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ECONOMIC AND COMMUNITY BENEFITS OF LOCAL BUS TRANSIT SERVICE (PHASE TWO)

Case Study: Statewide Analysis

July 28, 2010

HDR | Decision Economics

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CASE STUDY: STATEWIDE ANALYSIS

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1. EXECUTIVE SUMMARY

More than 100 million trips are made on public transit annually in Michigan. These trips satisfy the mobility needs of numerous households for whom owning and driving a vehicle is not an effective or affordable transportation option. While the direct benefits of transit to its users are clear, it is generally accepted that the overall benefits of these trips extend beyond just transit riders. Through improved mobility, safety, air quality and economic development, public transit also benefits users of the roadway network and the community at large.

Therefore, while each dollar spent on public transit results in a dollar's worth of service being delivered to consumers of that service, there are additional benefits that extend beyond the service being delivered. These additional benefits are divided into two broad categories: social benefits and economic impacts.[1] The social benefits of transit can be further broken down into:

- *Transportation cost savings*, which consist of out-of-pocket cost savings (e.g., vehicle ownership and operating cost savings), travel time cost savings, accident cost savings and environmental emissions cost savings; and

- *Low-cost mobility benefits*, which consist of affordable mobility benefits (the economic value to access services such as healthcare, education and retail for transit dependent people) and cross-sector benefits (budget savings for welfare and social services, such as unemployment and homecare, due to the presence of transit).

In addition to the social benefits are the impacts on the State economy resulting from:

- Transit operating and maintenance expenses; and

- The re-spending of a portion of out-of-pocket cost savings that are accruing to transit riders.

This report presents a quantitative analysis of the social benefits and economic impacts of transit for the State of Michigan in 2008. For the purpose of the report, public transit includes 79 individual agencies that receive operating assistance from the Michigan Department of Transportation. All but nine of the 83 counties in the State are served by these 79 transit agencies and each of these 74 counties have some form of demand response service (the other nine counties have specialized transportation services only). Eighteen of the 74 counties also provide fixed route service. Sixty of the 74 counties provide countywide service with varying service levels. Operating and maintenance costs are covered by a mixture of federal, state and local funds in addition to farebox revenues. The report employs methods developed by HDR Decision Economics for the Federal Transit Administration (FTA) with data compiled in the Public Transportation Management System (PTMS). The main conclusions are listed below.

[1] Please note that when the term "overall benefits" is used in this document it refers to both social benefits and economic impacts.

Transit Saves Money for Riders

- ✓ *Reduces the cost of transportation* – When people use public transit instead of a more costly alternative (personal car or taxi) they save money, which in turn can be spent on food, healthcare, housing and other staples. In 2008, out-of-pocket cost savings totaled $348.8 million for riders in Michigan.

> *"Public transportation helps many who medically or financially can't drive. It is a very vital part of the community."*
>
> — A Michigan transit rider

- ✓ *Increases tax savings for commuters* – The 2009 American Recovery and Reinvestment Act (ARRA) raised the monthly limit commuters can deduct from their paychecks on a pre-tax basis from $120 to $230 to pay for their commute. Employers who enroll in the program also save money since this transit benefit cap is not subject to payroll taxes.

Transit Alleviates Traffic Congestion

- ✓ *Shortens commutes* – Investing in public transit is an effective congestion management strategy. A full bus can take more than 30 cars off the road. The choice of transportation mode for commute helps reduce congestion delays during rush hours.

- ✓ *Frees up time for other activities* – Thanks to public transit, travelers saved more than 17.5 million person hours of travel in 2008. This means more time spent with families, at work and on other activities (such as shopping and recreation) that can also generate revenue. Overall, the economic value of travel time savings is estimated at $340.4 million.

Transit Saves Lives

- ✓ *Lowers the risk of accidents* – In general, transit riders are less likely to be involved in a crash than those who use personal vehicles. Thus transit use reduces the number of injuries and deaths on the road and their related costs (medical treatment, police services, property damage, etc.).[2]

[2] As shown in the summary table on page 8, safety benefits were negative in 2008. There are structural and circumstantial reasons for this:

- Although public transit is typically safer than personal vehicles, this is truer for rail than for bus. Apart from Detroit Transportation Corporation, transit agencies in Michigan do not provide rail service.
- Safety benefits are sensitive to the amount of foregone travel: the higher the percentage of trips foregone in the absence of public transit, the higher the likelihood that safety benefits will be negative.
- Safety benefits are also very sensitive to the number of fatalities because of their high cost ($4.2 million per fatality). If the total number of transit fatalities had been reduced by two, safety benefits would have amounted to -$0.4 million.
- Traffic fatalities were down by 9.6 percent in Michigan in 2008, partly because of a reduction in travel due to socio-economic factors (economic recession and decline in population). The death rate per 100 million miles traveled was the lowest ever recorded at 0.97, putting Michigan among the 10 safest states to drive in the United States.
- Only a handful of transit agencies displayed large negative safety benefits. Most agencies actually generated positive safety benefits.

- ✓ *Reduces respiratory and other air pollution-related illnesses* – By reducing emissions of air pollutants, public transit reduces air pollution-related illnesses such as asthma, chronic obstructive pulmonary disease and lung cancer.

Transit Expands Mobility

- ✓ *Facilitates access to jobs and medical care* – Over 40 percent of trips made by transit patrons in Michigan are for work or medical purposes. A number of those patrons (especially those with low income, no access to a car, or with disabilities) rely entirely on public transit for their mobility needs. If public transit was no longer available they would have no choice but to forego their trips. The economic value of those foregone trips is estimated at $67.6 million in 2008. Some patrons would also require homecare or they would no longer be able to go to work. Thus, an estimated $56.6 million in cross-sector benefits (i.e., homecare cost savings and welfare cost savings) in 2008 are attributable to public transit.

> *"Dial-A-Ride has helped a lot. I recently lost my car and need transportation for me and my children."*
>
> — A Michigan transit rider

- ✓ *Provides greater access to education* – Over a quarter of trips made by transit patrons are for education purposes. In the absence of public transit, more than 16 thousand students would not be able to attend school or college.

Transit Brings the Community Together

- ✓ *Provides a vital transportation link for senior citizens and persons with disabilities* – Public transit ensures that persons with disabilities and the growing number of senior citizens remain actively involved in their communities and have access to the full range of facilities and services. Many transit agencies in Michigan offer discounted fares to senior citizens and provide complementary ADA paratransit service to persons with disabilities.

> *"I would not be able to travel with a disabled person if bus was not available."*
>
> — A Michigan transit rider

- ✓ *Expands social and recreational opportunities in rural areas* – More than two thirds of public transit agencies in Michigan are located in rural areas. Many of them are participating in community-sponsored events and programs such as Meals-on-Wheels.

Transit Stimulates the Economy

- ✓ *Creates jobs in Michigan* – For every 10 jobs created in the public transit sector, 6 additional jobs are created in the rest of the economy as a result of the multiplier effect. It is estimated that transit operations sustained more than 9,200 jobs and contributed about $1.08 billion in economic output in Michigan in 2008. Moreover, the re-spending of a portion of out-of-pocket cost savings by transit riders added $264.4 million to the Michigan economy.

- ✓ *Encourages economic development* – Public transportation facilities and corridors act like a catalyst to economic development – in the form of more job opportunities, higher income, addition to the tax base, increased productivity and property value appreciation – thereby helping build strong, stable, livable neighborhoods.

Transit Protects the Environment

- ✓ *Improves air quality* – By taking cars off the road, public transit can decrease vehicular emissions of air pollutants such as volatile organic compounds and nitrogen oxides, the principal contributors to smog, as well as carbon monoxide and sulfur dioxide.[3]

- ✓ *Fights global warming* – New technologies (hybrid engines) and cleaner energy sources (compressed natural gas and electricity) help reduce vehicular emissions of carbon dioxide (CO_2), one of the main greenhouse gases that contribute to global warming.

Overall, public transit contributed nearly $805 million in benefits to Michigan communities in 2008. These benefits exceeded transit operating and maintenance (O&M) costs by as much as $252 million. In other words, transit agencies in Michigan delivered $1.46 of economic value for each dollar spent on providing transit services. This value was in addition to the actual transportation service provided to the individual consumers of that service.

Public transit also contributed to economic activity through O&M expenses as well as through the re-spending of out-of-pocket cost savings by riders. The combined output impact is estimated at $1.34 billion in 2008.

Although this study attempted to assess the benefits of transit in a comprehensive manner, it does not account for some benefits (such as land use impacts and agglomeration economies) that *could* arise in some urban systems. These other benefits are very difficult to quantify, even at the corridor level. Therefore, the results presented in this report can be considered as somewhat conservative.

[3] Please note that environmental emission cost savings are difficult to quantify accurately at the agency level and therefore were not estimated as part of this case study.

Summary of Results

SOCIAL BENEFITS	
Transportation cost savings	
Riders' out-of-pocket cost savings (thousands)	$348,811
Travel time savings (thousands)	$340,382
Accident cost savings (thousands)	-$8,787
Transportation cost savings – subtotal (thousands)	**$680,407**
Low cost mobility benefits	
Affordable mobility benefits (thousands)	$67,602
Cross-sector benefits (thousands)	$56,637
Low-cost mobility benefits – subtotal (thousands)	**$124,239**
TOTAL social benefits of public transit (thousands)	**$804,646***

Total passenger trips (thousands)	**100,441**
Total transit O&M expenses (thousands)	**$552,181**
Social benefits per trip	**$9.23**
Social benefits per dollar spent on transit O&M	**$1.46**

ECONOMIC IMPACTS	
Job impact of transit operations	9,283
Job impact of out-of-pocket cost savings	2,186
TOTAL job impact	**11,469**
Output impact of transit operations (thousands)	$1,077,567
Output impact of out-of-pocket cost savings (thousands)	$264,412
TOTAL output impact (thousands)	**$1,341,979***

** HDR advises against adding these two numbers because they result from two different analyses.*

2. INTRODUCTION

In its continuous effort to foster better governmental decision making and planning for public transportation, the Michigan Department of Transportation (MDOT) has commissioned HDR Decision Economics (HDR) to build a model to estimate the economic and community benefits of local bus transit service.

The study consists of two phases. Phase One focuses on the development of an economic model to measure the economic and community benefits of local bus transit service in Michigan. Phase Two deals with the implementation of the model and the assessment of benefits for a sample of representative agencies and under various scenarios.

As part of the implementation of the transit benefit model (Phase Two), HDR has been tasked by MDOT to conduct a minimum of five case studies that would illustrate the benefits of transit at different geographical or jurisdictional levels. A case study has been conducted for all transit agencies at the state level.

2.1 Case Study Objectives

This case study serves three main purposes:

- Demonstrate how the HDR model can be used to estimate the economic and community benefits of local bus transit service in Michigan;
- Assess the benefits of transit for the State of Michigan using 2008 data;
- Document the analysis results in non-technical terms so they can be easily understood by the general public and effectively communicated by policy makers, planners and transportation managers for education, marketing, policy or planning purposes.

2.2 Plan of the Report

This report documents the results of the case study. Following this introduction, Chapter 3 gives an overview of the model, explains the technical approach and discusses the model inputs used to estimate the benefits of transit as they pertain to the State of Michigan. The results of the case study are presented in detail in Chapter 4.

The report also includes three appendices. Appendix A contains the complete survey results for all agencies combined. Additional charts from the transit benefit model and detailed results of the economic impact analysis of transit operations are provided in Appendix B and Appendix C respectively.

3. TRANSIT BENEFIT MODEL

This chapter gives an overview of the transit benefit model used to estimate the benefits of transit in Michigan. A general description of the model capabilities and its organization is provided in Section 3.1. The technical approach implemented to estimate the overall benefits of transit is presented in Section 3.2. The different data sources and model inputs are discussed in Section 3.3. More detailed information, including a full presentation of the methodology, can be found in the final report for Phase One.[4]

3.1 General Description

3.1.1 Purpose of the Model

The purpose of the model developed by HDR is to quantify the overall benefits of local bus transit service in Michigan. These benefits are divided into two broad categories: social benefits and economic impacts. The social benefits of transit can be further broken down into:

- *Transportation cost savings*, which consist of out-of-pocket cost savings, travel time cost savings, accident cost savings and environmental emissions cost savings; and

- *Low-cost mobility benefits*, which consist of affordable mobility benefits (the economic value to access services such as healthcare, education and retail for transit dependent people) and cross-sector benefits (budget savings for welfare and social services, such as unemployment and homecare, due to the presence of transit).

These benefits of transit are often defined as social or societal benefits because they accrue to the society as a whole, rather than just to the transit riders. They are estimated for all key socioeconomic sectors based on a breakdown of ridership by trip purpose: work; healthcare; education; shopping, recreation, and tourism; and other purposes.

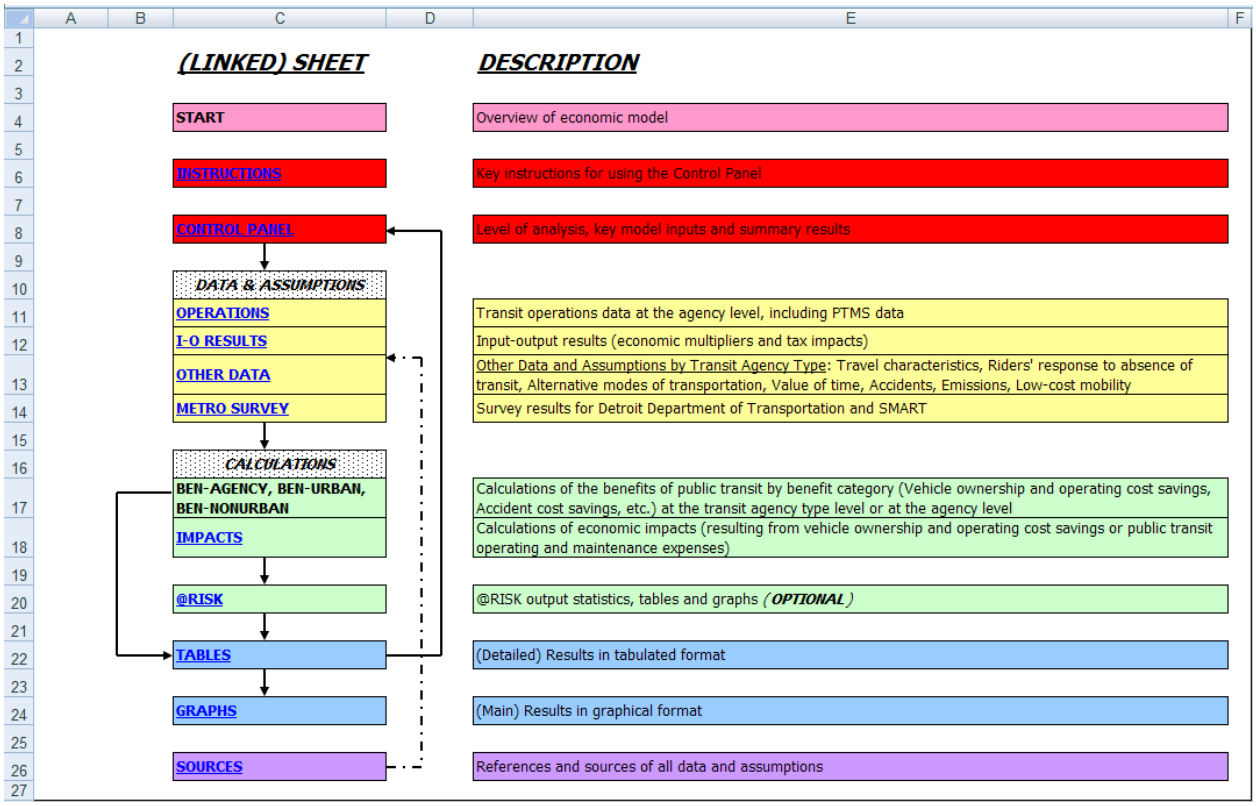
In addition to the social benefits, the model measures the impacts of transit services on the State economy resulting from: *(i)* transit operating and maintenance expenses; and *(ii)* out-of-pocket cost savings that are accruing to transit riders.

3.1.2 Organization of the Model

The transit benefit model is packaged as a Microsoft Excel workbook with fifteen (15) sheets. To facilitate both user navigation and the update of the model, color codes are used. In general, blue font denotes a cell that contains a formula or is linked to another cell, and is protected. Black font denotes a cell that does not contain a formula (e.g., model inputs). Sheet tabs are also color coded to help the user, as shown in Figure 1 below. A brief description of each sheet follows on page 11 and page 12.

[4] HDR Decision Economics, *Economic and Community Benefits of Local Bus Transit Service (Phase One) Final Report*, prepared for the Michigan Department of Transportation, June 2009.

Figure 1: General Structure of the Model



1. START: General structure and logic of the model; brief description of model components; and hyperlinks to each sheet.

Control Panel sheets (Red sheet tabs):

2. INSTRUCTIONS: Step-by-step instructions for using the Control Panel.

3. CONTROL PANEL: Selection of level of analysis and other options (year of analysis, risk analysis and estimation of emissions cost savings); user-specified input values for quick update or scenario analysis; and summary output tables and charts.

Input sheets (Yellow sheet tabs):

4. OPERATIONS: Operations statistics at the agency level.

5. I-O RESULTS: Input-output results for different economic impact metrics (output, value added, employment, and tax revenue) over the 2008 – 2012 period.

6. OTHER DATA: Other model inputs (such as trip purpose) by transit agency type.

7. METRO SURVEY: Survey results for Detroit Department of Transportation and SMART.

Calculation sheets (Green sheet tabs):

8. BEN-AGENCY: Calculations of transit benefits by trip purpose and benefit category at the agency level only.

9. BEN-URBAN: Calculations of transit benefits by trip purpose and benefit category for urban agencies.

10. BEN-NONURBAN: Calculations of transit benefits by trip purpose and benefit category for nonurban agencies.

11. IMPACTS: Calculations of economic impacts resulting from transit operating and maintenance expenses, and the re-spending of out-of-pocket cost savings accruing to transit riders.

12. @RISK: List of risk variables and detailed risk analysis statistics from @RISK.

Results sheets (Blue sheet tabs):

13. TABLES: Tables summarizing all the results of the analysis.

14. GRAPHS: Graphs representing key analysis results.

15. SOURCES: List of data sources and references used in the model.

3.2 Technical Approach

3.2.1 Guiding Principles

HDR's approach to developing a model capable of assessing the benefits of transit recognizes a number of principles, or pillars, upon which the accuracy, credibility, and usefulness of any economic assessment rest. These guiding principles are summarized below.

- *Account for all positive and negative effects of public transportation* – Positive effects are treated as benefits (or cost savings), while negative effects are treated as costs in the model. For instance, diesel powered buses are known for emitting more nitrogen oxides than cars.

- *Assess the "incrementality" of benefits* – In accordance with this principle, the model measures the incremental cost savings associated with individuals switching from personal vehicles (and other less affordable transportation modes) to public transit.

- *Avoid double-counting* – Benefits should not be estimated more than once. This is important because the economic value of some effects can arise in more than one category. HDR recommends not adding the dollar value of social benefits to the dollar value of economic impacts in part for this reason. For instance, a portion of out-of-pocket cost savings (social benefits) is re-spent by households thereby generating additional business activity (economic impacts).

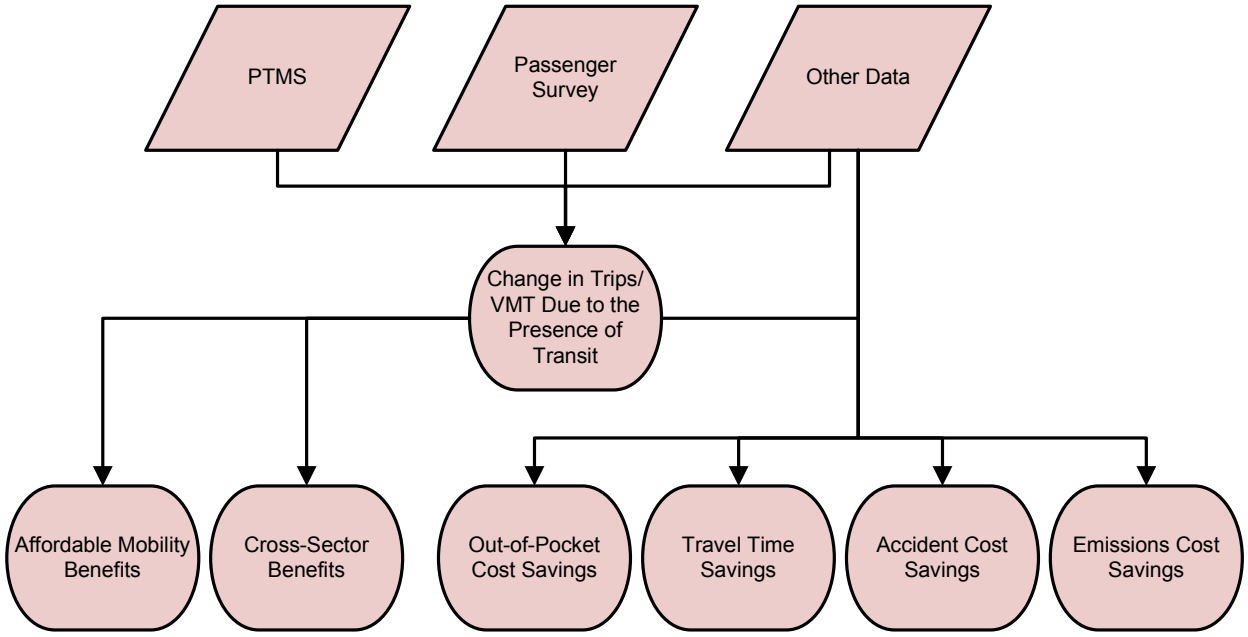
- *Acknowledge the uncertainty surrounding model assumptions* by constructing the model within a risk analysis framework, and thereby providing model users with the full spectrum of potential outcomes in lieu of single point estimates.

3.2.2 Calculation of Social Benefits

The starting point of the analysis is to model the decisions made by transit riders if transit service were not available. Some people would choose to switch to alternative transportation modes (personal vehicle, taxi, etc.), while others would have no choice but to forego their trips. Transportation costs are then estimated under two scenarios: in the presence of transit and in the absence of transit. The difference between the two represents transportation cost savings. The change in the total number of trips due to the presence of transit is also used to estimate the benefits of providing low-cost mobility.

Figure 2 below illustrates the methodology used to estimate the transportation cost savings and the low-cost mobility benefits associated with transit systems.

Figure 2: Method for Estimating the Social Benefits of Transit



3.2.3 Calculation of Economic Impacts

The presence of transit contributes to economic activity in two ways:

1. The on-going operation of transit systems requires inputs (purchases) of labor, materials, equipment and services, which are supplied by local (and non-local) producers. This is normally measured in terms of operating and maintenance expenses.[5]

2. People who use transit instead of more expensive alternative modes can make substantial cost savings (out-of-pocket cost savings). A portion of these savings is re-directed toward

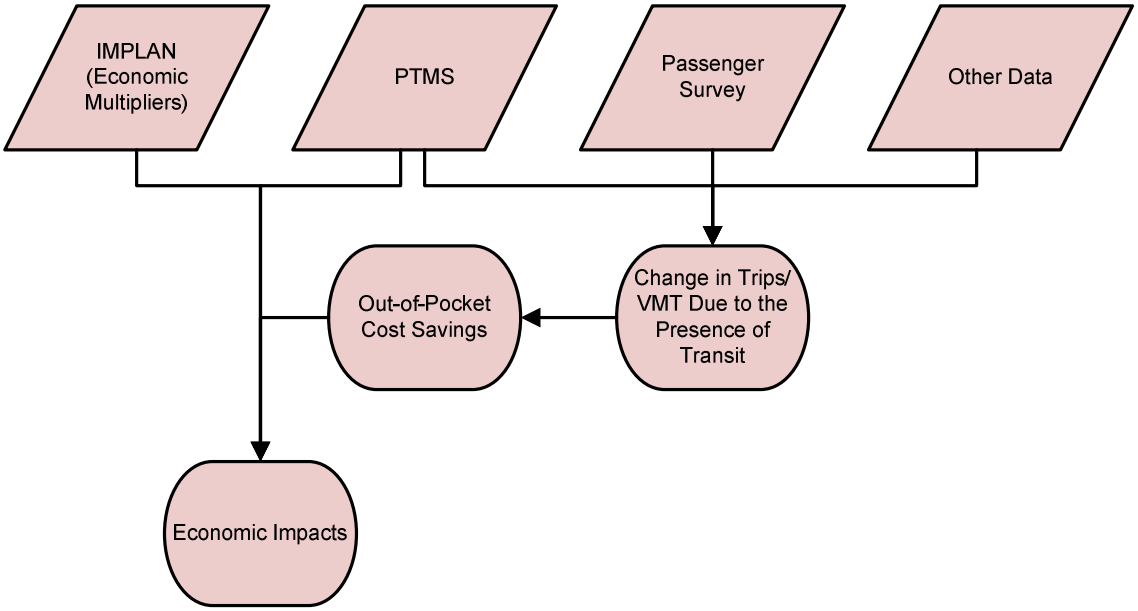
[5] Capital expenses are not considered for two main reasons: *i)* though operating and maintenance expenses are typically incurred locally (they mainly consist of wages and salaries), that is not necessarily the case for capital expenses (e.g., purchase of buses); *ii)* the model estimates the benefits associated with local bus transit for a given year, whereas transit capital projects are often associated with multi-year projects.

other household expenses such as housing or healthcare.

To measure the direct, indirect and induced impacts of transit on the Michigan economy, HDR utilizes IMPLAN Professional®, an economic impact assessment modeling system structured as an input-output model.

Figure 3 illustrates the methodology used to estimate the economic impacts of transit operations and the economic impacts resulting from the re-spending of transit riders' out-of-pocket cost savings.

Figure 3: Method for Estimating the Economic Impacts of Transit



3.3 Model Inputs

3.3.1 Passenger Survey Results

As part of the model implementation, HDR conducted an on-board passenger survey for a sample of seven representative transit agencies across Michigan in November 2009:

- Suburban Mobility Authority for Regional Transportation (SMART);
- Detroit Department of Transportation (DDOT);
- Capital Area Transportation Authority (CATA);
- Jackson Transportation Authority (JTA);
- Twin Cities Area Transportation Authority (TCATA);
- Huron County Transit (Huron Co.); and

- Alma Dial-A-Ride Transit (Alma DART).

The selection of agencies was made based on the classification of agencies currently used in PTMS: one agency was selected per agency type, with the exception of non-urban township. To ensure that candidate agencies are indeed representative of all agencies in Michigan, the selection was based on various criteria, including area (urban vs. rural), location (MDOT Region), service (fixed-route vs. demand response), ridership, and socio-economic characteristics. MDOT dispatched personnel from their Data Collection Section to each agency to hand out surveys, answer any questions from riders and collect completed surveys. The survey focused on the current trip made by the respondent. The primary objectives of the survey were to determine trip purpose and rider behavior in the absence of bus service. Responses are used in the transit benefit model to:

- Allocate ridership by trip purpose (work, healthcare, retail, education and other);

- Estimate the percentage of trips diverted to other transportation modes (personal vehicle, taxi, etc.); and

- Estimate the percentage of trips foregone in the absence of bus service (in order to determine the degree to which public transportation provides basic mobility for riders).

Table 1 on the next page summarizes the combined results for the seven agencies surveyed. More detailed results are available in Appendix A.

Table 1: Survey Results (Percent Estimates)

1) What is the main purpose of your trip? If going home, indicate where you came from before you got on the bus.	
a. Work / Work-related	33.8%
b. Medical / Dental	8.2%
c. Education	25.6%
d. Shopping, recreation or tourism	20.0%
e. Other	12.4%
2.a) For work trips - If public transportation was not available, you would:	
a. Not be able to work	25.3%
b. Look for another job (closer to home)	12.4%
c. Adjust your working hours	5.1%
d. Work at home	2.3%
e. Use another means of transportation	54.4%
f. Other	0.5%
2.b) For medical trips - If public transportation was not available, you would:	
a. Not seek medical assistance	24.1%
b. Select another physician / care provider	9.9%
c. Receive home care	3.4%
d. Use another means of transportation	59.5%
e. Other	3.1%
2.c) For education trips - If public transportation was not available, you would:	
a. Not be able to attend school / college	23.4%
b. Miss more classes or school activities	14.3%
c. Choose another school (closer to home)	5.8%
d. Use another means of transportation	55.1%
e. Other	1.5%
2.d) For shopping, recreation or tourism trips - If public transportation was not available, you would:	
a. Make fewer trips	35.3%
b. Go to a different shopping center/attraction	5.6%
c. Shop online or by catalog	4.9%
d. Use another means of transportation	51.1%
e. Other	3.1%
2.e) For other trips - If public transportation was not available, you would:	
a. Make fewer trips	38.2%
b. Use another means of transportation	58.3%
c. Other	3.5%
3) If public transportation was not available, what other means of transportation would you use?	
a. Drive your personal vehicle	16.8%
b. Ride with someone else	43.5%
c. Taxi	10.2%
d. Bicycle	6.7%
e. Walk	22.4%
f. Other	0.4%

3.3.2 Transit System Characteristics

The development of the model entailed an extensive data collection effort. Various methods and sources were used to gather all of the necessary information to estimate the benefits of transit. Nearly all the transit data at the agency level was extracted from the Public Transportation Management System (PTMS) with the help of MDOT staff. In particular, we collected data on the following variables:

- Population (of the service area);
- Total passengers (regular, elderly, persons with disabilities, and elderly persons with disabilities);
- Vehicle miles (including deadhead miles and purchased transportation service miles);
- Fare revenue (passenger fares and contract fares);
- Total expenses (eligible and ineligible; excluding depreciation);
- Accidents (collision, non-collision, and station accidents resulting in a fatality, personal injury or property damage);
- Diesel and gasoline consumption (in gallons); and
- Liquefied petroleum gas (LPG) or compressed natural gas (CNG) consumption (in gallons equivalent consumed).

Table 2 below shows statewide operational and financial data broken down by type of service – line haul (or fixed route) and demand response.

Table 2: PTMS Data (FY 2008)

Variable	Urban		Nonurban	
	Line Haul	Demand Response	Line Haul	Demand Response
Population	7,982,352			
Passengers	89,735,224	4,230,336	723,237	5,752,417
Vehicle Miles	51,139,384	22,281,372	1,623,496	25,992,756
Total Expenses	$411,738,166	$58,828,634	$6,364,265	$75,250,130
Fare Revenue	$59,368,760	$5,800,605	$925,042	$15,161,439
Fatal Accidents	2	0	0	0

4. ANALYSIS RESULTS

Based on the methodology and the data sources described in Chapter 3, the benefits of transit have been estimated for the State of Michigan using the most recent information available. This chapter presents the results of the analysis. Transportation cost savings and low-cost mobility benefits are discussed in Section 4.1 and Section 4.2 respectively. The results of the economic impact analysis are provided in Section 4.3.

4.1 Social Benefits – Transportation Cost Savings

In the presence of transit, a number of vehicles are removed from the roads, resulting in a decrease in vehicle miles traveled (VMT). Transportation cost savings are the cost savings of these additional VMT to users of the roadway network and the community at large.

4.1.1 Out-of-Pocket Cost Savings

When people use the bus instead of a more costly alternative (personal vehicle or taxi) they save money on transportation. These out-of-pocket cost savings are the most recognized benefits of transit. In particular, they account for the cost savings associated with owning, operating, and maintaining a vehicle. These cost components generally consist of fuel consumption, oil consumption, maintenance and repairs, tire wear and tear, insurance, license, registration, taxes, and roadway related vehicle depreciation.

The out-of-pocket cost savings accruing to public transit patrons for urban and non-urban systems are broken down by trip purpose in Table 3 below. Out-of-pocket cost savings totaled $348.8 million in 2008, about 36 percent of which went to riders who commute to work.

Table 3: Out-of-Pocket Cost Savings by Trip Purpose

Trip Purpose	Urban	Non-urban	Total
Work	$126,106	$739	$126,845
Healthcare	$45,541	$2,723	$48,264
Retail	$61,327	-$730	$60,597
Education	$72,032	$114	$72,146
Other	$40,884	$75	$40,959
Total	**$345,890**	**$2,921**	**$348,811**

Note: All dollar amounts are expressed in thousands of 2008 dollars.

4.1.2 Other Transportation Cost Savings

Other transportation cost savings include travel time savings, accident cost savings and emissions cost savings due to less congestion and fewer vehicle miles traveled in the presence of transit. While travel time savings and accident cost savings accrue solely to users of the roadway network, emissions cost savings benefit the community at large.

As shown in Table 4 below, other transportation cost savings totaled $331.6 million at the state level. In particular, nearly 17.5 million hours of delay were saved in Michigan in 2008. This result stresses public transit's effective role in reducing congestion. Note also that emissions cost savings are typically negligible for non-rail modes and are not estimated in this case study.[6]

Table 4: Other Transportation Cost Savings by Benefit Sub-Category

Benefit Sub-Category	Urban	Non-urban	Total
Travel time savings	$340,743	-$361	$340,382
Accident cost savings	-$4,552	-$4,235	-$8,787
Emissions cost savings	n/a	n/a	n/a
Total	**$336,191**	**-$4,596**	**$331,595**

Note: All dollar amounts are expressed in thousands of 2008 dollars.

4.2 Social Benefits – Low-Cost Mobility Benefits

Low-cost mobility benefits are the benefits from providing affordable mobility to transit-dependent people, and cross-sector benefits.

4.2.1 Affordable Mobility Benefits

Affordable mobility benefits refer to the economic value people obtain from low-cost mobility, i.e. they represent the value of subsidized trips to people (especially those with low income, no access to a car, or with disabilities) who rely on public transit for their mobility needs.

Affordable mobility benefits are broken down by trip purpose in Table 5 below for urban and non-urban systems. Affordable mobility benefits totaled $67.6 million in 2008 at the state level. About 24 percent of these benefits accrued to people who used public transit to go to school/college.

Table 5: Affordable Mobility Benefits by Trip Purpose

Trip Purpose	Urban	Non-urban	Total
Work	$23,325	$144	$23,469
Healthcare	$14,711	$658	$15,369
Retail	$6,963	-$77	$6,886
Education	$16,414	$41	$16,455
Other	$5,417	$6	$5,423
Total	**$66,831**	**$772**	**$67,602**

Note: All dollar amounts are expressed in thousands of 2008 dollars.

[6] The HDR model offers the option (in the Control Panel) to estimate those benefits if desired.

4.2.2 Cross-Sector Benefits

Cross-sector benefits are defined as economies achievable in another sector of the economy as a result of public transit's provision of low-cost mobility. These benefits accrue when public transit diminishes the demand for mobility-substitute services (such as homecare services) and publicly subsidized programs that show some vulnerability to reduced mobility (such as the Food Stamp Program).

If public transit was no longer available in Michigan a number of low-income people would require homecare or they would be rendered dependent on public assistance due to their inability to go to work. Table 6 below shows cross-sector benefits at the state level for urban and non-urban systems. Overall, homecare cost savings are estimated at $17.4 million while public assistance cost savings are estimated at $39.3 million.

Table 6: Cross-Sector Benefits by Benefit Sub-Category

Benefit Sub-Category	Urban	Non-urban	Total
Home care cost savings	$10,699	$6,682	$17,381
Public assistance cost savings	$37,345	$1,911	$39,256
Total	**$48,044**	**$8,593**	**$56,637**

Note: All dollar amounts are expressed in thousands of 2008 dollars.

4.3 Economic and Fiscal Impacts

In addition to the social benefits discussed above, there are macroeconomic impacts attributed to public transit. These impacts are associated with: *(i)* the re-spending of out-of-pocket cost savings by riders; and *(ii)* transit operating and maintenance expenses. They are discussed below.

4.3.1 Impacts of Out-of-Pocket Cost Savings

Out-of-pocket cost savings (in particular, vehicle ownership and operating cost savings) accruing to riders amounted to $348.8 million in 2008, of which an estimated 48 percent were spent on other goods and services (housing, healthcare and retail, in particular) in Michigan. Table 7 below shows the breakdown of economic impacts of those expenses by impact metric (output, value added, employment and tax revenue)[7] and type of effect (direct, indirect and induced).[8] Overall, the re-spending of out-of-pocket cost savings generated $264.4 million in business output and $147.5 million in total value added (or gross state product) and sustained nearly 2,200

[7] While output refers to the total volume of sales, value added refers to the value a company adds to a product or service. It is measured by the difference between the amount a company spends to acquire that product or service and its value at the time it is sold to other users. The total value added within a State is equivalent to the gross state product (GSP).

[8] The *direct* effect refers to the economic activity occurring as a result of direct spending by businesses or agencies located in the study area (e.g., transit operating expenses). The *indirect* effect refers to the economic activity resulting from purchases by local firms who are the suppliers to the directly affected businesses or agencies (e.g., spending on motor vehicle parts by suppliers of buses to transit agencies). The *induced* effect represents the increase in economic activity associated with increased labor income that accrue to workers (of directly and indirectly affected businesses) and is spent on household goods and services purchased from businesses within Michigan.

jobs in Michigan.[9] Federal and state/local tax revenues amounted to $38.6 million, including $18.5 million in state/local taxes.

Table 7: Summary of Impacts – Out-of-Pocket Cost Savings

Impact Metric	Direct	Indirect	Induced	Total
Output	$166,550	$53,922	$43,939	$264,412
Value Added	$92,436	$30,005	$25,040	$147,481
Employment	1,443	359	383	2,186
Taxes				$38,577
Federal Taxes				$20,172
State/Local Taxes				$18,463

Notes: All dollar amounts are expressed in thousands of 2008 dollars.
Total taxes include transfers to/from corporations not shown in the table.

4.3.2 Impacts of Transit Operations

Transit operating and maintenance expenses (excluding depreciation) amounted to $552.2 million dollars in FY 2008. They correspond to the direct output impact in Table 8 below. This direct effect in turn spurred indirect and induced economic activity throughout Michigan, thus raising total output impact to $1.08 billion. Nearly 30 percent of total output (or $313.7 million) was effectively a value added to the state economy. Transit operations also generated $89.7 million in tax revenue, including $26.4 million in state/local taxes. A detailed tax impact report is shown in Table 12 in Appendix C.

Table 8: Summary of Impacts – Transit Operations

Impact Metric	Direct	Indirect	Induced	Total
Output	$552,181	$299,746	$225,640	$1,077,567
Value Added	$32,175	$152,888	$128,589	$313,652
Employment	5,721	1,598	1,965	9,283
Taxes				$89,745
Federal Taxes				$63,679
State/Local Taxes				$26,387

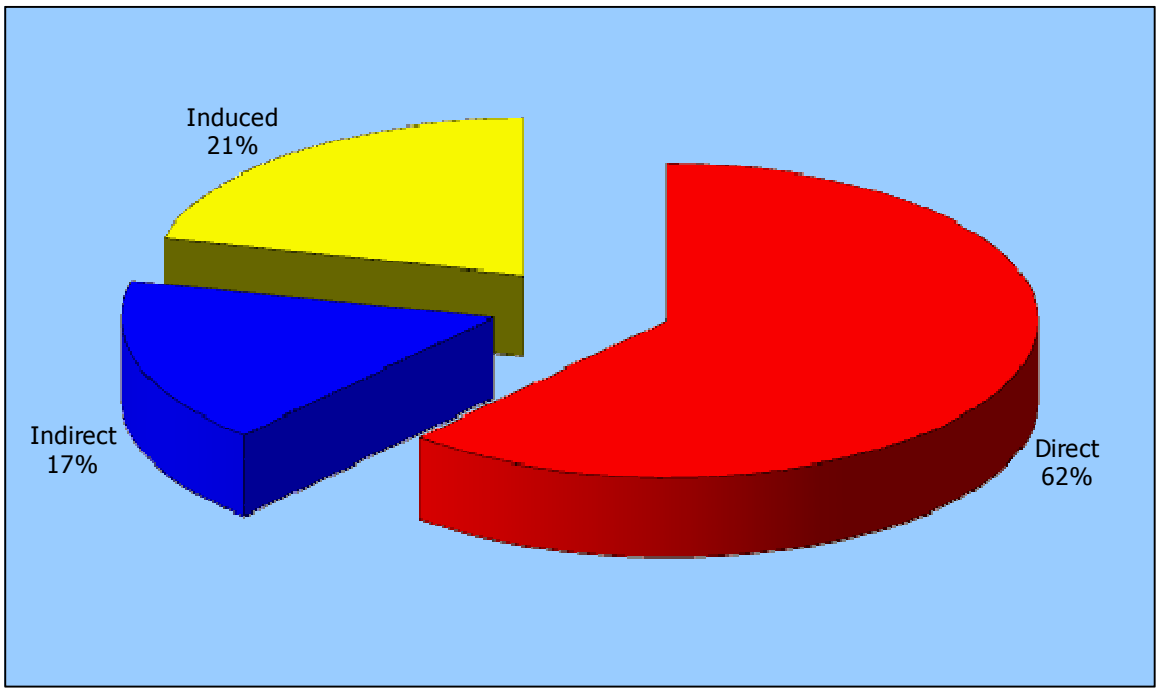
Notes: All dollar amounts are expressed in thousands of 2008 dollars.
Total taxes include transfers to/from corporations not shown in the table.

Public transit operations sustained more than 9,200 jobs in Michigan in FY 2008. As shown in Figure 4 below, about 62 percent of those jobs were held in the public transit sector, which is

[9] These impacts should not be interpreted as full-time equivalent (FTE) as they reflect the mix of full and part time jobs that is typical for each sector.

traditionally labor intensive. The job multiplier is estimated at 1.62. This implies that, on average, when an agency hires 10 new bus drivers 6 additional jobs are created in the rest of the economy, as a result of the indirect and induced effects. It is noteworthy that the job multiplier is significantly higher for the public transit sector than for households (see Section 4.3.1).

Figure 4: Distribution of Jobs by Type of Effect – Transit Operations



In addition to the public transit sector, other sectors of the economy are impacted through the indirect and induced effects. Table 9 below lists the top five sectors impacted and shows the combined indirect and induced impacts (in terms of output and employment) associated with transit operations. Note that sectors are ranked according to their combined indirect and induced *output* impact. The Manufacturing sector generates the most indirect and induced output ($113.7 million), followed by Professional services ($74.8 million). A complete breakdown of the job impact by type of effect and by industry is available in Table 11 in Appendix C.

Table 9: Top Five Sectors Impacted – Transit Operations

Industry	Output	Employment
Manufacturing	$113,669	174
Professional – Scientific & technical services	$74,782	539
Real estate & rental	$47,894	106
Wholesale trade	$38,212	205
Health & social services	$34,918	429

Notes: Sectors are ranked according to their combined indirect and induced output impact.
Sectors are aggregated at the 2-digit NAICS (North American Industry Classification System) level.
All dollar amounts are expressed in thousands of 2008 dollars.

APPENDIX A: COMPLETE SURVEY RESULTS

Table 10: Survey Results (Unweighted Count and Weighted Percent Estimates)

1) What is the main purpose of your trip? If going home, indicate where you came from before you got on the bus.	Weighted Percent Estimates		
	Most Likely	Low	High
a. Work / Work-related	33.8%	30.9%	36.6%
b. Medical / Dental	8.2%	6.6%	9.9%
c. Education	25.6%	22.9%	28.2%
d. Shopping, recreation or tourism	20.0%	17.6%	22.4%
e. Other	12.4%	10.4%	14.4%
2.a) For work trips - If public transportation was not available, you would:			
a. Not be able to work	25.3%	22.7%	28.0%
b. Look for another job (closer to home)	12.4%	10.4%	14.4%
c. Adjust your working hours	5.1%	3.7%	6.4%
d. Work at home	2.3%	1.4%	3.2%
e. Use another means of transportation	54.4%	51.4%	57.4%
f. Other	0.5%	0.1%	0.9%
2.b) For medical trips - If public transportation was not available, you would:			
a. Not seek medical assistance	24.1%	21.5%	26.6%
b. Select another physician / care provider	9.9%	8.1%	11.7%
c. Receive home care	3.4%	2.3%	4.5%
d. Use another means of transportation	59.5%	56.5%	62.4%
e. Other	3.1%	2.1%	4.2%
2.c) For education trips - If public transportation was not available, you would:			
a. Not be able to attend school / college	23.4%	20.8%	25.9%
b. Miss more classes or school activities	14.3%	12.2%	16.4%
c. Choose another school (closer to home)	5.8%	4.4%	7.2%
d. Use another means of transportation	55.1%	52.1%	58.1%
e. Other	1.5%	0.7%	2.2%
2.d) For shopping, recreation or tourism trips - If public transportation was not available, you would:			
a. Make fewer trips	35.3%	32.5%	38.2%
b. Go to a different shopping center / attraction	5.6%	4.2%	6.9%
c. Shop online or by catalog	4.9%	3.6%	6.2%
d. Use another means of transportation	51.1%	48.1%	54.1%
e. Other	3.1%	2.1%	4.2%
2.e) For other trips - If public transportation was not available, you would:			
a. Make fewer trips	38.2%	35.3%	41.2%
b. Use another means of transportation	58.3%	55.3%	61.3%
c. Other	3.5%	2.4%	4.6%
3) If public transportation was not available, what other means of transportation would you use?			
a. Drive your personal vehicle	16.8%	14.5%	19.0%
b. Ride with someone else	43.5%	40.5%	46.5%
c. Taxi	10.2%	8.4%	12.0%
d. Bicycle	6.7%	5.2%	8.2%
e. Walk	22.4%	19.9%	25.0%
f. Other	0.4%	0.0%	0.7%

Note: Weighted percent estimates reflect a 95 percent confidence interval.

APPENDIX B: ADDITIONAL CHARTS FROM TRANSIT BENEFIT MODEL

Figure 5: Distribution of Transportation Cost Savings by Benefit Category

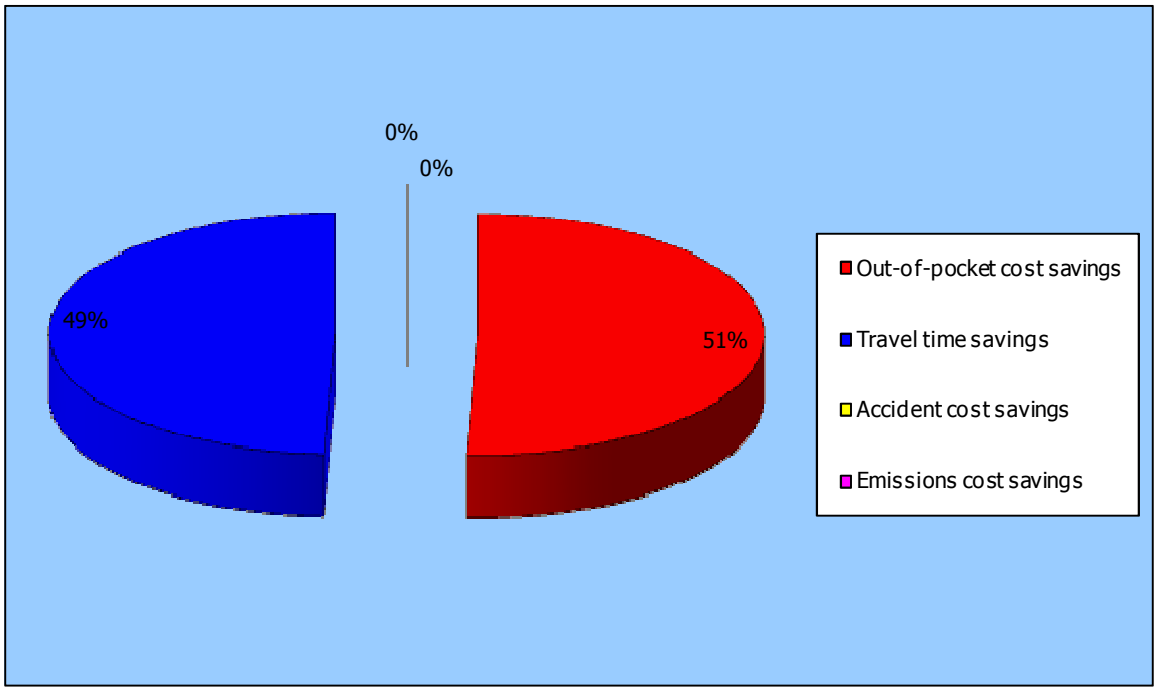
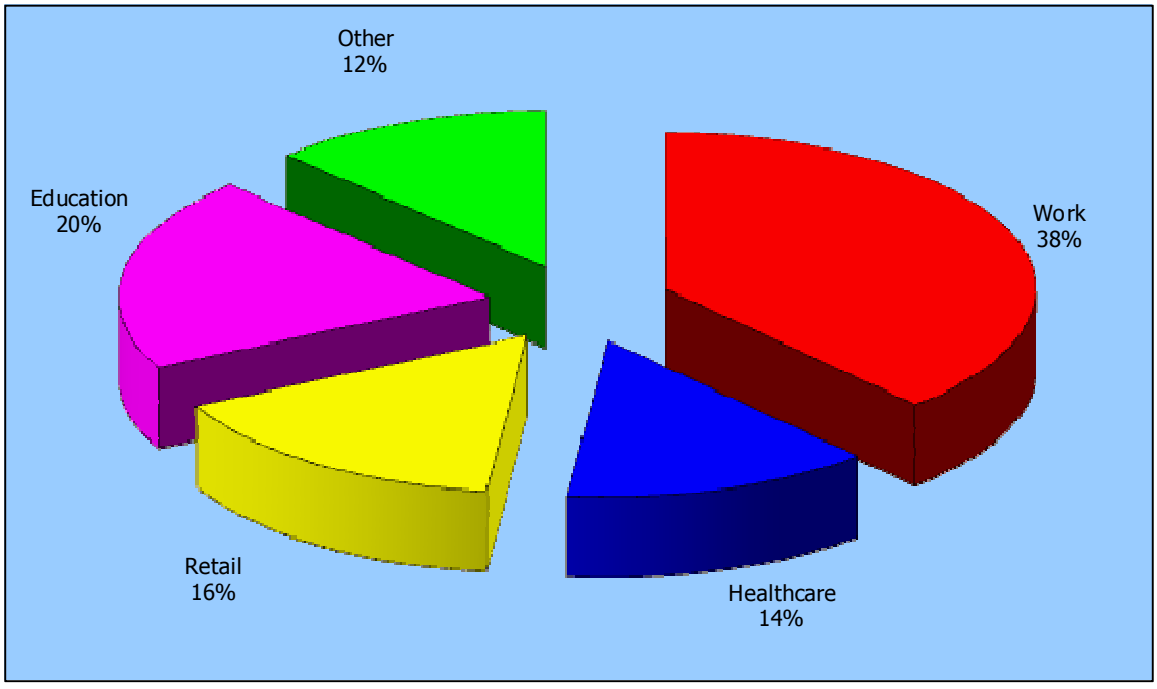


Figure 6: Distribution of Total Benefits by Trip Purpose



APPENDIX C: DETAILED RESULTS FOR ECONOMIC IMPACT ANALYSIS OF TRANSIT OPERATIONS

Table 11: Employment Impact by Aggregate Sector

NAICS Code	Industry	Direct	Indirect	Induced	Total
11	Agriculture, forestry, fishing and hunting	0	1	19	21
21	Mining	0	39	3	41
22	Utilities	0	17	8	25
23	Construction	0	45	11	57
31-33	Manufacturing	0	126	48	174
42	Wholesale trade	0	154	50	205
48-49	Retail trade	0	12	436	447
44-45	Transportation and warehousing	0	141	40	181
51	Information	0	21	27	48
52	Finance and insurance	0	105	104	209
53	Real estate and rental	0	33	73	106
54	Professional - Scientific and technical services	0	466	73	539
55	Management of companies	0	14	10	24
56	Administrative and waste services	0	172	71	243
61	Educational services	0	2	57	59
62	Health and social services	0	0	429	429
71	Arts, entertainment and recreation	0	13	58	71
72	Accommodation and food services	0	71	243	314
81	Other services	0	85	185	269
92	Government and non NAICs	5,721	81	19	5,821
	TOTAL	**5,721**	**1,598**	**1,965**	**9,283**

Note: Sectors are aggregated at the 2-digit NAICS level.

Table 12: Tax Impact Report

		Employee Compensation	Proprietary Income	Household Expenditures	Enterprises	Indirect Business Taxes	Total
Enterprises (Corporations): Transfers		-$321	$0	$0	$0	$0	-$321
Federal Government Non-Defense	Corporate Profits Tax	$0	$0	$0	-$12,703	$0	-$12,703
	Indirect Business Tax: Custom Duty	$0	$0	$0	$0	$606	$606
	Indirect Business Tax: Excise Taxes	$0	$0	$0	$0	$1,450	$1,450
	Indirect Business Tax: Federal Non-taxes	$0	$0	$0	$0	$726	$726
	Personal Tax: Income Tax	$0	$0	$27,886	$0	$0	$27,886
	Social Insurance Tax - Employee Contribution	$21,625	$1,378	$0	$0	$0	$23,004
	Social Insurance Tax - Employer Contribution	$22,710	$0	$0	$0	$0	$22,710
	Sub-Total	**$44,335**	**$1,378**	**$27,886**	**-$12,703**	**$2,782**	**$63,679**
State/Local Government Non-Education	Corporate Profits Tax	$0	$0	$0	-$2,654	$0	-$2,654
	Dividends	$0	$0	$0	-$3,944	$0	-$3,944
	Indirect Business Tax: Motor Vehicle License	$0	$0	$0	$0	$266	$266
	Indirect Business Tax: Other Taxes	$0	$0	$0	$0	$780	$780
	Indirect Business Tax: Property Tax	$0	$0	$0	$0	$9,748	$9,748
	Indirect Business Tax: State/Local Non-taxes	$0	$0	$0	$0	$904	$904
	Indirect Business Tax: Sales Tax	$0	$0	$0	$0	$9,536	$9,536
	Indirect Business Tax: Severance Tax	$0	$0	$0	$0	$73	$73
	Personal Tax: Income Tax	$0	$0	$7,075	$0	$0	$7,075
	Personal Tax: Motor Vehicle License	$0	$0	$592	$0	$0	$592
	Personal Tax: Non-taxes (Fines, Fees)	$0	$0	$2,465	$0	$0	$2,465
	Personal Tax: Other Tax (Fishing/Hunting)	$0	$0	$186	$0	$0	$186
	Personal Tax: Property Taxes	$0	$0	$216	$0	$0	$216
	Social Insurance Tax - Employee Contribution	$216	$0	$0	$0	$0	$216
	Social Insurance Tax - Employer Contribution	$929	$0	$0	$0	$0	$929
	Sub-Total	**$1,145**	**$0**	**$10,534**	**-$6,599**	**$21,306**	**$26,387**
	Total	**$45,159**	**$1,378**	**$38,421**	**-$19,302**	**$24,088**	**$89,745**

Note: All dollar amounts are expressed in thousands of 2008 dollars.