PUBLIC/PRIVATE COOPERATION IN RURAL ROADWAY IMPROVEMENTS

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The practice of statewide highway planning by state transportation agencies involves setting priorities and scheduling improvement projects. Providing adequate rural roads and bridges to support rural economic activity is becoming more crucial as economic deregulation and reductions in rail and air service continue to occur and as the rural residents' expectations with respect to mobility change. With less attention being given to planning future systems, the Transportation Research Board suggests transportation agencies devote more time to supporting the development and expansion of the states' economic development.[1] To accomplish this, the agencies will have to maintain a greater level of awareness of the events in the private transportation sector, recognize the role transportation plays in the transport of products, and extend their studies into the systems of enterprises which exist. The systems of enterprises, for example, may be combinations of farms, railroads or trucking firms, storage or processing companies, and even international shippers. Included in this task is the need to understand the demographic, geographic, and economic forces at work and how these forces relate to the state's transportation system. To achieve this understanding, the agencies will have to work more closely with the other departments of government, such as agriculture, as well as with the private enterprises.

Rural Roads and Bridges - National Perspective

In the United States, the rural road system is vast, consisting of 3.2 million miles. This accounts for over 80 percent of the total U.S. mileage (Table 1). The rural mileage, as classified by the Federal Highway Administration (FHWA), includes all roads outside of populated areas of more than 5,000 people. On these roads FHWA reports there are over 460 thousand bridges twenty feet or greater in length.[2]

The rural system is composed of four functional classes of highways: interstate, other arterial highways, collectors, and local roads. Arterial highways, including the Interstate System, provide the network for intrastate and interstate travel and generally accomodate high volume traffic on long trips. Collectors generally provide for travel of a more localized nature, serving county seats and other traffic generators such as shipping and receiving points which are not directly served by the arterial routes. Local roads are by far the most extensive network in rural areas, providing for short distance travel to access homes, businesses, and land. In 1981, local roads accounted for 69 percent of the rural road mileage and 58 percent of the

total mileage, rural and urban, in the U.S. (Table 1).

Table 1. Rural Mileage by Functional Classification by Region--1981

Census Region	Inter-state	Other Arterial	Collector	Local	Total Rural Miles	Total U.S. Miles
Northeast	3,188	21,649	55,998	165,778	246,613	369,977
North Central	8,673	79,442	276,901	778,814	1,143,830	1,306,382
South	11,068	82,398	264,864	728,313	1,086,643	1,311,042
West	10,030	46,992	142,161	544,415	743,598	865,296
Total	32,959	230,481	739,924	2,217,320	3,220,684	3,852,697
Percent of Rural Miles	1.0	7.1	23.0	68.9	100.0	-
Percent of U.S. Miles	0.9	6.0	19.2	57.5	83.6	100.0

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, 1981, Table HM-20.

Most of this rural road system is owned, operated, and maintained by State or local jurisdictions. In 1981, 69 percent of the rural road mileage was under local (county or town/township) control, 23 percent under State control, and 8 percent under Federal control (Table 2). A significant portion of the rural mileage in the West is under Federal control due to the large amounts of public land in Federal parks, forests, and reservations; furthermore, many of the South Atlantic states in the South have assumed legal responsibility for all or a portion of their county roads.

Many rural roads and bridges, primarily those on the local and collector systems, were constructed in the late 1800's and early 1900's when overland transportation was limited to horse and wagon or the recently built railroad lines. Through some improvements, the widths, grades, bases, surface designs, and capacities of many rural roads and bridges are currently based on the traffic needs of the 1940's and 1950's.[3] FHWA reports in its 1983 status report to Congress that the secondary, or rural major collector, system is in the poorest condition of the systems eligible for Federal financing.[4] Information on the physical and operating conditions of the local roads is scarce since only a very limited data collection exists for local roads. The most recent and in-depth local road information was collected in a U.S. DOT survey in 1970.[5] The information suggests that more than 50 percent of the local

road mileage is structurally inadequate by reason of surface type and condition and/or safety deficiencies, such as inadequate lane width or lack of shoulders. This survey has not been updated, but the General Accounting Office reports that the available statistics indicate the deficiencies still exist.[6]

Table 2. Percentage of Rural Mileage by Jurisdiction by Region--1981

Census Region	Local Control	State Control	Federal Control
Northeast	68	32	<1
North Central	87	13	<1
South	62	37	1
West	55	13	32
United States	69	23	8

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, 1981, Table HM-10.

U.S. DOT believes these road conditions are significant but reports to Congress that bridge conditions are of special concern because bridge deficiencies can cause substantial loss of life, can interrupt the efficient flow of traffic, and repair or replacement is usually much more expensive than other types of highway improvements.[7] Nearly half the Nation's rural bridges are rated deficient (Table 3), either for structural or functional reasons. About 90 percent of these deficient rural bridges are on rural collector or local roads, which also account for 80 percent of the total number of deficient bridges in the U.S.

Structural deficiencies occur primarily because of the lack of proper maintenance due to perhaps insufficient funds, exposure to the elements, general wear, and poor initial design. Functional obsolescence results from increased traffic, changing patterns and needs, and higher safety standards. U.S. DOT reports that many bridges may be considered functionally obsolete even though they are in good structural condition. For example, if a 30-year old bridge was designed and built for 10-ton loads and is now required to carry 20-ton loads, then its structural condition is no longer adequate and the bridge is considered to be functionally obsolete.

The goals, conditions, and needs of the rural roadways vary widely by region, but in general, the sheer magnitude of the rural system creates a

problem. Today there is a shift in emphasis from building new roadways to maintaining adequate performance levels on the existing roads and bridges. Given today's financial realities, the challenge for road officials is to find and use innovative ways to provide for adequate transportation with the limited funds available. A case study follows explaining how one state through public/private cooperation is trying to plan and program road and bridge improvements that will support the economic development of its rural areas.

Table 3. Rural Bridges by Functional Classification--1981

Item	Inter-state	Other Arterial	Collector	Local	Total Rural Bridges	Total U.S. Bridges
Number of Bridges	26,474	74,327	141,503	219,480	461,784	553,310
Number of Deficient Bridges	2,405	19,088	54,339	143,339	219,480	244,241
Percent of Class	9.1	25.7	38.4	65.3	47.5	44.1
Percent of Total Rural Deficiencies	1.1	8.7	24.8	65.4	100.0	-
Percent of Total U.S. Deficiencies	1.0	7.8	22.3	58.7	89.8	100.0

Source: U.S. Department of Transportation, Status of the Nation's Highways: Conditions and Performance (Washington, D.C.: Federal Highway Administration, June 1983), p. III-26 and III-27.

A Case Study - Pennsylvania

In Pennsylvania (PA), an effort is underway to incorporate the State's agricultural transportation needs into its statewide highway planning and programming activities. Incorporating the agricultural needs is very important to PA, since one of five jobs in PA is reported to be agriculture or agri-business, including those jobs with supermarkets, trucking, processing, and production firms. These businesses also indirectly contribute to the economy of the State by purchasing large quantities of petroleum products, machinery, equipment, materials, and services.

The statewide effort is based upon the results of a two-county pilot study which was completed earlier this year. The pilot study developed a process for incorporating local input from local agricultural producers and

suppliers, for identifying the essential roadways which provide access to the rural agricultural areas for the transport of agricultural and forestry products to market and supplies to the businesses, and for identifying the key transportation obstructions inhibiting the movement of the products and supplies. The identification of an Agricultural Access (Agri-Access) Network of roadways provides PA with important information concerning which future roadway improvement projects will yield the greatest economic benefits to its agricultural and rural communities.

Background

Many of PA's rural roads and bridges were first constructed when farm and forestry products moved to nearby markets in small quantities on small lightweight vehicles. Today, both commodities and farm supplies travel greater distances in larger trucks which carry loads at or near maximum legal limits of 80,000 pounds. PA, with approximately 56,000 bridges, has over 4,000 structures which are restricted to loads of 20 tons or less and many other bridges which are obsolete for today's travel. These obstructions cause trip diversions which translate into higher operating costs and eventually higher costs paid by consumers.

The identification of an Agri-Access Network is a follow-up to another recent planning initiative of the PA Department of Transportation (DOT) involving the improvement of commercial transportation and promotion of economic development. In 1982, planning personnel worked with local and regional planning agencies to identify a Priority Commercial Network (PCN) which is mainly composed of interstate routes, primary traffic routes and key coal haul routes, handling heavy volumes of truck traffic and serving as the economic backbone of the State. While the PCN provided valuable priority-setting information on the heaviest truck routes, many roads serving the rural areas and the agricultural industry were not included. For this reason, the pilot study was conducted to identify those highways providing access between the PCN and the rural agricultural areas.

The approach used in the pilot study, and which is being carried over to the statewide effort, had two principle characteristics:

(1) the study used existing data bases and information sources, thereby eliminating the need for extensive new data collection, and

(2) the study relied upon input from representatives at the local level for the identification and refinement of the network.

Coordination and Local Participation

The pilot study was guided at the State level by an Agricultural Transportation Task Force consisting of representatives of Federal, State, and local government and the farm organizations. The Task Force was structured into a steering committee and a work group. The steering committee provided direction and advice throughout the study. The work group assured the timely performance of scheduled tasks. Work group participants provided the link between state officials and local leaders of their respective organizations.

Local participation was very prominent at several points in the study. In the initial meeting at the county level, county Extension agents provided

valuable knowledge on the agricultural economy and the location of generators of heavy agricultural loads. Meetings with key representatives of the farm organizations yielded the preliminary network identification and information on how the transportation system affects particular operations. During the refinement task, all involved groups reviewed the initial findings and made recommendations for revisions and priorities.

Methodology

The work program for the pilot study was composed of several tasks, each yielding specific products. While most tasks were related to the identification of the Agri-Access Network and obstructions on that network, certain tasks were directed to the development of information to aid the formation and application of a statewide study. A description of the methodology is divided into three general phases: preliminary identification; data analysis and evaluation; and refinement and review.

Preliminary Identification:

The first phase of the study was accomplished through field visits and interviews with county extension agents and key representatives of the farm organizations. The main objectives were to identify where the major agricultural activities are taking place and to identify a preliminary Agri-Access Network. Maps, specifying the previously identified PCN, provided the basis for identification. This eliminated the need for the duplicate identification of the major commercial routes.

Within each county, the major areas of farming activity, the main points for delivery of agricultural products, and the main sources of agricultural supplies were identified and plotted on maps. This included information concerning the major rural products and the locations where various activities related to these products are taking place. These included, but were not limited to, generators of heavy loads such as lumber, milk and poultry processing plants, feed mills and fertilizer plants. The local participants' knowledge of the agri-business functions was extensive and provided a sound base for further development of the Agri-Access Network.

The next step was the development of a preliminary system of highways deemed most important to carry heavy agricultural loads. These highways provided a complementary network to the PCN. They consisted of those routes providing access to groups of farms and essential agricultural and rural functions. The local representatives readily identified this preliminary Agri-Access Network from their experience. They also noted specific transportation problems related to this network.

Data Analysis and Evaluation:

The preliminary network and bridges on the network were identified on the PA DOT data bases. This facilitated data retrieval and analysis during the pilot study. It will also provide for future periodic review and development of information for program prioritization.

Analysis was conducted to identify those agri-access roads most critical to hauling 40 ton loads. Available average daily traffic (ADT) information and truck classification counts were analyzed to determine which highways carry larger 4 and 5 axle trucks. Information gathered from local farm representives in earlier tasks concerning the benefits of lower rather than maximum load limits to particular activities was also important. Bridge engineers were consulted to determine the feasibility and cost effectiveness of incrementally upgrading bridges to less than maximum load limits.

A most important portion of the work program involved the identification of highway obstructions. Weight-restricted bridges, posted and bonded roads, and other obstructions to agricultural truck traffic on the identified agri-access roadways were identified and located on maps. The bridge information was extracted from PA's inventory of state and local bridges. Throughout the entire study, other data was compiled to be useful in prioritizing the obstructions and deficiences which were identified. This included such items as 1) county production figures and economic information, 2) approximate number of farmers dependent on a particular deficient bridge or route, and 3) increase in distance and/or time required due to detour.

The evaluations of the preliminary Agri-Access Network involved examining the characteristics of the highways, especially related to function and usage. This facilitated developing criteria as a basis for evaluating agri-access roads in other counties of the State. Several sources of information were examined. Sample truck classification counts were taken to determine the existing level of trucks on the identified roads, the functional classification of the identified network of roads was analyzed to determine the type of use on these highways, and county economic information was examined to develop comparisons of agricultural dependence.

Refinement and Review:

The particular objective of this task was to refine initial findings from local knowledge. Organizations participating in this task included the farm organizations, the County Extension Service, regional agricultural representatives, township representatives, local transportation officials, and county planning agencies. Participating organizations were provided maps of the preliminary network and associated listins of identified obstructions. This included the description and status of programmed projects which will eliminate the obstructions.

Each organization was asked to verify information, make suggestions for revisions, and note additional problems related to the movements of agricultural products and supplies. Local officials were also requested to include problems related to the movements of emergency vehicles and loaded school buses. The collection and compilation of the refinement products was facilitated through the county Extension office. Through this task, all organizations had ample opportunity for equal review.

At the conclusion of this local review period, recommenations were incorporated into the network and listings of obstructions. The final products were presented to and approved by the Agricultural Transportation Task Force. This provided a final product which was agreeable to all participating organizations.

Demonstration Counties

Tioga and Lancaster were the two PA counties chosen for the pilot study. Both areas are highly agricultural, but have differing characteristics which were felt to be representative of conditions in other sections of the State. Tioga County is located along the north central border of the State and Lancaster County is along the southeastern border. A comparison of the two counties is given below.

Table 4. Background Information on Demonstration Counties

Item	Tioga County	Lancaster County
Population	40,973 (50th)	362,346 (7th)
Rural Population	33,846 (83%)	164,580 (45%)
Population of Largest City/Borough	3,805	54,725
Total Miles of Roadway	1,763	3,588
Total Land Area	1,146 sq.mi.	946 sq.mi.
% Forest Land	64	16
% Crop Land	16	62
% Pasture Land	10	3
% Other	10	19
Number of Farms	1,060 (12th)	5,330 (1st)
Value of Agricultural Products	$47.937 mill. (12th)	$435.580 mill. (1st)

Sources: Pennsylvania Crop and Livestock Annual Summary, 1981
Pennsylvania Department of Commerce, Bureau of Statistics
Pennsylvania Department of Transportation, Bureau of Strategic Planning
U.S. Department of Commerce, Bureau of the Census

There are significant variations between these counties in the levels of population, road mileage, land usage, and value of agricultural production. The land use patterns are quite different primarily due to differences in the topography of the land.

Lancaster County is very unique since it is the leading agricultural producing county in the State and also contains one of the major urban areas. Much of the value of its agricultural production is reflected in the extensive livestock activities involving dairy, poultry, and meat animals. The county is a leading producer of several crops, including wheat, corn, alfalfa, hay, and tobacco. Heavy truck tonnages are customarily associated with the hauling of such commodities as milk, feed, fertilizer, and products of the poultry processors (broilers and eggs). The city of Lancaster, located in the center of the county, is the hub of economic activity. Many of the industries located in and around the city are related to the agri-business industry. The majority of generators of heavy tonnages to and from the farm are located along main arterial routes included on the PCN.

Tioga County is typical of many of the rural northern counties of PA. This area is mountainous and very sparsely populated. Since the county has no major urban center, much of the economic activity is related to farming. Largely due to the county's mountainous terrain, dairy farming is the principal agricultural activity. Milk production ranks sixth in the state. Heavy truck tonnages are associated with hauling milk in the form of 10-wheel tankers holding approximately 30,000 pounds of milk. The larger milk tanker could provide cheaper costs and more efficient service to the dairy farmer, but the terrain and the current posted bridge situation prevents the use of these larger vehicles. This is a concern since the dairy farmer is responsible for the transportation costs. Over 63 percent of Tioga's land area is forested. The lumber industry produces heavy loads in excess of 75,000 pounds. The timbering activities, however, are scattered and constantly changing locations. Sawmills are located near the PCN routes. A major problem associated with Tioga County is lack of alternative routes. Tioga has 21 percent more land area than Lancaster but has only one-half the mileage of roadways. This is due to the differences in terrain and population. Because of this, detours associated with posted bridges are generally longer.

Results

The Agri-Access Network was identified in both Lancaster and Tioga counties. The mileage totals are shown in Table 5. The network mileage comparisons between the two counties indicate both similarities and differences. The Agri-Access Network in Lancaster included 50.5 highway miles which are owned by townships, while the network in Tioga included only state-owned mileage. The Agri-Access Network consists of similar mileage totals in the two counties. Although the PCN mileage in Lancaster (376.9 miles) is more than twice that in Tioga (155.1 miles), a summation of both networks indicates that these comprise 51 percent of all state-owned roads in Lancaster and 54 percent in Tioga County.

The Agri-Access Network, as defined during the pilot study, will not necessarily remain constant over time. As with the PCN, the definition and constraints of the Agri-Access Network will be reviewed and revised at timely intervals. Revisions in the network may result from changes in the size and number of farms or in the type and size of farm equipment. The establishment or relocation of agricultural truck generators may affect the importance of adjacent highways. The continuing trend toward rail line abandonments may also place additional burdens on other rural roads and bridges not previously identified.

Table 5. Number of Miles and Bridges on the Agri-Access Network

Item	Tioga County	Lancaster County
Network Mileage	261.9	289.8
State-owned	261.9	239.3
Locally-owned	-	50.5
Network Bridges	189	124
Number Structurally Deficient	52	31
Number Functionally Deficient	24	26
Number Posted	16	18
Number Programmed for Repair	14	15

Bridge restrictions were found to be the most significant restrictions to movements of agricultural products. There are 133 agri-access bridges which are classified as structurally deficient or functionally obsolete. A total of 52 of these deficient bridges were identified during the pilot study. These bridges are currently weight-restricted, critically in need of repair to avoid posting, or were identified by reviewing agencies as obsolete for current travel demands. A total of 29 bridges on the Agri-Access Network are programmed for replacement or rehabilitation under either PA's Bridge Bill, Twelve Year Program, or Maintenance Program.

The Agri-Access Network was evaluated and compared for the two counties. The findings can be used to generalize the type of roadways which were identified during the study and to provide criteria for eventual application of the pilot study principle to other counties of the State. The travel levels and functional classification of the network roadways were the main characteristics which were examined.

A comparison of travel levels indicates considerable variance between the two counties. The majority of network roadways in Lancaster have traffic levels above 1000 ADT. In Tioga, 77 percent of the network roads have less than 1000 ADT, and 44 percent are under 500 vehicles per day. An analysis of truck traffic levels on the network also produces similar results. From sample truck classification counts, an estimate was developed of mileage by average daily truck traffic (ADTT) range. The figures indicate that it is difficult to define equal truck traffic criteria for differing counties such as Lancaster and Tioga. A level of 50 trucks per day is reasonable in Lancaster, but 50 percent of the identified network in Tioga has ADTT below this level.

A comparison of other highway characteristics of the Agri-Access Network yields greater similarities. A large majority of roads in both counties are either major or minor collectors. Collector roads comprise 76 percent of the network in both counties. The separation of mileage by Federal-aid classification indicates that the majority of mileage (56.7 percent) in Tioga is not on a Federal-aid system, and therefore, is not eligible for Federal funding. If locally-owned mileage is included for Lancaster County, 57.1 percent is non-Federal-aid.

Due to the larger and heavier vehicles used in Lancaster County, preliminary analysis did not identify any bridges that would be beneficial at less than the maximum load limits. Because of the conditions particular to Tioga County, such as rugged mountain terrain, isolated rural areas, and long detours, six bridges in Tioga were identified by farm representatives as beneficial if posting limits were raised to only 20 tons. Such upgrading would mean the difference between survival and ruination to approximately 16 farms in Tioga County.

The feasibility of building or upgrading bridges to less than maximum load limits was investigated with bridge engineers. Their analysis showed that it would not be cost effective to build or replace bridges for less than 40-ton limits. It was determined, however, that in certain cases bridges could benefit users if strengthened temporarily to raise load limits above very low levels. Future replacement of the bridge would be necessary as funding becomes available.

A detailed description of the pilot study is available in a report titled Pennsylvania Agricultural Access Network - Pilot Study. The report can be obtained from the Pennsylvania Department of Transportation or from USDA's Office of Transportation.

Conclusions

The pilot study did identify an Agri-Access Network and provided valuable information for decision making in the PA DOT. It has provided vital knowledge for two counties concerning the relative importance of rural roads and bridges to the rural economic activities. The results can be useful in the determination of which improvement projects will provide for the greatest economic benefits to rural areas.

Involvement of local representatives at various stages was important to the success of the study. The individuals who are most affected by constructions on the roadway system provided direct input concerning the relative importance of particular roads and bridges. The exchange of information between state and local representatives supported the process and resulted in a better local appreciation of state government.

Statewide application of the approach used in the pilot study is expected to require certain flexibility. Travel levels on the Agri-Access Network are expected to vary considerably between different areas of the State. In rural, sparsely populated counties such as Tioga, the relative importance of agricultural activities must guide the development of the network. Certain criteria have been established to evaluate future network identification. Application of these principles in a responsible manner can yield reliable and defendable information.

FOOTNOTES

[1]Transportation Research Board, "Statewide Transportation Planning," Synthesis of Highway Practice 95 (November 1982), p.4.

[2]U.S. Department of Transportation, Status of the Nation's Highways: Conditions and Performance (Washington, D.C.: Federal Highway Administration, June 1983), p. III-27.

[3]C. Phillip Baumel and Eldo Schornhorst, "Local Rural Roads and Bridges: Current and Future Problems and Alternatives," Transportation Research Record 898 (Washington, D.C.: Transportation Research Board, 1983), p. 374.

[4]U.S. Department of Transportation, Status of the Nation's Highways: Conditions and Performance (Washington, D.C.: Federal Highway Administration, June 1983), p. S-7.

[5]U.S. Department of Transportation, The Status of the Nation's Highways: Conditions and Performance (Washington, D.C.: Government Printing Office, January 1981), p. 103.

[6]U.S. General Accounting Office, U.S. Grain Transportation Network Needs System Perspective to Meet Future World Needs (Washington, D.C., April 8, 1981), pp. 38-42.

[7]U.S. Department of Transportation, The Status of the Nation's Highways: Conditions and Performance (Washington, D.C.: Government Printing Office, January 1981), p. 80.