Transportation in Rural America: Challenges and Opportunities
by
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The Rural Context

Most transportation policy, analysis, and technology focus on urban transportation. However, nearly 50 million Americans live in rural areas—open country and settlements with fewer than 2,500 residents—spread out in 2,303 non-metropolitan counties across four-fifths of the land area. During the 1990s, millions of Americans moved to non-metro areas, contributing to a 10 percent increase in small urban and rural communities. With the continuing “metropolitization” of the country, rural transportation issues take on special significance. In the sections that follow, some of the key features of rural transportation are briefly described in three areas—social needs, economic development, and quality-of-life. The promising strategies for responding effectively to support economic and community development and provide basic mobility are noted, including potential technology and systems applications. Key policy and research issues are then outlined.

Not Your Grandmother’s Countryside

A traditional view of rural America as sprinkling of isolated small farm towns within vast expanses of undeveloped lands undergoing gradual economic and population decline is obsolete. Most rural areas have long-since outgrown that model. Today’s rural reality is both more complex and more dynamic. Economic, social, and technological change—local, regional, national, and even global—are creating a much more complex pattern of rural transportation than in the past. As the national economy has become more service-oriented, and as resource-based industries declined, and as advances in communication, health care, and other services have taken place, rural America is being transformed. Rural regions have developed their own dynamics, many partaking of the full range of urban characteristics in terms of social mix, economic activities, and associated problems. They also they exhibit a complex mix of both growth and decline in what is normally called “rural”: “When you’ve seen one rural community ... you’ve seen one rural community.”

The Rural-to-Urban Spectrum

From a transportation perspective, “rural” transportation may best be understood as points along the spectrum, from isolated settlements to the urban fringe. Some important distinctions with special transportation service requirements are generated—with special technical and policy implications. At the one end, rural needs still include the characteristically farm-to-market or mine-to-plant connections and the challenges of rural service delivery. At the metropolitan fringe end, rural needs share many of the familiar challenges of suburbanization. But along the entire spectrum, rural areas are rapidly differentiating, resulting from the unique mixes of legacy rural context with recent urbanization.

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Legacy Rural Infrastructure and Transportation Service
The legacy context of infrastructure and service provision to rural America is well-understood. The historic farm-to-market roadways and the interstate highway system are the basic network, overlaid by systems serving other areas of special economic production.

*Rural Public Infrastructure*—Rural highways constitute about 3.1 million of the 3.9 million miles of public roads carrying about 40 percent of the total volume. These are mostly two-lane roads, and a high percentage of lower-class roads (more than 50 percent) remain unpaved. There are more than 450,000 rural bridges, and almost one-half of the bridges more than 20 feet long are structurally deficient. Rural highways experience growing congestion and traffic volumes have been growing well in excess of the national rates. The shift of shipping from rail to truck service, discussed below, has added to maintenance burdens of rural roads. The cost of highway maintenance and improvements in relatively remote locations is high—especially when spread across low volumes of use. This extensive highway mileage and the high percentage of deficient bridges impose a major economic burden on rural state and local government. The definition of appropriate standards (lanes, shoulders, barriers, fencing) and the associated costs is also a major problem for state departments of transportation and for local public works entities. Waterborne activity continues to be constrained by the high cost and uncertain economics of major port and waterway improvements under federal jurisdiction.

The rural level-of-service issue, unlike urban areas, is characteristically access rather than congestion. The strategic concern is access time and cost of access. Travel times over low- or intermediate-class roadways can become significant. Principal sources of delay, other than distances, are road operating constraints (capacity, speed limits, and weight constraints) and the impact of rural incidents—more likely to be weather-related than traffic-caused. From a safety perspective, rural highways are a major problem: 58 percent of highway fatalities occur on rural roads at an overall fatality rate twice that of urban roads. In particular, single-vehicle, run-off-the-road crashes are much more frequent on rural roads.

*Rural Private Services*—In general, rural freight service—by all modes—has been the victim of deregulation since the 1980s, presenting a major challenge of unstable trucking, abandoned rail lines, and essential air service. Intercity motor coach service is provided by hundreds of small companies, with many of the larger ones operating under the franchise of the two large national consolidators. Rural public transportation consists of a patchwork of thousands of small carriers, heavily subsidized by federal and state transportation and social service agencies.

Technology and Policy Issues
The current federal highway-aid program has a set of programs that, with state match, target rural needs. These include the Surface Transportation Program (STP) rural set-asides, the Deficient Bridge Program (especially with its off-system set-asides), Scenic Byways, and the Borders and Corridors Program. Each of these programs received a significant boost in both the Intermodal Surface Transportation Act of 1991 (ISTEA) and
the Transportation Equity Act for the 21st Century (TEA-21), and each may increase within the current funding reauthorization scenarios. Rural research and technology transfer is likely to increase as well. The funds may never appear adequate to the needs, and states will have to continue to make hard decisions about resource allocations and local governments must continue to do the same. Some advance may be expected as research regarding rural roads—mostly state-sponsored—provides new technology for more effective preservation (new material and designs for longer life cycles), as well as asset management methods, to make the most efficient use of scarce funds.

Rural Society and Passenger Transportation Needs

As the United States becomes a more service-oriented economy, rural society is becoming more and more like its metropolitan counterpart. This includes a shift in age distribution (aging-in-place, new families with children), ethnic mix (minorities and recent immigrants), broader household income spread, and growth in labor-force participation of women. These changes have added familiar urban mobility problems to the traditional concerns of rural isolation and distances. Sometimes it has also resulted in the burdens of rapid change with large percentage changes in population—up or down—in short time periods.

The Mix of Legacy and New Problems

The combination of a more complex society—especially in less-urbanized settings—still presents the historic rural problems associated with separation and access. Long distances between rural populations centers and areas of economic activity (such as farm, mine, or plant) have been associated with a tradition of local self-sufficiency combined with extended travel for special household and business purposes. But overall, rural transportation patterns and needs are beginning to mirror those of urban areas and the more complex demographic and social realities they reflect. Despite overall auto dependency, there are increased demands for transit service on the part of low-income, elderly, and handicapped drivers. Nearly 40 percent of the country’s transit-dependent population—primarily senior citizens, persons with disabilities, and low-income individuals—resides in rural areas.

Distinctive Rural Passenger Transportation Challenges

The mix of characteristically rural mobility needs, together with the new needs imposed by “urbanization of the countryside,”\(^2\) has generated a more complex mix of trip purposes and geographic patterns of trip making. These patterns and dynamics have introduced a distinct set of transportation challenges.

Increased Highway Travel—Rural passenger travel is almost all by private vehicle. Travel has been increasing 2-3 percent on rural arterials and around 4 percent on rural interstates. The general increase in traffic volumes is based, in part, on new employment

mixes, an increase in service trips, and increased local-goods delivery. Reduction of freight rail service has increased truck traffic on rural highways—including larger and heavier vehicles. New high-tech employment and shipping clusters, especially on the metropolitan fringe, concentrate travel and congestion on modest rural networks. At the same time, the number and length of trips per household have also increased, especially in metropolitan fringe areas with more and longer commutation between rural and metropolitan areas. Together these patterns have imposed new traffic burdens on the rural highway systems, in terms of both capacity and safety.

**Peak Demands**—New and more concentrated centers of employment introduce significant local peak-travel demands. Even in remote small-town environments, the impacts of seasonal recreation peaks can introduce new peak demands. Agricultural peak truck traffic adds to this concentration. Rural congestion has become a significant problem, increasing at twice the urban rate, or nearly 10 percent per year.

**Special Mobility Needs**—The increasingly complex social mix in rural areas—with its growing labor force participation of women and an increased elderly population—has introduced a wider range of special mobility needs and greater demands for rural public and special transit. There is a long tradition of rural public and special transit service operating and capital assistance from federal and state government. For example, the Federal Transit Administration has 5,311 rural and intercity transit programs, and there is special federal and state transportation support for special mobility services transport. In addition, social services funding is available. Local general and special transit service providers use a variety of small equipment, special computerized dispatching, and operating and cost-sharing regimes to meet these needs within a highly resource-constrained environment. Regardless of their current economic fortunes, however, small urban and rural communities often lag behind in adequate public transportation. Nearly two-thirds of all residents in these communities have few, if any, transportation options.

**Long-Distance Intermodal Travel**—Most rural residents (more than 90 percent) live within 25 miles of at least one commercial intercity transportation mode (non-hub or small hub airport, an intercity rail station, or an intercity bus terminal) or within 70 miles of a major airport. Motor coach service is the sole mode for many of these communities. But as rural areas urbanize, these choices may not be sufficient. Managers and employees of new more nationally and globally connected business also require efficient connection to headquarters and market locations, placing special importance on scheduled air service and general aviation, as well as on passenger rail connections.

Rural and small town air service also presents a continuing challenge. Deregulation, airline reorganization, economics of small aircraft, fuel prices, and the impact of 9-11 have together negatively impacted airline economics and, in particular, pressured the economics of small-community service. Federal and state aid has supported increased federal subsidies of existing service more than 70 miles from a major airport that were already dependent on scheduled service. But these services have experienced increasing subsidies and reduced traffic in recent years. There is also increased consideration of the development of secondary airports in exurban areas.
Regarding other modes, Amtrak is in an extended period of retrenchment that both undercut their contemporary reliability and long-term prospects. Fixed route/scheduled intercity bus service has been on the decline, though it is sensitive to the national economy.

Technology and Policy Issues—At the national level, rural travel demand is not well-understood, and there is very little research focused exclusively on rural passenger needs within the U.S. Department of Transportation context or among the state and local government associations. Agricultural and social service entities, together with rural transit providers, appear to have the clearest picture of rural needs. Some recent state transportation-planning exercises have included survey and stakeholder participation approaches that fill these knowledge gaps locally.

The Transportation Equity Act for the 21st Century (TEA-21) called for enhanced consultation with rural local officials and encourages states to use existing regional development organizations to facilitate the participation of elected officials. Many of these organizations have been able to bring to the table extensive knowledge of economic development, land use, and environmental planning in their areas.

As the private vehicle is the principal mode of rural transport, improvements in rural highway operations can be significant—especially in the context of characteristic rural weather-related challenges and the special nature of rural congestion. Important strides have been made regarding road and weather information systems (RWIS) and the related systems for utilizing the information in snow, ice, and slide control, as well as for highway travel-condition reporting systems (HTCRS). The major advances are in remote sensing and mezzo-level scales related to treatment applications, combined with user-friendly advance warnings to drivers on a work/home or roadside basis. Several states and consortia are developing new technology and systems.

Another key area is incident response (crashes and breakdowns). Rural incidents can be more serious than their urban counterparts owing to limited rural network capacity and the special problems of remote locations and limited incident-response capacities. These characteristics place special importance on 911 detection, rapid communication among public safety and transportation entities, and rapid response. A few pilot programs have been established, but most states are not substantially addressing these issues.

Other rural intelligent transportation systems (ITS) initiatives also hold some promise. These include improved communications, both within and between state DOTs and other public-safety entities. The growing use of wireless communication increases the viability of remote field devices, such as variable-message signs and camera surveillance of critical areas. New technologies are becoming available for more effective railroad grade-crossing protection, fog detection, speed and animal warnings, and construction work-zone speed-management systems. In addition, renewable energy sources (solar) are needed to power these devices and their related communications. State transportation policy is critical to progress in these areas. At present, real-time systems operations—
including rural operations—is not an identified program area within most state DOTs. Addressing these issues in policy priority and in programs is essential to serious progress.

The operating issues and economics for non-auto modes, including bus, rail, and aviation, are highly constrained and fare-sensitive—with very limited federal support. State policy regarding subsidies to such services have been key to the more robust programs, but most complete with other state and rural non-transportation needs.

The Rural Economy and Freight Transportation Needs

Rural goods movement—like passenger travel—faces the characteristic rural transportation challenges of accessibility and connections (distances and density), together with the costs of service, competition, and integration in low-density environments. However, the specific transportation strategy in support of rural economic development is substantially responsive to the nature of the economic activity.

Sustaining Legacy Rural Economies

In many areas of the United States, the rural economy is dependent on the movement of product from rural source to metropolitan processing centers or markets. Historically, these products have been relatively high-bulk, low-value, such as timber, mineral, and agricultural products. These commodities have historically depended on a national network of highway, rail, and waterway systems that grew up during the last century. Global sourcing and trade agreements (such as NAFTA) have increased the transportation cost-sensitivity of many of these commodities. The traditional logistics have evolved as intermediaries, such as elevator companies, have consolidated operations. This, in turn, has placed pressure on the producer/shippers to seek means of retaining and attracting competitive service. At the same time, deregulation of rail and trucking has reduced the array of options available, leaving shippers in potentially captive positions.

Supporting Transitioning Rural Economies

Though in some areas “transition” has meant facing the reality of depopulation, other areas have been focused on rural development strategies that can capitalize on the existing infrastructure and labor force to move from the inherited resource-dependent economy to higher value-added economy with a more stable economic potential. In these areas, vectors of economic development have been shifting from resource-based (extraction/agriculture) to workforce/lifestyle-oriented (high-tech, recreation, second home). Tourism and technology (IT and software) are the most prevalent targets with industrial parks, lakeside/mountain-base villages, and casinos as characteristic development icons.

Transportation is not the most essential ingredient in the success of such transitions, but it can play an important contributory role. While older economic bases require new efficiency, new industries—such as recreation and information technology—may require special transportation support and new capacity or connections supporting growth,
access, and integration. In some cases, improved ground transportation can improve the “scale economies” of certain industries by providing closer connections in time or distance to regional hubs and metropolitan areas. In addition, retaining the work forces—such as the educated worker required by the IT industry—require access to urban-type amenities that may imply significant transportation improvements.

The New Mix
Some states need to meet the needs of economic maintenance and transition simultaneously. For example, a state like Minnesota combines substantial natural-resource exports—long-distance freight movement, such as bulk grain traveling on the Great Lakes or unit coal trains to a port together with high-value packaged goods, such as medical instruments moving through the state to regional metropolitan areas. The logistics of moving these goods requires maintenance of a competitive multimodal freight system for local trucking, short- and long-haul rail service, and long-haul waterborne transportation.

Distinctive Rural Freight Transportation Challenges
A legacy of in-place freight systems has been challenged not only by the escalating costs of providing transportation service, but also by the declining margins for the commodities themselves. Thus, shippers are seeking to control or reduce consolidation and shipping costs, obtain additional flexibility, and retain modal and intermodal competition. At the same time, transportation service providers are pursuing means to more efficient operations. Starting with the deregulation of the 1980s and driven by recent increases in costs, global competition, and security burdens, some freight service has been consolidated, cutback, or abandoned. Interacting with these forces are the opportunities presented by new technology applications and public-sector policy that may provide some relief. Some of the key issues include:

Rural Trucking Operations—Rural operations are also important. From the private operator side, the convergence of GPS and wireless communications has substantially aided long-distance truck dispatching, routing, and safety. The public-sector responsibility for infrastructure operations includes response to vehicle mixes that include large slower vehicles that can be addressed with passing lanes, bypass ramps, and special staging areas. Changes in operating restrictions (such as truck size and weight restrictions, and variable weight limits) may also be required to deal with special product shipments and seasonality. Automation of commercial-vehicle safety and economic regulation (such as credential-checking and vehicle-weight enforcement) can also play an important role in increased efficiency of rural trucking. This same issue is a special focus at international border crossings, where significant delays are experienced owing to tightened security, and where automated tracking, clearance, and pre-clearance technologies are under testing.

Rural Rail Service—The 1980s deregulation impacts continue with rail consolidation and mergers, leaving only four truly national Class I rail entities together with extensive branch-line and terminal abandonment. In many states, the state DOTs have subsidized local government support of branch-line rail operations through public-private
partnerships to maintain multimodal competitive access to key industries, such as timber, mining, and agriculture. Key issues have included upgrading these lines to handle heavier, high-capacity freight cars (weighing 286,000 pounds) common on the Class I railroads, and selective investment in grade crossing elimination.

*Rural Intermodal, Port, and Waterway Service*—Bulk commodity transport is substantially dependent on rail and waterborne transport. At the same time, most waterborne improvements (such as lock capacity, draft, year-round operations) are subject to federal government (U.S. Army Corps of Engineers) and, in some cases, bi-national jurisdiction. This places substantial limits on the likelihood and timing of any major waterway improvements within a reasonable time frame. Nevertheless, there are efficiency improvements essentially under private and state control, such as modifications to local intermodal-container operations. New equipment can improve efficiency of current operations, and new terminals can introduce highway or rail competition and eliminate expensive drayage. The use of “freeports” (foreign trade zones) is another tool that can be combined with intermodal improvements.

*Technology and Policy Issues*—The active incorporation of transportation strategies into rural development programs is increasingly evident. Rural county and regional economic development entities, considering the importance of maintenance and improvement of freight service to current and future economic activities, have worked hard to forge a workable solution with private-sector service providers and to receive consideration in overall state policy. Statewide and corridor freight plans have been developed, in some cases working through the Federal Highway Administration’s Borders and Corridors program.

Each mode has characteristic potential for operational improvements. The means of improving truck freight service, for instance, is a major consideration. From a public-sector perspective, the costs and delays associated with regulation present a major area for improvement. The FHWA-sponsored CVISN (Commercial Vehicle Information Systems and Networks) program places special emphasis on a cooperative national network for safety-information exchange, credential administration, and electronic screening. The field applications include innovative public-private partnerships to develop credentials, safety screening, and weigh-station bypass (or weigh-in-motion) that can substantially reduce trucking delays. These activities are part of a broader trend to commercial-vehicle automation for productivity and safety improvements, including mobile communications systems, navigation and tracking systems, on-board vehicle monitors, collision-avoidance devices, crash restraints, and vision enhancement equipment. Since 9-11, new security requirements are visible within the border crossing activity at international ports of entry where cargo and driver credentials are manually checked. New technology for vehicle tracking (GPS), driver identification confirmation (biometric identifiers), cargo and container security (electronic seals) is being developed by FHWA, the Federal Motor Carrier Safety Administration, and the Department of Justice. Not all states are equally aggressive in participating in this program.
The sustainability of short-line freight-rail service has been the subject of state grants to local governments and/or directly to industries and railroads for preserving essential rail lines and rehabilitating them following purchase, or loans to support a range of private short-line railroad improvements, such as better connections to Class I lines. Some of these arrangements involve sale or lease of lines legally abandoned to new operators. A major issue has been the capital cost of upgrading these lines for the 286,000-pound cars, with interested states seeking federal aid.

**Transportation and Quality-of-Life Issues**

Though considerable energies have been focused on maintaining and developing rural economies as vital parts of regional economies, rural development has its down side as well. One of these is the impact of traffic, congestion, and visual clutter associated with major new developments, such as gaming complexes, prisons, and even peripheral Wal-Marts or seasonal developments providing recreational activities. Another area of concern is rural sprawl.

**Rural Sprawl**

While there is much attention on the well-known phenomenon of urban sprawl, its country analogue is less well-known. Rural sprawl occurs outside of rural towns, in areas not yet suburbanized. There are two types of rural sprawl. The first is residential. Because older existing structures are often considered unsuitable for contemporary living, residential rural sprawl typically involves large-lot piecemeal development (“McMansions”) as a result of an individual preference—rather than in housing developments. Because it is a slower, unorganized process not requiring detailed approvals from government bodies, this spread-out pattern happens, facilitated by low land prices, state subdivision restrictions, lack of suitable housing stock, and suburban highway extensions.

The second type of rural sprawl is the strip commercial development along the rural highways, leading into and out of rural settlements or near rural places of employment.

*Sprawl Impacts*—This type of development can actually cause density to decrease as rural population increases. It has many of the same negative features as its urban counterpart:

- consumes large acreages of land, especially along roads
- changes the character of rural areas, which traditionally focus development in mixed land-use villages, with open spaces between the settlement areas and pedestrian-friendly streets
- depopulates existing rural settlements
- degrades wildlife habitats
- increases auto dependency/long commutes and is difficult to serve with transit
- raises the cost of public services
- impacts shoreline development
Rural Sprawl and Health—Most recently, the national concern over the obesity epidemic has led the Centers for Disease Control and Prevention to work on establishing a link between urban sprawl and obesity, concentrating on related diseases like diabetes and heart problems. While it is not clear that there is a singular correlation of health problems in settlement patterns, it is clear that a more sedentary lifestyle (including being seated in a vehicle for significant amounts of time) is an important contributing factor.

Technology and Policy Issues—Some rural areas have responded to the challenge of sprawl using the same “smart growth” set of tools employed in some urban areas: preservation of open space (for example, through farmland preservation incentives), limiting and focusing growth (through planning and zoning) in settlement areas or in relatively dense, cluster-style developments, and investing in infrastructure (such as public transit) that reduces congestion and encourages growth near this infrastructure. However, even communities that have responded with growth-reduction strategies have found that these approaches may only confound their problems by spreading out the growth in a sprawling fashion that can put strains on the environment, prove costly in providing public services, and destroy the sense of community. Other areas have undertaken deliberate attempts to preserve and adapt traditional environments and local historic resources to serve as a basis for control of growth. Adaptive reuse of buildings and conversion of rails to trails are two such examples.