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Local Rural Roads and Bridges: Current and Future Problems and Alternatives

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The existing county road and bridge system was basically designed and developed during the 1930s and 1940s to accommodate the small motor vehicles of that era. Today, the traffic moving on this system is substantially larger, wider, and heavier than the traffic for which the system was designed. The condition of the county road and bridge system is deteriorating rapidly in all sections of the United States with the possible exception of the Western states. The most serious problems are in Texas, Missouri, Iowa, Nebraska, New York, and West Virginia. This paper identifies several alternative policies to deal with the problem of inadequate funds to rebuild and maintain all the existing county roads and bridges to handle the levels and types of traffic moving on the system.

A major characteristic of the local rural road system in the United States is the large number of roads. There are about 2.3 million miles in the local rural road system (which refers to those rural roads and bridges that are not in the federal-aid system). This is 71 percent of the 3.2 million miles of rural roads in the United States. A second characteristic of the local rural road system in the Midwest and West is the rectangular road grid. The grid usually conforms to a 1-mile spacing. The density and regularity of the county road system date back to the Ordinance of 1785. This act established townships and the 1-mile survey grids. The objective of Congress was to open the land for settlement.

Many of today's local rural roads and bridges were built in the late 1800s and early 1900s, when overland transportation for both passengers and freight was limited to horse and wagon or the recently built railroad lines. Farms were small, and farmers needed road access to homes, schools, churches, and markets. Technological change soon took its toll on the rural roads and bridges. First came the steam engine and the 4- to 5-ton threshing machine. Some of the bridges collapsed under the weight of these machines. The discovery of large petroleum reserves in Texas and Oklahoma spurred the development of the automobile and small-truck industries during the 1920s and 1930s. This created a need to get rural America "out of the mud." Roads were surfaced, and some bridges were replaced to accommodate the trucks with gross weights of 6-7 tons. About 70 percent of today's rural bridges were built before 1935. Most of the bridges constructed in the 1940s were designed for 15-ton loads. By 1950, about 50 percent of the local rural roads were improved with all-weather surfaces. Thus, the widths, grades, bases, surface designs, and capacities of many local rural roads and bridges are based on the traffic needs during the 1940s and 1950s.

Agricultural technology also changed the type of local rural roads and bridges needed in rural America today. Agricultural output has become export oriented and increasing amounts of grain move over the local road system. There are no weight limits on "implements of husbandry" (farm equipment) in many states. Today, it is common for farmers to use a tractor and two wagons to haul 600-900 bushels of grain with a gross weight of 28-36 tons to the local elevator. Many bridges are 55 ft long or longer, so the entire load is on the bridge simultaneously. Some single-axle wagons hold more than 800 bushels of grain. If we deduct about 6000 lb of hitch weight, the loaded weight ranges up to 50 000 lb/axle.

Farm equipment manufacturers have been forced by farm consolidation and farmer demand to create larger, more efficient machinery. Present-day disks and row-crop cultivators are up to 54 ft wide. These types of equipment can be folded to 18-20 ft wide. But even the folded equipment will not pass through the 16- to 18-ft widths of many local rural bridges. One county engineer in Iowa reported that the entire railing and the posts from two wooden bridges located about 1000 ft apart were missing. There was no doubt in the engineer's mind that some frustrated

farmer used a chain saw to widen the bridge to accommodate his wide farm equipment. Moreover, wide farm equipment uses almost the entire width of the road, which creates hazardous conditions for approaching traffic, particularly in hilly country with limited sight distance.

Advanced agriculture technology creates pressures for larger farms. In most instances, the only way a farmer can obtain more land is to buy or lease from neighboring farms, which thereby reduces the total number of farms. The large reduction in the number of farms means that some rural roads may no longer be needed for access to homes, schools, and markets. Many observers believe that the number of miles of rural roads might be reduced and still provide needed access to the remaining farms.

As farm size has increased, feed, fertilizer, and petroleum delivery trucks and bulk milk trucks have become larger. Tandem-axle trucks with gross weights of 27 tons are common on rural roads and bridges. In 1975, the U.S. Congress permitted states to set higher weight limits for trucks on the Interstate system. An increasing number of states have adopted the federal limits and have raised the weight limits to the federal standards of 20 000 lb/axle, 34 000 lb/two-axle tandem, and 80 000-lb maximum overall weight. The introduction of low-cost unit-grain trains in the Corn Belt states has encouraged the use of larger farm vehicles to haul grain longer distances. Some farmers are buying used semitrucks to move their grain out of the field quickly, to increase their marketing options, to reduce hauling costs, and to eliminate the safety hazards of farm tractor-wagon combinations.

The declining rural population has resulted in a reduction in the number of rural schools. To help minimize the cost of transporting school children longer distances to fewer schools, school boards are purchasing 72- to 89-passenger school buses. Loaded buses of these sizes weigh between 9 and 10 tons. These buses cannot cross bridges posted at less than 10 tons. Pressure from school districts results in the surfacing of some roads not needed for one-way-out farm access for just school bus traffic.

The recent emphasis on increased coal production to substitute for petroleum as a source of energy for electric generation also has had a major impact on local rural roads. Fifty-eight percent of all coal produced in Appalachia in 1974, or about 221 million tons, was transported by truck for part of its journey from the mine to the ultimate consumer. About 80 percent of this coal was trucked to rail or water transshipment points. Most of the trucked coal was hauled in semitrailer units. A 1974 survey at truck weighing stations in Appalachia indicated that gross weights were 5-25 percent above legal weight limits; six-axle units averaged 91 490 lb gross weight. About 25 percent of the coal traffic was on local rural roads.

Nationwide, large amounts of coal move directly to market by truck. In addition, a large portion of the coal that moves by rail or water is transported by truck from mines to rail or water loading points. Increased emphasis on coal as an energy source will impose even greater repetitive weight problems on local rural roads and bridges in coal-producing states.

CONDITION OF COUNTY ROAD AND BRIDGE SYSTEM

Precise data on the current condition of off-system rural roads are not available, since no on-going coordinated data-collection system exists for local roads. The most recent information (1972) suggests that more than 50 percent of local road mileage is structurally inadequate because of surface type or has safety deficiencies that result from narrow lanes or lack of shoulders. There is ample evidence to suggest that the system is deteriorating rapidly. Common complaints about the local rural roads include the following:

1. Overweight vehicles are breaking up road surfaces,
2. Lack of hard surfaces creates dust and rideability problems,
3. Road widths and other design characteristics are inadequate for today's large farm equipment and heavy trucks, and
4. Narrow lanes create safety problems.

Although the local road deficiencies are significant, the condition of local bridges is of even greater concern. Deficient bridges on local rural roads are creating serious safety and traffic constraints. Table 1 gives the number of bridges inventoried in each state as of December 1980 along with the number of structurally deficient and functionally obsolete bridges and the percentage of deficient bridges. A structurally deficient bridge will not carry a legal load. A functionally obsolete bridge will carry a legal limit but is too narrow or has other characteristics that do not meet minimum standards. Nationally, 151 180 bridges, or 56 percent of all the off-federal-aid bridges that had been inventoried, were deficient. The estimated replacement and rehabilitation costs of these deficient off-system bridges totaled $20.5 billion. By June 1981, the number of deficient off-system bridges had increased from 151 000 to more than 173 000. Even this more current number understates the magnitude of the problem. Bridges less than 20 ft long were not included in the inventory. There are thousands of structures less than 20 ft in length that need replacement or rehabilitation. Moreover, the inventory was based on the legal load limit in the states at the time of the inspection. Since the inventory has been under way, several states have increased the maximum legal weight limits from 73 280 to 80 000 lb. These increased legal weight limits have undoubtedly increased the number of structurally deficient bridges.

The distribution of deficient bridges among states indicates that the off-system bridge problem is national in scope. The states with the highest percentage of deficient bridges are North Carolina, Missouri, Nebraska, Louisiana, New York, and Vermont. The states with the largest number of deficient bridges are Texas, Iowa, Missouri, Nebraska, North Carolina, and Indiana. States in the Northeast, Midwest, Southeast, and Southwest are included in the groups with a higher percentage or a high total number of deficient bridges. States in the Far West have the least problem, both in terms of the total number and the percentage of deficient bridges.

CURRENT FUNDING

Local rural road and bridge construction and maintenance funds are derived from highway user taxes, local property taxes, and general-fund appropriations from the state and federal governments. Highway user tax collections are declining in real terms because of more fuel-efficient vehicles, fewer miles traveled, and inflation. The levels of state and federal general appropriations are under great pressure from declining government revenues and large budget deficits. Many counties are already at the maximum level of the all-county tax levy. For example, 68 percent of the counties in Iowa are at the maximum all-county tax levy and cannot increase

Table 1. Number of deficient bridges by state, off-federal-aid system, December 31, 1980.

State	No. of Bridges Inventoried	No. of Structurally Deficient Bridges	No. of Functionally Obsolete Bridges	Total	Percentage
Alabama	7 392	1 459	953	2 412	32.6
Alaska	246	49	30	79	32.1
Arizona	604	73	29	102	16.9
Arkansas	8 825	1 702	4 006	5 708	64.7
California	4 471	781	1 465	2 246	50.2
Colorado	576	147	40	187	32.5
Connecticut	1 189	139	277	416	35.0
Delaware	239	54	13	67	23.8
District of Columbia	15	1	0	1	6.7
Florida	3 460	348	529	877	25.3
Georgia	7 015	3 409	1 308	4 717	67.2
Hawaii	373	31	72	103	27.6
Idaho	1 844	522	462	984	53.4
Illinois	14 723	4 293	2 644	6 937	47.1
Indiana	11 335	3 728	4 748	8 476	74.8
Iowa	18 925	4 369	6 083	10 452	55.2
Kansas	12 304	4 994	1 585	6 579	53.5
Kentucky	7 818	2 818	1 158	3 976	50.9
Louisiana	8 618	5 059	1 900	6 959	80.7
Maine	1 362	48	214	262	19.2
Maryland	1 466	121	205	326	22.2
Massachusetts	435	128	20	148	34.0
Michigan	4 297	2 228	324	2 552	59.4
Minnesota	8 012	1 354	2 348	3 702	46.2
Mississippi	9 167	4 914	1 888	6 802	74.2
Missouri	12 351	2 091	8 322	10 413	84.3
Montana	3 164	253	234	487	15.4
Nebraska	11 636	5 150	4 289	9 439	81.1
Nevada	248	25	47	72	29.0
New Hampshire	1 181	387	517	904	76.5
New Jersey	1 392	338	145	483	34.7
New Mexico	599	156	100	256	42.7
New York	8 619	5 647	973	6 620	76.8
North Carolina	10 043	5 150	3 539	8 689	86.5
North Dakota	3 719	1 056	1 481	2 537	68.2
Ohio	14 664	1 838	1 646	3 484	23.6
Oklahoma	5 634	2 366	1 142	3 508	62.3
Oregon	2 383	249	540	789	33.1
Pennsylvania	8 073	1 838	1 069	2 907	36.0
Rhode Island	123	21	26	47	38.2
South Carolina	3 861	571	225	796	20.6
South Dakota	3 150	648	1 514	2 162	68.6
Tennessee	4 063	1 713	922	2 635	64.9
Texas	17 621	6 596	4 918	11 514	65.3
Utah	878	237	106	343	39.1
Vermont	1 377	158	825	983	71.4
Virginia	5 471	351	418	769	14.1
Washington	2 942	312	187	499	17.0
West Virginia	3 071	608	360	968	31.5
Wisconsin	6 453	2 399	1 960	4 359	67.5
Wyoming	140	22	6	28	20.0
Puerto Rico	794	105	314	419	52.8
Total	268 361	83 054	68 126	151 180	56.3

Note: Data are from Federal Highway Administration, U.S. Department of Transportation, Washington, DC, Aug. 1981.

property taxes without changes in state legislation. An additional 10 percent are between 95 and 99 percent of the maximum all-county levy. Only 11 percent of the counties can raise the all-county levy by 20 percent or more. This means that there are major constraints on additional revenues to rebuild the rural road system. Yet there are major needs for increased local rural road and bridge funding. For example, the average projected revenue for local roads and bridges in Iowa over the 1978-1997 period is $249 million. Yet the projected average annual need for the same period is $428 million. The projected revenue is only 58 percent of projected need. Counties in other states face similar budget problems.

RELATIONSHIP OF OFF-SYSTEM ROADS AND BRIDGES TO RAIL ABANDONMENT

It has been suggested that railroad abandonment is a major cause of the rural road and bridge problem. We can speak with some authority on this subject since Shelby County, Iowa, has just joined that select group of counties that have no rail service. Although rail abandonment does result in increased application of heavy-weight vehicles and the related damage caused by them, some of the cost of the damage is offset by increased taxes on vehicles and fuel. The logic used in the argument is that it is cheaper to build and maintain railroads than highways. This position assumes that all road traffic could be diverted to railroads. It is not possible for railroads to transport feed to the hog, cattle, and chicken feeders; to deliver petroleum to farm tanks; to transport children to school; to haul grain from fields to the local elevator; to haul milk or livestock from the farm to the processing plant; or to transport large farm equipment from farmsteads to fields. Thus the local road system was an important transportation link before rail abandonment and must be rehabilitated and maintained to handle the increasing demands placed on the system regardless of what happens to railroad branch lines.

ALTERNATIVE SOLUTIONS

The local rural road and bridge problem is basically a shortage of funds to reconstruct and maintain the current system to accommodate the changing transportation needs of rural America. A number of alternative solutions exist, including the following.

1. Continue the present sources and levels of funds for the local rural road and bridge system. This alternative would mean that there would be no large increases in property or road-use taxes to finance the reconstruction of the local rural road system. However, counties and townships would continue to face increasing maintenance costs to repair existing surfaces and bridges. Moreover, many bridges would need to be closed without additional replacement funds. Perhaps more important, county and township governments could face increased exposure to large tort liability claims from damages that result from deteriorating roads and bridges. Courts historically have been generous to these kinds of claims. This alternative is the one most likely to continue, with some modifications.

2. Make large increases in state and federal funding. Potential sources of state funds include increased state or federal fuel taxes, increased state registration fees, and increased funding from state and federal general funds. It is unlikely that the existing political climate would permit raising the fuel and registration fees enough or shifting additional funds from state general funds to meet the increasing needs of the rural road system. At this time, the federal government is attempting to reduce its role in financing local roads and bridges. However, the magnitude of the local rural bridge problem suggests that the federal government may be forced to maintain its interest in local roads and to assume some of the costs of rebuilding the local rural bridges.

3. Impose local-option taxes alone or with bonding authority for local rural road and bridge funding. The local-option taxes could be in the form of property, sales, fuel, excise, or other taxes. When levied alone, they would approximate user taxes because a significant portion of the traffic on local roads is local traffic. When these taxes are used to support a bonding program for capital improvements, the program becomes in effect a mortgage on the future and reduces the desirability of this program.

4. Reduce the minimum local rural road and bridge reconstruction and maintenance standards. The minimum standards for local rural roads and bridges are generally based on a design guide published by the American Association of State Highway and Transportation Officials. In some cases, road plans must be approved by state and federal agencies. Future reconstruction costs could be reduced by lowering the minimum design standards on low-volume, off-system rural roads. Costs could be cut by reducing the widths of rights-of-way and shoulders and bridges, by reducing the thickness of the pavement, and by reducing maximum grades. Lower minimum standards, on the other hand, could result in increased maintenance costs through greater erosion from steeper slopes, faster deterioration of pavements and bridges, and reduced snow-storage capacities. Operating costs for the traveling public would also be increased by this action.

The accident rate per vehicle mile traveled on local rural roads is about double that on Interstate highways. Reduced road and bridge reconstruction and maintenance standards may further increase the accident rates on the local rural road system. Safety features result in higher construction costs, but they usually result in accident reduction.

5. Lower the level of service on some rural roads by reducing the number of property-access routes. A large portion of the Midwest and West has the rectangular road-grid system. With this system, many property owners have four-way access to their farmsteads and other property. It is possible to maintain primary access to property but to provide only three-, two-, or one-way access. In fact, Shelby County, along with a number of other Iowa counties, has a policy that provides only one all-weather surfaced access to an occupied rural residence unless increased service is necessary to provide system continuity. Although this policy does permit the use of unsurfaced roads in dry weather, it does cause some disruptions in school bus and mail routes in bad weather and does increase travel time and costs.

6. Return some roads to private ownership. A 1976 editorial in the Des Moines Register states:

> County roads that served dozens of farms 40 years ago may be serving only two or three farms today. Many roads that were once vital to a county's well being have become, in effect, private roads although the county is responsible for their upkeep. Such roads no longer belong in a county road system.

Although some observers believe that returning some roads to private ownership is the fundamental answer to the lack of funds for rural road and bridge construction and maintenance, it often costs more to vacate a road than to keep it. District courts have tended to make large awards to landowners for the loss of public access. Many county engineers believe that only a very small number of off-system rural roads will be vacated unless laws are changed to permit counties to remove a secondary or field access to property and smaller or no damage claims for the action or to transfer the responsibility for maintenance and liability for a publicly owned field-access road to the benefitted property. Iowa has studied legislation to this effect, and the Iowa legislature has permitted the establishment of two levels of service for local roads with a minimum of liability exposure to the county. This has yet to be tested in court. There is a need to study the additional costs to property owners from the loss or partial loss of access from abandonment compared with the costs of reconstructing and maintaining the roads and bridges involved. The question of property rights should also be included in the study.

7. Return portions of the local rural road system to states and/or place a portion of this system under the federal-aid system. This alternative would require reversing action taken in 1976 in transferring portions of the federal-aid system to the off-system local road system. At that time, about 240 000 miles of federal-aid rural secondary roads were transferred to the local rural road system, which is under the jurisdiction of counties or townships in most states. The entire burden of financing the reconstruction and maintenance of these roads also was transferred to the local agencies. We see little chance for this alternative to occur.

8. Reduce and enforce weight limits on local rural roads and place weight and width limits on "implements of husbandry." This alternative undoubtedly would reduce maintenance costs of existing roads and bridges. However, a reduction of current weight limits and placing weight and width limits on "implements of husbandry" could increase the costs of agricultural production and of moving these products to market. It would also create enforcement

Table 2. Deficient off-federal-aid bridges and percentage of farmers who believe county roads and bridges are problem.

State	Deficient Roads and Bridges		Percentage of Farmers Believing Roads and Bridges a Problem
	No.	Percentage	
Colorado	187	32	26
Illinois	6 937	47	50
Indiana	8 476	75	54
Iowa	10 452	55	25
Kansas	6 579	53	48
Michigan	2 552	59	46
Minnesota	3 702	46	20
Missouri	10 413	84	59
Nebraska	9 439	81	32
North Dakota	2 537	68	34
Ohio	3 484	24	50
Oklahoma	3 507	62	61
South Dakota	2 162	68	19
Texas	11 514	65	28
Wisconsin	4 359	68	23

Table 3. Farmer responses to alternative solutions to problem of local rural roads and bridges.

Alternative	Agree (%)	Disagree (%)	Not Sure (%)
Upgrading key county roads and dropping others from system	18	50	20
Continue current program and reduce weight limits	31	42	27
Additional federal funds	57	18	14
Additional state funds	51	16	21
Reduce or eliminate agricultural motor fuel tax exemption	22	54	14
Levy county tax on all real estate	12	58	18

problems. There is a need to study the reconstruction and maintenance costs of increased weight limits versus the increased costs of agricultural production if lower weight limits were imposed.

9. Impose a special tax on coal to finance the reconstruction and maintenance of coal-hauling roads. This tax, which could be imposed on each ton of coal mined, could be adjusted to cover the additional costs from increased coal traffic on some local rural roads and bridges.

FARMER ATTITUDES ON LOCAL ROAD AND BRIDGE PROBLEMS

In 1980, Pioneer Hi-Bred International Incorporated, a seed company located in Des Moines, conducted a 16-state poll on farmers' attitudes on grain transportation. Questionnaires were distributed to about 99 000 Pioneer customers, and almost 35 000 completed questionnaires were returned. Although the sample was not randomly selected, the large number of responses provides useful information on farmer attitudes toward local rural roads and bridges.

One question asked farmers whether the deterioration of county roads and bridges is a problem affecting their area in moving farm machinery or grain from the fields or to the elevator. Only 34 percent of the farmers responding indicated that it was a problem. The responses varied widely by states. Table 2 (1,2) compares the responses by states with the number and percentage of deficient bridges. The percentage of farmers who believed that roads and bridges were a problem was low in many of the states, including Iowa, Nebraska, South Dakota, and Texas, which have the largest number and percentage of deficient bridges. This suggests that farmers are not fully aware of the magnitude of the problem.

One question asked the respondents to rank six alternative solutions to the local rural road and bridge problem. The alternatives and responses are presented in Table 3. Reducing the size of the system, reducing or eliminating the agricultural motor fuel tax exemption, and imposing a county tax on real estate were the least-preferred solutions. Almost one-third of the farmers were willing to try to live with the current system. The preferred solutions were increased federal or state funds for upgrading roads and bridges. Some states, including North Carolina, Virginia, West Virginia, and Delaware, have taken over the maintenance and rehabilitation of the county road system.

More fuel-efficient cars and trucks and reduced miles driven are resulting in reduced state and federal highway tax funds. Moreover, inflation has seriously eroded the purchasing power of the available tax revenues. The declining real highway tax funds are leading the federal and state governments to attempt to shift the road maintenance and rehabilitation responsibility to local governments. But agriculture and local governments are looking to the state and federal governments to assume a major role in the local road and bridge programs. One way out of this circular dilemma is for representatives of each group to attempt to define and agree on the role of each level of government--federal, state, and local--in dealing with the rural local road and bridge problem. Once these roles have been agreed on, each level of government can proceed with making choices from the above set of alternatives, all of which are painful.

An advisory panel to Pioneer Hi-Bred International consisting of farmers and transportation specialists made the following recommendations for dealing with the local rural road and bridge problem:

1. With the reduction in the number of farmsteads, removing some roads from the county system should be feasible in order to properly maintain the remaining part of the system.
2. Those whose livelihoods depend on doing business with farmers should share in the cost of maintaining an efficient system of county roads.
3. Reduction of weight limits in an effort to keep the current system is not a workable long-range solution.
4. Local control over the setting of priorities and supervision of work should be maintained, regardless of the source of funds.

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