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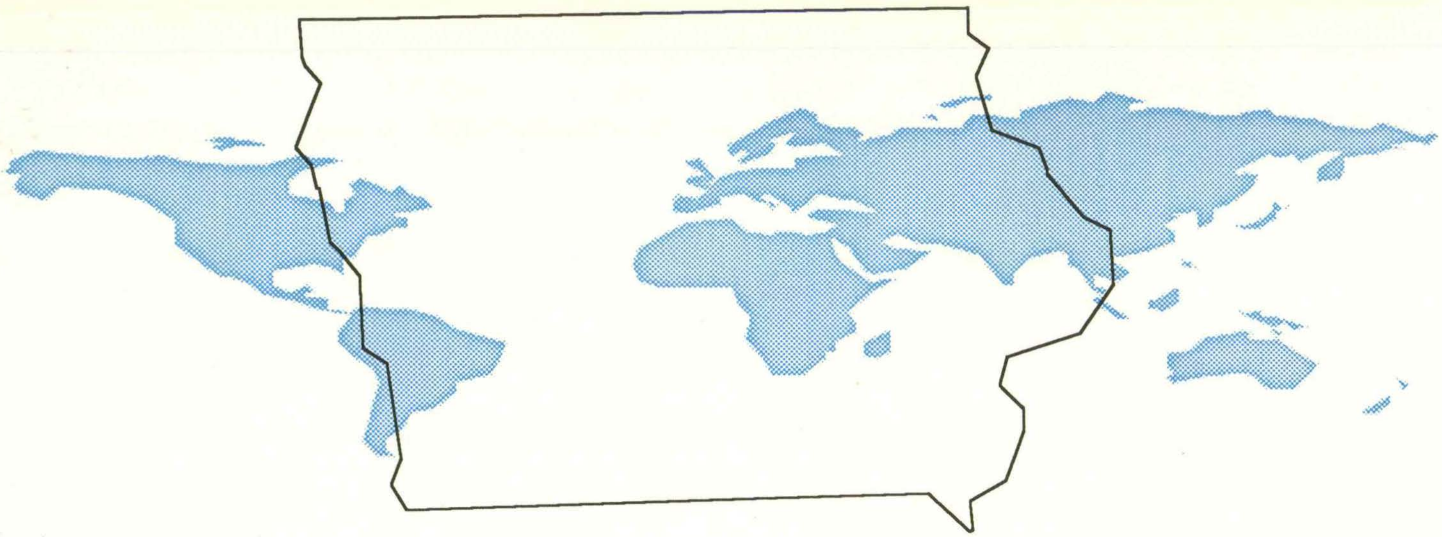

Transportation Services in Iowa
Summary and Assessment

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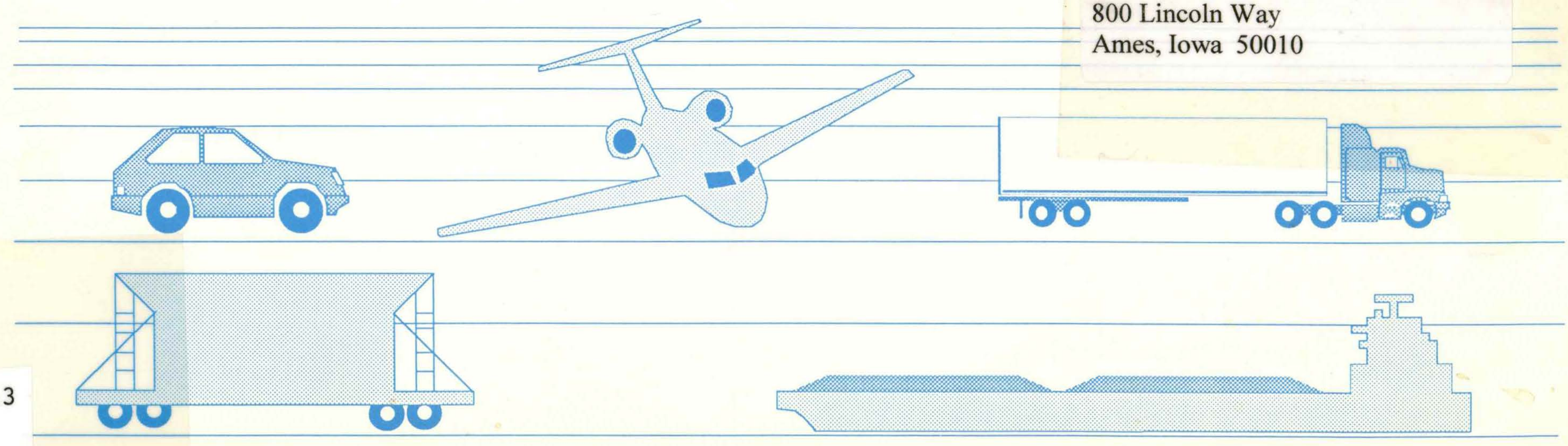

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TRANSPORTATION AND IOWA'S ECONOMIC FUTURE

TRANSPORTATION SERVICES IN IOWA
SUMMARY AND ASSESSMENT

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Prepared by
The University of Iowa
Public Policy Center
in conjunction with the

MIDWEST TRANSPORTATION CENTER

September, 1991

PREFACE

Iowa is a state undergoing a major transition economically, socially, and demographically. The state has much to suggest that its economic future well may be bright: a well-educated population that possesses a good work ethic, a central location within the United States, a reputation for openness and free discussion of matters of public interest, and many businesses recognized as innovators and producers of high quality products.

Yet the state is at an important point of transition. To realize its potential in a world that is changing rapidly, Iowa must look ahead. It must re-evaluate past and current practices and make changes where appropriate.

One of the key levers Iowa or any other state has to make it an attractive location for economic activity is its transportation system. By offering reliable, fast, and cost-effective transportation involving various modes as appropriate, Iowa can reduce the cost of doing business. As a result, it can strengthen its competitive position within the region, nation, and world.

How can Iowa best make its transportation system able to foster and support a stronger economy as we approach the twenty-first century? To address this question, an 18-month study is underway at the University of Iowa's Public Policy Center. The project involves an interdisciplinary research team from both the University of Iowa and Iowa State University. On the team are senior faculty, research professionals, and graduate students. Working closely with the research team is an advisory committee of business and government leaders. Composition of the committee, led by Robert Peterson of IBP, is shown on the inside cover.

The report addresses one major purpose of the project: to present a clear, useful summary and assessment of transportation services in Iowa. Various modes and areas of the state are analyzed for level and cost of service, financing practices, and emerging trends in movements of goods and people. This assessment provides a sound basis for the analysis to follow in later stages of the project.

Professor David J. Forkenbrock, the Director of the University of Iowa Public Policy Center, is coordinating the overall project. Professor Michael Crum, from the Department of Transportation and Logistics at Iowa State University, is co-investigator. This report was developed from a presentation made to the Project Advisory Committee in Des Moines, Iowa, on July 3, 1991. Norman S. J. Foster, a Research Associate at the Public Policy Center, coordinated production of this report. A number of Graduate Research Assistants assisted greatly in its preparation. At the University of Iowa, Claudia Stevenson-Monroy and Mark Pierson analyzed highways; Mark Simonson, railroads; and Randy Rowson, barge movements. At Iowa State University, Solomon Ghorayeb examined recent trends in freight movements.

Funding for this project is being provided by the U.S. Department of Transportation, University Transportation Centers Program, Northwest Area Foundation, Iowa Business Council, Iowa Department of Transportation, University of Iowa, and Iowa State University.

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SECTION 1
DEMOGRAPHIC AND ECONOMIC TRENDS IN IOWA

During the past few decades, Iowa has been undergoing substantial change. Both in terms of its population—composition and location of residence—and its economic base, the state continues to evolve. This evolution has major implications in terms of the types of transportation services that will be necessary and affordable. Before examining the state's transportation system, it is instructive to consider the nature and magnitude of changes occurring within Iowa. It is not the objective of this section to provide a comprehensive analysis of the types and levels of transportation the state is going to need in future years. Rather, the section is intended to provide a useful context for an assessment of Iowa's transportation systems.

Population Changes

The population of the state of Iowa fell during the decade of the 1980s, after growing for almost all of the twentieth century. This loss in population reflects poor economic conditions in the state during these years. However, longer-term changes in where people live *within* the state may be as significant as the statewide changes. Figure 1-1 illustrates some of these longer term changes, from the vantage point of 1980. The figure shows that most counties in Iowa reached their maximum populations before 1980, and in many cases several decades earlier. Moreover, in 1980 many counties had less than three-quarters of the largest population they reached at an earlier time. Indeed, six counties had less than half of their maximum population. The 22 counties still growing in 1980 are clustered around large urban centers: Des Moines, Waterloo, Cedar Rapids and Iowa City, Davenport, and Dubuque.

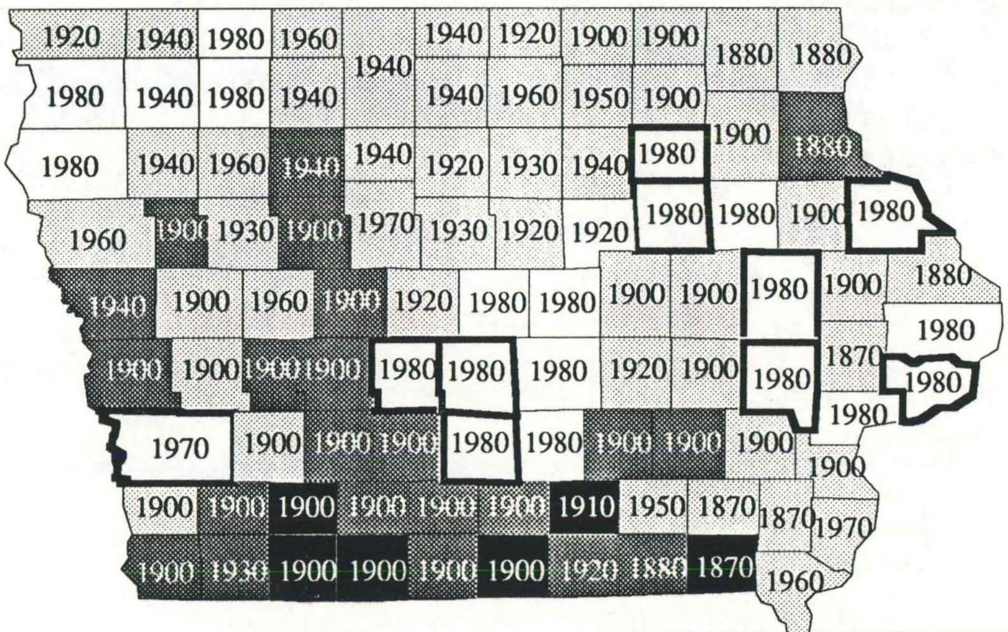

Figure 1-1. County Population Changes in Iowa: Year of Maximum Population and 1980 Population as Percent of Maximum

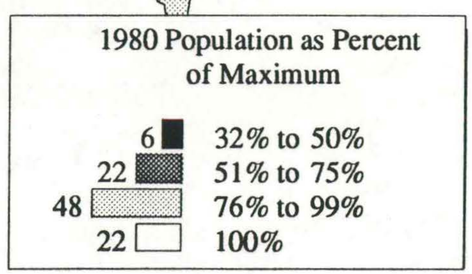

Figure 1-2 shows how the situation changed over the 1980s and reflects 1990 Census data. Two changes are especially noticeable. First, the number of counties with less than half their maximum populations grew from six to 11, clustered along Iowa's southern border. Second, the number of counties still growing by 1990 has fallen to only six—around Des Moines and Iowa City. The pattern of counties with less than three-quarters of their maximum population in 1990 has developed to encompass a large part of rural western Iowa, as well as much of the northern portion of the state.

This trend of declines in population is long-standing, continuing, and cumulatively of significant magnitude in many counties. Since many of the important decisions on infrastructure development were made around the time many of these counties stopped growing, the current infrastructure may not be well suited to their needs today or in the future.

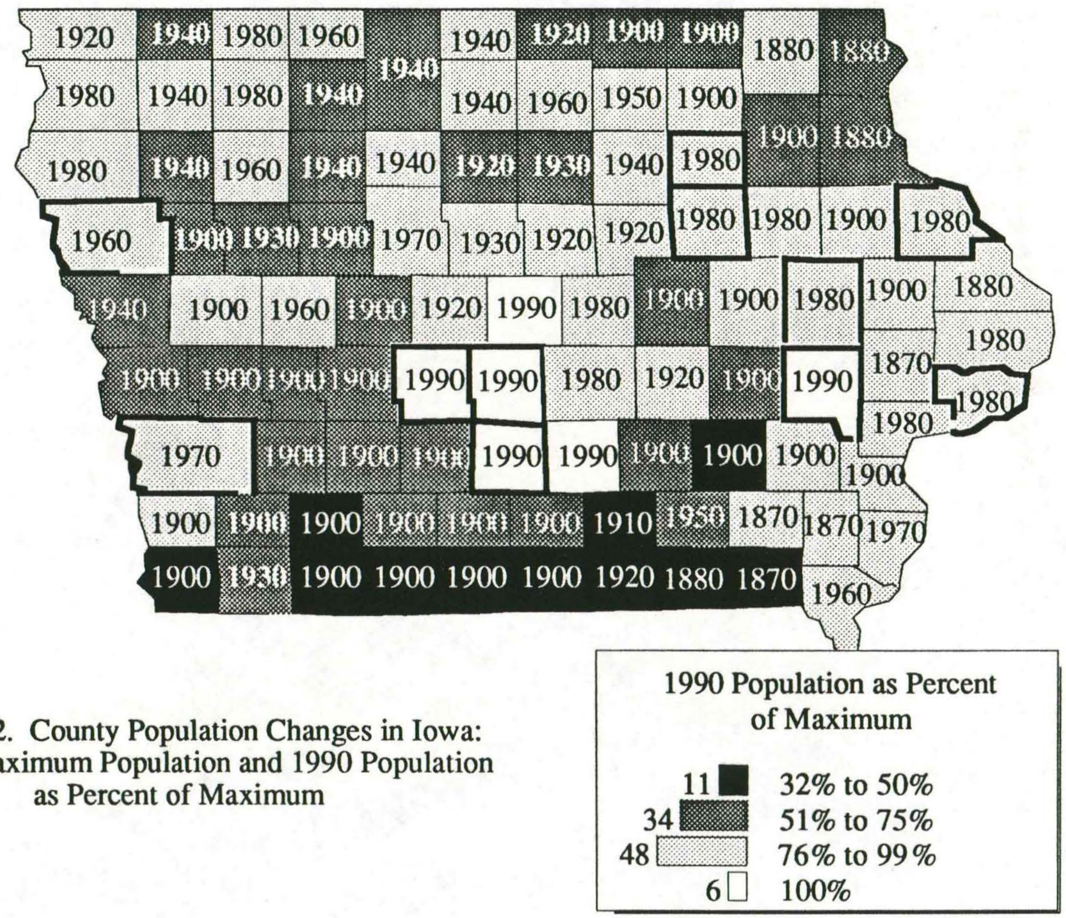

Figure 1-2. County Population Changes in Iowa: Year of Maximum Population and 1990 Population as Percent of Maximum

Employment Changes

Since 1965, the distribution of Iowa's nonagricultural employment across industries has shifted in important ways (Figure 1-3). The service sector had the greatest increase, the manufacturing sector the greatest decrease. In large measure, changes in industry mix in Iowa have paralleled changes at the national level, but they have been slightly smaller. From 1965 to 1989, the share of nonagricultural employment in manufacturing dropped from 29.7 percent to 18.0 percent in the nation and from 25.6 percent to 19.1 percent in Iowa. For the same period, the share of employment in the service sector increased from 14.9 percent to 24.8 percent in the nation and from 14.3 percent to 21.6 percent in Iowa. For a more detailed discussion of recent labor market trends in Iowa, see "Labor Supply in Iowa: Policies for Economic Growth," a recent report prepared by the Public Policy Center in conjunction with the Iowa Business Council and the Northwest Area Foundation (Pogue, Neumann, and Forkenbrock, 1991).

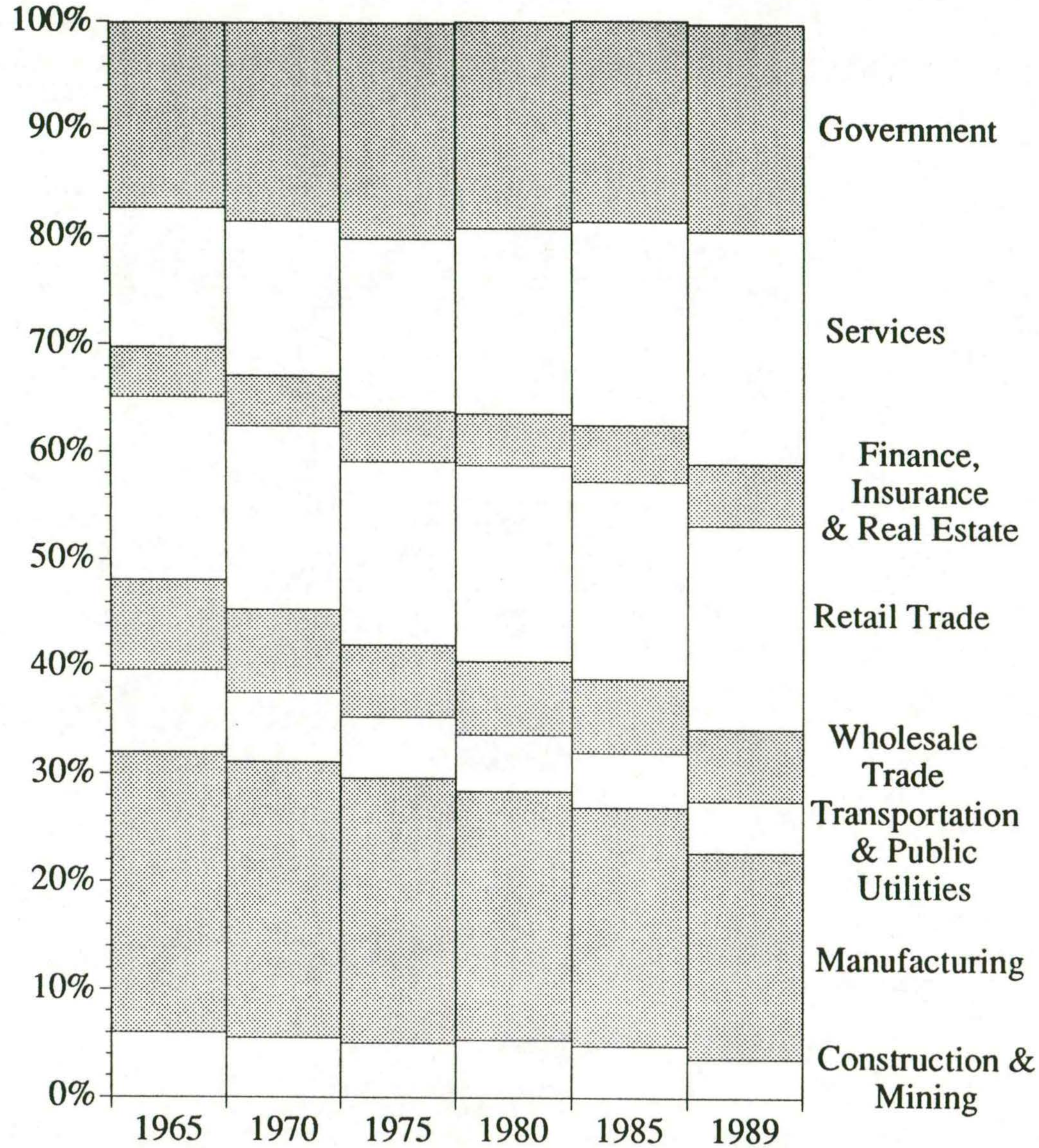

Figure 1-3. Percentage Distribution of Iowa's Nonagricultural Employment, By Industry, 1965-89

The spatial configuration of employment in Iowa has been changing. As Figure 1-4 shows, manufacturing employment has decreased in some of the metropolitan areas, particularly Waterloo and the Quad Cities. Increases have been experienced in some of the state's smaller communities. Smaller-scale plants have increasingly employed farmers and smaller community residents, often on a part-time basis. Thus, while manufacturing employment in Iowa has diminished, it also has shifted. By and large, these shifts have been accompanied by lower real wage levels. There is evidence, however, that the value added by manufacturing in Iowa has not decreased in a parallel manner with total employment in this sector.

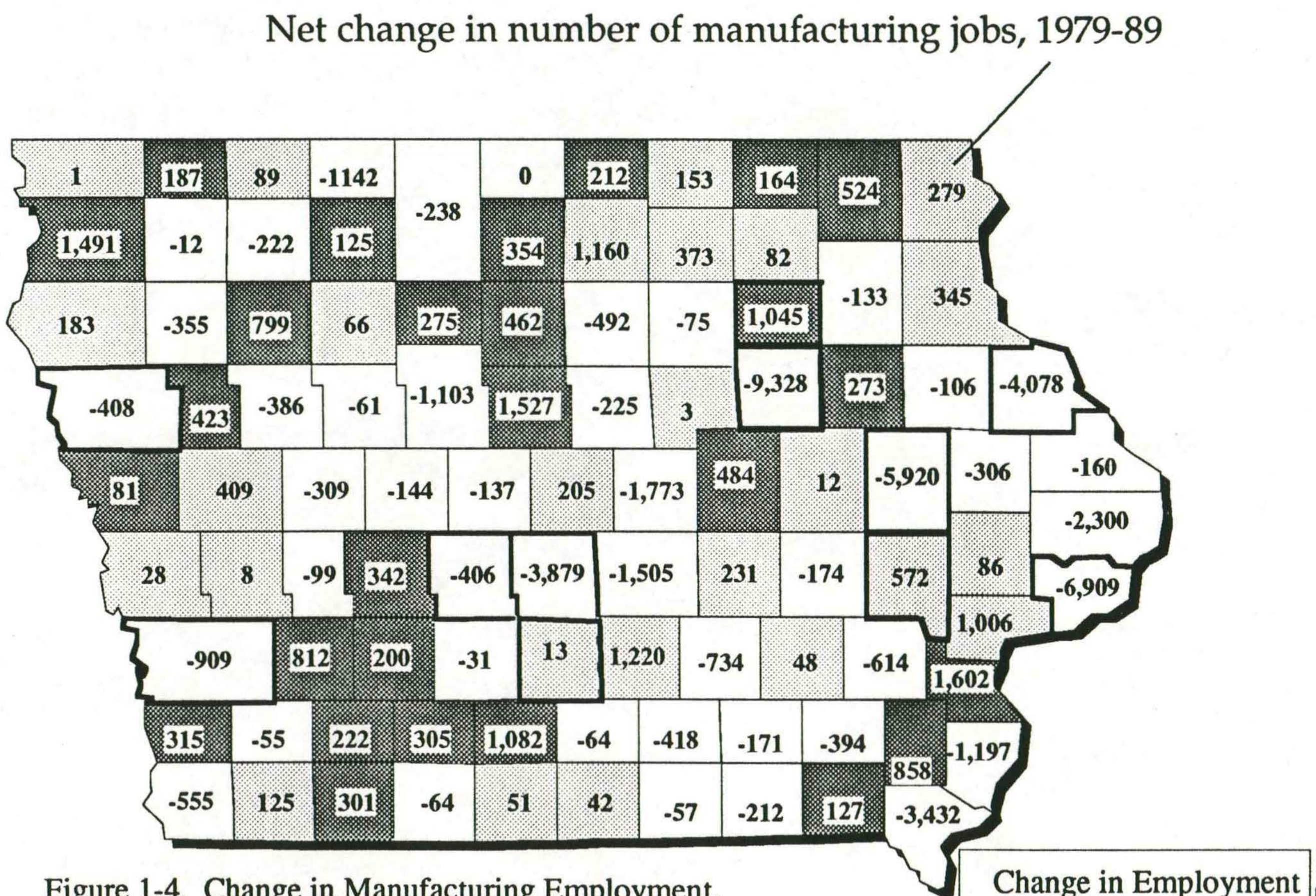

Figure 1-4. Change in Manufacturing Employment, Iowa, 1979-89

Total Change for State: -11.44%, -29,911 Jobs
Source: County Business Patterns

Income Circumstances

Just as population has concentrated to some degree in the urban areas of Iowa in recent years, income has tended to be higher in these areas. The trend toward higher incomes in larger urban areas became especially evident during the early 1980s, as the farm recession deepened. Figure 1-5 shows how the level of per capita income varied across the state in 1987, as estimated by the Census Bureau, and Figure 1-6 shows how it changed from 1979 to 1987. As Figure 1-5 indicates, the absolute level of income tended to be the highest in the metropolitan areas of central Iowa, along with the Quad Cities. A sizable non-metropolitan area in central Iowa also had relatively high per capita income in 1987. Comparatively low per capita incomes were found in counties in southern, northeastern, and parts of western Iowa.

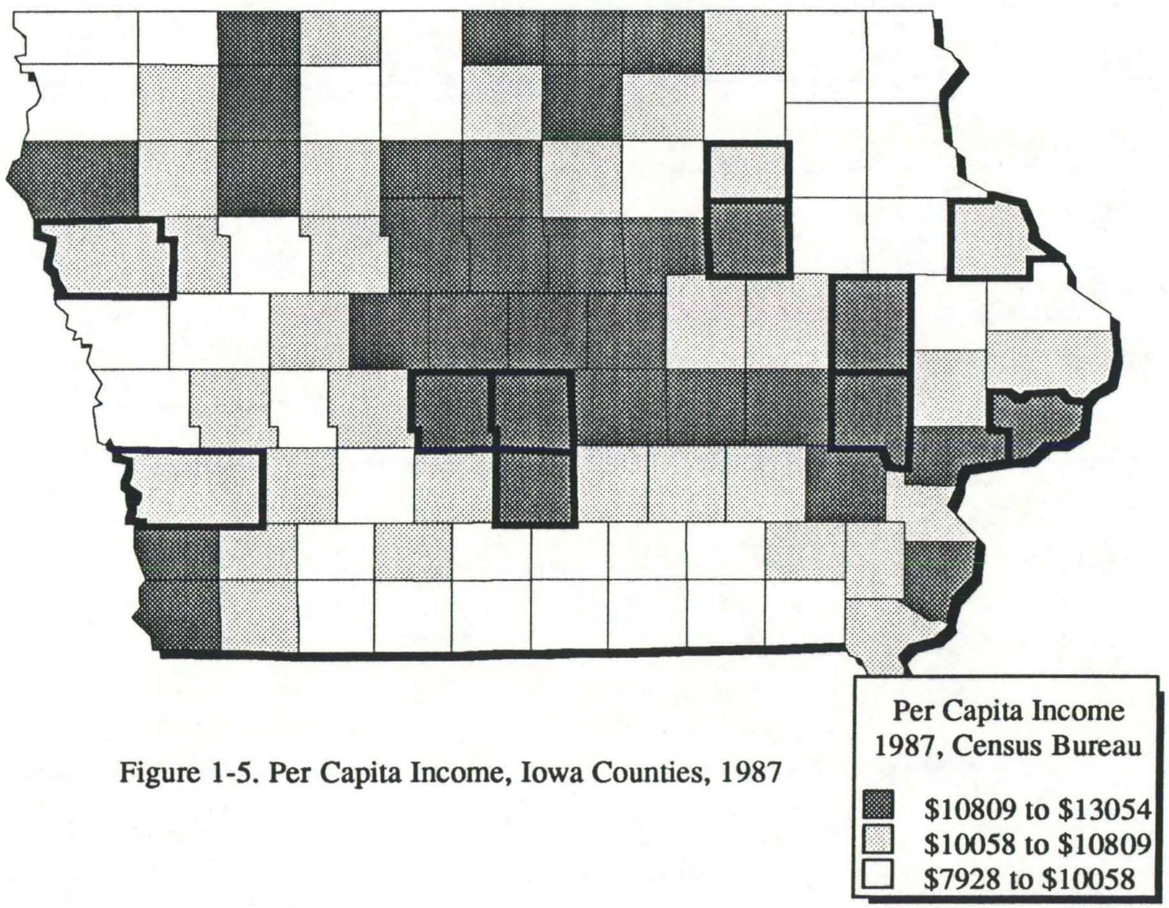

Figure 1-5. Per Capita Income, Iowa Counties, 1987

Figure 1-6 sheds further light on Iowa's changing income circumstances. The greatest percentage growth in per capita income between 1979 and 1987 did not occur in metropolitan areas, except Iowa City. Rather, some of the lower income counties of northeast and western Iowa posted substantial per capita income gains. Likewise, a belt of counties across south-central Iowa experienced good income growth. Less significant were the gains in income in northwest and part of northern Iowa.

It should be noted that when analyzing income across Iowa, we observed that patterns of change varied somewhat from year to year. For example, in 1985 we found a more distinct difference between per capita income levels in metropolitan areas versus rural areas. Between 1985 and 1987 income levels in parts of rural Iowa grew impressively. As farm incomes vary with crop yields and prices, a fair amount of difference in the patterns of per capita income seems to be in evidence. In all recent years, however, the highest per capita incomes were found in the Des Moines, Waterloo, Cedar Rapids, Iowa City, and Quad Cities areas.

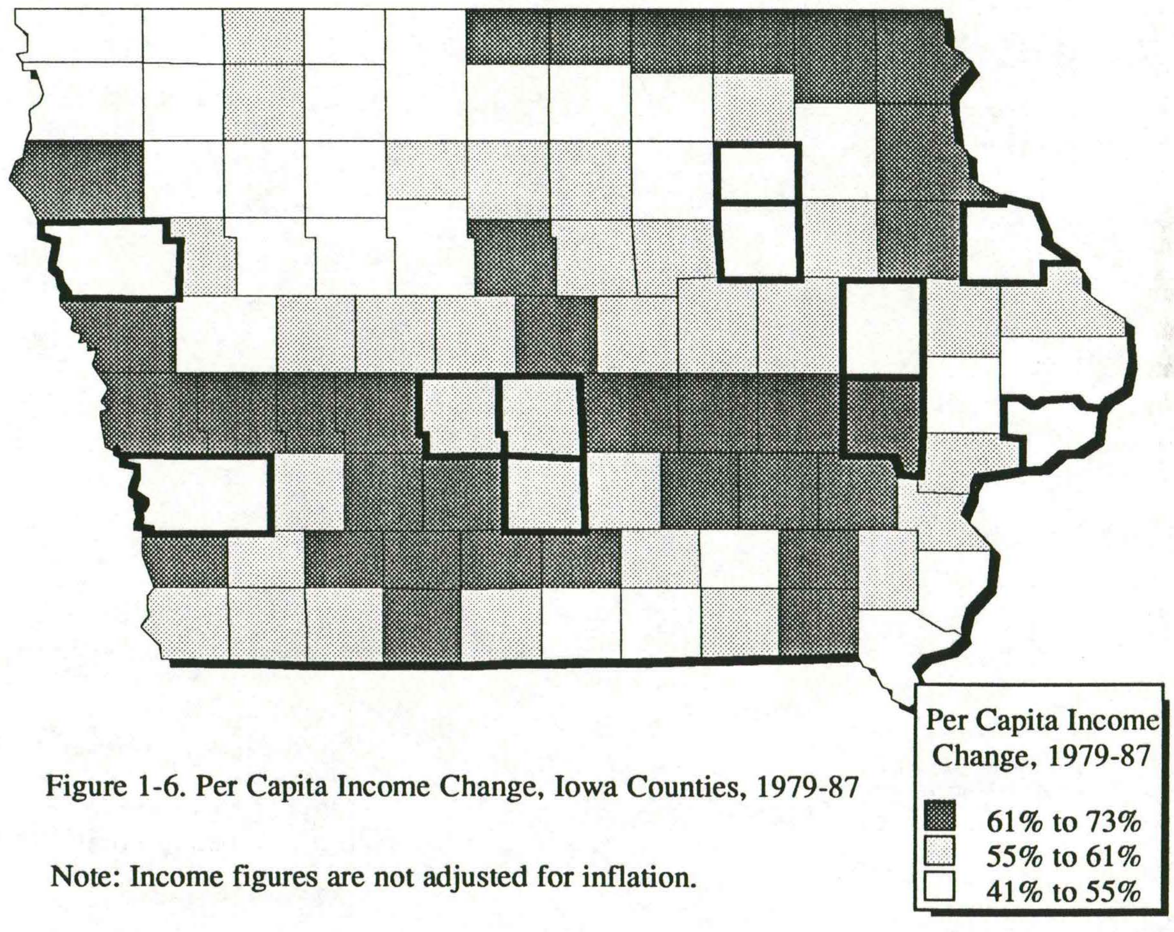

Figure 1-6. Per Capita Income Change, Iowa Counties, 1979-87

Note: Income figures are not adjusted for inflation.

Vehicle Ownership

In Iowa as a whole, there are more registered vehicles than people. Indeed, in 1990, there were 1.16 vehicles registered for every person. Figure 1-7 shows how this ratio varies across the state. A clear pattern can be seen: rural counties in western Iowa tend to have significantly higher numbers of registered vehicles per person than urban counties and their neighbors in the central and eastern part of the state. The greater need for personal transportation in rural areas, together with the demands of agriculture, are major factors in explaining this difference. Worth noting is the fact that a reverse relationship exists between per capita vehicle ownership levels by county and per capita income levels by county. Though metropolitan areas tend to have comparatively high per capita incomes, vehicle ownership rates in these areas are relatively low.

This reverse relationship highlights the importance of motor vehicles to the economy and life-style of rural Iowa. It is worth noting that decreases in population in the state's rural counties have not always been mirrored by reductions in vehicle miles traveled.

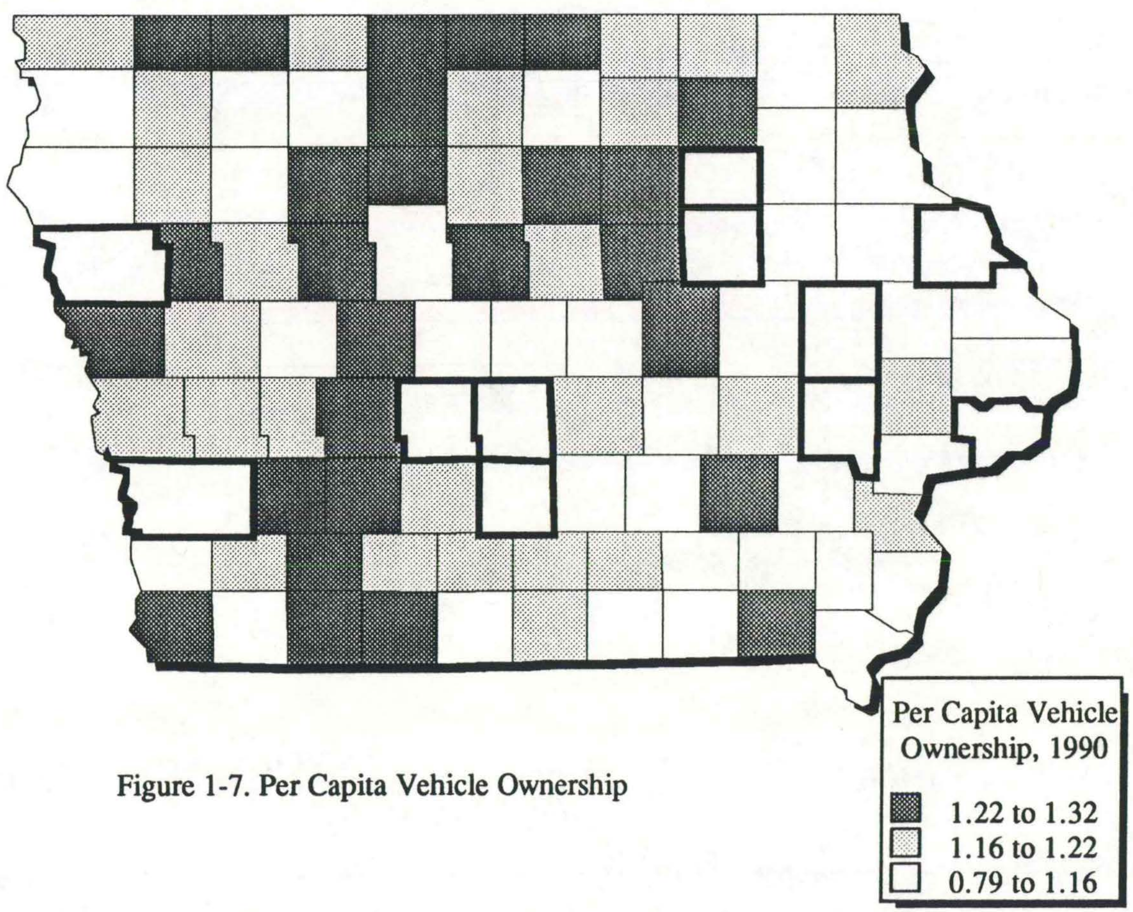

Figure 1-7. Per Capita Vehicle Ownership

SECTION 2
ROADS AND HIGHWAYS

HIGHWAY CONDITIONS IN THE MIDWEST

Iowa's roads and highways are the backbone of the state's transportation system. In this section, we first compare the service Iowa's highway network offers its residents with the service offered by highways in other Midwestern states. We focus on a number of indicators that measure road condition, congestion, and productivity. Our objective is to assess how well Iowa compares to these similar states in achieving a desirable balance between the performance of its highway network and the cost of providing the service it offers.

In the comparisons that follow, we use eight states to represent the Midwest: North and South Dakota, Nebraska, Kansas, Missouri, Illinois, Wisconsin, and Minnesota. This group not only surrounds Iowa but also encompasses those states that represent competitive locations to Iowa for future economic growth.

Roads and highways are classified into a number of different types. Interstate highways and expressways connect major metropolitan areas. Arterial highways provide links between and within smaller metropolitan areas. Collectors serve as the link between these large highways and local roads that serve individual residences and businesses in both urban and rural areas. Given our focus on examining Iowa's highway system in the context of its ability to support future economic growth development, we concentrate in parts of this discussion on the portion of the network that facilitates intra- and interstate travel: Interstates and rural arterial highways, commonly referred to as primary highways.

Miles and Types of Roads and Highways

Iowa has a total of 112,488 miles of roads and highways, which is the fifth largest network of the nine Midwestern states. Illinois has the largest system, with 135,506 miles; South Dakota has the smallest, with 86,311 miles. Figure 2-1 shows the size of each state's system and the distribution by type and location of roads.

Ninety-two percent of Iowa's road miles are in rural areas, a percentage that is typical of most of the other states in the region. Illinois has the lowest percentage of road miles in rural areas, at 77 percent, not far from the national average of 81 percent. Not unexpectedly, North Dakota and South Dakota have only 2 percent of their systems in urban areas.

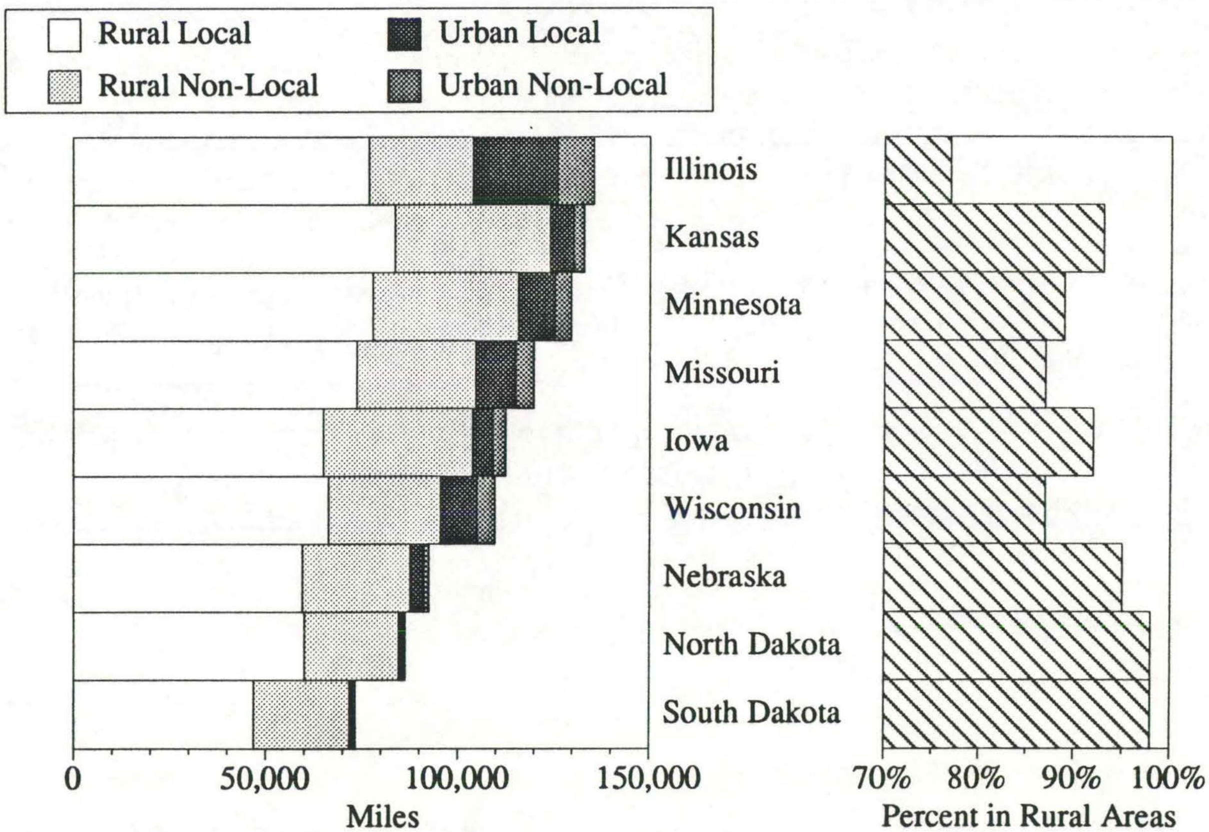

Figure 2-1. Distribution of Road Mileage by Type in Midwestern States, 1988, and Percentage of System in Rural Areas

The density of rural road networks varies across the Midwest. Figure 2-2 shows how, *for rural areas*, population per square mile and miles of road per square mile varies among Iowa and its neighbors. Iowa is third in the Midwest with 2.11 miles of rural roads per rural square mile, just below Wisconsin. Three states, North and South Dakota and Nebraska, have comparatively low rural road densities, but Nebraska has close to double the rural population density of its northern neighbors. These general characteristics suggest that the per capita cost of supporting rural roads is likely to be relatively high in the Dakotas and lower in Illinois. The costs of building and maintaining a mile of road may well be different across states, however, so the overall relative burden is difficult to determine with precision.

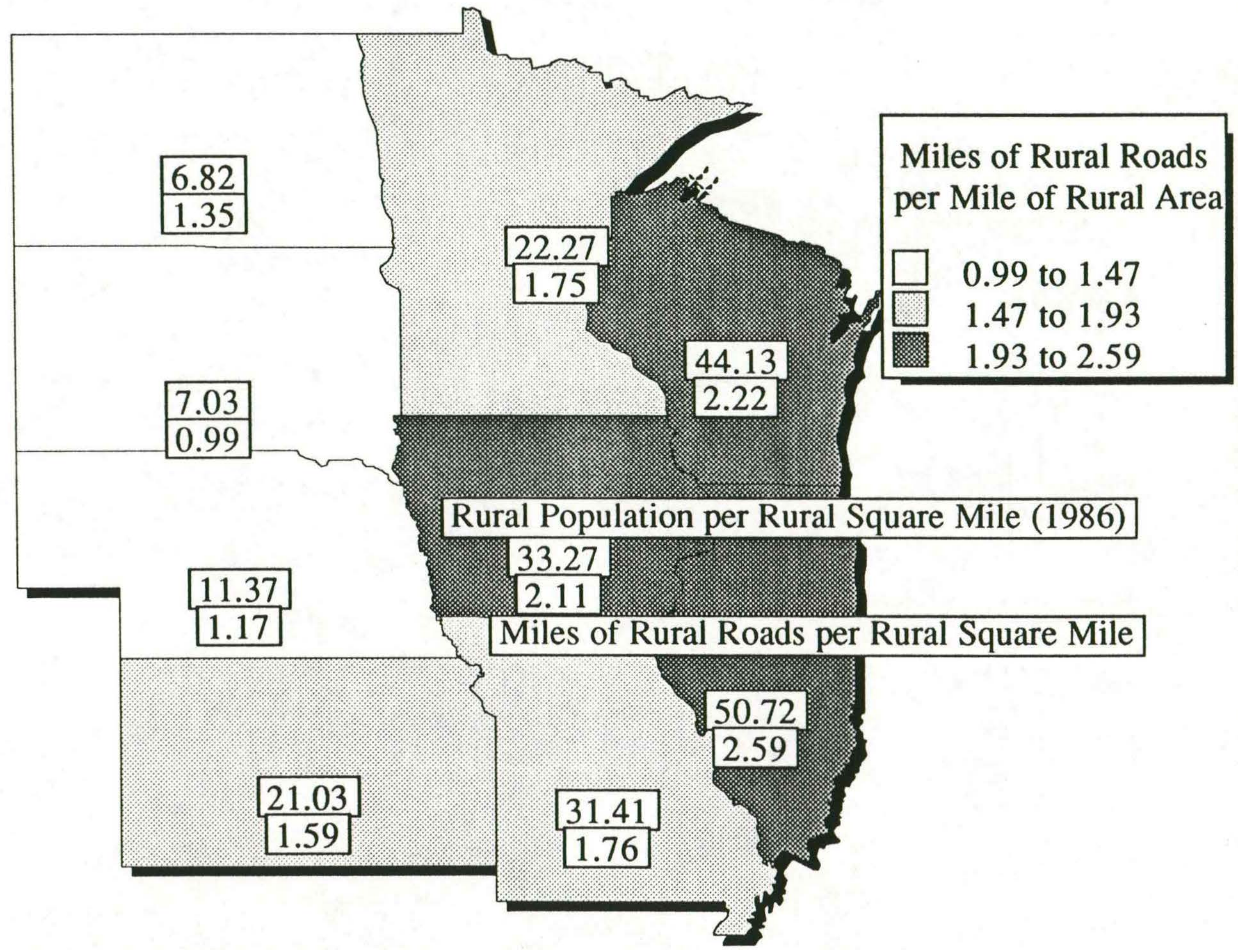

Figure 2-2. Population and Road Mileage Density for Rural Areas in Midwest

Shading and lower number reflect road density.
Upper number shows population density. All for rural areas only.

One important difference across Midwestern states is the degree of urbanization. Figure 2-3 shows how the relative population that supports a rural road network varies greatly depending on the definition used for population. In Illinois, over one hundred people live in the state per mile of rural road; when only rural residents are considered, the number falls to twenty. The ratio of rural to state population, shown in Figure 2-3, is thus 18 percent. The population that supports rural roads is clearly much lower if only rural residents are assumed to support rural roads. This difference is greatest in the most urbanized states: Illinois, Wisconsin, and Missouri. In the Dakotas, the difference is very small given the relatively small urban populations in these states. Iowa lies roughly midway between urbanized Illinois and the sparsely populated rural Dakotas.

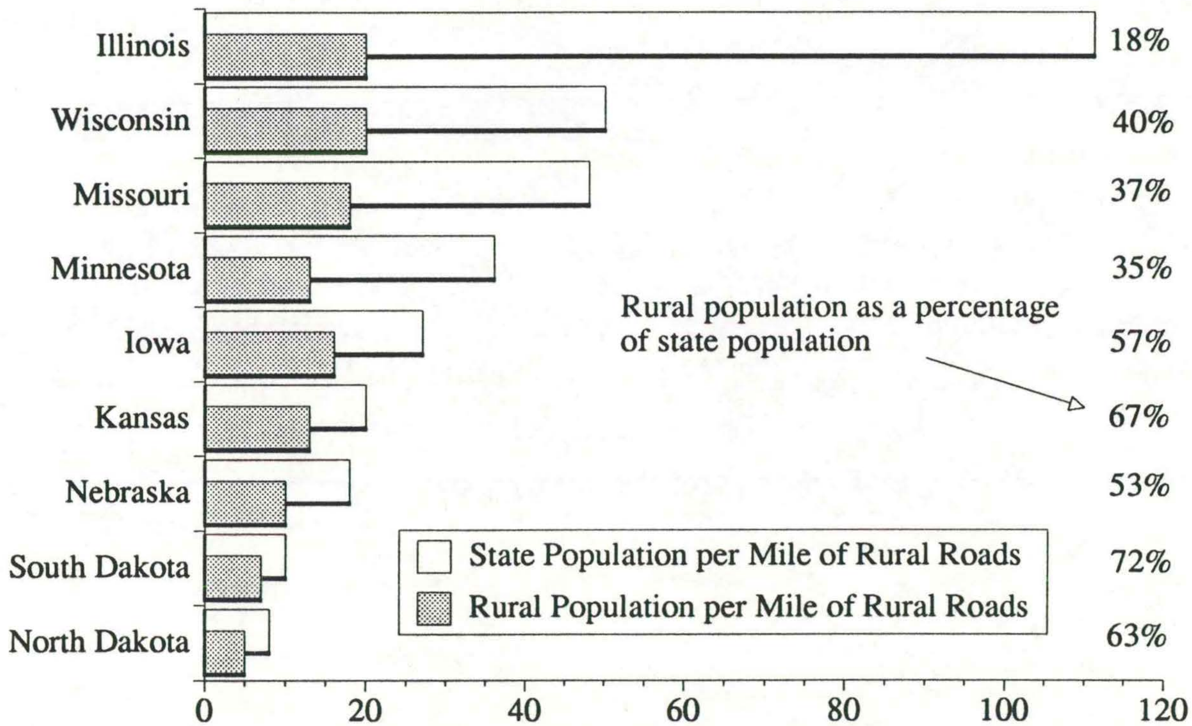

Figure 2-3. People per Mile of Rural Roads: Rural Population Only Versus State Population

Vehicle Density

For the nine Midwestern states, Figure 2-4 shows how many automobiles and total vehicles (includes automobiles, trucks, and buses) are registered per mile of roadway. Illinois and Wisconsin approximate the national average; Missouri, Minnesota, and Iowa have automobile densities only about half to two-thirds of the national average; and the other four states have very low automobile densities. This pattern is similar but not identical when all vehicles are considered. States in the Midwest have low ratios of cars and vehicles to miles of road, compared to the nation as a whole.

The real message in Figure 2-4 is that states with relatively low population densities also tend to have low vehicle ownership densities. It is the case, though, that generally speaking there are more vehicles per capita in rural areas than in cities. Even considering this fact, the comparatively low population densities within Iowa and other rural Midwestern states result in low vehicle counts per mile of road.

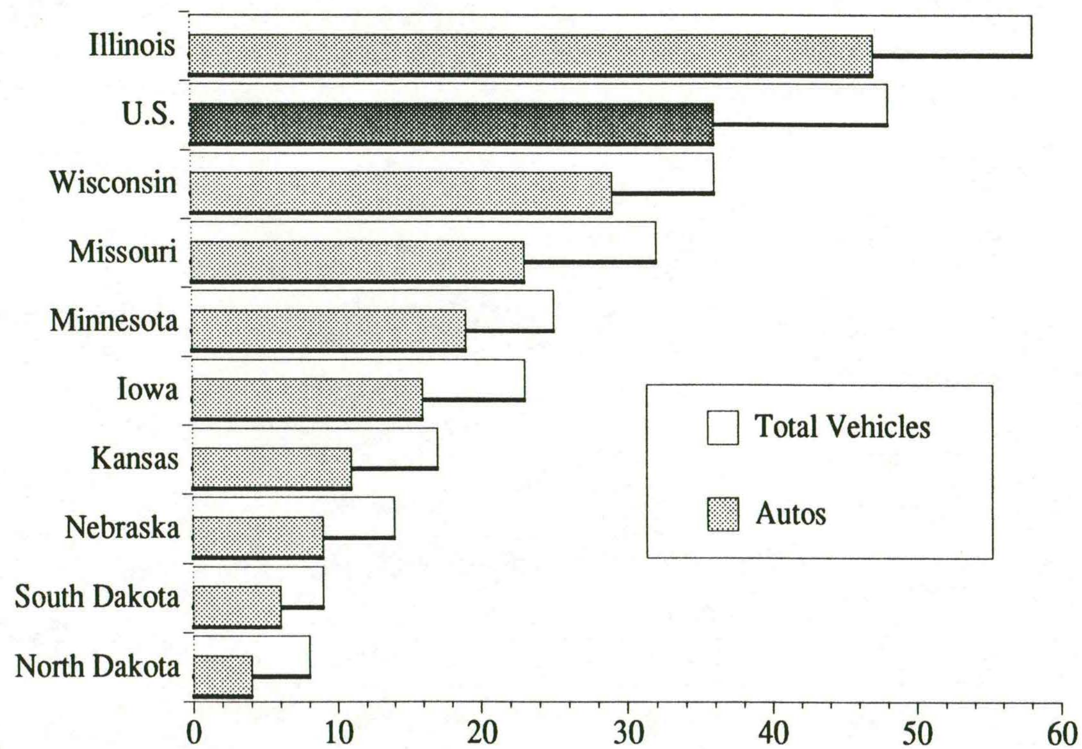

Figure 2-4. Automobiles and Total Vehicles Per Mile of Road, 1988

Traffic Patterns

Each part of a state's highway system performs a different role. When we examine data on vehicle miles of travel (VMT), we find that the bulk of all traffic is concentrated on the primary highway network. In the Midwest overall, major highways—Interstates, expressways, and arterials—carry about 63 percent of all VMT in rural areas and 75 percent in urban areas. This concentration of traffic can be illustrated by comparing how much of each system carries certain proportions of total traffic. Figures 2-5 and 2-6 show how much of total VMT is carried by cumulative miles of the urban and rural road systems in Iowa and the nation. For example, Figure 2-5 shows that the first ten percent of urban road miles in Iowa (encompassing first Interstates, then other major highways, and so on) carries about 45 percent of all VMT.

If all road miles carried equal traffic volumes, these charts would have 45 degree lines: 20 percent of the road mileage would carry 20 percent of VMT. Figure 2-5 shows that Iowa has a somewhat more equally distributed traffic load on its urban network than does the nation. In contrast, traffic on Iowa's rural network is more concentrated than the nation, although the difference is small (see Figure 2-6). In other Midwestern states, the traffic concentration mirrors that in Iowa.

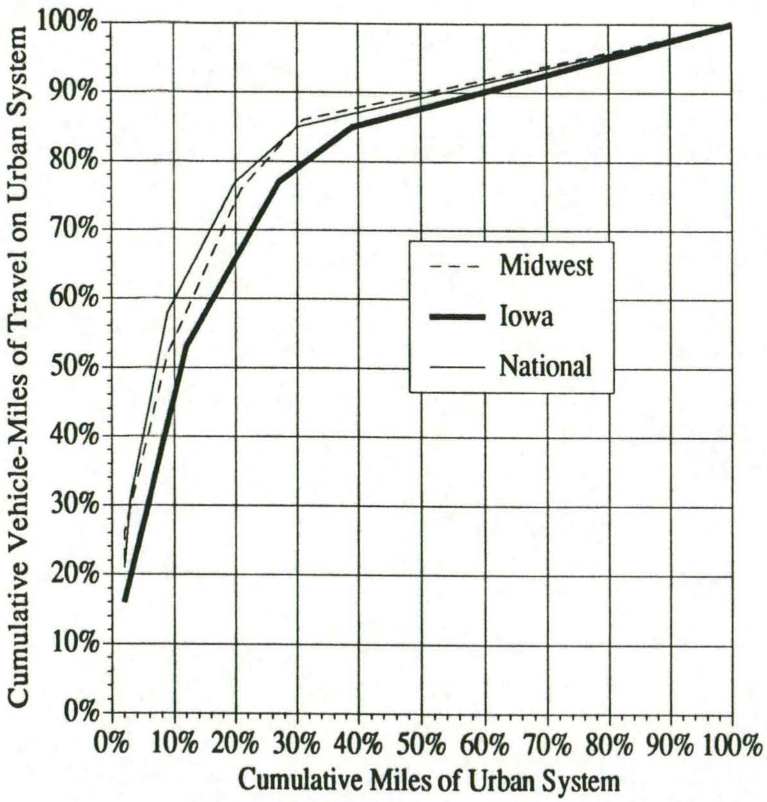

Figure 2-5. Cumulative Miles of Urban System Versus Cumulative Vehicle-miles of Travel (VMT), Iowa, Midwest, and U.S., 1988

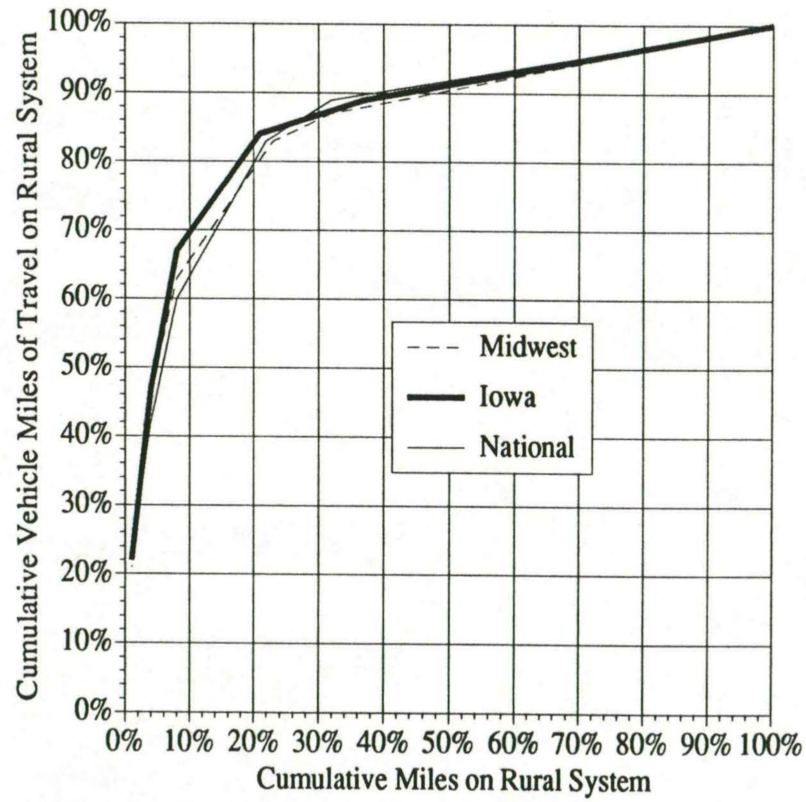

Figure 2-6. Cumulative Miles of Rural System Versus Cumulative Vehicle-miles of Travel (VMT), Iowa, Midwest, and U.S., 1988

We can also use information about VMT to obtain a sense of how "productive" each part of the highway system is. By dividing VMT by road mileage for each category of highway, the relative contribution of each type of highway can be compared. Not surprisingly, Interstates carry much more VMT per mile than local roads do. It also is interesting to examine how the same type of highway compares across states. Higher traffic per mile of road indicates a somewhat larger ability to support the costs of maintaining the highway, provided the type of increased traffic does not disproportionately damage the road surface.

Figure 2-7 shows the general pattern for VMT per mile clearly for rural areas in the Midwest. Interstates and arterials are, on a weighted average basis, about 20 times more productive than the rest of the rural road system, as they were designed to be. Within each road type, however, traffic density varies significantly. Rural Interstates in Wisconsin have a density that is over four times as high as North Dakota's. An interesting comparison is between Iowa and Illinois: Interstate densities are essentially equal, but the traffic density of principal arterials in Illinois is over twice that in Iowa. The significant amount of through traffic on Iowa's Interstates may explain some of this difference. The productivity of Iowa's roads and highways is about average for the Midwest on this broad measure.

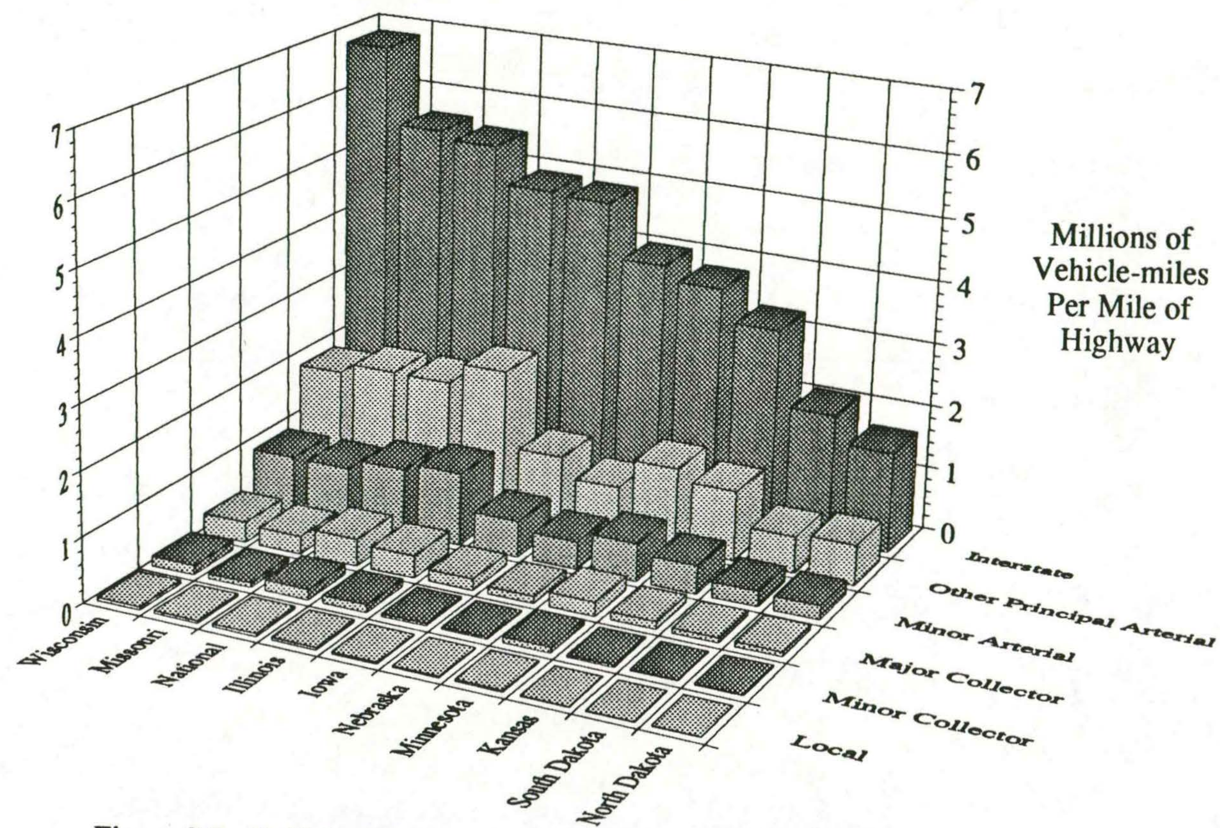

Figure 2-7. Vehicle-miles of Travel Per Mile of Rural Highway, By Type of Highway and State, 1988

Pavement Condition

A road network's quality of service depends in part on the condition of the road surface itself. We can compare Pavement Serviceability Ratings (PSRs) to approximate differences in pavement condition. A PSR is a numerical value ranging from zero to five, reflecting poor pavement conditions at the lower end of the scale and very good pavement conditions at the higher end. Although PSRs are to some degree subjective rather than objective measures of actual pavement quality, we can use them to gain a general sense of comparative conditions among states' highways. The U.S. Department of Transportation reports comparative ratings for all urban and rural road classifications except local roads. These data cover about one-third of Midwestern states' road systems by mileage—these roads carry between 80 and 90 percent of the traffic in these states.

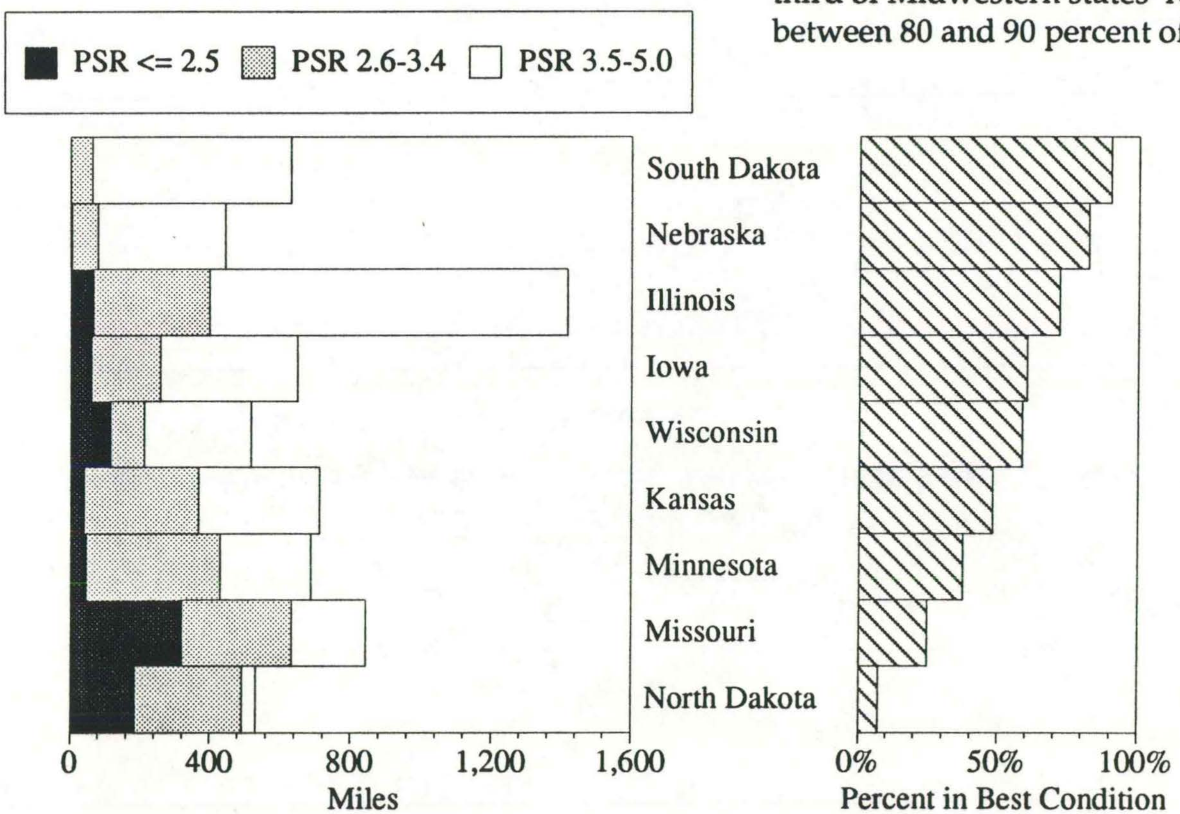

Figure 2-8. Distribution of Rural Interstate Mileage by Pavement Serviceability Rating (PSR), 1988, and Percentage of Rural Interstates in Best Condition

Figure 2-8 shows how pavement conditions vary for rural Interstate highways in the Midwest. Iowa ranks fourth in terms of the proportion of its Interstate miles that are in good condition (PSR above 3.5). The proportion of Iowa's system in bad condition (PSR below 2.5) is fairly small. Figure 2-9 shows the same comparison for rural arterial highways. These systems have about 7-8,000 miles of highways in most Midwestern states, compared to about 600 miles for Interstates. For these arterial highways, Iowa ranks low in terms of the proportion in good condition, but, again, the proportion in bad condition (PSR below 2.0) is fairly small. Iowa's urban Interstates also rank fairly low in terms of pavement in good condition.

The message conveyed by the comparative PSR figures is that Iowa's road and highways tend to be in good but not excellent condition. Arterial roads are not among the best maintained in the region, but few are in very poor condition. There is little evidence that the condition of Iowa's rural road network in any significant way places the state in a disadvantageous competitive position.

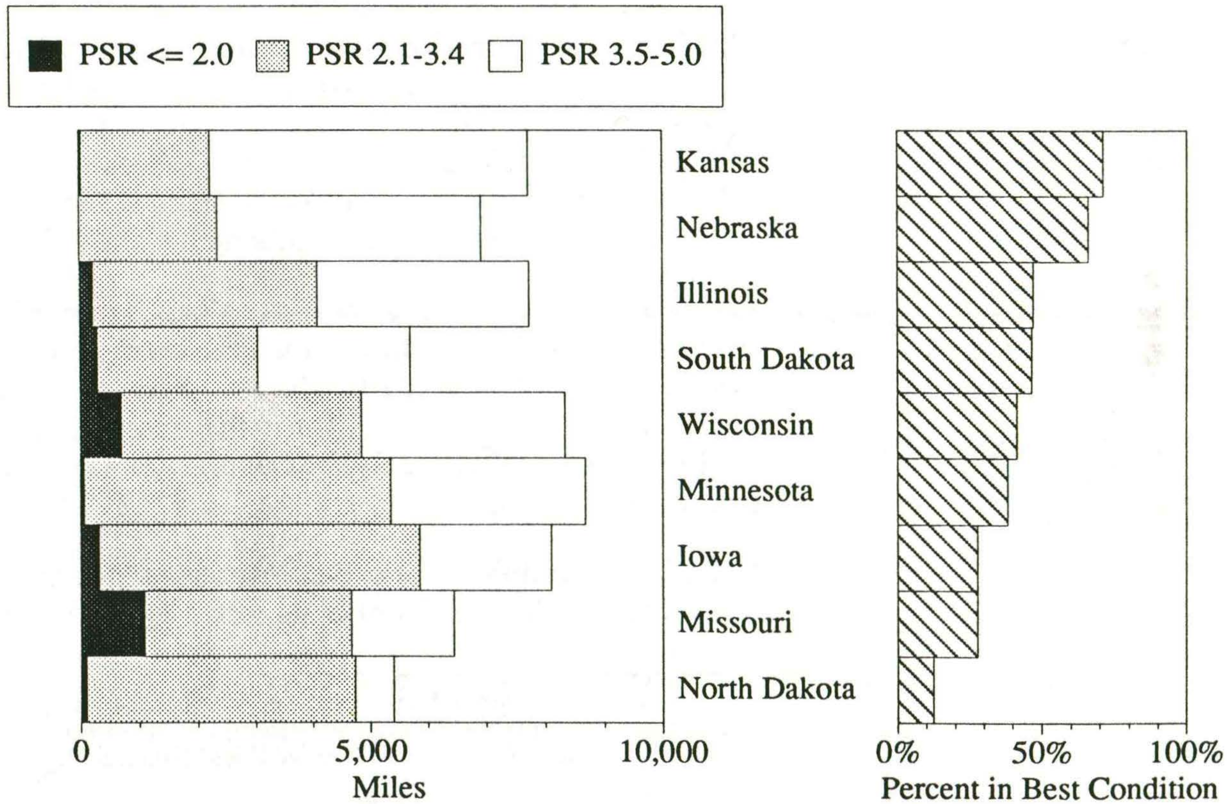

Figure 2-9. Distribution of Rural Arterial Mileage by Pavement Serviceability Rating (PSR), 1988, and Percentage of Rural Arterials in Best Condition

HIGHWAY REVENUES AND EXPENDITURES IN THE MIDWEST

Transportation affects a state's competitive position not only in terms of its condition but also how it is financed. If users of the road system must pay comparatively high user charges for comparable service in a given state, a competitive disadvantage would be created. An incentive would exist for owners of capital and for workers to shift to other places where their returns will be more favorable.

In general terms, the two financing categories are user taxes or fees and non-user taxes. User taxes are paid by those actually driving on the facility, and in Iowa they are of four types: motor fuel taxes, vehicle registration fees, driver license fees, and use tax (sales tax on vehicle purchases). Non-user taxes are dominated by the property taxes levied by municipal and county governments. Currently, just over half of the revenue for financing Iowa's road system comes from road user taxes.

Most experts on transportation finance argue that normally user taxes are the preferable mechanism for financing roads. It is fair to "pay as you go," in that those who use roads most will tend to pay the most. Numerous questions exist, however, regarding equity. Operators of fuel-efficient vehicles may pay considerably less in user taxes, and the relationship between vehicle size and weight and appropriate user tax level is a subject of continuing debate.

For lesser traveled roads, it is unlikely that user taxes will generate sufficient revenue to cover more than a small fraction of associated costs. In such cases non-user taxes often are a more logical choice.

The types of expenditures also are of great policy significance. The most basic breakdown is capital versus maintenance spending. Capital investments are those that enable new facilities to be built or existing facilities to be restored or upgraded. Maintenance expenditures go for routine repairs, as well as snow removal, grass cutting, and the like. Normally, as a road system reaches a mature state, a greater portion of expenditures are devoted to maintenance, and rehabilitation costs eventually become major, as well. This means that capital expenditures now will require an increase in maintenance costs in future years.

In examining Iowa's revenue and expenditures relating to its road system, it is important to consider the practices of other states in the region. How do the various user taxes in Iowa compare with those in the other states? Are Iowa's spending levels on capital and maintenance comparable to its peer states? This information, coupled with information on the comparative condition of Iowa's roads, will enable an assessment of whether the state's road system is currently contributing to a competitive advantage.

Highway Revenue Sources in the Midwest

All nine Midwestern states included in this analysis rely heavily on user taxes to finance their road systems. As Figure 2-10 shows, about 60 percent of these states' revenue is drawn from user taxes. Of all user taxes, those collected at the state level constitute approximately two-thirds. Any variation in shares is due to state and federal allocation practices.

Looking at these data in a different way, 75 percent of the user taxes in Iowa are levied by the state. Only Minnesota raises a higher proportion of its total user tax revenue through state user taxes, 77 percent.

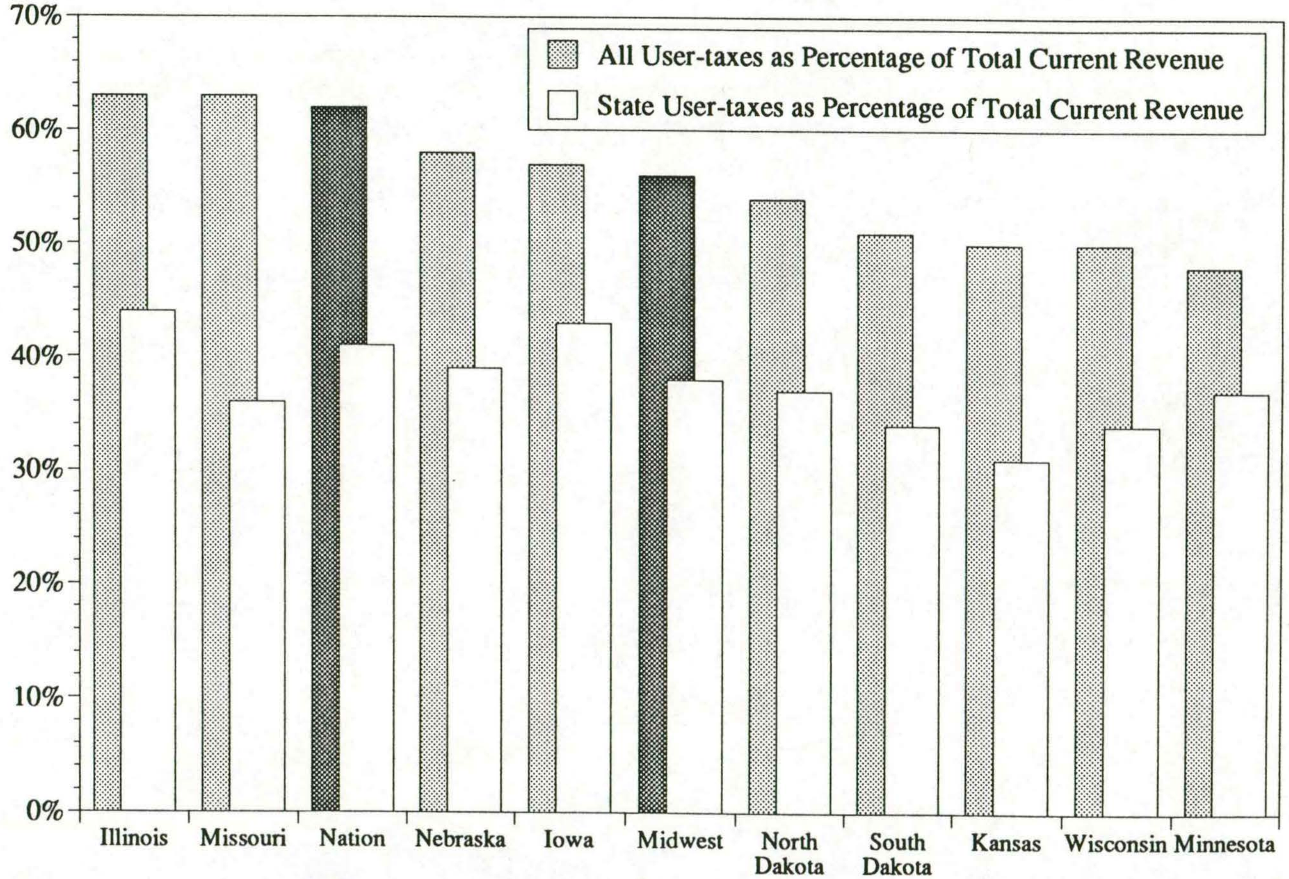

Figure 2-10. User-taxes as Percentage of Total Current Revenues for Highways, All Levels of Government, 1987

State User-Tax Structures

State governments generate revenues for highways from a variety of sources. These revenue sources include taxes on the purchase of gasoline and other fuels, vehicle registration fees, sale taxes on vehicles, miscellaneous fees for items such as driver licenses, and vehicle certificates of title. As noted earlier, the state of Iowa generates most of its revenue for highways from these sources, supplemented by distributions from the Federal Highway Trust Fund. The rate at which Iowa levies taxes on users of highways is relatively high compared to other Midwest states.

Motor Fuel Taxes

As of August, 1991, Midwestern states generally had fairly high rates of tax on gasoline, as Figure 2-11 illustrates. These figures reflect not just specific sales taxes but also any gross receipts taxes or underground storage tank fees levied on gasoline. Excluding Missouri, which has a tax rate of only 11 cents per gallon, the average rate of tax in the Midwest was 20.3 cents per gallon of gasoline. Illinois had the highest rate within the Midwest, at 24.5 cents per gallon. At 20 cents per gallon, Iowa was one of 19 states having a tax of at least 20 cents. In Iowa, like most other states, the state tax on diesel and other fuels is slightly higher than the tax on gasoline. Overall, in Iowa, state taxes on fuel yielded over $300 million in revenue in 1990.

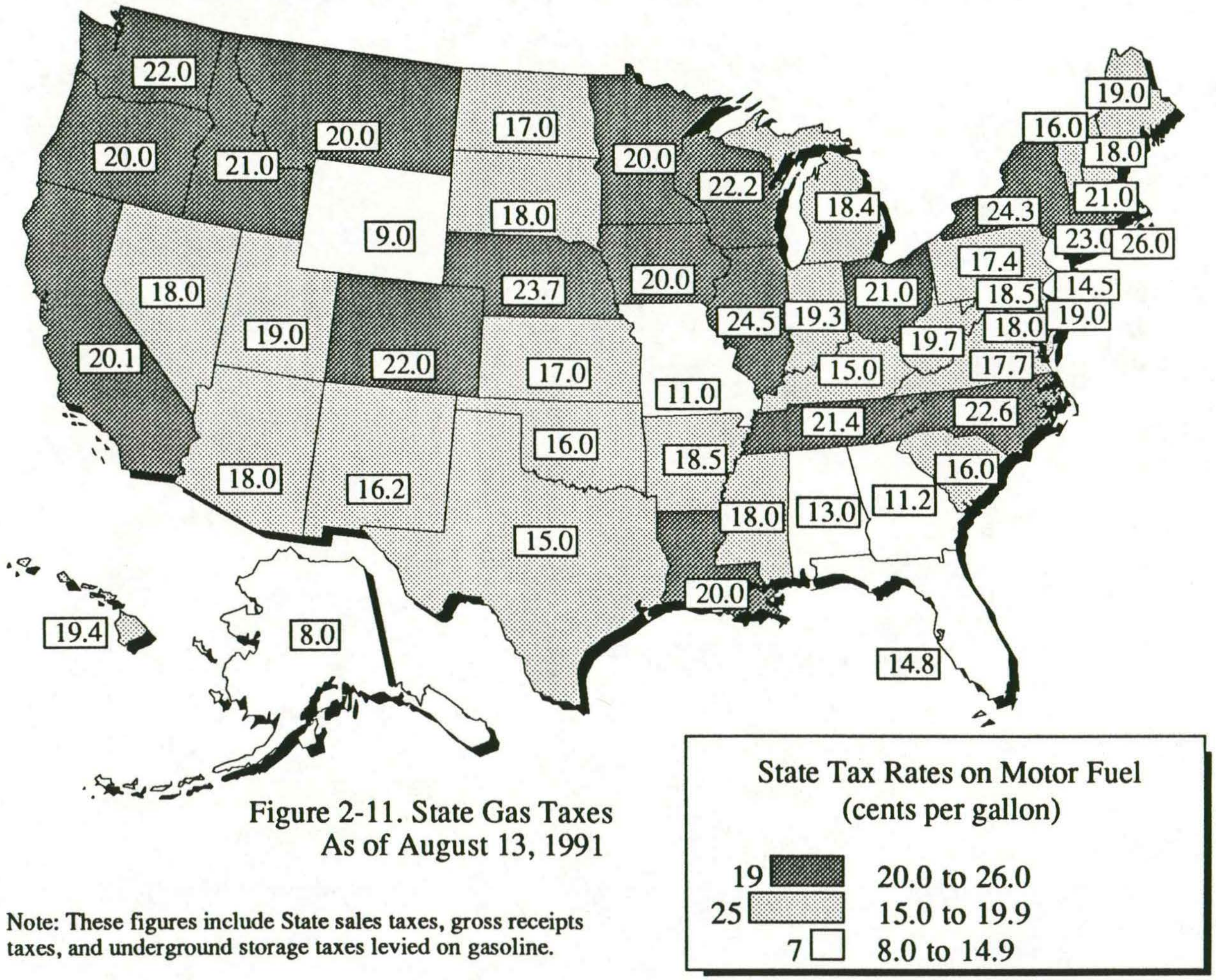

Figure 2-11. State Gas Taxes
As of August 13, 1991

Note: These figures include State sales taxes, gross receipts taxes, and underground storage taxes levied on gasoline.

Registration Fees

In 1989, 2,765,977 vehicles were registered in the state of Iowa, including automobiles, trucks, buses and motor-cycles, both publicly and privately owned. Illinois has the largest number of registered vehicles in the Midwest, with a total of 8,247,260.

States levy registration and other fees on these vehicles. Figure 2-12 shows how these fees varied per vehicle across the Midwest in 1989. Iowa had the second highest average registration fee on both automobiles and trucks (averages of $61 and $95, respectively). With comparatively high registration fees, the state of Iowa raised $188 million in 1989, the third highest amount in the region. Only Illinois and Minnesota raised more revenue from registration fees. Illinois raises large amounts because it has a much larger number of cars; Iowa and Minnesota have fewer vehicles but levy higher average fees.

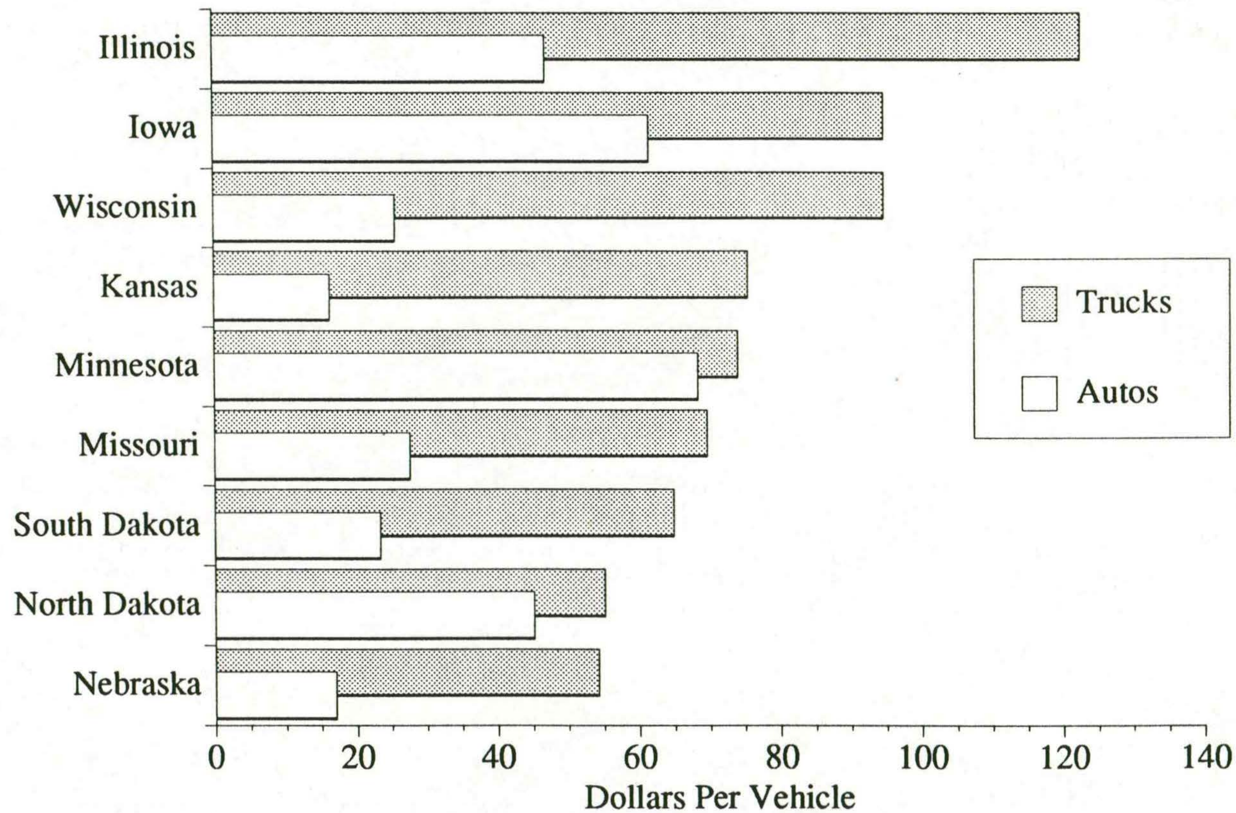

Figure 2-12. State Registration Fees Per Vehicle, Automobiles and Trucks, 1989
(dollars per vehicle)

Iowa, like a number of other states, levies an *ad valorem* (property) tax as part of its annual vehicle registration fee. More expensive automobiles have higher fees than lower cost automobiles of the same weight. This *ad valorem* component serves to raise Iowa's average automobile registration fee considerably. In the case of luxury automobiles, the *ad valorem* component may constitute over 90 percent of the fee. Figure 2-13 shows how the registration fee for a late model premium automobile differs for one of approximately the same size but much older. The table also shows that registration fees for late model automobiles in Iowa are comparatively high. Also like most other states, Iowa graduates its registration fees for trucks on the basis of weight and configuration. The maximum fee is $1695 for an 80,000 pound, 18-wheel semi truck. Figure 2-13 shows that Iowa's practice of weight-based registration fees is similar to that in other Midwestern states. Iowa's registration fees for semi trucks weighing 60,000 pounds is comparatively high; four states in the region have higher fees for 80,000 pound semi trucks.

Other User Taxes

States levy charges not just on fuel and vehicle registrations. Fees are also levied on driver licenses, certificates of title, and fines and penalties are also imposed for various reasons. Together, these fees raised a total of over $31 million in Iowa in 1989, the fifth highest total in the Midwest.

Iowa also derives revenue to support its system of roads and highways from vehicle use (sales) taxes. Like most other states, the use or sales tax is set at the normal sales tax rate. Iowa's sales tax rate of four percent is the lowest in the region; North Dakota and Minnesota's rate is six percent, and Illinois' rate is 6.25 percent. Unlike nearly all other states, however, Iowa's vehicle use tax revenues flow into the Road Use Tax Fund (RUTF) rather than the general fund. In fiscal year 1990, the vehicle use tax totalled $111.4 million.

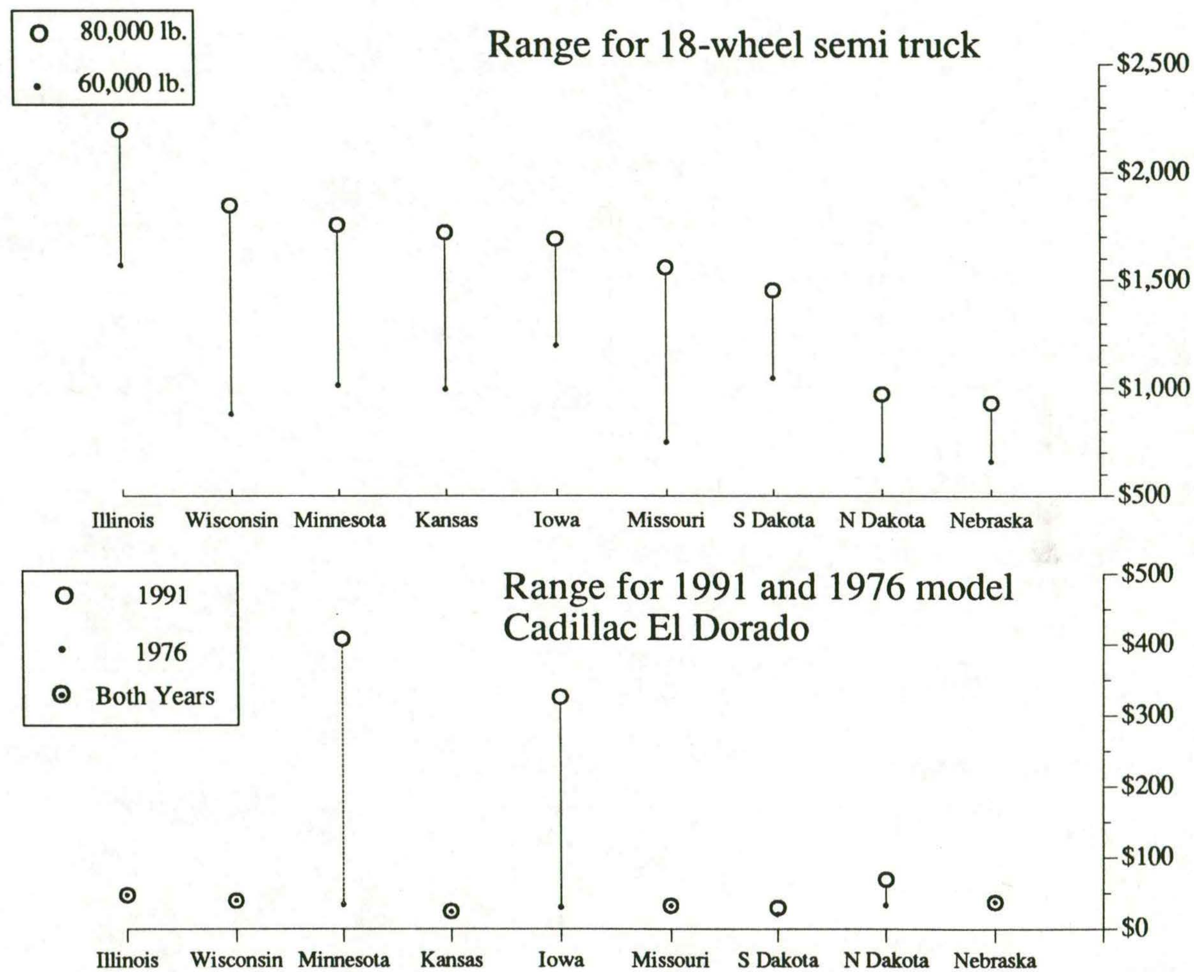

Figure 2-13. Typical Registration Fees for Automobiles and Trucks, By Age and Weight, 1991

Highway Expenditures in the Midwest

A few major categories account for almost all road spending in the Midwest and the United States. As Figure 2-14 shows, about 80-85 percent of all government spending for roads is used for capital and maintenance, with some variations as to the mix between these categories. Administrative costs and law enforcement account for most of the remaining expenditures.

Table 2-2 shows the total government spending on capital and maintenance in each state, broken down by road classification. State highways dominate in terms of capital expenditures—rural roads predominate in terms of total maintenance expenditures except in Illinois and Missouri.

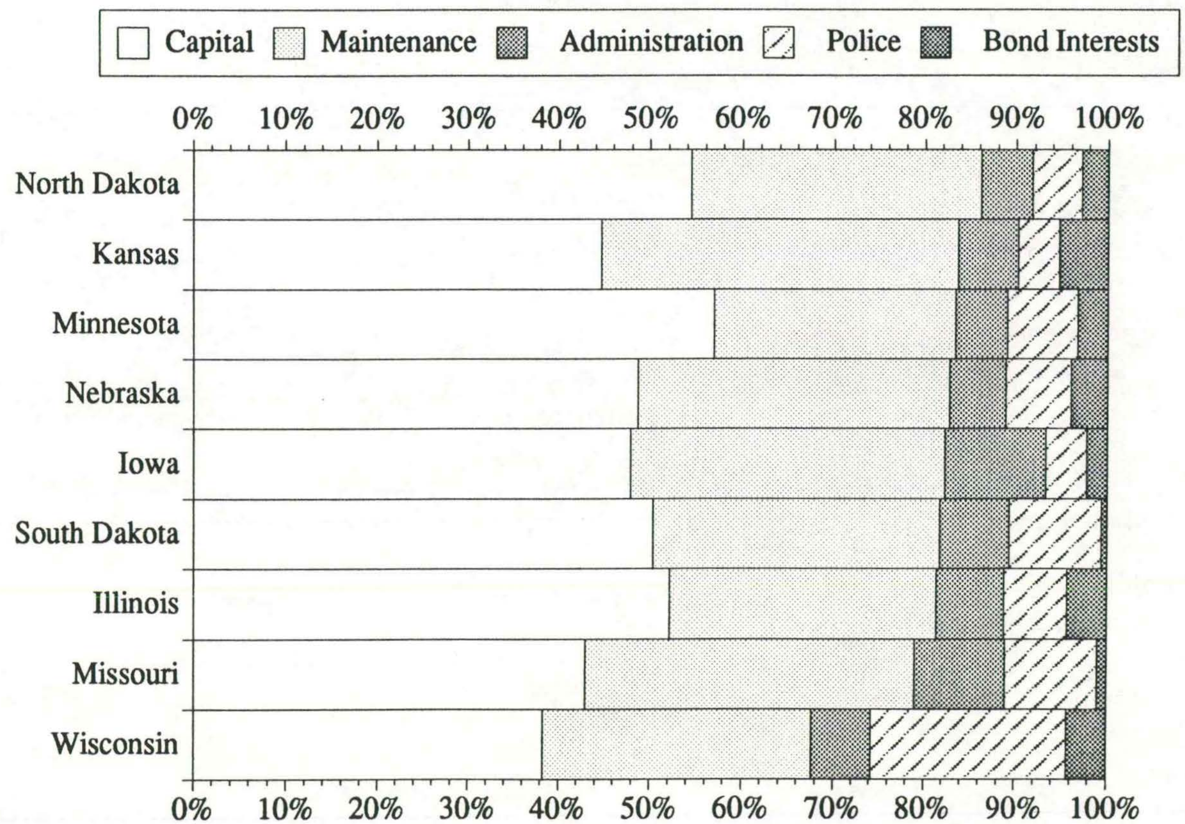

Figure 2-14. Distribution of Total Spending on Roads and Highways, By All Levels of Government, 1987

Table 2-2. Capital and Maintenance Spending on Roads and Highways in the Midwest, By Jurisdiction of Road, 1987
(millions of dollars)

State†	IL	MN	WI	MO	IA	KS	NE	SD	ND
Capital									
State	$1,010.5	$490.0	$297.2	$311.3	$258.3	$271.8	$123.1	$84.9	$74.4
Rural	235.6	208.9	121.7	45.3	112.0	52.7	52.2	29.1	42.5
Municipal	155.8	277.8	147.8	108.8	99.8	37.1	48.9	26.1	17.6
Federal	0.6	5.9	6.3	4.6	0.0	0.1	0.2	2.3	10.0
Maintenance									
State	243.7	109.7	125.2	190.7	93.0	73.7	45.8	31.5	30.3
Rural	257.3	196.0	166.1	108.5	160.1	160.0	77.0	39.9	39.0
Municipal	283.2	148.7	146.2	92.8	84.6	82.0	34.1	14.0	13.3
Federal	0.3	2.7	1.1	1.5	0.1	0.4	0.5	3.1	1.8

†States are arranged from highest to lowest spender on total capital and maintenance expenditures.

Revenue and Expenditure Comparisons

Governments in Iowa compare favorably with other Midwestern states in terms of capital and maintenance expenditures per mile of road. Figures 2-15 and 2-16 show how capital and maintenance spending per mile vary over the nine states for each of the three major road systems: state-administered highways, city streets, and rural roads. Iowa ranks third or fourth on these measures. Given that construction costs are probably higher in some of the more urbanized states in the Midwest, Iowa's governments appear to be reinvesting in and maintaining their roads, relative to their system size, at as high a level as almost any other Midwestern state.

One general point also emerges from these comparisons. On state roads, typical capital spending is about $30,000 per mile, and maintenance is about $9,000 per mile. Thus the ratio of capital spending is about three times maintenance, per mile. For city streets, this ratio is about 1.33, for rural roads, less than one. This pattern illustrates the fact that, in the Midwest, state systems can still be thought of as expanding, in quality if not quantity, while with rural road systems, the most emphasis is placed on maintaining the system with only selective improvements.

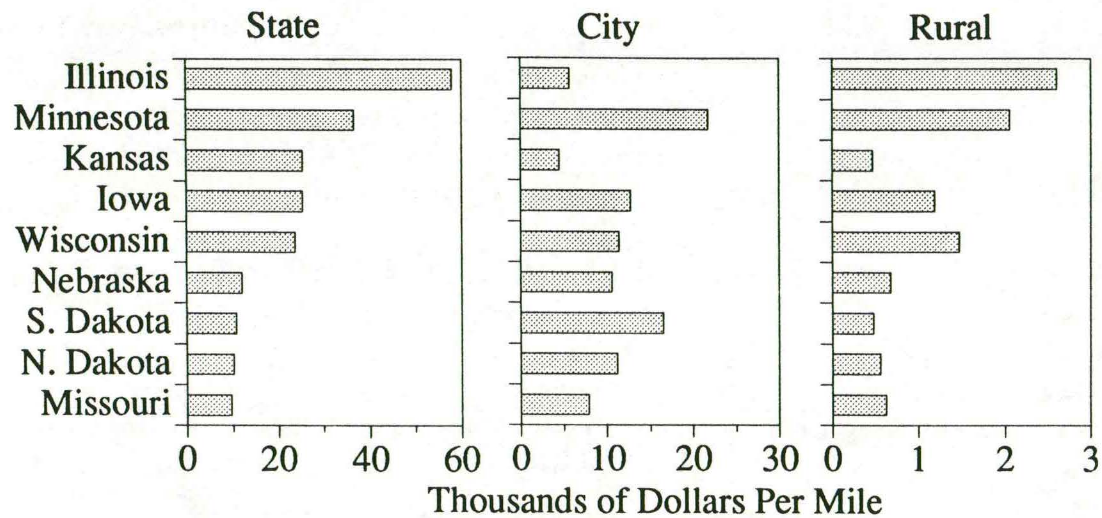

Figure 2-15. Capital Spending Per Mile of Road by All Levels of Government, 1987, By Road Jurisdiction

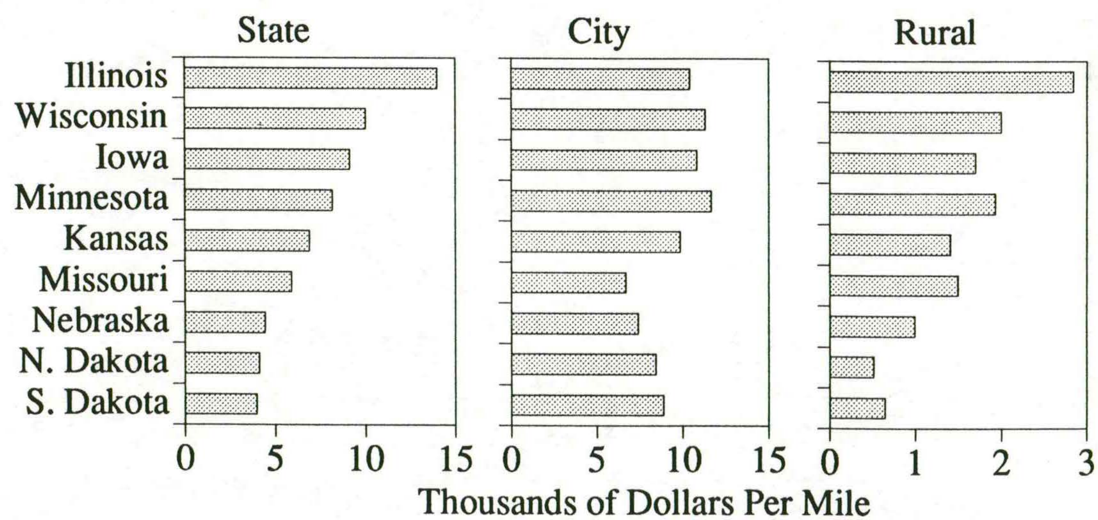

Figure 2-16. Maintenance Spending Per Mile of Road by All Levels of Government, 1987, By Road Jurisdiction

Local Revenue and Expenditure

The structure of local government and jurisdictional responsibility for roads varies in Midwestern states. It is useful first to compare briefly revenue and expenditure patterns for all local governments since not all states have the same arrangements as Iowa with respect to counties and cities and their respective responsibilities.

County Receipts and Disbursements

At the county level of government, Iowa's counties have the least diversified sources of revenue for roads in the Midwest. Figure 2-17 shows how counties raise revenue for road spending. Iowa's counties are significantly different from counties in other states in two major respects. First, Iowa's counties receive over half of all their road revenues in the form of transfers from the state, the highest percentage in the Midwest. Second, Iowa's counties rely almost entirely on these state transfers and on local property taxes for road financing. These two sources together make up 95 percent of all county revenues for roads. The average percentage of total revenue that these two sources make up in the Midwest is only 71 percent, and no state except Iowa exceeds 82 percent. Iowa's counties are thus more dependent on state transfers and local property tax revenues than are counties in other Midwestern states.

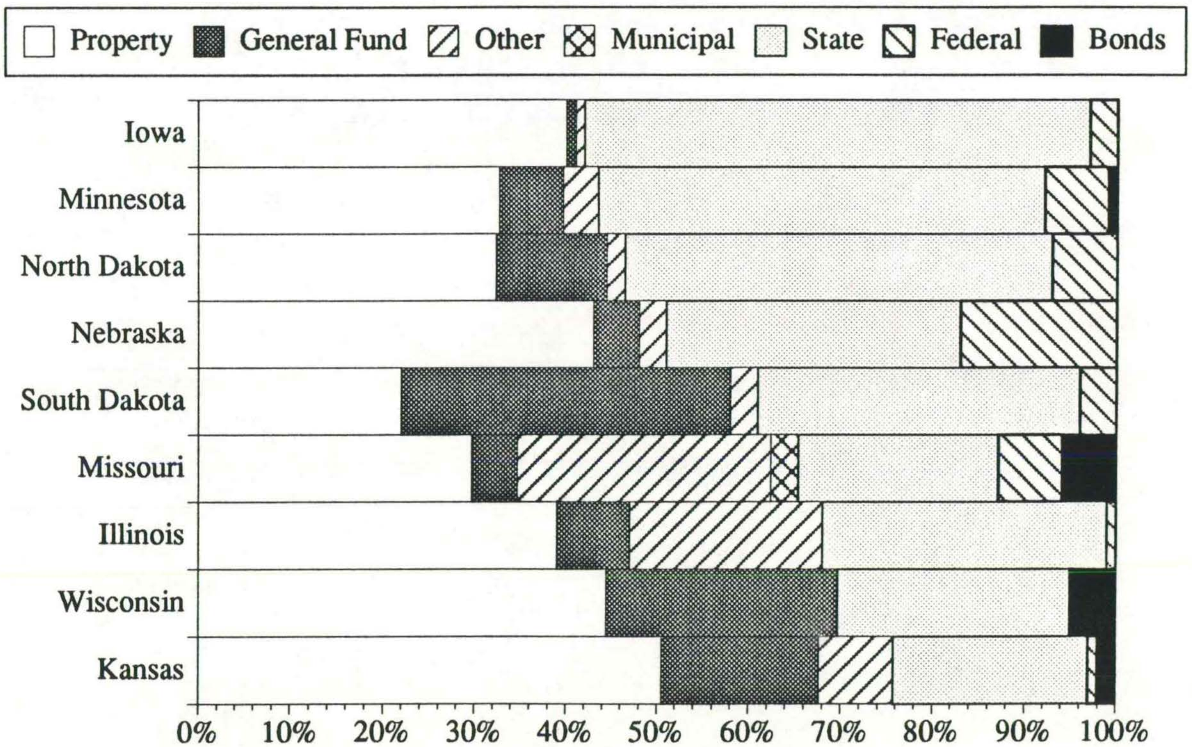

Figure 2-17. County Government Revenues for Highways and Roads, By Source, 1987
(percent)

As is true at the state level, most county road funds are spent on capital improvements and maintenance. Figure 2-18 shows the distribution of spending by counties in each state. Counties in the Midwest devote between 68 and 92 percent of all spending to capital and maintenance, with Wisconsin lowest and South Dakota highest. On average, Iowa's counties spend 87 percent of their budgets for highways on capital and maintenance.

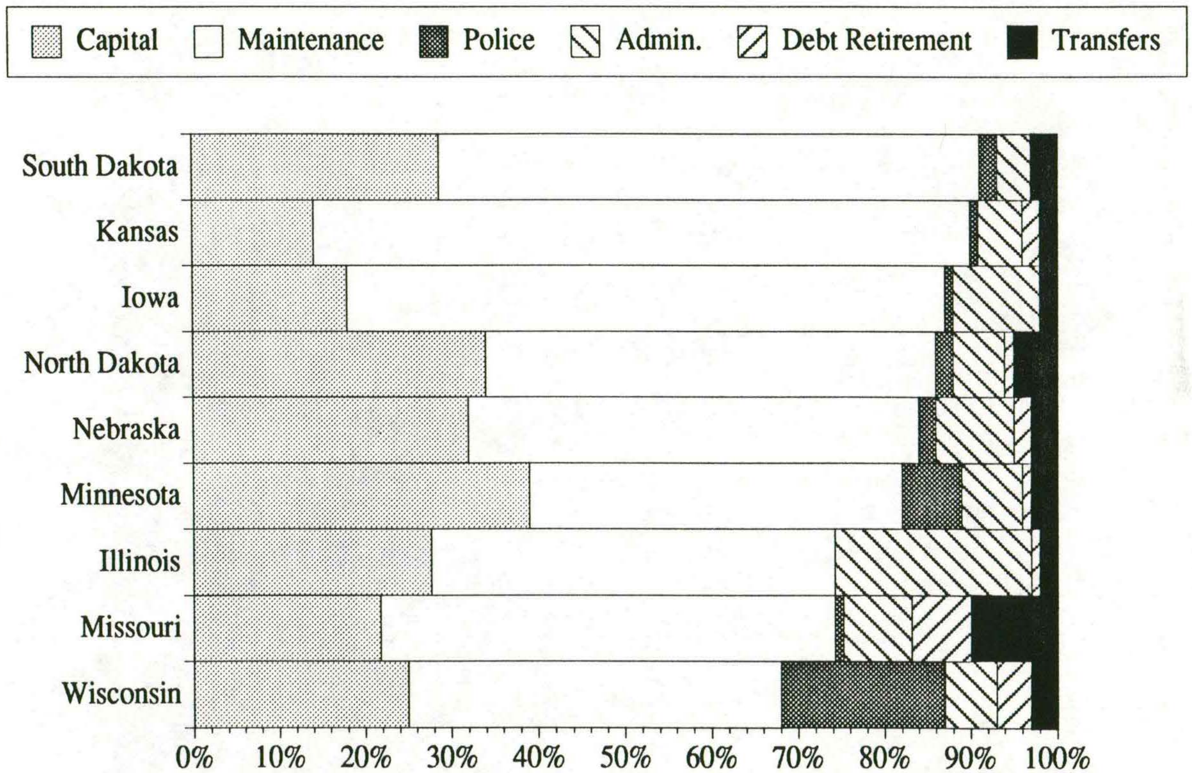

Figure 2-18. County Government Disbursements for Highways and Roads, By Type, 1987
(percent)

Municipal Receipts and Disbursements

Municipalities in Iowa typically have a more diversified base of funding for highways than do counties. Figure 2-19 shows how revenue sources vary for municipalities among Midwestern states. In Iowa, state transfers constitute a larger percentage of total revenue than does any other single source, contributing 35 percent. In contrast, Iowa's municipalities generate less than 7 percent of all revenues from general funds, whereas municipalities in other states generate an average of 42 percent from this source. Municipalities in South Dakota raise 82 percent of total revenues for roads from general funds. In Iowa, municipalities raise the lowest proportion of their total revenue from local sources of any of the nine states—56 percent—the remainder coming from county, state and federal governments.

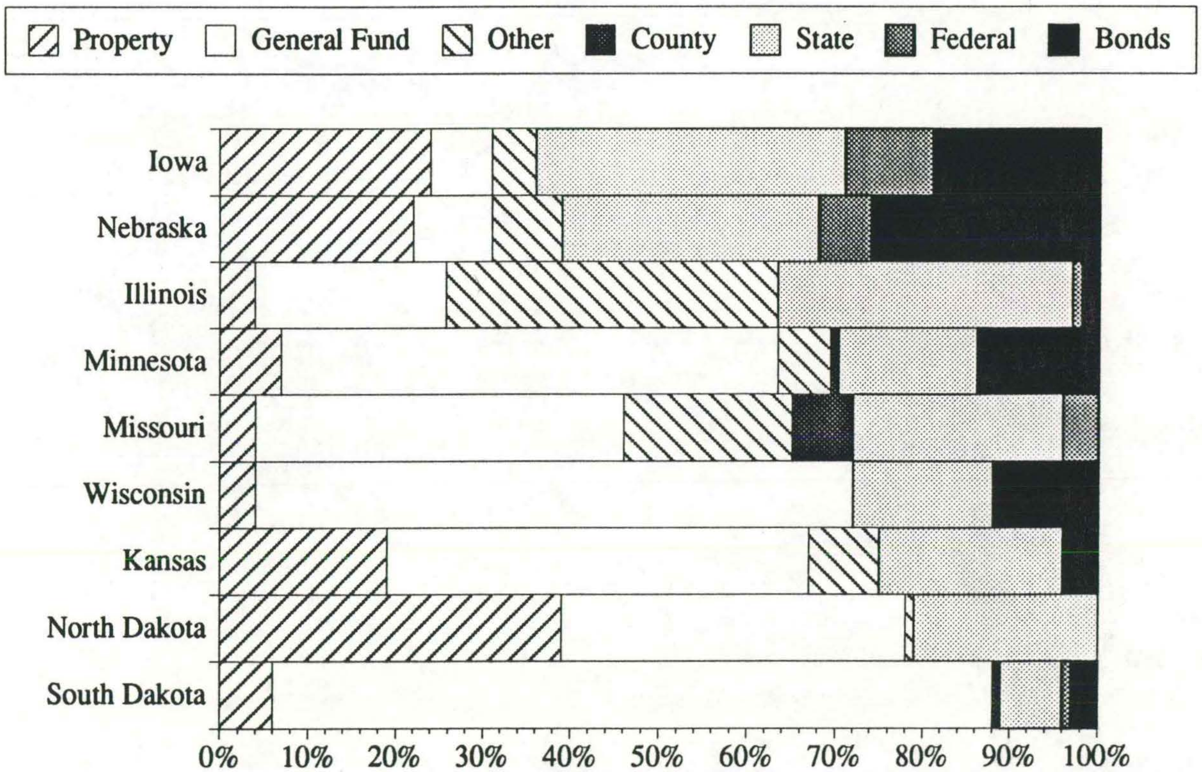

Figure 2-19. Municipal Government Revenues for Highways and Roads, By Source, 1987
(percent)

Municipalities, as with states and counties, spend most of their highway revenue on capital and maintenance. Iowa's municipalities spend 68 percent of their revenue on these items, which is about average for the Midwest. Figure 2-20 shows how expenditure varies by category across the Midwest. If we also include debt retirement as spending for past capital and maintenance, the relative position of Iowa's municipalities changes. Including debt retirement, Iowa's municipalities devote 82 percent of their expenditures to capital and maintenance, past and present, which ties with Illinois' municipalities for highest percentage in the Midwest.

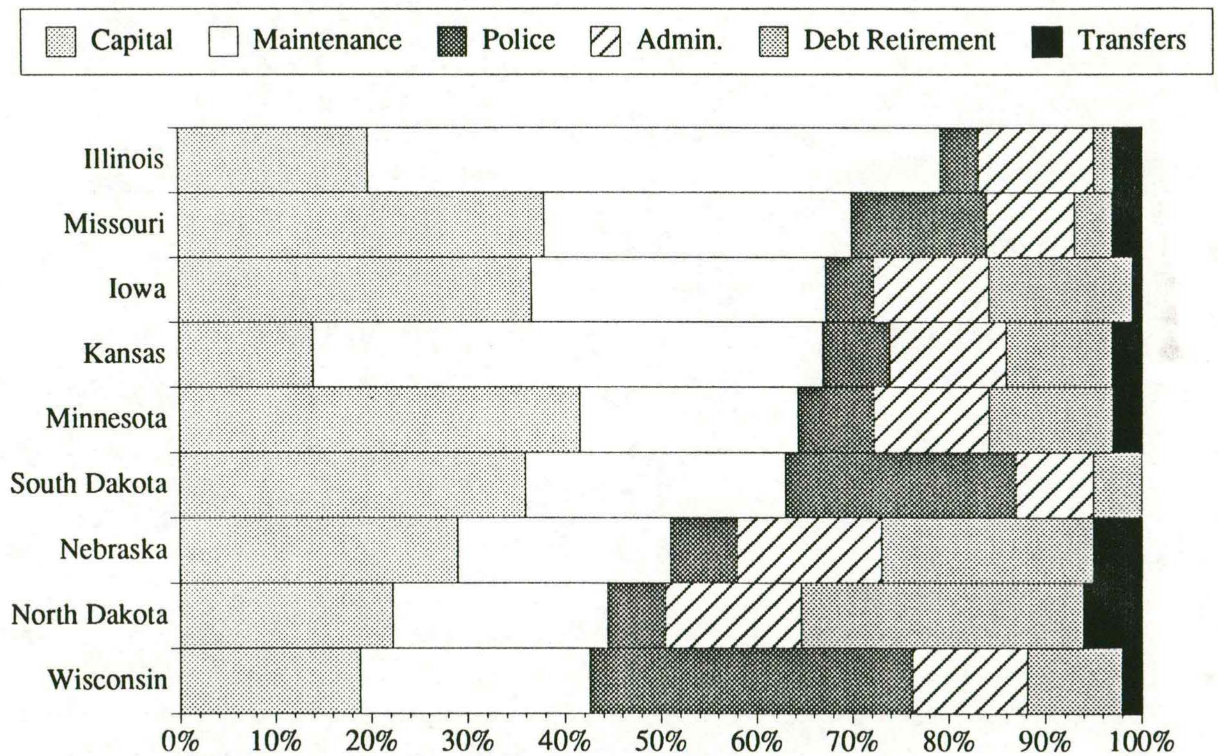

Figure 2-20. Municipal Government Disbursements for Highways and Roads, By Type, 1987
(percent)

HIGHWAYS IN IOWA

By far the largest infrastructural investment Iowans have is the state's road and highway system. More goods are shipped on the state's roads and highways and more person miles occur on them than by all other modes combined. Within this vast 112,448-mile system there is great diversity. Interstate highways carry many times more vehicles than do arterials, which in turn serve a far greater volume of traffic than do county roads. Yet without an adequate collector and distribution system, access to points throughout Iowa would not be sufficient to support economic activity.

Having reviewed comparative data that contrast Iowa with other Midwestern states in terms of roads and highways, we turn to a more detailed look at Iowa itself. We begin by examining financing practices for roads and highways within the state. Then, the physical condition of various categories of roads and highways is assessed using standard rating mechanisms. Finally, needs to rehabilitate facilities whose condition has deteriorated are examined. Given a limited budget, a key question in Iowa increasingly will be which roads and highways should be repaired and upgraded and which should be allowed to decline to lower performance levels.

Highway Financing in Iowa

Over one billion dollars a year is spent in the state of Iowa building, maintaining and policing roads and highways. As Figure 2–21 shows, $673.6 million is derived from state user taxes, the greatest of which is the motor fuel tax. In fact, almost one-third of the total revenue for highway programs ($1,173.7 million) comes from the motor fuel tax. Vehicle registration fees are the second most important source of user fees, followed by the motor vehicle use tax and a small amount of revenue from driver license fees.

State user tax revenues are supplemented by federal aid, local property taxes, new borrowings and a small amount of miscellaneous funds, as Figure 2-22 shows. The federal aid is an apportionment of the 14.1 cent per gallon motor fuel tax and several other federal user taxes, including truck registration fees. Property taxes are collected by municipal and county governments and spent on streets and roads. Borrowing is in the form of bonding, and all bonding is done by municipal and county governments. It has been many years since the Iowa DOT has issued bonds of any kind.

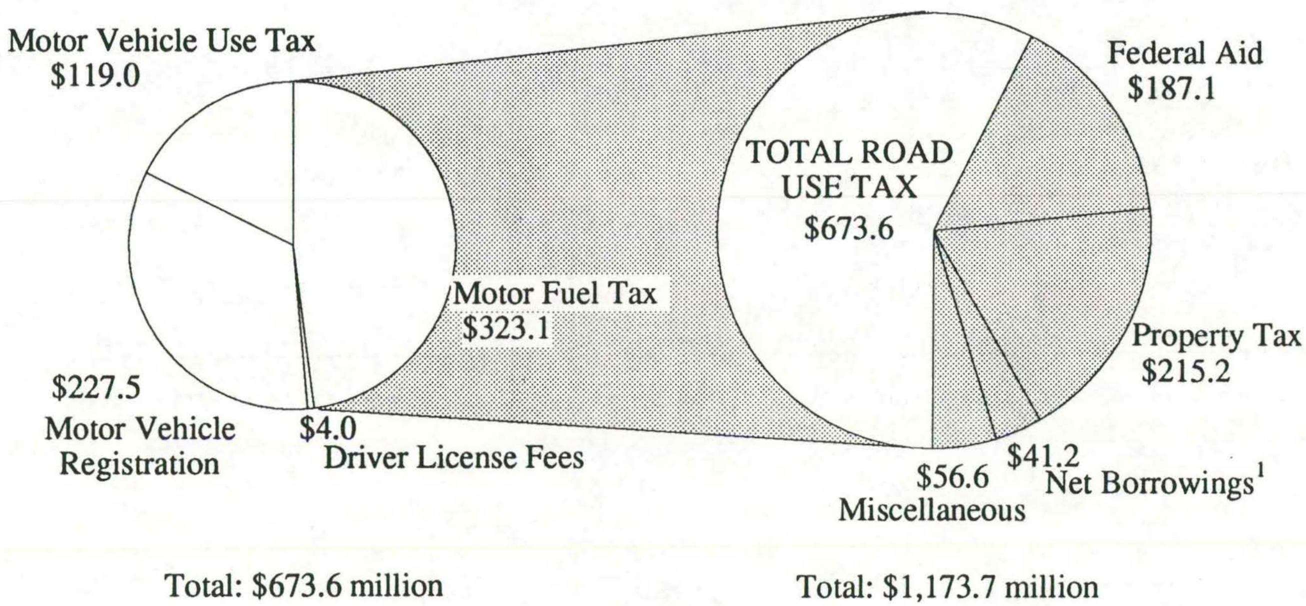

Figure 2-21. Total Highway User Revenue in Iowa, 1990 (millions)

Figure 2-22. All Highway Funds in Iowa, 1990 (millions)

[1] All borrowing (bonding) is done by municipal governments. The Iowa DOT does not bond.

On the expenditure side (see Figure 2-23), most of the $673.6 million flowing into the Road Use Tax Fund (RUTF) is distributed through a legislatively-determined formula that allocates 47.5 percent to primary roads (including Interstate highways), 32.5 percent to county roads (including farm-to-market roads and secondary roads), and 20.0 percent to city streets. This formula was revised in the 1988 legislative session to increase the fractions allocated to primary roads and city streets, with less going to county roads. Before RUTF resources are allocated via the formula, a series of off-the-top distributions are made, totalling $88.0 million. Off-the-top distributions include $28.1 million for the RISE program (road improvements to promote economic development), the Highway Patrol, Iowa DOT administration, public transit assistance, and a series of smaller activities.

The legislature also directs that portions of the RUTF be spent on certain projects, such as state park access and assistance for specified road improvements. The remainder of the RUTF, $562.2 in fiscal year 1990, is distributed according to the aforementioned formula.

In the cases of primary roads, county roads, and city streets, various other specific sources of funds are available. These include federal programs, local revenue, and smaller miscellaneous sources. All told, the primary system received $440.7 million in fiscal year 1990, county roads $340.8 milion, and city streets $306.2 million.

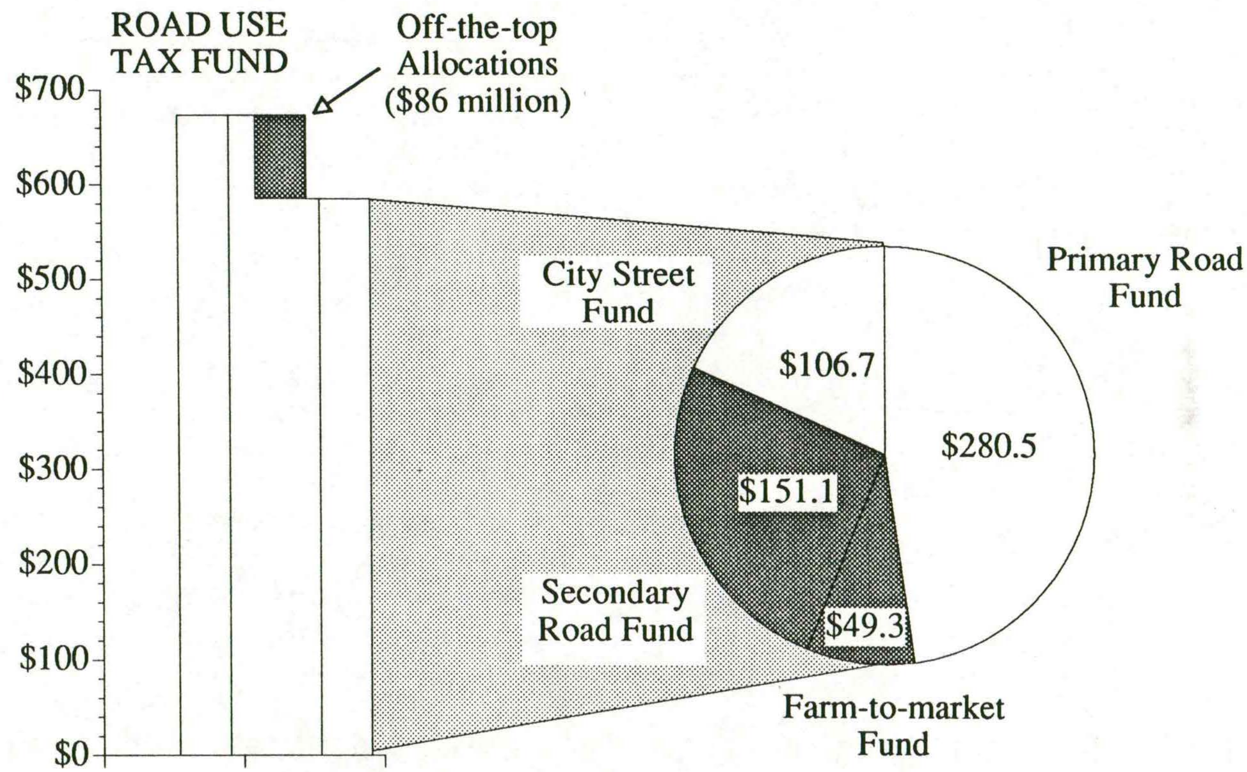

Figure 2-23. Total Highway Expenditures From Road Use Tax Fund in Iowa, 1990 ($673.6 million)

Condition

Having examined how Iowa's roads compare in general terms to its neighbors, we can now examine in detail how conditions vary across the state's roads. The Iowa Department of Transportation assesses the condition of all segments of the state's primary road network using a set of sufficiency ratings. The method used to develop these ratings is shown in Figure 2-24 for rural segments of the network (Office of Advance Planning, Iowa DOT, 1988). A similar approach is used for municipal and suburban sections, with different factors used that are more appropriate for those settings.

This approach is based on the concept of a "tolerable standard." The Iowa DOT defines a tolerable standard as "the minimum prudent condition, geometric or structural, which can exist without being in need of upgrading" (Office of Advance Planning, Iowa DOT, 1988, p. i). For each factor considered, the tolerable standard is given one-half of the maximum points available for that factor.

The basic rating for a segment of road is found by rating each of the factors shown in Figure 2-24. For example, the wearing surface is rated on a seven-point scale, with three points being the tolerable standard. These ratings are aggregated for each factor considered, and a basic rating is obtained. The basic rating cannot exceed 100, and a score of below 50 indicates that the segment "is considered to be in need of upgrading to eliminate the intolerable conditions" (Office of Advance Planning, Iowa DOT, 1988, p. i).

Three kinds of adjustments can be made to the basic rating. The first adjustment reduces the basic rating if any of the scores on the components is below the tolerable standard for that factor. The basic rating is reduced by an amount that depends on the degree to which the tolerable standard is not met. Note that the basic rating for a road that has no factors below the tolerable standard will not change. Only those segments with factors below standard are affected.

A second adjustment is made to reflect the volume-to-capacity (v/c) ratio that the road segment has. This ratio is calculated based on certain levels of service. Roads with lower v/c ratios than tolerable standards for each functional class of road have their tolerability adjustment ratings increased, and vice verse.

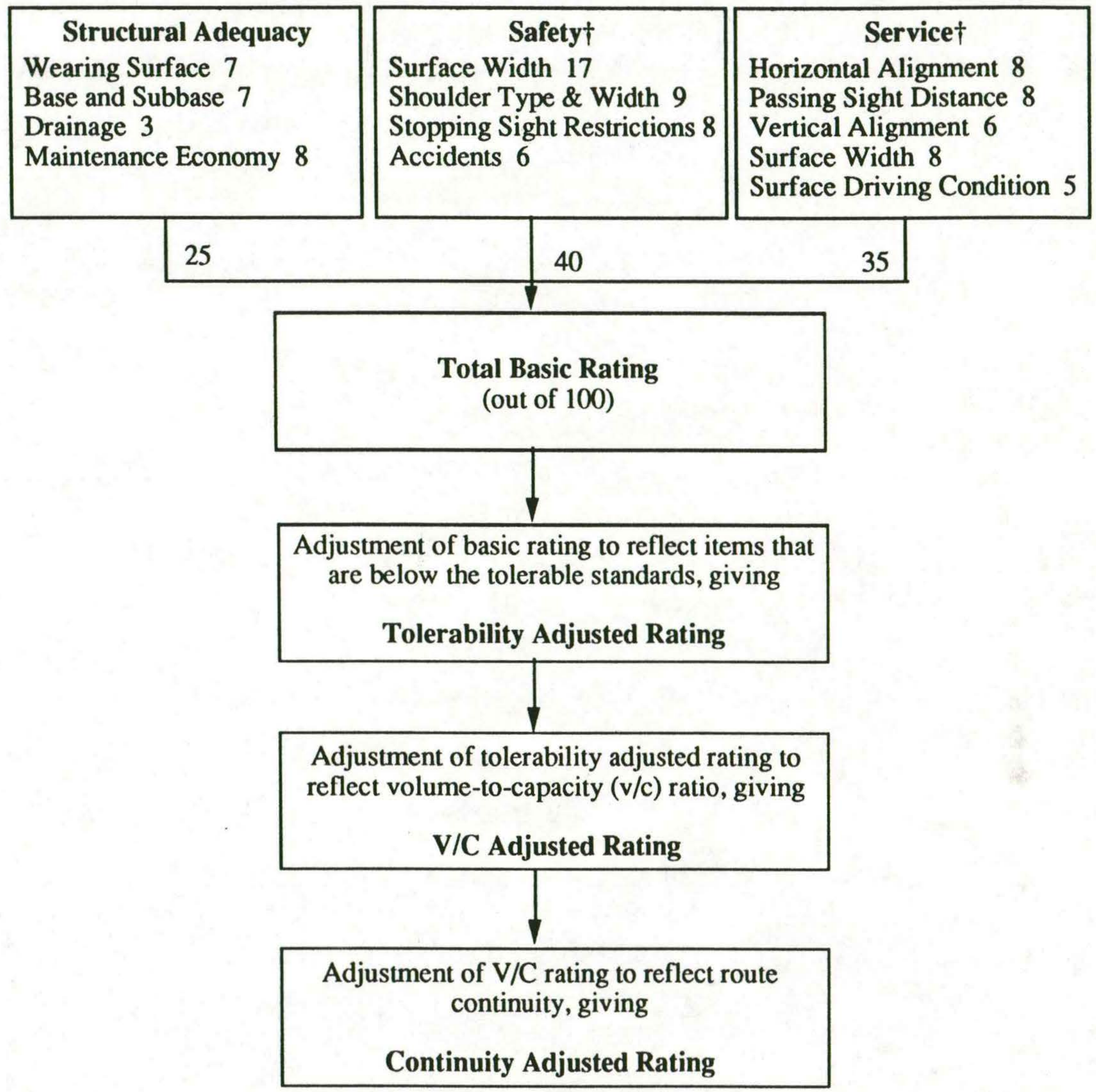

Figure 2-24. Factors and Weightings Used by Iowa Department of Transportation to Develop Primary Highway Sufficiency Ratings

†These factors are for Rural sections of the Primary road system: different factors are used for municipal and suburban sections.

The final adjustment is made to allow for different concentrations of traffic. If a segment has a higher v/c ratio than the route it is part of, its rating is increased, and vice verse. This continuity adjustment is made to emphasize individual sections of road that have significantly different v/c ratios than the route of which they are a part.

The final rating is called the continuity adjusted rating. We can use this rating to assess the condition of primary roads in Iowa in much more detail than was possible for the nine other states that make up the Midwest.

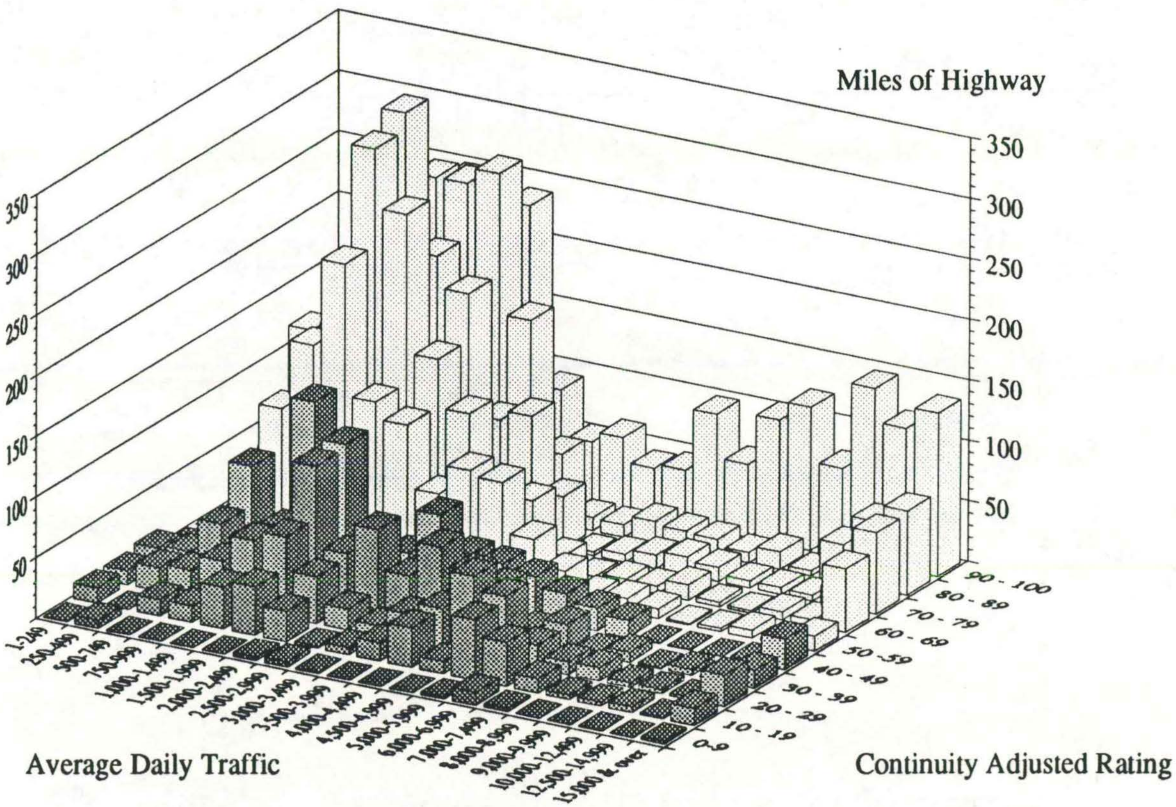

Figure 2-25. Distribution of Miles of Highway on Primary System, Iowa, 1990, By Average Daily Traffic (ADT) and Continuity Adjusted Rating

Iowa's primary highway network has 8,652 miles of rural roads, and 1,100 miles of municipal extensions. We can examine the condition of this system by reference to the continuity adjusted ratings described above.

Of the 8,652 miles of rural highway, 23 percent had a continuity adjusted rating of below 50 in 1988, that is to say, below the tolerable standard. Figure 2-25 shows the distribution of road miles by continuity adjusted rating and daily traffic. Two conclusions are clear from Figure 2-25. First, most of the miles of Iowa's rural primary system are in good condition (rating above 50), and carry low to moderate traffic volumes (below 5,000 vehicles per day). Fully 66 percent of the rural miles fall into this category. Second, only a small portion of the heavily travelled part of the system does not meet the tolerable standard. This fact is demonstrated by the small number of miles shown in the lower right corner of Figure 2-25.

The distribution of road miles is not the only important factor. In many respects, this distribution does not take into account how much each segment is used, although there are some factors incorporated into the ratings to allow for congestion. The continuity adjustment rating essentially allows us to assess the physical condition of the miles on the system, but we need to allow for the relative value of each part of the system in terms of providing service to road users. We can do this at a crude level by weighting each mile of road by the volume of traffic it carries—average daily traffic (ADT). Figure 2-26 shows the distribution of vehicle-miles per day (calculated by multiplying the miles of road by the average daily traffic) by continuity adjusted rating and traffic volume. It is now clear that Iowa's rural highway network is in very good condition—the heavily travelled parts of the system are clearly in the best condition. Over one-third of the rural primary system is in good condition and heavily travelled when mileage is weighted by ADT, versus only six percent when mileage is considered alone. Nevertheless, around one-fifth of the system, by either measure, is judged to be below the tolerable standard.

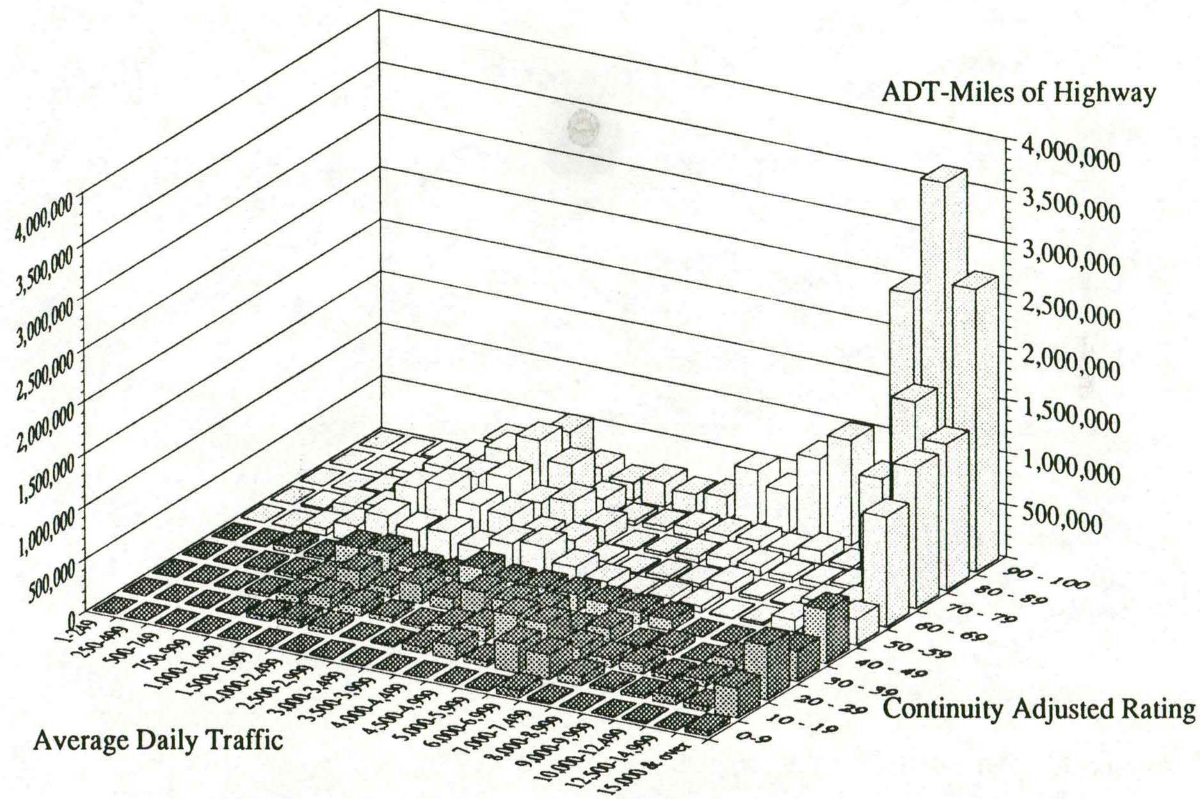

Figure 2-26. Distribution of ADT-Miles of Highway on Primary System, Iowa, 1990, By Average Daily Traffic (ADT) and Continuity Adjusted Rating

Needs Analysis

State departments of transportation periodically conduct needs studies to assess the condition of their road systems and to estimate the cost of making necessary improvements. Needs studies have advanced over the years from melodramatic efforts to acquire more funding to rather sophisticated evaluations of financial requirements to achieve specific standards and levels of service. Levels of service for road segments are dictated by their functional classification and the traffic volumes they serve.

The Iowa Department of Transportation has recently completed a needs study for the state's highways, roads and streets for the next 20 years (Office of Advance Planning, Iowa DOT, 1991a). The study was conducted in five steps:

- Classify each road section
- Develop design guidelines for each classification
- Collect data on the current condition of each road segment
- Compare the current condition of road segment with design guideline both now and in the future, identify timing and type of improvements needed to correct any deficiencies identified
- Estimate cost of making these improvements, allowing for regional variations within the state, and including maintenance and administrative costs

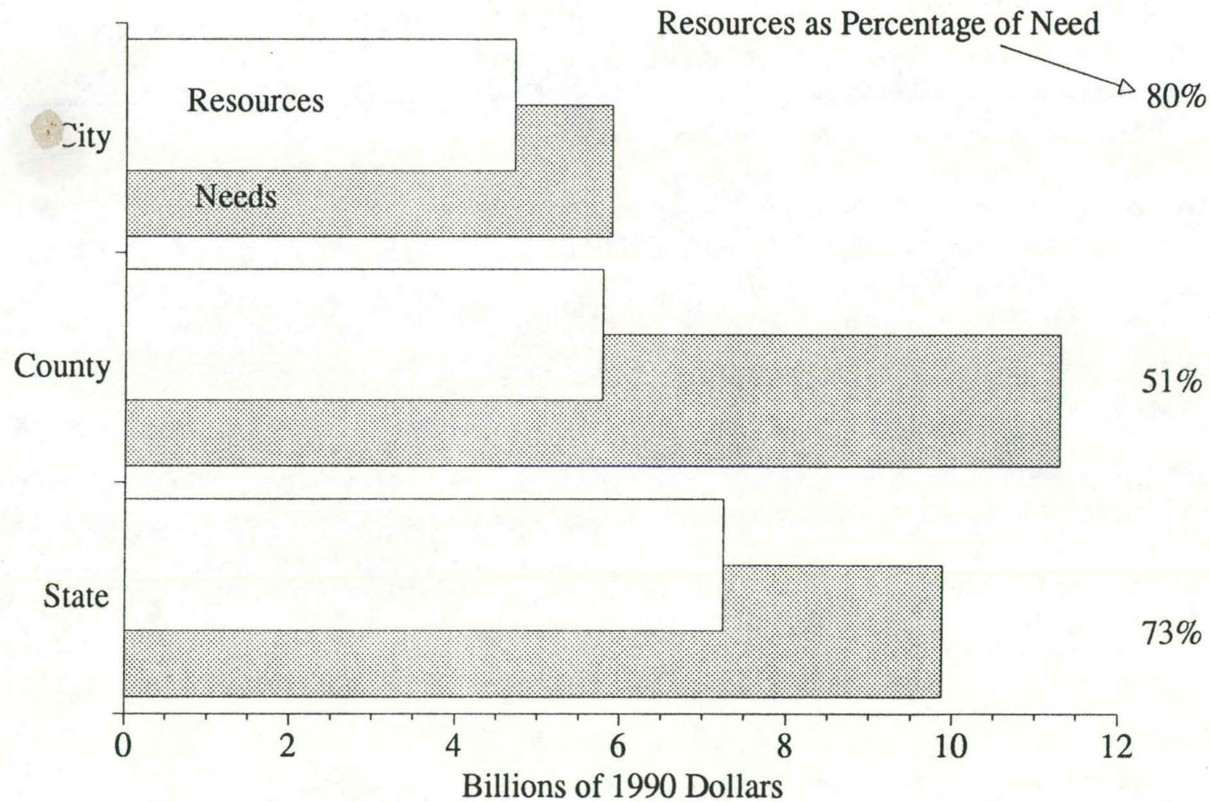

Figure 2-27. Comparison of Forecast Needs and Resources for Roads in Iowa, 1990-2009, By Jurisdiction

Over the 20-year period of the forecast, the Iowa DOT estimates that the total cost, in 1990 dollars, of keeping the entire road system above appropriate design standards would be $27 billion. The DOT also forecasted the amount of revenue that would be available at the state, county, and city level to meet these needs. These revenue forecasts were based on assumptions that basic policy decisions at the state and federal level would not change concerning gas tax levels and distribution formulas. Using this approach, the Iowa DOT estimated that revenues over the 20-year period would total $18 billion, about two-thirds of the forecast need.

Figure 2-27 shows the needs and revenues for each part of the system. Given the uncertainties inherent in any projection of this kind, and given the fact that the needs estimate is in essence an "ideal" target, the forecast is reasonably reassuring. At the city and state levels, forecast revenues are about three-quarters or more of forecast needs. In broad terms, these jurisdictions should be reasonably confident of making the majority of needed improvements that arise in the next two decades, so long as highway policy remains fairly constant. For counties, however, the outlook is more troublesome. With revenues only projected to meet half of needs, it is unlikely that the gap can be accommodated without significant changes as to system size or maintenance standards.

The majority of the projected needs on the state system lies in rural areas, on arterial roads. Figure 2-28 shows the distribution of needs by road type and funding jurisdiction. Counties face significant needs on trunk roads, trunk collectors and, especially, on area service roads. The $5 billion that is forecast to be needed on county area service roads over the next 20 years constitutes one-fifth of the entire need for the state. Cities' needs are almost exclusively municipal streets.

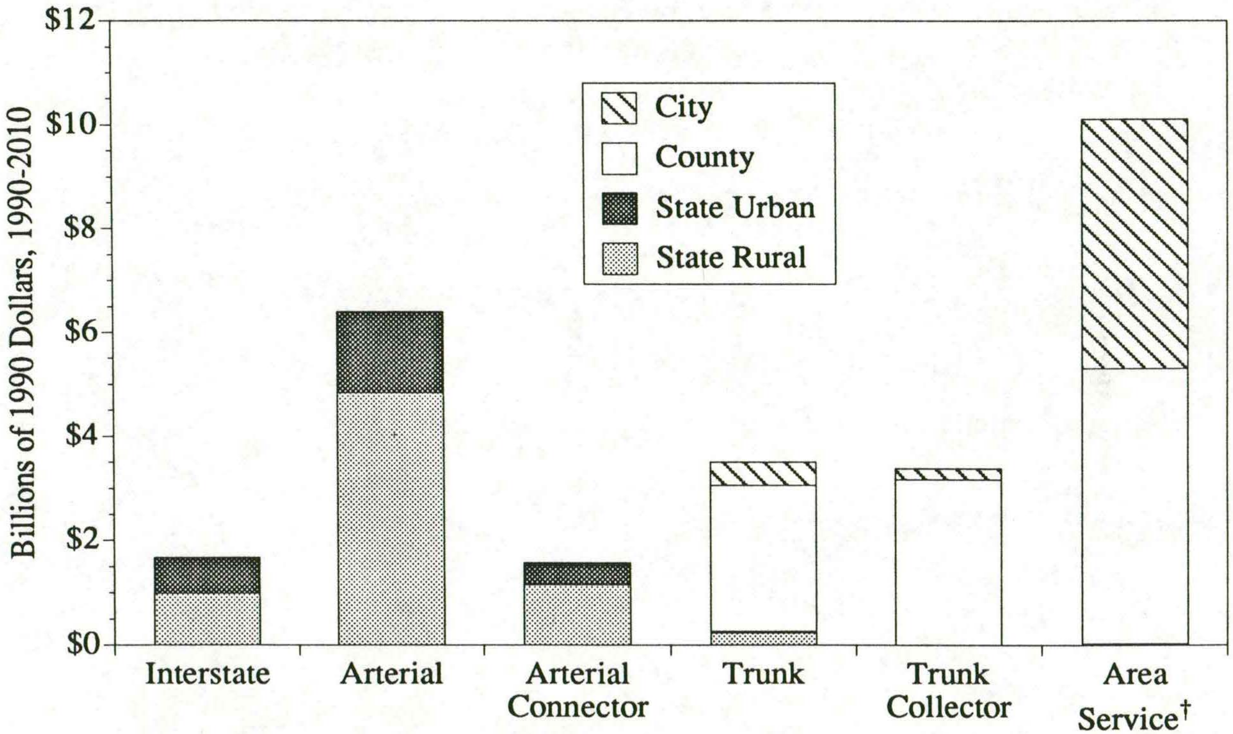

Figure 2-28. Distribution of Estimated Needs for Highway Investment, 1990-2009, By Road Type and Jurisdiction
(billions of 1990 dollars)

† Municipal Streets in cities.

The combined effects of system size and traffic volumes on needs by jurisdiction can be clearly seen in Figure 2-29. When we compare the forecast needs per mile, counties are forecast to need about $6,000 each year for each mile they are responsible for. In contrast, state roads are forecast to need about $50,000 per mile. The differential concentration of traffic on each system changes this relationship. When needs are compared to VMT (vehicle-miles of travel), state roads need about four cents per VMT annually—county roads need over four times as much.

Repair, reconstruction, and maintenance of bridge structures are important elements of total estimated needs. Figure 2-30 shows how the importance of bridge repairs varies among the three jurisdictions. One-quarter of all needs on the rural system relate to bridges, compared to only seven percent of city needs. Thus about $2.8 billion is estimated to be needed for rural structures over the next 20 years, an annual cost of $140 million in 1990 dollars. To put this cost in perspective, the total county share of the Road Use Tax Fund in Iowa in 1991 is slightly over $200 million. Thus, on average over the next 20 years, almost three-quarters of all state transfers to counties for road spending could be taken up by bridge repairs alone.

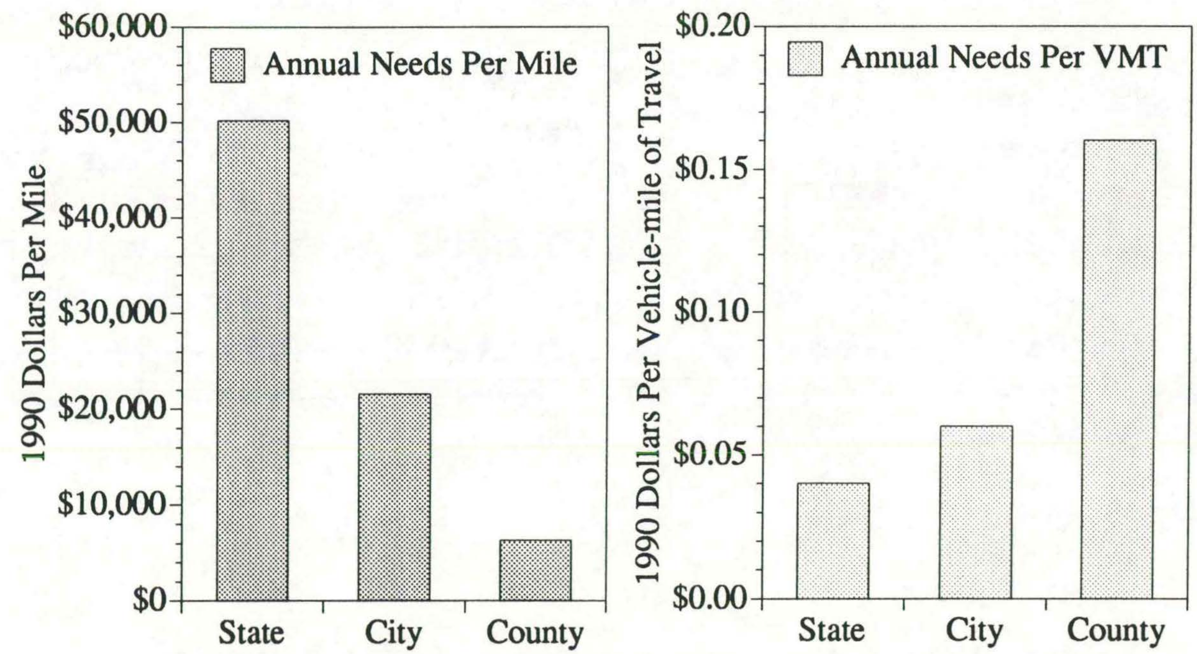

Figure 2-29. Estimated Needs for Highway Improvements in Iowa, 1990-2009, Per Vehicle-mile of Travel and Per Mile of Road, By Jurisdiction: Annual Cost†

†Twenty-year cost in 1990 dollars divided by 20.

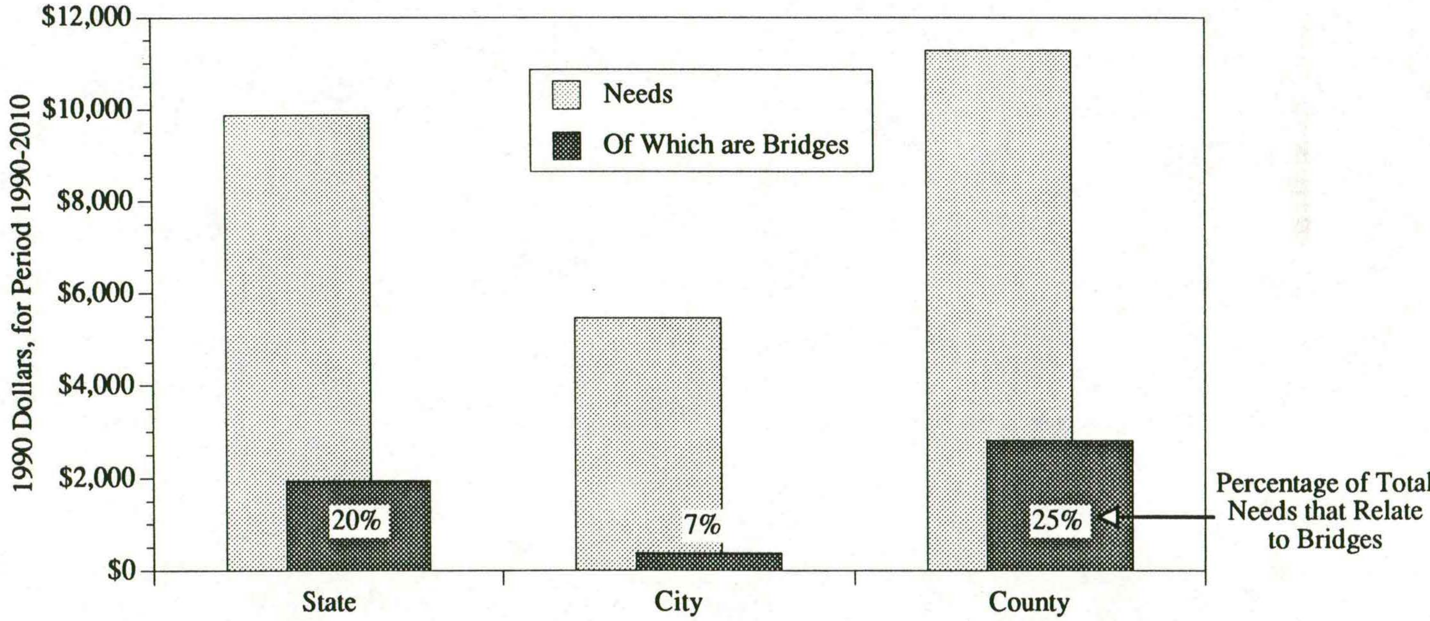

Figure 2-30. Estimated Needs for Highway Improvements in Iowa, 1990-2009, By Jurisdiction: Needs for Bridges Only and Total Needs (millions)

SECTION 3
RAIL TRAFFIC

Railroads move a significant amount of freight into and out of Iowa each year. In large part, rail carries bulk agricultural products (both processed and unprocessed) out of the state, and coal and farm products into Iowa. A small number of areas within the state are responsible for shipping and receiving this rail traffic, and a small number of railroads carry most of the state's total freight.

In both Iowa and the nation, the rail network has shrunk from the peak size it attained in the early part of this century. In 1916, the United States had a network of 254,251 miles serving the continental states (Association of American Railroads, 1986). By 1989, the total miles of rail track remaining had fallen by more than one-third (Association of American Railroads, 1990). Iowa's rail network, developed to move agricultural products out of the state, was over 10,000 miles in length in 1914 (Planning and Research Division, 1986). By 1988, it had fallen to 4,414 miles, a decrease of 56 percent (Iowa Department of Economic Development, 1991). Although Iowa's rail network is smaller than in its heyday, it carries a significant amount of bulk products into and out of the state. In 1989, railroads carried 31 million tons of goods into Iowa and 37 million tons out of Iowa.

Comprehensive information on rail shipments between states is not collected. The primary method used to assess interstate shipments is by analyzing a sample of rail waybills. Typically, a one percent sample of all waybills is analyzed and estimates of total traffic made. One limitation of waybill samples is that they produce information mostly about tonnage—they are much less useful for determining values of different kinds of shipments.

For traffic to and from Iowa, the Iowa Department of Transportation analyzes waybill samples annually. In this review, we report these estimates of rail freight movements for 1980 through 1984, derived from the most recent Iowa Rail Plan (Planning and Research Division, 1986) and from later analysis for 1989 (Office of Advance Planning, 1991b). A separate analysis of rail waybills for the Midwest for 1980 and 1987 was conducted as part of an on-going Midwest Transportation Center project, led by Professor Maze at Iowa State University, focussing on freight trends in the Midwest. We use this study to illustrate changes in intrastate and bridge(through) traffic, rail carriers operating in Iowa, and patterns of rail terminations and originations within the state (Maze, Walter and Allen, 1990).

Key Products Shipped by Rail

Shippers use rail to move bulky, largely unprocessed goods to markets, modal transfer points and processing plants. Even though the number of miles of track within the state fell during the 1980s, both originating and terminating rail traffic increased significantly in tonnage terms. Originating tonnage in Iowa rose 25 percent during the decade (1980-89), whereas in the nation as a whole it fell by 6 percent (Association of American Railroads, 1990). Rail shipments terminating in Iowa also grew significantly during the 1980s, by 54 percent. Figures 3-1 and 3-2 show how the level and composition of rail traffic changed from 1980 to 1989.

Most of the rail traffic that is loaded in Iowa is agricultural in nature. In 1989, 59 percent of all Iowa's originating rail tonnage was farm products, largely grain. When processed farm products are also added, these two classes of agriculturally related products comprise about 85 percent of all originating rail tonnage in Iowa. Furthermore, the actual amount of farm-related goods carried has risen over the decade, from 24.6 million tons in 1980 to 31.1 million tons in 1989.

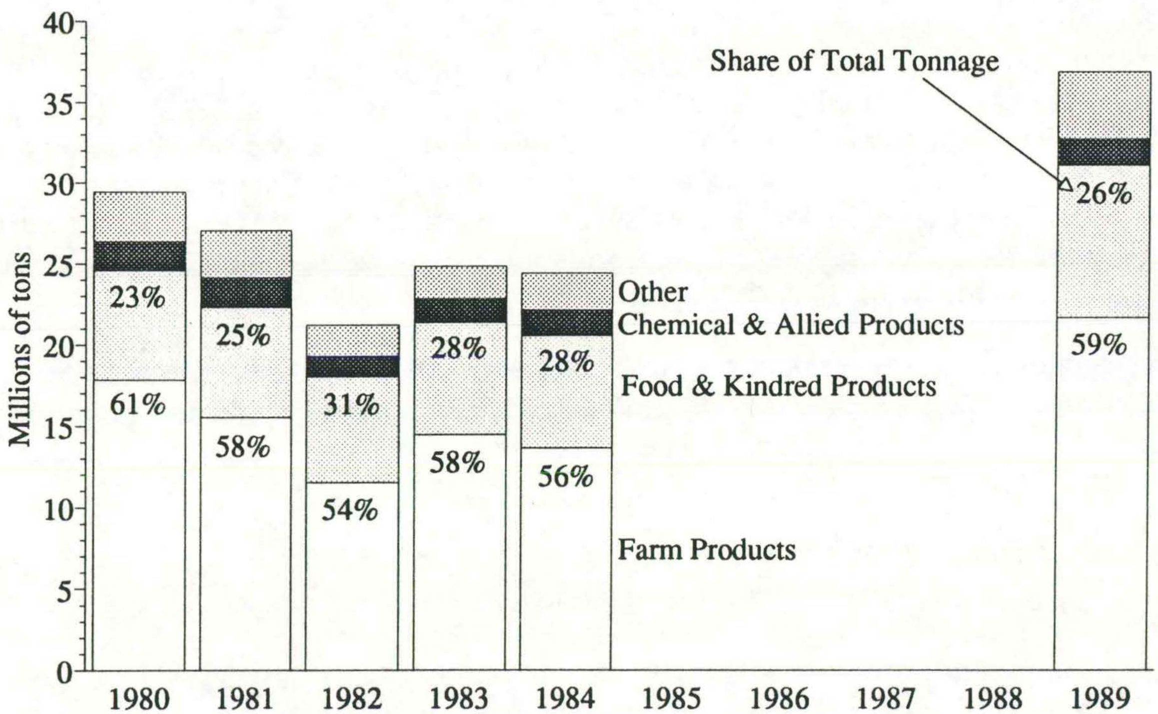

Figure 3-1. Distribution of Railcar Traffic Leaving Iowa, 1980 to 1989, By Product (in millions of tons)

Coal is the most important commodity unloaded from railcars in Iowa, accounting for 41 percent of the tonnage unloaded in the state in 1989. Iowa's power plants and coal-burning industries have imported a rising amount of coal since 1980, with the total tonnage increasing 38 percent over the decade. Farm products are the second most important terminating commodity, and have doubled their share of the total tonnage unloaded over the past ten years. A large part of this terminating traffic also originated in Iowa–this flow is grain moving from elevator to barge port or processing plant.

As Figures 3-1 and 3-2 make clear, the increase in both originating and terminating rail traffic in Iowa during the 1980s involved only a small number of commodities. The most important five commodities accounted for 95 percent of all originating shipments in 1989; the corresponding share was 91 percent for terminating shipments.

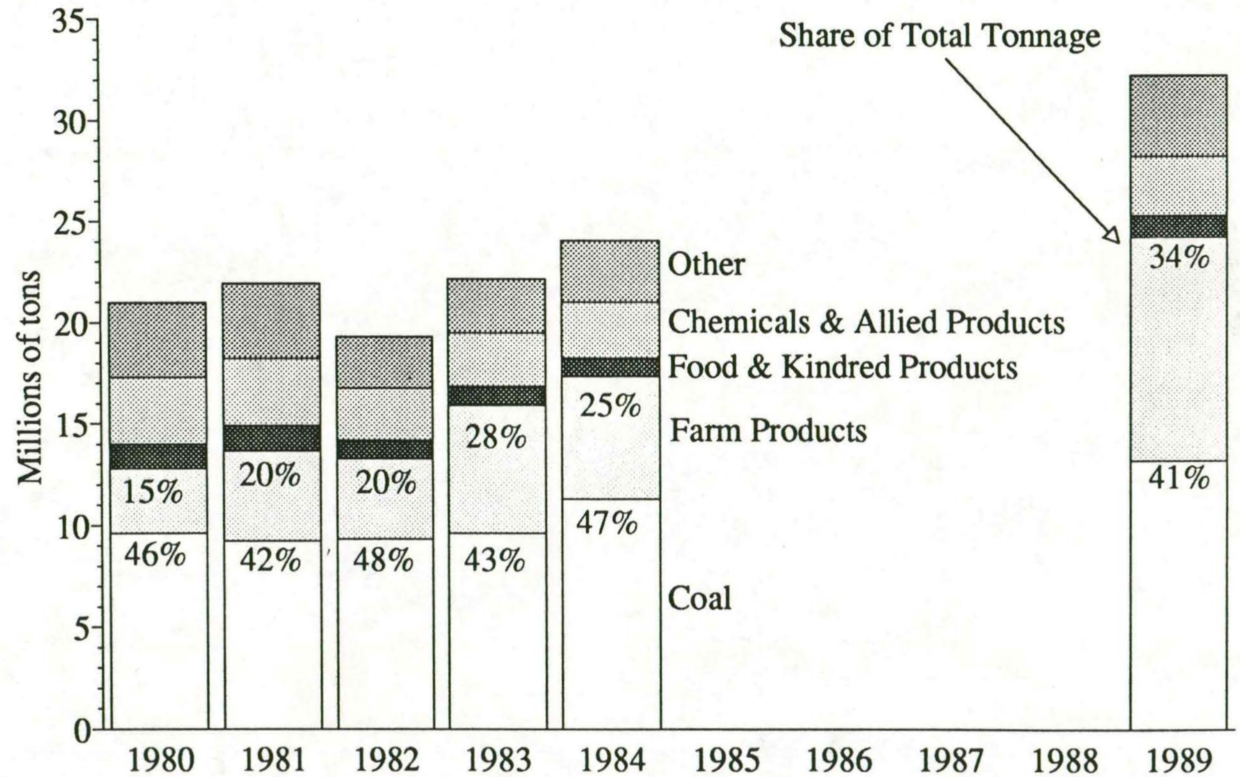

Figure 3-2. Distribution of Railcar Traffic Arriving in Iowa, 1980 to 1989, By Product (in millions of tons)

Origins and Destinations of Iowa's Rail Traffic

Just as a few commodities dominate originations and terminations, a small number of states and regions dominate where rail traffic to and from Iowa comes from and goes. Figure 3-3 shows the most significant destinations for rail traffic loaded in Iowa in 1988, and the change since 1980. In 1980, the top four areas—Illinois, Iowa, the Southeastern region and the South Central region—received 68 percent of Iowa's shipments (Planning and Research Division, 1986). By 1988, the top three areas alone, Illinois, Iowa and the Southeast, accounted for almost 70 percent of all rail shipments from Iowa.

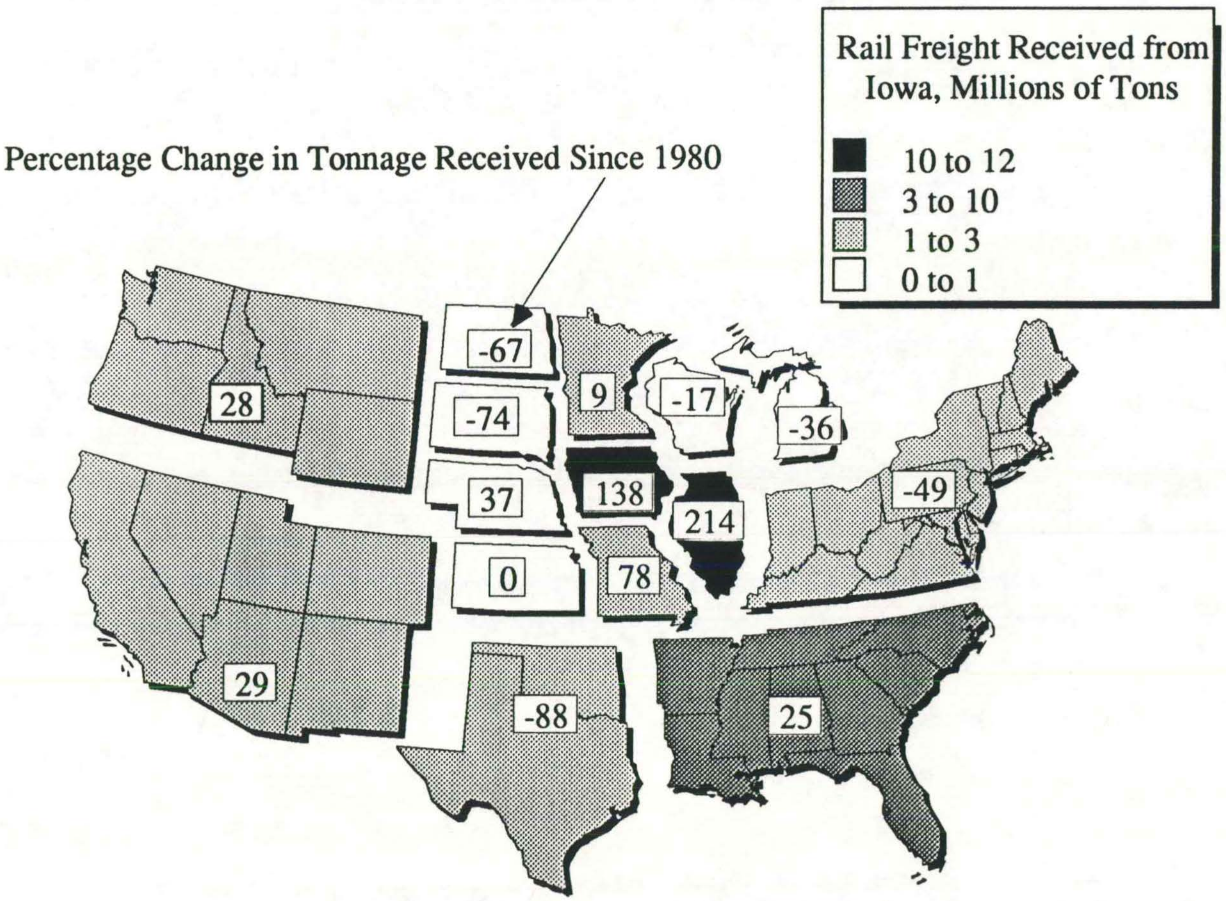

Figure 3-3. Destinations of Rail Traffic, Leaving Iowa, 1988

One clear trend during the 1980s has been the increasing importance of relatively local destinations for rail freight loaded in Iowa. To some extent, this concentration is artificial since grain traffic, for example, terminates locally at barge ports but they are not the cargo's final destination. Nevertheless, the trend is significant. In 1980, rail freight terminating in Illinois, Missouri, Minnesota and Iowa totalled 10.4 million tons, or just over one-third of the state's total shipments (Planning and Research Division, 1986). By 1988, these four states accounted for 25.3 million tons of freight, representing almost 70 percent of the state's total. Illinois and points within Iowa are dominant even within this group, and as Figure 3-3 shows, both have shown very significant growth in the 1980s as destinations. This increasing importance of short haul rail shipments from Iowa may well be related to the emergence of competitive regional and local railroads and the growing importance of intermodal shipping systems.

States and regions shipping products into Iowa by rail are also becoming more concentrated. Figure 3-4 shows where rail traffic unloaded in Iowa comes from. In 1980 the top four areas, including the Northwest region (largely coal from Wyoming), Iowa, Illinois, and the Southeast region provided 15.2 million tons of freight, which was 72 percent of the tonnage terminating in Iowa. In 1988, the Northwest region and Iowa alone provided 71 percent of the total. Adding Illinois and Minnesota, the top four areas supplied 84 percent of all rail traffic bound for Iowa.

The most important single source of rail traffic that terminates in Iowa is Wyoming. Wyoming's role as a provider of coal shipments has increased in importance during the decade, with shipments of over 11 million tons of coal to Iowa in 1987, up sharply from 6.3 million tons in 1980 (Maze, Walter and Allen, 1990). This increase coincided with the decrease of coal shipments from Illinois and Colorado. By 1987, Wyoming was supplying 95 percent of all coal shipments terminating in Iowa by rail (Maze, Walter and Allen, 1990).

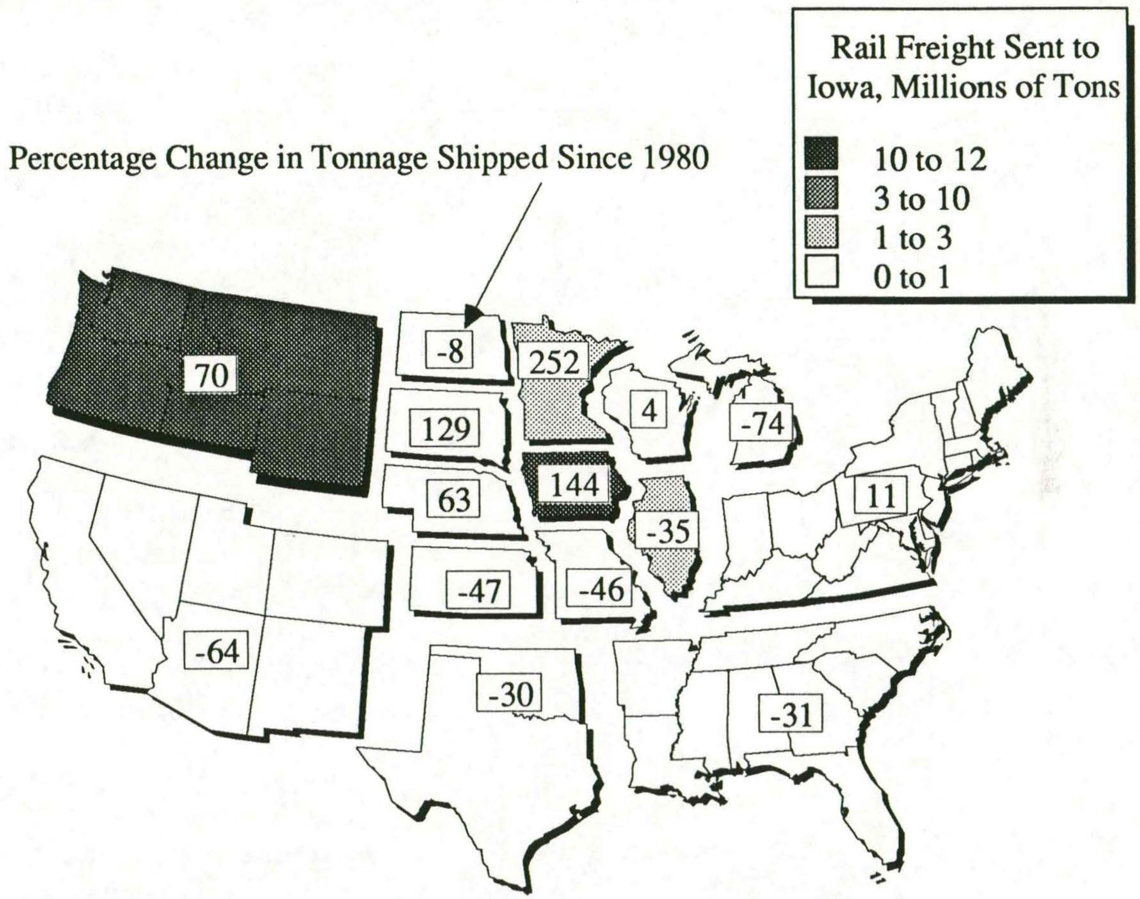

Figure 3-4. Sources of Rail Traffic Arriving in Iowa, 1988

Rail Origins and Destinations Within Iowa

Within Iowa, a pattern of increasing rail traffic concentration has occurred during the 1980s. The recent Midwest Transportation Center report on freight trends analyzed rail traffic patterns at the county level for 1980 and 1987 from waybill samples (Maze, Walter and Allen, 1990). In 1987, the top ten counties originated 66 percent of all rail traffic in the state, up from 50 percent in 1980. Terminating traffic also became more focused. The top ten counties received 86 percent of all Iowa's terminating rail traffic in 1987, up from 77 percent in 1980. Figures 3-5 and 3-6 show the leading counties in shipping and receiving rail freight in Iowa during 1987. The pattern is fairly clear: counties that are farm shipment centers originate the most tonnage, while counties with coal burning power plants, food processing plants, or river terminals lead in terminating tonnage.

For originating shipments, the counties with the largest tonnage in 1987 also grew fastest in the 1980s, reflecting the concentration of rail facilities in particular areas. Wright, Pottawattamie, and Cerro Gordo counties all originated over 3.5 million tons in 1987. The lowest growth rate among them was an increase of 199 percent since 1980. All three of these counties generate the bulk of their rail shipments from agricultural products. In each county, farm products supplied over two-thirds of the tonnage shipped out in 1987.

Rail shipments terminating in Iowa, consisting largely of coal and grain from within the state, are concentrated in counties with large power plants and barge ports. For example, in 1987, two-third of the terminating tonnage Pottawattamie received was coal (Maze, Walter and Allen, 1990). Pottawattamie received an additional 900,000 tons of grain; combined with coal, these products accounted for 90 percent of the county's terminating shipments. An additional attraction for terminating tonnage is the food processing industry. Linn county originated 2.7 million tons of food and kindred products in 1987, which means the county is probably a primary destination of intrastate grain shipments (Maze, Walter and Allen, 1990).

Other Types of Rail Traffic—Bridge and Intrastate

The distribution of rail traffic in Iowa has changed during the 1980s. The total amount of bridge—that is to say, through—rail traffic has increased somewhat during the decade. However, this growth of bridge traffic has not kept pace with the growth rates of originating and terminating rail traffic. As a result, the composition of Iowa's rail freight also has changed. From 1982 to 1987, bridge rail traffic has declined from over half of all rail shipments to around 40 percent (Maze, Walter and Allen, 1990; Planning and Research Division, 1986).

The recent increase in intrastate shipments is the primary factor underlying the growth in overall rail traffic. To a large extent, Iowa is its own best supplier and customer for rail traffic. Intrastate shipments increased faster than shipments to any other leading state or area from 1980 to 1987, rising 181 percent from 3.4 million tons in 1980 to 9.5 million tons in 1987 (Maze, Walter and Allen, 1990). Of the 9.5 million tons of intrastate shipments in 1987, 7.4 million tons were grain shipments, from rail terminals to barge terminals on the Mississippi River. The final destination for this grain could be Louisiana, Texas, or export markets around the world.

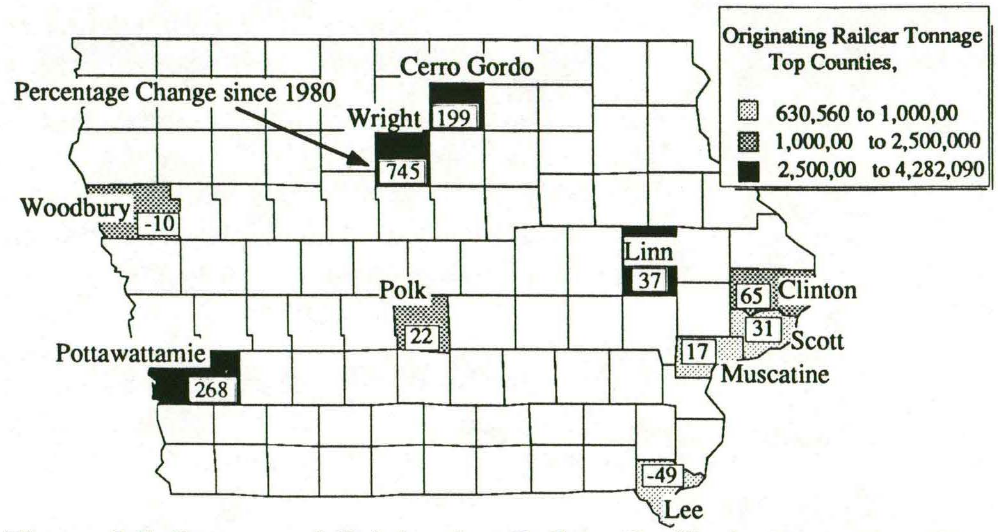

Figure 3-5. Sources of Originating Railcar Traffic in Iowa, Top Counties, 1987, With Percentage Change in Originations since 1980 (tons)

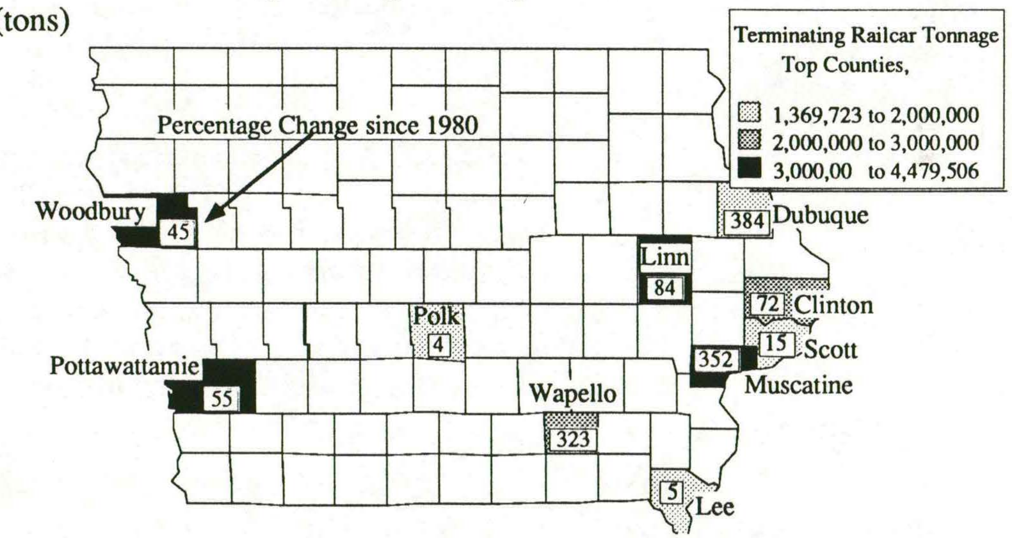

Figure 3-6. Destinations of Terminating Railcar Traffic in Iowa, Top Counties, 1987, With Percentage Change in Terminations since 1980 (tons)

Leading Rail Carriers In Iowa

Class 1 railroads still dominate rail traffic in the state of Iowa despite having lost some of their markets to expanding regional and local railroads. The Interstate Commerce Commission distinguishes between Class 1, 2 and 3 railroads by the total operating revenue of each company. In 1989, a Class 1 carrier had to have at least $93.5 million in operating revenue. Class 2 railroads are those with revenue between $18.7 million and $93.4 million, while Class 3 railroads are those with operating revenue less than $18.6 million annually. As of 1988, there were six Class 1, two Class 2, and 12 Class 3 carriers serving Iowa (Iowa Department of Economic Development, 1991).

Figure 3-7 shows the amount of tonnage shipped and received by Iowa rail carriers in 1987, as analyzed in the Midwest Transportation Center report (Maze, Walter and Allen, 1990). These figures do not include bridge traffic. About 84 percent of the total rail tonnage originated or terminated on Class 1 railroads, compared to 96 percent in 1980. The leading carrier in 1987 was the Chicago and Northwestern (C&NW). With lines running across the state and networked into the farming areas of northern Iowa, the C&NW carried 47 percent of all freight into, out of, or to points within Iowa. The second leading carrier was Burlington Northern, which handled 11.3 million tons, followed by the Soo Line, which carried 13 percent of the state's rail traffic. Combined, the top three Class 1 carriers handled about three-quarters of Iowa's 1987 rail traffic.

Non-Class 1 railroads handled 14 percent of the freight tonnage in the state in 1987. A Class 2 carrier, the Chicago Central and Pacific railroad, ranked second among all carriers in terms of originating rail traffic. In 1987 this railroad company shipped 4.4 million tons and received another 2.8 million, for an 11 percent share of all traffic into and out of Iowa. In terms of non-Class 1 railroads, the Chicago, Central and Pacific railroad accounted for 65 percent of all shipments. While the gross weight of products handled by Class 3 railroads increased, their market share increased only moderately: from three percent in 1980 to about four percent in 1987.

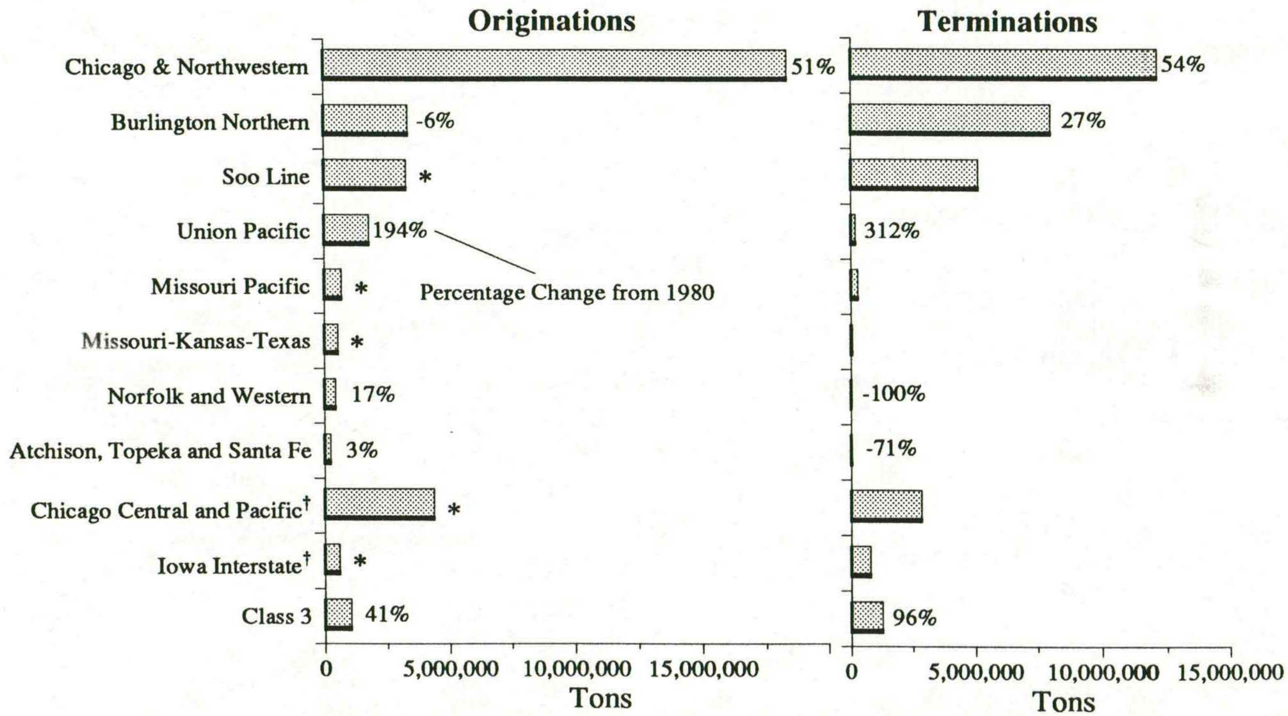

Figure 3-7. Distribution of Originating and Terminating Railcar Traffic, Iowa, 1987, By Railroad
(tons)

† Class 2 Railroad

* Not operating in Iowa in 1980

SECTION 4
BARGE TRAFFIC

Iowa, bordered on its west by the Missouri River and on its east by the Mississippi, has access to 490 miles of navigable rivers. Barges travelling along these rivers carry a significant amount of freight into and out of the state. In 1989, a total of 16.5 million tons of goods and commodities left or arrived in ports in Iowa along the Mississippi River and 290,000 tons in ports on the Missouri.

The most important commodity shipped by barge is grain, although coal is also an important part of overall shipments. Most of the grain that moves by barge is transported by truck to or from a barge port within Iowa. Railroads play an important role in carrying grain to the Mississippi River barge ports.

Iowa's Barge Traffic on the Mississippi

The amount of freight moved through Iowa's barge ports on the Mississippi River has increased sharply during the 1980s, and was 36 percent higher in 1989 than in 1979 (Iowa Department of Transportation, 1990; Planning and Research Division, 1981). By 1989, Iowa had a total of 68 terminals on the Mississippi River, up from 64 ten years earlier. Terminals in Bellevue and Camanche each closed during the decade, while terminals were opened in Clayton, Davenport, Buffalo, Burlington, and Montrose (two).

The mix of commodities moved by barge on the Mississippi has remained fairly stable over the last 20 years, as the total amount carried has grown. Figure 4-1 shows how each of the major commodities carried by barge has grown from 1979 to 1989. Grain continues to dominate barge traffic by tonnage, reaching 8.2 million tons in 1989, an increase of 17 percent over 1979. Shipments of coal doubled over the decade, from 1.9 million tons in 1979 to 3.8 million tons in 1989. Petroleum became less significant during this period, with shipments falling 19 percent to 537,000 tons.

The modal distribution for freight traffic to barge ports has also been fairly stable over the 1980s. The modes used to transport each commodity to and from barge ports are shown in Figure 4-1. For grain, trucks carried 72 percent of the total amount, down from 85 percent in 1979. Rail increased its share of grain traffic significantly, from 15 percent in 1979 to 28 percent in 1989. Coal is largely consumed at the terminals, with the balance transported roughly equally by truck and rail.

Iowa's Barge Traffic on the Missouri River

Only two percent of all barge traffic to and from Iowa uses the ten barge ports on the Missouri River. There has been no change in the number of ports on the Missouri during the 1980s. In 1989, ports on the Missouri handled 290,000 tons of goods leaving or bound for Iowa.

In 1979, these commodities were largely transported by truck, which accounted for 75 percent of the total tonnage. Five percent moved by rail and the balance (primarily coal) was consumed at the terminals. By 1989, 87 percent of all goods moved by truck, 5 percent by rail, and only 8 percent was consumed at the terminals.

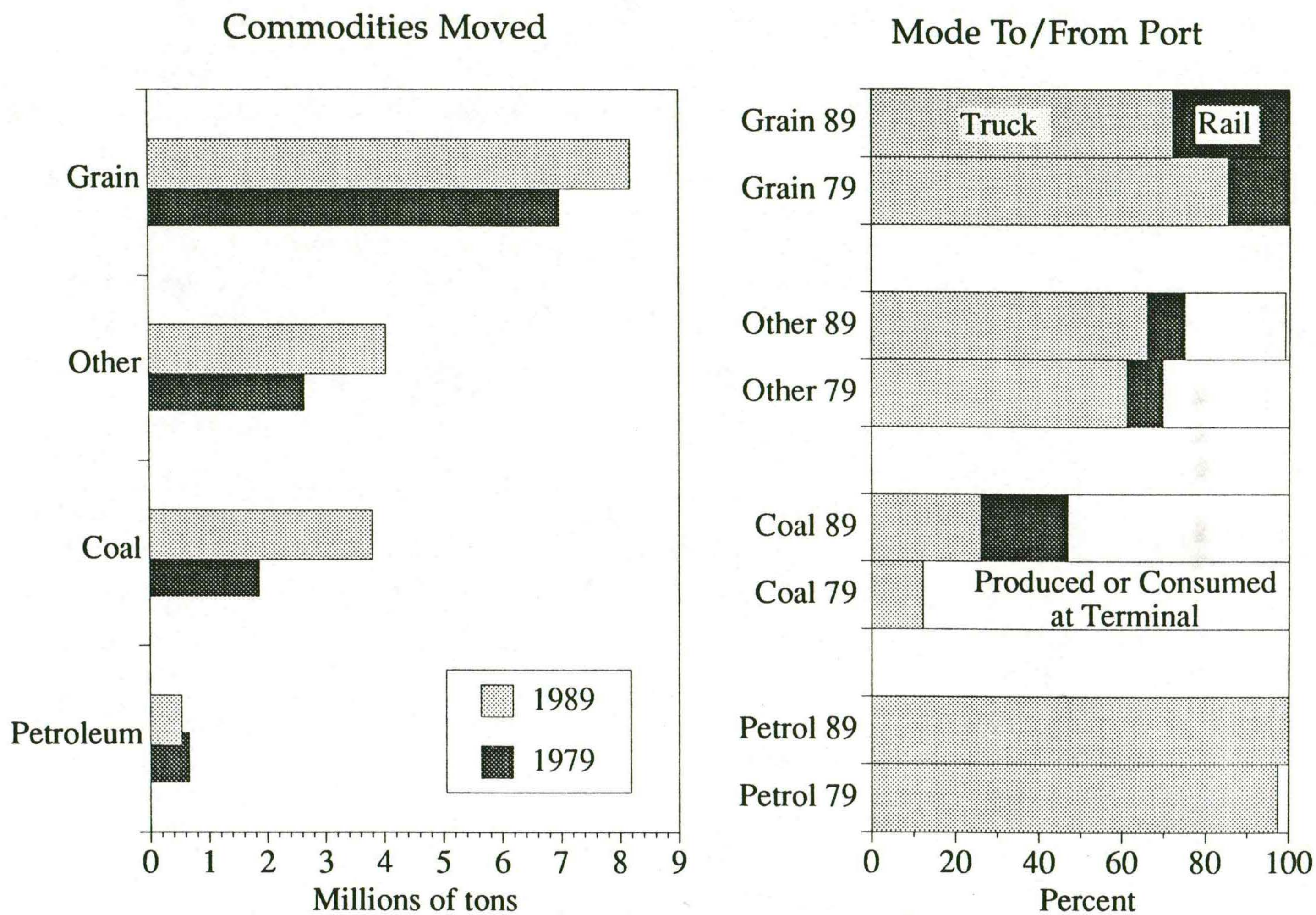

Figure 4-1. Commodities Moved Through Iowa Barge Ports on the Mississippi, 1979 & 1989, By Type and Distribution of Mode Used to Transport To and From Port

Total River Traffic

The total amount of barge traffic using ports on the Mississippi, whether in Iowa or Illinois, Wisconsin or Missouri, increased substantially from 1979 to 1989. Barge shipments grew by 88 percent in these years in the Rock Island District of the river, from 22.8 million tons in 1979 to 42.6 million tons in 1989. The Rock Island District covers the Mississippi River from Guttenberg, Iowa (Lock and Dam 10), to Saverton, Missouri (Lock and Dam 22), and contains most of Iowa's ports. It excludes four of Iowa's ports in Lansing, McGregor, and Clayton.

Since 1985, commercial barge traffic in the Rock Island District has increased by 25 percent. Figure 4-2 shows the composition of commodities passing through ports in the Rock Island District. The amount of grain shipped has grown dramatically since 1970 and is now more than 150 percent higher. Shipments of coal have doubled since 1970. Iowa terminals have, over this period, handled about one third of the Rock Island District's total commercial barge traffic.

Commercial barge traffic on the Missouri River fluctuated between 466,000 and 288,000 tons from 1979 to 1989. During dry years in 1988 and 1989, water availability on the Missouri shortened the navigational season, forced barges to carry lighter loads, and increased average travel times.

Our analysis of barge transportation suggests that, given the growth in tons shipped, this mode of transportation is an important contributor to Iowa's competitiveness as a grain-producing state. It is yet to become a common mode of choice for industrial products.

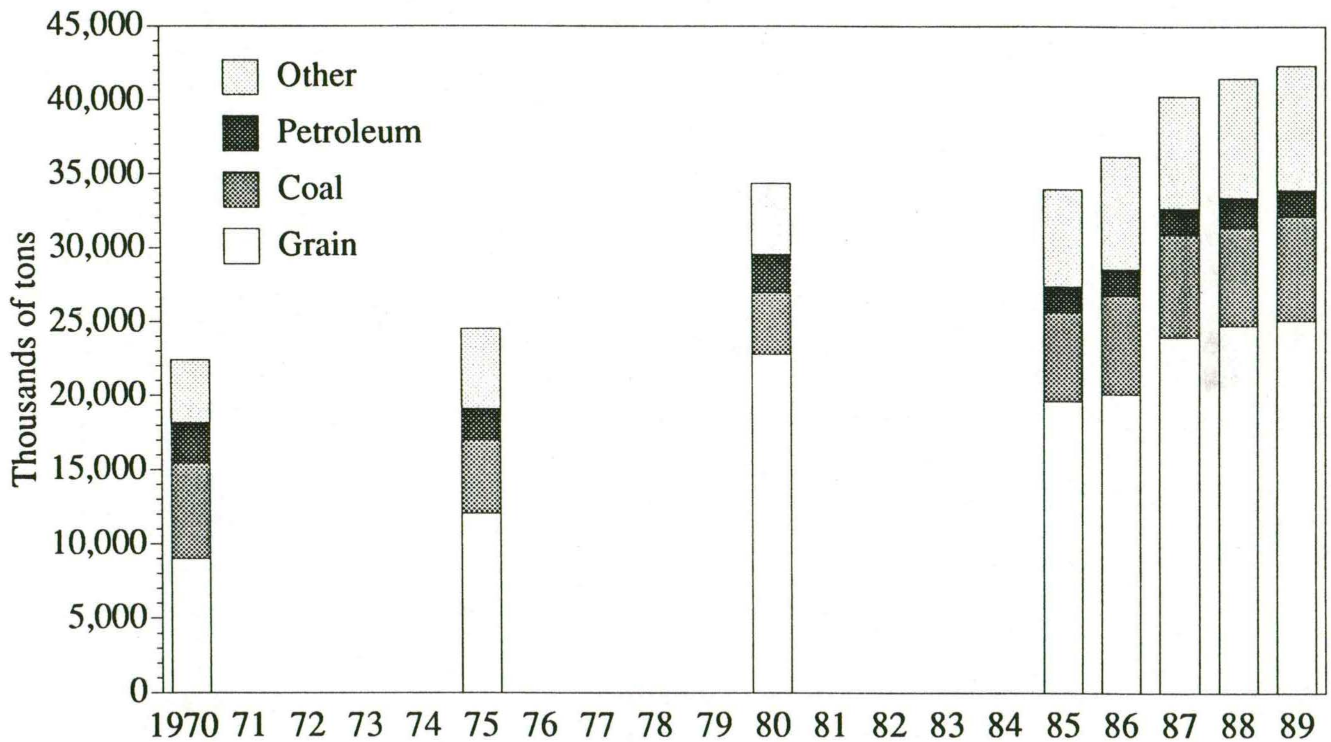

Figure 4-2. Total Barge Shipments Through Ports in the Rock Island District on the Mississippi River, 1970-89
(thousands of tons)

SECTION 5
AIR TRANSPORTATION

An important factor in a state's ability to attract and retain economic activity is the quality of air transportation to its communities. There are two components to air transportation: passenger service and air freight. Data on the latter component are difficult to gather; we do know that high quality overnight delivery service is available to most locations in Iowa, and regional airports are able to serve longer, bulkier shipments that require cargo aircraft.

The emphasis here is on air passenger service. We initially review changes in the regulatory environment that have had a significant effect on service levels and cost in Iowa. Then we examine changes in enplanements at airports within the state.

Airline Deregulation

The Airline Deregulation Act of 1978 eliminated the Civil Aeronautics Board's authority over the routes airlines could serve, as well as its control over air fares. Since December 31, 1981, individual airlines have been largely free to deliver or not deliver service to any location and to charge fares as they see fit. While carriers can suspend service to a given location, the Act introduced the Essential Air Service program which guaranteed that small communities having regulated service prior to deregulation would continue to be served for at least ten years. The program was funded at about $25 million per year nationally. Carriers can still terminate or decrease service but must file notice with the Department of Transportation and with the appropriate state and community agencies involved. If alternative carriers cannot be found, the airline can be subsidized to the extent of actual financial loss, and some subsidies are now available to provide an incentive for carriers to provide service on non-profitable routes.

Overall, deregulation has probably led to a modest but significant improvement in air service to small communities. Before deregulation, many small markets were served by relatively large jet aircraft which made multi-stop journeys to larger cities (Bailey, Graham, and Kaplan, 1985, Chapter 6). With deregulation, commuter airlines have been able to substitute smaller propeller-driven aircraft for jet service and increase departure frequencies from small airports. Moreover, by concentrating on non-stop or single-stop service to nearby hub airports, travel time has decreased in many instances. The result has been significant growth in the total market to many small communities. The total number of passengers carried by regional and commuter airlines (those flying planes with fewer than 60 seats) increased from 12.9 million in 1980 to an estimated 27.2 million in 1987, an increase of 111 percent (FAA, 1988). Although some of this increase simply reflects situations where major carriers dropped service and commuters replaced them, the overall commuter market has still shown impressive growth. By contrast, the number of domestic passengers carried by the large trunk airlines increased by only 49 percent over the same period.

Although the overall effect of deregulation has been positive for small communities, there have been winners and losers. Approximately 140 communities have lost all air service (U.S. Congress, 1987, p. 62). However, almost all of this lost service was unregulated before deregulation, so the airlines serving these communities could have stopped service at any time (Morrison and Wilson, 1986, p. 49). Only those places served by regulated carriers were guaranteed continued service by Congress. Thus, the public policy issue of how to respond to a complete loss of scheduled air service is one that would have been faced today even if deregulation had not taken place.

A number of communities now have fewer departures per day than before deregulation. Deregulation has been largely responsible for this change as airlines have been free to reassign their equipment across their entire route network. Moreover, many small communities believe that the replacement of jet service by propeller-driven aircraft has reduced the quality of air service significantly, even if the number of daily flights has increased. These reductions in service to some communities have been matched by increased frequencies from other small communities; overall, aircraft departures from small communities increased by nine percent from 1978 to 1984 (Meyer and Oster, 1987, p. 43).

The effect of deregulation on air fares has varied greatly. In general, overall fares paid are lower in real terms than before deregulation, but the benefits have varied greatly. At one extreme, business travelers who wish to retain flexibility in their travel plans pay close to the same real fare as before deregulation. At the other extreme, leisure travelers who can stay over weekends and book in advance have benefited greatly, especially when travelling between major cities. By 1983, over 60 percent of all passengers received discounts of up to 40 percent or more from full Coach fares (Meyer and Oster, 1987, pp. 113–116).

Travelers from small communities have benefited less from lower fares available under deregulation (Murphy and Watkins, 1986). A smaller proportion of travelers on commuter airlines than on larger carriers used discount fares in the early years of deregulation. On some routes to small communities, fares have increased in real terms, although this may reflect a higher proportion of business travelers in those markets. Thus, the effect of these changes in air service to small communities on their potential for economic development is uncertain. For those communities that have retained or increased service, regular flights to a nearby hub airport provide a level of service that is probably no less attractive, overall, than existed before deregulation. On the other hand the hub-and-spoke service configuration that has emerged under airline deregulation has made flying to and from smaller communities relatively less convenient than is the case with larger cities.

One issue that may become increasingly important in the future is whether commuter airlines can maintain access to large airports, especially during peak hours. Given the shortage of capacity at some major airports, authorities may seek to reduce the number of commuter flights during these periods. Since business travelers wish to fly at precisely these times, small communities may experience a loss in service.

A small number of communities may have faced difficulties because scheduled air service has been uncertain, rather than withdrawn completely. As carriers withdraw and add routes, some cities may have experienced periods without service. The uncertainty generated cannot help efforts to attract investment to the area. How widespread this problem is remains unclear, although it may greatly reduce the attractiveness of the cities affected to outside investors while the uncertainty persists.

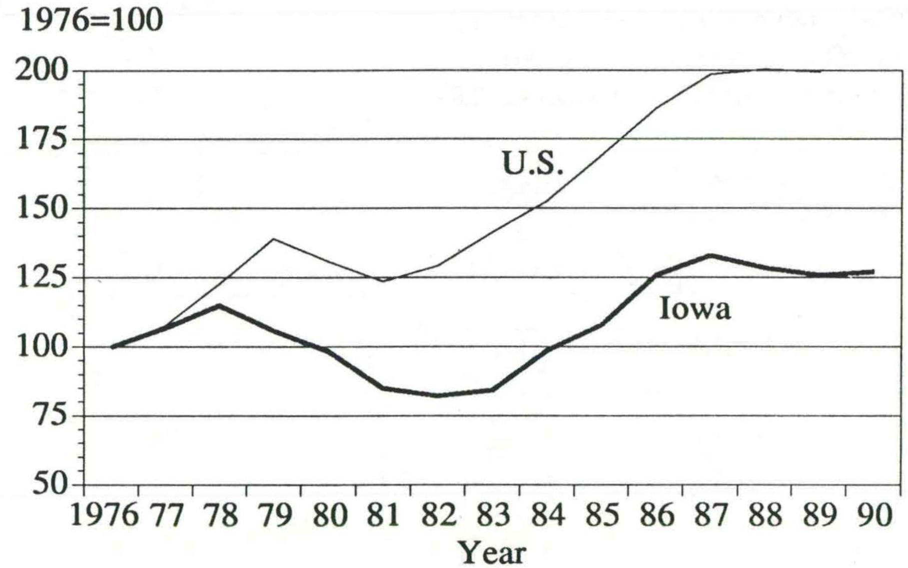

Figure 5-1. Trends in Passenger Enplanements in Iowa and U.S., 1976-1990

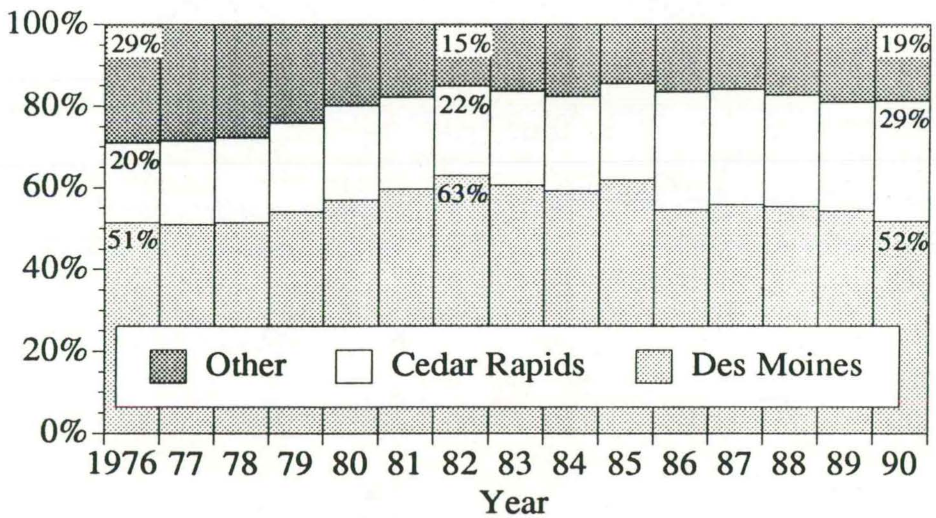

Figure 5-2. Distribution of Enplanements in Iowa, By Selected Airport, 1976-1990

Airline Service in Iowa

Passenger travel by air from Iowa in the 1980s was significantly affected by the recession in the early half of the decade. Figure 5-1 shows how the number of enplanements changed in Iowa compared to the nation as a whole from 1976 to 1990. Nationally, the recession in 1980 and 1981 led traffic to fall but it soon recovered. In Iowa the downturn was both more pronounced and longer. It was not until 1986 that enplanements in Iowa reached the level they had been in 1978, before the recession.

These years were also the first years of airline deregulation so traffic was also affected by this change. Figure 5-2 shows how the market share of airports in Iowa changed over the decade. It should be noted that these figures cover airports in Iowa offering scheduled service—those in neighboring states such as Omaha, which serve Iowa passengers, are not included. Des Moines increased its share of the market from 1976 to 1982 to 63 percent, a fifth higher than the mid-1970s, at the expense of the eight other scheduled airports. From 1982 on, this pattern reversed somewhat. Both Cedar Rapids and the smaller airports increased their market share, with Des Moines falling back to about half of all enplanements by 1990. Cedar Rapids' growth has been particularly sharp, up by almost one-third since the early 1980s.

Figure 5-3 shows this regional pattern of enplanements in more detail. The circles represent the number of enplanements in 1990. Des Moines and Cedar Rapids dominate scheduled services. The other airports are important for the areas they serve. Moreover, the change in enplanements since 1980s suggests that their roles continue to be significant. For example, Dubuque, Sioux City, Fort

Dodge, Mason City, and Spencer have all increased enplanements by between 19 percent and 2,566 percent (Spencer, from a very low base). The airports with falling enplanements over the decade: Waterloo, Ottumwa and Burlington, serve areas particularly hard hit by the recession or lost a major part of their flights due to the relative proximity to major airports.

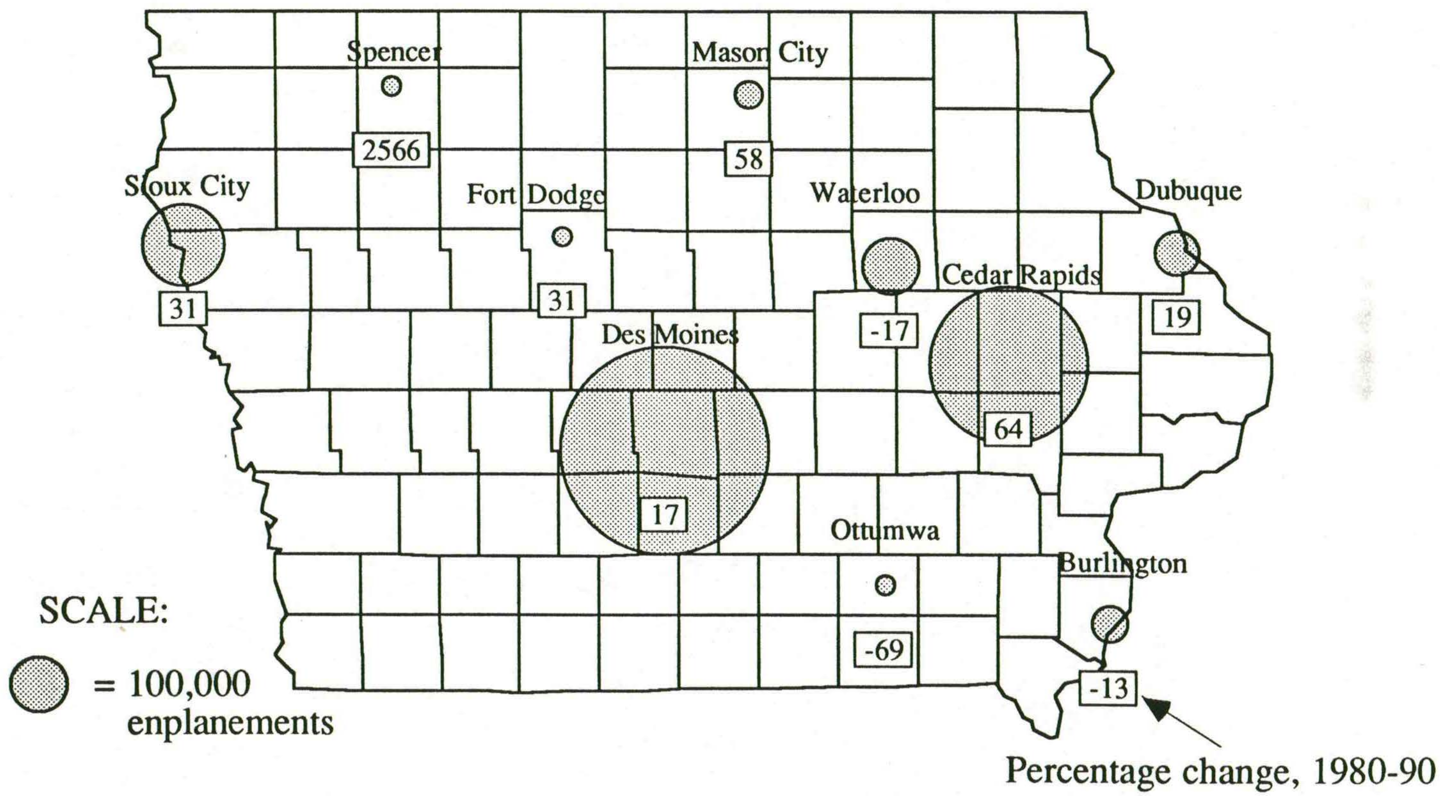

Figure 5-3. Passenger Enplanements at Iowa's Largest Airports, 1990

Likely Future Service Levels

In the current deregulated operating environment, the level of airline service in a given area tends to be closely tied to demand. Demand, in turn, is inextricably tied to the level of economic activity within the area, as well as personal income levels. As Iowa recovered from the severe recession of the early 1980s enplanements increased, not only in Des Moines and Cedar Rapids, but also in other locations. Future demand levels at the various airports in Iowa will depend on economic circumstances in their service areas and on how competitive fares will be compared to alternative airports.

We observed that since the airline industry was deregulated, real fares often have fallen for discretionary travelers. We also noted that fares have tended to fall significantly more in larger, more competitive markets. The net effect has been that at smaller airports in Iowa, fares tend to be appreciably higher than at the airports in Des Moines and Cedar Rapids. An incentive exists for travelers to drive several hours to one of these airports to board a flight. The greater the extent to which this occurs, the more competitive leading airports will become. This reasoning portends increasing domination by the state's larger airports.

Other airports enplanement levels generally will be dependent on their ability to attract and retain good quality regional carriers. While these carriers usually will not offer jet service, they well may enable easy movement to a regional hub (e.g., Chicago, St. Louis, Kansas City, or Minneapolis). The key is that sufficient demand must exist in the area to support the service. A sort of chicken-and-egg phenomenon thus will exist: communities' growth will be fostered by good air service, but good air service requires sufficient demand to make it viable.

SECTION 6
FREIGHT SHIPMENT PRACTICES

Earlier sections have examined, among other topics, Iowa's road system and the nature of rail service in the state. We now focus on how manufacturing freight is transported into and from Iowa. To understand the roles trucking and rail currently are playing in freight movements, it is useful to consider the changed regulatory environment in which the two modes operate. Over the past decade, both trucking and rail have been deregulated. One consequence of deregulation is that less information must be provided to governmental agencies than was previously the case. Thus, fewer data are available about the kinds and amounts of goods that are shipped, as well as the geography of these shipments. National data are still gathered, but information at the state or regional levels has become sketchy. Moreover, severe problems exist when examining trends in total freight movements, regardless of mode, because few sources gather data across transportation modes.

Deregulation of Freight Carriers

Congress and recent administrations have significantly deregulated various transportation modes since 1980. Earlier, we discussed airline deregulation and its impacts on service availability and cost. Trucking and rail deregulation also have had profound effects on freight service in Iowa.

Trucking Deregulation

The Motor Carrier Act of 1980 was passed into law to create a more competitive environment for the U.S. trucking industry. Barriers to entry and exit were almost completely removed, rate-making policies became less restrictive, and trucking companies were allowed to transport a wide range of products. Deregulation also has greatly eased route restrictions which, in turn, have caused shipping rates to fall dramatically. It also has allowed private carriers (i.e., businesses that operate trucks to distribute their products) to transport other freight.

Iowa has benefited from trucking deregulation. Easier entry into the industry has led to a large increase in the number of trucking companies, especially small firms serving localized markets. Nationally, the number of trucking companies increased from 18,000 in 1980 to over 30,000 in 1984 (Interstate Commerce Commission, 1980, 1984). The advent of trucking brokerage firms has enabled small carriers to enjoy coordination and networking benefits previously provided by and for large companies. The result has been much more competitive rates for smaller communities and rural areas. Furthermore, businesses in small communities no longer need to be locked into long-term arrangements with specific carriers. The net effect has been a better value for shippers on the basis of both price and service quality.

From the perspective of trucking companies, greater freedom in responding to market realities has allowed more rational practices. Avoiding unnecessary trips, following more efficient routes, and experiencing generally lower operating costs have made it feasible to reduce rates. With trucking becoming a more competitive industry, much of the cost savings are being passed on to shippers.

It is the case that the shippers who have gained the most from deregulation are those shipping the largest volumes. These shippers are able to obtain discounted rates (not possible before deregulation), giving them a competitive advantage over smaller shippers. Similarly, larger manufacturers are able to use their private fleets and intercorporate and for-hire carriers to increase their revenue.

Rail Deregulation

Out of concern regarding the financial and physical condition of the rail industry, Congress passed legislation that substantially deregulated this industry. The Staggers Rail Act of 1980 gave railroads the ability to set rates on the basis of competition, demand, and operating costs. Rail companies now have freedom to establish rates based on market conditions and to enter into private confidential contracts with shippers. It also became easier to abandon or sell off unprofitable lines.

On balance, costs to shippers for rail delivery have declined during the deregulated period. These cost reductions are due in part to the ability of rail companies to carry more tonnage per car and to increase the number of fully loaded cars. The abandonment of certain unprofitable lines also has contributed to lower costs. Railroads no longer are required to subsidize expensive short-haul lines with revenues from more lucrative long-haul operations. In general, these changes have led to a higher level of profitability for rail companies.

Implications for rural areas and smaller communities of rail deregulation have not always been positive. Service to many locations has been discontinued as branch lines have been abandoned. In the 20 years before the Staggers Act in 1980, an average of 1,574 miles of track was abandoned by major railroads each year. After the Staggers Act, abandonments increased to 3,766 miles per year between 1980 and 1985. However, new short-line rail companies have taken up an increasing number of miles of track formerly operated by major railroads. These short-line companies added on net 3,151 miles in 1986 and 6,557 in 1987.

It is difficult to be precise about the overall effect of changes in the rail industry since 1980 on rates and service levels in Iowa. Where short-line railroads replaced major rail companies, most shippers seem to be satisfied with both the service offered and the rates charged (Federal Railroad Administration/Interstate Commerce Commission, 1989).

With respect to grain transportation, greater efficiency has become possible since deregulation. Shippers now use three, five, or 12 car shipments and unit trains for larger movements. Unit trains—with 60 or 120 cars—are easier to classify and organize, so they have lower switching and processing costs per ton-mile. The net result is lower costs for the rail company which can be passed on to the shipper as lower rates in a competitive marketplace. The increased role of larger grain shipments by rail is evidenced by the fact that while over 30 percent of the corn shipped in the U.S. was carried in single-car shipments, by 1985 the proportion had dropped to 11 percent (MacDonald, 1989).

Current Shipping Practices in Iowa

As noted earlier, under deregulation the reporting requirements of either trucking or rail companies is far less than was the case previously. There now are few reliable data sources on the number of ton-miles of different types of goods transported between an origin-destination pair. The data that do exist tend to be drawn from very small samples, making their reliability questionable. We contrasted data from several available sources and often found rather sizable inconsistencies.

Given data reliability problems we are able to present only aggregate measures of manufacturing freight. The American Trucking Association (ATA) Foundation publishes estimates of total manufactured freight movements into and out of Iowa, by mode. These estimates are shown in Figure 6-1 for 1982, 1987, and 1989, the most recent year available. Total outbound shipments were estimated to be about 52 million tons in 1989, of which trucking accounted for about three-quarters of the total. Trucking is itself divided into for-hire and private trucking—firms moving their own goods—whose shares were roughly equal in 1989. Inbound shipments in 1989 totalled about 42 million tons, with trucks carrying over 80 percent.

One trend that appears significant is that for-hire trucking has gained market share from private trucking. The size of this change is uncertain but appears to be about ten percent of the total manufactured freight. Thus, for-hire trucking carried about 33 percent of all manufactured freight in 1989, versus 24 percent in 1982. Private trucking has fallen in 1989 to 44 percent of outbound freight and 49 percent of inbound, both about ten percent lower than 1982. These trends are consistent with what is occuring across the nation. While deregulation granted significant operating freedoms to make private carriage more efficient, for-hire service and rate levels have improved dramatically as well. More and more shippers are deciding to get out of the transportation business and employ for-hire trucking firms. Private carriers still play a very prominent role in trucking, however.

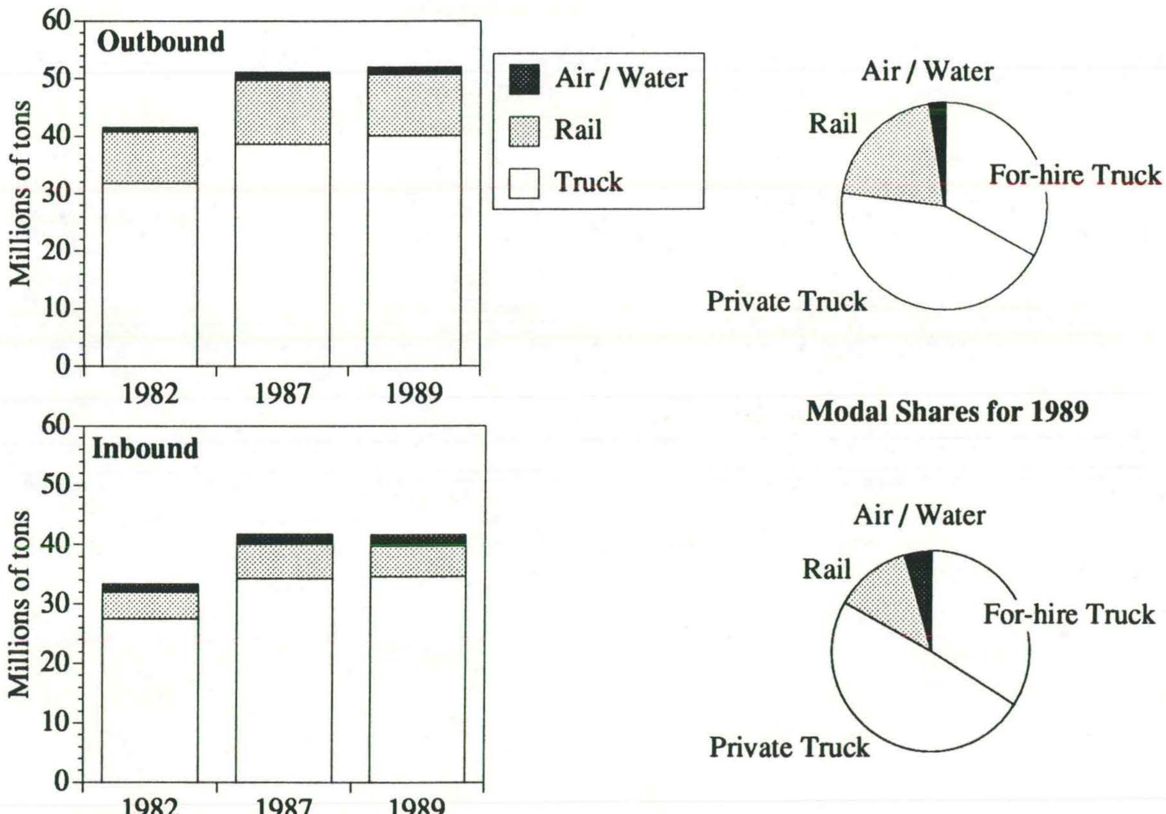

Figure 6-1. Outbound and Inbound Manufacturing Freight for Iowa, 1982, 1987 and 1989, By Mode
Source: ATA Foundation

SECTION 7
SUMMARY ASSESSMENT

This report has presented data on how Iowa's transportation systems are performing, including whether the cost of transportation in Iowa is in line with costs in other Midwestern states. We also have examined how important several modes are to Iowa's economic growth and development. The changing environment in which these transportation modes operate and their prospects for the future also have been assessed.

Following is a brief summary of our conclusions drawn from the analysis of Iowa's transportation systems.

Demographic and Economic Trends

- Population growth in and around metropolitan areas stand in contrast with reductions in many rural areas. It is likely that additional transportation facilities will be needed in metropolitan areas.

- Manufacturing employment has steadily decreased over the past quarter century. The greatest losses have occurred in metropolitan areas, particularly Waterloo, the Quad Cities, and Cedar Rapids. Increases in manufacturing employment have taken place in a number of rural counties. Quite likely, workers in these rural plants commute from rather diverse locations.

- The highest per capita income levels in Iowa are found in the metropolitan areas of central and eastern Iowa and in central Iowa generally. There is not a strong relationship between a county's per capita income and per capita vehicle ownership. Lower income rural areas of Iowa often exhibit the greatest vehicle ownership rates.

Roads and Highways

- Iowa has the third highest number of miles of rural roads per rural square mile in the Midwest; both states with a higher ratio have considerably greater rural population densities, however.

- Vehicular traffic on Iowa's rural roads is quite concentrated on Interstate and other major highways. The most productive ten percent of the state's rural highways carry 45 percent of all vehicle miles of travel (VMT). Interstates and arterials are, on a weighted average basis, about 20 times more productive than the rest of the road system. This degree of traffic concentration is typical of Midwestern states.

- Pavement conditions on Iowa's rural highways generally compare favorably with those of other Midwestern states. In Iowa, a smaller proportion of the rural highways are in excellent condition than is true of most other states in the region, but it also is the case that a relatively small fraction of the state's rural highways are in bad condition.

- The relative absence of traffic congestion is a significant advantage for Iowa. The state has about a quarter the level of congestion on its urban Interstate highways as is the norm among Midwestern states. Because congestion significantly increases transportation costs for both people and goods, this is an important point in Iowa's favor.

- Compared with other Midwestern states, a relatively high fraction of Iowa's revenue for roads and highways comes from user taxes. This generally is good because it implies that "pay as you go" financing is prevalent. The state's motor fuel tax rate is close to the regional average, but its vehicle registration fee schedule is second highest. Iowa is one of few states nationally that places the revenue from its vehicle use (sales) tax in the Road Use Tax Fund (RUTF).

- Iowa's expenditure patterns on its roads closely mirrors those of other Midwestern states. About 80 percent of its revenue is spent on capital improvements and maintenance. The spending per mile on the state highway system is third highest. Given that this part of the road network is by far the most productive, the practice of making it a priority is appropriate. Compared with state highways, a larger fraction of expenditures on county roads in Iowa is devoted to maintenance.

- According to a needs analysis by the Iowa DOT, it would cost $27 billion to remove all deficiencies from highways and roads within the state. This estimate is based on bringing roads and bridges up to a standard based on usage patterns and design considerations. Twenty-three percent of the primary road system is below the "tolerable" standard. It is the case, however, that very few of the more heavily-traveled portions of the primary system are below this standard.

Rail Traffic

- Iowa's rail network has shrunk considerably over the years, but it remains a vital transportation service. Its most heavy usage is in transporting farm products out of Iowa and coal into the state. Very few manufactured goods leave the state by rail.

- A recent analysis of rail traffic in Iowa has concluded that moving agricultural products from terminals to river transshipment points is the primary role of rail service. Class 1 (large) rail companies handle most of Iowa's rail traffic, but smaller operations are gaining in market share.

Barge Traffic

- The amount of freight moved through Iowa's barge ports on the Mississippi River has increased sharply in recent years. The number of river terminals is growing, as well. By far the largest proportion of goods shipped by barge is grain.

- A slightly lower percentage of grain shipped by barge arrived at the terminal via truck than was true a decade ago. Still, about 80 percent of the grain arrives at river ports by truck. Most coal arriving by barge is consumed at the point of arrival, typically a power-generating plant.

Air Transportation

- Airline deregulation has had a significant effect on air service in Iowa. Improved service is found in growing areas, while communities with limited demand for air travel have experienced reductions in service. Furthermore, competitive airfares at airports with higher traffic have created an incentive for travelers to drive several hours to these airports.

- Perhaps the key issue in terms of quality air service in Iowa in future years will be the availability of gate space at major regional hub airports. Gate availability will be a determining factor in how many flights can be accommodated each day.

Freight Shipment Practices

- Deregulation of railroads and trucking companies in the early 1980s has contributed to improved service and lower transportation costs. Generally, these cost reductions have benefited Iowa because the state is relatively transportation dependent. Small communities, however, have generally fared less well than larger metropolitan areas. This is because higher volume shippers are able to negotiate more competitive rates.

- In Iowa today, trucking is by far the dominant mode of transportation for both outbound and inbound shipments. For-hire trucking has grown at the expense of private trucking.

Final Observations

The analyses contained in this report lead to the general conclusion that Iowa is well served by its several modes of transportation. Private sector providers of freight and passenger transportation respond to market signals, meaning that indications of economic growth within the state will tend to result in more and better service. The public sector provides the state's largest transportation facility, the 112,448-mile rural road network. Maintaining and improving this network, and financing it adequately and fairly, is an important challenge facing the governmental sector.

Adjusting creatively to external forces, like federal policy, changing technology, and shifting market conditions, is crucial if transportation is to be a positive force in Iowa's economic development. Later reports in this continuing research project will address public policies intended to make transportation in Iowa best able to help foster a strong economic future for the state.

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