South Dakota
Department of Transportation
Office of Research

SD2010-01-F

Costs and Benefits of Public Transit in South Dakota

Study SD2010-01-F
Final Report

HDR Decision Economics
8403 Colesville Road, Suite 910
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December 2011

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Acknowledgments

This work was performed under the supervision of the SD2010-01-F Technical Panel.

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Technical Report Standard Title Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
SD2010-01-F		

4. Title and Subtitle	5. Report Date
Costs and Benefits of Public Transit in South Dakota	December 31, 2011
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Bruno Penet	

9. Performing Organization Name and Address	10. Work Unit No.
HDR Decision Economics 8403 Colesville Road, Suite 910 Silver Spring, MD 20910-3313	11. Contract or Grant No. 310977

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
South Dakota Department of Transportation Office of Research 700 East Broadway Avenue Pierre, SD 57501-2586	Final Report September 2010 to December 2011
	14. Sponsoring Agency Code HRY001

15. Supplementary Notes

An executive summary is published separately as SD2010-01-X.

16. Abstract

This report presents the results of a comprehensive analysis of the costs and benefits of providing public transit in South Dakota. To facilitate the assessment, transit providers operating in the state are grouped into four categories. This categorization reflects in particular the system size, the system usage and key socioeconomic characteristics of transit riders. A taxonomy of the different social benefits and economic impacts of public transit is provided along with a detailed methodology to quantify them. Social benefits are estimated by analyzing the effects on society of not providing transit service. The contribution of public transit to the state economy is measured using data on transit capital and operating expenses. The results are presented at the statewide level and for each transit category. To account for uncertainty, the analysis is conducted within a risk analysis framework where model parameters are defined by a range of estimates. The study indicates that the benefits to society and to the economy of providing public transit in South Dakota not only are significant, but also outweigh the costs, thereby confirming it is a sound public investment. The study also recognizes the existence of less tangible or less apparent benefits, especially in rural settings, such as community cohesion benefits, relocation cost savings and the provision of transportation service during emergencies, either natural or man-made. These other benefits are briefly discussed but are not computed because they are difficult to quantify and to monetize. Therefore, the results presented here can be considered as somewhat conservative.

17. Keywords	8. Distribution Statement
	No restrictions. This document is available to the public from the sponsoring agency.

19. Security Classification (of this report)	20. Security Classification (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	81	

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1.1 Problem Description

The problem of providing cost-effective transit service in sparsely populated rural areas is not new in the U.S. Below some population density threshold, fixed routes and regularly scheduled forms of public transportation are too expensive to operate. The solution, in many parts of the country, has been to use demand response services to meet the demand for public transportation. However, these demand response services have come under fire because they often carry few passengers and because they are subsidized to some extent through public funds. They also suffer from the absence of economies of scale, thus leaving little room for productivity gains.

At the same time, transit agencies are struggling to secure funding, especially from local sources. The problem is even more acute today as a result of the recent economic downturn. Many public transit agencies have reported flat or decreased funding since the onset of the Great Recession. This revenue shortfall is forcing them to raise fares, cut service, lay off employees and take other extreme measures to survive.

Yet, the economic value of public transit to rural communities is undeniable. Few would dispute, for instance, that providing affordable access to healthcare facilities is critical to the rural population, which is aging faster than the urban population. A portion of the rural population (especially that with low income or disabilities) relies entirely on public transit for its mobility needs. If public transit were no longer available these people would require home care or would no longer seek medical assistance.

In addition, the estimation of the economic value of rural public transit is necessary for policy makers to make informed investment decisions. During these recessionary times, every transportation dollar is expected to maximize return on investment in the form of job growth and increased benefits to society. But, in part because of the difficulty and cost of acquiring the necessary data, little research effort has been devoted to quantifying the benefits of public transit in rural areas.

1.2 Research Objectives and Tasks

In light of the above, the South Dakota Department of Transportation (SDDOT) sponsored a research project to objectively and comprehensively assess the costs and benefits of public transit in South Dakota with the intent of helping state and local officials make more informed decisions regarding the funding and operation of transit operations. The research project is organized around five objectives:

1. Develop a detailed methodology for assessing the economic benefits of public transit at the local and statewide levels;

2. Estimate the economic costs and benefits of public transit in South Dakota;

3. Identify and describe social, environmental, and other intangible benefits of public transit in South Dakota;

4. Describe recent and current funding mechanisms and levels for public transit in South Dakota; and

5. Develop concise educational material summarizing the costs, benefits, and funding of public transit operations in South Dakota.

To achieve these objectives, the following eleven tasks were completed:

1. Meet with the project's technical oversight panel to review the project scope and work plan;

2. Conduct interviews with transit providers, public officials, and other contacts suggested by the project's technical oversight panel to identify factors that affect actual or perceived costs and benefits associated with public transit in South Dakota;

3. Propose a grouping of South Dakota's public transit operations into categories that will permit convenient but sound characterization and analysis of costs, tangible benefits, and intangible benefits;

4. Propose for approval of the project's technical oversight panel a detailed methodology for characterizing, analyzing, and documenting costs, tangible benefits, and intangible benefits of transit operations within the public transit categories defined in Task 5;

5. Upon approval of the project's technical oversight panel, demonstrate the application of the methodology in at least one transit operation in each public transit category;

6. Prepare and submit for approval of the project's technical oversight panel a technical memorandum summarizing the demonstration of the methodology and recommending needed changes or enhancements;

7. Upon approval of the project's technical oversight panel, make needed enhancements and apply the methodology to complete analysis of each public transit category and to statewide public transit operations;

8. Describe recent and current funding mechanisms and levels for public transit in South Dakota;

9. Develop an educational brochure or other material that concisely communicates the costs, benefits, and funding of public transit in South Dakota;

10. In conformance with Guidelines for Performing Research for the South Dakota Department of Transportation, prepare a final report and executive summary of the research methodology, findings, conclusions, and recommendations; and

11. Make executive presentations to the SDDOT Research Review Board and the Dakota Transit Association at the conclusion of the project.

1.3 Study Findings

The overall benefits of public transit can be divided into two broad categories: social benefits and economic impacts. The social benefits can be further broken down into:

- **Transportation cost savings**, which consist of out-of-pocket cost savings (e.g., fuel 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 and education for transit dependent people) and cross-sector benefits (budget savings for welfare and medical services due to the presence of public transit).

In addition to these social benefits, public transit contributes to the economy through:

- Operating and capital expenses; and
- The spending of a portion of out-of-pocket cost savings accrued to transit riders.

TRANSIT SAVES MONEY

- **Reduces the cost of transportation** – When people use public transit instead of a more expensive alternative (personal car or taxi) they save money, which in turn can be spent on food, healthcare, housing and other needs. In 2010, riders' out-of-pocket cost savings totaled $10.3 million in South Dakota.

- **Increases tax savings** – The 2009 American Recovery and Reinvestment Act raised the monthly limit employees can deduct from their paychecks on a pre-tax basis from $120 to $230 to pay for their commute by transit. Employers also save money since this benefit is not subject to payroll taxes.

TRANSIT STIMULATES THE ECONOMY

- **Creates jobs** – For every 10 jobs created in the public transit sector, 3 additional jobs are created in the rest of the state economy as a result of the multiplier effect. Public transit operating expenses as well as capital expenses sustained 460 jobs and contributed about $38.5 million in economic output (or business sales) in South Dakota in 2010. In addition, the spending of a portion of out-of-pocket cost savings by transit riders added $7.6 million and 70 jobs to the state economy.

- **Connects people to jobs** – Public transportation not only helps to maintain and create jobs, it also moves people to and from their jobs. Businesses located near public transportation experience more employee reliability and less absenteeism and turnover. Employers have a larger labor pool from which to choose, and employees are happier because they are not driving in heavy traffic.

TRANSIT EXPANDS MOBILITY

- **Facilitates access to jobs and medical care** – Nearly half of the trips made on public transit in South Dakota are for work or medical purposes. A number of riders (especially those with low income 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. As a result, some riders would lose their job while others would require homecare or would have to move to a nursing home facility. Overall, an estimated $7.1 million in low-cost mobility benefits (including homecare cost savings and welfare cost savings) in 2010 are attributable to public transit statewide.

- **Provides greater access to education** – About 22 percent of trips made by transit patrons in South Dakota are for education purposes. Without public transit, more than 500 students would find it difficult to attend school or college.

TRANSIT BRINGS THE COMMUNITY TOGETHER

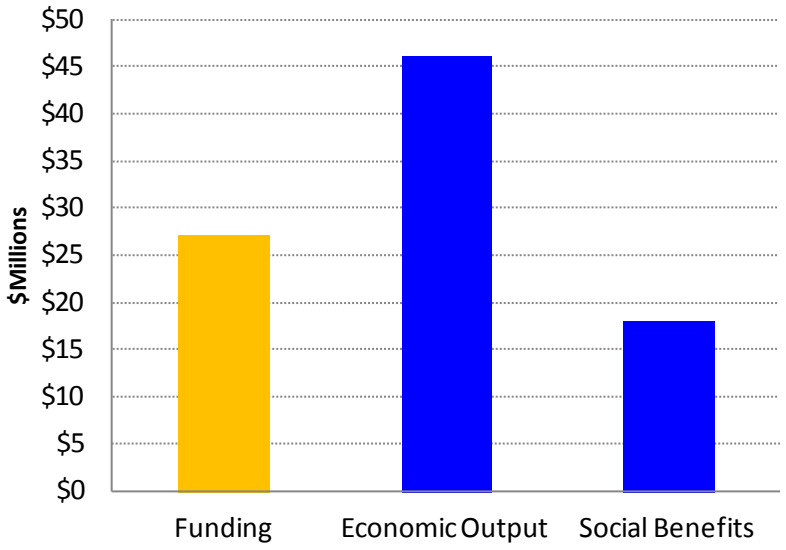
- **Provides a vital transportation link for senior citizens and persons with disabilities** – Public transit ensures that people who cannot drive a vehicle (because of age or illness) remain actively involved in their communities and have access to the full range of facilities and services. In low-density rural areas especially, public transit serves as a lifeline and contributes to improving the quality of life in many ways.

- **Expands social and recreational opportunities in rural areas** – Twenty-two (out of 24) public transit systems operating in South Dakota are located in rural (or small urban) areas. Many of them are participating in community-sponsored events and programs such as Meals-on-Wheels.

Overall, public transit contributed nearly $18 million in social benefits to South Dakota communities in 2010. The average benefit per trip was $5.90. Public transit also contributed to economic activity through operating and capital expenses as well as through the spending of out-of-pocket cost savings by riders. The combined economic impact is estimated at $46.1 million annually. In other words, every dollar spent on public transit in the state generates $1.90 in economic activity on average.

A comparison of the costs and benefits of public transit in South Dakota is provided in Figure 1 on the next page.

Figure 1: Comparison of the Costs and Benefits of Public Transit



1.4 Recommendations

The following are the main recommendations to SDDOT on the application and the implementation of the study findings:

1. HDR strongly advises against adding social benefits to economic impacts because they result from two distinct (and potentially overlapping) analyses: while a benefit analysis measures the increase in society's welfare (as measured by travel time savings, safety cost savings, environmental cost savings, etc.) an economic impact analysis evaluates the effects on local/regional economic activity (in terms of business output, jobs, tax revenue, etc.).

2. Given the uncertainty surrounding model parameters, some may prefer to use the risk adjusted results (defined by a range of estimates) in lieu of the most likely results (single point estimates) whenever possible. For instance, "There is an 80 percent chance that the social benefits of public transit in South Dakota lie between $15.9 million and $20.1 million" may be preferred to "The social benefits of public transit in South Dakota are estimated at $ 17.9 million".

3. To validate and further refine the study findings, it is suggested to conduct a passenger survey for a sample of representative transit systems across the state with a view to assess the behavior of South Dakotan riders in the absence of public transit. The survey results could then be compared with the assumptions used in the present study.

4. The estimation of the environmental emissions cost savings would benefit from more detailed information on gasoline and diesel fuel consumption at the transit agency level. Also, future research efforts should use EPA's Motor Vehicle Emission Simulator (MOVES) to obtain emission rates, instead of MOBILE6.2.

5. Though the research team made a comprehensive effort to assess the benefits associated with public transit, there are less tangible or less apparent benefits, such as agglomeration economies, community cohesion benefits, relocation cost savings, groundwater pollution cost savings, noise pollution cost savings, land conservation benefits and the provision of transportation service during emergencies, either natural (e.g., tornadoes and floods) or man-made (e.g., fuel shortage). These other benefits are difficult to quantify and to monetize. Further research would be required to assess them. Therefore, the results presented in this report can be considered as somewhat conservative.

2 Problem Description

The problem of providing cost-effective transit service in sparsely populated rural areas is not new in the U.S. Below some population density threshold, fixed routes and regularly scheduled forms of public transportation are too expensive to operate. The solution, in many parts of the country, has been to use demand response services (defined as curb-to-curb, advance reservation, shared ride transportation services) to meet the demand for public transportation in rural areas. However, these demand response services have come under fire because they often carry few passengers and because they are subsidized to some extent through public funds. They also suffer from the absence of economies of scale, thus leaving little room for productivity gains.

At the same time, transit agencies are struggling to secure funding, especially from local sources. The problem is even more acute today as a result of the recent economic downturn. According to a survey conducted by the American Public Transportation Association (APTA) in March 2010, nearly 90 percent of public transit agencies reported flat or decreased local and state funding.[1] This widespread revenue shortfall is forcing many agencies to raise fares, cut service, lay off employees and take other extreme measures to survive. This creates a need for identifying new funding strategies and opportunities, either from untapped public sources or from the private sector.[2]

Yet, the economic value of public transit to rural communities is undeniable. Few would argue, for instance, that providing affordable access to healthcare facilities and providers is critical to the rural population, which is aging faster than the urban population (as a result of the continued migration of young adults to metropolitan areas).[3] A portion of the rural population (especially that with low income, disabilities or no access to a car) relies entirely on public transit for its mobility needs. If public transit were no longer available these people would require home care or would no longer seek medical assistance.

In addition, the estimation of the economic value of rural public transit is necessary for policy makers to make informed investment decisions. Sound investments in public transit are those whose benefits exceed their costs. But, in part because of the difficulty and cost of acquiring the necessary data, little research effort has been devoted to quantifying the benefits of public transit in rural areas. The literature on this topic is scarce, to say the least. This may change with the recent establishment of the rural National Transit Database. Transit managers at the nation's rural systems must now comply with specific federal reporting requirements. These requirements will help standardize data and data reporting practices for rural systems. Over time, the database will provide a large reservoir of rural transit information that will be useful in assessing trends and comparing systems.

In light of the above, the South Dakota Department of Transportation (SDDOT) sponsored a research project to objectively and comprehensively assess the costs and benefits of public transit in South Dakota with the intent of helping state and local officials make more informed decisions regarding the funding and operation of transit operations.

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[1] American Public Transportation Association. *Impacts of the Recession on Public Transportation Agencies: Survey Results*, March 2010, p. 3.

[2] For instance, a July 2009 amendment to the American Recovery and Reinvestment Act (ARRA) permitted transit agencies to use up to 10 percent of their allocated ARRA funds for operations.

[3] South Dakota Department of Transportation, Office of Planning and Programs. *Statewide Intermodal Long Range Plan*, 2003, p. 59.

3 Research Objectives

3.1 Develop Assessment Methodology

Develop a detailed methodology for assessing economic benefits of public transit at the local and statewide levels.

The research team used a methodology originally developed for the Federal Transit Administration to measure the economic benefits and costs of public transit in South Dakota.[4] This methodology was refined to include the most recent developments in transportation research (e.g., findings of the 2009 National Household Travel Survey), customized to transit operations in South Dakota and adapted, when necessary, to account for data availability.

The starting point of the analysis of transit benefits is to model the decisions made by transit riders if public transit was no longer 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.

The study also included an assessment of the impacts on the South Dakota economy resulting from:

- The on-going operation of transit systems, which requires inputs (purchases) of labor, materials, equipment and services supplied by state (and non-state) producers;
- Transit capital expenditures (e.g., construction of passenger intermodal facilities), provided that they are incurred within South Dakota; and
- The spending of out-of-pocket cost savings accrued to transit riders on other goods and services purchased in the State.

To measure the direct, indirect and induced impacts of public transit we use IMPLAN® Version 3.0, an economic impact assessment modeling system structured as an input-output model.

3.2 Estimate Economic Costs and Benefits

Estimate the economic costs and benefits of public transit in South Dakota.

Our approach to assessing the benefits of public transit in South Dakota 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

[4] U.S. Department of Transportation, Federal Transit Administration, Office of Policy Development. *Transit Benefits 2000 Working Papers: A Public Choice Policy Analysis*, 2000.

instance, diesel powered vans are known for emitting more nitrogen oxides (NO_x) than passenger cars.

- **Assess the "incrementality" of benefits** – In accordance with this principle we measure the incremental cost savings associated with (i) individuals switching from personal vehicles (and other less affordable transportation modes) to public transit, and (ii) the change in the total number of trips as a result of the presence of 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.

- **Attach monetary values to all benefits** – The benefits of public transit are diverse in nature, from reduced motor vehicle emissions and crashes to travel time savings due to less congested roads. By expressing these benefits in a common measurement unit (dollars) we can compare them more easily and add them up to estimate total benefits.

- **Acknowledge the uncertainty surrounding model assumptions** – To account for this uncertainty the analysis is conducted within a risk analysis framework, thereby providing the full distribution of potential outcomes in lieu of single point estimates.

The estimation of the benefits of public transit relies primarily on operational and financial data at the transit agency level provided by SDDOT and transit agencies operating in South Dakota. Supplemental data were collected from other state sources (e.g., Department of Public Safety and Department of Social Services) and national sources (APTA, U.S. Environmental Protection Agency, Federal Highway Administration, etc.).

3.3 Characterize Intangible Benefits

Identify and describe social, environmental, and other intangible benefits of public transit in South Dakota.

The research team built on its extensive transportation literature database to identify and describe in a comprehensive manner the benefits of public transit in South Dakota. To ensure that the database was up to date, we examined recent research conducted by academics, government agencies, and independent research organizations, including: the American Public Transportation Association, the Center for Transportation Excellence, the Canadian Urban Transit Association, the Federal Transit Administration, the Transportation Research Board and the Victoria Transport Policy Institute. We also gained valuable information on benefits specific to rural parts of South Dakota from interviews with SDDOT management, transit providers and local officials.

Typically, the benefits of public transit are broken down into the following three categories:

- **Low-cost mobility benefits** – These are the benefits from providing low-cost mobility to transit-dependent households. The benefits include: the economic value to access services such as healthcare, education, retail and attractions (affordable mobility benefits); and budget savings for welfare and social services, such as unemployment and homecare, due to the presence of transit (cross-sector benefits).

- **Transportation cost savings** – These are the savings in vehicle ownership and operating cost (purchase/lease, insurance, fuel consumption, etc.), travel time, accidents and environmental emissions (such as carbon monoxide, nitrogen oxides and volatile organic compounds) due to less congestion and fewer miles traveled by personal vehicles in the presence of transit. These cost savings mean greater disposable household income for other purposes.

- **Economic development benefits** – Proximity to transit systems can have a positive effect on residential property values and commercial activities due to the increased availability of travel opportunities and improved linkages between residential and commercial centers.

There are also less tangible benefits such as agglomeration economies, community cohesion benefits, relocation cost savings,[5] groundwater pollution cost savings, noise pollution cost savings, land conservation benefits and the provision of transportation service during emergencies, either natural (e.g., tornadoes and floods) or man-made (e.g., fuel shortage). However, they are seldom quantified because of the difficulty in putting a monetary value on such benefits.

3.4 Describe Funding Mechanisms and Levels

Describe recent and current funding mechanisms and levels for public transit in South Dakota.

The research team examined and described the funding mechanisms and levels for public transit in South Dakota. The various public funding sources were identified at the federal, state and local levels. The primary source of information is the Federal Transit Administration (FTA), which provides detailed information on existing federal grant programs (Job Access and Reverse Commute Program (5316), New Freedom Program (5317), etc.). Recent data on federal and state public funding sources were obtained from SDDOT. Public funding sources are organized in a taxonomy distinguishing operating funding from capital funding and describing the eligibility criteria, funding allocation practices and possible uses of funds. New or less known funding strategies and opportunities, either from untapped public sources or from the private sector (e.g., establishing effective payment schemes for human service agency riders), are also recommended to help transit agencies operating in South Dakota secure funding.

3.5 Develop Educational Material

Develop concise educational material summarizing the costs, benefits, and funding of public transit operations in South Dakota.

The research team prepared a brochure summarizing the study findings. The brochure focuses on the benefits, costs, funding mechanisms and levels for public transit in South Dakota and demonstrates that public transit is beneficial to society as a whole and not just to transit riders. It is designed as an outreach document and is written in non-technical terms so as to be easily understood by the general public and effectively communicated by policy makers, planners and transit managers for educational, marketing, policy or planning purposes.

[5] In the absence of public transit, people who do not have access to a car may need to relocate closer to their place of work or to the services they need (healthcare, education, etc.).

4 Task Description

4.1 Meet with the Technical Panel

Meet with the project's technical oversight panel to review the project scope and work plan.

The research team met with the project's technical oversight panel in September 2010 at the South Dakota Department of Transportation in Pierre, SD. The panel consisted of transit directors and personnel from the Office of Research, the Office of the Secretary and the Office of Local Transportation Programs. Some panel members participated via conference call/teleconference. The objectives of this collaborative meeting were to review the proposed research plan, answer questions from the panel, as well as clarify and finalize the objectives of the study and the approach.

4.2 Interview Transit Providers and Officials

Conduct interviews with transit providers, public officials, and other contacts suggested by the project's technical panel to identify factors that affect actual or perceived costs and benefits associated with public transit in South Dakota.

The research team conducted a series of phone interviews with transit managers, local and state officials to identify factors that affect costs and benefits associated with public transit in South Dakota. A tentative list of topics and issues to be discussed was sent in advance to twelve individuals selected by SDDOT. The phone interviews were structured around the following topics: transit system characteristics; benefits of public transit; costs of public transit; funding; effects of the recession; and outreach material. These interviews were also useful to find out the type of data that could be directly provided by transit agencies.

4.3 Categorize Public Transit Operations

Propose a grouping of South Dakota's public transit operations into categories that will permit convenient but sound characterization and analysis of costs, tangible benefits, and intangible benefits.

To allow for a comprehensive, yet practical, assessment of transit benefits and costs, the various transit agencies operating in South Dakota were grouped into a limited number of categories based on a number of key operational (e.g., type of service and breakdown of passengers by trip purpose) and socioeconomic characteristics (e.g., population and location in an Indian reservation). A set of model inputs (e.g., value of time) specific to each public transit category was subsequently developed.

4.4 Propose a Cost and Benefit Methodology

Propose for approval of the project's technical oversight panel a detailed methodology for characterizing, analyzing, and documenting costs, tangible benefits, and intangible benefits of transit operations within the public transit categories defined in Task 5.

The research team drew upon more than 15 years of experience in economic modeling for local, state and federal transportation agencies, including the Federal Transit Administration, Transport Canada, Arizona Department of Transportation, Utah Department of Transportation and Virginia Department of Rail and Public Transportation. We built upon a methodology originally developed for the Federal Transit

Administration to measure the effects and the economic benefits and costs of public transit.[6] This methodology was refined to include the most recent developments in the transportation literature. It was also customized to the State of South Dakota and adapted to account for potential data limitations.

The starting point of the analysis is to model the decisions made by transit riders if transit service were no longer 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.

The study also includes an assessment of the impacts on the South Dakota economy resulting from:

- The on-going operation of transit systems, which requires inputs (purchases) of labor, materials, equipment and services supplied by state (and non-state) producers;
- Transit capital expenditures (e.g., construction of passenger intermodal facilities), provided that they are incurred within South Dakota; and
- The spending of out-of-pocket cost savings accrued to transit riders on other goods and services purchased in the State.

To measure the direct, indirect and induced impacts of public transit we use IMPLAN® Version 3.0, an economic impact assessment modeling system structured as an input-output model.

4.5 Demonstrate the Cost and Benefit Methodology

Upon approval of the project's technical oversight panel, demonstrate the application of the methodology in at least one transit operation in each public transit category.

After the methodology was refined in accordance with the project's technical oversight panel recommendations, the benefits and costs of public transit are estimated for a sample of representative transit agencies operating in South Dakota. This task mainly served three purposes:

- Demonstrate how the methodology could be applied to estimate the benefits and costs of public transit in South Dakota;
- Assess the validity and reliability of the methodology by applying it consistently to each selected transit operation; and
- Evaluate the benefits of transit for all selected transit operations using the most recent available data (2010).

The following transit agencies were selected to demonstrate the application of the methodology: Community Transit, Rapid Transit System, River Cities Transit and Vermillion Public Transit. The

[6] U.S. Department of Transportation, Federal Transit Administration, Office of Policy Development. *Transit Benefits 2000 Working Papers: A Public Choice Policy Analysis*, 2000.

estimation was conducted within a risk analysis framework to account for uncertainty surrounding model assumptions.

4.6 Prepare a Technical Memorandum

Prepare and submit for approval of the project's technical oversight panel a technical memorandum summarizing the demonstration of the methodology and recommending needed changes or enhancements.

The research team prepared a technical memorandum detailing the preliminary results of the methodology demonstration for the four selected transit agencies. The memorandum also gave an overview of the methodology, discussed the grouping of transit providers and presented key model inputs. Data sources and references used in the estimation process along with the results of the risk analysis for each selected transit agency were provided in appendices.

The memorandum was submitted first in draft form to the technical oversight panel and then in a final form incorporating the members' comments and recommendations.

4.7 Apply the Cost and Benefit Methodology

Upon approval of the project's technical oversight panel, make needed enhancements and apply the methodology to complete analysis of each public transit category and to statewide public transit operations.

After the methodology was successfully applied to the four selected transit operations and the technical memorandum presenting the preliminary results was approved by the project's technical oversight panel, the analysis was completed by fully implementing the methodology to the remaining transit operations. Thus, the benefits and costs of public transit were assessed at various levels of analysis: type of service (fixed route or demand response), transit agency, public transit category and state.

4.8 Describe Transit Funding Mechanisms and Levels

Describe recent and current funding mechanisms and levels for public transit in South Dakota.

The research team examined and described the funding mechanisms and levels for public transit in South Dakota. The various public funding sources were identified at the federal, state and local levels. The primary source of information is FTA's website, which provides detailed information on existing federal grant programs (JARC Program (5316), New Freedom Program (5317), etc.). This information was supplemented with recent data provided by SDDOT. Public funding sources were organized in a taxonomy distinguishing operating funding from capital funding and describing the eligibility criteria, funding allocation practices and possible uses of funds. New or less known funding strategies and opportunities, either from untapped public sources or from the private sector (e.g., establishing effective payment schemes for human service agency riders), are also recommended to help transit agencies operating in South Dakota secure funding.

4.9 Develop an Educational Brochure

Develop an educational brochure or other material that concisely communicates the costs, benefits, and funding of public transit in South Dakota.

The research team prepared a brochure summarizing the study findings. The brochure focuses on the benefits, costs, funding mechanisms and levels for public transit in South Dakota and demonstrates that public transit is beneficial to society as a whole and not just to transit riders. It is designed as an outreach document and is written in non-technical terms so as to be easily understood by the general public and effectively communicated by policy makers, planners and transit managers for educational, marketing, policy or planning purposes

4.10 Prepare a Final Report

In conformance with Guidelines for Performing Research for the South Dakota Department of Transportation, prepare a final report and executive summary of the research methodology, findings, conclusions, and recommendations.

The research team documented the methodology, key model inputs, study findings and recommendations in a final report that complies with the *Guidelines for Performing Research for the South Dakota Department of Transportation*. An executive summary presenting the study findings in layman's terms was also prepared. The report and the executive summary were submitted to SDDOT first in draft form and again in final form, the latter reflecting comments and recommendations provided by the project's technical oversight panel.

4.11 Make Executive Presentations

Make executive presentations to the SDDOT Research Review Board and the Dakota Transit Association at the conclusion of the project.

At the conclusion of the project, the research team made two executive presentations to the SDDOT Research Review Board on October 20, 2011 in Pierre, SD and to transit directors convened at the SDDOT quarterly transit meeting on November 14-15, 2011 in Brookings, SD. A Microsoft PowerPoint presentation summarizing all the research methodology, findings and recommendations was distributed electronically to SDDOT ahead of the meetings for review and comments.

5 Findings and Conclusions

The following is an overview of the main findings and conclusions of the study. The chapter is organized around the main research objectives described in Chapter 3.

5.1 Characterization of the Benefits of Public Transit

The overall benefits of public transit can be divided into two main categories:

- **The social benefits** measure the net increase in society's welfare (and not just transit riders' welfare); and
- **The economic impacts** measure the contribution to the economy (in terms of jobs, output, tax revenue, etc.).

The social benefits of public transit can be further broken down into two sub-categories:

- *Transportation cost savings* consist of out-of-pocket cost savings (e.g., vehicle ownership and operating cost savings), travel time cost savings (from reduced congestion in urban areas), accident cost savings and environmental emissions cost savings; and
- *Low-cost mobility benefits* are the benefits from providing low-cost mobility to transit-dependent (or low-income) households and consist of affordable mobility benefits (the economic value to individuals of accessing services such as healthcare, education and retail for transit dependent people) and cross-sector benefits (budget savings for welfare services as well as for medical services).

In addition to the social benefits, there are economic impacts resulting from:

- Transit capital and operating expenses; and
- The spending of a portion of out-of-pocket cost savings accrued to transit riders (on housing, healthcare, food, etc.).

5.2 Development of the Methodology

To allow for a comprehensive, yet practical, assessment of the benefits and costs of public transit, transit providers operating in South Dakota were grouped into a few categories based on a mix of socioeconomic data and transit statistics:

- **Urbanized** – Provider serves a city with a population of at least 50,000; a majority of trips are for work purposes; fixed route service is available; providers receive FTA Section 5307 funds and FTA Section 5316 funds.
- **Small urban** – Service area primarily focuses on a city with a population of at least 2,500 but less than 50,000; only demand response service is available; a high percentage of riders have disabilities; some providers receive FTA Section 5316 funds.

- **Rural** – Service area is sparsely populated (i.e., density is less than 10 people per square mile) and does not include any city with a population of 2,500 or more; some providers serve Indian reservations and/or have a multi-county service area; high percentage of nutrition trips.

Note that three transit providers could not be assigned to any of these categories: Inter-Lakes Community Action (social service agency serving primarily low-income families and senior citizens); River Cities Public Transit (very large service area); and Siouxland Regional Transit System (provides only medical trips in an urbanized area). Accordingly, these systems are treated separately ("Other" category) in the analysis. The proposed breakdown of transit providers is shown in Table 1 below.

Table 1: Public Transit Providers by Category

Category	Public Transit Provider
Urbanized	Rapid Transit System
	Sioux Area Metro
Small urban	Aberdeen Ride Line
	Brandon City Transit
	Brookings Area Transit Authority
	Dell Rapids Transit
	East Dakota Transit, Inc.
	Palace Transit
	People's Transit
	Vermillion Public Transit
	Watertown Area Transit
	West River Transit Authority, Inc.
	Yankton Transit, Inc.
Rural	Arrow Transit
	Community Transit, Inc.
	Groton Community Transit, Inc.
	Rosebud Sioux Tribe Transportation
	Rural Office of Community Services
	Sanborn County Transit
	Spink County Public Transit
	Standing Rock Public Transportation
Other	Inter-Lakes Community Action
	River Cities Public Transit
	Siouxland Regional Transit System

To quantify the social benefits of public transit we first model the decisions made by transit riders if transit service was 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 to transit dependent people.

In addition, the presence of public transit can contribute to economic activity in several ways:

- 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.

- Investing in transit capital projects (construction of a bus depot, renewal of vehicle fleet, etc.) also spurs job creation.

- In addition, people who use public transit instead of more expensive alternative modes save substantial money (i.e., out-of-pocket cost savings). A majority of these savings is re-directed toward other household expenses such as housing or healthcare.

To measure the direct, indirect and induced impacts of public transit on the South Dakota economy, we used IMPLAN Version 3.0, an economic impact assessment modeling system structured as an input-output model.

5.3 Estimation of the Benefits of Public Transit

5.3.1 Social Benefits

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 public transit. In addition, public transit can reduce congestion in urban areas, resulting in travel time savings, accident cost savings and emissions cost savings. 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 2 below, out-of-pocket cost savings account for most of the transportation cost savings, ranging from $341 thousand for Other systems to $7.61 million for Urbanized systems. Note that emissions cost savings are negative for all four transit categories. This is mainly due to the fact that in the absence of public transit there would be a net reduction in vehicle miles traveled (VMT) that would more than offset the difference in emission rates (and in vehicle occupancy) between transit vehicles and personal vehicles. Also, travel time savings are negligible (or even slightly negative) because congestion is not an issue, except in large urban areas.

Table 2: Transportation Cost Savings

Benefit Category	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Out-of-pocket cost savings	$7,614	$1,951	$361	$341	$10,267
Travel time savings	$344	-$9	-$11	-$8	$317
Accident cost savings	$476	$190	$55	-$20	$702
Emissions cost savings	-$150	-$136	-$103	-$90	-$479
Total	$8,284	$1,997	$303	$223	$10,807

Note: All amounts are expressed in thousands of 2010 dollars.

A number of South Dakota residents do not have access to a personal vehicle and depend entirely upon public transit for their mobility needs. In the absence of public transit, many of them would have no choice but to forego their trips. This implies that some people would lose their job and apply for public assistance, or require home care, or move to a nursing home facility. Therefore, by providing an

affordable transportation alternative, public transit creates economic value and generates cost-savings in other sectors of the economy.

As shown in Table 3 below, affordable mobility benefits range from $78 thousand for Other systems to $816 thousand for Urbanized systems. Home care/institutionalization cost savings account for the majority of low-cost mobility benefits. At the state level, they amount to $5.16 million.

Table 3: Low-Cost Mobility Benefits

Benefit Category	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Affordable mobility benefits	$816	$138	$86	$78	$1,118
Cross-sector benefits	$3,378	$1,355	$715	$534	$5,981
Home care/Institutionalization cost savings	$2,923	$1,176	$614	$442	$5,155
Public assistance cost savings	$455	$179	$100	$92	$826
Total	$4,194	$1,493	$801	$612	$7,099

Note: All amounts are expressed in thousands of 2010 dollars.

5.3.2 Economic Impacts

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

Table 4 below shows the economic impacts of these expenses by impact metric and by transit agency. For Small Urban systems, the spending of out-of-pocket cost savings generated $1.45 million in business output (or total sales) in 2010, including $844 thousand in total value added, and resulted in about $192 thousand in Federal and State/Local tax revenue.

Table 4: Economic Impacts of Out-of-Pocket Cost Savings

Impact Metric	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Output	$5,651	$1,448	$268	$253	$7,620
Value added	$3,295	$844	$156	$147	$4,443
Employment	52	13	2	2	70
Taxes	$749	$192	$36	$34	$1,010
Federal taxes	$349	$89	$17	$16	$470
State/Local taxes	$400	$103	$19	$18	$540

Notes: All dollar amounts are expressed in thousands of 2010 dollars.
Value added is a component of output and the two should not be added together.
Employment 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 of the economy.
State and local tax impacts are combined and cannot be separated within IMPLAN.

Furthermore, the on-going operation of transit systems requires inputs (purchases) of labor, materials, equipment and services supplied by state producers. These operating and maintenance expenses in turn

spur indirect and induced economic activity throughout South Dakota. As shown in Table 5 below, O&M expenses incurred by Rural systems generated $3.86 million in business output and $145 thousand in taxes in 2010. Note, however, that total value added is negative because of government subsidies to the public transit sector.

Table 5: Economic Impacts of Transit O&M Expenses

Impact Metric	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Output	$14,279	$7,937	$3,863	$4,740	$30,819
Value added	-$237	-$132	-$64	-$79	-$512
Employment	196	109	53	65	423
Taxes	$538	$299	$145	$178	$1,160
Federal taxes	$581	$323	$157	$193	$1,254
State/Local taxes	-$44	-$24	-$12	-$14	-$94

Notes: All dollar amounts are expressed in thousands of 2010 dollars.
Value added is a component of output and the two should not be added together.
Employment 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 of the economy.
State and local tax impacts are combined and cannot be separated within IMPLAN.

In the same way, public transit spending on capital goods contributes to economic growth. The economic impacts of capital expenses are reported for each transit category and at the state level in Table 6 Table 18 below. For instance, capital expenses incurred by Other systems generated nearly $856 thousand in business output, including $643 thousand in total value added, and resulted in about $192 thousand in Federal and State/Local tax revenue.

Table 6: Economic Impacts of Transit Capital Expenses

Impact Metric	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Output	$4,048	$2,237	$560	$856	$7,701
Value added	$2,826	$1,501	$366	$643	$5,336
Employment	18	13	3	3	37
Taxes	$816	$420	$102	$192	$1,530
Federal taxes	$377	$198	$48	$86	$709
State/Local taxes	$439	$222	$54	$106	$821

Notes: All dollar amounts are expressed in thousands of 2010 dollars.
Value added is a component of output and the two should not be added together.
Employment 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 of the economy.
State and local tax impacts are combined and cannot be separated within IMPLAN.

5.4 Description of the Funding Mechanisms and Levels

Public transit funding is provided from a mix of federal, state, local and transit agency sources.

5.4.1 Federal Funding

Federal funds are the primary source of funding for public transit in South Dakota. The Office of Local Transportation Programs at the South Dakota Department of Transportation is responsible for several federal programs that support public and specialized transportation service providers in South Dakota. These programs are typically identified by a section number (of Title 49 of the United States Code) and/or a name and include the following:

- **Section 5303 – Metropolitan Planning**: Formula funding to state departments of transportation (and subsequently to metropolitan planning organizations) for transit planning activities in metropolitan areas, such as those increasing the safety of the transportation system or those enhancing the accessibility and mobility of people.

- **Section 5304 – Statewide Planning**: Formula funding to state departments of transportation for transit planning activities in rural or small-sized urban areas.

- **Section 5309 – Bus and Bus Facilities**: Discretionary funding to state and local governments, as well as public agencies, private companies engaged in public transportation and private non-profit organizations for capital assistance for new and replacement buses, related equipment and facilities.

- **Section 5310 – Elderly and Disabled**: Formula funding to states for transit capital assistance to private nonprofit groups serving the transportation needs of the elderly and persons with disabilities. Funds are apportioned based on each State's share of population for these groups of people.

- **Section 5311 – Rural Areas**: Formula funding to states for transit capital, operating and administrative assistance in rural areas, with populations of less than 50,000. A portion of funds is directed towards federally recognized tribes (FTA Section 5311(c)). In FY 2010, section 5311 funds amounted to $5.6 million for public transit providers in South Dakota.

- **Section 5316 – Job Access and Reverse Commute (JARC)**: Formula funding to state and local governments, public transit agencies and non-profit organizations for the purpose of addressing the unique transportation challenges faced by welfare recipients and low-income persons seeking to obtain and maintain employment.

- **Section 5317 – New Freedom**: Formula funding to state and local governments, public transit agencies and non-profit organizations for transit capital and operating assistance to transportation services for people with disabilities, beyond the requirements of the Americans with Disabilities Act (ADA) of 1990.

In addition, Rapid Transit System and Sioux Area Metro receive funds directly from the FTA for the following program:

- **Section 5307 – Urbanized Areas**: Formula funding to urbanized areas and to Governors for transit capital and operating assistance in urbanized areas and for transportation-related planning. An urbanized area is an incorporated area with a population of 50,000 or more that is designated as such by the U.S. Census Bureau.

Finally, the TIGER (Transportation Investment Generating Economic Recovery) discretionary grant program was included in the 2009 American Recovery and Reinvestment Act to provide capital assistance for innovative, multi-modal and multi-jurisdictional transportation projects that promise significant economic and environmental benefits.[7] Grants are awarded on a competitive basis. Since 2009 the FTA has funded more than 90 capital transit projects across the country through the TIGER discretionary grant program. As of September 2011, none of them was located in South Dakota.

A local match is often required to be eligible for FTA funding programs. But unlike federal funding, state and local funds come from a variety of public and private sources.

5.4.2 State Funding

State transit funding in FY 2010 was estimated at $0.8 million (unchanged from FY 2009) or $0.95 per capita and represented less than 10 percent of total federal funding. These funds are eligible only for operating expenses and are allocated using a formula-based method. Until the early 1990s the State did not provide any funding for public transit.

In South Dakota, state transit funds come entirely from the State Highway Fund. However, additional funding sources are commonly used by other states, such as gas taxes, bond proceeds, motor vehicle registration/license/title fees, general sales taxes, motor vehicle/rental car sales taxes and interest income. Other potential sources include trust funds, lottery funds and documentary stamps.

In addition, the Division of Adult Services and Aging at the South Dakota Department of Social Services provides funds to cover transportation costs for some transit agencies. Transportation is considered a supportive function eligible through Title III-B. In FY 2010, these funds amounted to $0.4 million.

5.4.3 Local Funding

Local revenues (rider fares, contract fares, advertising, and donations) totaled $2.7 million in FY 2010. Given the cost of operating demand response service systems in rural areas and state funding limitations, many rural and small urban transit agencies have been resorting to unconventional and innovative local funding sources. A national survey of transportation providers in rural and small urban communities conducted for Easter Seals Project ACTION in 2005[8] identified the following sources in particular:

- Community foundations and service clubs;
- Human service agencies, businesses, community organizations (e.g., YMCA and United Way), or school districts that contract for client transportation services or purchase transit passes;
- Faith-based organizations; and

[7] Congress dedicated $1.5 billion for TIGER I in 2009, $600 million for TIGER II in 2010 and $527 million for TIGER III in 2011.

[8] TranSystems Corporation, RLS & Associates and Nelson\Nygaard Consulting Services. *Transportation Services for People with Disabilities in Rural and Small Communities: Final Report*, prepared for Easter Seals Project Action, 2006, pp. 55-57.

- Revenues from lease of facility space, provision of vehicle maintenance services and advertising on vehicles, on websites or in public information materials (e.g., rider's guide).

Some transit agencies in South Dakota already have access to these funding sources. For instance, Standing Rock Public Transportation uses profits from its oil changing and maintenance business with other government agencies. Palace Transit has been selling advertising space for years. Brookings Area Transit Authority gets funds from United Way.

6 Introduction

The issue of providing cost-effective transit service in sparsely populated rural areas is not new in the U.S. Below some population density threshold, fixed routes and regularly scheduled forms of public transportation are too expensive to operate. The solution, in many parts of the country, has been to use demand response services (i.e., curb-to-curb, advance reservation, shared ride transportation services) to meet the demand for public transportation in rural areas. However, these demand response services have come under fire because they often carry few passengers and because they are subsidized to some extent through public funds. They also suffer from the absence of economies of scale, thus leaving little room for productivity gains.

At the same time, transit agencies are struggling to secure funding, especially from local sources. The problem is even more acute today as a result of the recent economic downturn. According to a survey conducted by the American Public Transportation Association (APTA) in March 2010, nearly 90 percent of public transit agencies reported flat or decreased local and state funding.[9] This widespread revenue shortfall has forced many agencies to raise fares, cut service, lay off employees and take other extreme measures to survive. This creates a need to identify new funding strategies and opportunities, either from untapped public sources or from the private sector.

Yet, the economic value of public transit to rural communities is undeniable. Few would argue, for instance, that providing affordable access to healthcare facilities and providers is critical to the rural population, which is aging faster than the urban population (as a result of the continued migration of young adults to metropolitan areas). A portion of the rural population (especially those with low income, disabilities or no access to a car) relies entirely on public transit for its mobility needs. If public transit were no longer available, these people would require home care or would no longer seek medical assistance.

In addition, estimating the economic value of public transit is necessary for policy makers to make informed investment decisions. Sound investments in public transit are those whose benefits exceed their costs. But, in part because of the difficulty and cost of acquiring the necessary data, little research effort has been devoted to quantifying the benefits of transit in rural areas. The literature on this topic is scarce, to say the least.

In light of the above, the South Dakota Department of Transportation (SDDOT) hired HDR Decision Economics (HDR) to assess the costs and benefits of public transit in South Dakota. The present report documents the methodology, the data and the results of this study. After this introduction, Chapter 7 summarizes the findings of the interviews with the public transit community. Chapter 8 describes how public transit providers were grouped into a limited number of categories for the purposes of the analysis. Chapter 9 discusses funding mechanisms and levels for public transit in South Dakota. The methodology employed to estimate the benefits of public transit is explained in detail in Chapter 10. The model inputs and the analysis results are presented in Chapter 11 and Chapter 12 respectively. Recommendations for further research are made in Chapter 13 and a summary of the research benefits is provided in Chapter 14.

The report also includes a number of appendices. A list of acronyms used in the report is included in Appendix A. A map representing all public transit providers operating in South Dakota is available in

[9] American Public Transportation Association. Imp*acts of the Recession on Public Transportation Agencies: Survey Results*, March 2010, p. 3.

Appendix B. The analysis results for a sample of four transit agencies are presented in Appendix C. Detailed results of the statewide economic impact analysis are included in Appendix D. Risk analysis results are discussed in Appendix E. And Appendix F provides a list of references and data sources used throughout the study.

7 Interview Findings

In November and December 2010, the research team conducted a series of phone interviews with various stakeholders in the public transit community to identify factors that affect actual or perceived costs and benefits associated with public transit in South Dakota. The phone interviews were structured around the following topics: transit system characteristics; benefits of public transit; costs of public transit; funding; effects of the recession; and outreach material. This chapter summarizes the responses given.

7.1 Transit System Characteristics

In general, the level of awareness of the community with regard to public transit is considered good by interviewees. Some agencies are very active on the marketing front and advertise in the local media. This has paid off in terms of ridership. For instance, Standing Rock Public Transportation reported that their ridership has doubled over the last couple of years thanks to their marketing efforts (name change, new logo, webpage and advertising in local community papers and on the radio).

In large urban systems, some areas are underserved and service is not provided at night or on Sundays. A couple of agencies stated that more could be done to better serve the elderly and those on dialysis in small rural communities.

Generally speaking, work is the number one destination in urban areas. A few small transit systems are mainly transporting people to school (e.g., Spink County Public Transit) or to healthcare facilities. In the Sioux Falls metropolitan area, a large proportion of trips (21 percent) are for medical purposes because of the presence of several hospitals (the city has become a major medical hub in the Upper Midwest).

A majority of transit agencies are Medicaid providers and some participate in FTA's JARC program (Section 5316).

7.2 Benefits of Public Transit

Interviewees stressed the mobility benefits of public transit in South Dakota. For many residents, public transit serves as a lifeline to essential services such as healthcare and nutrition. In a majority of transit systems, seniors are the number one ridership group. These people tend to drive less as they get older and rely more on public transit for grocery shopping and medical appointments.

A lot of households residing in poor rural areas counties do not have access to a car and rely almost entirely on public transit for their transportation needs.[10] Some agencies providing service 24/7 reported that their service is very useful to (low-income) people who work at night.

In addition, public transit can prevent work disruptions for working households by taking children to school and recreational activities.

Interestingly, money saved by riders on gasoline and other transportation costs was mentioned by only one interviewee.

[10] Five of the ten poorest counties in the United States (as measured by per capita income) are located in South Dakota: Buffalo, Shannon, Ziebach, Todd and Corson.

7.3 Costs of Public Transit

Payroll (labor and fringe benefits) is the main component of operating and maintenance expenses. Fuel, vehicle maintenance and insurance come next. Fuel cost, in particular, can be an issue when prices soar rapidly.

Eight transit agencies operating in South Dakota have multi-county service areas where distances can be very long, thus putting additional pressure on operating expenses.

Some transit agencies took advantage of ARRA funds to cover capital expenses in 2010.

7.4 Funding

Overall, transit agencies consider that the level of funding they get is sufficient to operate their system efficiently. At the same time, as stated above (Section 7.1), they recognize that with more funding they would be able to better serve their respective community. One agency stated that state funding was not enough. Also, finding the required local funding match has become challenging for a few rural systems since the onset of the recession.

Local funds come primarily from the city's General Fund. Most agencies also receive contributions from local organizations (e.g., United Way), but these have dried out over the last couple of years. A few urban systems get additional revenue by advertising on their buses.

All but one interviewee expect local and state funding to stay the same over the next three years. One agency was concerned that FTA's Tribal Transit 5311c funds might go away next fiscal year.

7.5 Effects of the Recession

None of the interviewees reported a budget shortfall as a result of the 2008-2009 recession. However, three transit agencies experienced a slight decline in local funding. If funding were significantly reduced, most transit agencies would, in order of preference: 1) defer capital expenses, 2) improve their productivity ("do the same with less") and 3) increase fares. Service cuts and layoffs would be considered as a last resort only. One agency reported that they were experiencing a two-year freeze on wages.

Many transit agencies have experienced an increase in ridership since 2008 which is attributed, directly or indirectly, to the recession. About half of interviewees reported that they recently experienced "load shifting", in other words an increase in ridership as a result of transportation service cuts from human service agencies. For instance, Indian Health Service is no longer providing transportation to its customers in the Rapid City area. These people are now using Rapid Transit System for their transportation needs.

If agencies had to cut service as a result of reduced funding, many seniors and people with disabilities would be stranded at home. Some people could lose their jobs or skip medical appointments with ensuing health problems. The consequences would be particularly dire for people on dialysis who require medical treatment several times a week. All this would ultimately impact social service programs (e.g., Medicaid). Some businesses that run 24/7 would also be negatively impacted.

7.6 Outreach Material

Most interviewees insisted that the educational brochure should be factual, have as little narrative as possible and consist primarily of graphs and tables. They intend to use it to show city, county and state officials that public transit can be as good an investment as highways and convince them to put more money into public transit.

8 Grouping of Public Transit Providers

As part of the study, public transit providers operating in the State of South Dakota were grouped into a limited number of categories. These categories are meant to allow for a comprehensive, yet practical, assessment of transit benefits and costs. As a consequence, some model inputs are common to all transit providers within the same category (e.g., value of travel time). After a brief overview of the data collection process in Section 8.1, the breakdown of transit providers operating in South Dakota is presented in Section 8.2.

8.1 Data Collection

The research team compiled recent data on transit operations (e.g., service area type and number of unlinked passenger trips), funding (e.g., participation in FTA Section 5316 program) and population for each transit provider using various state and national sources (South Dakota Department of Transportation, Federal Transit Administration, U.S. Census Bureau and U.S. Geological Survey).

Key transit operating data at the transit provider level for 2010 are provided in Section 11.1.1. A map representing all public transit providers operating in South Dakota is available in Appendix B.

8.2 Public Transit Categories

Based on the information gathered, public transit providers were grouped into the following three categories:

- **Urbanized** – Provider serves a city with a population of at least 50,000; majority of trips are for work purposes; fixed route service is available; provider receives FTA Section 5316 funds (JARC program) and FTA Section 5307 funds (Urbanized Area Formula Funding program);

- **Small urban** – Service area primarily focuses on a city with a population of at least 2,500 but less than 50,000; only demand response service is available; a high percentage of riders have disabilities; some providers receive FTA Section 5316 funds; and

- **Rural** – Service area is sparsely populated (i.e., density is less than 10 people per square mile) and does not include any city with a population of 2,500 or more; some providers serve Indian reservations and/or have a multi-county service area; high percentage of nutrition trips.

This categorization reflects in particular the system size (as measured by population and ridership), the system usage (as depicted by trip purpose) and key socioeconomic characteristics of transit riders (e.g., share of trips taken by seniors). Note, however, that the following transit providers could not be assigned to any of these three categories: Inter-Lakes Community Action (social service agency serving primarily low-income families and senior citizens); River Cities Public Transit (very large and heterogeneous service area); and Siouxland Regional Transit System (provides only medical trips in an urbanized area). Therefore, they are treated separately in the analysis.

The breakdown of transit providers by category is shown in Table 7 on the following page.

Table 7: Public Transit Providers by Category

Category	Public Transit Provider
Urbanized	Rapid Transit System Sioux Area Metro
Small urban	Aberdeen Ride Line Brandon City Transit Brookings Area Transit Authority Dell Rapids Transit East Dakota Transit, Inc. Palace Transit People's Transit Vermillion Public Transit Watertown Area Transit West River Transit Authority, Inc. Yankton Transit, Inc.
Rural	Arrow Transit Community Transit, Inc. Groton Community Transit, Inc. Rosebud Sioux Tribe Transportation Rural Office of Community Services Sanborn County Transit Spink County Public Transit Standing Rock Public Transportation
Other	Inter-Lakes Community Action River Cities Public Transit Siouxland Regional Transit System

9 Public Transit Funding

Public transit funding is provided from a mix of federal, state, local and transit agency sources. This chapter gives an overview of funding mechanisms and levels for public transit in South Dakota and presents new or less known options, either from untapped public sources or from the private sector, to help transit agencies secure funding. Federal funding is discussed in Section 9.1, while state and local funding are considered in Section 9.2.

9.1 Federal Funding

Federal funds are the primary source of funding for public transit in South Dakota. The Federal Transit Administration administers a number of funding programs for planning, vehicle purchases, facility construction, operations and other purposes.

9.1.1 Funding Sources

Federal transit programs are funded from two sources: the Mass Transit Account (MTA) of the Highway Trust Fund (HTF) and General Revenues of the Treasury (also called General Funds). The 1982 Surface Transportation Assistance Act (STAA) created the MTA as a separate account in the HTF for accrual of a portion of revenues from the federal motor fuel tax for transit uses. The 1982 STAA specified that 1 cent of a 5 cents per gallon increase in the federal motor fuel tax would be deposited in the newly created MTA. Since then, 20 percent of each subsequent increase in the motor fuel tax has been deposited in the MTA. In 2010, 15.5 percent of the gasoline tax and 11.7 percent of the diesel fuel tax were dedicated to the MTA.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), Public Law (P.L.) 109-59, was the authorizing law that established authority to appropriate General Revenues and to spend trust fund monies through limitations on obligations, for highways and transit, on an annual basis from FY 2005 through FY 2009. Because SAFETEA-LU expired on September 30, 2009 and no long-term authorization law has been enacted yet, the authorization of spending for FY 2010 and FY 2011 has been accomplished by a series of laws extending the authorizations in SAFETEA-LU.

9.1.2 Funding Programs

The Office of Local Transportation Programs at the South Dakota Department of Transportation is responsible for several federal programs that support public and specialized transportation service providers in South Dakota. These programs are typically identified by a section number (of Title 49 of the United States Code) and/or a name and include the following:

- **Section 5303 – Metropolitan Planning**: Formula funding to state departments of transportation (and subsequently to metropolitan planning organizations) for transit planning activities in metropolitan areas, such as those increasing the safety of the transportation system or those enhancing the accessibility and mobility of people.

- **Section 5304 – Statewide Planning**: Formula funding to state departments of transportation for transit planning activities in rural or small-sized urban areas.

- **Section 5309 – Bus and Bus Facilities**: Discretionary funding to state and local governments, as well as public agencies, private companies engaged in public transportation and private non-profit organizations for capital assistance for new and replacement buses, related equipment and facilities.

- **Section 5310 – Elderly and Disabled**: Formula funding to states for transit capital assistance to private nonprofit groups serving the transportation needs of the elderly and persons with disabilities. Funds are apportioned based on each State's share of population for these groups of people.

- **Section 5311 – Rural Areas**: Formula funding to states for transit capital, operating and administrative assistance in rural areas, with populations of less than 50,000. A portion of funds is directed towards federally recognized tribes (FTA Section 5311(c)). In FY 2010, section 5311 funds amounted to $5.6 million for public transit providers in South Dakota.

- **Section 5316 – Job Access and Reverse Commute (JARC)**: Formula funding to state and local governments, public transit agencies and non-profit organizations for the purpose of addressing the unique transportation challenges faced by welfare recipients and low-income persons seeking to obtain and maintain employment.

- **Section 5317 – New Freedom**: Formula funding to state and local governments, public transit agencies and non-profit organizations for transit capital and operating assistance to transportation services for people with disabilities, beyond the requirements of the Americans with Disabilities Act (ADA) of 1990.

In addition, Rapid Transit System and Sioux Area Metro receive funds directly from the FTA for the following program:

- **Section 5307 – Urbanized Areas**: Formula funding to urbanized areas and to Governors for transit capital and operating assistance in urbanized areas and for transportation-related planning. An urbanized area is an incorporated area with a population of 50,000 or more that is designated as such by the U.S. Census Bureau.

Finally, the TIGER (Transportation Investment Generating Economic Recovery) discretionary grant program was included in the 2009 American Recovery and Reinvestment Act to provide capital assistance for innovative, multi-modal and multi-jurisdictional transportation projects that promise significant economic and environmental benefits.[11] Grants are awarded on a competitive basis. Since 2009 the FTA has funded more than 90 capital transit projects across the country through the TIGER discretionary grant program. As of September 2011, none of them was located in South Dakota.

9.2 State and Local Funding

A local match is often required to be eligible for FTA funding programs. But unlike federal funding, state and local funds come from a variety of public and private sources.

[11] Congress dedicated $1.5 billion for TIGER I in 2009, $600 million for TIGER II in 2010 and $527 million for TIGER III in 2011.

9.2.1 State Funding

State transit funding in FY 2010 was estimated at $0.8 million (unchanged from FY 2009) or $0.95 per capita and represented less than 10 percent of total federal funding. These funds are eligible only for operating expenses and are allocated using a formula-based method. Until the early 1990s the State did not provide any funding for public transit.

In South Dakota, state transit funds come entirely from the State Highway Fund. However, additional funding sources are commonly used by other states, such as gas taxes, bond proceeds, motor vehicle registration/license/title fees, general sales taxes, motor vehicle/rental car sales taxes and interest income. Other potential sources include trust funds, lottery funds and documentary stamps.

In addition, the Division of Adult Services and Aging at the South Dakota Department of Social Services provides funds to cover transportation costs for some transit agencies. Transportation is considered a supportive function eligible through Title III-B. In FY 2010, these funds amounted to $0.4 million.

9.2.2 Local Funding

Revenues from bus fares (rider fares, contract fares and donations) totaled $2.7 million in FY 2010 (see Table 9 on page 45 for a breakdown of fare revenues by transit category). Given the cost of operating demand response service systems in rural areas and state funding limitations, many rural and small urban transit agencies have been resorting to unconventional and innovative local funding sources. A national survey of transportation providers in rural and small urban communities conducted for Easter Seals Project ACTION in 2005[12] identified the following sources in particular:

- Community foundations and service clubs;
- Human service agencies, businesses, community organizations (e.g., YMCA and United Way), or school districts that contract for client transportation services or purchase transit passes;
- Faith-based organizations; and
- Revenues from lease of facility space, provision of vehicle maintenance services and advertising on vehicles, on websites or in public information materials (e.g., rider's guide).

Some transit agencies in South Dakota already have access to these funding sources. For instance, Standing Rock Public Transportation uses profits from its oil changing and maintenance business with other government agencies. Palace Transit has been selling advertising space for years. Brookings Area Transit Authority gets funds from United Way.

Rural transit agencies have shown creativity in accessing local funding sources elsewhere as well. For instance, agencies in Kootenai County, ID worked cooperatively to develop funding to continue a public transportation service as the area transitioned from a rural area (funded under Section 5311) to a small urban area (funded under Section 5307). A major challenge was generating non-federal funds to match Section 5307 funding. A key partner in the effort was the Coeur d'Alene Tribal Government, which

[12] TranSystems Corporation, RLS & Associates and Nelson\Nygaard Consulting Services. *Transportation Services for People with Disabilities in Rural and Small Communities: Final Report*, prepared for Easter Seals Project Action, 2006, pp. 55-57.

agreed to both operate the service as well as provide a $400,000 operating and capital match. Other local partners who agreed to support the service include the Kootenai Medical Center, the North Idaho College and Aging and Adult Services. Each agency recognized the benefits that it would receive from having access to the transportation service and agreed to be partners in funding it.

Also, the Area Transportation Authority of North Central Pennsylvania (ATA) actively markets available federal commuter tax credits. The program, called "Company Car", generates revenues from area employers. Utilizing available federal tax law,[13] employers can give employees a tax-free contribution of up to $60 per month toward the cost of transit tokens, tickets or passes. ATA works with employers to market the program and provides documentation to claim tax benefits. ATA also generates additional revenues by providing freight and small package delivery throughout its area.

[13] Section 132(f) of the IRS Code.

10 Methodology

This chapter describes the methodology for assessing the overall benefits of public transit in South Dakota. These benefits are divided into two broad categories: **social benefits** and **economic impacts**.[14] Section 10.1 presents the framework developed by the research team to evaluate the social benefits of public transit. Section 10.2 discusses the computation of economic impacts resulting from the presence of public transit. To facilitate understanding of the methodology, we use structure and logic diagrams that identify the various model inputs and outputs and the relationships between them.

10.1 Guiding Principles

Our approach recognizes a number of principles 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** – Positive effects are treated as benefits (or cost savings), while negative effects are treated as costs in the analysis. For instance, diesel powered vans (often used for demand responses service in rural areas) are known for emitting more nitrogen oxides (NO_x) than passenger cars.

- **Assess the "incrementality" of benefits** – In accordance with this principle we measure the incremental cost savings associated with (i) individuals switching from personal vehicles (and other less affordable transportation modes) to public transit, and (ii) the change in the total number of trips as a result of the presence of 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. For instance, car insurance should not be included in vehicle ownership and operating costs if it is already accounted for in accident costs.

- **Attach monetary values to all benefits** – The benefits of public transit are diverse in nature, from reduced motor vehicle emissions and crashes to travel time savings due to less congested roads. By expressing these benefits in a common measurement unit (dollars) we can compare them more easily and add them up to estimate total benefits.

- **Acknowledge the uncertainty surrounding model assumptions** – To account for uncertainty surrounding model inputs the analysis is conducted within a risk analysis framework, where risk variables (such as the percentage of trips foregone in the absence of public transit) are defined as a range of values (with low and high estimates) rather than a single point estimate.

10.2 Estimation of Social Benefits

Nearly 3 million trips are made on public transit annually in South Dakota. Public transit benefits local communities in different ways, from reducing vehicle traffic on the roadway network to providing low-cost mobility to those with limited financial resources. These benefits are often defined as social or societal benefits because they represent a net increase in society's welfare (and not just transit riders'

[14] Note that when "overall benefits" is used in this report it refers to both social benefits and economic impacts.

welfare). In addition, they can be estimated for the different socioeconomic sectors based on a breakdown of ridership by trip purpose (work, medical, education, etc.).

10.2.1 Overview

From federal government agencies to local community organizations, many public and private institutions have sponsored or conducted transit benefit studies over the last two decades. A list of key references used to develop the methodology is available at the end of the report in Appendix F. For the most part, research has focused on the following three benefit categories:

- **Transportation cost savings** – These are the savings in out-of-pocket cost savings,[15] travel time, accidents and environmental emissions (such as carbon monoxide, nitrogen oxides, volatile organic compounds and carbon dioxide)[16] attributable to reduced congestion and fewer miles traveled by personal vehicles in the presence of public transit.

- **Low-cost mobility benefits** – These are the benefits from providing low-cost mobility to transit-dependent (or low-income) households. The benefits include: the economic value to access services such as healthcare, education, retail and attractions (affordable mobility benefits); and budget savings for healthcare and welfare services such as Temporary Assistance for Needy Families and Supplemental Nutrition Assistance, due to the presence of public transit (cross-sector benefits).

- **Economic development benefits** – Proximity to transit systems can have a positive effect on residential property values and commercial activities due to the increased availability of travel opportunities and improved linkages between residential and commercial centers.[17]

Other less tangible or less frequent benefits have been claimed for public transit, such as agglomeration economies, community cohesion benefits, relocation cost savings, groundwater pollution cost savings, noise pollution cost savings, land conservation benefits and the provision of transportation service during emergencies, either natural (e.g., tornadoes and floods) or man-made (e.g., fuel shortage). However, they are seldom quantified in part because of the difficulty in putting a credible monetary value on such benefits.

10.2.2 Methodology for Estimating Transportation Cost Savings

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, while others would have no choice but to forego their trips. Transportation costs are then estimated under two scenarios: in the presence of public transit and in the absence of public transit. In other words, the methodology followed for this study evaluates the **incremental costs** associated with individuals

[15] In particular, out-of-pocket cost savings include the cost savings associated with owning, operating and maintaining a vehicle (fuel consumption, oil consumption, tire wear and tear, repairs, etc.).

[16] Transportation accounts for about 80 percent of carbon monoxide emissions, 50 percent of nitrogen oxide emissions, 50 percent of volatile organic compounds emissions and 30 percent of carbon dioxide emissions.

[17] Note, however, that economic development benefits are mainly found in corridors with rail transit systems. Therefore, they are not considered in this study.

switching from public transit to alternative transportation modes. More specifically, the calculation of transportation cost savings consists of six steps:

1. For each transit system, passenger trips are allocated by trip purpose (work, medical, etc.).

2. Assuming that transit service is no longer available, the number of trips foregone and the number of trips diverted from transit to other transportation modes (private vehicle, taxi, etc.) are calculated by means of passenger surveys.[18]

3. The remaining trips are translated into vehicle miles traveled (VMT) based on the average trip length.

4. The various transportation costs associated with VMT generated in the absence of public transit are subsequently estimated:

    - **Out-of-pocket costs** are calculated for private vehicle trips (vehicle ownership and operating costs, augmented with parking costs in urban areas) and taxi trips (fare) in particular;

    - **Travel time costs** are calculated based on the relationship between traffic volume (vehicle miles) and congestion delays (hours), and the value of time ($/hour);

    - **Accident costs** are assessed by accident severity (fatalities, injuries and property damage only (PDO) accidents); and

    - **Environmental emissions costs** are assessed for all major vehicle emission factors (volatile organic compounds, carbon monoxide, nitrogen oxides, etc.);

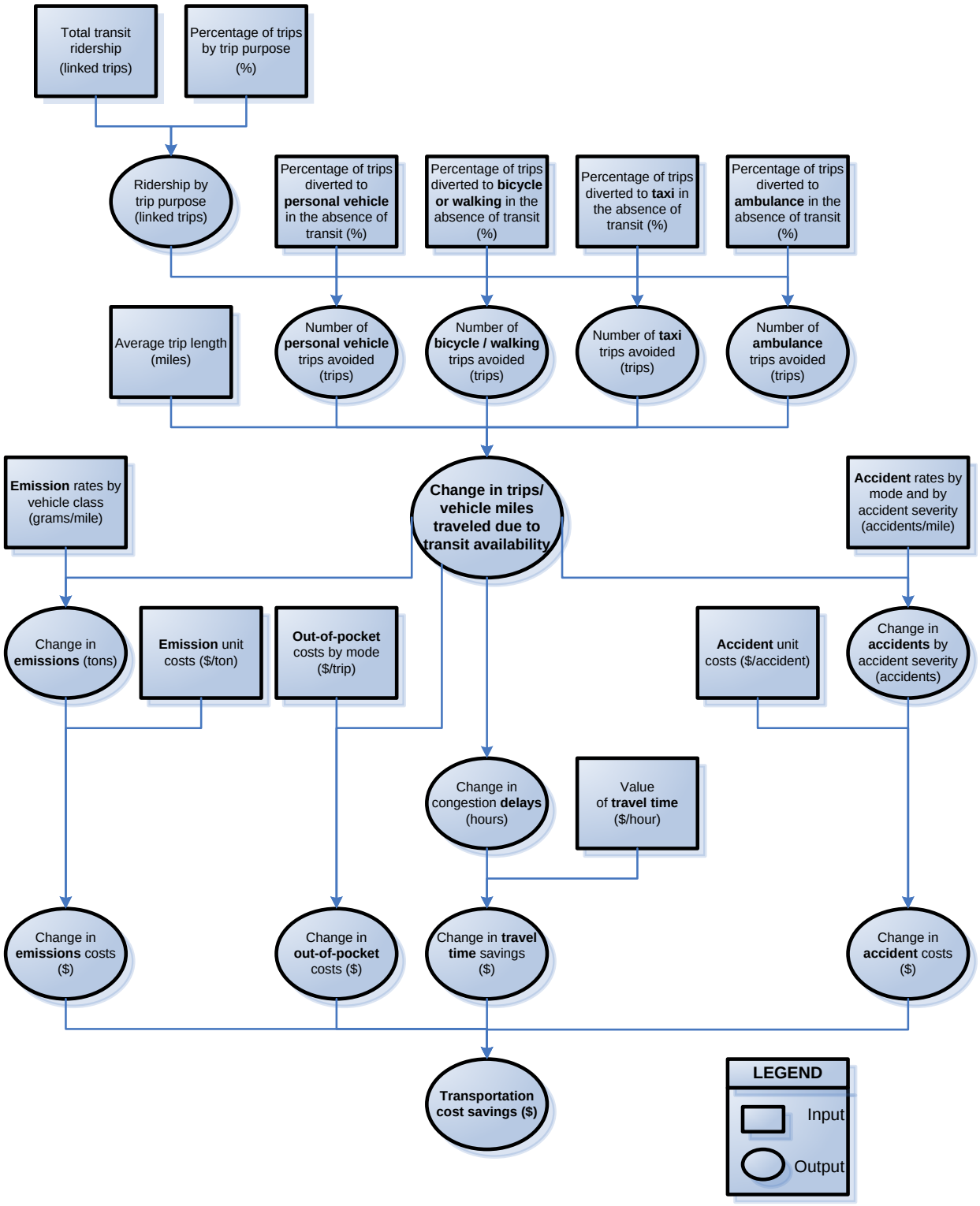
5. In the same way, transportation costs are estimated in the presence of public transit.

6. Transportation cost savings are the difference between total transportation costs in the absence of public transit (steps 1-4) and total transportation costs in the presence of public transit (step 5).

Figure 2 below illustrates, in a simplified way, the methodology used to estimate transportation cost savings associated with public transit.

[18] HDR conducted several on-board surveys in Wisconsin, Virginia and Michigan in the past to evaluate riders' behavior in the absence of public transit. Despite socioeconomic differences between locations, survey results were fairly consistent, suggesting the existence of significant similarities in the travel behavior of transit riders in rural areas. For instance, it was found that the percentage of trips foregone in the absence of transit varied from 10 percent to 41 percent depending on the trip purpose. This finding is corroborated by a recent study (American Public Transportation Association, 2007) which showed that nationwide about 24 percent of riders (roadway modes only) would not be able to make their trips in the absence of public transit.

Figure 2: Estimation of Transportation Cost Savings



10.2.3 Methodology for Estimating Affordable Mobility Benefits

The calculation of affordable mobility benefits is based on the conventional **consumer surplus** theory. Economists call the difference between the amount people actually pay for something and the amount they would pay for the next most costly alternative "consumer surplus." In this particular case, the consumer surplus is the monetary quantity that equates to the **economic value** of the mobility afforded to people by the availability of public transit. Formally, it can be expressed in the following way:

$$EV = (P^f_1 - P^f_0)\, Q^f_1 + \tfrac{1}{2}\,[(P^f_1 - P^f_0)\,(Q^f_0 - Q^f_1)]$$

$$= \tfrac{1}{2}\,(Q^f_0 + Q^f_1)\,(P^f_1 - P^f_0)$$

Where: - EV is the economic value of low-cost mobility;

- P^f_0 is the average fare paid by transit riders;

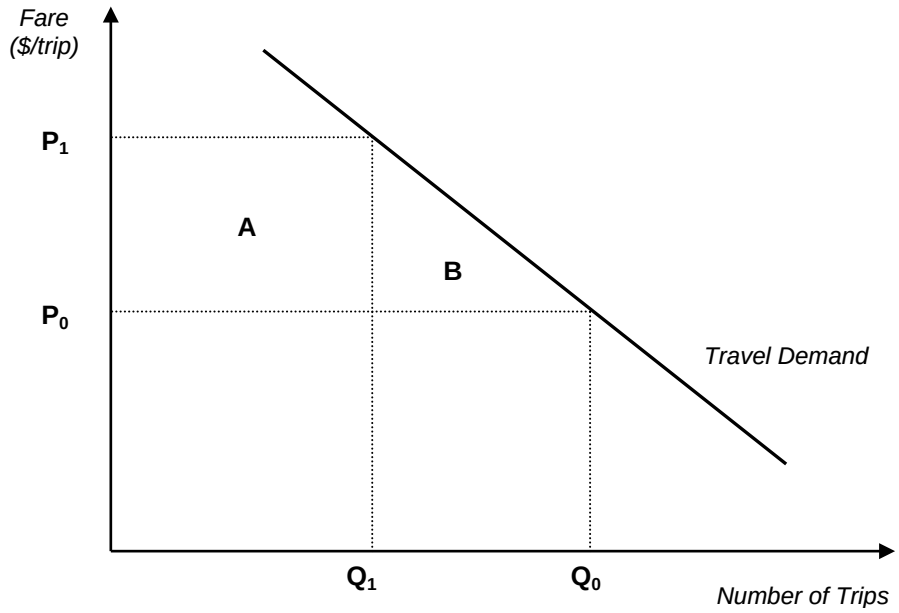
- Q^f_0 is the number of passenger trips (ridership);

- P^f_1 is the fare that people pay when using other transportation modes (personal vehicle, taxi, etc.); and

- Q^f_1 is the number of passenger trips when using other transportation modes.

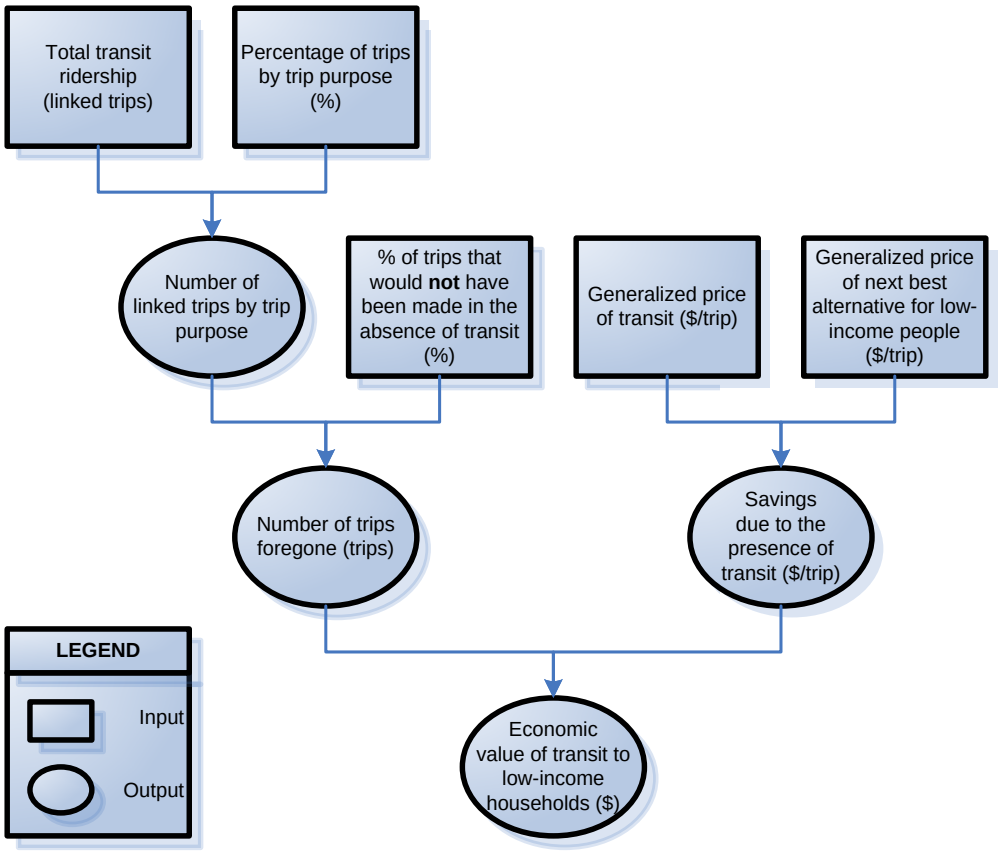
The level of demand for public transit and the price difference between public transit and other transportation modes measure the consumer surplus, or economic value of low-cost mobility. This is illustrated in Figure 3 below. In the presence of public transit, riders pay P_0 and demand Q_0 number of trips. When public transit is eliminated, transit-dependent (or low-income) riders have no choice but to forego their trips while other riders shift to more costly transportation modes. P_1 is the new fare per trip using other modes and Q_1 is the corresponding trip demand. The difference between P_1 and P_0 is the increase in fare, while the difference between Q_0 and Q_1 is the number of foregone trips. The economic value of low-cost mobility is represented by areas *A* and *B*: rectangle area *A* represents the benefits accrued to travelers switching to public transit (i.e., out-of-pocket cost savings) and **triangle area *B* represents the benefits accrued to transit-dependent people**. Note that, to avoid any double-counting only triangle area B is estimated as part of affordable mobility benefits.

Figure 3: The Concept of Consumer Surplus



The complete methodology used to estimate affordable mobility benefits is illustrated in Figure 4 below.

Figure 4: Estimation of Affordable Mobility Benefits

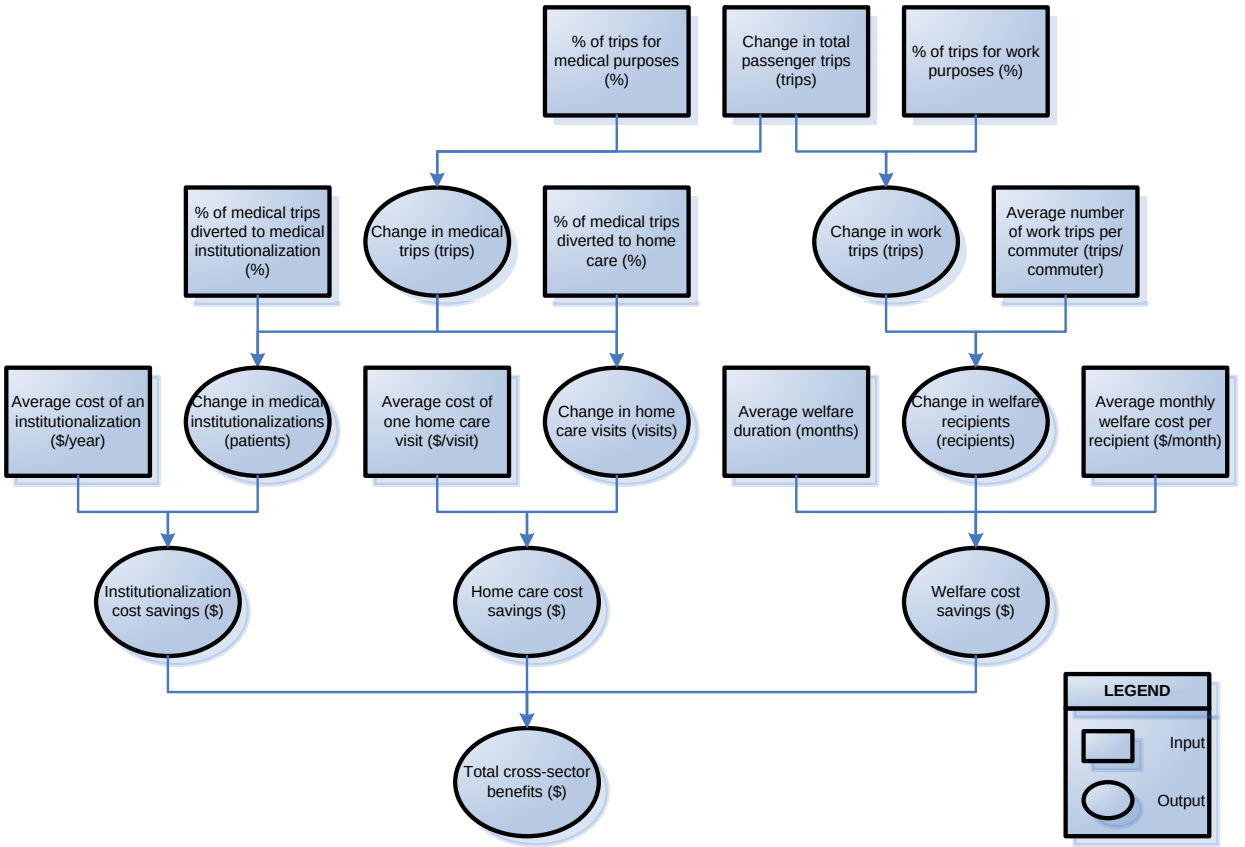


10.2.4 Methodology for Estimating Cross-Sector Benefits

Cross-sector benefits represent economies achievable in other sectors of the economy as a result of spending in the public transit sector. In particular, by providing low-cost mobility, public transit can generate **home care cost savings** (for people on dialysis, for instance), **medical institutionalization cost savings** (for the elderly or people with disabilities) and **welfare cost savings** (in particular, for low-income people who rely on public transit to go to work).

Figure 5 below provides a graphical illustration of the methodology used for assessing cross-sector benefits. The starting point assumes a number of passenger trips forgone in the absence of public transit. These trips are broken down by trip purpose. The percentage of lost medical trips leading to home care or medical institutionalization and the average number of work trips per commuter generate estimates of the number of added home care visits, medical institutionalizations and welfare recipients (or job losses). The average cost of a home care visit is multiplied by the number of added visits to estimate the monetary value of these trips; and the average cost of a medical institutionalization is multiplied by the number of trips diverted to medical institutionalization to estimate the monetary value of these trips. Likewise, the added welfare costs per recipient are multiplied by the number of welfare recipients and the average welfare duration to arrive at estimates of the monetary value of lost employment. The resulting home care cost savings, medical institutionalization cost savings and welfare cost savings are then summed to arrive at total cross-sector benefits.

Figure 5: Estimation of Cross-Sector Benefits



10.3 Estimation of Economic Impacts

In addition to providing social benefits, the presence of public transit can contribute to economic activity in several ways:

- 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 by **operating and maintenance expenses**;

- **Investments in transit capital projects** (construction of a bus depot, renewal of vehicle fleet, etc.) also spur job creation, as evidenced by the TIGER (Transportation Investment Generating Economic Recovery) discretionary grants program.[19]

- People who use public transit instead of more expensive alternative modes save substantial money (i.e., **out-of-pocket cost savings**). A majority of these savings is re-directed toward other household expenses (such as housing and healthcare) within the state.[20]

10.3.1 Key Terminology and Concepts

Economic impact analysis can be simply defined as the study of the effect of a change in the demand for goods and services on the level of economic activity in a given area.

10.3.1.1 Types of Effect

Traditionally, economic impact analysis involves the estimation of three types of effect, commonly referred to as direct effect, indirect effect and induced effect. The total economic impact is the sum of these direct, indirect and induced effects for the activity or project being evaluated.

- **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., operating and maintenance expenses incurred by River Cities Public Transit).

- **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 River Cities Public Transit).

- **Induced effect** – Represents the increase in economic activity – over and above the direct and indirect effects – 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 the study area.

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[19] The program is part of the 2009 American Recovery and Reinvestment Act (ARRA). According to a recent publication of the Congressional Budget Office, ARRA funded more than half a million of full-time equivalent (FTE) jobs during the second quarter of 2011 alone (U.S. Congress, Congressional Budget Office. *Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output from April 2011 Through June 2011*, August 2011, p. 3).

[20] The portion of household savings that is actually re-spent in South Dakota can be derived from the social accounting matrix.

The indirect and induced effects are sometimes referred to as **multiplier** effects, since they can make the total economic impact substantially larger than the direct effect alone: in theory, the larger the multiplier, the larger the overall response (total economic impact) to the initial shock (direct effect). In reality though, while indirect and induced impacts do always occur, the net impact on the total level of economic activity in an area may or may not be increased by multiplier effects. That outcome depends on the definition of the study area and its ability to provide additional workers and capital resources, or attract them from elsewhere.

An employment multiplier measures the total increase in the number of jobs in the economy per new job created in a specific industry. Consider a transit agency that hires 10 new bus drivers. Let's assume that the employment multiplier for the public transit sector is 1.5. In this example, 5 additional jobs[21] would be created in the economy as a result of the 10 positions created at the transit agency, for a total of 15 new jobs.

10.3.1.2 Impact Metrics

Typically, economic impacts are measured in terms of business output, value added, employment and tax revenue. While **business output** refers the total volume of sales (including intermediate output), **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 it and its value at the time it is sold to other users. The total value added within a state is equivalent to the gross domestic product (GDP) for that state and includes employee compensation, proprietary income (i.e., income of self-employed individuals such as lawyers), other property type income (e.g., rents) and indirect business taxes (e.g., excise taxes).

Employment impacts measure the number of jobs created for a full year. 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. And, strictly speaking, they should not be interpreted as permanent jobs either, but rather as job-years.

Tax impacts are divided into State/Local governments and Federal government. Note that state and local tax impacts are combined and cannot be separated into state vs. local in IMPLAN – the economic impact modeling system used in the analysis (see Section 10.3.2 below). However, a breakdown of tax impacts by institution (households, corporations, etc.) and by type of tax (sales tax, income tax, etc.) can be provided.

10.3.2 The IMPLAN® System

To measure the direct, indirect and induced effects of public transit in South Dakota, we used IMPLAN Version 3.0, an economic impact assessment modeling system structured as an **input-output model**[22] – originally developed by the U.S. Forest Service and now maintained by MIG, Inc.[23] The IMPLAN data files include transaction information (intra-regional and import/export) on 440 industrial sectors (corresponding to four and five digit North American Industry Classification System (NAICS) codes) and

[21] (10*1.5)-10=5

[22] An input-output model uses a matrix representation of inter-industry transactions to calculate the effects of a change in one industry on other industries.

[23] For more information on the IMPLAN® system, visit http://www.implan.com/.

data on 21 economic variables, including business output, value added and employment. For this study we used the most recent available data file (2009) for the State of South Dakota.

In the course of the analysis, several adjustments need to be made:

- The model inputs are **adjusted for inflation** to express the impact analysis results in 2011 (or year of analysis) dollars;[24]

- **Type SAM multipliers**,[25] used for estimating indirect and induced effects, are modified with regional purchase coefficients (RPCs)[26] derived from the **trade flow model** to ensure that any spending "leaking" out of the study area is not counted (if, for example, buses purchased by River Cities Public Transit are manufactured outside of South Dakota); and

- **Households** are the only institution considered when constructing type SAM multipliers (government and capital are typically not internalized); as a result, the induced effects are based on the income of households living in the study area only.

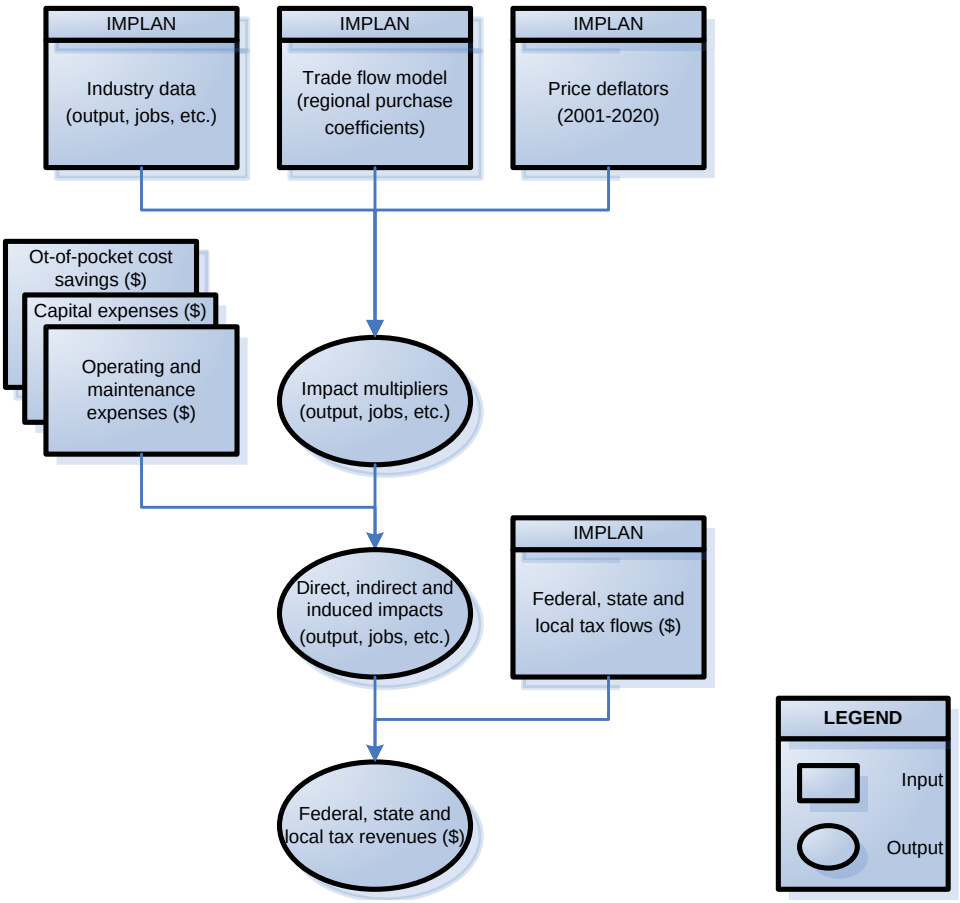
Figure 6 on the next page shows a graphical representation of the general process followed to conduct the economic impact analysis in IMPLAN.

[24] Deflators derived from the most current Bureau of Labor Statistics (BLS) growth model are used in IMPLAN to account for relative price changes over time. These deflators are available through year 2020 and applied at the commodity level.

[25] Type SAM (Social Accounting Matrix) multipliers are the direct, indirect and induced effects where the induced effect is based on information in the social accounting matrix. Type SAM multipliers capture inter-institutional transfers (such as transfers between households and the Federal government) in addition to all commodity flows (purchases of goods). It is commonly accepted that only households should be internalized when building type SAM multipliers. Internalizing households relies on the assumption that local workers will re-spend their labor income.

[26] RPCs represent the portion of the total regional demand that is met by regional production and attempt to account for cross-hauling – the regional importation and exportation of commodities from the same sector. All remaining demand is satisfied by imports, which provide no economic benefit to the region. In other words, RPCs filter-out economic leakages from the region.

Figure 6: Estimation of Economic Impacts



11 Model Inputs

Various methods and sources were used to gather all of the necessary information to estimate the costs and benefits of public transit in South Dakota. To the extent possible, we collected data specific to existing conditions at the agency, county or state level. When the data were not available for South Dakota we used national estimates (e.g., emissions costs). A summary of operating and financial statistics for 2010, by transit category, is presented in Section 11.1. Other data (IMPLAN data, emission rates, unit costs, etc.) are discussed in Section 11.2. A complete list of data sources and references is provided in Appendix F.

11.1 Public Transit Operating and Financial Statistics

Public transit operating and financial statistics were obtained from SDDOT for all 22 rural transit providers operating in South Dakota. The same information was provided directly by Rapid Transit System and Sioux Area Metro, the only two urbanized transit systems in the state.

11.1.1 Operating Data

2010 data on passengers (by trip purpose) and vehicle miles traveled (including deadhead miles) by type of service (fixed-route vs. demand response) were collected for each transit agency in South Dakota. Last year, public transit ridership totaled 3.1 million. Rapid Transit System and Sioux Area Metro accounted for nearly half of it. While demand response represented 61 percent of total ridership it represented more than 84 percent of total vehicle miles. Table 8 below summarizes the operating data for each transit category.

Table 8: Operating Data by Transit Category (2010)

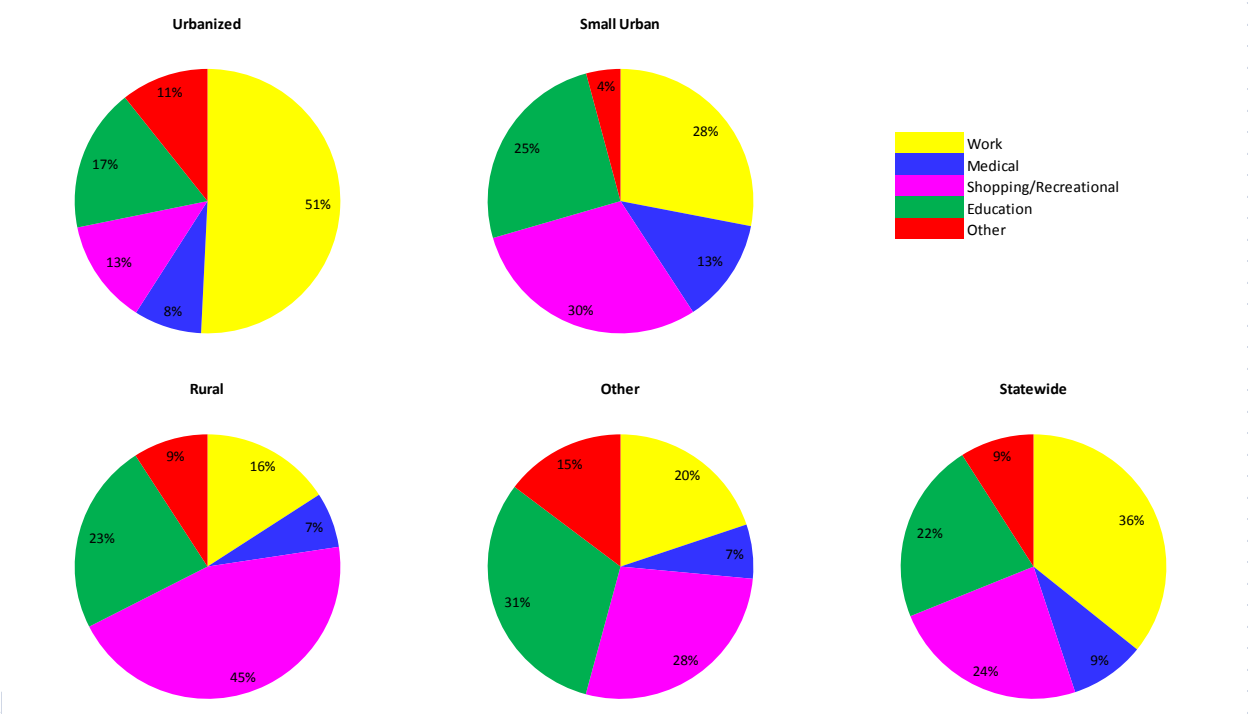
Transit Category	Passengers			Vehicle Miles		
	Fixed Route	Demand Response	Total	Fixed Route	Demand Response	Total
Urbanized	1,200,610	209,060	1,409,670	1,019,877	910,296	1,930,173
Small Urban	0	886,405	886,405	0	1,975,743	1,975,743
Rural	0	455,361	455,361	0	1,358,910	1,358,910
Other	0	334,262	334,262	0	1,205,159	1,205,159
Total	1,200,610	1,885,088	3,085,698	1,019,877	5,450,108	6,469,985

Sources: South Dakota Department of Transportation, Rapid Transit System and Sioux Area Metro.

Note: Four systems (Arrow Transit, Dells Rapid Transit, Community Transit and Rosebud Transit) operate a few routes in neighboring states.

Figure 7 on the following page shows the breakdown of ridership by trip purpose for the four transit categories separately. As expected, the more urban the service area and the larger the share of ridership for work purposes (51 percent for Urbanized vs. 16 percent for Rural). On the other hand, the more rural the service area and the larger the share of ridership for shopping/social/recreational/nutrition purposes (45 percent for Rural vs. 13 percent for Urbanized).

Figure 7: Passengers by Trip Purpose (2010)



Sources: South Dakota Department of Transportation, Rapid Transit System and Sioux Area Metro.

11.1.2 Financial Data

Data on fares (contract fares, rider fares and donations), operating and maintenance (O&M) expenses (excluding depreciation) and capital expenses (broken down by cost item) were also collected for all transit agencies. Last year, O&M expenses totaled $19.1 million while capital expenses amounted to $6.0 million. Note, however, that several agencies received ARRA funds, so the capital cost estimate can be considered as above average. Table 9 below summarizes the financial data for each transit category.

Table 9: Financial Data by Transit Category (2010)

Transit Category	Fares	O&M Expenses	Capital Expenses
Urbanized	$1,206,686	$8,847,687	$2,250,852
Small Urban	$665,588	$4,917,945	$2,503,738
Rural	$461,494	$2,393,713	$465,185
Other	$394,875	$2,937,178	$802,304
Total	$2,728,643	$19,096,524	$6,022,079

Sources: South Dakota Department of Transportation, Rapid Transit System and Sioux Area Metro.

Note: O&M and capital expenses are reported for South Dakota funded routes only.

Table 10 on the next page shows a breakdown of capital expenses by major cost item: vehicles; bus facilities; preventive maintenance; and automatic data processing (ADP) hardware and software. For the purpose of the analysis, annual capital expenses over the last five years were averaged to account for

large variations from year to year. It is noteworthy that vehicles represent 64 percent of total capital expenses.

Table 10: Capital Costs by Cost Item (2006-2010 Average)

Transit Category	Vehicles	Bus Facilities	Preventive Maintenance	ADP Hardware	Total
Urbanized	$1,904,994	$663,174	$18,728	$150,107	$2,737,003
Small Urban	$808,809	$443,619	$131,962	$132,654	$1,517,043
Rural	$207,666	$130,057	$37,423	$4,893	$380,039
Other	$414,134	$19,270	$53,762	$90,783	$577,950
Total	$3,335,603	$1,256,119	$241,876	$378,437	$5,212,035

Sources: South Dakota Department of Transportation, Rapid Transit System and Sioux Area Metro.

Note: To account for large variations from year to year, capital costs incurred over the 2006-2010 period were averaged.

11.2 Other Key Data

In addition to transit operating and financial data, data on travel characteristics, value of time, accidents, emissions and low-cost mobility were collected from various state and federal sources. Whenever possible, we used data specific to each transit agency (e.g., accident data) or transit category (value of time).

To measure the contribution of public transit to South Dakota's economy we used the IMPLAN® system. Economic multipliers were computed for each type of activity (public transit operations, purchase of transit vehicles, household consumption, etc.) and for various impact metrics (output, value added, employment, etc.) using the 2009 IMPLAN data file for South Dakota.

To model riders' behavior in the absence of public transit, we used the results of on-board passenger surveys conducted by HDR for a sample of transit agencies in Michigan in 2009. Transit categories defined for this study were closely matched with transit systems for which survey results were available based on criteria such the type of service offered and system size. In particular, survey responses were used to estimate the percentage of trips diverted to other transportation modes (personal vehicle, taxi, etc.) and the percentage of trips foregone by trip purpose. Table 11 below shows the percent of trips foregone estimates used for each transit category.

Table 11: Trips Foregone by Trip Purpose

	Urbanized	Small Urban	Rural	Other
% work trips foregone	12.8%	14.1%	27.2%	27.2%
% medical trips foregone	20.3%	1.7%	30.9%	30.9%
% shopping/recreational trips foregone	10.7%	12.1%	17.8%	17.8%
% school trips foregone	40.8%	32.8%	32.9%	32.9%
% other trips foregone	9.7%	12.5%	17.3%	17.3%

Source: HDR Decision Economics (on-board passenger surveys conducted for a sample of transit agencies across Michigan in November 2009).

Data on motor vehicle crashes (fatalities, injuries, and PDO accidents) involving transit vehicles in South Dakota over the period 2007-2010 were obtained from Rapid transit System, Sioux Area Metro and the South Dakota Department of Public Safety, Office of Accident Records. For the purpose of the analysis, given the low number of accidents per year (less than 40 in 2010), we used the fatality, injury and PDO accident rates (per 100 million VMT) over the four-year period for each agency to avoid skewing the annual safety benefits.[27]

Emission rates for various vehicle classes (light duty vehicles, light duty trucks and transit buses) operating in South Dakota were obtained from the U.S. Environmental Protection Agency's MOBILE6 Vehicle Emission Modeling Software. MOBILE6 is an emission factor model for predicting gram per mile emissions of volatile organic compounds or hydrocarbons (HC), carbon monoxide (CO), nitrogen oxides (NO_x), carbon dioxide (CO_2), sulfur dioxide (SO_2), particulate matter (PM) and toxics from highway motor vehicles under various conditions. It accounts for emission impacts of factors such as a change in vehicle emission standards, a change in vehicle population and activity, and a change in local conditions such as temperature, humidity, and the quality of fuel. The emission rates used in the analysis are reported in Table 12 below. Note that for light duty trucks the low, median and high values account for different vehicle weight limits (the heavier the vehicle the higher the emission rates).

Table 12: Emission Rates by Vehicle Class

Vehicle Class		HC	CO	NO_x	CO_2	SO_2	PM2.5
Light duty vehicle (gasoline)		0.80	15.27	0.64	368	0.007	0.02
Light duty truck (gasoline)		0.94	17.01	0.77	478	0.009	0.03
Light duty truck (diesel)	Low	0.17	0.64	2.56	789	0.013	0.09
	Median	0.24	0.86	3.77	980	0.016	0.13
	High	0.32	1.08	4.98	1,172	0.020	0.17
Transit bus (gasoline)		3.96	33.33	7.61	1,406	0.026	0.13
Transit bus (diesel)		0.29	2.71	12.87	2,343	0.039	0.22

Sources: U.S. Environmental Protection Agency, Office of Transportation and Air Quality, MOBILE6 Vehicle Emission Modeling Software.

Note: For light duty trucks the low, median and high values account for different vehicle weight limits.

Finally, to monetize the social benefits of public transit we used unit cost estimates (e.g., cost of one metric ton of carbon dioxide emissions) published in the literature. When necessary, these estimates were inflated to 2010 dollars. Cost estimates used in the model are presented in Table 13 on the following page. In most cases, they are identical for all transit categories.

[27] Note that no fatality was recorded over the period 2007-2010.

Table 13: Unit Costs, Most Likely Estimates ($2010)

Model Variable	Urbanized	Small Urban	Rural	Other
Transportation Costs				
Vehicle ownership and operating cost ($/mile)	$0.72	$0.72	$0.72	$0.72
Parking cost ($/trip)	$2.00	$0.00	$0.00	$0.00
Taxi base fare ($/trip)	$2.23	$8.00	N/A	N/A
Taxi fare per mile ($/mile)	$2.73	$0.00	N/A	N/A
Cost of operating a bicycle ($/mile)	$0.14	$0.14	$0.14	$0.14
Ambulance cost ($/trip)	$550	$550	$550	$550
Value of Time				
Value of time, in-vehicle personal ($/hour)	$12.12	$11.00	$9.56	$9.92
Accident Costs				
Fatality cost ($/fatality)	$6,000,000	$6,000,000	$6,000,000	$6,000,000
Injury cost ($/injury)	$65,793	$65,793	$65,793	$65,793
Property damage only accident cost ($/accident)	$2,440	$2,440	$2,440	$2,440
Emissions Costs				
HC emissions cost ($/metric ton)	$1,367	$1,367	$1,367	$1,367
CO emissions cost ($/metric ton)	$528	$528	$528	$528
NOx emissions cost ($/metric ton)	$5,575	$5,575	$5,575	$5,575
CO2 emissions cost ($/metric ton)	$22	$22	$22	$22
SO2 emissions cost ($/metric ton)	$32,606	$32,606	$32,606	$32,606
PM 2.5 emissions cost ($/metric ton)	$305,026	$305,026	$305,026	$305,026
Public Assistance and Medical Costs				
Public assistance cost ($/month/recipient)	$357	$357	$357	$357
Home care incremental cost ($/medical visit)	$50	$50	$50	$50
Institutionalization incremental cost ($/month/person)	$1,654	$1,654	$1,654	$1,654

Sources: Transportation cost estimates were derived from various sources at the local (e.g., City of Rapid City and City of Sioux Falls), state (South Dakota Department of Public Safety) and national (American Automobile Association) levels. Accident cost estimates were obtained from publications by the National Safety Council (2010) and the U.S. Department of Transportation (2002, 2009). Value of time estimates are based on household income data from the U.S. Census Bureau following the methodology developed by the U.S Department of Transportation (2003). Emissions cost estimates were derived from a recent publication by the U.S. Department of Transportation (2010), except for carbon monoxide emissions (Litman, 2006). Public assistance and medical cost estimates were obtained from communications with the South Dakota Department of Social Services (2011) and publications by Lewis and Williams (1999) and MetLife Mature Market Institute (2010). Exact references are available in Appendix F at the end of the report.

Notes: The fatality cost, or value of a statistical life, represents the benefit of preventing a fatality and is defined as the value of improvements in safety that result in a reduction by one in the expected number of fatalities. Estimates of VSL are derived from the concept of individual willingness to pay for small reductions in risk.

The incremental cost of home care represents the cost difference between a home care visit and a medical visit at a healthcare facility. In the same way, the incremental cost of institutionalization represents the cost difference between living in a nursing home facility and living at home (this applies to older persons in particular).

When necessary cost estimates from the literature were inflated to 2010 dollars using the U.S. consumer price index (CPI).

Public assistance cost accounts for the following programs: Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP) and Low Income Energy Assistance Program.

12 Analysis Results

Based on the methodology and the data described in Chapter 10 and Chapter 11 respectively, the overall benefits of public transit in South Dakota in 2010 were estimated. This chapter presents the results of the analysis. Transportation cost savings and low-cost mobility benefits are discussed in Section 12.1.1 and Section 12.1.2 respectively. The results of the economic impact analysis are presented in Section 12.2. Note that additional results are also available in Appendix C (results for a sample of transit agencies), Appendix D (supplemental statewide economic impact analysis results) and Appendix E (risk analysis results).

12.1 Social Benefits

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

12.1.1 Transportation 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 public transit. In addition, public transit can reduce congestion in urban areas, resulting in travel time savings, accident cost savings and emissions cost savings. 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 14 below, out-of-pocket cost savings account for most of the transportation cost savings, ranging from $341 thousand for Other systems to $7.61 million for Urbanized systems. Note that emissions cost savings are negative for all four transit categories. This is mainly due to the fact that in the absence of public transit there would be a net reduction in VMT that would more than offset the difference in emission rates (and vehicle occupancy) between transit vehicles and personal vehicles. Also, travel time savings are negligible (or even slightly negative) because congestion is not an issue, except in large urban areas.

Table 14: Transportation Cost Savings

Benefit Category	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Out-of-pocket cost savings	$7,614	$1,951	$361	$341	$10,267
Travel time savings	$344	-$9	-$11	-$8	$317
Accident cost savings	$476	$190	$55	-$20	$702
Emissions cost savings	-$150	-$136	-$103	-$90	-$479
Total	$8,284	$1,997	$303	$223	$10,807

Note: All amounts are expressed in thousands of 2010 dollars.

12.1.2 Low-Cost Mobility Benefits

A number of South Dakota residents do not have access to a personal vehicle and depend entirely upon public transit for their mobility needs.[28] In the absence of public transit, many of them would have no choice but to forego their trips. This implies that some people would lose their job and apply for public assistance, or require home care, or move to a nursing home facility. Therefore, by providing an affordable transportation alternative, public transit creates economic value and generates cost-savings in other sectors of the economy.

As shown in Table 15 below, affordable mobility benefits range from $78 thousand for Other systems to $816 thousand for Urbanized systems. Home care/institutionalization cost savings account for the majority of low-cost mobility benefits across all transit categories. At the state level, they amount to $5.16 million.

Table 15: Low-Cost Mobility Benefits

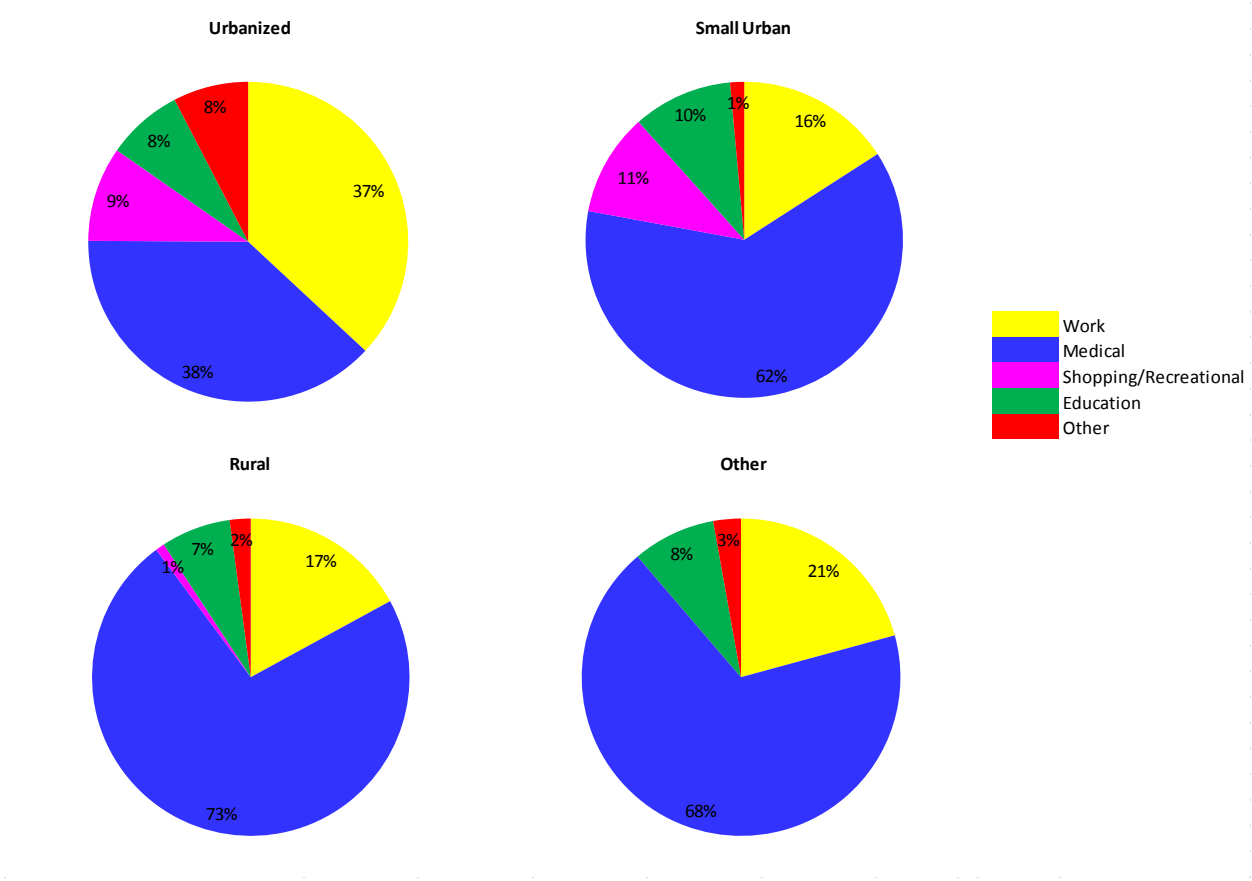
Benefit Category	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Affordable mobility benefits	$816	$138	$86	$78	$1,118
Cross-sector benefits	$3,378	$1,355	$715	$534	$5,981
Home care/Institutionalization cost savings	$2,923	$1,176	$614	$442	$5,155
Public assistance cost savings	$455	$179	$100	$92	$826
Total	$4,194	$1,493	$801	$612	$7,099

Note: All amounts are expressed in thousands of 2010 dollars.

The total social benefits of public transit are broken down by trip purpose for each transit category in Figure 8 on the next page. In general, more than 75 percent of social benefits go to riders who use public transit for work or medical purposes. Also, the more rural the service area and the larger the share of benefits attributed to medical trips. For instance, benefits attributed to medical trips represent 73 percent of total benefits for Rural systems whereas they account for just 38 percent of total benefits for Urbanized systems. This difference can be explained by two factors: the share of medical trips is typically higher for rural transit providers than for urban transit providers (see Figure 7 on page 45); congestion related benefits (travel time savings and emissions cost savings in particular) are non-existent (or slightly negative in some cases) in rural settings.

[28] According to the U.S. Census Bureau (*2007-2009 American Community Survey*), 5 percent of occupied housing units in South Dakota do not have a vehicle.

Figure 8: Distribution of Social Benefits by Trip Purpose



12.2 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 spending of out-of-pocket cost savings by riders; *(ii)* transit operating and maintenance expenses and *(iii)* transit capital expenses.

12.2.1 Impacts of Riders' Out-of-Pocket Cost Savings

Using the social accounting matrix for South Dakota from IMPLAN, it is estimated that about 74 percent of out-of-pocket cost savings to riders was spent on other goods and services in the state. Table 16 on the next page shows the economic impacts of these expenses by impact metric (output, value added, employment and tax revenue) and by transit agency. For Small Urban systems, the spending of out-of-pocket cost savings generated $1.45 million in business output (or total sales) in 2010, including $844 thousand in total value added, and resulted in about $192 thousand in Federal and State/Local tax revenue.

Table 16: Economic Impacts of Out-of-Pocket Cost Savings

Impact Metric	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Output	$5,651	$1,448	$268	$253	$7,620
Value added	$3,295	$844	$156	$147	$4,443
Employment	52	13	2	2	70
Taxes	$749	$192	$36	$34	$1,010
Federal taxes	$349	$89	$17	$16	$470
State/Local taxes	$400	$103	$19	$18	$540

Notes: All dollar amounts are expressed in thousands of 2010 dollars.
Value added is a component of output and the two should not be added together.
Employment 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 of the economy.
State and local tax impacts are combined and cannot be separated within IMPLAN.

12.2.2 Impacts of Public Transit Expenses

Furthermore, the on-going operation of transit systems requires inputs (purchases) of labor, materials, equipment and services supplied by state producers. These operating and maintenance expenses in turn spur indirect and induced economic activity throughout South Dakota. As shown in Table 17 below, O&M expenses incurred by Rural systems generated $3.86 million in business output and $145 thousand in taxes in 2010. Note, however, that total value added is negative because of government subsidies to the public transit sector.[29] A breakdown of the statewide output impact by aggregate sector and type of effect (direct, indirect and induced) along with a detailed tax impact report are available in Appendix D.

Table 17: Economic Impacts of Transit O&M Expenses

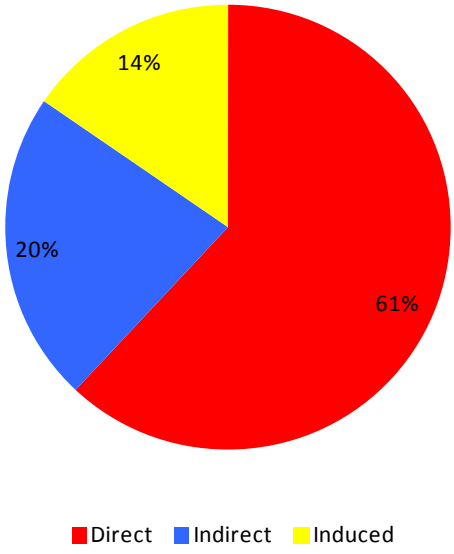
Impact Metric	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Output	$14,279	$7,937	$3,863	$4,740	$30,819
Value added	-$237	-$132	-$64	-$79	-$512
Employment	196	109	53	65	423
Taxes	$538	$299	$145	$178	$1,160
Federal taxes	$581	$323	$157	$193	$1,254
State/Local taxes	-$44	-$24	-$12	-$14	-$94

Notes: All dollar amounts are expressed in thousands of 2010 dollars.
Value added is a component of output and the two should not be added together.
Employment 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 of the economy.
State and local tax impacts are combined and cannot be separated within IMPLAN.

[29] The indirect and induced portions of the value added (e.g., value added generated by suppliers to transit agencies), though positive, do not offset the negative value added associated with the public transit sector.

The operation of Rural systems also sustained 53 jobs in 2010. As shown in Figure 9 below, about 61 percent of these jobs were held in the public transit sector, which is traditionally labor intensive. The job multiplier for this sector is estimated at 1.31. This implies that, on average, when a transit agency hires 10 new bus drivers 3 additional jobs are created in the rest of the economy, as a result of the indirect and induced effects.

Figure 9: Distribution of Output Impact of Transit O&M Expenses by Type of Effect



In the same way, public transit spending on capital goods (such as buses and computer equipment) contributes to economic growth. The economic impacts of capital expenses are reported for each transit category and at the state level in Table 18 below. For instance, capital expenses incurred by Other systems over the 2006-2010 period generated nearly $856 thousand in business output per year, including $643 thousand in total value added, and resulted in about $192 thousand in Federal and State/Local tax revenue.

Table 18: Economic Impacts of Transit Capital Expenses

Impact Metric	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Output	$4,048	$2,237	$560	$856	$7,701
Value added	$2,826	$1,501	$366	$643	$5,336
Employment	18	13	3	3	37
Taxes	$816	$420	$102	$192	$1,530
Federal taxes	$377	$198	$48	$86	$709
State/Local taxes	$439	$222	$54	$106	$821

Notes: All dollar amounts are expressed in thousands of 2010 dollars.
Value added is a component of output and the two should not be added together.
Employment 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 of the economy.
State and local tax impacts are combined and cannot be separated within IMPLAN.

In addition to the public transit sector, other sectors of the South Dakota economy are impacted through the indirect and induced effects. Table 19 below lists the top five sectors impacted and shows the combined indirect and induced output impacts associated with total transit expenses (O&M and capital). The Wholesale trade sector generates the most indirect and induced output ($1.85 million annually at the state level), followed by Finance and insurance and Professional services ($1.63 million each annually at the state level).

Table 19: Top Five Industries Impacted by Transit O&M and Capital Expenses

Industry	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Wholesale trade	$927	$517	$242	$298	$1,984
Finance and insurance	$956	$528	$231	$295	$2,010
Professional - Scientific & technical services	$818	$458	$215	$258	$1,749
Real estate and rental	$727	$399	$165	$217	$1,508
Health and social services	$582	$319	$132	$174	$1,208

Notes: All amounts are expressed in thousands of 2010 dollars.
Industries are ranked according to their combined indirect and induced output impact.
Industries are aggregated at the 2-digit NAICS level.

12.3 Summary of Findings

A summary of the results, at the transit category level and state level, is provided in Table 20 below. Overall, the social benefits of public transit in South Dakota amounted to $17.9 million in 2010, including $12.5 million (or 70 percent) for Urbanized systems alone. On a per trip basis, these benefits ranged from $2.42 for Rural systems to $9.11 for Urbanized systems. Generally speaking, the more urban the service area and the larger the benefits. The contribution of public transit to the South Dakota economy is estimated at $46.14 million (or 530 jobs). In other words, every dollar spent on public transit in the state generates $1.90 in economic activity on average.

Table 20: Summary Results

	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Social benefits ($000s)	$12,478	$3,490	$1,103	$835	$17,906
Social benefits per passenger trip	$9.11	$3.94	$2.42	$2.50	$5.88
Job impact	266	135	59	71	530
Output impact ($000s)	$23,978	$11,622	$4,691	$5,849	$46,140
Output impact per $ spent on public transit	$2.07	$1.81	$1.69	$1.66	$1.90

Note: It is strongly advised against adding economic impacts to social benefits because they result from two different analyses.

Although this study attempted to assess the benefits of public transit in a comprehensive manner, it does not account for some benefits that are too difficult to quantify. For instance, in low-density rural areas, public transit serves as a "lifeline" and contributes to improving the quality of life in many ways. In the absence of transit, people who cannot drive a vehicle (because of age, illness or income) would

simply be denied the right to fully participate in community life. Therefore, the results presented in this technical memorandum can be considered as somewhat conservative.

13 Recommendations

The following are the main recommendations to SDDOT on the application and the implementation of the study findings:

1. HDR strongly advises against adding social benefits to economic impacts because they result from two distinct (and potentially overlapping) analyses: while a benefit analysis measures the increase in society's welfare (as measured by travel time savings, safety cost savings, environmental cost savings, etc.) an economic impact analysis evaluates the effects on local/regional economic activity (in terms of business output, jobs, tax revenue, etc.).

2. Given the uncertainty surrounding model parameters, some may prefer to use the risk adjusted results (defined by a range of estimates) in lieu of the most likely results (single point estimates) whenever possible. For instance, "There is an 80 percent chance that the social benefits of public transit in South Dakota lie between $15.9 million and $20.1 million" may be preferred to "The social benefits of public transit in South Dakota are estimated at $ 17.9 million".

3. To validate and further refine the study findings, it is suggested to conduct a passenger survey for a sample of representative transit systems across the state with a view to assess the behavior of South Dakotan riders in the absence of public transit. The survey results could then be compared with the assumptions used in the present study.

4. The estimation of the environmental emissions cost savings would benefit from more detailed information on gasoline and diesel fuel consumption at the transit agency level. Also, future research efforts should use EPA's Motor Vehicle Emission Simulator (MOVES) to obtain emission rates, instead of MOBILE6.2.

5. Though the research team made a comprehensive effort to assess the benefits associated with public transit, there are less tangible or less apparent benefits, such as agglomeration economies, community cohesion benefits, relocation cost savings, groundwater pollution cost savings, noise pollution cost savings, land conservation benefits and the provision of transportation service during emergencies, either natural (e.g., tornadoes and floods) or man-made (e.g., fuel shortage). These other benefits are difficult to quantify and to monetize. Further research would be required to assess them. Therefore, the results presented in this report can be considered as somewhat conservative.

14 Research Benefits

As part of this study, HDR developed and implemented a general framework for estimating in a comprehensive manner the social benefits and the economic impacts of public transit in South Dakota. A number of data sources and references (most of them readily accessible online) were also identified and could be used in the future to update the study results.

This research effort shows that the benefits to society and to the economy of providing public transit in rural areas not only are significant, but also outweigh the costs, thereby proving it is a sound public investment. In 2010, the social benefits of public transit in South Dakota amounted to $17.9 million, including $12.5 million (or 70 percent) for Urbanized systems alone. On a per trip basis, these benefits ranged from $2.42 for Rural systems to $9.11 for Urbanized systems. Generally speaking, the more urban the service area, the larger the benefits. The contribution of public transit to the South Dakota economy (as measured by transit capital and operating expenses and the spending of out of-pocket cost savings accrued by riders) is estimated at $46.14 million annually, or 530 jobs. In other words, every dollar spent on public transit in the state generates $1.90 in economic activity on average.

A summary of the results, at the transit category level and state level, is provided in Table 21 below. (For a complete discussion of the methodology, model assumptions and results, refer to Chapter 10 through Chapter 12.)

Table 21: Summary of Research Benefits

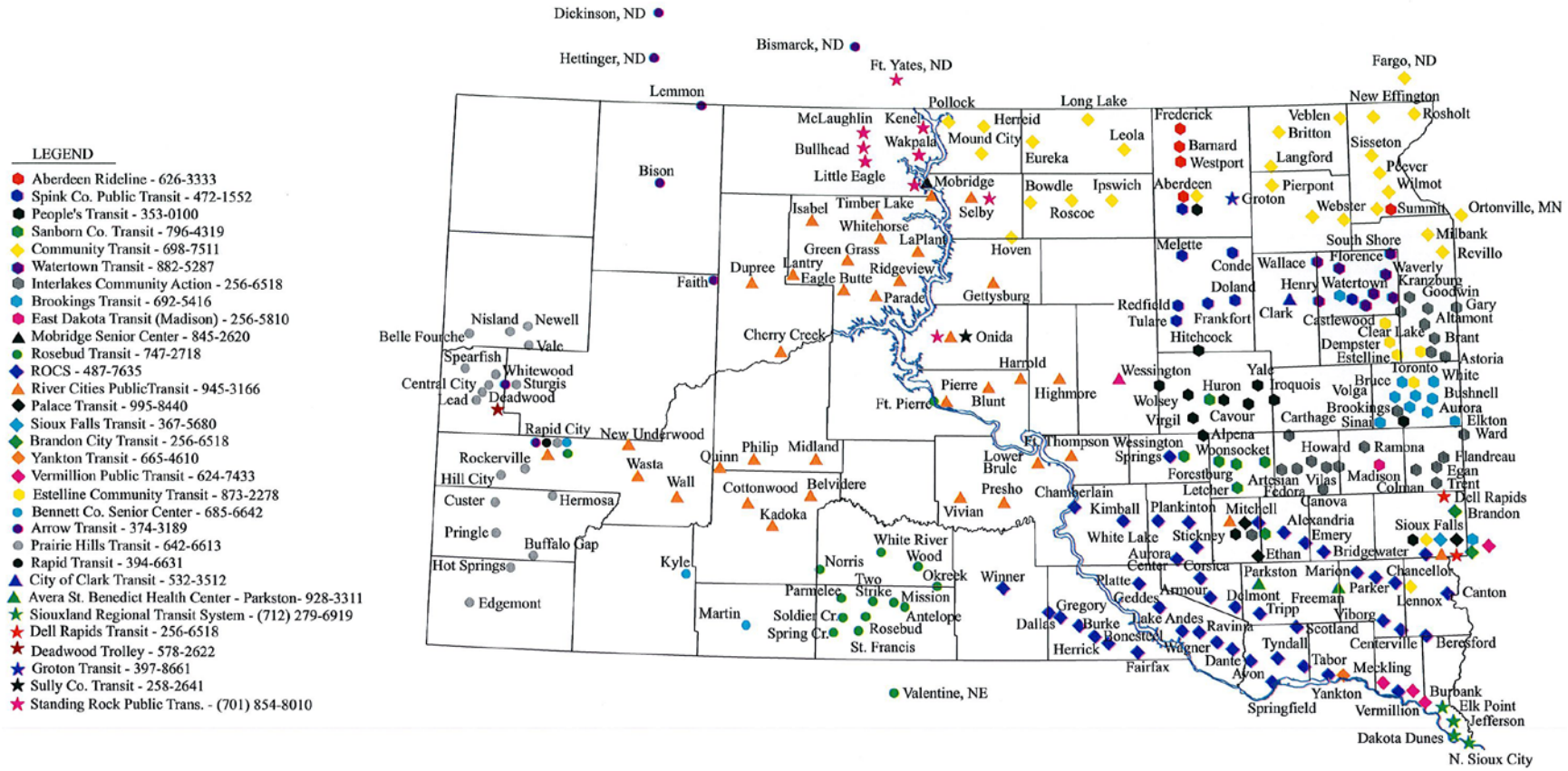
	Urbanized	Small Urban	Rural	Other	Total (Statewide)
Social benefits ($000s)	$12,478	$3,490	$1,103	$835	$17,906
Social benefits per passenger trip	$9.11	$3.94	$2.42	$2.50	$5.88
Job impact	266	135	59	71	530
Output impact ($000s)	$23,978	$11,622	$4,691	$5,849	$46,140
Output impact per $ spent on public transit	$2.07	$1.81	$1.69	$1.66	$1.90

Note: It is strongly advised against adding economic impacts to social benefits because they result from two different analyses.

Appendix A: List of Acronyms

American Public Transportation Association	APTA
American Recovery and Reinvestment Act	ARRA
Americans with Disabilities Act	ADA
Area Transportation Authority of North Central Pennsylvania	ATA
Automatic data processing	ADP
Consumer Price Indexes	CPI
Federal Transit Administration	FTA
Full-time equivalent	FTE
Highway Trust Fund	HTF
Job Access and Reverse Commute	JARC
Mass Transit Account	MTA
Motor Vehicle Emission Simulator	MOVES
National Cooperative Highway Research Program	NCHRP
North American Industry Classification System	NAICS
Operating and maintenance	O&M
Organisation for Economic Co-operation and Development	OECD
Particulate matter	PM
Property damage only	PDO
Regional purchase coefficient	RPC
Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users	SAFETEA-LU
South Dakota Codified Law	SDCL
Supplemental Nutrition Assistance Program	SNAP
Surface Transportation Assistance Act	STAA
Temporary Assistance for Needy Families	TANF
Transportation Investment Generating Economic Recovery	TIGER
Vehicle miles traveled	VMT

Appendix B: Map of Public Transit Providers in South Dakota



Source: South Dakota Department of Transportation

Appendix C: Analysis Results for a Sample of Transit Systems

To demonstrate the application of the methodology, the costs and benefits of public transit in South Dakota were estimated for one agency within each of the four transit categories defined in Chapter 8. The selected agencies are Rapid Transit System (Urbanized), Vermillion Public Transit (Small Urban), Community Transit (Rural) and River Cities Public Transit (Other). The following tables and figures summarize the analysis results for each agency.

Table 22: Transportation Cost Savings

Benefit Category	Rapid Transit System	Vermillion Public Transit	Community Transit	River Cities Public Transit
Out-of-pocket cost savings	$1,153	$112	$82	$326
Travel time savings	$5	$0	-$2	-$8
Accident cost savings	$41	$11	-$9	-$22
Emissions cost savings	-$62	-$7	-$16	-$86
Total	$1,137	$115	$56	$210

Note: All amounts are expressed in thousands of 2010 dollars.

Table 23: Low-Cost Mobility Benefits

Benefit Category	Rapid Transit System	Vermillion Public Transit	Community Transit	River Cities Public Transit
Affordable mobility benefits	$126	$7	$21	$73
Cross-sector benefits	$175	$65	$215	$469
Home care/Institutionalization cost savings	$72	$43	$209	$378
Public assistance cost savings	$104	$22	$5	$91
Total	$301	$71	$235	$543

Note: All amounts are expressed in thousands of 2010 dollars.

Figure 10: Distribution of Social Benefits by Trip Purpose

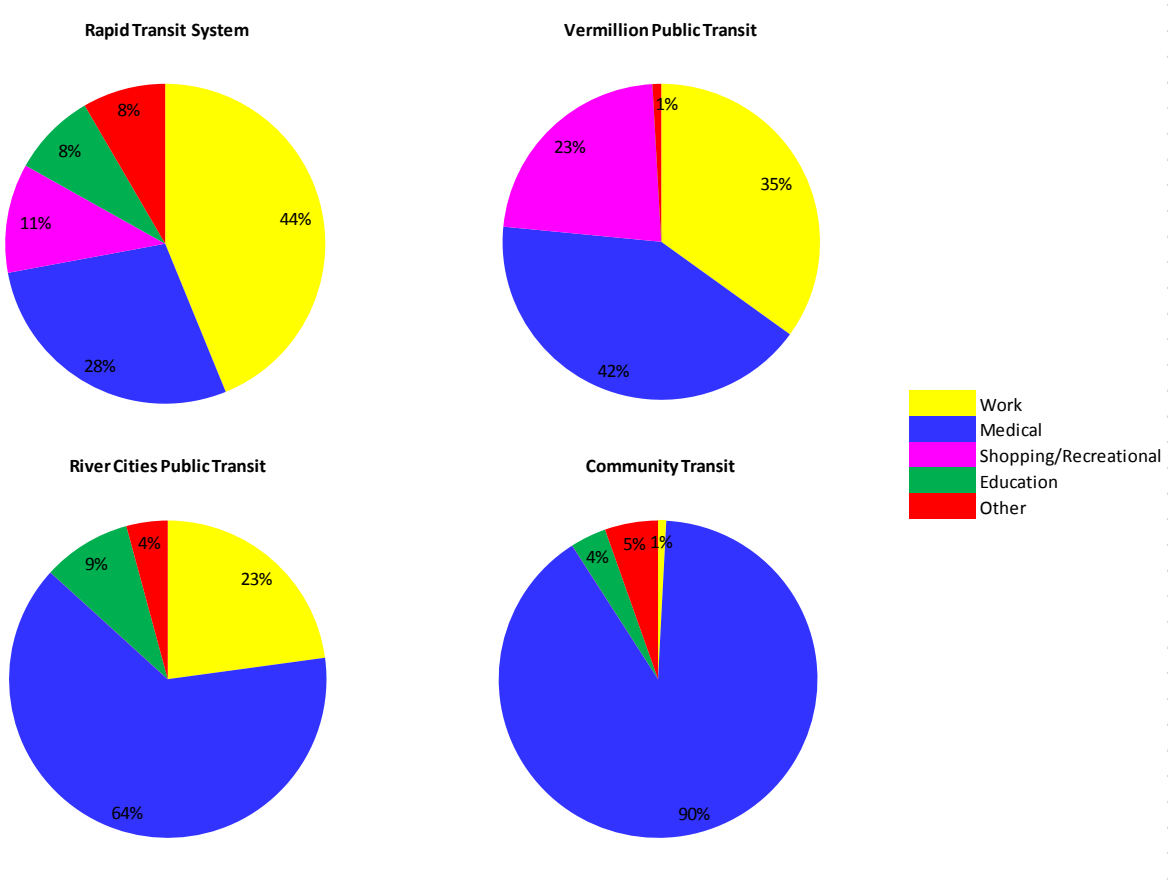


Table 24: Economic Impacts of Out-of-Pocket Cost Savings

Impact Metric	Rapid Transit System	Vermillion Public Transit	Community Transit	River Cities Public Transit
Output	$856	$83	$61	$242
Value added	$499	$48	$36	$141
Employment	8	1	1	2
Taxes	$113	$11	$8	$32
Federal taxes	$53	$5	$4	$15
State/Local taxes	$61	$6	$4	$17

Notes: All dollar amounts are expressed in thousands of 2010 dollars.
Value added is a component of output and the two should not be added together.
Employment 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 of the economy.
State and local tax impacts are combined and cannot be separated within IMPLAN.

Table 25: Economic Impacts of Transit O&M Expenses

Impact Metric	Rapid Transit System	Vermillion Public Transit	Community Transit	River Cities Public Transit
Output	$2,765	$505	$705	$4,423
Value added	-$46	-$8	-$12	-$74
Employment	38	7	10	61
Taxes	$104	$19	$27	$167
Federal taxes	$113	$21	$29	$180
State/Local taxes	-$8	-$2	-$2	-$13

Notes: All dollar amounts are expressed in thousands of 2010 dollars.
Value added is a component of output and the two should not be added together.
Employment 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 of the economy.
State and local tax impacts are combined and cannot be separated within IMPLAN.

Table 26: Economic Impacts of Transit Capital Expenses

Impact Metric	Rapid Transit System	Vermillion Public Transit	Community Transit	River Cities Public Transit
Output	$1,636	$146	$196	$815
Value added	$995	$99	$116	$621
Employment	10	1	1	3
Taxes	$261	$28	$30	$187
Federal taxes	$131	$13	$15	$83
State/Local taxes	$130	$15	$15	$104

Notes: All dollar amounts are expressed in thousands of 2010 dollars.
Value added is a component of output and the two should not be added together.
Employment 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 of the economy.
State and local tax impacts are combined and cannot be separated within IMPLAN.

Table 27: Top Five Industries Impacted by Transit O&M and Capital Expenses

Industry	Rapid Transit System	Vermillion Public Transit	Community Transit	River Cities Public Transit
Wholesale trade	$197	$33	$46	$276
Finance and insurance	$220	$33	$46	$269
Professional - Scientific & technical services	$187	$29	$42	$239
Real estate and rental	$177	$25	$34	$196
Health and social services	$140	$20	$27	$158

Notes: All amounts are expressed in thousands of 2010 dollars.
Industries are ranked according to their combined indirect and induced output impact.
Industries are aggregated at the 2-digit NAICS level.

Table 28: Summary Results

	Rapid Transit System	Vermillion Public Transit	Community Transit	River Cities Public Transit
Social benefits ($000s)	$1,439	$187	$291	$753
Social benefits per passenger trip	$4.6	$2.9	$3.3	$2.3
Job impact	56	9	12	66
Output impact ($000s)	$5,257	$734	$962	$5,480
Output impact per $ spent on public transit	$1.9	$1.8	$1.7	$1.7

Note: It is strongly advised against adding economic impacts to social benefits because they result from two different analyses.

Appendix D: Supplemental Statewide Economic Impact Analysis Results

Table 29: Output Impact of Transit O&M Expenses by Aggregate Sector and by Type of Effect

NAICS Code	Industry	Direct	Indirect	Induced	Total
11	Agriculture, forestry, fishing and hunting	$0.0	$4.4	$20.4	$24.8
21	Mining	$0.0	$25.3	$1.5	$26.8
22	Utilities	$0.0	$459.4	$114.6	$574.0
23	Construction	$0.0	$35.1	$39.3	$74.5
31-33	Manufacturing	$0.0	$400.8	$116.3	$517.1
42	Wholesale trade	$0.0	$1,632.6	$216.1	$1,848.8
48-49	Retail trade	$0.0	$16.1	$558.3	$574.4
44-45	Transportation and warehousing	$0.0	$597.3	$88.1	$685.4
51	Information	$0.0	$324.7	$119.5	$444.2
52	Finance and insurance	$0.0	$889.4	$738.7	$1,628.0
53	Real estate and rental	$0.0	$138.7	$936.4	$1,075.1
54	Professional - Scientific and technical services	$0.0	$1,550.9	$75.4	$1,626.3
55	Management of companies	$0.0	$44.5	$23.6	$68.1
56	Administrative and waste services	$0.0	$203.5	$52.2	$255.7
61	Educational services	$0.0	$3.6	$40.8	$44.4
62	Health and social services	$0.0	$0.0	$872.7	$872.7
71	Arts, entertainment and recreation	$0.0	$32.8	$91.3	$124.1
72	Accommodation and food services	$0.0	$99.1	$275.2	$374.3
81	Other services	$0.0	$268.7	$249.8	$518.6
92	Government and non NAICs	$19,096.5	$240.7	$124.7	$19,461.9
	TOTAL	**$19,096.5**	**$6,967.7**	**$4,755.1**	**$30,819.3**

Notes: All amounts are expressed in thousands of 2010 dollars.
Industries are aggregated at the 2-digit NAICS level.

Table 30: Tax Impact of Transit O&M Expenses by Type of Tax

		Employee Compensation	Proprietary Income	Household Expenditures	Enterprises (Corporations)	Indirect Business Taxes	Total
Federal	Corporate Profits Tax	$0.0	$0.0	$0.0	-$413.9	$0.0	-$413.9
	Indirect Business Tax: Custom Duty	$0.0	$0.0	$0.0	$0.0	$5.1	$5.1
	Indirect Business Tax: Excise Taxes	$0.0	$0.0	$0.0	$0.0	$15.8	$15.8
	Indirect Business Tax: Federal Non-Taxes	$0.0	$0.0	$0.0	$0.0	$13.5	$13.5
	Personal Tax: Income Tax	$0.0	$0.0	$360.0	$0.0	$0.0	$360.0
	Social Insurance Tax: Employee Contribution	$614.4	$55.3	$0.0	$0.0	$0.0	$669.7
	Social Insurance Tax: Employer Contribution	$603.9	$0.0	$0.0	$0.0	$0.0	$603.9
	Sub-Total	**$1,218.3**	**$55.3**	**$360.0**	**-$413.9**	**$34.4**	**$1,254.2**
State/Local	Corporate Profits Tax	$0.0	$0.0	$0.0	-$101.0	$0.0	-$101.0
	Dividends	$0.0	$0.0	$0.0	-$503.9	$0.0	-$503.9
	Indirect Business Tax: Motor Vehicle License	$0.0	$0.0	$0.0	$0.0	$3.7	$3.7
	Indirect Business Tax: Other Taxes	$0.0	$0.0	$0.0	$0.0	$7.7	$7.7
	Indirect Business Tax: Property Tax	$0.0	$0.0	$0.0	$0.0	$177.9	$177.9
	Indirect Business Tax: State/Local Non-Taxes	$0.0	$0.0	$0.0	$0.0	$14.8	$14.8
	Indirect Business Tax: Sales Tax	$0.0	$0.0	$0.0	$0.0	$141.9	$141.9
	Indirect Business Tax: Severance Tax	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	Personal Tax: Income Tax	$0.0	$0.0	$82.7	$0.0	$0.0	$82.7
	Personal Tax: Motor Vehicle License	$0.0	$0.0	$15.7	$0.0	$0.0	$15.7
	Personal Tax: Non-Taxes (Fines and Fees)	$0.0	$0.0	$43.1	$0.0	$0.0	$43.1
	Personal Tax: Other Tax (Fishing/Hunting)	$0.0	$0.0	$5.0	$0.0	$0.0	$5.0
	Personal Tax: Property Taxes	$0.0	$0.0	$8.6	$0.0	$0.0	$8.6
	Social Insurance Tax - Employee Contribution	$2.8	$0.0	$0.0	$0.0	$0.0	$2.8
	Social Insurance Tax - Employer Contribution	$7.0	$0.0	$0.0	$0.0	$0.0	$7.0
	Sub-Total	**$9.9**	**$0.0**	**$155.1**	**-$604.9**	**$346.0**	**-$94.0**
TOTAL		**$1,228.1**	**$55.3**	**$515.1**	**-$1,018.8**	**$380.4**	**$1,160.2**

Notes: All amounts are expressed in thousands of 2010 dollars.
State and local tax impacts are combined and cannot be separated within IMPLAN.
Negative numbers reflect government subsidies to the public transit sector.

Appendix E: Risk Analysis Results

To account for the uncertainty surrounding specific model inputs, the social benefits of public transit were estimated within a risk analysis framework, where risk variables are defined as a range of values (low, median and high estimates) rather than a single point estimate.[30] For instance, the value of time (used to compute travel time savings) is based on the median household income from the U.S. Census Bureau's American Community Survey, following the methodology recommended by the U.S Department of Transportation.[31] As shown in Table 31 below, a range of estimates was defined for each of the four transit categories, using the median household income estimates of all counties served by the different public transit agencies within each category. In particular, the margin of error associated with each median household income estimate (and derived from the survey results) was used to calculate the lower and upper bound estimates.

Table 31: Value of Time ($/hour)

Transit Category	Median	Lower 10% Limit	Upper 10% Limit
Urbanized	$12.12	$8.27	$14.92
Small Urban	$11.00	$7.24	$14.00
Rural	$9.56	$6.03	$12.61
Other	$9.92	$5.25	$13.40

Sources: U.S. Census Bureau and U.S. Department of Transportation.

Once the inputs for the risk variables have been entered, the model transforms the ranges into statistical probability distributions. These probability distributions are then combined using simulation techniques (such as Monte Carlo simulation method) that allow all variables to vary simultaneously. The end result is the expected benefits of public transit together with estimates of the probability of achieving alternative outcomes given the uncertainty in the underlying assumptions. As shown in Table 32 below, Rural systems are expected to have generated $329 thousand in transportation cost savings in 2010. However, there is a 10 percent chance that these savings could be in excess of $510 thousand.

Table 32: Transportation Cost Savings, Risk Analysis Results

Transit Category	Median	Lower 10% Limit	Upper 10% Limit
Urbanized	$8,274	$6,974	$9,629
Small Urban	$2,026	$1,229	$2,858
Rural	$329	$155	$510
Other	$244	$110	$388
Total (Statewide)	$10,878	$9,339	$12,411

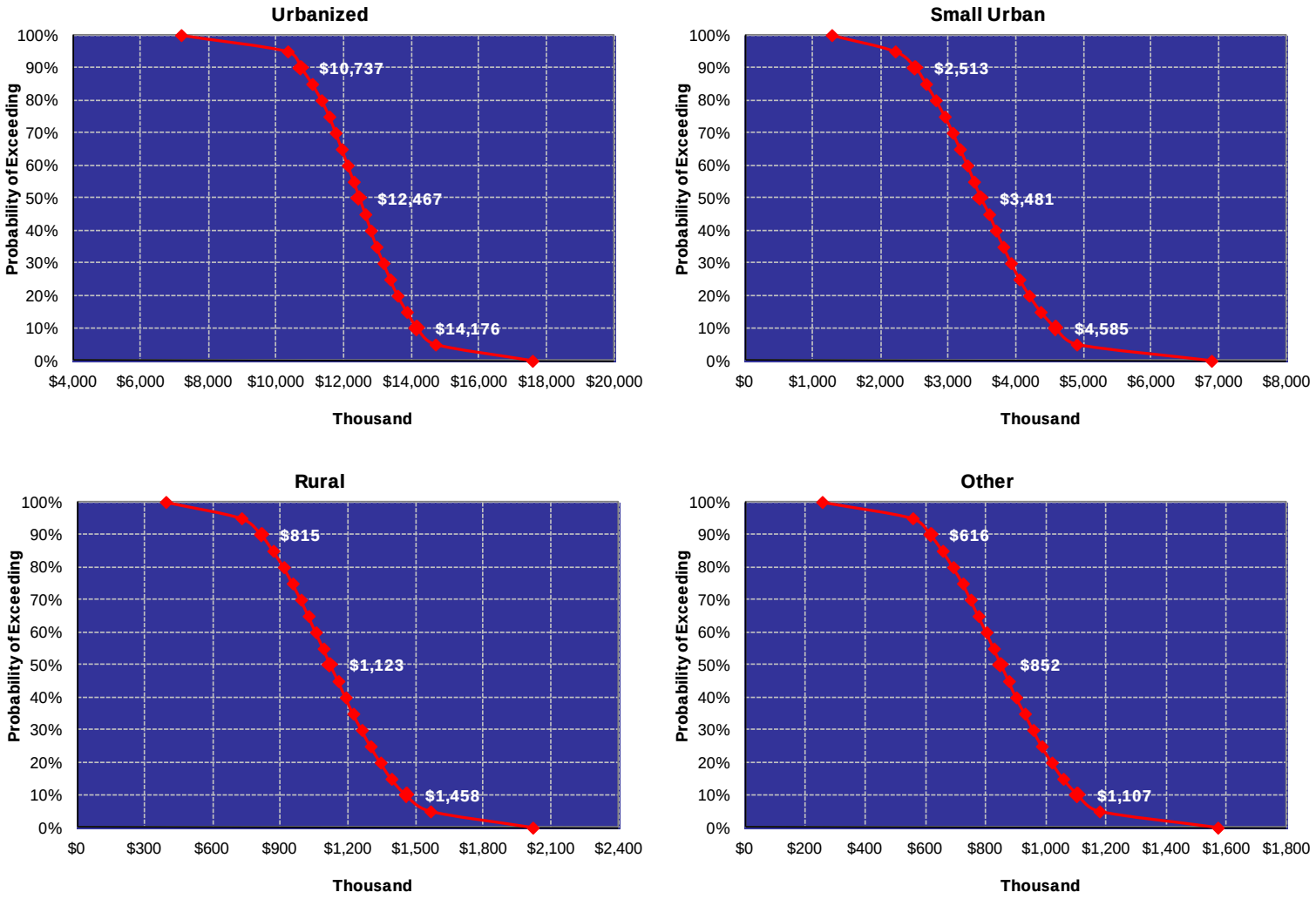
Notes: All amounts are expressed in thousands of 2010 dollars.
Risk-adjusted results should not be added across transit categories.

[30] Note that there is no risk analysis for the economic impacts of transit O&M and capital costs since the cost estimates and the economic multipliers are fixed.

[31] U.S. Department of Transportation, Office of the Secretary of Transportation. *Revised Departmental Guidance: Valuation of Travel Time in Economic Analysis*, February 2003.

Figure 11 on the next page represents the cumulative probability distribution of total social benefits for each of the four transit categories. The figure shows that while there is a 50 percent probability that social benefits are above (or below) $1.12 million for Rural systems, there is only a 10 percent chance that these benefits exceed $1.46 million.

Figure 11: Social Benefits of Transit, Risk Analysis Results



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