
	Small	Medium	Large	
Consumer Surplus	$2.21	$5.84	$125.86	$133.92
Home Healthcare Savings	$1.28	$3.85	$53.76	$58.89
Total Savings	**$3.48**	**$9.69**	**$179.63**	**$192.80**

With a total annual savings of $192.80 million and an annual ridership of 10.41 million medical purpose trips, the average savings per healthcare related trip on public transit is $18.52.

4.5 Economic Impact of Out of Pocket Savings

In addition to the above, HLB carefully considers the employment, output and tax effects of the out of pocket savings from healthcare transit. We note, however, that it is extremely difficult to ascertain incremental (as distinct from transfer) effects in relation to these factors. Glib accounting for such effects is often the demise of Benefit-Cost Studies and HLB counsels great care. Our typical approach is to separate these impacts to comment as carefully as possible on their impact (needed for valid inclusion in the analysis) and demonstrate their influence on the results in "what-if" modality. Because of the difficulty in separating the incremental and transfer portion of these factors, their impacts are not included in the concluding benefit values, but are instead presented in solely in this section of the report.

Through the utilization of the IMPLAN© modeling process it was determined that healthcare transit riders, by spending their out of pocket transportation savings elsewhere, generate 2,500 jobs, $235.01 million in output and $34.99 million in total tax revenue. As the out of pocket savings is spent on items such as housing, food, manufactured goods, and other expenditures, the new economic activity has a rippling effect. New spending allows the affected industries to increase their employment levels and in turn increase orders from their suppliers, who are then able to do the same. IMPLAN© keeps detailed statistics on the interactions of industrial sectors, and is thus able to map how the increased spending moves through the economy while generating the impacts illustrated in table 11.

Table 10: Impact of Out of Pocket Healthcare Transportation Savings

	Direct	Indirect	Induced	Total
Employment	1,315	540	647	**2,502**
Output	$123,770,000	$52,900,000	$58,340,000	**$235,010,000**
Tax Revenue	$18,390,000	$7,550,000	$9,050,000	**$34,990,000**

The direct effects of the increased spending occur in sectors of the economy where transit riders directly spend the out of pocket savings. Indirect effects are secondary as a result of increased orders to suppliers. Induced effects are tertiary and are as a result of increased wages in the direct and indirect industries.

4.6 Risk Analysis

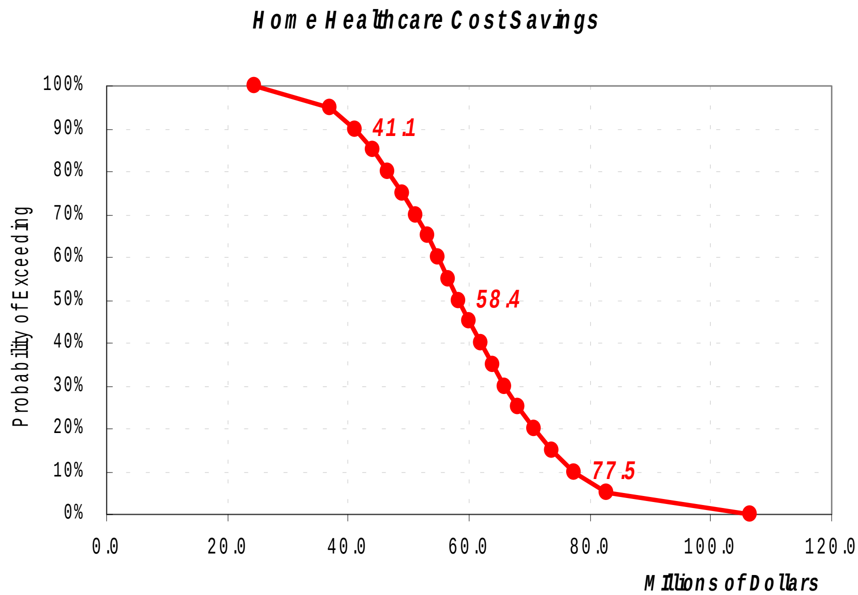
In addition to the point estimates it is important to note the range of possibilities that may occur with the associated likelihoods. Throughout the modeling process inputs were measured as probability distributions rather than point estimates so that final probability distributions relating to the healthcare sector could be determined. While the previously listed point estimates are all based upon the mean expected values from the simulation process, the following decumulative probability charts show the probability the “real value” exceeds the value presented on the horizontal axis. The risk analysis was conducted primarily to account for uncertainty surrounding ridership estimates and other assumptions that populate the benefit estimation model. For further information on how the Risk Analysis Process was conducted see Appendix B.

4.6.1 Savings in Home Healthcare Spending

The following are the risk analysis results shown as a decumulative probability graph indicating the range of home healthcare savings at different probability level. Figure 4 shows that while the expected home healthcare savings in 2002 is estimated at $58 million, there is a 10% probability that the savings can be as high as $77.5 million.

Figure 4: Risk Analysis of Savings in Home Healthcare Spending

Probability of Exceeding	Home Healthcare Cost Savings (Millions of Dollars)
100%	24.6
95%	37.1
90%	**41.1**
85%	44.0
80%	46.6
75%	48.9
70%	51.2
65%	53.2
60%	54.9
55%	56.6
50%	**58.4**
45%	60.0
40%	61.9
35%	63.9
30%	66.0
25%	68.2
20%	70.8
15%	73.6
10%	**77.5**
5%	82.7
0%	106.5
Mean Expected Value	**58.9**

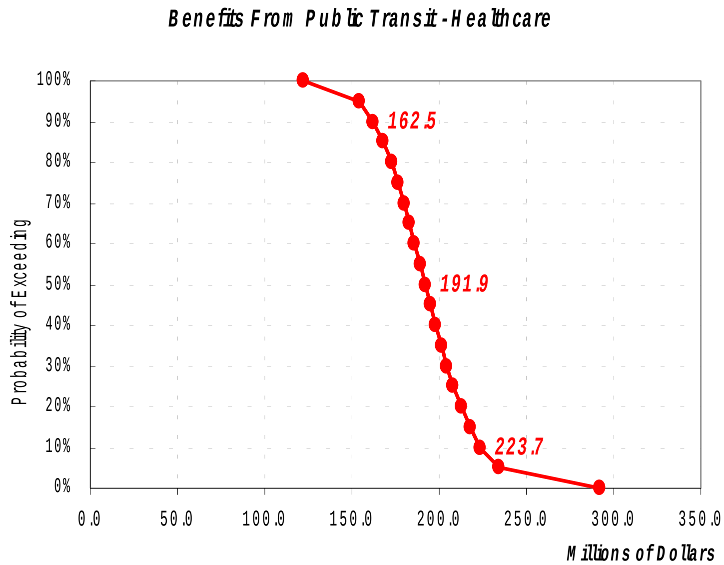


4.6.2 Total Benefits to the Healthcare Sector

Similarly to the home healthcare savings shown above, a risk analysis was conducted to estimate the overall healthcare sector benefits at different probability level. The following decumulative probability graph indicates that there is a 50% probability that the total benefit from public transit to the healthcare sector exceeds $192 million and that this benefits reach over $223 million at the 10% probability level.

Figure 5: Risk Analysis of Total Benefits from Public Transit to Healthcare

Probability of Exceeding	Benefits From Public Transit - Healthcare (Millions of Dollars)
100%	122.0
95%	154.4
90%	**162.5**
85%	168.2
80%	172.7
75%	176.4
70%	179.9
65%	183.0
60%	186.0
55%	189.0
50%	**191.9**
45%	194.9
40%	197.9
35%	201.2
30%	204.5
25%	208.1
20%	213.2
15%	217.8
10%	**223.7**
5%	234.1
0%	292.0
Mean Expected Value	**192.8**



5. CONCLUSION

The existence of public transportation affords a benefit of $192.80 million as a result of health related transit trips. $133.92 million is the consumer surplus to transit users who are able to avoid more costly forms of transportation, while $58.89 million is saved in home healthcare costs that would be required by individuals unable to reach medical facilities otherwise. The availability of public transit allows for 1,388,000 trips to medical facilities that would have been forgone in its absence. 552,000 trips would have resulted in home healthcare visits.

While the largest transit systems account for the majority of benefits in Wisconsin, it should be noted that small communities have the transit systems with the highest proportion of medical purpose use. While only one-tenth of rides are for medical purposes in large systems, over one third of the transit trips in small communities are for healthcare.

Although the sector that benefits most from transit service is work, the most valuable trips on a per trip basis are those for healthcare purposes. With a medical purpose ridership of 10.41 million and a total savings of $192.80 million the average healthcare trip made on public transit generates $18.52 in benefits. The results summary is shown in Table 11.

Table 11: Model Results and Confidence Limits (in 2003 dollars)

Benefits of Transit to Healthcare	Mean Expected Value	Lower 10% Confidence Limit	Upper 10% Confidence Limit
Consumer Surplus -Travel Cost Savings (in millions)	$133.92	$110.7	$158.4
Home Healthcare Cost Savings (in millions)	$58.89	$41.1	$77.5
Total Benefit to the Healthcare Sector (in millions)	$192.80	$162.5	$223.7
Per Trip Benefit for Healthcare	**$18.52**	**$15.84**	**$21.27**

From a public policy standpoint, an incremental change in medical purpose trips will benefit the state more than an incremental change in any of the other sectors studied. Thus, it is important that the state strive to maximize the availability of transit for medical purposes.

Although the mean expected values presented are the best single value estimates of benefits to the healthcare sector from transit, the 80% confidence intervals presented in table 12 give the best illustration of the upside of these benefits. In fact, while the total benefit to the healthcare sector from transit is most probably near $192.8 million for 2002 alone, there is a 10% probability that the benefits can be as high as $224 million for the year. .

Overcoming Handicaps with Wisconsin's Public Transport

The disabled of Wisconsin are finding that their public transportation system is enabling them to carry out tasks that their handicaps may have prevented. The handicapped accessible services offered in many locations throughout the State of Wisconsin provide much need assistance to those who often are forced to deal with increased difficulties in traveling.

Paul White of Chippewa Falls noted that the service allows him to keep appointments that he would not be able to reach otherwise. "In order to be mobile I need a service that is handicap accessible," said White. Another traveler, Cheri Ouimette mentioned, "Since I am disabled, if there were not access to a transportation service, it would be a notable hardship."

Carol, who works in the special education department of the Stevens Point High School, noted that without the transportation service, "We wouldn't be able to do our job well by getting our special education students involved in the community. It provides a great opportunity. It allows the community to become a learning tool for the students."

In Chippewa Falls, Stevens Point and locations around the state, public transportation is allowing handicapped individuals the means to move throughout the community without a disability standing in the way.

APPENDIX A: WISCONSIN COMMUNITIES WITH TRANSIT SYSTEMS

City	Total Population	Community Size	Transit System	Region
Appleton[8]	70,087	Large	Large Bus	East
Baraboo	10,711	Medium	Shared-Ride Taxi	Center
Beaver Dam	15,169	Medium	Shared-Ride Taxi	East
Beloit	35,775	Medium	Large Bus	Center
Berlin	5,305	Small	Shared-Ride Taxi	Center
Black River Falls	3,618	Small	Shared-Ride Taxi	West
Chippewa Falls	12,925	Medium	Shared-Ride Taxi	West
Clintonville	4,736	Small	Shared-Ride Taxi	East
Eau Clair County	93,142	Large	Large Bus	West
Edgerton	4,933	Small	Shared-Ride Taxi	Center
Fond du Lac	42,203	Medium	Small Bus	East
Fort Atkinson	11,621	Medium	Shared-Ride Taxi	East
Grant County	49,597	Medium	Shared-Ride Taxi	West
Green Bay	102,313	Large	Large Bus	East
Hartford	10,905	Medium	Shared-Ride Taxi	East
Janesville	59,498	Large	Large Bus	Center
Jefferson	7,338	Small	Shared-Ride Taxi	East
Kenosha	90,352	Large	Large Bus	East
La Crosse	51,818	Large	Large Bus	West
Ladysmith	3,932	Small	Small Bus	West
Lake Mills	4,843	Small	Shared-Ride Taxi	East
Madison	**208,054**	**Large**	**Large Bus**	**Center**
Manitowoc	34,053	Medium	Small Bus	East
Marinette	11,749	Medium	Shared-Ride Taxi	East
Marshfield	18,800	Medium	Shared-Ride Taxi	Center
Mauston	3,740	Small	Shared-Ride Taxi	Center
Medford	4,350	Small	Shared-Ride Taxi	Center
Menominee Tribe	**4,562**	**Small**	**Rural Bus**	**East**
Merrill	**10,146**	**Medium**	**Small Bus**	**Center**
Milwaukee County	**940,164**	**Large**	**Large Bus**	**East**
Monona	8,018	Small	Large Bus	Center
Monroe	10,843	Medium	Shared-Ride Taxi	Center
Neillsville	2,731	Small	Shared-Ride Taxi	West
New Richmond	6,310	Small	Shared-Ride Taxi	West
Onalaska	14,839	Medium	Shared-Ride Taxi	West
Oneida Town	4,001	Small	Rural Bus	East
Oshkosh	62,916	Large	Large Bus	East
Ozaukee County	82,317	Large	Commuter/Shared-Ride Taxi	East
Platteville	9,989	Small	Shared-Ride Taxi	West
Plover village, Portage County	10,520	Medium	Shared-Ride Taxi	Center
Port Washington	10,467	Medium	Shared-Ride Taxi	East
Portage	9,728	Small	Shared-Ride Taxi	Center
Prairie du Chien	6,018	Small	Shared-Ride Taxi	West
Prairie du Sac village	3,231	Small	Shared-Ride Taxi	Center

8 The Fox Cities metropolitan region (population 188,000) includes the following communities: City of Appleton, City of Kaukauna, City of Menasha, City of Neenah, Town of Buchanan, Town of Grand Chute, Town of Menasha, Village of Kimberly, and Village of Little Chute.

City	Total Population	Community Size	Transit System	Region
Racine	81,855	Large	Large Bus/Commuter	Center
Reedsburg	7,827	Small	Shared-Ride Taxi	Center
Rhinelander	7,735	Small	Shared-Ride Taxi	Center
Rice Lake	8,320	Small	Small Bus	West
Ripon	6,828	Small	Shared-Ride Taxi	Center
River Falls	**12,560**	**Medium**	**Shared-Ride Taxi**	**West**
Rusk County	15,347	Medium	Rural Bus	West
Sawyer County	16,196	Medium	Rural Bus	West
Shawano	8,298	Small	Shared-Ride Taxi	East
Sheboygan	50,792	Large	Large Bus	East
Stevens Point	24,551	Medium	Small Bus	Center
Stoughton	12,354	Medium	Shared-Ride Taxi	Center
Sun Prairie	20,369	Medium	Shared-Ride Taxi	Center
Superior	27,368	Medium	Large Bus	West
Viroqua	**4,335**	**Small**	**Shared-Ride Taxi**	**West**
Washington County	117,493	Large	Commuter/Shared-Ride Taxi	East
Waterloo	3,259	Small	Shared-Ride Taxi	East
Watertown	21,598	Medium	Shared-Ride Taxi	East
Waukesha City	64,825	Large	Large Bus	East
Waukesha County	360,767	Large	Large Bus	East
Waupaca	5,676	Small	Shared-Ride Taxi	East
Waupun	10,718	Medium	Shared-Ride Taxi	East
Wausau	38,426	Medium	Large Bus	Center
West Bend	28,152	Medium	Shared-Ride Taxi	East
Whitewater	13,437	Medium	Shared-Ride Taxi	East
Wisconsin Rapids	18,435	Medium	Shared-Ride Taxi	Center

* *Survey communities are in shaded boxes.*

APPENDIX B: RISK ANALYSIS PROCESS

Economic forecasts traditionally take the form of a single "expected outcome" supplemented with alternative scenarios. The limitation of a forecast with a single expected outcome is clear -- while it may provide the single best statistical estimate, it offers no information about the range of other possible outcomes and their associated probabilities. The problem becomes acute when uncertainty surrounding the forecast's underlying assumptions is material.

A common approach is to create "high case" and "low case" scenarios to bracket the central estimate. This scenario approach can exacerbate the problem of dealing with risk because it gives no indication of likelihood associated with the alternative outcomes. The commonly reported "high case" may assume that most underlying assumptions deviate in the same direction from their expected value, and likewise for the "low case." In reality, the likelihood that all underlying factors shift in the same direction simultaneously is just as remote as that of everything turning out as expected.

Another common approach to providing added perspective on reality is "sensitivity analysis." Key forecast assumptions are varied one at a time in order to assess their relative impact on the expected outcome. A problem here is that the assumptions are often varied by arbitrary amounts. A more serious concern with this approach is that, in the real world, assumptions do not veer from actual outcomes one at a time. It is the impact of simultaneous differences between assumptions and actual outcomes that is needed to provide a realistic perspective on the riskiness of a forecast.

Risk Analysis provides a way around the problems outlined above. It helps avoid the lack of perspective in "high" and "low" cases by measuring the probability or "odds" that an outcome will actually materialize. This is accomplished by attaching ranges (probability distributions) to the forecasts of each input variable. The approach allows all inputs to be varied simultaneously within their distributions, thus avoiding the problems inherent in conventional sensitivity analysis. The approach also recognizes interrelationships between variables and their associated probability distributions.

The Risk Analysis Process involves four steps:

Step 1: Define the structure and logic of the forecasting problem;

Step 2: Assign estimates and ranges (probability distributions) to each variable and forecasting coefficient in the forecasting structure and logic;

Step 3: Engage experts and stakeholders in assessment of model and assumption risks (the "RAP Session"); and

Step 4: Issue forecast risk analysis.

Step 1: Define Structure and Logic of the Forecasting Problem

A "structure and logic model" depicts the variables and cause and effect relationships that underpin the forecasting problem at-hand (See Figure 1). Although the structure and logic model is written down mathematically to facilitate analysis, it is also depicted diagrammatically in order to permit stakeholder scrutiny and modification in Step 3 of the process.

Step 2: Assign Central Estimates and Conduct Probability Analysis

Each variable is assigned a central estimate and a range (a probability distribution) to represent the degree of uncertainty. Special data sheets are used to record the estimates. The first column gives an initial median while the second and third columns define an uncertainty range representing an 80 percent confidence interval. This is the range within which there exists an 80 percent probability of finding the actual outcome. The greater the uncertainty associated with a forecast variable the wider the range.

Figure 6: Example of Data Sheet

Variable	Median	10% Lower Limit	10% Higher Limit
Percentage of trips for healthcare purpose	10.5%	9.3%	10.8%

Probability ranges are established on the basis of both statistical analysis and subjective probability. Probability ranges need not be normal or symmetrical -- that is, there is no need to assume the bell shaped normal probability curve. The bell curve assumes an equal likelihood of being too low and being too high in forecasting a particular value. It might well be, for example, that if a projected percentage deviates from expectations; circumstances are such that it is more likely to be higher than the median expected outcome than lower.

The RAP computer program transforms the ranges as depicted above into formal probability distributions (or "probability density functions"). This liberates the non-statistician from the need to appreciate the abstract statistical depiction of probability and thus enables stakeholders to understand and participate in the process whether or not they possess statistical training.

From where do the central estimates and probability ranges for each assumption in the forecasting structure and logic framework come? There are two sources. The first is an historical analysis of statistical uncertainty in all variables and an error analysis of the forecasting "coefficients." "Coefficients" are numbers that represent the measured impact of one variable (say, income) on another (such as retail sales). While these coefficients can only be known with uncertainty, statistical methods help uncover the magnitude of such error (using diagnostic statistics such as "standard deviation," "standard error," "confidence intervals" and so on).

The uncertainty analysis outlined above is known in the textbooks as “frequentist” probability. The second line of uncertainty analysis employed in risk analysis is called “subjective probability” (also called “Bayesian” statistics, for the mathematician Bayes who developed it). Whereas a frequentist probability represents the measured frequency with which different outcomes occur (i.e., the number of heads and tails after thousands of tosses) the Bayesian probability of an event occurring is the degree of belief held by an informed person or group that it will occur. Obtaining subjective probabilities is the subject of Step 3.

Step 3: Conduct Expert Evaluation: The RAP Session

Step 3 involves the formation of an expert panel and the use of facilitation techniques to elicit, from the panel, risk and probability beliefs about:

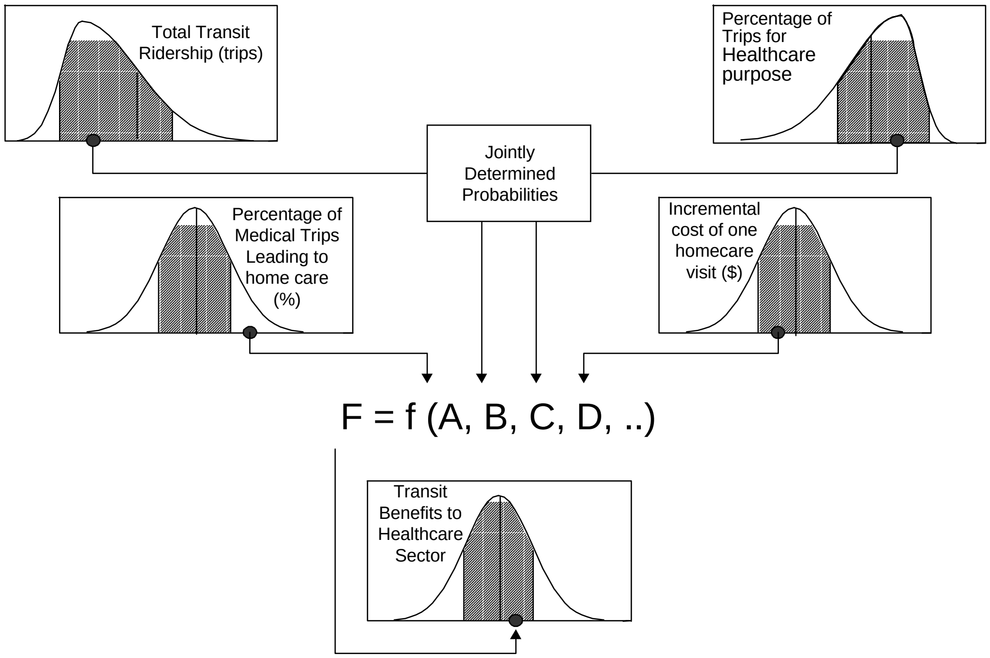
- The structure of the forecasting framework; and
- The degree of uncertainty attached to each variable and forecasting coefficient within the framework.

In (1), experts are invited to add variables and hypothesized causal relationships that may be material, yet missing from the model. In (2), panelists are engaged in a discursive protocol during which the frequentist-based central estimates and ranges, provided to panelists in advance of the session, are modified according to subjective expert beliefs. This process is aided with an interactive “groupware” computer tool that permits the visualization of probability ranges under alternative belief systems.

Step 4: Issue Risk Analysis

The final probability distributions are formulated by the risk analyst (HLB) and represent a combination of “frequentist” and subjective probability information drawn from Step 3. These are combined using a simulation technique (Monte Carlo analysis) that allows each variable and forecasting coefficient to vary simultaneously according to its associated probability distribution (see Figure 7).

Figure 7: Combining Probability Distributions



The end result is a central forecast, together with estimates of the probability of achieving alternative outcomes given uncertainties in underlying variables and coefficients (as presented in Figures 4 and 5, Results).

APPENDIX C: EXPERTS THAT PARTICIPATED AT THE RISK ANALYSIS WORKSHOP

Ingrid Rothe
Researcher, Institute for Research on Poverty
University of Wisconsin - Madison

Dr. Edward Beimborn
Director, Center for Urban Transportation Studies
University of Wisconsin-Milwaukee

Joe Caruso
Marketing Director
Milwaukee County Transit

Sharon Persich
Planning Manager
Metro Transit, Madison

Susan Lemke
Transit Manager
Stevens Point Transit

Mark Jones
Manager
Abby Vans, Inc., Neillsville

Beverly Scott (No show)
President
Top Hat Inc., La Crosse/River Falls

Ken Yunker
Deputy Director
Southeastern WI Regional Planning Commission, Waukesha

Dixon Nuber
Director
University of WI - Milwaukee School of Continuing Studies

Pat McGinty
Title: President
Brown Cab Service, Inc., Fort Atkinson

Chuck Kamp
General Manager
Valley Transit, Appleton

Greg Seubert
Transit Director
Wausau Area Transit System

Ann Gullickson
Transit Service Manager
Metro Transit, Madison

Anita Gullota-Connelly
Director of Administration
Milwaukee County Transit System

Bob Johnson
Transit Director
Waukesha Metro Transit

John Etzler
Public Transit Section
WI Dept of Transportation

David Vickman
Public Transit Section
WI Dept of Transportation

STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION

THE SOCIO-ECONOMIC BENEFITS OF TRANSIT IN WISCONSIN

CHAPTER 3: EDUCATION

Prepared By:

HLB DECISION ECONOMICS INC.
8403 Colesville Road, Suite 910
Silver Spring, MD 20910

December 1, 2003

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EXECUTIVE SUMMARY

TRANSIT BENEFITS

The availability of public transportation has become increasingly important to the education sector as schools and universities are more frequently constructed farther from the central urban and residential areas. As average commuting distances for educational purposes have increased over past decades, so have the transportation requirements to move students from home to the school. In addition to the burden of distance, students often face age or budgetary constraints to owning private vehicles. For such individuals, transit services can be essential in reaching the classroom.

Describing the benefits of transit service has historically been completed through qualitative analysis. In conducting literature reviews in transit cost benefit analysis, HLB has found that even today the vast majority of studies fall into the category of qualitative reports. Anecdotal evidence and theoretical postulating are relied upon to describe the interactions taking place as a result of the existence of transit services. Such studies, conducted from federal agencies to community organizations, each attempt to describe the costs and benefits of transit without the thorough scrutiny of empirical case data. While the studies have played an important role in developing the areas of interest for measurement, such as low-cost mobility and reduced traffic congestion, they have done so primarily in the absence of sound quantitative analysis. What remains to be explained and accounted for are the actual benefits being generated by transit within specific regions.

In recent years, however, the development of transportation research has begun to focus upon the quantification of transit benefits as a valuable tool in describing the return on expenditure, as well as for comparing alternative capital investment options. The current economic theory tends to segment the total benefits of transit into three areas: congestion management, economic development, and affordable mobility. Measuring each type of benefit requires a different methodology, which if conducted inappropriately can undervalue public transit by considering just a portion of the total potential benefits.

Congestion Management

The study of congestion management evaluates how the existence of transit services causes a decrease in the costs of owning and operating a personal vehicle. With increased reliance on transit services there is an improvement in travel time, fewer accidents, and lower pollution emissions as fewer miles are traveled via personal vehicles. The two principal benefits attributed to congestion management are the reduction in travel by personal vehicles and the less congested traveling conditions for the vehicles that remain on the roadway.

Economic Development

The study of development and transportation considers the relationship that exists between the economic activities of an area and the proximity of transportation services. Greater access via transit presents the opportunity for increased commercial activity, as travel to the location is more readily available for both patrons and employees. As commercial opportunities expand, secondary effects appear. With an increase in commercial activity, a higher demand for real estate emerges along with increasing property values.

Affordable Mobility

Studies of affordable mobility attempt to define the benefits to riders who are transit dependent as well as choice riders. Transit dependent riders are those who cannot drive due to physical factors or monetary restraints, while choice riders have access and the ability to use an automobile, but make the choice to use transit. The benefits to riders can be measured by their expenditure savings in accessing different sector services via public transit instead of a more costly alternative. In addition to the expenditure savings measure, certain cross sector benefits also exist. By providing access to employment sites, transit helps decrease spending on welfare to work programs. Similarly, by providing a means of transit to medical services, transit helps prevent cases that might otherwise become dependent upon home healthcare.

BENEFITS OF TRANSIT TO ACCESS EDUCATION SERVICES

Sector studies in affordable mobility, such as the Wisconsin Transit Sectors Socioeconomic Analysis Study, attempt to show not simply a total benefit figure for a given region, but how each of the various sectors within the regional economy benefit from transit service. As transit riders' purposes for using public transportation will differ depending upon the geographical, cultural and socioeconomic characteristics of a region, it is necessary to define how users act with transit versus the actions they would take in the absence of transit. The sectors of analysis are divided into: work purposed trips, educational purpose trips, healthcare purpose trips, as well as retail, tourism and recreation trips. Such a list is not, of course, exhaustive. Each of the four sectors could be further divided to type of employment, place of education, etc. for studies on a micro or community level basis.

The Wisconsin Transit Sectors Socioeconomic Analysis is a sector benefits study of transit to the State of Wisconsin. This report specifically focuses upon the benefits of public transit service to the education sector of Wisconsin's economy. HLB Decision Economics has prepared the following report as one component of a larger study of the various sector benefits of public transit in Wisconsin. The analysis relies on methodology developed by HLB Decision Economics over the past decade on behalf of the Federal Transit Administration and other state agencies. The approach to such a study involves application of acceptable economic theory by identifying user preferences and actions as well as modeling the impact of such decisions on the education sector.

STUDY APPROACH

HLB employed various sources of information and data to conduct this quantitative study. These included an extensive literature search, an HLB conducted survey, information from several transit agencies in Wisconsin, panel opinions from a group of experts, as well as reports and publications from earlier studies conducted by HLB.

STUDY FINDINGS

The results of the study indicate that within the State of Wisconsin 22.64 million transit trips are made annually for educational purposes, the proportion of which is second only to work purpose trips. For each education trip that is made, an estimated $4.03 is saved in out of pocket and time costs. The transit trips for educational purposes benefit users a total of $91.30 million in annual cost savings.

In addition to the cost savings, there are external benefits to the existence of public transit in the education sector. 12.5% of education trips across the state would not be made if transit services did not exist. This accounts for 2.82 million annual education trips. However, the students seeking to further their education are not the only individuals who benefit from their ability to access educational facilities. It must also be noted that the community at large benefits from the positive externalities associated with having a better-educated populace. Summary Table 1 provides a summary of the study findings.

SUMMARY Table 1: SUMMARY OF TRANSIT BENEFITS TO THE EDUCATION SECTOR

Percent of Transit Trips for Education Purposes	22.9%
Number of Trips for Education Purposes (annual)	22.64 million
Survey Response, User Actions Without Transit	
Use Alternative Transport Mode for the Same Trip	48.0%
Be Unable to Attend School/College	12.6%
Miss More Class or School Activities	21.6%
Choose Another School (Closer to Home)	14.9%
Other	3.0%
Consequences if Transit were not Available	
Number of Forgone Education Trips	2.82 million
Benefits of Transit to Education	
Total Benefit from Transit to the Education Sector	$91.30 million
Per Trip Benefit from Transit Service	$4.03

In addition to the above, IMPLAN© input/output modeling calculated that as the out of pocket cost savings to transit riders is spent in other sectors of Wisconsin's economy 1,840 jobs are generated, total output increases by $173.04 million and $25.76 million more is collected in total tax revenue.(See Summary Table 2).

The following report details the process of determining each of the statistics presented in Table 1. All statistics were calculated after careful consideration of survey statistics, literature findings, panel opinions, data from Wisconsin transit systems, as well as sound and accepted economic modeling methods conducted by HLB Decision Economics Inc.

SUMMARY Table 2: ECONOMIC IMPACT DUE TO EDUCATION TRANSPORTATION SAVINGS

	Direct	Indirect	Induced	Total
Employment	966	397	476	1,839
Output	$91,170,000	$38,940,000	$42,930,000	$173,030,000
Tax Revenue	$13,530,000	$5,560,000	$6,670,000	$25,760,000

1. INTRODUCTION

Students at both the secondary school and university level have become increasingly dependent on transit over the course of the past decades. A survey by the Public Transportation Partnership for Tomorrow found that 15% of transit trips nationally are for education related purposes, a proportion second only to work purposed trips.[1] Thus, public transportation clearly plays a supportive role for educational systems. There are a number of reasons why students rely on transit services including:

- Not being old enough to obtain a driver's license;
- Not being able to afford the costs of buying and operating a privately-owned vehicle; and
- The need to access other educational resources such as other campuses or libraries.

The following are a few of the findings of recent research of the linkages between education and public transportation.

1.1 The Increasing Reliance on Transportation for Education Trips

In 1969, according to the Federal Highway Administration, about half of all children ages five to 18 either walked or hiked to school. By 2001, 85 percent of all children between five and 15 were chauffeured to school by either a parent or a bus driver.[2] This change alone has caused a disastrous effect on the morning commute. In some communities around the nation it is estimated that 21 to 27 percent of peak morning traffic is school related. The journey between home and school has become longer and more dangerous because of decades of auto-oriented suburbanization.

National school guidelines recommending minimum school lot sizes can often be met only on the fringes of urban areas. Sidewalks, crosswalks, and bike paths are scarce in many locations. Forty percent of parents polled in a 1999 national survey by the Centers for Disease Control cited traffic danger as a major barrier to allowing children to walk to school. In the same survey fifty percent of parents responded that their children are driven to school in a private vehicle.[3] In 9,000 "walkability" audits conducted across the country, the National Safe Kids Campaign found that nearly 60 percent of children encountered at least one serious hazard on their way to school.[4] For many students, transit fills the need for transportation service in locations where walking or biking to school simply is not an option.

In addition to the transportation service to and from school, the educational sector also enjoys benefits from the use of public transport for various programs including transportation for class outings as well as mobility training for disabled and special education students. Many such educational activities would be forgone without readily available access to transit service.

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[1] "Facts on Transit." The Public Transportation Partnership for Tomorrow." 2002.
[2] Appleyard, Bruce. "Planning Safe Routes to School." Planning. Chicago, May 2003.
[3] "Barriers to Children Walking and Biking to School." Centers for Disease Control and Prevention. 1999.
[4] "Child Pedestrian Safety: The Problem." The National Safe Kids Campaign, 2001.

1.2 Access to Universities

University students also face increased challenges in reaching their educational destinations. There is a growing pattern throughout US cities in that older existing colleges have campuses conveniently located in the downtown areas, while newer colleges and universities feel forced to build on the outskirts of the community due to lower land prices. Although going to the outskirts can save funds that make it financially feasible to build new campuses, this greatly increases the transportation burdens and costs for students who try to commute daily from their homes to these distant institutions. The only practical solution for these potential students is often to buy a car or truck, but the costs of buying and operating a vehicle are often too high for them to then be able to attend such a college or university. The availability of reliable public transportation service can often ease this burden and open access to a host of additional academic programs that may not be centrally located in the urban area.

Although students are the primary benefactors from attending university courses, the community at large also has an interest in the educational level of its members. A large pool of well-educated workers can attract business to a region. The increased wages that well educated workers command translates into a larger tax base for the community at large.

1.3 Plan of the Report

The following chapters of the report will present a quantification of the benefits of transit to the education sector. An overview of the methodology used by HLB Decision Economics in Chapter 2 will indicate how the modeling process proceeded. Chapter 3 presents the data and sources used to build the modeling assumptions including results from a survey of Wisconsin transit riders, opinions from a panel of experts, as well as transit statistics from service providers and government agencies. The results of the modeling process are presented in Chapter 4, followed by a discussion of the implications and concluding observations from the study in Chapter 5.

2. METHODOLOGY

There are two major components that are considered when measuring the benefits to the educational sector from public transportation. The first is a measure of the cost savings from affordable mobility, which benefits consumers directly by allowing them to avoid higher cost transit modes. The second component is a measure of educational access within the community. While students do individually benefit from the furthering of their educational endeavors, there is also some measure of externality benefit that society receives from having well educated members.

Segmenting Ridership by System and Purpose

In order to arrive at these components it is first necessary to apportion the total Wisconsin ridership into its appropriate segments. As trip purpose and riders' actions will vary by community size, the total Wisconsin ridership is first divided into three community size categories: large with populations of 50,000+, medium with populations of 10,000-50,000 and small with populations less than 10,000. By establishing the total ridership within each community size category, as well as the percentage of trips for education purposes within the category, the number of education trips within each system is determined.

Users' Actions in the Absence of Transit

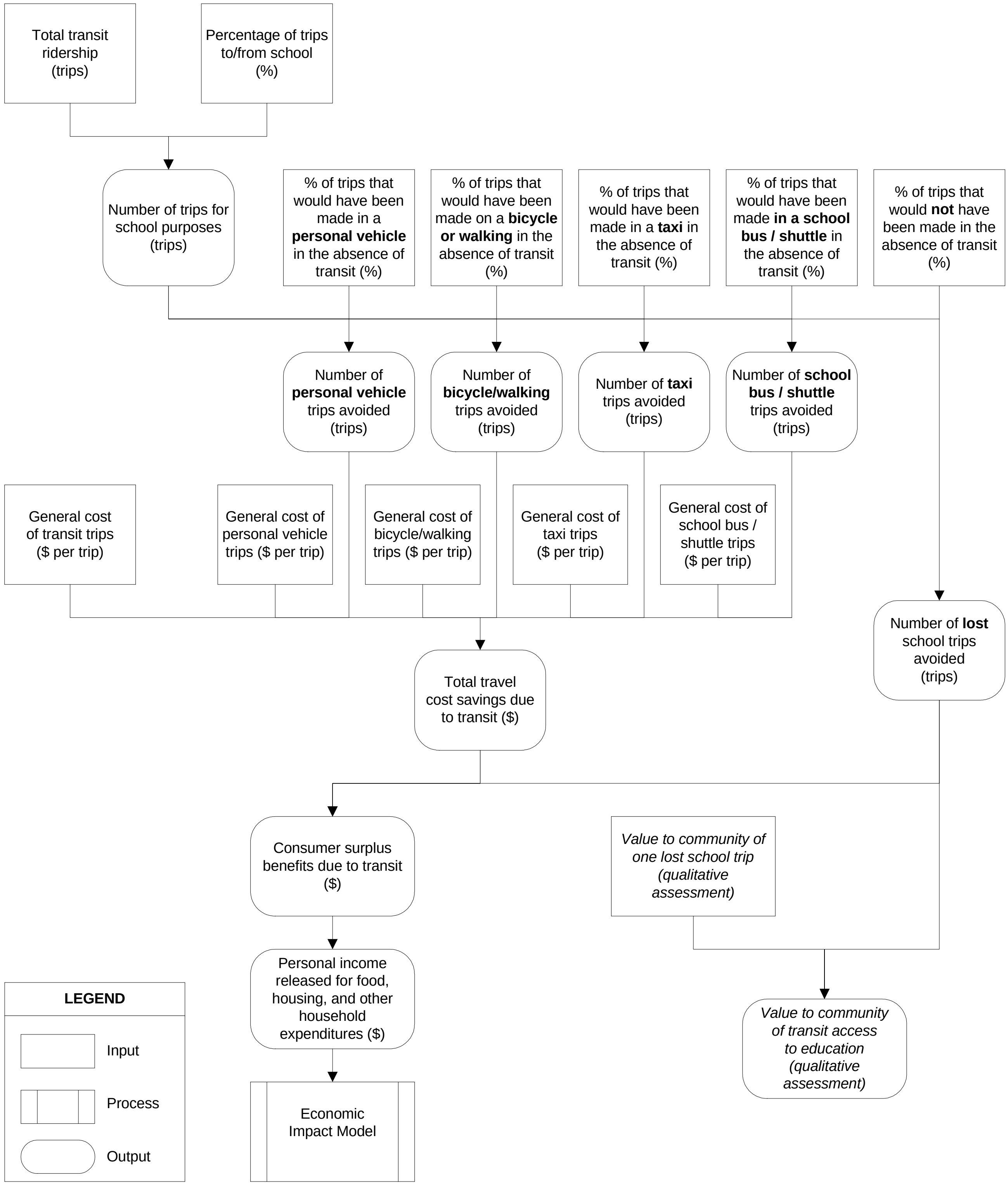
The next stage in the process is to define what actions transit users would take in the absence of transit service. Each of the possible alternatives is established, including alternative transit modes: walking, personal vehicle, taxi, etc. as well as the percentage of trips that would not be made in the absence of transit. For each of the trips that would be made on an alternative transit mode, the generalized cost difference between transit and the given alternative is estimated to arrive at a cost savings for that specific trip. The sum of these differences is the total cost savings in the education sector due to transit.

Forgone Education Trips

Access to education within a community is an indicator of the area's quality of life. While individual students benefit from access to educational institutions, the community at large also enjoys the benefits of having a well-educated populace. A measurement of the number of lost transit trips prevented by the existence of public transit will be used as an indication of the benefit that is afforded to the community by providing access to educational institutions.

The following structure and logic diagram illustrates the methodology used by HLB to estimate the expenditure value and the public transportation impact on education. The figure illustrates the model followed to calculate the corresponding savings by identifying all the inputs and the relationships between the inputs.

Figure 1: Estimating Public Transportation Benefits to Education



Risk Analysis
For the statistical assumptions used to build the model, distributions were defined to describe the uncertainty associated with the knowledge of each particular variable. While point estimates could have been used in the modeling assumptions to arrive at a single value of the benefit of transit to the education sector, there would be no measure of confidence in this resulting point value. There is a very significant difference between a mean expected value of $100 million with an 80% confidence interval of ($90 million, $110 million), and the same mean expected value with an 80% confidence interval of ($40 million, $160 million). The certainty of the first is much greater than that for the second. Therefore, in addition to the mean expected values presented throughout the report, probability distributions have been generated to express the certainty in the resulting benefit values. The probability distributions are presented in section 4.3. For a detailed discussion on how the risk analysis process is conducted see Appendix B.

Economic Impact Model
In addition to the direct effect of out-of-pocket savings by transit riders avoiding more costly transportation modes, there are multiplier effects that need to be considered on the cost savings. The expenditure that is saved in transportation cost is redirected toward purchases in housing, food, and other household expenditures. As this dollar amount is re-spent the benefit multiplies within other sectors of the economy. HLB utilizes the IMPLAN© model which is an economic impact assessment modeling system (structured as an input-output model) originally developed by the U.S. Forest Service (and now maintained by the Minnesota IMPLAN Group, Inc.).[5] By analyzing the change in spending patterns across the 528 industrial sectors that IMPLAN tracks within Wisconsin, the model is able to establish the resulting direct, indirect and induced changes in employment, output and tax revenue as result of the out of pocket savings for education purpose trips.

More Than a Ride to Class for Wisconsin Students

A wide range of Madison's students regularly take advantage of the local transportation system. Public transport is used not only for the commute to and from school, but also for school field trips, outings, access to employment services for special education, mobility training for blind students and even to get local medical students to the training they need to become the doctors of tomorrow.

Laurie Frank recently used the bus service for her class's field trip. "We love that we…

[5] An input-output ("I/O") approach was followed in this study, drawing on an extensive body of research and experience with successful applications to transportation project analysis. An I/O model calculates impact multipliers, which are then used to compute direct, indirect, and induced effects – output, employment, personal income, and local tax revenue generated per dollar of direct spending for labor, goods, and services.

…have this option available, without it we would have to rent a bus at a very high cost. There are many trips taken by classes in Madison - especially to places like the Civic Center, museums, the capitol, etc. Most of the time other classes rent a school bus. It would be great to see some outreach to teachers and administrators to show that the city bus is a viable option, and it teaches students about public transportation available to them outside of school."

"I teach students to use the bus system," noted Joshua Ludke an educational trainer for special education students in Madison. "We would lose a valuable part of our program if the transport system didn't exist. It would be very expensive to plan outings and employment services for special education without it."

Diane Coughlin, who works on mobility training with blind students in the Madison area, comments that access to public transportation service is vital for her students. "It is very important our students to learn to be mobile and active in the community."

Megan Trester, a local medical student, reports that the bus service allows her to reside further away from campus to help avoid additional living expenses. "This bus is very crucial for medical students who need to get back and forth to the hospital. There are very few other means to reach the hospital now." A fellow UW-Madison student, Brian Erskine, who is studying for his doctorate degree in pharmacy, also says that public transportation plays an important role. "Although I also use a bicycle, I use the bus if I have to carry a lot of work, as well as during the winter. I have sometimes had problems with early or late buses, but overall the system is good. I typically make 10 trips per week using the service."

The transportation system throughout Madison is clearly much more than a ride to class. It is an important tool used by students of various education programs in the area. Without such access Wisconsin's students would surly be at a disadvantage in preparing for their future.

3. DATA SOURCES

A variety of data sources were used in building the analysis model. An on board survey of Wisconsin transit users was conducted to obtain information on riders' motivation, purpose and available alternatives. A panel of transportation experts from Wisconsin then offered their opinions on the survey statistics and methodology. Supplementary statistics were also obtained from sources such as the National Transit Database, the Wisconsin Department of Transportation, information provided by local transit providers, the Federal Transportation Administration, as well as previous research conducted in the field of transit benefit analysis.

3.1 Survey Results

The on board survey was an essential component in the data collection process. Survey responses were critical in determining rider purpose, alternative transportation options and actions that would be taken in the absence of transit service. The following survey results were generated from an on board survey conducted in six Wisconsin transit districts of varying sizes. A total of 3,035 riders were sampled in the survey.

3.1.1 Community Type Weighting

The final survey results were taken as a weighted average of survey statistics by community size. Rather than simply using raw percentages from the survey, the sample areas were divided into three community sizes. As trip purpose and available alternatives are likely to differ among the given areas, the best manner in which to make the survey reflect the Wisconsin population as a whole is to take the results from the three area types and weight these results by the percentage of Wisconsin population served by public transport within each size category (ridership). The size categories were chosen as Large (population 50,000+), Medium (population 10,000-50,000) and Small (population 0-10,000). The classification used for each area served by public transport is shown in Appendix A. The weights were derived from the percentage of ridership found in each size category. For further discussion on ridership see section 3.3. Table 1 shows the weights used within the HLB modeling process, which can also be used to combine the survey results from each area to representative figures for the State of Wisconsin. The survey results presented below include either the results by community size or, where estimated for the entire state, the weighted result.

Table 1: Survey Weights for Community Size by Ridership

Community Surveyed	**Transit System**	**Region**	**Population**	**Population Percentage**	**Population Group**	**Ridership Weight**
Milwaukee County	Large Bus	East	940,164	72.86%	Large	96.11%
Green Bay	Large Bus	East	102,313	7.93%	Large	
Madison	Large Bus	Center	208,054	16.12%	Large	
Stevens Point	Small Bus	Center	24,551	1.90%	Medium	3.22%
River Falls	Shared-Ride Taxi	West	12,560	0.97%	Medium	
Neillsville	Shared-Ride Taxi	West	2,731	0.21%	Small	0.67%

3.1.2 Trip Purpose

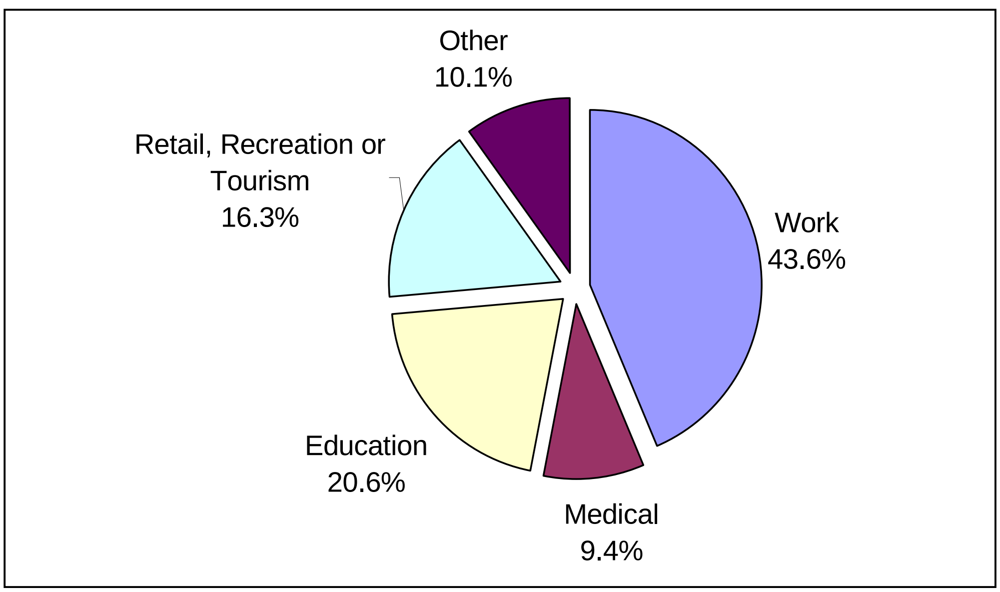
The results of the survey indicated that 20.6% of trips on public transportation in Wisconsin are for the purpose of reaching educational destinations.[6] The percentage of trips for educational purposes is highest in large communities with populations of 50,000 or more, with some 20.9% of trips for education. Transit in the medium and small communities is less intensively used for educational purposes, 14.6% and 7.7% respectively (see Table 2).

Table 2: Educational Trips – Survey Results

Survey Results: Percent of Trips for Educational Purposes		
Region	**Percentage**	**Standard Error**
Wisconsin	20.6%	0.73%
Small	7.7%	1.93%
Neillsville	*7.7%*	1.93%
Medium	14.6%	2.40%
River Falls	*16.6%*	2.90%
Stevens Point	*9.2%*	3.98%
Large	20.9%	0.79%
Green Bay	*14.5%*	1.62%
Madison	*23.4%*	1.26%
Milwaukee	*21.6%*	1.28%

On the statewide level, education purpose trips account for the second largest proportion of the transit ridership, second only to work purpose trips (Figure 2).

Figure 2: Wisconsin Transit by Purpose

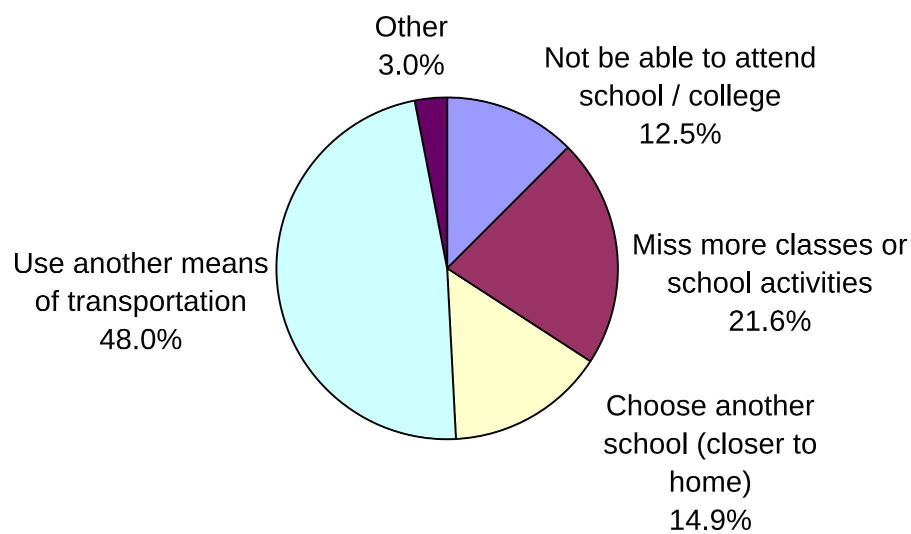


[6] For details on how the purpose statistics were applied to the modeling process see section 3.4

3.1.3 Educationally related activity in the absence of Public Transit

Of the individuals who responded that they were using public transport for the purpose of commuting to or from educational institutions, 48% indicated that without transit they would have made the same trip, but via an alternative transportation mode. The remaining individuals responded that they would alter their educational activities. 12.5% indicated that they would not be able to attend school or college; 21.6% would miss more classes or school activities; while 14.9% would choose another school that is closer to their place of residence. Figure 3 shows a summary of the activity choice responses.

Figure 3: Activity choice in the absence of Public Transit



3.1.4 Alternative Transportation choice in the absence of Public Transit

Individuals who responded that they would use an alternative transportation mode for educational purposes indicated that they would switch to the forms of transportation shown in the Table below.

Table 3: Alternate Transportation choice if public transit were unavailable

Transportation Alternative Chosen	Small Systems	Medium Systems	Large Systems	Weighted Average
Drive a personal vehicle	0.0%	6.9%	20.2%	19.7%
Ride with family or friends	66.7%	10.3%	30.1%	29.7%
Use a taxi-cab (other than shared-ride taxi)	0.0%	3.5%	5.5%	5.4%
Ride a bicycle	0.0%	58.6%	20.7%	21.7%
Walk	33.3%	20.7%	20.2%	20.3%
Other	0.0%	0.0%	3.3%	3.2%

3.1.5 Follow up Interviews

In addition to the statistical survey, an in depth series of interviews were conducted via telephone with selected transit riders identified from the rider survey. Over 100 interviews were used to identify and assess the specific purposes and circumstances surrounding an individual's decision to use transit service in Wisconsin.

3.2 Risk Analysis Panel Of Experts

After compiling preliminary results from the survey, HLB sought input from local transportation and academic experts familiar with the particular circumstances of Wisconsin. The group provided valuable feedback to the study on a variety of levels. Not only were the survey statistics and values for model population discussed at length, but conceptual concerns and improvements on the theoretical framework were also addressed. See Panel list in Appendix C.

3.2.1 Weighting the Survey Results by Sampling Areas

The original survey methodology called for sampling in each of the selected communities to be conducted in approximate proportion to the transit population that is represented by not only the geographic portion of Wisconsin, but also type of transportation systems present. The panel indicated that they felt community size was the most important factor influencing the riders' survey responses, and thus recommended the weighting of survey results by ridership according to community size. The weights used are further detailed in section 3.1. With the use of such weights HLB calculated not only total benefit figures for each of the sectors under study, but also the origin of the benefits, by community size. Although the weights were used directly in the modeling process, they can also be used to summarize the survey statistics to reach values that provide the most representative depiction of the average Wisconsin transit user. Although some adjustments were noted from the preliminary survey analysis, the values were not greatly changed as the survey was originally applied in close proportion to the ratios represented by the weights. Nonetheless, all state-level survey results are interpreted from the community level data using the specified weights.

3.2.2 Adjustments to Survey Data

The purpose of the Wisconsin ridership survey was to gain an understanding of both the purpose of transit and the alternatives that transit riders would turn to should access be unavailable. The risk analysis panel indicated that they felt the proportion of trips made for educational purposes as indicated by the survey statistics was underestimated. As educationally related trips tend to be intensively focused on very specific portions of the day, it was felt that the survey might have underestimated the number of students using public transit. Thus an alternative set of proportion distributions were chosen to test the model for robustness. The alternative case was established with small, medium and large areas respectively having 16.6%, 25.1%, and 26.2% of transit trips for educational purposes. The balance was accounted for in healthcare trips, which the panel felt was higher than expected proportions.

3.3 Ridership

Ridership is a pivotal assumption in the model. Under or overestimation of the ridership figures will cause the ultimate model results to be inaccurate in similar proportion. In order to reach a base figure for annual public transportation ridership in Wisconsin, HLB began with the revenue generating rides recorded by the Wisconsin Department of Transportation. The total revenue generating ridership for the 2002 year was 73,133,315. This, however, does not represent the total number of public transit trips provided in the state. There are additional trips, which are not revenue generating, that must be included in the final ridership figure to accurately describe the benefits of public transit to the state. The National Transit Database provides records of total ridership figures, revenue and non-revenue generating, for the largest transportation systems across the nation. The eighteen largest transportation systems in Wisconsin are included in the database (2001). The selected areas were thus adjusted to include the non-revenue generating trips. These areas alone account for the vast majority of transit trips in Wisconsin, some 97% of ridership. For the smaller transportation systems across the state, Wisconsin DOT revenue generating counts were used as a best conservative estimation. The final ridership value used in the modeling process was thus 98,961,000.

3.4 Education Purpose Trips

The HLB model first analyzed the benefits according to community size (small, medium, large, as described in 3.1.1). Thus, the distribution of education purpose trips was defined separately for each area. It should be noted that the values chosen differ from the raw statistics of the rider survey. After an analysis of the surveys it was discovered that many of the 10.1% of individuals who chose the purpose "other" were actually over specifying a trip that would be more appropriately categorized into one of the existing categories. Examples given such as: library, school, church, counseling, welfare, and physical therapy could all be easily categorized into one of the other purposes. The "other" category was thus eliminated with the 10.1% proportionally distributed among the other areas. The ultimate modeling distributions chosen for education purposes for each area type are as follows.

Table 4:Transit Trips for Educational Purpose

System	Median	Low 10%	High 10%
Large	23.18%	22.13%	24.23%
Medium	16.98%	13.71%	20.25%
Small	8.70%	6.07%	11.32%

3.5 Forgone Trips

The on board survey indicated that on average 12.6% of the trips made for educational purposes statewide would not be made if public transit were unavailable. As indicated previously, separate distributions were developed for each system size.

Table 5: Percent of Education Trips Forgone

System	Median	Low 10%	High 10%
Large	12.21%	10.51%	13.91%
Medium	21.21%	12.48%	29.94%
Small	22.22%	8.90%	35.54%

3.6 Alternatives Used in Absence of Transit for Education Trips

Table 4 gives an indication of the transportation modes that would be substituted if public transportation were unavailable for education purposes. As mentioned in section 3.2 adjustments were made to the raw survey statistics to obtain the most realistic approximation of behavioral patterns in the absence of public transit. The chosen modeling distributions are presented in Table 6.

Table 6: Alternative Modes Used in Absence of Transit

Alternative	System Size		
	Small	Medium	Large
Personal Vehicle	66.67%	17.24%	52.05%
Bicycle or Walking	33.33%	79.31%	42.27%
Taxi	0.00%	4.16%	5.68%

3.7 Transportation Costs

Transportation Costs for each mode of transportation were based upon three generalized costs: out of pocket costs, time costs and accident costs. Out of pocket cost were estimated on a per trip basis. Time costs were calculated by using the average trip length, average speed for the given mode and a valuation of the time expenditure. Accident costs were derived from published accident statistics, and the estimated losses from such incidents per mile traveled. The total estimated transportation costs per trip are given in Table 7 for the various modes.

Table 7: Generalized cost of trip by mode

	System Size		
Mode	**Small**		**Large**
Transit	$ 5.74	$ 5.50	$ 5.61
Personal Car	$ 11.11	$ 11.17	$ 12.55
Bicycle or Walking	$ 3.33	$ 3.33	$ 3.33
Taxi	$ 16.14	$ 19.42	$ 21.39
School Bus or Shuttle	$ 5.70	$ 5.70	$ 5.70
EMS	$ 294.33	$ 319.81	$ 332.89

3.8 Alternative Scenarios

In addition to the distributions and assumptions defined above through a consideration of all input sources, the model also allowed for the testing of the values as given directly by individual sources, such as the panel opinions. The values defined above are the most appropriate values, as they consider input from all sources. The alternative cases were used simply to test the results for robustness, in making sure that the results were not overly sensitive to any one variable on which there were conflicting distributions from the various input sources.

moving away from home for Wisconsin's university students. Choosing to live at home while attending college is not simply a matter of convenience,

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4. TRANSIT BENEFITS RESULTING FROM ACCESS TO EDUCATION

The following results were determined using HLB's benefit measurement methodology given the assumption distributions that were presented in Chapter 3.

4.1 Ridership by System

There are approximately 22.64 million annual trips on public transit in the State of Wisconsin that are for education purposes (Table 8).

Table 8: Education Purpose Ridership

Education Purpose Trips		
System	**Percent in System**	**Number of Trips**
Small	8.7%	55,000
Medium	17.0%	540,000
Large	23.2%	22,045,000
Total	**22.9%**	**22,640,000**

The model results indicate that public transportation provides 2.82 million trips for education purposes that would not have been made if the transit system did not exist.

4.2 Total Cost Savings

The benefit of public transit assumed by transit users amounts to a savings of $91.30 million for education purpose trips. This is the generalized cost that users would have to pay by switching to their chosen alternative in the absence of transit service. (See Table 9 below).

Table 9:Total Cost Savings to the Education Sector (Millions of Dollars)

Savings	**System Size**		
	Small	**Medium**	**Large**
Consumer Surplus	$0.17	$0.65	90.48
Total Savings Across Systems			**$91.30**

With a total annual cost savings of $91.30 million and an annual ridership of 22.64 million education purpose trips, the average savings per education related trip on public transit is $4.03.

4.3 Economic Impact of Out of Pocket Savings

In addition to the above, HLB carefully considers the employment, output and tax effects of the out of pocket savings from education transit. We note, however, that it is extremely difficult to ascertain incremental (as distinct from transfer) effects in relation to these factors.

Glib accounting for such effects is often the demise of Benefit-Cost Studies and HLB counsels great care. Our typical approach is to separate these impacts to comment as carefully as possible on their impact (needed for valid inclusion in the analysis) and demonstrate their influence on the results in "what-if" modality. Because of the difficulty in separating the incremental and transfer portion of these factors, their impacts are not included in the concluding benefit values, but are instead presented in solely in this section of the report.

Through the utilization of the IMPLAN© modeling process it was determined that education transit riders, by spending their out of pocket transportation savings elsewhere, generate 1,839 jobs, $173.03 million in output and $25.76 million in total tax revenue. As the out of pocket savings is spent on items such as housing, food, manufactured goods, and other expenditures, the new economic activity has a rippling effect. New spending allows the affected industries to increase their employment levels and in turn increase orders from their suppliers, who are then able to do the same. IMPLAN© keeps detailed statistics on the interactions of industrial sectors, and is thus able to map how the increased spending moves through the economy while generating the impacts illustrated in Table 10.

Table 10: Impact of Out of Pocket Education Transportation Savings

	Direct	Indirect	Induced	Total
Employment	966	397	476	1,839
Output	$91,170,000	$38,940,000	$42,930,000	$173,030,000
Tax Revenue	$13,530,000	$5,560,000	$6,670,000	$25,760,000

The direct effects of the increased spending occur in sectors of the economy where transit riders directly spend the out of pocket savings. Indirect effects are secondary as a result of increased orders to suppliers. Induced effects are tertiary and are as a result of increased wages in the direct and indirect industries. (For more detailed results see Appendix D.)

4.4 Risk Analysis

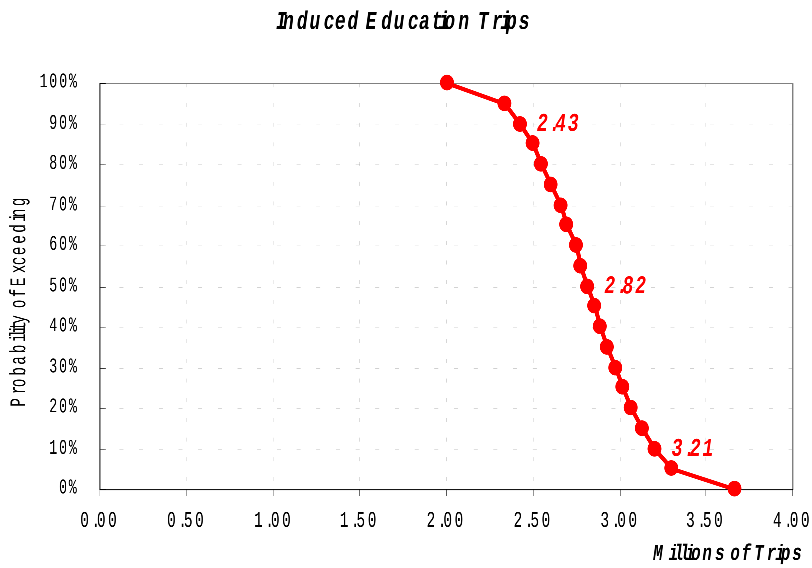
In addition to the point estimates it is important to note the range of possibilities that may occur with the associated likelihoods. Throughout the modeling process inputs were measured as probability distributions rather than point estimates so that a final probability distribution of the benefit to the education sector could be determined. While the previously listed point estimates are all based upon mean expected values, the following decumulative probability chart shows the probability the "real value" exceeds the value presented on the horizontal axis. For further information on how the Risk Analysis Process is conducted see Appendix B.

4.4.1 Trips Induced by the Existence of Public Transit

The following are the risk analysis results shown as a decumulative probability graph indicating the range of the number of induced trips at different probability levels. Figure 4 shows that while the expected number of induced trips in 2002 is estimated at 282 million, there is a 10% probability that the number could be as high as 321 million.

Figure 4: Risk Analysis of Education Trips Induced by Public Transit

Probability of Exceeding	Induced Education Trips (Millions of Trips)
100%	2.01
95%	2.34
90%	2.43
85%	2.50
80%	2.55
75%	2.61
70%	2.66
65%	2.70
60%	2.75
55%	2.78
50%	2.82
45%	2.86
40%	2.89
35%	2.93
30%	2.98
25%	3.02
20%	3.07
15%	3.13
10%	3.21
5%	3.30
0%	3.67
Mean Expected Value	2.82

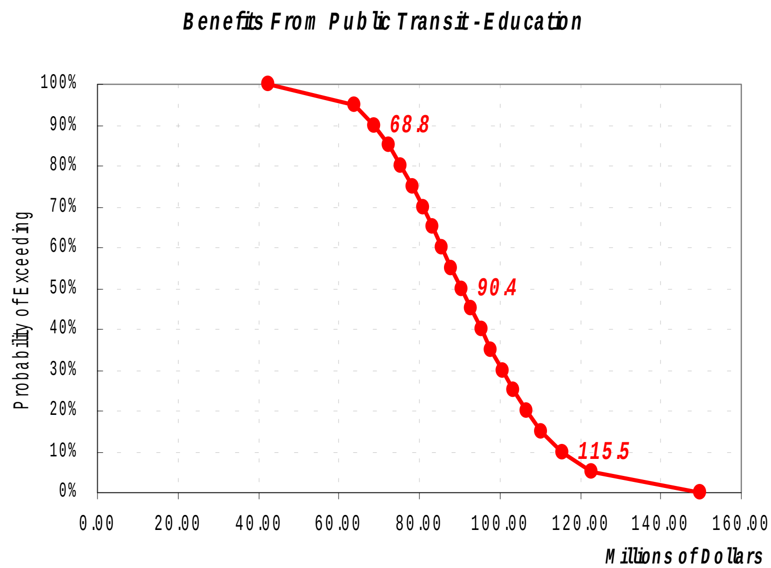


4.4.2 Total Benefits to the Education Sector

Similarly to the number of trips shown above, a risk analysis was conducted to estimate the overall education sector benefits at different probability levels. The following decumulative probability graph indicates that there is a 50% probability that the total benefit from public transit to the education sector exceeds $90.5 million and that these benefits reach over $115.5 million at the 10% probability level.

Figure 5: Risk Analysis of Total Benefits from Public Transit to Education

Probability of Exceeding	Benefits From Public Tranist - Education (Millions of Dollars)
100%	42.4
95%	63.9
90%	**68.8**
85%	72.5
80%	75.5
75%	78.2
70%	80.9
65%	83.3
60%	85.5
55%	87.8
50%	**90.4**
45%	92.8
40%	95.4
35%	97.7
30%	100.6
25%	103.4
20%	106.7
15%	110.3
10%	**115.5**
5%	122.8
0%	149.6
Mean Expected Value	**91.3**



5. CONCLUSION

The existence of public transportation affords considerable benefit in cost savings to students who use the service rather than a higher cost alternative transportation mode. For every trip that is made on Wisconsin public transit for education purposes an estimated $4.03 cost is saved in out of pocket and time travel costs.

The annual number of trips for educational purposes in Wisconsin is 22.64 million, representing 22.9% of all transit trips made in the state. The total savings to education riders in the state on an annual basis is $91.30 million. The results summary is shown in Table 11.

In addition to the direct cost savings, some 2.82 million educational trips are made each year that would be forgone if public transit did not exist. These trips are largely from students seeking post secondary education at institutions that are not in the immediate vicinity to their residential areas, although a portion of the missed trips undoubtedly comes from younger students, who have been shown to have a higher absentee rates when without reliable transportation forms. However, students able to seek further education are not the only individuals who benefit from their access to transit. The community at large benefits from the positive externalities associated with having a more educated workforce and community. As levels of education in a community increase there is a greater availability of skilled workers for employers. At the same time highly skilled workers earn premium wages increasing the community's tax base.

Table 11: Model Results and Confidence Limits

Benefits of Transit to Education	Mean Expected Value	Lower 10% Confidence Limit	Upper 10% Confidence Limit
Number of Induced Education Trips (millions)	2.82	2.43	3.21
Total Benefit to the Education Sector (millions of 2003 dollars)	$91.30	$68.80	$115.92
Per Trip Benefit for Education	**$4.03**	**$3.05**	**$5.10**

Although the mean expected values presented are the best single value estimates of benefits to the education sector from transit, the 80% confidence intervals presented in Table 11 give the best illustration of the upside of these benefits. In fact, while the total benefit to the education sector from transit is most probably near $91.3 million for 2002 alone, there is a 10% probability that the benefits can be as high as $115.9 million for the year.

APPENDIX A: WISCONSIN COMMUNITIES WITH TRANSIT SYSTEMS

City	Total Population	Community Size	Transit System	Region
Appleton[7]	70,087	Large	Large Bus	East
Baraboo	10,711	Medium	Shared-Ride Taxi	Center
Beaver Dam	15,169	Medium	Shared-Ride Taxi	East
Beloit	35,775	Medium	Large Bus	Center
Berlin	5,305	Small	Shared-Ride Taxi	Center
Black River Falls	3,618	Small	Shared-Ride Taxi	West
Chippewa Falls	12,925	Medium	Shared-Ride Taxi	West
Clintonville	4,736	Small	Shared-Ride Taxi	East
Eau Clair County	93,142	Large	Large Bus	West
Edgerton	4,933	Small	Shared-Ride Taxi	Center
Fond du Lac	42,203	Medium	Small Bus	East
Fort Atkinson	11,621	Medium	Shared-Ride Taxi	East
Grant County	49,597	Medium	Shared-Ride Taxi	West
Green Bay	102,313	Large	Large Bus	East
Hartford	10,905	Medium	Shared-Ride Taxi	East
Janesville	59,498	Large	Large Bus	Center
Jefferson	7,338	Small	Shared-Ride Taxi	East
Kenosha	90,352	Large	Large Bus	East
La Crosse	51,818	Large	Large Bus	West
Ladysmith	3,932	Small	Small Bus	West
Lake Mills	4,843	Small	Shared-Ride Taxi	East
Madison	**208,054**	**Large**	**Large Bus**	**Center**
Manitowoc	34,053	Medium	Small Bus	East
Marinette	11,749	Medium	Shared-Ride Taxi	East
Marshfield	18,800	Medium	Shared-Ride Taxi	Center
Mauston	3,740	Small	Shared-Ride Taxi	Center
Medford	4,350	Small	Shared-Ride Taxi	Center
Menominee Tribe	**4,562**	**Small**	**Rural Bus**	**East**
Merrill	**10,146**	**Medium**	**Small Bus**	**Center**
Milwaukee County	**940,164**	**Large**	**Large Bus**	**East**
Monona	8,018	Small	Large Bus	Center
Monroe	10,843	Medium	Shared-Ride Taxi	Center
Neillsville	2,731	Small	Shared-Ride Taxi	West
New Richmond	6,310	Small	Shared-Ride Taxi	West
Onalaska	14,839	Medium	Shared-Ride Taxi	West
Oneida Town	4,001	Small	Rural Bus	East
Oshkosh	62,916	Large	Large Bus	East
Ozaukee County	82,317	Large	Commuter/Shared-Ride Taxi	East
Platteville	9,989	Small	Shared-Ride Taxi	West
Plover village, Portage County	10,520	Medium	Shared-Ride Taxi	Center
Port Washington	10,467	Medium	Shared-Ride Taxi	East
Portage	9,728	Small	Shared-Ride Taxi	Center
Prairie du Chien	6,018	Small	Shared-Ride Taxi	West
Prairie du Sac village	3,231	Small	Shared-Ride Taxi	Center

7 The Fox Cities metropolitan region (population 188,000) includes the following communities: City of Appleton, City of Kaukauna, City of Menasha, City of Neenah, Town of Buchanan, Town of Grand Chute, Town of Menasha, Village of Kimberly, and Village of Little Chute.

City	Total Population	Community Size	Transit System	Region
Racine	81,855	Large	Large Bus/Commuter	Center
Reedsburg	7,827	Small	Shared-Ride Taxi	Center
Rhinelander	7,735	Small	Shared-Ride Taxi	Center
Rice Lake	8,320	Small	Small Bus	West
Ripon	6,828	Small	Shared-Ride Taxi	Center
River Falls	**12,560**	**Medium**	**Shared-Ride Taxi**	**West**
Rusk County	15,347	Medium	Rural Bus	West
Sawyer County	16,196	Medium	Rural Bus	West
Shawano	8,298	Small	Shared-Ride Taxi	East
Sheboygan	50,792	Large	Large Bus	East
Stevens Point	24,551	Medium	Small Bus	Center
Stoughton	12,354	Medium	Shared-Ride Taxi	Center
Sun Prairie	20,369	Medium	Shared-Ride Taxi	Center
Superior	27,368	Medium	Large Bus	West
Viroqua	**4,335**	**Small**	**Shared-Ride Taxi**	**West**
Washington County	117,493	Large	Commuter/Shared-Ride Taxi	East
Waterloo	3,259	Small	Shared-Ride Taxi	East
Watertown	21,598	Medium	Shared-Ride Taxi	East
Waukesha City	64,825	Large	Large Bus	East
Waukesha County	360,767	Large	Large Bus	East
Waupaca	5,676	Small	Shared-Ride Taxi	East
Waupun	10,718	Medium	Shared-Ride Taxi	East
Wausau	38,426	Medium	Large Bus	Center
West Bend	28,152	Medium	Shared-Ride Taxi	East
Whitewater	13,437	Medium	Shared-Ride Taxi	East
Wisconsin Rapids	18,435	Medium	Shared-Ride Taxi	Center

* *Survey communities are in shaded boxes.*

APPENDIX B: RISK ANALYSIS PROCESS

Economic forecasts traditionally take the form of a single "expected outcome" supplemented with alternative scenarios. The limitation of a forecast with a single expected outcome is clear -- while it may provide the single best statistical estimate, it offers no information about the range of other possible outcomes and their associated probabilities. The problem becomes acute when uncertainty surrounding the forecast's underlying assumptions is material.

A common approach is to create "high case" and "low case" scenarios to bracket the central estimate. This scenario approach can exacerbate the problem of dealing with risk because it gives no indication of likelihood associated with the alternative outcomes. The commonly reported "high case" may assume that most underlying assumptions deviate in the same direction from their expected value, and likewise for the "low case." In reality, the likelihood that all underlying factors shift in the same direction simultaneously is just as remote as that of everything turning out as expected.

Another common approach to providing added perspective on reality is "sensitivity analysis." Key forecast assumptions are varied one at a time in order to assess their relative impact on the expected outcome. A problem here is that the assumptions are often varied by arbitrary amounts. A more serious concern with this approach is that, in the real world, assumptions do not veer from actual outcomes one at a time. It is the impact of simultaneous differences between assumptions and actual outcomes that is needed to provide a realistic perspective on the riskiness of a forecast.

Risk Analysis provides a way around the problems outlined above. It helps avoid the lack of perspective in "high" and "low" cases by measuring the probability or "odds" that an outcome will actually materialize. This is accomplished by attaching ranges (probability distributions) to the forecasts of each input variable. The approach allows all inputs to be varied simultaneously within their distributions, thus avoiding the problems inherent in conventional sensitivity analysis. The approach also recognizes interrelationships between variables and their associated probability distributions.

The Risk Analysis Process involves four steps:

Step 1: Define the structure and logic of the forecasting problem;

Step 2: Assign estimates and ranges (probability distributions) to each variable and forecasting coefficient in the forecasting structure and logic;

Step 3: Engage experts and stakeholders in assessment of model and assumption risks (the "RAP Session"); and

Step 4: Issue forecast risk analysis.

Step 1: Define Structure and Logic of the Forecasting Problem

A "structure and logic model" depicts the variables and cause and effect relationships that underpin the forecasting problem at-hand (See Figure 1). Although the structure and logic model is written down mathematically to facilitate analysis, it is also depicted diagrammatically in order to permit stakeholder scrutiny and modification in Step 3 of the process.

Step 2: Assign Central Estimates and Conduct Probability Analysis

Each variable is assigned a central estimate and a range (a probability distribution) to represent the degree of uncertainty. Special data sheets are used to record the estimates. The first column gives an initial median while the second and third columns define an uncertainty range representing an 80 percent confidence interval. This is the range within which there exists an 80 probability finding the actual outcome. The greater the uncertainty associated with a forecast variable the wider the range.

Figure 6: Example of Data Sheet

Variable	Median	10% Lower Limit	10% Higher Limit
Percentage of trips for healthcare purpose	10.5%	9.3%	10.8%

Probability ranges are established on the basis of both statistical analysis and subjective probability. Probability ranges need not be normal or symmetrical -- that is, there is no need to assume the bell shaped normal probability curve. The bell curve assumes an equal likelihood of being too low and being too high in forecasting a particular value. It might well be, for example, that if a projected percentage deviates from expectations; circumstances are such that it is more likely to be higher than the median expected outcome than lower.

The RAP computer program transforms the ranges as depicted above into formal probability distributions (or "probability density functions"). This liberates the non-statistician from the need to appreciate the abstract statistical depiction of probability and thus enables stakeholders to understand and participate in the process whether or not they possess statistical training.

From where do the central estimates and probability ranges for each assumption in the forecasting structure and logic framework come? There are two sources. The first is an historical analysis of statistical uncertainty in all variables and an error analysis of the forecasting "coefficients." "Coefficients" are numbers that represent the measured impact of one variable (say, income) on another (such as retail sales). While these coefficients can only be known with uncertainty, statistical methods help uncover the magnitude of such error (using diagnostic statistics such as "standard deviation," "standard error," "confidence intervals" and so on).

The uncertainty analysis outlined above is known in the textbooks as “frequentist” probability. The second line of uncertainty analysis employed in risk analysis is called “subjective probability” (also called “Bayesian” statistics, for the mathematician Bayes who developed it). Whereas a frequentist probability represents the measured frequency with which different outcomes occur (i.e., the number of heads and tails after thousands of tosses) the Bayesian probability of an event occurring is the degree of belief held by an informed person or group that it will occur. Obtaining subjective probabilities is the subject of Step 3.

Step 3: Conduct Expert Evaluation: The RAP Session

Step 3 involves the formation of an expert panel and the use of facilitation techniques to elicit, from the panel, risk and probability beliefs about:

- The structure of the forecasting framework; and

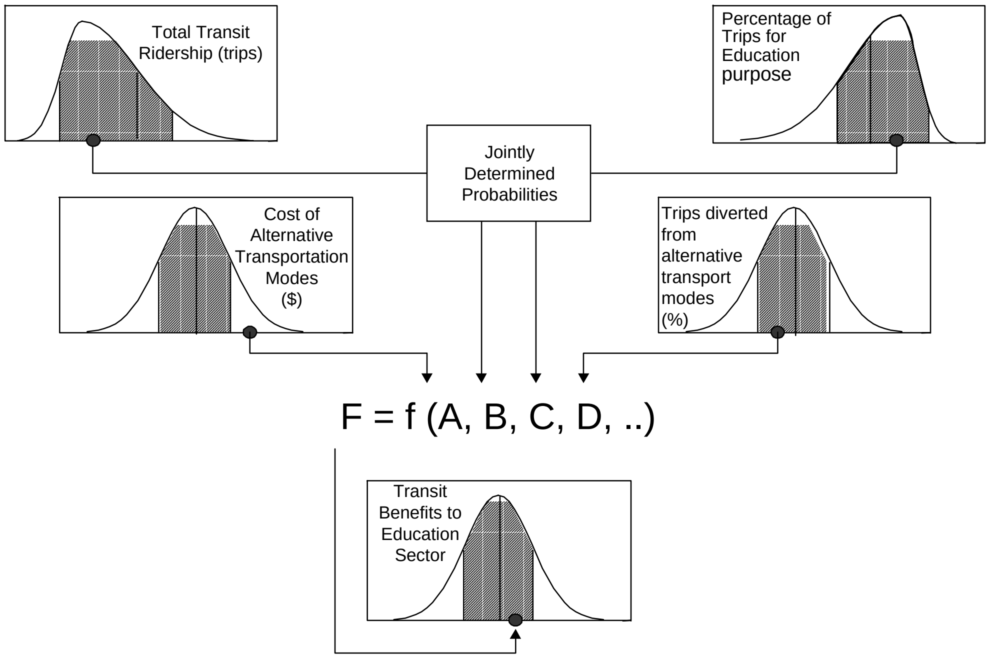
- The degree of uncertainty attached to each variable and forecasting coefficient within the framework.

In (1), experts are invited to add variables and hypothesized causal relationships that may be material, yet missing from the model. In (2), panelists are engaged in a discursive protocol during which the frequentist-based central estimates and ranges, provided to panelists in advance of the session, are modified according to subjective expert beliefs. This process is aided with an interactive “groupware” computer tool that permits the visualization of probability ranges under alternative belief systems.

Step 4: Issue Risk Analysis

The final probability distributions are formulated by the risk analyst (HLB) and represent a combination of “frequentist” and subjective probability information drawn from Step 3. These are combined using a simulation technique (Monte Carlo analysis) that allows each variable and forecasting coefficient to vary simultaneously according to its associated probability distribution (see Figure 7).

Figure 7: Combining Probability Distributions



The end result is a central forecast, together with estimates of the probability of achieving alternative outcomes given uncertainties in underlying variables and coefficients (as presented in Figure 4 and 5, Results).

APPENDIX C: EXPERTS THAT PARTICIPATED A T THE RISK ANALYSIS WORKSHOP

Ingrid Rothe
Researcher, Institute for Research on Poverty
University of Wisconsin - Madison

Dr. Edward Beimborn
Director, Center for Urban Transportation Studies
University of Wisconsin-Milwaukee

Joe Caruso
Marketing Director
Milwaukee County Transit

Sharon Persich
Planning Manager
Metro Transit, Madison

Susan Lemke
Transit Manager
Stevens Point Transit

Mark Jones
Manager
Abby Vans, Inc., Neillsville

Beverly Scott (No show)
President
Top Hat Inc., La Crosse/River Falls

Ken Yunker
Deputy Director
Southeastern WI Regional Planning Commission, Waukesha

Dixon Nuber
Director
University of WI - Milwaukee School of Continuing Studies

Pat McGinty
Title: President
Brown Cab Service, Inc., Fort Atkinson

Chuck Kamp
General Manager
Valley Transit, Appleton

Greg Seubert
Transit Director
Wausau Area Transit System

Ann Gullickson
Transit Service Manager
Metro Transit, Madison

Anita Gullota-Connelly
Director of Administration
Milwaukee County Transit System

Bob Johnson
Transit Director
Waukesha Metro Transit

John Etzler
Public Transit Section
WI Dept of Transportation

David Vickman
Public Transit Section
WI Dept of Transportation

APPENDIX D: ECONOMIC IMPACT OF TRANSPORTATION SAVINGS BEING RE-SPENT IN THE WISCONSIN ECONOMY

The following impact tables were generated using Input/Output modeling techniques of IMPLAN© in order to measure the effect of the spending the transportation savings of households in the Wisconsin economy. Table 12 indicates the additional output in the major sectors of Wisconsin economy, while Table 13 illustrates the change in employment.

Table 12: Education Transportation Savings - Output Impact

Output Impact				
Impact of Education Transportation Savings Being Re-spent in the Economy (2003 Dollars)				
Industry	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	546,636	851,965	410,793	1,809,395
Mining	0	71,317	25,426	96,743
Construction	0	1,555,521	499,223	2,054,744
Manufacturing	17,219,036	11,994,181	9,737,475	38,950,688
TCPU	6,195,206	4,179,932	3,589,572	13,964,711
Trade	16,672,394	3,174,079	8,023,302	27,869,774
FIRE	19,041,156	5,864,530	8,494,064	33,399,752
Services	28,880,592	10,331,484	11,331,148	50,543,224
Government	728,848	915,478	814,166	2,458,491
Other	1,882,120	0	0	1,882,120
Institutions	0	0	0	0
Total	**91,165,988**	**38,938,487**	**42,925,169**	**173,029,641**

Table 13: Education Transportation Savings - Employment Impact

Employment Impact				
Impact of Education Transportation Savings Being Re-spent in the Economy				
Industry	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	8.5	13.3	6.4	28.2
Mining	0	0.5	0.2	0.6
Construction	0	12	3.9	15.9
Manufacturing	82.5	57.5	46.7	186.7
TCPU	36.6	25.3	23.1	85
Trade	306.5	58.1	144.5	509.1
FIRE	83.5	35.5	40.6	159.6
Services	497.6	178	195.2	870.8
Government	13.6	17.1	15.2	46
Other	-62.9	0	0	-62.9
Institutions	0	0	0	0
Total	**966**	**397.2**	**475.7**	**1,839.00**

STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION

THE SOCIO-ECONOMIC BENEFITS OF TRANSIT IN WISCONSIN

CHAPTER 4: EMPLOYMENT

Prepared By:

HLB DECISION ECONOMICS INC.
8403 Colesville Road, Suite 910
Silver Spring, MD 20910

December 1, 2003

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EXECUTIVE SUMMARY

TRANSIT BENEFITS

Individuals traveling to and from work are the largest group of transit riders in the State of Wisconsin. Each year Wisconsin public transit services provide 48 million work trips, allowing riders to avoid higher cost transportation modes. Furthermore, if transit were unavailable employees within the state would make 8.8 million fewer work trips annually. However, the existence of transit does not only benefit work purpose riders, but also prevents increased social expenditures in public assistance programs caused by higher unemployment rates. Thus, both workers and the state as a whole stand to gain an improved quality of life attributable to public transit.

Describing the benefits of transit service has historically been completed through qualitative analysis. In conducting literature reviews in transit cost benefit analysis, HLB Decision Economics Inc. (HLB) has found that even today many of these studies fall into the category of qualitative reports. Anecdotal evidence and theoretical postulating are relied upon to describe the interactions taking place as a result of the existence of transit services. Some studies, conducted by federal agencies and local community organizations, attempt to describe the costs and benefits of transit without the thorough scrutiny of empirical case studies. What often remain to be explained and accounted for are the actual benefits being generated by transit within specific regions.

In recent years, however, the development of transportation research has begun to focus upon the quantification of transit benefits as a valuable tool to describe the return on expenditure and compare alternative capital investment options. In general, the benefits of transit fall into three main categories that can be defined as follows: congestion management, economic development, and affordable mobility. Measuring each type of benefit requires a different methodology, which if conducted inappropriately can undervalue public transit by considering just a portion of the total potential benefits.

Congestion Management

The study of congestion management evaluates how the existence of transit services causes a decrease in the costs of owning and operating a personal vehicle. With increased reliance on transit services there is an improvement in travel time, fewer accidents, and lower pollution emissions as fewer miles are traveled via personal vehicles. The two principal benefits attributed to congestion management are the reduction in travel by personal vehicles and the less congested traveling conditions for the vehicles that remain on the roadway.

Economic Development

The study of development and transportation considers the relationship that exists between the economic activities of an area and the proximity of transportation services. Greater access via transit presents the opportunity for increased commercial activity, as travel to the location is more readily available for both patrons and employees. As commercial opportunities expand, secondary effects appear. With an increase in commercial activity, a higher demand for real estate emerges along with increasing property values.

Affordable Mobility

Studies of affordable mobility attempt to define the benefits to riders who are transit dependent as well as choice riders. Transit dependent riders are those who cannot drive due to physical factors or monetary restraints, while choice riders have access and the ability to use an automobile, but make the choice to use transit. The benefits to riders can be measured by their expenditure savings in accessing different sector services via public transit instead of a more costly alternative. In addition to the expenditure savings measure, certain cross sector benefits also exist. By providing access to employment sites, transit helps decrease spending on welfare to work programs. Similarly, by providing a means of transit to medical services, transit helps prevent cases that might otherwise become dependent upon home healthcare.

BENEFITS OF TRANSIT TO ACCESS EMPLOYMENT

This study of affordable mobility benefits of transit attempts to show not simply a total benefit figure for Wisconsin, but how each of the various sectors within the regional economy benefit from transit service. As transit riders' purposes for using public transportation will differ depending upon the geographical, cultural and socioeconomic characteristics of a region, the sectors of analysis are divided into: work purposed trips, educational purpose trips, healthcare purpose trips, as well as retail, tourism and recreation trips. Such a list is not, of course, exhaustive. Each of the four sectors can be further divided to type of employment, place of education, etc. for studies on a micro or community level basis.

The Wisconsin Transit Sectors Socioeconomic Analysis is a sector benefits study of transit to the State of Wisconsin. This report specifically focuses upon the benefits of public transit service to the work sector of Wisconsin's economy. HLB has prepared the following report as one component of a larger study of the various sector benefits of public transit in Wisconsin. The analysis relies on methodology developed by HLB over the past decade on behalf of the Federal Transit Administration and other state agencies. The approach to such a study involves application of acceptable economic theory by identifying user preferences and actions as well as modeling the impact of such decisions on the work sector.

STUDY APPROACH

HLB employed various sources of information and data to conduct this quantitative study. These included an extensive literature search, an HLB conducted survey, information from several transit agencies in Wisconsin, panel opinions from a group of experts, as well as reports and publications from earlier studies conducted by HLB.

The measures included in this account of public transit benefits to the working sector include the cost savings to transit riders, the savings in public expenditure in Wisconsin's W-2 and work support programs, as well as a measure of work trips that would be lost if public transit were not readily available to the working public.

STUDY FINDINGS

It is estimated that for every work related trip made on public transit, $6.96 worth of benefit is generated in cost savings for the commuting worker and prevented public assistance spending for society. Considering that some 48 million transit trips are made annually for work related purposes in Wisconsin, it is clear that a sizable benefit exists due to the existence of public transit.

Of the $333 million in total employment sector benefits in the state, transit riders gain $259 million from avoiding more expensive transit forms, while $74 million is saved in public assistance measures, preventing a 12% increase over current program spending levels.

In addition to the cost savings, 8.8 million work related trips are feasibly made only in the existence of public transit; in the absence of public transit these trips would be lost. The qualitative benefits of permitting these trips include the many ancillary quality of life effects on the community caused by preventing an increase in unemployment (See Summary Table 1).

SUMMARY TABLE 1: SUMMARY OF TRANSIT BENEFITS TO THE WORK SECTOR

Percent of Transit Trips for Work Purposes	48.4%
Number of Trips for Work Purposes (annual)	47,910,000
Survey Response, User Actions Without Transit	
Use Alternative Transport Mode for the Same Trip	48.0%
Not be Able to Work	18.5%
Look for Another Job (Closer to Home)	22.2%
Adjust Working Hours	4.9%
Work at Home	3.4%
Other	3.0%
Consequences if Transit were not Available	
Number of Forgone Work Trips	8.82 million
Increase in Average Public Assistance Caseload	13,800
Benefits of Transit to Work	
Consumer Surplus (Travel Cost Savings)	$259.05 million
Public Assistance Program Savings	$74.26 million
Total Benefit from Transit to the Work Sector	$333.31 million
Per Trip Benefit from Transit Service	$6.96

In addition to the above, HLB used input/output modeling to calculate the economic impact caused by the re-spending of the out of pocket cost savings in other sectors of Wisconsin's economy. The use of the savings in other sectors of the economy generates 5,080 jobs, increases total output by $477.48 million and adds $71.10 million to total tax revenue collections. (See Summary Table 2.)

The following report details the process of determining each of the statistics presented here. All statistics were calculated after careful consideration of survey statistics, literature findings, panel opinions, data from Wisconsin transit systems, as well as sound and accepted economic modeling methods conducted by HLB.

SUMMARY TABLE 2: ECONOMIC IMPACT DUE TO HEALTHCARE TRANSPORTATION SAVINGS

	Direct	Indirect	Induced	Total
Employment	2,672	1,097	1,314	5,082
Output	$251,470,000	$107,480,000	$118,540,000	$477,480,000
Tax Revenue	$37,380,000	$15,350,000	$18,380,000	$71,100,000

1. INTRODUCTION

Lack of adequate transportation is considered one of the main barriers to job access. The commute that must be made on a daily basis causes even relatively small incremental changes in transit costs to multiply to a significant annual amount. Research has shown that access to transportation, the geographical location of job and residential centers, as well as differences in labor demand and skills required among different regions have significant impacts on individuals' access to employment. The findings presented below are but a portion of the research on the links between transportation and employment.

1.1 Transportation and Access to Employment

Nationwide, both human service and transportation agencies recognize the critical need for adequate public transportation to parents transitioning from welfare to work who need transportation to their job and childcare. Public transportation is key to moving former welfare recipients into the workforce as permanent wage earners. In the US, an estimated 94% of welfare recipients attempting to move into the workforce do not own cars and rely on public transportation[1]. Beside low-income groups, public transportation provides valuable options for suburban commuters who work in the city. Their savings include not only out of pocket savings (vehicle ownership and operating costs, parking, etc.) but other savings such as safety, and better air quality for the community as well.

Additional economic benefits arise from the provision of transit to low-income groups by increasing their access to employment. Kain (1992)[2] examined the spatial mismatch hypothesis in the context of housing policies. Kain asserts that if employment centers were made accessible by bus to the inner city, it would likely result in an increase in the percentage of jobs held by inner city residents in those areas. Consequently, this would decrease unemployment and social service expenditures.

1.2 Geographic Barriers

In April 2003, over 90 academics, public policy makers and community leaders met at the Federal Reserve Bank of Chicago to discuss key trends affecting the nation's metropolitan areas. The conference, of the Bank's Midwest Infrastructure Project, focused on access to employment for urban residents who may have geographically limited housing options. Steven Raphael of the University of California at Berkeley presented findings that racially defined neighborhoods exhibited the highest degree of spatial mismatch.[3] Conversely, more integrated metropolitan areas, such as Minneapolis-St.Paul and Pittsburg, showed a decline. While Rafael's work studied the movement of household units closer to places of employment, he also found that improving transportation access was valuable in allowing inner city residents to find jobs in the employment-rich suburbs.

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[1] Survey by Public Transportation Partnership for Tomorrow, 2000.

[2] Kain, John F. (1992) *Housing Policy Debate – The Spatial Mismatch Hypothesis: Three Decades Later,* Fannie Mae, Office of Housing Policy Research, p. 397.

[3] Raphael, Steven. "Racial Differences in Spatial Job Search Patterns: Exploring the Causes and Consequences," with Michael Stoll, *Economic Geography,* 76(3): 201-223, (2000).

1.2.1 Geography, Employment and Crime

In addition to the direct employment effects, research by Keith Ihlanfeldt addressed the spatial variation in crime across neighborhoods.[4] Crime tends to occur in the local neighborhood of the criminal; 52% of burglaries occur within one mile of the burglar's residence, with young males between 16 and 24 committing the majority of offenses. The study indicates that employment opportunities for this group have a direct effect on their tendency to commit crime. In effect, the lack of access to jobs appears to explain a significant portion of the spatial variation in crime.

1.2.2 Labor Demand for Less Educated Populations

Rucker Johnson of the University of Michigan concluded with a discussion of access to employment in the suburbs and central city. He detailed the shift in geographic labor demand to the suburbs that has occurred over the past three decades. This shift has not been uniform, with suburban job growth concentrated in specific locations. In light of the trend, Johnson attempted to explain whether job search patterns were expanding, in particular for non-college graduates. Johnson noted various constraints to the job search, including low car ownership rates among less-educated populations. Ironically Johnson found that job availability for less-educated workers was greatest in "job rich" suburb areas that tended not to be served by public transportation.

Jobs and Interviews in Wisconsin

As the national and local economy attempt to regain momentum, the hardworking men and women of Wisconsin act as the crux that adjusts to the changes occurring in the state's economy. Over the past year, unemployment rates in the State of Wisconsin reached levels not seen for twelve years. With hopes of a recovery in sight, workers are no longer simply worrying about the commute to work, but the trips to the many interviews they must attend, before securing a position. Public transportation is providing them with convenient and affordable mobility to assist them in their job search.

Danielle and Gary of Milwaukee are both currently using the bus service to make the commute to their interviews and search for jobs. "If the bus were not available I would have to take a taxi, something I really cannot afford while looking for a job," observed Danielle. "It gets me where I need to go," said Gary. "In order to find a job you have to talk to employers in person. They want to see who you are before they hire you. Telephone interviews just don't seem to work." (continued)

[4] Ihlanfeldt, Keith. "Spatial Mismatch in the Labor Market and Racial Differences in Neighborhood Crime," *Economic Letters*, Volume 76, No. 1 (2002): 73-76.

Even once a job is secured, public transportation is essential for some who would have difficulty reaching their destinations otherwise. Cecilia, a commuter in Madison, remarks that she is very dependent on the public transportation system to reach City View Drive where she works. "A cab would be too expensive to use every day, so I would be really stuck if the service was unavailable." Between her commute to work and errands, Cecilia makes twelve trips per week on average. She does, however, note that some areas have more convenient service than others. "I used to live in Milwaukee and it was very convenient to use public transportation there. The buses came every few minutes; you didn't really need to look at the schedule at all. I wish that Madison were more like that. If you don't have a traditional schedule, sometimes it is difficult to use the bus."

Lea Macklem of Stevens Point notes, "The bus is really important for people like me who cannot afford a car." Lea not only relies on the service for her commute to work at the Stevens Point Wal-Mart, but also her necessary errands. "It takes me about 1.5 hours to walk to work. Although I do sometimes walk on nice days, I am glad I don't have to do it every day." Betty Walton also of Stevens Point notes that without the transportation service she would be dependent on others to make her commute. "Without the bus services I would have to try to find a ride home with someone from work who is willing to go out of their way. Perhaps I could rely on a friend or family member who could shuttle me."

Self-sufficiency, affordability and mobility are what the public transit system provides to Wisconsin's workers and job seekers. For those men and women who are currently burdened with seeking a job, the service providers hope to soon be providing a lift to work.

1.3 Plan of the Report

The following chapters of the report will present a quantification of the benefits of transit to the work sector. An overview of the methodology used by HLB Decision Economics in Chapter 2 indicates how the modeling process proceeded. Chapter 3 presents the data and sources used to build the modeling assumptions including results from a survey of Wisconsin transit riders, opinions from a panel of experts, as well as transit statistics from service providers and government agencies. The results of the modeling process are presented in Chapter 4, followed by a discussion of the implications and concluding observations from the study in Chapter 5.

2. METHODOLOGY

There are three specific components that must be considered when evaluating the total benefit of public transportation from work travel. The first component, affordable mobility is a measure of the benefit that accrues to the consumer, the individual who is using the transit service to reach his/her work destination. The second component is a public expenditure savings from public assistance programs. If public transport were not available, a category of individuals would be unable to reach their designated employment sites and thus would be forced to turn to public assistance measures for support. The third component is a qualitative assessment of work transit to the community. This is most concretely expressed as the value of the lost work trips that would occur if public transit options were unavailable.

Segmenting Ridership by System and Purpose

In order to arrive at these three components it is first necessary to apportion the total Wisconsin ridership into its appropriate segments. As trip purpose and riders' actions will vary by community size, the total Wisconsin ridership is first divided into three community size categories: large with populations of 50,000+, medium with populations of 10,000-50,000 and small with populations less than 10,000. By establishing the total ridership within each community size category, as well as the percentage of trips for work purposes within the category, the number of work trips within each system is determined.

Users' Actions in the Absence of Transit

The next stage in the process is to define what actions transit users would take in the absence of transit service. Each of the possible alternatives is established, including alternative transit modes: walking, personal vehicle, taxi, etc. as well as the percentage of trips that would not be made in the absence of transit. For each of the trips that would be made on an alternative transit mode, the generalized cost difference between transit and the given alternative is estimated to arrive at a cost savings for that specific trip. The sum of these differences is the total cost savings in the work sector due to transit.

Effects of Forgone Work Trips

The number of trips that would not be made in the absence of transit is then used for two purposes. The first is a measure of lost trips that would result in increased social services usage. These individuals would be seeking W-2 support to prepare for employment closer to home, or assistance that would become required after assuming a less profitable position than that to which they are currently able to commute. In order to determine the public expenditure savings, it is assumed that current per case level of support would need to be expanded to cover these individuals displaced in their work without access to public transit. Thus, the current per case expenditure level is multiplied by the increase in public assistance cases to reach the public cost savings value.

The prevention of forgone work trips, however, has additional effects. The community at large also benefits in terms of quality of life with higher employment levels in the area. Employment levels are a driving factor in community conditions, including crime rates. An increase in unemployment levels not only increases the inefficiencies and cost figures in public expenditure levels to support individuals looking for work, but decreases living conditions as communities deal with the negative externalities associated with unemployment. To fully capture the impact of such negative externalities would require a qualitative analysis of the changes, such as crime rates, that will vary across geographic regions and cultural subgroups. While we strive not predict social conditions at the individual community level, a comprehensive analysis requires a quantification of this change. The most tangible manner in which to present such quantification is with the number of jobs that would be lost across the region of analysis.

Risk Analysis

For the statistical assumptions used to build the model, distributions were defined to describe the uncertainty associated with the knowledge of each particular variable. While point estimates could have been used in the modeling assumptions to arrive at a single value of the benefit of transit to the work sector, there would be no measure of confidence in this resulting point value. There is a very significant difference between a mean expected value of $100 million with a 90% confidence interval of ($90 million, $110 million), and the same mean expected value with a confidence interval of ($40 million, $160 million). The certainty of the first is much greater than that for the second. Therefore, in addition to the mean expected values presented throughout the report, probability distributions have been generated to express the certainty in the resulting benefit values. The probability distributions are presented in section 4.5. For a detailed discussion on how the risk analysis process is conducted see Appendix B.

Economic Impact Model

In addition to the direct effect of out-of-pocket savings by transit riders avoiding more costly transportation modes, there are multiplier effects that need to be considered on the cost savings. The expenditure that is saved in transportation cost is redirected toward purchases in housing, food, and other household expenditures. As this dollar amount is re-spent the benefit multiplies within other sectors of the economy. HLB utilizes the IMPLAN© model which is an economic impact assessment modeling system (structured as an input-output model) originally developed by the U.S. Forest Service (and now maintained by the Minnesota IMPLAN Group, Inc.).[5] By analyzing the change in spending patterns across the 528 industrial sectors that IMPLAN tracks within Wisconsin, the model is able to establish the resulting direct, indirect and induced changes in employment, output and tax revenue as result of the out of pocket savings for work purpose trips.

[5] An input-output ("I/O") approach was followed in this study, drawing on an extensive body of research and experience with successful applications to transportation project analysis. An I/O model calculates impact multipliers, which are then used to compute direct, indirect, and induced effects – output, employment, personal income, and local tax revenue generated per dollar of direct spending for labor, goods, and services.

The structure and logic diagram below illustrates the methodology used by HLB to estimate the expenditure value and the public transportation impact on the work sector. The figure illustrates the model followed to calculate the corresponding savings by identifying all the inputs and the relationships between these inputs.

Figure 1: Estimating Public Transportation Benefits to Employment

3. DATA SOURCES

A variety of data sources were used in building the analysis model. An on board survey of Wisconsin transit users was conducted to obtain information on riders' motivation, purpose and available alternatives. A panel of transportation experts from Wisconsin then offered their opinions on the survey statistics and methodology. Supplementary statistics were also obtained from sources such as the National Transit Database, the Wisconsin Department of Transportation, information provided by local transit providers, the Federal Transportation Administration, as well as previous research conducted in the field of transit benefit analysis.

3.1 Survey Results

The on board survey was an essential component in the data collection process. Survey responses were critical in determining rider purpose, alternative transportation options and actions that would be taken in the absence of transit service. The following survey results were generated from an on board survey conducted in six Wisconsin transit districts of varying sizes. A total of 3,035 riders were sampled in the survey.

3.1.1 Community Type Weighting

The final survey results were taken as a weighted average of survey statistics by community size. Rather than simply using raw percentages from the survey, the sample areas were divided into three community sizes. As trip purpose and available alternatives are likely to differ among the given areas, the best manner in which to make the survey reflect the Wisconsin population as a whole is to take the results from the three area types and weight these results by the percentage of Wisconsin population served by public transport within each size category (ridership). The size categories were chosen as Large (population 50,000+), Medium (population 10,000-50,000) and Small (population 0-10,000). The classification used for each area served by public transport is shown in Appendix A. The weights were derived from the percentage of ridership found in each size category. For further discussion on ridership see section 3.3. Table 1 shows the weights used within the HLB modeling process, which can also be used to combine the survey results from each area to representative figures for the State of Wisconsin. The survey results presented below include either the results by community size or, where estimated for the entire state, the weighted result.

Table 1: Survey Weights for Community Size by Ridership

Community Surveyed	**Transit System**	**Region**	**Population**	**Population Percentage**	**Population Group**	**Ridership Weight**
Milwaukee County	Large Bus	East	940,164	72.86%	Large	96.11%
Green Bay	Large Bus	East	102,313	7.93%	Large	
Madison	Large Bus	Center	208,054	16.12%	Large	
Stevens Point	Small Bus	Center	24,551	1.90%	Medium	3.22%
River Falls	Shared-Ride Taxi	West	12,560	0.97%	Medium	
Neillsville	Shared-Ride Taxi	West	2,731	0.21%	Small	0.67%

3.1.2 Trip Purpose

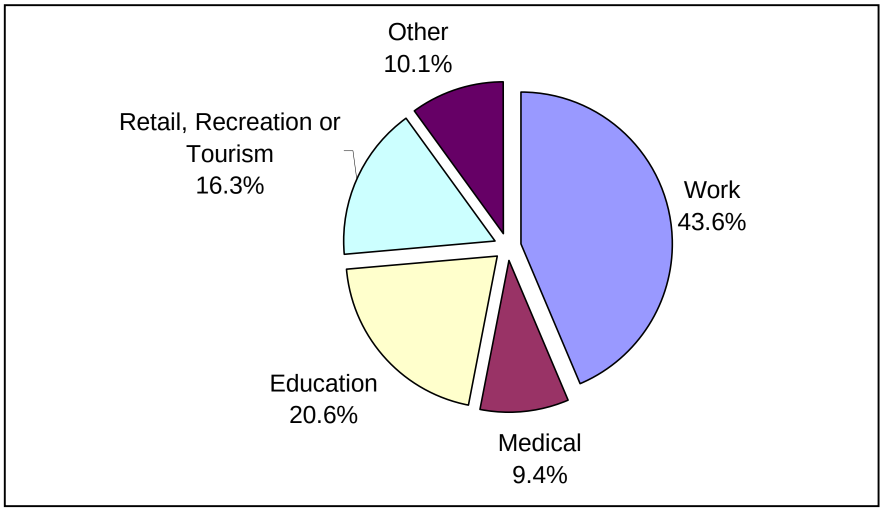
The results of the survey indicated that 43.6% of trips on public transportation in Wisconsin are for the purposes of traveling to or from work.[6] The percentage of trips for work purposes is highest in large communities with populations of 50,000 or greater, with some 44.1% of trips for work. Transit in the medium and small communities is less intensively used for work purposes, 30.1% and 34.5% respectively (see Table 2).

Table 2: Work Trips – Survey Results

Survey Results: Percent of Trips for Work Purposes		
Region	**Percentage**	**Standard Error**
Wisconsin	43.6%	0.90%
Small Systems	34.5%	3.46%
Neillsville	*34.5%*	3.46%
Medium Systems	30.1%	3.11%
River Falls	*26.0%*	3.43%
Stevens Point	*41.6%*	6.77%
Large Systems	44.1%	0.97%
Green Bay	*44.5%*	2.29%
Madison	*47.8%*	1.49%
Milwaukee	*39.7%*	1.52%

On the statewide level, work is the purpose accounting for the largest proportion of the transit ridership (Figure 2). Work accounts for twice as many trips as any of the other purposes reported

Figure 2: Wisconsin Transit by Purpose

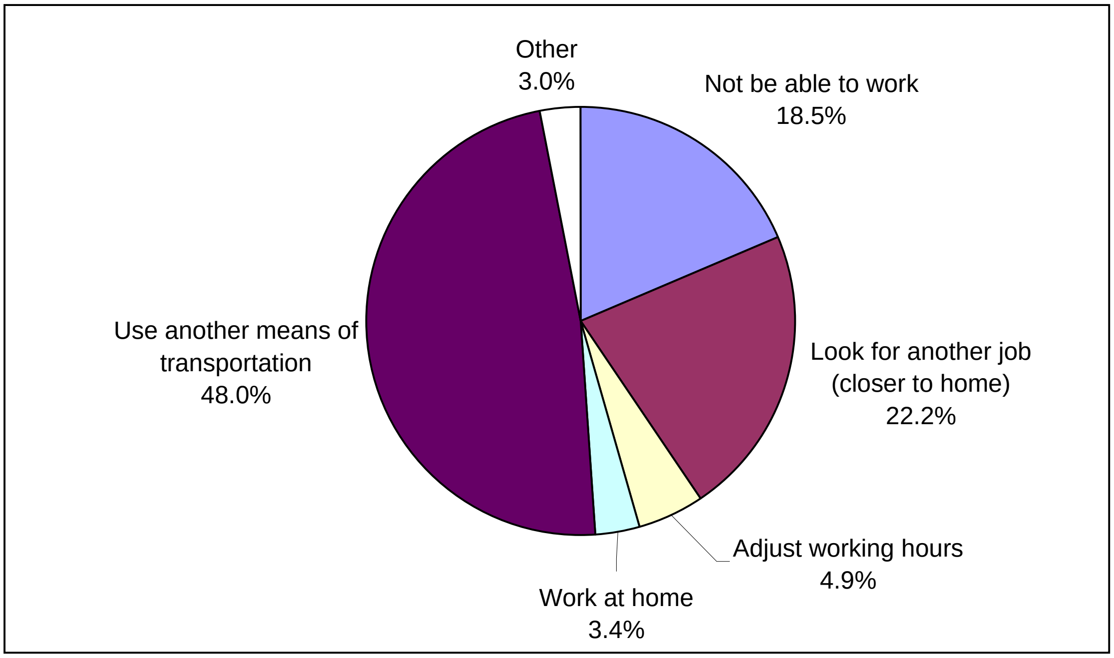


[6] For details on how the purpose statistics were applied to the modeling process see section 3.4

3.1.3 Work related activity in the absence of Public Transit

Of the individuals who responded that they were using public transport for the purpose of commuting to or from work, 48.0% indicated that in the absence of public transit they would have made the same trip, but via an alternative transportation mode. The remaining individuals responded that they would alter their work patterns. 18.5% indicated that they would be unable to work; 22.2% would look for another job closer to home; 4.9% would attempt to adjust their working hours; and 3.4% would try to work at home. Figure 3 shows a summary of the activity choice responses.

Figure 3: Activity choice in the absence of Public Transit



3.1.4 Alternative Transportation choice in the absence of Public Transit

Individuals who responded that they would use an alternative transportation mode for work purposes indicated that they would switch to the forms of transportation shown in the Table below.

Table 3: Alternate Transportation choice if public transit were unavailable

Transportation Alternative Chosen	Small Systems	Medium Systems	Large Systems	Weighted Average
Drive your personal vehicle	0.0%	3.7%	31.6%	30.5%
Ride with family or friends	64.9%	34.6%	22.1%	22.8%
Use a taxi-cab (other than shared-ride taxi)	27.0%	21.0%	9.7%	10.2%
Ride a bicycle	0.0%	9.9%	18.0%	17.6%
Walk	5.4%	28.4%	16.9%	17.2%
Other	2.7%	2.5%	1.7%	1.8%

3.1.5 Follow up Interviews

In addition to the statistical survey, an in depth series of interviews were conducted via telephone with selected transit riders identified from the rider survey. The interviews were used to identify the specific purposes and circumstances surrounding an individual's decision to use transit service in Wisconsin.

3.2 Risk Analysis Panel Of Experts

After compiling preliminary results from the survey, HLB sought input from local transportation and academic experts familiar with the particular circumstances of Wisconsin. The group provided valuable feedback to the study on a variety of levels. Not only were the survey statistics and values for model population discussed at length, but conceptual concerns and improvements on the theoretical framework were also addressed. See Panel list in Appendix C.

3.2.1 Weighting the Survey Results by Sampling Areas

The original survey methodology called for sampling in each of the selected communities to be conducted in approximate proportion to the transit population that is represented by not only the geographic portion of Wisconsin, but also type of transportation systems present. The panel indicated that they felt community size was the most important factor influencing the riders' survey responses, and thus recommended the weighting of survey results by ridership according to community size. The weights used are further detailed in section 3.1. With the use of such weights HLB calculated not only total benefit figures for each of the sectors under study, but also the origin of the benefits, by community size. Although the weights were used directly in the modeling process, they can also be used to summarize the survey statistics to reach values that provide the most representative depiction of the average Wisconsin transit user. Although some adjustments were noted from the preliminary survey analysis, the values were not greatly changed as the survey was originally applied in close proportion to the ratios represented by the weights. Nonetheless, all state-level survey results are interpreted from the community level data using the specified weights.

3.2.2 Adjustments to Survey Data

The purpose of the Wisconsin ridership survey was to gain not only an understanding of the purpose of transit trips, but also the alternatives that transit riders would turn to should access be unavailable. While sample subjects can be relied upon to indicate their present or past actions with a high degree of accuracy, there is some question as to the reliability of their responses to a conditional statement. In short, when asked what action or transit form they would take in the absence of public transportation, respondents indicated the action they thought they would perform. The choice that they would ultimately take under such circumstances could very well be different. After conferring with the panel assembled, HLB adjusted some of the statistics for application in the benefit model. One area that seemed particularly problematic from the survey data was the number of individuals who claimed they would walk or bike in the absence of transit. For any system size that reported above 25% walking/biking use as the alternative choice for work purpose trips, an upper bound was established at 25% with the remaining distributed proportionally to the alternative options.

Wisconsin Works Participants Rely on Public Transport

The Wisconsin Works (W-2) program, the welfare replacement program for Aid to Families with Dependent Children, strives to find a place of employment for everyone who is willing to work to their ability. Much of the W-2 program's focus is on training individuals to enter or return to the workplace as quickly as possible. Reliable, affordable and convenient transportation is critical to participant self-sufficiency and the overall success of W-2.

The Division of Workforce Solution Staff reports, "While Wisconsin has an array of local public transit services, many W-2 participants live in rural areas or are looking for work in outlying suburban areas not served by public transit. Many do not own automobiles and are dependent on other transportation options, such as public bus transit, shared-ride taxi, car pools, van services or other group trips. Many jobs, including second and third shift, weekend, split-shift jobs, and suburban jobs, are not now served by public transit services."

One W-2 participant, Terrie, who uses public transport to make the hour commute to her daily training at a center in Milwaukee, notes that half of the W-2 participants she has met also do not have access to a car. Terrie uses the bus services for her commute. "The system has its good days and its bad days. There are occasions when buses do not make full stops, or wait for individuals running to catch the bus. But the system is essential for the elderly, young, and unemployed to find jobs."

In order to assist in areas where public transportation is limited, W-2 agencies are attempting to find other means to meet the participants needs, including the establishment of van pools, volunteer driver programs, as well as accessing loan resources for personal vehicle repair or purchase. In some locations the expansion of transit hours and services areas has also assisted in getting W-2 families back to work.

3.3 Ridership

Ridership is a pivotal assumption in the model. Under or overestimation of the ridership figures will cause the ultimate model results to be inaccurate in similar proportion. In order to reach a base figure for annual public transportation ridership in Wisconsin, HLB began with the revenue generating rides recorded by the Wisconsin Department of Transportation. The total revenue generating ridership for the 2002 year was 73,133,315. This, however, does not represent the total number of public transit trips provided in the state. There are additional trips, which are not revenue generating, that must be included in the final ridership figure to accurately describe the benefits of public transit to the state. The National Transit Database provides records of total ridership figures, revenue and non-revenue generating, for the largest transportation systems across the nation. The eighteen largest transportation systems in Wisconsin are included in the database (2001). The selected areas were thus adjusted to include the non-revenue generating trips. These areas alone account for the vast majority of transit trips in Wisconsin, some 97% of ridership. For the smaller transportation systems across the state, Wisconsin DOT revenue generating counts were used as a best conservative estimation. The final ridership value used in the modeling process was thus 98,961,000.

3.4 Work Purpose Trips

The HLB model first analyzed the benefits according to community size (small, medium, large, as described in 3.1.1). Thus, the distribution of work purpose trips was defined separately for each area. It should be noted that the values chosen differ from the raw statistics of the rider survey. After an analysis of the surveys it was discovered that many of the 10.08% of individuals who chose the purpose "other" were actually over specifying a trip that would be more appropriately categorized into one of the existing categories. Examples given such as: library, school, church, counseling, welfare, and physical therapy could all be easily categorized into one of the other purposes. The "other" category was thus eliminated with the 10.08% proportionally distributed among the other areas. The ultimate modeling distributions chosen for work purposes for each area type are as follows.

Table 4:Transit Trips for Work Purpose

System	Median	Low 10%	High 10%
Large	48.93%	47.68%	50.18%
Medium	34.91%	30.76%	39.06%
Small	39.13%	34.58%	43.68%

3.5 Forgone Trips

The on board survey indicated that on average 18.5% of the trips made for work purposes statewide would not be made if public transit were unavailable. As indicated previously, separate distributions were developed for each system size.

Table 5: Percent of Work Trips Forgone

System	Median	Low 10%	High 10%
Large	18.23%	16.85%	19.61%
Medium	23.86%	17.51%	30.21%
Small	27.63%	20.88%	34.38%

3.6 Alternatives Used in Absence of Transit for Work Trips

Table 3 gives an indication of the transportation modes that would be substituted if public transportation were unavailable for work purposes. As mentioned in section 3.2 adjustments were made to the raw survey statistics to obtain the most realistic approximation of behavioral patterns in the absence of public transit. Table 6 presents the median values for alternative work trip modes used in the modeling process.

Table 6: Alternative Modes Used in Absence of Transit

Alternative	System Size		
	Small	Medium	Large
Personal Vehicle	66.67%	48.44%	63.53%
Bicycle or Walking	5.55%	25.00%	25.00%
Taxi	27.78%	26.56%	11.47%

3.7 Transportation Costs

Transportation Costs for each mode of transportation were based upon three generalized costs: out of pocket costs, time costs and accident costs. Out of pocket cost were estimated on a per trip basis. Time costs were calculated by using the average trip length, average speed for the given mode and a valuation of the time expenditure. Accident costs were derived from published accident statistics, and the estimated losses from such incidents per mile traveled. The total estimated transportation costs per trip are given in Table 7 for the various modes.

Table 7: Generalized Cost of Trip by Mode and System

	System Size		
Mode	Small	Medium	Large
Transit	$ 5.74	$ 5.50	$ 5.61
Personal Car	$ 11.11	$ 11.17	$ 12.55
Bicycle or Walking	$ 3.33	$ 3.33	$ 3.33
Taxi	$ 16.14	$ 19.42	$ 21.39
School Bus or Shuttle	$ 5.70	$ 5.70	$ 5.70
EMS	$ 294.33	$ 319.81	$ 332.89

3.8 Public Assistance Statistics

3.8.1 Transfer Payment vs. Work Support

Determining the public assistance that would be required to maintain the same level of support to needy individuals and families in the absence of public transit is multi-dimensional in the new era of assistance programs. Under the old “cash-payment” welfare system the additional costs to a welfare program could simply be calculated as the level of transfer payment per unemployed worker times the estimated number of new cases of unemployment that would result from the lack of access to transit services. Such a methodology would, however, be inappropriate under new systems, particularly in a state such as Wisconsin, where the emphasis has been unequivocally transformed from cash assistance to work support. Wisconsin Works (W-2), the state's major public assistance program makes the emphasis quite clear, "Under W-2 there is no entitlement to assistance, but a place for everyone who is willing to work to their ability." Instead of simply measuring the transfer payments, a valuation of all services provided to those who are attempting to reach, retrain for, find or maintain work must be considered.

3.8.2 Establishing a Per Case Measure of Support

After calculating total expenditures in public assistance for such programs, a measure of the average number of cases at any point throughout the year must be established. In her article, "What is a 'Case' in Postreform Wisconsin? Reconciling Caseload with Workload" Rebecca Swartz provides a detailed account of the caseload faced by Wisconsin's public assistance programs. Rather than simply measuring a count for the number of individuals using a specific program, she establishes the number of individuals using any public assistance program and fully accounts for duplicated counts from families using multiple programs.

Once calculations of total public assistance expenditure and a case count are established, a per case measure of support in Wisconsin can be determined. With the assumption that Wisconsin would desire to maintain the same level of support to new cases, the additional reliance on W-2/TANF/MOE funds can be calculated with an estimate of the number of lost work trips leading to such program use. In so doing, the additional public assistance expenditures that would be required in the absence of public transportation can be fully calculated.

3.8.3 Supplementary Research

In the 2001 paper "Toward Work Stability and Career Advancement – The Next Stage of Reform," Thomas Corbett and Rachel Weber of the Institute for Research on Poverty at the University of Wisconsin-Madison provide not only an account of the development of the current work support system in Wisconsin, but also the challenges of program integration, perception and accounting that remain. In order to properly illustrate the costs and case measurement, they relied heavily upon the aforementioned work by Rebecca Swartz at the Hudson Institute in Madison. The following (Tables 8 and 9) are from their reports:

Table 8: Wisconsin Budget Allocations for Public Assistance Programs

Wisconsin Budget Allocation for TANF and MOE Expenditures FY 2001	
Total Cash Support	$ 150,600,000
Targeted Service Programs	$ 61,827,000
Program Administration	$ 35,461,400
Programs that Support Work	
Child Care	$ 224,000,000
Employment, Education and Training Services	$ 128,700,000
Workforce Attachment and Advancement	$ 10,000,000
Community Reinvestment Programs	$ 5,500,000
Transportation	$ 2,000,000
Total	**$ 618,088,400**

Table 9: Wisconsin Family Case Counts 1995 and 2000

Wisconsin AFDC and TANF Family Caseloads 1995, 2000		
	1995	**2000**
Cash Assistance (AFDC/W-2) cases	62,752	6,642
NLRR/Kinship Care Cases	5,094	5,905
C-support (SSI parents) cases	6,121	5,648
Case Management Cases	0	4,032
Family Food Stamps Cases	78,904	44,863
Family Medicaid cases	111,170	101,991
Child Care Cases	9,844	18,784
Total Duplicated Case Counts	273,885	187,875
Total Unduplicated Case Counts	**118,595**	**114,725**

*The numbers reported above are estimates of the number of cases in the Wisconsin system at any point in time, not cumulative yearly totals.

The transformation of Wisconsin's public assistance program is quite clear. Over the 5-year period there was an 89% drop in cash assistance cases as well as a 43% drop in food stamp cases. However, the total case count remained virtually unchanged. Instead of simply accepting a cash handout, individuals are now relying on support services such as childcare, employment training, Medicaid, and case specific assistance. It is quite obvious that the total expenditure in public funds would be underestimated by simply measuring transfer payments.

By using a simple average one can calculate the public expenditure per case for such programs, $5,388. This is the cost per case valuation that is used to estimate Wisconsin public assistance savings provided by the existence of public transit.

3.8.4 Forgone Trips Leading to Public Assistance Dependence

Research at HLB has indicated that approximately half of the individuals who would be unable to reach work in the absence of public transit would become dependent on public assistance in either direct transfer payments or in assistance measures in retraining, work subsidization, child care, and other forms of public support. To transform ridership values into individuals making trips an annualization factor of 120 days is applied.

These data, along with an estimation of forgone trips from ridership surveys in Wisconsin, are integrated into the HLB model to determine the total cost savings in public assistance.

3.9 Alternative Scenarios

In addition to the distributions and assumptions defined above through a consideration of all input sources, the model also allowed for the testing of the values as given directly by individual sources, such as the panel opinions. The values defined above are the most appropriate values, as they consider input from all sources. The alternative cases were used simply to test the results for robustness, in making sure that the results were not overly sensitive to any one variable on which there were conflicting distributions from the various input sources.

4. TRANSIT BENEFITS RESULTING FROM ACCESS TO WORK

The following results were determined using HLB's benefit measurement methodology given the assumption distributions that were presented in Chapter 3.

4.1 Ridership by System

There are approximately 47,910,000 annual trips on public transit in the State of Wisconsin that are for work purposes (Table 10).

Table 10: Work Purpose Ridership

Work Purpose Trips		
System	**Percent in System**	**Number of Trips**
Small	39.1%	260,000
Medium	34.9%	1,110,000
Large	48.9%	46,540,000
Total	**48.4%**	**47,910,000**

The model results indicate that public transportation provides 8.82 million trips for work purposes that would not have been made if the transit system did not exist.

4.2 Public Assistance Cases Prevented

In allowing individuals the mobility to reach their place of employment, public transit prevents a 13,800 increase in average public assistance caseloads from those listed in Table 8. This 12% increase in public assistance cases would cost the State of Wisconsin $74.26 million per year in additional public assistance spending, assuming that the same level currently spent on W-2 and work support programs would be applied to the prevented cases (See Table 11 below).

Table 11:Prevented Loss in Work Trips and Increase in Public Assistance Cases

Without Transit			
System	**Number of Lost Trips**	**Public Assistance Cases Prevented***	**Public Assistance Savings**
Small	71,533	112	$ 600,000
Medium	265,449	415	$ 2,240,000
Large	8,484,515	13,257	$ 71,420,000
Total	**8,821,498**	**13,784**	**$ 74,260,000**

*Increase in average monthly caseload

4.3 Consumer Surplus

The benefit of public transit assumed by work purpose transit users amounts to a savings of some $259.05 million. This is the generalized increase in costs that users would lose by switching to their chosen alternative in the absence of transit service.

4.4 Total Cost Savings

The total cost savings includes both the consumer surplus measured by cost savings enjoyed by the consumer, as well as the savings in public assistance measures. Table 12 shows that the total savings from the work sector amounts to a sum of $333.31 million.

Table 12: Total Cost Savings to the Work Sector (Millions of Dollars)

Savings	Regions			Total
	Small	Medium	Large	
Consumer Surplus	$1.31	$5.86	$251.87	$259.05
Public Assistance	$0.60	$2.23	$71.42	$74.26
Total Savings	**$1.92**	**$8.10**	**$323.30**	**$333.31**

With a total annual cost savings of $333.31 million and an annual ridership of 47.91 million work purpose trips, the average savings per work related trip on public transit is $6.96.

4.5 Economic Impact of Out of Pocket Savings

In addition to the above, HLB carefully considers the employment, output and tax effects of the out of pocket savings from work transit. We note, however, that it is extremely difficult to ascertain incremental (as distinct from transfer) effects in relation to these factors. Glib accounting for such effects is often the demise of Benefit-Cost Studies and HLB counsels great care. Our typical approach is to separate these impacts to comment as carefully as possible on their impact (needed for valid inclusion in the analysis) and demonstrate their influence on the results in “what-if” modality. Because of the difficulty in separating the incremental and transfer portion of these factors, their impacts are not included in the concluding benefit values, but are instead presented in solely in this section of the report.

Through the utilization of the IMPLAN© modeling process it was determined that work transit riders, by spending their out of pocket transportation savings elsewhere, generate 5,080 jobs, $477.48 million in output and $71.1 million in total tax revenue. As the out of pocket savings is spent on items such as housing, food, manufactured goods, and other expenditures, the new economic activity has a rippling effect. New spending allows the affected industries to increase their employment levels and in turn increase orders from their suppliers, who are then able to do the same. IMPLAN© keeps detailed statistics on the interactions of industrial sectors, and is thus able to map how the increased spending moves through the economy while generating the impacts illustrated in Table 13.

Table 13: Impact of Out of Pocket Work Transportation Savings

	Direct	Indirect	Induced	Total
Employment	2,672	1,097	1,314	5,082
Output	$251,470,000	$107,480,000	$118,540,000	$477,480,000
Tax Revenue	$37,380,000	$15,350,000	$18,380,000	$71,100,000

The direct effects of the increased spending occur in sectors of the economy where transit riders directly spend the out of pocket savings. Indirect effects are secondary as a result of increased orders to suppliers. Induced effects are tertiary and are as a result of increased wages in the direct and indirect industries. (For more detailed results see Appendix D.)

4.6 Risk Analysis

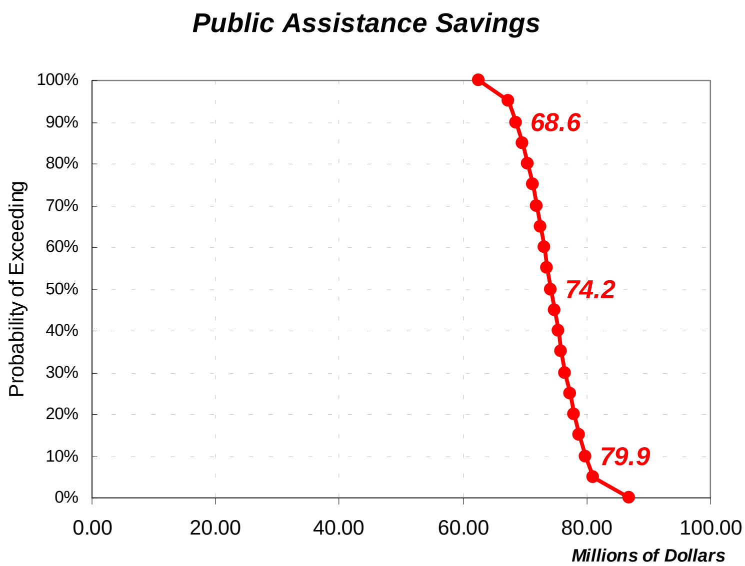
In addition to the point estimates it is important to note the range of possibilities that may occur with the associated likelihoods. Throughout the modeling process inputs were measured as probability distributions rather than point estimates so that final probability distributions relating to the work sector could be determined. While the previously listed point estimates are all based upon the mean expected values from the simulation process, the following decumulative probability charts show the probability the "real value" exceeds the value presented on the horizontal axis, given the initial modeling assumptions. For further information on how the Risk Analysis Process is conducted see Appendix B.

4.6.1 Savings in Public Assistance Spending

The following are the risk analysis results shown as a decumulative probability graph indicating the range of public assistance savings at different probability levels. Figure 4 shows that while the expected public assistance savings in 2002 is estimated at $74 million, there is a 10% probability that the savings can be as high as $80 million.

Figure 4: Risk Analysis of Public Assistance Savings

Probability of Exceeding	Public Assistance Savings (Millions of Dollars)
100%	62.6
95%	67.3
90%	**68.6**
85%	69.6
80%	70.5
75%	71.3
70%	71.9
65%	72.6
60%	73.2
55%	73.7
50%	**74.2**
45%	74.8
40%	75.4
35%	75.9
30%	76.5
25%	77.2
20%	78.0
15%	78.8
10%	**79.9**
5%	81.2
0%	87.0
Mean Expected Value	**74.3**

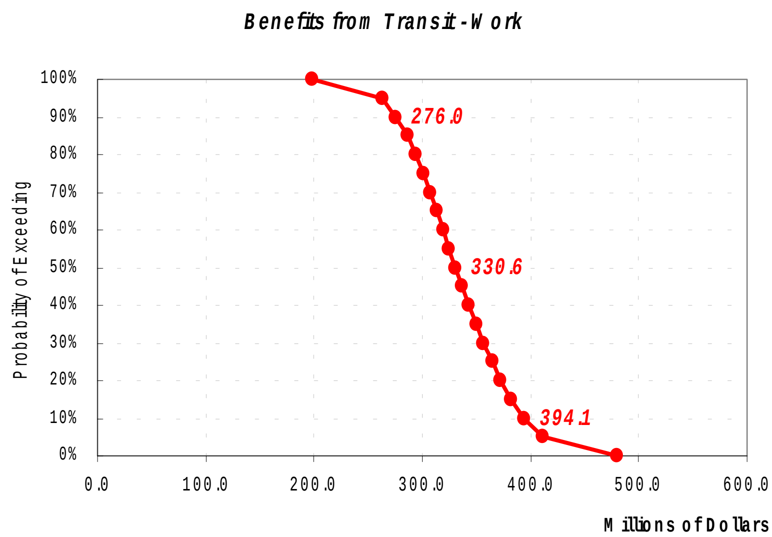


4.6.2 Total Benefits to the Work Sector

Similarly to the public assistance savings shown above, a risk analysis was conducted to estimate the overall work sector benefits at different probability levels. The following decumulative probability graph indicates that there is a 50% probability that the total benefit from public transit to the healthcare sector exceeds $330.6 million and that these benefits reach over $394 million at the 10% probability level.

Figure 5: Risk Analysis of Total Benefits from Public Transit to Work Sector

Probability of Exceeding	Benefits from Transit - Work (Millions of Dollars)
100%	198.0
95%	263.0
90%	**276.0**
85%	286.1
80%	293.8
75%	301.2
70%	307.3
65%	313.8
60%	319.2
55%	325.1
50%	**330.6**
45%	337.3
40%	343.1
35%	349.9
30%	356.9
25%	364.3
20%	372.7
15%	382.1
10%	**394.1**
5%	411.2
0%	479.5
Mean Expected Value	**333.3**



5. CONCLUSION

The existence of public transit in Wisconsin affords a total benefit of $333.31 million in savings to the various interests in the work sector. Of this total, $259.05 million is from the cost saving to transit riders who are able to avoid more costly forms of transit. $74.36 million is saved in public assistance spending, resulting from the 8.82 million annual work trips that would be lost in the absence of public transit. In addition to the direct cost savings in public assistance measures, it should be noted that the increase in unemployment has a direct impact upon the quality of life in Wisconsin's communities.

The 8.82 million lost work trips per year translate into a 13,800 increase in the average monthly public assistance caseload for the State of Wisconsin. Assuming that the per case expenditure in public assistance caseload were to be in equal proportion to those currently served, $5,388 per individual, a twelve percent increase over current spending levels would be required for these new cases.

The vast majority of these benefits, 95.8%, accrue from transit trips made in larger communities, those with a population greater than 50,000. 48.9% of transit trips in these areas are for work related purposes while only 34.9% and 39.1% of transit trips are for work related purposes in medium and small communities respectively.

With a total annual cost savings of $333.31 million and an annual ridership of 47.91 million work purpose trips, the average savings per work related trip on public transit in Wisconsin is $6.96. The results summary is shown in Table 14.

Table 14: Model Results and Confidence Limits (in 2003 dollars)

Benefits of Transit to Work	Mean Expected Value	Lower 10% Confidence Limit	Upper 10% Confidence Limit
Consumer Surplus -Travel Cost Savings (in millions)	$259.05	$201.5	$319.8
Public Assistance Program Savings (in millions)	$74.26	$68.6	$79.9
Total Benefit to the Work Sector (in millions)	$333.31	$276.0	$394.1
Per Trip Benefit for Work (in millions)	**$6.96**	**$5.77**	**$8.22**

Although the mean expected values presented are the best single value estimates of benefits to the healthcare sector from transit, the 80% confidence intervals presented in Table 12 give the best illustration of the upside of these benefits. In fact, while the total benefit to the work sector from transit is most probably near $333.31 million for 2002 alone, there is a 10% probability that the benefits can be as high as $394.1 million for the year. .

APPENDIX A: WISCONSIN COMMUNITIES WITH TRANSIT SYSTEMS

City	Total Population	Community Size	Transit System	Region
Appleton[7]	70,087	Large	Large Bus	East
Baraboo	10,711	Medium	Shared-Ride Taxi	Center
Beaver Dam	15,169	Medium	Shared-Ride Taxi	East
Beloit	35,775	Medium	Large Bus	Center
Berlin	5,305	Small	Shared-Ride Taxi	Center
Black River Falls	3,618	Small	Shared-Ride Taxi	West
Chippewa Falls	12,925	Medium	Shared-Ride Taxi	West
Clintonville	4,736	Small	Shared-Ride Taxi	East
Eau Clair County	93,142	Large	Large Bus	West
Edgerton	4,933	Small	Shared-Ride Taxi	Center
Fond du Lac	42,203	Medium	Small Bus	East
Fort Atkinson	11,621	Medium	Shared-Ride Taxi	East
Grant County	49,597	Medium	Shared-Ride Taxi	West
Green Bay	102,313	Large	Large Bus	East
Hartford	10,905	Medium	Shared-Ride Taxi	East
Janesville	59,498	Large	Large Bus	Center
Jefferson	7,338	Small	Shared-Ride Taxi	East
Kenosha	90,352	Large	Large Bus	East
La Crosse	51,818	Large	Large Bus	West
Ladysmith	3,932	Small	Small Bus	West
Lake Mills	4,843	Small	Shared-Ride Taxi	East
Madison	**208,054**	**Large**	**Large Bus**	**Center**
Manitowoc	34,053	Medium	Small Bus	East
Marinette	11,749	Medium	Shared-Ride Taxi	East
Marshfield	18,800	Medium	Shared-Ride Taxi	Center
Mauston	3,740	Small	Shared-Ride Taxi	Center
Medford	4,350	Small	Shared-Ride Taxi	Center
Menominee Tribe	**4,562**	**Small**	**Rural Bus**	**East**
Merrill	**10,146**	**Medium**	**Small Bus**	**Center**
Milwaukee County	**940,164**	**Large**	**Large Bus**	**East**
Monona	8,018	Small	Large Bus	Center
Monroe	10,843	Medium	Shared-Ride Taxi	Center
Neillsville	2,731	Small	Shared-Ride Taxi	West
New Richmond	6,310	Small	Shared-Ride Taxi	West
Onalaska	14,839	Medium	Shared-Ride Taxi	West
Oneida Town	4,001	Small	Rural Bus	East
Oshkosh	62,916	Large	Large Bus	East
Ozaukee County	82,317	Large	Commuter/Shared-Ride Taxi	East
Platteville	9,989	Small	Shared-Ride Taxi	West
Plover village, Portage County	10,520	Medium	Shared-Ride Taxi	Center
Port Washington	10,467	Medium	Shared-Ride Taxi	East
Portage	9,728	Small	Shared-Ride Taxi	Center
Prairie du Chien	6,018	Small	Shared-Ride Taxi	West
Prairie du Sac village	3,231	Small	Shared-Ride Taxi	Center

7 The Fox Cities metropolitan region (population 188,000) includes the following communities: City of Appleton, City of Kaukauna, City of Menasha, City of Neenah, Town of Buchanan, Town of Grand Chute, Town of Menasha, Village of Kimberly, and Village of Little Chute.

City	Total Population	Community Size	Transit System	Region
Racine	81,855	Large	Large Bus/Commuter	Center
Reedsburg	7,827	Small	Shared-Ride Taxi	Center
Rhinelander	7,735	Small	Shared-Ride Taxi	Center
Rice Lake	8,320	Small	Small Bus	West
Ripon	6,828	Small	Shared-Ride Taxi	Center
River Falls	**12,560**	**Medium**	**Shared-Ride Taxi**	**West**
Rusk County	15,347	Medium	Rural Bus	West
Sawyer County	16,196	Medium	Rural Bus	West
Shawano	8,298	Small	Shared-Ride Taxi	East
Sheboygan	50,792	Large	Large Bus	East
Stevens Point	24,551	Medium	Small Bus	Center
Stoughton	12,354	Medium	Shared-Ride Taxi	Center
Sun Prairie	20,369	Medium	Shared-Ride Taxi	Center
Superior	27,368	Medium	Large Bus	West
Viroqua	**4,335**	**Small**	**Shared-Ride Taxi**	**West**
Washington County	117,493	Large	Commuter/Shared-Ride Taxi	East
Waterloo	3,259	Small	Shared-Ride Taxi	East
Watertown	21,598	Medium	Shared-Ride Taxi	East
Waukesha City	64,825	Large	Large Bus	East
Waukesha County	360,767	Large	Large Bus	East
Waupaca	5,676	Small	Shared-Ride Taxi	East
Waupun	10,718	Medium	Shared-Ride Taxi	East
Wausau	38,426	Medium	Large Bus	Center
West Bend	28,152	Medium	Shared-Ride Taxi	East
Whitewater	13,437	Medium	Shared-Ride Taxi	East
Wisconsin Rapids	18,435	Medium	Shared-Ride Taxi	Center

* *Survey communities are in shaded boxes.*

APPENDIX B: RISK ANALYSIS PROCESS

Economic forecasts traditionally take the form of a single "expected outcome" supplemented with alternative scenarios. The limitation of a forecast with a single expected outcome is clear -- while it may provide the single best statistical estimate, it offers no information about the range of other possible outcomes and their associated probabilities. The problem becomes acute when uncertainty surrounding the forecast's underlying assumptions is material.

A common approach is to create "high case" and "low case" scenarios to bracket the central estimate. This scenario approach can exacerbate the problem of dealing with risk because it gives no indication of likelihood associated with the alternative outcomes. The commonly reported "high case" may assume that most underlying assumptions deviate in the same direction from their expected value, and likewise for the "low case." In reality, the likelihood that all underlying factors shift in the same direction simultaneously is just as remote as that of everything turning out as expected.

Another common approach to providing added perspective on reality is "sensitivity analysis." Key forecast assumptions are varied one at a time in order to assess their relative impact on the expected outcome. A problem here is that the assumptions are often varied by arbitrary amounts. A more serious concern with this approach is that, in the real world, assumptions do not veer from actual outcomes one at a time. It is the impact of simultaneous differences between assumptions and actual outcomes that is needed to provide a realistic perspective on the riskiness of a forecast.

Risk Analysis provides a way around the problems outlined above. It helps avoid the lack of perspective in "high" and "low" cases by measuring the probability or "odds" that an outcome will actually materialize. This is accomplished by attaching ranges (probability distributions) to the forecasts of each input variable. The approach allows all inputs to be varied simultaneously within their distributions, thus avoiding the problems inherent in conventional sensitivity analysis. The approach also recognizes interrelationships between variables and their associated probability distributions.

The Risk Analysis Process involves four steps:

Step 1: Define the structure and logic of the forecasting problem;

Step 2: Assign estimates and ranges (probability distributions) to each variable and forecasting coefficient in the forecasting structure and logic;

Step 3: Engage experts and stakeholders in assessment of model and assumption risks (the "RAP Session"); and

Step 4: Issue forecast risk analysis.

Step 1: Define Structure and Logic of the Forecasting Problem

A "structure and logic model" depicts the variables and cause and effect relationships that underpin the forecasting problem at-hand (See Figure 1). Although the structure and logic model is written down mathematically to facilitate analysis, it is also depicted diagrammatically in order to permit stakeholder scrutiny and modification in Step 3 of the process.

Step 2: Assign Central Estimates and Conduct Probability Analysis

Each variable is assigned a central estimate and a range (a probability distribution) to represent the degree of uncertainty. Special data sheets are used to record the estimates. The first column gives an initial median while the second and third columns define an uncertainty range representing an 80 percent confidence interval. This is the range within which there exists an 80 probability finding the actual outcome. The greater the uncertainty associated with a forecast variable the wider the range.

Figure 6: Example of Data Sheet

Variable	Median	10% Lower Limit	10% Higher Limit
Percentage of trips for healthcare purpose	10.5%	9.3%	10.8%

Probability ranges are established on the basis of both statistical analysis and subjective probability. Probability ranges need not be normal or symmetrical -- that is, there is no need to assume the bell shaped normal probability curve. The bell curve assumes an equal likelihood of being too low and being too high in forecasting a particular value. It might well be, for example, that if a projected percentage deviates from expectations; circumstances are such that it is more likely to be higher than the median expected outcome than lower.

The RAP computer program transforms the ranges as depicted above into formal probability distributions (or "probability density functions"). This liberates the non-statistician from the need to appreciate the abstract statistical depiction of probability and thus enables stakeholders to understand and participate in the process whether or not they possess statistical training.

From where do the central estimates and probability ranges for each assumption in the forecasting structure and logic framework come? There are two sources. The first is an historical analysis of statistical uncertainty in all variables and an error analysis of the forecasting "coefficients." "Coefficients" are numbers that represent the measured impact of one variable (say, income) on another (such as retail sales). While these coefficients can only be known with uncertainty, statistical methods help uncover the magnitude of such error (using diagnostic statistics such as "standard deviation," "standard error," "confidence intervals" and so on).

The uncertainty analysis outlined above is known in the textbooks as "frequentist" probability. The second line of uncertainty analysis employed in risk analysis is called "subjective probability" (also called "Bayesian" statistics, for the mathematician Bayes who developed it). Whereas a frequentist probability represents the measured frequency with which different outcomes occur (i.e., the number of heads and tails after thousands of tosses) the Bayesian probability of an event occurring is the degree of belief held by an informed person or group that it will occur. Obtaining subjective probabilities is the subject of Step 3.

Step 3: Conduct Expert Evaluation: The RAP Session

Step 3 involves the formation of an expert panel and the use of facilitation techniques to elicit, from the panel, risk and probability beliefs about:

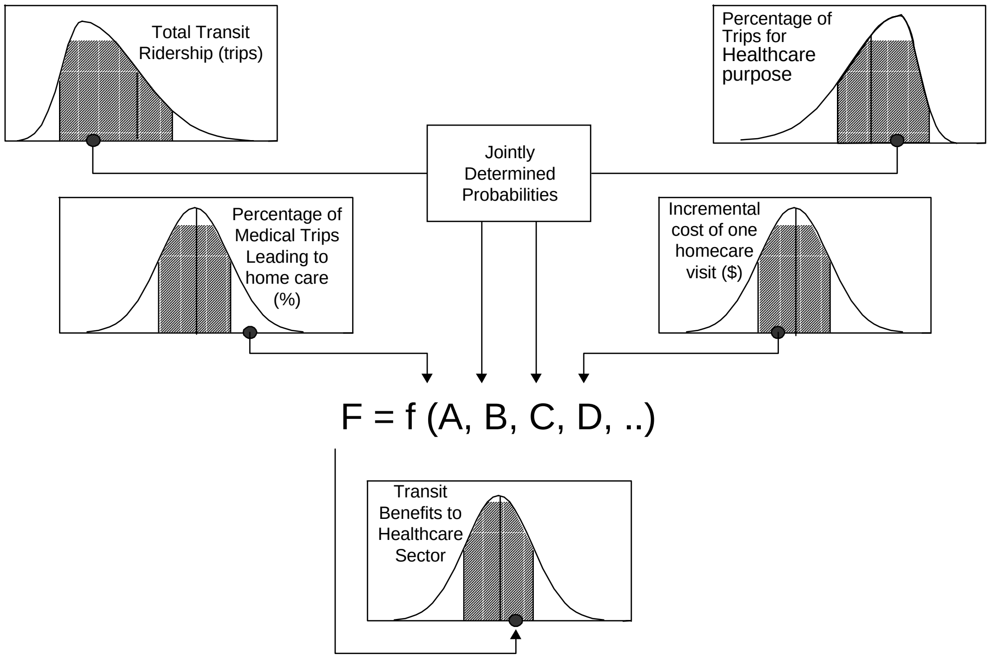
- The structure of the forecasting framework; and
- The degree of uncertainty attached to each variable and forecasting coefficient within the framework.

In (1), experts are invited to add variables and hypothesized causal relationships that may be material, yet missing from the model. In (2), panelists are engaged in a discursive protocol during which the frequentist-based central estimates and ranges, provided to panelists in advance of the session, are modified according to subjective expert beliefs. This process is aided with an interactive "groupware" computer tool that permits the visualization of probability ranges under alternative belief systems.

Step 4: Issue Risk Analysis

The final probability distributions are formulated by the risk analyst (HLB) and represent a combination of "frequentist" and subjective probability information drawn from Step 3. These are combined using a simulation technique (Monte Carlo analysis) that allows each variable and forecasting coefficient to vary simultaneously according to its associated probability distribution (see Figure 7).

Figure 7: Combining Probability Distributions



The end result is a central forecast, together with estimates of the probability of achieving alternative outcomes given uncertainties in underlying variables and coefficients (as presented in Figures 4 and 5, Results).

APPENDIX C: EXPERTS THAT PARTICIPATED AT THE RISK ANALYSIS WORKSHOP

Ingrid Rothe
Researcher, Institute for Research on Poverty
University of Wisconsin - Madison

Dr. Edward Beimborn
Director, Center for Urban Transportation Studies
University of Wisconsin-Milwaukee

Joe Caruso
Marketing Director
Milwaukee County Transit

Sharon Persich
Planning Manager
Metro Transit, Madison

Susan Lemke
Transit Manager
Stevens Point Transit

Mark Jones
Manager
Abby Vans, Inc., Neillsville

Beverly Scott (No show)
President
Top Hat Inc., La Crosse/River Falls

Ken Yunker
Deputy Director
Southeastern WI Regional Planning Commission, Waukesha

Dixon Nuber
Director
University of WI - Milwaukee School of Continuing Studies

Pat McGinty
Title: President
Brown Cab Service, Inc., Fort Atkinson

Chuck Kamp
General Manager
Valley Transit, Appleton

Greg Seubert
Transit Director
Wausau Area Transit System

Ann Gullickson
Transit Service Manager
Metro Transit, Madison

Anita Gullota-Connelly
Director of Administration
Milwaukee County Transit System

Bob Johnson
Transit Director
Waukesha Metro Transit

John Etzler
Public Transit Section
WI Dept of Transportation

David Vickman
Public Transit Section
WI Dept of Transportation

APPENDIX D: ECONOMIC IMPACT OF TRANSPORTATION SAVINGS BEING RE-SPENT IN THE WISCONSIN ECONOMY

The following impact tables were generated using Input/Output modeling techniques of IMPLAN© in order to measure the effect of the spending the transportation savings of households in the Wisconsin economy. Table 15 indicates the additional output in the major sectors of Wisconsin economy, while Table 16 illustrates the change in employment.

Table 15: Work Transportation Savings - Output Impact

Output Impact				
Impact of Work Transportation Savings Being Re-spent in the Economy (2003 Dollars)				
Industry	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	1,508,808	2,351,569	1,134,382	4,994,758
Mining	0	196,847	70,213	267,060
Construction	0	4,293,502	1,378,575	5,672,077
Manufacturing	47,527,456	33,105,972	26,889,484	107,522,912
TCPU	17,099,818	11,537,321	9,912,400	38,549,540
Trade	46,018,632	8,760,995	22,155,894	76,935,520
FIRE	52,556,816	16,187,098	23,455,878	92,199,792
Services	79,715,336	28,516,646	31,290,324	139,522,304
Government	2,011,743	2,526,874	2,248,273	6,786,890
Other	5,029,360	0	0	5,029,360
Institutions	0	0	0	0
Total	**251,467,969**	**107,476,823**	**118,535,422**	**477,480,212**

Table 16: Work Transportation Savings - Employment Impact

Employment Impact				
Impact of Work Transportation Savings Being Re-spent in the Economy				
Industry	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	23.5	36.7	17.7	77.9
Mining	0	1.3	0.4	1.7
Construction	0	33.2	10.7	43.9
Manufacturing	227.8	158.7	128.9	515.3
TCPU	101	69.9	63.7	234.6
Trade	846.1	160.3	399.1	1,405.50
FIRE	230.6	97.9	112.1	440.5
Services	1,373.40	491.3	539.1	2,403.70
Government	37.6	47.3	42.1	127
Other	-168	0	0	-168
Institutions	0	0	0	0
Total	**2,672.00**	**1,096.50**	**1,313.70**	**5,082.10**

STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION

THE SOCIO-ECONOMIC BENEFITS OF TRANSIT IN WISCONSIN

CHAPTER 5: RETAIL, RECREATION AND TOURISM

Prepared By:

HLB DECISION ECONOMICS INC.
8403 Colesville Road, Suite 910
Silver Spring, MD 20910

December 1, 2003

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EXECUTIVE SUMMARY

TRANSIT BENEFITS

The availability of public transit contributes not only to the access of education, jobs and healthcare, but also to the community's involvement in cultural and entertainment events as well as recreation programs and shopping. Each year 18 million trips on Wisconsin public transit are made for such purposes. The opportunity to reach these areas contributes to communities' attractiveness for both residence and tourism.

Transit users participate in the regional economy in various ways. They play the role of workers providing goods and services, as well as consumers purchasing them. Transit riders make purchases at shopping centers, grocery stores and businesses near work or school. The extent of such activities makes a significant contribution to Wisconsin's economy. One of the keys to maintaining economic activity in a region is access to commercial sites. If individuals are unable to make trips to shopping centers, the economic activity of the community slows. This impacts not only the direct sales figures, but also the larger economy, as less revenue is available to be re-spent by businesses.

Besides slowing the economic activity in the region, limited access to shopping centers also reduces the diversity and quality of goods businesses are able to sell. Firms consistently compete for prime locations near transportation lines or transit stations. By having access to a larger pool of consumers businesses are able to offer more diverse product lines, and higher quality goods appealing to a wider range of consumers. Without access to a large diverse clientele, stores are only able to supply the most basic of necessities. Transit, thus not only affects the economic activity of the area in dollar terms, but also the quality and variety of goods consumers are able to purchase.

TRANSPORTATION RESEARCH

Describing the benefits of transit service has historically been completed through qualitative analysis. In conducting literature reviews in transit cost benefit analysis, HLB Decision Economics Inc. (HLB) has found that many of these studies fall into the category of qualitative reports. Anecdotal evidence and theoretical postulating are relied upon to describe the interactions taking place as a result of the existence of transit services. Some studies conducted by federal agencies and local community organizations attempt to describe the costs and benefits of transit without the thorough scrutiny of empirical case studies. What often remain to be explained and accounted for are the actual benefits being generated by transit within specific regions.

In recent years, however, the development of transportation research has begun to focus upon the quantification of transit benefits as a valuable tool to describe the return on expenditure and compare alternative capital investment options. In general, the benefits of transit fall into three main categories that can be defined as follows: congestion management, economic development, and affordable mobility. Measuring each type of benefit requires a different methodology, which if conducted inappropriately can undervalue public transit by considering just a portion of the total potential benefits.

Congestion Management
The study of congestion management evaluates how the existence of transit services causes a decrease in the costs of owning and operating a personal vehicle. With increased reliance on transit services there is an improvement in travel time, fewer accidents, and lower pollution emissions as fewer miles are traveled via personal vehicles. The two principal benefits attributed to congestion management are the reduction in travel by personal vehicles and the less congested traveling conditions for the vehicles that remain on the roadway.

Economic Development
The study of development and transportation considers the relationship that exists between the economic activities of an area and the proximity of transportation services. Greater access via transit presents the opportunity for increased commercial activity, as travel to the location is more readily available for both patrons and employees. As commercial opportunities expand, secondary effects appear. With an increase in commercial activity, a higher demand for real estate emerges along with increasing property values.

Affordable Mobility
Studies of affordable mobility attempt to define the benefits to riders who are transit dependent as well as choice riders. Transit dependent riders are those who cannot drive due to physical factors or monetary restraints, while choice riders have access and the ability to use an automobile, but make the choice to use transit. The benefits to riders can be measured by their expenditure savings in accessing different sector services via public transit instead of a more costly alternative. In addition to the expenditure savings measure, certain cross sector benefits also exist. By providing access to employment sites, transit helps decrease spending on welfare to work programs. Similarly, by providing a means of transit to medical services, transit helps prevent cases that might otherwise become dependent upon home healthcare.

BENEFITS OF TRANSIT TO ACCESS RETAIL, RECREATION & TOURISM

This study of affordable mobility benefits of transit attempts to show not simply a total benefit figure for Wisconsin, but how each of the various sectors within the regional economy benefit from transit service. The sectors of analysis are divided into: work purposed trips, educational purpose trips, healthcare purpose trips, as well as retail, tourism and recreation trips. Such a list is not, of course, exhaustive. Each of the four sectors could be further divided to type of employment, place of education, etc. for studies on a micro or community level basis.

The Wisconsin Transit Sectors Socioeconomic Analysis is a sector benefits study of transit to the State of Wisconsin. This report specifically focuses upon the benefits of public transit service to the retail, recreation and tourism sector of Wisconsin's economy. HLB has prepared the following report as one component of a larger study of the various sector benefits of public transit in Wisconsin. The analysis relies on methodology developed by HLB over the past decade on behalf of the Federal Transit Administration and other state agencies. The approach to such a study involves application of acceptable economic theory, identifying user preferences as well as modeling the impact of their decisions on the retail, recreation and tourism sector.

STUDY APPROACH

HLB employed various sources of information and data to conduct this quantitative study. These included an extensive literature search, an HLB conducted survey, information from several transit agencies in Wisconsin, panel opinions from a group of experts, as well as reports and publications from earlier studies conducted by HLB.

STUDY FINDINGS

Within the State of Wisconsin 18 million trips are made annually on transit services for retail, recreation or tourism purposes. For each trip that is made it is estimated that $6.27 in cost savings is realized by consumers in out of pocket, time and accident costs. The total annual benefit to retail, recreation and tourism riders amounts to a consumer surplus of $113 million.

The consumers themselves, however, are not the only individuals who benefit from the existence of transit service for such purposes. The existence of access to cultural and entertainment events contributes to the community involvement and livability, a criterion used by individuals deciding to move to the city permanently, or to visit as tourists. In the absence of transit service 2 million such trips made for retail, recreation or tourism purposes would be lost within the State of Wisconsin yearly. Table 1 provides a summary of the study findings.

SUMMARY TABLE 1: SUMMARY OF TRANSIT BENEFITS TO THE RETAIL RECREATION AND TOURISM SECTOR

Percent of Transit Trips for Retail, Recreation, and Tourism Purposes	18.2%
Number of Trips for Retail, Recreation, and Tourism Purposes (annual)	17.99 million
Survey Response, User Actions Without Transit	
Use an Alternative Transit Mode for the Same Trip	32.7%
Go to a Different Shopping Center	18.8%
Shop Online or by Catalog	9.1%
Make Less Shopping Trips	36.8%
Other	2.7%
Consequences if Transit were not Available	
Number of Forgone Retail, Recreation, and Tourism Trips	2.07 million
Benefits of Transit to Work	
Total Benefit from Transit to the Retail, Recreation, and Tourism Sector	$112.76 million
Per Trip Benefit from Transit Service	$6.27

In addition to the above, HLB used input/output modeling to calculate the economic impact caused by the re-spending of the out of pocket cost savings in other sectors of Wisconsin's economy. The use of this savings in other sectors of the economy generates 2,250 jobs, increases total output by $211.36 million and adds $31.47 million to total tax revenue collections (See Summary Table 2).

The following report details the process of determining each of the statistics presented here. All statistics were calculated after careful consideration of survey statistics, literature findings, panel opinions, data from Wisconsin transit systems, as well as sound and accepted economic modeling methods conducted by HLB.

SUMMARY TABLE 2: ECONOMIC IMPACT DUE TO RETAIL, RECREATION AND TOURISM TRANSPORTATION SAVINGS

	Direct	Indirect	Induced	Total
Employment	1,183	485	582	2,250
Output	$111,310,000	$47,570,000	$52,470,000	$211,360,000
Tax Revenue	$16,550,000	$6,780,000	$8,140,000	$31,470,000

1. INTRODUCTION

Besides its role in supplying transport to jobs, healthcare, and education, public transportation also provides access to shopping centers, tourist attractions, and other entertainment and recreation centers. In fact, transportation cost is a principal component in making a decision to take shopping and entertainment trips. The savings in transportation costs can provide the transit user with additional cash to spend on his or her shopping or entertainment journey. Shopping centers themselves are common landmarks used as prominent stops along transit lines. Such service provides access for both employees as well as store patrons.

1.1 Access to Retail Centers and Business Development

Ensuring that commercial centers are easily accessible to shoppers is fundamental in supporting the economic vitality of a region. Such access benefits both the businesses and consumers in the market. The opportunity to locate in a business district allows businesses to enjoy the benefits that exist when multiple establishments are able to locate together to mutually attract clientele. At the same time consumers are able to reach locations with a greater variety of products available at a lower cost.

Some argue that reduced spending at commercial centers implies an equal increase in spending in local “corner stores”. What such a claim ignores, however, are the inefficiencies that arise from diverting sales from central business districts. If transport services for low-income populations are unavailable, many families have little choice but to shop at the closest of businesses. Being less efficient, these stores charge higher prices than could be obtained elsewhere, because customers cannot easily reach competitors’ locations. For families on limited incomes the diminished purchasing power of their income can have disastrous consequences on the household budget. Additionally, such stores are rarely able to offer the same scope of products – variety that consumers cherish.

As mobility and access to community centers is increased, the community as a whole stands to gain. Transit service also allows for community centers to be built that are more attractive for the establishment of businesses. Instead of serving individual neighborhoods, businesses are able to enjoy the networking effects associated with locating in central business districts made accessible to clients by the existence of public transportation. The desirability of locations near transportation lines and transit stations is made clear by the competition that often exists for these key business locations. By increasing transit ridership, firms near transit lines stand to gain clientele, allowing them to improve the quality and variety of products in their stores. By increasing the geographic coverage of transit, the likelihood of new business development along the transit lines is prone to increase.

1.2 Discretionary Transit and Recreation Across Community Groups

Recreation and entertainment trips are made by many different groups of transit riders. Children have access to after school programs, while seniors have access to volunteer centers where they share their skills and hobbies with others. While other sector trips such as work or healthcare activities are necessities, recreation spending is often discretionary, and will often be induced with a decrease in transportation costs.

One illustration of such price elasticity can commonly be found in areas that have started free or discounted student bus passes. One such program in Alameda and Contra Costa Counties of California offered free bus passes to any middle or high school aged student qualifying for free school lunches. The system first noted that these targeted students were arriving to class with greater regularity. Moreover, the school also experienced a tripling of the students in after-school programs, regarded a phenomenal success by program directors.[1]

Within Wisconsin, various programs have also established free or reduced fares for participants. Stevens Point offers one such program for any 8-18 year old enrolled in any of the Stevens Point Summer Recreation Programs. The joint venture between the Parks and Recreation Department and the Transit Department provides youths an opportunity to be more involved in recreational programs, according to Susan Lemke, transit manager.

Valley Transit of Appleton, Wisconsin attempted to attract retail passengers during the busy holiday shopping season with a similar program. Every Saturday between Thanksgiving and New Years, transit service was offered at a reduced fare of 25 cents. "The Quarter fares offer people a chance to avoid the heavy traffic and overcrowded parking lots so common this time of year," explained Chuck Kamp, General Manager. "This is a busy time of year. Knowing you'll get where you want to go, on time and without searching for parking or fighting traffic can be a great incentive to give the bus a try." [2]

1.3 Community Livability

Transit users, however, are not the only beneficiaries. The community at large also benefits from the positive externalities associated with the availability of transit services. Youth engaged in productive activities, as well as the community's access to cultural, recreation, and shopping centers provides for a higher standard of living within the community. Such attributes contribute to the economic and cultural livelihood of the city.

1.4 Plan of the Report

The following chapters of the report will present a quantification of the benefits of transit to the retail, recreation and tourism sector. An overview of the methodology used by HLB Decision Economics in Chapter 2 will indicate how the modeling process proceeded. Chapter 3 presents the data and sources used to build the modeling assumptions including results from a survey of Wisconsin transit riders, opinions from a panel of experts, as well as transit statistics from service providers and government agencies. The results of the modeling process are presented in Chapter 4, followed by a discussion of the implications and concluding observations from the study in Chapter 5.

[1] "No Ride, No School, No Way." San Francisco Chronicle. 18 May 2003.
[2] "Valley Transit Offers Quarter Saturdays this Holiday Season." 22 November 2002.

2. METHODOLOGY

There are two major components that are considered when measuring the benefits to the retail, recreation and tourism sector from public transportation. The first is a measure of the cost savings from affordable mobility, which benefits consumers directly by allowing them to avoid higher cost transit modes. The second component is a measure of access to retail, recreation or tourism locations within the community - a measure of quality of life. Thus, one must also consider the reduction of retail, recreation and tourism usage that would occur should the community be without access to public transit.

Segmenting Ridership by System and Purpose

In order to arrive at these components it is first necessary to apportion the total Wisconsin ridership into its appropriate segments. As trip purpose and riders' actions will vary by community size, the total Wisconsin ridership is first divided into three community size categories: large with populations of 50,000+, medium with populations of 10,000-50,000 and small with populations less than 10,000. By establishing the total ridership within each community size category, as well as the percentage of trips for retail, recreation or tourism purposes within the category, the number of trips for such purposes within each system is determined.

Users' Actions in the Absence of Transit

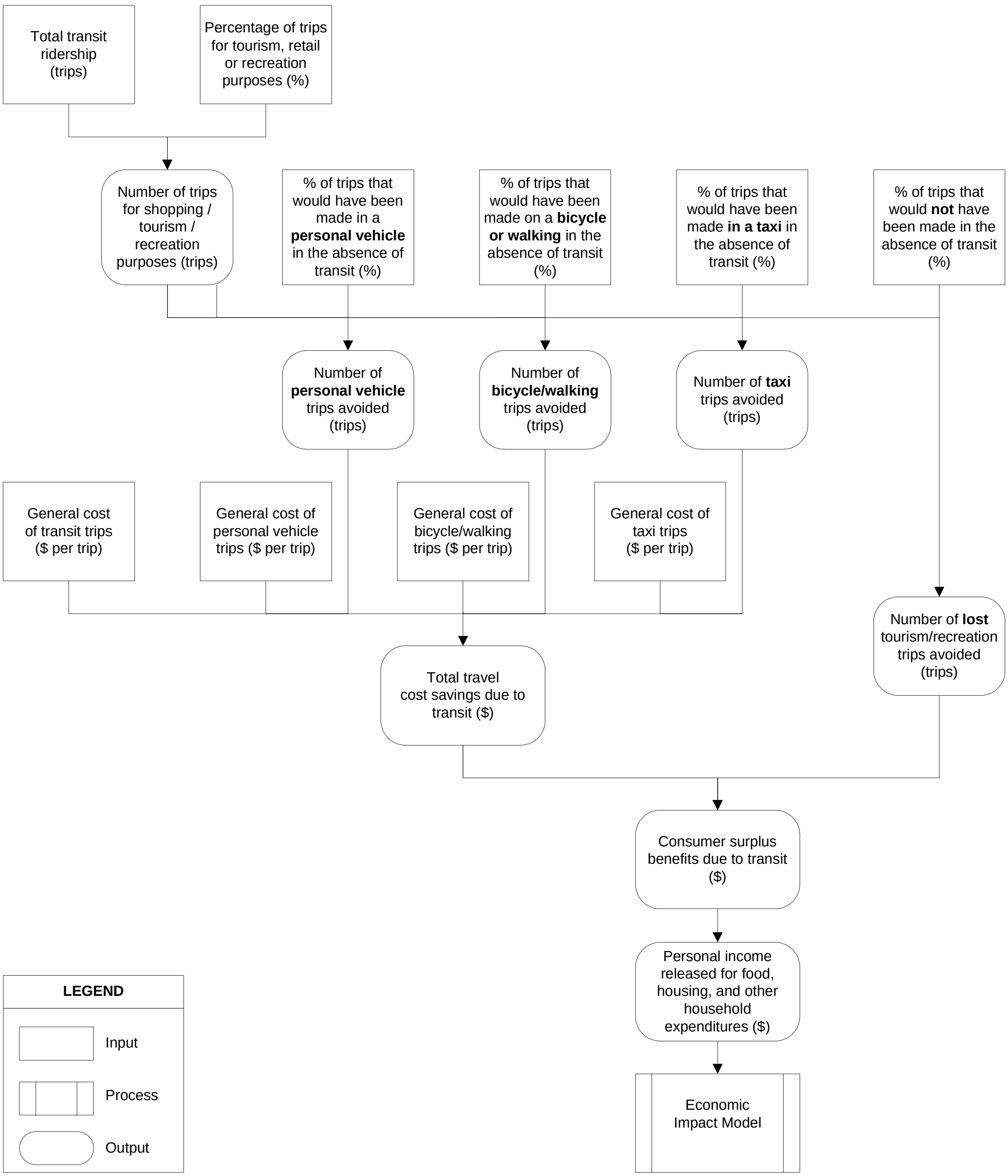
The next stage in the process is to define what actions transit users would take in the absence of transit service. Each of the possible alternatives is established, including alternative transit modes: walking, personal vehicle, taxi, etc. as well as the percentage of trips that would not be made in the absence of transit. For each of the trips that would be made on an alternative transit mode, the generalized cost difference between transit and the given alternative is estimated to arrive at a cost savings for that specific trip. The sum of these differences is the total cost savings in the retail, recreation and tourism sector due to transit.

Forgone Retail, Recreation and Tourism Trips

While individual riders benefit, in cost savings terms, from access to less expensive transportation modes, the community at large also enjoys the benefits of having a community with recreation, retail and tourism opportunities available. A measurement of the number of lost transit trips prevented by the existence of public transit will be used as an indication of the benefit that is afforded to the community from public transit by providing access to such areas.

The following structure and logic diagram illustrates the methodology used by HLB to estimate the expenditure value and the public transportation impact on retail, recreation and tourism. The figure illustrates the model followed to calculate the corresponding savings by identifying all the inputs and the relationships between the inputs.

Figure 1: Estimating Public Transportation Benefits to Retail, Recreation & Tourism



Risk Analysis

For the statistical assumptions used to build the model, distributions were defined to describe the uncertainty associated with the knowledge of each particular variable. While point estimates could have been used in the modeling assumptions to arrive at a single value of the benefit of transit to the retail, recreation and tourism sector, there would be no measure of confidence in this resulting point value. There is a very significant difference between a mean expected value of $100 million with an 80% confidence interval of ($90 million, $110 million), and the same mean expected value with an 80% confidence interval of ($40 million, $160 million). The certainty of the first is much greater than that for the second. Therefore, in addition to the mean expected values presented throughout the report, probability distributions have been generated to express the certainty in the resulting benefit values. The probability distributions are presented in section 4.3. For a detailed discussion on how the risk analysis process is conducted see Appendix B.

Economic Impact Model

In addition to the direct effect of out-of-pocket savings by transit riders avoiding more costly transportation modes, there are multiplier effects that need to be considered on the cost savings. The expenditure that is saved in transportation cost is redirected toward purchases in housing, food, and other household expenditures. As this dollar amount is re-spent the benefit multiplies within other sectors of the economy. HLB utilizes the IMPLAN© model which is an economic impact assessment modeling system (structured as an input-output model) originally developed by the U.S. Forest Service (and now maintained by the Minnesota IMPLAN Group, Inc.).[3] By analyzing the change in spending patterns across the 528 industrial sectors that IMPLAN tracks within Wisconsin, the model is able to establish the resulting direct, indirect and induced changes in employment, output and tax revenue as result of the out of pocket savings for retail, recreation or tourism purpose trips.

[3] An input-output ("I/O") approach was followed in this study, drawing on an extensive body of research and experience with successful applications to transportation project analysis. An I/O model calculates impact multipliers, which are then used to compute direct, indirect, and induced effects – output, employment, personal income, and local tax revenue generated per dollar of direct spending for labor, goods, and services.

3. DATA SOURCES

A variety of data sources were used in building the analysis model. An on board survey of Wisconsin transit users was conducted to obtain information on riders' motivation, purpose and available alternatives. A panel of transportation experts from Wisconsin then offered their opinions on the survey statistics and methodology. Supplementary statistics were also obtained from sources such as the National Transit Database, the Wisconsin Department of Transportation, information provided by local transit providers, the Federal Transportation Administration, as well as previous research conducted in the field of transit benefit analysis.

3.1 Survey Results

The on board survey was an essential component in the data collection process. Survey responses were critical in determining rider purpose, alternative transportation options and actions that would be taken in the absence of transit service. The following survey results were generated from an on board survey conducted in six Wisconsin transit districts of varying sizes. A total of 3,035 riders were sampled in the survey.

3.1.1 Community Type Weighting

The final survey results were taken as a weighted average of survey statistics by community size. Rather than simply using raw percentages from the survey, the sample areas were divided into three community sizes. As trip purpose and available alternatives are likely to differ among the given areas, the best manner in which to make the survey reflect the Wisconsin population as a whole is to take the results from the three area types and weight these results by the percentage of Wisconsin population served by public transport within each size category (ridership). The size categories were chosen as Large (population 50,000+), Medium (population 10,000-50,000) and Small (population 0-10,000). The classification used for each area served by public transport is shown in Appendix A. The weights were derived from the percentage of ridership found in each size category. For further discussion on ridership see section 3.3. Table 1 shows the weights used within the HLB modeling process, which can also be used to combine the survey results from each area to representative figures for the State of Wisconsin. The survey results presented below include either the results by community size or, where estimated for the entire state, the weighted result.

Table 1: Survey Weights for Community Size by Ridership

Community Surveyed	**Transit System**	**Region**	**Population**	**Population Percentage**	**Population Group**	**Ridership Weight**
Milwaukee County	Large Bus	East	940,164	72.86%	Large	96.11%
Green Bay	Large Bus	East	102,313	7.93%	Large	
Madison	Large Bus	Center	208,054	16.12%	Large	
Stevens Point	Small Bus	Center	24,551	1.90%	Medium	3.22%
River Falls	Shared-Ride Taxi	West	12,560	0.97%	Medium	
Neillsville	Shared-Ride Taxi	West	2,731	0.21%	Small	0.67%

3.1.2 Trip Purpose

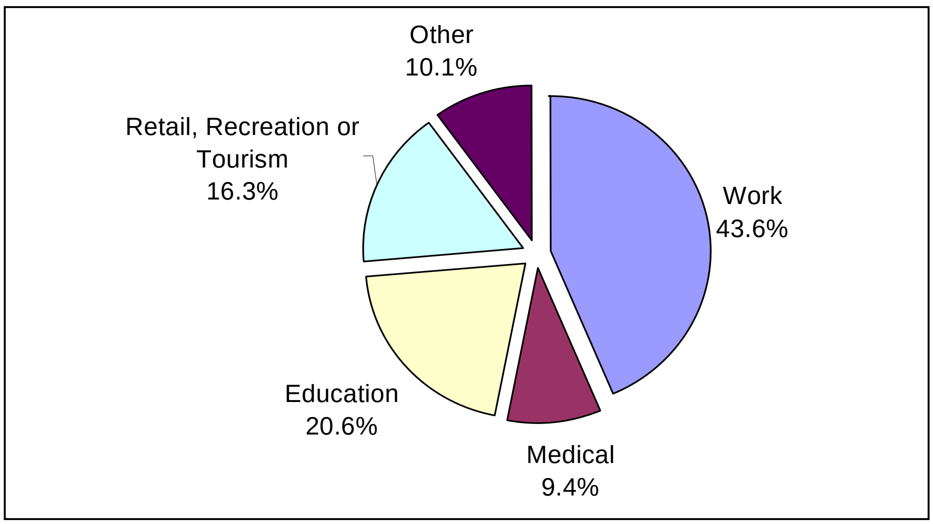
The results of the survey indicated that 16.3% of trips on public transportation in Wisconsin are for the purpose of reaching retail, recreation or tourism destinations.[4] The percentage of trips for these purposes is highest in medium size communities with populations of 10,000 to 50,000, with some 24.8% of trips. Transit in the small and large communities is less intensively used for such purposes, 14.4% and 16.06% respectively (see Table 2).

Table 2: Retail, Recreation or Tourism Trips – Survey Results

Survey Results: Percent of Trips for Retail, Recreation or Tourism Purposes		
Region	**Percentage**	**Standard Error**
Wisconsin	16.3%	0.67%
Small	14.4%	2.55%
Neillsville	*14.4%*	2.55%
Medium	24.8%	2.93%
River Falls	*23.2%*	3.30%
Stevens Point	*29.2%*	6.25%
Large	16.1%	0.72%
Green Bay	*20.7%*	1.86%
Madison	*13.4%*	1.02%
Milwaukee	*16.5%*	1.15%

On the statewide level, retail, recreation or tourism purpose trips account for the 16.3% of the total transit ridership. (Figure 2)

Figure 2: Wisconsin Transit by Purpose

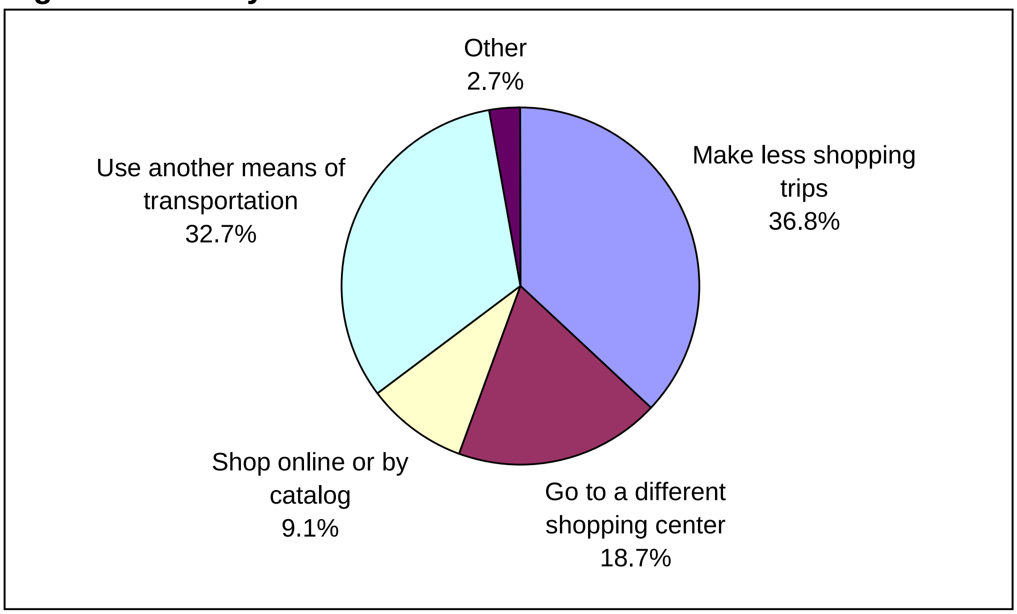


[4] For details on how the purpose statistics were applied to the modeling process see section 3.4

3.1.3 Retail, Recreation or Tourism Related Activity without Public Transit

Of the individuals who responded that they were using public transport for the purpose of commuting for retail, recreation or tourism purposes, 32.7% indicated that without transit they would have made the same trip, but via an alternative transportation mode. The remaining individuals responded that they would alter their activities. 36.8% would make less shopping trips; 18.7% would patronize another shopping center; while 9.1% would choose to shop online or by catalogue. Figure 3 shows a summary of the activity choice responses.

Figure 3: Activity choice in the absence of Public Transit



3.1.4 Alternative Transportation choice in the absence of Public Transit

Individuals who responded that they would use an alternative transportation mode for retail, recreation or tourism purposes indicated that they would switch to the forms of transportation shown in the table below.

Table 3: Alternate Transportation choice if public transit were unavailable

Transportation Alternative Chosen	Small Systems	Medium Systems	Large Systems	Weighted Average
Drive a personal vehicle	0.0%	2.6%	11.6%	11.2%
Ride with family or friends	50.0%	25.6%	27.5%	27.6%
Use a taxi-cab (other than shared-ride taxi)	37.5%	28.2%	17.6%	18.0%
Ride a bicycle	0.0%	12.8%	14.9%	14.7%
Walk	12.5%	30.8%	26.2%	26.2%
Other	0.0%	0.0%	2.3%	2.2%

3.1.5 Follow up Interviews

In addition to the statistical survey, an in depth series of interviews were conducted via telephone with selected transit riders identified from the rider survey. Over 100 interviews were used to identify and assess the specific purposes and circumstances surrounding an individual's decision to use transit service in Wisconsin.

3.2 Risk Analysis Panel Of Experts

After compiling preliminary results from the survey, HLB sought input from local transportation and academic experts familiar with the particular circumstances of Wisconsin. The group provided valuable feedback to the study on a variety of levels. Not only were the survey statistics and values for model population discussed at length, but conceptual concerns and improvements on the theoretical framework were also addressed. See Panel list in Appendix C.

3.2.1 Weighting the Survey Results by Sampling Areas

The original survey methodology called for sampling in each of the selected communities to be conducted in approximate proportion to the transit population that is represented by not only the geographic portion of Wisconsin, but also type of transportation systems present. The panel indicated that they felt community size was the most important factor influencing the riders' survey responses, and thus recommended the weighting of survey results by ridership according to community size. The weights used are further detailed in section 3.1. With the use of such weights HLB calculated not only total benefit figures for each of the sectors under study, but also the origin of the benefits, by community size. Although the weights were used directly in the modeling process, they can also be used to summarize the survey statistics to reach values that provide the most representative depiction of the average Wisconsin transit user. Although some adjustments were noted from the preliminary survey analysis, the values were not greatly changed as the survey was originally applied in close proportion to the ratios represented by the weights. Nonetheless, all state-level survey results are interpreted from the community level data using the specified weights.

3.2.2 Adjustments to Survey Data

The purpose of the Wisconsin ridership survey was to gain not only an understanding of the purpose of transit trips, but also the alternatives that transit riders would turn to should access be unavailable. While sample subjects can be relied upon to indicate their present or past actions with a high degree of accuracy, there is some question as to the reliability of their responses to a conditional statement. In short, when asked what action or transit form they would take in the absence of public transportation, respondents indicated the action they thought they would perform. The choice that they would ultimately take under such circumstances could very well be different. After conferring with the assembled panel, HLB adjusted some of the statistics for application in the benefit model. One area that seemed particularly problematic from the survey data was the number of individuals who claimed they would walk or bike in the absence of transit. For any system size that reported above 30% walking/biking use as the alternative choice for retail, recreation or tourism purpose trips, an upper bound was established at 30% with the remaining distributed proportionally to the alternative options.

Wisconsin's Volunteers Riding Public Transit

After completing their professional careers many of Wisconsin's retirees soon find that retirement is simply not an option. Access to public transportation is allowing them to continue in the dedication given to their own professional field by volunteering and offering their services to others.

Michael France of De Pere decided to pursue such service to the community after retiring. Michael currently volunteers with the reading program at Franklin Middle School, teaches sixth grade religion at Our Lady of Lords and conducts reading sessions with first grade students at Dickinson Elementary School. During the school year Mr. France relies on the public transportation service five times per week to reach his classes. He comments that his students also frequent the afternoon bus from Franklin. "Since I don't own a car, having public transportation nearby makes it possible for me to get to school during the winter months when walking really isn't possible."

Betty Bennett, a volunteer with the Lifelong Learning Program in Green Bay notes: "Volunteering prolongs the viable life; you give and receive. A sense of camaraderie is built between volunteers and those they serve. It provides a sense of companionship and a way of life." While her passion remains the courses she volunteers to teach in literature and current events, Betty has spent the past twelve years serving on the transit commission for the city of Green Bay. "I became involved with the local transit commission because I use the system every day." In addition to commuting to her classes six times per week, Betty also regularly uses the system for shopping, social events and traveling to the area she most enjoys –nature. "Bay Beach is one of my favorite locations. The transportation system here in Green Bay really can be a way of life. When we live in a world where consumption is often out of bounds with our resources, it is refreshing to know that there is a convenient alternative that meets our needs."

3.3 Ridership

Ridership is a pivotal assumption in the model. Under or overestimation of the ridership figures will cause the ultimate model results to be inaccurate in similar proportion. In order to reach a base figure for annual public transportation ridership in Wisconsin, HLB began with the revenue generating rides recorded by the Wisconsin Department of Transportation. The total revenue generating ridership for the 2002 year was 73,133,315. This, however, does not represent the total number of public transit trips provided in the state. There are additional trips, which are not revenue generating, that must be included in the final ridership figure to accurately describe the benefits of public transit to the state. The National Transit Database provides records of total ridership figures, revenue and non-revenue generating, for the largest transportation systems across the nation. The eighteen largest transportation systems in Wisconsin are included in the database (2001). The selected areas were thus adjusted to include the non-revenue generating trips. These areas alone account for the vast majority of transit trips in Wisconsin, some 97% of ridership. For the smaller transportation systems across the state, Wisconsin DOT revenue generating counts were used as a best conservative estimation. The final ridership value used in the modeling process was thus 98,961,000.

3.4 Retail, Recreation and Tourism Purpose Trips

The HLB model first analyzed the benefits according to community size (small, medium, large, as described in 3.1.1). Thus, the distribution of retail, recreation and tourism purpose trips was defined separately for each area. It should be noted that the values chosen differ from the raw statistics of the rider survey. After an analysis of the surveys it was discovered that many of the 10.1% of individuals who chose the purpose "other" were actually over specifying a trip that would be more appropriately categorized into one of the existing categories. Examples given such as: library, school, church, counseling, welfare, and physical therapy could all be easily categorized into one of the other purposes. The "other" category was thus eliminated with the 10.1% proportionally distributed among the other areas. The ultimate modeling distributions chosen for retail, recreation or tourism purposes for each area type are as follows.

Table 4:Transit Trips for Recreation, Retail or Tourism Purpose

System	Median	Low 10%	High 10%
Large	17.84%	16.88%	18.80%
Medium	28.77%	24.83%	32.71%
Small	16.30%	12.86%	19.75%

3.5 Forgone Trips

The on board survey indicated that on average 36.8% of individuals statewide would choose to make less trips for retail, recreation or tourism purposes if public transit were unavailable. It is assumed that these individuals would make 75% of their current trips in the absence of public transit.[5] There were also 9.1% of respondents who indicated that they would switch to shopping via internet or by catalogue. As indicated previously, separate distributions were developed for each system size. These results for these responses were thus combined at the system level in order to arrive at a figure for foregone trips. 11.5% was the determined statewide average.

[5] Based on prior research and interviews by HLB.

3.6 Alternatives Modes Used in the Absence of Transit

Table 3 gives an indication of the transportation modes that would be substituted if public transportation were unavailable for retail, recreation and tourism purposes. As mentioned in section 4.2 adjustments were made to the raw survey statistics to obtain the most realistic approximation of behavioral patterns in the absence of public transit. Table 5 presents the median values for alternative modes used in the modeling process.

Table 5: Alternative Modes Used in Absence of Transit

Alternative	System Size		
	Small	Medium	Large
Personal Vehicle	50.00%	35.00%	48.30%
Bicycle or Walking	12.50%	30.00%	30.00%
Taxi	37.50%	35.00%	21.70%

3.7 Transportation Costs

Transportation Costs for each mode of transportation were based upon three generalized costs: out of pocket costs, time costs and accident costs. Out of pocket cost were estimated on a per trip basis. Time costs were calculated by using the average trip length, average speed for the given mode and a valuation of the time expenditure. Accident costs were derived from published accident statistics, and the estimated losses from such incidents per mile traveled. The total estimated transportation costs per trip are given in table 6 for the various modes.

Table 6: Generalized Cost of Trip by Mode and System

	System Size		
Mode	**Small**	**Medium**	**Large**
Transit	$ 5.74	$ 5.50	$ 5.61
Personal Car	$ 11.11	$ 11.17	$ 12.55
Bicycle or Walking	$ 3.33	$ 3.33	$ 3.33
Taxi	$ 16.14	$ 19.42	$ 21.39
School Bus or Shuttle	$ 5.70	$ 5.70	$ 5.70
EMS	$ 294.33	$ 319.81	$ 332.89

3.8 Alternative Scenarios

In addition to the distributions and assumptions defined above through a consideration of all input sources, the model also allowed for the testing of the values as given directly by individual sources, such as the panel opinions. The values defined above are the most appropriate values, as they consider input from all sources. The alternative cases were used simply to test the results for robustness, in making sure that the results were not overly sensitive to any one variable on which there were conflicting distributions from the various input sources.

4. TRANSIT BENEFITS RESULTING FROM ACCESS TO RETAIL, RECREATION AND TOURISM

The following results were determined using HLB's benefit measurement methodology given the assumption distributions that were presented in Chapter 3.

4.1 Ridership by System

There are approximately 18 million annual trips on public transit in the State of Wisconsin that are for retail, recreation or tourism purposes (Table 7).

Table 7: Retail, Recreation and Tourism Purpose Ridership

Retail, Recreation and Tourism Purpose Trips		
System	**Percent in System**	**Number of Trips**
Small	16.3%	105,000
Medium	28.8%	920,000
Large	17.8%	16,965,000
Total	**18.2%**	**17,990,000**

The model results indicate that public transportation provides 2.07 million trips for retail, recreation or tourism purposes that would not have been made if the transit system did not exist.

4.2 Total Cost Savings

Table 8 shows the benefit of public transit assumed by transit users amounts to a savings of some $112.76 million for retail, recreation and tourism purpose trips. This is the generalized cost that users would have to pay by switching to their chosen alternative in the absence of transit service.

Table 8:Total Cost Savings to the Retail, Recreation and Tourism Sector (Millions of Dollars)

Savings	**Regions**		
	Small	**Medium**	**Large**
Consumer Surplus	$0.60	$5.74	$106.42
Total Savings Across Systems			**$112.76**

With a total annual cost savings of $112.76 million and an annual ridership of 17.99 million retail, recreation or tourism purpose trips, the average savings per trip on public transit for such purposes is $6.27.

4.3 Economic Impact of Out of Pocket Savings

In addition to the above, HLB carefully considers the employment, output and tax effects of the out of pocket savings from retail, recreation, and tourism transit. We note, however, that it is extremely difficult to ascertain incremental (as distinct from transfer) effects in relation to these factors. Glib accounting for such effects is often the demise of Benefit-Cost Studies and HLB counsels great care. Our typical approach is to separate these impacts to comment as carefully as possible on their impact (needed for valid inclusion in the analysis) and demonstrate their influence on the results in "what-if" modality. Because of the difficulty in separating the incremental and transfer portion of these factors, their impacts are not included in the concluding benefit values, but are instead presented in solely in this section of the report.

Through the utilization of the IMPLAN© modeling process it was determined that retail, recreation and toursim transit riders, by spending their out of pocket transportation savings elsewhere, generate 2,250 jobs, $211.36 million in output and $31.47 million in total tax revenue. As the out of pocket savings is spent on items such as housing, food, manufactured goods, and other expenditures, the new economic activity has a rippling effect. New spending allows the affected industries to increase their employment levels and in turn increase orders from their suppliers, who are then able to do the same. IMPLAN© keeps detailed statistics on the interactions of industrial sectors, and is thus able to map how the increased spending moves through the economy while generating the impacts illustrated in table 9.

Table 9: Impact of Out of Pocket Education Transportation Savings

	Direct	Indirect	Induced	Total
Employment	1,183	485	582	2,250
Output	$111,310,000	$47,570,000	$52,470,000	$211,360,000
Tax Revenue	$16,550,000	$6,780,000	$8,140,000	$31,470,000

The direct effects of the increased spending occur in sectors of the economy where transit riders directly spend the out of pocket savings. Indirect effects are secondary as a result of increased orders to suppliers. Induced effects are tertiary and are as a result of increased wages in the direct and indirect industries. (For more detailed results see Appendix D.)

4.4 Risk Analysis

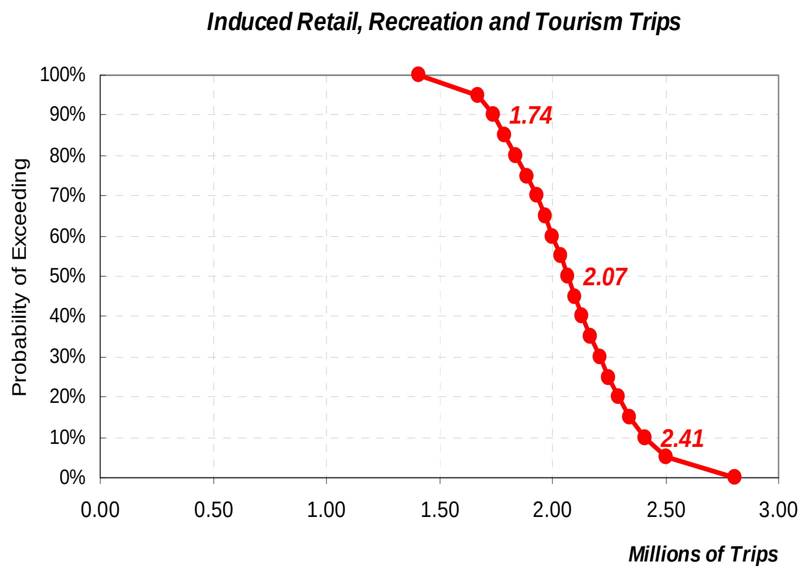
In addition to the point estimates it is important to note the range of possibilities that may occur with the associated likelihoods. Throughout the modeling process inputs were measured as probability distributions rather than point estimates so that final probability distributions relating to the retail, recreation and tourism sector could be determined. While the previously listed point estimates are all based upon mean expected values, the following decumulative probability charts show the probability the "real value" exceeds the value presented on the horizontal axis, given the initial modeling assumptions. For further information on how the Risk Analysis Process is conducted see Appendix B.

4.4.1 Trips Induced by the Existence of Public Transit

The following are the risk analysis results shown as a decumulative probability graph indicating the range of the number of induced trips at different probability levels. Figure 4 shows that while the expected number of induced trips in 2002 is estimated at 207 million, there is a 10% probability that the number could be as high as 241 million.

Figure 4: Risk Analysis of Induced Retail, Recreation and Tourism

Probability of Exceeding	Induced Retail, Recreation and Tourism Trips (Millions of Trips)
100%	1.41
95%	1.67
90%	1.74
85%	1.79
80%	1.84
75%	1.89
70%	1.93
65%	1.97
60%	2.00
55%	2.04
50%	2.07
45%	2.10
40%	2.13
35%	2.17
30%	2.21
25%	2.25
20%	2.29
15%	2.34
10%	2.41
5%	2.50
0%	2.81
Mean Expected Value	**2.07**

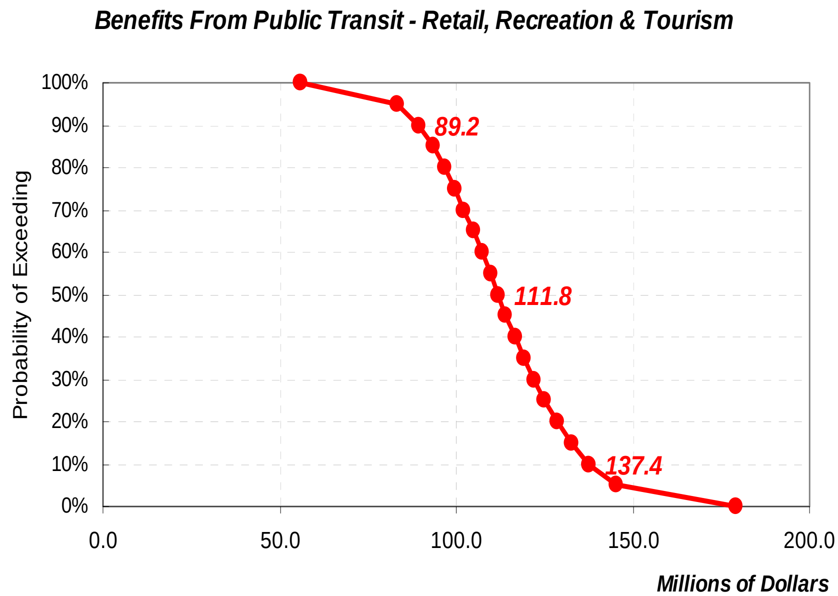


4.4.2 Total Benefits to the Retail, Recreation and Tourism Sector

Similarly to the number of trips shown above, a risk analysis was conducted to estimate the overall retail, recreation and tourism sector benefits at different probability levels. The following decumulative probability graph indicates that there is a 50% probability that the total benefit from public transit to the education sector exceeds $111.8 million and that these benefits reach over $137.4 million at the 10% probability level.

Figure 5: Risk Analysis of Total Benefits to Retail, Recreation and Tourism

Probability of Exceeding	Benefits From Public Transit - Retail, Recreation & Tourism (Millions of Dollars)
100%	56.1
95%	83.2
90%	**89.2**
85%	93.3
80%	96.6
75%	99.6
70%	102.2
65%	105.1
60%	107.5
55%	109.7
50%	**111.8**
45%	114.1
40%	116.7
35%	119.3
30%	122.0
25%	125.1
20%	128.5
15%	132.5
10%	**137.4**
5%	145.3
0%	179.1
Mean Expected Value	**112.8**



CONCLUSION

Public transit affords benefits to various groups for retail, recreation or tourism purposes. Not only do the riders benefit in cost savings terms, but the community at large also gains from having youth engaged in productive recreation programs, seniors accessing social centers, and the community as a whole being able to reach shopping centers as well as attend cultural and entertainment events. Retail stores, entertainment centers, as well as those who use their services all benefit from the transit service within the community.

In addition to the benefits presented in dollar figures, it must also be noted that the quality of goods and services provided depend greatly on the ability of business establishments being able to cater to a large clientele. By locating in areas easily accessible to transit riders stores are able to attract a variety of customers, which allows them to offer a more diverse product line. By serving more clients stores can provide better quality products at a lower cost to consumers.

The existence of public transit affords considerable benefit in cost savings to individuals who use the system rather than a higher cost alternative for retail, recreation or tourism purposes. For every trip that is made on Wisconsin public transportation for such purposes there is a corresponding $6.27 savings to consumers. Such savings is realized in out of pocket, time and accident costs. In total, public transit in Wisconsin affords a total benefit of $112.76 million in cost savings to transit users of this category.

However, these are not the only individuals who benefit due to the existence of public transit. There is an additional class of riders who would not make the retail, recreation or tourism trip if it were not for transit service. Rather than switching to a higher cost alternative, their trips would simply be forgone. Access to centers of such activity is one measure of the quality of life in a given community; within the State of Wisconsin 2.07 million such trips would be forgone without the availability of transit services.

Table 10: Model Results and Confidence Limits

Benefits of Transit to Retail, Recreation & Tourism	Mean Expected Value	Lower 10% Confidence Limit	Upper 10% Confidence Limit
Number of Induced Trips (in millions)	2.07	1.74	2.41
Total Benefit to the Sector (in millions)	$112.76	$89.19	$137.36
Per Trip Benefit	$6.27	$4.97	$7.61

Although the mean expected values presented are the best single value estimates of benefits to the retail, recreation and tourism sector from transit, the 80% confidence intervals presented in table 10 give the best illustration of the upside of these benefits. In fact, while the total benefit to the healthcare sector from transit is most probably near $112.76 million for 2002 alone, there is a 10% probability that the benefits can be as high as $137.36 million for the year.

APPENDIX A: WISCONSIN COMMUNITIES WITH TRANSIT SYSTEMS

City	Total Population	Community Size	Transit System	Region
Appleton[6]	70,087	Large	Large Bus	East
Baraboo	10,711	Medium	Shared-Ride Taxi	Center
Beaver Dam	15,169	Medium	Shared-Ride Taxi	East
Beloit	35,775	Medium	Large Bus	Center
Berlin	5,305	Small	Shared-Ride Taxi	Center
Black River Falls	3,618	Small	Shared-Ride Taxi	West
Chippewa Falls	12,925	Medium	Shared-Ride Taxi	West
Clintonville	4,736	Small	Shared-Ride Taxi	East
Eau Clair County	93,142	Large	Large Bus	West
Edgerton	4,933	Small	Shared-Ride Taxi	Center
Fond du Lac	42,203	Medium	Small Bus	East
Fort Atkinson	11,621	Medium	Shared-Ride Taxi	East
Grant County	49,597	Medium	Shared-Ride Taxi	West
Green Bay	102,313	Large	Large Bus	East
Hartford	10,905	Medium	Shared-Ride Taxi	East
Janesville	59,498	Large	Large Bus	Center
Jefferson	7,338	Small	Shared-Ride Taxi	East
Kenosha	90,352	Large	Large Bus	East
La Crosse	51,818	Large	Large Bus	West
Ladysmith	3,932	Small	Small Bus	West
Lake Mills	4,843	Small	Shared-Ride Taxi	East
Madison	**208,054**	**Large**	**Large Bus**	**Center**
Manitowoc	34,053	Medium	Small Bus	East
Marinette	11,749	Medium	Shared-Ride Taxi	East
Marshfield	18,800	Medium	Shared-Ride Taxi	Center
Mauston	3,740	Small	Shared-Ride Taxi	Center
Medford	4,350	Small	Shared-Ride Taxi	Center
Menominee Tribe	**4,562**	**Small**	**Rural Bus**	**East**
Merrill	**10,146**	**Medium**	**Small Bus**	**Center**
Milwaukee County	**940,164**	**Large**	**Large Bus**	**East**
Monona	8,018	Small	Large Bus	Center
Monroe	10,843	Medium	Shared-Ride Taxi	Center
Neillsville	2,731	Small	Shared-Ride Taxi	West
New Richmond	6,310	Small	Shared-Ride Taxi	West
Onalaska	14,839	Medium	Shared-Ride Taxi	West
Oneida Town	4,001	Small	Rural Bus	East
Oshkosh	62,916	Large	Large Bus	East
Ozaukee County	82,317	Large	Commuter/Shared-Ride Taxi	East
Platteville	9,989	Small	Shared-Ride Taxi	West
Plover village, Portage County	10,520	Medium	Shared-Ride Taxi	Center
Port Washington	10,467	Medium	Shared-Ride Taxi	East
Portage	9,728	Small	Shared-Ride Taxi	Center
Prairie du Chien	6,018	Small	Shared-Ride Taxi	West
Prairie du Sac village	3,231	Small	Shared-Ride Taxi	Center

6 The Fox Cities metropolitan region (population 188,000) includes the following communities: City of Appleton, City of Kaukauna, City of Menasha, City of Neenah, Town of Buchanan, Town of Grand Chute, Town of Menasha, Village of Kimberly, and Village of Little Chute.

City	Total Population	Community Size	Transit System	Region
Racine	81,855	Large	Large Bus/Commuter	Center
Reedsburg	7,827	Small	Shared-Ride Taxi	Center
Rhinelander	7,735	Small	Shared-Ride Taxi	Center
Rice Lake	8,320	Small	Small Bus	West
Ripon	6,828	Small	Shared-Ride Taxi	Center
River Falls	**12,560**	**Medium**	**Shared-Ride Taxi**	**West**
Rusk County	15,347	Medium	Rural Bus	West
Sawyer County	16,196	Medium	Rural Bus	West
Shawano	8,298	Small	Shared-Ride Taxi	East
Sheboygan	50,792	Large	Large Bus	East
Stevens Point	24,551	Medium	Small Bus	Center
Stoughton	12,354	Medium	Shared-Ride Taxi	Center
Sun Prairie	20,369	Medium	Shared-Ride Taxi	Center
Superior	27,368	Medium	Large Bus	West
Viroqua	**4,335**	**Small**	**Shared-Ride Taxi**	**West**
Washington County	117,493	Large	Commuter/Shared-Ride Taxi	East
Waterloo	3,259	Small	Shared-Ride Taxi	East
Watertown	21,598	Medium	Shared-Ride Taxi	East
Waukesha City	64,825	Large	Large Bus	East
Waukesha County	360,767	Large	Large Bus	East
Waupaca	5,676	Small	Shared-Ride Taxi	East
Waupun	10,718	Medium	Shared-Ride Taxi	East
Wausau	38,426	Medium	Large Bus	Center
West Bend	28,152	Medium	Shared-Ride Taxi	East
Whitewater	13,437	Medium	Shared-Ride Taxi	East
Wisconsin Rapids	18,435	Medium	Shared-Ride Taxi	Center

* *Survey communities are in shaded boxes.*

APPENDIX B: RISK ANALYSIS PROCESS

Economic forecasts traditionally take the form of a single "expected outcome" supplemented with alternative scenarios. The limitation of a forecast with a single expected outcome is clear -- while it may provide the single best statistical estimate, it offers no information about the range of other possible outcomes and their associated probabilities. The problem becomes acute when uncertainty surrounding the forecast's underlying assumptions is material.

A common approach is to create "high case" and "low case" scenarios to bracket the central estimate. This scenario approach can exacerbate the problem of dealing with risk because it gives no indication of likelihood associated with the alternative outcomes. The commonly reported "high case" may assume that most underlying assumptions deviate in the same direction from their expected value, and likewise for the "low case." In reality, the likelihood that all underlying factors shift in the same direction simultaneously is just as remote as that of everything turning out as expected.

Another common approach to providing added perspective on reality is "sensitivity analysis." Key forecast assumptions are varied one at a time in order to assess their relative impact on the expected outcome. A problem here is that the assumptions are often varied by arbitrary amounts. A more serious concern with this approach is that, in the real world, assumptions do not veer from actual outcomes one at a time. It is the impact of simultaneous differences between assumptions and actual outcomes that is needed to provide a realistic perspective on the riskiness of a forecast.

Risk Analysis provides a way around the problems outlined above. It helps avoid the lack of perspective in "high" and "low" cases by measuring the probability or "odds" that an outcome will actually materialize. This is accomplished by attaching ranges (probability distributions) to the forecasts of each input variable. The approach allows all inputs to be varied simultaneously within their distributions, thus avoiding the problems inherent in conventional sensitivity analysis. The approach also recognizes interrelationships between variables and their associated probability distributions.

The Risk Analysis Process involves four steps:

Step 1: Define the structure and logic of the forecasting problem;

Step 2: Assign estimates and ranges (probability distributions) to each variable and forecasting coefficient in the forecasting structure and logic;

Step 3: Engage experts and stakeholders in assessment of model and assumption risks (the "RAP Session"); and

Step 4: Issue forecast risk analysis.

Step 1: Define Structure and Logic of the Forecasting Problem

A "structure and logic model" depicts the variables and cause and effect relationships that underpin the forecasting problem at-hand (See Figure 1). Although the structure and logic model is written down mathematically to facilitate analysis, it is also depicted diagrammatically in order to permit stakeholder scrutiny and modification in Step 3 of the process.

Step 2: Assign Central Estimates and Conduct Probability Analysis

Each variable is assigned a central estimate and a range (a probability distribution) to represent the degree of uncertainty. Special data sheets are used to record the estimates. The first column gives an initial median while the second and third columns define an uncertainty range representing an 80 percent confidence interval. This is the range within which there exists an 80 probability finding the actual outcome. The greater the uncertainty associated with a forecast variable the wider the range.

Figure 6: Example of Data Sheet

Variable	Median	10% Lower Limit	10% Higher Limit
Percentage of trips for healthcare purpose	10.5%	9.3%	10.8%

Probability ranges are established on the basis of both statistical analysis and subjective probability. Probability ranges need not be normal or symmetrical -- that is, there is no need to assume the bell shaped normal probability curve. The bell curve assumes an equal likelihood of being too low and being too high in forecasting a particular value. It might well be, for example, that if a projected percentage deviates from expectations; circumstances are such that it is more likely to be higher than the median expected outcome than lower.

The RAP computer program transforms the ranges as depicted above into formal probability distributions (or "probability density functions"). This liberates the non-statistician from the need to appreciate the abstract statistical depiction of probability and thus enables stakeholders to understand and participate in the process whether or not they possess statistical training.

From where do the central estimates and probability ranges for each assumption in the forecasting structure and logic framework come? There are two sources. The first is an historical analysis of statistical uncertainty in all variables and an error analysis of the forecasting "coefficients." "Coefficients" are numbers that represent the measured impact of one variable (say, income) on another (such as retail sales). While these coefficients can only be known with uncertainty, statistical methods help uncover the magnitude of such error (using diagnostic statistics such as "standard deviation," "standard error," "confidence intervals" and so on).

The uncertainty analysis outlined above is known in the textbooks as "frequentist" probability. The second line of uncertainty analysis employed in risk analysis is called "subjective probability" (also called "Bayesian" statistics, for the mathematician Bayes who developed it). Whereas a frequentist probability represents the measured frequency with which different outcomes occur (i.e., the number of heads and tails after thousands of tosses) the Bayesian probability of an event occurring is the degree of belief held by an informed person or group that it will occur. Obtaining subjective probabilities is the subject of Step 3.

Step 3: Conduct Expert Evaluation: The RAP Session

Step 3 involves the formation of an expert panel and the use of facilitation techniques to elicit, from the panel, risk and probability beliefs about:

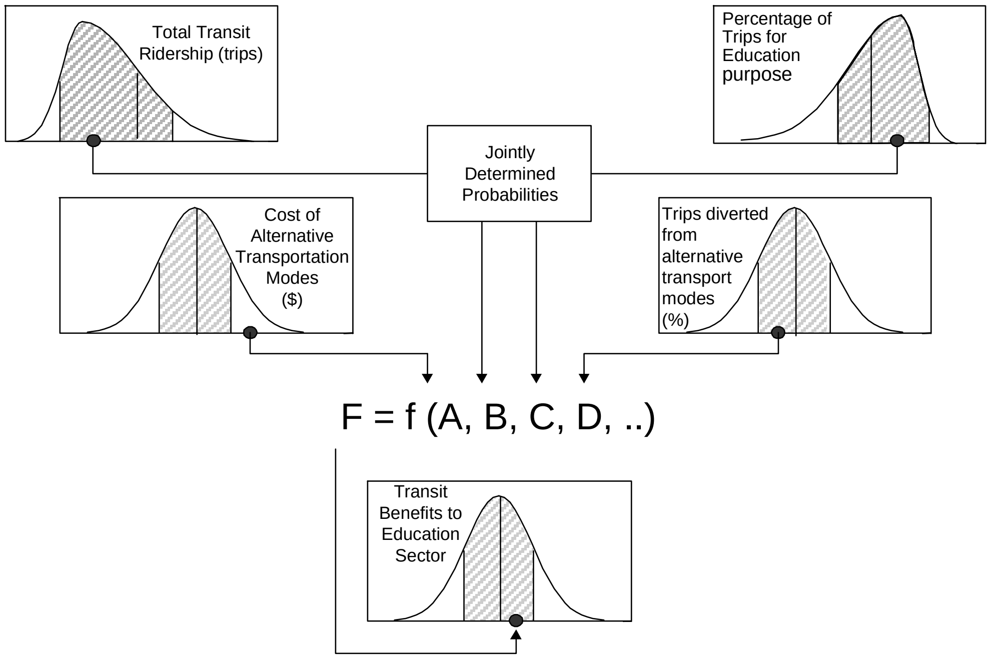
- The structure of the forecasting framework; and
- The degree of uncertainty attached to each variable and forecasting coefficient within the framework.

In (1), experts are invited to add variables and hypothesized causal relationships that may be material, yet missing from the model. In (2), panelists are engaged in a discursive protocol during which the frequentist-based central estimates and ranges, provided to panelists in advance of the session, are modified according to subjective expert beliefs. This process is aided with an interactive "groupware" computer tool that permits the visualization of probability ranges under alternative belief systems.

Step 4: Issue Risk Analysis

The final probability distributions are formulated by the risk analyst (HLB) and represent a combination of "frequentist" and subjective probability information drawn from Step 3. These are combined using a simulation technique (Monte Carlo analysis) that allows each variable and forecasting coefficient to vary simultaneously according to its associated probability distribution (see Figure 7).

Figure 7: Combining Probability Distributions



The end result is a central forecast, together with estimates of the probability of achieving alternative outcomes given uncertainties in underlying variables and coefficients (as presented in Figures 4 and 5, Results).

APPENDIX C: EXPERTS THAT PARTICIPATED AT THE RISK ANALYSIS WORKSHOP

Ingrid Rothe
Researcher, Institute for Research on Poverty
University of Wisconsin - Madison

Dr. Edward Beimborn
Director, Center for Urban Transportation Studies
University of Wisconsin-Milwaukee

Joe Caruso
Marketing Director
Milwaukee County Transit

Sharon Persich
Planning Manager
Metro Transit, Madison

Susan Lemke
Transit Manager
Stevens Point Transit

Mark Jones
Manager
Abby Vans, Inc., Neillsville

Beverly Scott (No show)
President
Top Hat Inc., La Crosse/River Falls

Ken Yunker
Deputy Director
Southeastern WI Regional Planning Commission, Waukesha

Dixon Nuber
Director
University of WI - Milwaukee School of Continuing Studies

Pat McGinty
Title: President
Brown Cab Service, Inc., Fort Atkinson

Chuck Kamp
General Manager
Valley Transit, Appleton

Greg Seubert
Transit Director
Wausau Area Transit System

Ann Gullickson
Transit Service Manager
Metro Transit, Madison

Anita Gullota-Connelly
Director of Administration
Milwaukee County Transit System

Bob Johnson
Transit Director
Waukesha Metro Transit

John Etzler
Public Transit Section
WI Dept of Transportation

David Vickman
Public Transit Section
WI Dept of Transportation

APPENDIX D: ECONOMIC IMPACT OF TRANSPORTATION SAVINGS BEING RE-SPENT IN THE WISCONSIN ECONOMY

The following impact tables were generated using Input/Output modeling techniques of IMPLAN© in order to measure the effect of the spending the transportation savings of households in the Wisconsin economy. Table 11 indicates the additional output in the major sectors of Wisconsin economy, while Table 12 illustrates the change in employment.

Table 11: Retail, Recreation & Tourism Transportation Savings - Output Impact

Output Impact				
Impact of Retail, Recreation and Tourism Transportation Savings Being Re-spent in the Economy (2003 Dollars)				
Industry	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	667,872	1,040,919	502,133	2,210,924
Mining	0	87,134	31,080	118,214
Construction	0	1,900,513	610,224	2,510,738
Manufacturing	21,037,970	14,654,313	11,902,597	47,594,880
TCPU	7,569,214	5,106,980	4,387,712	17,063,906
Trade	20,370,092	3,878,044	9,807,279	34,055,412
FIRE	23,264,210	7,165,198	10,382,715	40,812,124
Services	35,285,892	12,622,861	13,850,622	61,759,372
Government	890,496	1,118,518	995,195	3,004,208
Other	2,226,240	0	0	2,226,240
Institutions	0	0	0	0
Total	**111,311,985**	**47,574,480**	**52,469,556**	**211,356,018**

Table 12: Retail, Recreation & Tourism Transportation Savings - Employment Impact

Employment Impact				
Impact of Retail, Recreation and Tourism Transportation Savings Being Re-spent in the Economy				
Industry	**Direct**	**Indirect**	**Induced**	**Total**
Agriculture	10.4	16.2	7.8	34.5
Mining	0	0.6	0.2	0.8
Construction	0	14.7	4.7	19.4
Manufacturing	100.8	70.2	57	228.1
TCPU	44.7	30.9	28.2	103.8
Trade	374.5	71	176.7	622.1
FIRE	102.1	43.3	49.6	195
Services	607.9	217.5	238.6	1,064.00
Government	16.7	20.9	18.6	56.2
Other	-74.3	0	0	-74.3
Institutions	0	0	0	0
Total	**1,182.70**	**485.3**	**581.5**	**2,249.60**