Financing and Maintaining Low-Volume Roads in the Midwestern United States

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Rural governments in the Midwest have encountered major difficulties maintaining the roads and bridges that are needed to serve rural regions and the agricultural industry. Advances in farming technology have resulted in the use of larger and heavier equipment, which has placed greater load-bearing requirements on low-volume roads and bridges. Weakened property tax bases and shrinking federal and state intergovernmental assistance are resulting in stringent fiscal conditions for responsible local rural governments. Four issues are examined in this paper. First, the uses of rural roads by the farm sector are reviewed. Second, the condition of roads and bridges is described, including detail regarding the costs of upgrading the transportation structures to an acceptable condition. Third, the main revenue sources that fund rural roads and bridges are discussed, including a review of the expected trends in these sources. Fourth, policy options to address the rebuilding of rural road systems are considered. Infrastructure financing issues are not easily addressed. Rising costs, increased demands driven by advancing agricultural technologies and nonfarm business activity, and shrinking revenues are forcing disinvestment unless new revenue sources are used. The magnitude of the costs of upgrading the system to acceptable levels, however, is so large that local rural governments do not have the fiscal capacity to make needed improvements without financial help from states and the federal government. Timing is critical because further delays and continued disinvestment may force costs to rise in the future.

The condition of the nation's infrastructure has been a cause of national concern. Policymakers realized that the cost of upgrading the infrastructure to an acceptable level of perfor-
mance was estimated to have reached trillions of dollars, which far exceeds the resources currently available to most state and local governments (1). The options available for raising the necessary revenues are limited, but the importance of safety issues and the contribution of the local infrastructure to the effective functioning of the U.S. economy demands that the problem receive immediate attention.

Much of the national concern involves the condition of streets, water mains, and sewer systems in large metropolitan areas. Only recently have comprehensive studies been reported for nonmetropolitan areas (2, 3). Available information, however, indicates that in light of the revenue-raising capacity of rural governments, the infrastructure problems in rural communities may be just as severe as those in major urban areas. The continued poor economic performance of the farm sector suggests that the fiscal capacity of many rural governments will deteriorate in the future (4).

The problems experienced with financing low-volume roads in rural areas are examined from four perspectives. First, the use of the roads, particularly in regard to agriculture and agribusiness travel demands, is reviewed. Second, a detailed analysis of the conditions of rural road systems and estimates on the costs of upgrading are provided. Third, financing patterns for low-volume roads and bridges are discussed, including particular attention to changes and trends in revenue sources. Finally, alternatives available to policymakers in rural areas to improve the condition of the low-volume rural roads and bridges that are maintained by townships are presented. The descriptions and analyses are based on data collected from township governments and farmers, as major users of rural roads, in Illinois, Minnesota, Ohio, and Wisconsin. The 16,734 townships studied are responsible for approximately 55 percent of all rural roads in the four-state region. Although these states are in the Midwest, they represent sufficient variation in arrangements for providing and financing low-volume rural transportation that these results can be generalized to other regions of the United States, as well as other areas of the world.

Many perceptions of low-volume roads exist, depending on the region of the country and the level of government. Because of the importance of farm-to-market roads, roads maintained by townships are used as the basis for comparison in the Midwest. These routes provide the first link in moving commodities to market and are critical to the transport of purchased inputs to farms. Because of the poor farm economy, rural roads have become essential in linking farm families with off-farm jobs.

The administration of low-volume roads differs among the states. In some states (e.g., Iowa and Indiana) counties have primary responsibility for low-volume roads. In other states (e.g., Illinois, Minnesota, Ohio, and Wisconsin), township governments are responsible for constructing and maintaining a significant majority of low-volume rural roads and bridges. Counties in these states also maintain overlapping higher-volume routes. In still other states (e.g., Kansas, New York, and Idaho), a combination of counties, townships, and special districts share responsibilities for low-volume roads. Finally, in states such as Virginia and West Virginia, low-volume roads are administered by the state governments.

For the purposes of this discussion, low-volume roads are defined as the farm-to-market roads that bring rural families to communities and the connecting roads between farms and county collectors or state highways. Many of the roads (48.6 percent) have a loose aggregate surface and a narrow right of way, and most (62.7 percent) have traffic loads of fewer than 50 trips per day (2, p. 49). Connecting bridges on these systems were typically constructed in the early 1900s and many currently will not support the loads imposed by loaded school buses or farmers who are marketing commodities. In the Midwest and West, low-volume road systems are characterized by rectangular road grid patterns that follow section lines from the land survey tasked in the Ordinance of 1785. A typical Midwest township is responsible for about 50 miles of section line road and 9 or 10 connecting single-lane bridges.

SERVICE DEMANDS ON LOW-VOLUME ROADS AND BRIDGES

The weight of the produce transported over low-volume roads and bridges is a major determinant of the conditions in which these transportation systems must be maintained. Simple vehicle counts fall short of measuring the service demands of farmers. The agriculture industry is a prime user of the rural roads, and the weights transported provide a reasonable estimate of the demands on low-volume roads in the Midwest. The largest number of farmers in the midwestern survey (43.8 percent) reported using straight-trucks with a gross loaded weight of 25,100 lbs coming to the farm and 28,000 lbs leaving the farm (Table 1). Most low-volume roads and bridges will therefore have to accommodate these loads.

Semi-trucks were reported by 10 percent of the farmers as the type of vehicle used to transport commodities to market. Farmers reported that the average weight of semi-trucks hauling to market was 66,300 lbs (Table 1).

Although the percentage of farmers that use semi-trucks is relatively small, some of the rural roads and bridges will have to accommodate these weights. Because the consolidation of farms into larger operating units is being accelerated by the financial crisis in American agriculture, the use of semi-trucks in agriculture, and therefore on low-volume roads, will probably grow.

Farm tractors and wagons are more common on these roads. The average weight of these vehicles is between 14,800 lbs and 19,400 lbs. Also common are pickup trucks that range between 6,100 lbs and 6,700 lbs. The use of private automobiles was not reported, but these vehicles are unlikely to pose weight problems for rural roads and bridges.

Although the use of heavy trucks is seasonal, their reported requirements must unquestionably be met by the transportation system to be of service to the farm sector. Unfortunately, the spring season, which involves planting and the delivery of inputs to farms, may pose the greatest hazards to roads, especially those with a loose aggregate surface and little base. Spring road use by vehicles with heavy loads can also be expected to increase with the consolidation of farms and advances in technology as farms purchase larger amounts of off-farm inputs for bulk delivery and possibly field application. These off-farm inputs include fertilizers and herbicides that are delivered in bulk quantities and applied by the farmers themselves. The agribusinesses that serve farmers in Illinois reported that 29.9 percent of their trips were made during the spring season (2, p. 46). In the four midwestern states, 48.6 percent of the road miles maintained by townships were gravel (2, p. 49). Measures of road usage by traffic volume do not reflect the agricultural transport demands on rural roads that are evidenced by the load weights and seasonality of trips.
CONDITION AND STATUS OF LOW-VOLUME ROADS

The limited information available on the condition and financing of low-volume roads and bridges is a major dilemma that faces scholars and policymakers. Major secondary data sources, such as the Highway Statistics series of the Federal Highway Administration, report the miles of road administered by townships and other very general data but virtually no information on the condition of low-volume roads (5). Any detailed analysis of low-volume road systems must rely on primary data. Even state highway departments, in many instances, do not have extensive information on the condition of low-volume roads.

The collection of information on low-volume roads is made more difficult by the part-time status of local officials responsible for rural roads in many states (2, pp. 109-128). Road officials in townships are usually elected and have little formal training in road building or management practices. Many of these officials are full-time farmers or operate small businesses; others are retired and serve as township officials, road commissioners, superintendents, or masters to supplement their incomes. All of these officials reflect the volunteer spirit of local government in rural areas.

Data Collection Procedures

Two approaches are used to collect data on the condition of low-volume roads and bridges. The first, and preferred, approach is an engineering inspection of each mile of the road or selected samples. The inspection procedure should be followed for all bridges 20 ft or longer as part of the biennial federal bridge inspection program. Unfortunately, a similar regular and systematic inspection of low-volume roads does not take place. Such a program would be expensive and was certainly beyond the scope of this research project.

The second approach is to ask local officials most familiar with the roads and bridges in their jurisdiction to evaluate them according to specific condition criteria and to apply a rating to the road mileage and bridges. Because of budget constraints, this approach was followed to develop some information on the township rural road system in the four states studied.

Even though this approach is less exacting than a full engineering study, there are several reasons why it provides useful information. First, local officials are able to identify the condition characteristics easily and are familiar with how their roads and bridges compare to these criteria. Second, local officials are responsible for making budget decisions on the roads and bridges in their jurisdiction, and their perceptions of the conditions and quality of these routes and structures, and how they relate to service demands, determine how resources are allocated. The perception of a local road official on the condition of a road or bridge therefore may be more important than the engineering rating. In practice, some recommended engineering ratings may not even be appropriate for low-volume rural roads. Budgetary decisions take service demands, current route and bridge conditions, and available revenues into account. It may be difficult to capture the decision-making scenario solely with an engineering inspection of a road or a bridge. Yet, the decisions made by thousands of local public officials affect the performance of low-volume road and bridge systems throughout the world.

In the spring of 1984, a questionnaire was mailed to all township highway officials in Illinois, Minnesota, Ohio, and Wisconsin. The questionnaire was prepared in consultation with representatives of the township officials' association in each state.

An effective understanding of the condition of low-volume roads and bridges is enhanced by information obtained from users of these systems, especially farmers who in many cases pay a substantial part of the taxes that finance rural transportation systems. A random sample of farmers was obtained from the Crop Reporting Service in each of the four states studied. Farmers were asked in a mail survey about the condition of township roads and bridges as well as their preferences for financing needed improvements.

<table>
<thead>
<tr>
<th>Type of Vehicle</th>
<th>Illinois To Farm</th>
<th>Illinois To Market</th>
<th>Minnesota To Farm</th>
<th>Minnesota To Market</th>
<th>Ohio To Farm</th>
<th>Ohio To Market</th>
<th>Wisconsin To Farm</th>
<th>Wisconsin To Market</th>
<th>Four-State Average To Farm</th>
<th>Four-State Average To Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight truck (tank truck) (wt)</td>
<td>25.7</td>
<td>27.3</td>
<td>27.2</td>
<td>30.1</td>
<td>22.4</td>
<td>25.5</td>
<td>25.3</td>
<td>29.1</td>
<td>25.1</td>
<td>28.0</td>
</tr>
<tr>
<td>(%)</td>
<td>54.3</td>
<td>48.9</td>
<td>47.0</td>
<td>53.1</td>
<td>29.0</td>
<td>38.7</td>
<td>44.7</td>
<td>64.3</td>
<td>43.8</td>
<td>51.0</td>
</tr>
<tr>
<td>Semi-truck (wt)</td>
<td>62.9</td>
<td>65.5</td>
<td>65.4</td>
<td>73.5</td>
<td>56.2</td>
<td>63.0</td>
<td>62.0</td>
<td>63.2</td>
<td>61.6</td>
<td>66.3</td>
</tr>
<tr>
<td>(%)</td>
<td>3.3</td>
<td>14.3</td>
<td>1.1</td>
<td>7.3</td>
<td>2.8</td>
<td>10.9</td>
<td>1.4</td>
<td>7.4</td>
<td>2.2</td>
<td>10.0</td>
</tr>
<tr>
<td>Farm tractor (two-wheel wagon) (wt)</td>
<td>19.4</td>
<td>24.5</td>
<td>14.8</td>
<td>15.1</td>
<td>13.6</td>
<td>17.4</td>
<td>11.5</td>
<td>9.7</td>
<td>14.8</td>
<td>16.7</td>
</tr>
<tr>
<td>(%)</td>
<td>3.9</td>
<td>17.7</td>
<td>2.5</td>
<td>1.5</td>
<td>5.6</td>
<td>1.1</td>
<td>2.8</td>
<td>1.2</td>
<td>3.7</td>
<td>1.4</td>
</tr>
<tr>
<td>Farm tractor (four-wheel wagon) (wt)</td>
<td>20.7</td>
<td>26.8</td>
<td>16.3</td>
<td>19.5</td>
<td>15.3</td>
<td>18.7</td>
<td>12.3</td>
<td>12.8</td>
<td>16.2</td>
<td>19.4</td>
</tr>
<tr>
<td>(%)</td>
<td>8.6</td>
<td>16.0</td>
<td>21.8</td>
<td>18.3</td>
<td>19.2</td>
<td>18.0</td>
<td>16.5</td>
<td>8.1</td>
<td>16.6</td>
<td>15.1</td>
</tr>
<tr>
<td>Pick-up/goose-neck trailer (wt)</td>
<td>18.5</td>
<td>18.3</td>
<td>14.1</td>
<td>14.3</td>
<td>13.8</td>
<td>14.3</td>
<td>11.2</td>
<td>13.2</td>
<td>14.4</td>
<td>15.0</td>
</tr>
<tr>
<td>(%)</td>
<td>4.5</td>
<td>7.3</td>
<td>1.8</td>
<td>8.4</td>
<td>3.1</td>
<td>7.1</td>
<td>2.1</td>
<td>5.4</td>
<td>2.9</td>
<td>7.1</td>
</tr>
<tr>
<td>Pick-up (wt)</td>
<td>6.5</td>
<td>7.5</td>
<td>6.1</td>
<td>6.6</td>
<td>5.6</td>
<td>6.0</td>
<td>6.3</td>
<td>6.6</td>
<td>6.1</td>
<td>6.7</td>
</tr>
<tr>
<td>(%)</td>
<td>23.4</td>
<td>9.3</td>
<td>22.8</td>
<td>7.3</td>
<td>37.1</td>
<td>21.1</td>
<td>30.6</td>
<td>11.6</td>
<td>28.5</td>
<td>12.3</td>
</tr>
<tr>
<td>Other (%)</td>
<td>1.9</td>
<td>3.4</td>
<td>3.2</td>
<td>4.2</td>
<td>3.1</td>
<td>3.0</td>
<td>1.8</td>
<td>1.9</td>
<td>2.5</td>
<td>3.1</td>
</tr>
</tbody>
</table>

*Thousands of pounds
Condition of Rural Road Systems

Farmers and township highway officials reported that low-volume roads and bridges in the Midwest need improvements. To ease the comparison of reported data, the percentages of volume roads and bridges in the Midwest need improvements.

Condition of Rural Road

Farmers and township highway officials reported that low-volume roads and bridges in the Midwest need improvements. Local highway officials in the four midwestern states reported that 63.9 percent of the roads for which they have responsibility met the criteria for adequate road surface with normal maintenance. Farmers reported that 74.9 percent of the roads belonged in this condition category. The converse is that between 36.1 percent and 25.1 percent of the roads are not adequate with normal maintenance.

Differences between the ratings of farmers and local road officials can be explained by several factors. First, although township officials have better knowledge of road-building practices, they also may set standards above those chosen by users. Second, farmers and highway officials may not have always responded about the same roads. In other words, the analysis did not include only those townships in which both farmers and a township highway official responded. Also, farmers may have developed travel patterns that avoided the poorest routes; their perceptions may have been based on some subset of total mileage. Township officials probably responded for all the routes in their jurisdiction.

These results indicate that between 1 mile of road in 3 and 1 mile of road in 4 requires more than normal maintenance to have an adequate surface. There were surprisingly small differences in the ratings between states.

Township highway officials were also asked to rate the condition of the bridges they maintain. They rated the condition of slightly less than one-half of the bridges (49.4 percent) as 6 or higher (Table 3). A rating of 6 means that the condition of a bridge at least equals present minimum criteria. Approximately one-half of the bridges on low-volume rural roads in the sample townships therefore do not meet minimum criteria. A condition rating of 3 or less indicates that the bridge is basically impassable and has a high repair priority. A total of 20.9 percent of the bridges in the four midwestern states were reported to be in this category. Again, there was little variation among the four states.

The level of condition and standards applied to bridges are determined by local officials according to the types of traffic loads and volume that must be supported. Infrequently traveled bridges that provide access to campgrounds and recreational areas, for instance, may be maintained at lower standards than bridges traveled by semi-trucks loaded with grain that weigh 60,000 lbs or more. Likewise, some bridges are posted with load limits that restrict certain types of travel. The greatest inconvenience and expense in lost time occurs when farm implements are diverted because of load limits or inadequate bridges (6). Farmers reported that the most common vehicle used on the farm was a straight truck that averaged between 25,100 and 28,000 lbs. These vehicles place the greatest overall weight requirements on roads and bridge structures because they use these routes more frequently. A farm tractor and four-wheel wagon was reported to weigh between 16,200 and 19,400 lbs. Many, if not most, of the bridges in the four states will need to accommodate this weight. Trucks are more easily diverted with a lower cost in time lost than a tractor and wagon or field equipment.

Estimated Upgrading Costs

Highway officials were also asked to indicate the cost of upgrading roads and bridges to acceptable standards. Disagreement can exist about the precise standards for bridges, as well as low-volume roads, based on traffic demands. There is often substantial disagreement within states between local officials responsible for providing the transportation network and state administrators responsible for coordinating local efforts (7, 8).

Because relatively few statutory requirements exist for the load-bearing capacity of low-volume bridges, township officials are free to determine which bridges will be posted with weight

<table>
<thead>
<tr>
<th>NUMERIC RATING</th>
<th>CONDITION DESCRIPTION</th>
<th>ILLINOIS (%)</th>
<th>MINNESOTA (%)</th>
<th>OHIO (%)</th>
<th>WISCONSIN (%)</th>
<th>FOUR STATE AVERAGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>OFFICIALS</td>
<td>FARMERS</td>
<td>OFFICIALS</td>
<td>FARMERS</td>
<td>OFFICIALS</td>
</tr>
<tr>
<td>9</td>
<td>New or nearly perfect condition</td>
<td>9.3</td>
<td>3.9</td>
<td>6.6</td>
<td>2.7</td>
<td>8.4</td>
</tr>
<tr>
<td>8</td>
<td>Surface adequate with normal maintenance</td>
<td>10.0</td>
<td>20.9</td>
<td>9.7</td>
<td>15.5</td>
<td>8.2</td>
</tr>
<tr>
<td>7</td>
<td>Limited failures and barely adequate maintenance will be considerably higher than normal to prevent continued deterioration</td>
<td>32.9</td>
<td>32.9</td>
<td>45.6</td>
<td>42.0</td>
<td>41.5</td>
</tr>
<tr>
<td>6</td>
<td>Considerable failures and disintegration beyond practical limits of normal maintenance</td>
<td>7.9</td>
<td>11.2</td>
<td>9.4</td>
<td>15.5</td>
<td>8.7</td>
</tr>
<tr>
<td>5</td>
<td>Failures to extent that operation of traffic is severely affected</td>
<td>16.3</td>
<td>11.0</td>
<td>14.1</td>
<td>14.3</td>
<td>14.1</td>
</tr>
<tr>
<td>4</td>
<td>Estimated Upgrading Costs</td>
<td>11.0</td>
<td>7.2</td>
<td>6.9</td>
<td>2.7</td>
<td>10.0</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>7.3</td>
<td>8.5</td>
<td>3.8</td>
<td>5.3</td>
<td>5.5</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>1.5</td>
<td>2.9</td>
<td>1.3</td>
<td>.7</td>
<td>1.3</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>2.9</td>
<td>1.4</td>
<td>1.9</td>
<td>1.4</td>
<td>1.9</td>
</tr>
<tr>
<td>0</td>
<td>Closed awaiting repairs</td>
<td>.8</td>
<td>.6</td>
<td>.3</td>
<td>.4</td>
<td>.5</td>
</tr>
</tbody>
</table>
TABLE 3  CONDITION OF RURAL BRIDGES

<table>
<thead>
<tr>
<th>Numeric Rating</th>
<th>Condition Description</th>
<th>Illinois (%)</th>
<th>Minnesota (%)</th>
<th>Wisconsin (%)</th>
<th>Ohio (%)</th>
<th>Four-State Average (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Condition superior to present desirable criteria</td>
<td>20.5</td>
<td>14.5</td>
<td>10.6</td>
<td>5.3</td>
<td>13.6</td>
</tr>
<tr>
<td>8</td>
<td>Condition equal to present desirable criteria</td>
<td>19.6</td>
<td>14.5</td>
<td>16.6</td>
<td>12.4</td>
<td>16.0</td>
</tr>
<tr>
<td>7</td>
<td>Condition better than present minimum criteria</td>
<td>7.1</td>
<td>7.3</td>
<td>7.6</td>
<td>8.0</td>
<td>7.4</td>
</tr>
<tr>
<td>6</td>
<td>Condition equal to present minimum criteria</td>
<td>8.9</td>
<td>12.7</td>
<td>15.1</td>
<td>15.9</td>
<td>12.3</td>
</tr>
<tr>
<td>5</td>
<td>Condition somewhat better than minimum adequacy to tolerate being left in place as is</td>
<td>9.8</td>
<td>12.7</td>
<td>12.1</td>
<td>16.8</td>
<td>12.3</td>
</tr>
<tr>
<td>4</td>
<td>Condition meeting minimum tolerable limits to being left in place as is</td>
<td>13.4</td>
<td>16.4</td>
<td>19.6</td>
<td>19.5</td>
<td>17.3</td>
</tr>
<tr>
<td>3</td>
<td>Basically intolerable condition requiring high priority to repair</td>
<td>8.0</td>
<td>9.1</td>
<td>9.1</td>
<td>12.4</td>
<td>9.9</td>
</tr>
<tr>
<td>2</td>
<td>Basically intolerable condition requiring high priority of replacement</td>
<td>9.8</td>
<td>9.1</td>
<td>7.6</td>
<td>8.0</td>
<td>8.6</td>
</tr>
<tr>
<td>1</td>
<td>Immediate repair necessary to put back in service</td>
<td>.9</td>
<td>1.8</td>
<td>1.5</td>
<td>.9</td>
<td>1.2</td>
</tr>
<tr>
<td>0</td>
<td>Closed, awaiting repairs</td>
<td>1.8</td>
<td>1.8</td>
<td>.3</td>
<td>.9</td>
<td>1.2</td>
</tr>
</tbody>
</table>

restrictions or closed and in what condition those kept open will be maintained. When fiscal conditions are tight, officials responsible for low-volume roads must make more informed decisions concerning priorities, and must take travel needs into account, in terms of both weight and vehicle counts and the resources available.

When information was gathered on the costs of upgrading low-volume roads and bridges, local officials were not given precise standards because such standards probably would create an upward bias in estimates relative to actual service demands. In practice, many local bridges will not be maintained at an ideal level, such as that advocated by AASHTO. Some bridges will accommodate only 9 tons and others will be maintained at a much higher standard. A more representative, and possibly less inflated, estimate of expected future costs can be obtained by asking local officials what the costs are of upgrading roads and bridges to standards they consider acceptable for the traffic demands in their jurisdiction.

Township road officials estimated in 1984 that it would cost an average of $7,946 per mile to bring roads for which they have responsibility to an acceptable condition (Table 4). This estimate took into consideration the fact that a certain proportion of roads requires no upgrading and some can be closed. Of course, because of differences in travel demands, not all roads would be maintained at the same condition level. The estimates ranged from an average of $13,752 per mile in Ohio to an average of $4,448 per mile in Minnesota. A total of 217,938 miles of low-volume roads are maintained by townships in the four midwestern states studied. A total outlay of $1,731.9 million (in 1984 dollars) will be required to improve the roads, based on the costs just mentioned. The range of costs between the four states varies from $910.1 million in Illinois to $385.4 million in Minnesota and reflects the variation in both costs per mile and total mileage.

A similar approach was used to compute the costs of improving bridges. Township officials estimated an average cost of $27,060 to improve existing bridges (Table 4). This accounts for the fact that some of the bridges will need no work at all and others must be completely reconstructed. Likewise, not all bridges will have the same load-bearing capacity.

An average cost of $27,060 per bridge (1984 estimate) and a total of 29,940 bridges on the township system yields an aggregate cost of $810.2 million to improve the bridges, which is a staggering cost given the size of the typical township budget. The costs would be much higher if all township bridges were brought to nationally recognized professional standards.

REVENUE SOURCES AND FISCAL CONDITIONS

Rural township governments responsible for farm-to-market roads often are not in a fiscal position to finance the investment needed to improve low-volume roads and connecting bridges to the condition needed to meet traffic demands. In recent years, the depressed farm economy has, in some cases, decreased the rural property tax base by as much as one-third or more (9). In
the midwestern states, in which township governments rely on property taxes for a substantial portion of the revenues spent on roads, tax base losses of this magnitude would cause significant fiscal stress and present difficult choices to responsible road officials. Because dependence on property taxes to finance rural road services varies markedly among states, not all rural road systems will be affected to the same degree (10).

Local governments also suffered a major financial blow with the loss of federal revenue sharing. Township officials in the Midwest that responded to the 1984 survey reported that 83.8 percent used federal revenue sharing for road purposes and that an average of 84.5 percent of the federal revenue sharing funds received was spent on roads and bridges. These funds were very important. In Illinois about 13 percent of the funds spent per mile of township roads was financed by federal general revenue sharing. In Minnesota, Ohio, and Wisconsin, these percentages were estimated as 27, 22, and 19, respectively, with a four-state average of 20 percent (11).

The loss of this revenue source compounds the fiscal stress of rural road systems and raises serious questions about the quality of the infrastructure in the future. In the current climate of taxpayer resistance and worsening farm property tax bases, it will not be easy to replace the lost federal revenue sharing funds with property tax increases. Without other sources of revenue, current levels of spending will be difficult to maintain and increased outlays appear unlikely.

The third revenue source available to township governments in the Midwest, and commonly throughout the United States, is state motor fuel tax (MFT) and, possibly, license fee rebates. States collect MFTs and rebate a portion of their receipts to local governments based on population, vehicle registrations, miles of road maintained, and other factors. In some states, these funds are allocated to local governments in the form of grants, based on some indication of financial need or service demand.

Even though states have raised the MFTs in recent years, there is still strong evidence that state grants to local governments for roads have not kept pace with inflation. The allocation to Illinois townships in 1985 represented the level of purchasing power typical of the early 1970s (12). OPEC policies in the early 1970s contributed to major price increases for petroleum-based products, many of which are used in road construction and repair. Thus, local governments faced double-digit increases in prices paid for road materials and other supplies whereas property taxes and state road grants were increasing much less rapidly or, in some instances, declining.

Combined with the loss of federal revenue sharing, the result is a very tight fiscal condition with a possible decline in property tax revenues in the future because of a weakening farm property tax base.

Townships will have to raise property taxes by up to 23 percent just to replace the federal revenue sharing grant if spending on rural roads in the four midwestern states is to be maintained. An average of $1,254 was spent per mile of road in 1982, which was the most recent year for which complete data were available. The average expenditures in each of the four states were $1,529 per mile in Illinois, $671 per mile in Minnesota, $1,801 in Ohio, and $1,662 per mile in Wisconsin (11). Little capacity exists during these economic conditions to finance the improvements necessary (an average of $7,946 per mile) to raise service levels on rural township roads to the acceptable condition identified by township officials.

**POLICY OPTIONS**

Few policy options are available to township governments that address the disequilibrium between available revenues and expenditures required to maintain and improve the rural road infrastructure. However, some options should be evaluated. The implementation of specific policies will vary from state to state, but these policies will determine the future condition of low-volume transportation systems that serve agricultural and rural areas. Several alternatives are discussed in the following paragraphs. Policy options, in some cases, are drawn from the analyses of rural township road systems in the four states.

**Reduce Number of Roads and Bridges**

Transportation systems in rural areas in many regions of the United States, particularly the Midwest, were established in the mid- to late 1800s when the travel conditions and needs of residents differed markedly from those of today. The most notable difference in the Midwest is the existence of a section line rectangular road grid with one mile of road at each mile intersection. This road system provided critical access to land during settlement and was necessary with horse-powered transportation, but some of these roads are not needed today. A reduction in the number of road miles and bridges under maintenance could provide a savings in cost.
A common reply from local township officials is that politics prevents the closing of roads and bridges. However, recent evidence exists to the contrary. More than one-fourth (28.8 percent) of the farmers that responded to the midwestern low-volume road survey indicated that an average of 8.7 miles of road and two bridges in their area could be closed to save costs without causing serious hardship or significant disruptions in travel patterns. For the typical midwest township, these figures represent about 1 in 5 miles of rural road and one in five connecting bridges (2, p. 172).

Township highway officials expressed a similar perception. Nearly one-fourth (24.9 percent) responded that roads and bridges could be closed, but that this strategy would affect only 3.2 miles of roads and an average of 1.8 bridges in the township (2, p. 171). It should be noted that in a survey such as this, farmers answered the question of which roads or bridges should probably be closed under the assumption that the road or bridge that served their property would not be closed. As long as someone else is affected, closing a road or bridge as an adjustment policy is acceptable.

Although reducing the number of roads or bridges appears to be logical given the changes in travel patterns and service demands, intrastate revenue allocation systems do not always encourage the adoption of this alternative. In practice, states frequently allocate state road grants to local governments based on the number of road miles in service. When roads are closed, the funds are reduced. Local governments are therefore given an incentive to keep the maximum number of road miles open and maintain them less. This could possibly lead to serious liability problems as more and more travel occurs on roads where disinvestment is taking place. Furthermore, in situations in which rural road systems rely heavily on property taxes, property owners certainly have no incentive to accept road or bridge closures that affect their property unless there are offsetting adjustments in property tax bills.

**Reduce Conditions and Maintenance Selectively**

One approach to alleviating the fiscal stress of maintaining low-volume roads in some states (i.e., Washington and Iowa) is to designate certain roads for lower levels of maintenance. The designation of roads as "primitive or limited service roads" limits the liability of local governments and local government officials for accidents on roads that are designated as having a reduced quality of service as long as certain conditions are met. Travelers are advised by the placement of many signs that they travel at their own risk when they enter a reduced maintenance route. When the prescribed conditions are met, local governments can significantly reduce the maintenance on these roads and allocate scarce resources to other critical routes.

A side-attraction of this approach is that as long as the road is legally open, it qualifies for state MFT rebates when funds are allocated on this basis. This approach also creates an opportunity if demands and travel patterns shift for local governments to later approach road users and propose that the property owners provide supplemental resources for road improvements through special assessments as is now commonly practiced in urban areas. In other words, those users that are interested in upgrading road conditions can pay a portion of the cost or contribute labor and materials toward improvements. This option is attractive to local officials as long as they are convinced that the state government, in changing liability statutes, does not intend to withdraw full support for roads designated as reduced maintenance roads. However, without a lower property tax bill for road purposes, there is no incentive for landowners to voluntarily agree to accept "primitive roads" in areas in which property taxes are a significant source of revenue.

**Raise Additional Revenues**

A strong argument can be made for allowing users of low-volume roads to bear a major portion of their costs. Agricultural businesses are one of the dominant users and in many if not most states they pay for rural roads and bridges through local property taxes and/or state motor fuels taxes and license fees that are distributed to local road agencies. A main concern now is the poor financial condition of many farmers, which is reducing the fiscal capacity of rural townships and counties, particularly in the Midwest. Property taxes are already troublesome for farmers in some states and further increases could be devastating and would likely meet significant resistance.

Farmers and agribusiness users of low-volume roads are willing to pay for road and bridge improvements, but they do not favor higher property taxes. Farmers responding to the Midwest low-volume road survey reported a willingness to pay between $8.62 and $18.20 more per month for better roads, depending on whether they were farming as few as 150 acres or as many as 1,000 or more acres (2, p. 158). In light of the fact that the average township in the four states raised $106.16 per capita, an increase of $8.62 per month represents $103.44 per year and $18.20 per month represents $218.40 a year. Increases of these magnitudes could be a significant help to rural townships. However, strong resistance will exist to raising these revenues with property tax hikes.

The farmers that responded to the survey expressed the view that road users at both state and local levels should be required to pay for the roads and property owners should not have to pay the full cost. The respondents were presumably supporting greater use of state motor fuels taxes and/or license fees in which receipts were shared with local governments. Another revenue source available to some local governments is optional local road users' taxes, such as a wheel tax. For example, counties in Ohio and Indiana are authorized to adopt a local fee to piggyback on the state vehicle registration charge. Counties and townships in Wisconsin also have an option to use this revenue source. However, the revenue potential of a local wheel tax on cars and light trucks at reasonable rates appears to be rather limited for low-population, rural townships. For example, a $10 passenger vehicle wheel tax would raise an estimated $6,300 in a typical rural Midwest township with a population of 1,000. For the typical township this represents $126 per mile, but only 1.6 percent of the estimated cost of improving the average rural road to an acceptable condition. The potential small revenue yield may not outweigh political resistance. This type of levy, however, does diversify the revenue base that finances rural low-volume road systems, which may be a compensating advantage (II).

**Restructure Local Public Finance**

Taxpayers nationwide have resisted increases in property taxes since the era of Proposition 13 in the late 1970s. Pressure is
currently growing in such states as Illinois and Wisconsin that are heavily reliant on the property tax to re-examine the financing of local public services, especially schools. Schools nationwide are heavy users of property taxes, and many farm families no longer have children of school age. They therefore see property taxes as a burden that has few direct benefits.

A strong case can be made for financing a greater portion of school expenditures, particularly in rural areas, from state-wide levies, such as income tax, because of the out-migration of secondary school graduates from rural communities. Many rural school district graduates are leaving the area in search of employment. Local public investments of property taxes are not recovered in local tax receipts; therefore, other places and the state as a whole reap most of the benefits of property tax expenditures on rural schools. The financing of a larger share of local educational programs from state (or federal) sources would have the advantage of revenues being collected from a wider population base, which would help realign the costs and benefits of education expenditures. Shifting some of the burden of school financing off property taxes would make more of the property tax base available to finance local services such as low-volume roads and bridges.

**Improve Management and Organizational Efficiency**

Low-volume rural roads and bridges are overseen by part-time officials of small governmental units. The inexperience and unsophisticated administration of officials frequently create a potential for improvements in management practices and, therefore, cost savings (13, 14). Efficiency can be improved in at least three ways. The first way is to increase cooperation among small governmental units. These cooperative agreements could include sharing expensive capital equipment and/or technical expertise (15). Group purchasing programs can also be effective and result in significant price advantages to cooperating local agencies.

An alternative approach that is used in several states (New York, for example) is to use a “circuit rider” who provides management expertise to small rural governments. The circuit rider provides specific technical expertise on a short-term, low-cost basis. Multiple local governments pool their resources to finance this assistance and to maintain regular contact with state government agencies. This type of project has been well-received by local governments and could serve as a model to improve the administrative performance of smaller governments (15).

The second approach is to create an organized training and profession improvement program for local officials on specialized topics and general administration and planning. Instruction on road construction techniques, financial management, purchasing practices, and related topics could be considered as a way to upgrade the management skills of part-time local road officials.

The third approach to improve administrative performance is the possibility of combining the smallest administrative units into larger, more efficient, and better managed jurisdictions. Larger units can attract more qualified workers, make more effective use of specialized machinery and employee skills, and achieve cost savings from quantity discounts on services (16). Consolidation efforts are likely to run into opposition, especially by rural residents who often suspect the quality of service will be reduced when the administration of the road system becomes more centralized. The effective execution of a consolidation program requires that assurances be made to continue to provide adequate roads and responsive governance.

**Make Greater Use of Volunteers**

Policymakers in rural areas that are interested in lowering road costs could make more effective use of volunteer efforts. Farmers and other road users could work together to assist local governments in maintaining routes. The use of private trucks to haul gravel and assistance from farmers in dragging gravel roads and maintaining the right of way could save considerable tax dollars. Likewise, the greater care taken by road users during seasons in which heavy loads are moved could keep a high-quality road from becoming a low-quality road.

The use of volunteers has its limitations, however. The volunteers must be trained in the essentials of road maintenance or the outcome may not be satisfactory and costs might increase even more. Liability problems associated with the possible injury of working volunteers and liabilities for vehicle accidents on roads partially maintained by volunteers may limit use of this option. The high cost of liability insurance is already a major problem for local governments.

**Reduce Overall Level of Service**

The least desirable option, but one that is most likely to be used during tight fiscal situations, is to reduce the overall level of maintenance throughout the jurisdiction. When revenues fall short of needed spending, there is a tendency to make temporary and less costly repairs to roads and bridges. What may appear to be a lower cost in the short run may cost much more in the long run. Nevertheless, demands by residents leave local officials with few options but to apply temporary patches to the roads and exacerbate the slow disinvestment in rural road systems by inadequately maintaining them.

The uniform reduction in service levels throughout a jurisdiction was the option least favored by Midwest farmers that responded to the road survey. Most farmers favored the differentiation of service levels according to traffic and load demands as an approach to reestablishing the equilibrium between spending and revenues. Township road officials alternatively indicated that a uniform reduction in service was the management approach favored to address revenue short-falls (2, pp. 168, 172).

**CONCLUSIONS**

Rural roads and bridges that serve agricultural and low-population density areas are deteriorating in the Midwest. Between 1 in 3 and 1 in 4 miles are inadequate for local travel demands if normal maintenance is continued. One-third of the bridges are inadequate in their present condition. Without a serious program to improve them, these roads and bridges will further deteriorate and disinvestment will continue.

Few options exist for financing low-volume roads and bridges in the Midwest at their current level of service. The probability of financing increased spending to improve service levels under existing road financing systems is small. Townships responsible for these transportation systems have experienced
real declines in their main revenue sources. The farm recession is causing significant declines in the local tax base in some areas. State motor fuel tax rebates have not kept pace with inflation, even though the tax rates have increased recently. Federal revenue sharing, which was used by a great proportion of townships to maintain roads and bridges, has been eliminated. All of these changes will have a significant negative effect on the fiscal capacity of responsible local governments to adequately provide roads and bridges to meet even minimum service needs.

Options available to state and local policymakers involve a combination of reductions in the number of miles or bridges maintained, increases in revenues from current sources or the use of new sources, reduction in maintenance on less frequently traveled roads or bridges, and improvements in management and organizational efficiency. Some thought should be given to restructuring local public finance so that schools could be financed more from revenue sources such as state income taxes and less from property taxes. Shifts in school financing could allow the greater use of property taxes for localized services such as roads. The authorization of local option user taxes, such as piggyback wheel taxes, would further diversify the financial system that supports rural roads. However, potential revenues from this type of levy in rural townships would fall short of replacing lost revenues and would contribute little to the revenues needed to rebuild rural routes.

None of these options is easy. However, the future of low-volume roads necessitates strong actions by local officials and state policymakers. Without strong corrective actions, problems will worsen, disinvestment will continue if not accelerate, and the costs to remedy conditions and reestablish an acceptable level of road service will ultimately be higher.

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REFERENCES