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Rural Transportation

AN ANNOTATED BIBLIOGRAPHY

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Rural Transportation:

An Annotated Bibliography

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Contents

Introduction 1

Rural Transportation: Availability, Demand, and Condition
- A. Roads and Bridges 7
- B. Railroads/Rail Network 11
- C. Air and Water Transportation 13
- D. General Transportation (All Modes) 15

Transportation and Rural Development
- A. Roads and Bridges 18
- B. Rail Service 22
- C. Airports 24
- D. Passenger Transportation 26
- E. General Studies on Infrastructure. 28

Federal and Local Governmental Issues
- A. Financing/Funding 32
- B. Planning and Management. 38
- C. Regulatory Issues 43

Other Issues
- A. Social Services Transportation 44
- B. Safety 48
- C. Environmental Issues. 50

Additional Resources 51

Other Studies
- A. Rural Transportation: Availability, Demand, and Condition 53
- B. Transportation and Rural Development 56
- C. Federal and Local Governmental Issues 57
- D. Other Issues 59
- E. Additional Resources 61

Index 62

Introduction

Transportation serves an important role in rural America. By offering mobility and access for rural residents to jobs and services and enhancing the movement of agricultural products, transportation functions as an essential cornerstone of rural development (Rubel, 1990). However, evidence suggests that the transportation network in nonmetro America has fallen into a state of disrepair in many areas (U.S. Department of Agriculture, 1991). Not only are portions of the physical infrastructure in need of overhaul, but the system requires many technological changes to be brought up-to-date.

The literature on rural transportation is wide-ranging. Much attention is given to the status and condition of roads and bridges, with a major theme being the inadequate condition of the infrastructure. According to the U.S. Department of Transportation (1994), nearly 40 percent of the Nation's 3.2 million miles of rural roads, out of a total National network of 3.9 million highway miles, are inadequate for current travel patterns. The U.S. Department of Agriculture (1991) reports that over 40 percent of the Nation's 470,000 bridges (those that are at least 20 feet in length) are either structurally or functionally deficient. At the local level, according to Walzer and Deller (1996a), nearly one half of the roads (by mileage) maintained by counties, towns, and townships in rural areas are considered less than adequate under normal maintenance procedures.

Rural rail abandonment is another issue given attention in the rural transportation literature. This topic is generally examined in terms of rural development, with an emphasis on ways in which communities can prevent abandonments. For example, Babcock, Prater, Morrill, and Russell

(1993) examine a popular alternative to rural rail abandonment, short line railroads, and identify factors that determine their success and failure. A good resource for communities facing abandonment is the study by Batson and Norton (1988) that looks at the rail abandonment process.

Much less has been written about rural air and water transportation. Bayer, Mitenko, and O'Hara (1994) examine rural intrastate air service, with the purpose of gaining a better understanding of when it makes economic sense to use air transportation compared to ground-based transportation. Fruin and Halbach (1995) look at the importance of rural water transportation, specifically, barge transportation, with an emphasis on various implications for agriculture.

Another area of the literature deals with rural development. In general, studies focusing on transportation's impact on rural communities can be divided into those dealing with freight issues and those dealing with the transportation of passengers (intercity passenger rail service, intercity bus service, and public transportation). A good example of a freight-oriented study is Russell and Babcock (1995), which looks at the public cost associated with rural rail abandonment in terms of its effects on farmers, shippers, and rural communities. Among those studies dealing with passenger transportation issues, such as Burkhardt, Hedrick, and McGavock (1998), common themes include inadequate funding (Isaacs, 1993), lack of coordination among providers (Bogren, 1991), and specific transportation modes, such as passenger rail, and their importance for rural residents (Brown, 1997b). Relatively few "rural development" studies deal with air transportation; those that do tend to focus on the developmental benefits of rural airports.

For example, Cooper (1990) finds that airports are important in attracting high-technology industries in rural areas.

A small number of studies deal with the general effects of infrastructure, with specific mention of transportation. An example is Crane and Leatham (1993), which examines the impact of transportation spending on rural development and concludes that transportation expenditures have a positive economic impact on nonfarm and farm incomes and on employment in rural areas. Munnell (1990) looks at the effects of State investments in infrastructure and concludes that those States with large investments experienced greater output, more private investment, and more employment growth.

Another category of studies focuses on what can be termed, "governmental involvement," at the Federal and local levels. This class of studies refers to a broad range of rural transportation concerns, including financing, planning and management, and regulatory issues. Many studies support the conclusion that local funding is inadequate for rural transportation. For example, Walzer and Deller (1996b) found that nearly 70 percent of local respondents in a county-based survey agreed that current funding is inadequate for maintaining the local road and bridge network. However, recent articles have noted the large transportation funding increases under the new Federal highway legislation, TEA-21 (the Transportation Equity Act for the 21st Century). According to Bogren and Zeilinger (1998), rural areas and rural transit agencies should directly benefit from large funding increases under TEA-21, which also encompasses a greater share of rural public transportation formula funds.

In terms of planning and management issues, Brown (1996b) notes that some of the difficulties associated with rural transportation planning stem from the fact that many nonmetro transportation projects serve scattered and isolated populations and have high per capita costs. Rural transportation planning, therefore, requires input at the local level, but until ISTEA (the Intermodal Surface Transportation Efficiency Act of 1991) Federal legislation had not required local participation in the planning process outside of metropolitan areas. The involvement of local rural officials should improve under TEA-21, which further strengthened provisions that require consultation between local officials and States in the State transportation planning process (Wohlbruck, 1998b).

A comprehensive treatment of regulatory issues during the 1980's is provided by Due, Allen, Kihl, and Crum (1990), which examines impacts resulting from changes following deregulation in the airline, trucking, bus, and rail industries. The authors develop several global, intermodal policies and strategies for maintaining adequate transportation service for both passengers and freight to small rural communities. Batson, Bearer, and Norton (1997) focus exclusively on the effects of deregulation in the rail industry in terms of the effects on rural communities. They conclude that while deregulation may have brought benefits, such as lower costs, to the rail industry, some rural businesses, including agriculture, have been negatively affected, at least in the short run.

A final section of this bibliography deals with a broad range of studies not easily classifiable into one of the previous categories. These include studies that look at such issues as social services

transportation, safety concerns, and various environmental issues.

Social services transportation studies deal with a broad range of mobility issues, focusing mainly on the use of public transportation by specific demographic groups, such as older Americans, women and children, and Native Americans. Kihl (1990) looks at the transportation needs of the rural elderly in southern Iowa and argues that public transportation serves a vital role in small communities, with few transportation alternatives existing for elderly transit users. A study by Moorehead and Holden (1996) examines various public transportation problems encountered by Native Americans, concluding that inadequate transit services negatively affect tribal economic development efforts.

Rural transportation safety studies generally agree that rural roads are, on average, more dangerous than urban roads, with the number and severity of accidents tending to be greater in rural areas. Wilson and French (1992) advocate the need for posting current road and travel conditions to prevent wintertime traffic accidents. Jernigan and Lynn (1991) argue that higher speeds associated with the 65-mph interstate highway speed limit in rural Virginia contributes to an increased number of traffic fatalities.

A common theme among environmental studies is the effect of environmental regulations, often referred to as "enhancements," on transportation programs. Some have argued that problems arise when environmental regulations have been too stringently applied, diverting limited resources away from the primary goal of providing transportation spending (Beachy and Eck,

1995). Others have been less concerned with specific environmental regulations, but have argued for improved standards in road building and maintenance activities to minimize negative environmental impacts (Alexander, 1992; Moll, 1993).

This annotated bibliography is intended to provide an overview of different aspects of transportation in rural America. Emphasis is on those studies published within the last 10 years, but some earlier citations are also included. Citations are organized into five categories. Studies dealing with the availability, demand, and condition of rural infrastructure are described first. Second, studies dealing with the importance of transportation for rural development are examined. Third, studies dealing with Federal and local governmental issues are identified, including financing, planning, and regulatory issues. Fourth, studies not fitting into one of the previous groupings, covering topics such as social services transportation, safety issues, and environmental concerns, are discussed. A fifth section highlights miscellaneous references, such as maps, atlases, and bibliographies. Finally, a non-annotated bibliography of additional studies on rural transportation is included.

Rural Transportation: Availability, Demand, and Condition

Studies that focus on the overall state of rural transportation deal with a variety of topics, including the demand for and condition of roads and bridges, railroad performance and abandonments, the quality of existing air and water infrastructure, and the importance of maintaining adequate public transportation services to meet the needs and demands of rural residents. A good example of this type of study is the report by Fruin and Baumel (1992), which looks at rural America's need for investments in transportation infrastructure and examines the deterioration of inland waterway systems as well as deficiencies in the rural rail infrastructure.

A. Roads and Bridges

Crane, Laurence M., Nat Pinnoi, and Stephen W. Fuller. 1994. "Estimating Demand for Public Rural Roads in Texas," *Review of Regional Studies* 24 (2), pp. 195-209.

> Estimates private demand functions, at the county level, for public rural roads in Texas. Identifies the effect of different income levels and tax rates on the expected demand for rural roads over time. Concludes that demand for roads has become more inelastic, while income had a moderating influence on demand for roads.

Daniels, Bob. 1991. *Modern Timber Bridges: An Alternative for Mississippi.* Mississippi State University, Cooperative Extension Service, publication no. 1783.

> Looks at the condition of rural bridges, with special emphasis on those that are structurally and functionally deficient. Identifies various advantages of modern timber bridges for Mississippi. Suggests that solving the problems associated with rural bridges will involve a combination of efforts by legislators, engineers, and local officials, in association with the research community.

Fruin, Jerry E., and Dan Halbach. 1993. "Does Minnesota Have Too Many Rural Roads?" *Minnesota Agricultural Economist* 673 (Summer), pp. 1-5.

> Discusses the need for the elimination of some rural roads due to technological changes in transportation, agriculture, and related industries. Addresses the issues of road improvement, bridge replacement versus abandonment, and the effects of intensive crop production on rural roads.

Gillis, William R., ed. 1989. *Profitability and Mobility in Rural America: Successful Approaches to Tackling Rural Transportation Problems.* University Park: Pennsylvania State University Press.

Provides an overview of emerging rural transportation issues and the educational challenges associated with those concerns. Addresses critical transportation problems faced by rural areas from the perspective of educational and technical assistance providers. Documents successful approaches that have been used by State and local government and various rural enterprises in dealing with rural transportation problems.

Hamlett, Cathy A., Sherry Brennan, and C. Phillip Baumel. 1989. "Local Rural Roads: A Policy Analysis," *Journal of the Transportation Research Forum* 30 (1), pp. 1-8.

Uses a traffic simulation model to investigate several policy options for the rural road system. Policies discussed include abandonment, conversion of low-volume roads to low-maintenance, returning public roads to private ownership, and reconstructing bridges. Suggests that optimal restructuring of the system will require multiple investment and disinvestment policies and will vary at both the interstate and intrastate levels.

Hough, Jill A., Ayman G. Smadi, and Gene Griffin. 1996. *An Assessment of Road User Needs in a Rural Environment.* Mountain-Plains Consortium Report No. 96-58. Fargo: North Dakota State University, Upper Great Plains Transportation Institute.

Addresses various differences in the perception of rural road needs among users and providers of transportation services. Concludes that differences in perceptions with regard to wintertime road maintenance issues suggest the need for better communication between user groups.

Lamberton, Charles E. 1992. *South Dakota's Rural Roads.* Economic Research Report 91-10. Brookings: South Dakota State University, Department of Economics.

Discusses the importance of transportation in providing access to agricultural areas. Outlines the general condition of South Dakota rural roads and bridges. Addresses issues involved in the financing of local roads and bridges, with special emphasis on the availability of fund sources.

Nice, David C. 1992. "Interstate and Intergovernmental Factors Affecting the Conditions of Rural Bridges," *Publius* 22 (Fall), pp. 1-13.

Examines the role of the Federal and local governments in financing and maintaining rural bridges. Indicates that the distribution of responsibility between local governments and the Federal Government affects the condition of the infrastructure. Finds that Federal involvement is associated with bridges that tend to be structurally and functionally adequate. Local financial responsibility is usually associated with bridges that have structural or functional problems.

U.S. Department of Agriculture, Agricultural Marketing Service. 1991 (April). *Transportation in Rural America: A Policy Backgrounder.*

Discusses key rural transportation policy issues, with specific mention of individual modes. Outlines the condition of the rural transportation network, identifies issues of concern to transportation providers and users, and details various policy options. Notes that the relative share of rehabilitation and replacement costs borne by the public sector versus the private sector remains a critical issue with regard to rural roads and bridges, as well as rail transportation. Concludes that public and private institutions need to develop a more integrated transportation system and that priorities for agriculture and rural America must be more firmly established.

Walzer, Norman, and David L. Chicoine. 1990 (September). *Rural Roads and Bridges: Where Do We Go from Here?* Washington, D.C.: U.S. Department of Agriculture, Office of Transportation.

Reviews the condition of rural roads and examines the status of local bridges as a means of better informing policymakers, practitioners, and the public about different aspects of rural road and bridge finance and administration. Analyzes costs to upgrade roads and bridges to acceptable standards for existing traffic. Considers trends in financing methods with special emphasis on reliance on Federal and State revenues. Summarizes State and local options for providing better maintenance of rural roads and bridges.

Walzer, Norman, and Steven C. Deller. 1996a (September). *Rural Roads and Bridges: Condition and Status of Roads.* Washington, D.C.: U.S. Department of Agriculture, Agricultural Marketing Service.

Examines the condition of roads maintained by local governments. Findings are based on mail questionnaire responses from county engineers and town/township road administrators throughout the Nation. Discusses changes in road surface type, road conditions, and the priorities of local road managers when managing the local transportation system. Concludes that obtaining adequate financing for roads and bridges will continue to be problematic due to the lagging economic base and decreasing populations of many rural areas.

Walzer, Norman, and Claudia McFadden. 1989. *Linking America: The County Highway System.* Washington, D.C.: National Association of Counties.

Presents an overview of the county highway system on a State-by-State basis. Surveys State highway agencies to better understand major issues affecting county and town roads and bridges. Stresses the importance of county highway and bridge finance, maintenance concerns, and the general condition of the infrastructure.

B. Railroads/Rail Network

Babcock, Michael W., Marvin Prater, John Morrill, and Eugene R. Russell. 1995. "Short-Line Railroads' Performance," *Transportation Quarterly* 49 (2), pp. 73-86.

> Examines factors that lead to the formation of short-line railroads. Notes that some short-lines can be operated profitably and are important for local rural and small community-based shippers, while many others remain unprofitable. May be of interest to both transportation policymakers engaged in evaluating the feasibility of State assistance for short-line railroads and to shippers evaluating different modes of transportation.

Babcock, Michael W., Eugene R. Russell, Marvin Prater, and John Morrill. 1993. "State Short Line Railroads and the Rural Economy." Report No. K-TRAN: KSU-92-2. Kansas State University, Department of Civil Engineering.

> Examines the issue of short line railroads in the context of rural rail abandonments. Identifies key factors that determine short line success or failure and develops a profile for a profitable short line railroad. Concludes that short line railroads may represent a viable transportation alternative for some rural areas, but stresses the long-term financial survivability of short line railroads is not assured.

Batson, John A., Martha A. Bearer, and Jerry D. Norton. 1997 (January). *Maintaining Local Rail Freight Service.* Washington, D.C.: U.S. Department of Agriculture, Agricultural Marketing Service.

> Provides rural communities with an overview of the rail abandonment process. Offers a detailed summary of how and why abandonments occur, and includes a discussion of how they can be prevented. Examines various alternatives to abandonment and provides additional sources of information and assistance for affected rural communities. Represents a valuable resource for rural communities facing rail abandonments.

Wolfe, K. Eric. 1989. "Financial and Demographic Conditions Associated With Local and Regional Railroad Service Failures," *Transportation Quarterly* 43 (1), pp. 3-28.

Seeks to determine which quantitative factors have been historically related to local and regional railroad success and failure. Examines the role of various financial and demographic ratios in assessing the viability of rail service. Concludes that no single factor determines the success of a railroad, and that other variables are also of significance, including macroeconomic conditions, the competitive environment, and railroad managerial expertise.

C. Air and Water Transportation

Bayer, Curtis K., Graham R. Mitenko, and Michael O'Hara. 1994. "Rural Intrastate Air Service Systems: A Basic Planning and Evaluation Tool," *Regional Science Perspectives* 24 (1), pp. 3-17.

> Provides an analytical approach for comparing costs of air travel versus ground travel. Advocates the need for air transportation planning tools that can be understood and employed by participants in the decision-making process. Introduces a "sensitivity analysis platform" that can be used to better understand the economic implications of alternative approaches to providing rural intrastate air services.

Connin, Larry, and Keith Leggett. 1992. "Demand for Rural Airport Business Travel: Altoona-Blair County Airport," *Transportation Quarterly* 46 (3), pp. 447-458.

> Addresses the question of whether continued financial support for small, rural airports is justified when applied on a "needs assessment" basis. Specific attention is given to the case of the Altoona-Blair County Airport, in south-central Pennsylvania. Argues that continued rural economic development requires transportation planners to develop and design more flexible strategies suited to rural air travel needs.

Fruin, Jerry E., and Dan Halbach. 1994. "Barge Movements on the Upper Mississippi River: Trends and Projections 1963-2002." Staff Paper P94-19. University of Minnesota, Department of Agricultural and Applied Economics.

> Reviews trends and identifies contributing factors related to the decline in commodity shipments moved by barge on the Upper Mississippi River during the late 1980's. Addresses the competitiveness of other modes of transportation and discusses various structural changes in the economy. Concludes that rail deregulation and other macroeconomic changes had little effect on the competitiveness of the barge industry for the movement of bulk commodities.

Fruin, Jerry E., and Dan Halbach. 1995. "The Mississippi River Ties Minnesota Agriculture to the World," *Minnesota Agricultural Economist* 680, pp. 1-4.

Summarizes the importance of barge transportation for U.S. agriculture. Specifically examines the role of the inland waterway system in moving Upper Midwest grain to ocean ports. Asserts that vast distances between the U.S. heartland and ocean ports would prove problematic for American agriculture if the shallow draft barge system, with its low costs and efficiencies, were not available.

D. General Transportation (All Modes)

Bearer, Martha A., Ruth T. McWilliams, and Eileen S. Stommes. 1989 (January). "Beyond Isolation: The Future of Rural Transportation as Described at the Transportation 2020 Forums." *Transportation Facts*. Washington, D.C.: U.S. Department of Agriculture, Office of Transportation.

Provides an overview of major rural transportation issues in the late 1980's. Describes structural changes occurring within rural America and examines how the transportation sector is likely to be affected. Establishes priorities for policy development by local, State, and national transportation leaders.

Bogren, Scott. 1998. "Rural Transit: You Can Get There From Here," *Community Transportation* 16 (3), pp. 10-13.

Discusses the history of rural public transportation, with an emphasis on funding changes. Identifies various benefits of the Section 5311 (rural public transportation) program for rural communities. Highlights several major challenges faced by rural public transportation providers, including growing demand and insufficient resources.

Brown, Dennis M. 1996a. "The State of Transportation in Rural America," *Small Town* 27 (3), pp. 12-19.

Discusses the need for an overhaul of rural America's transportation infrastructure. Addresses specific issues dealing with rural roads and bridges, rural passenger transportation, air service, intercity bus service, local public transit, rural rail freight, and inland waterways. Reviews recent changes in Federal transportation policy and concludes with a discussion of various transportation policy options.

Due, John F., Benjamin J. Allen, Mary R. Kihl, and Michael R. Crum. 1990. *Transportation Service to Small Rural Communities: Effects of Deregulation.* Ames: Iowa State University Press.

Examines the impacts of changing governmental policy on transportation service to small rural communities. Focuses on the impacts resulting from changes in the economic regulatory environment. Addresses the effects of regulatory reform in the airline, trucking, bus, and rail industries. Develops global, intermodal policies and strategies for maintaining adequate transportation service for both passengers and freight to small rural communities in a time of deregulation.

Fruin, Jerry E. and C. Phillip Baumel. 1992. "How Much Transportation Infrastructure Does Rural America Need?" Staff Paper No. P92-8. Department of Agricultural and Applied Economics, University of Minnesota.

Discusses rural America's need for large investments in transportation infrastructure. Addresses the need for investments in new rail technology and adequate loading facilities in rural areas. Examines the deterioration of inland waterway systems and rural rail infrastructure. Argues that future rural transportation infrastructure investments will depend on the needs of agriculture and other rural interests.

Gildemeister, Morris, and Fred P. Tanzer. 1991. "Multimodal Transportation Approaches in Minnesota," *Transportation Research Record* 1305, pp. 264-268.

Discusses multimodal and intermodal approaches aimed at reducing transportation costs and providing effective rural access. Suggests that present transportation challenges can best be met if interested parties support multimodal transportation alternatives and intermodal connections.

Rubel, Tom. 1990. "Future of Rural Transportation," in *Proceedings of the 76th Annual Road School* (Held at Purdue University, March 6-8), 161, pp. 55-60.

Discusses individual modes of rural transportation, including roads and bridges, passenger transportation, and rail service, in the context of public and private sector involvement. Specific topics examined include the mobility and access of rural residents to jobs and services and the movement of agricultural products. Suggests the need for better cooperation between the public and private sectors and enhanced intergovernmental cooperation.

U.S. Department of Agriculture, Office of Transportation. 1988. "Rural Intercity Passenger Transportation: Report on the Eastern Regional Symposium." *Transportation Facts*.

Identifies key components necessary for a national strategy on rural transportation. Outlines a variety of demographic and economic factors thought to impact the provision of transportation services in rural areas. Examines the impact of transportation deregulation on rural passenger transportation. Includes an annotated bibliography on rural intercity passenger transportation.

Transportation and Rural Development

Studies addressing the importance of transportation for rural development look at the effect of roads and bridges, rail service, airports, and passenger transportation on rural communities. The importance of infrastructure for attracting business and providing employment is examined, as are the economic impacts resulting from loss of transportation services. A good example is the study by Forkenbrock and Foster (1996), which examines the degree to which investments in high-capacity highways are likely to influence business location decisions. A second representative study is that by Cooper (1990), which looks at the relationship between airports and the location decisions of high-technology firms.

A. Roads and Bridges

Baldwin, Fred D. 1996. "Appalachian Highways: Almost Home but a Long Way to Go," *Appalachia* 29 (2), pp. 4-13.

> Examines the important role of Appalachian highways for many local communities, with an emphasis on the economic impacts that highways have on rural areas. Describes the effect of the Appalachian Development Highway System (ADHS) in attracting manufacturing plants along highway corridors. Advocates the need for investment in low-volume rural roads.

Broder, Josef M., Teresa D. Taylor, and Kevin T. McNamara. 1992. "Quasi-Experimental Designs for Measuring Impacts of Developmental Highways in Rural Areas," *Southern Journal of Agricultural Economics* 24 (1), pp. 199-207.

> Uses regression-discontinuity analysis to compare economic changes in counties with "developmental" highways to those in adjacent and non-adjacent control counties for the period 1975-81. Results show statistically significant changes in population, per capita income, and taxable sales related to highway development. Most counties benefited from developmental highways, although some were unaffected, and a few even experienced economic decline. Results also indicate that adjacent county control models may have understated highway-related impacts, while non-adjacent county models may have overstated these impacts.

Forkenbrock, David J., and Norman S. J. Foster. 1996. "Highways and Business Location Decisions," *Economic Development Quarterly* 10 (3), pp. 239-248.

Examines the degree to which investments in high-capacity highways are likely to influence business location decisions. Through case studies, concludes that access to highways generally has become a less important factor in location decisions than was the case previously. State-level highway investment policies that emphasize proper maintenance and relatively minor improvements are likely to be more cost-effective strategies for economic development than expensive highway construction projects.

Fruin, Jerry E., and Dan Halbach. 1992. "Rural Roads, Investment and Disinvestment in a Minnesota County." Staff Paper No. P92-25. University of Minnesota, Department of Agricultural and Applied Economics.

Examines the importance of the local road system for rural residents and businesses in Polk County, Minnesota. Methodology consists of evaluating different strategies for maintaining and improving roads with limited resources. Concludes that up to 40 percent of rural roads and bridges in the study area could be abandoned with little impact on local economic development.

Isserman, Andrew M., Terance J. Rephann, and David J. Sorenson. 1989. "Highways and Rural Economic Development: Results from the Quasi-Experimental Approaches." Paper presented at the Seminar on Transportation Networks and Regional Development, Leningrad, U.S.S.R., May 23-26.

Investigates the effect of highways on smaller communities and rural areas by examining income growth rates, by employment sector, for the period 1969-84. Findings indicate that rural counties with highways did not grow significantly faster than those without highways. Rural towns with more than one highway link did not grow more rapidly than those rural communities with just one link.

Kusmin, Lorin D., John M. Redman, and David W. Sears. 1996 (September). *Factors Associated with Rural Economic Growth: Lessons from the 1980's*. Technical Bulletin No. 1850. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service.

Identifies characteristics of rural areas conducive to economic growth for the period 1979-89. Explains growth in total real earnings by place of work for nonmetro U.S. counties from 1979-89 using multiple regression analysis. Finds that access to interstate highway interchanges contributed to earnings growth in rural areas, although the relationship is not among the most important factors in the analysis. Each interchange was associated with approximately 0.42 percent in additional income growth during the period.

Moon, Henry E., Jr. 1988. "Interstate Highway Interchanges as Instigators of Nonmetropolitan Development," *Transportation Research Record* 1125, pp. 8-14.

Looks at the nonurban impact of the Interstate Highway System by examining 65 nonmetropolitan interchanges in Kentucky in 1985. Analyzes the cyclic pattern of evolution of nonmetropolitan interchanges and discusses possible effects for this set of previously remote and isolated interchange sites. Finds that nonmetropolitan interstate interchanges often vary according to different functions that they perform, with some acting as "interchange villages," performing the role of central places in their respective regions. Fills a void in the literature by providing an in-depth nonurban analysis based on a significantly large number of observations.

Porterfield, Shirley L. 1990. "Producer Services: A Viable Option for Rural Economic Development?" Paper presented at the 29th Annual Meeting of the Southern Regional Science Association, Washington, D.C., March.

Measures employment growth by industrial sector for manufacturing and producer services in rural areas for the period 1981-86. Separate models are estimated for metropolitan counties, nonmetropolitan counties adjacent to metro areas, and remote nonmetropolitan counties. Finds that access to interstate highways may be a significant factor for job growth in producer services, but proximity to an interstate highway was negatively related to employment growth in the manufacturing sector.

Rephann, Terance J. 1993. "Highway Investment and Regional Economic Development: Decision Methods and Empirical Foundations," *Urban Studies* 30 (2), pp. 437-450.

Reviews Federal and State highway programs in the context of regional development theory. Factors identified in determining where highways are routed include socioeconomic, spatial, resource, and institutional "triggering forces." Advocates the need for further research to assess the impact of regional development theories on local highway planning practices.

Rephann, Terance J. 1997. "Highways and Regional Economic Development: What Can We Learn from Regional Economics Theory and Models?" Discussion Paper. Cumberland, Maryland: Allegany College of Maryland.

Reviews and evaluates theories and models that describe highway economic impacts. Argues that regional economic theory is a useful construct for answering questions about the relationship between highways and economic development. Effects of different regional economic policies are thought to be conditioned by various regional and extra-regional characteristics, thereby influencing highway economic impacts.

Rephann, Terance J., and Andrew M. Isserman. 1994. "New Highways as Economic Development Tools: An Evaluation Using Quasi-Experimental Matching Methods," *Regional Science and Urban Economics* 24 (6), pp. 723-751.

Examines the effectiveness of highway investment as an economic development tool. Uses a quasi-experimental matching method to examine the effects of interstate highways on counties that obtained interstate links during the period 1963-75. Results show that economic growth of counties with interstate highways is greatest for those in close proximity to large cities or those with some degree of prior urbanization. "Interstate counties" that are isolated or rural are shown to have few benefits.

Wilson, Eugene M., Khaled Ksaibati, Donald Warder, and Gene Bryan. 1994. *Determining Economic Effects of Wyoming's Loop Tours*. Mountain-Plains Consortium Report No. 94-29A. Fargo: North Dakota State University.

Discusses various models used to determine the economic benefits associated with two "scenic loop tours" in Wyoming. Argues that positive economic benefits are associated with these roads. Advocates the need for better marketing of Wyoming's scenic roads, arguing that local communities would benefit from increased tourism revenues.

B. Rail Service

Babcock, Michael W., Eugene R. Russell, and Robert E. Burns. 1992. "Economic Development and Transportation Impacts of Railroad Branchline Abandonment in South Central Kansas." Report No. K-TRAN: KSU-91-2. Kansas State University: Department of Civil Engineering.

Measures the potential impacts resulting from a rail abandonment in a ten county region in south-central Kansas. Identifies lost economic development potential for communities that lost rail service, and assesses indirect effects on the social structure of affected communities. Argues that one alternative for communities facing a rail abandonment is to provide public assistance for "truck only" transportation.

Brown, Dennis M. 1997a. "The Effects of Consolidation in the Rail Freight Industry on Rural America," *Small Town* 28 (1), pp. 12-17.

Explores consolidations in the rail freight industry and their impacts on rural America. Provides a historical overview of the Nation's rail network. Discusses various strategies for dealing with cutbacks in rail service. Concludes with a statement of how future consolidations may affect rural areas.

Fruin, Jerry E. 1992. "A Summary of Research Studies on the Community Impacts of Rail Abandonment in the Midwest." Staff Paper P92-16. University of Minnesota, Department of Agricultural and Applied Economics.

Reviews the results of studies dealing with the impacts of rail abandonment in rural communities in the Midwest. Details different categories of rail abandonment community impact studies. Provides a comprehensive list of references.

Honeyman, Joel S. 1995. *A Method for Assessing the Impact of Railroad Abandonment on Rural Communities.* Mountain-Plains Consortium Report No. 95-48. Fargo: North Dakota State University, Upper Great Plains Transportation Institute.

Develops a method for measuring the impacts of rail deregulation on rural communities. Quantifies results using the case of rail abandonment. Proposes a practical method for communities to evaluate whether additional local investment can help prevent the loss of rail service.

Klindworth, Keith A., and John A. Batson. 1991 (July). *Economic Impact of Proposed Kansas Rail Abandonments.* Washington, D.C.: U.S. Department of Agriculture, Agricultural Marketing Service.

Assesses direct economic impacts associated with rail line abandonments in rural communities in Kansas. Highlights the importance of rail service for agriculturally-dependent communities. Estimates specific economic impacts of proposed abandonments on grain firms, local communities, and State and local governments.

Nevel, Bonnie, and Peter Harnik. 1990. *Railroads Recycled: How Local Initiative and Federal Support Launched the Rails-to-Trails Movement, 1965-1990.* Washington, D.C.: Rails-to-Trails Conservancy.

Provides a history of the Rails-to-Trails movement, with reference to specific trails. Identifies various economic impacts of the program, including increased tourism revenue for small towns and a rise in property values along some rail corridors. Lists other benefits, such as "railbanking" (the preservation of the rail corridor network for potential future reconversion to rail use).

Russell, Eugene R., and Michael W. Babcock. 1995. "Study of Impact of Rail Abandonment on Local Roads and Streets." Paper presented at the Sixth International Conference on Low-Volume Roads (Volume 1), Minneapolis, Minn., June 25-29. Washington, D.C.: National Academy Press, Transportation Research Board.

Examines various negative effects associated with railroad abandonment in Kansas. Measures the public costs of rail abandonment in terms of the effect on farmers, shippers, and rural communities. Finds that rail abandonment resulted in only a negligible increase in trucking activity, but such activity led to a significant increase in road damage costs. Advocates the use of motor carrier user fees to provide for road maintenance costs.

C. Airports

Aziz, Riaz. 1998. *North Dakota Airport and Fixed-Base Operator Study.* Upper Great Plains Transportation Institute Report No. 121. Fargo: North Dakota State University.

Examines the relationship between Fixed-Base Operators (FBOs), which are responsible for day-to-day operations at airports, and local Economic Development Agencies. Addresses the impact that regulations have had on FBOs, the cause of decline in aviation-related businesses at airports, and economic impacts on an airport and its local economy resulting from closure of an FBO. Concludes that the closure of an FBO often results in economic loss to a community.

Aziz, Riaz, and Doug Benson. 1995. *Survey of Aviation Activity at Airports in North Dakota.* Upper Great Plains Transportation Institute Report No. 109. Fargo: North Dakota State University.

Identifies issues critical to the aviation community in North Dakota. Survey methods reveal that airport managers are most concerned about maintaining profitability and continuing to receive financial support from State and local agencies. Results also indicate that airport managers may need help in learning how to more effectively participate in State and regional economic development programs.

Cooper, Ronald. 1990. "Airports and Economic Development: An Overview," *Transportation Research Record* 1274, pp. 125-133.

Reviews the literature on airports and economic development. Finds that air transport usually has strong connections to local businesses. Reports that access to air transportation frequently plays an important role in allowing high-technology industries to compete. Also finds that the location of airport facilities often influences the location of high-tech industries.

Norris, Bahar B., and Richard Golaszewski. 1990. "Economic Development Impact of Airports: A Cross-Sectional Analysis of Consumer Surplus," *Transportation Research Record* 1274, pp. 82-88.

Examines the community economic impacts associated with airport construction. Develops a methodology for using consumer surplus as a proxy for the net economic development benefits derived from the construction of a regional airport. Emphasizes the importance of the industry mix, the diversity of the economy, regional transportation infrastructure, and the employment status of the local economy in determining the size of the impact from an airport.

Reeder, Richard J., and Cory Wanek. 1995. "The Importance of Local Airports to Rural Businesses," in *Rural Development Strategies*, David W. Sears and J. Norman Reid, eds. Chicago: Nelson-Hall Publishers, pp. 162-186.

Reviews recent research on the importance of airports for businesses, with an emphasis on small towns and rural areas. Examines the literature on business location decisions using surveys of businesspeople. Looks at the empirical literature identifying statistical relationships between airports and rural economic development. Finds that high-tech industries rank access to air service among the most important locational factors and that improvements to some general aviation airports are needed.

Weisbrod, Glen. 1990. "Economic Impacts of Improving General Aviation Airports," *Transportation Research Record* 1274, pp. 134-143.

Examines State and local economic impacts of general aviation airports. Presents a model for evaluating the benefits arising from improvements to these airports. Finds that benefits include those derived by local and regional businesses, as well as other, less quantifiable impacts, such as quality-of-life issues.

D. Passenger Transportation

Bogren, Scott. 1991. "Small Towns Reap Economic Benefits from Transit," *Community Transportation Reporter* 9 (8), pp. 8-9.

Discusses the role public transportation plays in rural economic development. Presents examples of transit-spurred economic growth resulting from the Community Transportation Association of America (CTTA) Rural Passenger Transportation Technical Assistance Program. Specifically mentions benefits such as business attraction and quality of life issues.

Brown, Dennis M. 1997b. "When Rural Communities Lose Passenger Rail Service," *Rural Development Perspectives* 12 (2), pp. 13-18.

Explores various issues surrounding the provision of passenger rail service to nonmetro communities and discusses some of the options available to these communities. Notes that Amtrak's recent financial difficulties have put parts of the national network in jeopardy, affecting some rural areas. Concludes that while the loss of rural passenger rail service will not usually, by itself, threaten a community's economic survival, it may have adverse effects that can be offset by public policy.

Burkhardt, Jon E., James L. Hedrick, and Adam T. McGavock. 1998. *Assessment of the Economic Impacts of Rural Public Transportation*. Report 34. Washington, D.C.: National Academy Press, Transportation Research Board.

Identifies and quantifies the economic impacts of rural public transportation services at both local and national levels. Uses case studies to develop and present an economic impact methodology for evaluating the importance of public transportation. May be of interest to State and local transportation planners, analysts, and decisionmakers involved in introducing or expanding rural public transportation services.

Butler, Darlene P., and Tracy Maxwell. 1997. *Assessment of Arkansas Economic Impacts of Rural Public Transportation.* Report MBTC FR-1062. University of Arkansas, Mack-Blackwell National Rural Transportation Study Center.

Documents the linkages existing between public transportation and economic activities in rural Arkansas. Develops a methodology for estimating impacts of public transportation on rural development. Uses the developed methodology to address quantitative deficiencies that currently exist in many rural public transportation systems.

Isaacs, Randy. 1993 (September). *Intercity Bus Transportation: New Opportunities for Rural America.* Technical Assistance Brief No. 11. Washington, D.C.: Community Transportation Association of America, Rural Transit Assistance Program.

Provides a brief overview of the history of intercity bus transportation. Discusses developments in financial support of bus transportation, including congressional efforts and State assistance programs. Describes regulatory issues affecting the provision of intercity bus services. Examines new funding opportunities in the context of the Section 18 (rural transportation) program.

E. General Studies on Infrastructure

Crane, Laurence M., and David J. Leatham. 1993. "Distributed Lag Effects of Transportation Expenditures on Rural Income and Employment," *Review of Regional Studies* 23 (2), pp. 163-181.

Examines the relationship between transportation expenditures and economic growth for rural and urban areas in Texas. Uses polynomial distributed lags to estimate income and employment growth arising from transportation investment. Results indicate that transportation expenditures have a positive economic impact on nonfarm and farm incomes and on employment in rural areas.

Eberts, Randall W. 1990. "Public Infrastructure and Regional Economic Development," *Economic Review* (Federal Reserve Bank of Cleveland) 26 (1), pp. 15-27.

Summarizes recent work on the effect of public infrastructure on economic activity at State and local levels. Identifies the significant role that transportation systems play in determining regional economic output. Sees transportation as a necessary, but not sufficient, condition for economic growth.

Fendley, Kim, and Will Miller. 1995. "Community Impact of Regional Transportation Infrastructure Growth." Report No. MBTC FR-1017. University of Arkansas, Mack-Blackwell National Rural Transportation Study Center.

Uses a mail survey of voters in Northwest Arkansas to explore attitudes of local citizens toward improved transportation infrastructure (regional airport, highway expansion) and continued growth. Concludes that local voters want the benefits associated with growth in the form of improved transportation and higher quality jobs, while preserving quality of life issues, including environmental factors.

Forkenbrock, David J. 1990. "Putting Transportation and Economic Development in Perspective," *Transportation Research Record* 1274, pp. 3-11.

Discusses the relationship between transportation and economic development. Six standards are identified for the types of trade-offs that local development practitioners must make when choosing among different projects with limited resources. Presents a series of "decision screens" to provide a practical basis for applying the principles discussed.

Forkenbrock, David J., Thomas F. Pogue, David J. Finnegan, and Norman S. J. Foster. 1990 (November). "Transportation Investment to Promote Economic Development," in *Infrastructure Investment and Economic Development: Rural Strategies for the 1990's*. Report No. AGES-9069. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service.

Examines different modes of transportation in the context of rural development. Argues that "highways are necessary but not sufficient for economic growth and development." Provides a good overview of the literature, including a discussion of empirical studies, and summarizes some of the major costs and benefits associated with highway investment.

Haynes, Kingsley E. 1997. "Labor Markets and Regional Transportation Improvements: The Case of High-Speed Trains," *Annals of Regional Science* 31 (1), pp. 57-76.

Reviews labor market issues in terms of mobility and policy resulting from transportation improvements. Examines empirical evidence of the impact of high-speed rail on labor markets and their structure. Outlines a spatial interaction approach for assessing changes in regional access and regional industrial mix.

Henry, Mark, and Johnson, Thomas G. 1993. "The Contribution of Transportation to Rural Economic Development." *Southern Rural Development Center* (Mississippi State University) 171, pp. 35-46.

Provides an overview of the literature on highways and rural economic development. Finds that most studies support the conclusion that a positive association exists between highways and economic growth, but individual studies vary in methodologies. Offers a number of recommendations for improving the analysis of the effects of highways.

Hough, Jill A., Frank Dooley, and Gary Otto. 1991. *Transportation and Rural Economic Development: A Comparative Analysis of Important Location Factors*. Mountain-Plains Consortium Report No. 94-1. Fargo: North Dakota State University, Upper Great Plains Transportation Institute.

Seeks to develop a better understanding of the relationship between transportation and rural economic development. Compares the perceptions of economic development specialists and manufacturers about various business location factors, including transportation.

Huddleston, Jack R., and Prem P. Pangotra. 1990. "Regional and Local Economic Impacts of Transportation Investments," *Transportation Quarterly* 44 (4), pp. 579-594.

Presents an "impact assessment" framework for the regional economic analysis of transportation investments. Describes the types of stimuli that transportation represents for regional economies. Identifies a broad array of local economic variables likely to be impacted by transportation investments.

Johnson, Thomas G. 1989. *New Alliances for Rural America: State Rural Transportation Programs in an Era of Contraction.* Washington, D.C.: National Governors' Association.

Focuses on the role of transportation infrastructure and services in rural economic development. Examines methods of investing in transportation infrastructure in an era of fiscal austerity and economic decline in many rural areas. Reviews State experiences with transportation investment strategies and considers innovative strategies.

Johnson, Thomas G. 1996. "The Economic Impacts of Infrastructure Development," in *Rural Development Research: A Foundation For Policy*, pp. 85-101. Westport, Connecticut: Greenwood Press.

Examines the relationship between physical infrastructure development and rural quality of life issues, with an emphasis on the associated economic effects. Reviews issues related to the empirical estimation of economic impacts of investing in infrastructure. Considers the empirical evidence related to such investments, especially the differential impacts of alternative strategies involved in providing infrastructure.

Munnell, Alicia H. 1990. "How Does Public Infrastructure Affect Regional Economic Performance?" *New England Economic Review* (Federal Reserve Bank of Boston) September/October, pp. 11-33.

Explores the effect of public capital on economic activity at the State and regional levels for the period 1970-86. Concludes that those States that have invested in infrastructure, including transportation, have greater output, more private investment, and more employment growth. Highways have the greatest effect on regional output in the South.

Federal and Local Governmental Issues

Studies examining Federal and local governmental issues focus on the financing, planning, and management of rural transportation systems, and regulatory issues affecting intercity bus, rail freight, and passenger air services. An example of a study focusing on financing issues is Deller and Halstead (1991), which examines the condition and financing of the local road network in three New England States, with special attention on managerial practices in maintaining the local road network. Walzer and Deller's (1996b) article focuses on the impact of ISTEA (the Intermodal Surface Transportation Efficiency Act of 1991) on local road management practices. Regulatory issues are examined by Oster (1988), which tries to determine whether small towns have been hurt by deregulation in the transportation industry.

A. Financing/Funding

Baumel, C. Phillip, Sherry B. Miller, Gregory Pautsch, and Cathy A. Hamlett. 1989. *The Local Rural Road System: Alternative Investment Strategies*. CARD Technical Report No. 89-TR6. Ames: Iowa State University.

> Employs a cost-benefit analysis, using three case study areas in Iowa, to study the effects of alternative investment strategies on local rural road systems. Develops guidelines for local supervisors and engineers in evaluating investment or disinvestment proposals. Provides information to State legislatures for developing local rural road and bridge policies.

Baumhover, Stephen B., Marty J. McVey, Michael Lipsman, and C. Phillip Baumel. 1990. "Investment Strategies for the Rural Road and Branch Rail Line Systems," *Journal of the Transportation Research Forum* 31 (1), pp. 167-179.

> Discusses the need for substantial reinvestment in the Nation's railroads and highways. Develops a methodology for addressing the problems of rural transportation systems that function as integrated units. Identifies policy implications for the redirection of public investment to rural surface transportation infrastructure.

Bogren, Scott, and Chris Zeilinger. 1998. "TEA-21: A Significant Victory for Community Transportation," *Community Transportation* 16 (5), pp. 9-12.

Describes funding issues under TEA-21 (the Transportation Equity Act for the 21st Century). Provides a general overview of the legislation, with special attention to rural areas. Discusses rural public transportation funding increases, both in absolute and proportional terms, and lists possible impacts of the legislation for rural transit agencies.

Brown, Dennis M. 1998. "The Federal Highway Funding Formula and Rural America." Paper presented at the 94th annual meeting of the Association of American Geographers, Boston, March 26-29.

Examines Federal highway funding in the context of rural transportation needs and Federal transportation policy. Discusses the importance of highways for rural development and provides an overview of the highway funding formula under ISTEA (the Intermodal Surface Transportation Efficiency Act of 1991). Highlights various limitations of the formula and describes spatial patterns of funding. Concludes with a statement of how changes in the funding formula may affect rural areas.

Deller, Steven C., and Rodney L. Clouser. 1993 (June). "Changes in the State and Local Public Sector," in *Rural Infrastructure Issues: State and Local Financing, Transportation, Health, and Solid Waste*. Publication No. 171, pp. 1-34. Mississippi State University, Southern Rural Development Center.

Discusses the types of expenditures historically undertaken by State and local governments in the Southeast to identify shifts in governmental focus. Pays special attention to capital expenditures as they relate to infrastructure investments. Examines the ability of rural governments to develop sufficient revenue sources while populations are declining.

Deller, Steven C., and John M. Halstead. 1991 (October). *Financing Rural Roads and Bridges in the Northern New England States*. Bulletin No. 836. University of Maine, Maine Agricultural Experiment Station.

Examines the condition and financing of the local road system in three New England States (Maine, New Hampshire, and Vermont). Focuses on local transportation management practices in an attempt to improve upon current institutional arrangements. Provides recommendations for improving the delivery of transportation services.

Deller, Steven C., and Norman Walzer. 1995. "Structural Shifts in the Treatment of Intergovernmental Aid: The Case of Rural Roads," *Journal Of Agricultural and Applied Economics* 27 (2), pp. 522-535.

Evaluates the effects of structural shifts in the treatment of intergovernmental aid during the 1980's by using a sample of rural counties with local road responsibilities. Employs a model to test the hypothesis that local officials treated intergovernmental aid differently after the Reagan/Bush policy of fiscal federalism was implemented. Finds that Federal aid was more stimulative at the end of the decade than in earlier years, but the effects of State aid was unchanged throughout the 1980s. Attributes these differences to a perception that Federal aid is seen as being less permanent than State financing.

Fitzpatrick, Kay, Karen Kuenzer, Torsten Lienau, and Tom Urbanik II. 1993. "Intercity Bus Industry in Texas." Research Report No. 1337-1F. Texas A&M University, Texas Transportation Institute.

Examines use of Section 18 (rural public transportation) funds by nonmetro Texas communities. Uses survey methods to determine opinions and demographic characteristics of both the general public and intercity bus riders. Survey results reveal a variety of recommendations aimed at making the Texas intercity bus industry more efficient and user-friendly.

Hough, Jill A., Ayman G. Smadi, and John D. Bitzan. 1997. *Innovative Financing Methods for Local Roads in the Midwest and Mountain-Plains States*. Mountain-Plains Consortium Report No. 97-74. Fargo: North Dakota State University, Upper Great Plains Transportation Institute.

Examines the need for counties to explore alternative financing methods that increase revenue and/or decrease costs. Describes a number of innovative financing methods for local governments that face challenges in maintaining their road networks, including the creation of rural improvement districts and cost sharing road maintenance equipment. Discusses advantages and disadvantages of each of these strategies.

Johnson, Thomas G. 1990. "Strategies in Transportation Financing." Paper presented at the regional conference, "Community Strategies for Tomorrow's Local Infrastructure," Birmingham, Alabama, May 1-3. Publication No. 135. Mississippi State University, Southern Rural Development Center.

Addresses the dilemma faced by many rural jurisdictions of increasing transportation needs in an era of declining financial resources. Identifies a general framework for better understanding different categories of solutions for funding shortfalls. Discusses five specific solutions: new or diverted sources of revenue, targeting of funds to economically strategic projects, strategic disinvestment in infrastructure, greater efficiency in service provision, and greater reliance on the public sector.

Leistritz, F. Larry, and Steve H. Murdock. 1988. "Financing Infrastructure in Rapid Growth Communities: The North Dakota Experience," in *Local Infrastructure Investment in Rural America*, pp. 141-154. Thomas G. Johnson, Brady J. Deaton, and Eduardo Segarra, eds. Boulder, CO: Westview Press.

Examines the experience of North Dakota in assisting rapidly growing communities with financing needed infrastructure and services. Focuses on the nature of fiscal problems in developing areas within the State and discusses the context of rapid, energy-related growth. Describes different approaches for dealing with these issues, including various taxation measures and other fiscal programs implemented to address the financial requirements for local government services.

Walzer, Norman, and Steven C. Deller. 1993. "Federal Aid and Rural County Highway Spending: A Review of the 1980s," *Policy Studies Journal* 21 (2), pp. 309-324.

Examines the effect of Federal and State aid on county highway spending throughout the Nation. Notes that some studies have shown that Federal aid has a stimulative effect on spending for infrastructure, while others report that Federal aid substitutes for local resources. Reports that Federal aid was stimulative in 1987, but State aid was not, revealing that Federal aid may have a stronger relationship with local highway spending.

Walzer, Norman, and Steven C. Deller. 1997 (January). *Rural Roads and Bridges: Financing Local Roads and Bridges in Rural Areas.* Washington, D.C.: U.S. Department of Agriculture, Agricultural Marketing Service.

Examines the mechanisms used by counties and towns throughout the Nation to finance local roads and bridges and compares current patterns with those recorded during the 1980's. Discusses reliance on different revenue sources. Looks at change in expenditures compared to the rate of inflation and examines the perceptions of local road administrators regarding the adequacy of expected future funding.

Walzer, Norman, Steven C. Deller, Nicholas Marathon, and Lori York. 1996 (September). *Rural Roads and Bridges: Condition and Financing of Local Bridges.* Washington, D.C.: U.S. Department of Agriculture, Agricultural Marketing Service.

Examines the current condition of the Nation's rural county and town bridges, with special attention to whether conditions have improved or worsened since 1989. Discusses the adequacy of funds available for bridges in order to determine whether local administrators can maintain current structures and/or meet expansion needs. Investigates management practices used for maintaining bridges and discusses potential changes that may be needed in these practices.

Welton, Richard D. 1995. "What Did ISTEA Do To Our Rural Roads?" *Better Roads* 65 (9), pp. 21-22.

Suggests that ISTEA (the Intermodal Surface Transportation Efficiency Act of 1991) created competition for funds available to local governments. Reports that criteria for receiving funds under ISTEA favor urban areas over rural areas and do not recognize differences in urban and rural transportation systems. Argues that funding for preservation and capacity improvements should both be high priorities under ISTEA. Concludes that competition for funds and processing procedures should be reduced or eliminated.

Wheeler, Linda M., Joseph Voccia, and William Lenski. 1989. "Financial Resource Needs of Public Transportation Systems," *Transportation Quarterly* 43, pp. 527-548.

Analyzes the differences between estimated capital investment costs and projected available capital funding for three transportation system categories: systems serving urbanized areas, those serving small urban areas, and rural transit systems. Concludes that, given current funding patterns, the condition of the Nation's public transportation facilities, equipment, and rolling stock will significantly deteriorate.

B. Planning and Management

Benhart, John E., and William Welsh. 1992. "The Interstate 81 Corridor of South-Central Pennsylvania: Land Use in Nonmetropolitan America," *Small Town* 22 (4), pp. 12-18.

> Examines the Interstate 81 corridor in southern Pennsylvania to illustrate a growing rural nonmetropolitan region experiencing a variety of land use problems. Specific development-related issues cited include water quality concerns, solid waste disposal issues, preservation of agricultural land, and traffic congestion. Suggests that lack of planning is responsible for these problems. Basic land use controls, such as zoning laws and subdivision and land development ordinances, are recommended as possible tools available to decisionmakers.

Bitzan, John D., and Jill A. Hough. 1994. *An Evaluation Guidebook for Rural and Small Urban Transportation Systems in the Mountain-Plains Region*. Mountain-Plains Consortium Report No. 94-36. Fargo: North Dakota State University, Upper Great Plains Transportation Institute.

> Discusses the lack of evaluation tools for rural and small urban transit operators. Provides one such tool available for transit operators for evaluating performance in comparison to similar transit systems. Provides objective criteria for converting raw data elements into these performance measures. Concludes with various proposals aimed at dealing more effectively with poor performance.

Chicoine, David L., Steven C. Deller, and Norman Walzer. 1989. "The Size Efficiency of Rural Governments: The Case of Low-Volume, Rural Roads." *Publius* 19 (Winter), pp. 127-138.

> Examines low-volume rural roads in order to investigate size efficiency in local government. Uses a sample of Midwest townships in Illinois, Minnesota, and Ohio to develop a simple decision model based on a long-run average cost curve. Finds that substantial size inefficiencies exist and suggests that cost reductions might be realized through the restructuring of the production of rural roads. Recommends contractual agreements between smaller jurisdictions and larger units of government.

Deller, Steven C., David L. Chicoine, and Norman Walzer. 1988. "Economies of Size and Scope in Rural Low-Volume Roads," *Review of Economics and Statistics* 70 (3), pp. 459-465.

Explores technical efficiencies in producing local government services. Examines economies of size and suggests that cost savings may be realized from reorganizing low-volume rural township road systems into larger units. Economies of scope suggest that joint use of inputs will produce lower overall costs rather than having townships specialize in providing certain types of roads.

Deller, Steven C., and John M. Halstead. 1994. "Efficiency in the Production of Rural Road Services: The Case of New England Towns," *Land Economics* 70 (2), pp. 247-259.

Analyzes the size and managerial efficiency of northern New England towns in the production of rural road services. Provides evidence on economies of size in the production of road service and notes that size inefficiencies are present. Results suggest that managerial inefficiencies, or input use inefficiencies, are operating and costs may be 40 percent higher than necessary. Argues that small town governments may be matching local demand with services, but only at a high cost.

Deller, Steven C., and Carl H. Nelson. 1991. "Measuring the Economic Efficiency of Producing Rural Road Services," *American Journal of Agricultural Economics* 73 (1), pp. 194-201.

Examines the ability of various Midwest township officials to produce low-volume rural road services in an economically efficient manner. Survey results suggest that over 50 percent of costs may be unnecessary because of input use inefficiencies and that larger jurisdictions may be more efficient than smaller jurisdictions. Estimates that nearly 85 percent of townships sampled exhibit technology characterized by increasing returns to scale. Argues that jurisdictional consolidation of production-related responsibilities may yield substantial cost savings.

Ford, Jack J. 1994. "Managing Growth Along a Rural Highway Corridor: The Role of Zoning on a Pennsylvania Highway," *Small Town* 25 (1), pp. 26-29.

Examines the changing role of rural highways as adjacent land evolves from agricultural to nonagricultural uses. Chronicles historic land use changes that have occurred along a rural highway in south-central Pennsylvania. Describes policy changes that could be implemented to manage growth along rural corridors.

Goble, Robert T. 1995. "Planning Intermodal and Operations Facilities for Rural and Small Urban Transit Systems: Workshop Manual." 12th National Conference: Rural Public and Intercity Bus Transportation, Des Moines, Iowa, October 22-25. Washington, D.C.: United States Department of Transportation.

Explores the possibility of developing an intermodal passenger facility in a rural or developing area. Discusses various advantages of such facilities, including improving commuting conditions, increasing mobility of the elderly and disabled, increasing the attractiveness of transit services, and becoming a support factor for growth. Describes how facilities can be developed to suit the scale and conditions of rural and small urban areas. Reviews a sequence of steps and methods and provides technical analysis used for rural intermodal passenger facility development.

Greenstein, J. 1995. "Issues Related to Planning and Administration of Low-Volume Roads," *Transportation Research Circular* 446, pp. 7-8.

Comments on several issues involved in rural road planning. Addresses optimization of expenditures on road improvement, the use of knowledge-based expert systems, the applications of environmental procedures in the administration of low-volume roads, and the use of the pavement condition index (PCI) and the International Roughness Index (IRI) to describe road surface conditions.

Hamlett, Cathy A., and C. Phillip Baumel. 1990. "Rural Road Abandonment: Policy Criteria and Empirical Analysis," *American Journal of Agricultural Economics* 72 (1), pp. 114-120.

Discusses the changing use patterns of the rural road system and considers various policy options for local government officials. Discusses abandonment of some low-volume, rural roads as one possible option. Develops a model, using utility maximization and Pareto-optimal criteria, that allows for identification of policy criteria for abandonment.

Sorensen, Paul C., Eric Irelan, Brian Winningham, and Thomas A. Noyes. 1997. "Skagit Countywide Air, Rail, Water, and Port Transportation System Study," *Transportation Research Record* 1602, pp. 4-13.

Examines the movement of freight for different modes of transportation (road, rail, water, air, and pipeline). Presents a methodology for estimating existing freight traffic flows by mode and by location, and forecasts future flows. Develops a methodology for determining future transportation system plan priorities of small urban and rural communities.

Stommes, Eileen S., Steve Miller, and Cindy Johnson. 1992 (January). "Multicommunity Collaboration Addresses Rural Transportation," *Rural Development News* 16 (1), pp. 24-26.

Summarizes some of the current issues involving transportation in rural America and identifies emerging trends. Gives examples of rural communities providing cost-effective transportation infrastructure. Highlights the advantages of collaboration among local communities in providing transportation services.

U.S. Department of Transportation. 1990. *Guidebook for Planning Small Urban and Rural Transportation Programs*. Vols. 1 and 2. Prepared for the New Mexico State Highway and Transportation Department, Transportation Programs Division.

Assists small urban and rural communities in New Mexico in assessing their public transportation needs and programs. Examines various issues of importance for providers of local public transportation services, including public transportation needs in small communities and rural areas, the role of alternative transportation systems, funding and finance issues, generating community involvement, and program monitoring.

Wallace, Charles E., Andrew K. Kilpatrick, and Keith R. Schneider. 1996 (April). "Rural Applications of Intelligent Transportation Systems." Knoxville: University of Tennessee, Transportation Center.

Addresses the needs of rural transportation users and looks at potential benefits that Intelligent Transportation Systems (ITS) can deliver. Compares ITS user requirements to perceived rural traveler needs. Summarizes the results of several specialty conferences on rural ITS and describes a number of related projects. Recommends a plan for increasing the awareness of ITS needs in rural areas.

Walther, Erskine S. 1990 (June). *Coordination of Rural Public Transportation Services in Three Southeastern States*. Report No. DOT-T-90-17. Washington, D.C.: Urban Mass Transportation Administration, Office of Technical Assistance and Safety, University Research and Training Program.

Examines the Federal Section 18 (rural public transportation) program in the context of transit providers in the Southeast. Documents the historical development and current practices of coordinated systems. Discusses the benefits of coordination, which include quality of service delivery issues and financial concerns.

Walzer, Norman and Steven C. Deller. 1996b (September). *Rural Roads and Bridges: Management Issues Facing Local Highway Officials.* Washington, D.C.: U.S. Department of Agriculture, Agricultural Marketing Service.

Documents management practices used by, and issues facing, local transportation administrators. Addresses the impact of ISTEA (the Intermodal Surface Transportation Efficiency Act of 1991) on local road management. Proposes a shift in how local road officials view intergovernmental aid in management decisions. Concludes with a discussion of policy changes for improving local resource management in road and bridge administration.

C. Regulatory Issues

Astrop, Angela. 1993. *The Trend in Rural Bus Services Since Deregulation.* Project Report 21. Crowthorne, Berkshire (U.K.): Traffic and Transport Resource Centre, Transport Research Laboratory.

Examines the effects of deregulation on rural bus service in Britain under the Transport Act of 1985. Discusses the continued provision of rural bus service through a sampling of small communities. Highlights parallels between the British and U.S. intercity bus industries in terms of the difficulties of maintaining service to rural communities in an environment of deregulation.

Kihl, Mary R. 1988. "The Impacts of Deregulation on Passenger Transportation in Small Towns," *Transportation Quarterly* 42 (2), pp. 243-268.

Examines various options in providing small town intercity passenger service, with a focus on developing a broad systems approach to service provision. Assesses the impact of scheduling, service levels, and pricing on air and bus service to small communities. Advocates the establishment of coordinated intermodal linkages to deal more effectively with the effects of deregulation.

Oster, Clinton V., Jr. 1988. "Is Deregulation Cutting Small Communities' Transportation Links?" *Rural Development Perspectives* 4 (3), pp. 13-16.

Discusses various changes in the provision of rural bus and airline service following deregulation and examines geographical variations in the loss of service. Notes that many bus lines had abandoned rural routes prior to deregulation, and that most airline abandonments occurred as a result of market inefficiencies. Argues that cuts in bus service often have serious negative rural effects because patrons have few available transportation options.

Other Issues in Rural Transportation

Studies not easily classifiable into previous groupings are categorized as "other." This group includes studies dealing with a variety of issues, including social services transportation, rural transportation safety concerns, and rural transportation issues affecting the environment. Social services studies focus primarily on transportation of the elderly, Native Americans, and women. A good example is Kihl's (1992) study, which addresses the underutilization of rural transportation systems by older residents. Studies on safety often deal with programs and policies designed to improve rural roadways. Kamerud's (1988) study addresses the benefits and costs of speed limits in improving safety. Beachy and Eck's (1995) article, which represents an environmental study, analyzes environmental considerations in highway construction projects.

A. Social Services Transportation

Anding, Thomas L., and R. Evan Fulton. 1993. *Assessing Transportation Needs on Indian Reservations*. Mountain-Plains Consortium Report No. 93-21. Fargo: North Dakota State University, Upper Great Plains Transportation Institute.

> Summarizes major transportation concerns for members of various Native American tribes in Minnesota. Concludes that substandard quality and lack of availability of personal transportation on rural reservations is of chief concern to residents. Suggests several ways to improve transportation services on rural reservations.

Bogren, Scott. 1998. "The Secret Passage," *Community Transportation* 16 (3), pp. 17-19.

> Describes the condition of transportation infrastructure on the Zuni Nation Reservation in New Mexico. Examines the efforts of Zuni Entrepreneurial Enterprises (ZEE) in providing public transportation services to the reservation. Reviews the growth and success of the program in providing reservation residents with access to jobs, education, and public services.

Damiano, Peter C., Elizabeth T. Momany, Norman S. J. Foster, and Hermine T. McLeran. 1994. *Transportation of Rural Elders and Access to Health Care.* Ames: University of Iowa, Public Policy Center.

Discusses the use of public transportation services by elderly Iowa residents in rural areas. Assesses their needs and the capacity for Iowa's public transit system to provide an adequate level of service. Discusses several issues of importance for rural elderly residents, such as access to health care services.

Foster, Norman S. J., Peter C. Damiano, Elizabeth T. Momany, and Hermine T. McLeran. 1996. "Rural Public Transportation: Perceptions of Transit Managers, Directors of Area Agencies on Aging, and Elders," *Transportation Research Record* 1557, pp. 58-63.

Uses survey methods to determine the opinions of transit managers, area agency on aging (AAA) directors, and rural elders concerning the quality and availability of public transportation services for rural residents in Iowa. Survey results show that an unmet transportation need exists in the study area and that lack of information is a primary cause. Results also indicate that among rural elderly residents, those who use public transportation services generally have the highest opinions of transit.

Howard, David M. 1990. *A Handbook on Rural Elderly Transportation Services: A Practical Introduction to Operating and Evaluating a Rural Elderly Transportation System.* University of Missouri - Kansas City, National Resource Center for Rural Elderly.

Presents practical information in a handbook format for initiating, financing, and operating transportation systems that primarily serve rural elders. Offers various suggestions on how best to provide service to rural elderly residents. Provides criteria for effectively evaluating rural elderly transportation services.

Howard, David M., and C. Neil Bull. 1989. *Rural Elderly Transportation Services: A Self-Evaluation Checklist.* University of Missouri - Kansas City, National Resource Center for Rural Elderly.

Presents transit operators and policymakers with a checklist for evaluating rural elderly transportation operations. Highlights ways to improve transit service for rural elderly residents. Provides information on technical assistance for transit operators and lists additional resources.

Kihl, Mary R. 1990. *The Need for Transportation Alternatives for the Rural Elderly.* Ames, Iowa: Midwest Transportation Center.

Documents transportation patterns of the rural elderly in six counties in southern Iowa and identifies the potential need for alternative services. Concludes that although there are relatively few elderly transit patrons, not many transportation alternatives exist for this population. Argues that others might be encouraged to use public transportation if the system better met their needs.

Kihl, Mary R. 1992. "Marketing Rural Transit Among Senior Populations," *Transportation Research Record* 1338, pp. 60-64.

Examines underutilization of rural transportation systems by older residents. Proposes developing responsive rural transportation systems and targeting them to senior residents. Reviews strategies developed by marketing analysts and provides various perspectives of gerontologists. Suggests several innovative approaches for better meeting the transportation needs of the rural senior population.

Moorehead, Paul, and Robert I. Holden. 1996 (March). *National Indian Tribal Transit Report.* Project No. DC-26-7022. Washington, D.C.: United States Department of Transportation, Federal Transit Administration.

Addresses problems faced by American Indian and Alaska Native tribal governments with regard to transit and related issues. Discusses the importance of transit systems for tribal economies and their communities. Views inadequate transit services as negatively affecting tribal efforts in attracting and maintaining outside investment in infrastructure development (transportation services, water systems, waste disposal plants) and job creation. Argues that tribal governments should be assisted by the Federal Government in development policy efforts.

Peters, Alan H., and Heather I. MacDonald. 1994. "The Worktrips of Rural Non-Metropolitan Women in Iowa," *Growth and Change* 25 (3), pp. 335-351.

Presents a model of worktrip length for rural nonmetropolitan women. Finds that some factors important in constraining the length of urban women's commute, such as linking worktrips with household-related trips, are less relevant in a rural setting. Concludes that those women who either work in nontraditional occupations, receive employer-provided health benefits, and/or have access to better transportation resources, tend to have longer worktrips.

Ramsbottom-Lucier, Mary, Kim Emmett, Eugene C. Rich, and John F. Wilson. 1996. "Hills, Ridges, Mountains, and Roads: Geographical Factors and Access to Care in Rural Kentucky," *Journal of Rural Health* 12 (5), pp. 386-394.

Investigates the relationship between road quality, county elevation, and access to health care for individuals in rural and urban areas of Kentucky. Examines the demographic characteristics of rural and urban residents, and notes that rural residents are generally poorer and older. Finds that poor road conditions, as measured by a road "rideability" index, resulted in longer times to reach medical care.

Shawn, Kelly. 1994. *American Indian Transportation: Issues and Successful Models*. Technical Assistance Brief No. 14. Washington, D.C.: Community Transportation Association of America, Rural Transit Assistance Program.

Addresses transportation-related issues faced by American Indians, such as sovereignty, funding, coordination, economic growth, and computerization. Provides examples of ongoing efforts to provide transportation services to Native Americans in isolated rural areas of Mississippi, Arizona, Wyoming, and Oklahoma. Provides information on additional resources.

Stunkel, Edith. 1997. "Rural Public Transportation and the Mobility of Older Persons: Paradigms for Policy," *Journal of Aging and Social Policy* 9 (3), pp. 67-86.

Develops a comprehensive literature review of Federal public transportation policy in rural areas. Suggests three alternative paradigms for guiding future policy: addressing social issues, focusing on economic concerns, and emphasizing sustainability. Provides specific recommendations within each paradigm.

B. Safety

Caldwell, R. Craig, and Eugene M. Wilson. 1997. *A Safety Improvement Program for Rural Unpaved Roads.* Mountain-Plains Consortium Report No. 97-70. University of Wyoming, Department of Civil and Architectural Engineering.

Presents a prototype safety improvement program (SIP) developed for unpaved roads. Argues that the SIP is economically and procedurally appropriate for local road agencies. Provides a systematic means of prioritizing road sections for safety analysis and identifying safety improvement needs, and includes results of case studies to validate the procedure.

Clarke, David B, Arun Chatterjee, Stephen M. Rutner, and Harry L. Sink. 1996. "Intermodal Freight Transportation and Highway Safety," *Transportation Quarterly* 50 (2), pp. 97-110.

Identifies a number of highway safety implications of intermodal transportation. Quantifies the effect on highway safety of switching some freight traffic to railroads. Discusses overall truck traffic reduction, shifts from rural to urban roads, terminal location and access, and other related issues.

Jernigan, J. D., and C. W. Lynn. 1991. "Impact of 65-MPH Speed Limit on Virginia's Rural Interstate Highways Through 1989," *Transportation Research Record* 1318, pp. 14-21.

Reviews the 1987 Surface Transportation and Uniform Relocation Assistance Act, which permitted States to raise their maximum speed limit on rural interstate highways. Finds that fatal crashes and fatalities increased more in Virginia, on average, than in other States that raised their maximum speed limits. Suggests that the increased speed limit may have been a contributing factor for the increased number of accidents in Virginia.

Kamerud, Dana B. 1988. "Benefits and Costs of the 55 mph Speed Limit: New Estimates and Their Implications," *Journal of Policy Analysis and Management* 7 (2), pp. 341-352.

Summarizes costs and benefits of the national 55 mile-per-hour speed limit for rural interstates compared to all other roads. Estimates the cost of saving a life by reducing speed limits is significantly higher on rural interstates compared to other roads. Suggests that these findings support increasing speed limits on rural interstates.

Martz, Eston. 1994. "Beware of Rural Roads," *Traffic Safety* 94 (5), pp. 16-19.

Provides data on rural road accidents in Canada. Discusses various hazards associated with rural roads, including higher speeds and poorer road conditions. Suggests several ways for drivers to reduce risks associated with nonmetro roads.

Schwartz, David J., James A. Bonneson, and Patrick T. McCoy. 1994. *Analysis of Policies for Safety Improvements on Low-Volume Rural Roadways.* Lincoln: University of Nebraska, Department of Civil Engineering.

Compares highway safety policies of Iowa, Kansas, Missouri, and Nebraska. Pays special attention to low-volume rural roadways. Provides recommendations for reducing hazardous conditions on these roads.

Wilson, Eugene M., and Kevin A. French. 1992. *Evaluating the Potential of Remote Sensing Rural Road and Travel Conditions*. Mountain-Plains Consortium Report No. 92-10. University of Wyoming, Department of Civil Engineering.

Examines the issue of safety on rural roads. Advocates the need for posting current road and travel conditions as a means of reducing the number of wintertime accidents in rural mountain States. Evaluates the use of real-time remote weather information for updating road and travel conditions.

C. Environmental Issues

Alexander, Susan V. 1992. *Rural Roads: Pollution Prevention and Control Measures.* Washington, D.C.: U.S. Environmental Protection Agency.

Argues that changes made by local governments in routine maintenance and road upgrade activities can provide protection for an area's streams, rivers, lakes, and wetlands. Presents a fact sheet that lists various roadway changes that can be easily implemented. Identifies a set of specific sites where such practices may prove beneficial.

Beachy, Kevin T., and Ronald W. Eck. 1995. "Environmental Dilemma of Administering and Maintaining Low-Volume Roads." *Sixth International Conference on Low-Volume Roads*, Volume 1. Minneapolis, June 25-29. Washington, D.C.: National Academy Press, Transportation Research Board.

Provides an overview of various environmental regulations and restrictions covering maintenance, rehabilitation, and reconstruction activities on low-volume rural roads in western Maryland. Analyzes environmental considerations concerning the feasibility, design, and construction phases of highway projects in conjunction with construction costs. Offers several recommendations designed to assist public officials to deal more effectively with environmental constraints.

Moll, Jeffry E. 1993. "Reducing Low-Volume Road Impacts on the Environment: Success in the United States Department of Agriculture Forest Service," *Transportation Research Record* 1426, pp. 10-14.

Discusses how low-impact roads can effectively mitigate various negative environmental consequences associated with road construction activities. Identifies the reduction of sediment in road maintenance as a positive strategy for the environment. Advocates the need for comprehensive planning prior to construction activities.

Additional Resources

The following citations are miscellaneous rural transportation references. They include an assortment of summaries, status reports, guides, maps, atlases, and bibliographies.

Atlas of Public Transportation in Rural America. 1995. Washington, D.C.: National Transit Resource Center, Community Transportation Association of America.

Provides a visual documentation of the nature of rural public transit services on a regional, State, and intrastate basis. Indicates that 41 percent of rural residents live in counties without any public transportation services, while another 25 percent live in areas with inadequate transit.

Batson, John A., and Jerry D. Norton. 1988 (November). *Maintaining Local Rail Service.* Washington, D.C.: U.S. Department of Agriculture, Office of Transportation.

Describes how shippers and rural communities can retain local rail service. Gives a brief summary of rail regulation as it applies to railroad abandonment and discusses the abandonment process. Identifies available assistance programs for communities faced with an abandonment, including those from the U.S. Department of Agriculture's Office of Transportation.

Rucker, George. 1994. *Status Report on Public Transportation in Rural America.* Washington, D.C.: National Transit Resource Center, Community Transportation Association of America.

Reports findings from a nationwide study of transit systems. Provides a demographic profile of rural transit patrons, and discusses characteristics of the services provided. Identifies the number and selected attributes of local rural transit agencies. Assesses the transit needs of rural residents who are underserved by public transportation services.

Stommes, Eileen S., and Martha A. Bearer. 1988 (August). "Annotated Bibliography on Rural Intercity Passenger Transportation." *Transportation Facts*. Washington, D.C.: U.S. Department of Agriculture, Office of Transportation.

Summarizes State-level studies on rural intercity passenger transportation. Provides background information on studies conducted and reports written during the 1980's. Emphasizes those studies completed since passage of the Bus Regulatory Reform Act of 1982.

Transportation Research Board. 1991. "Rural and Specialized Transportation Abstracts," Prepared for the 10th National Conference on Rural Public Transportation, Asheville, North Carolina, October 13-16.

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A. Rural Transportation: Availability, Demand, and Condition

American Society of Civil Engineers. 1992. *Local Low-Volume Roads and Streets.* Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration.

Attaluri, P., P. N. Seneviratne, and M. Javid. 1997. "Modeling Demand for Public Transit Services in Rural Areas," *Journal of Transportation Engineering* 123 (3), pp. 216-222.

Beadle, Charles R., and Sheldon M. Edner. 1988. "*The Eighth National Conference on Rural Public Transportation: Final Report.* Washington, D.C.: U.S. Department of Transportation: Technology Sharing Program.

Black, W. R. 1993. "Development of an Ideal Model For Identification of Rural Public Transit Needs," *Transportation Research Record* 1402, pp. 107-109.

Botha, Jan L. 1990. *The Role of Transit and Paratransit in Rural Communities in Alaska.* Seattle, WA: Transportation Northwest, Department of Civil Engineering, University of Washington.

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Index

Abdelwahab, W. M., 58
Agent, Kenneth R., 59
Al-Masaeid, H. R., 59
Alexander, M. David, 59
Alexander, Susan V., 50
Allen, Benjamin J., 16
American Society of Civil Engineers, 53
Anderson, Dale G., 58
Andersen, S. J., 56
Anding, Thomas L., 44
Astrop, Angela, 43
Atlas of Public Transportation in Rural America, 51
Attaluri, P., 53
Aziz, Riaz, 24
Babcock, Michael W., 11, 22, 23, 56
Baldwin, Fred D., 18
Batson, John A., 11, 23, 51, 56
Baumel, C. Phillip, 8, 16, 32, 40, 57
Baumhover, Stephen B., 32
Bayer, Curtis K., 13
Beachy, Kevin T., 50
Beadle, Charles R., 53
Bearer, Martha A., 11, 15, 52
Benekohal, R. F., 59
Benhart, John E., 38
Benson, Doug, 24
Berndt, Ernst R., 57
Bitzan, John D., 35, 38, 57, 59
Black, W. R., 53
Bogren, Scott, 15, 26, 33, 44
Bonneson, James A., 49, 60
Botha, Jan L., 53, 57
Boyce, D. E., 60
Branch, D., 57
Brennan, Sherry, 8
Broder, Josef M., 18
Brown, Dennis M., 15, 22, 26, 33, 53
Bryan, Gene, 21, 55
Bull, C. Neil, 45
Burkhardt, Jon E., 26
Burns, Robert E., 22
Burton, Mark L., 53
Butler, Darlene P., 27
Caldwell, R. Craig, 48
Calvo, Christina M., 56
Casavant, K., 57
Casto, James, 53
Cavinato, Joseph L., 60
Chatterjee, Arun, 48
Chiang, Judy Shaw-Er Wang, 57
Chicoine, David L., 9, 38, 39, 55, 57, 59
Clarke, David B., 48
Clouser, Rodney L., 33
Comp, Patricia, 54
Connin, Larry, 13
Cook, Cynthia C., 60
Cooper, Ronald, 24
Council, F., 61
Crane, Laurence M., 7, 28, 56
Crum, Michael R., 16
Cuckovich, Martha L., 60
Damiano, Peter C., 45
Daniel, J., 58
Daniels, Bob, 7
Deaton, Brady J., 35
Deller, Steven C., 10, 33, 34, 36, 38, 39, 42, 54
Dempsey, Steven P., 56
Dooley, Frank, 30
Due, John F., 16
Eberts, Randall W., 28
Eck, Ronald W., 50
Edner, Sheldon M., 53
Emmett, Kim, 47
Euritt, M. A., 56
Eusebio, Victor E., 54
Felton, Richard J., 58
Fendley, Kim, 28
Finnegan, David J., 29
Fitzpatrick, Kay, 34
Fitzsimmons, Edward L., 58

Flad, H. K., 60
Ford, Jack J., 39
Forkenbrock, David J., 19, 29
Foster, Norman S. J., 19, 29, 45
Fox, Michael, 60
Fravel, Frederic D., 54
French, Kevin A., 49
Friedlaender, Ann F., 57
Fruin, Jerry E., 7, 13, 14, 16, 19, 22, 56
Fuller, Stephen W., 7
Fulton, R. Evan, 44
Gaines, David, 58
Gildemeister, Morris, 16
Gillis, William R., 8
Gittings, G. L., 58
Goble, Robert T., 40
Golaszewski, Richard, 25
Gonzalez-Ayala, Salvador, 54
Greenstein, J., 40
Griffen, Lindsay I., 60
Griffin, Gene, 8, 54
Griffith, M. S., 60
Grimm, Curtis M., 58
Halbach, Dan, 7, 13, 14, 19
Hall, J. W., 60
Halstead, John M., 34, 39
Hamlett, Cathy A., 8, 32, 40
Hansen, Christian O., 54
Harnik, Peter, 23
Harrison, R., 55, 56
Hartgen, D. T., 56
Harwood, D. W., 61
Hashmi, A. M., 59
Hauser, E. W., 58, 60
Haynes, Kingsley E., 29
Hedrick, James L., 26
Helaakoski, R., 56
Helfrich, Kathleen M., 58
Henry, Mark, 29
Holden, Robert I., 46
Honeyman, Joel S., 22
Hough, Jill A., 8, 30, 35, 38, 54
Howard, David M., 45
Huddleston, Jack R., 30
Irelan, Eric, 41
Isaacs, Randy, 27
Isserman, Andrew M., 19, 21
Ivey, Don L., 60
James, June, 60
Javid, M., 53
Jensen, Ric, 56
Jernigan, J. D., 48
Johnson, Cindy, 41
Johnson, Thomas G., 29, 30, 35
Jones, Warren, 54, 61
Jordan, Constance W., 58
Kamerud, Dana B., 48
Kihl, Mary R., 16, 43, 46, 56
Kilpatrick, Andrew K., 41
Klaassen, L. H., 56
Klindworth, Keith A., 23
Ksaibati, Khaled, 21, 55
Kuczek, T., 59
Kuenzer, Karen, 34
Kusmin, Lorin D., 20
La Caille, John, 54
Lamberton, Charles E., 8
Leatham, David J., 28
Lee, M. H., 59
Leggett, Keith, 13
Leinbach, Thomas R., 60
Leistritz, F. Larry, 35
Lenski, William, 37
Lienau, Torsten, 34
Lipsman, Michael, 32
Long, S. G., 60
Lynn, C. W., 48
MacDonald, Heather I., 47
MacDonald, James M., 58
Mahmassani, H. S., 56
Marathon, Nicholas, 36, 54
Martz, Eston, 49
Maxwell, Tracy, 27
Mazur, G. D., 58
McCoy, Patrick T., 49, 60
McCracken, C., 57

McDermott, K. P., 58
McFadden, Claudia, 10
McFarland, David, 56
McGavock, Adam T., 26
McGranahan, David A., 57
McGregor, Brian M., 55
McIntyre, Robert J., 54
McLeran, Hermine T., 45
McNamara, Kevin T., 18
McVey, Marty J., 32
McWilliams, Ruth T., 15, 55
Miller, Jennine, 60
Miller, Sherry B., 32
Miller, Steve, 41
Miller, Will, 28
Mitenko, Graham R., 13
Moll, Jeffry E., 50
Momany, Elizabeth T., 45
Moon, Henry E., Jr., 20
Moorehead, Paul, 46
Morral, J. F., 58
Morrill, John, 11, 56
Munnell, Alicia H., 31
Murdock, Steve H., 35
Nelson, Carl H., 39
Neuman, T. R., 61
Nevel, Bonnie, 23
Nice, David C., 9
Norris, Bahar B., 25
North, D., 58
Norton, Jerry D., 11, 51, 54
Noyes, Thomas A., 41
Nutley, Stephen D., 58
O'Callaghan, J. E., 56
O'Hara, Michael, 13
O'Neill, Wende A., 61
Opgenorth, J., 56
Oster, Clinton V., Jr., 43
Otto, Gary, 30
Pangotra, Prem P., 30
Pautsch Gregory, 32
Pendleton, O. J., 60
Peters, Alan H., 47
Pinnoi, Nat, 7
Pogue, Thomas F., 29
Porterfield, Shirley L., 20
Prater, Marvin, 11, 56
Ramsbottom-Lucier, Mary, 47
Redman, John M., 20
Reeder, Richard J., 25
Reid, J. Norman, 25
Rephann, Terance J., 19, 21
Report on Speed Limits and Safety for Iowa Highways, 60
Rich, Eugene C., 47
Rosenbloom, Sandra, 55
Rozic, P., 55
Rubel, Tom, 17
Rucker, George, 51
Russell, Eugene R., 11, 22, 23, 56
Rutner, Stephen M., 48
St. John, A. D., 61
Sapienza, Harry J., 58
Sarasua, W., 58
Schneider, Keith R., 41
Schwartz, David J., 49
Sears, David W., 20, 25
Segarra, Eduardo, 35
Seneviratne, P. N., 53
Shawn, Kelly, 47
Sheftick, Daniel E., 55, 59
Sieber, Niklas, 61
Sinha, K. C., 59
Sink, Harry L., 48
Smadi, Ayman G., 8, 35
Smith, Jean, 55
Sorenson, David J., 19
Sorensen, Paul C., 41
Spychalski, J. C., 58
Stamatiadis, Nikiforos, 60
Stewart, R., 61
Stommes, Eileen S., 15, 41, 52, 55
Stover, J. K., 58
Stunkel, Edith, 47
Sullivan, Edward C., 53, 57
Tanzer, Fred P., 16

Taylor, Teresa D., 18
Terry, D., 60
Tolliver, Denver, 57
Transportation Research Board, 52, 55, 57, 61
Tye, W. B., 59
U.S. Department of Agriculture
Agricultural Marketing Service, 9
Office of Transportation, 17, 55
U.S. Department of Transportation, 41
Bureau of Transportation Statistics, 61
Federal Transit Administration, 61
Ullah, K., 61
Urbanik, Tom, II, 34
Vachal, Kimberly, 57
Vellturo, Christopher A., 57
Voccia, Joseph, 37
Walcott, W. A., 56
Wallace, Charles E., 41
Walther, Erskine S., 42
Walton, C. M., 56
Walzer, Norman, 9, 10, 34, 36, 38, 39, 42, 54, 55, 57, 59
Wanek, Cory, 25
Wang, J., 59
Wang, M., 61
Warder, Donald, 21, 55
Watkins, John F., 60
Weisbrod, Glen, 25
Weissman, J., 55
Welby, Ellen M., 55
Welsh, William, 38
Welton, Richard D., 37
Wheeler, Linda M., 37
Wilson, Eugene M., 21, 48, 49, 55, 59
Wilson, John F., 47
Winningham, Brian, 41
Wohlbruck, Aliceann, 57, 59
Wolfe, K. Eric, 12
Yontz, Mark, 56
York, Lori, 36
Zangwill, L. A., 58
Zegeer, C. V., 61
Zeilinger, Chris, 33
Zeng, Xiaohong, 53, 57