# Performance Measures for Iowa Transportation Systems

## Interim Report
## February 2006

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**Technical Report Documentation Page**

| 1. Report No.<br>CTRE Project 03-140 | 2. Government Accession No. | 3. Recipient's Catalog No. | |
|---|---|---|---|
| 4. Title and Subtitle<br>Performance Measures for Iowa Transportation Systems | | 5. Report Date<br>February 2006 | |
| | | 6. Performing Organization Code | |
| 7. Author<br>David Plazak | | 8. Performing Organization Report No.<br>CTRE Project 03-140 | |
| 9. Performing Organization Name and Address<br>Center for Transportation Research and Education<br>Iowa State University<br>2901 South Loop Drive, Suite 3100<br>Ames, IA 50010-8634 | | 10. Work Unit No. (TRAIS) | |
| | | 11. Contract or Grant No. | |
| 12. Sponsoring Organization Name and Address<br>Iowa Department of Transportation<br>800 Lincoln Way<br>Ames, IA 50010 | | 13. Type of Report and Period Covered<br>Interim Report | |
| | | 14. Sponsoring Agency Code | |
| 15. Supplementary Notes<br>Visit www.ctre.iastate.edu for color PDF files of this and other research reports. | | | |


**16. Abstract**

The purpose of performance measures in planning operations is to identify and track meaningful, quantifiable measures that reflect progress toward the goals of the plan. The Iowa Department of Transportation (DOT) has already adopted performance measures in a number of operational areas, including highway maintenance, highway safety, public transportation, and aeronautics.

This report is an initial effort to utilize performance measures for transportation system planning. The selected measures provide a cross-section of system performance indicators across three selected transportation planning goals (safety, efficiency, and quality of life) and five transportation modes (highways/bridges, public transit, railroads, aviation, and pedestrian/bicycle). These performance measures are exploratory in nature, and constitute a first attempt to apply performance measures in the context of a statewide, multimodal transportation plan from the Iowa DOT. As such, the set of performance measures that the Iowa DOT uses for planning will change over time as more is learned about the application of such measures.

The performance measures explained in this document were developed through consultation with Iowa DOT modal staff (aviation, railroads, highways, public transportation, and pedestrian/bicycle) and the Office of Traffic and Safety. In addition, faculty and staff at the Iowa State University Center for Transportation Research and Education were consulted about performance measurement and data within their areas of expertise.


| 17. Key Words<br>efficiency—Iowa transportation systems—performance measures—quality of life—safety | | 18. Distribution Statement<br>No restrictions. | |
|---|---|---|---|
| 19. Security Classification (of this report)<br>Unclassified. | 20. Security Classification (of this page)<br>Unclassified. | 21. No. of Pages<br>56 | 22. Price<br>NA |

**Form DOT F 1700.7 (8-72)** **Reproduction of completed page authorized**

# PERFORMANCE MEASURES FOR IOWA TRANSPORTATION SYSTEMS

**Interim Report**
**February 2006**

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Preparation of this report was financed in part
through funds provided by the Iowa Department of Transportation
through its research management agreement with the
Center for Transportation Research and Education,
CTRE Project 03-140.

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**ACKNOWLEDGMENTS**

The authors would like to thank the Iowa Department of Transportation and the Midwest Transportation Consortium for sponsoring this research.

## OVERVIEW OF SYSTEM PERFORMANCE MEASURES

System performance measures are one way to measure the progress being made toward implementing a transportation plan. The purpose of using performance measures for planning is to identify and track meaningful, quantifiable measures that reflect progress toward the goals of the plan. In other words, if improving transportation safety is a goal of the plan, it makes sense to track fatalities, injuries, and other impacts of transportation crashes over time to determine whether improvements are being made.

The Iowa Department of Transportation (Iowa DOT) has already adopted performance measures in a number of operational areas, including highway maintenance, highway safety, public transportation, and aeronautics. The update to the plan in this report represents an initial effort to utilize performance measures for transportation system planning. The measures selected provide a cross-section of system performance indicators across three selected transportation planning goals (safety, efficiency, and quality of life) and various transportation modes.

The performance measures presented in this plan update are intended to be planning tools. They should not be viewed as "written in stone." Some of the performance measures presented in this report require additional data collection and development to be used. Others may need to be modified or replaced as experience dictates. New performance measures may also be added as the plan is updated, and system performance measures will change as learning occurs.

In this report, draft system performance measures are presented according to three plan themes: safety, efficiency, and quality of life. Measures exist for each transportation mode (highways/bridges, public transit, railroads, aviation, and pedestrian/bike). These performance measures are exploratory in nature, and constitute a first attempt to apply performance measures in the context of a statewide, multimodal transportation plan from the Iowa DOT. As such, the set of performance measures that the Iowa DOT uses for planning will change over time as more is learned about the application of such measures.

### Process of Developing System Performance Measures

The performance measures explained in this document were developed through consultation with Iowa DOT modal staff (aviation, railroads, highways, public transportation, and pedestrian/bicycle) and the Office of Traffic and Safety. In addition, faculty and staff at the Iowa State University Center for Transportation Research and Education (CTRE) were consulted about performance measurement and data within their areas of expertise.

### Highlights of System Performance Measures

As noted above, the system performance measures developed for this document are grouped into three categories. These categories (safety, efficiency, and quality of life) correspond to the underlying goals of the statewide transportation plan. The contents of each category are briefly summarized below.

*Safety*

The system performance measures for safety paint a very positive picture overall. Highway safety trends, which have the largest impact on overall safety in Iowa, are uniformly moving in a positive direction. Railroad safety performance measures are also improving. Indicators for the other modes are stable; however, these other modes are already relatively safe, so significant improvements are more difficult.

*Efficiency*

The system performance measures for efficiency depict a transportation system being maintained at a constant level of performance. Pavements and bridges are in relatively good condition. Public transit vehicles are being replaced on a normal schedule, with the possible exception of rural transit vehicles, which are, on average, older than desirable. Railroads are seeing relatively constant revenue per ton-mile, but are also having difficulty maintaining a satisfactory return on investment. This should be a serious concern, because it seems that the current Iowa rail system cannot be sustained. The Iowa recreational trails system is rapidly being expanded, though data are lacking that would reliably assess performance for this mode.

*Quality of Life*

Quality of life system performance measures are showing positive trends in some areas and are lacking in others. Highway fuel use is moving in a positive direction. Public transit systems serve Iowa relatively well, but may not be keeping up with the pace of suburbanization. Railroad infrastructure is in good condition overall, though new, heavier equipment will require the upgrading of a large number of track miles. Inadequate data exists to evaluate pedestrian and bicycle transportation effectively in terms of their impact on the quality of life.

Table 1 summarizes the system-wide performance measures selected for this report.

## Table 1. Summary of System Performance Measures

| Perf. goal | Mode | | | | |
|---|---|---|---|---|---|
| | **Aviation** | **Highways/bridges** | **Pedestrian/bike** | **Public transit** | **Railroads** |
| **Safety** | 1. Percent of airports with clear landing zones | 1.Overall crash rate | 1. Bicycle and pedestrian fatalities and injuries | 1. Percent of public transit fleet with two-way communications on board | 1. Total crashes at rail highway crossings |
| | 2. Number of runway incursions at towered airports | 2. Fatal and injury crash rate | | 2. Public transit crash rate per vehicle-mile | 2. Derailments per million ton-miles |
| | 3. Number of accidents and fatalities | 3. Crash rate for large trucks (combination vehicle) | | | |
| **Efficiency** | 1. Airports with a PCI value of 70 percent or above on their paved runways | 1. Percent of pavements with good or excellent and poor ride quality | 1. Percentage of paved off-road trails | 1. Percent of public transit systems with in-house maintenance capabilities | 1. Average rail operating revenue per ton-mile |
| | 2. Percent of communities with a land use plan in place around their airport | 2. Percent of bridges functionally obsolete or structurally deficient | 2. Percentage of on-road trails that meet AASHTO standards | 2. Percentage of public transit fleet operating beyond their normal useful life | 2. Percentage of Iowa rail carriers that are earning a reasonable return on investment |
| | | | 3. Average age of off-road trails | | |
| **Quality of life** | 1. Population within a two-hour drive of commercial air service | 1. Percent of system operating at traffic LOS "C" or better (separate for urban and rural) | 1. Miles of off-road trails | 1. Population in communities with public transit services sufficient to support independent living and employment | 1. Percent of track-miles able to handle 286,000-pound cars |
| | 2. Percent of communities within 30 minutes of a general aviation or commercial service airport | 2. Approximate travel times to major external markets in the Midwest region | 2. Miles of highway routes rideable, based on bicycle level of service | 2. Total jobs within 1/4-mile of a fixed route transit system | 2. Percentage of track-miles able to operate at 30 miles per hour or more |
| | | | | | 3. Rail fuel use per ton-mile |

## KEY OBSERVATIONS ABOUT IOWA TRANSPORTATION SYSTEMS

The following observations about Iowa's present transportation systems, based on an analysis of system performance measures, are organized by the three planning themes.

### Safety

Positive trends or conditions

- Highway safety in Iowa has improved dramatically on a per-million-vehicle-mile-of-travel basis since the 1980s. Safety is still improving, but it can always be improved.
- Iowa's public transit systems have had a very good record of safety for their passengers.
- Rail safety in Iowa has improved dramatically, both in terms of derailments and rail/highway grade crossing crashes. Some of this improvement can be attributed to reduced numbers of low-traffic/low-speed track and crossings.
- The rate of bicycle and pedestrian fatalities and injuries in Iowa has been falling since the 1980s and is currently relatively low.

Moderately positive or stable trends or conditions

- About three-fourths of public transit vehicles in the Iowa fleet now have two-way communication systems. This is considered valuable for safety as well as efficiency.

### Efficiency

Positive trends or conditions

- The condition of Iowa's primary highways and bridges generally ranges from acceptable to good. The overall condition levels are stable.
- Most airport runways in Iowa are in good or excellent condition.

Moderately positive or stable trends or conditions

- Half of Iowa's public transportation vehicle fleet is operating within the generally accepted useful life for buses. Rural public transit vehicles are the primary concern; this fleet is relatively old.
- The average rail operating revenue to move a ton of freight one mile has been rather flat but increasing in the past three years.

Detrimental trends or poor conditions

- All large railroads that serve Iowa are earning a return on investment well below the level needed to recapitalize the investment made in track and equipment. Some smaller railroads in Iowa are earning a sufficient return while others are not.
- Most Iowa airports, both commercial and general aviation, do not have sufficient clear zones in place around them, and many do not have effective land use plans for their surrounding areas.

**Quality of Life**

Positive trends or conditions

- Railroads in Iowa are using considerably less fuel over time to move a ton of freight one mile.
- Almost the entire population of Iowa is within a two-hour drive of an airport with extensive commercial air service. Almost all Iowa communities are within a 30-minute drive of a high-quality general aviation airport.

Moderately positive or stable trends or conditions

- Average highway travel speeds between major cities in Iowa and major external markets in the Upper Midwest are almost all 60 to 70 miles per hour. The notable exception is for travel to and from Chicago, which is mainly attributable to low travel speeds on US Highway 20 between Dubuque, Iowa, and Rockford, Illinois.
- Many Iowa communities are served by either urban or rural public transportation systems. A high proportion of residences are served within one-fourth of a mile. However, Iowa jobs and shopping places are suburbanizing and decentralizing rapidly and are less well-served by public transportation than places of residence.

Detrimental trends or poor conditions

- About 22% of Iowa's current rail track miles are unable to handle the current car standard of 286,000 pounds; this track will need to be modernized if economically feasible. These same tracks often are operated at speeds below 30 miles per hour.
- Data on Iowa's trail system are in need of improvement to better assess the trail system's condition and usage.

**Detailed Performance Measure Information**

The following sections provide detailed information about each of the selected performance measures, including what the measures mean, why they are important to measure and track over time, the showings of recent data, the source of the data, and a graph or map visualizing the data. Graphs or maps were chosen depending on the nature of the data. Data with important spatial dimensions, for example those indicating travel times or access to service, are usually shown using maps.

## SAFETY PERFORMANCE MEASURES

### Overall Highway Crash Rate

*What this Performance Measure Means*

The overall crash rate is a measure of highway safety created by dividing the total number of crashes for automobiles in Iowa by the total amount of vehicle-miles traveled (VMT) within the state. A vehicle-mile is considered one vehicle traveling one mile.

*Why this Performance Measure is Important*

The overall crash rate measures the safety of driving on Iowa's roadways. As this rate falls, there is a smaller chance of being involved in an automobile accident within the state of Iowa.

*Recent Data and Interpretation*

A substantial downward trend is evident over the past two decades, as indicated in Figure 1 (Center for Transportation Research and Education, Iowa Traffic Safety Data Service). Other than a large drop in overall crash rate from 1996 to 1998, the trend has maintained an overall steadily descending progression. In 2003, there were over 31 billion VMT within the state, but the crash rate was only 1.88 crashes for every one million miles. This is just over half the rate in 1981, which was 3.65. This indicates a dramatic positive trend for highway safety in Iowa.

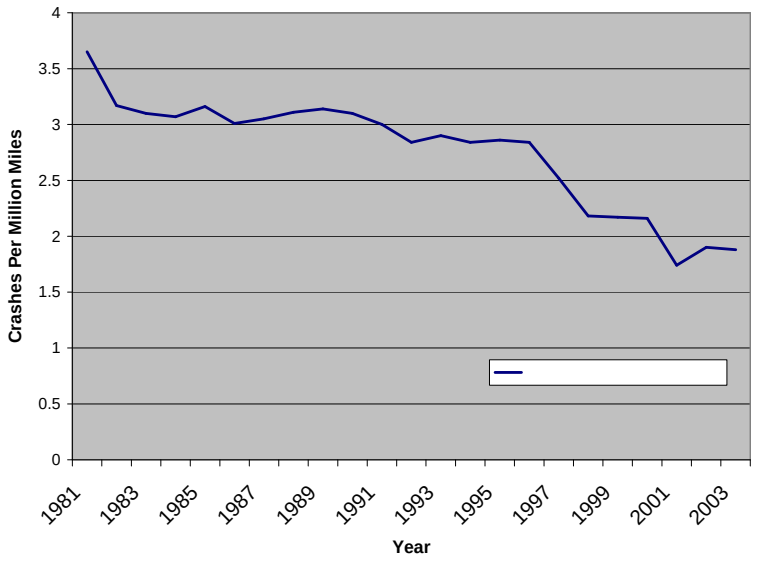


**Figure 1. Overall crash rate per million vehicle miles**

## Fatal and Injury Highway Crash Rate

*What this Performance Measure Means*

The fatal and injury crash rate measures highway safety and indicates the number of fatal and injury crashes for every one million VMT. This is found by totaling the number of crashes that involved a death or injury in a given calendar year and dividing that number by the number of million vehicle miles within the state.

*Why this Performance Measure is Important*

This rate illustrates the number of crashes in the state that involved either injuries or fatalities. Naturally, as this rate decreases it is safer to drive on Iowa's roadways, because there is a smaller chance of being involved in one of these crashes.

*Recent Data and Interpretation*

An overall downward trend can be seen in this rate over the past 22 years, as shown in Figure 2 (Iowa Department of Transportation, Motor Vehicle Division; Center for Transportation Research and Education, Iowa Traffic Safety Data Service). In 1981, the fatal and injury crash rate was the highest in these past two decades, and was nearly twice as high as in 2003. Interestingly, a second peak can be seen in 1995, when there were 1.0 fatal or injury crashes per million VMT. Since this peak in the mid-1990s, the rate has been falling drastically to its lowest point in 2003 of 0.56 fatal and injury crashes per million VMT, or one of these crashes per every 1.79 VMT.

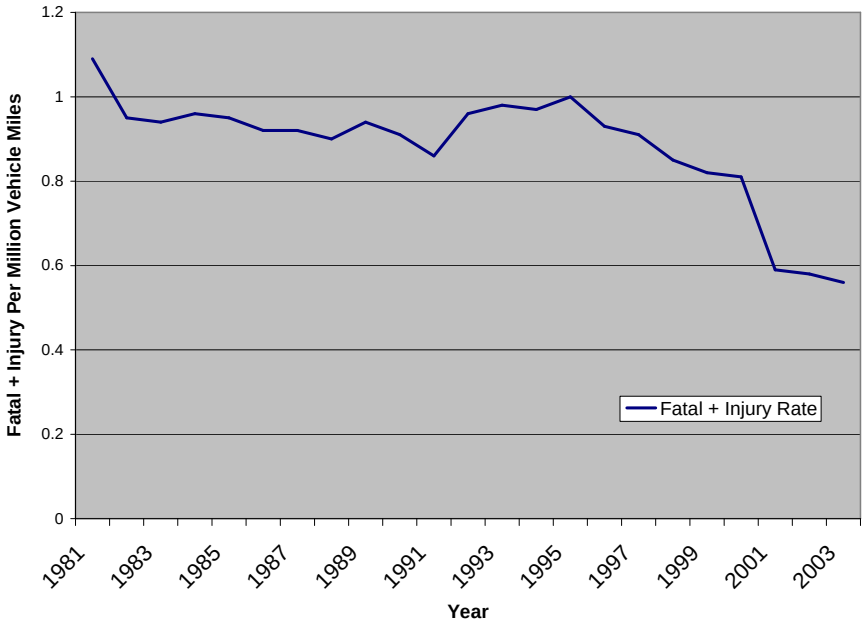


**Figure 2. Fatal and injury crash rate per million vehicle miles**

**Highway Crash Rate per Million Vehicle Miles for Large Trucks**

*What this Performance Measure Means*

Large trucks are those considered combination vehicles with four or more axles. The crash rate indicates the number of truck crashes for every million VMT by these trucks.

*Why this Performance Measure is Important*

The crash rate for large trucks measures the safety of driving on Iowa's roadways. A lower rate indicates a smaller chance of a large truck being involved in a crash within Iowa.

*Recent Data and Interpretation*

More than 10 years ago in 1993, the large truck crash rate reached its highest point for this period, 1.29 crashes for every million VMT, as shown in Figure 3 (Iowa Department of Transportation, Motor Vehicle Division; Center for Transportation Research and Education). Over this period, the rate has fallen dramatically while VMT has increased by nearly 50%. In 2001, when the rate was the lowest seen here, there were 2.674 billion VMT and only about two-thousand large truck crashes. In the last year recorded on this graph, the crash rate was 0.85 crashes per million VMT, which is the second lowest rate seen in this period.

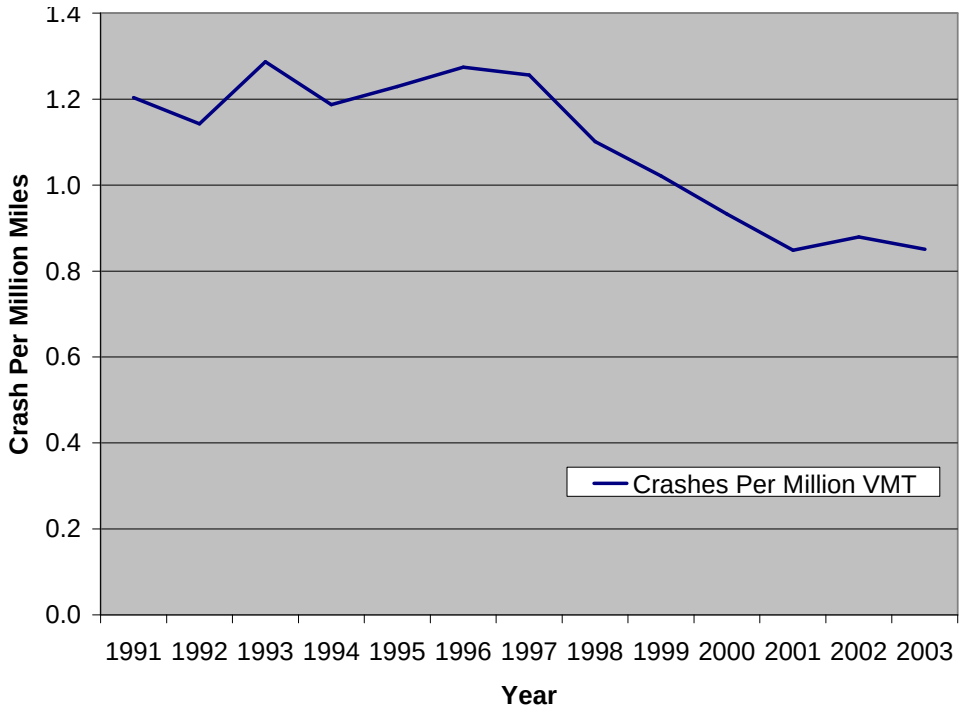


**Figure 3. Combination truck crash rate**

**Public Transit Crash Rate per Million Vehicle Miles**

*What this Performance Measure Means*

This crash rate is calculated by finding the number of non-school bus crashes for every million VMT by Iowa transit vehicles. A small portion of the non-school bus crashes used in this rate may be private bus crashes. However, because the vast majority of the non-school bus transit used is public transit, it was determined that these numbers provide an adequate picture of the safety of the Iowa public transit systems.

*Why this Performance Measure is Important*

The public transit crash rate indicates the safety of riding the public transit services of Iowa. As this rate falls, there is a smaller chance of a public transit vehicle being involved in a crash.

*Recent Data and Interpretation*

The performance measure data is given in state fiscal years and exists for the past seven years. Overall, a downward trend can be seen in Figure 4 (Iowa Department of Transportation Office of Public Transit; Center for Transportation Research and Education), with a slight rise in the transit crash rate between 2001 and 2003. In 2004, this rate reached its lowest level of 1.74 crashes per million VMT. That year also happened to have the lowest public transit VMT in the past five years, which is the opposite of the crash rate for large trucks.

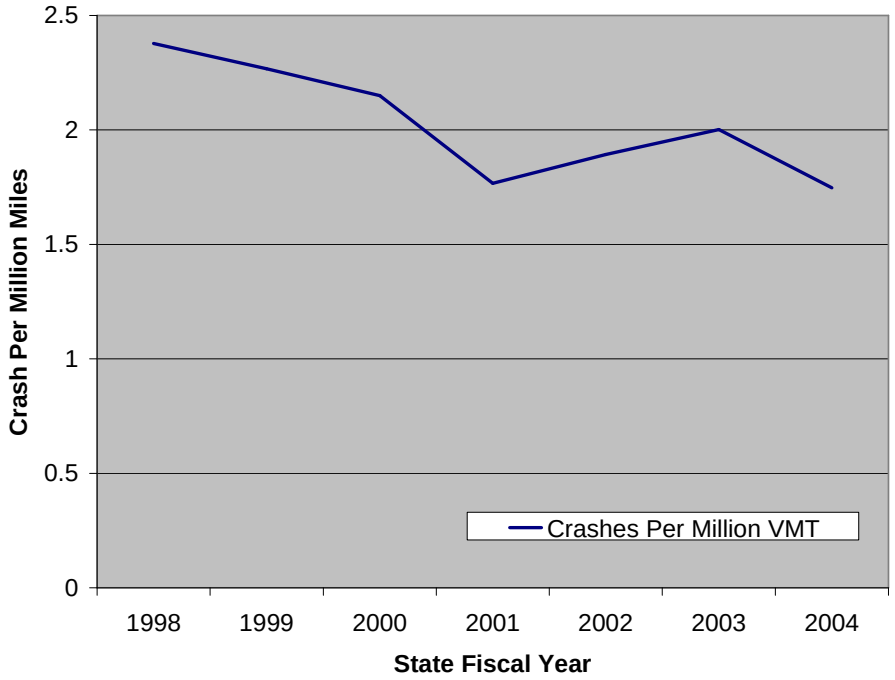


**Figure 4. Crash rate for public transit vehicles**

**Percent of Public Transit Fleet with Two-Way Communications on Board**

*What this Performance Measure Means*

The percent of the public transit fleet with two-way communications on board indicates the proportion of transit vehicles with communication devices (usually two-way radios) in the vehicles.

*Why this Performance Measure is Important*

The percent of the public transit fleet with two-way communications indicates safety, as this figure measures the communication capabilities for the public transit fleets. Communication is a key factor in reporting accidents and problems that can occur with transit vehicles.

*Recent Data and Interpretation*

As shown in Figure 5 (Iowa Department of Transportation Office of Public Transit; American Public Transit Association), over three-quarters of the public transit fleet in Iowa have two-way communications. An increase in the percentage of the fleet with two-way communications is desired. The American Public Transit Association (APTA) provides a goal for this performance measure. According the APTA's findings, 95% of the vehicles surveyed had either two-way radios or telephones on board. This percentage is much higher than that of the Iowa public transit fleet. However, it must also be noted that the APTA tends to represent the larger urban transit systems. The percentage is most likely higher than it would be if all systems in smaller urban areas were taken into account. That said, the APTA's data offers the best comparison available, and it is desired that the percentage of the Iowa public transit fleet with two-way communications be nearer the APTA's data.

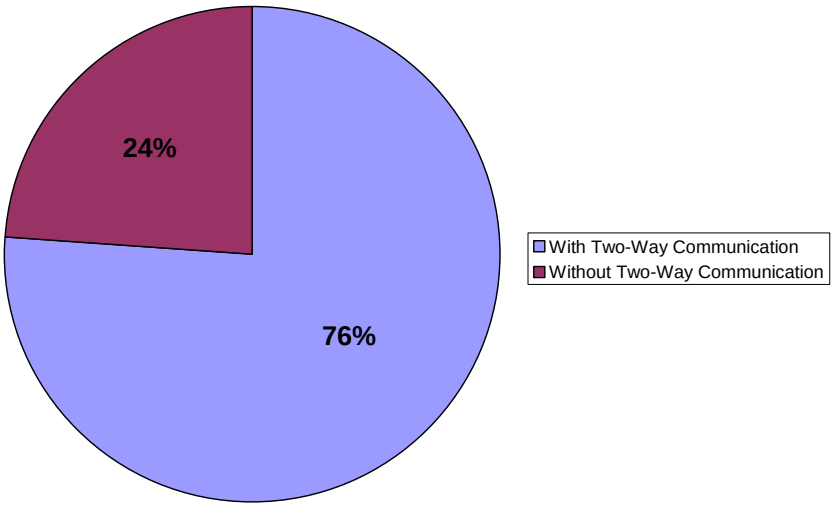


**Figure 5. Percentage of public transit fleet with two-way communications on board**

**Total Crashes at Rail Highway Crossings**

*What this Performance Measure Means*

The total crashes at rail highway crossings are a measure of safety calculated by summing the number of crashes that occur in Iowa where highways cross railroad tracks.

*Why this Performance Measure is Important*

The total number of crashes indicates the safety of the Iowa rail systems. With fewer crashes at these crossings, it is safer for trains to travel across the state and for motor vehicles to cross railroad tracks.

*Recent Data and Interpretation*

The trend in the data shown in Figure 6 indicates a strong downward tendency (Iowa Department of Transportation, Office of Rail Transportation). This is a desirable trend. One factor explaining this trend is that the number of track crossings in Iowa has also been decreasing. In 1990, there were 189 accidents at highway crossings. In the past thirteen years, this number has declined to 58, which is only about one-third of the total in 1990.

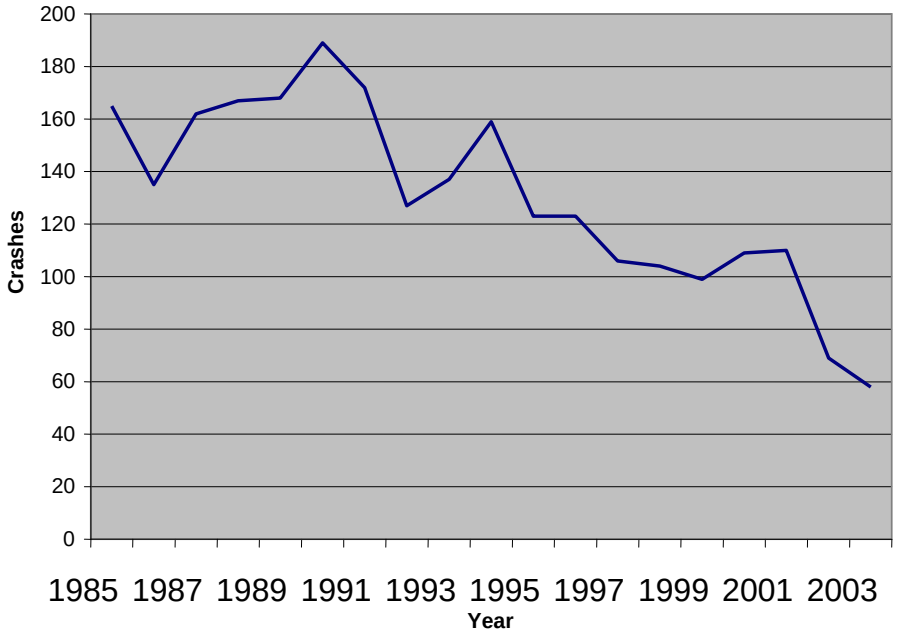


**Figure 6. Crashes at rail highway crossings**

**Railroad Derailments per Million Ton-Miles**

*What this Performance Measure Means*

Railroad derailments per million ton-miles is a prime measure of the safety of the Iowa railroads. This measure indicates the number of derailments for moving one ton of freight one million miles. A derailment is defined as when one or more cars or locomotives leave the tracks. A ton-mile is defined as one ton of freight moving one mile. In 2003, Iowa had nearly 14.7 billion ton-miles across the state.

*Why this Performance Measure is Important*

Derailments per million ton-miles are a measure of the safety of using Iowa railways. As this rate decreases, there is a smaller chance of seeing a derailment in Iowa. A decrease in derailments not only means a safer rail system in Iowa, but also decreases in the cost of rail services.

*Recent Data and Interpretation*

Overall, since 1985 the derailment rate has decreased drastically, as shown in Figure 7 (Iowa DOT, Office of Rail Transportation). Derailments per one million ton-miles have been cut by over three-fourths since 1986, when this value peaked at 0.020. Even in the last ten years, this rate has decreased by approximately one-third, to under 0.005 per one million ton-miles. There were about 40 fewer derailments in 2003 than in 1986, 65 and 107 respectively, but there was an increase of over 9 billion ton miles in the same time span. This performance measure, in conjunction with the crashes at highway crossings, indicates a strong increase in safety.

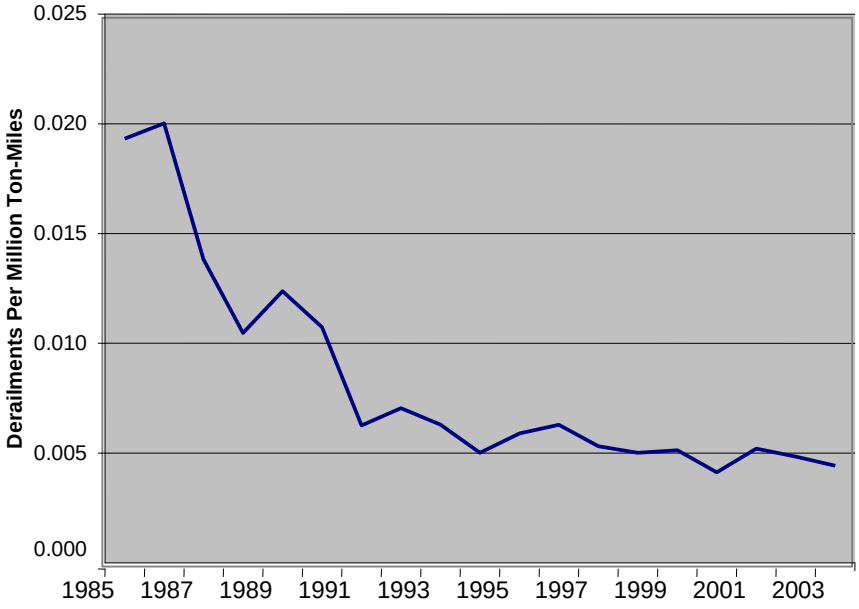


**Figure 7. Rail derailment trend**

## Number of Runway Incursions at Towered Airports

*What this Performance Measure Means*

The Federal Aviation Administration (FAA) defines an incursion as "any occurrence at an airport involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in loss of separation with an aircraft taking off, or intending to take off, landing, or intending to land." This performance measure indicates the number of these incursions.

*Why this Performance Measure is Important*

This performance measure is an important indication of both safety and security at airports. Incursions occur for several reasons, including miscommunication from the pilot, co-pilot, runway markings, or air traffic controller. Additionally, this performance measure includes unauthorized entries on runways, which are security concerns.

*Recent Data and Interpretation*

In 2003, there were only two incursions at towered airports in Iowa (Iowa Department of Transportation, Office of Aviation). This number appears to be a positive safety indicator, especially considering that the FAA states that incursions are on the rise nationwide. The number of incursions in previous years would be helpful to provide a comparison.

**Percentage of Airports with Clear Landing Approaches**

*What this Performance Measure Means*

The FAA defines a clear landing approach as the area extending from the end and widths of the runway to the point directly below where the approach surface slope is 50 feet. The purpose of this clear zone is for the safety of landing and departing aircraft. This measure indicates the percentage of airports in Iowa that have this clear area.

*Why this Performance Measure is Important*

It is important to evaluate this characteristic of airports because aviation can be made safer with these clear landing approaches. A clear landing approach allows for greater ability to see the runway visually.

*Recent Data and Interpretation*

As can be seen in Figure 8 (Iowa Department of Transportation, Office of Aviation), 17% of the landing approaches at Iowa airports are considered clear. The 83% could improve safety by creating clear landing approaches.

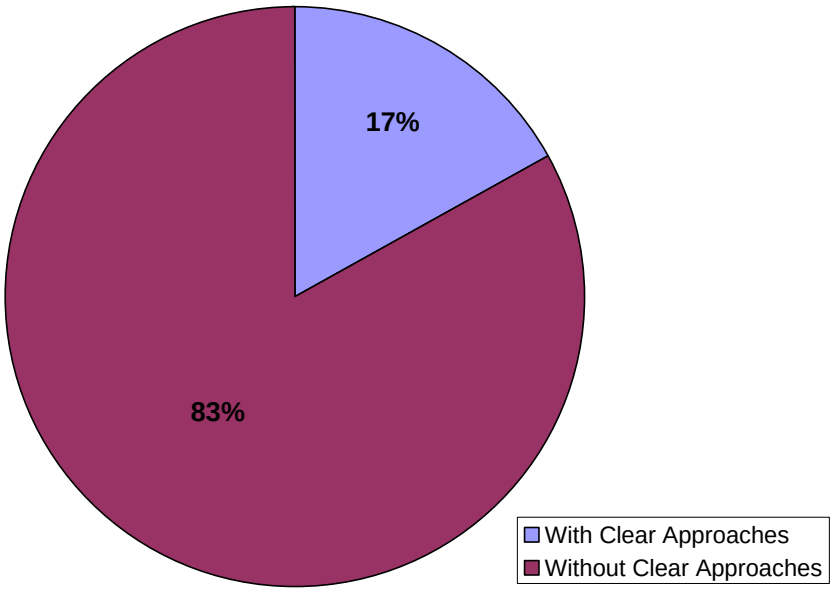


**Figure 8. Percent of airports with clear landing approaches**

**Number of Aviation Accidents and Fatalities**

*What this Performance Measure Means*

The number of accidents and fatalities measures the safety of the aviation system in Iowa by totaling the number of accidents and fatalities that occurred in each year for the past five years.

*Why this Performance Measure is Important*

Accidents and fatalities are one of the most apparent and observable measures of safety. Obviously, with fewer accidents and fatalities the passengers and workers of the aviation system are safer.

*Recent Data and Interpretation*

In 2003, the state of Iowa had 10 aviation fatalities and 20 accidents. Although these numbers are high compared to the last five years, these figures do not necessarily mean that aviation in Iowa is less safe. The information for this performance measure is obviously quite volatile over time. Since the numbers are so small, a slight increase in the number of accidents can double the previous year's accidents. That said, there has been a significant increase in the number of accidents and fatalities since 2001, when there were only three fatalities and seven accidents. Figure 9 illustrates the change (National Transportation Research Safety Board).

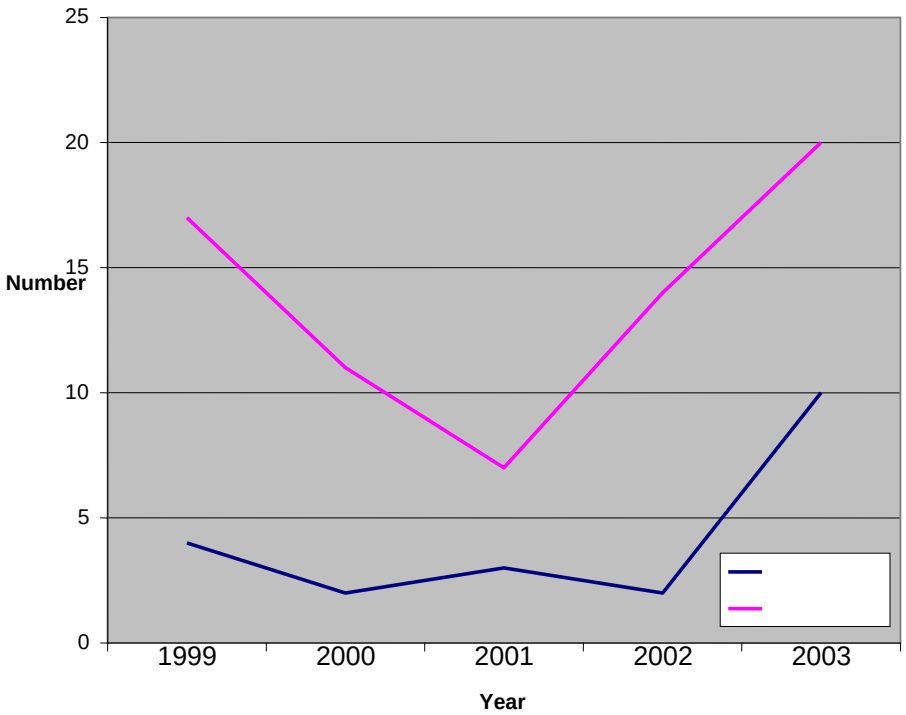


**Figure 9. Aviation accidents and fatalities**

**Bicycle and Pedestrian Fatalities and Injuries**

*What this Performance Measure Means*

Bicycle and pedestrian fatalities and injuries measures safety by totaling the number of deaths and injuries in these two modes of transportation combined during a calendar year.

*Why this Performance Measure is Important*

Bicycle and pedestrian fatalities and injuries measure the safety of traveling by foot or by bicycle in Iowa, according to the number of deaths and injuries of people who travel by these modes.

*Recent Data and Interpretation*

In general, during the past 12 years the number of these fatalities and injuries has been decreasing, as shown in Figure 10 (Iowa Department of Transportation, Office of Systems Planning). In the past 4 years, Iowa has seen the lowest number of both injuries and fatalities than it has in the past 12 years. The year 2001 saw the lowest total, when the number of fatalities for both pedestrians and bicyclists were 16 and 3, respectively. Since 2001, these numbers have risen. Unfortunately, it is impossible to find the total distance traveled in these two modes, which could assist in safety evaluation by allowing for the calculation of an injury and fatality rate.

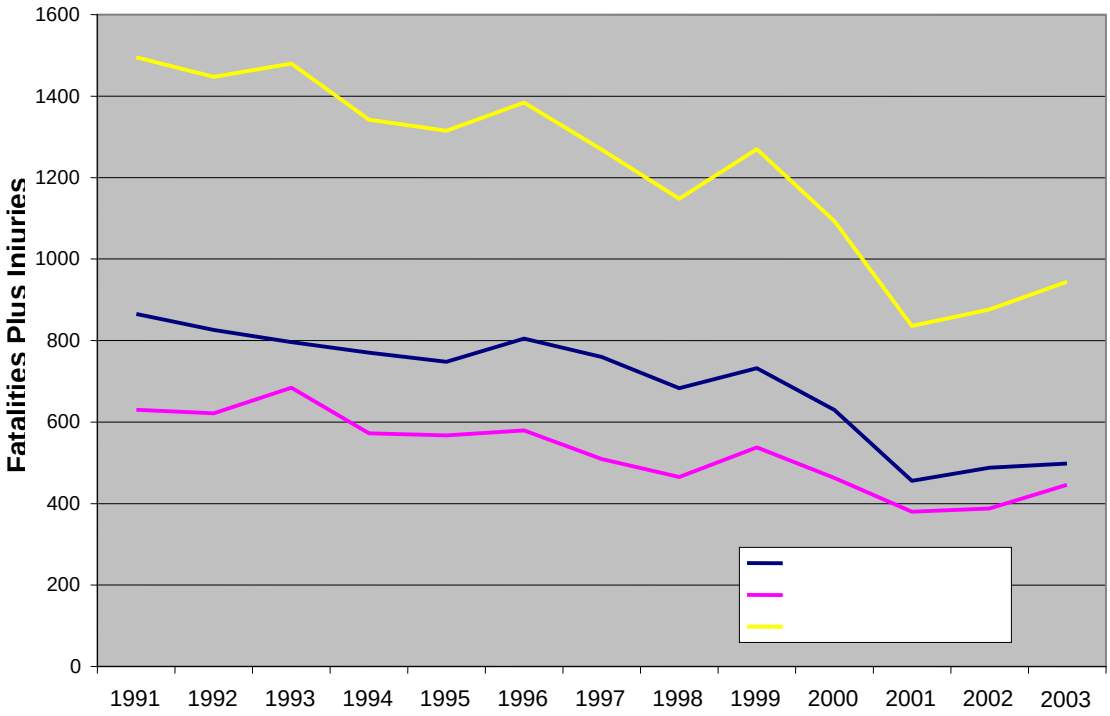


**Figure 10. Bicycle and pedestrian fatalities and injuries**

## EFFICIENCY PERFORMANCE MEASURES

### Percentage of Functionally Obsolete or Structurally Deficient Bridges

*What this Performance Measure Means*

This performance measure provides a picture of the bridge ratings across Iowa. A bridge is structurally deficient if it is in relatively poor condition or has insufficient load-carrying capacity. The insufficient load capacity could be due to the original design of an older bridge that used lighter design loads, or it could be due to deterioration. A bridge is functionally obsolete if it is narrow, has inadequate under-clearances, has insufficient load-carrying capacity, is poorly aligned with the roadway, or can no longer service traffic adequately.

*Why this Performance Measure is Important*

The percentage of bridges with ratings below 50 is a measure of efficiency, as it indicates the conditions of bridges across the state. Bridges that do not meet the standards may make travel difficult or hazardous for large vehicles or large volumes of traffic.

*Recent Data and Interpretation*

Over the past nine years, Iowa has seen an overall increase in the percentage of structurally deficient bridges and a decrease in the percentage of functionally obsolete bridges. See Figure 11 (Iowa Department of Transportation, Office of Bridges and Structures). In the past three years, the total number of bridges in the state system has decreased by over 200 due to jurisdictional transfers. This decrease has also led to the decline in the percentage of both structurally deficient and functionally obsolete bridges. Therefore, it will be important to consider this trend against the new benchmark set in 2003/2004 after the transfers occurred.

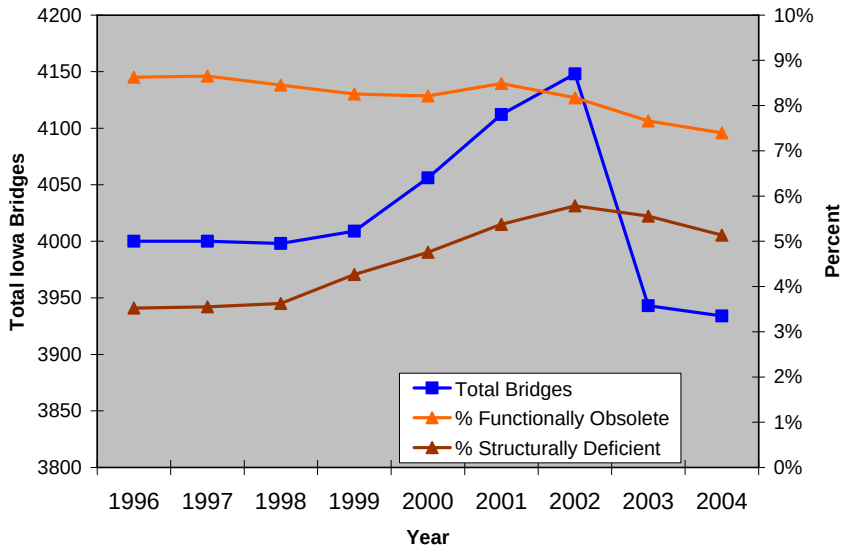


**Figure 11. Percent of bridges functionally obsolete or structurally deficient**

**Percent of Highway Lane-Miles with Good or Excellent Ride Quality**

*What this Performance Measure Means*

The percent of lane-miles with good or excellent ride quality measures the percent of interstate, U.S., and state highways in Iowa that have an international roughness index (IRI) rating of 2.2 or below. The IRI rating was created to compare the roughness of different roads. The scale ranges from 0, which is perfectly smooth, to 10 or more, which is an extremely rough ride. The rating of 2.2 was selected based on a study about the perceptions of pavements performed by the Transportation Research Center at Marquette University.

*Why this Performance Measure is Important*

The percent of lane-miles with good or excellent ride quality measures efficiency because the figure indicates how easy it is to drive a motor vehicle on highways in Iowa. As the IRI gets higher, the rougher the ride becomes, which can then forces drivers to lower their speeds. In addition, rough roads can be hard on vehicles. If drivers use roads with poor IRI ratings, vehicle maintenance costs can increase.

The IRI is then divided into interstate highways, highways that are part of the commercial and industrial network (CIN), and other primary highways. This performance measure is divided because funding is often allocated for highway maintenance and improvements based on these divisions. The CIN was created to include a number of both U.S. and state highways that provide key links to most of Iowa.

*Recent Data and Interpretation*

For all roads across Iowa, three-quarters of the lane miles are considered “Good” or “Excellent,” and 6% are considered “poor,” as indicated in Figure 12 (Iowa DOT, Highway Division). When these roads are divided into interstate, CIN, and other primary highways, the ride quality looks quite different. When looking specifically at interstate highways in the state, the good and excellent ratings make up an even larger percentage (81%) of the lane-miles, and only 2% are considered poor (see Figure 12).

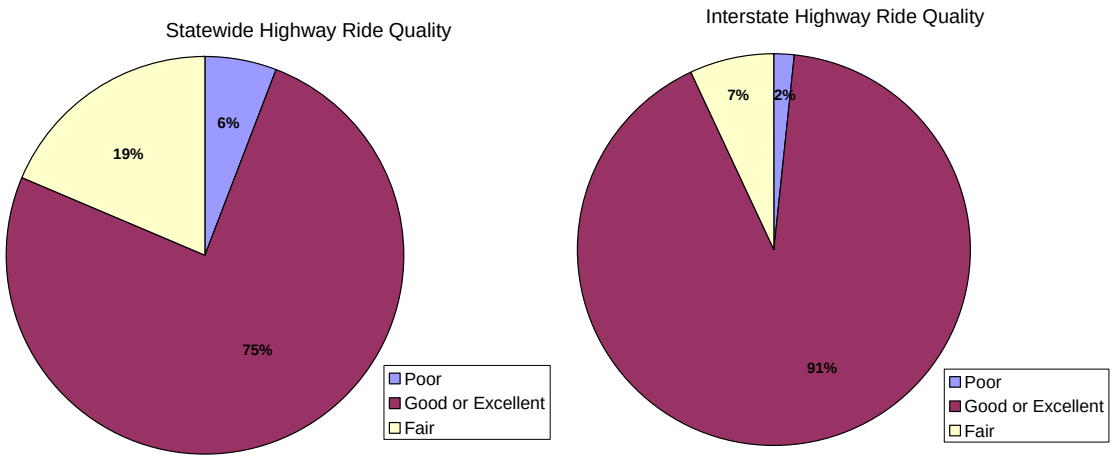


**Figure 12. Overall highway ride quality in Iowa**

As for the CIN in Iowa, Figure 13 (Iowa Department of Transportation, Highway Division) illustrates that the percentage of lane-miles meeting the desired rating are better than that of the state system total, with 84% considered good or excellent and only 4% considered poor. The remaining primary routes in the state, which actually make up the majority of these lane-miles considered, have a much lower percentage of good or excellent, with only 67% meeting the desired rating and 8% considered poor (see Figure 13).

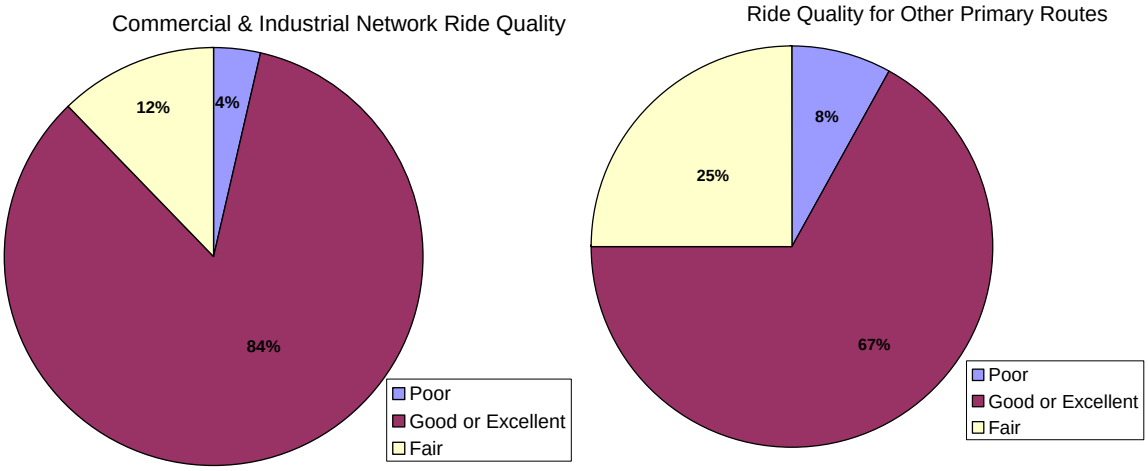


**Figure 13. Ride quality for commercial and other routes in Iowa**

**Percent of Public Transit Fleet Operating Beyond its Normal Useful Life**

*What this Performance Measure Means*

The percent of the public transit fleet operating beyond its normal useful life measures the efficiency of the Iowa public transit systems. The figure indicates the age and mileage of the transit fleet. However, the numbers for this measure are constantly changing as the many transit systems across the state purchase new vehicles and as new vehicles cross the Federal Transit Authority's (FTA) threshold for age and mileage every year. For the various vehicle types used by public transit systems in Iowa, there are different threshold levels. The more heavy duty public transit vehicles are generally built to last much longer than those that are lighter.

*Why this Performance Measure is Important*

The percent of the public transit fleet operating beyond its normal useful life measures the efficiency of the Iowa public transit systems. As the transit vehicles become older, the maintenance and operating costs of these vehicles typically become significantly higher.

*Recent Data and Interpretation*

For the fiscal year of 2003, the public transit systems in Iowa had a total of 1,539 vehicles in the fleet. From the year-end inventories, a total of 870 vehicles exceeded their threshold age, which is approximately 57% of the public transit fleet. See Figure 14 (Iowa DOT, Office of Public Transit). For light duty buses, the threshold age is 4 years, for medium duty buses it is 7 years, for heavy duty buses under 35 feet it is 10 years, and for those over 35 feet it is 12years.

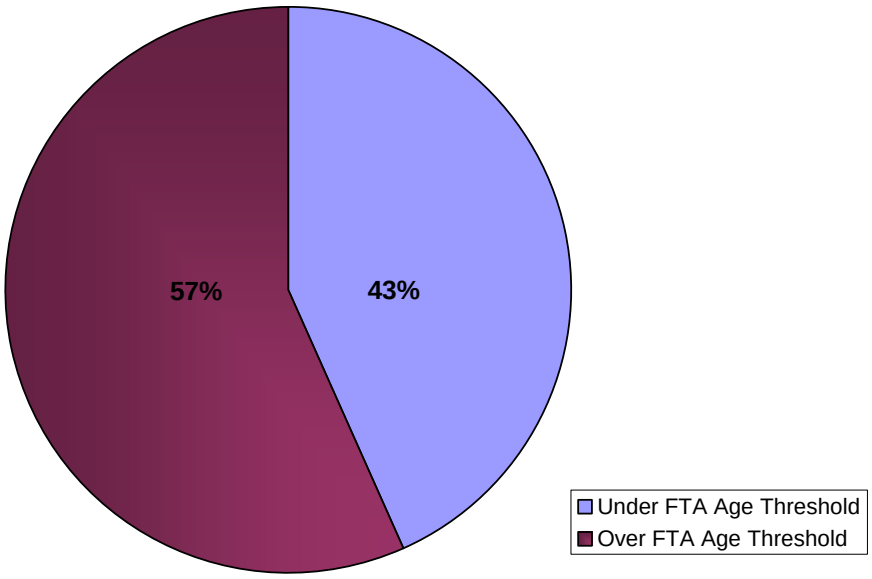


**Figure 14. Total public transit vehicles over the FTA age threshold in Iowa**

In addition, this percentage varies by vehicle type. The four charts in Figure 15 illustrate the percentages of four types of transit buses that exceed their age.

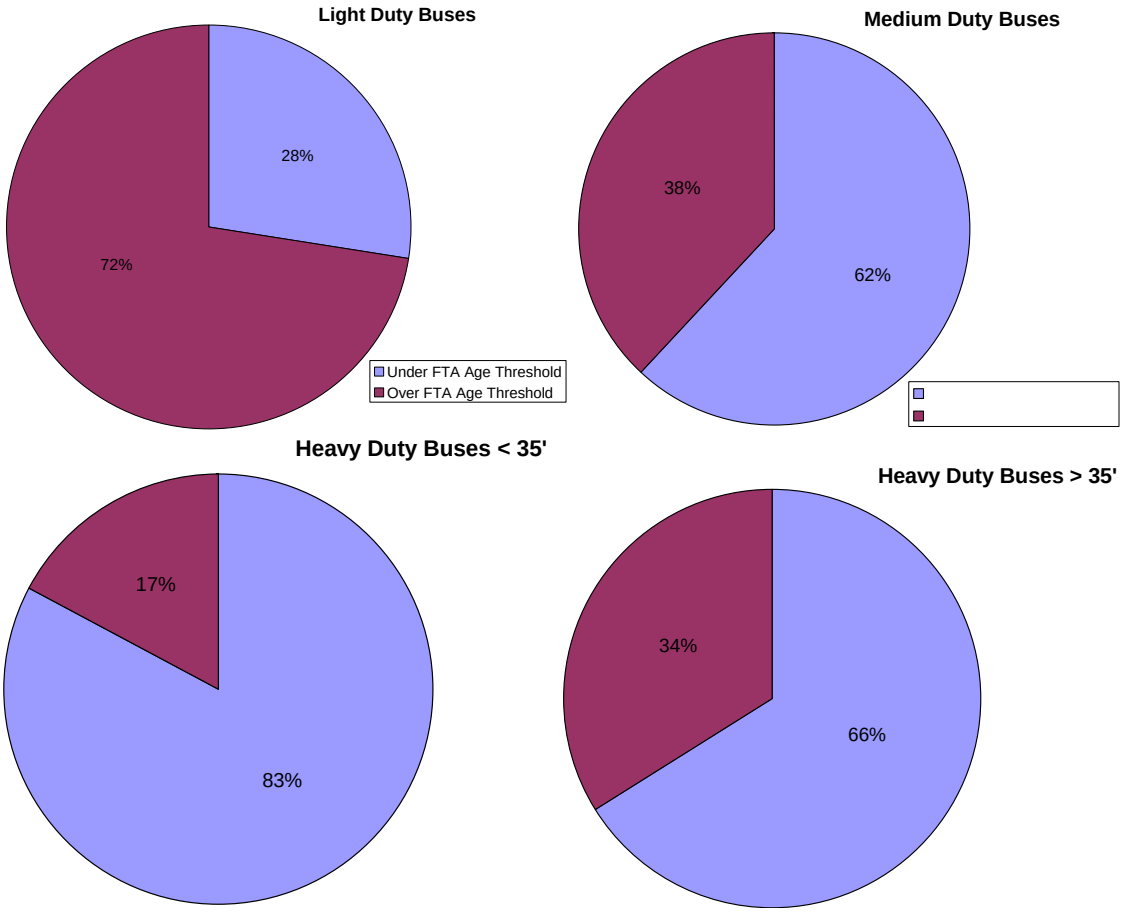


**Figure 15. Vehicles over the FTA age threshold by type**

Another way to calculate this performance measure is to examine the mileage of the public transit vehicles. According to the FTA, the threshold for normal useful mileage also varies by type of vehicle. In Iowa, 698 of these vehicles are over the FTA mileage threshold, which is approximately 45% of the total fleet. See Figure 16.

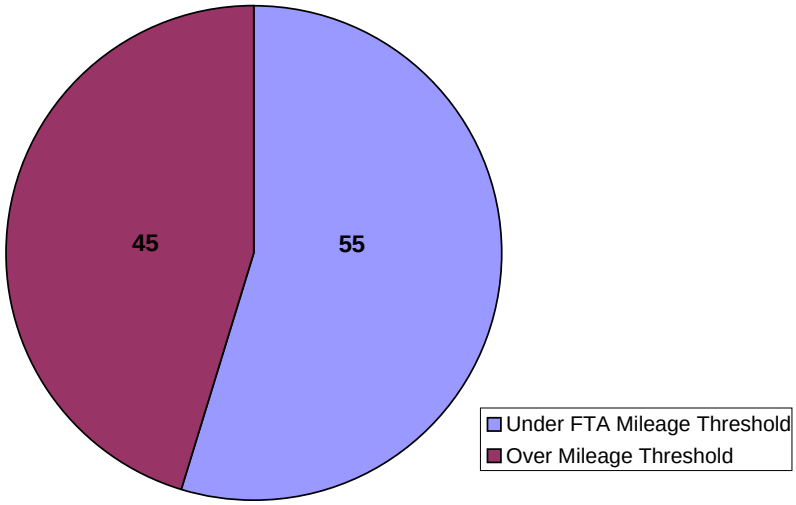


**Figure 16. Iowa public transit vehicles over the mileage threshold**

It is interesting to note that while the percentage of vehicles over the age threshold is 57%, those over the vehicle miles threshold is only 45%.

**Percent of Public Transit Systems with In-House Maintenance Capabilities**

*What this Performance Measure Means*

The percent of public transit systems with in-house maintenance capabilities indicates that 25 of the 35 public transit systems in Iowa have some ability to complete vehicle maintenance. The amount of maintenance each of the transit systems actually does varies greatly.

*Why this Performance Measure is Important*

The percent of public transit systems with in-house maintenance capabilities is important because it is desirable for transit systems to be able to provide at least some amount of maintenance efficiently for themselves.

*Recent Data and Interpretation*

Iowa currently has 16 regional public transit systems and 19 urban transit systems. Of the regional systems, 5 currently own a facility that performs some degree of maintenance on the vehicles, and 18 of Iowa's 19 urban transit agencies perform varying aspects of transit vehicle maintenance at a municipal public works facility or a facility owned and dedicated to transit. These data are illustrated in Figure 17 (Iowa DOT, Office of Public Transit). One regional transit system, Region 2, is in the process of constructing a joint use facility with Mason City that will permit each agency to have a considerable portion of its vehicle maintenance performed onsite after construction is complete. The one urban transit system that outsources maintenance is Council Bluffs, which shares public transit with the City of Omaha.

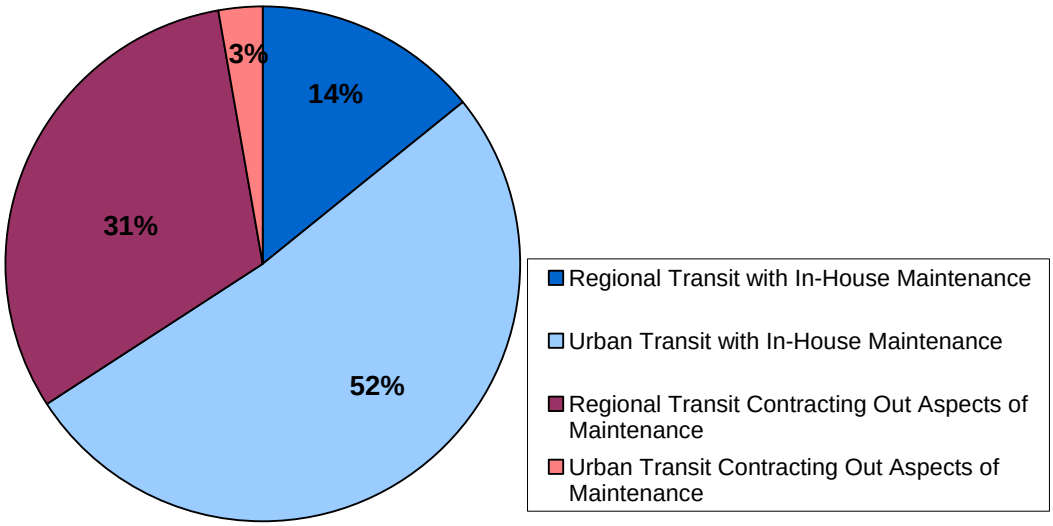


**Figure 17. Transit systems with in-house maintenance capabilities**

**Percentage of Iowa Rail Carriers Earning a Reasonable Return on Investment**

*What this Performance Measure Means*

The percentage of Iowa rail carriers earning a reasonable return on investment is a measure of efficiency. A higher return on investment means that the money a railroad company puts into its business generates more in profits. One measure of a reasonable return on investment is whether the railroad company is meeting its cost of capital. The cost of capital is the amount of money the company needs to make to maintain its physical capital. Recently, the cost of capital for Class 1 carriers has been around 10%.

*Why this Performance Measure is Important*

The percentage of Iowa rail carriers earning a reasonable return on investment measures the efficiency of the railroad companies operating in Iowa. Railroad companies need to have a return on investment that is high enough to pay for the upkeep of capital and to provide investors returns on the investments made.

*Recent Data and Interpretation*

Class 1 railroad companies include Burlington Northern Santa Fe Railroad Co. (BNSF), Norfolk and Southern Railway Co. (NS), and Union Pacific Railroad (UP). None of the Class 1 railroad companies over the past 14 years has earned more than a 10% return on investment. This indicates that, in recent years, none of these companies earned the cost of capital. The data in Figure 18 show that none of the Class I companies are earning what would be considered a minimal, reasonable return on investment. This should raise a red flag.

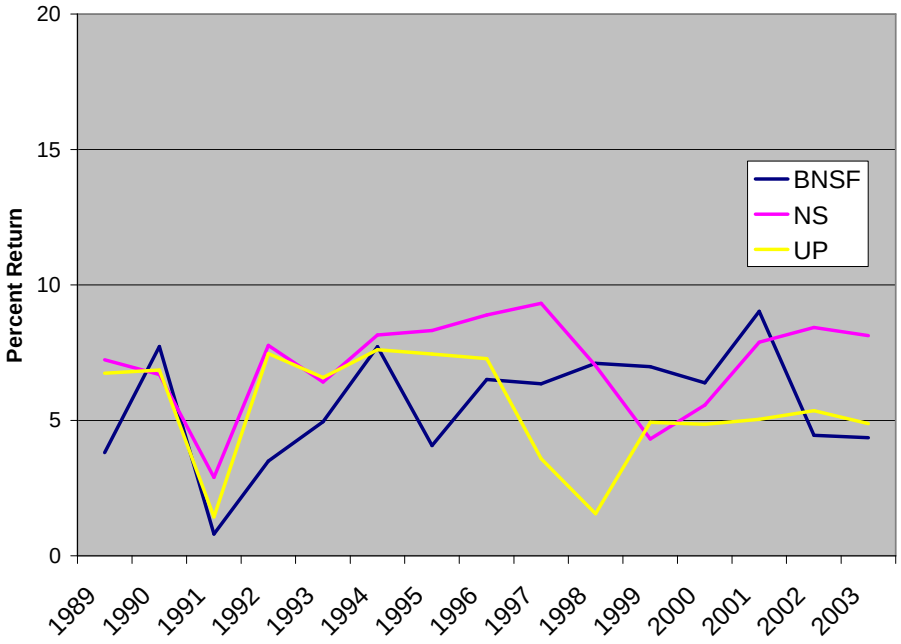


**Figure 18. Class I railroad return on investment**

For Class II railroad companies, there is a much wider range of returns on investment. Class II railroads are smaller than the Class I national railroads and operate on a regional level. Class II railroad companies include Chicago, Central, and Pacific Railroad Co. (CC); Dakota, Minnesota, and Eastern Railroad Co. (DME); Iowa Interstate Railroad Ltd. (IAIS); and I & M Rail Link, LLC. (IMRL), which was purchased by Iowa, Chicago, & Eastern Railroad Corporation in 2002. Importantly, Figure 19 (Iowa DOT, Office of Systems Planning) shows that all Class II companies increased their return on investment from 2002 to 2003.

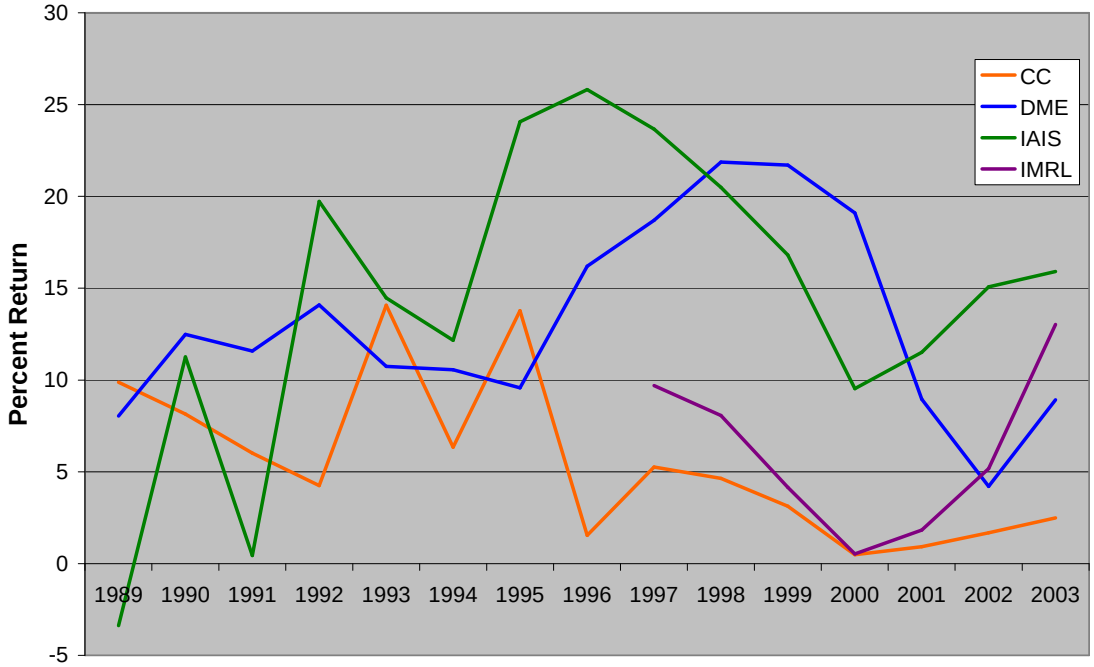


**Figure 19. Class II railroad return on investment**

Class III railroad companies operate only locally within Iowa. In terms of returns on investment, these companies are by far the most volatile when compared to regional and national rail companies. Nine of the 11 Class III railroad companies that operate in the state earn returns of between 5% and 15%, with a typical return being just over 5%. Those that do not are the D & I Railroad Co. and the Burlington Junction Railway Co. These are also among the smallest railroads operating in Iowa. Due to the complexity of these data and the lack of return on investment data for some carriers for some years, a chart is not presented here.

**Average Rail Revenue per Ton-Mile**

*What this Performance Measure Means*

Average rail revenue per ton-mile measures efficiency, in that this figure is calculated by dividing the total rail revenue by the number of ton-miles in Iowa. A ton-mile describes one ton of freight traveling one track mile. Iowa had over 14.6 billion ton-miles in 2003, and this number has been increasing steadily over the past two decades.

*Why this Performance Measure is Important*

Average rail revenue per ton-mile measures the efficiency of the railroad companies that operate in Iowa. An increase in revenue per ton-mile generally indicates a more efficient rail system in Iowa. For the many railroad companies operating in Iowa, an increase in revenue per ton-mile would be necessary to achieve reasonable profits.

*Recent Data and Interpretation*

The overall trend since 1985 has been downward, but in the last three years the average rail revenue per ton-mile has risen to nearly seven cents. The total revenue reached 962 million dollars in revenue, with 14.7 billion ton-miles in 2003. The overall negative trend, shown in Figure 20 (Iowa Department of Transportation, Office of Systems Planning), is one factor in the poor returns on investment for most rail carriers in Iowa.

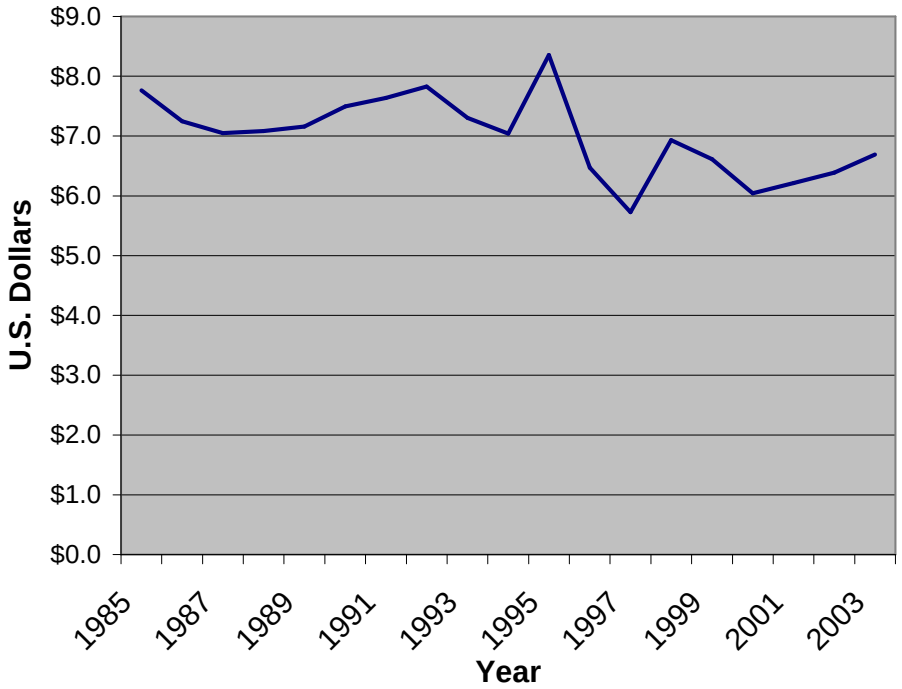


**Figure 20. Operating revenue per ton mile**

**Percent of Communities with a Land Use Plan in Place Surrounding their Airport**

*What this Performance Measure Means*

Communities with a land use plan surrounding their airport have established a plan guiding land use in the future. A land use plan indicates the areas in a community that should be developed for certain uses and those areas that should be left undeveloped.

*Why this Performance Measure is Important*

The percent of communities that have a land use plan in place surrounding their airport is important because airports often find that new development occurs directly adjacent to the airport. This development in close proximity may impede the needed infrastructure upgrades and encroach on clear zones, which may in turn compromise safety.

*Recent Data and Interpretation*

As shown in Figure 21 (Iowa DOT, Office of Aviation), currently 81% of the communities with airports have land use plans in place surrounding their airport.

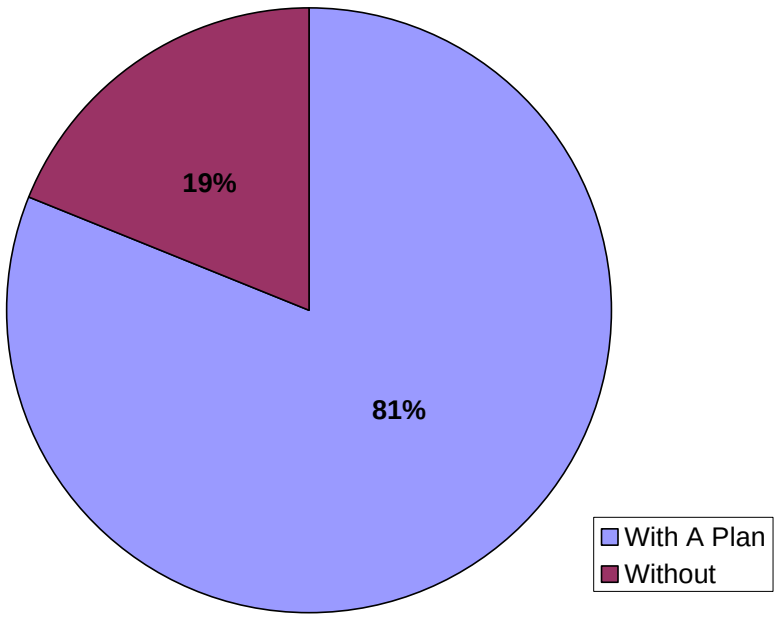


**Figure 21. Communities with a land-use plan surrounding their airport**

**Percentage of Airports with a Reasonable Pavement Condition Index Value**

*What this Performance Measure Means*

The number of airports with a pavement condition index (PCI) value of 70 or above for their paved runways is a measure of aviation efficiency. The PCI rates the condition of the pavement, according to FAA guidelines, on a scale of 0–100, 100 representing the best conditions. A PCI rating over 70 generally indicates the need for only minor preventative maintenance to prolong the pavement life.

*Why this Performance Measure is Important*

For several reasons, the number of airports with a PCI value of 70 or above for their paved runways is an important measure of efficiency. The runway pavement usually deteriorates slowly for a significant amount of time until it reaches a certain point. It then deteriorates quite rapidly. The period of slow deterioration can be prolonged by proper maintenance and repairs. Runway pavements with a PCI rating below 70 are generally much more costly to repair due to the difficulties of keeping up with rapid deterioration.

*Recent Data and Interpretation*

In 2003, over three-fourths of the airports in Iowa had a PCI of 70 or above, as shown in Figure 22 (Iowa DOT, Office of Aviation). This leaves approximately one-quarter of the airports with runway conditions that may require costly repairs to prolong or maintain the pavement's useful life.

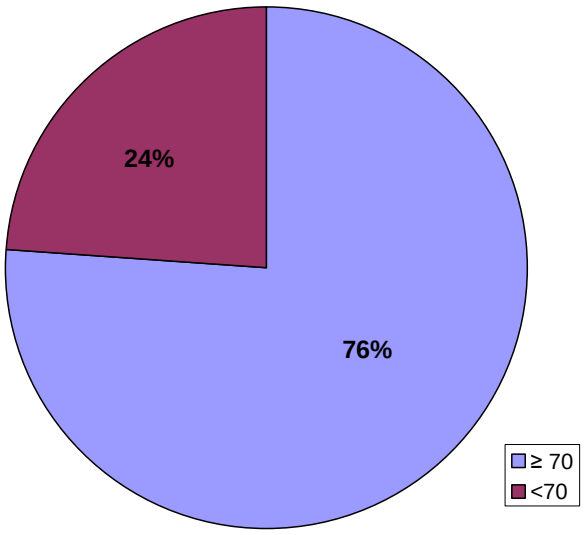


**Figure 22. Percent of airports with a PCI of 70 or above**

**Unavailable Efficiency Performance Measures**

The following performance measures for efficiency lack the data necessary for calculation:

- Percentage of paved off-road trails
- Percentage of off-road trails that meet AASHTO standards
- Average age of off-road trails

All of the efficiency performance measures that need more data are from the pedestrian/bicycle mode of transportation.

## QUALITY OF LIFE PERFORMANCE MEASURES

### Highway Fuel Use per Vehicle Mile Traveled

*What this Performance Measure Means*

Highway fuel use per VMT is calculated by dividing the fuel consumed for highway use in Iowa by the total VMT in the state. A vehicle mile describes one motor vehicle traveling one mile.

*Why this Performance Measure is Important*

Highway fuel use per VMT is important because fuel costs and the amount of emissions from fuel consumption are significant quality of life concerns. With a lower rate of fuel use, people and goods are able to travel with lower costs and lower emissions for every mile they travel.

*Recent Data and Interpretation*

Figure 23 indicates an overall downward trend for this performance measure over the past nine years (Federal Highway Administration, Office of Highway Policy Information). Interestingly, VMT has increased significantly over this same period. In 1995, there were nearly 26 billion vehicle miles in the state of Iowa, while in 2003 there were over 31.1 billion vehicle miles. Fuel consumed was 0.054 gallons for every VMT in 1995, compared to 0.049 in 2003. However, the rate has changed very little in the past three years after decreasing significantly over the preceding three years. Another way to compare fuel use and VMT is by calculating the number of vehicle miles for every gallon of fuel consumed. In 1996, there were 18.46 vehicle miles for every gallon; in 1999, there were 19.26; and in 2003, there were 20.30 vehicle miles for every gallon of fuel consumption.

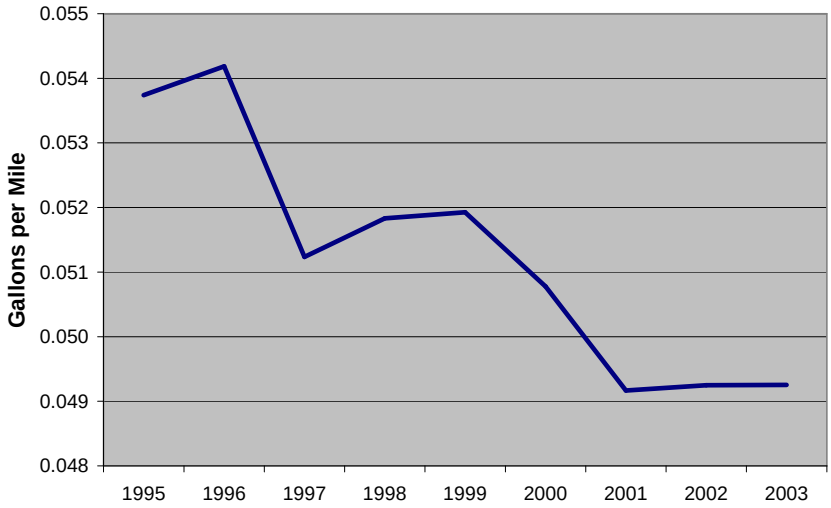


**Figure 23. Highway fuel use per vehicle-mile traveled**

## Approximate Travel Times to Major External Markets in the Midwest Region

*What this Performance Measure Means*

The approximate travel times to major external markets in the Midwest region measure highway quality of life. These measures are created by finding the travel times according to internet databases. Routes were selected by the internet database and do not necessarily reflect the most traveled routes from city to city. Average speeds were calculated according to the time and distance indicated by the databases. Six major cities were selected as the major external markets in the Midwest region: Minneapolis, Chicago, St. Louis, Kansas City, Detroit, and Denver. The database used the center of each city for its calculations.

*Why this Performance Measure is Important*

The approximate travel times to major external markets in the Midwest region are important because greater automobile access to these cities allows Iowa residents and the transportation of goods to save time and money.

*Recent Data and Interpretation*

Table 2 lists the travel times from selected Iowa cities to major external markets (CTRE analysis prepared using Yahoo! Maps). These figures indicate the approximate amount of time it takes to travel from the center of one city to the center of the other. One interesting observation emerges when comparing the travel times to St. Louis and Kansas City. Both cities are similar distances to the south of Iowa, but the travel times to St. Louis are significantly higher than those to Kansas City.

**Table 2. Travel times to external markets**

| | Dubuque | Davenport | Cedar Rapids | Des Moines | Council Bluffs | Sioux City |
|---|---|---|---|---|---|---|
| **Minneapolis, MN** | 5:12 | 5:37 | 4:19 | 3:42 | 5:36 | 5:22 |
| **Chicago, IL** | 3:44 | 2:53 | 4:02 | 5:13 | 7:05 | 8:11 |
| **St. Louis, MO** | 5:48 | 4:19 | 5:39 | 6:39 | 6:38 | 8:08 |
| **Kansas City, MO** | 6:18 | 5:34 | 4:58 | 3:03 | 2:50 | 4:16 |
| **Detroit, MI** | 7:12 | 6:39 | 8:28 | 9:12 | 11:10 | 12:15 |
| **Denver, CO** | 13:38 | 12:56 | 10:20 | 10:20 | 8:23 | 9:45 |

The data shown in Table 3 indicate the average traveling speeds from selected Iowa cities to major external markets (CTRE analysis prepared using Yahoo! Maps). This table provides a rate that can be directly compared between cities. Dubuque stands out in this comparison, as it has a number of average speeds lower than that of other cities. This analysis indicates the importance of improving US Highway 20 in Illinois. However, all of the selected Iowa cities have at least one route to an external market that is significantly slower than the others.

**Table 3. Average speeds to external markets (in mph)**

| | Dubuque | Davenport | Cedar Rapids | Des Moines | Council Bluffs | Sioux City |
|---|---|---|---|---|---|---|
| **Detroit, MI** | 65.06 | 65.11 | 65.10 | 65.10 | 65.08 | 65.00 |
| **Denver, CO** | 65.00 | 65.03 | 65.07 | 65.03 | 65.02 | 65.05 |
| **Kansas City, MO** | 62.38 | 65.21 | 65.01 | 63.54 | 63.56 | 64.95 |
| **St. Louis, MO** | 58.38 | 61.90 | 62.37 | 65.14 | 65.02 | 65.03 |
| **Minneapolis, MN** | 59.88 | 63.60 | 63.43 | 65.78 | 66.27 | 66.47 |
| **Chicago, IL** | 48.11 | 61.56 | 62.18 | 63.89 | 65.10 | 65.06 |

*Maps*

Figure 24 shows the travel times from the Iowa cities listed above. Figure 25 shows an approximate maximum distance that can be traveled in an eight-hour day averaging 60 miles per hour. However, some of these markets may not be within eight hours because of the structure of the existing road network.

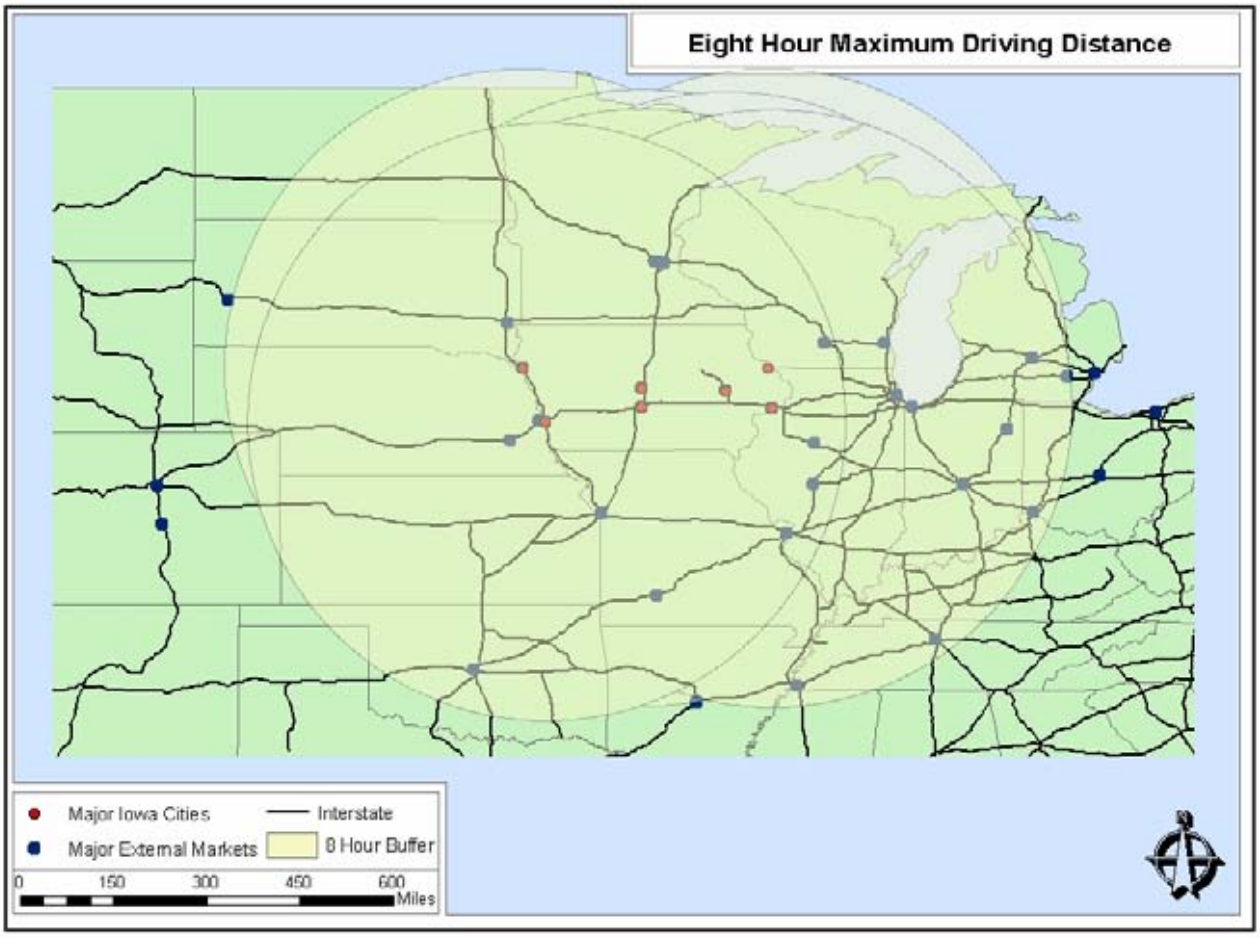


**Figure 24. Eight-hour maximum driving distance from several Iowa cities**

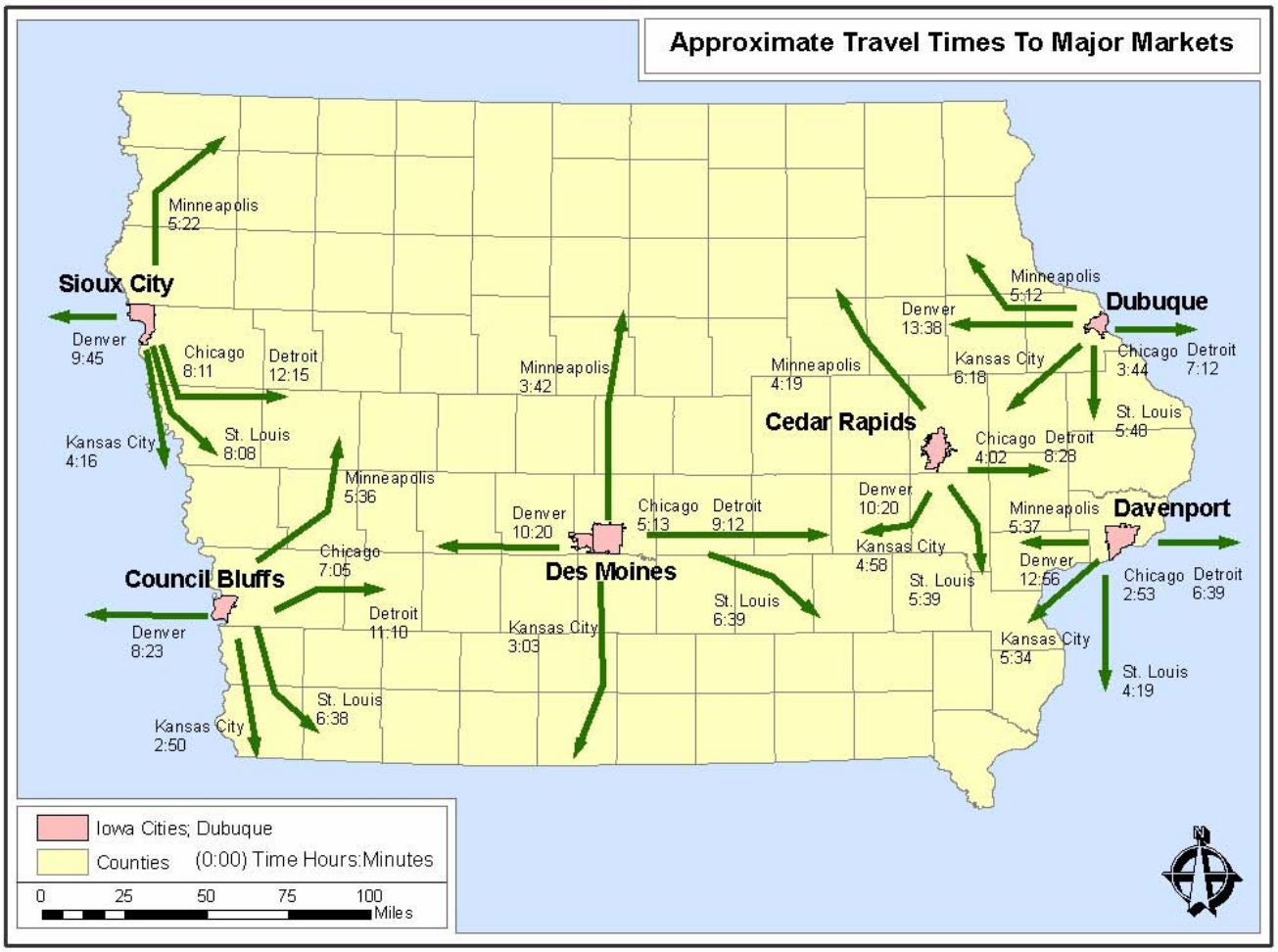


**Figure 25. Approximate travel times to major markets from Iowa cities**

**Total Jobs within One-fourth of a Mile from a Fixed Route Public Transit System**

*What this Performance Measure Means*

The total jobs within one-fourth of a mile from a fixed route transit system indicate how well the current routes serve the jobs in Iowa. Since many Iowa jobs are outside cities that have transit systems, it may appear that only a small portion of the jobs are served.

*Why this Performance Measure is Important*

The total jobs within one-fourth of a mile from a fixed route transit system are important because of the relationship between walking distance and transit routes. A person walking three miles per hour can walk one-fourth of a mile in five minutes. Therefore, jobs within this distance can be considered within a reasonable walking distance of a fixed transit route and, therefore, are served by the system. If a job is within this walking distance, an automobile is less of a necessity.

*Recent Data and Interpretation*

The available, accurate data on jobs is at the level of the census block group; therefore, determining the number of jobs within this given distance is somewhat difficult. There may be many jobs within a census block group that are near fixed transit routes, but many others in the same census block group well outside the one quarter-mile distance. The census block groups selected to be within one-fourth of a mile from transit routes had at least 50% of their area within this distance.

Approximately 414,000 of Iowa's 1.47 million jobs are within one-fourth of a mile from fixed route transit systems. This means that over 28% of the jobs in Iowa are within a five-minute walk of a fixed transit route. Of the 72% of jobs that are not within this distance, most are located in the rural areas of the state.

As shown in Figure 26 (GeoGraphics Laboratory; GeoLytics Inc.), the percentages change when looking only at census block groups within metropolitan statistical areas (MSA). Over 40% of the jobs in these areas are within one-fourth of a mile from a fixed route transit system. Twenty of Iowa's 99 counties are considered to be in MSAs.

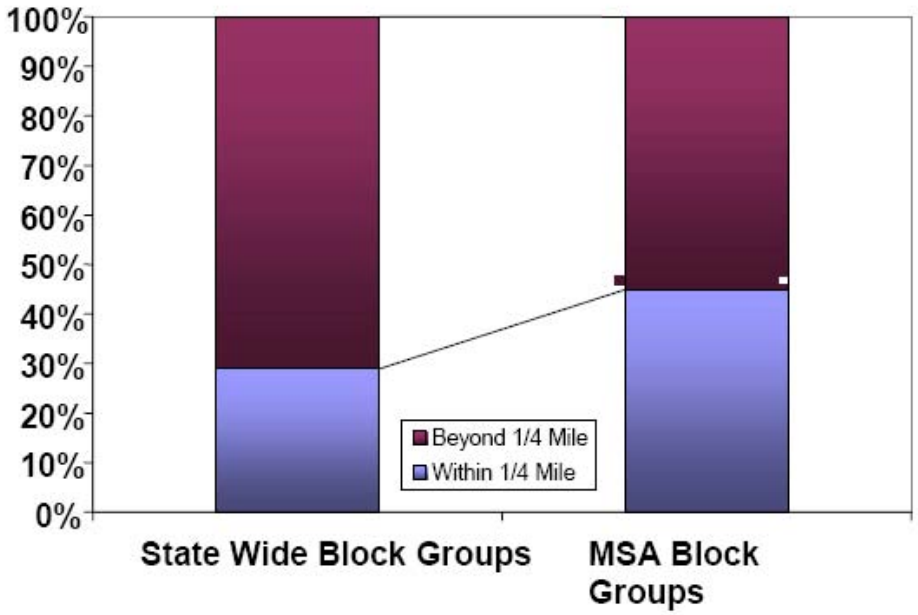


**Figure 26. Percent of Iowa jobs within one-fourth of a mile from a fixed route transit system**

**Percent of Railroad Track-Miles Able to Handle 286,000-Pound Cars**

*What this Performance Measure Means*

The percent of track-miles able to handle 286,000-pound cars is a measure of quality of life that is created by comparing the track-miles that can carry this weight to those that cannot.

*Why this Performance Measure is Important*

The percent of track-miles able to handle 286,000-pound cars is a measure of efficiency for railroad companies that operate in Iowa. The figure of 286,000 pounds is critical because as train cars become increasingly heavier, it is likewise increasingly important for Iowa railroads to be able to carry these loads. If some track is unable to handle cars with heavier weights, trains must travel significantly slower over the rails.

*Recent Data and Interpretation*

There are 4,057 track-miles in Iowa. Of these, 3,164 are able to carry 286,000-pound cars, which leave 893 track-miles incapable of carrying 286,000-pound cars. See the map in Figure 28. This means that approximately 78% of the track-miles in Iowa can handle the critical weight, as shown in Figure 27 (Iowa DOT, Office of Rail Transportation). Additionally, less than one-fourth of the track-miles would need improvements to achieve this ability.

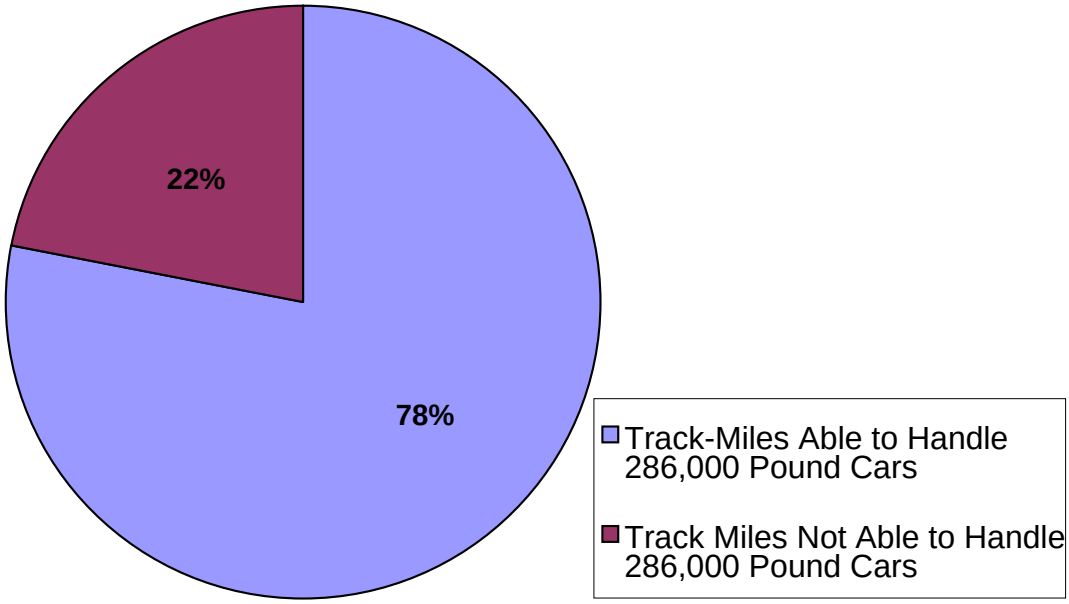


**Figure 27. Percent of track-miles able to handle 286,000-pound cars**

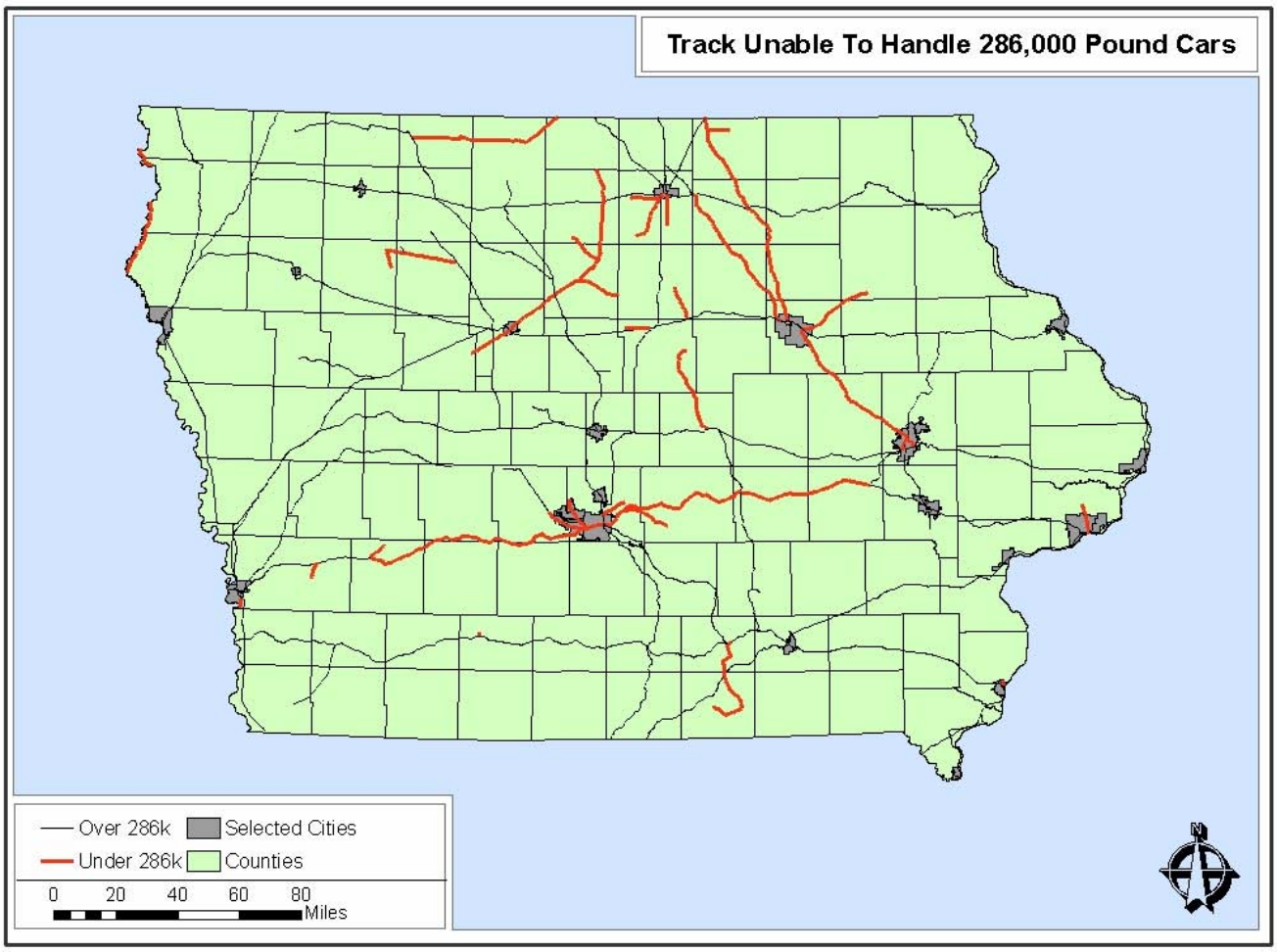


**Figure 28. Track in Iowa unable to handle 286,000-pound cars**

**Percentage of Railroad Track-Miles Able to Operate at 30 Miles per Hour or More**

*What this Performance Measure Means*

The percentage of track-miles able to operate at 30 mph or more measures the speed of freight movement across and around Iowa. This measure compares track that can operate at this desired speed with track that cannot.

*Why this Performance Measure is Important*

The percentage of track-miles able to operate at 30 mph or more is a measure of the quality of life in terms of Iowa railroads. With an increase in speed, companies can send and receive freight faster and more efficiently. As the percentage of track-miles able to operate at this speed increases, the freight movement around and across Iowa becomes faster and more efficient and allow companies to spend less time with freight in transit.

*Recent Data and Interpretation*

There are currently 4,057 track-miles in Iowa. Of these, 1,982 can operate at 30 mph or more, which leaves 2,075 track-miles that operate at speeds less than 30 mph. See the map in Figure 30. As Figure 29 shows, slightly more than half of the track-miles in Iowa cannot operate over this given speed (Iowa DOT, Office of Rail Transportation). Most of these low-speed track miles are owned by Class III rail companies. All track in Iowa owned by the Class I companies can operate at over 30 mph; in fact, most of this track can operate at 49 mph or more.

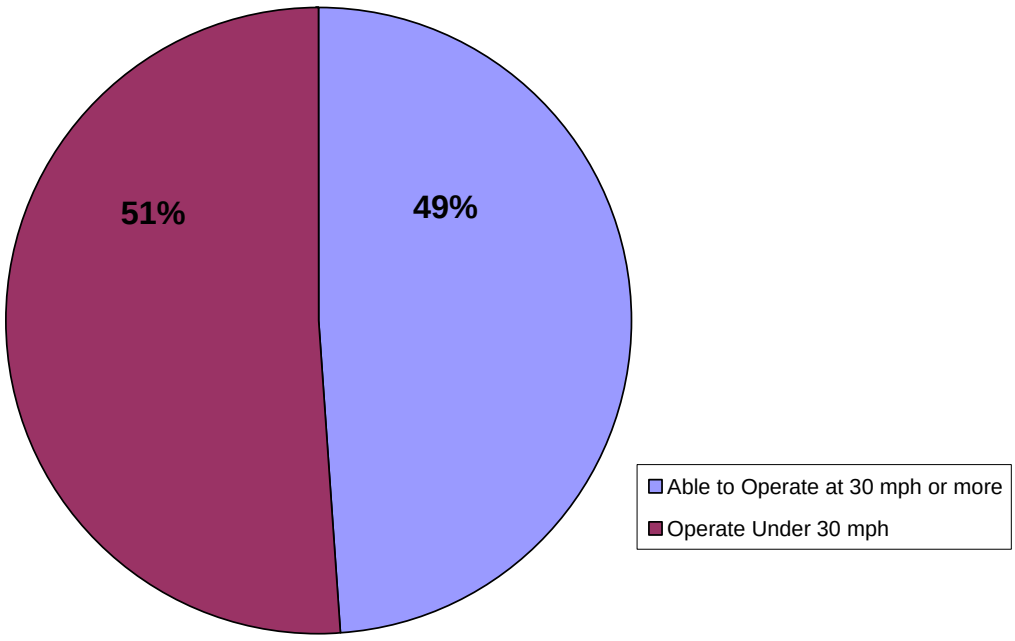


**Figure 29. Percent of track-miles able to operate at 30 mph or more**

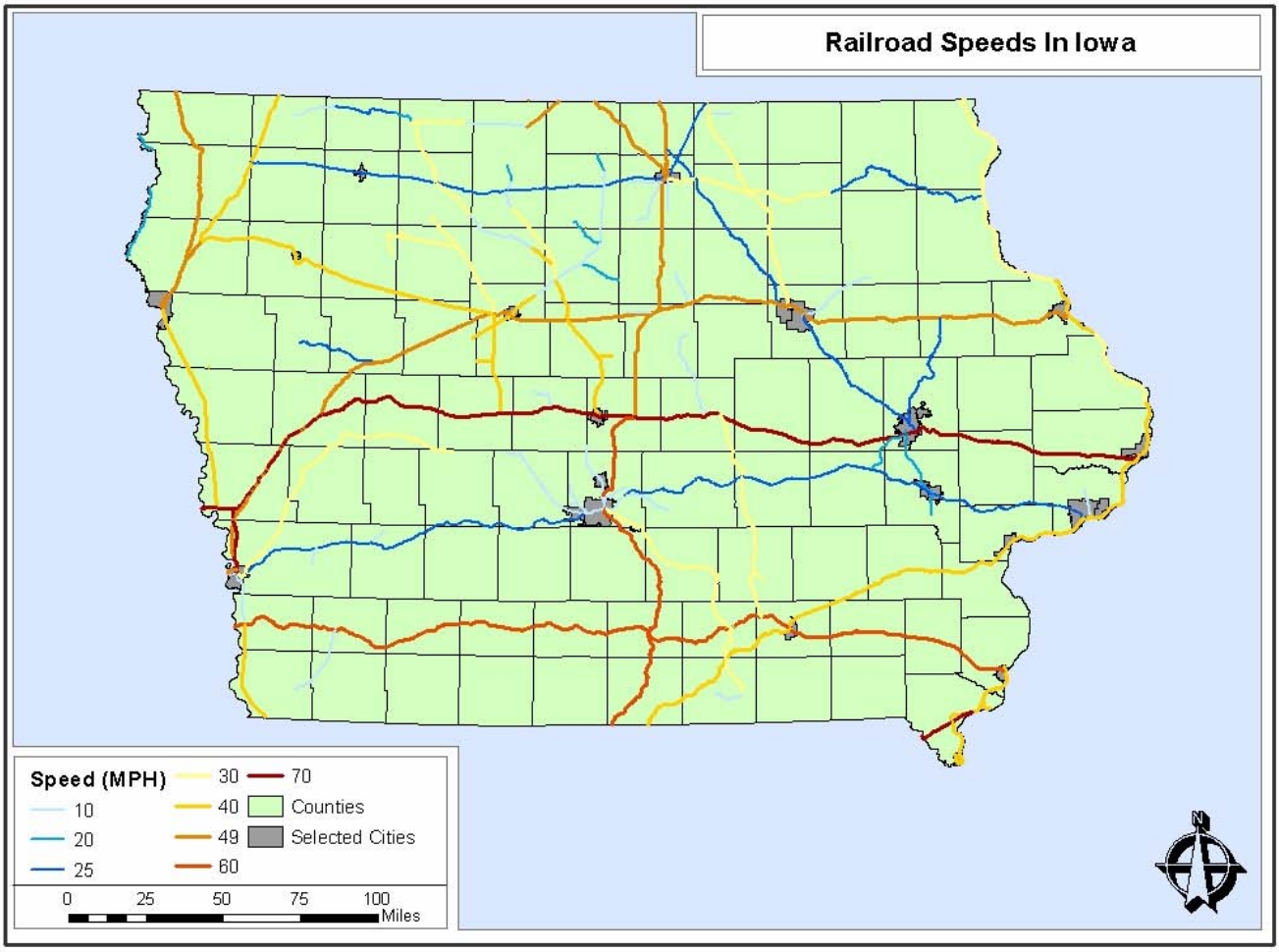


**Figure 30. Railroad track speeds in Iowa**

**Rail Fuel Use per Ton-Mile**

*What this Performance Measure Means*

In 2003, there were nearly 14.7 billion ton-miles across Iowa. A ton-mile describes one ton of freight traveling one mile on railroad track. Rail fuel use per ton-mile is the number of gallons of fuel it takes to move one ton of freight one mile.

*Why this Performance Measure is Important*

Rail fuel use per ton-mile measures the efficiency of the railroad companies operating in Iowa. With lower fuel consumption, operating costs and air pollution decrease.

*Recent Data and Interpretation*

In 1985, there were approximately 4.45 billion ton-miles in Iowa, which means that ton-miles in Iowa have more than tripled since then. At the same time, fuel consumption has only doubled. The overall result is a fairly consistent downward trend from 1985 to 2003 in rail fuel use per ton-mile, as shown in Figure 31 (Iowa DOT, Office of Rail Transportation). Iowa railroads have become considerably more energy efficient in the past 20 years. Since 1997, fuel use per ton-mile has fallen by about 14% to just under one-hundredth of a gallon of fuel per ton-mile.

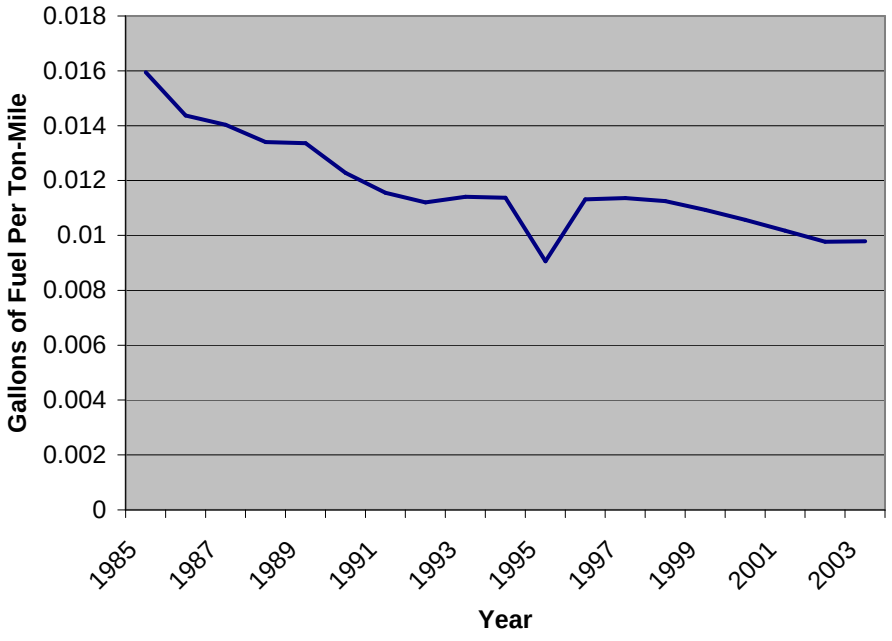


**Figure 31. Gallons of fuel use per ton-mile**

## Population within a Two-Hour Drive of Commercial Air Service

*What this Performance Measure Means*

The population within a two-hour drive of commercial air service is the proportion of the population within Iowa that can drive to a commercial airport in two hours or less.

*Why this Performance Measure is Important*

The population within a two-hour drive of commercial air service is important because it indicates the availability of air travel for Iowa's population.

*Recent Data and Interpretation*

The data created for the Aviation System Plan show that 99.5% of the population in Iowa lives within two hours of commercial air service. Figure 32 shows the areas within two hours of major commercial air service and the areas within one hour of the remaining commercial airports. Two small portions of Iowa account for the 0.5% outside the two-hour distance. These areas exist in the northwest and southeast areas of the state.

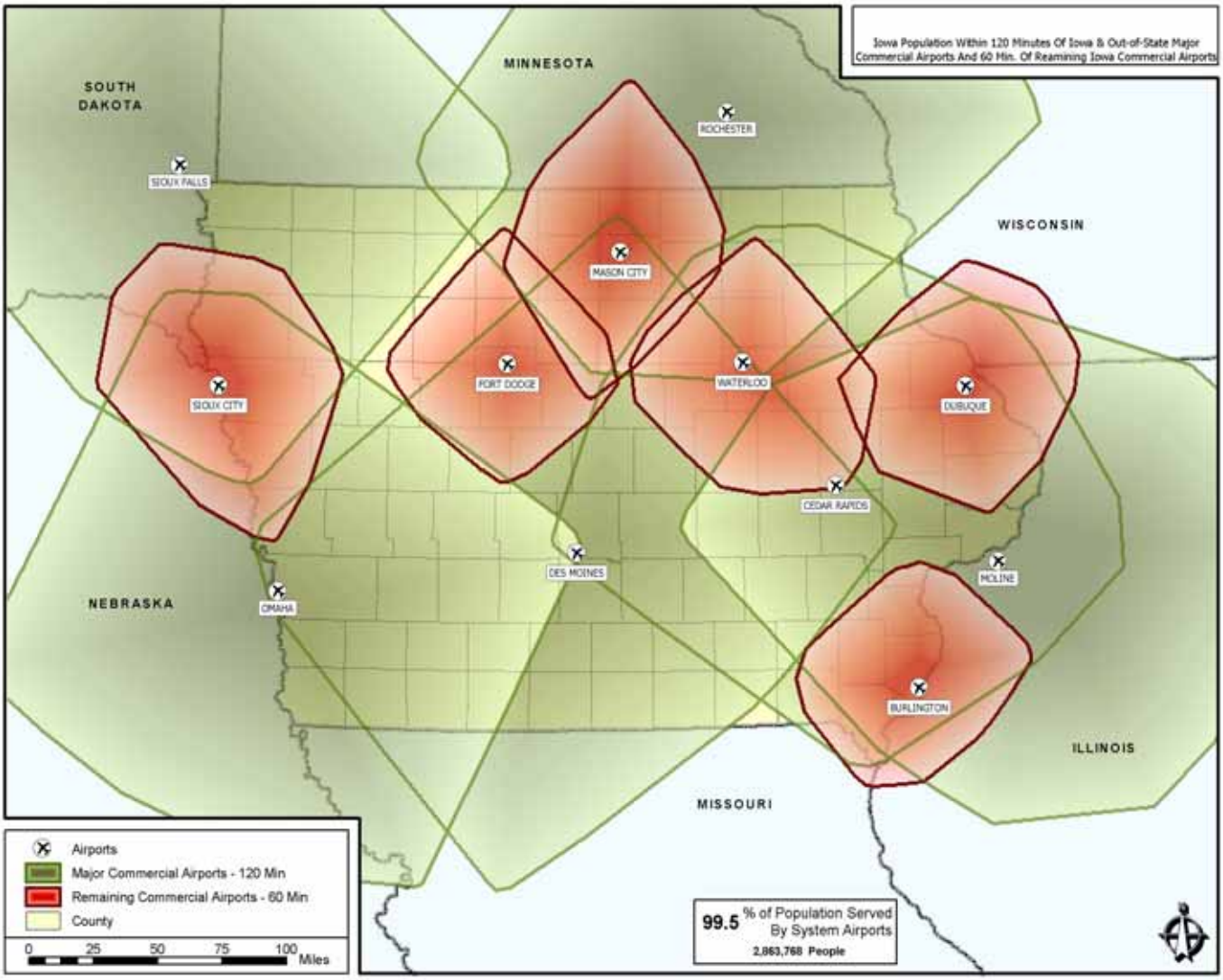


**Figure 32. Proximity to commercial airports**

**Communities within 30 Minutes of a General Aviation or Commercial Airport**

*What this Performance Measure Means*

This performance measure indicates the incorporated cities in Iowa that are within a 30-minute drive from a general aviation or commercial service airport. In determining the linear distance, it is assumed that the motor vehicle is traveling at right angles and traveling at an average of either 45 or 55 mph. These assumed speeds resulted in radii of 15.9 and 19.4 miles, respectively.

*Why this Performance Measure is Important*

The percent of communities within 30 minutes of a general aviation or commercial service airport is important because the figure indicates quality of life. It is desirable to travel shorter distances for the opportunities and advantages associated with these aviation facilities.

*Recent Data and Interpretation*

Iowa has 954 incorporated cities within its boundaries. All but one of these cities is within 30 minutes of a general aviation or commercial service airport, according to the 55 mph assumption. See the map in Figure 33 (Iowa Department of Natural Resources). When the average speed is decreased to 45 mph, a total of 11 cities fall outside the given distance. In terms of percentages, 99.9% of Iowa communities are within 30 minutes of these airport facilities when the average speed is 55 mph, and 98.8% of Iowa communities are within the given distance when the average speed is 45 mph.

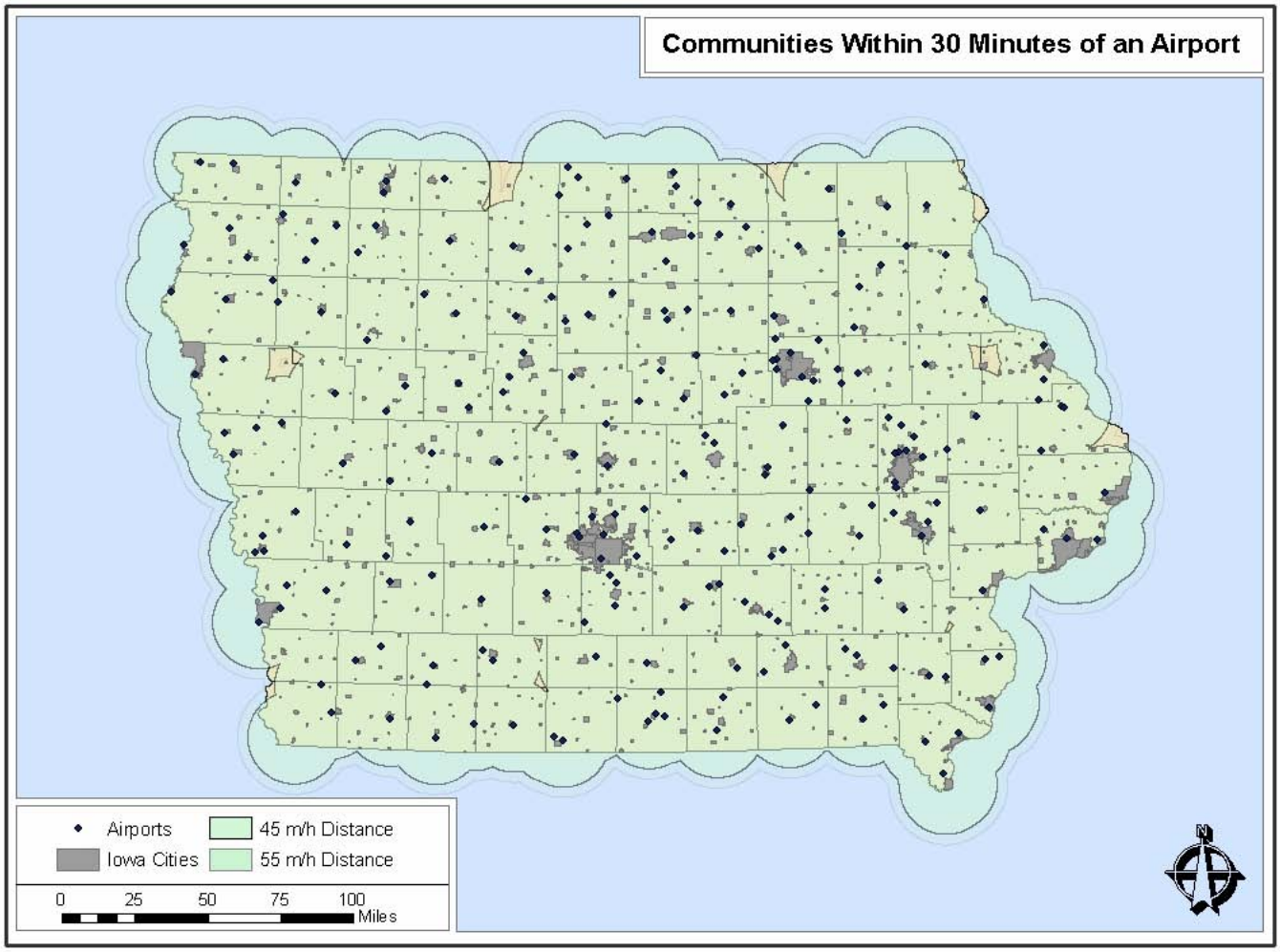


**Figure 33. Iowa communities within 30 minutes of an airport**

**Unavailable Quality of Life Performance Measures**

The following quality of life performance measures cannot be calculated from the available data:

- The highway/bridges category of transportation lacks the data necessary to calculate the "Percent of the System Operating at Traffic Level of Service 'C' or Better (Separate for Urban and Rural)." Much of the level of service data is known for the interstate system across the state, but there is a lack of data statewide.
- The public transit mode of transportation does not yet have the adequate data to calculate the "Population in Communities with Public Transit Services Sufficient to Support Independent Living and Employment." A beta survey has been conducted by the Iowa Department of Transportation, Office of Public Transit, but, again, complete statewide data is unavailable.

For the pedestrian/bicycle mode of transportation, two performance measures need data:

- "Miles of Off-Road Trails"
- "Miles of Rideable Highway Routes Based on Bicycle Level of Service (BLOS)." BLOS is a system that evaluates potential bicycle routes on the basis of rider safety and comfort. BLOS is a grading system, with "A" indicating an excellent route (where cyclists are likely to be safe and feel comfortable riding) and "F" indicating a route that is incompatible with bicycle travel. For instance, a freeway with high motor vehicle speeds, a narrow space for cyclists to ride, and a high volume of heavy truck traffic would likely get a BLOS grade of "F".

These measures need to be developed and data need to be collected so that these measures can help evaluate the current transportation system in Iowa.