RURAL TRANSIT AND MOBILITY RESEARCH AGENDA

By

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INTRODUCTION

North Dakota's transportation network is an important aspect for the economic vitality of the state. The network allows and enhances the movement of people and goods to desired destinations. The focal point of this paper is to provide a research and service plan that will benefit North Dakota's rural elderly and handicapped residents. A description of trends impacting rural communities and a research agenda that will work with these trends are presented in this paper.

The Upper Great Plains Transportation Institute (UGPTI) has played a key role in research, service, and problem solving for North Dakota's transportation issues since 1967. The movement of agricultural goods is important for the economic vitality of North Dakota but the movement of North Dakota citizens is also important for economic and social stability.

Justification

Rural passenger transportation is an important part of rural life for many. Some rural residents rely on public transportation for access to basic services, such as medical appointments, grocery shopping, and recreational activities. Furthermore, many rural residents depend on public transportation for mobility.[1]

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[1]Access is identified with necessities, while mobility is associated with increasing quality of life. Access is necessary for satisfying 'basic needs' such as medical appointments, grocery shopping, and organized activities. Mobility improvements enable transit dependent individuals to socialize and increase recreational activities.

In 1988, more than one fourth of all public transportation demand was generated in rural areas.[2]

Several trends support the premise of an increased need for rural transit research. These trends include migration of young rural residents to urban areas, aging of the rural population, deterioration of rural roads, and the federal government's goal of increased transit efficiency.

Organization

Trends impacting rural transit services is the first section of this report. Next, the research agenda is presented. Five categories of researchable topics are expressed within this section. In the final section, the research and service agenda is summarized.

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[2]Wallin, Theodore O. "Volunteer/Based Rural Transportation Alternatives," *Specialized Transportation Planning and Practices*. Vol. 2. Gordon and Breach, Science Publishers, Inc. 1988, p. 27.

TRENDS IMPACTING TRANSPORTATION SERVICES

Demographic trends and changes in government philosophy are impacting transportation requirements and services available in rural areas.

Demographic Trends

The demographic trend in the United States is important to the future of rural transit. Due to advances in medicine and a declining birth rate, the United States population is aging considerably. While those above age 60 accounted for about 13 percent of the population in 1960, they are expected make up nearly 25 percent of the population by the year 2020 (Figure 1).

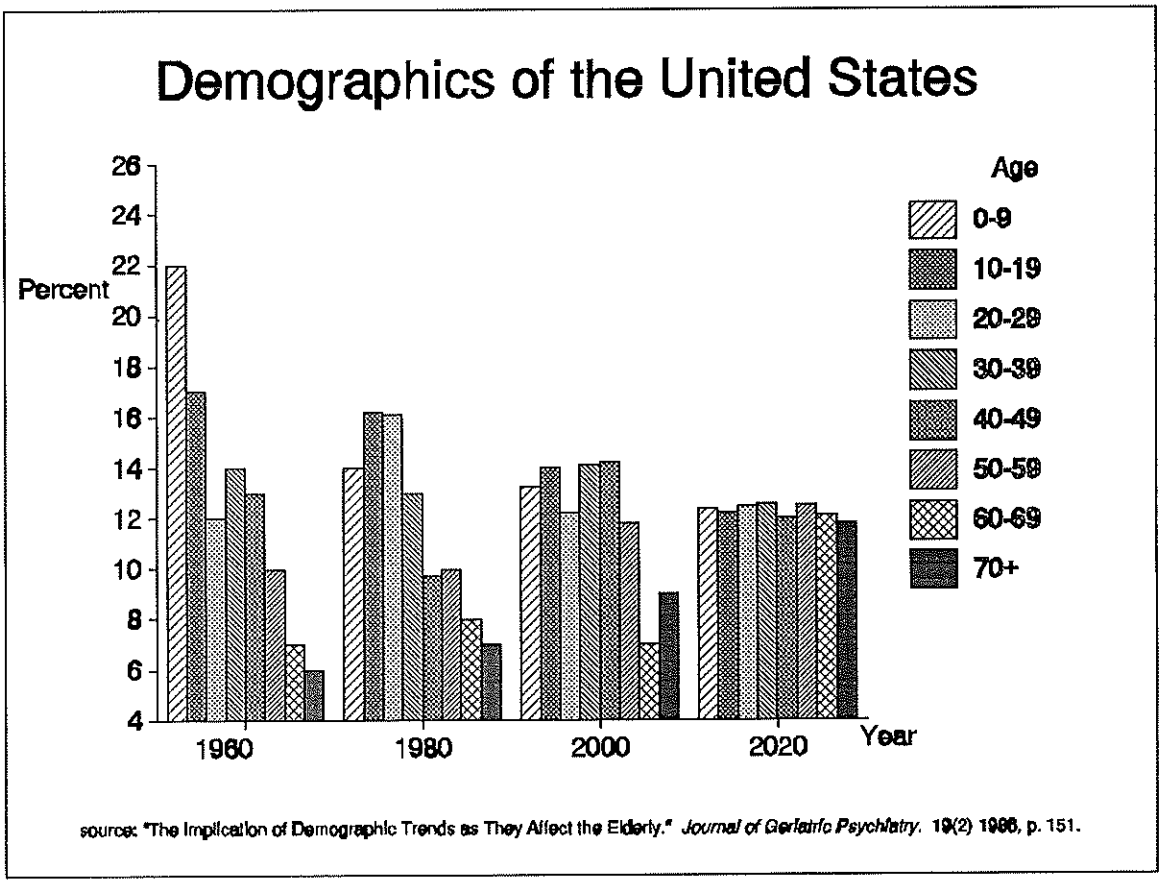

Figure 1

In rural areas this trend is even stronger, partially because of the outmigration of young rural residents. Figure 2 shows that the rural population has aged considerably in relation to the urban population. It seems likely this trend will continue as long as economies in rural areas are unable to provide incentives that attract younger generations.

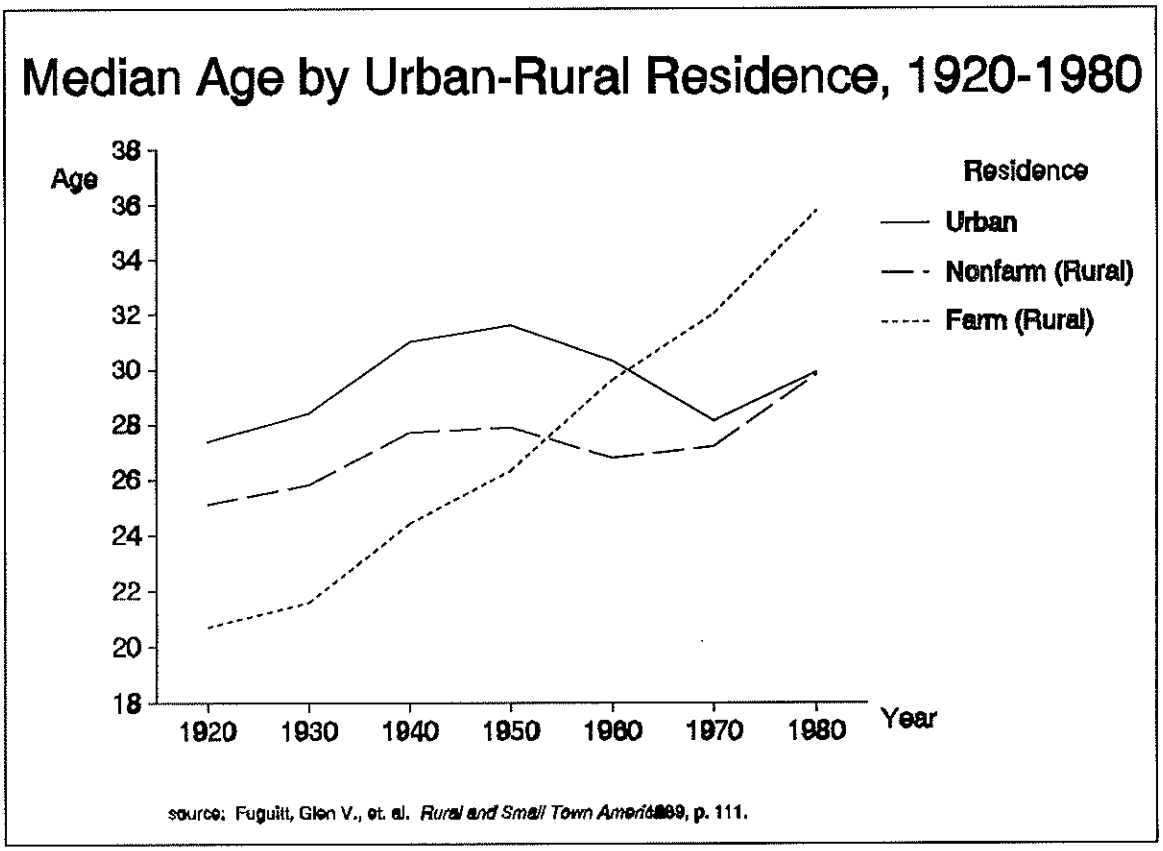

Figure 2

This suggests that the nation's dependence on public transportation (particularly in rural areas) for basic mobility and access to services will continue to increase. This increasing dependence on public transit is expected, since personal mobility becomes more limited with age. A 1981 survey showed that 14

percent of the nation's population, who were 65 years and older, indicated that "getting transportation to stores, doctors, places of recreation, and so forth" was "a very serious problem" for them.[3] The 1980 census data show that mobility decreases dramatically with age.[4] Thus, the importance of rural and specialized transit is expected to expand in the future as the median age of the rural population increases.

A related trend that will influence the future of rural transit is migration. Part of the reason the rural population has been aging is the outmigration of young residents from rural areas. Due to decreased job opportunities and the erosion of the family farm, young rural residents have been migrating and continue to migrate to urban areas. Figure 3 shows that non-metropolitan population declined from 33 to 23 percent of the nation's total population between 1960 and 1990.

Outmigration, primarily of the younger population, affects rural mobility in two ways. First, outmigration decreases population density in rural areas, reducing the tax base. This declining tax base will lead to increasingly limited funding for transit in rural areas. Another implication of this outmigration is that fewer younger family members will be available to provide transportation for

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[3]Lowy, Louis. "Implications of Demographic Trends as They Affect the Elderly," *Journal of Geriatric Psychiatry*. Boston University, Boston, Massachusetts. Vol. 19(2). 1986, pp. 149-174.

[4]Logue, Barbara. "Public Transportation Disability and the Elderly: An Assessment Based on 1980 Census Data," *Population Research and Policy and Review*. Martinus Nijhoff Publishers, Netherlands. Vol. 6, pp. 177-193.

aging family members. Thus, the importance of rural transit efficiency will increase significantly in the future as a result of this outmigration.

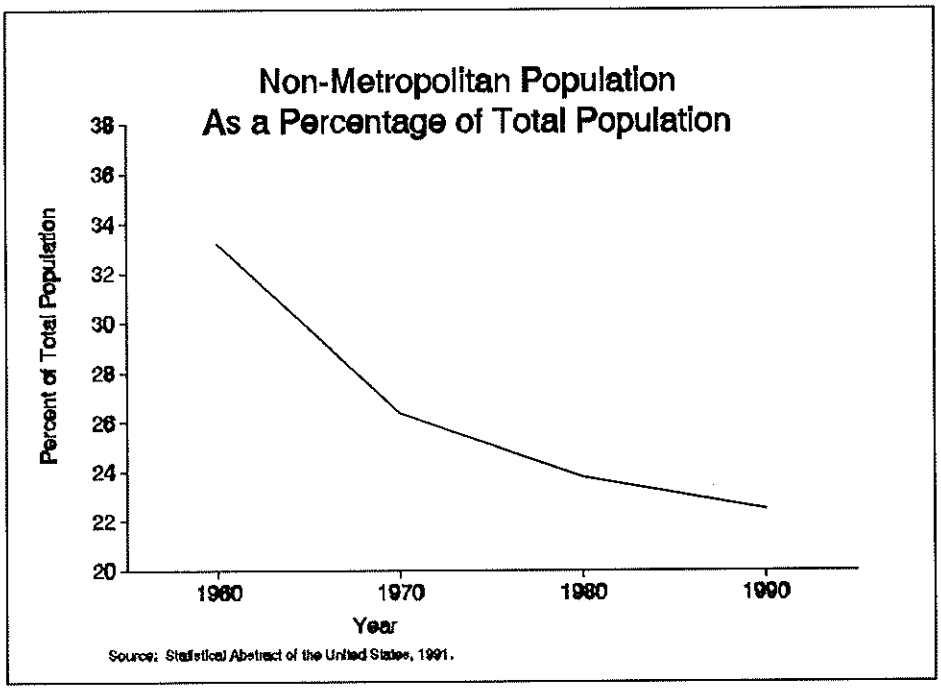

Figure 3

Change in Federal Government Philosophy

A change in federal government focus will present challenges for the future of rural transit. The new national transportation policy mentions several points of emphasis which differ greatly from past policy and provide the potential for radical change in the future. These points of emphasis include: (1) A reduction in transit's dependence on the Federal General Fund, and an increased focus on user-based financing; (2) Increased attention to the efficiency of transit systems, and application of cost- effectiveness standards to transit that receives federal assistance; (3) Increased reliance on the states in the funding of transit; (4)

Increased concentration on enhancing mobility in rural areas; (5) Increased flexibility in the use of federal funds; (6) Coordination of transit programs between agencies (to eliminate duplication) and with other modes such as airports, highways, and intercity rail service (to improve intermodal connections); (7) Encouragement of private participation in transit and coordinated efforts with private business and community groups. In order to meet these policy objectives, rural transit systems will have to provide more services with less resources in the future.

RURAL TRANSIT RESEARCH AND SERVICE AGENDA

Until recently, public access and mobility in rural areas was virtually ignored by researchers in the transportation sector. Several case studies of rural transit systems were sponsored by the Urban Mass Transit Administration. However, the majority of research funding went into urban transit in the past. In recent years, the federal government has recognized the importance of rural transit and is attempting to enhance the environment for rural transit operations.

In 1986, the Rural Transit Assistance Program (RTAP) was created by Congress.[5] State and national RTAP programs coordinate efforts to provide training, technical assistance, research, and support to rural transit providers nationwide. The emphasis of RTAP is to collect information from secondary sources. Only a small portion of RTAP funding is allocated to research.[6]

While RTAP has greatly improved the accessibility of information pertinent to rural transit, it has done little to satisfy the growing need for transit research specific to rural transit interests. Several recent trends support the premise of an increased need for rural transit research. These trends include migration of young

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[5]American Public Works Association. *National Trends in the Urban Mass Transportation Administration's State Rural Transit Assistance Programs: The Benchmark Report.* prepared under a cooperative agreement with U.S. Department of Transportation, Urban Mass Transportation Administration, 1989.

[6]Only 5 percent of the funding for the state program went towards research in 1989. Similarly, a small portion of the funding for the national program went towards research in 1989. UMTA, RTAP.

rural residents to urban areas, aging of the rural population, deterioration of rural roads, and the federal government's goal of increased transit efficiency.

Five categories of research provide a basis for possible research topics. They are Transit safety, evaluation, efficiency, policy, and technology (Figure 4).

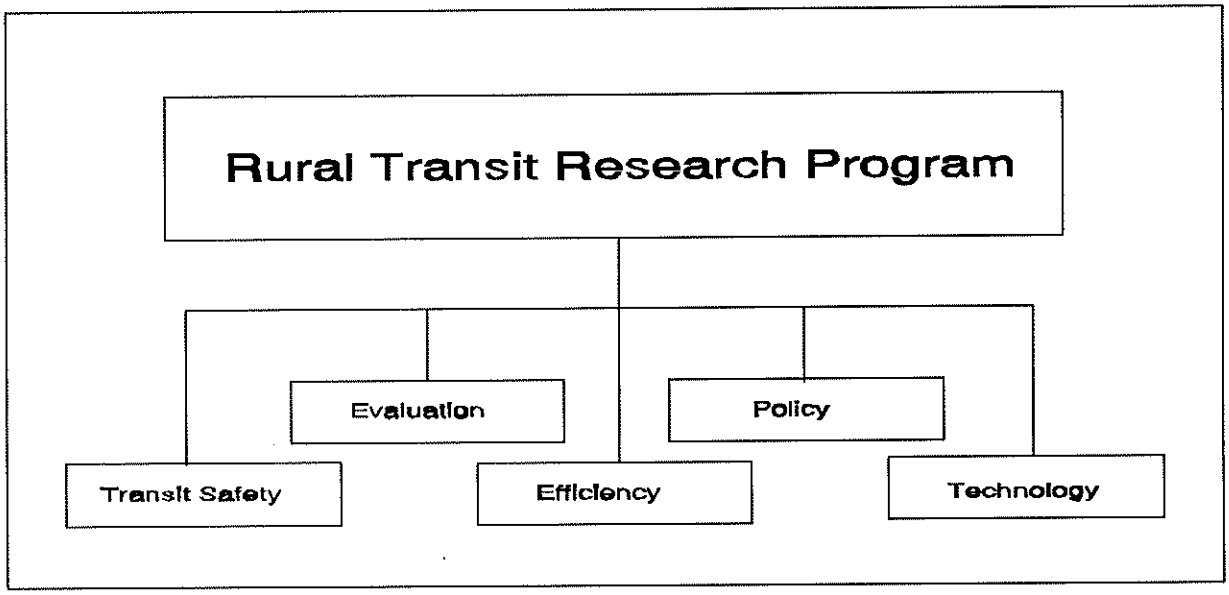

Figure 4

Safety

The federal government has stated that its top priority in transportation is safety.[7] With the changing environment in rural transit and the introduction of new technologies, safety research must represent a significant portion of future rural transit research.

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[7]U.S. Department of Transportation. *Moving America - New Directions, New Opportunities: A Statement of National Transportation Policy Strategies for Action.* U.S. Department of Transportation, Washington, D.C. February, 1990, p. 81.

One safety research issue stems from the federal government's commitment to using alternative fuels. New fuels must be tested to ensure they will not endanger humans, in the case of a possible fuel leak or in the case of regular emissions. Also, the new vehicles which use these fuels must be tested for their safety and reliability. Safety considerations must be the foremost factors in the decisions regarding the use of alternative fuels.

Another research topic in this area is the training of rural transit operators in the use of handicapped accessibility devices.[8] Because of the Americans with Disabilities Act (ADA) and the growing number of elderly and handicapped persons, there will be an increase in the elderly and handicapped ridership base. Consequently, there will be more rural transit operators using handicapped accessibility devices. If transit operators are not properly trained in the use and maintenance of these devices, transit safety will decline.

In addition, a safety reporting system would be beneficial for rural transit. Currently, the Federal Transit Administration (FTA), researchers, and others have little knowledge of the safety problems encountered by rural transit providers, as no safety problems need to be reported. In order to improve rural transit safety, an awareness of these problems should be obtained. Research into the formulation of a reporting system which includes data on accidents and safety concerns would be beneficial.

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[8]While some training programs in this area have been created by RTAP, a further need exists as more accessibility devices are being developed, and many more will have to be developed as a result of the ADA.

There are also many other safety issues in rural transit. The *Transportation and Traffic Engineering Handbook* identifies three types of accidents that occur on transit systems. These three types are: (1) Vehicle collision accidents, (2) On-board passenger accidents, and (3) Non-vehicle station accidents. Possible research in vehicle collision accidents might focus on the implications of driver drug testing, vehicle safety design, or the length of hours that drivers are operating vehicles. Research in on-board passenger accidents might focus on aspects of the vehicle design such as entry ramps, door operation mechanisms, and seating. Finally, research on non-vehicle station safety might focus on aspects of the waiting station such as traffic at the location and size of the waiting area.

Evaluation

Because of increased federal budget problems, and increased operating costs of transit systems, the federal government has become interested in efficiency and effectiveness evaluation in recent years. As the use of efficiency and effectiveness measures are expanded, more research will be needed in improving evaluation measures and in increasing the uses of evaluation.

One possible research topic emanates from the need for evaluation data for rural transit systems. Section 15 of the Urban Mass Transportation Act of 1964 requires transit systems requesting urban formula grants (Section 9) to comply with a data reporting system. The data requirements for this system are fairly comprehensive, and all data are compiled in an annual report. The data obtained

under this system provide an effective means for government evaluation, or in-house evaluation. However, no such system exists for rural transit systems. In fact, a previous study suggests that many rural transit systems do not even collect the data needed for in-house evaluation.[9] Data needs for evaluating rural transit systems may be quite different from those for evaluating urban transit systems. Thus, one possible area of research might include the data needs of rural transit systems and the formulation of a standardized reporting system (including safety data).

Another justification for research in this area is that most of the evaluation methodologies are geared toward urban transit. While some performance measures are available for rural transit evaluation, the development of additional measures that take into account the size and scope of rural transit is necessary. Using urban performance measures to evaluate rural transit systems may be meaningless. In addition, more evaluation studies in rural transit must be performed to set a baseline for performance of various sized rural transit systems. Evaluation of a specific rural transit system is relatively meaningless without a baseline or standards for comparison.

Research that aims at educating rural transit operators in evaluation methodology and in tailoring evaluation to their specific system is also necessary.

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[9]Bitzan, John D. and Denver D. Tolliver. *An Analysis of the Efficiency and Effectiveness of Selected Rural Transit Systems in the State of North Dakota.* UGPTI Publication No. 84. Upper Great Plains Transportation Institute, North Dakota State University, Fargo, 1990.

All those involved in rural transit must gain an increased understanding of performance evaluation. In order for transit managers, government, and outside observers to use performance evaluation to its fullest extent, the performance measures, comparison methodologies, and implications of these comparisons must be understood by all.

Efficiency

The quality of transit service and the efficiency with which it is provided will always be important aspects of public transit. The efficiency category aims at finding ways to improve the service of public transit, and to minimize the costs of providing such services. Some possible research topics aimed at improving the efficiency and effectiveness of rural transit are addressed in the remainder of this section.

One area of research in the efficiency category is the result of recent demographic trends. The Transit 2000 Task Force has pointed out some demographic trends which suggest that the demand for rural transit services will grow in the near future. They point out expected increases in the elderly and handicapped populations. The elderly population (65 and over) was 25.7 million in 1980, and is expected to grow to a level of 35.1 million by the year 2000, when it will equal 13.1 percent of the overall population. If present trends continue, the elderly population is expected to grow to nearly 65 million by 2030, when it will equal 21 percent of the population. Further, the very elderly population (75 and over) is expected grow by 50 percent between 1985 and 2000. According to the

Transit 2000 Task Force, the disabled population is also expected to grow faster than the population as a whole. Their fast growth is attributed to improved medical care, increases in auto accidents, and increased longevity. As a result, research is needed in improving transit service efficiency and effectiveness for the elderly and handicapped.

Another research topic deals with the costs associated with transporting rural residents to schools. The costs of transporting students to schools is high in rural areas, and a larger percentage of the education budget is typically spent on transportation in rural areas than in urban areas.[10] The higher costs of transporting rural students mean that less money is spent on facilities and teachers, thereby affecting the quality of education in rural areas. Alternatives for reducing the costs of rural school transportation are needed. A possibility includes using school buses for public or specialized transportation when they are not in use for transporting students. Rural school buses are typically idle for long periods of time, as students are only transported to and from school. Research is needed in finding ways to reduce the costs of transportation for education in rural areas.

A third area of research in the efficiency area is in the area of coordinating transportation services between various agencies. In many rural areas, several different human service agencies, elderly homes, and other interests provide

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[10]Parks, Gail A., Peggy J. Ross, and Anne E. Just. "Education," *Rural Society in the U.S.: Issues for the 1980s*, ed. by Don A. Dillman and Daryl J. Hobbs, Boulder, CO: Westview Press. 1982, p. 191.

somewhat duplicative services. Many researchers believe that there are substantial potential cost savings from coordinating these services. More research is needed to quantify the benefits from such coordination, and to identify and eliminate the barriers to it. While a great deal of research has focussed on coordination between agencies, and FTA and Health and Human Services (HHS) have formed a coordinating council, the continued existence of a problem in this area suggests further research is necessary.

A fourth research area stems from psychological barriers to rural transit. Ira Kaye (1977)[11] suggests that psychological barriers to public transit exist in many rural areas. When an attempt to introduce public transit in these areas is made, resistance is often encountered. This resistance is seen in the form of a reluctance of the elderly to ride with the young, a reluctance of the well to ride with the ill, and a reluctance of the affluent to ride with the poor, or vice versa in any case. This hypothesized resistance may account for the limited success in generating ridership in many rural communities. Research in identifying and overcoming possible attitudinal barriers to rural people using public transit is needed.

Another research area is a result of the need for rural connections. Prior to deregulation, intercity passenger carriers were required to continue service to rural areas, where costs often exceeded revenues. However, these carriers had

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[11]Kaye, Ira. "Transportation," *Rural Society in the U.S.: Issues for the 1980s*, ed. Don A. Dillman and Daryl J. Hobbs, Boulder, CO: Westview Press. 1982, p. 156.

protection from competition for profitable routes. Thus, intercity carriers used profitable routes to subsidize unprofitable rural routes. The Bus Regulatory Reform Act (BRRA) of 1982 was an attempt to promote competition in the transit industry. Intercity carriers were no longer required to serve unprofitable routes, and were no longer protected from competition on profitable routes. Intercity carriers dropped service to several rural communities following the passage of this act, leaving many rural residents with no alternatives to the automobile for intercity travel.[12] Many rural residents who did not have access to an automobile, did not have a driver's license, or were unable to drive because of some physical or mental limitation could no longer travel to distant cities.

Greyhound's rural connection program is one program aimed at improving the intercity mobility of rural residents. However, the success of this program has been very limited to date. Thus, more research in intramodal and intermodal coordination is needed to enhance the mobility of rural residents. The long distances between rural cities and major metropolitan areas in many states necessitate greater coordination between rural transit and other travel modes (including air, rail, and intercity bus services). Lack of coordination often causes travelers from rural communities to incur excess costs in time and money. Research aimed at a feasible coordination of rural transit with these other modes

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[12]Fravel, Frederic D., Elisabeth R. Hayes, and Kenneth I. Hosen. *Intercity Bus Feeder Project Program Analysis*, prepared for Community Transportation Association of America and funded by Urban Mass Transportation Administration, U.S. Department of Transportation, Washington, DC, 1990.

and within the transit mode, and at estimating the demand for such coordination is needed.

Labor productivity is also an important topic in both rural and urban transit. There are several transit operating policies that affect the productivity and attitude of its workers. Rural transit research is needed in this area to examine what kinds of factors influence the job satisfaction of transit operators, and how this satisfaction affects performance. In addition, research is needed in alternate driver scheduling to minimize excess capacity while maximizing reliable service. Since alternate driver wages comprise such a large portion of rural transit costs, they are especially important in rural transit.

Research in reducing operating deficits will be very important for the future of rural transit. In recent years, rural transit costs have increased greatly, while passenger revenues have not.[13] Because of the federal government's goals of reducing transit's dependence on the Federal General Fund and increasing the funding responsibility of the states, future survival of many rural transit systems will depend on cost reductions and/or increased passenger funding. Strategies such as user-side subsidies, which pay transit providers a subsidy amount for each trip provided to the transit dependent rather than paying a lump sum subsidy to a provider for maintaining a specified fare and service level, have been shown to reduce operating assistance supplied by government. This has occurred because

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[13]*Transit Planning for Small and Medium Sized Areas.* Education Extension Course, Georgia Institute of Technology, Atlanta, Georgia, May 9-10, 1991.

only those who are most in need are subsidized, rather than all transit users. New strategies such as this should be researched and tested on rural transit systems. Furthermore, research estimating the price elasticities of demand for transit of different groups, as well as research in distance-based pricing is needed. Knowledge of price elasticities of different groups will allow rural operators to maximize passenger revenues through differential pricing, and distance-based pricing may also increase revenues. Because the elderly and handicapped form a large segment of the rural population, a specific focus on how price changes would affect them is needed. New financing methods for rural transit, such as these, will become necessary in the near future, to assure the viability of many systems. Research aimed at cost reduction for rural transit systems is also needed. This research should focus on internal and external factors that could be altered to reduce costs.

Finally, research in reducing the insurance costs of rural transit will be important for the future viability of rural transit. The rising costs of liability insurance for rural transit operators have become a great concern in recent years. Between 1983 and 1986 the cost of liability insurance for commercial vehicles rose 121 percent in the United States. This occurred as the cost of liability insurance for private vehicles rose only 40 percent.[14] Mazaheri (1988) attributes the increase in liability insurance rates to two factors: (1) an increasing number of

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[14]Mazaheri, Mort L. *Transit Insurance Options and Alternatives for North Dakota*. College of Engineering and Architecture, North Dakota State University, Fargo, 1988.

claims, and (2) declining interest rates. Many rural and specialized transit systems are finding it more difficult to pay for increased liability insurance costs, because financial resources are limited. Further, many of these systems incur higher rates than other systems, and several have difficulty obtaining liability insurance since these systems are perceived by insurance providers to carry higher risks. These systems have more medical claims, greater frailty of passengers, and less training and safety programs. Several states have attempted to reduce liability insurance costs of transit systems by forming pooled insurance programs. However, the results of such programs have been mixed. More alternatives to the rising costs of conventional liability insurance are needed.

Policy

Several research topics are also present in the policy category of rural transit. These topics examine present policy and discuss possible revisions to present policy, the consequences of proposed policy changes, and policies which may improve rural transit efficiency, effectiveness, and safety. The following examples represent some possible research topics in this area.

One recent policy proposal which would have a significant effect on rural transportation places restrictions on elderly drivers. Although a larger percentage of the elderly are expected to own driver's licenses in the future, somewhat offsetting the increased need for transit due to demographic trends, recent discussions have focussed on the possibility of placing restrictions on elderly drivers. These discussions have resulted from increased accident incidence

involving the elderly. However, the costs of such a decision must be weighed against the benefits. The costs associated with increasing the transit dependence of the elderly may outweigh the benefits associated with increased safety.

Another policy affecting rural public transit is the recently passed Americans with Disabilities Act (ADA). The Americans with Disabilities Act imposes several rules on transit systems in order to make them more sensitive to the transportation needs of the disabled. It does not allow discrimination against an individual with a disability in connection with the provision of transportation service for the general public. Several provisions are made to assure this, including: (1) a rule prohibiting extra charges for providing services for the handicapped such as wheelchair lifts, (2) a rule making training of employees in operating handicapped-accessible equipment and in dealing with the handicapped mandatory, (3) a rule stating that all transportation vehicles purchased for fixed route services must be handicapped accessible in the future, (4) a rule stating that demand responsive services may purchase non-accessible vehicles only if the system in its entirety provides equal service to the disabled, (5) a rule stating that a public agency may not diminish its percentage of handicapped-accessible vehicles used in transportation service when adding an extra route through contract with a private agency, (6) a rule stating that private agencies contracting with public agencies are bound by the same rules, (7) a rule imposing the same vehicle acquirement regulations on private agencies acting without contract to the public with the exception that if the system viewed in its entirety provides

equivalent service for handicapped riders as it does for other riders, (8) a rule stating that alterations or additions to transportation facilities must (with some exceptions) include making the facilities handicapped accessible, and (9) a rule stating that paratransit must be provided as a complement to fixed route service for those unable to use the fixed route service, even when the fixed route service has handicapped accessible vehicles.

These regulations are not likely to have the great impact on rural transit that they will on urban transit for two main reasons. First, most rural transit systems are demand responsive systems. Fixed route systems are not feasible in rural areas in most cases. This fact reduces the impact of this act, since these systems will not have to make all future bus purchases handicapped accessible. Second, the main customers served by many rural transit systems are currently the elderly and handicapped. Thus, most rural transit systems already have several handicapped-accessible vehicles in place, and most have a program for serving this population which is comparable to the service provided to non-handicapped population. Also, most of these systems have trained personnel who are well versed in operating the handicapped-accessible equipment and in dealing with the handicapped.

However, the ADA will affect rural transit, especially in communities where the transit system does not have handicapped-accessible vehicles. This act will assure equal access to rural transit by the handicapped in these areas. Thus, the mobility and access of these groups will be enhanced. In addition, this act defines

access for the disabled to include vehicles with special features for the hearing impaired, the blind, and the mentally ill. These features will improve access in rural areas for these groups which have traditionally been neglected in vehicle accessibility design (i.e. most handicapped accessible vehicles only provide access for wheelchairs).

In addition to the improvements in mobility realized by the rural handicapped population as a result of this act, transit costs are likely to increase for many rural systems. Thus, the federal government must take this into account when evaluating the efficiency of systems. The introduction of the ADA at the same time that the federal government is taking a renewed interest in cost efficiency suggests that the federal government's goals for rural transit should be stated more clearly. Efficiency evaluation measures used by the federal government should reflect the goals that the Federal Transit Administration (FTA) sets for rural transit. More research on the impacts of the ADA, and appropriate evaluation by the federal government is needed.

A third policy issue involves the federal government's interest in the involvement of the private sector in transit. Past trends have suggested that private sector involvement in transit may be most feasible in rural areas. More research is needed to find an environment where private sector involvement in transit is most likely to succeed, and to determine to what degree the private sector should be involved in rural transit.

The federal government has also shown an interest in using efficiency measures in order to determine the amount of federal assistance to give to transit. In the event that a data reporting schedule is formulated for rural transit systems, the consequences of using this data in deciding funding should be studied. Research is needed to examine how this policy would affect transit, and to formulate an evaluation system that is consistent with the goals of rural transit.

Another important policy issue relates to the federal government's disadvantaged business enterprise program (DBE). This program, as amended in 1987, requires transit projects and transit vehicle manufacturers who meet certain threshold requirements to designate that a minimum of 10 percent of appropriations will be spent with disadvantaged business enterprises. DBEs are defined as minority, women-owned, and other disadvantaged firms. The government's goal with this program is to allow disadvantaged firms to develop into strong economic entities in the transportation marketplace. However, this program may conflict with the federal government's goal of maximizing transit efficiency in some cases. It is possible that a strong efficiency evaluation effort and the provision of funding levels based on efficiency by the federal government could achieve both goals. This is because transit firms would lose funding by discriminating under such a system (i.e., if the lowest cost supplier is a minority owned firm, and the transit firm chooses to discriminate, his efficiency level will suffer, and, therefore, he will lose federal government funding). Thus,

disadvantaged suppliers may no longer be at a disadvantage in supplying the transit industry, and the efficiency of the transit industry may improve under such a system. More research in this area is needed in order to determine the best policy for achieving the goals of allowing disadvantaged firms to compete and to maximize transit efficiency in doing so.

Criteria for distributing the costs of regional transit systems among the towns within the region is another important research area. Collura et al.[15] suggest that the variety of procedures used can be evaluated with respect to two criteria: 1) the ease and cost of use, and 2) the equity of the results. More study on the effects of the allocation of regional transit costs among towns may prove beneficial.

Another important issue in public transportation involves the criteria used at the state or federal level in distributing transit assistance. Forkenbrock[16] lists five criteria which may be used by states in allocating the funding between transit projects:

1) efficiency maximization, 2) uniform service quality, 3) equal funding for similar sized areas, 4) meeting the needs of the transportation disadvantaged, and 5)

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[15]Collura, John, James W. Male, and Ayodele Mobolurin. "Examination of Regional Transit Cost Allocation Among Towns: Five Case Studies." *Transportation Research Record,* No. 813, Transportation Research Board, National Research Council, Washington, D.C., 1981.

[16]Forkenbrock, David J. "Transit Performance Measures and Local Objectives: State-Level Policy Considerations (Abridgement)." *Transportation Research Record,* No. 813, Transportation Research Board, National Research Council, Washington, D.C., 1981.

responsiveness to local preferences. Forkenbrock suggests that the best method of allocation involves a mix of efficiency maximization and responsiveness to local preferences. More research into the methods of allocation of funding at the federal and state level could benefit rural transit.

With increasing reliance on funding from state and local sources in the future, the issue arises of how different funding sources would affect different income groups, that is who bears the burden of the tax? Rock[17] uses U.S. Labor Statistics data to analyze the incidence of several types of taxes at the local level. He finds household taxes, cigarette taxes, and increased transit fares to be regressive, while finding income taxes, parking taxes, and stock transfer taxes to be progressive. He suggests that decreased federal funding will lead to more regressive taxes for the continuation of transit services. However, more research is needed in this area, as Rock only looked at the incidence of the tax (ability to pay approach) and not the benefits in relation to the costs (the benefit principle). Also, he only looked at consumer taxes, while ignoring taxes on industry.

Other questions related to the increased reliance on funding from state and local sources are as follows: Should transit subsidies come from non-transportation users? Should transit funding take into account social considerations (e.g. taxes on cigarettes and alcohol)? Is the distribution of funding between roads and transit an equitable distribution? Are rural areas and cities

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[17]Rock, Steven M. "New Funding Sources For Public Transit: Who Pays?" *Transportation Research Record*, No. 900, Transportation Research Board, National Research Council, Washington, D.C., 1983.

being treated equally as far as transit benefits and costs are concerned? What funding sources are politically acceptable and substantial enough to offer short-term or long-term assistance? Answers to these questions are important to the future of rural transit funding.

Finally, the effect of transit investment on rural economic development is another important policy question. Watterson[18] argues that, while the economic development impacts of a transit project are most often not the primary concern when evaluating transit investment, they still should be clear and known. Watterson attempts to improve the methodology for measuring the economic impacts of a transit investment. The economic and development impacts of transit investment should be included in transit investment decisions. More research on the effects of transit investment on economic development is needed.

Technology

There are several problems facing rural transit that can only be solved through technological solutions. Technology research will increase as the demands placed on rural transit grow. The following are some possible research topics in the technology category of research.

Several rural transit systems have provided wheelchair-accessible vehicles on their routes in the past. However, few (if any) have provided special services

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[18]Watterson, W.T. "Estimating Economic and Development Impacts of Transit Investments." *Transportation Research Record*, No. 1046, Transportation Research Board, National Research Council, Washington, D.C., 1985.

for the hearing impaired and sight impaired. The hearing impaired and sight impaired miss connections, experience long delays, and encounter increased risk in emergencies due to the lack of special services to accommodate them. Furthermore, the ADA will require specialized services for these groups. Thus, technology research is needed to find ways to accommodate these groups in rural transit. This research might consist of merely adapting the several current technologies which exist in serving the hearing impaired and sight impaired to rural transit, or it may involve developing new technologies. However, this technology research must aim at providing these services at costs that are feasible for small rural transit systems.

Another research topic stems from the passage of Clean Air Act Amendments in 1990 and the proposed National Energy Strategy (NES) by the President. The goal of these policies is to reduce vehicle exhaust emissions and reduce the U.S. dependence on foreign oil. The Clean Air Act Amendments impose tighter emission standards, while the NES requires the conversion of buses to alternative fuels in urban areas. While these standards currently apply to urban transit only, it is likely that the standards may be imposed in rural areas in the future. Research in finding new alternative fuels, as well as feasible ways to use these fuels is necessary. FTA's Clean Air Program (CAP) provides for research in estimating the capital and operating impacts of such a conversion, and provides some technical assistance for this transition. However, research which finds

alternative fuels is not provided for in this program. The benefits of such research are likely to be great.

Other research issues in the technology area include adapting Intelligent Vehicle Highway Systems (IVHS) technology to rural transit, developing computerized maintenance and routing systems, and adapting vehicle diagnostic equipment for use on transit vehicles. These developments could improve the efficiency of routing, planning, management, fare collection, and maintenance.

Finally, while many new technologies may prove beneficial to rural transit, research aimed at reducing the costs of existing technologies is also greatly needed. The most prevalent problem with adapting technologies to rural transit is the costs. While efficiencies may justify the costs of technologies for large transit systems, most rural transit systems are small enough that use of these technologies could not be justified without a reduction in costs.

CONCLUSION

These five research categories have been defined to encompass the transportation concerns and interests of North Dakota's rural elderly and handicapped citizens. A brief discussion of each provides an overview of specific research topics. As demographic trends in rural areas continue and government philosophies change regarding transit and mobility, research will need to be conducted on a continual basis to improve efficiency and guarantee service to rural communities.

UGPTI is a member of the Mountains-Plains Consortium (MPC). MPC members include North Dakota, South Dakota, Montana, Wyoming, Colorado, and Utah. These states work cooperatively to compose research projects concerned with rural and non-metropolitan transportation. The goal of this cooperative effort is to enhance the ability of our organization to serve the interests of rural citizens as well as the users and suppliers of agricultural transportation.

The Upper Great Plains Transportation Institute (UGPTI) will continue to serve the interests of North Dakota's rural communities through timely research. UGPTI also provides transportation information upon request, collects and interprets grain and oilseed movement data, and distributes a transportation newsletter.