

PennDOT, the number of roadway surface improvements to be accomplished over the next several years on the PCN is being examined. This includes the amount of restoration to be accomplished on the Interstate portion of the network. It also includes determining the magnitude of resurfacing, surface treatment, and seal coating to be accomplished on the non-Interstate portions. Resurfacing is applicable to those

sections with higher traffic volumes; surface treatment and seal coating are preventive maintenance techniques used to protect those parts of the network with lower volumes of traffic.

In conclusion, the Priority Commercial Network has been an essential tool in departmental decision making and is now becoming a recognized highway system in Pennsylvania.

Development of Pennsylvania's Agricultural Access Network

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ABSTRACT

A two-county pilot study was conducted to develop an Agricultural Access Network in Pennsylvania. The study identified the essential roadways that provide access to the rural agricultural areas for the transport of agricultural commodities to market and supplies to the farm. It further identified key transportation obstructions inhibiting movement of products and supplies. The pilot study used direct input from local representatives in the identification and refinement of the network. The process used in developing the network is described and the results of the study are summarized. The identification of the Agricultural Access Network provides important information concerning which projects will yield the greatest economic benefits to the agricultural and rural communities of Pennsylvania.

The efficient movement of agricultural products and farm inputs in Pennsylvania is highly dependent on rural roads and bridges. Restrictions on Pennsylvania's vast rural transportation system can result in substantial economic impacts on the agricultural and rural communities.

The Pennsylvania Department of Transportation (PennDOT) conducted a pilot study to develop an Agricultural Access (Agri-Access) Network. The purpose of the study was to provide information for responsible decision making and improve roadway service and access for rural communities and related agricultural commercial activities. This concept was an extension of another important initiative that involved the development of a Priority Commercial Network (PCN) composed of the major commercial routes in the state.

The objectives of the pilot study were to

- Identify the essential roadways that provide

access between rural agricultural areas and the PCN,

- Identify key transportation obstructions that inhibit movement of farm and forestry products to market and supplies to the farm, and
- Evaluate the effectiveness of the process used in the pilot study before applying the concept statewide.

In this paper the approach used in the development of the Agri-Access Network is described and the results of the analysis conducted in the two demonstration counties are summarized.

BACKGROUND

Agriculture is an extremely important segment of Pennsylvania's overall economy. There are 61,000 farms that market nearly \$3 billion worth of crops and livestock annually. There are also numerous related activities comprising the agribusiness industry that employ supermarket clerks and trucking, processing, and production personnel. One of five jobs in Pennsylvania is in agriculture or agribusiness. Farming operations also indirectly contribute to the economy through large purchases of petroleum products, machinery, equipment, materials, and services.

The transportation system has significant impacts on agriculture and rural communities. An adequate system of rural roads and bridges is important for farming and forestry operations and for overall rural economic development. The many agribusinesses and rural communities of Pennsylvania are geographically dispersed, have varying transportation requirements, and often have fewer transportation alternatives than do sectors located in the urban and suburban areas.

Providing an effective system of rural roads and bridges that meet the various needs of residents and businesses has become a difficult challenge for state and local governments. Many of Pennsylvania'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 that carry loads at or near the maximum legal limit of 80,000 lb. Pennsylvania, with approximately 56,000 bridges, has more than 4,000 structures that are restricted to loads of 20 tons or less and many other bridges that are obsolete for modern travel. These obstructions cause trip diversions that 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 PennDOT involving the improvement of commercial transportation and the promotion of economic development. In 1982 planning personnel worked with local and regional planning agencies to identify a Priority Commercial Network (PCN). This network is mainly composed of Interstate routes, primary traffic routes, and key coal-haul routes that handle heavy volumes of truck traffic and serve as the economic backbone of the state. The PCN has been important for setting priorities of projects that will yield the greatest returns to Pennsylvania's economy. It has been particularly instrumental in the passage of a \$1.4 billion bridge bill to address the state's serious bridge problem. This program will address a variety of bridge deficiencies and, in particular, will eliminate all bridge obstructions to commercial traffic on the PCN, ultimately saving millions of dollars annually in trucking costs associated with detours.

Although the PCN provided valuable information on the heaviest truck routes, many roads serving the rural areas and the agricultural industry were not included. For this reason, a pilot study was conducted to identify those highways providing access between the PCN and the rural agricultural areas. This study provided information on which roads are most important to rural farming areas and on which obstructions are creating the greatest hardships for the movement of agricultural products and supplies.

APPROACH

The approach used in the pilot study had two principal characteristics:

- The study used existing data bases and information sources and thereby eliminated the need for extensive new data collection.
- The study relied on input from representatives at the local level for the identification and refinement of the network.

Data Base and Information Sources

Several PennDOT computer data bases facilitated network evaluation and data retrieval:

- The Pennsylvania Roadway Information System (PARIS) provided information on roadway characteristics and use that was helpful in analyzing and evaluating initial network findings. Data extracted from PARIS included average daily traffic (ADT), truck percentages, functional class, and federal-aid classifications.
- The Structure Inventory and Record System (SIRS), an inventory of state and local bridges, was used to identify structurally deficient, functionally obsolete, and weight-restricted bridges on the Agri-Access Network.

- The Project Management System (PMS) was accessed to categorize deficiencies according to their program status.

Other sources of agricultural and economic information were used in the analysis of the pilot counties and in the development of criteria to assist in future statewide application of the study process. These included

- Pennsylvania Crop and Livestock Summary,
- 1977 Economic Census, and
- The Structure and Characteristics of Bulk Milk Pickup Routes in Pennsylvania, 1982.

Coordination and Local Participation

The pilot study was guided at the state level by the Agricultural Transportation Task Force consisting of representatives of federal, state, and local government and farm organizations. The task force was structured as 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 of the study. In the initial meetings at the county level, county extension agents provided valuable knowledge of the agricultural economy and the location of generators of heavy agricultural loads. Meetings with key representatives of 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. Although most tasks were related to the identification of an Agri-Access Network and obstructions on that network, certain tasks were directed to the development of information to aid in 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 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, showing the previously identified PCN, provided the basis for identification. This eliminated the need for duplicate identification of these 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. Information concerning the major agricultural products and lumber, and the lo-

cations of various activities related to these products, was included. Locations included, but were not limited to, generators of heavy loads such as lumber, milk and poultry processing plants, feed mills, and fertilizer plants. This information was plotted on maps including an indication of where commodities move from one county or state to another. The local participants' knowledge of the agribusiness functions was extensive and provided the sound base needed 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 network complementary to the PCN. They consisted of those routes providing access to groups of farms and essential agricultural and rural functions. 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 PennDOT 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 setting program priorities.

Analysis was conducted to identify those agri-access roads most critical to hauling of 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 representatives in earlier tasks, about the benefits of lower-than-maximum load limits to particular county activities was also important. Bridge engineers were consulted to determine the feasibility and cost-effectiveness of 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 highways were identified and located on maps. The bridge information was extracted from the Structure Inventory and Record System (SIRS). Throughout the study, other data were compiled to be used in assigning priority to the obstructions and deficiencies that were identified. This included such items as (a) county production figures and economic information, (b) approximate number of farmers dependent on a particular deficient bridge or route, and (c) increase in distance or time or both due to detour.

The evaluation of the preliminary Agri-Access Network involved examining the characteristics of the highways, especially those characteristics related to function and use. This facilitated the establishment of criteria to provide a basis for the evaluation of 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 truck traffic on the identified roads in the pilot counties. These counts separated traffic by vehicle type and number of axles. This information was combined with existing traffic count information from PennDOT files and data bases to determine truck traffic levels on the preliminary network.

- The functional classification of the identified network roads was examined to determine the type of use made of these highways. Comparisons were made between the two demonstration counties. These were also compared to similar findings for the PCN to determine similarities and differences.
- County economic information was examined to develop comparisons according to agricultural dependence. The total economic activity sales for each county were extracted from census information. This total was compared with the total agricultural activity sales to determine each county's economic dependence on agriculture.

Refinement and Review

The objective of this task was to refine initial findings from local knowledge. Farm organizations, the county extension service, regional agricultural representatives, township representatives, local transportation officials, and county planning agencies participated in this task. Participating organizations were provided maps of the preliminary network and associated listings of the identified obstructions. Project descriptions and the status of projects programmed to eliminate the obstruction were included.

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 movement of emergency vehicles and loaded school buses. The collection and compilation of the refinement products were facilitated by the county extension offices. Throughout this task, all organizations had ample opportunity for equal review.

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

DEMONSTRATION COUNTIES

Lancaster and Tioga were the two Pennsylvania counties chosen for this pilot study. Both areas are highly agricultural, but they also have other differing characteristics that were thought to be representative of conditions in other sections of the state. A comparison of several county facts is presented in Table 1. There are significant variations between these counties in the levels of population, road mileage, and agricultural production. The land use patterns are also quite different, which is primarily a result of the topography of the land.

Lancaster County

Lancaster County is unique because it is the leading agricultural producing county in the state and also contains one of the major urban areas. The county is located along the southern border of Pennsylvania east of the Susquehanna River. Many of the commodities produced in Lancaster County are transported to the city of Philadelphia located only 60 miles to the east.

Fertile soil and gentle terrain have made Lancaster County one of the richest farming areas of the nation. This county is the leading producer of

TABLE 1 Data on Demonstration Counties

	Lancaster	Tioga
Total population	362,346; 7th in state	40,973; 50th in state
Rural population	164,580 or 45% of total county population	33,846 or 83% of total county population
Total land area (miles ²)	946.1	1,146.0
Forest land	153.3 (16.2%)	728.9 (63.6%)
Crop land	584.7 (61.8%)	187.9 (16.4%)
Pasture land	32.2 (3.4%)	116.9 (10.2%)
Other	175.9 (18.6%)	112.3 (9.8%)
Largest cities and boroughs	Lancaster (city, pop. 54,725) Columbia (boro., pop. 10,466) Elizabethtown (boro., pop. 8,223)	Wellsboro (boro., pop. 3,805) Mansfield (boro., pop. 3,322) Elkland (boro., pop. 1,974)
	3,588.1	1,763.4
Total roadway (miles)	1,318.7	769.0
State system	2,269.4	994.4
Local system	1,008	601
Bridges (total)	754	488
State system	254	113
Local system	5,330 (1st in state)	1,060 (12th in state)
No. of farms		
Agricultural production		
Primary activity/Rank	Cattle, calves, milk, and crops (wheat, corn, alfalfa, hay, tobacco)/1st	Milk, sheep, lambs/6th, hay/4th
Value/Rank in value of agricultural products	\$435,580,000/1st	\$47,937,000/12th

agricultural products in Pennsylvania. Lancaster County's agricultural products are valued at over \$400 million annually. Much of this value reflects 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. Despite its high production levels, the county's output is unable to meet the feed requirement of all livestock. Tobacco is grown primarily in the eastern portion of the county. Poultry operations are generally located in the northern half of the county, and dairy farming is prominent in the southern half.

Heavy truck tonnages are customarily associated with the hauling of such commodities as milk, feed, the products of poultry processors (broilers and eggs), and fertilizer. Although there are some dairies located in the county, most of the milk produced there is trucked from the farm to the Philadelphia region. Most of the milk is transported in large tractor-trailer tank trucks. Milk pickups and feed deliveries are the activities most associated with the heavy daily truck trips. The trucking of fertilizer from plant to farm is a seasonal activity, mainly occurring in the spring and fall.

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 agribusiness. The majority of generators of heavy tonnages to and from the farm are located along main arterial routes included in the PCN.

Tioga County

Tioga County is typical of many of the rural northern counties of Pennsylvania. This region is mountainous and sparsely populated. Tioga is located along the border of New York State and has the second largest land area of any county in Pennsylvania.

Because the county has no major urban centers, much of the economic activity is related to farming. Largely because of the county's mountainous terrain, dairy farming is the principal agricultural activity. Milk production ranks sixth in the state. Of \$53 million in total 1981 agricultural cash receipts in Tioga, \$49 million resulted from livestock products—primarily milk.

The majority of the milk produced in Tioga County is trucked to New York State. Heavy truck tonnages

of milk hauling are in the form of 10-wheel tankers holding approximately 30,000 pounds of milk. The use of larger milk tankers could provide cheaper and more efficient service to the dairy farmer. The terrain and the current posted bridge situation prevent the use of these larger vehicles in this county. This is a concern in Tioga County because the dairy farmer is responsible for transportation costs.

More than 63 percent of Tioga's land area is forested. There is little access to the southwestern quadrant of the county, which is primarily mountainous. The lumber industry produces heavy loads in excess of 75,000 pounds. The timbering activities are scattered and constantly changing locations. Sawmills are located near US-6 and other main PCN routes.

A major problem associated with Tioga County is lack of alternate routes. Tioga has 21 percent more land area than Lancaster County but only one-half the mileage of highways. This is because of the differences in terrain and population. For this reason, detours associated with posted bridges are generally longer.

RESULTS

Network

The Agri-Access Network was identified in both Lancaster and Tioga counties. The mileage totals are

	Lancaster	Tioga
Preliminary network		
State owned	227.7	245.6
Locally owned	37.0	
Refinement additions		
State owned	11.6	16.3
Locally owned	13.5	
Final network	289.8	261.9
PCN	376.9	155.1

The network mileage comparisons between the two counties indicate both similarities and differences. The Agri-Access Network in Lancaster includes 50.5 highway miles that are owned by townships; the network in Tioga includes only state-owned mileage. The Agri-Access Network consists of similar mileage totals in the two counties. Although the PCN mileage

in Lancaster is more than twice that in Tioga, a summation of both networks indicates that these networks comprise 51 percent of all state-owned roads in Lancaster and 54 percent in Tioga.

The Agri-Access Network, as defined during this pilot study, will not necessarily remain constant. As is done with the PCN, the Agri-Access Network definition and constraints 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. Continuing rail line abandonments may also place an additional burden on other rural roads and bridges not previously identified.

Obstructions

Bridge restrictions were found to be the most significant restrictions to the movement of agricultural products. The following table gives the status of the bridges on the Agri-Access Network.

	Lancaster	Tioga
Total bridges	124	189
Structurally deficient	31	52
Functionally obsolete	26	24
Posted	18	16
Programmed for repair		
Bridge bill	6	8
Twelve-year program	4	1
Maintenance program	5	5

There are 133 agri-access bridges that are classified as structurally deficient or functionally obsolete. A total of 52 of these deficient bridges were identified during this study. These bridges are currently weight restricted, critically need 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. Improvements are identified under one of three programs: bridge bill, twelve-year program, or maintenance program. The bridge bill projects are capital improvement projects contained in the \$1.4 billion bridge bill and will be under way within the next 6 years. The twelve-year program projects are capital improvements recommended for the 6 years beyond the bridge bill. Maintenance projects are smaller cost improvements that are completed with county maintenance appropriations.

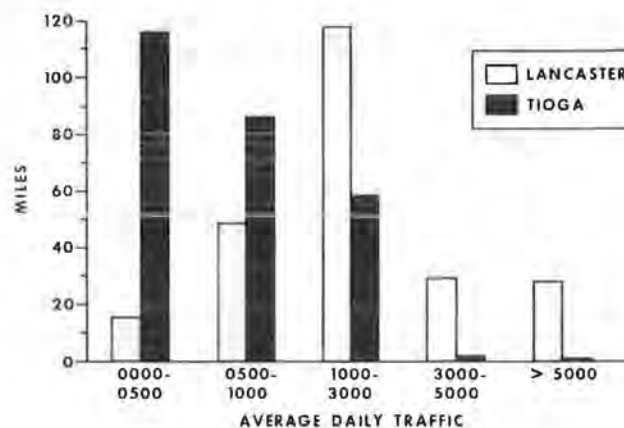
There were other obstructions noted during the refinement stage of the pilot study. These generally involved maintenance level problems related to roadway conditions or problems inhibiting the use of large farm equipment. A particular problem noted in Tioga County involved coal hauling on several routes in the northeastern quadrant of the county. Each year after surface treatment is applied to the routes, heavy coal trucks use the roads, which results in rapid deterioration of the roadways. These routes provide better access for marketing of products than the alternate route, Traffic Route 549. Using this alternate route involves traversing a long steep grade that is difficult for truck travel.

Network Evaluation

The Agri-Access Network for the two counties was evaluated and compared. The findings can be used to generalize the type of highways that 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 highways were the main characteristics examined.

A comparison of travel levels indicates considerable variance between the two counties. Figure 1 shows a summary of mileage by average daily traffic (ADT) range. The majority of network highways in



ADT RANGE	LANCASTER	TIOGA
0000-0500	= 15.403 MILES	115.740 MILES
0500-1000	= 49.605 MILES	86.434 MILES
1000-3000	= 118.838 MILES	58.526 MILES
3000-5000	= 28.062 MILES	.737 MILES
5000 & GREATER	= 27.367 MILES	.485 MILES
TOTAL	= 239.275 STATE-OWNED MILES	261.922 STATE-OWNED MILES

FIGURE 1 Mileage by ADT range.

Lancaster has traffic levels above 1,000 ADT. In Tioga, 77 percent of the network roads carry less than 1,000 ADT, and 44 percent carry under 500 vehicles per day. An analysis of truck traffic levels on the network 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 dissimilar 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. The following is an estimate of mileage by ADTT range.

ADTT	Miles	
	Lancaster	Tioga
25 to 50	22	130
50 to 100	126	78
100 to 300	101	51
Above 300	41	3

A comparison of other highway characteristics of the Agri-Access Network yields greater similarities. The functional classification status of the network is shown in Figure 2. An important finding is that a large majority of roads in both counties are either major or minor collectors. The network in both counties is composed of 76 percent collector roads. The separation of mileage by federal-aid classification

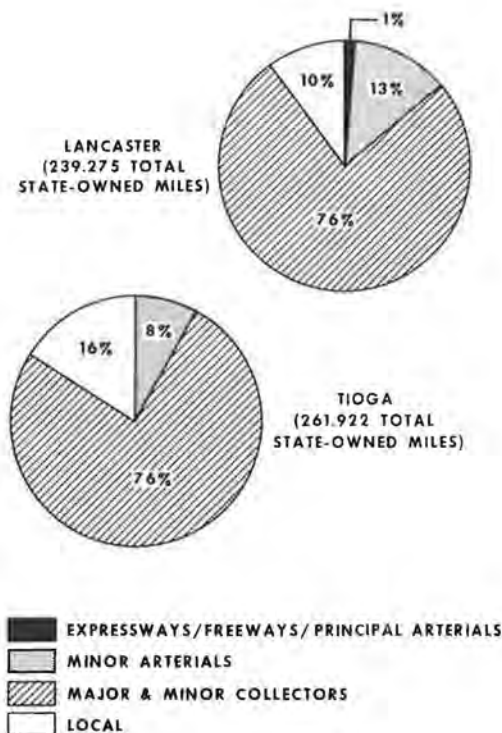


FIGURE 2 Mileage by functional class.

is given in Table 2. The majority of mileage (56.7 percent) in Tioga is not on a federal-aid system. If locally owned mileage is included for Lancaster, 57.1 percent is non-federal-aid.

Figure 3 and Table 3 present the same comparisons for the PCN in the two counties. A large majority of highways on the PCN are arterials. Approximately 98 percent of the PCN is on the federal-aid system. The PCN serves statewide and regional travel and links cities and boroughs. The Agri-Access Network provides connections between the higher and lower systems, serves smaller communities and intracounty travel, and links local traffic generators.

Network Criteria

After examining alternative methods of determining

TABLE 2 Agri-Access Network Mileage by Federal-Aid System

System	Lancaster	Tioga
Federal-aid primary		
Principal arterials (urban)	2,840	0
Minor arterials (rural)	14,342	21,420
Subtotal	17,182 (7.2%)	21,420 (8.2%)
Federal-aid secondary		
Major collectors (rural)	85,537	92,080
Subtotal	85,537 (35.7%)	92,080 (35.1%)
Federal-aid urban		
Minor arterials	17,946	0
Collectors	3,293	0
Subtotal	21,239 (8.9%)	0
Non-federal-aid		
Minor collectors (rural)	91,827	107,069
Locals (rural)	23,490	41,353
Subtotal	115,317 (48.2%)	148,422 (56.7%)
Total state-owned miles	239,275	261,922

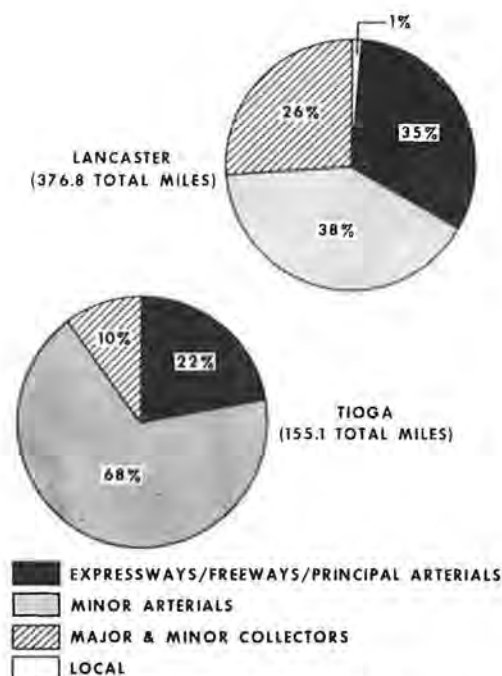


FIGURE 3 PCN mileage by functional class.

TABLE 3 Priority Commercial Network Mileage by Federal-Aid System

System	Lancaster	Tioga
Federal-aid primary		
Freeways and expressways	10,826	0
Principal arterials (urban)	52,328	0
Principal arterials (rural)	66,332	34,414
Minor arterials (rural)	122,424	105,784
Subtotal	251,910 (66.9%)	140,198 (90.4%)
Federal-aid secondary		
Major collectors (rural)	90,620	12,223
Subtotal	90,620 (24.0%)	12,223 (7.9%)
Federal-aid urban		
Principal arterials	3,706	0
Minor arterials	20,873	0
Collectors	0,673	0
Subtotal	25,252 (6.7%)	0
Non-federal-aid		
Minor collectors (rural)	8,246	2,693
Local (rural)	0,864	0
Subtotal	9,110 (2.4%)	2,693 (1.7%)
Total	376,892 (100.0%)	115,114 (100.0%)

truck criteria, three guideline criteria for evaluating agri-access roads were established:

- Functional class of selected roads,
- A 25 to 50 sliding scale of trucks per day, and
- Agricultural activity by county.

The network analysis in Lancaster and Tioga showed a large portion (76 percent) of the network was composed of collector roads. These findings substantiated the basis on which functional criteria could apply statewide.

A sliding scale of 25 to 50 trucks per day was established after analysis of truck traffic levels on the Agri-Access Network. Table 4 gives guidelines for the determination of levels of truck traffic to be expected on the Agri-Access Network in different

TABLE 4. Guidelines for Truck Criteria: County Scale of 25 to 50 Trucks per Day, County Ranking by Agricultural Importance

County	Agricultural Activity (%)	County	Agricultural Activity (%)
25 Trucks/Day			
Fulton	40.0	Wyoming	15.9
Sullivan	32.2	Tioga	15.5
Susquehanna	26.9	Adams	13.0
Juniata	25.6	Wayne	12.6
Potter	22.0	Bradford	11.9
Perry	21.5	Snyder	10.8
50 Trucks/Day			
Union	9.2	Schuylkill	1.8
Bedford	8.4	Jefferson	1.6
Franklin	7.7	Erie	1.6
Huntingdon	7.4	Lycoming	1.4
Lancaster	7.3	Venango	1.3
Mifflin	6.3	Warren	1.2
Armstrong	5.7	Northampton	1.2
Somerset	5.1	Fayette	1.1
Chester	4.8	Dauphin	1.0
Crawford	4.7	Washington	0.9
Lebanon	4.1	Cambria	0.9
Columbia	3.6	Monroe	0.8
Montour	3.5	McKean	0.8
Centre	3.2	Elk	0.8
Clarion	3.0	Westmoreland	0.7
Northumberland	2.8	Carbon	0.7
Indiana	2.8	Bucks	0.7
Berks	2.6	Clearfield	0.6
Mercer	2.5	Lehigh	0.5
Clinton	2.5	Cameron	0.5
Forest	2.2	Lackawanna	0.4
Pike	2.0	Luzerne	0.3
Greene	2.0	Beaver	0.3
Cumberland	2.0	Montgomery	0.2
Butler	2.0	Delaware	0.2
York	1.9	Philadelphia	0.0
Lawrence	1.9	Allegheny	0.0
Blair	1.9		

counties. The criteria for county ranking of agricultural importance were developed based on the percentage of agricultural activity compared to total economic activity sales. The greater a county's dependence on agricultural activities, the lower the level of truck traffic required on identified highways. This concept proved acceptable as long as there remained a degree of flexibility and consideration for the seasonal dimensions of farming activities.

The third criterion to consider is the level of agricultural activity in each county. Future network development in the remainder of the state should take into account relative levels of agricultural activity in counties. The total mileage identified in each county should be in general proportion to that county's agricultural level of agricultural activity.

Critical Heavy-Load Roads

Because of the larger and heavier vehicles used in Lancaster County, preliminary analysis did not identify any bridges beneficial at less than maximum load limits. However, because of conditions peculiar to Tioga County's agricultural community, such as rugged mountain terrain, isolated rural areas, and long detours, six bridges in this county were identified by farm representatives as beneficial if posting limits were raised to 20 tons. Such upgrading would mean the difference between survival and ruin to approximately 15 farms in Tioga.

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

After conferring with PennDOT bridge engineers, it was decided that future recommendations for less than 40-ton load limits would be determined on a project-by-project basis.

CONCLUSIONS

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

Involvement of local representatives at various stages was important to the success of the study. These individuals, who are most affected by obstructions on the highway 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 parts 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 as a basis for future network identification. Application of these principles in a responsible manner can yield reliable and defensible information.