ASSESSMENT OF ARKANSAS ECONOMIC IMPACTS OF RURAL PUBLIC TRANSPORTATION

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This research documents the linkages between public transportation and economic activities in the rural areas of Arkansas. A methodology is developed to estimate the impacts of rural public transportation and economic activities in the rural areas of Arkansas. The developed methodology is used to estimate several rural public transportation systems in the state of Arkansas. The data obtained can provide rural transportation providers with an opportunity to link the economic strength of a region and the public transit system that serves it.

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ASSESSMENT OF ARKANSAS ECONOMIC IMPACTS OF RURAL PUBLIC TRANPSORTATION

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Table of Contents

Table of Figures

Table of Equations

TABLE OF FIGURES

TABLE OF EQUATIONS

1.0 INTRODUCTION

1.1 Introduction

Public transportation has been and continues to be an important instrument in the development of American communities. Every day people use buses, advanced rail systems, minibuses, vans, and other modes of public transportation to face the challenges of daily survival. In some cases, public transportation is used to reduce traffic congestion, parking problems, and air pollution by decreasing the number of cars used by urban travelers.

Public transit systems also help promote the economic growth of a community and supply its riders with increased mobility and independence by transporting individuals to work and other necessary activities. Particularly for individuals who are unable to afford or use cars, transportation to work, medical facilities, shopping areas, and social services is vital in order for them to maintain healthy and full lives. This is especially true for rural areas which are generally made up of elderly and low income populations. Therefore, public transportation enhances the quality of life for those who may use them.

Despite its importance to the communities and citizens, public transit system are suffering because of cutbacks in federal funding. A decrease in financial support will cause some transit providers to reduce or discontinue their services. If this happens, the individuals who would be most affected are the handicapped, elderly, young, and low income; more specifically, rural communities.

Rural public transit is an indispensable public service which is vital to the economic and social well-being of the rural community and its citizens. This study documents the linkages between public transportation and economic activities in rural areas of Arkansas, estimates the impacts of rural public transportation in the state of Arkansas and in the local communities, and develops new and augments current methodologies for estimating the economic impacts of Arkansas rural public transportation.

In Arkansas, rural public transportation contributes to the enhancement of the quality of life for those individuals living in and around small towns. Not only is it important for the economic health of those using it to commute to work, but it also provides for a means of transportation for patrons traveling to shopping centers, medical facilities, and social services.

Although the qualitative aspects of providing public transportation services in rural areas has been recognized, the quantitative data which represents the economic impacts of such services has not been fully explored. The heart of this study focuses on the development of a conceptual framework for identifying and analyzing the tangible and intangible benefits of rural transit systems. It is believed that this type of data will provide rural transit providers with an opportunity to link the economic strength of a region and the rural public transportation system which serves it. This study will address the quantitative deficiencies that currently exist by estimating the economic impacts of Arkansas rural public transit systems.

2.0 REVIEW OF RELATIVE LITERATURE

2.1 Overview of Public Transportation

In order to understand the importance of public transportation, both historical and current issues related to public transit were examined. The following sections outlines various topics covered in the literature that are related to this study.

2.1.1 Past

One of the earliest modes of public transportation was the omnibus line of Paris. This horse-drawn wagon was operated by Pascal, the mathematician, in 1662. During the initial period of operation, the omnibus line offered free services and was very successful in attracting passengers. However, later when the fare was changed, the patrons rebelled and the drop in support caused Pascal to discontinue the services [27]. Despite the failure of this system, Pascal's omnibus gave birth to many public transportation services all across the world.

In 1831, the United States installed it's first major omnibus system in New York city [27]. Although expensive to ride, the omnibus was believed to have "strengthened the central business district of cities," by making "the central area the focal point for internal travel" [27,71]. According to Sam Warner's study of the growth in Boston between 1870 and 1900, the physical plan of metropolitan Boston depended on the development of urban transportation [71]. Other city omnibus services were setup, but only in large cities.

The next mode of public transit introduced in the United States was the horse-drawn streetcar. This vehicle, which had metal wheels operating on a metal rail, was larger and faster than the omnibus [27]. Streetcars offered a large variety of boarding and exiting stops, thus giving the patrons different options of destinations [71]. It also continued to magnify the strength of the central business district by carrying more people to their traveling destinations. Streetcar systems were started in many cities of various sizes and the fare cost depended on the distance traveled [27].

Although their business was successful at this time, transportation managers wanted to eliminate the use of horses. Specifically, for Boston, the streets were too narrow to carry all of the cars needed and the four mile street extending out from city hall was long and tedious for some riders [43]. In 1873, the first cable car was installed in San Francisco. This system was drawn by a cable which ran continuously between the rails beneath the street. The car had a mechanism that would grip the cable to move and release it in order to stop. The cable car mode of transportation spread quickly, but it could only be used in relatively flat land areas [27].

During the mid 1880's, electric railway cars were being developed [27,70,71]. At first there were problems in getting the car to run smoothly on the rails, but in 1888 Frank Sprague installed a smooth running electric railway system in Richmond, Virginia. Because of the faster speed, the electric rail cars enabled street railways to be extended farther out from the central business districts and allowed people to travel to work or to shopping areas within a half hour [27]. Particularly for Boston, the electric streetcar brought convenient transportation to a range extending six miles from the city hall. This extension caused the rate of building and settlement to become so rapid that the physical plan of Boston was reconstructed [71]. "By the time of World War I, the electric streetcar had had a major impact on the growth and structure of cities" [27]. Since services were good and fare prices were relatively cheap, the electric transit system became the basic mode of transportation before the introduction of the automobile [27].

Also, during the introduction of the electric railway systems, public commuter services were being developed. Commuting was believed to permit "persons of ordinary means the opportunity to find good housing and, perhaps a more favorable environment than was available in the major city center" [27]. One type of commuter service was the public ferryboat. These systems allowed citizens, bound by water barriers, to travel to better jobs, markets, and other services. Another type of commuter service was the public railroads. Originally the traditional railroads were only used for freight deliveries, but later they transported people to cities and

towns which were not within walking distance. The railroad was a major link for many small communities which helped them to obtain social and economic growth [27,71].

By the mid 20th century the street railway business became bankrupt and the motor bus was introduced [27,70]. At first there were numerous motor problems and the buses were not very dependable. As auto technology advanced, the motor bus became the ultimate mode of transportation in the United States. Although these buses were not very comfortable to ride they were capable of transporting 50 or more seated passengers. This helped to deal with the increased traffic congestion in growing urban communities. The greatest advantage of the motor bus was its flexibility. It could travel to different locations without the need to reconstruct or develop a railing system [27,70]. This flexibility enabled citizens living or working in non-centralized areas (areas outside central business districts) to travel to various locations.

2.1.2 Present

It is believed, even from the beginning, that public transportation has been an important tool "in the economic health and quality of life of an individual" [35]. In an article written by David Raphael, it was estimated that 75 million people are unable to provide or afford their own transportation and must rely on others for their mobility [53]. Of the 75 million, 26 million were older Americans, 24 million were people with disabilities, and 25 million were adults and children in poor families [53]. Public transportation becomes the link that helps people to maintain healthy and independent lives by transporting people to work, shopping centers, and social services [21,35,4972].

After World War II, there was an increased dependence on personal automobiles [27]. This dependence is stated to have the three following disadvantages: restricts the mobility of those who are unable to afford cars, "causes inordinate energy consumption and is environmentally destructive", and many areas lack the space and money to accommodate an increase in auto traffic [27]. Therefore, public transportation can be used to help reduce traffic congestion, parking problems, and air pollution by transporting car owners from one place to

another [27,31,42,70,73]. Today buses, advanced rail systems, minibuses, taxis, and other modes of transportation are used to help citizens and communities handle the challenges of daily survival.

2.2 Types of Public Transportation Systems

There are two main types of public transportation systems: fixed-route and demand-response [27,28,47,70]. Extending from these two systems are numerous forms of public transportation systems and services. A selected list of transit systems are discussed in the following sections.

2.2.1 Fixed Route Systems

The conventional fixed-route systems usually consists of large capacity buses that run on a specified route and allow the loading or unloading of passengers at designated locations. This type of system is generally used in urban and suburban areas were the passenger supply is high and relatively constant [27,47,70]. Since there is a high demand for service, the fare cost is low and affordable for most patrons [27,47]. The sources of funding for these systems includes federal and state governments aids, fare box and contracted revenues, and state and local subsides [5,27,47,70,74].

Fixed-route systems are the most widely used transit service and are helpful in the efforts to control traffic congestion. In many urban areas, transit operators include a "park and ride" route [27,47,70]. This route allows patrons to park their cars in a specific location outside of downtown area and enables them to ride the bus to their needed destination. By parking cars away from the inner city, park and ride services helps to reduce the flow of traffic in and out of the central city [27,47,70].

2.2.2 Demand-Response Systems

In a demand-response system, transportation services are catered to specific needs or requests of the passengers [21,27,28,47,61]. Although there are demand response systems in urban and rural areas, this type of system operates well in communities which have small populations and low travel demands [26,27,28,60]. Several authors believed that demand

response systems help provide a high degree of mobility to those who might otherwise be unable to travel [20,27,28].

Most demand response systems offer door-to-door services, particularly for patrons who are handicapped and elderly [20]. The dial-a-ride service is one type of demand-response system. In a typical dial-a-ride service, pickups are scheduled upon the request of the rider [20,26,46,69]. The passenger calls the transit office 24 hours in advance and requests a ride. After the dispatcher receives the origin, destination, and the time of travel, he or she then schedules the passenger to be transported to the desired locations.

Since demand-response often require movement through narrow areas, transit operators use vans, minibuses, cars or any other type of small vehicle to service the special needs of citizens [26,46]. Funding for these services are also received from fare and contracted revenues, state and federal governments, and state and local subsidies [26,60,69]. However, since demand response systems usually cater to patrons who have lower incomes, demand response systems rely more heavily on funding received from the federal, state, and local authorities [60].

2.2.3 Paratransit System

A paratransit system is referred to as a demand response system [69]. This type of system is usually marketed toward certain social groups such as: elderly, handicapped, and children. For example, a paratransit van may pick up a handicapped patron and transport him to a medical facility. Thus, a paratransit system is a demand response system [26,69].

2.2.4 Hybrid System

A hybrid system, is a combination of fixed-route and flexible route characteristics [26,69]. One type of hybrid system is a fixed route with deviations. In these fixed route systems, the transit authorities may alter their fixed route in order to service a patron desiring special needs [20,34]. In other words, the transit vehicle (usually a mini-bus or van) will normally operate on a fixed route. When a special request is called in, the transit vehicle will detour from the scheduled route in order to pick up or drop off patrons [26]. After the task is completed, the transit vehicle

will return to its normal fixed route schedule [27,70]. Hybrid services often work well in rural areas were the population is not very dense.

2.3 Transportation in Rural Areas

The availability of transportation in rural areas is usually lower than in urban areas. One major reason for the lack of transportation in a rural area is the low population density. These communities often do not have the population size, adequate road development, or the financial income needed to support a stable public transit system [49].

2.3.1 The rural communities

In the 1990 United States Census, the Census Bureau defines rural areas as places with populations of less than 2,500 citizens [64]. These rural areas have been described as having scattered populations which mainly consist of elderly and low income citizens [27,36,61].

Knowles [35] suggested that rural citizens may need public services which are located in far away business centers. In a health dependency study conducted by Krout, it was discovered that health care services and facilities are less accessible in rural areas and that citizens must often travel long distances to receive the needed services [36]. This restrictive range of health opportunities may cause citizens to delay health services until a health condition becomes severe (resulting in more expensive health care), or until they are not able to take care of themselves. In addition not only are health facilities difficult to access, but jobs, shopping areas, and social services are also located in distant locations [36,49,54].

To describe the geographic make up of rural communities, the Resource Management Corporation (RMC) stated that rural areas have long distances and rough terrain. This means that most rural communities lack adequate land and road development [49,54]. For example in the article published by the Mass Transit Magazine, the Endless Mountain Transit System provides transportation over a large area which lacks road development [49] The unknown author stated that most of the two lane roads are narrow and that some of the roads leading to resident homes

are gravel and dirt roads [49]. These conditions make transportation both difficult and long [27,49]

Since a considerable portion of the rural population will not be able to afford or have access to private transportation [27,49,61], they must depend on public transportation as their sole means of conveyance [47]. If public transportation is not available rural citizens would be devastated because they would not be able to afford or obtain other options of transportation [61]. Unlike urban areas which have many other accessible transit modes (such as advanced rail systems, taxis, private transit systems), rural areas are limited in the number of available public transportation options [54]. Therefore, transportation is an important tool which affects the social and economic growth of rural communities [35,54,61].

2.3.2 Rural Transit Issues

The primary concerns of rural public transportation operators are with providing services for the transit-dependent groups (elderly, youth, low income, handicapped, etc.) rather than with reducing traffic congestion [15,49,54]. According to David Raphael [52], in 1995, almost 1,200 small transit systems were established to meet the needs of 900 rural American counties.

Rural transit providers strive to serve the needs of the community in the most efficient way and with the least cost [27,28,70]. Since rural areas contain low density populations and widely dispersed travel ranges, it is difficult and expensive to operate a fixed-route system [27,35]. Therefore, the smaller compact vehicles of demand-response systems are used to handle the smaller passenger load and the longer travel distances at a lower cost [27,28,35]. Demand-response systems are often used in rural areas because of the large number of elderly and low income populations who have specific transportation needs [27,28,33,54].

In some situations the demand for transit services are overwhelming and fixed-route systems have to be implemented in order to handle the load [61]. Also, fixed routes with deviations (hybrid services) may be installed in order to cut cost and to maintain some of the "demand response" needs of patrons [27]. System alterations such as these are common,

particularly when a rural community is experiencing steady growth in population and area development [61].

2.3.3 Benefits of Rural Public Transportation

There are many benefits which can be received by both the users and the community from the provision of rural public transportation. The benefits for the transit users are: increased mobility for non drivers, increased flexibility in travel arrangements, improved accessibility to other areas, travel cost savings, and life style benefits [21,22,27,28,29,35,42,47,54,72]. These benefits can be experienced in rural areas where public transportation is adequate and accessible [21,49,54,72].

Benefits for the whole community include: increased employment, increases in jobs, educational, medical service, cultural and recreational opportunities, widened employment market for businesses, environmental impacts, and land use impacts [5,21,25,27,34,41,42,44,47,50,54, 61,72]. Therefore, "for many Americans, public transportation means opportunities to remain independent and self-sufficient and to participate fully in the life of the community" [52].

2.4 Financing Public Transportation

Transit systems receive funding from the local (community) governments, state government, the federal government, fares, and from private donations. These financial sources help public transit providers to service and meet the needs of growing communities.

2.4.1 Federal sources

In the United States, federal financial assistance for public transportation was regulated by the Urban Mass Transportation Act (UMTA) of 1964 [27,70]. This Act gave guidelines for the amount of money given to an urban transportation system. Over the years many amendments and titles have been written and added in order to assist transportation operators in providing transit services. Federal funding sources that have been available for public transit services are listed below.

- The Urban Mass Transportation Assistance Act of 1970 was the first long-term commitment of federal funds. This Act supplied an expenditure of at least $10 billion over a 12-year period for continuous local planning and flexible administration programs. The 1970 Act also authorized that 2% of the capital grant and 1.5% of the research funds be allocated to financially support aid programs for elderly and handicapped persons [5,27,70].
- The Federal-Aid Highway Act of 1973 contained two provisions which increased the use of highway funds for urban mass transportation. One provision was that "federal-aid system funds can be used for capital expenditures on urban mass transportation projects" [27]. The other provision was that "funds for interstate highway projects can be relinquished and replaced by an equivalent amount from the general fund and spent on mass transportation projects" [27]. This Act also had other provisions: increased matching federal shares for mass transit projects from 66.67% to 80%; increased the amount of funds under the UMTA capital grant program from $3.1 billion to $6.1 billion; and allowed the spending of highway funds for bus-related public transportation facilities [5, 23,27]
- The National Mass Transportation Assistance Act of 1974 was the first act that allocated federal funding for transit operating assistance. It authorized $11.8 billion over a period of six years. About $4 billion, derived by a formula based on population data, could be used for either capital projects or operating assistance [5,27,30,70]. Of the remaining funds, "$7.3 billion was made available for capital assistance at the discretion of the Secretary of Transportation" and $.5 billion was given to rural mass transportation [27,70].
- The Federal Public Transportation Act of 1978 was established under Title III of the Surface Transportation Assistance Act of 1978. This Act divided the formula grant into categories such as: capital grants for bus purchase; and additional operating grants for fixed guideway systems and places outside of urbanized areas [5,24].

- "The Omnibus Budget Reconciliation Act of 1993 raised to $0.02 the portion of the Highway Trust Fund tax on motor fuels to be placed in the Mass Transit Account, effective October 1, 1995" [5].
- The Section 5 formula grant of the Urban Mass Transportation Act was initiated in 1974. It provides grants for urban areas with a population above 50,000. The amount allocated is based on 50% of the total population and 50% of the population density [74]. The Section 5 grant can be used to pay 80% of the capital project or cover up to 50% of the operating deficit [29,74]. Section 5 recipients must provide reduced fares to the elderly and handicapped during the off-peak periods [29].
- Section 18 formula grant of the Urban Mass Transportation Act of 1964, was amended in 1978. This grant was constructed for areas that are non-urbanized. About 15% of UMTA funds could be used for technical assistance, such as project planning, management development, and program development [27]. The objectives of this program are to improve or initiate public transit programs by providing financial assistance for both capital and operation expenses [27,70]. The section 18 grant is developed to improve the "access of people in rural areas to health care, shopping, education, recreation, and employment as well as public services" [15].
- Section 16(b)(2) of the Urban Mass Transportation Act is to be allocated toward the planning and design of mass transportation facilities to meet special needs of elderly persons and persons with disabilities [27,51,70]. This section of the Urban Mass Transportation Act of 1964 was to provide additional funding for transit vehicles to meet the needs of elderly and handicapped [27,51]. This program provided $21 million in grants in 1975, from which 2000 vehicles were purchased [27,70]. Since many citizens, such as the elderly and handicapped, suffer the most if public transportation is not supplied, this grant helps transit providers to meet the needs of transit dependent [27].

- In the Section 9 Grant Formula Program of the Urban Mass Transportation Act, urban and small urban areas are eligible to receive funding to operate transportation system in municipalities with a population of more than 50,000. These funds can be used for buses, terminal construction or rental, office furnishing, and equipment, including computer equipment [51,74,70].
- The Section 3 Program of the Urban Mass Transportation Act of 1964 provides grants to pay for up to 80% of the cost of the construction of new services and the extension of existing transit systems [5,74]. Funding can be allocated toward vehicle replacement and maintenance. Allocations can also be made toward the modernization of existing fixed guide-way systems called "Rail Modernization" [5]. This grant was created for public and private non-profit transit providers in order to increase vehicle efficiency, decrease maintenance costs, and increase safety [51,74].
- The Vocational Rehabilitation Act of 1973 allocated funding for services that provide for employment training and related transportation for those who qualify [29].
- Titles XX of the Social Security Act supplies social services to low income residents in each state. This act provides free transport services to those whose income level does not exceed 80% of the state's median income [29].
- Title XIX of the Social Security Act (Medicaid) states that state transportation plans must provide necessary transportation for recipients to and from medical facilities [29].
- The Federal Highway Administration's Rural Public Transportation Demonstration Program (Section 147) of the Federal-Aid Highway Act of 1973 was developed to aid in the selection, routing, and scheduling of vehicles in rural areas [29]. This program enhances access of rural populations to employment, health care, retail centers, education, and public services [29].

Over time federal funds have been adjusted and revised in order to supply transit systems with necessary funding. Listed below are some of the latest Federal funding regulations.

- Major Capital Investment, 49 USC 5309 (formerly Section 3, which was mentioned earlier in this section) was created for state or local public bodies and agencies. Authorizing legislation designates 40% of the funds for new starts, 40% for rail modernization, and 20% for Bus Capital [5].
- Urbanized Area Formula (UAF), 49 USC 5307 and 5336 (formerly Section 9) was to be received directly by urbanized areas with over a population of 200,000 and through state governors for urbanized areas under a population of 200,000 [5]. For operating assistance, about 50% is received from federal and 50% from state and local. Allocations of 80% from federal and 20% from state and local, are received for capital assistance [5].
- Elderly and Disabled Persons, 49 USC 5310 (formerly Section 16(b)) is allocated for capital equipment, contracted service, and state administrative costs. The 5310 grant can be received by private, nonprofit corporations and associations providing mass transportation services for the elderly and disabled or to public bodies coordinating such service or providing service where no non-profit service is available [5].
- Rural Area Formula (RAF), 49 USC 5311 (formerly Section 18) authorizes funding through FY 1997 [5]. These funds are available for mass transportation providers which operate outside of urbanized areas [5]. For operating assistance 50% comes from federal and 50% comes from state and local. For capital assistance, about 80% comes from federal and 20% comes from state and local [5].
- Rural Transit Assistance Program, 49 USC 5311 (b)(2) (formerly Section 18(h)) was established by the FMT Act of 1987 to provide research, technical assistance, and training grants and related support services to non-urbanized areas [5].

2.4.2 State and Local Sources

Funding for public transportation is also received from state and local sources. Sources such as tax based support, sales tax, utilities tax, gasoline tax, and lotteries are used to support public transportation systems at the state and local levels [27,70,74].

Some states provide operating subsidies to the local transit systems. In Baltimore, the state funds the transit system's operating deficits that are not covered by federal financial aid [74]. California and Illinois provide operating subsidies to transit systems on the basis of the states sales tax revenues that are collected in that particular transit service area [74].

Financial support from local governments for public transportation is mainly generated from residential taxes. In Cincinnati, a 0.3% income earnings tax is dedicated to the support of the local public transportation systems. In New York and San Francisco, subsidies from bridge and tunnel tolls are collected to help public transportation [74].

2.4.3 Revenue sources & Private Donations

Revenues are generated from "fare box" collections and from private charters for special events [27] Fare for most demand response systems are based on the distance traveled by the patron [21,28]. Private donations are sometimes received to aid transit systems in developing communities.

2.4.4 Decrease in Funding

Presently, transit providers are dealing with greater demands and smaller amounts of federal funding [61]. The government, in efforts to create a workable budget, is making large cuts in the money that is allocated for public transportation [52,61]. With the increased cost of operating transit systems, a decrease in the budget will and has to be devastating [61].

In several articles, many transit providers expressed a need for more money to handle vehicle maintenance cost, technical equipment costs, vehicle replacement costs, and all other operating cost [61,73]. Although public transportation is important to the communities and the people, the lack of funding will probably cause many transit systems to discontinue their services [61].

Fares usually cover less than 40% of the operating cost [27]. Therefore, the funding received from the government compensates for most of the public transportation cost [61].

2.4.5 Alternatives for Funding Cuts

Many transit agencies have reduced services in an effort to handle funding cuts [53,61]. Some transit operators stated that they would have to offer fewer services and restrict the hours of travel due to funding cut. Transit providers operating smaller services stated that they would have to create deviated fixed-route services instead of pure demand-response systems in order to continue services [53].

2.5 Previous Studies on Economic Impacts

Several types of economic impact studies have been conducted in the past. The following sections summarizes those studies.

2.5.1 "Market Opportunity Analysis for Short-Range Public Transportation Planning: Economic, Energy, and Environmental Impacts"

The Transportation Research Board published a report which discussed and presented the benefits of public transportation and the economic, energy, and environmental impacts of public transit systems. This report is a part of the National Cooperative Highway Research Program Report (NCHRP) Project 8-16, "Guidelines for Public Transportation levels of Service and Evaluation". This project information is to be used as a tool in the development of improved methodology for short-range public transportation programs in urban areas with a population range of 50,000 to 500,000 [72].

Several benefits resulting from the provision of public transportation were presented and are listed in Figure 2-1. These benefits (categorized as either direct economic benefits, quantitative benefits, or non-quantitative benefits), were derived from the improvement of transit services in a medium-sized city and are stratified into three groups:

1) User benefits - includes benefits experienced by current transit users that have increased mobility and reduced travel costs.
2) Special group benefits - includes special treatment that is given to groups or institutions, such as large employment densities and business owners that exist near a transit station.

3) Community at large benefits - includes benefits experienced by the whole community such as increased property values, reduced traffic congestion, and reduced energy conservation.

Figure 2-1: Categorization of Alleged Benefits from Improved Transit Systems

DIRECT ECONOMIC BENEFITS	
	For the user: Savings in travel time; savings in travel costs (Such as saving in auto purchasing); savings in reduced congestion; and savings in highway safety.
	For special groups: Savings in parking construction requirements for merchants and employers; increased land values (office and residential growth).
	For the community at large: Increase in taxes from areas of higher density development; savings in highway and bridge construction cost in heavily traveled corridors; taxes from land not taken off tax rolls for public highway and parking construction; and some savings in school district busing cost.
OTHER QUANTIFIABLE BENEFITS	
	For the user: Increased flexibility in travel arrangements; choices available for trips to work, airport, etc.; improved accessibility to other areas; and improved mobility for non-drivers
	For special groups: Widened retail market areas by improved accessibility (such as shopping centers); and widened employment market for major employers
	For the Community at large: Reduction in unemployment; reductions in highway noise in some corridors; reductions in vehicle crank case emissions (smog); and improved civil defense capability and energy conservation.
NON-QUANTIFIABLE BENEFITS	
	For the users: increased pleasure and comfort of travel
	For special groups: New life-style available to elderly, young, and handicapped; and job, educational, service, cultural, recreational opportunities - social impacts
	For the community at large: Community development opportunities; environmental and aesthetic benefits; and greater community efficiency.

[Source: Wilburn Smith and Associates, Inc., Community Benefits Resulting from an Improved Transit Program in the Sacramento Region, prepared for the Sacramento Regional Area Planning Commission, Sacramento, California, March 1971]

2.5.1.1 Economic benefits of public transportation. In the economic impact portion of this report, the authors review the effects of decreased public transportation services upon its economic environment. Major emphasis is placed on patronage (user effects), employment, and business development. Since it is difficult to analyze impacts resulting from increased transit, the analysis was based on describing the impacts resulting from the temporary removal (strikes) of transit services.

The authors reviewed past cases of strikes to determine the changes in travel behavior and economic loss resulting from temporary transit interruption. Although strikes were not

permanent, it is believed that the results can help to assess the intensity of economic benefits supplied by public transportation.

There were several limitations associated with this approach. A major problem encountered was the lack of research and uniform analysis within the field. Another problem was that the population size and the availability of transit alternatives varied in each strike community. In addition, each transit system resumed service immediately after the strike. Therefore, all impacts were temporary, which only presents a basis for short-term reasoning. The alleged benefits could be revealed in the magnitude of economic dislocations resulting from a strike.

2.5.1.2 Effects on transit patrons. In the National Cooperative Study, the mass transit market was broken into three basic user market segments:

1) Transit dependent riders (captive riders). Individuals are dependent on mass transit for their transportation. Individuals such as the elderly, the young, the handicapped, and the low-income families.
2) Semi-dependent riders (semi-captive riders). Individuals who use the transit system, but are able to travel by another transportation mode. These usually consisted of members of a one-car family in which there are two or more drivers.
3) Independent Riders (choice riders). Individuals who have cars (or other definite alternative transportation mode) immediately available for use.

In the strike cases studied, the transit interruptions lasted between 12 and 120 days. Each strike reviewed resulted in increased traffic congestion and longer travel time as most transit patrons temporarily pursued another form of transportation. In some situations, individuals were unable to adjust their transportation methods; therefore, many trips were suppressed. The level of travel suppression depends on whether or not the rider was able to afford or obtain other transit modes operating in the same area. The author suggests that the shifting of modes and extent of travel suppression stimulate the economic impact and that the scope of activities (such as shopping, medical care, etc.) determines the dimensions of impact.

It is noted that all user segments will experience a loss of flexibility and convenience, but the greatest impact will be felt by the transit dependent, the individual who lacks alternative transportation options. The semi-dependent and independent riders were able to obtain other modes of transportation; thus travel suppression was minimal.

In order to trace the economic impacts, the authors suggest that it is necessary to acknowledge the number of individuals falling under the definitions of captive, semi-captive, and choice riders. Also, that the available alternative modes of transportation services be determined. From this information, the impacts are determined on the basis of how individuals make adjustments.

2.5.1.3 Suppression of travel. In 1974 Alameda-Contra Costa (California) experienced a transit strike, there was a trip suppression rate (the percentage of the trips discontinued) of 50 to 60 percent for the elderly and the young, which was about twice the average trip suppression rates for all other transit users. In San Bernardino, twenty-five percent of the dependent riders ceased their travel during the 1974 Southern California Rapid Transit strike. In contrast, only 4% of the semi-dependent patrons eliminated travel. During the 1966 New York City Transit strike, 60% of the dependent riders discontinued trips during the strike, compared to 15% of the semi-dependent. In Knoxville, Tenn., it was discovered that elderly captive riders had suppressed their travel at twice the rate of the elderly non-captive riders. The impact of the strike was felt most dramatically by the elderly living in senior citizens housing. The trips most frequently suppressed were discretionary trip such as trips for religious purposes, visiting friends and relatives, leisure and recreational trips, and personal business. In spite of the loss in transit service, non-discretionary travel continued to be made for shopping, medical appointments, and work trips. The author stated that the most commonly used alternative mode was the car (carpooling, relatives, and personal).

2.5.1.4 Effects of travel suppression on employment. One benefit commonly associated with mass transit is increased job opportunities for lower income residents because of

available mobility. It is thought that the transit dependent rider, which includes low-income individuals, is most likely to suffer from a transit interruption, since the access to the job site is interrupted. However, strike statistics did not show this to be the case.

The 1974 Southern California Rapid Transit District strike showed that few people were affected by the strike. A large number of people were slightly inconvenienced (traffic tie-ups, etc.) and only a small number were hurt directly because of missed non-discretionary trips. Of the 316 people interviewed, only 4% stated that they lost their jobs because of the transportation strike. In November, the comparative statistic of new unemployment applications for Los Angeles County and the state of California recorded no statistical evidence that unemployment occurred because of lack of transportation.

The Connecticut cities went without bus services for 121 days in the fall and winter of 1972 and 1973. Yet, the cities did not experience any serious dislocations in economic or social activities because of lack of service. Similarly, in Knoxville, there was no noticeable increase in community unemployment resulting from the 6- week strike. Major industrial firms and employment centers, except for the downtown retail merchants, all reported no difficulty in having employees reach work sites.

This general observation has also been seen in the studies of large metropolitan areas (Los Angeles and Houston, Texas.) and small cities (Hartford, New Haven and Stanford). The effects of these transit strikes are not evident within the county's statistical unemployment records. There were some jobs lost due to transit strikes, but the number was so low that it was not detectable within the over-all statistics.

In another case, a St. Louis, Missouri sponsor reported that many patrons who used the bus to find jobs bought automobiles quickly thereafter and discontinued using the public transit buses. It was assessed that the over-all impact of bus services on the unemployment status was minimal. In the cases studied, individuals endured hardships in order to continue making "vital' or

necessary trips. Therefore, the authors of this report question the idea that mass transit is vital for individuals to reach job markets.

2.5.1.5 Mode shifts as a result of travel suppression. In a study to identify consumer behavior during a strike, Bigelo-Crain Associates conducted a survey of 270 riders of the Southern California Rapid Transit District. It was discovered that the private automobile met the needs of 60% of the usual transit patronage. Taxi providers in the Los Angeles area experienced an over-all increase in revenues of 26%. (However, many who used taxis reduced their amount of travel because of the rider cost).

In the Knoxville transit strike, other modes of transportation did not experience revenue or patronage increases (This excludes the transit services which were provided for students at the University of Tennessee). Local cab companies reported no significant increase in revenues during or after the transit strike.

The authors stated that most impacts that result from the provision of transportation depends up on the community in which it serves. The studies revealed that the choice rider used different modes of transportation during a transit system interruption and that most of the captive transit riders, who did not own automobiles, relied on friends and family for transportation needs.

2.5.1.6 Effects of travel suppression on retail businesses. Changes in travel patterns can have an impact on retail trade. (For evaluation purposes, the businesses are classified by the transit market segments which they primarily serve.) In Los Angeles, retail establishments experienced a 10 to 50 percent reduction in sales during a transit strike. This Los Angeles study proved that the reduction in sale resulted from the recession and loss of transit patrons.

In Knoxville, retail stores experienced a 10 to 80 percent reduction in sales. The businesses selling smaller and lower priced items were affected more than larger, more expensive stores. For example, Knoxville's downtown specialty stores (clothing and shoe stores, food/drug/variety stores, and restaurants), which depend on patron access, were hit the hardest during the strike.

The author suggest that retail stores and small specialty shops receive the most adverse impact for a public transit strike. Although these studies were distributed between medium-sized and major metro areas and strikes lasted 12 to 120 days, they provide good insight into the dislocations that result for the loss of public transportation.

2.5.1.7 Conclusions. As the authors expected, the strikes mostly affected portions of the population that directly rely on public transportation as a principal means of mobility. However, in most cases transit dependent riders were able to find alternative travel arrangements for essential travel. Therefore most of the shopping, work, school, and medical trips continued. The discretionary trips, such as religious and visitation trip, were reduced or discontinued.

In retail sales, the small low priced retail facilities experienced more sales reduction during the interruption of public transportation. Most of the CBD (central business district) establishments and expensive retail stores felt only minor repercussions of losses, about 5 to 10 percent.

The authors suggest that the actual benefit experience for a public transportation system depends on the number of transit riders; the number of riders categorized as captive, semi-captive, and choice; the number of available substitute modes of transportation; the level of social opportunity that is affordable to the citizens; and the commitment to the economic vitality of the downtown area. On the basis of the studies in this report, it was concluded that public transit alone is neither necessary nor sufficient for the economic vitality in a small-to-medium sized city.

2.5.2 SEPTA System

Research was conducted on the economic impacts of the Southeastern Pennsylvania Transportation Authority (SEPTA) on the regional and state economy. The study, funded by a grant from the Urban Mass Transportation Administration, was commissioned by the Delaware Valley Regional Planning Commission [18].

The SEPTA system supplies services to a metropolitan area consisting of five counties in Pennsylvania (Bucks, Chester, Delaware, Montgomery, Philadelphia) and three counties in New

Jersey (Camden, Gloucester, Burlington). It is believed that the Southeastern transit system contributes to the role in supporting the health and growth of the metropolitan, Pennsylvania, and New Jersey economy. However, the SEPTA system is in need of rehabilitation. Aging facilities, such as buses, trains, track bridges, tunnels and viaducts, require constant and expensive capital investments to maintain an adequate level of service. In previous years, before this study, the public transit system had not received the amount of funds needed to support "rehabilitation expenditures at levels consistent with continued long run maintenance of service" [18]. In addition, more funding was needed for increasing operating and capital costs.

2.5.2.1 Purpose. The study was done to evaluate whether the "transit rehabilitation programs would 'pay off' as investments" [18]. Since there was not sufficient funding for current rehabilitation, this study was done to provide an objective answer to the question of whether it is worth it to the state and the region to fund SEPTA's program of rehabilitation at the level recommended by SEPTA and local officials for years 1992-2001.

2.5.2.2 The evaluating scenarios. In order to evaluate the impacts of the transit system, the benefits and costs were compared in four different scenarios:

- Rehabilitation Scenario - (Rehabilitation of SEPTA, and the continuation of SEPTA services): under this scenario the proposed rehabilitation projects and minor expansions would be adequately funded for the ten years (1992-2001) to improve transportation and service quality for all modes of transportation.
- Immediate Shutdown Scenario - (An immediate permanent shutdown of all SEPTA services): this scenario assumes that SEPTA services would immediately close down and that no public policy efforts would be made to start up services.
- Gradual Phaseout Scenario - (A gradual shutdown of all SEPTA services within ten years): under this scenario a public policy decision would be made that only the operating costs of SEPTA would be funded, and that the system would be allowed to go out of service as the number of riders diminished and as services were eliminated.

- Partial Reduction Scenario (A 50 percent reduction of services within 5 years, and rehabilitation of the remainder of the system) : the partial reduction scenario is similar to gradual shutdown. However, it is assumed that one-half the services would be maintained, and that the deterioration of services and ridership ends when SEPTA reaches about half its current size.

2.5.2.3 The analysis. The analysis process contained six steps. They are listed below.

1. Define Transportation System Changes - The SEPTA Scenarios were defined in terms of transportation supply (capacity) and level-of-service (travel time) for public transit, car and truck travel, for each year over the period 1992 to 2020.
2. Transportation Model - a computer model of regional transportation impacts is applied to estimate the impacts of transportation system changes on travelers, in terms of changes in operating costs, travel time costs, safety costs, and out-of-pocket costs and travel times incurred. These are estimated separately by mode of travel (public transit, car and truck), for each year over the period 1992 to 2020.
3. Economic Model- Economic simulation models for the Philadelphia metropolitan region and State of Pennsylvania are applied to estimate the impacts of travel cost and time changes on the economy, in terms of business sales, employment, income and population. These impacts are estimated for each type of business and occupation group, for each year over the period 1992 to 2020
4. Fiscal Model - fiscal models for the Pennsylvania state government and for the Philadelphia region's local governments are applied to estimate the impacts of business sales, employment, income and population changes on government revenues and expenditures. These impacts are estimated in terms of net revenue changes for each year over the period 1992-2020.
5. Energy and Air Pollution Estimation - Energy and emissions models are applied to estimate the impacts of changes in vehicle-miles of travel by public transit, car and truck on

consumption of gasoline and emissions of air pollutants. These impacts are estimated for each year over the period 1992 to 2020.

6. Interviews - findings from interviews with businesses, economic development professionals and representatives of elderly, handicapped, low income and minority groups are used to supplement the economic model analysis (Step 3, above), and to better distinguish the differential impacts on particular groups in the population.

2.5.2.4 Data Collection. The data used for this study involved the information shown in Figure 2-2.

Figure 2-2: Sources and Types of Data

Obtained from	Data Collected
SEPTA	transportation budgets, ridership and revenue patterns
Delaware Valley Regional Planning Commission	population, employment, highway volumes, levels of service
Greater Philadelphia Economic Development Coalition	regional economic competitiveness
U.S. Dept. of Commerce (Bureau of Economic Analysis)	local, state and national economic growth/ decline trends and national industry forecasts
Pennsylvania Dept. of Revenue & Pennsylvania Economy League	local and state government revenues and expenditures
Interviews (businesses, social agencies individuals, etc.)	their dependence on, or sensitivity to, public transportation

2.5.2.5 Impacts. This economic study analyzes the impacts of potential lack of rehabilitation of SEPTA's services relative to the necessary funding needed to keep the system in operation. The impacts were addressed in several categories:

- Transportation Impacts: the additional travel cost and travel time incurred by the former riders of SEPTA who have to travel by car or other modes of transportation. This also includes costs experienced by present automobile and truck users who have to contend with increased traffic congestion.

- Regional and State Economic Impacts: the changes resulting from the increase in local cost and expenditures for businesses and residents; such as, changes in business sales, population, employment and personal income.
- Fiscal Impacts: changes in local and state government costs and revenues that would occur resulting from population and employment losses.
- Social Impacts: specific segments of society that are affected by changes in mobility.
- Environmental Impacts: the changes in energy consumption and air quality resulting from increased car ownership and reliance.

Each category of impacts can be compared to the costs incurred by maintaining SEPTA services, or by the costs saved by reducing expenditures of SEPTA.

2.5.2.6 Transportation impact model. For this model, there are two main user impacts of eliminating SEPTA services. First, the increase of automobile transportation which can create a greater personal cost for former SEPTA users. The other impact is the increase in traffic congestion, causing longer travel times and greater out-of-pocket operating costs for existing car and truck users. These impacts will vary depending on the nature of the users travel.

Some of the SEPTA users have access to cars or some other mode of transportation but the other portion, who can not afford other alternatives, suffer greatly. If trips to work can not be made a loss of income is experienced. If social trips are restricted, there will be a loss of public welfare and independence.

2.5.2.7 The computer model. To estimate the changes, a computerized transportation impact model was developed for this study. The model includes estimated cost of SEPTA users and highway users. In the scenarios which involve the shutdown of SEPTA services, the former users are removed from the SEPTA system and their transit user cost are subtracted, and added to the highway system, with the highway user costs recalculated based upon the higher traffic volumes.

Since each scenario removes a portion of transit users and causes an increase in highway users, most of the impacts modeled are highway user impacts. The increase highway cost are not only experienced by SEPTA users but by the present auto and truck users.

The SEPTA user costs for this model were: in-vehicle travel times for SEPTA riders (SEPTA passenger miles at an average speed of 13.6 mph); highway costs (estimated from data of current traffic, forecaster population and employment); motor vehicle cost and travel times; accident costs; parking costs; and automobile ownership costs.

2.5.2.8 The economic model: overall regional impacts. The impacts for eliminating or reducing SEPTA services are:

- Increased cost of doing business in the region (increased delivery cost due to traffic congestion).
- Decrease in the access to labor markets
- Greater cost of living in the region due to the increase in out of pocket personal costs such as congested road travel cost and car ownership cost.
- Loss of SEPTA employee jobs
- Decrease in quality of life
- Shift in personal spending (the increase in the purchase of cars causes increased spending on petroleum products, insurance, parking and repairs versus the amount that would have been spent on transit fares and other expenditures).
- Reduced attraction of visitors.

2.5.2.9 The computerized economic model. The magnitude of the economic impacts described above were estimated using a regional economic simulation model. The REMI forecasting and simulation model, developed by Regional Economic Models, Inc., was specifically calibrated for two regions; 1) the 8-county Philadelphia metro area, and 2) the State of Pennsylvania excluding the Philadelphia area.

The REMI Forecasting and Simulation Model includes all of the inter industry interaction among 49 private sectors in the economy. It includes the trading flows by industry between the Philadelphia metro area and the rest of the state of Pennsylvania. In addition to containing a complete inter-industry and trade flow structure, the model also includes key aspects of the economy that are regarded as important for policy evaluation. Key aspects such as the effect of industry location on the relative cost of doing business. This relative cost of doing business is built up for each industry based on tax costs, fuel costs, wage costs, and the costs of all the intermediate inputs in the area. The model includes a migration response to employment conditions in the area.

The calibration starts with the detailed analysis of the economy at the level of 500 separate industries. The model makes a forecast for over 2000 variables (including the Gross Regional Product by final demand sectors and by industries and employment and cost of doing business of 53 industries) with a complete history of forecast for all of these variables from 1969 through 2035. Using any of over 700 policy variables it is possible to introduce changes that the region may experience due to policy initiatives.

The report describes the modeling and analysis process as being dynamic, due to the fact that transportation impact costs and overall economic impacts are modeled year-to-year for each scenario. The two basic steps of the analysis are: 1) the transportation related cost are estimated for a particular year; then 2) these costs are used in the economic model to estimate the economic activity for the next year. As a result, the changes in business sales, employment, personal income and population at the metropolitan and statewide levels are predicted.

2.5.2.10 Fiscal model. The predictions derived from the economic model will affect the revenues and expenditures for local and state governments. Specifically, the decreases experienced in business sales, employment, and income will bring proportional reductions in some sources of government revenue.

To estimate the impacts of economic changes on local and state levels of government, the Pennsylvania Economy League (PEL) applied its Fiscal Impact Models. These models were developed and maintained by PEL. The models for the local and state governments are briefly discussed in the sections that follow.

2.5.2.11 Local government impact. The economic impacts represent the overall impact on all municipal governments within the metropolitan area. It was constructed based on detailed analysis of revenues and expenditures of the city of Philadelphia and the communities in each county in the area.

The analysis of local government revenues takes into account the fact that there are great variations in taxes. For the area outside of Philadelphia, the principle tax levied is the real estate tax for residents and companies. However, principle taxes of the area within Philadelphia are non-property taxes which include wage/occupation taxes, per capita taxes, mercantile or business privilege taxes and real estate transfer taxes.

2.5.2.12 State government impacts. The model of state impacts indicates how state government revenues and expenditures would be affected by the reduction or elimination of SEPTA services. The sources for state government revenues include: personal income taxes, corporate profit taxes, sales tax, motor fuel tax, the lottery, and various fees. These revenues would change proportionally to changes in employment, personal income, and population. (The four main changes of state government expenditures are: SEPTA, unemployment compensation, income maintenance programs, health and human service programs).

The government cost increases as greater numbers of jobs are lost, but decrease as some people eventually move out of the state. "These changes in government expenditures are predicted by the fiscal impact model, based on regression studies of relationships of expenditures to changes in population, employment and income changes over time"[18].

2.5.2.13 Benefit/ cost analysis. The report states that a benefit/cost analysis provides a means of assessing the net public benefits of SEPTA reduction alternatives, with respect to the

rehabilitation and continuing of SEPTA services. Each comparison is made in terms of the "net benefit" (benefits minus costs) and the benefit/cost ratio (benefits divided by costs).

The costs and benefits associated with SEPTA alternatives are defined by the fact that all of the alternatives are negative changes in transit services. Thus, the economic cost of reducing or eliminating SEPTA is "a loss of personal income due to contraction of the state economy as a result of the degraded transportation system"[18]. Therefore, the economic benefit of reducing or eliminating SEPTA is a savings in public spending that will subsidize the price of providing public transportation services.

The benefit/cost comparison effectively compares the benefit of money entering the pockets of residents versus the costs of money leaving their pockets. The reports suggest that this is a clear and straightforward way of assessing economic impacts on the state economy [18].

In order to evaluate each of the three SEPTA alternatives (relative to the rehabilitation case alternative), it is necessary to compare annual streams of cost and benefits estimated for the 30-year study period from 1991 - 2020. Each future annual cost and benefit is estimated in terms of constant 1990 dollars and it is then discounted to its equivalent present value. Since a dollar available in the future has less present value than a dollar available right now, discounting helps to reflect the value of money over time. The further into the future a cost or benefit occurs, the more heavily it is discounted and thus, the lower its equivalent present value. Discounting is important because the attractiveness of one transit service alternative over another is determined by both the size and timing of its costs and benefits.

2.5.2 14 Results of economic impact study. All three alternatives for the reduction or elimination of SEPTA services produced a negative net benefit regardless of the discount rates. The partial scenario is the smaller of the three, due to the fact that it has both a much smaller cost and a much smaller benefit.

In terms of benefit/cost ratios, all three alternatives should be rejected. In each case, the benefit/cost ratio is 0.35 or lower. The ratio only considers the transportation cost, which means

that the "benefits (in terms of public expenditures saved) are no more than one-third of the cost in terms of traveler impacts. Considering all impacts on the economy of the state of Pennsylvania, the benefit/cost ratio of elimination or reduction of SEPTA resulted in values below 0.2. This means that the public expenditure benefits of not rehabilitating and continuing SEPTA services are less than 20% of the income losses incurred to the state economy. The benefit/cost analysis clearly demonstrates that none of the reduction and elimination alternatives of SEPTA are cost-effective from the public point of view.

The report states that the cost/ benefit findings can also be viewed another way. They indicate that public expenditures to continue SEPTA operations return $3 of transportation benefit to the region and the state for every dollar spent on SEPTA. In terms of the economic impact, the return to the region and the state represents at least $5 of income for every dollar spent on SEPTA [18].

2.5.3 Summary Report: Economic Benefits of Transit in Indiana

This study, conducted by the Indiana Transportation Association, evaluates the economic benefits of public transportation systems in Indiana. There are 38 transit systems throughout the state which collectively serve an average of 27 million people per year. The service area consists of thirty nine counties which represent 60% of Indiana's population [31].

The impacts presented in this study were: economic, environmental, and social. These impacts were analyzed by using data from annual reports written by the Indiana Transportation Association, and by using a computerized model called the IMPLAN Input/Output Model.

2.5.3.1 Economic impact. The economic impact category included employment impacts, sales impacts, and property value impacts due to the supply of public transportation. The employment impact was divided into two categories: changes in the number of employees hired or fired, and changes in unemployment compensations due to changes in employment. The employment change category outlined three areas of employment scenarios. They are:

- Direct employment - the actual employment change in the transit industry due to any changes in transit serves.
- Indirect employment - employment changes in other industries (industries such as transit vendors) which result from the purchases made by transit for expansion or reduction of the transit system.
- Induced employment - employment increases due to the increase in household expenditures. ("This expenditure change follows the change in incomes that result from the direct and indirect effects of the change in transit output").

The direct, indirect, and induced employment changes were summed together to obtain the total change in employment.

By using the IMPLAN input/output model, Indiana was able to estimate the changes in employment due to $1,000,000 change in transit expenditures. The IMPLAN model determined that for every million dollar increase in transit output, there would be an employment impact of 40.6601 for direct employment, 4.0240 for indirect employment, and 21.9101 for induced employment. This means that 41 new workers would be hired by the transit system, 4 workers hired by the transit supporting industries (indirect employment), and 22 new jobs created because of increases in household expenditures. Thus, " the total employment effect of the initial $1 million change, then, is an increase of approximately 67 workers" [31].

The IMPLAN model also generated two multipliers (Type I and Type III) that were used to estimate the changes in employment as a result of the change in transit expenditure. The Type I multiplier was determined to be 1.0990, which represents the direct and indirect employment changes. Type III multiplier was determined to be 1.6378 and it represents direct, indirect, and induced employment. Therefore the Type III multiplier could be multiplied by the impact value and by the estimated change in transit expenditure to obtain the total employment change to the economy. To demonstrate this application, an example is shown in Figure 2-3.

Figure 2-3: Multiplier Demonstration

Given: - a decrease of $87.7 million in transit expenditures,
- a direct impact value is 40.6601 (derived from the IMPLAN model), and a
- Type III multiplier of 1.6378 (derived from the IMPLAN model)

The reduction in direct employment would be :

(87.7 * 40.6601)= 3566 reduction of employees for the transit system.

The reduction in direct, indirect, and induced employment would be:

(87.7*40.6601*1.6378) = 5,840 reduction of employees for entire state.

The change in unemployment compensation expenditures was estimated by multiplying the number of hired or fired employees by the average weekly unemployment compensation cost per person ($141.69 per week). This calculation produces a dollar amount that would be saved or the amount of money that would be spent on unemployment because of a change in employment due to the change in transit expenditures.

The retail impacts determined by multiplying an average purchase amount (per transit rider) by one-half of the total number of round trips. The average purchase amount was estimated to be $7.62 per round trip and was obtained from surveys given in Mobile, AL, Fr. Worth, TX, and Nashville, TN. This amount represents the total impact of retail sales due to consumers traveling to buy goods and services [31].

At the State and local levels, the economic impacts were described as tax revenues brought about by public transit due to the increase in property values and increase in personal spending. The multipliers for both personal income (employee compensation for direct and indirect employment) and total income (personal income plus incomes associated with proprietary income and other property income) were determined from the IMPLAN model. The multiplier for property value was then obtained by taking the difference between the personal multiplier and the total multiplier. This property value multiplier was then multiplied by the change in transit expenditures to get the property value impact [31].

The Indiana transit system was estimated to have an employment impact of 4,300. This means that over four thousand people were employed due to the transit system. If the transit system did not exist, the State would experience a $10.4 million increase in unemployment expenditures. It was also discovered that the total annual retail sales associated with a person riding transit amounted to $104 million and that the tax revenues to the State and Local governments were estimated as $16.5 million, due to public transit.

Therefore the total economic impact of public transportation on Indiana was estimated to be $121.5 million per year based on the economic IMPLAN input-output model. Thus for every $1.00 invested in public transportation, there would be a return of $1.38 or 38%.

2.5.3.2 Environmental impacts. The environmental impacts category evaluated the effects of public transit on air pollution, parking space construction (in central business locations), and vehicle accidents. The impact of transit on air pollution was estimated by multiplying the total pollution emission rate per vehicle mile for a transit vehicle by the total number of transit vehicle miles. The total emission rate was the sum of the three pollutant rates, shown below:

POLLUTANTS	RATE (grams per vehicle mile)
non-methane hydrocarbons (NMHC)	3.25
carbon monoxide (CO)	18.86
nitrous oxides (NOx)	15.91

The impact of transit on parking cost incurred by private automobile drivers was determined by first estimating the number of auto trips by dividing the total transit trips by the average auto occupancy. Then the number of auto trips was divided by two to estimate the number of auto trip destinations for which new spaces would be needed if transit were eliminated. To obtain the dollar value, specifically for Central Business Districts, the number of spaces needed was multiplied by the cost of one parking space (The parking space cost was estimated to be $5,000 per space).

The accident impacts for transit were estimated using the national statistics rates of accidents per rider. The rates were:

TYPE	RATE (per rider)
property damage	.0000105
Personal injury	.0000072
fatalities	.000000019

It was estimated that if public transit did not exist "harmful air pollutants non-methane hydrocarbons (NMHC), carbon monoxide (CO), and nitrous oxides (NOx) would increase by four-hundred and sixty (460); three thousand three-hundred and eighty (3,880); and forty (40) tons, respectively. The Indiana Transportation Association estimated that 6,900 parking spaces would have to be constructed if the transit system did not exist. At a cost of $5,000 per single parking space, parking accommodations would cost almost $35,000,000 without public transportation. An increase of $4.5 million was estimated for vehicle accident costs, if the transit system did not exist [31].

2.5.3.3 Social Impacts. Social impacts were viewed as the "opportunity for people to travel economically" and as an increase in "mobility for those who are too young, too old or too disadvantaged to own or operate a private vehicle" [31]. The economic effect of using transit was determined by comparing the fare cost of transit to the cost of using other modes of transportation [31].

If transit did not exist, it was estimated that travel expenditures would increase by $18.2 million each year because transit riders would have to find alternative means of travel. In reference to the disadvantaged, the following was estimated:

- 8% of Indiana households did not own an automobile
- 10% of the population was below the poverty level
- 4% of the population could not travel without mobility assistance.
- 23% of the population was too young to drive
- 13% of the population was 65 and older [31].

2.5.4 Transportation Cost Analysis: Techniques, Estimates and Implications

This cost analysis was conducted by Todd Litman of the Victoria Transport Policy Institute. The report presents a "framework estimating and comparing total roadway transportation costs, including internal and external, market and non-market costs" [42]. Litman reviewed previous cost studies and outlined twenty cost estimates, which will be discussed in the following paragraphs. These estimates were calculated for 11 modes of travel under various conditions (urban peak, urban off-peak, and rural travel). The modes are as follows:

- Average automobile
- Compact (fuel efficient) car
- Electric car
- Van or light truck
- Diesel bus
- Electric bus/ Trolley
- Motorcycle
- Bicycle
- Walk
-Telecommute

2.5.4.1 Vehicle cost. Vehicle cost were costs associated with owning and operating a vehicle. These costs were separated into two categories: Fixed vehicle ownership cost and variable vehicle operating costs. Fixed costs included vehicle purchase or lease costs, insurance costs, and registration and vehicle tax costs. The variable costs included maintenance and repair costs, fuel, fuel taxes, oil, paid parking, and toll costs. Figure 2-4 and 2-5 show the estimated cost for fixed vehicle ownership costs and variable vehicle operating cost.

Figure 2-4: Fixed Vehicle Ownership Costs (1996 U.S. dollars/vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.206	0.206	0.206	0.206
Compact Car	0.181	0.181	0.181	0.181
Electric Car	0.258	0.258	0.258	0.258
Van/Light Truck	0.268	0.268	0.268	0.268
Rideshare Passenger	0	0	0	0
Diesel Bus	0	0	0	0
Electric Bus/ Trolley	0	0	0	0
Motorcycle	0.252	.252	0.252	0.252
Bicycle	0.05	0.05	0.05	0.05
Walk	0	0	0	0
Telecommute	0.2	0.2	0.2	0.2

Figure 2-5: Variable Vehicle Operating Cost 1996 U.S. dollars/vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.147	0.128	0.109	0.124
Compact Car	0.107	0.093	0.079	0.090
Electric Car	0.207	0.180	0.153	0.175
Van/Light Truck	0.207	0.180	0.153	0.175
Rideshare Passenger	0.003	0.003	0.002	0.002
Diesel Bus	3.75	0.750	0.75	1.35
Electric Bus/ Trolley	4.50	1.05	1.05	1.74
Motorcycle	0.062	0.054	0.05	0.054
Bicycle	0.020	0.020	0.020	0.020
Walk	0.040	0.040	0.040	0.04
Telecommute	0	0	0	0

2.5.4.2 Travel time costs. Travel time cost is the value of travel time to the user. Litman uses a value of $6.00 (50% of the national average wages of $12/hour) per hour to represent the value of time for automobile drivers and $4.20 per hour (35% of the national average wages of $12/hour) for the value of time for passengers. In order to obtain the cost of time per vehicle mile, the time value per hour was multiplied by the average speed. The urban peak speed was 30 mph plus a 16.5% congestion premium, urban off-peak and rural speeds were averaged to be 35 mph and 40 mph respectively with no congestion premium. Litman's estimates for user travel time costs are presented in Figure 2-6.

Figure 2-6: User Travel Time Costs (1996 U.S. dollars per Passenger Mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.23	0.17	0.15	0.174
Compact Car	0.23	0.17	0.15	0.174
Electric Car	0.23	0.17	0.15	0.174
Van/Light Truck	0.23	0.17	0.15	0.174
Rideshare Passenger	0.18	0.154	0.135	0.152
Diesel Bus	0.281	0.208	0.184	0.213
Electric Bus/ Trolley	0.281	0.208	0.184	0.213
Motorcycle	0.23	0.17	0.15	0.174
Bicycle	0.35	0.30	0.30	0.31
Walk	1.00	1.00	1.00	1.00
Telecommute	0	0	0	.0

2.5.4.3 Accident costs. The automobile accident costs were defined as net insurance disbursement estimates. These costs were divided into two categories: internal and external costs. Internal costs were vehicle damage deductibles and uncompensated injuries. External costs were uncompensated damages, lost income, pain and grief. The cost estimates for accident cost are displayed in Figure 2-7 and 2-8.

Figure 2-7: Internal Accident Costs (1996 U.S. dollars per passenger mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	.05	.05	.05	.05
Compact Car	.055	.055	.055	.055
Electric Car	0.05	0.05	0.05	0.05
Van/Light Truck	0.05	0.05	0.05	0.05
Rideshare Passenger	0.05	0.05	0.05	0.05
Diesel Bus	0.003	0.003	0.003	0.003
Electric Bus/ Trolley	0.003	0.003	0.003	0.003
Motorcycle	0.437	0.437	0.437	0.437
Bicycle	0.05	0.05	0.05	0.05
Walk	0.05	0.05	0.05	0.05
Telecommute	0	0	0	0

Figure 2-8: External Accident Costs (1996 U.S. dollars per passenger mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	.035	.035	.035	.035
Compact Car	.033	.033	.033	.033
Electric Car	0.035	0.035	0.035	0.035
Van/Light Truck	0.035	0.035	0.035	0.035
Rideshare Passenger	0	0	0	0
Diesel Bus	0.02	0.02	0.02	0.02
Electric Bus/ Trolley	0.02	0.02	0.02	0.02
Motorcycle	0.077	0.077	0.077	0.077
Bicycle	0.002	0.002	0.002	0.002
Walk	0.002	0.002	0.002	0.002
Telecommute	0	0	0	0

2.5.4.4 Parking. Parking cost consist of off-street parking costs. Parking costs were separated into two categories: internal and external. Internal costs were estimated by dividing the non residential parking space costs ($600 per parking space) by the average number of miles

driven per year (12,000 miles per year). To make the adjustment for each vehicle class, various percentage savings of one mode over another mode were applied. The external costs were estimated by converting the average cost of parking per day to an average cost of parking per vehicle mile. The internal and external parking cost are shown in Figures 2-9 and 2-10.

Figure 2-9: Internal Parking costs (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.05	0.05	0.025	0.042
Compact Car	0.045	0.045	0.023	0.038
Electric Car	0.05	0.05	0.025	0.042
Van/Light Truck	0.05	0.05	0.025	0.042
Rideshare Passenger	0	0	0	0
Diesel Bus	0	0	0	0
Electric Bus/ Trolley	0	0	0	0
Motorcycle	0.04	0.04	0.020	0.033
Bicycle	0.003	0.003	0.001	0.002
Walk	0	0	0	0
Telecommute	0	0	0	0

Figure 2-10: External Parking Costs (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.12	0.040	0.020	0.048
Compact Car	0.114	0.038	0.019	0.046
Electric Car	0.120	0.040	0.020	0.048
Van/Light Truck	0.120	0.040	0.020	0.048
Rideshare Passenger	0	0	0	0
Diesel Bus	0	0	0	0
Electric Bus/ Trolley	0	0	0	0
Motorcycle	0.090	0.030	0.015	0.036
Bicycle	0.006	0.002	0.001	0.002
Walk	0	0	0	0
Telecommute	0	0	0	0

2.5.4.5 Congestion. Litman defined congestion as "incremental costs resulting from interference among road users". Congestion costs for urban peak time were estimated by:

$$\frac{(\$100 \text{ billion in nation congestion cost})^* (80\%)}{(2{,}300 \text{ billion U.S. miles driven annually})^*(20\%)} = \$0.17 \text{ per mile}$$

The 80% represents the percentage of congestion costs and 20% represents the percentage of driving which occurs under urban peak conditions.

The congestion cost for urban off-peak periods were calculated by:

$$\frac{(\$100 \text{ billion in nation congestion cost})^* (20\%)}{(2{,}300 \text{ billion U.S. miles driven annually})^*(40\%)} = .02 \text{ per mile}$$

The 20% represents the percentage of congestion costs and 40% represents the percentage of driving which occurs under urban peak conditions. There is a zero congestion cost rate for rural areas because rural areas usually do not experience congestion. Figure 2-11 displays the cost for congestion .

Figure 2-11: Congestion Costs (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.17	0.02	0	0.042
Compact Car	0.17	0.02	0	0.042
Electric Car	0.17	0.02	0	0.042
Van/Light Truck	0.17	0.02	0	0.042
Rideshare Passenger	0	0	0	0
Diesel Bus	0.34	0.04	0	0.084
Electric Bus/ Trolley	0.34	0.04	0	0.084
Motorcycle	0.17	0.02	0	0.042
Bicycle	0.009	0.001	0	0.002
Walk	0	0	0	0
Telecommute	0	0	0	0

2.5.4.6 Road facility external costs. Roadway facility costs were defined as costs required for automobile use not borne by user fees. This cost includes "road construction and maintenance, land acquisition, financing expenses, and the portion of roadway support facilities and programs required for automobile traffic" [42]. The costs were allocated between different vehicle classes based on their use of road space and road damages. The road facility costs are shown in Figure 2-12 [42].

Figure 2-12: The Road Facility External Costs

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	.016	.016	.010	.014
Compact Car	.016	.016	.010	.014
Electric Car	0.038	0.038	0.023	0.032
Van/Light Truck	0.021	0.021	0.013	0.018
Rideshare Passenger	0	0	0	0
Diesel Bus	0.07	0.07	0.042	0.059
Electric Bus/ Trolley	0.07	0.07	0.042	0.059
Motorcycle	0.009	0.009	0.005	0.007
Bicycle	0.001	0.001	0	0.001
Walk	0	0	0	0
Telecommute	0	0	0	0

2.5.4.7 Roadway land value. The roadway land value was defined as the opportunity costs of land used for roadways. This cost includes the "value of land used for road rights-of-way and other public facilities dedicated for automobile use" [42]. First to obtain the annual roadway cost, the roadway land worth of $75 billion is multiplied by 75%, which is the percentage of road way which represents right-of-ways. This amount is then divided by the national average of vehicle miles (2,300 billion) to obtain the roadway land value per vehicle mile. The roadway land value costs are presented in Figure 2-13.

Figure 2-13: Roadway Land Value Costs (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.024	0.024	0.024	0.024
Compact Car	0.024	0.024	0.024	0.024
Electric Car	0.024	0.024	0.024	0.024
Van/Light Truck	0.024	0.024	0.024	0.024
Rideshare Passenger	0	0	0	0
Diesel Bus	0.024	0.024	0.024	0.024
Electric Bus/ Trolley	0.024	0.024	0.024	0.024
Motorcycle	0.024	0.024	0.024	0.024
Bicycle	0.001	0.001	0.001	0.001
Walk	0	0	0	0
Telecommute	0	0	0	0

2.5.4.8 Municipal services. Municipal service costs are costs of public services for motor vehicles not funded by user fees. This cost includes policing, emergency response, planning, courts, street lighting, parking enforcement, and driver training provided for motor vehicle use. The cost of municipal services estimated by Litman are shown in Figure 2-14.

Figure 2-14: Municipal Service costs (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.015	0.010	0.005	0.009
Compact Car	0.015	0.010	0.005	0.009
Electric Car	0.015	0.010	0.005	0.009
Van/Light Truck	0.015	0.010	0.005	0.009
Rideshare Passenger	0	0	0	0
Diesel Bus	0.015	0.010	0.005	0.009
Electric Bus/ Trolley	0.015	0.010	0.005	0.009
Motorcycle	0.015	0.010	0.005	0.009
Bicycle	0.002	0.001	0.	0.001
Walk	0.002	0.001	0	0.001
Telecommute	0.002	0.001	0	0.001

Figure 2-15: Equity and option value costs (1996 U.S. Dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.005	0.005	0.005	0.005
Compact Car	0.005	0.005	0.005	0.005
Electric Car	0.005	0.005	0.005	0.005
Van/Light Truck	0.005	0.005	0.005	0.005
Rideshare Passenger	0	0	0	0
Diesel Bus	0	0	0	0
Electric Bus/ Trolley	0	0	0	0
Motorcycle	0.005	0.005	0.005	0.005
Bicycle	0	0	0	0
Walk	0	0	0	0
Telecommute	0	0	0	0

2.5.4.9 Transportation equity & option value. Transportation equity is defined as the adequate transportation for people who are economically, socially, or physically disadvantaged. Transportation option value was defined as the value of having a variety of transport choices. The

equity and option values are affected by the transportation system, land use patterns, facility design, and social habits that affect travel requirements. Litman notes that there is little research available for this cost and that its estimate is extremely uncertain. The transportation equity and option values are displayed in Figure 2-15, above.

2.5.4.10 Air pollution costs. Air pollution costs are defined as air pollution caused by motor vehicle use. The pollutants used for this study include: carbon monoxide (CO), particulate (PM), nitrogen oxides (NOx), volatile organic compound (VOC), sulfur oxides (SOx), carbon dioxide (CO2), methane (CH4), road dust, and toxic gases such as benzene. Using previous studies and estimations of air pollution, Litman estimated the cost per vehicle mile for air pollution. The air pollution costs are presented in Figure 2-16.

Figure 2-16: Air Pollution Costs (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.062	0.052	0.016	0.040
Compact Car	0.051	0.042	0.010	0.031
Electric Car	0.016	0.013	0.004	0.010
Van/Light Truck	0.112	0.094	0.029	0.071
Rideshare Passenger	0.002	0.002	0.001	0.001
Diesel Bus	0.185	0.16	0.070	0.129
Electric Bus/ Trolley	0.078	0.065	0.020	0.050
Motorcycle	0.106	0.086	0.014	0.061
Bicycle	0	0	0	0
Walk	0	0	0	0
Telecommute	0	0	0	0

2.5.4.11 Noise. Noise was defined as unwanted sounds and vibrations produced by motor vehicle use. Noise included traffic noise (engine acceleration, tire/road contact, braking, and horns) and vibrations included low frequency noise, which is produced by heavy vehicles. Using previous studies and estimations of noise pollution, Litman estimated the cost per vehicle mile for noise pollution. Figure 2-17 displays cost for noise.

Figure 2-17: Noise costs (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.010	0.010	0.005	0.005
Compact Car	0.010	0.010	0.005	0.005
Electric Car	0.003	0.003	0.003	0.003
Van/Light Truck	0.010	0.010	0.005	0.008
Rideshare Passenger	0	0	0	0
Diesel Bus	0.050	0.050	0.025	0.04
Electric Bus/ Trolley	0.030	0.030	0.015	0.024
Motorcycle	0.100	0.1	0.050	0.08
Bicycle	0	0	0	0
Walk	0	0	0	0
Telecommute	0	0	0	0

2.5.4.12 External resource consumption costs. External costs are costs of resources consumed by vehicle production and use. It was estimated that the United States consumes 24% of aluminum, 30% of iron, 15% of steel, 76% of lead, 67% of rubber production, and over 50% of petroleum for automobile construction and usage. Using these percentages and previous consumption studies, Litman estimated a cost of external resources per vehicle mile. These costs are presented in Figure 2-18.

Figure 2-18: External Resource Costs (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.029	0.025	0.021	0.024
Compact Car	0.014	0.013	0.011	0.012
Electric Car	0.007	0.006	0.006	0.006
Van/Light Truck	0.039	0.033	0.028	0.032
Rideshare Passenger	0.001	0.001	0	0.001
Diesel Bus	0.152	0.131	0.110	0.127
Electric Bus/ Trolley	0.045	0.038	0.032	0.037
Motorcycle	0.012	0.010	0.009	0.010
Bicycle	0	0	0	0
Walk	0	0	0	0
Telecommute	0.003	0.003	0.002	0.003

2.5.4.13 Barrier effects. Barrier effects is defined as the "motor traffic impacts on the mobility, security and comfort of pedestrians and cyclists, and its effect on their movement and

activities". This cost is obtained from previous literature and imposes costs in terms of increased automobile dependency and use, and increased chauffeuring. Figure 2-19 displays the barrier effect costs.

Figure 2-19: Barrier Effect cost (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.015	0.010	0.005	0.009
Compact Car	0.015	0.010	0.005	0.009
Electric Car	0.015	0.010	0.005	0.009
Van/Light Truck	0.015	0.010	0.005	0.009
Rideshare Passenger	0	0	0	0
Diesel Bus	0.038	0.025	0.013	0.023
Electric Bus/ Trolley	0.038	0.025	0.013	0.023
Motorcycle	0.015	0.010	0.005	0.009
Bicycle	0.001	0	0	0
Walk	0	0	0	0
Telecommute	0	0	0	0

2.5.4.14 Land use impacts. Land use impacts are defined as external costs of land use impacts caused by roads and automobile traffic. Based upon previous studies Litman estimates land use costs for cars, trucks, motorcycles, and telecommuting (ridesharing, public transit, bicycling, and walking impose no land use impacts because they decrease road building requirements and encourage higher densities). Figure 2-20 displays the land use impact costs.

Figure 2-20: Land Use Impacts Costs (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.070	0.070	0.035	0.056
Compact Car	0.070	0.070	0.035	0.056
Electric Car	0.070	0.070	0.035	0.056
Van/Light Truck	0.070	0.070	0.035	0.056
Rideshare Passenger	0	0	0	0
Diesel Bus	0	0	0	0
Electric Bus/ Trolley	0	0	0	0
Motorcycle	0.070	0.070	0.035	0.56
Bicycle	0	0	0	0
Walk	0	0	0	0
Telecommute	0.070	0.070	0.035	0.056

2.5.4.15 Water pollution and hydrologic impacts. Water pollution and hydrologic impacts are pollution and hydrologic effects from vehicles, roads, and parking usage. Water pollution included: crankcase oil drips and disposal, road de-icing (salt) damage, roadside herbicides, leaking underground storage tanks and air pollution settlements. Hydrologic impacts include: increased impervious surfaces, concentrated runoff and increased flooding, loss of wetlands, shoreline modifications, and construction activities along shorelines. By dividing the estimated annual cost of water pollution ($29 billion) by the estimated number of vehicle miles per year (2,300 billion), the estimated cost of pollution is $0.13 per vehicle mile. The cost of electric vehicles is estimated at half of this rate. The water pollution costs are presented in Figure 2-21.

Figure 2-21: Water Pollution Costs (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.013	0.013	0.013	0.013
Compact Car	0.013	0.013	0.013	0.013
Electric Car	0.007	0.007	0.007	0.007
Van/Light Truck	0.013	0.013	0.013	0.013
Rideshare Passenger	0	0	0	0
Diesel Bus	0.013	0.013	0.013	0.013
Electric Bus/ Trolley	0.007	0.007	0.007	0.007
Motorcycle	0.013	0.013	0.013	0.013
Bicycle	0	0	0	0
Walk	0	0	0	0
Telecommute	0	0	0	0

2.5.4.16 Waste disposal. Waste disposal is defined as the external costs of automobile waste disposal. This cost includes: disposal of used tires, batteries, junked cars, oil and other semi-hazardous materials resulting from motor vehicle production and maintenance. The waste disposal cost are estimated by dividing the annual external motor vehicle waste cost ($4.2 billion per year) by the average number of annual vehicle miles (2,300 billion miles per year). The waste disposal cost are shown in Figure 2-22.

Figure 2-22: Waste Disposal Costs (1996 U.S. dollars per vehicle mile)

Vehicle Class	Urban peak	Urban off-peak	Rural	Average
Average Car	0.002	0.002	0.002	0.002
Compact Car	0.002	0.002	0.002	0.002
Electric Car	0.002	0.002	0.002	0.002
Van/Light Truck	0.002	0.002	0.002	0.002
Rideshare Passenger	0	0	0	0
Diesel Bus	0.002	0.002	0.002	0.002
Electric Bus/ Trolley	0.002	0.002	0.002	0.002
Motorcycle	0.0002	0.002	0.002	0.002
Bicycle	0	0	0	0
Walk	0	0	0	0
Telecommute	0	0	0	0

2.6 Other Transportation Studies

Other studies were conducted that are useful in estimating the economic impacts of public transportation. They are discussed in the following sections.

2.6.1 Puget Sound: Case Study

This case study was developed by ECONorthwest for the Puget Sound Regional Council and the U.S. Department of Transportation Federal Highway Administration. The study focuses on the analytic approach to integrated transportation planing, specifically, "the evaluation of long-term, large-scale system alternatives of the type contemplated in a metropolitan transportation plan" [20]. ECONorthwest goals were to:

- demonstrate the application of integrated transportation planning analysis methods to the analysis and evaluation of several hypothetical system-level transportation plans
- identify short-term and long-term changes to current transportation data collection and modeling techniques that would support integrated transportation planning

- identify further refinements to integrated transportation planning analysis and evaluation methods.

This study tests the application of integrated transportation planning by applying it to three hypothetical transportation system plans for the central Puget Sound region. The hypothetical plans were: 1) additions to highway capacity, 2) major additions to transit capacity, and 3) economically efficient pricing of transportation facilities. The form of each alternative was selected based on its similarity to a policy for which the Regional Council had already done most of the necessary modeling. This analysis tested the "application of integrated transportation planning across substantially different alternatives in order to reveal the strengths and weaknesses of the approach and the adequacy of the available data" [20].

2.6.2 A Guidebook for Rural Public Transit Services

A study was conducted by the University of Oklahoma to estimate the ridership of Oklahoma's rural public transportation. This study will be used as a tool in developing new transit systems for Oklahoma's rural areas. The estimation of ridership on public transit is a critical and difficult step in the planning process for any system. This is due to the fact that ridership affects operational decisions such as vehicle size, type of service provided, and frequency of route provision [35].

A multivariate regression modeling approach was used because of the data available from Oklahoma rural transit systems. This approach has the advantage of allowing for the consideration of many factors affecting transit usage. The details of the model are discussed in the following sections.

2.6.2.1 Ridership model. The model developed for estimating passenger trips is based on the theory that ridership depends on demographic characteristics, characteristic of the transit service, and the availability of other transit services. It is recognized that transit systems might

need different kinds of ridership estimates. Operators who are attempting to establish a new transit system would want to look at ridership estimates for the entire system within a county. Alternatively, an existing transit system may want to alter the type or extent of services offered and would only want to analyze ridership for a particular route or routes. The following three models were developed:

- *County model* - considers ridership in a county for an entire transit system.
- *Demand response model* - examines ridership for intra-community demand-responsive services
- *Fixed route model* - looks at inter-community fixed route use.

The data for this study was collected from six, Section 18, systems serving 19 counties in Oklahoma. The transportation systems located in these areas consisted of various fixed route, demand response, and contractual services. Data was collected on a monthly basis for 19 months. The information gathered consisted of the following:

1. ridership
2. type and extent of service provision
3. fares
4. presence of other transit services in the area
5. population
6. income levels
7. vehicle registration
8. population densities

2.6.2.2 The model variables. The variables used in the model are listed and described in Figure 2-23 .

Figure 2-23: Variable Definitions

Variable Name	Description
County Model	
SERPOP	sum of populations of incorporated places where the transit system picks up riders. Population of destinations are not included. Estimated annually using preliminary Census reports and projections.
INCHH	average 1979 income per household by county
AUTO	number of auto, pick-up, and farm truck registrations per household by county.
MILES	number of vehicle miles of transit service provided per month
FREQ	Frequency of service is proxied by the sum of the number of days each route is run per month
OTHBUS	number of other public or human service agency transit vehicles operating in the service area
SUMMER	dummy variable, where 1 indicates the month of May, June, July, or August and 0 indicates any non-summer month. Used to examine summer observations versus non-summer observations
Demand Res. Model	
POPSEC	Population of the incorporated place which is served. Estimated annually using preliminary Census reports and projections.
FREQ	number of days the route is provided per month
Fixed Route Model	
POPDEST	population of city which is destination of route, estimated annually
DIST	Round trip mileage of route
PERMIL	percentage of total monthly vehicle miles provided by system which are run on the fixed route.
FREQ	number of days per month the route is run

[Elizabeth F. Knowles and Gerald A. Doeksen, *A Guidebook for Rural Public Transit Services*, University of Oklahoma, November 1987].

2.6.2.3 County model. One way passenger trips per month were calculated by the equation below:

County Model =3196.7 + .0351(SERPOP) + .1408(MILES) + 7.5935(FREQ) - .1003(INCHH) - 325.428(OTHBUS) - 190.2434(SUMMER) - 824.6981(AUTO) (2-1)

Calculation of county-wide ridership estimates were performed on a step-by-step basis. First, the value of the model variable was calculated according to its definition. Second, the product of the variable values and their respective parameter estimates were summed. This sum is the estimate of total ridership per month.

2.6.2.4 Demand response model. One way passenger trips per month was described in the study by equation (2-2) below:

Demand Response Model = -156.8 + .0711(POPSEC) + 12.8973(FREQ) (2-2)

The projection of rides per month for a demand responsive system in Community A was calculated by using the population of the sector served and the frequency of service.

2.6.2.5 Fixed route model. One way passenger trips per month was defined in the study by equation (2-3).

$$\text{Fixed Route Model} = 15.4 + .0006(\text{POPDEST}) - .2720\ (\text{DIST}) + 7.7072(\text{FREQ}) + 139.0134(\text{PERMIL}) \quad (2\text{-}3)$$

To calculate this estimate, the variable PERMIL was calculated and the variables population, distance, and frequency was provided. PERMIL is calculated by dividing the total monthly miles run per route by the total monthly miles run by the system.

The authors states that, "the success of these models may partially depend on how similar the community characteristics are to those on which the model was initially based" [35]. The examination of the ridership estimates can lead to important decisions regarding fleet capacity and route scheduling. Once a transit system has operated for several years it will have a history on which to base ridership projections. Models, such as those presented, may help transit operators to examine potential ridership in a community.

2.6.3 A Disaggregate Discrete Choice Model of Transportation Demand by Elderly and Disabled People in Rural Virginia

In the study undertaken by Steven Stern, a correlated multinomial and a Poisson regression model was used to measure the demand for public transportation (fixed-route buses and special paratransit) by the disabled and elderly people living in rural Virginia. The disabled and elderly people in this study are referred to as the transportation-handicapped (TH) [60].

Data was obtained from a transit system located in Albemarle County SMSA of Charlottesville, Virginia. This information included the characteristics of paratransit (called JAUNT) and fixed-route transit used by elderly and disabled people. The study attempts to determine how fare cost and location characteristics affect demand for paratransit and fixed-route

transit. The study also attempts to show how the existence of attractive paratransit and accessible fixed-route transit increases the TH opportunities outside of their homes.

The author reports that most previous discrete choice studies assume that an individual uses the same mode of transportation every trip. However, TH people used many modes of transportation because they could not rely upon any one mode all of the time. The study provided for each individual to use more than one mode.

2.6.3.1 Conclusions. The author concluded the following:

- That paratransit systems providing door-to-door service was highly valued by the transportation-handicapped populations.
- The taxi services was a potential mode of transportation, but was inferior due to its fare cost.
- Buses were estimated at being a poor alternative, especially in rural areas were distances between destinations is far apart.
- Buses that were handicapped accessible showed a statistical significance, but had a small effect on mode choice.
- The demand was price inelastic.
- The total number of trips taken by TH were insensitive to the availability and characteristics of the transportation mode.

Therefore, based on these conclusions the author suggests that TH limit the number of trips they take and that most of the trips the TH take are necessary (such as trips to medical facilities).

This chapter has summarized relevant literature related to the proposed research. Some aspects of the work surveyed was used in this research. The method of analysis used in this project is the subject of the chapter that follows.

3.0 METHOD OF ANALYSIS

3.1 System Selection

The first step of this study was to select and analyze the rural transportation systems. According to the United States Census, rural is defined as a place with a population of less than 2,500 [64]. Hence for this study, rural transportation is defined as public transportation which is supplied to areas with less than 2,500 people. The project requirements for transit system selection were: that the system operates non-private services, that the transit supplies services to rural areas, and that the transit system received Section 18 funding for non-urbanized areas.

Under these requirements the following fourteen Arkansas Public Transit systems were selected:

Ozark Regional	Razorback Transit
Fort Smith Public Transit	City of Siloam Springs
South Central Arkansas Transit	East Central Arkansas E.D.C.
North Arkansas Transit System	Pine Bluff City Transit
Southeastern Arkansas Transit	City of Hot Springs
Central Arkansas Transit Authority	Eureka Springs Transit
Mid-Delta Community Services	Black River Area Development

Razorback Transit, Central Arkansas Transit (CAT), and Pine Bluff City Transit receive Section 9 funding for urban and small urban areas, these three transit operators were added to this study due to their supply of services to surrounding rural areas. Each transit system is considered to be a rural public transportation system.

3.2 Data Collection

In order to determine the economic impacts of any rural transit operator, data concerning the transit system's service area and the public transportation providers was collected. This data

was instrumental in outlining the benefits of public transportation and determining the impacts of each rural public transportation system.

3.2.1 Demographic Data

Demographic data was collected on each of the public transit operator service area. This information aided in understanding the social and economical structure of the area served by the public transit systems. The analyst recognizes that many of the rural areas consist of more than one Arkansas county. Therefore for the multi-county service areas, the demographic data from all of the counties of that particular service area were combined. Demographic data included the following:

- names of the counties within each transit service area
- characteristics of the citizens living in that area (the average number of elderly, poor, disabled, and youth),
- the size and density of the population,
- the average cost of living index,
- the average amount of personal household income,
- the average number of cars per household,
- the average annual amount of consumer expenditures per county (spending on health care, personal goods, etc.),
- the number of employers per county,
- and the demographic information specifically on elderly populations (average income, percentage living in nursing homes, annual expenditures).

This data was collected from various sources such as the United States Census-Arkansas, Arkansas Statistical Abstracts, Arkansas Census of Retail Trade, Demographics USA- County Edition, and United States Statistical Abstracts [9,17,43,58,62,63,64,65,66,67].

3.2.2 Transit Operator Data & Survey

It was necessary to collect information regarding each public transit system and a survey was developed to obtain relevant transit system information. Before sending the survey to all Arkansas transit systems, a preliminary run was conducted to test the feasibility of the survey. The developed survey was delivered to a public transit operator, who confirmed that the answers to the survey questions could be gathered. After a comprehensive discussion, the final changes and adjustments were made to the document. Copies of the survey were sent with a cover letter which explained the contents and basis for the tool. The survey was composed of two sections. The first section sought information concerning the history of the transit system, types of services offered by the transit system (fixed-route, demand-responses, contractual services, etc.), the days and times transportation services are available, the transit fleet size, travel data (average number of miles per trip, average number of passengers per mile, average travel time per patron, average vehicle speed, average number of trips to medical facilities, etc.), the general characteristics of patrons using the transit services (number of elderly riders, number of disabled patrons, etc.), and other demographic data for the transit's service area (tourist attractions, educational facilities, etc.).

The second section requested information concerning the financial aspects of the public transit system, such as: the average annual expenditures (maintenance and wage costs), estimated annual revenues (rider fares and contracts), and other types of financial support received by the transit providers (formula grants and taxes). The complete survey is presented in Figure 3-1.

Figure 3-1: Survey

UNIVERSITY of ARKANSAS

4207 Bell Engineering Center • Fayetteville, Arkansas 72701 • 501-575-3156 • 501-575-8431 (FAX)

College of Engineering
Department of Industrial Engineering

March 12, 1997

Dear

We need your help in conducting an economic impact study on Rural Public Transit systems in Arkansas. It has been recognized that rural public transportation contributes to the enhancement of the quality of life for those individuals living in and around small towns. Rural transit can be credited with providing services to health care facilities, shopping centers, places of employment, and senior adult centers. The qualitative aspects of rural public transportation systems is usually emphasized. But, the quantitative data illustrating the economic impacts of rural public transportation has not been addressed with any fervor. This type of data would provide rural transit providers with an opportunity to link the economic strength of a region(s) and the rural public transportation system which serves it. This study will address the deficiencies that currently exist by estimating the economic impacts of Arkansas rural transit systems.

Your transportation system has been selected to participate in this study. We feel that information from your system will allow us to formulate an economic model that will be representative of the overall economic impacts of Arkansas' rural public transportation.

Please take the time to complete the questionnaire and return it in the enclosed self-addressed stamped envelope. It would be very helpful to have your completed questionnaire returned to us by April 1, 1997.

If you have any questions or concerns, please feel free to call me at (501) 575-7425, (fax) (501) 575-8431, or e-mail me at dpb@engr.uark.edu.

Sincerely,

Darlene Butler, Ph.D.
Assistant Professor

Arkansas Public Transit Economic Assessment Survey

Transit Director's Name _____
Name of the transit system. _____

There are two sections of questions below. Please answer as completely as possible and print your answers in the appropriate blanks for each question.

SECTION 1: This section will ask for information concerning the transportation system's characteristics, types of transit services offered, and the citizens it serves.

1) How many years has the transit service been in existence. _____

2) List counties served by transit system.

_____

_____

3) How many Fixed routes are serviced daily (if any)? _____

4) How many Demand-Response call are responded to daily? _____

5) How many vehicles are in your fleet? _____

6) What average speed is traveled by transit vehicles. _____

7) List vehicles owned by transit system and their approximate cost (list seating capacity of each vehicle if not obvious from title).

_____

_____

_____

_____

8) Days and times of services

Monday	____to____	Friday	____to____
Tuesday	____to____	Saturday	____to____
Wednesday	____to____	Sunday	____to____
Thursday	____to____		

Figure 3-1: Survey(Continued)

9) For each Fixed Route, with what frequency is the route traveled

_____ # days/week _____ # times per day

_____ # days/week _____ # times per day

_____ # days/week _____ # times per day

10) In general, does the service demand in the summer:

_____increase ____decrease ____remain constant [Place a X in the appropriate blank].

11) Over the last three years demand for services in the region has (decreased, increased) [circle your answer].

12) Estimate annual amount of vehicle miles _____

13) Estimate the number of trips per day to the following destinations. [List quantities for all that apply.]

shopping areas _____

educational institutions _____

medical facilities _____

social services _____

job sites _____

other (specify) _____

14) Average number of miles covered per trip. _____

15) Average number of passengers per mile. _____

16) What is the average travel time to destination per patron? _____

17) What is the average wait time per patron? _____

18) What is the estimated number of trips per month for:

elderly (age 65 and older)_____per month

disabled _____per month

youth (under 13)_____ per month

19) What is the total annual miles traveled? _____

20) Are there any retirement or elderly homes in the transit service areas? ___yes ____no

21) Are special services contracted by the transit system? _____yes _____no

If so, please describe the service (i.e. transportation of residents from retirement home to shopping areas).

_____

_____

_____

22) Do you have direct services with employers to provide transportation for their employees? _____yes _____no

If so, how many employees are transported per week?_____

Who pays for this transit service (the worker, employer, etc)?

_____

_____

_____

23) How many medical facilities are in your transit service area? [Write the number in the appropriate blanks.]

medical care clinics _____ medical hospital_____

mental hospital _____

Family trauma centers (example: abused children center)_____

Rehabilitation center (example: alcohol, drug) _____

Other (specify)_____

24) Excluding this transit service what other modes of public transportation exists in your areas (taxis, railways, etc.)?

_____

_____

_____

_____

Figure 3-1: Survey (Continued)

25) List the higher educational institutions in your area (such as universities, colleges, vo-tech, high technology institutes).

_____

_____

_____

_____

_____

26) Are there any type of tourist attractions in the areas served by the transit system. If so, please list their names and the months in which they are open.(Examples: Top Theme Park , May thru October; Harp Museum, July thru August, etc.)

_____

_____

_____

_____

_____

_____

Section 2: This section Request information concerning expenses, revenues, and financial support. Please make your best approximations.

1) Estimate the amounts of the following operating expenses per year:

maintenance expense
(such as fuel, lubricants, tires) _____

wage expense (including fringe benefits) _____

other expenses
(such as insurance or vehicle leases)_____

2) What is the total number of people working for the transit system. _____

3) What is the average pay (inclusive of fringe benefits) per hour (also list the number of hour worked per week)?

full-time employees _____/hr

number of work hours per week _____/wk

part-time employees _____

number of work hours per week _____/wk

4) Are rider fares collected. ____yes ____no

If so, what is the cost? $_____/person.

5) If fares are collected, do you offer special rates for certain groups. [write the amount in the blanks for all that apply]

elderly (over _____ age) $_____/ person

Estimate the number of paying patrons in this group. _____

disabled $_____/person

Estimate the number of paying patrons in this group. _____

children (under _____ age) $_____/person

Estimate the number of paying patrons in this group. _____

other (specify) _____

Estimate the number of paying patrons in this group. _____

6) Estimate the number of patrons served each day whose fares are paid by social service programs. (For example Medicaid programs.) _____

7) What percentage of your annual revenues come from tourist attractions.

_____%

8) Estimated annual revenue amount.? _____

9) List the transit systems sources of financial support. (Example: section 18 grants, fares).

_____

_____

3.2.3 Data Obtained

Summaries of the demographic data for each transit system is presented in Figures 3-2, and 3-3. The counties serviced by each transit system and demographic data such as the average household income, number of manufacturing businesses, total population, and total number of households per transit area are shown in Figure 3-2. The percentage of the population in each transit area that is transit dependent is shown in Figure 3-3. Transit dependents are defined as households that do not have personal transportation, households with low income, individuals who are sixty-five and older, and individuals with mobility limitations [21,29,53,61].

From the fourteen surveys that were sent to Arkansas transit systems there was a return rate of 92.86%. After the documents were reviewed, a data sheet for each transit system was created and is contained in Appendix B. A partial summary of each transit system is outlined in Figure 3-4.

There were three basic types of routing services among the Arkansas transit operators: fixed route, demand-response, and/or fixed routes with deviations (or scheduled routes with deviations). The fixed route systems provided pick-up and drop-off locations along a specified route. The demand-response services respond to or react upon the request of the patrons desiring transportation. In the scheduled routes with deviation service, a transit vehicle operates on a scheduled route and will deviate from its course in order to supply services to patrons who may need transportation outside of the routing area. The types of routes for each transit system are also displayed in Figure 3-4.

Figure 3-2: Counties Served and Demographics per Public Transit System

Transit System	Counties serviced	Total population	Avg. household income ($/year)	Number of business establishments	Total Number of households
Ozark Regional	Washington, Benton, Carroll, Madison	241,130	27,231	6,441	87,504
Fort Smith Public Transit	Sebastian (City of Fort Smith)	99,590	30,865	3,209	39,298
South Central Arkansas Transit	Clark, Hot Springs, Montgomery, Pike, Saline	129,662	22,998	2,406	48,007
North Arkansas Transit System (NATS)	Baxter, Boone, Carroll, Fulton, Izard, Marion, Newton, Searcy	127,046	22,469	3,077	51,766
Southeastern Arkansas Transit	Ashley, Bradley, Calhoun, Cleveland, Chicot, Dallas, Desha, Drew, Grant, Jefferson, Lincoln	222,338	27,231	4,302	78,677
Central Arkansas Transit Authority (CAT)	Pulaski	349,660	34,770	11,158	137,209
Mid-Delta Community Services	Arkansas, Monroe, Phillips	49,681	20,204	1,032	18,205
Razorback Transit	Washington	113,409	30,010	3,168	43,372
City of Siloam Springs	Benton	97,449	31,722	2,478	37,550
East Central Arkansas E.D.C	Crittenden, Lee, St. Francis	91,489	21,884	1,643	31,656
Pine Bluff City Transit	Jefferson	85,487	27,246	1,750	30,001
City of Hot Springs	Hot Springs	26,115	23,290	2,266	30,836
Eureka Springs Transit	Carroll	18,654	24,928	636	7,550
Black River Area Development (BRAD)	Clay, Lawrence, Randolph	52,122	21,125	1,007	20,806

Figure 3-3: Percentage of Transit Dependent Populations per Transit system (1990 Census).

Transit system	Low income households	Population age 60+	Households without cars	Population with mobility limitations
Ozark Regional	18.3	14.7	5.85	3.4
Fort Smith Public Transit	18.4	18.1	6.4	3.9
South Central Arkansas Transit	21.1	18.9	7.8	4.9
North Arkansas Transit System (NATS)	25.1	21.9	7.7	5.2
Southeastern Arkansas Transit	16.5	14.1	13.2	4.4
Central Arkansas Transit Authority (CAT)	16.7	15.5	10.8	3.4
Mid-Delta Community Services	22.8	20.9	6.37	5.6
Razorback Transit	19.1	14.9	5.7	3.2
City of Siloam Springs	13.4	23.1	6.4	3.5
Pine Bluff City Transit	26.9	17.7	13.2	4.0
City of Hot Springs	24.2	21.7	10.8	4.9
Eureka Springs Transit	20.9	24.7	6.1	3.9
Black River Area Development (BRAD)	11.6	24.5	6.37	6.5

Figure 3-4: Transit System Summary

Transit system	Type of routings	Fleet Size	Ann. vehicle miles	Average Annual Ridership	Fare Cost	Age of the Transit System
Eureka Springs Transit	fixed route,	13	120,000	19,200	$3.00/person	14 years
North Arkansas Transportation	demand-response, fixed routes w/ deviations	28	300,000	165,120	$14.5/person /week	16 years
Hot Springs Intra-city	fixed	18	363,700	190,400	$1.00/person	16 years
Razorback Transit	fixed route, demand-response	24	271,040		free	17 years
Ozark Regional Transit	fixed route, demand-response	38	923,792	212,509	$1.25/person	19 years
Mid-Delta Transit	fixed route, demand-response	48	963,000	19,200	$3.50/person	14 years
BRAD Public Transit	demand-response	10	171,150	63,680	$1.00/person	22 years
Pine Bluff Transit	fixed route, demand response	13	200,000	138,240	$0.80/person	23 years
Southeast Arkansas	fixed route, demand response	54	77,500	169,258	varies	3 years
Fort Smith public Transit	fixed route	10	300,000	85,232	$1.00/person	1 year
Central Arkansas Transit	fixed route, demand-response	78	2,622,583	319,984	$0.90/person	11 years
South Central Arkansas Transit	fixed route, demand-response	63	638,240	254,720	$2.00/person	over 60 years

3.3 Benefits

A list of possible benefits derived from rural public transit were established utilizing demographic and transit operator data. These benefits can be described as any economic/social advantage(s) that may be received by a state, community, or individual from the availability of public transportation. Developing the list of benefits involved reviewing the different characteristics (demographics) and writing descriptions of how the public transit system could positively support or contribute to these characteristics. For example, if an area has a large population of elderly citizens who are unable to drive, public transportation may help the elderly to maintain their independence by transporting them to shopping and medical facilities. Also, if the ratio of car ownership per household is low in an area, businesses and industries may experience large turnover rates due to employees not being able to obtain dependable transportation to work. In this case, public transportation could be contracted by employers to supply a dependable source of transportation for their employees, thus, decreasing the rate of turnovers for employers.

The list of benefits were then separated into two main categories: individual and community benefits. The benefits are shown in Figure 3-5 for each category.

Figure 3-5: Benefits for the Transit User and Community

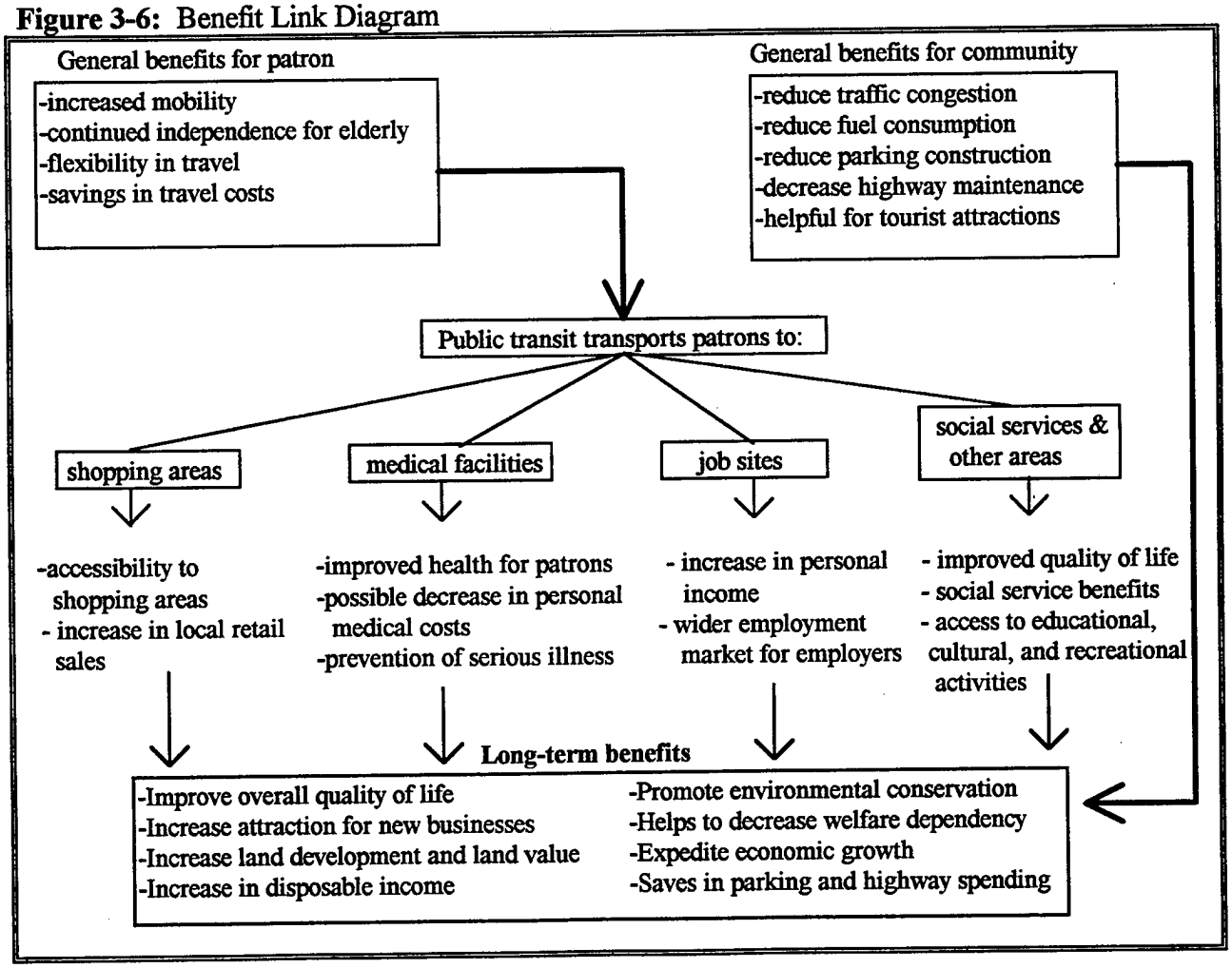
User benefits:
- increased mobility for non drivers
- increased flexibility in travel arrangements
- improved accessibility to other areas
- decreased cost in travel
- improved lifestyle

Community benefits:
- improved employment
- increased opportunities in medical services, educational advancement, and recreational activities
- increased employment market for businesses
- multiplier effect of expenditures
- improved environment
- increased land use

It was assumed that some of the benefits in the list would be of minimal importance to the rural communities evaluated and thus could be excluded from this study. For example, the benefit of public transit being used to reduce traffic congestion, was unlikely to be an important issue for the rural areas in this study. Since rural areas do not have dense populations, there are very few cases of traffic congestion problems. Therefore, traffic reduction was not considered a viable benefit for most rural areas.

The next phase of this study involved establishing links between transit benefits, patrons currently riding transit, and the services provided by the public transit system. The relationship among these three links were used to determine the impacts for this study. The links analyzed in this study are displayed in a diagram in Figure 3-6.

Figure 3-6: Benefit Link Diagram



3.4 Selecting Impacts

The objective of this study is to analyze the economic impacts of Arkansas rural public transportation. An extensive review of economic impacts was necessary in determining those applicable to the Arkansas transit systems. The impacts reviewed from the literature are listed as follows:

- Social - cost savings to the community and individual transit user
- Employment - economic effects to employees and employers
- Environmental - effects to the environmental area
- Land use - development and usage of land
- Retail sales - effects of retail sales on an area
- Accident - costs of accidents
- Elderly - effects on elderly populations
- Medical - effects on medical costs
- Delivery - effects on delivery and commercial transportation

The impacts were selected by comparing the links established in the previous section to the characteristics of the available impacts. The impacts which were similar in character to the links were selected. Impact selection was also based upon the amount of data obtained from the data collection. For example, if there was not enough data to support a quantitative estimation of an impact, it was not included.

The impacts selected were: social, elderly, medical, employment, and retail. (The environmental, land use, and accident impacts were included in the social cost estimations). Each category is defined, discussed, and quantitatively represented in the following sections.

The impacts were analyzed by one of two methods. One method compared the quantitative estimates of using the existing transit versus estimates of the area without the public transit. The other method was a cost-benefit analysis of the impact category.

3.5 Parameters

The parameter *I* (the increase in the number of automobiles) was calculated for impacts which compared the cost of using the existing transit system to the cost of increased automobile usage due to the absence of the public transit system. This parameter represents the increased number of automobiles that could be added to the transit service area if the public transportation system did not exist. To calculate the increase in the number of automobiles to the area, the following equation was used:

$$I = \frac{\Sigma PAS}{N} \qquad (3\text{-}1)$$

where:

I = estimated increase in automobile if the transit system did not exist
PAS = passenger capacity per transit vehicle.
N = average number of persons per automobile

The variable *PAS* was obtained from the survey received from each transit system. The variable *N* is equal to 1.2 persons per automobile and is the national average of persons per automobile [5]. Parameter *I* will be utilized in the following sections.

3.6 Social Impacts

The social impact is the estimated cost savings for individuals and the community serviced by a public transportation system. In this analysis it is assumed that patrons will select the mode of transportation that is most economical for them. Thus, the social impact for the individual was estimated by comparing the cost of using public transit verses the cost of using other modes of transportation. Social impacts to the community were based on the savings in cost when public transit is supplied verses the estimated cost that would occur if the transit system did not exist.

3.6.1 Individual Cost Savings

The cost savings received by a public transit user was estimated by comparing the usage or operation costs for various modes of transportation within a service area. The modes of transportation used for comparison in this study were the personal automobile, taxi, and the public transit system. Based on information received from each transit system analyzed, the aforementioned modes are the most commonly used forms of transportation.

The operating cost of each transportation mode was calculated in order to determine the savings or social impact (if any) to the individual using one mode of transportation over another. The following equation was used to calculate the estimated annual individual social cost of using the automobile or taxi.

$$U_X = [G*R_X + FEE]* D \qquad (3\text{-}2)$$

where:

U_X = estimated annual social cost per mode x (automobile or taxi) for individuals
G = average number of miles traveled per day
R_X = average operation cost per vehicle mile for transportation mode x (automobile or taxi)
FEE = additional daily fees incurred by the selected mode (parking or base fees)
D = average number of workdays per year (250 days)

The average operation cost for automobiles of $0.43 per vehicle mile was obtained from the United States Statistical Abstract [58]. The operation cost for taxi, $1.20 per vehicle mile, was averaged from taxi fare estimates received from taxi companies in Arkansas [14,56]. The parking fee for automobiles was obtained from the literature and estimated to average $3.00 per day [31,42]. The taxi base fee (taxi pick-up fee) was averaged to be $2.13 per pick up and was multiplied by two to represent the addition taxi fee cost per trip [14,56]. Therefore, the taxi fee was $4.26 per day. The estimated annual social cost of public transit for individuals was calculated using the following equation:

$$YP = K*D \quad (3\text{-}3)$$

where:

YP = estimated annual social cost of public transit for individuals
K = fare cost per unit of time ($/ day)
D = number of workdays per year (250 days)

After estimating the annual cost for the public transit system, automobile and taxi, the cost difference of the public transit system and the automobile or taxi was determined. This was done to determine the savings or increase in using one mode over another. The results for each transit system are shown in Appendix A.

3.6.2 Social Impact on the Community

The social impacts to the community were determined by comparing the community social cost with the existing transit system to the social costs to the community if the current transit system did not exist. It is assumed that if the transit system were to disappear, there would be an increase in the number of automobiles for the transit area. Thus, this increase in automobiles in the area would increase the social cost to the community.

Community social costs were calculated using cost variables from a study conducted by Todd Litman. In Litman's study, cost variables of various modes of transportation, area type (rural or urban), and time periods were presented [42]. It should be noted that the rural social cost variables were used for all transit systems, except for Central Arkansas Transit Authority and Pine Bluff City Transit. The urban social cost variables were used for these systems due to their more urbanized transit service area. The social cost variables are described as dollars per vehicle mile and are displayed in Figure 3-7.

The travel time variable was adjusted for each transit system, due to the availability of transit vehicle speeds and Arkansas's average wage rate. The adjustment for each transit system was calculated using the following equation:

$$TIM = \frac{L * WAGE}{S} \quad (3\text{-}4)$$

where:

TIM = cost of travel time per vehicle mile for transit
L = percentage of wage which represents the value of time per hour (0.35 or 0.5)
WAGE = average wage per hour ($10.41/hour)
S = average speed of the transit vehicle (miles per hour)

The variable ***L*** (0.35 for rural bus and 0.5 for urban bus) was taken from Litman's study, as the percentage of the hourly wages that is representative of the value of the transit rider's time. Litman's study uses an average wage of $12 per hour [42]. The average wage for Arkansas was estimated by the Arkansas Economic Development Commission to be $10.41 per hour and the average speeds for the transit vehicle was obtained from surveys received from the transit systems [7]. Therefore, the ***TIM*** was calculated for each transit system and summed with the other cost variables (for transit) to obtain the total social cost per vehicle mile for transit (***SCT***). The ***SCT*** variable is used later in this section to calculate the annual social cost to the community with the current transit system.

Since the actual speeds for automobiles were unknown for the transit areas, the travel time variables for the urban- peak automobile and rural automobile were adjusted by using Arkansas's average wage rate and Litman's estimate of automobile speeds [42]. The adjustments for the travel time variable of urban-peak automobile and rural automobile are shown in Figure 3- 8.

The adjusted ***TIM*** variables, calculated in Figure 3-8, were used to represent the travel time variable for all urban-peak and rural automobiles ($0.202 per vehicle mile and $0.091 per vehicle mile, respectively). The travel time variable for the automobile was summed with the other social cost variables (for automobiles) to obtain the total social cost per vehicle mile for automobile (***SCA***). The ***SCA*** variable is used in the following sections to calculate the annual social cost to the community if the transit system did not exist.

Figure 3-7: Social Cost Variables

Cost Variables	Definition	Urban peak-bus (transit)	Urban peak-auto	Rural bus (transit)	Rural auto
user cost *					
fixed	Vehicle purchase or lease	------	------	-----	-----
variable	Maint., repair, fuel cost, parking toll	------	------	-----	-----
Travel time **	Value of travel time.	varies	.203	varies	.091
Accident cost					
internal	Cost for motor vehicle occupants	.003	.05	.003	.05
external	Cost for non-occupants of motor vehicle	.20	.035	.20	.035
Parking					
internal	Opportunity cost of residential parking space	0	.05	0	.025
external	Opportunity cost of non-residential parking space	0	.12	0	.020
Congestion	Incremental costs resulting from interference among road users.	.34	.17	0	0
Road costs	Roadway facility costs required for automobile use not borne by user fees.	.070	.016	.042	.010
Right-of-Way, Land	Opportunity costs of land used for roadways	.024	.024	.024	.024
Public Services	Costs of public services for motor vehicles not funded by user	.015	.015	.005	.005
Trans. Equity, Option Value	Equity- adequate provision of transportation for disadvantage Option value- value of having a variety of mode choices	0	.005	0	.005
Air pollution	Costs of air pollution caused by motor vehicle use	.185	.062	.07	.016
Noise	Unwanted sounds and vibrations produced by motor vehicle use	.050	.010	.025	.005
Resource Consumption	External costs of resources consumed by vehicle production and use.	.152	.029	.110	.021
Barrier Effect (severance)	Effect of motor vehicle on non-motorized transportation modes in public ways	.038	.015	.013	.005
Land use Impacts	External costs of land use impacts caused by roads and automobile traffic	0	.070	0	.035
Water Pollution	Water pollution & hydrologic impacts from vehicles, roads, and parking.	.013	.013	.013	.013
Waste Disposal	External costs of automobile waste disposal	.002	.002	.002	.002

* The user cost variables were not used in this section due to the estimation of social cost estimations presented in the previous section.

** The travel time variable was adjusted for the transit system and the automobile.

Figure 3-8: Adjusted Travel Time Variables for Automobiles

Urban-peak automobile	**Rural automobile**
TIM = $\frac{(.5)*(\$10.41 \text{ per hour})}{30 \text{ miles per hour}}$ = \$0.1735 per vehicle mile	TIM = $\frac{(.35)*(\$10.41 \text{ per hour})}{40 \text{ miles per hour}}$ = \$0.0911 per vehicle mile
(Litman adds 16.5% to the urban-peak automobile to account for a congestion premium. Therefore, the urban-peak automobile is \$0.202 per vehicle mile)	

To calculate the social cost to the community, the appropriate cost variables (as listed in Figure 3-7) for each mode (transit and automobile) were summed to obtain a total social cost per vehicle mile (*SCT* for transit and *SCA* for automobiles). After the totals were established, the estimated annual cost was calculated for each mode of transportation in a transit area. The estimated annual cost for transit was calculated using the following equation:

$$SOT = MT*SCT + OM \quad (3\text{-}5)$$

where:

SOT = estimated annual social cost to the community with the transit system
MT = average number of vehicle miles per year for transit system
SCT = total social cost per vehicle mile for transit system (dollars per vehicle mile)
OM = annual operating and maintenance cost for transit system

If the transit system did not exist, it was assumed that there would be an increase in automobile usage. Therefore, the social cost for automobile usage to the community was calculated using the following equation:

$$SOA = MA*SCA*I \quad (3\text{-}6)$$

where:

SOA = estimated annual social cost for the community without the transit system
MA = estimated annual miles per automobile
SCA = total social cost per vehicle mile for automobile
I = increase in the number of automobiles if transit is not supplied.

It has been estimated that the average number of miles traveled per year by private automobile is 15,000 miles per year [58]. The parameter *I* was calculated for each transit service area using equations discussed in a previous section. The results for each transit system are shown in Appendix A.

3.7 Retail Sales Impact

This section discusses the procedure used to estimate the effects of the existing transit system on the sales of local retail businesses. In a study conducted by the American Public Transit Association (APTA), it was estimated that for every $1 invested in transportation, there would be an economic increase for industries located in the transit service area [4]. For example, the economic increase (or multiplier) for textile manufacturing industries is 0.0361. Therefore for one dollar spent by transit, the textile industries would experience a $0.0361 increase in revenues. APTA estimated multipliers for thirty-eight industries by using an Input/Output model called the Regional Industrial Modeling System (RIMS II) [3,4].

To represent the effects of public transit on retail sales, APTA's multipliers for retail trade and eating and drinking establishments, were added together to obtain the total retail multiplier. The retail trade multiplier (estimated as 0.1534) represents any establishment which sells merchandise for personal or household consumption and renders services leading to the sale of goods [57]. The eating and drinking multiplier (estimated as 0.0757) represents retail establishments which sell prepared foods and beverages for personal consumption on the premises or for immediate consumption [57]. Thus, the combination of these two multipliers were used to represent the total retail multiplier for this study.

After obtaining the total retail multiplier, the retail sales impact was estimated using the following equation.

$$RTI\text{-}= Q_r * OM \qquad (3\text{-}7)$$

where:

RTI = estimated annual increase in retail sales due to the supply of public transportation

Q_r = total retail multiplier per retail trade establishments (0.2291)
OM = annual operation and maintenance cost for transit system

The retail sales results for each transit system is obtained in Appendix A.

3.8 Medical Impacts

It is believed that public transportation positively affects the physical health of the community by transporting patrons to medical facilities. The analyst assumed that thirty percent of the patrons traveling to medical facilities would not be able to receive regular medical attention, if the transit system did not exist. Thus, to estimate the medical impacts of the transit system, the following equation was used.

$$MED = B*N*P \tag{3-8}$$

where:

MED = estimated medical impact per transit system
B = average cost of hospitalization
N = number of people traveling to medical facilities
P = percentage of people who would be unable to receive regular medical attention if the transit system did not exist (0.30)

The ***MED*** represents the increase in medical costs that would occur, if the public transit system did not exist. The average hospitalization cost (***B***) was $8,181 per hospital trip and was obtained from a report produced by the Arkansas Department of Health [6]. ***N*** was obtained from the surveys received from each of the transit systems, assuming that the number of medical trips per week represents the number of people of people traveling to medical facilities. The calculated results of the medical impacts for each transit system are presented in Appendix A.

3.9 Impacts on Elderly

A large percentage of elderly people maintain their independence by using public transportation to travel to medical facilities, shopping areas, social services, and etc. According to Jahnigen and Binstock, the population of elderly Americans increases each year. Jahnigen and Binstock reported that by the year 2000, the elderly persons at ages 85 and older will represent

thirteen percent of the total population and that persons between ages 65 and 84 will represent forty-eight percent [32]. Thus, with the steady growth of elderly populations, the demand for transportation services for the elderly will increase.

If public transportation systems did not exist, portions of elderly transit riders may be forced to live in nursing homes because they have no other means of getting from one place to another. In an article written by Joseph Stroud, several public transit directors responded to issues concerning federal funding cuts [61]. The article suggests that both elderly and low-income populations would suffer greatly if transit services were to diminish [61]. Taunya Kopke (former transit director of the Ozark Regional Transit) suggested that a loss in pubic transit services would be "killing people's freedom". Kopke believes that decreases in transit services would cause people, who are elderly or who need medical treatment, to lose their freedom because the lack of transportation would force them to enter nursing homes in order to receive necessary care [61].

To determine the impact of public transit on the elderly population for this study, the number of elderly people who may be forced to enter the nursing home , if transit did not exist, was estimated. In a survey taken of 1,083 poor elderly people in Florida, it was discovered that 6.1 percent of these people could not receive regular medical attention because of the lack of transportation [55]. Therefore, it is assumed that the people who lacked transportation to medical services, were also unable to reach other services and places (such as social services, shopping, nutritional services, etc.). Thus, the 6.1 percent was used as an adequate indicator of the percentage of elderly who would not be able to travel due to the lack of transportation. In another study conducted by Jahnigen and Binstock, it was reported that twenty-nine percent of persons aged 65 and older are living in nursing homes [32]. This percentage (29%) was used to determine the number of elderly persons who would enter the nursing home if the transit system did not exist. The number of elderly persons who would have to enter a nursing home due to the lack of public transit was estimated using the equation below:

$$NUE = LT * ER * NH \quad (3\text{-}9)$$

where:

NUE = number of elderly riders who would enter the nursing home if the transit system did not exist.
LT = percentage of persons who would not be able to travel due to the lack of transportation (0.061)
ER = number of elderly riders per transit system
NH = percentage of elderly persons who would enter the nursing home if transit did not exist (0.29)

The variable ***ER*** was obtained from the surveys received from each transit system, assuming that the number of elderly trips per week represents the number of elderly patrons.

To estimate the impact on elderly population in terms of annual dollars, the following equation was used:

$$ELD = NUE * (HCT - AVI) \quad (3\text{-}10)$$

where:

ELD = estimated impact on elderly per transit system
NUE = number of elderly riders who would enter the nursing home if the transit system did not exist
HCT = estimated annual cost to live in the nursing home
AVI = average household income per transit area

The difference in the variables ***HCT*** and ***AVI*** estimates the additional amount of income that would be needed if a patron has to enter a nursing home. The average annual income per transit area was obtained from the U. S. Census for Arkansas [67]. The Department of Human Services of Little Rock estimated the average cost of living in a nursing home at $4,000 per month [19]. Therefore, the estimated annual cost of living in the nursing home was $48,000 per year. The results for each transit system is presented in Appendix A.

3.10 Employment

Public transportation directly effects employment within a community by transporting patrons to jobs daily. Public transportation improves employment by connecting non-drivers/

non-car owners to jobs and supplying employers with a steady flow of employees. Thus, patrons using transit for commuting to work receive a regular income and employers save money from less turnover which in turn results in less training cost and less administration cost (due to decreases in hiring, tardiness, and production downtime).

To estimate employment impacts, multipliers outlined in a study conducted by the American Public Transit Association (APTA) were used. APTA obtained multipliers for 38 industries by using an Input/Output model called the Regional Industrial Modeling System (RIMS II). The RIMS II multipliers indicate that for every $ 1 spent on transit expenditures there is a certain dollar increase in the revenues of 38 industries [3,4]. The list of the industries and their multipliers are shown in Figure 3- 9.

Figure 3-9: APTA's Multipliers per Industry Due to Transit Expenditures [4]

Industry	multiplier
Agriculture	0.0923
Forestry and Fisheries	0.0027
Coal mining	0.0055
Petroleum and natural gas mining	0.0255
Other mining	0.0088
New construction	0.0
Maintenance and repair	1.0353
Food and kindred products	0.1630
Textiles	0.0361
Apparel	0.0341
Paper products	0.0308
Printing and publishing	0.0354
Chemicals	0.1282
Rubber and leather	0.0397
Lumber and Furniture	0.0358
Stone, clay and glass	0.0146
Primary metals	0.0570
Fabricated metals	0.0518
Non-electrical Machinery	0.0319

Industry	multiplier
Electrical machinery	0.0668
Motor vehicles	0.0531
Other transportation equipment	0.0071
Instrument	0.0085
Miscellaneous manufacturing	0.0137
Transportation	0.1012
Communication	0.0475
Utilities	0.0671
Wholesale trade	0.1194
Finance	0.0554
Insurance	0.0548
Real estate	0.1302
Lodging and amusement	0.0277
Personal services	0.0279
Business Services	0.0846
Health services	0.0639
Other services	0.0882
Households	1.2195

The retail trade and the eating and drinking multipliers were not included, since they were used to calculate the retail impact of the transit systems.

In addition to the industrial multipliers, APTA also generated a multiplier for the overall household income. This multiplier represents the impact on household earning (wages and benefits) for the household sector of the transit area [3,4]. In other words, the overall income includes the wage and benefit incomes for all households of the transit service area. Therefore, for one dollar spent on transit expenditures, there would be a $1.22 increase in the overall household income of the transit area. The increase in the overall household income due to the supply of public transit was estimated using the following equation:

$$HOS = MUH * OM \quad (3\text{-}11)$$

where:

HOS = estimated annual increase in the overall household income of the transit service area
MUH = multiplier for the overall household income per transit service area
OM = average annual operating and maintenance cost for transit

This estimated annual increase in household income represents the personal employment impacts due to the supply of public transit.

To estimate the effect of public transit on employers of the community, it was assumed that increased transit spending would result in more patrons being attracted to the transit system. Thus, the expenditures per transit system was used to estimate the increase in employment (employment impact) for industries serviced by the public transit system.

In order to estimate the community employment impacts, the types of industries located in the transit service area were determined so that the industrial multipliers for the system could be ascertained. The industries existing in each transit area was found in the U. S. States County Business Patterns and U. S. Census of Retail Trade publications [62,66]. The equation to estimate the employment impact for the community is shown below:

$$EMPI\text{-} = (\Sigma Q_j) * OM \quad (3\text{-}12)$$

where:

EMPI = estimated annual employment impact for the community due to transit spending
Q_j = industry j multiplier

OM = annual operating and maintenance cost for transit system

The employment impact results for each system are presented in Appendix A. The next chapter presents a numerical example of the methodology described.

4.0 NUMERICAL EXAMPLE

This section will demonstrate the mechanics of the methodology section by estimating impact obtained for one of the analyzed transit systems. The public transit system used for this numerical example was the North Arkansas Transit System (NATS). This system operates in the Northern section of Arkansas and serves six counties; Baxter, Boone, Carroll, Fulton, Izard, Marion, Newton, and Searcy.

Parameters & Variable Adjustment

Car increase estimations (I)

NATS reported that they had twenty-eight vehicles within their fleet, which consisted of the following types of vehicles: 21 passenger buses, 17 passenger buses, 14 passenger buses, 15 passenger vans, 12 passenger buses and mini vans. The following equation was used to calculate the estimated increase in automobiles, if the transit system did not exist:

$$I = \frac{\sum PAS}{N}$$

where:

I = estimated increase in automobile if the transit system did not exist
PAS = passenger capacity per transit vehicle
N = average number of persons per automobile

Assuming that there are an equal number of each vehicle type, the sum of the passenger capacity for NATS was calculated below.

Given 28 vehicles within the fleet, it was assumed that NATS had the following transit vehicles:

five - 21 passenger buses
five - 17 passenger buses
five - 15 passenger buses
five - 14 passenger vans
four - 12 passenger buses
four - 6 passenger mini vans

The passenger capacity for NATS was:

$\Sigma PAS = (5*21) + (5*17) + (5*15) + (5*14) + (4*12) + (4*6) = 407$ passenger capacity

Therefore the estimated increase of automobiles, if NATS did not exist, was:

$$I = \frac{\Sigma PAS}{N}$$
$$= \frac{407}{1.2}$$

= 339.166 or 339 automobiles would be introduced into the service area if NATS did not exists.

Social Impacts:

Individual social impacts

The following equation was used to calculate the individual social cost for using the automobile and the taxi.

$$U_x = [(G*R_x) + FEE]* D$$

where:

U_x = estimated annual social costs per mode x (automobile or taxi) for the individual
G = average of number of miles traveled per day
R_x = operation cost per vehicle mile for a transportation mode x (automobile or taxi)
FEE = additional daily fees incurred by the selected mode (parking or base fees)
D = average number of workdays per year (250 days)

The total estimated annual social cost per year for automobile and private taxi usage are as follows:

$U_x = [(G*R_x) + FEE]* D$
$U_a = [(25)(\$0.43) + \$3.00] *250 = \$3437.50$ per year
$U_t = [(25)(\$1.14) + \$4.26] *250 = \$8190.00$ per year

The estimated annual social cost for an individual using NATS is

YP= K*D

where:

YP = estimated annual social cost of public transit for individuals
K = average fare cost per day ($/ day)
D = average number of workdays in a year (250 days)

The passenger capacity for NATS was:

$\Sigma PAS = (5*21) + (5*17) + (5*15) + (5*14) + (4*12) + (4*6) = 407$ passenger capacity

Therefore the estimated increase of automobiles, if NATS did not exist, was:

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$U_t = [(25)(\$1.14) + \$4.26] *250 = \$8190.00$ per year

The estimated annual social cost for an individual using NATS is

$YP = K*D$

where:

YP = estimated annual social cost of public transit for individuals
K = average fare cost per day ($/ day)
D = average number of workdays in a year (250 days)

Therefore the annual individual social cost for NATS was:

YP= K*D
= ($2.90/day)(250 days)
= $725.00 per year

Thus, taking the difference between automobile social cost and NATS social cost, the social cost savings to the individual was:

3437.50 - 725 = $2712.50 per year in social cost savings when NATS is utilized instead of the automobile.

Taking the difference between taxi social costs and NATS social cost, the social cost savings for the individual was:

8190.00 - 725 = $7465 per year in social cost savings when NATS is utilized instead verses the taxi.

By using NATS, an individual could save between $2,712.50 to $6,932.50 per year in travel cost.

Community Social impacts

The travel time variable for each transit system was calculated. The calculation for the travel time variable cost per vehicle mile is shown below:

$$TIM = \frac{L * WAGE}{S}$$

where:

TIM = cost of travel time per vehicle mile for transit
L = percentage of wage which represents the value of time per hour (0.35 or 0.5)
WAGE = average wage per hour ($10.41/hour)
S = average speed of the transit vehicle (miles per hour)

The *TIM* for NATS was:

$$TIM = \frac{L * WAGES}{S}$$
$$= \frac{(0.35 * 10.41)}{(50 \text{ mph})}$$
= $0.0728 per transit vehicle mile

This travel time cost variable for NATS was added to the other social cost variables, listed in Figure 3-7, to obtain the total social cost per vehicle mile for the transit system. Thus, the total social cost per transit vehicle mile (SCT) for NATS is $0.5699 The equation for estimating the annual social cost for the transit system is shown below:

$$SOT = MT*SCT + OM$$

where:

SOT = estimated annual social cost to the community with the transit system
MT = average number of vehicle miles per year for transit system
SCT = total social cost per vehicle mile for transit system (dollars per vehicle mile)
OM = annual operation and maintenance cost for transit system (maintenance + wage + other)

Therefore the social cost to the community with the presence of NATS was:

$$SOT = MT*SCT + OM$$
$$= (300,000)(0.5699) + (140,833 + 155,071 + 48,665)$$
$$= \$515,539 \text{ per year in social costs to the community}$$

To estimate the social cost for automobile usage, the cost variables for automobiles (taken from Litman's study) were added to obtain the total social cost per automobile vehicle mile. Total social cost per mile per automobile usage (SCA) was $0.361. The social cost to the community if the transit system did not exist was calculated as follows:

$$SOA = MA*SCA*I$$

where:

SOA = estimated annual social cost to the community with out the transit system.
MA = estimated annual miles per automobile
SCA = total social cost per vehicle mile for automobile
I = increase in the number of automobiles, if transit is not supplied.

The social cost to the community if NATS did not exist resulted in the following:

$$SOA = MA*SCA*I$$
$$= (15,000)(0.361)(339)$$
$$= \$1,835,685 \text{ per year in social costs to the community if NATS did not exist.}$$

These estimates show that the community social cost is less with the presence of NATS. The

community saves a total of $1,320,155 ($1,835,685-515,530) per year in social cost due to the supply of NATS services.

Retail Sales Impact:

The impact for retail sales was estimated using the following equation

$RTI-= Q_r * OM$

where:

RTI = estimated annual increase in retail sales due to the supply of public transportation
Q_r = total retail multiplier per retail trade establishments (0.2291)
OM = annual operating and maintenance cost for transit system (maintenance + wage + other)

The impact on retail sales for NATS was as follows:

$$RTI = Q_r * OM$$
$$= (0.2291) * (140,833 + 155,071 + 48,665)$$
$$= \$78,940.76 \text{ per year}$$

NATS is estimated to be responsible for $78,940 in sales revenue per year for retail establishments in the NATS service area. Hence, the continued spending and improvement of the transit system will continue to increase the sales of the retail trade establishments.

Medical Impacts

Medical impacts were estimated using the following equation

$MED = B*N*P$

where:

MED = estimated medical impact per transit system
B = average cost of hospitalization
N = number of people traveling to medical facilities
P = percentage of people who would be unable to receive regular medical attention if the transit system did not exist (0.30)

The ***MED*** represents the increase in medical costs that would occur, if the public transit system did not exist. Therefore, the medical impact if NATS did not exist was estimated as:

MED = B*N*P
= ($8,181*50*0.3)
=$122,715 increase in medical cost

There would be and increase of $122,715 in medical expenditure for the NATS transit area if the transit system did not exist.

Elderly Impacts

The impacts on the elderly population was calculated by estimating the number of elderly persons who would have to enter nursing homes if the transit system did not exist. The following equation was used:

NUE = LT * ER * NH

where:

NUE = number of elderly riders who would enter the nursing home, if the transit system did not exist.
LT = percentage of elderly persons who would not be able to travel due to the lack of transportation
(0.061)
ER = number of elderly riders per transit system
NH = percentage of elderly persons who would enter the nursing home if transit did not exist
(0.29)

The number of elderly persons who would have to enter the nursing home if NATS did not exist was:

NUE = LT * ER * NH
= .061 * 65* .29
= 1.131 or 2 elderly patrons would have to enter nursing homes if NATS did not exist

To view the impacts on elderly in terms of annual dollars, the following equation was used:

ELD = NUE * (HCT - AVI)

where:

ELD = estimated impact on elderly per transit system
NUE = number of elderly riders who would enter the nursing home, if the transit system did not exist
HCT = estimated annual cost to live in the nursing home
AVI = average household income per transit area

Therefore, the impact on elderly in terms of dollars for NATS was:

ELD = NUE * (HCT - AVI)
= 2 * (48,000 - 22,469)
= $51,062 per year

Therefore, without the provision of the public transit, the elderly patrons (who would enter the nursing home) would need an increase of $51,062 per year in household income.

Employment Impacts.

The employment impact on the overall household income of the NATS service area was calculated as follows:

HOS = MUH * OM

where:

HOS = estimated annual increase in the overall household income for the transit service area
MUH = multiplier for household income
OM = average annual operating and maintenance cost for transit (maintenance + wages + other)

Thus, the amount of overall household income due to the annual spending on NATS was:

HOS = MUH * OM
= (1.2195)* (140,833 + 155,071 + 48,665)
= $265,630 per year of the overall household income is due to the existence of NATS

Therefore NATS contributes $265,630 per year to the household income of the its service area.

The NATS service area consists of the following industries (the multiplier for each industry is shown in parenthesis):

agriculture (0.0923)
forestry and fisheries (0.0027)
construction (0)
apparel (0.0361)
paper products (0.0308)
lumber and furniture (0.0358)
printing and publishing (0.0354)
rubber and leather (0.0397)
primary metals (0.057)
fabricated metal (0.0518)
electrical machinery(0.0668)
instruments (0.0085)
misc. manufacturing (0.0137)
transportation (0.1012)
communication (0.0475)
utilities (0.0671)
wholesale trade (0.1194)
finance (0.0554)
insurance (0.0548)
real estate (0.1302)
lodg. & amusmt. (0.0277)
personal services (0.0279)
business services (0.0846)
health services (0.0639)
other services (0.0882)

The total multiplier is 1.3385. NATS reported an average annual maintenance cost $140,833 per year. The employment impact of the NATS to the community was calculated as:

$$EMPI = (\Sigma Q_j) * OM$$

where:

EMPI = estimated annual employment impact for the community
Q_j = industry j multiplier
OM = annual operating and maintenance cost for transit system (maintenance + wage + other)

$$EMPI-= (\Sigma Qj) * OM$$
$$= (1.3385)(\$344,569)$$
$$= \$461,205.60$$ increase in business sales per year due to the supply of transit

Therefore, a revenue increase of $461,205 for local industries is estimated due to NATS.

Conclusion for NATS

The social impact category showed that an individual using NATS saved between $2,713 to $7,465 per year in travel costs. The social cost to the community with the existing transit system, was $1,320,155 less than the social cost to the community, if the transit system did not exist. The amount of retail sales due to the annual NATS expenditures was $78,941 per year. The medical savings due to the existence of NATS was estimated to be $122,715.

For NATS, it was estimated that 2 elderly patrons would enter the nursing home if the transit system did not exist. Elderly patrons living in nursing homes would experience an increase of $51,062 per year in living expenses. Therefore, NATS enables elderly patrons and their families to maintain their mobility and save money in living costs.

The employment impact of the household sector of NATS service area was estimated to be $420,202 per year. This means that $420,202 of the overall household income of NATS service area was due to the annual amount spent on public transit expenditures. There was a positive employment impact to the community for NATS. Therefore, it was concluded that NATS positively affects the economic structure of the individuals and community it serves.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Rural public transportation is vital to the economic and social well-being of the rural community and its citizens. Rural areas generally have a high percentage of elderly and low income populations who may find it more difficult to obtain personal transportation. Rural public transportation helps to enhance the quality of life for those who may use them.

Although the qualitative aspects of providing public transit services in rural areas has been recognized the quantitative data which represents the economic impact of such services has not been fully explored The main objectives of this project were to document the linkages between public transportation and economic activities in the rural areas of Arkansas, estimate the impacts of rural public transportation in the state of Arkansas and in local communities, and develop new or augment current methodologies for estimating the economic impacts of Arkansas rural public transportation. This data will provide rural transit providers with an opportunity to link the economic strength of a region(s) and the rural public transportation system which serves it.

From the extensive review of the literature, it was determined that both the individual and the community receive benefits from public transportation. Individuals who use public transit experience increased mobility, flexibility in travel arrangements, improved accessibility to other areas, savings in travel costs, and improved lifestyles. The benefits to the community include improved employment, larger employment market for businesses, and improved environment.

For the thirteen transit systems analyzed in this study, there were five impacts estimated: social, retail sales, medical, elderly, and employment. The calculated results of the social impacts showed that money is saved when the public transit system is used by the individual and the community. The retail impacts calculated for each transit system had a positive impact on retail trade revenues. Therefore the amount of money spent on transit expenditures contributes to the amount of revenue experienced by retail trade businesses of the transit service area.

For the medical impacts, it was determined that current transit patrons traveling to medical facilities would have to spend more money in medical cost (if the transit system did not exist). The existence of transit also saves money for elderly patrons. Since the elderly patrons have a

dependable source of transportation, they do not have to obtain additional income to live in nursing homes.

There was a positive employment impact on the overall household income and the industries located within the transit services area. Thus, spending on annual transit expenditures contributes to the overall household income and the revenues of local industries. In reference to the calculated results of all impact categories, it is concluded that the thirteen Arkansas rural public transit systems positively affect the economic structure of the individuals and communities they serve.

Despite the economic significance of rural transit, public transit systems are suffering because of cutbacks in federal funding. These cutbacks will cause transit providers to reduce or discontinue their services. Thus, preventing some rural transit riders from maintaining their mobility and independence to travel to shopping areas, medical facilities, and jobs.

The impact methodology developed in this research could be used to show the benefits derived by having a public transit system. In an effort to obtain funds public transit operators may find it beneficial to show quantitatively how the transit system affects an area. An extension of this research could be the development of a software tool that does the necessary calculations and provides the user with appropriate view graphs for such presentations.

For the past couple of years, the government has tried to reduce spending and reshape the welfare structure in America. One of the main objectives of the welfare reform is to help able bodied citizens to obtain work and establish a positive source of income for themselves. This means that more people, who do not have private transportation, will have to depend on public transit for transportation to work or training and for transportation to child care facilities. With the cutbacks in transportation funding, these welfare recipients may have a difficult time finding an adequate supply of public transportation to job sites. In an article written by J. Stroud of *Mass Transit Magazine*, Maggie Franklin stated,

> "They're wanting to cut welfare spending, and public transportation is a must for welfare recipients," she continues, "They don't have a car, and public transportation is what gets

them back and forth to work. So if they don't have public transportation they can't go to work " [61].

The relationship between welfare reform and public transportation needs to be established. An extension of this research could be an analysis to estimate and quantify the economic impact of welfare reform on public transportation.

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APPENDIX A

IMPACT RESULTS FOR EACH TRANSIT SYSTEM

The following tables show the estimated impact results for each transit system. The tables in this appendix include: social impacts - individual, social impacts - community, retail sales impact, medical impact, impact on elderly, and employment impact. Variables used in each table are defined for each impact category. However, it should be noted that all variables used to calculate the impacts are not shown or defined in the tables. (Equations used for the calculations are presented and defined in the methodology section of this report). There is a brief summary of the results at the end of each table.

SOCIAL IMPACTS -Individual

	Variables					Social Cost Savings	
TRANSIT SYSTEM	*G* (mi./day)	*K* ($/day)	*Ua* ($/year)	*Ut* ($/year)	*YP* ($/year)	Transit Use Over Auto. ($/year)	Transit Use Over Taxi ($/year)
Black River Area Development	4	1	1180	2205	250	930	1955
City of Hot Springs	n/a	1	-----	-----	----	-----	-------
City of Siloam Springs	4	1	1180	2205	250	930	1955
Central Arkansas Transit Authority	7.29	0.9	1534	3143	225	1309	2918
Eureka Springs Transit	4	3	1180	2205	750	430	1455
Ft. Smith Public Transit	3.9	1	1169	2176.5	250	920	1927
Mid-Delta Community Services	35	3.5	4513	11040	875	3638	10165
North Arkansas Transit System	25	2.9	3438	8190	725	2713	7465
Ozark Regional	4.35	1.25	1218	2305	313	905	1992
Pine Bluff City Transit	2	0.8	965	1635	200	765	1435
Razorback Transit	1.8	0	943.5	1578	0	944	1578
South Central Arkansas Transit	3.1	2	1083	1949	500	584	1449
Southeastern Arkansas Transit	40	n/a	5050	12465	-----	-----	-------

G = average number of mile traveled per day

K = average fare cost per day ($/day)

Ua = estimated annual social cost of automobile for individual

Ut = estimated annual social cost of taxis for individuals

YP = estimated annual social cost of transit for individuals

Summary of Results:

From a comparison of the individual social cost Ua (automobile), Ut (taxi), and YP (transit), it was evident that the social cost of transit is much less than the costs of the automobile and taxi. This means that a patron saves money when they use the public transit system. The last two columns of this table shows the savings for individuals using the transit over the automobile (Ua-YP) and the savings using the transit over taxis (Ut-YP). The table shows that the Arkansas transit systems were more cost efficient for an individual.

The variables Ua, Ut,, and YP could not be calculated for the City of Hot Springs, because the average miles per day were unknown. The YP could not be calculated for the Southeastern Arkansas Transit system because the fare was unknown. However based on the estimates of Ua and Ut for Southeastern Arkansas Transit, it was determined that social cost of transit would be smaller.

SOCIAL IMPACT - Community

	Variables								Savings
TRANSIT SYSTEM	*I*	*TIM* ($/ve. mi.)	*MT* (mi./year)	*SCT* ($/mile)	*SCA* ($/mile)	*OM* ($/year)	*SOT* ($/year)	*SOA* ($/year)	*SOA-SOT* ($/Year)
Black River Area Development	129	0.08573	171500	0.58273	0.361	145162	245101	699438	454337
City of Hot Springs	378	0.12145	363700	0.61845	0.361	775925	1000856	2048675	1047819
City of Siloam Springs	1	0.12145	6000	0.61845	0.361	13970	17681	5415	-12266
Central Arkansas Transit Authority	2034	0.37179	2503867	1.46379	0.889	6651862	10316987	27125613	16808626
Eureka Springs Transit	313	0.14574	120000	0.64274	0.361	344000	421129	1696700	1275571
Ft. Smith Public Transit	168	0.12145	300000	0.61845	0.361	565000	750535	907013	156478
Mid-Delta Community Services	595	0.08097	963000	0.57797	0.361	350852	907434	3221925	2314491
North Arkansas Transit System	339	0.07287	300000	0.56987	0.361	344569	515530	1835685	1320155
Ozark Regional	500	0.09109	923792	0.58809	0.361	1552059	2095330	2707500	612170
Pine Bluff City Transit	313	0.18218	200000	1.27418	0.889	796360	1051195	4178300	3127105
Razorback Transit	573	0.35135	271040	0.84835	0.361	763943	993880	3100088	2106208
South Central Arkansas Transit	758	0.09109	638240	0.58809	0.361	727211	1102552	4106375	3003823
Southeastern Arkansas Transit	695	0.09109	775000	1.18309	0.889	700000	1616893	9267825	7650932

I = estimated increase in automobiles if public transit did not exist
TIM = travel time variable for transit
MT = average number of miles per year for the transit system
SCT= social cost per vehicle mile for the transit system
SCA = social cost per vehicle mile for the automobile
OM = annual operating and maintenance for the transit system
SOT = estimated annual social cost to the community with the transit system
SOA = estimated annual social cost to the community without the transit system

Summary of Results:

The social impact to the community was based on the comparison of social cost with the existence of the transit system and the social cost without the transit system. The majority of the transit systems above showed a significant number of automobiles would be added to the transit area, if the transit system did not exist. Therefore the existence of each transit systems, with the exception of Siloam Springs, exhibited saving in social costs to the community.

There was not a significant increase in automobiles for the City of Siloam Springs. Therefore, there was not a savings in social cost for the Siloam Springs service area. The lack of social cost savings to the community was due to the fact that Siloam Springs has a small fleet size.

RETAIL SALES IMPACT

TRANSIT SYSTEM	Variables		
	Qr	*OM* ($/year)	*RTI* ($/year)
Black River Area Development	0.23	145162	33257
City of Hot Springs	0.23	775925	177765
City of Siloam Springs	0.23	13970	3201
Central Arkansas Transit Authority	0.23	6651862	1523942
Eureka Springs Transit	0.23	344000	78811
Ft. Smith Public Transit	0.23	565000	129442
Mid-Delta Community Services	0.23	350852	80381
North Arkansas Transit System	0.23	344569	78941
Ozark Regional	0.23	1152059	263937
Pine Bluff City Transit	0.23	796360	182447
Razorback Transit	0.23	763943	175020
South Central Arkansas Transit	0.23	727211	166605
Southeastern Arkansas Transit	0.23	700000	160370

Qr = total multiplier for retail trade establishments

OM= annual operating and maintenance cost for the transit system

RTI= estimated annual increase in retail sales revenue due to the amount of expenditures spent on public transit

Summary of Results:

It was assumed that the supply of public transit would have a positive effect on the retail sales of the transit service area. The amount of sales revenue resulting from the annual expenditures of the transit system are shown in the table above (variable RTI).

All transit systems showed a positive contribution to the sales of the retail business in their service area. The City of Siloam Springs had the smallest retail impact ($3,200 per year), due to its small fleet size. The largest retail impact of $1,523,942 per year, was estimated for the Central Arkansas Transit Authority. This large estimate was due to the transit system's large fleet size, vehicle capacity, service area, and amount of annual expenditures.

MEDICAL IMPACT

TRANSIT SYSTEM	Variables		
	B ($)	*N*	*MED* ($)
Black River Area Development	8,181	70	171801
City of Hot Springs	8181	460	1128978
City of Siloam Springs	8181	5	12272
Central Arkansas Transit Authority	8181	n/a	0
Eureka Springs Transit	8181	n/a	0
Ft. Smith Public Transit	8181	88	215978
Mid-Delta Community Services	8181	140	343602
North Arkansas Transit System	8181	50	122715
Ozark Regional	8181	1061	2604012
Pine Bluff City Transit	8181	240	589032
Razorback Transit	8181	n/a	0
South Central Arkansas Transit	8181	250	613575
Southeastern Arkansas Transit	8181	528	1295870

B = Arkansas's average cost of hospitalization

N = number of patrons traveling to medical facilities

MED= estimated medical impact

Summary of Results:

The actual number of patrons traveling to medical facilities were not available. Therefore, the estimated number of trips per week to medical facilities was used to represent the number of patrons traveling to medical facilities. The table shows, in the MED column, the additional amount of money that may have to be spent for medical reasons, if the transit system did not exist.

The variable N was unknown for the Central Arkansas Transit Authority, Eureka Springs, and Razorback transit systems. Thus, the medical impact was not estimated for these transit systems.

IMPACTS ON ELDERLY

TRANSIT SYSTEM	Variables ER	LT*NH	NUE	HCT -AV ($/year)	ELD ($/year)
Black River Area Development	208	0.0174	4	26,875	107500
City of Hot Springs	353	0.0174	7	20965	146755
City of Siloam Springs	14	0.0174	1	16278	16278
Central Arkansas Transit Authority	n/a	0.0174	0	13230	0
Eureka Springs Transit	5884	0.0174	103	23072	2376416
Ft. Smith Public Transit	n/a	0.0174	0	17135	0
Mid-Delta Community Services	10	0.0174	1	27796	27796
North Arkansas Transit System	65	0.0174	2	25,531	51062
Ozark Regional	839	0.0174	15	20769	311535
Pine Bluff City Transit	575	0.0174	11	20754	228294
Razorback Transit	n/a	0.0174	0	17990	0
South Central Arkansas Transit	1633	0.0174	29	25002	725058
Southeastern Arkansas Transit	3750	0.0174	66	20769	1370754

ER = number of elderly patrons using the transit

LT = percentage of elderly who would not be able to travel due to the lack of transportation (.061)

NH = percentage of elderly who would enter nursing homes due to the lack of transportation (.29)

NUE = number of elderly riders who would enter nursing homes, if the transit system did not exist

HCT = estimated annual cost to live in the nursing home ($48,000 per year)

AVI = average household income per transit service area

Summary of Results:

Since the actual number of elderly patrons using the transit system was unknown, the estimated number of elderly trips per week were used to represent the variable ER. The NUE column of the table above shows the estimated number of elderly patrons who would have to enter nursing homes if the transit system did not exist.

The table shows a significant impact on elderly populations for all transit systems. To represent the impacts on elderly in annual dollars, the additional annual income needed to live in nursing homes was estimated, variable ELD. It was determined that additional income would be needed to live in the nursing home for all transit systems.

Since the variable ER was not available for Central Arkansas Transit Authority, Ft. Smith Public Transit, and Razorback Transit, the impact on the elderly could not be estimated for these transit systems.

Employment Impact

TRANSIT SYSTEM	Variables				
	MUH	*OM* ($/year)	*tot. Qj*	*HOS* ($/year)	*EMPI* ($/year)
Black River Area Development	1.22	145162	0.958	177025	139037
City of Hot Springs	1.22	775925	2.443	946241	1895818
City of Siloam Springs	1.22	13970	1.709	17036.4	23874
Central Arkansas Transit Authority	1.22	6651862	2.954	8111946	19651596
Eureka Springs Transit	1.22	344000	0.98	419508	337086
Ft. Smith Public Transit	1.22	565000	1.706	689018	964060
Mid-Delta Community Services	1.22	350852	1.252	427864	439197
North Arkansas Transit System	1.22	344569	1.339	420202	461206
Ozark Regional	1.22	1152059	2.759	1404936	3178646
Pine Bluff City Transit	1.22	796360	1.472	971161	1171844
Razorback Transit	1.22	763943	1.694	931628	1294196
South Central Arkansas Transit	1.22	727211	1.517	886834	1103252
Southeastern Arkansas Transit	1.22	700000	1.575	853650	1102430

MUH = multiplier for the overall household income per transit service area

OM = estimated annual operating and maintenance cost for the transit system

Qj = multiplier per industry j

HOS = estimated increase in the overall household income due to the transit system

EMPI = estimated annual employment impact for the community due to transit expenditures

Summary of Results:

The variable HOS represents the amount of overall household income(per transit service area) due to the amount of spending on transit expenditures. This number represents the increase in wages and benefits experienced by all households existing within the transit service area (the employment impact on the individual). The expenditures per transit system were used to estimate the increase in employment for industries within the transit service area. The variable EMPI represents the effects of the transit system on the revenues of industries located within the transit service area (employment impact for the community).

The table shows positive estimates for HOS and EMPI. This suggests that each transit system has a positive impact on the patrons and community it serves. Central Arkansas Transit Authority had the largest employment impact due to its large transit service area and annual expenditures.

APPENDIX B

SUMMARIZED DATA OF RURAL PUBLIC TRANSIT SYSTEMS

A transit data summary sheet was prepared for each transit system analyzed in this study. The data presented in each summary was obtained from the surveys received from the transit operators. The summaries present the characteristics of the transit service, riders, service area, and the financial structure of each transit system.

Transit System: BRAD Public Transit
Director: Lurline Brown

Transit System Characteristics

This transit system has been in existence for 22 years and serves four counties (Randolph, Clay, Madison, and Lawrence). Its current days and time of services are: Monday through Friday from 7:00 a.m. to 5:30 p.m.. There are no true fixed route services supplied by BRAD. The route scheduling consists of daily demand response services.

Traveling with an average speed of 30 mph city and 55 mph count, 10 vehicles transport patrons to shopping centers (121), educational institutions (36), medical facilities (14), social services (6), job sites (5), and nutrition (17). [The value in () is the number of trips per day made to each specific destination]. The description of vehicles are as follows:

Vehicle	Estimated Cost
17 passenger buses	$38,000 to $45,000
14 passenger buses	$34,000 and up
15 passenger buses	$16,000 and up

According to BRAD, the average number of miles covered per trip is 1 to 4, the average number of passengers per mile is 5 and the estimated total mileage per year is 171,500.

Riders

To describe the types of riders BRAD outlined the following estimations:

elderly over age 60 = 831 riders per month

disabled = 573 riders per month

youth under age 6 = 850 riders per month

The average waiting time per patron is 15 minutes and the travel time to destination per patron is 10 minutes to 30 minutes.

Service Area

As mentioned above, BRAD Public Transportation operates in three counties: Randolph, Clay and Lawrence. Selected information concerning each county is listed in the table below.

	Clay	Lawrence	Randolph
Population	18,107	17,455	16,558
# households w/o vehicles	811=> 10.8%	716 => 10.4%	621=> 9.6
# households w/ ann. income < $10,000	2,416	2,405	2,019
Average personal income per household (dollars)	21,624	20,685	21,065
# households w/ public assistance	7953	939	756
Average amount of public asst. (dollars)	2,531	2,293	2,364
# working within residential county	75,682	4,919	4,888
# working outside residential county	1,406	1,658	1,316
Population 60+	4,878	4,112	3,811
# [60+] in nursing homes	183	215	169

To further describe the area, BRAD reported that there were:

Living and Medical Facilities
retirement and elderly homes
5 medical clinics
1 medical hospitals

Educational Facilities
Black River Vo-Tech

Tourist Attractions
Hardy Arts & Crafts (yearly)
Old Davidsonville State Park (April to September)

BRAD also reported Amtrak in Lawrence County as another mode of transportation operating in the same area.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration's Section 18 grant, fares, and donations. The estimated annual revenue amount is $10,000 and less than 0% of the revenues come from tourist attractions. Therefore it is assumed that the majority of the revenues comes from fare box collections. The fare rates are as follows:

$1.00/person

$0.50 / elderly person

$0.50/ disabled person

$0.50 / child under age 6

It is estimated that 0 patrons, serviced per day, fares are paid by social service programs such as Medicaid.

BRAD system contracts services to:

- Randolph County Nursing Home,
- Convalescent Center,
- Head Start Center,

Expenses are averaged as follows:

maintenance = $22,496
wages = $109,166
other expenses = $13,500

The total number of people working for the transit system is 6. Full time employees work 40 hours per week @ $6.78/hr and part-time employees work variable hours per week.

Transit System: Hot Springs Intracity Transit
Director: Monya M. Merritt

Transit System Characteristics

This transit system has been in existence for 16 years and serves one county (Garland). Its current days and time of services are: Monday through Friday from 6:00 a.m. to 6:00 p.m. with service on Saturday 8:00 a.m. to 5:00 p.m.. There are 3 fixed route services supplied by Hot Springs. The frequency for the fixed routes is outlined below.

3 routes supplied 5 days/ week @ 12 times/day

Traveling with an average speed of 30 mph, 18 vehicles transport patrons to shopping centers (194), educational institutions (124), medical facilities (92), social services (60), and job sites (125). [The value in () is the number of trips per day made to each specific destination]. The description of vehicles are as follows:

Vehicle	Estimated Cost
43 passenger buses	$64,000 and up
36 passenger buses	$180,000 and up
32 passenger buses	$128,000 and up
30 passenger buses	$158,000 and up
28 passenger buses	$119,000 and up
26 passenger buses	$42,000 and up
20 passenger buses	$169,000 and up
11 passenger vans	$37,000 and up
5 passenger vans	$25,000 and up

According to Hot Springs, the estimated total mileage per year is 363,700.

Riders

To describe the types of riders Hot Springs outlined the following estimations:

elderly over age 65 = 1,413 riders per month
disabled = 1,850 riders per month
youth under age 18 = 880 riders per month

Service Area

As mentioned above, Hot Springs Transportation Service operates in one county: Garland.

Selected information concerning each county is listed in the table below.

	Garland
Population	73,397
# households w/o vehicles	3,337=> 10.8%
# households w/ ann. income < $10,000	7,465
Average personal income per household (dollars)	20,260
# households w/ public assistance	2,105
Average amount of public asst. (dollars)	3,105
# working within residential county	26,516
# working outside residential county	2,487
Population 60+	21,003
# [60+] in nursing homes	663

To further describe the area, Hot Springs reported that there were:

Living and Medical Facilities
retirement and elderly homes
2 medical hospitals
and 1 developmental disabled center for rehabilitation
Educational Facilities
Garland County Community College
Quapaw Vo-tech
Tourist Attractions
Several Attractions in the Downtown Area

The Hot Springs system also reported that taxis are another mode of transportation operating in the same area.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration's Section 18 grant, state of Arkansas funding, and Act 45 funding. The estimated annual revenue amount is $223,300 and less than 10% of the revenues come from tourist attractions. Therefore it is assumed that the majority of the revenues comes from fare box collections. The fare rates are as follows:

$1.00/person/ one way trip

and no special rates for elderly, disabled, or children

Hot Springs contracts services to:

- First Step School
- Abilities Unlimited
- St. Joseph's Senior Center

Expenses are averaged as follows:

maintenance = $271,000
wages = $358,175
other expenses = $146,500

The total number of people working for the transit system is 22. Full time employees work 40 hours per week @ $7.15/hr.

Transit System: City of Siloam Springs
Director: Mark Latham

Transit System Characteristics

This transit system has been in existence for 3 years and serves one county (Benton). Its current days and time of services are: Monday through Friday from 8:00 a. m. to 5:00 p. m.. There are no true fixed route services supplied by Siloam Springs. The route scheduling consists of daily demand response services.

Traveling with an average speed of 30 mph, 2 vehicles transport patrons to shopping centers (1), educational institution (0), medical facilities (1), social services (1), and job sites (0). [The value in () is the number of trips made to each specific destination.] The description of vehicles are as follows:

Vehicle	Estimated Cost
Handicap Accessible van	$30,000
Station wagon	$17,00

According to Siloam Springs the average number of miles covered per trip is 4, the average number of passengers per mile is 1 and the estimated total mileage per year is 6,000.

Riders

To describe the types of riders the Siloam Springs outlined the following estimations.

elderly over age 60 = 55 riders per month

disabled = 12 riders per month

youth under age 13 = 0 riders per month

The average waiting time per patron is 10 minutes an the travel time to destination per patron is 15 minutes.

Service Area

As mention above, Siloam Springs Transportation Service operates in one county: Benton.

Selected information concerning each county is list in the table below.

	Benton
Population	97,499
# households w/o vehicles	1,842 ==> 4.9%
# households w/ ann. income < $10,000	5,020
Average personal income per household (dollars)	31,722
# households w/ public assistance	1,625
average amount of public asst. (dollars)	3,232
# working within residential county	36,439
# working outside residential county	7,365
Population 60+	22,508
# [60+] in nursing home	674

To further describe the area, Siloam Springs reported that there were

Living and Medical Facilities

3 medical clinics

1 medical hospital

Education Facilities

John Brown University

Siloam Springs also reported taxis as another mode of transportation operating in the same area.

Funding, Revenues, and Expenses

Funding is received from grant from the state of Arkansas and fares. The estimated annual revenue amount is $1,800. Therefore it is assumed that the majority of the revenues comes from fare box collections. The fare rates are as follows:

$1.00 / person/ one-way trip

and no special rates for elderly, disabled, or children

Expenses are averaged as follows:

maintenance = $1,370
wages = $12,000
other expenses = $600.00

The total number of people working for the transit system is 4. Full time employees work 40 hours per week @ $6.00/hr.

Transit System: Central Arkansas Transit Authority
Director: Keith Jones

Transit System Characteristics

This transit system has been in existence for 13 years and services one county (Pulaski). Its current days and time of services are: Monday through Friday from 4:45 a.m. to 11:45 p.m., Saturday from 4:45 a.m. to 7:45 p.m., and Sunday 8:30 a.m. to 5:30 p.m.. There were twenty-one regular fixed routes, ten express fixed routes, and demand response services available.

Traveling with an average speed of 14 mph, 78 vehicles transport patrons to shopping centers, educational institutions, medical facilities, job sites, restaurants, and volunteer agencies. [The number of trips per day made to each destination is unknown for this transit system]. The description of vehicles are as follows:

Vehicle	Estimated Cost
35 passenger buses	n/a
32 passenger buses	
28 passenger buses	
40 passenger buses	
41 passenger buses	
45 passenger buses	
18 passenger vans	

According to Central Arkansas Transit Authority, the average number of miles covered per trip is 7.29 miles for the fixed routes and 5 miles for the demand response. The average number of passengers per mile is 1.6 and the estimated total mileage per year is 2,503,867.

Riders

Since the number of patrons is so large, the number of elderly, disabled, and youth was not available. The average waiting time and travel time per patron was also not available.

Service Area

As mentioned above, Central Arkansas Transit Authority operates in one county: Pulaski. Selected information concerning the county is listed in the table below.

	Pulaski
Population	349660
# households w/o vehicles	13,220 =>10.8
# households w/ ann. income < $10,000	22,920
Average personal income per household (dollars)	34,770
# households w/ public assistance	8,100
Average amount of public asst. (dollars)	3,074
# working within residential county	n/a
# working outside residential county	n/a
Population 60+	5,411
# [60+] in nursing homes	2,336

To further describe the area, Central Arkansas reported that there are numerous living areas, medical facilities, education institutions, and tourists attractions within their service area. There are numerous other modes of transportation operating in the same service area.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration, local contributions, and operating fares. The estimated annual revenue amount is $1,482,754 which mainly comes from fare box collections. The fare rates are as follows:

$.90/person

$.45/elderly person

$.45/disabled person

$.45/child between ages 5-11

The Central Arkansas Transit Authority contracts services to numerous retirement homes and senior citizens centers.

The expenses per year are averaged as follows:

maintenance = $794,915
wages = $5,178,426
other expenses = $678,521

The total number of people working for the transit system is 160. Full time employees work 40 hours per week @ $15.90/hr and part-time employees work 30 per week @ $12.42/ hr.

Transit System: Eureka Springs Transit
Director: Charles Fargo

Transit System Characteristics

This transit system has been in existence for 14 years and serves one county (Carroll). Its current days and time of services are: Monday through Friday from 9:00 a.m. to 5:00 p.m. with service on Saturday 9:00 a.m. to 6:00 p.m. and Sunday from 9:00 a.m. to 5:00 p. m.. There are five true fixed route services supplied by Eureka Springs. This transit system also offers daily demand response services. The frequency for the fixed routes is outlined below.

5 routes supplied 7 days/ week @ 12 times/day

Traveling with an average speed of 25 mph, 13 vehicles transport patrons to shopping centers (60). [The value in () is the number of trips per day made to each specific destination]. The description of vehicles are as follows:

Vehicle	Estimated Cost
44 passenger buses	$150,000
24 passenger buses	$125,000
16 passenger buses	$41,000

According to Eureka Springs, the average number of miles covered per trip is 4, the average number of passengers per mile is 39 and the estimated total mileage per year is 120,000.

Riders

To describe the types of riders Eureka Springs outlined the following estimations:

elderly over age 65 = 23,535 riders per month

disabled = 124 riders per month

other = 27,224 riders per month

The average waiting time per patron is 10 minutes and the travel time to destination per patron is 25 minutes.

Service Area

As mentioned above, Eureka Springs Transportation Service operates in one county: Carroll.

Selected information concerning the county is listed in the table below.

	Carroll
Population	18,654
# households w/o vehicles	461=> 6.1%
# households w/ ann. income < $10,000	1,577
Average personal income per household (dollars)	24,928
# households w/ public assistance	440
Average amount of public asst. (dollars)	3,163
# working within residential county	7,422
# working outside residential county	831
Population 60+	4,612
# [60+] in nursing homes	55

To further describe the area, Eureka Springs reported that there were:

Living and Medical Facilities

retirement and elderly homes
1 medical clinics
1 medical hospital

Tourist Attractions

The city of Eureka Springs is a tourism destination, with a season from Aril to October.

The Eureka Springs System also reported that taxis are another mode of transportation operating in the same area.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration's Section 18 grant, and fares. The estimated annual revenue amount is $362,000 and less than 99% of the revenues come from tourist attractions. The fare rates are as follows:

$3.00/person

and no special rates for elderly, disabled, or children

Expenses are averaged as follows:

maintenance = $47,000
wages = $259,000
other expenses = $38,000

The total number of people working for the transit system is 30. Full time employees work 40 hours per week @ $8.30/hr and part-time employees work 25-30 hours per week @ $6.93/hr.

Transit System: Fort Smith Public Transit
Director: Carl Adams

Transit System Characteristics

This transit system has been in existence for 1 year and serves one county (Sebastian - City limits of Fort Smith). Its current days and time of services are: Monday through Friday from 5:45 a.m. to 6:45 p.m. and Saturday from 7:45 a.m. to 6:45 p.m.. There are three fixed route and daily demand response services supplied by Fort Smith. The frequency for each fixed route is outlined below.

3 routes supplied 6 days/ week @ 11 times/day

Traveling with an average speed of 30 mph, 10 vehicles transport patrons to shopping centers (58), educational institutions (23), medical facilities (305), and job sites (655). [The value in () is the number of trips per day made to each specific destination]. The description of vehicles are as follows:

Vehicle	Estimated Cost
20 passenger buses	$38,000 to $45,000
22 passenger buses	
18 passenger buses	$48,000
25 passenger buses	$125,000

According to Fort Smith the average number of miles covered per trip is 3.9, the average number of passengers per mile is 3.33 and the estimated total mileage per year is 151,258.

Riders

The average waiting time per patron is 15 minutes and the travel time to destination per patron is 60 minutes.

Service Area

As mentioned above, Fort Smith Transportation Service operates in one county: Sebastian.

Selected information concerning the county is listed in the table below.

	Sebastian
Population	99,590
# households w/o vehicles	3,359=> 8.5%
# households w/ ann. income < $10,000	7,219
Average personal income per household (dollars)	30,865
# households w/ public assistance	2,009
Average amount of public asst. (dollars)	3,006
# working within residential county	n/a
# working outside residential county	n/a
Population 60+	18,019
# [60+] in nursing homes	927

To further describe the area, Fort Smith reported that there were:

Living and Medical Facilities

retirement and elderly homes
2 medical; clinics
2 medical hospitals
1 family trauma center
1 mental hospital
and 1 developmental disabled center for rehabilitation

Educational Facilities

Westark Community College

Tourist Attractions

Belle Grove Historic District

Fort Smith Transit system also reported that taxis are another mode of transportation operating in the same area.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration's Section 5307 grant, Section 3 grant, and local sales tax. Therefore it is assumed that the majority of the revenues comes from fare box collections. The fare rates are as follows:

$1.00/person

and no special rates for elderly, disabled, or children

Expenses are averaged as follows:

maintenance = $50,000

wages = $415,000

other expenses = $100,000

The total number of people working for the transit system is 21. Full time employees work 40 hours per week @ $10.00/hr and part-time employees work 20 per week @ $10.00/hr.

Transit System: Mid-Delta Transit
Director: DeJuan Locke

Transit System Characteristics

This transit system has been in existence for 14 years and serves three counties (Phillips, Monroe, and Prairie). Its current days and time of services are: Monday through Friday from 7:00 a.m. to 12:30 p.m. with occasional service available on Saturday and Sunday. There are two fixed route services supplied by Mid-Delta. This system also supplies daily demand response services. The frequency for each the fixed route is outlined below.

1 route supplied 5 days/ week @ 2 times/day

1 route supplied 2 days/ week @ 2 times/ day

Traveling with an average speed of 45 mph, 48 vehicles transport patrons to shopping centers (8), educational institutions (6), medical facilities (28), social services (10), and job sites (8). [The value in () is the number of trips per day made to each specific destination]. The description of vehicles are as follows:

Vehicle	Estimated Cost
24 passenger buses	$35,000 and up
20 passenger buses	$38,000 to $45,000
14 passenger buses	" "
14 passenger vans	$16,000 and up
1 passenger vans	$14,000 and up

According to Mid-Delta, the average number of miles covered per trip is 35, the average number of passengers per mile is 3 and the estimated total mileage per year is 357,192.

Riders

To describe the types of riders Mid-Delta outlined the following estimations:

elderly over age 60 = 20 riders per month
disabled = 24 riders per month
youth = 20 riders per month

The average waiting time per patron is 10 minutes and the travel time to destination per patron is 30 minutes.

Service Area

As mentioned above, Mid-Delta Transportation Service operates in three counties: Phillips, Monroe, and Prairie. Selected information concerning each county is listed in the table below.

	Phillips	Monroe	Prairie
Population	28,830	11,333	9,518
# households w/o vehicles	2,559 ==> 25.1%	924 => 21.2%	397=> 10.8%
# households w/ ann. income < $10,000	4,156	1,673	1,059
Average personal income per household (dollars)	18,777	19,573	22,262
# households w/ public assistance	2,396	829	396
Average amount of public asst. (dollars)	2,995	3,184	3,001
# working within residential county	8,355	2,952	2,535
# working outside residential county	683	866	1,321
Population 60+	5,672	2,613	2,109
# [60+] in nursing homes	221	90	76

To further describe the area, Mid-Delta reported that there were:

Living and Medical Facilities
retirement and elderly homes
35 medical clinics
1 medical hospitals
1 family trauma center
and 2 developmental disabled centers for rehabilitation

Educational Facilities
Phillips County College of UA-Helena

Tourist Attractions
Blues Festival- Helena, month of October
Mississippi Delta Queen-stops at Helena (passengers taken on tours)

Mid-Delta Transit also reported that taxi service for the Helena/ West Helena area is another mode of transportation.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration's Section 18 grant, contracts, fares, advertising, and Medicaid. The estimated annual revenue amount is $172,000. Therefore it is assumed that the majority of the revenues comes from fare box collections. The fare rates are as follows:

$3.50/person
$3.50 /elderly person
$2.5 /child

It is estimated that 8 patrons, serviced per day, fares are paid by social service programs such as Medicaid.

The Mid-Delta Transportation System contracts services to:

- Phillips Community College,
- Behavioral Health Services
- Walton Family Project
- Department of Human Services

Services are also supplied to employers to provide transportation for the employees. Mid-Delta reports that 200 workers are transported per week and that the employee pays for his/her own ride.

Expenses are averaged as follows:

maintenance = $72,168
wages = $252,012
other expenses = $26,672

The total number of people working for the transit system is 35. Full time employees work 40 hours per week @ $5.00/hr and part-time employees work 20 hours per week @ $4.75/hr.

Transit System: North Arkansas Transportation Service (NATS)
Director: Jo Anna Cartwright

Transit System Characteristics

This transit system has been in existence for 16 years and serves eight counties: (Boone, Baxter, Carroll, Fulton, Izard, Marion, Newton, and Seracy). Its current days and time of services are: Monday through Friday from 5:30 a.m. to 6:30 p.m. with occasional services available on Saturday and Sunday. There are no true fixed route services supplied by NATS. The route scheduling consists of daily demand response services and scheduled routes which allow for route deviation whenever necessary. The frequency for the deviated scheduling schema is outlined below.

1 route supplied 4 days/ week @ 4 times/day
18 routes supplied 5 days/ week @ 2 times/day
2 routes supplied 2 days /week @ 2 times/day

Traveling with an average speed of 50 mph, 28 vehicles transport patrons to shopping centers (25), educational institutions (88), medical facilities (10), social services (168), and job sites (225). [The value in () is the number of trips per day made to each specific destination]. The description of vehicles are as follows:

Vehicle	Estimated Cost
21 passenger buses	$38,000 to $45,000
17 passenger buses	" "
14 passenger buses	" "
15 passenger buses	$16,000 and up
12 passenger buses	$20,000 and up
accessible mini van	$30,000 and up

According to NATS the average number of miles covered per trip is 25, the average number of passengers per mile is 4.12 and the estimated total mileage per year is 300,000.

Riders

To describe the types of riders NATS outlined the following estimations:

elderly over age 60 = 260 riders per month
disabled = 2,600 riders per month
youth under age 15 = 25 riders per month

The average waiting time per patron is 3 minutes and the travel time to destination per patron is 20 minutes.

Service Area

As mentioned above, North Arkansas Transportation System operates in eight counties: Boone, Baxter, Carroll, Fulton, Izard, Marion, Newton, and Seracy. Selected information concerning each county is listed in the table below.

	Baxter	Boone	Carroll	Fulton	Izard	Marion	Newton	Seracy
Population	31,186	28,297	18,654	10,037	11,364	12,001	7,666	7,841
# households w/o vehicles	869 => 6.4%	730 => 6.6%	461 => 6.1%	332 => 8.3%	380 => 8.1%	331 => 6.7%	253 => 9.0%	357=> 11.5%
# households w/ ann. income < $10,000	2,849	2,503	1,577	1,385	1,281	1,256	934	1,196
Average personal income per household (dollars)	24,540	25,635	24,928	20,390	21,135	22,393	19,147	18,262
# households w/ public assistance	788	792	440	507	448	384	434	480
Average amount of public asst. (dollars)	2,957	3,853	3,163	2,767	3,132	2,653	2,687	2,943
# working within residential county	9,370	11,185	7,422	2,094	2,919	2,981	1,231	1,962
# working outside residential county	1,131	1,198	831	1,408	1,019	1,310	1,353	818
Population 60+	11,446	6,426	4,512	2,776	3,683	3,659	2,325	1,985
# [60+] in nursing homes	357	272	55	86	184	107	27	71

To further describe the area, NATS reported that there were:

Living and Medical Facilities
retirement and elderly homes
several medical clinics
4 to 5 medical hospitals
2 family trauma centers
and 2 developmental disabled center for rehabilitation

Educational Facilities
North Arkansas College in Harrison
ASU Branch in Mountain Home

Tourist Attractions
The Scenic Railway located in Marion and Baxter counties

NATS also reported that taxis, aging service agencies, and other non-profit agencies are the other modes of transportation operating in the same area.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration's Section 18 grant, state grants, contracts, fares, and Medicaid. The estimated annual revenue amount is $452,000 and less than 1% of the revenues come from tourist attractions. Therefore it is assumed that the majority of the revenues comes from fare box collections. The fare rates are as follows:

$14.50/person/week (average commuter routes)
$0.87 per mile for contracted rates
$0.75 - $6.00 per boarding fare for one way day time routes
and no special rates for elderly, disabled, or children

It is estimated 98 patrons, serviced per day, fares are paid by social service programs such as Medicaid.

The North Arkansas Transportation System contracts services to:

- Developmentally disabled center
- Youth center
- Day care centers
- Field trips and education
- Churches for Sunday and midweek services
- Business groups for entertainment purposes

- Medical trips

Services are also supplied to employers to provide transportation for employees. NATS reports that 500 workers are transported per week and that the employee pays for his/her own ride. (Fare is collected per an established rate of schedule.)

Expenses are averaged as follows:

maintenance = $140,833
wages = $155,071
other expenses = $48,665

The total number of people working for the transit system is 13. Full time employees work 40 hours per week @ $8.50/hr and part-time employees work 20 hours per week @ $5.50/hr.

Transit System: Ozark Regional Transit
Director: Deborah Corley

Transit System Characteristics

This transit system has been in existence for 19 years and serves four counties (Benton, Carroll, Madison, and Washington). Its current days and time of services are: Monday, Wednesday, and Friday from 7:00 a.m. to 5:30 p.m. and Tuesday and Thursday from 7:00 a.m. to 9:30 p.m with services available on Saturday from 6:30 a.m. to 5:00 p.m.. There is 1 fixed route services supplied by Ozark. This system mainly supplies daily demand response services. The frequency for the fixed route is outlined below.

1 routes supplied 6 days/ week @ 9:30 a. m. to 4:30 p.m. continuous

Ozark has a total of 38 vehicles which transport patrons to shopping centers (21,345), educational institutions (15,517), medical facilities (50,912), nutrition sites (12,446), and job sites (59,384). [The value in () is the number of trips per year made to each specific destination]. The description of vehicles are as follows:

Vehicle	Estimated Cost
24 passenger buses	$38,000 to $45,000
20 passenger buses	" "
19 passenger buses	$37,000 to $38,000
18 passenger buses	$27,,000 to $42,000
17 passenger buses	$37,000 and up
15 passenger buses	$15,000 to $36,000
11 passenger buses	$31,000 to $32,000
7 passenger vans	$26,000 to $27,000

According to Ozark the average number of miles covered per trip is 4.35 and the estimated total per year is 923,792.

Riders

To describe the types of riders Ozark outlined the following estimations:

elderly over age 60 = 40,286 riders per month
disabled = 100,013 riders per month
youth under age 18 = 880 riders per month

Service Area

As mentioned above, Ozark Regional Transportation Service operates in four counties: Benton, Carroll, Madison, and Washington. Selected information concerning each county is listed in the table below.

	Benton	Carroll	Madison	Washington
Population	97,499	18,654	11,618	113,409
# households w/o vehicles	1,842 ==> 4.9%	461 => 6.1%	296 => 6.7%	2,470 =>5.7
# households w/ ann. income < $10,000	5,020	1,577	1,131	8,281
Average personal income per household (dollars)	31,722	24,928	22,264	30,010
# households w/ public assistance	1,625	440	422	1,961
Average amount of public asst. (dollars)	3,232	3,163	2,480	3,105
# working within residential county	36,439	7,422	3,025	n/a
# working outside residential county	7,365	831	1,806	n/a
Population 60+	22,508	4,512	2,477	16,852
# [60+] in nursing homes	674	55	107	1,376

To further describe the area, Ozark Regional reported that there were:

Living and Medical Facilities
retirement and elderly homes

Educational Facilities
University of Arkansas
John Brown University
Northwest Arkansas Vo-tech
Remington College
Northwest Arkansas Community College

Tourist Attractions

transportation to tourists attractions supplied upon request

The Ozark system also reported that taxis, Razorback Transit, aging service agencies, and other non-profit agencies are the other modes of transportation operating in the same area.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration's Section 18 grant, Section 9 grant, state funds, contributions, fares and Medicaid. The estimated annual revenue amount is $1,401,352. Therefore it is assumed that the majority of the revenues comes from fare box collections. The fare rates are as follows:

$1.25/person/ one way trip

and free for elderly, disabled, or children under 5

Ozark Regional reported that 165,000 trips per years are paid by social services such as Medicaid.

Expenses are averaged as follows:

maintenance = $125,9222
wages = $766,980
other expenses = $259,157

The total number of people working for the transit system is 47.

Transit System: Pine Bluff Transit
Director: Larry Reynolds

Transit System Characteristics

This transit system has been in existence for 23 years and serves one county (part of Jefferson county). Its current days and time of services are: Monday through Friday from 6:00 a.m. to 6:00 p.m.. There are 6 fixed route services supplied by Pine Bluff. This system also supplies daily demand response services. The frequency for the fixed routes is outlined below.

3 routes supplied 5 days/ week @ 24 times/day

3 routes supplied 5 days/week @ 12 times/ day

Traveling with an average speed of 20 mph, 13 vehicles transport patrons to shopping centers (144), educational institutions (48), medical facilities (48), social services (48), and job sites (144). [The value in () is the number of trips per day made to each specific destination]. The description of vehicles are as follows:

Vehicle	Estimated Cost
29 passenger buses	$110,000 to $205,000
27 passenger buses	$140,000 and up
15 passenger buses	$38,000 to $42,000

According to Pine Bluff the average number of miles covered per trip is 2, the average number of passengers per mile is 1.5 and the estimated total mileage per year is 200,000.

Riders

To describe the types of riders Pine Bluff outlined the following estimations:

elderly over age 62 = 2,300 riders per month
disabled = 4000 riders per month
youth under age 12 = 2,000 riders per month

The average waiting time per patron is 10 minutes and the travel time to destination per patron is minutes.

Service Area

As mentioned above, Pine Bluff Transportation Service operates in one county: Jefferson.

Selected information concerning the county is listed in the table below.

	Jefferson
Population	85,487
# households w/o vehicles	3,951 => 13.3%
# households w/ ann. income < $10,000	8,056
Average personal income per household (dollars)	21,322
# households w/ public assistance	3,585
Average amount of public asst. (dollars)	2,593
# working within residential county	n/a
# working outside residential county	n/a
Population 60+	15,100
# [60+] in nursing homes	692

To further describe the area, Pine Bluff reported that there were:

Living and Medical Facilities
retirement and elderly homes
2 medical clinics
1 medical hospitals
1 family trauma center
and 1 developmental disabled center for rehabilitation

Educational Facilities
University of Arkansas at Pine Bluff
Southeastern Arkansas Technical College

The Pine Bluff system also reported that taxis, aging services, and charter bus services are other modes of transportation operating in the same area.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration's Section 9 grant, local funding, and fares. The estimated annual revenue amount is $100,000. Therefore it is assumed that the majority of the revenues comes from fare box collections. The fare rates are as follows:

$0.40/elderly/ one way trip
$1.60 disabled /one way trip
$0.80 child (under 12)/one way trip
$0.65 student/ one way trip

Expenses are averaged as follows:

maintenance = $100,000
wages = $531
other expenses = $165,000

The total number of people working for the transit system is 23. Full time employees work 40 hours per week @ $9.50/hr and part-time employees work 30 hours per week @ $7.86 /hr.

Transit System: Razorback Transit
Director: Billy Riley

Transit System Characteristics

This transit system has been in existence for 17 years and services one county (Washington). Its current days and time of services are: Monday through Friday from 7:00 a.m. to 6:00 p.m.. There were eight fixed route and daily demand response services offered by Razorback Transit. The frequency of routes vary.

Traveling with an average speed of 10.37 mph, 24 vehicles transport patrons to shopping centers, educational institutions, medical facilities, and job sites. [The number of trips per day made to each destination is not available for this transit system]. The description of vehicles are as follows:

Vehicle	Estimated Cost
35 passenger buses	$175,092
vans with lifts	$29,758

According to Razorback Transit, the average number of miles covered per trip is 1.8 miles. The average number of passengers per mile is 6 for fixed routes and 1.72 for demand-response. The estimated total mileage per year is 2,470,802.

Riders

Since the number of patrons is so large, the number of elderly, disabled, and youth was not available. The average waiting time and travel time per patron was also not available.

Service Area

As mentioned above, Razorback Transit operates in one county: Washington. Selected information concerning the county is listed in the table below.

	Washington
Population	113,409
# households w/o vehicles	2,470 =>5.7
# households w/ ann. income < $10,000	8,281
Average personal income per household (dollars)	30,010
# households w/ public assistance	1,961
Average amount of public asst. (dollars)	3,105
# working within residential county	n/a
# working outside residential county	n/a
Population 60+	16,852
# [60+] in nursing homes	1,376

To further describe the area, Razorback Transit reported that there were numerous living areas, medical facilities, education institutions, and tourists attractions within their service area. There were taxis and other modes of transportation operating in the same service area.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration, State franchise tax, parking permit fees, and fines. The estimated annual revenue amount is $1,200,000. Fares are not collected for this transit system. The Razorback Transit contracts services to educational and social institutions.

The expenses per year are averaged as follows:

maintenance = $105,139
wages = $638,576
other expenses = $20,231

Transit System: South Central Arkansas Transit
Director: Jean Smith

Transit System Characteristics

This transit system has been in existence for 20 years and serves five counties (Clark, Hot Springs, Montgomery, Pike, and Saline). Its current days and time of services are: Monday through Saturday from 5:45 a.m. to 5:30 p.m.. There were five fixed routes and daily demand-response services offered by South Central Arkansas Transit.

Traveling with an average speed of 40 mph, 63 vehicles transport patrons to shopping centers (96), educational institutions (333), medical facilities (50), social services (229), and job sites (88). [The value in () is the number of trips per day made to each specific destination]. The description of vehicles are as follows:

Vehicle	Estimated Cost
7 passenger vans	n/a
8 passenger vans	
9 passenger vans	
10 passenger vans	
12 passenger vans	
14 passenger vans	
15 passenger vans	
16 passenger buses	
18 passenger buses	
21 passenger buses	
22 passenger buses	

According to South Central Arkansas Transit, the average number of miles covered per trip is 3.14 miles. The average number of passengers per mile is 1 and the estimated total mileage per year is 638,240.

Riders

The number of elderly, disabled, and youth was not available. The average waiting time and travel time per patron was 10 minutes.

Service Area

As mentioned above, South Central Arkansas Transit operates in five counties: Clark, Hot Springs, Montgomery, Pike, and Saline. Selected information concerning each county is listed in the table below.

	Clark	Hot Springs	Montgomery	Pike	Saline
Population	21,437	26,115	7,841	10,086	64,183
# households w/o vehicles	7,907 => 12.2	854 => 8.4	181 => 5.9	306 => 7.4	1,176 => 5.1
# households w/ ann. income < $10,000	2,411	2,743	893	1,055	3,041
Average personal income per household (dollars)	24,098	22,546	19,523	19,240	28,262
# households w/ public assistance	747	745	288	289	1,127
Average amount of public asst. (dollars)	2,633	3,057	3,125	2,796	3,539
# working within residential county	7,537	5,772	2,063	2,343	n/a
# working outside residential county	1,355	4,347	1,013	1,699	n/a
Population 60+	4,489	5,666	1,994	2,352	9,961
# [60+] in nursing homes	227	223	153	136	608

To further describe the area, South Central Arkansas reported that there were:

Living and Medical Facilities

25 medical care clinics
2 mental hospitals
3 medical hospitals

Educational Facilities

Ouachita Technical College - Malvern

Henderson State University - Arkadelphia
Ouachita Baptist Universe - Arkadelphia
University at Little Rock

Tourist Attractions

Crater of Diamonds State Park - Murfreesboro
Lake Catherine State Park - Malvern

Tourist Attractions

DeGray State Park Resort Lodge (golf) - Arkadelphia
Daisy State park at Royal

Taxis, Amtrak, and Greyhound are the other modes of transportation operating in the same service area.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration, Medicaid, Arkansas Area on Aging, fares, contracted services, and used vehicle sales. The estimated annual revenue amount is $605,676. The fare rate was $2.00 per person.

The number of patrons, serviced per year, whose fares are paid by social service programs was 152,451. The South Central Arkansas Transit Authority contracts services to medical clients, employers, and senior citizens centers.

The expenses per year are averaged as follows:

maintenance = $165,00
wages = $512,211
other expenses = $50,000

The total number of people working for the transit system is 38. Full time employees work 40 hours per week @ $11.36/hr and part-time employees work variable hours per week @ $11.32/ hr.

Transit System: Southeast Arkansas Transportation (SEAT)
Director: David Norton

Transit System Characteristics

This transit system has been in existence for 3 years and serves thirteen counties (Arkansas, Ashley, Bradley, Calhoun, Chicot, Cleveland, Drew, Dallas, Desha, Lincoln, Grant, Jefferson, Union). Its current days and time of services are: Monday through Thursday from 7:00 a.m. to 6:00 p.m. with occasional services on Friday 8:00 a.m. to 5:00 p.m.. There are twenty fixed route and daily demand-response services are supplied by SEAT. The frequency for each fixed route is outlined below.

19 routes supplied 5 days/ week @ 2 times/day

1 route supplied 4 days/ week @ 2 times/ day

Traveling with an average speed of 40 mph, 54 vehicles transport patrons to shopping centers (14,800), educational institutions (960), medical facilities (25,338), social services (2,600), and job sites (4,946). [The value in () is the number of trips per year made to each specific destination]. The description of vehicles are as follows:

Vehicle	Estimated Cost
18 passenger buses	$42,000
15 passenger buses	$36,000
15 passenger buses	$32,000
15 passenger vans	$23,000
4 passenger vans	$26,000
4 passenger wagon	$17,000
20 passenger buses	$169,000 and up
11 passenger vans	$37,000 and up
5 passenger vans	$25,000 and up

According to SEAT the average number of miles covered per trip is 40, the average number of passengers per mile is 9, and the estimated total mileage per year is 775,000.

Riders

To describe the types of riders SEAT outlined the following estimations:

elderly over age 62 = 15,000 riders per month
disabled = 2,500 riders per month
youth under age 12 = 400 riders per month

The average waiting time per patron varies and the travel time to destination per patron is 40 minutes.

Service Area

As mentioned above, SEAT Transportation Service operates in thirteen counties: Arkansas, Ashley, Bradley, Calhoun, Chicot, Cleveland, Drew, Dallas, Desha, Lincoln, Grant Jefferson, and Union.. Selected information concerning each county is listed in the table that follows.

	Arkansas	Ashley	Bradley	Calhoun	Chicot	Cleveland	Drew	Desha	Dallas	Lincoln
Population	21,653	24,319	11,793	5,826	15,713	7,781	17,369	16,798	9,614	13,690
# households w/o vehicles	1,014 => 12.1%	981 => 11.0%	557 => 12.3%	273 => 12.5%	1,345 => 24.2%	252 => 8.8%	802 => 12.6	1,211 => 20.3%	473 => 13.1%	512 => 13.5%
# households w/ ann. income < $10,000	2,143	2,235	1,440	558	2,259	772	1,784	2,151	1,067	1,189
Average personal income per household (dollars)	28,483	26,427	31,722	24,911	20,981	24,731	24,550	23,461	23,912	24,611
# households w/ public assistance	643	940	1,625	236	1,405	227	752	970	392	603
Average amount of public asst. (dollars)	2,998	2,967	3,232	2,488	2,519	2,818	2,695	2,829	2,775	3,312
# working within residential county	8,614	8,757	3,491	1,005	3,783	997	5,823	4,965	2,534	2,416
# working outside residential county	562	742	886	1,228	1,096	2,054	1,331	730	1,103	1,540
Population 60+	4,616	4,576	2,788	1,229	3,235	1,494	3,010	3,205	2,66	2,140
# [60+] in nursing homes	299	198	269	55	80	68	129	164	161	127

	Grant	Jefferson	Union
Population	13,948	85,487	46,719
# households w/o vehicles	274 => 5.4%	3,951 => 13.2%	2,176 => 12.2
# households w/ ann. income < $10,000	1,122	8,056	4,554
Average personal income per household (dollars)	27,961	27,246	27,622
# households w/ public assistance	296	3,585	1,779
Average amount of public asst. (dollars)	2,773	2,593	2,755
# working within residential county	2,856	n/a	17,050
# working outside residential county	3,277	n/a	1,175
Population 60+	2,321	15,100	10,193
# [60+] in nursing homes	110	692	473

To further describe the area, SEAT reported that there were:

Living and Medical Facilities
retirement and elderly homes
45 medical clinics
12 medical hospitals
2 family trauma centers
and 2 developmental disabled center for rehabilitation

Educational Facilities
University of Monticello
University of Arkansas at Pine Bluff
Southeast Technical College
Several other technical colleges

The SEAT system also reported that taxis service and private Medicaid transportation providers are the other modes of transportation operating in the same area.

Funding, Revenues, and Expenses

Funding is received from the Federal Transit Administration's Section 18 grant, section 5311 grant, section 16 grant, Title III Older Americans Act, and cigarette taxes. The estimated annual revenue amount is $200,000. Therefore it is assumed that the majority of the revenues comes from fare box collections. The fare rates vary depending on the length of the trip. Elderly and disabled pay the normal rate while children pay half of the normal rate. It is estimated that 100 patrons, serviced per day fares are paid by social service programs such as Medicaid.

SEAT system contracts services to:

- Human Development Resource System
- Department of Human Services
- Senior Centers

Expenses are averaged as follows:

maintenance = $240,000
wages = $300,000
other expenses = $160,000

The total number of people working for the transit system is 42. Full time employees work 40 hours per week @ $7.50/hr and part-time employees work 16 hours per week @ $5.00 / hr.