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IOWA IN MOTION 2045

STATE TRANSPORTATION PLAN

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IOWA DOT

IOWA IN MOTION 2045

STATE TRANSPORTATION PLAN

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1. LOOKING AHEAD TO 2045

One hundred years ago, in 1917-1918, Iowa's first interurban highway was constructed with the paving of 11 miles between Mason City and Clear Lake. During this same era, the Ford Model T became the first automobile truly affordable to the masses. Although a century in the past, these developments occurred during the lifetime of today's oldest living generation.

By the middle of the 20th century, postwar demand led to rapidly escalating auto and truck sales, producing heavy traffic on a neglected highway system. In response to these trends, along with mobility and defense concerns, the Federal-Aid Highway Acts of 1944 and 1956 funneled billions of dollars to the nation's highways and new Interstate Highway System. In the meantime, the Iowa General Assembly created a dedicated fund to direct road-user taxes to the state's primary, secondary, and municipal roads.

Just a half-century later, the momentum began to shift. A century of highway-centric system development has slowed, and philosophies regarding land use and alternative transportation modes have been evolving. As this Plan development effort concludes, many experts are predicting widespread adoption of automated and connected vehicle technology within the next few decades, which has the potential to revolutionize travel.

Transportation in Iowa has always been an evolution – from horses and buggies to trains and trollies to cars and trucks. Now more than ever, it is critical that we plan for the system of the future, and not simply rebuild the system of today. This will require informed and dynamic investment in the transportation system. Iowa's oldest generation has lived through 100 years of incredible transportation advancements. This Plan seeks to position the state of Iowa for the coming decades of change.

1.1 What the Plan is

The state transportation plan (Plan) is a long-range document that addresses federal requirements[1] and serves as a transportation investment guide. The Iowa Department of Transportation's (DOT) long-range planning process is called Iowa in Motion, and the most recent Plan developed through this process was adopted in 2012. The Plan is updated every five years in order to stay current with trends, forecasts, and factors that influence decision-making, such as legislation, funding, technological changes, and state priorities.

The Plan forecasts the demand for transportation infrastructure and services to 2045 based on consideration of social and economic changes likely to occur during this time. Iowa's dynamic economy and the need to meet future challenges will continue to place pressure on the transportation system. With this in mind, the Plan provides direction for each transportation mode and supports a continued emphasis on stewardship. The Iowa DOT views stewardship as efficient investment and prudent, responsible management of the existing transportation system.

As Iowa changes and the transportation system evolves, one constant will be that the safe and efficient movement of people and goods is essential for stable growth in Iowa's economy. Iowa's extensive multimodal and multijurisdictional transportation system is a critical component of economic development and job creation throughout the state. The system is also a major contributor to Iowans' quality of life.

1. See Appendix 1 for a list of federal requirements for state transportation plans.

1.2 What the Plan includes

Some of the key components of the document include the following.

- **Trends**: An analysis of demographic, economic, passenger, and freight trends and what these trends mean for Iowa's transportation system.
- **Planning considerations**: An overview of several issues and factors that influence transportation planning.
- **System condition**: An overview of each mode within the transportation system.
- **Vision**: A broad statement that captures the overall vision for Iowa's future transportation system.
- **Investment areas**: Overarching areas within which actions will be defined to implement the system vision.
- **Strategies and improvements**: Actions and initiatives that will be utilized by the department to implement the vision.
- **Costs and revenues**: An analysis of annual costs and revenues for each transportation mode.
- **Implementation**: A discussion related to addressing funding shortfalls, programming future investments, and ongoing performance monitoring.

1.3 How the Plan was developed

Development of the Plan involved input from a wide variety of stakeholders and resources. While it is impossible to capture every resource used in an exhaustive list, the sources identified below played a critical role in shaping this planning effort and document.

Public input

The Iowa DOT's current public participation process[2] identifies several steps to be used in developing the long-range state transportation plan to ensure opportunities for public input, review, and comment. Each of the following steps was used during the development of the Plan.

1. Use appropriate mailing (including email) lists to notify the public.
2. Use advisory committees.
3. Hold regional public information/listening meetings, when appropriate.
4. Use the Iowa Transportation Commission meetings.
5. Encourage letters and written comments.
6. Distribute draft plans and documents for review.
7. Review the state public participation process.

The following sections provide more detailed information about public and stakeholder input efforts during the planning process.

2 Iowa DOT's public participation adheres to the process outlined in 23 CFR 450.210(a).
The process can be viewed at http://www.iowadot.gov/program_management/StatePublicParticipationProcess.pdf.

Public surveys

In order to gather public input throughout the planning process, two public surveys were conducted during Plan development. The surveys are described briefly here, and their results have been integrated throughout the Plan. A summary of survey results can be found in Appendix 2.

In February 2016, a survey was developed to gather initial feedback on possible investment areas and strategies for the Plan. This survey involved ranking four potential investment areas and suggesting others; providing a one to five-star rating for each of five possible strategies under each investment area; and answering three open-ended questions on what activities the department should continue doing, should enhance or expand, and should discontinue. A total of 520 people provided data through the survey. Results helped form the draft vision, investment area structure, and content that was carried forward in Plan development.

A second survey was conducted in August and September 2016 to gather additional input. The survey focused on questions regarding how people would like to live and travel in the future and asked for opinions on various highway investment strategies. The survey was available concurrently with the Iowa State Fair and tied in with the Iowa DOT's 2016 State Fair booth theme "Future of Transportation." A total of 1,646 people took the survey, and the input was used to help develop action plan strategies and improvement needs.

Blog posts and news releases

Information was distributed in the form of news releases and posts to the Iowa DOT's Transportation Matters blog throughout the plan development process. These included the following.

- Jan. 14, 2016: First blog on the Plan, which focused on the reasons for developing the Plan and what was changing from the 2012 document.
- Feb. 1, 2016: News release regarding the first public input survey, which sought input on conceptual investment areas and strategies, as well as open-ended feedback.
- April 26, 2016: Blog on results of first round of public input.
- Aug. 9, 2016: News release regarding the second public input survey that sought input on how people want to live and travel in the future.
- Sept. 13, 2016: Blog on vision and investment areas.
- Nov. 1, 2016: First in a series of three blogs covering highway improvement needs analysis, which focused on statewide capacity and mobility and safety needs.
- Dec. 22, 2016: Second in a series of three blogs covering highway improvement needs analysis, which focused on freight and condition needs.
- Jan. 20, 2017: Third in a series of three blogs covering highway improvement needs analysis, which focused on urban capacity, operations, and bridge needs.
- Feb. 14, 2017: Blog on modal needs analysis, including aviation, bicycle and pedestrian, public transit, rail, and water.

Public input surveys were also advertised through the department's social media platforms.

Public meeting and comment period

In addition to the public input surveys, a public meeting was held March 21, 2017 to provide an opportunity for in-person feedback following draft Plan development. The meeting, a 45-day public comment period, and methods for providing comments on the draft Plan were advertised through a series of news releases and social media posts. The following statistics summarize the level of public input achieved during the comment period.

- Webpage visitors: 2,400
- Total public meeting attendance: 14
- Written comments received: 21

Iowa Transportation Commission

The Iowa Transportation Commission (Commission) sets policy for the department through its approval of the state transportation plan and the Iowa Transportation Improvement Program (Five-Year Program). The governor appoints the seven transportation commissioners, with political and gender balance required. Commissioners are confirmed by the Iowa Senate and serve on a staggered basis for four-year terms. Meetings occur monthly, with eight of the 12 Commission meetings held in Ames. The other four meetings involve tours and stakeholder input opportunities in various locations around the state. The meetings are open to the public and streamed online.

Commission meetings typically include an informal workshop and formal business meeting. Commission workshops were used to inform the Commissioners on the progress of the Plan and ask for their feedback. Presentations were made at seven Commission workshops between January 2016 and April 2017, prior to final action at the Commission's May 2017 business meeting. These presentations were also made available online at the project website.[3]

3 http://www.iowadot.gov/iowainmotion/index.html

Internal stakeholders

Individuals representing a diverse cross section of the Iowa DOT were involved in the development of the Plan through a combination of topical communication and meetings as well as two formal committees. Staff members from the following Iowa DOT offices were involved in some manner during Plan development.

- Aviation
- Bridges and Structures
- Contracts
- Design
- Local Systems
- Location and Environment
- Maintenance
- Performance and Technology
- Policy and Legislative Services
- Program Management
- Public Transit
- Rail Transportation
- Right of Way
- Strategic Communications
- Systems Planning
- Traffic and Safety
- Traffic Operations

Planners representing each of the state's six transportation districts were also engaged throughout the planning process.

Two committees were established early in the planning process to create more structured opportunities for discussing Plan development and gathering feedback. An Internal Steering Committee (ISC) was created to serve as a sounding board for Plan development and to help provide guidance for the overall process. The ISC included broad representation from across the department to ensure the opportunity for a wide range of perspectives to provide input to the Plan, and included a Federal Highway Administration (FHWA) liaison. A second committee, the Action Plan Focus Group (APFG), was also established.

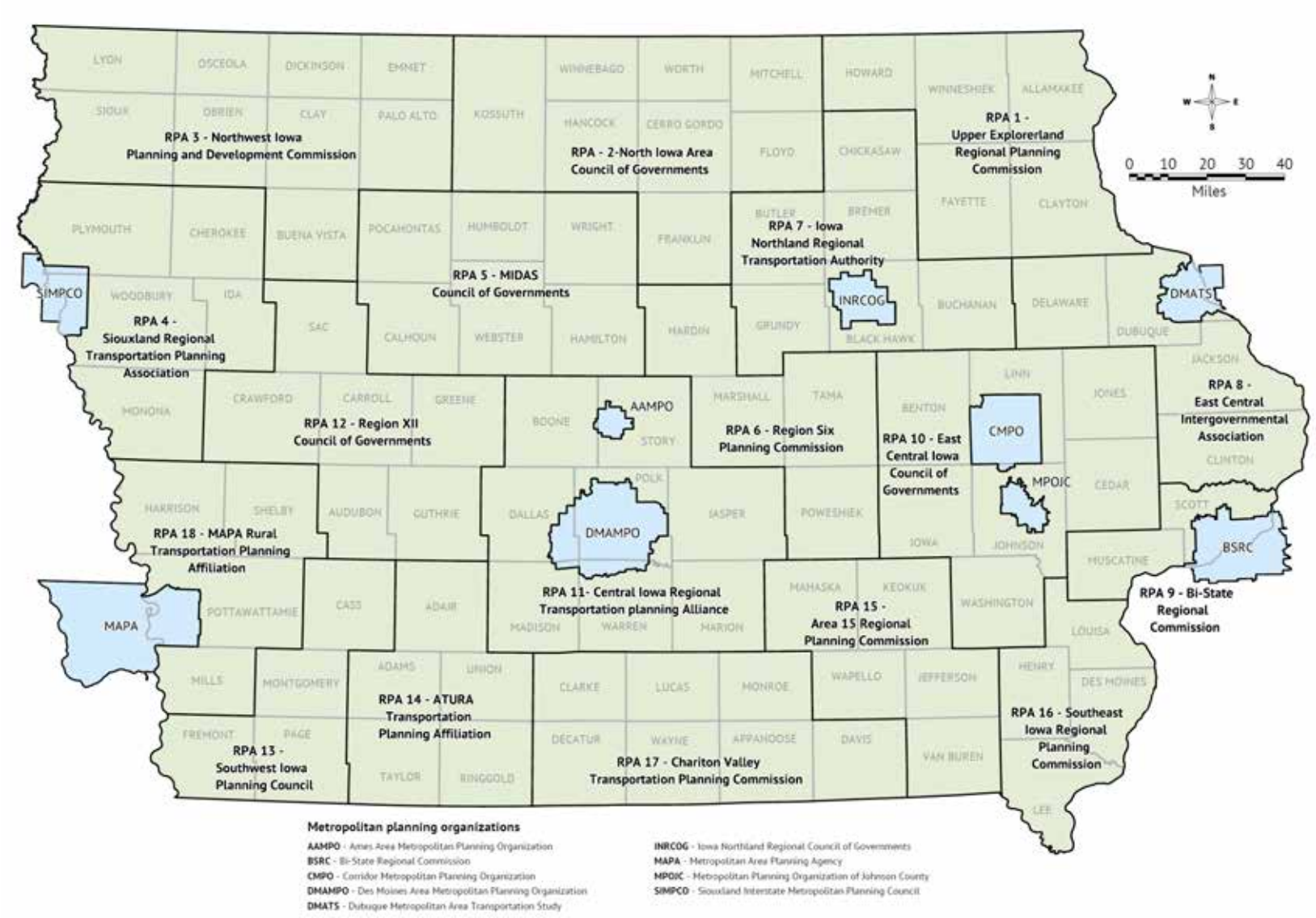
The APFG involved a subset of individuals from the ISC and additional representation from the department. The APFG was charged with assisting in the development of the strategies and improvements contained in this Plan. The ISC met eight times and the APFG met seven times during Plan development.

State planning agencies

The state's transportation planning agencies, which include metropolitan planning organizations (MPOs) and regional planning affiliations (RPAs), partnered with the Iowa DOT and were critical in the development of the Plan. MPOs conduct transportation planning and programming activities in the state's nine urban areas with populations greater than 50,000, which include Ames, Cedar Rapids, Council Bluffs, Davenport, Des Moines, Dubuque, Iowa City, Sioux City, and Waterloo. Iowa's 18 RPAs conduct transportation planning and programming activities in the remaining nonmetropolitan areas of the state, covering all 99 counties. The locations of these agencies are shown in Figure 1.1.

The MPOs and RPAs were engaged in a number of different ways during development of the Plan. Input was gathered through quarterly meetings held between the agencies and Iowa DOT, survey responses, policy board and technical committee meetings, and numerous interactions with staff. In addition, MPO and RPA long-range transportation plans (LRTP) were referenced throughout the development of the Plan. MPO and RPA input was very valuable to Plan development; ultimately, it is anticipated that the Plan will be useful to MPOs and RPAs in their transportation planning and programming activities.

Figure 1.1: Iowa metropolitan planning organizations and regional planning affiliations



Source: Iowa DOT

Interagency and external stakeholder consultation

Another important part of developing the Plan is consulting with other various government agencies, including Federal, State, Tribal, and local governments. Consultation with these agencies was achieved in two main ways: By reviewing plans and maps from these entities, and inviting them to review and comment on draft Plan content. As part of the consultation process, the Iowa DOT contacted the following agencies and tribal governments.

- Federal Highway Administration, Iowa Division
- Federal Transit Administration, Region 7
- Iowa Department for the Blind
- Iowa Department of Agriculture and Land Stewardship
- Iowa Department of Cultural Affairs
- Iowa Department of Education
- Iowa Department of Human Rights
- Iowa Department of Human Services
- Iowa Department of Natural Resources
- Iowa Department of Public Health
- Iowa Department of Public Safety
- Iowa Department on Aging
- Iowa Economic Development Authority
- Iowa Homeland Security and Emergency Management
- Iowa Tourism
- Iowa Utilities Board
- Iowa Workforce Development
- Meskwaki Tribe
- Office of the State Archaeologist
- State Historical Society
- U.S. Army Corps of Engineers, Rock Island District
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Environmental Protection Agency, Region 7
- U.S. Fish and Wildlife Service

In addition to the abovementioned agencies, the Iowa DOT consulted with a variety of modal interest groups throughout the development of the Plan. These groups included, but were not limited to, public transportation providers, the Iowa Bicycle Coalition, the Iowa Bicycle and Pedestrian Advisory Committee, the Iowa Transportation Coordination Council, the Freight Advisory Council, the Passenger Rail Advisory Committee, and the Railroad Advisory Committee.

Other plans and studies

A large variety of plans, reports, and studies were considered throughout the Plan development process. The following summarizes many of the documents and planning efforts that were utilized.

- Americans with Disabilities Act (ADA) Transition Plan (2016)
- Climate Change Impacts on Iowa (2010)
- Economic and Health Benefits of Bicycling in Iowa (2012)
- Governor's Transportation 2020 Citizen Advisory Commission – Report and Recommendations (2011)
- Iowa Air Service Study (2008)
- Iowa Aviation System Plan Update (2011)
- Iowa Bicycle and Pedestrian Long-Range Plan (Draft, 2017)
- Iowa Comprehensive Highway Safety Plan (2006)
- Iowa Crude Oil and Biofuels Rail Transportation Study (2016)
- Iowa Energy Plan (2016)
- Iowa in Motion – Planning Ahead 2040 (2012)
- Iowa in Motion – Iowa Park and Ride System Plan (2014)
- Iowa in Motion – State Freight Plan (2016)
- Iowa in Motion – State Transportation Plan (1997)
- Iowa Infrastructure Condition Evaluation (ICE) – 2016-2017 Highway Planning Report (2017)
- Iowa Interstate Corridor Plan (2013)
- Iowa Passenger Transportation Funding Study (2009)
- Iowa State Rail Plan (2017)
- Iowa Strategic Highway Safety Plan (2013, 2017)
- Iowa Trails 2000 (2000)
- Iowa's Mississippi River Trail Plan (2003)
- Iowa's Renewable Energy and Infrastructure Impacts (2010)
- Lewis and Clark Multiuse Trail Study (2010)
- Livability in Transportation Guidebook (2010)
- Policy Strategies for Iowa in Making Major Road Investments (2002)
- Road Use Tax Fund (RUTF) Study (2006, 2008, 2011, 2016)
- The Fix We're In For: The State of Our Nation's Bridges (2013)
- Transportation Asset Management Plan (2016)
- Transportation Planning and the Environment (2009)
- Transportation Systems Management and Operations Program Plan (2016)
- Transportation Systems Management and Operations Strategic Plan (2016)
- Uses and Benefits of Aviation in Iowa (2009)

1.4 How the Plan is used

The Plan is a multimodal transportation planning effort intended to assist the department and Commission in making informed transportation investment decisions for the state. It helps provide policy direction for the types of investments the department should be making, and also identifies specific strategies and corridor-level improvement types for consideration. Additionally, MPO and RPA policy boards and technical committees may use the Plan to help capture the Iowa DOT's perspective for their local planning efforts and guide their own investment decisions.

Projects programmed within the Iowa DOT Five-Year Program, which is approved by the Commission, support implementation of the Plan. In addition, more specialized plans will provide further detail concerning the implementation of elements of the Plan. Figure 1.2 highlights the Plan's role in the transportation planning cycle.

Public policy and input

Congress outlines specific requirements and factors to be addressed in planning and programming activities. Federal and state legislation provide parameters for the administration of transportation funds. The governor, state legislature, and citizens provide statewide direction; the Iowa Code lays out numerous program operational criteria.

Transportation plan

The Plan serves as a guide for the development of transportation policies, strategies, and improvements between now and 2045. The Plan evaluates transportation in Iowa from a system perspective, focusing on the movement of people and freight.

Five-Year Program

The Five-Year Program is a listing of specific departmental project investments and is approved by the Commission annually. Major elements include individual modal projects scheduled over the next five years, sources of funds, annual accomplishments, and criteria/eligibility of different modal funding programs.

Performance monitoring

The Iowa DOT has been involved with performance monitoring and reporting for many years. However, these monitoring efforts have, for the most part, been done by individual mode. Following on the performance-based planning requirements of the Moving Ahead for Progress in the 21st Century (MAP-21) Act and the Fixing America's Surface Transportation (FAST) Act, the Plan brings these modal monitoring elements into a more coordinated and comprehensive transportation system evaluation process.

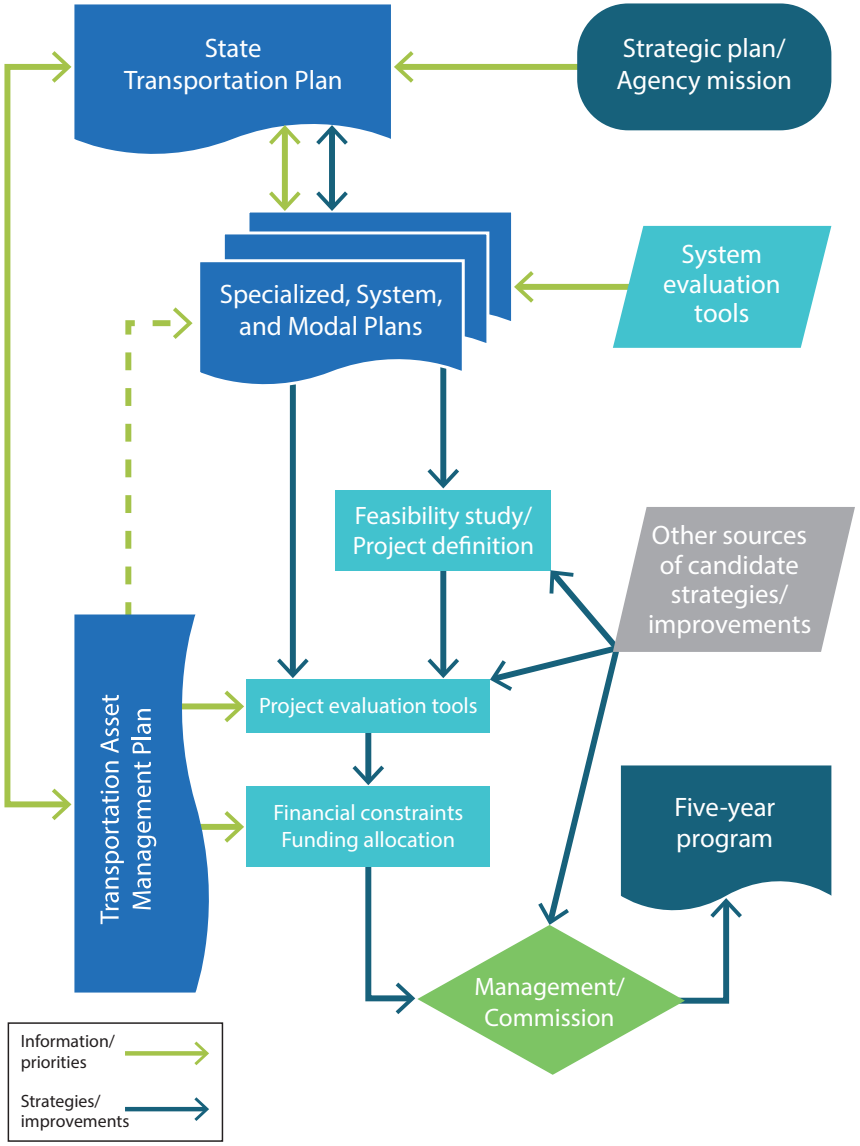
Figure 1.2: Transportation planning and programming cycle

Source: Iowa DOT

Beyond this generalized four-step cycle, Figure 1.3 illustrates in more detail how the Plan relates to the variety of additional plans and tools the department utilizes to ultimately inform the development of the Five-Year Program. These include more specialized plans (e.g., State Freight Plan and Transportation Asset Management Plan), system evaluation tools (e.g., Infrastructure Condition Evaluation tool), and project-level evaluation tools (e.g., Project Prioritization). The programming discussion in Chapter 7 provides more detail regarding the ways specific projects are developed and prioritized for funding, which largely occurs in the steps identified as feasibility study/project definition, project evaluation tools, and financial constraints/funding allocation on Figure 1.3.

While the development process for each update to the Plan considers all available planning resources and tools, the planning process also provides an opportunity to revisit the overarching policies, strategies, and improvements that will guide all other department planning efforts. The Plan is the cornerstone of the statewide transportation planning process, serving a critical function in transforming the state's policy directions into future investment actions.

Figure 1.3: Relationship between elements of the planning and programming process



Source: Iowa DOT

2. UNDERSTANDING IOWA

How will Iowa be different in 2045?

What are some of the key changes that may occur?

How will future economic development opportunities be addressed?

How will Iowa's transportation system be affected?

To answer these types of questions, it is important to understand past, current, and projected trends. This chapter looks at many of the key demographic, economic, passenger transportation, and freight transportation trends that have affected Iowa in the past; how they are affecting Iowa today; and how they are projected to affect Iowa in the future. An understanding of the characteristics that make Iowa unique will help project future needs and plan ahead to meet these challenges.

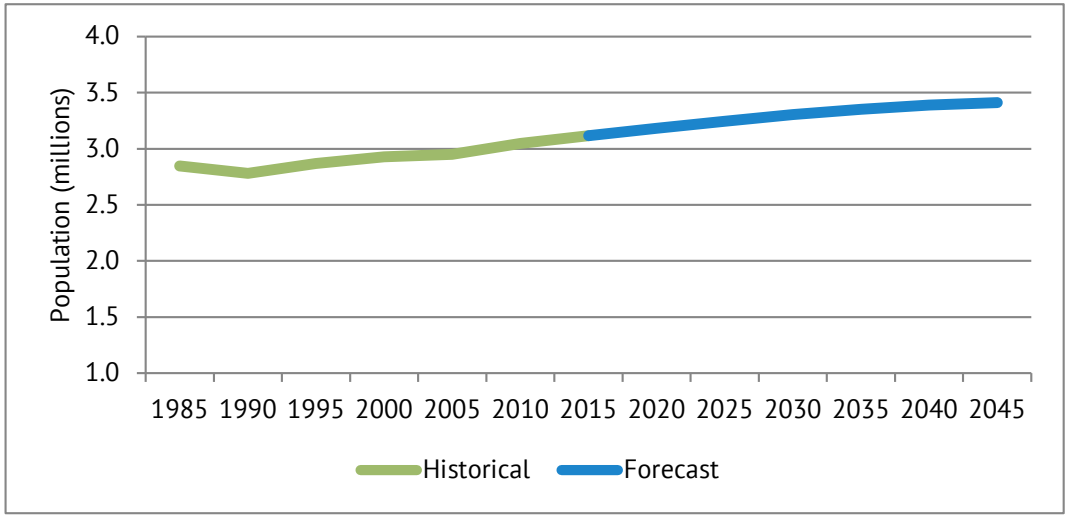
2.1 Demographic trends

Iowa's population is growing at a slow pace

Iowa's population has remained relatively stable since 1985, growing about 9.5 percent over the past 30 years. As of 2015, Iowa ranked 30th among all states when comparing total population. It is projected that Iowa's population will continue to increase at the same rate over the next three decades, growing from 3.12 million in 2015 to approximately 3.41 million in 2045 (see Figure 2.1).

Iowa's population growth from 2000 to 2010 was slower than the national growth rate, but was fairly consistent with the Midwest region, which the U.S. Census Bureau defines as the states of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. According to the 2010 census, Iowa's population grew 4.1 percent from 2000 to 2010, compared to 3.9 percent in the Midwest region and 9.7 percent nationally. Since the 2010 decennial census, Iowa's population has maintained a similar growth rate, with 2015 U.S. Census Bureau population estimates showing a 2.5 percent increase from 2010-2015. This exceeds growth in the Midwest region overall, which is 1.5 percent since 2010, but is less than the growth seen across the nation as a whole, which is 4.1 percent since 2010.

Figure 2.1: Iowa population, 1980-2045

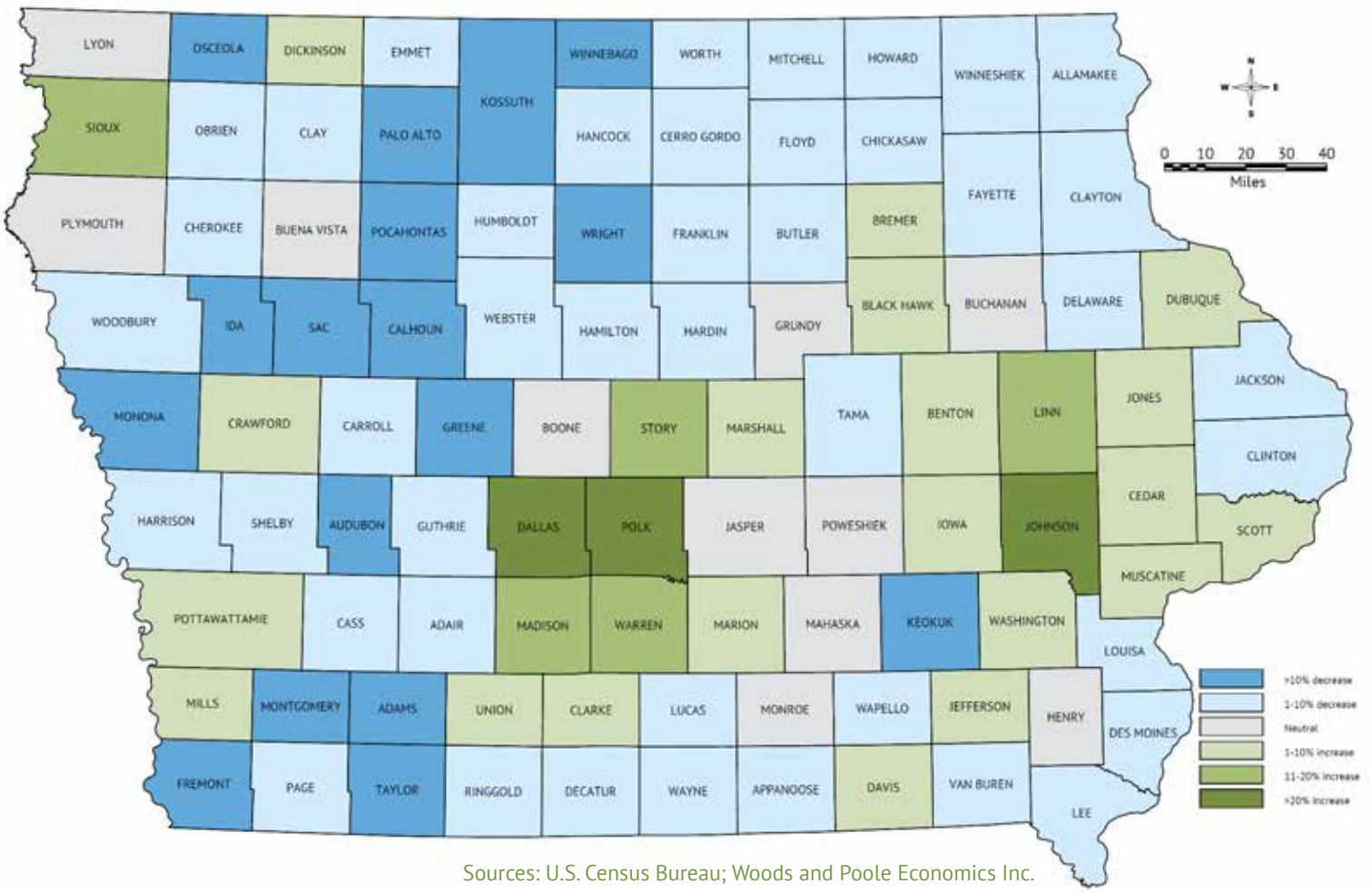


Sources: U.S. Census Bureau; Woods and Poole Economics Inc.

Iowa's population growth is not uniform throughout the state

Areas of population growth and decline vary around the state. Between 2000 and 2015, 28 of Iowa's 99 counties grew by 1 percent or more, 11 counties remained virtually unchanged, and 60 counties declined by 1 percent or more. While there was growth in various locations across Iowa, the majority of population increases took place within or near metropolitan areas. Figure 2.2 illustrates the 2000 to 2015 population change across Iowa's 99 counties.

Figure 2.2: County population change, 2000-2015

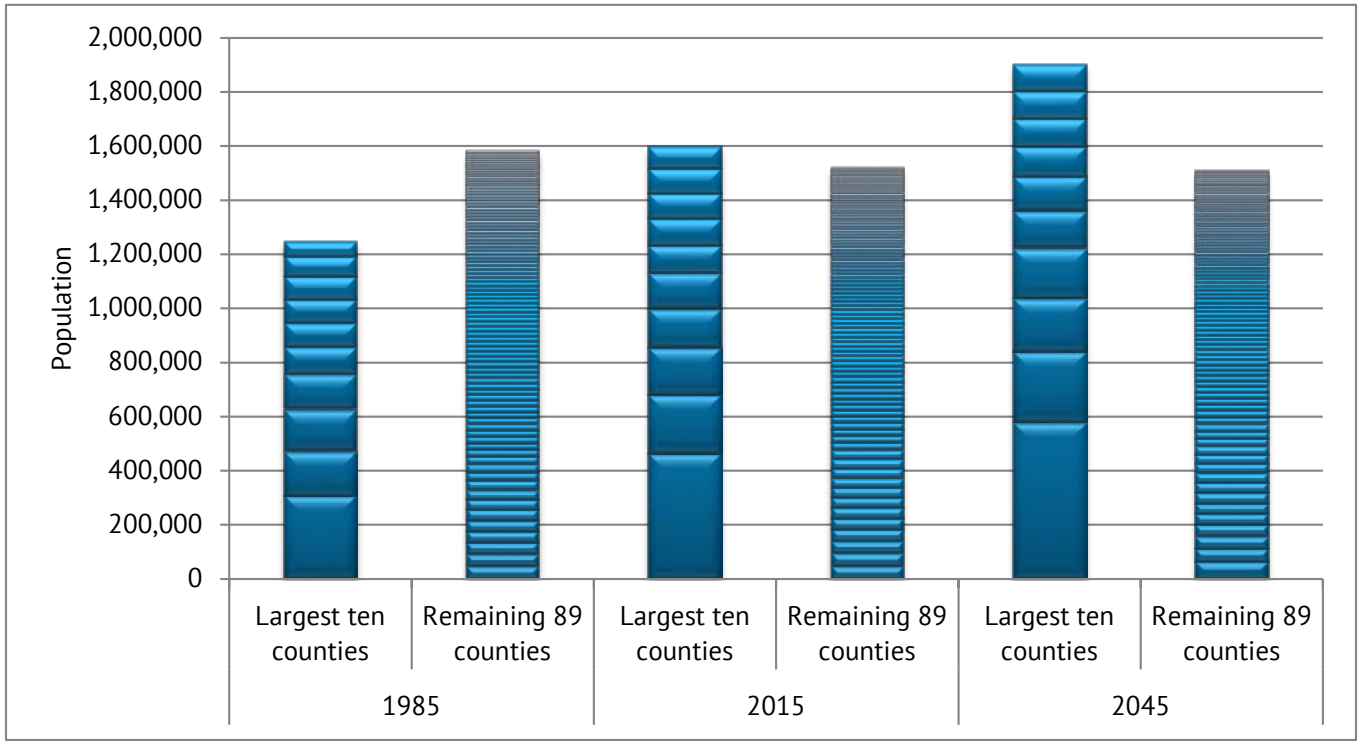


Sources: U.S. Census Bureau; Woods and Poole Economics Inc.

Iowa's population is urbanizing

As mentioned previously, Iowa's population is continuing to migrate toward the state's nine metropolitan areas, which have an urban core of at least 50,000 people. Historically, the majority of Iowa's population has resided in nonmetropolitan areas, yet most of the population growth in recent decades has been in counties that contain or are adjacent to metropolitan areas. This trend is reflected in data comparing the population for Iowa's 10 most populous counties with the remaining 89 counties. In 1985, the 10 largest counties accounted for 44 percent of Iowa's population, and the remaining 89 counties accounted for 56 percent. Projections for 2045 suggest a reversal of that trend, with the 10 largest counties accounting for 56 percent of Iowa's population, and the remaining 89 counties accounting for 44 percent of the population (see Figure 2.3). Although Iowa's population as a whole is growing at a slow pace, the shift in population from rural to urban communities has impacts on the transportation system. Increased population in metropolitan areas can create urban congestion and capacity issues, while local jurisdictions with decreasing population will be facing less funding for deteriorating roadways.

Figure 2.3: Comparison of Iowa's estimated county populations, 1985, 2015, and 2045



Source: Woods and Poole Economics Inc.

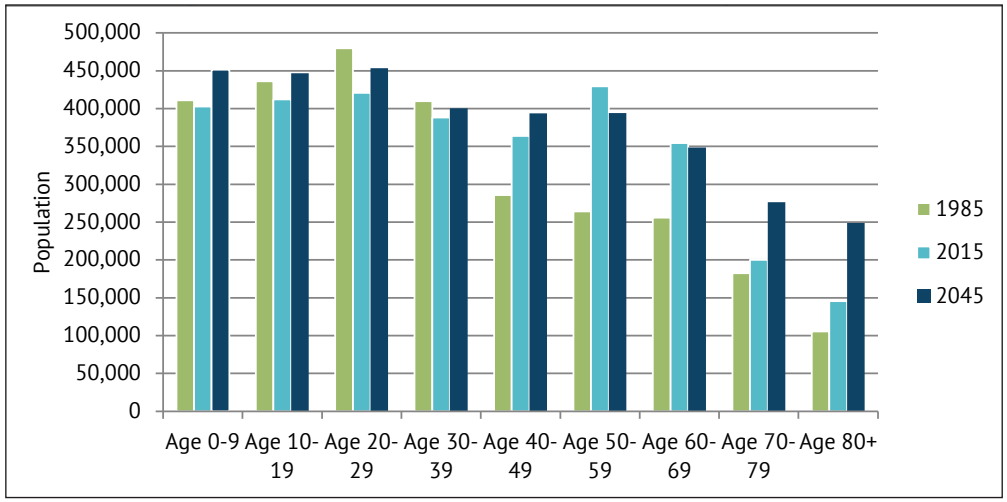
Iowa's population is undergoing generational shifts

Iowa's median age has increased from 30 years old in 1980 to 38 years old in 2015, and 15.5 percent of Iowa's population is older than 65 – the eighth-highest percent in the U.S. This number is expected to continue to grow as more of the "Baby Boomer" generation reaches this milestone in the coming years. At the same time, 40 percent of the population forecasted to live in Iowa in 2045 will be less than 30 years old – in other words, this segment of the population has not yet been born. Figure 2.4 shows Iowa's estimated population by age for 1985, 2015, and 2045.

Millennials (born between 1981 and 2000) currently account for the majority of Iowa's population, followed by Baby Boomers (born between 1946 and 1965). Planning for the entire population, which includes these and other distinct generational groups, requires a holistic approach. The importance of the generational change is significant given the shift in how younger generations work, where they live, and the mode of travel they prefer. Based on research and surveys conducted in National Cooperative Highway Research Program Project 20-24(89), *Role and Value of Transportation for U.S. Industries and Sectors*, it is anticipated that by 2020 nearly half of the U.S. workforce (46 percent) will be millennials. According to a 2012 American Public Transportation Association report, millennials are attracted to communities with a multitude of transportation choices. Millennials are also more likely to prefer to live in cities where a car is not needed.

Iowa's older generations have specific transportation needs that differ from younger generations. As Iowans continue to drive and live independently longer, improving the roadway and driving environment and expanding transportation options are necessary to help meet the needs of older citizens.

Figure 2.4: Historical and forecasted population by age for Iowa



Source: Woods and Poole Economics Inc.

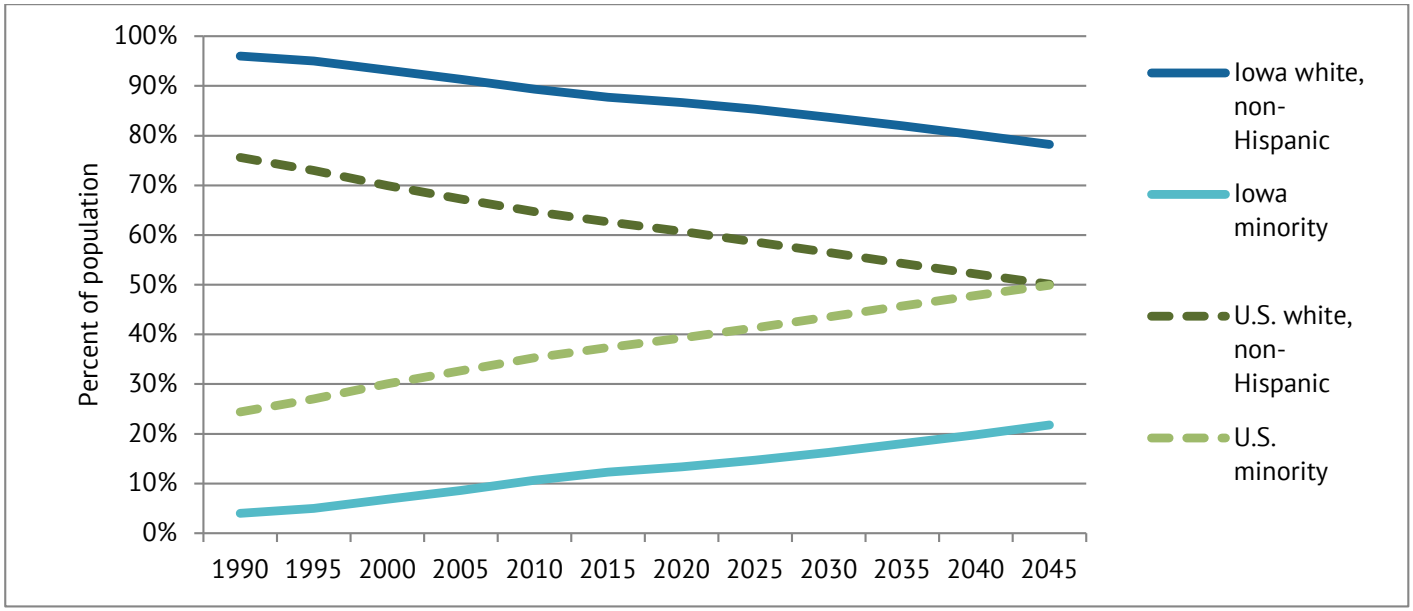
Some examples of ways to enhance roadway safety and transportation for all ages, particularly older citizens, include the following.

- Larger print on signs
- Safer turning movements at intersections
- More visible pavement markings
- Better roadway lighting
- Well-connected pedestrian facilities
- Improved transit options and coordination between transit providers and human service agencies

Iowa's minority population continues to grow

Iowa continues to become more diverse, with an increasing racial and ethnic minority population. Minorities accounted for 12 percent of Iowa's 2015 population, compared to less than 4 percent in 1990. By 2045, racial and ethnic minorities in Iowa are projected to account for almost 22 percent of the state's total population. However, this is far less diversity than in the nation as a whole. Figure 2.5 shows the actual and forecasted minority population in the U.S. and Iowa from 1990 to 2045. As shown, the minority population of the U.S. is projected to equal the white, non-Hispanic population by 2045.

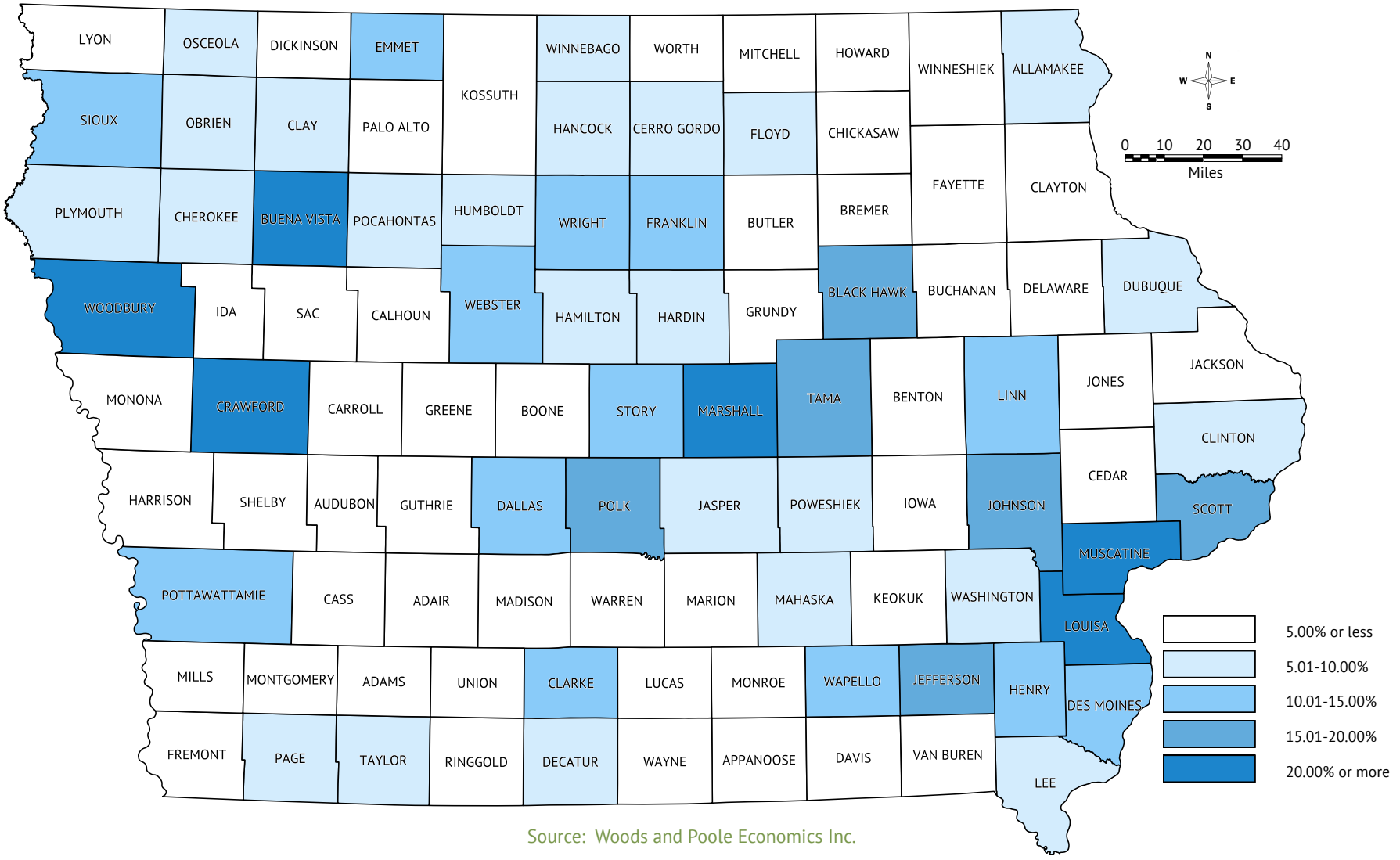
Figure 2.5: U.S. and Iowa white, non-Hispanic and minority population, 1990-2045



Source: Woods and Poole Economics Inc.

While most of the minority population in Iowa resides in the state's most populated counties, some of the areas with the highest percentage of minority populations are located in counties outside metropolitan areas (see Figure 2.6). It is important to understand the transportation needs of Iowa's minority population. Minority groups in Iowa are more likely to have a lower median household income and take a mode other than a personal automobile to work than nonminority populations. As Iowa's minority population increases, so will the need to accommodate persons with limited English proficiency (LEP) on the state's transportation system. Currently, approximately 3 percent of the state's population speaks English less than 'very well,' while 92 percent of the state's population speaks only English. The language most often spoken in Iowa other than English is Spanish, and this will likely continue as the Hispanic population is projected to grow faster than any other population group over the next 30 years. It is important to accommodate Iowa's LEP population in Iowa's multimodal transportation system in ways such as translating maps and transit schedules, and by offering interpretation services at public meetings.

Figure 2.6: Percent minority population by county, 2015



Source: Woods and Poole Economics Inc.

Implications for transportation – demographic trends

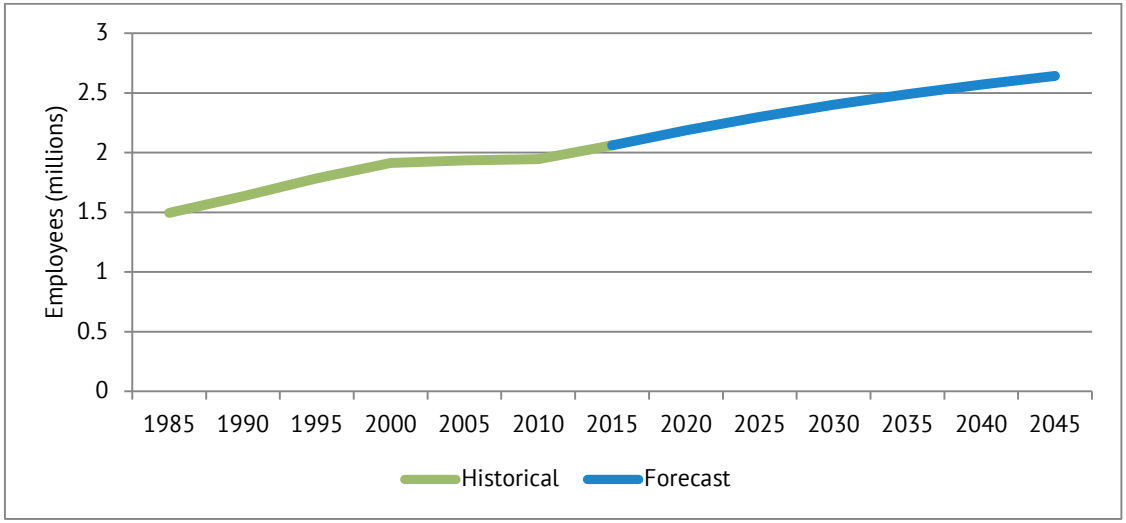
- Increased population in and around metropolitan areas may create congestion and capacity issues.
- Local jurisdictions with decreasing population will experience additional strain on already tight road budgets.
- Improving the roadway and driving environment and expanding transportation options are necessary to help meet the mobility needs of older residents.
- Transportation planning will need to account for varied work and life preferences across generations and consider how future generations will live, work, and travel.
- It is important that all Iowans, including minority, low-income, and disabled populations, have access to employment and services in both metropolitan and nonmetropolitan areas.

2.2 Economic trends

Total employment in Iowa is expected to increase slowly

In the past 30 years, total employment in Iowa has increased slowly, growing an average of 1.2 percent per year from 1985 to 2015. Iowa's employment is expected to continue to experience steady growth, increasing by another 28 percent between 2015 and 2045. Figure 2.7 charts the actual and projected total employment in Iowa from 1985-2045.

Figure 2.7: Iowa employment, 1985-2045

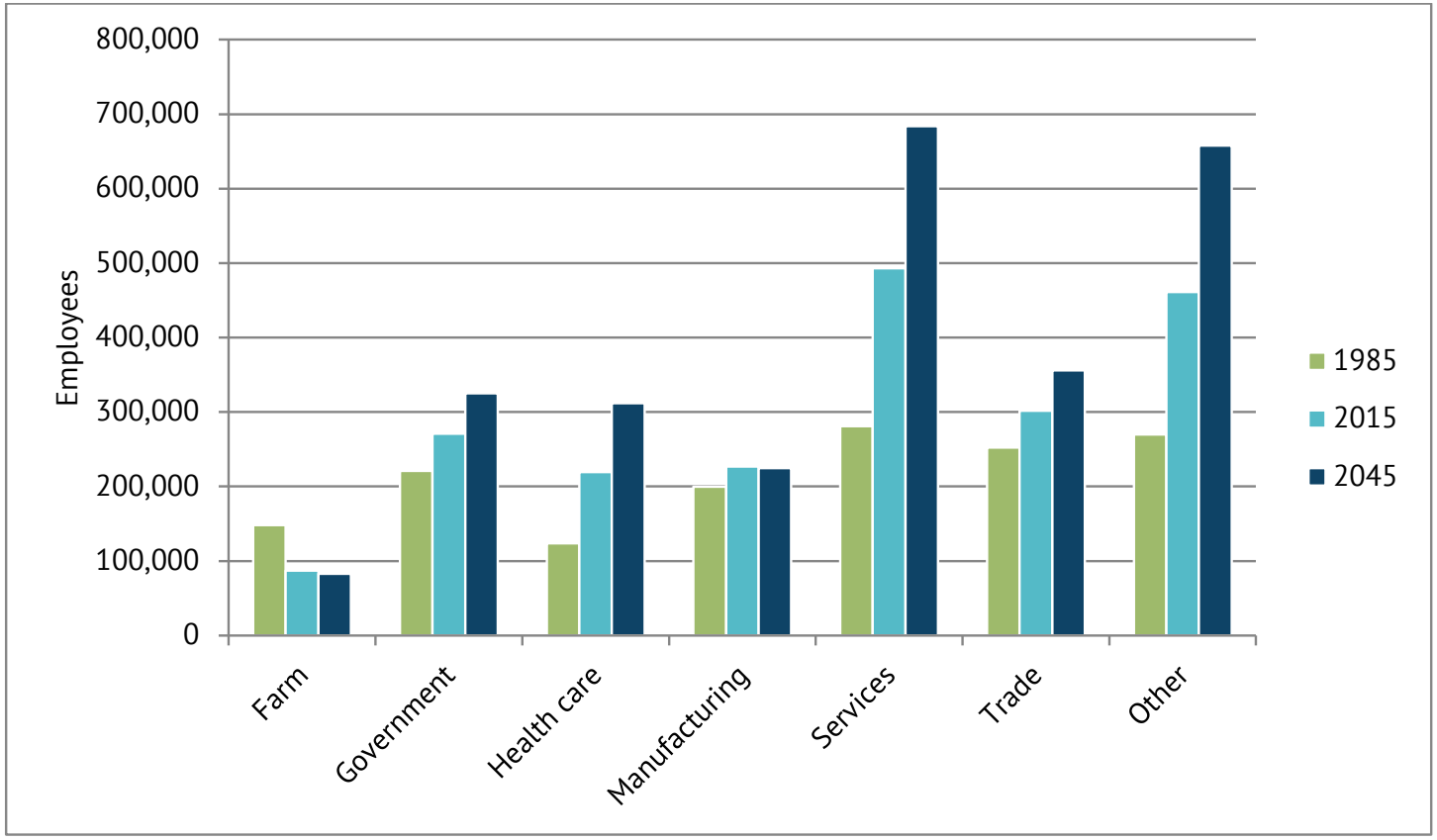


Source: Woods and Poole Economics Inc.

Iowa's traditional employment sectors have changed

Traditionally, farming and manufacturing have been two of the primary employment sectors in Iowa. Technological advancements and economic diversification have changed this in recent years. Since 1985, the farm sector has decreased by more than 60,000 jobs, which represents a decline of 40 percent in total farm employment in Iowa. This trend is projected to continue, though flatten out, with this sector losing an additional 4,600 jobs through 2045. The number of jobs in the service sector (professional, educational, administrative, arts, etc.) is expected to grow the most over the next 30 years. Currently, there are 493,000 service jobs, which are forecast to grow to almost 684,000 jobs in 2045. The largest growth in the "other" category shown on Figure 2.8 is in the finance and insurance category, which is expected to add more than 65,000 jobs between 2015 and 2045.

Figure 2.8: Iowa employment, 1985-2045



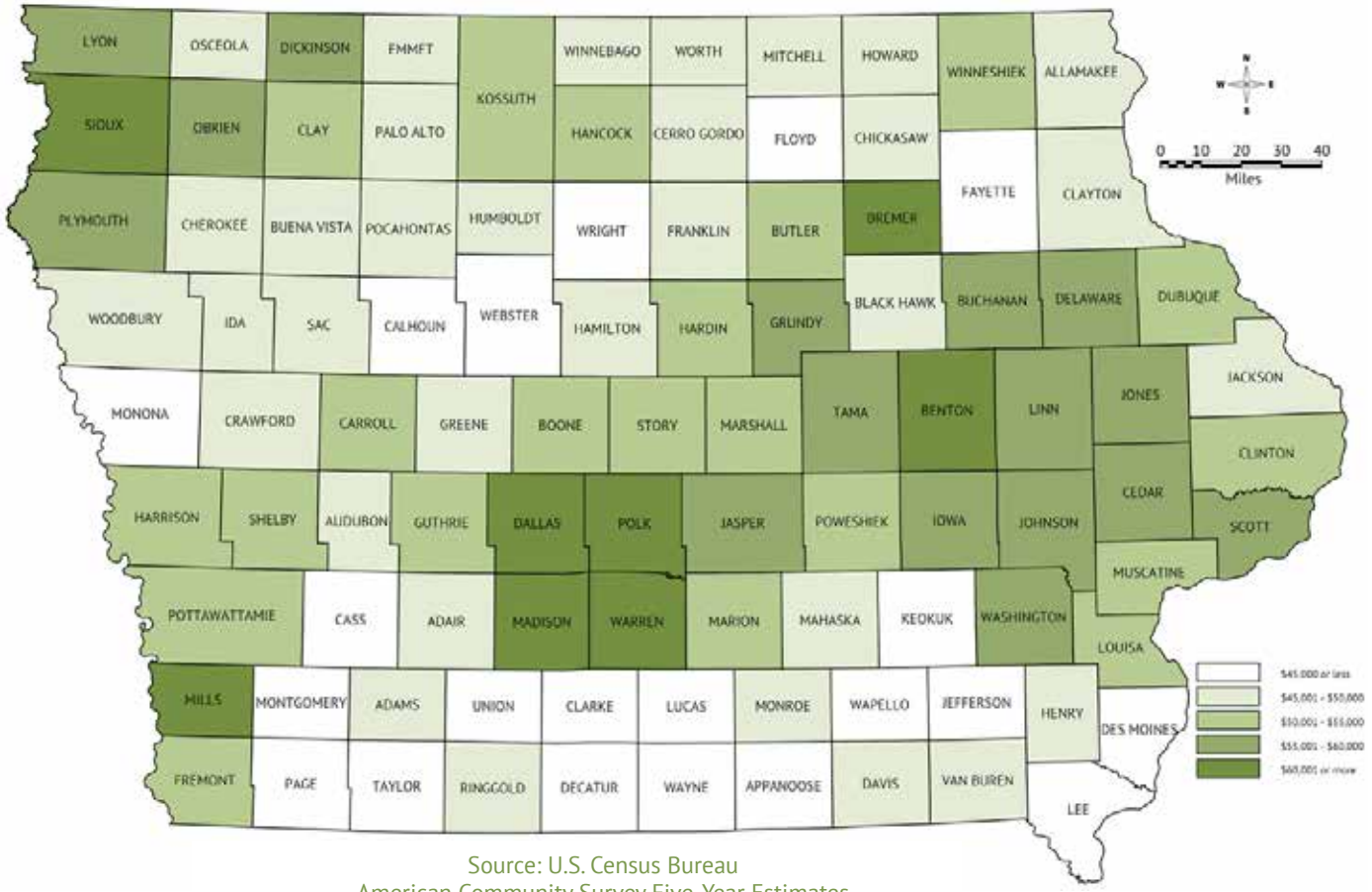
Source: Woods and Poole Economics Inc.

Iowa's per capita personal income and median household income are increasing but remain below the national average

Per capita personal income (total wages and salaries, transfer payments, dividends, interest, and rental income; divided by the total population) is used as a measure of the wealth of an area's population, as well as an indicator of the economic health of that region. According to data from the Bureau of Economic Analysis, Iowa's per capita personal income has grown 15.9 percent from 2010 to 2015, compared to 18.1 percent in the U.S. While Iowa's per capita personal income is currently 94 percent of the national average, this reflects an improvement from 2000 when Iowans earned 90 percent of the national average.

Among Iowa's households, the median income is currently $52,716, slightly less than the national average of $53,482. In general, the counties with the highest median household income are in or within close proximity to the state's metropolitan areas. Figure 2.9 shows the 2011-2015 estimated median household income across Iowa's 99 counties.

Figure 2.9: Median household income by county, 2011-2015



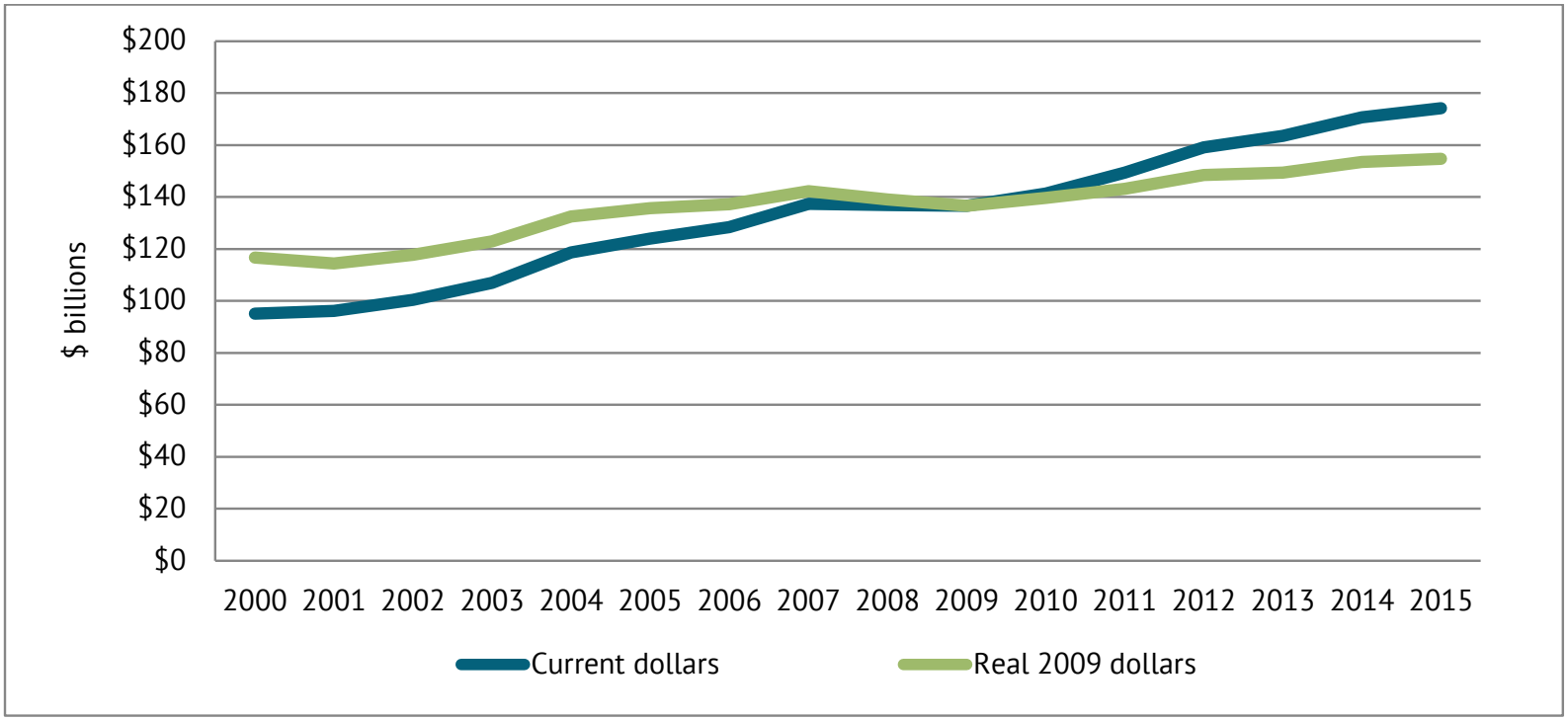
Source: U.S. Census Bureau
American Community Survey Five-Year Estimates

Iowa's gross domestic product is increasing

Gross domestic product (GDP) is the total market value of all goods and services produced in the economy. It is calculated in current dollars as well as real dollars. The word "real" refers to the adjusted total, which serves to remove the effects of inflation by using constant 2009 dollars. Since 2000, Iowa's current and real GDP have continued to grow, as shown in Figure 2.10.

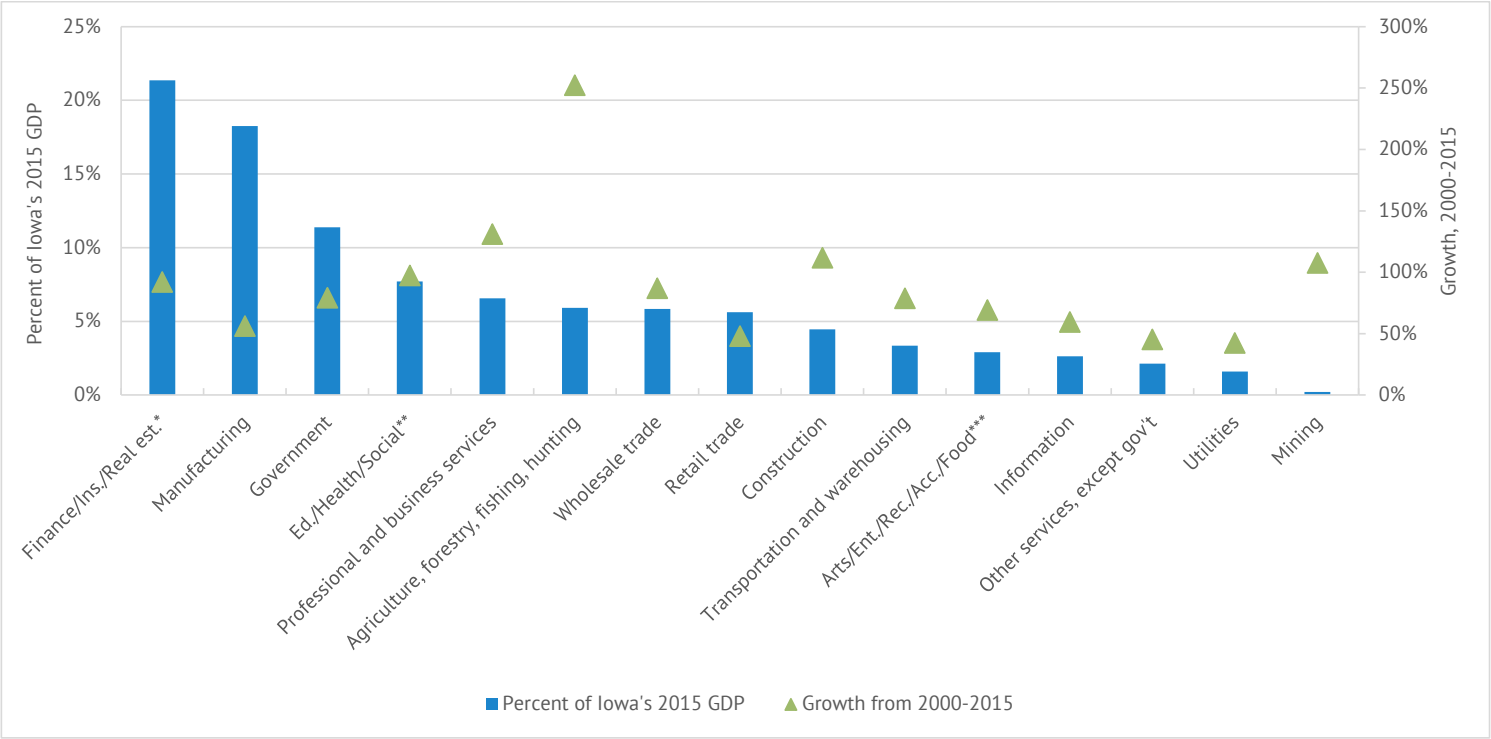
In 2000, Iowa's GDP in current dollars equaled $95 billion. By 2015, Iowa's current-dollar GDP had grown by 83 percent to $174 billion and ranked 30th in the U.S. Iowa's real GDP (in constant 2009 dollars) in 2015 totaled $155 billion compared to $117 billion in 2000, a 32.5 percent increase. During this same period, the U.S. economy increased by 26.9 percent in real GDP. Growth in Iowa's GDP has been fueled by increases in several sectors, as shown in Figure 2.11. In particular, agriculture and natural resources, professional and business services, construction, and mining have all increased by more than 100 percent from 2000 to 2015.

Figure 2.10: Iowa gross domestic product, 2000-2015



Source: U.S. Bureau of Economic Analysis

Figure 2.11: Iowa's gross domestic product by industry in 2015 and change from 2000 to 2015



**Finance/Ins./Real est.: Finance, insurance, real estate, rental, and leasing*
***Ed./Health/Social: Educational services, health care, and social assistance*
****Arts/Ent./Rec./Acc./Food: Arts, entertainment, recreation, accommodation, and food services*
Source: U.S. Bureau of Economic Analysis

Implications for transportation – economic trends

- Maintaining an accessible, reliable, and well-connected transportation system is an important factor in attracting and retaining employers.
- There will be changing demands on urban and rural transportation infrastructure to accommodate growing employment sectors.
- While the number of jobs tends to be increasing the most in service sectors, agriculture and other freight-intensive industries are experiencing large amounts of growth in terms of GDP. Both trends have significant implications regarding commuting patterns and freight transportation.

2.3 Passenger trends

Iowans are traveling more, but passenger travel is not uniform across all modes of transportation

Since 1990, travel across all passenger modes (aviation, highway, passenger rail, and public transit) has increased 42 percent in Iowa (see Table 2.1) and approximately 37 percent across the U.S. However, growth in passenger travel over the past 25 years has not been uniform across modes. In terms of relative change in Iowa, passenger vehicle-miles traveled (VMT) and aviation enplanements grew the most between 1990 and 2000, passenger rail and public transit had the most significant increases in passenger travel between 2000 and 2010, and aviation enplanements increased the most between 2010 and 2015. Overall, passenger VMT experienced the largest relative increase between 1990 and 2015, growing by 42 percent.

If trends from the past 25 years continue, all passenger travel modes will increase, but at varying rates. It should be noted that passenger travel trends are influenced in part by the cost of fuel, and fluctuations in this cost can create some uncertainty in forecasting future travel trends. Figure 2.12 shows the passenger transportation trends for each mode from 1990 to 2015.

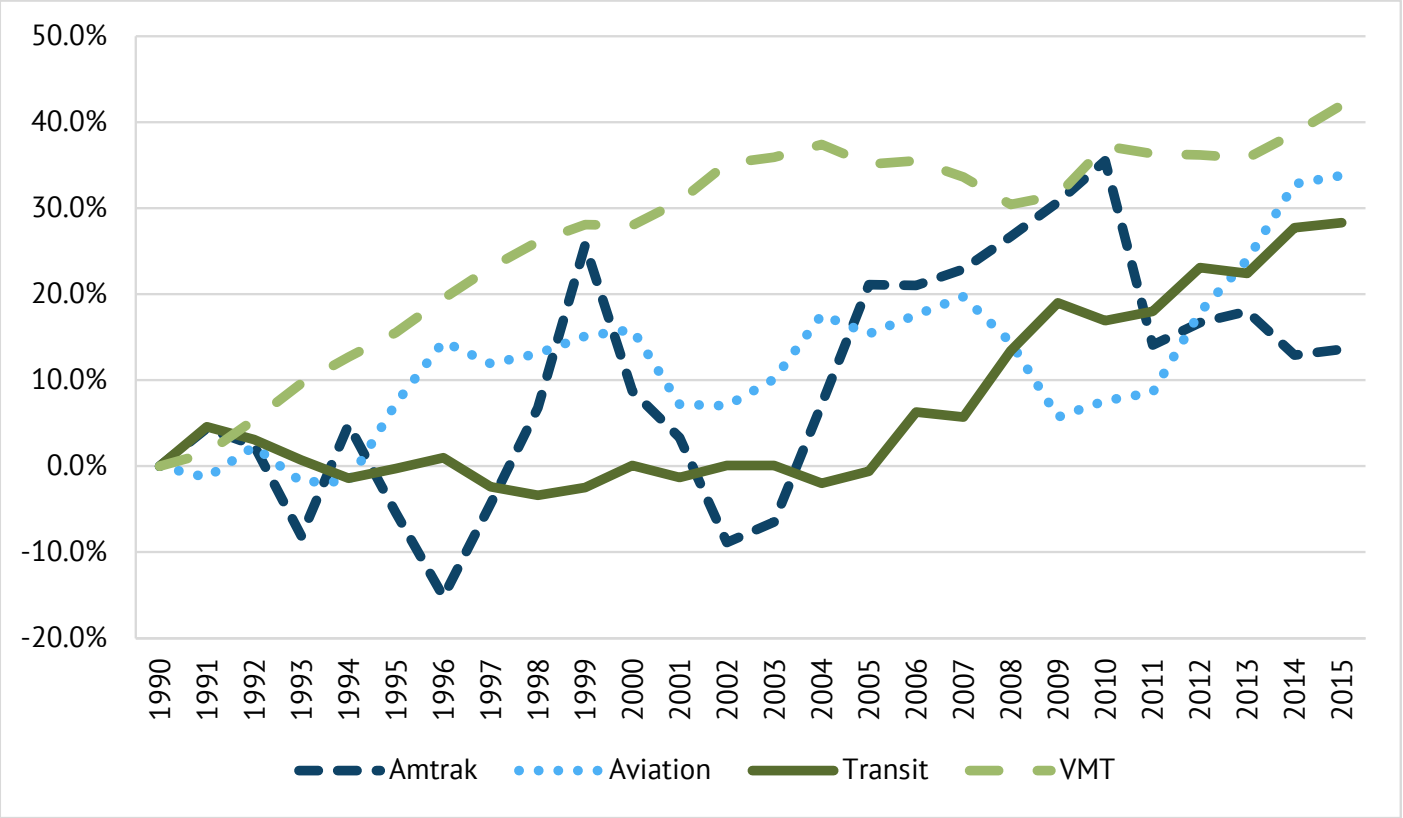
Table 2.1: Iowa passenger transportation trends, 1990-2015

	1990	2000	2010	2015
Amtrak rides	50,719	55,146	68,744	57,611
Aviation enplanements	1,363,840	1,581,217	1,468,158	1,824,963
Passenger VMT*	20,418,000,000	26,128,000,000	28,004,000,000	28,986,000,000
Public transit	22,417,065	22,449,367	26,208,453	28,768,539

**Passenger VMT includes passenger cars, light trucks, vans, SUVs, motorcycles, and buses over all road systems*

Source: Iowa DOT

Figure 2.12: Iowa passenger travel trends by mode, 1990-2015



Source: Iowa DOT

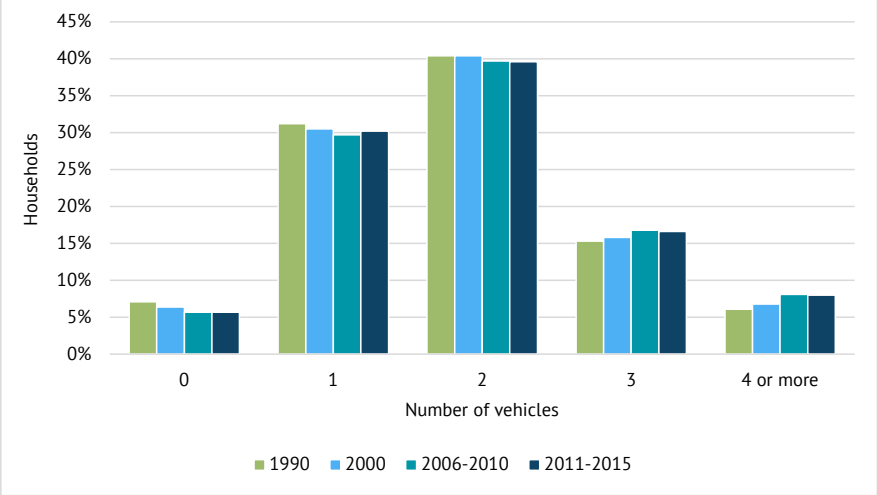
While aviation enplanements in Iowa grew 33.8 percent between 1990 and 2015, aviation enplanements throughout the U.S. increased by an even larger factor, 60.3 percent. Amtrak has only seen a 13.6 percent increase in ridership in Iowa from 1990 levels, while U.S. ridership has increased nearly 40 percent. A Chicago to Iowa City passenger rail route study estimated that 300,000 travelers would use the route on an annual basis. If this idea comes to fruition, passenger rail ridership could increase significantly in Iowa.

In relative terms, passenger VMT and public transit increased more in Iowa from 1990 to 2015 than the U.S. Iowa passenger VMT increased 42 percent from 1990 to 2015, while U.S. passenger VMT increased approximately 37 percent over this same period. Public transit rides increased 28.3 percent in Iowa from 1990-2015, but only 18.5 percent nationally.

The number of vehicles per household has increased

Between 1990 and 2015, the number of households with four or more vehicles increased 31 percent, while the number of households without any vehicles decreased nearly 20 percent. It is interesting to note that the percentage of households owning one or two vehicles decreased slightly between 1990 and 2015, but the percentage of households owning three vehicles increased 8.5 percent. However, as in 1990, the majority of households still have one or two vehicles. Figure 2.13 illustrates the number of vehicles per household from 1990 to 2015.

Figure 2.13: Number of vehicles available per household in Iowa, 1990-2015

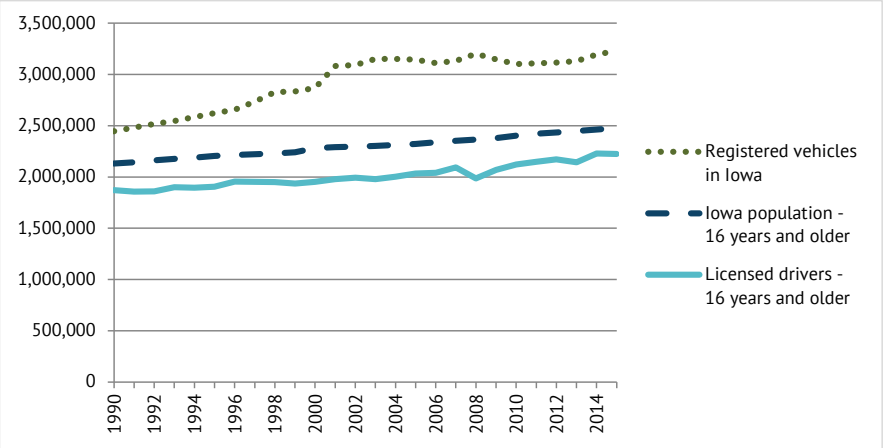


Sources: U.S. Census Bureau, American Community Survey Five-Year Estimates

The number of registered vehicles outnumbers licensed drivers

Figure 2.14 shows the relationship of licensed drivers to driving-age population (16 years and older), and the number of registered personal passenger vehicles in Iowa. Registered vehicles include private automobiles, trucks (up to 5 tons), vans, and sport utility vehicles (SUVs). In the U.S., the number of registered vehicles exceeded the number of licensed drivers in 1972. This trend has continued, although in varying degrees. From 1990 to 2015, the U.S. averaged 1.16 registered vehicles per licensed driver, with a peak of 1.21 vehicles in 2007. From 1990 to 2015, Iowa averaged 1.46 registered vehicles per licensed driver, with a peak of 1.61 vehicles in 2008.

Figure 2.14: Population, licensed drivers, and registered vehicles*, 1990-2015



**Registered vehicles include private automobiles, trucks (up to 5 tons), vans, and SUVs*

Sources: Iowa DOT, U.S. Census Bureau

Most Iowans drive to work alone

The overwhelming majority of Iowans drive to work alone. From 1990 to 2015, this trend continued to increase, while carpooling and walking to work saw the largest percentage decreases. The mode that saw the largest relative increase in users was bicycling, which increased 54.4 percent from 1990 to 2015. Table 2.2 shows the mode of transportation Iowans used to get to work from 1990 to 2015.

Table 2.2: Iowans' mode of transportation to work, 1990-2015

	1990	2000	2006-2010	2011-2015
Drove alone	73.4%	78.6%	78.7%	80.6%
Carpool	11.9%	10.8%	10.3%	8.8%
Public transportation	1.2%	1.0%	1.1%	1.1%
Bicycle	0.3%	0.4%	0.5%	0.5%
Walk	5.8%	4.0%	3.8%	3.5%
Other (includes motorcycle and taxi)	0.7%	0.6%	0.8%	1.0%
Worked at home	6.7%	4.7%	4.8%	4.5%

Sources: U.S. Census Bureau, American Community Survey Five-Year Estimates

Average travel time to work has increased, but Iowans still have one of the lowest average commute times nationally

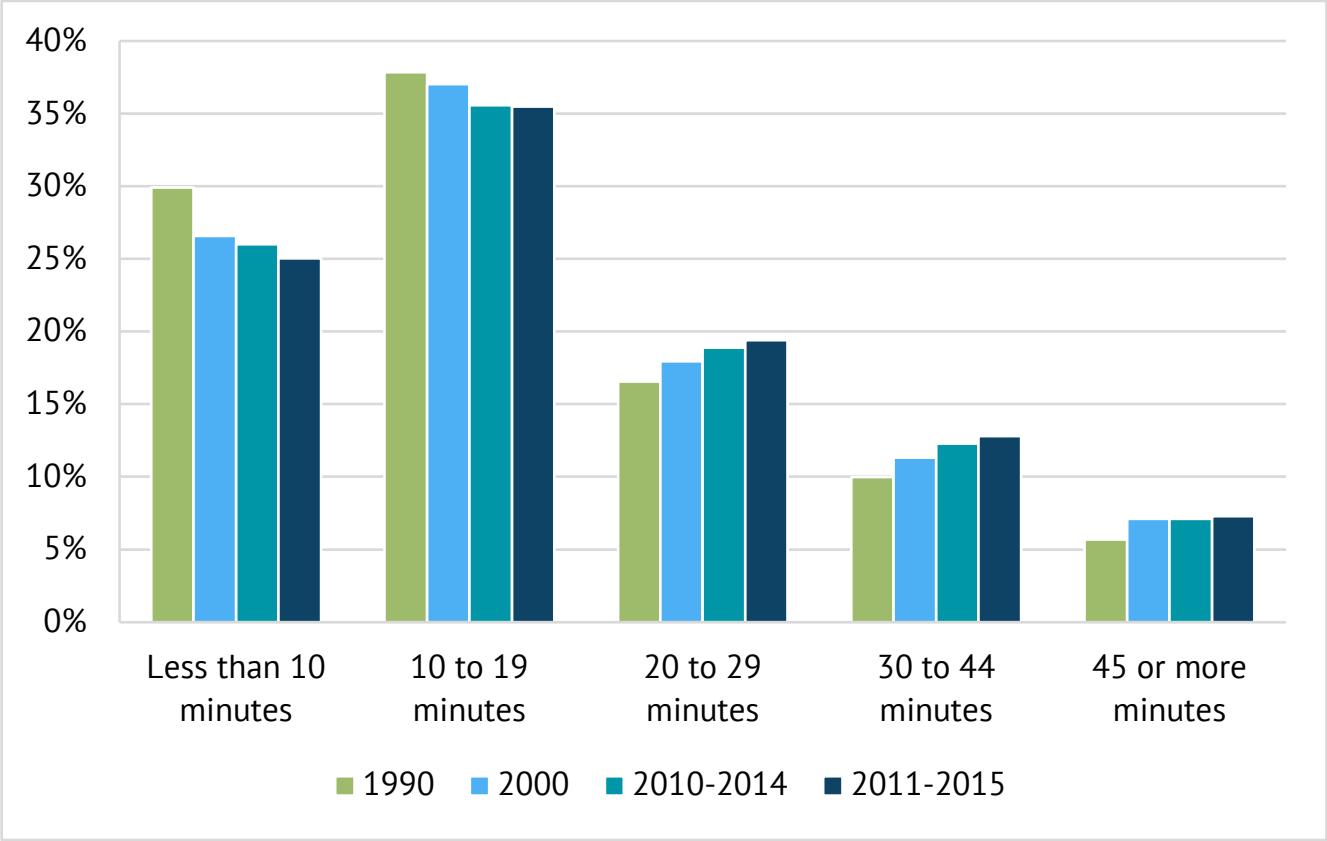
Average travel time to work for Iowans has slowly increased over the past 25 years, and this trend will likely continue. Since 1990, the percentage of workers commuting 30 minutes or more to work increased from 16 to 20 percent, while the percentage of workers commuting less than 10 minutes decreased from 30 percent in 1990 to 25 percent in 2015. Figure 2.15 shows the change in travel time to work for Iowans from 1990 to 2015. Despite the increase in travel time, Iowans enjoyed the sixth-shortest average commute time in the U.S. in 2015. The average travel time to work for Iowans was 18.9 minutes, compared to an average of 25.9 minutes nationally.

More Iowans are commuting to work locations outside their county of residence, which may help explain the increased travel times. In 1990, approximately 17 percent of workers commuted to a job outside their county of residence; by 2015, this increased to 24 percent. In 2015, more than 50 percent of the residents in 10 Iowa counties traveled to jobs outside their home county, compared to only two counties in 1990. Figure 2.16 illustrates some potential commuter routes, highlighting the passenger vehicle annual average daily traffic (AADT) on primary highways, along with the percentage of the workforce leaving their county of residence for work.

With jobs continuing to migrate toward Iowa's metropolitan areas, commuting has taken on more of a role to support the labor force necessary for these areas. The influence of a metropolitan area is not just on the urbanized area it encompasses, but on surrounding counties as well. An example of this is Polk County and the surrounding region.

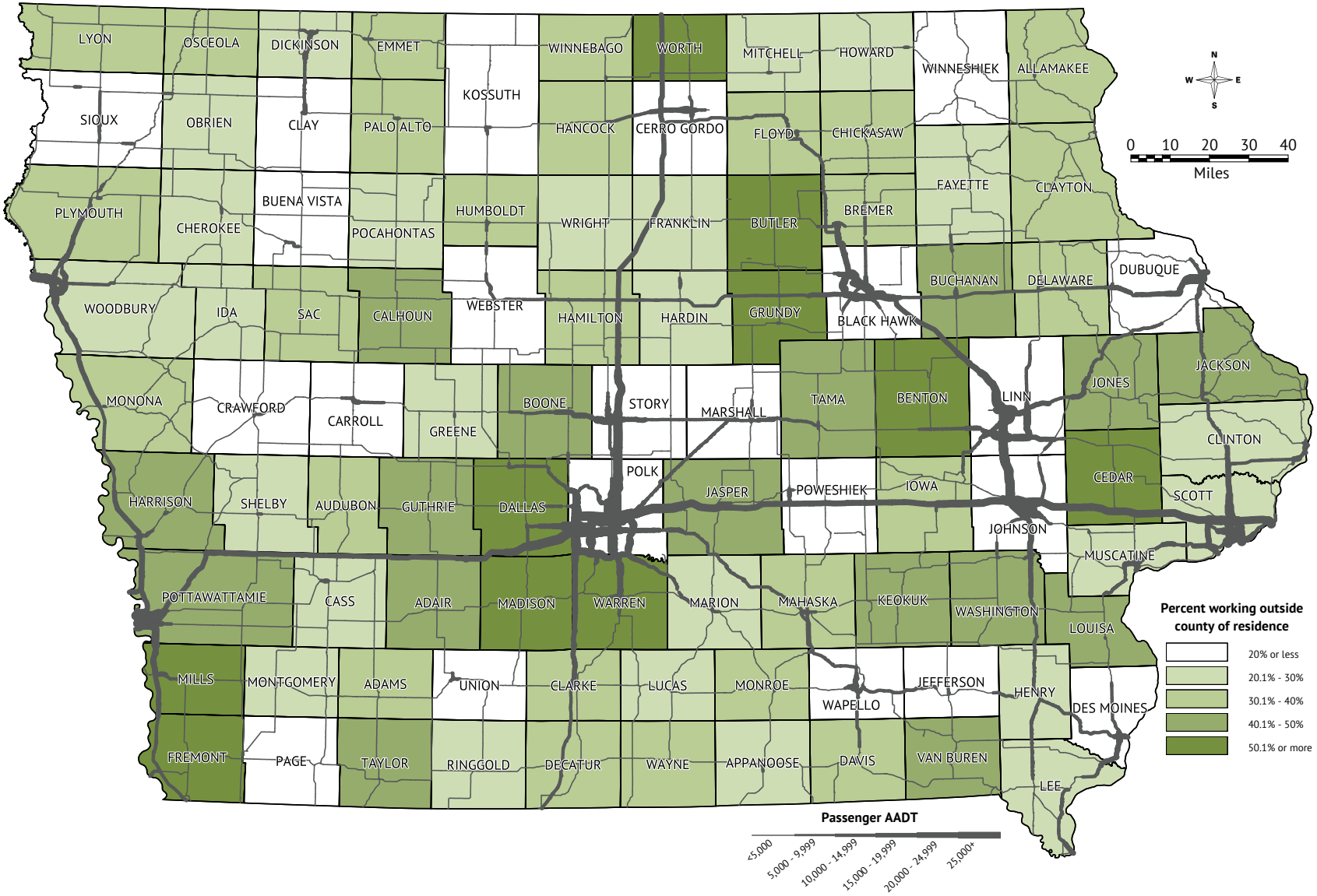
The U.S. Census Bureau's 2011-2015 American Community Survey estimated Polk County had approximately 235,000 workers age 16 and older, less than 10 percent of which commute to a different county for work. Two neighboring counties, Dallas and Warren, both have more than 50 percent of their workers traveling to Polk County for work.

Figure 2.15: Travel time to work in Iowa



Sources: U.S. Census Bureau, American Community Survey Five-Year Estimates

Figure 2.16: Commuting trends of passenger AADT on primary highways, and percent of workforce leaving county of residence to work, 2015



Sources: U.S. Census Bureau, American Community Survey Five-Year Estimates; Iowa DOT

Implications for transportation – passenger trends

- Travel across all passenger modes has increased nearly 43 percent since 1990, while Iowa's population has only grown by 12 percent. Investments in all passenger modes are necessary to ensure mobility options for Iowans.
- If population and vehicle ownership trends continue, there will be more vehicles on Iowa's roadway system.
- Driving to work alone is by far the most common mode choice for commuters, and its percentage share has increased over time. However, bicycling to work is becoming a more popular choice and saw the largest relative increase in users between 1990 and 2015.
- With more Iowans driving farther to work, it will be increasingly important to identify and maintain commuter routes and provide associated services.

2.4 Freight trends

The past several federal transportation reauthorization acts have encouraged states and metropolitan planning organizations to consider freight movements in their overall planning processes. The purpose is to bring attention to freight movement issues affecting transportation infrastructure and economic development. Iowa is part of a global economy that demands the efficient movement of freight. There is a growing need for adequate infrastructure to move freight safely, securely, and efficiently.

Like many other states, the majority of freight in and around Iowa is moved by truck and rail, both of which have experienced steady growth in freight traffic over the past two decades. Iowa has the advantage of a vast network of highways and railroads to serve these movements. Freight is also moved in the state via air, pipeline, and water. Over the past 10 years, air cargo movements have declined as trucking has been integrated into delivery systems. Iowa's two major waterways, the Mississippi and Missouri Rivers, move primarily grain and other bulk commodities to and from Iowa and provide access to the nation's extensive network of inland waterways.

Freight transportation in the U.S. is projected to double by the year 2045. This growth will be reflected in Iowa and will not be uniform across all modes. If the projected growth occurs, it will prove to be a sizable challenge for the overall freight transportation system. Understanding freight dynamics is a crucial element in a proactive planning approach.

Freight costs and efficiencies will continue to vary across modes

Transportation costs play a large role in the decisions of Iowa shippers. Having various transportation options is important to these companies as it allows for cost savings and opportunities to optimize their supply chains. The different transportation modes all play a crucial part in the overall freight transportation system, each having distinct strengths and weaknesses. The characteristics of each option may make the efficient transport of different commodities ideal for one mode but not another.

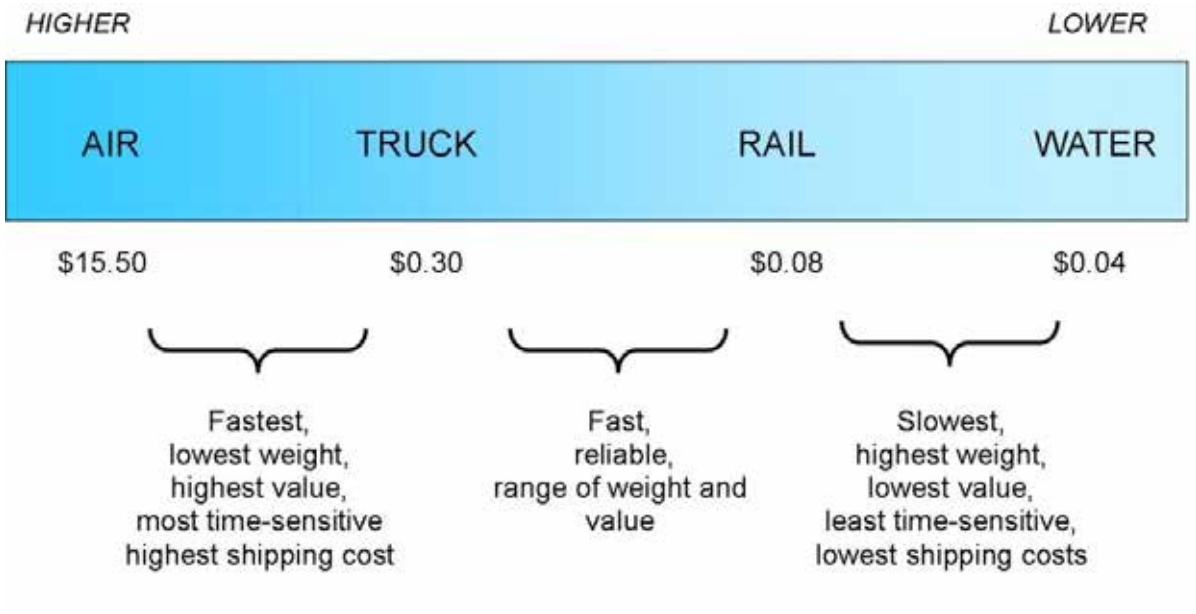
Figure 2.17 shows the per pound value of freight moved in Iowa by mode for total freight movements (originating, terminating, intrastate, and through). The value of freight per pound is substantially higher for air, which is the fastest way to ship. Air handles the most time-sensitive cargo and has the highest shipping costs. Truck and rail carry much lower values per pound and handle higher weights at lower shipping costs. The lowest value per pound is handled by water, which is also the slowest mode with the lowest shipping cost. These comparisons help explain which mode can handle a certain type of commodity most efficiently.

Currently, the majority of freight tonnage in Iowa is carried by truck, train, and barge. Although trucking is the most expensive per pound, it is the also the most flexible of these three modes.

Trucking companies provide various services to shippers. Full truckload service providers move products from one customer to another using a variety of equipment, including dry van, flatbed, hopper, and refrigerated. Trucks can move small amounts of a few hundred pounds all the way up to 48,000 pounds per shipment. Rail is less expensive than trucking and more fuel-efficient, but is more restricted due to the privately owned networks the trains move on. This mode is well suited for moving large volumes of freight between two shipping points and, like trucks, uses dry car, flatbed, hopper, and refrigerated equipment.

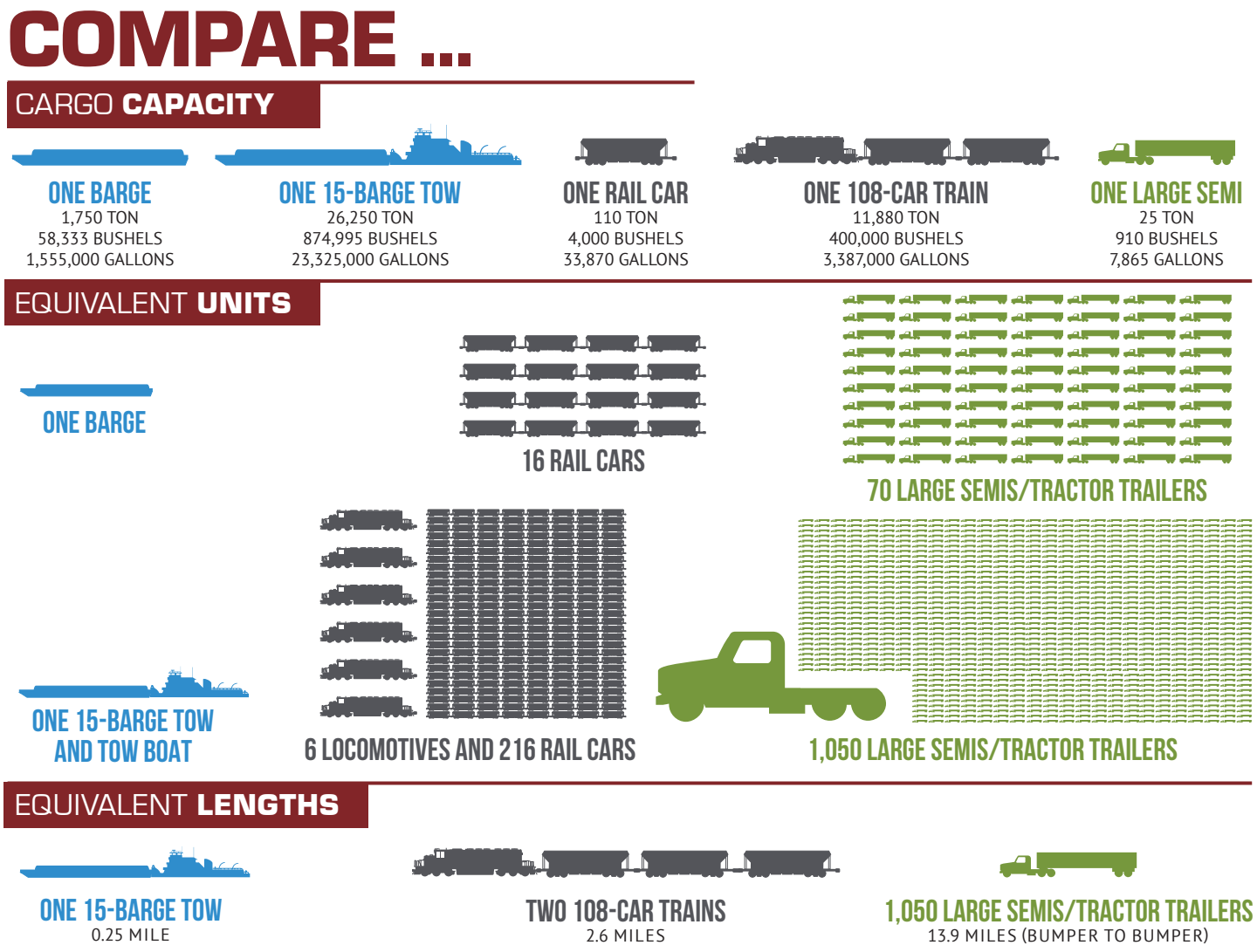
Transporting commodities via waterway is the slowest and least flexible of these three modes. However, it is the most fuel-efficient, the cheapest, and can handle the largest volumes per trip. Figure 2.18 compares these three modes by the amount of freight each can carry at a time. This comparison shows that one barge can handle as much freight as 70 trucks or more than 16 rail cars.

Figure 2.17: Value of freight per pound by mode in Iowa



Source: U.S. DOT, Bureau of Transportation Statistics, Commodity Flow Survey 2007

Figure 2.18: Iowa freight tonnage comparisons across truck, rail, and water transportation



Source: Iowa DOT

Each of the freight transportation options in Iowa has its own strengths that play a critical role in the state's freight transportation network. These options enable Iowa to be a major player in the global economy.

Iowa's freight is expected to steadily increase through 2045

In 2015, Iowa's transportation system facilitated the movement of approximately 1.1 billion tons of freight with an estimated value exceeding $608 billion. These numbers are anticipated to grow to 1.4 billion tons of freight with an estimated value exceeding $896 billion in 2045. Table 2.3 illustrates the tonnage and value for freight movements in 2015 and 2045. While all categories of movements are anticipated to increase significantly, goods exported from Iowa are projected to grow much more than goods imported into the state or moving solely within the state.

- The weight of goods **exported from Iowa** is expected to grow 39.5 percent from 2015 to 2045, with the value of these goods increasing 61.3 percent.
- The weight of goods being **imported into Iowa** is expected to grow 16.5 percent from 2015 to 2045, with the value of these goods increasing 40.9 percent.
- The weight of goods that have **both an origin and destination in Iowa** is expected to grow 21.2 percent from 2015 to 2045, with the value of these goods increasing 26.4 percent.

Table 2.3: Iowa commodity flows* by tonnage and value, 2015 and 2045

	2015		2045		Percent change, 2015-2045	
	Tons (millions)	Value ($ millions)	Tons (millions)	Value ($ millions)	Tons	Value
From Iowa	448.14	$263,256	625.18	$424,680	39.5%	61.3%
To Iowa	405.09	$242,671	471.88	$341,927	16.5%	40.9%
Within Iowa	264.53	$102,582	320.68	$129,622	21.2%	26.4%
Total	1,117.75	$608,508	1,417.74	$896,228	26.8%	47.3%

**Commodity flow data does not include freight moving solely through Iowa.*

Source: Federal Highway Administration (FHWA), Freight Analysis Framework (FAF)

Iowa's freight growth will not be uniform across modes

Truck is the dominant mode used for transporting freight in Iowa, handling 80 percent of the total freight in 2015. The total tonnage transported by truck is poised to grow by 25.7 percent by 2045. Rail and pipeline are the next largest contributors, handling 9 percent and 8 percent of the total tonnage, respectively. This trend is projected continue through 2045. Table 2.4 shows tonnage by mode projections from 2015 to 2045.

Table 2.4: Freight tonnage and value by mode, 2015 and 2045

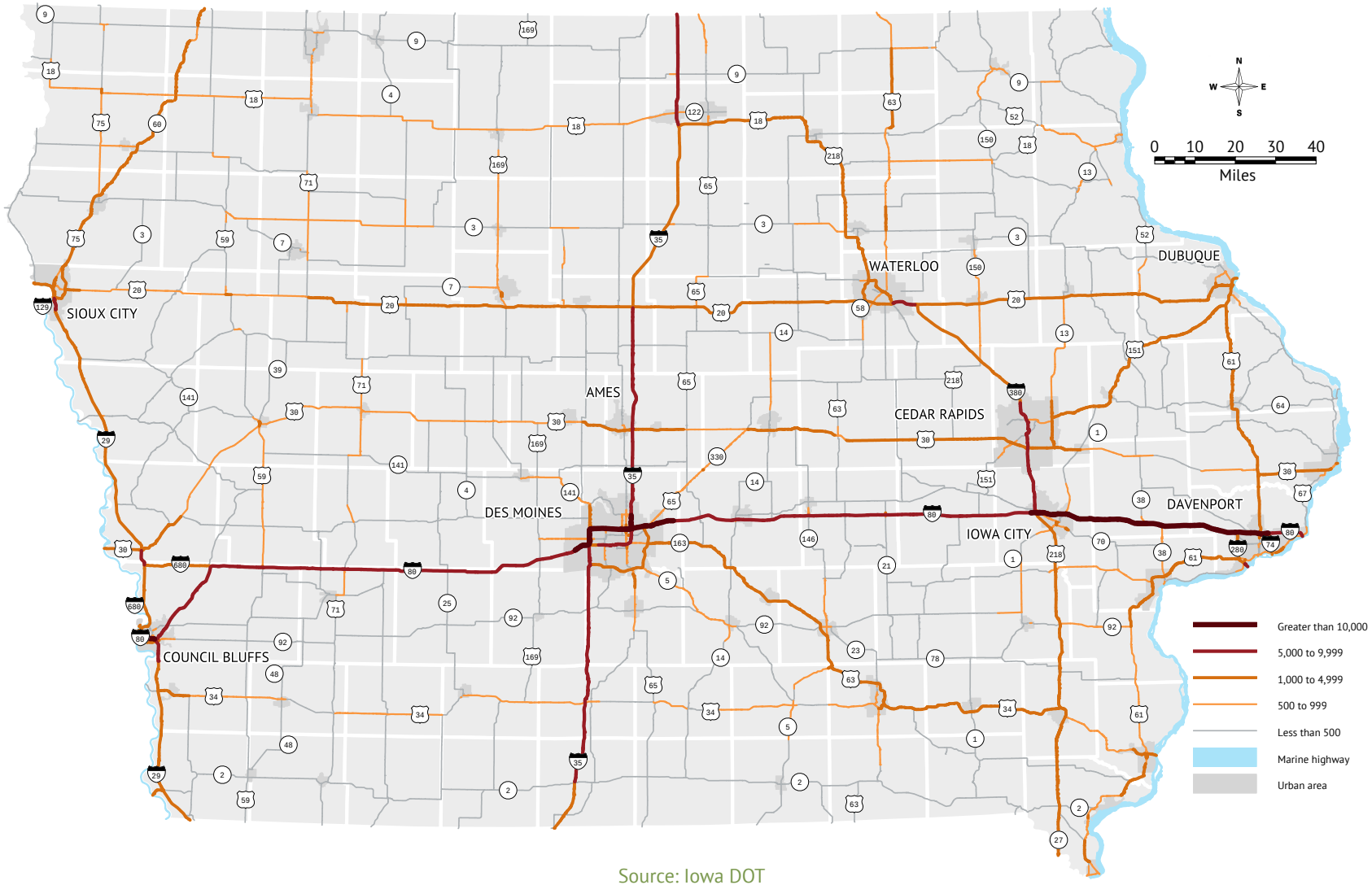
	2015		2045		Percent change, 2015-2045	
	Tons (millions)	Value ($millions)	Tons (millions)	Value ($millions)	Tons	Value
Truck	895.16	$486,707	1,125.36	$682,484	25.7%	40.2%
Rail	99.90	$39,512	129.98	$63,828	30.1%	61.5%
Water	7.29	$6,522	15.53	$19,691	112.9%	201.9%
Air (include truck-air)	0.10	$4,200	0.29	$16,044	188.4%	282.0%
Multiple modes & mail	21.23	$48,265	41.55	$87,453	95.7%	81.2%
Pipeline	94.04	$23,022	104.90	$25,626	11.6%	11.3%
Other and unknown	0.03	$281	0.13	$1,102	285.7%	292.8%
Total	1,117.75	$608,509	1,417.74	$896,229	26.8%	47.3%

Source: FHWA, FAF

The majority of Iowa's freight will continue to be moved by truck

Commodity movement by truck in Iowa is heavily concentrated on the Interstate Highway System and Commercial and Industrial Network (CIN), which comprise the majority of the National Highway System in the state (see Figure 2.19). The Interstate System carried 54 percent of the state's total truck traffic (single and combination units) in 2015, the CIN carried 32 percent, and the rest of the primary system carried the remaining 14 percent.

Figure 2.19: Total annual average daily truck traffic (AADTT), 2015



Source: Iowa DOT

Increasing amounts of freight will move through Iowa via rail main lines

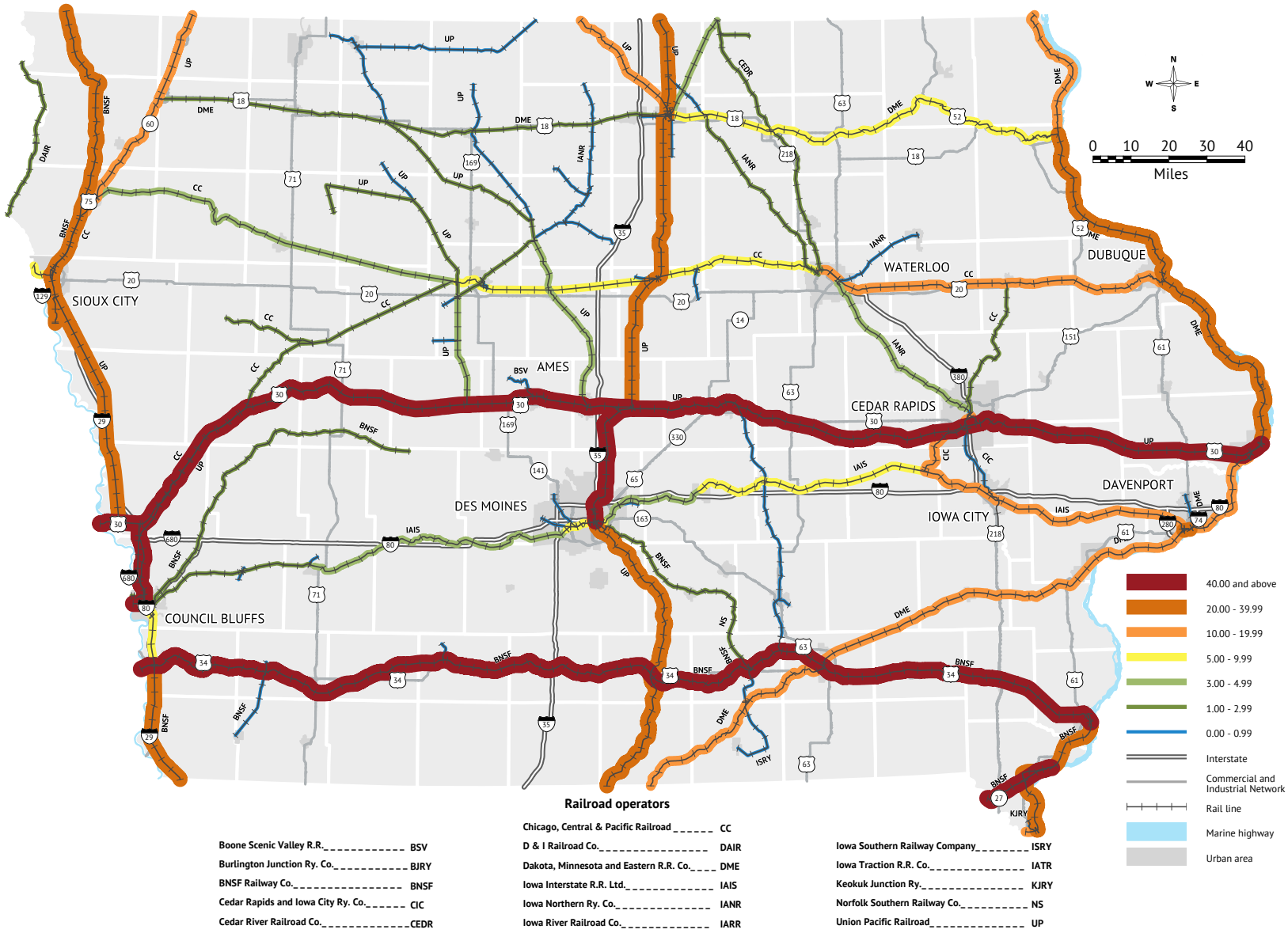
Rail service in Iowa is dominated by the six Class I carriers that operate 83 percent of the state's rail mileage, generate 91 percent of the ton-miles, and earn 94 percent of the revenues. Iowa's two busiest rail lines are the Union Pacific Railroad's Overland Route, an east-west double track route that passes through the center of Iowa (Clinton to Council Bluffs) and the BNSF Railway Co.'s line in southern Iowa, an east-west route that is partially double tracked (Burlington to west of Pacific Junction). The Class II and III railroads often provide feeder service to the Class I carriers which results in smaller allocations of mileage, ton-miles, and revenue.

The activity on individual rail lines is measured in terms of density or gross ton-miles per mile (gtm/m). Gross ton-miles are defined as the total weight of all freight traveling on the rail line, including the weight of freight train cars and locomotives. While Iowa's rail miles have remained stable, the amount of gross tonnage moving over the network has been increasing.

Between 1985 and 2015, gross ton-miles increased by approximately 134 percent while rail miles fell by 18 percent. Average rail line density has nearly tripled over the last 30 years, primarily as a result of the increased through traffic moving on Iowa's main lines. As of 2015, the average rail line density in Iowa was 29.5 gtm/m. Figure 2.20 shows Iowa's rail traffic density in 2015.

Additionally, railroads continue to focus their attention on heavier axle-load freight equipment and using longer, heavier trains to lower costs. Using larger rail cars in 100-plus car unit trains allows the greatest savings and economic benefits, and keeps would-be truck traffic off the highways, resulting in less congestion and roadway deterioration. The current industry standard for rail car weight, which includes the weight of the commodities and the rail car combined, is 286,000 pounds. Iowa has rail lines that are unable to carry the sizes and weights of railroad equipment that meet this threshold (reference Figure 5.7).

Figure 2.20: Rail density, gross ton-miles per mile, 2015



Source: Iowa DOT, Railroads' annual reports

Iowa exports to other states and other countries will continue to increase

Iowa will continue to trade primarily with Midwestern states

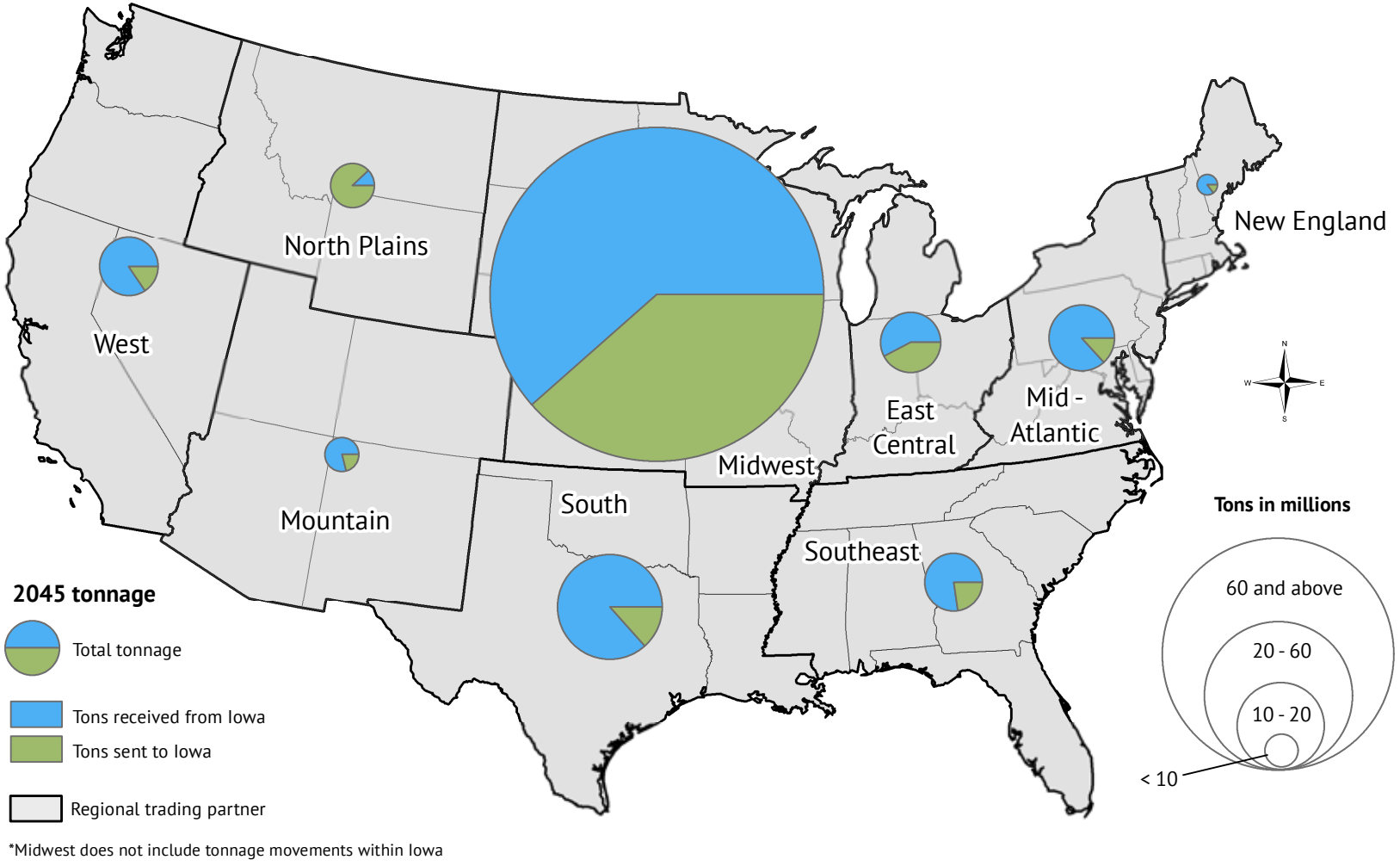
Iowa's regional trading partners provide markets for its producing industries and serve as suppliers to Iowa's consuming industries. In 2015, nearly 67 percent of the freight tonnage and 49 percent of the freight value leaving Iowa went to states in the Midwest. About 75 percent of the freight tonnage and 60 percent of the value coming into Iowa was from Midwestern states. This trend is projected to continue through 2045. Table 2.5 provides both tonnage and value of freight being shipped to and from Iowa in 2015 and projections for 2045. Figure 2.21 provides a visual of Iowa's regional trading partners and the projected amount of freight tonnage being sent from Iowa to those areas and from those areas to Iowa in 2045. Typically, the only region that sends more to Iowa than it receives from Iowa is the North Plains. A large portion of this tonnage is coal being delivered from Wyoming for utility generation. The amount of tonnage coming from the North Plains is expected to decrease roughly 45 percent by 2045, most likely because Iowa is increasingly using other resources such as wind and natural gas to generate power.

Table 2.5: Domestic trade by region, 2015 and 2045

	2015				2045			
	Sent to Iowa		Received from Iowa		Sent to Iowa		Received from Iowa	
Region	**Tons**	**$ millions**	**Tons**	**$ millions**	**Tons**	**$ millions**	**Tons**	**$ millions**
West	1.40	$7,826	7.73	$13,288	2.96	$14,981	15.93	$28,837
North Plains	16.99	$973	0.73	$1,192	9.36	$1,195	1.30	$1,851
Mountain	0.84	$1,970	2.99	$4,249	1.34	$3,221	5.01	$6,835
South	5.73	$10,340	23.50	$19,464	8.13	$19,638	52.60	$40,091
East Central	5.25	$13,054	5.65	$13,724	8.44	$20,903	11.53	$28,881
Southeast	3.34	$9,165	8.59	$12,675	4.16	$13,630	14.29	$22,104
Mid-Atlantic	2.03	$10,654	10.58	$15,733	3.15	$18,555	20.70	$35,001
New England	0.28	$2,863	1.07	$2,131	0.34	$4,123	1.97	$3,842
Midwest	104.71	$83,243	122.78	$78,217	113.32	$116,060	181.16	$127,615
Iowa	264.52	$102,582	264.52	$102,582	320.68	$129,622	320.68	$129,622

Source: FHWA, FAF

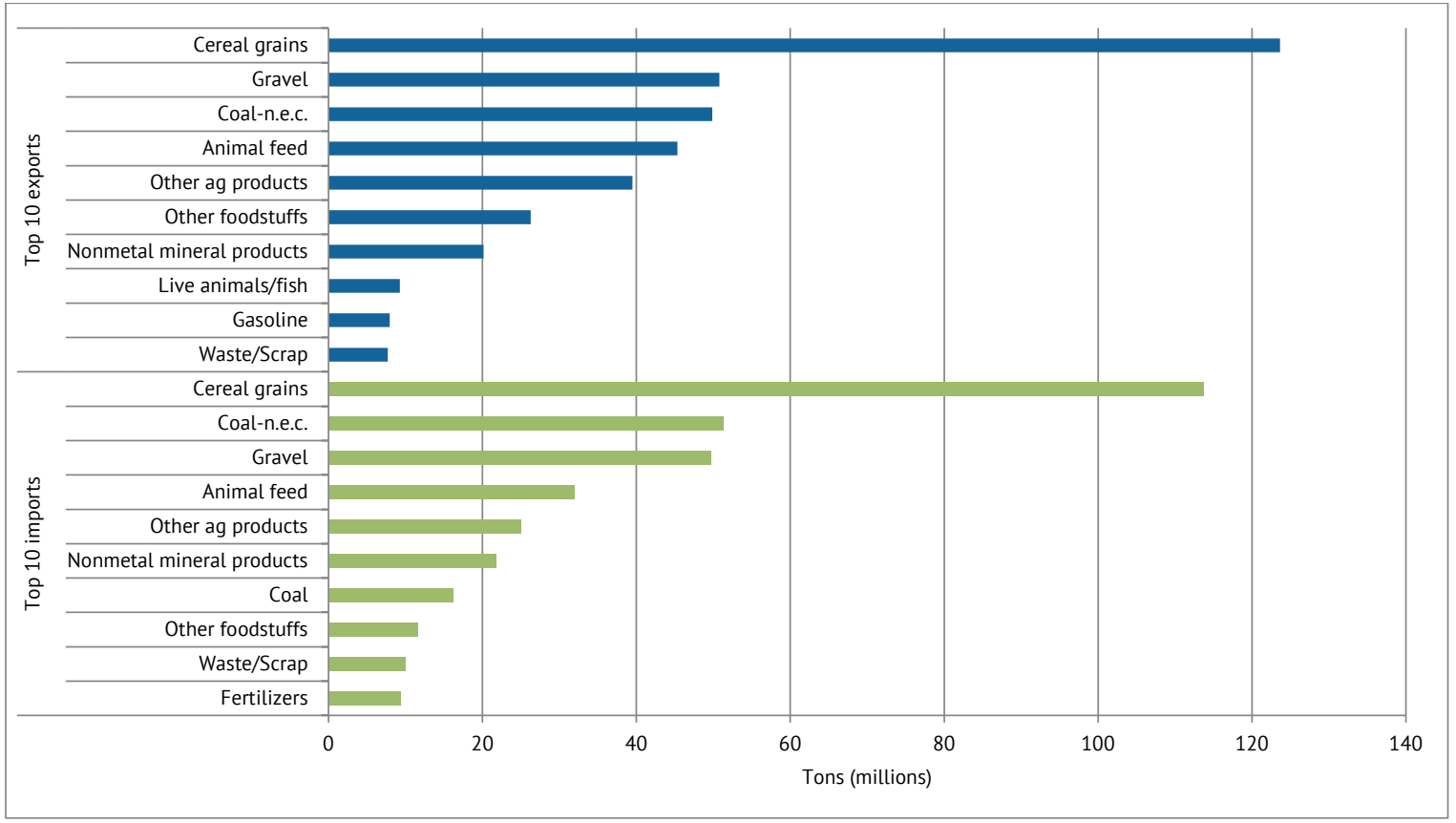
Figure 2.21: Regional trading partners and projected freight tonnage movements in 2045



Source: FHWA, FAF

In terms of types of commodities being moved, agriculture plays a key role in originating and terminating movements. Iowa is one of the leading states in the production of corn, soybeans, eggs, pork, and beef each year. However, cereal grains (includes corn, oats, and wheat) account for 123.6 million tons originating in the state and 113.7 million tons terminating in the state, far more than any other commodity. This accounts for nearly 27.6 percent of the total commodities shipped from Iowa, as well as 28.1 percent of the total commodities received into the state (for processing and transport to export terminals). Other top commodities being imported to and/or exported from Iowa include gravel, animal feed (includes eggs), coal-n.e.c. (includes natural gas and propane), other agricultural products (includes soybeans), and other foodstuffs. Figure 2.22 shows the top commodities originating and terminating in Iowa by total tonnage.

Figure 2.22: Top 10 domestic commodities exported from and imported to Iowa by weight, 2015



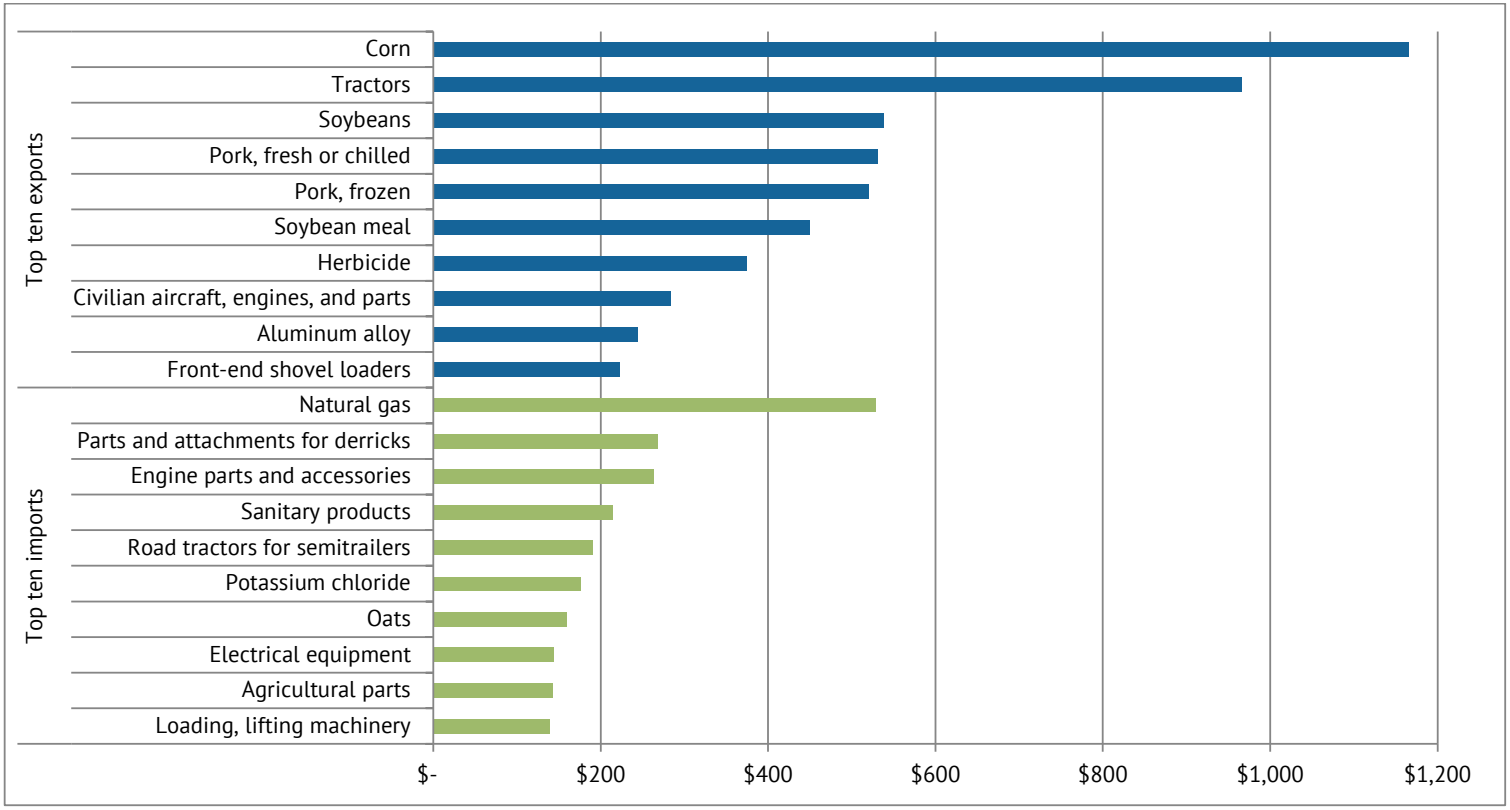
Source: FHWA, FAF

Canada and Mexico are Iowa's largest international trading partners

The state of Iowa exported roughly $15.1 billion in goods in 2014, which is about a 1 percent share of the entire U.S. export market. Corn was the top exported commodity by value at approximately $1.2 billion; tractors were the second-largest commodity group at $966 million; and soybeans were third at $538 million. Other top exports included pork (chilled and frozen), soybean meal, herbicides, and machinery parts.

Similar to the domestic import/export climate, Iowa's import totals from foreign countries are less than that of exports. In 2014, Iowa's total foreign imports were approximately $10 billion, contributing about a 0.4 percent share of the U.S. total foreign import market. Natural gas was by far the largest imported commodity by value at $528 million, followed by parts and attachments for derricks at $268 million. Other commodities in the top 10 included engine parts and accessories, sanitary products, road tractors, potassium chloride, oats, electrical equipment, agricultural parts, and loading/lifting machinery. Figure 2.23 shows the top 10 internationally imported and exported commodities by value in 2014.

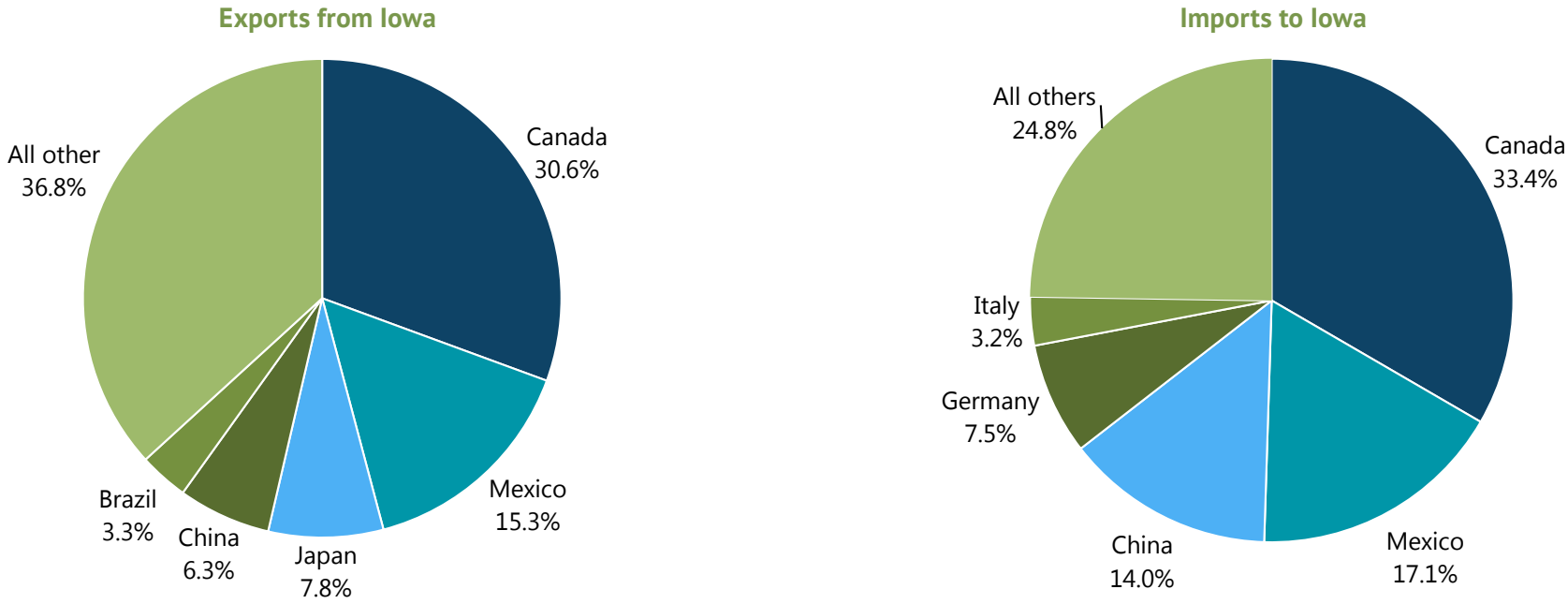
Figure 2.23: Top 10 international commodities exported from and imported to Iowa by value, 2014 ($ millions)



Source: U.S. Census Bureau, Foreign Trade Division

In 2014, Iowa's top international trading partner was Canada with exports valued at $4.6 billion. Other notable countries by value of exports included Mexico, Japan, China, and Brazil. Canada was also a leader in Iowa's foreign import trade market with imports valued at $3.4 billion or 33.4 percent of the market share. Other notable countries included Mexico, China, Germany, and Italy, making up approximately 75 percent of total imports to Iowa. Figure 2.24 show the breakdown of Iowa's exports to and imports from foreign trading partners.

Figure 2.24: Top international trading partners, 2014



Source: U.S. Census Bureau, Foreign Trade Division

Implications for transportation – freight trends

The advancement of globalization leads to constantly shifting market variables. This makes adapting and evolving a challenge for all involved parties, including manufacturers, shippers, and government agencies. To be proactive in addressing developing patterns and overcoming new obstacles, it is necessary to identify current trends and issues and attempt to forecast the changes that will come. A number of these major trends in the freight industry will affect Iowa's transportation system. These items include:

- Globalization and growth in both national and international trade are placing more demands on the freight system.
- With value-added production and overall economic activity increasing in Iowa, freight movements will increase.
- The growing demand for freight increases concerns about safety, energy consumption, and environmental impacts.
- With freight projected to increase, the effects of congestion on freight mobility, reliability, and costs will need to be taken into consideration.
- Reducing delays, maintaining infrastructure, and optimizing the state's freight system are key priorities.
- With weight limitations on trucks being relaxed in recent years, the impacts to infrastructure and operations need to be taken into consideration.

3. PLANNING CONSIDERATIONS

A wide variety of issues must be considered as the Iowa Department of Transportation (DOT) plans the future transportation system. While several far-reaching subjects are identified in this chapter, these planning considerations do not represent an exhaustive list, and new issues are likely to arise over the life of the Plan. This chapter will cover the following planning topics. Many of these themes recur in the strategies identified in Chapter 5.

- Economic vitality
- Energy
- Environmental justice
- Environmental mitigation
- Land use and livability
- Maintenance and preservation
- Management and operations
- Safety
- Security
- Technology

3.1 Economic vitality

One consideration critical to the transportation planning process is economic vitality. Throughout Iowa's history, economic growth has occurred along thoroughfares of all forms, from rivers to railroads to highways. While the relationship between transportation improvements and economic growth seems rather straightforward, many professionals and academics would argue it is not yet fully understood. Regardless, it is critical that the potential economic impacts of transportation projects are considered during the planning process.

The impact of each mode on Iowa's economy is covered in Chapter 4. Within the Iowa DOT, the importance of this consideration is manifested in a number of ways. For example, the Five-Year Program identifies several transportation policies, the first of which is to promote a safe transportation system that addresses user needs and maximizes economic and social benefits for Iowans. As part of the programming process, economic development impacts are considered as candidate projects are identified and evaluated. In addition, the Revitalize Iowa's Sound Economy (RISE) Program has funded more than 770 transportation projects and provided more than $405 million in assistance to support the creation and retention of nearly 83,000 jobs over the program's 30-year existence.

Another example of an effort related to economic vitality is the freight network optimization project, which was a joint effort with the Iowa Economic Development Authority (IEDA) completed in 2016. The goal of this project was to effectively identify and prioritize investment opportunities for an optimized public and private freight network to lower transportation costs for Iowa's businesses and to promote business growth in Iowa. The optimization strategy outlined in the report Development of Iowa Statewide Freight Transportation Network Optimization Strategy will assist in improving the effectiveness and performance of the multimodal freight transportation network. It is expected that, over time, the optimization strategy will lower or stabilize transportation costs for Iowa businesses, make Iowa's transportation system a more valuable and efficient asset in economic development, and enhance freight mobility. These examples are just a few illustrations of the value that the Iowa DOT has placed on economic vitality.

3.2 Energy

Energy issues are another important consideration in transportation planning. Areas where energy and transportation overlap include the cost and availability of fuel, the production and movement of different types of fuel, and the impact of alternative fuel vehicles on transportation.

Iowa Energy Plan

The Iowa Energy Plan[1] was developed in 2016. The plan is a joint initiative between the Iowa DOT and IEDA. Iowa's energy plan is a means to set state priorities and provide strategic guidance for decision-making while working to encourage energy, economic, and environmental benefits through goals and recommendations. It includes an assessment of current and future energy supply and demand, examines existing energy policies and programs, and identifies emerging energy challenges and opportunities. The plan synthesizes the existing state energy goals and strategies that are beneficial for the state, and outlines new objectives and strategies to position Iowa for the future.

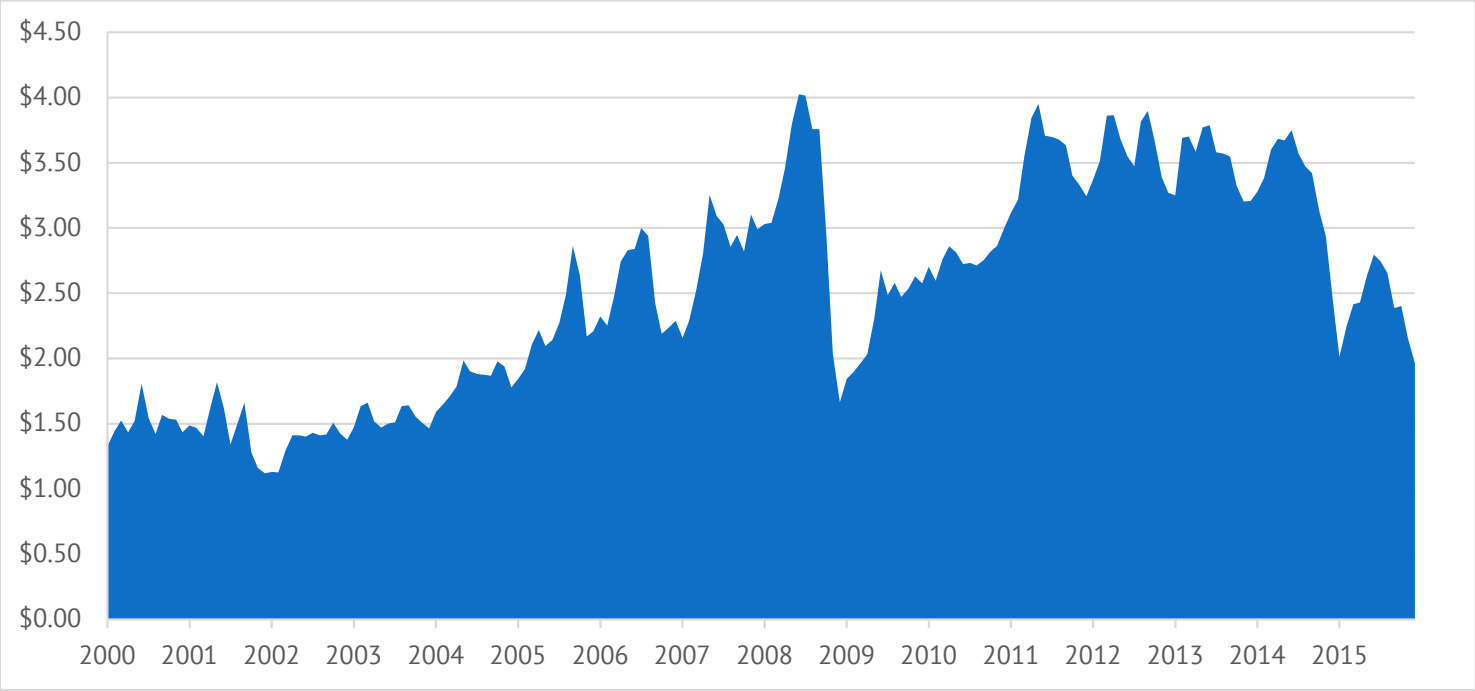
The plan was built on four foundational pillars, one of which is transportation and infrastructure. The other three are economic development and energy careers, Iowa's energy resources, and energy efficiency and conservation. Several strategies derived from the energy plan have been included in the action plan in Chapter 5.

Fuel supply and cost

Both the supply and cost of fuel can directly affect many facets of the transportation industry. For example, when the cost of fuel fluctuates noticeably, driving behavior can change and create an immediate impact on the transportation system through variations in number of miles driven and changes in mode of travel. Such changes in behavior can also have more far-reaching impacts, as notable increases or decreases in travel can affect transportation-related revenues such as those derived from fuel taxes. Figure 3.1 shows the average monthly price for gasoline in the Midwest from 2000-2015. The lowest price during that time was $1.12 per gallon in December 2001, the highest price was $4.03 per gallon in June 2008, and the average during the 15-year time period was $2.51 per gallon.

1. http://www.iowaenergyplan.org

Figure 3.1: Midwest retail average monthly gasoline price per gallon for all grades, all formulations, 2000-2015



Source: U.S. Energy Information Administration

The fuel market can also affect transportation construction costs. In recent years, many state transportation departments have experienced unprecedented construction cost increases. The escalation of global fuel prices is one of several factors that has contributed to higher bid prices. As construction cost inflation continues, the buying power for all revenue sources decreases. In fact, cost inflation can even negate the impacts of increased revenue, as was the case with the Road Use Tax Fund (RUTF) in recent years. An example of this was shown in the TIME-21 Funding Analysis, which noted that even with a 2.9 percent annual increase in RUTF revenue in fiscal year (FY) 2008, construction cost inflation resulted in an 11.0 percent decrease in buying power compared with FY 2007.

In addition to construction costs, the supply and cost of fuel also affect the operational costs associated with maintaining Iowa's expansive and aging public roadway system. If coupled with extreme weather, such as abnormal winter storms, the impacts of high fuel costs are compounded. Increased unit costs for fuel reduces funding available for maintenance, resulting in further deterioration of the system and loss of useful life.

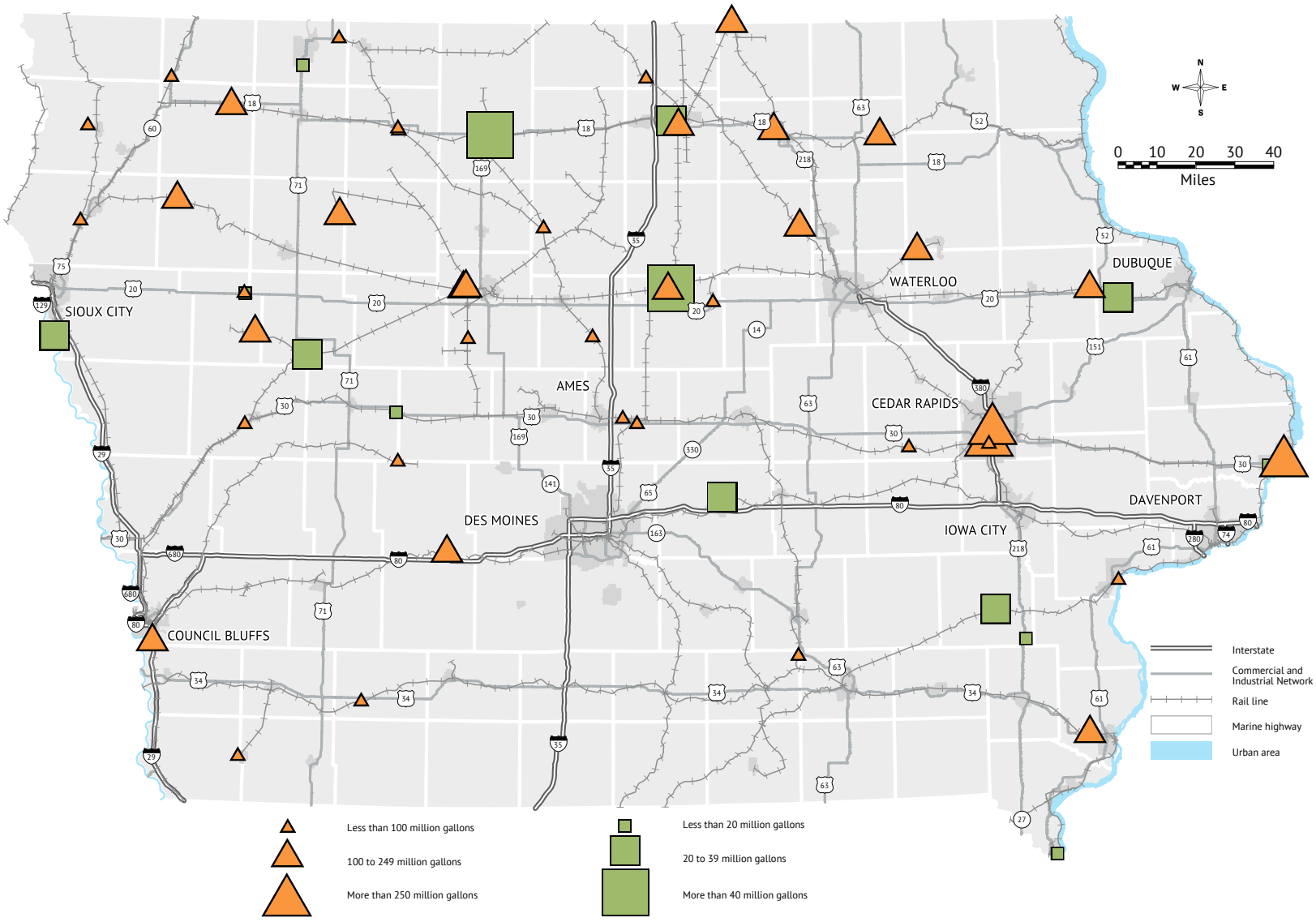
Energy production and movement

Biofuels and wind energy industries

Iowa has emerged as a national leader in both the biofuels and wind energy industries, resulting in physical and financial impacts. An example of these impacts is increased large truck traffic during the construction of a biofuels plant, with traffic remaining relatively high after construction to support plant operations. Increased rail traffic is also common on the lines that service these plants. This traffic growth leads to accelerated infrastructure deterioration and increased maintenance costs. Figure 3.2 provides a map of Iowa's biodiesel and ethanol plants along with their production capacity.

Ethanol and biodiesel fuels have become significant value-added products for Iowa's agricultural economy over the past few decades. Iowa produced 28 percent of the nation's fuel ethanol in 2014, the most of any state. Nationally, 70 percent of all ethanol produced is transported by rail.

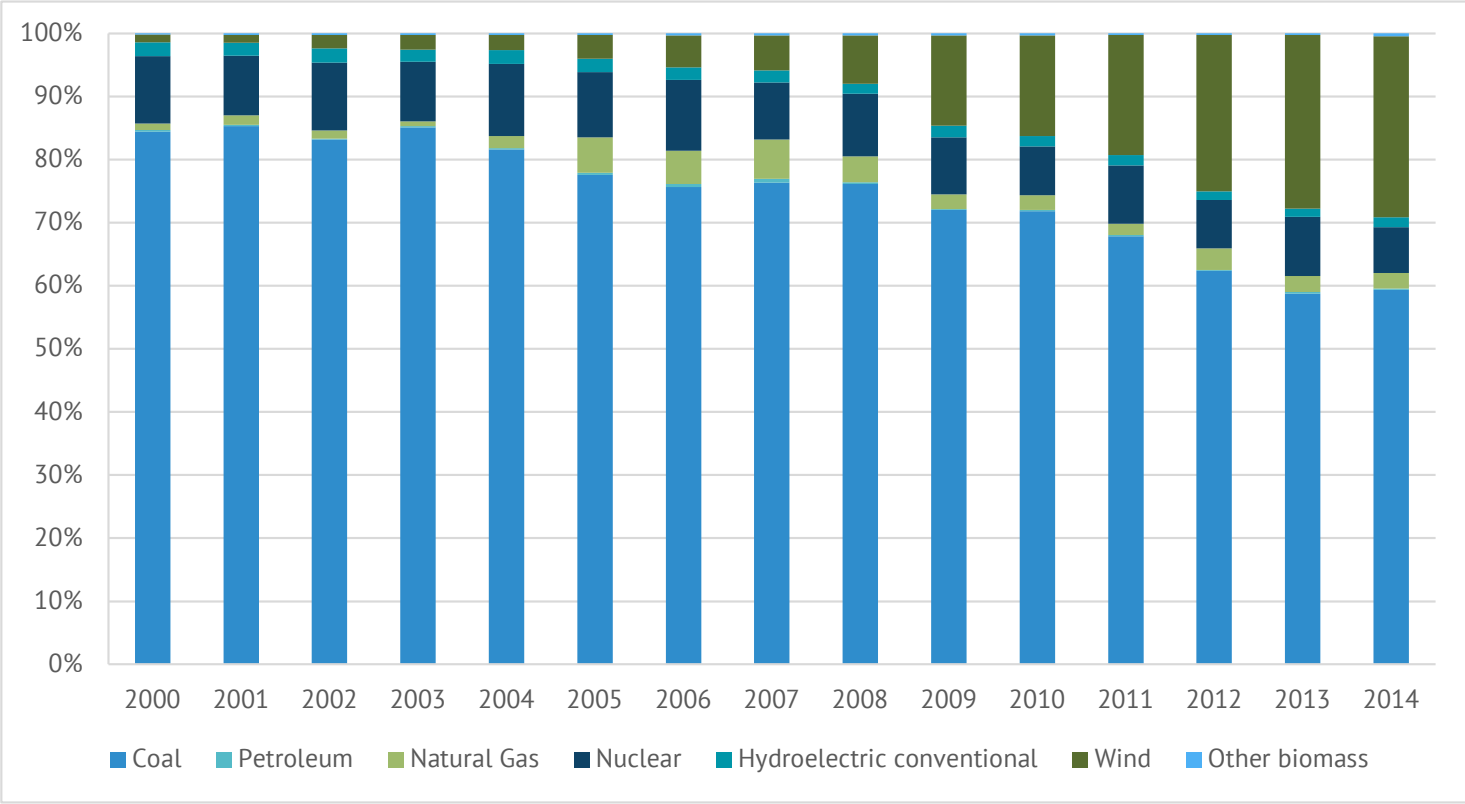
Figure 3.2: Iowa biodiesel and ethanol plants and annual production capacity



Source: Iowa DOT

Iowa has also become a leader in wind energy, and has a higher percentage of its power generated by wind than any other state. Figure 3.3 shows trends in Iowa's energy production since 2000. There are 15 manufacturing facilities in Iowa that produce parts for the wind industry, including a turbine manufacturer, two blade manufactures, and a tower manufacturer. The movements of the raw materials to make these components, the finished products, and the construction equipment to install the turbines have a significant impact on Iowa's transportation system. This requires coordination across modes and planning for the movement of oversize/overweight loads. If the transportation infrastructure supporting these movements deteriorates, costs to move the materials and products associated with these industries will increase. If this happens, the state could lose its competitive edge in these growing economies.

Figure 3.3: Iowa utility generation by source, 2000-2014



Source: U.S. Department of Energy

Crude oil movements

Energy production in the U.S. has been growing significantly since the turn of the century. One of the largest growing sectors, and perhaps the one with the largest impact on the national freight network, is hydraulic fracturing of rock or "fracking." This process allows for the recovery of deep sources of gas and petroleum products. Fracking has resulted in large amounts of gas and oil being extracted, particularly from the Bakken Shale formation region of North Dakota, Montana, and parts of Canada. This can have major transportation impacts, including increased freight traffic (product being shipped from the region and materials used for fracking being shipped to the region) and the potential for lower fuel prices.

Much of the freight movement to and from the Bakken region is by rail due to production increasing at a rate that exceeds the capacity of the nation's pipelines. Of all the oil produced in the Bakken region, roughly 63 percent is shipped by rail with a portion of that traveling through Iowa. Since 2008, oil shipments carried by two Class I railroads in Iowa have increased by nearly three million tons. There were two billion gallons of crude oil shipped on Iowa railways in 2014. Destinations include oil refineries on the East and Gulf coasts. In 2016, construction began on a pipeline to transport Bakken oil through South Dakota and Iowa to Illinois, which may affect the amount of crude oil shipped on Iowa rail lines.

Iowa DOT completed the Iowa Crude Oil and Biofuels Rail Transportation Study in 2016. The study considered both the physical characteristics (i.e., people, facilities, environment) in the vicinity of the crude oil and biofuels rail routes, as well as the insight of representatives from all sides of this industry. The study recommended improvement strategies in the areas of prevention, preparedness, response, and recovery.

Alternative fuel vehicles

In addition to the use of ethanol to make E85 and other fuel blends, and the use of biodiesel, additional fuel sources are becoming common options for alternative fuel vehicles. The use of natural gas as a transportation fuel is being explored and adopted by some trucking and railroad companies. When used as transportation fuel, natural gas comes in the form of either compressed natural gas (CNG) or liquefied natural gas. The use of natural gas as a fuel in the trucking industry has increased substantially in the past several years. Despite the lower cost of diesel fuel in recent years, the price of natural gas has remained even lower, and future projections show prices remaining steady. Typically, trucking companies will add CNG vehicles to their fleets allowing for greater diversification and the ability to switch between diesel and natural gas for higher-mileage routes depending on the lower-cost option.

Electric vehicles have also become increasingly popular. Hybrid electric vehicles are powered by a combination of an internal combustion engine and an electric motor that uses stored battery energy. These vehicles do not receive energy from plugged charging; typically, the battery is charged by either regenerative braking or by the internal combustion engine. Plug-in hybrid electric vehicles can be powered through plug-in sources, and may or may not have an internal combustion engine for charging and/or operating.

The growth in alternative fuel vehicles has several implications for transportation planning. They provide air quality benefits by aiding in the reduction of greenhouse gases. While many of these technologies require a higher up-front investment, the fuel sources tend to be a lower-cost option over the life of the vehicle. Some of these fuel sources require retrofitting equipment or providing new infrastructure, such as storage tanks for CNG and charging stations for electric vehicles. If alternative fuel vehicles continue to grow in popularity, they will also have significant implications for traditional transportation revenue sources, such as the fuel tax.

3.3 Environmental justice

On Feb. 11, 1994, Executive Order (EO) 12898 was signed into law by President Clinton and required "each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States." It is through E.O. 12898 that the policies set forth in the Civil Rights Act of 1964 and Title VI of the National Environmental Policy Act of 1969 are clarified and enforced. While federal regulations do not specifically require environmental justice (EJ) to be considered in the development and content of a long-range statewide transportation plan, the Iowa DOT believes that the importance of this issue warrants inclusion in the Plan.

EJ defined

According to the U.S. Environmental Protection Agency, EJ is defined as:

> "The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies."

EJ is the term used to describe the uneven environmental and social hardships that disadvantaged groups bear. EJ is a broad and multifaceted social welfare issue with the goal of improving the disparate or unequal impacts of growth and development, such as crime, hazardous waste sites, and pollution. It also aims to ensure equitable access to physical and social opportunities, such as clean air and water, education, food, jobs, and transportation.

EJ and transportation planning

Within the realm of transportation, consideration of EJ is important given that impacts of transportation can be both beneficial (e.g., improved access and mobility) and burdensome (e.g., increased noise and congestion). Because of the diverse and potentially uneven transportation impacts, it is important that EJ be included throughout the transportation planning process, including short- and long-range planning and public participation outreach efforts. Specifically, by identifying the transportation patterns of socially disadvantaged groups (e.g., minority and low-income) and involving them in the public participation process, the needs of these groups can be determined and assessed to guide transportation investment and ensure impacts are distributed as evenly as possible.

Americans with Disabilities Act (ADA) of 1990 compliance

Another issue closely tied to EJ under the umbrella of civil rights is that of compliance with ADA. Title II of this legislation emphasizes the accessibility of infrastructure within the public right of way. Title II also requires the Iowa DOT to develop a transition plan to bring facilities into compliance with ADA. As a result, a transition plan was developed identifying specific steps the Iowa DOT will take to achieve ADA compliance for pedestrian facilities. These steps are:

1. Identify physical obstacles limiting the accessibility of programs or activities to individuals with disabilities.
2. Describe in detail the methods that will be used to make facilities accessible.
3. Develop a schedule for achieving compliance.
4. Identify the Iowa DOT's ADA coordinator who will be responsible for ADA compliance.
5. Develop a grievance procedure to review complaints.
6. Initiate public involvement and provide community awareness.

The first four steps are the minimum requirements for a transition plan as set forth by 28 CFR 35.150. The remaining steps are additional requirements for achieving ADA compliance as set forth by Title II. In addition to the above steps, the Iowa DOT will track and report on their progress. To ensure ongoing compliance with ADA requirements, the Iowa DOT will perform periodic reviews of the transition plan and update as necessary.

3.4 Environmental mitigation

National Environmental Policy Act (NEPA)

NEPA defines the process used by decision-makers to make informed decisions on proposed federal actions, which includes federally funded Iowa DOT actions. NEPA requires the examination and avoidance of potential impacts to the social and natural environment when considering approval of proposed transportation projects. The NEPA process is an approach to balanced transportation decision-making that takes into account the potential impacts on the human and natural environment and the public's need for safe and efficient transportation. For recipients of federal funds, this means that before proceeding with final design, right of way acquisition, and construction, the project sponsor must first disclose any environmental consequences and evaluate alternatives that would avoid or lessen the project's impacts. In addition to evaluating the potential environmental effects, transportation needs of the public must also be taken into account when reaching a decision that is in the best overall public interest.

The U.S. DOT adopted the policy of managing the NEPA project development and decision-making process as an "umbrella," under which all applicable environmental laws, EOs, and regulations are considered and addressed prior to the final project decision and document approval. Conclusion of the NEPA process results in a decision that addresses multiple concerns and requirements, including many individual regulations under the NEPA umbrella.

Levels of environmental analysis

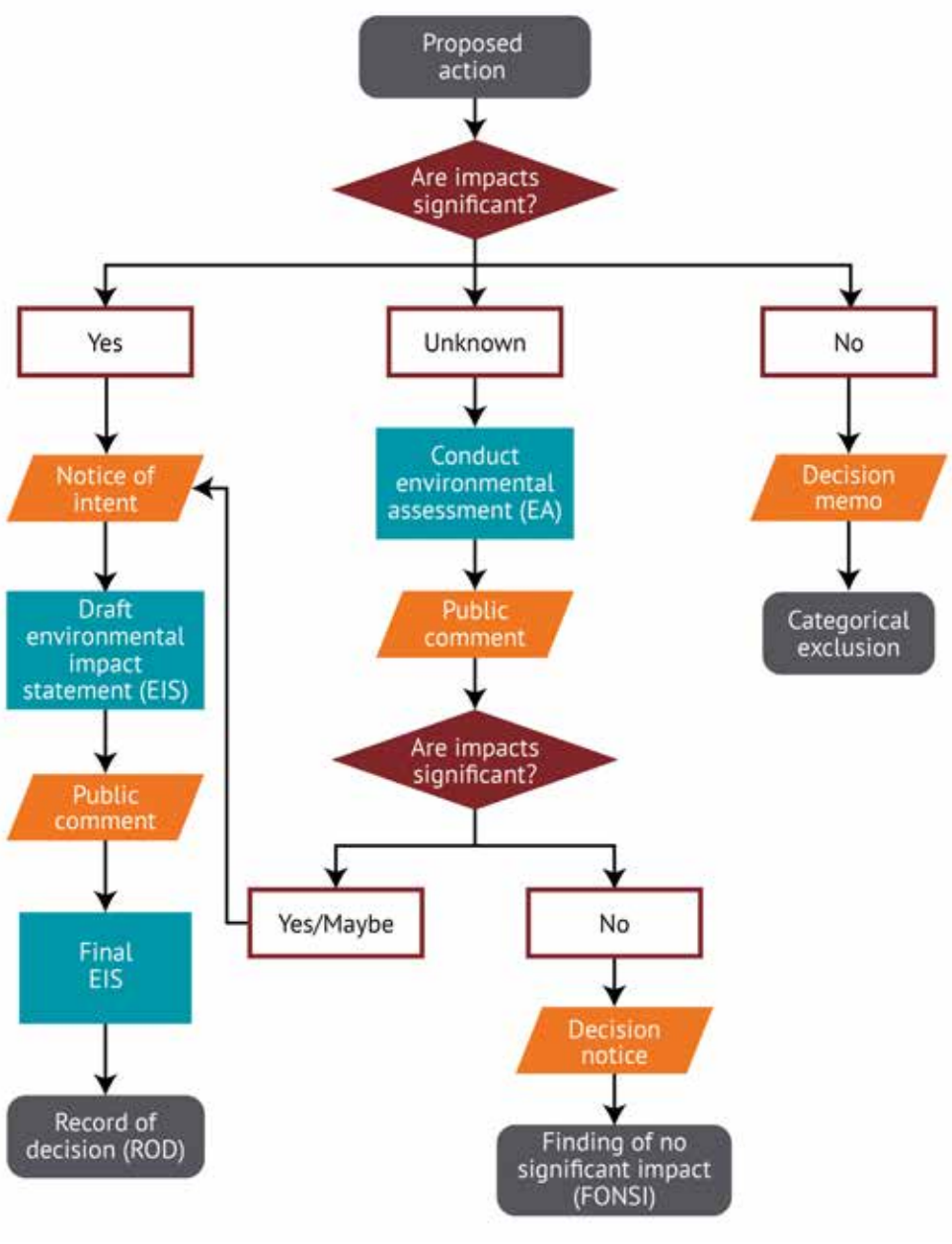
Transportation projects vary in type, size, complexity, and potential to affect the environment. Transportation project effects can range from minor to significant impacts on the natural and human environment. To account for the variability of project impacts, three basic "classes of action" are allowed, which determine how compliance with NEPA is carried out and documented. This decision-making process is shown in Figure 3.4.

- An environmental impact statement (EIS) is prepared for projects where it is known the action will have a significant effect on the environment.
- An environmental assessment (EA) is prepared for actions for which the significance of the environmental impact is not clearly established. Should environmental analysis and interagency review during the EA process find a project to have no significant impacts on the quality of the environment, a finding of no significant impact (FONSI) is issued. If significant issues are found, an EIS is prepared.
- Categorical exclusions are issued for actions that are not individually or cumulatively significantly affecting the environment.

Linking planning and NEPA

When possible, it is important to create an early linkage between planning and NEPA to discuss developing early analysis and preliminary decision-making that can be incorporated into the project-level NEPA process. The Federal Highway Administration (FHWA) defines the Planning and Environment Linkages (PEL) program as: "a collaborative and integrated approach to transportation decision-making that 1) considers environmental, community, and economic goals early in the transportation planning process; and 2) uses the information, analysis, and products

Figure 3.4: NEPA document decision process



Source: U.S. Environmental Protection Agency

developed during planning to inform the environmental review process." This helps provide a solid foundation of information for the environmental review process, and enables early analysis, public input, and decisions to help streamline the environmental review decision-making process. PEL activities at the Iowa DOT are discussed further in Chapter 5.

Environmental mitigation

Environmental mitigation proceeds differently at the planning and project development levels. At the broad, long-range planning level, it is primarily achieved through the inclusion of environmental resource inventories in the planning process and a comparison of transportation planning inputs and outputs to any environmentally sensitive resources. This is done to determine possible conflicts or benefits. Types of efforts typically conducted during this process include the development of inventories of environmentally sensitive resources, consultation with agencies at various levels of government that are responsible for environmental resources and oversight, and discussion of mitigation activities at the policy and strategy level.

The project development level involves the NEPA process outlined previously. Depending on the type of project and its potential environmental impacts, it may require a detailed environmental review. Should there be potential for major environmental impacts, mitigation measures will likely be required. Mitigation occurs in the following sequenced approach.

- Avoid the impact altogether by not taking a certain action or parts of an action.
- Minimize impacts by limiting the degree or magnitude of the action and its implementation.
- Rectify the impact by repairing, rehabilitating, or restoring the affected environment.
- Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action.
- Compensate for the impact by replacing or providing substitute resources or environments.

Some example mitigation activities may include:

- Replace impacted wetlands at a minimum of 1:1 or 1:1.5 ratio.
- Replacement of parkland at 1:1 ratio or equivalent usage ratio.
- Avoid parking and/or storing construction equipment in the vicinity of potential groundwater contamination.
- Preserve trees along watercourses to protect aquatic life and prevent streambank erosion.
- Construct noise and/or visual barriers.
- Physically move the impacted resource while maintaining the structural integrity and historic qualities.
- Document the historical nature of a structure prior to demolition.

The mitigation activities highlighted above have the potential to be very costly. However, these expenses should be considered as a cost of doing business, and should be reflected in the overall project cost estimates. Ultimately, the planning and coordination described in this section involves approaching a project area as one functioning ecosystem, which has the potential to be impacted by any planned activity.

Air quality and climate change

Two issues closely tied to the subject of environmental mitigation, air quality and climate change, have received a considerable amount of attention in recent years. The Iowa DOT has been monitoring a number of recent air quality developments, particularly those related to the National Ambient Air Quality Standards (NAAQS) for particulate matter and ozone. The NAAQS for particulate matter were last adjusted in 2013, and the NAAQS for ozone was most recently lowered in 2015. Iowa continues to remain in attainment for both these criteria air pollutants. A nonattainment status would result in additional transportation planning and programming requirements for the state.

As Iowa prepares for the possibility of increasing air quality regulation, the state is also preparing for the effects of a changing climate. These impacts, particularly extreme weather events, would not only affect the state in areas such as agriculture and public health, but could also result in serious implications for Iowa's transportation infrastructure. According to Climate Change Impacts on Iowa, a 2010 report by the Iowa Climate Change Impacts Committee, the 2008 flooding in Iowa accounted for $660 million in infrastructure losses. Resiliency has become increasingly important at all levels of planning, from designing projects to withstand extreme weather events to having plans in place for responding to emergency weather situations. Smaller-scale efforts are underway as well. As Iowa expects to continue to receive higher levels of precipitation than in the past, some areas of the state have already started implementing elements of "green" infrastructure to improve managing stormwater runoff, by using permeable pavements, bioswales, rain gardens, and more.

Iowa's changing climate and air quality levels have the potential to affect the state's current transportation infrastructure and future project decisions greatly, and it is vital these issues are considered during the planning process.

3.5 Land use and livability

The 2015 federal surface transportation reauthorization bill, Fixing America's Surface Transportation (FAST) Act, continued to emphasize the need to consider land use and quality of life as one of the bill's 10 transportation planning factors. This planning factor, which states: "Protect and enhance the environment, promote energy conservation, improve quality of life, and promote consistency between transportation improvements and state and local planned growth and economic development patterns," has been used to guide the following discussion on planning for transportation, land use, and livability in Iowa.

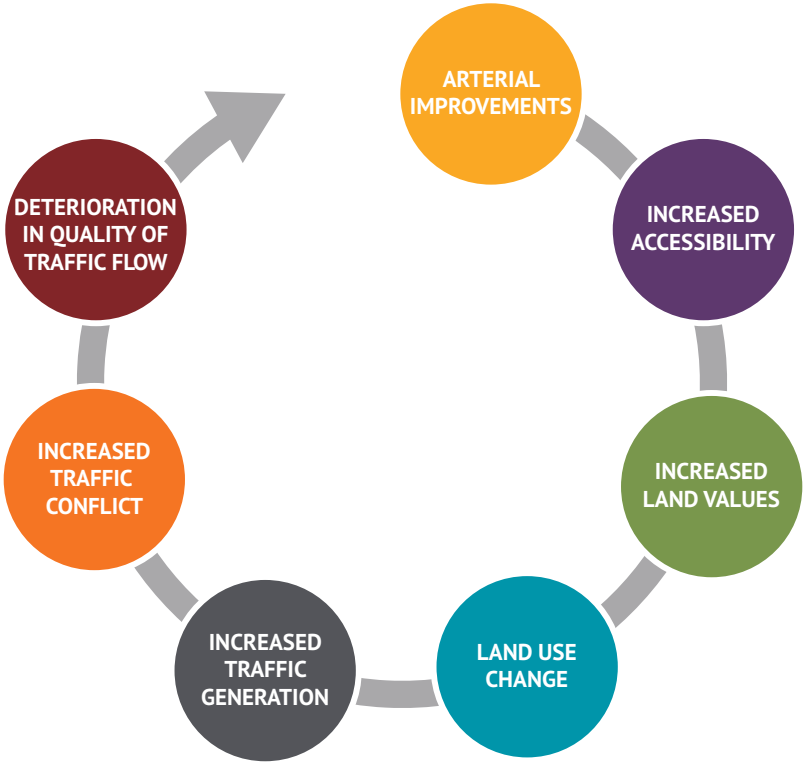
Land use

Land use can be defined as the human management of land. In land use planning, areas are often classified to accommodate a variety of uses, such as residential, commercial, industrial, agricultural, and more. Coordinating land use and transportation planning is essential in creating more sustainable, vibrant, and well-connected communities. Several recent planning initiatives involving concepts such as new urbanism, smart growth, complete streets, and transit-oriented development are only achievable when cooperation between the transportation and land use sectors takes place. In addition to creating healthier, safer, and more efficient communities, sensible land use decisions are essential to Iowa's economy, where urban expansion can permanently destroy valuable farmland.

The linkage between transportation and land use is also demonstrated through access management, which is the management of vehicular access points to adjacent land parcels. Managing access points increases safety and efficiency for travelers. Common access management techniques include providing larger spaces between driveways and side streets; increasing the distance between access points and traffic signals; safe turning lanes; median treatments; and right of way management.

While policies, principles, and strategies for integrating transportation and land use can be established on the state level, the most visible coordination takes place on the local level. Figure 3.5 illustrates the cyclical nature between land use and transportation, and shows the need to be continuously mindful of present and future land use needs when making transportation investment decisions. Transportation improvements can themselves induce additional travel by increasing accessibility and mobility. This can apply not only to roadways, but other modes as well.

Figure 3.5: Transportation and land use cycle



Source: FHWA

Livability

In June 2009, the U.S. DOT, in partnership with the U.S. Department of Housing and Urban Development and the Environmental Protection Agency, announced a new interagency effort, the Partnership for Sustainable Communities (PSC). This partnership, which aims to "improve access to affordable housing, provide more transportation options, and lower transportation costs while protecting the environment in communities nationwide," is founded on livability principles, including providing more transportation choices; promoting equitable, affordable housing; enhancing economic competitiveness; supporting existing communities; coordinating policies and leveraging investment; and valuing communities and neighborhoods. The PSC's 2015 priorities were:

1. Using PSC agency resources to advance Ladders of Opportunity for every American and every community.
2. Helping communities adapt to a changing climate, while mitigating future disaster losses.
3. Supporting implementation of community-based development priorities.

In the transportation planning process, livability is an important consideration in maintaining a community's quality of life. A livable community has a well-connected transportation network with many transportation choices and better facilities, which in turn provides access to quality jobs, housing, schools, and other amenities.

Enhancing livability in Iowa through transportation can be achieved by investing in multiple transportation modes, maintaining roadway infrastructure, expanding bicycle and pedestrian facilities, utilizing new technologies, and coordinating new investments with surrounding communities. As Iowa's population grows, it is important to strengthen communities through valuing and supporting the existing transportation network.

3.6 Maintenance and preservation

Routine maintenance refers to the daily functions and activities that provide for an acceptable level of service on the transportation system. Typical highway activities, for example, may address maintenance needs related to potholes, pavement markings, roadway shoulders, snow removal, traffic signs, and signals. Maintenance activities usually address immediate system needs, but they do not address underlying infrastructure deterioration due to time and usage.

In contrast to routine maintenance, preservation strategies appreciably extend the useful life of infrastructure. Preservation strives to use cost-effective and well-timed strategies, such as a surface treatment, to extend the life of system components. Safety and user expectations are important considerations in selecting a specific preservation strategy. Preservation strategies for all modes include a wide variety of improvement categories with specific corrective actions that must be matched to the current age and condition of the candidate component.

In recent years, especially in light of limited funding and increasing costs, the efficient management of Iowa's existing transportation system has been identified as the priority investment path. Iowa's citizens have overwhelmingly expressed their support of this stewardship philosophy and keeping the existing system in a state of good repair before pursuing expansion needs. Some expansion of the existing system is needed, but it will only occur when and where careful planning efforts have identified the need to do so. Yet even with minimal expansion, funding limitations will make maintaining and preserving the existing system at an acceptable level a challenge.

Beyond roadways: maintaining and preserving a multimodal system

It is important to note that maintenance and preservation of the transportation system is more than just highways and the maintenance of those highways. All modes of transportation have critical maintenance and preservation needs. In addition to including all modes, maintenance and preservation also addresses more than the infrastructure components of these modes. The transportation system involves the services and support functions keeping it operational. Examples of these functions include air traffic control, construction materials testing, driver's license renewal, highway patrol duties, intelligent transportation systems (ITS), lock and dam operation, planning support, transit fleet dispatching, and weight-restriction enforcement. Iowa has a comprehensive transportation system that involves many functions and roles that keep it operational.

Asset management

As defined by the American Association of State Highway and Transportation Officials' (AASHTO) Subcommittee on Asset Management, "transportation asset management is a strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively through their life cycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision-making based upon quality information and well defined objectives." Given the challenges posed by issues such as aging infrastructure and escalating construction and operating costs, tools such as asset management are increasingly valuable when seeking to balance funding realities with public needs and expectations.

According to FHWA, an effective asset management program can:

- Track system condition, needs, and performance.
- Clearly identify costs for maintaining and preserving existing assets.
- Clearly identify public expectations and desires.

- Directly compare needs to available funding, including operating and maintenance costs.
- Define asset conditions so decisions can be made on how best to manage and maintain assets.
- Determine when to undertake action on an asset, such as preservation, rehabilitation, reconstruction, capacity enhancement, or replacement.

Asset management provides insights and tools to help transportation professionals make wise investments that result in improved service and greater cost-effectiveness. Within the context of transportation planning and programming, asset management can positively influence every phase of the process. This influence is illustrated in Table 3.1.

Table 3.1: Influence of asset management on planning and programming

Common practice	Asset management best practice
Transportation options considered in the long-range plan reflect primarily the choices included in the current transportation program.	The long-range plan identifies transportation options broadly in terms of potential modes and intermodal linkages, types of investments, and program or funding alternatives.
Methods, formulas, and criteria to prioritize projects reflect a historical evolution of engineering, financial, and political factors.	Methods, formulas, and criteria to prioritize projects reflect stated policy objectives, performance measures, and targets.
Projects are evaluated largely in terms of initial cost and judgment as to potential benefit.	Projects are evaluated in terms of realistic estimates of lifecycle costs, benefits, and performance impacts.
Programming is based mainly on intuitive judgment.	Programming is based to the degree possible on objective information, supported by sound analytical procedures.
Management systems and condition surveys are used as engineering or research tools, but are not applied to program building or budgeting.	Information from condition surveys and management systems directly informs the process that builds the recommended program and budget.
Management systems are used only to rank the condition of assets; needs are programmed based on "worst first."	Management systems guide the programming of projects based on valid engineering and economic criteria.

Source: AASHTO

The Iowa DOT has begun an effort to develop and implement asset management strategies. The Iowa DOT believes asset management is necessary to continue providing a high level of service for infrastructure users while balancing maintenance and improvement costs of Iowa's transportation system. The Moving Ahead for Progress in the 21st Century (MAP-21) Act and the FAST Act include the requirement for states to develop transportation asset management (TAM) plans. While rulemaking was not finalized for these requirements until 2016, a steering committee was formed in 2014 to oversee the development of the Iowa DOT's first TAM plan. The initial TAM plan was finalized in fall 2016. In addition to TAM plan development, the Iowa DOT established a highway TAM governance structure, which was a need identified during the TAM plan development. A team was assembled to design a process and governance structure for highway program development with the objectives listed below. While this effort was developed independently of the ongoing MAP-21/FAST Act rulemaking process, much of the team's work aligns with the procedures that need to be formalized for the establishment of performance targets.

- Add transparency to the programming process, align associated tools and plans, and incorporate appropriate stakeholders.
- Define roles and responsibilities of the associated stakeholders.
- Create a process that is adaptable over time as technology, initiatives, and priorities change.
- Oversee the incorporation of risk management into the prioritization process. Provide input to critical plan development efforts, including the TAM plan and state transportation plan.
- Propose performance targets, propose funding levels to achieve those performance targets, and coordinate the associated monitoring and reporting.

Efforts related to TAM governance are discussed further in the programming discussion in Chapter 7. There have also been other parallel efforts pertinent to the development of the TAM plan.

- A committee was formed, including staff from Iowa's city and county governments, called the Iowa Transportation Asset Management (ITAM) group. This group has met on a periodic basis to discuss approaches to harmonize Iowa DOT and local TAM efforts and work together to improve the TAM process in Iowa.
- Pavement management has received a renewed focus. Although Iowa DOT has had pavement management tools for some time, there is work underway to improve pavement models and broaden their use.
- Likewise, for bridge management, there are efforts underway to improve bridge management system models to better forecast deterioration and use that information to select treatment strategies, as well as to forecast network condition under various funding scenarios.

Several asset management strategies derived from the TAM plan are included in the action plan in Chapter 5.

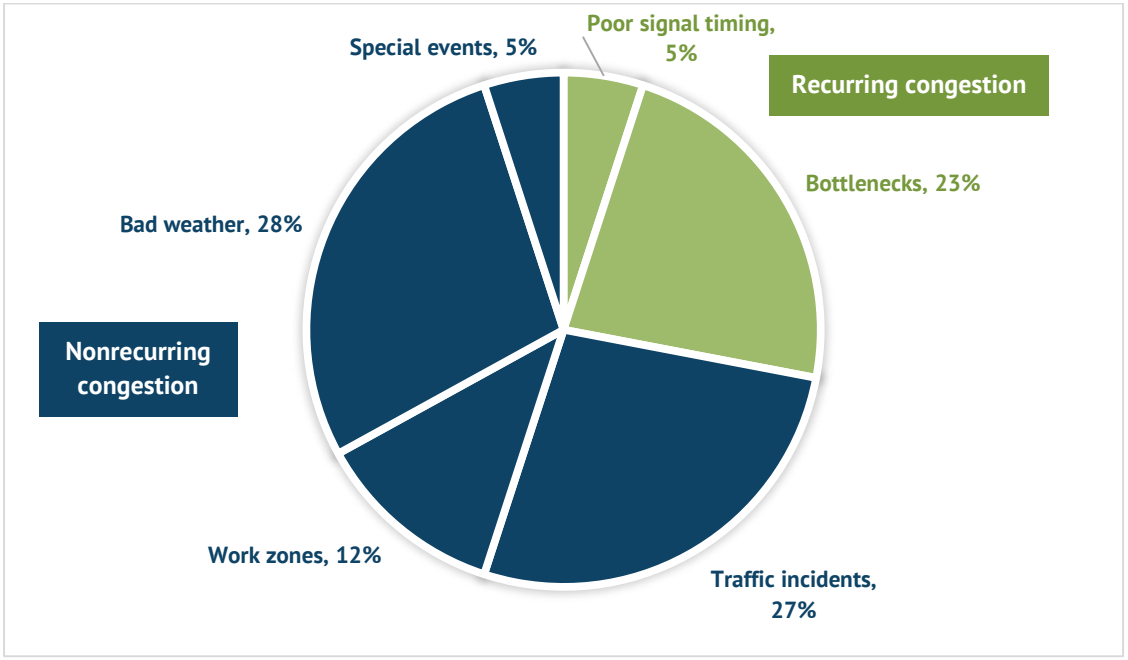
3.7 Management and operations

Traffic on Iowa's roadways has steadily grown over time, which has also increased the potential for crashes and congestion. Optimizing performance of the system is critical to keep traffic flowing in a safe and efficient manner. This is embodied in the strategic approach of transportation systems management and operations (TSMO). The aim of TSMO is to proactively manage and fine-tune the performance of the state's transportation system, particularly by managing or mitigating congestion and incidents. This includes current Iowa DOT strategies such as monitoring the system through traffic cameras and speed sensors, quickly deploying response resources to incidents, and providing traveler information through platforms like Iowa 511. TSMO also includes efforts to prepare for and adapt to changing technology, such as connected and highly automated vehicles and proactively enabling "smart" highway corridors with data and communications capacity.

Mobility challenges occur on Iowa's roadways every day. Recurring congestion, due to issues like poor signal timing or bottlenecks, accounts for a portion of this issue. However, in Iowa the most significant of these challenges are temporary disruptions that take away part of the roadway from use, known as nonrecurring congestion. Primary causes of this type of congestion include bad weather, traffic incidents, and work zones, as shown in Figure 3.6.

In Iowa, about 72 percent of the congestion and delay experienced by the traveling public is nonrecurring congestion. Nonrecurring congestion can happen anywhere in the state at any time, and the impact of congestion goes well beyond a traffic event. In calendar year 2015, there was an average of approximately 1,400 traffic incidents on state roadways per month, with an average duration of approximately 60 minutes for blocked lanes. Each minute a lane is blocked can lead to 4 to 5 minutes of delay, and for each minute that a primary incident continues, the likelihood of a secondary crash increases by 2.8 percent. The U.S. DOT estimates that secondary crashes represent more than 20 percent of all crashes and are often more deadly than the primary incident. Fewer incidents and quicker clearance of incidents help to reduce congestion, allowing the transportation system to operate more safely and efficiently.

Figure 3.6: Sources of congestion in Iowa, 2013-2015



Source: Iowa DOT

Cost-effective TSMO strategies are used to improve service by "taking back" the transportation system capacity lost to congestion without necessarily adding lanes. TSMO is important because it deals directly with the root causes of congestion, offers the potential to improve safety and efficiency, and can help to maximize existing infrastructure capacity through cost-effective strategies. Ultimately, this improves the safety and mobility of the transportation system and helps Iowans travel to their destinations safely, efficiently, and conveniently.

TSMO planning

There has been a significant TSMO planning effort at the Iowa DOT over the past several years. This has included the development of the overall TSMO plan, which has three levels: strategic, program, and service layer.

TSMO Strategic Plan

The TSMO Strategic Plan highlights Iowa's challenges, makes the case for TSMO, and describes the vision, mission, goals, and strategic objectives for TSMO. It focuses on the benefits of a comprehensive approach to TSMO to support Iowa DOT's vision, and provides a strategic direction for Iowa DOT's TSMO program and integration.

TSMO Program Plan

The TSMO Program Plan is a companion to the Strategic Plan, which provides the structure for a comprehensive TSMO program. The Program Plan outlines the programmatic objectives, strategies, processes, procedures, and resources needed to deliver the vision and goals of the Strategic Plan. The Program Plan covers the following areas.

- **Program objectives**: Provides specific programmatic objectives supporting the strategic goals and objectives.
- **TSMO integration with current plans and programs**: Highlights how TSMO principles support current Iowa DOT plans and programs, and how they can be integrated across the Iowa DOT from the earliest stages of planning and project development.
- **Leadership and organization**: Identifies how the Iowa DOT can adopt effective practices to improve TSMO capabilities and inform future organizational culture.
- **Business processes and resources**: Provides a detailed investigation into a variety of departmental TSMO activities.
- **Performance management and decision support assessment**: Provides a snapshot of ongoing performance measurement activities and highlights the need for improved decision support to make better TSMO-based decisions.
- **Five-Year TSMO Program**: The program includes three components: 1) a tool that leverages the original Interstate Condition Evaluation (ICE) methodology to reflect traffic operations criteria (ICE-OPS); 2) a five-year list of activities that deliver TSMO strategic goals and objectives; and 3) a five-year budget plan.

The program plan has served as the basis of the operations analysis and strategies discussed in Chapter 5. This includes using the ICE-OPS tool to evaluate interstate corridors from an operations perspective, and the incorporation of a number of strategies identified in the Program Plan.

Service layer plans

There will be eight service layer plans that will provide more detailed recommendations and actions for each of the service areas. Table 3.2 defines each service layer. Each service layer plan will outline opportunities and challenges associated with that area; describe existing services, activities, and projects; assess related existing conditions; identify service gaps; provide actionable recommendations; develop performance measures and an evaluation process; and provide a five-year service layer cost estimate.

Table 3.2: TSMO service layers

Service layer	Definition
Traffic management center (TMC)	The round-the-clock hub of traffic coordination and management activities throughout the state.
ITS and communications	Fixed and mobile traffic sensors, non-enforcement traffic cameras, dynamic message signs, highway advisory radio transmitters, and supporting communications infrastructure.
Traveler information	Traveler information tools that communicate planned and prevailing traffic conditions, such as Iowa 511 and various social media.
Traffic incident management	The coordination of Iowa DOT and its partners' response to routine highway traffic incidents.
Emergency transportation operations	The coordination of Iowa DOT and its partners' response to large scale incidents (not necessarily highway-related), such as flooding, tornadoes, epidemics, etc.
Work zone management	The planning and deployment of various strategies to maintain traffic flow and safety through highway work zones.
Active transportation and demand management	Innovative strategies to maximize available capacity of roadways, such as ramp metering, variable speed limits, lane control signing, active signal control, and time-of-day shoulder use.
Connected and autonomous vehicle	While still an emerging technology, this service layers considers the challenges and opportunities of vehicle-to-vehicle and vehicle-to-infrastructure connectivity and autonomous vehicles to improve vehicle safety and efficiency.

Source: Iowa DOT

Office of Traffic Operations

The Office of Traffic Operations was formed in 2013, partially to help consolidate staff working in areas of TSMO across the department. In addition to overseeing the department's TSMO efforts, some of the office's key duties include:

- Management of the day-to-day traffic operations on the highway system through the 24-hour statewide TMC.
- Management of the emergency transportation operations (ETO) response efforts on behalf of the Iowa DOT.

- Management and maintenance of the 511 Travel Information System.
- Deployment and maintenance of ITS on the highway system.
- Development and maintenance of a coordinated, comprehensive statewide traffic incident management (TIM) response plan.
- Traffic critical projects planning and deployment.
- Traffic incident and emergency management, including federal Emergency Relief program, statewide/regional TIM planning, state and local agency coordination, emergency management, and major incident after-action reviews.

3.8 Safety

Safety is a foundational consideration in this Plan. The department emphasizes safety in all efforts, including enforcement, education, engineering, and emergency response. Safety is most often thought of in terms of the highway mode, but each modal area is an important part of an interrelated transportation system. The overriding goal for all aspects of transportation safety is to reduce injuries and fatalities, thereby reducing personal and economic losses experienced by families, employers, and communities, and improving Iowa's quality of life. Educating users, designing safer facilities, and joining with partners in collaborative efforts can achieve this.

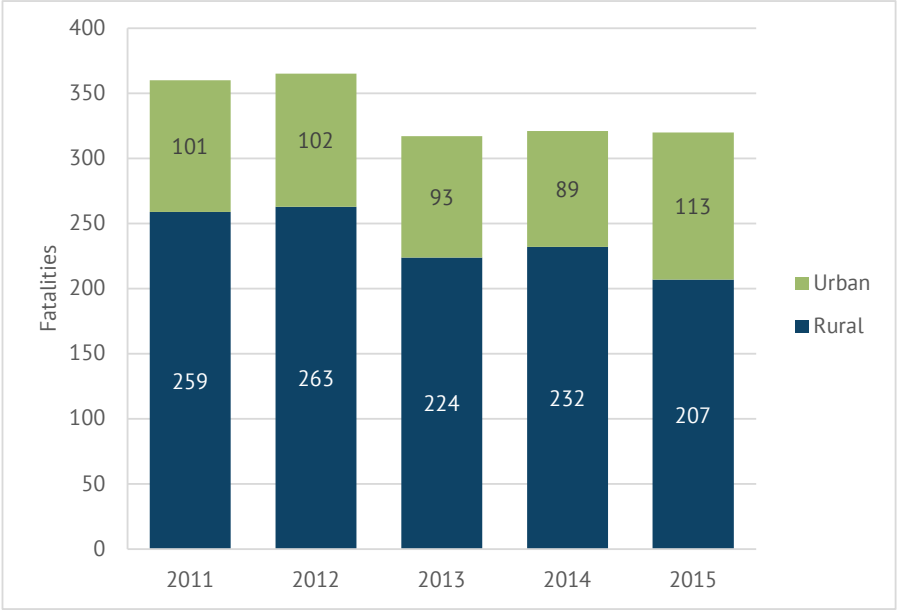
Safety trends

Between 2011 and 2015, there were 1,683 fatalities on Iowa roadways. During this five-year period, there was an 11 percent overall decrease in the number of fatalities, from 360 in 2011 to 320 in 2015 (see Figure 3.7). The most significant annual decrease occurred between 2012 and 2013, which had a 13 percent decrease in fatalities.

Although the rural population continues to decline in Iowa, roadway fatalities in rural areas continue to represent a disproportionate number of Iowa's fatalities as compared to urban areas. On average, 70 percent of Iowa fatalities occurred in rural areas during this period, while 30 percent occurred in urban areas. Unfortunately, preliminary numbers for 2016 show a marked increase in Iowa crash fatalities. This trend also occurred at the national level.

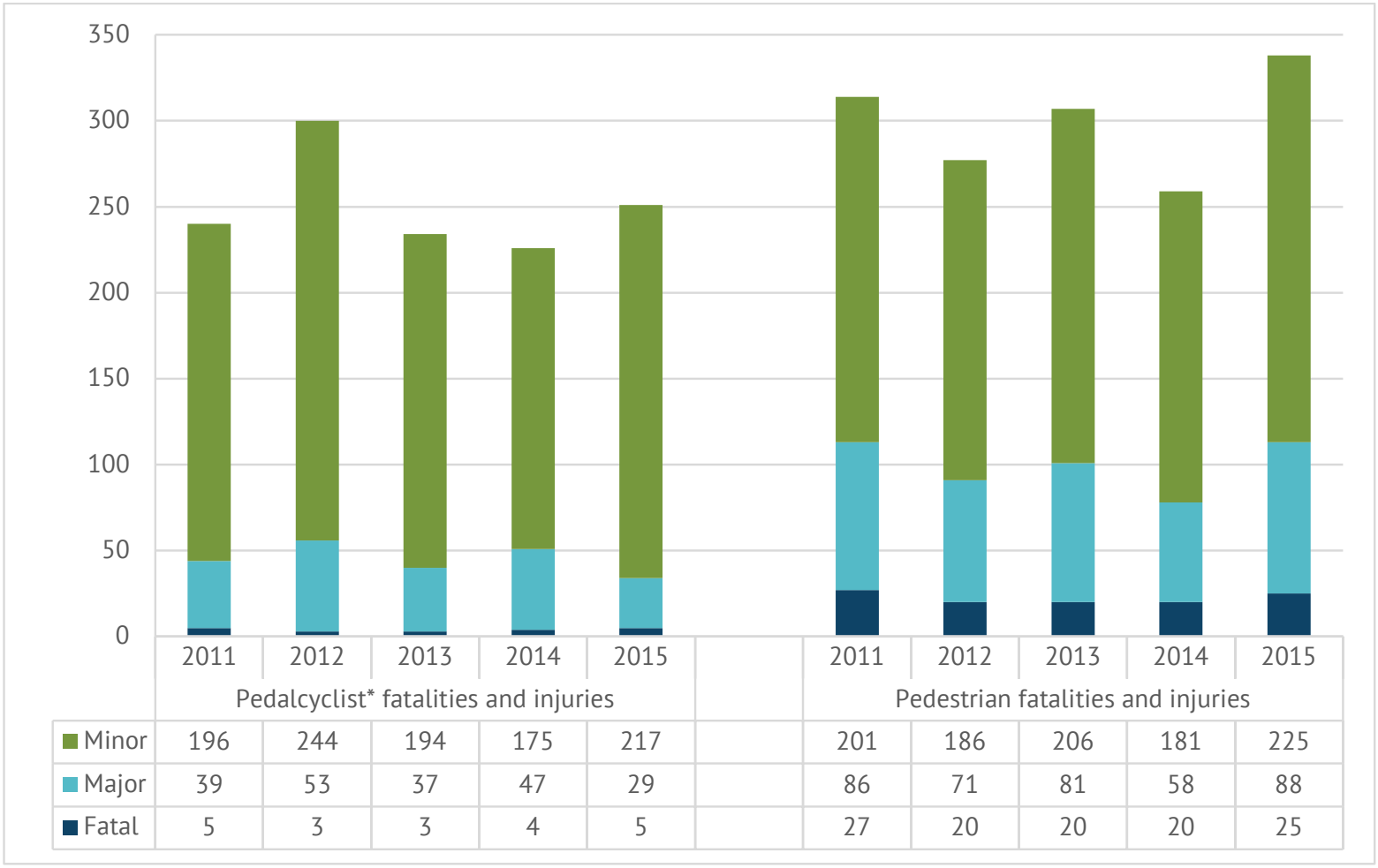
Injury and fatality crashes involving pedestrians or pedalcyclists (defined as a bicycle, tricycle, unicycle, pedal car; a two-wheeled, nonmotorized cycle or a vehicle that has three or four wheels but is propelled by pedal power) have increased during the past five years (see Figure 3.8). Preliminary numbers for 2016 indicate that the increase in severe crashes has continued, prompting efforts for additional study and implementation of measures to help decrease the number of nonmotorized fatalities.

Figure 3.7: Annual crash fatalities, divided into rural and urban crashes, 2011-2015



Source: Iowa DOT

Figure 3.8: Pedalcyclist and pedestrian fatalities and injuries, 2011-2015

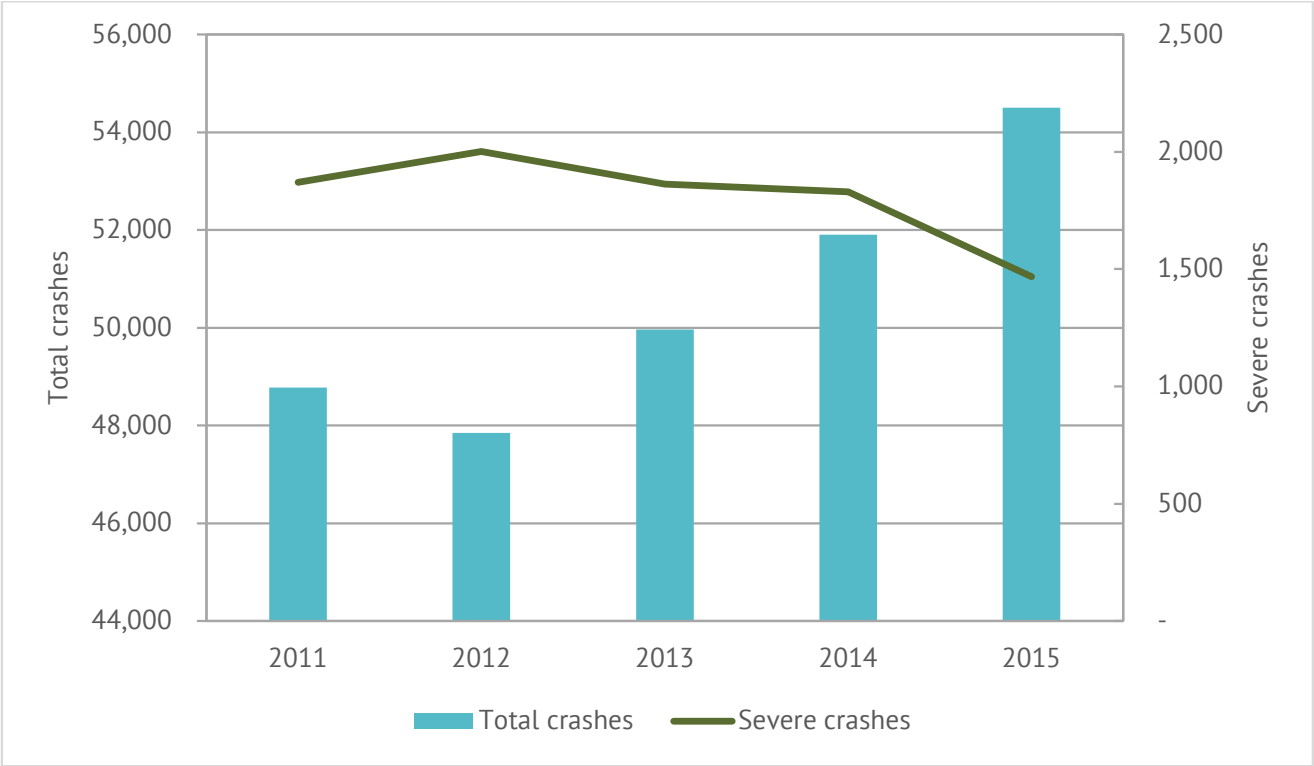


	Pedalcyclist* fatalities and injuries						Pedestrian fatalities and injuries				
	2011	2012	2013	2014	2015		2011	2012	2013	2014	2015
Minor	196	244	194	175	217		201	186	206	181	225
Major	39	53	37	47	29		86	71	81	58	88
Fatal	5	3	3	4	5		27	20	20	20	25

**Pedalcyclist (bicycle, tricycle, unicycle, pedal car) – a two-wheeled, nonmotorized cycle or a vehicle that has three or four wheels but is propelled by pedal power.*
Source: Iowa DOT

In Iowa, the total number of crashes increased between 2011 and 2015, as shown in Figure 3.9. Although there was a steady increase in the total number of motor vehicle crashes, the total number of severe crashes (fatal and major injury crashes combined) declined during this period. It is also important to note that vehicle-miles traveled (VMT) for the state has increased during this the same period (reference Figure 4.7).

Figure 3.9: Total crashes and severe crashes in Iowa, 2011-2015



Source: Iowa DOT

Federal legislation

The current federal surface transportation reauthorization legislation, the FAST Act, continued many comprehensive approaches to highway safety that started with previous reauthorization legislation. One key provision that has been continued under the FAST Act legislation is the Highway Safety Improvement Program (HSIP), which was created "to achieve a significant reduction in traffic fatalities and serious injuries on public roads."

The Fast Act continues the mandated state Strategic Highway Safety Plan (SHSP) and requires each state's transportation department to lead diverse road safety disciplines, such as engineering, education, enforcement, and emergency response services, in collaborating to develop their state's plan. Proposed strategies are required to address safety needs of all public roads, include projects or strategies that are regularly evaluated, and to be reported annually to the U.S. DOT secretary.

Iowa's SHSP

According to the U.S. DOT, a SHSP "is a statewide coordinated safety plan that provides a comprehensive framework for reducing highway fatalities and serious injuries on all public roads." The purpose of the SHSP is to identify and establish statewide goals, objectives, and key emphasis areas to address areas of greatest need to make roadways safer. The HSIP requires state transportation departments develop an SHSP that:

- Includes consultation from a variety of stakeholders during the development process.
- Analyzes and makes effective use of crash data.
- Addresses the Four E's (engineering, enforcement, education, and emergency services) plus management and operation.
- Considers the safety needs of all public roads.
- Describes a program of projects or strategies to reduce or eliminate safety hazards.
- Is implemented and evaluated.

In 2017, Iowa's traffic safety community finalized an update to Iowa's SHSP, which was previously adopted in 2013.

SHSP emphasis areas

The main objective for developing the SHSP is to identify severe crash types and characteristics (known as safety emphasis areas) that present the best opportunity to reduce severe and fatal injuries. Iowa's SHSP advisory team initially focused on 22 emphasis areas suggested by the AASHTO Strategic Highway Safety Plan Guide. Through research, crash data analysis, and concurrence among the SHSP Advisory Team, 10 emphasis areas were selected to be further analyzed in Iowa's 2017 SHSP.

The 10 emphasis areas were divided into the categories of behavioral or roadway/infrastructure-related. The 10 emphasis areas are listed below.

- Lane departures
- Local roads
- Speed-related
- Unprotected persons
- Younger drivers
- Roadside collisions
- Intersections
- Impaired driving
- Older drivers
- Motorcycles

SHSP vision and goals

During each SHSP update, the advisory team and stakeholders are tasked with creating a long-term vision and short-term goal for Iowa's SHSP. Since the adoption of the 2013 SHSP, Iowa has continued to align itself with the national vision to eliminate traffic fatalities on all public roads. In order to do this, the Zero Fatalities campaign was developed in 2014 in a partnership between the Iowa DOT, the Iowa Department of Public Safety, and the Iowa Department of Public Health. The vision of Zero Fatalities and the strategies associated with it have been continued in Iowa's 2017 SHSP update, and several of these strategies have been incorporated into the action plan in Chapter 5. While the partner agencies realize that zero fatalities is a lofty vision for the state, messaging strategies focus on the fact that zero is the only acceptable goal for individuals when it comes to their loved ones. Therefore, it should be the only goal for the state.

Local and district road safety plans

The Iowa DOT recognized the need to take proactive steps for addressing crashes on its rural roadways. Using Minnesota's local road safety plans (LRSP) as a model, the Iowa DOT began developing county specific LRSPs in 2015. The LRSPs analyze the types of crashes occurring on the road system and use a risk-based assessment to identify proactive improvements to mitigate crashes. The result of an LRSP is a prioritized list of safety projects for the county that proactively address the safety performance of the roadway. Similar to Iowa's SHSP, the LRSPs address how improved safety can be implemented at the county level. This is done with the understanding that in order to make the roadways safer, more than just engineering improvements need to be made. The Iowa DOT's district road safety plans will parallel the efforts of the county LRSPs for the primary system.

Modal safety

As was previously mentioned, safety is most often thought of in terms of the highway mode, yet it is an important component of each mode in the transportation arena. The following provides a brief overview of safety considerations for each mode.

Aviation safety

System planning and aviation programs strive to maintain infrastructure and services promoting safety in Iowa's air transportation system. Services specific to safety include a statewide network of aviation weather systems, a runway marking program, and windsocks for airports. While the Federal Aviation Administration certifies pilots, commercial airports, and aircraft, Iowa assumes responsibility for certifying that public-use airports meet minimum safety standards. The state also sponsors education safety programs geared toward pilots, aircraft mechanics, airport operators, and aerial applicators.

Bicycle and pedestrian safety

Bicycle and pedestrian facilities interplay with highway and local street systems, and include both shared and separated facilities. Iowa has incorporated many safety strategies and programs to protect those using bicycle and pedestrian facilities. These strategies and programs include the distribution of Transportation Alternatives Program (TAP) funding across metropolitan planning organizations (MPOs) and regional planning affiliations (RPAs), where it is primarily used for bicycle/pedestrian projects; federal and state recreational trails programs; complete streets design; safety compliance; AASHTO design guidelines; facility compliance; optimization of signal design; and support for bicycle helmet use.

Public transit safety

Safety is integrated throughout public transit, including planning, design, operations, maintenance, employee training, technology development, and implementation of the Federal Transit Administration's drug and alcohol testing programs. Intelligent technology systems, such as in-vehicle cameras and radio communications, are incorporated when possible to enhance safety.

Rail safety

Iowa's rail system includes both commercial freight and passenger rail. Due to the large number of rail and highway intersections, rail crossing safety is critical. Several rail crossing safety programs are administered by the Iowa DOT, including the federal-aid Highway-Railroad Crossing Safety Program, the Grade Crossing Surface Repair Program, and Iowa's Highway Railroad Grade Crossing Safety Program. Safety programs support projects such as grade separations, track maintenance, and signal upgrades. The Iowa DOT also cooperates with implementation of the National Rail Safety Action Plan and supports Operation Lifesaver, which is a nonprofit education and awareness program dedicated to ending highway-rail collisions.

Multidisciplinary safety approach

To maximize safety improvement efforts, the Iowa DOT has partnered with other public and private agencies to develop a multidisciplinary approach. Solutions to safety concerns can often be achieved by including input from law enforcement, emergency response, tow companies, firefighters, transit agencies, and many others. This multidisciplinary approach is promoted by FHWA and other national organizations. The Iowa DOT also partners with several state agencies to promote safety efforts, such as the Governor's Traffic Safety Bureau, Iowa Department of Public Safety, Iowa Department of Education, and Iowa Department of Natural Resources.

One unique way the multidisciplinary safety approach has been incorporated in planning efforts across the state is through the development of multidisciplinary safety teams (MDSTs). These groups meet to discuss safety issues for their region and are composed of individuals from various backgrounds, professions, and agencies. Some examples of MDST activities include road safety audits, crash analysis workshops, and local media and marketing campaigns. Currently there are nine MDST groups across the state.

3.9 Security

Security is an important consideration in the transportation planning process, and it has received heightened attention since the terrorist attacks of Sept. 11, 2001. Security should not be thought of only in terms of criminal or terrorist attacks, but also vulnerability to natural and manmade incidents, such as floods, tornadoes, and hazardous materials spills. In Iowa, recent flooding and winter weather events have dramatically affected both rural and urban transportation systems, requiring adjustments to response policies and procedures. All modes of transportation are vulnerable to disruption due to natural or manmade incidents. The Iowa DOT partners with agencies at all levels of government, as well as private firms, to implement security initiatives.

National response framework

The U.S. Department of Homeland Security issued the second edition of the National Response Framework (NRF) in May 2013. The NRF outlines key principles, roles, and frameworks that enable all response partners to prepare for and initiate a national response to emergencies and disasters. Iowa complies with the principles outlined in the NRF, which include:

- **Engaged partnership**: Those leading emergency response efforts must communicate and support engagement with the whole community through shared goals and aligning capabilities to ensure nobody is overwhelmed in times of crises.
- **Tiered response**: Incidents must be managed at the lowest possible jurisdictional level and supported by additional capabilities when needed.
- **Scalable, flexible, and adaptable operational capabilities**: As incidents change in size, scope, and complexity, response efforts must also adapt to meet dynamic requirements.

- **Unity of effort through unified command**: Effective unified command is essential to response efforts and requires clear understanding of the roles and responsibilities of each organization that will participate.
- **Readiness to act**: All partners must be in a state of readiness to act, but must also balance this with an understanding of risk.

National Incident Management System (NIMS)

The NIMS is a support document to the NRF and outlines standard command and management features that apply to response activities. This system enables all levels of government and private partners to provide a consistent nationwide structure to work together to prepare for, prevent, respond to, recover from, and mitigate the effect of incidents. The NIMS covers all incidents from daily occurrences to those of the highest national level. Iowa incorporates features of the NIMS into its incident management programs. Iowa developed its Emergency Transportation Operations (ETO) Plan in 2013 to guide statewide, multijurisdictional response to large-scale incidents and natural disasters. The Iowa ETO Plan follows a standardized, all-hazards approach to incident management consistent with the NIMS.

Iowa DOT's security and emergency response efforts

The Office of Traffic Operations is responsible for overseeing the Iowa DOT's security and emergency response efforts. Many of the office's core functions related to managing and operating the system are a key part of these efforts. In particular, this includes several ITS components. Iowa has a 511 traveler information system in operation, which has important applications for both emergency operations and homeland security concerns. The 511 system is a nationwide program that is administered and funded at the state level and provides callers, website visitors, and app users with free access to real-time, route-specific travel conditions, weather conditions, incidents, congestion, and construction information. Live feeds from the Iowa DOT's network of traffic cameras are available to the public. Dynamic message signs are also part of roadway safety and security ITS applications. The Iowa DOT has placed large electronic signs on interstates and primary highways for congestion mitigation, traffic management, and emergency diversion efforts. This system is operated remotely from the Iowa DOT.

The Iowa DOT partners and coordinates security-response efforts with a variety of entities, including local agencies (e.g., county sheriff and city police departments), which provide critical local enforcement services. Private companies (e.g., rail lines, trucking companies, emergency medical services, towing firms) also play a critical role in transportation security. This is especially true where the Iowa DOT has little jurisdictional authority. Other important partners include local urban and rural planning agencies, the Iowa Governor's Traffic Safety Bureau, and the Iowa Department of Homeland Security.

Security will continue to be a key consideration in the Iowa DOT's efforts. A proactive approach and coordination with many public and private partners will continue to be keys to success.

3.10 Technology

Technology is rapidly changing in the field of transportation. These changes will affect more than just mode choice and auto ownership; the impacts will likely affect how we utilize increasing amounts of data and how the future economy will function. Although experts disagree with how quickly some innovations will be adopted, it is clear technology will continually be integrated into the transportation system and will change the way people travel. Despite quickly changing technology, concerns and barriers still exist related to the cost, safety, security, privacy, and regulation of these new technologies. As the ways people travel and goods are transported continues to change, the Iowa DOT will continue to adapt to those changes and help ensure Iowa has a safe and reliable transportation system. The Iowa DOT is also taking a leadership role in the technological arena through some current initiatives and strategies, which are discussed in Chapter 5.

Transportation options

Many recent developments in technology are already influencing how people travel. Transportation network companies, such as Uber, Lyft, and others, connect passengers with drivers who provide the transportation in their own vehicles, typically through a website or mobile app. Shared transportation services are emerging that enable travelers to utilize vehicles they do not own on a limited, on-demand basis, typically by paying online or at a kiosk. Bike-sharing programs exist in some Iowa communities, and car-sharing programs are becoming more common nationwide. Transportation subscription services are also emerging, which enable consumers to pay a fee allowing them access to multiple modes of transportation. While many of these types of services are primarily applicable in urban areas, they are beginning to change the way people choose to travel, and may have significant effects on future planning across modes.

Automated and connected vehicles

Automated vehicles (AV) and connected vehicles (CV) have been rapidly developing and are likely the most anticipated form of technological advancement in the transportation industry. Although both AV and CV technologies are often talked about synonymously, the two emerging technologies have several differences. AV use a combination of light detection and ranging (LIDAR), global positioning systems (GPS), optical cameras, and processing power to analyze the roadway and make decisions for the driver. Recent tests of AV have demonstrated the feasibility of this technology. The most famous example of AV technology is likely the Google self-driving car, which was developed in 2010.

CV use wireless communication in various forms such as vehicle to vehicle (V2V), vehicle to pedestrian (V2P), and vehicle to infrastructure (V2I) to inform the driver of changing conditions of the roadway via sensors. These communications are collectively called V2X and are intended to improve the safety and operation capacity of roadways. The sensor technology necessary for handling such dynamic and complex problem solving is becoming more commonplace and is expected to not only advance CV technology, but also result in large amounts of data gathering.

One of the biggest attractions of AV and CV technology is the potential to eliminate driver error. This would have substantial improvements to transportation safety, as the vast majority of crashes are at least partially caused by driver error. By eliminating human error, future AV and CV technology could result in substantial reductions in the number of vehicle crashes and the number crash injuries and fatalities. Not only could this technology reduce the amount of human suffering, but it could also reduce the amount of economic loss from property damage and physical injury.

Levels of automation

Automation in vehicles exists at varying levels of complexity. Because of this, the U.S. DOT's National Highway Traffic Safety Administration has defined the following five levels of automation.

- No automation (Level 0): The driver is in complete and sole control of the primary vehicle controls at all times.
- Function-specific automation (Level 1): Automation involves one or more specific control functions (e.g., electronic stability control or precharged brakes).
- Combined function automation (Level 2): Automation of at least two or more control functions designed to work in unison, relieving the driver of control of those functions (e.g., adaptive cruise control in combination with lane centering).
- Limited self-driving automation (Level 3): At this level of automation, the driver is not expected to constantly monitor the roadway. The vehicle monitors roadway and environmental conditions and controls the vehicle accordingly. The driver is expected to be available for occasional control during certain conditions with a sufficient level of transition time to regain control of the vehicle. The Google car is an example of limited self-driving automation.
- Full self-driving automation (Level 4): The vehicle is designed to perform all safety critical driving functions and monitor roadway conditions for an entire trip and would not necessarily need a human driver for trips.

Potential impacts

Emerging trends and technologies will likely have a range of benefits that apply to the field of transportation and beyond. Specifically, the advancement of AV and CV technologies has the potential to increase the safety performance of roadways along with the operational capacity. It is believed this technology would result in numerous benefits such as fewer traffic incidents, increased reliability, reduced congestion, and more efficient use of the roadway system. Efficiency of operation coupled with clean energy technology could have substantial benefits to the environment. CV and AV may have significant effects for commercial industries, as they should help reduce costs and increase reliability and efficiency. In addition, full automation would potentially help provide a solution to the increasing truck driver shortage in the country.

The prospect of V2V and V2I presents a very unique opportunity for large amounts of data to be gathered. Conceptually, the predicted use of this information is still very hard to understand; however, the hope is that this large amount of data could rapidly advance the field of transportation and the use of transportation systems. For example, real-time information about the temporal and geographic distribution of trips could lead to better modeling and forecasting. Utilizing this data could also improve maintenance and operational capacity of transportation systems. Drivers could benefit by having real-time information to help them avoid congestion or be able to locate destinations and services easily. Private industry could potentially utilize this information to improve logistics and supply chain management.

In addition to the many potential benefits of these trends and technologies, there will be many other implications, some of which may be negative, that are yet unknown. It will be necessary to explore potential impacts to the rest of the transportation system, the economy, and land uses. With trends related to shared services and transportation network companies affecting how people choose to travel, and the potential for CV and AV technology to change the behavior of both travelers and vehicles, these technologies may have wide-ranging implications for land use and development.

Examples of impacts could include changes in areas such as patterns of vehicle ownership, the amount of parking needed by cities and individual households, the distance people live from work, and many others. Traffic forecasting methods will need to be adapted based on AV being part of the freight and passenger vehicle fleets. The potential impacts of technology and changing travel patterns lead to some types of projects being considered higher risk, in the sense that they may become less necessary or need to be re-evaluated. Examples of these types of projects include the following.

- High-dollar investments
- Purchasing right of way
- Highway capacity expansion
- Roadside infrastructure (e.g., dynamic message signs, overhead sign trusses)

Technology changes may have significant implications at not only the planning level, but at the project development level. Major projects take from several years to multiple decades to design and build, and the changing nature of transportation may require adaptation and scope refinement not just before, but also during the project development process. Strategies related to adapting to changing technology are included in the action plan in chapter 5.

4. SYSTEM OVERVIEW

To help plan for the future, it is important to understand the current structure and usage of the multimodal transportation system. This chapter provides an overview of each mode of transportation, focusing on six aspects: highlights, impact on Iowa's economy, planning efforts, inventory, current trends, and key issues. The chapter concludes by highlighting relationships between modes for both passengers and freight.

4.1 Aviation

Iowa's air transportation system plays a critical role in the economic development of the state and the quality of life for Iowans, providing an essential travel option for business and leisure. Airports are key transportation centers and economic catalysts, moving people and goods quickly and efficiently. The Federal Aviation Administration (FAA) lists more than 3,700 aircraft and 5,500 pilots in the state. With more than 1 million annual aircraft operations conducted at 108 publicly owned airports, the aviation system provides a valuable transportation mode to meet the needs of businesses, residents, and visitors.

Iowa's commercial service and general aviation airports provide access for many different types of aviation system users. More than 1.8 million people are boarded (enplanements) on commercial aircraft and nearly 98,000 tons of cargo are shipped from Iowa's eight commercial service airports each year. General aviation accounts for most aircraft operations in Iowa and includes uses for agriculture, business, charter, flight instruction, law enforcement, medical transport, and recreational activities.

Highlights

The 108 publicly owned airports in Iowa serve a variety of needs and functions, including business and leisure travel, medical transport, law enforcement, agriculture applications, freight transport, education, and recreation.

Four commercial airports and two general aviation airports in Iowa have on-site military units.

An estimated 86 percent of the publicly owned general aviation airports in Iowa support aerial applicator activity for agriculture, treating an area equal to the size of Connecticut each year.

An estimated 71 percent of Iowa's population lives within 30 minutes of a commercial or enhanced service airport.

An estimated 79 percent of Iowa's employers are located within 30 minutes of a commercial or enhanced service airport.

Impact of aviation on Iowa's economy

Aviation is vital to business recruitment and retention for many communities and economic development groups, and supports Iowa's economy through the movement of air freight and the provision of many vital functions, such as emergency response, that improve Iowans' quality of life. In 2009, a study was completed by the Iowa Department of Transportation's (DOT) Office of Aviation that documented the impact of Iowa's aviation system on the state's economy.

The 2009 Uses and Benefits of Aviation in Iowa[1] report found that aviation supports more than 47,000 jobs statewide and has a $5.4 billion impact on Iowa's economy. It was estimated that Iowa's aviation system also contributes approximately $12.8 billion to increased business productivity, and $214 million to increased agricultural productivity.

Aviation planning efforts

Along with the 2009 economic impact study, there have been additional planning studies completed for aviation in recent years, including the following.

- The Iowa Aviation System Plan (IASP)[2] provides a detailed overview of the Iowa aviation system. It evaluates existing conditions and makes recommendations for future development of the air transportation system to meet the needs of users over the timeframe of 2010-2030. The plan can be used as a guide for future investment and activity decisions to maintain and develop, as necessary, airports in the state of Iowa. An update to the plan is slated to begin in 2017.
- In 2014, the Iowa Legislature passed the Iowa DOT Omnibus bill, Senate File 2355, forming the Iowa Air Service Retention and Expansion Committee,[3] with the aim of developing a plan for the retention and expansion of passenger air service in Iowa. The committee was chaired by the Iowa DOT and consisted of managers of each commercial air service airport, as well as two members of the Senate and two members of the House of Representatives. The plan made recommendations related to continuing to grow and market Iowa's commercial service airports.

1 http://www.iowadot.gov/aviation/aviationiniowa/aviationimpact.html
2 http://www.iowadot.gov/aviation/studiesreports/systemplanreports.html
3 http://www.iowadot.gov/aviation/studiesreports/CommercialAirCommittee.html

Inventory

Iowa's airports

Airports in Iowa serve varying types of users and levels of demand. An airport's role in the aviation system depends on the aviation demand and type of facilities and services provided. As such, airports are categorized by one of five roles defined by a set of related criteria (see Figure 4.1). Facility and service targets have been determined for each airport role that will ensure the system is able to meet the needs of users.

Commercial service
Airports providing regularly scheduled commercial airline service and have the infrastructure and services to support a full range of general aviation activity. There are eight airports in Iowa that meet these criteria.

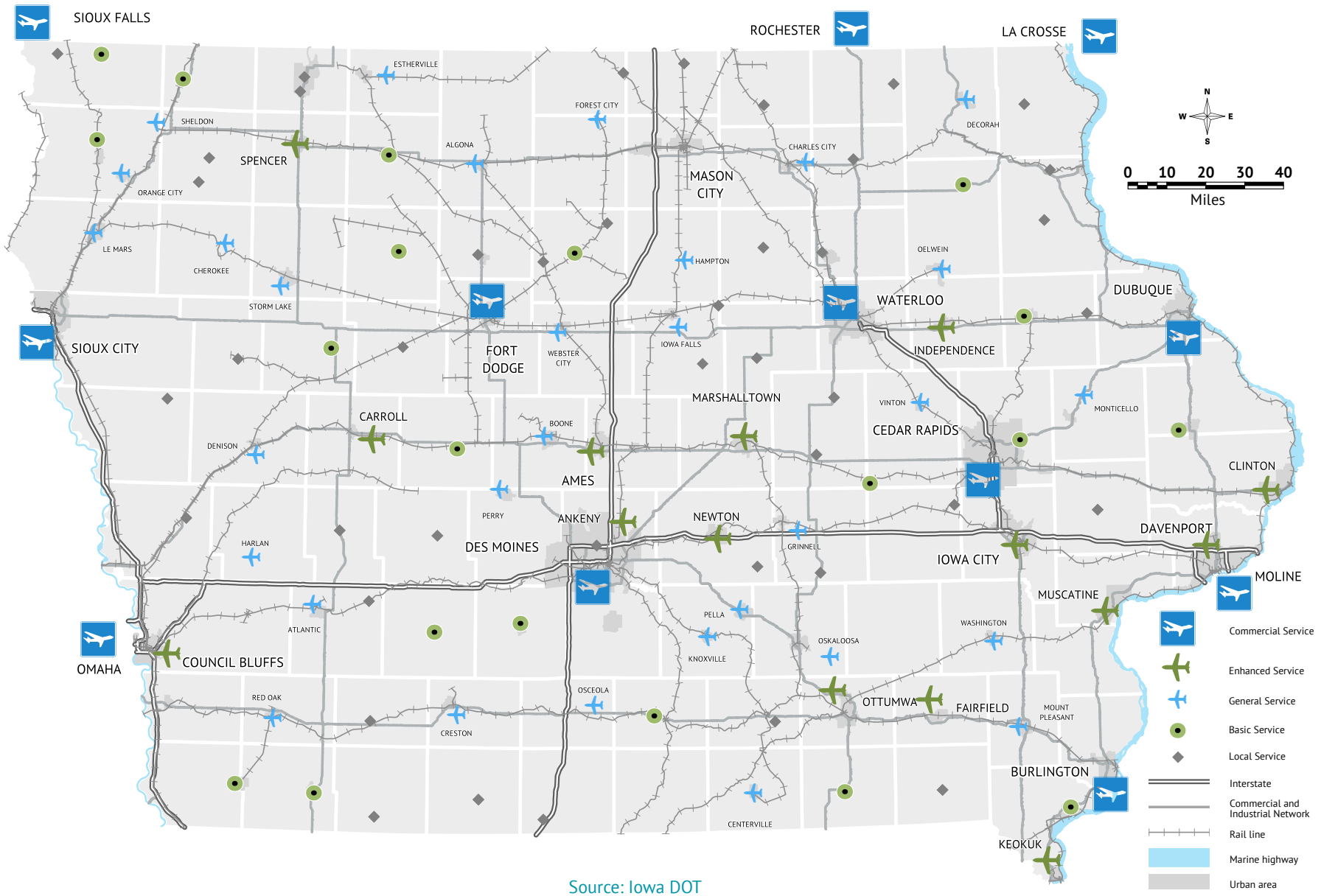
Enhanced service
Airports with a paved runway 5,000 feet or longer with facilities and services to support most general aviation aircraft, including business jets, and have weather observation equipment. Enhanced service airports serve business aviation and are regional transportation centers. There are 15 airports in Iowa that meet these criteria.

General service
Airports with a paved runway 4,000 feet or longer with facilities and services to support twin- and single-engine general aviation aircraft, as well as some business jets. General Service airports are important economic assets for their communities. There are 31 airports in Iowa that meet these criteria.

Basic service
Airports with a paved runway 3,000 feet or longer with facilities and services to support single-engine aircraft, as well as some smaller twin-engine aircraft, and provide fuel. There are 19 airports in Iowa that meet these criteria.

Local service
Airports with runways less than 3,000 feet, many of which are turf runways, and have little or no airport services. There are 42 airports in Iowa that do not meet the criteria for any other roles and fall into this category.

Figure 4.1: Iowa airports by role and bordering commercial airports



Source: Iowa DOT

Current trends

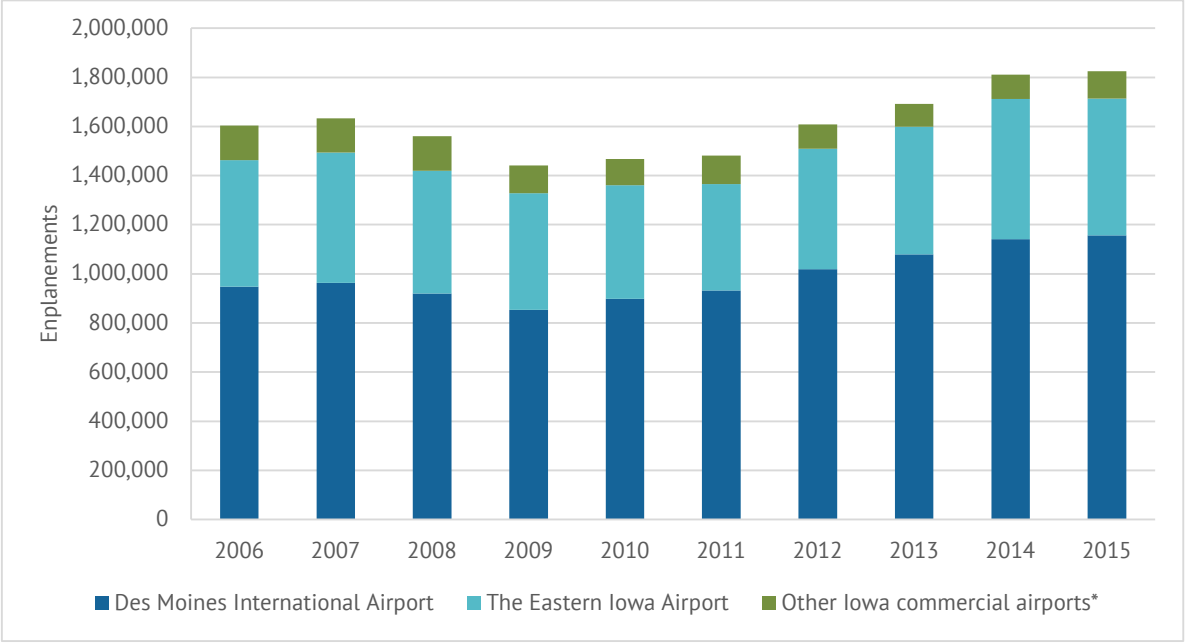
In recent years, the aviation industry has experienced changes related to the economy, new technologies, security, and regulatory impacts. In Iowa, commercial air service has returned to record highs. While overall cargo activity is down in recent years, this has more to do with changes in UPS Inc. and FedEx Corp. air cargo operations in Des Moines and Cedar Rapids than the amount of air freight that is originating or ending in Iowa.

General aviation has seen changes in recent years that include increased levels of business aviation, helicopter emergency medical services, and aerial application. A new industry is emerging in unmanned aircraft systems (UAS) and a continued increase in commercial UAS applications is expected to be significant in the coming years. At the same time, pilot flight training and recreational flying is down.

After a slight decline during 2008-2011, enplanements at Iowa's commercial service airports have been growing (see Figure 4.2). Forecasts suggest passenger traffic will experience annual increases of 2 percent over the next 20 years. During the same period, general aviation activity is expected to see modest increases in both based aircraft and operations. Increases in business aviation and growth in the UAS sector could influence the facilities and services needed at airports in the future. Additional trends that will be monitored for potential impacts to Iowa's aviation system will include the transition to the FAA's Next Generation Air Traffic System (NextGen) for air traffic control and the implementation of required Automated Dependence System-Broadcasting (ADS-B) in all aircraft by 2020.

Four of Iowa's airports (Burlington, Fort Dodge, Mason City, and Waterloo) are supported by the Essential Air Service (EAS) program, which is a federal program subsidizing commercial air service in smaller communities to help ensure that communities that had commercial service prior to airline deregulation are able to maintain a minimal level of air service. EAS eligibility rules have become more rigid in recent years. Issues related to a decreased number of pilots for EAS carriers and a decreased number of smaller aircraft in the fleet, along with the continual prospect of legislative changes, make planning for commercial service at these airports particularly important for the state and these communities.

Figure 4.2: Enplanements at Iowa's commercial service airports, 2006-2015



**This includes Dubuque Regional, Fort Dodge Regional, Mason City Municipal, Sioux Gateway, Southeast Iowa Regional, and Waterloo Regional Airports*

Source: FAA

Key issues

Planning issues for aviation were outlined in the IASP, which serves as a guide for aviation stakeholders to ensure that the aviation system is able to meet the needs of users over the next two decades. The plan includes recommendations for airport sponsors, the Iowa DOT, and FAA that address the following key issues.

- Approach obstruction mitigation is needed to improve the percent of primary runways with clear approaches.
- Height zoning is needed to encourage compatible land use around airports.
- Continuation of aviation weather observing stations maintenance and operation is needed for pilot safety and weather information dissemination.
- Strategic planning is needed for airport sponsors to incorporate business and local concerns in airport planning.
- Increased funding is needed to improve the percent of airports meeting recommended facility targets.
- Recommended service targets should be met to provide services adequate to meet user needs.
- Air service changes should be monitored to identify potential impacts to communities in Iowa.
- Continued safety initiatives are needed, including wildlife mitigation, pilot safety programs, pavement marking, and maintenance.

4.2 Bicycle and pedestrian

Bicycling and walking are two of the oldest, simplest, and most efficient forms of transportation available, but are often overlooked elements in a balanced intermodal transportation system. Nearly all transportation trips involve walking at some point, and for many Iowans, bicycling and walking are the only means of transportation to work, school, shopping, and medical appointments. Thousands of Iowans use bicycling and walking as forms of exercise and recreation. However, real or perceived safety concerns can present impediments for bicycling and walking to many Iowans. Lack of adequate infrastructure, distracted drivers, and fear of crime or unsafe neighborhoods are some of those potential barriers.

The amount of attention focused on pedestrian and bicycle facilities has steadily increased since the 1990s due to federal requirements to give consideration to accommodating bicyclists and pedestrians on roadway rights of way. Federal, state, and local funds have been directed toward improving these two means of transportation, enhancing the ability of communities to improve the safety and practicality of bicycling and walking for everyday travel. Bicycle and pedestrian facilities range from urban sidewalks and street crosswalks to multiuse trails and paved shoulders.

Highlights

Iowa has more than 3,000 miles of trails, paved shoulders, and other bicycle and pedestrian facilities.

It is estimated that 4 percent of Iowans walk or bike to work.

Integration of pedestrian, bicycle, and transit needs with vehicular movements is improving.

Trail use is increasing.

Bicycle helmet use is rising.

Businesses have identified local trails as an aid in recruitment.

Demand for urban sidewalks has increased.

Rising public attention for healthy lifestyles has caused an increase in bicycling and walking, including children traveling to and from schools.

Impact of bicycle and pedestrian transportation on Iowa's economy

The importance of bicycling and walking to Iowa's economy is significant, as both provide many benefits in the areas of health and fitness, tourism, and the environment.

Health and fitness

According to the Centers for Disease Control and Prevention's 2014 Iowa Behavioral Risk Factor Surveillance System, 36 percent of Iowans are overweight while 30.9 percent are obese. Although obesity has many factors (e.g., genetics, behavior, and community environment), increased physical activity levels will significantly reduce the risk of obesity-related chronic diseases, such as coronary heart disease, stroke, and diabetes; help lower health care costs; and improve quality of life, positive mental health, and healthy aging.

Tourism

A study was completed in fall 2011 by the University of Northern Iowa to look at the economic and health impacts of bicycling in Iowa. The report, Economic and Health Benefits of Bicycling in Iowa[4], estimated that commuter-cyclist spending generates nearly $52 million annually in direct and indirect impacts to the state of Iowa, assuming that each commuter spends on average $1,160 per year on bicycle-related activities. Recreational riders, assumed to spend approximately $1,200 per travel party on bicycle-related activities in Iowa, were estimated to generate close to $365 million annually in direct and indirect benefits.

Another significant contribution to the state's economy through bicycling is the Register's Annual Great Bicycle Ride Across Iowa (RAGBRAI). This weeklong bicycle ride across the state garners international attention every summer, and more than 275,000 riders from all over the world have participated in RAGBRAI since the ride began in 1973. According to the UNI study, total direct spending in Iowa for RAGBRAI is estimated at over $16.9 million annually.

In addition to attracting tourists, bicycle and pedestrian facilities are increasingly important to the recruitment and retention of Iowa businesses and their employees. Additionally, many communities have found that properties located adjacent to trails often increase in value, generating greater overall revenue for the community. Overall, walking and biking trails improve the quality of life for Iowa's citizens, providing an essential option for Iowans to get to work, school, and other destinations.

Environment

Bicycling and walking contribute to reduced air pollution and help Iowa maintain its air quality attainment status. Traffic congestion is also reduced when more people choose to bicycle and walk rather than drive a motor vehicle. Increased usage of these modes of transportation can also help lower oil imports and roadway maintenance costs.

Bicycle and pedestrian planning efforts

An update to the state's last bicycle and pedestrian plan, Iowa Trails 2000[5], is currently underway. The updated bicycle and pedestrian plan will serve as the primary guide for Iowa DOT decision-making regarding bicycle and pedestrian programs and facilities. The planning process has involved stakeholder input through policy and technical steering committees; public meetings and input opportunities; an existing conditions assessment; bicycle and pedestrian facility recommendations; funding and implementation strategies; and draft plan development. It is anticipated that the plan will be finalized after the adoption of Iowa in Motion 2045.

4 http://iowabicyclecoalition.org/wp-content/uploads/2012/04/2012-Economic-Impact-Study.pdf

5 http://www.iowadot.gov/iowabikes/trails/iowatrails2000.html

Statewide trails vision

During the early 2000s, the Iowa DOT determined that in order to most effectively invest its limited resources in a multiuse trail system, a smaller, more focused network needed to be established. Between the adoption of Iowa Trails 2000 and Iowa in Motion 2040, the Iowa DOT identified five trails of statewide significance from the statewide trails vision. These trails provide high-level connectivity with other major trails in Iowa and, in some cases, trails in other states. Development of some of these corridors was envisioned to involve improving primary highways and county roads with paved shoulders; constructing multi-use trails; and, in some cases, simply signing bicycle routes along low-traffic primary highways and county roads without making infrastructure improvements. This determination signified a shift away from a focus on a statewide network of multiuse trails to a network of mixed-facility "trail" routes.

Iowa's previous state transportation plan, adopted in 2012, projected the demand for transportation services out to 2040. Building on the prior work of Iowa Trails 2000, Iowa in Motion 2040 separated multiuse trails into three functional classifications.

Level 1 – trails of statewide significance
These trails, which are a subset of the larger statewide trails vision network, are part of Iowa's primary trail corridor network and have been a priority of the Iowa DOT. Completing these trail corridors will result in the expansion and improvement of a statewide network of safe and convenient routes for bicycle transportation and tourism, including access to and through many of the state's urban areas.

- American Discovery Trail – envisioned as a continuous multiuse trail but currently predominately utilizes on-road routes
- Mississippi River Trail – envisioned as a mixed-facility route, mostly on paved shoulders
- Lewis and Clark Trail – envisioned as a mixed-facility route, mostly on shared roadways
- Iowa Great Lakes Connection – envisioned as a multiuse trail, with potential for interim use of shared roadways and paved shoulders
- Central Iowa Trail Loop – envisioned as a multiuse trail

Level 2 – trails of regional significance
Level 2 trails are identified as trails that either connect to a Level 1 trail and are at least 10 miles in length or are part of an existing or programmed trail network of at least 25 miles in length. These trails result in significant economic impacts to the state by providing for longer rides and attracting more out-of-state visitors.

Level 3 – trails of local significance
These trails are shorter in length, and are located in communities and counties across Iowa. Level 3 trails typically do not draw visitors from afar, but are very important in providing a better quality of life and improved mobility for many Iowa communities.

Future implementation of statewide trails vision

The emphasis on the five Level 1 trails introduced over the last decade was intended to focus the Iowa DOT's resources and funding mechanisms to create a backbone system for the statewide trail network. However, in some cases this focus may have prioritized trail corridors that are not yet in high demand by Iowans. Trails in Iowa are typically built by expanding existing networks and seizing opportunities as they arise. In most cases, the successful development of a trail requires organized determination and commitment of local and regional governments, interest groups, and individual citizens to create the necessary momentum. While this sometimes includes segments of Level 1 trails, more often than not the trails prioritized by communities, planning organizations, and the public are not part of one of these five corridors.

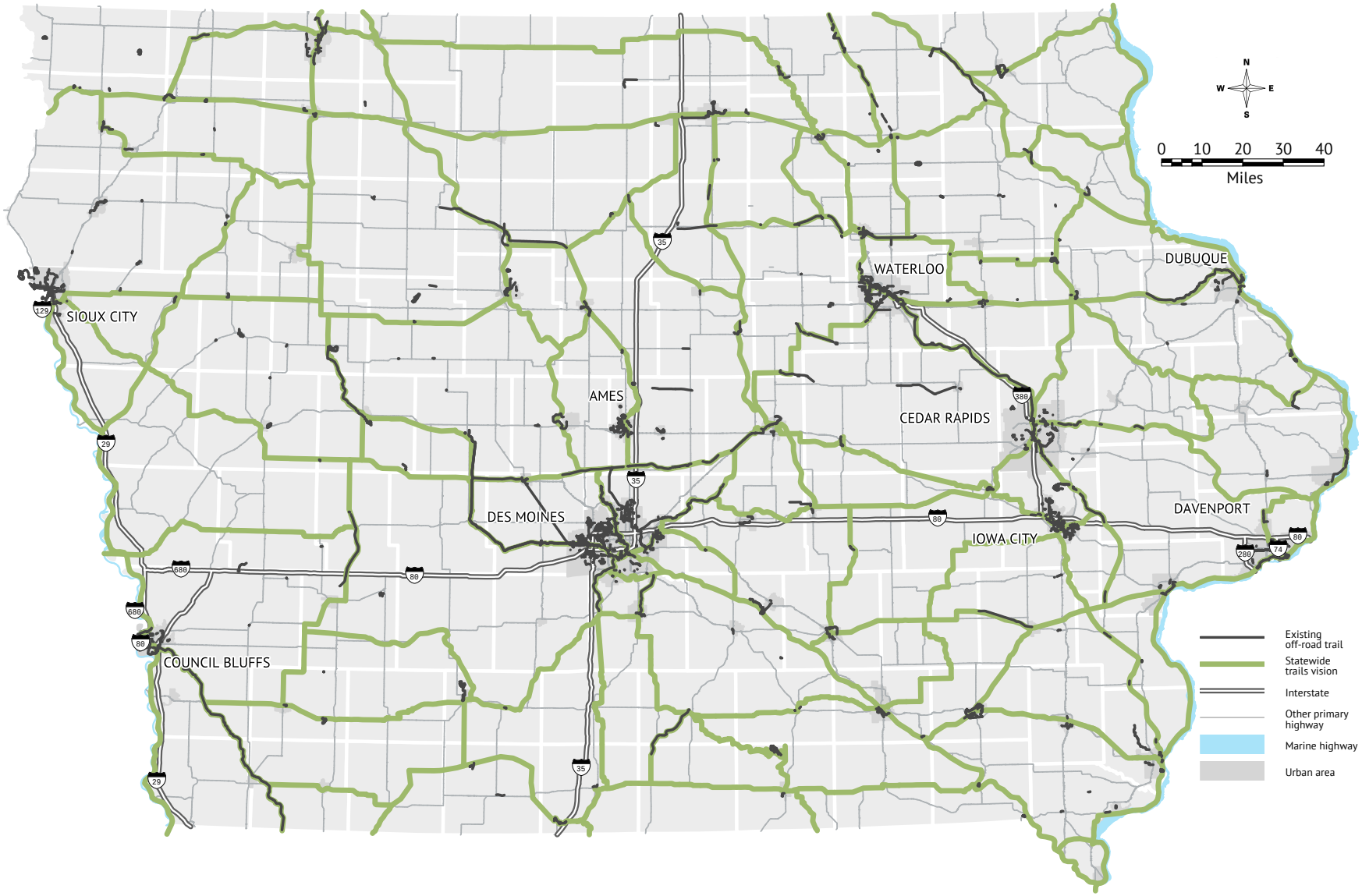
Furthermore, there is an expectation that a "trail" is a paved bicycle and pedestrian path separated from motor vehicle traffic. While the continued development of national "trail" routes (e.g., the Mississippi River Trail that is primarily composed of on-road routes) remains important, the consensus among local and regional governments, interest groups, and citizen stakeholders is to primarily use "trail" funding to develop true multipurpose trails, and only occasionally to fund on-road bicycle accommodations when significant opportunities arise.

Therefore, with this Plan, the vision for Iowa's statewide trail system is a renewed emphasis on a statewide network of separated multiuse trails connecting rural communities, metropolitan areas, state and county parks, and natural amenities (see Figure 4.3). The prioritization of projects will be based on the trail's ability to improve access and connectivity rather than on its functional classification. The Level 1-3 classification scheme will no longer be emphasized. Rather, trails in Iowa will be classified as part of the statewide trails vision or as a secondary connecting trail of local importance. This new classification will have an effect on prioritization for funding, but will not be an overriding determinant. This vision for the statewide trail system will compliment an overall approach to bicycle and pedestrian facilities that includes on-road accommodations, such as those described in the next section.

The statewide trails vision is a compilation of trail planning efforts completed over the last few decades. The network of completed trails has been updated to accurately depict the routes that have been constructed to date. The vision map is not intended to be a full build-out of all trail segments across Iowa. Rather, it should be utilized as a planning tool so development opportunities can be pursued as they arise. As local public agencies and planning organizations continue their trail planning efforts, the vision map will continue to evolve. The goal of the statewide map is to encourage consistent and continuous planning across jurisdictional and planning boundaries.

Included on the map is a depiction of the level of completeness of the system based on existing off-road trails. This was determined based upon past studies; known construction completion; a comparative analysis with trail planning efforts; and interviews with communities, planning organizations, and the Iowa Natural Heritage Foundation. Various planning organizations and local governments have ongoing trail planning efforts that could alter the network as proposed.

Figure 4.3: Statewide trails vision



Source: Iowa DOT

Inventory

Types of facilities

There are currently more than 3,000 miles of bicycle and pedestrian facilities in Iowa, excluding standard sidewalks. Of this, approximately 1,866 miles are off-road, multiuse trails (see Figure 4.4). The remaining mileage consists of several different types of on-road facilities (e.g., bicycle lanes, paved shoulders, widened sidewalks). Existing bicycle and pedestrian facilities in Iowa include the following types of accommodations.

Bicycle lane
A portion of the roadway designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists. Bicycle lanes should always be one-way facilities carrying bicycle traffic in the same direction as adjacent motor vehicle traffic, and they should not be placed between parking spaces and the curb. Bicycle lanes offer a channelizing effect on motor vehicles and bicycles.

Path
A bikeway and/or walkway physically separated from motorized vehicular traffic by an open space or barrier, and either within the highway right of way or within an independent right of way.

Protected bike lane
Provide a dedicated lane for bicyclists separated from traffic by a physical barrier (e.g., curbs, posts, planters).

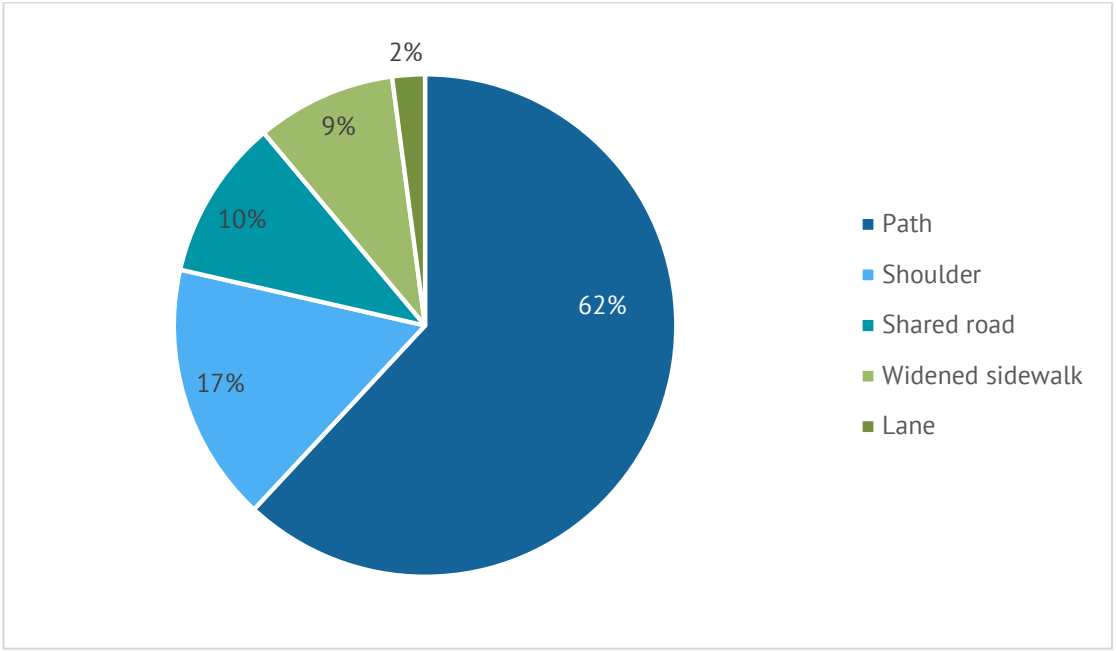
Sharrow
Pavement markings placed in the roadway lane, indicating that motorists should expect to see and share the road with bicyclists.

Shoulder
A paved portion of the roadway to the right of the white pavement marking at the edge of the roadway. Paved shoulders are especially practical for bicycle accommodations in rural areas. Bicycle traffic on a paved shoulder will typically be one-directional with the flow of traffic; therefore both shoulders should be paved when providing accommodation for bicyclists.

Side path
Accommodates more pedestrian traffic than a traditional sidewalk, and is typically at least 6 feet wide.

Sidewalk
Usually 4 to 5 feet wide and accommodates pedestrian travel.

Figure 4.4: Iowa bicycle and pedestrian facilities by type



Source: Iowa DOT

Current trends

As trail usage increases, many of Iowa's communities are seeing increasing economic and social benefits of bicycle and pedestrian facilities. For example, a 1998 survey of users of the Raccoon River Valley Trail in Dallas County identified five positive impacts of the trail: availability of recreational opportunities, a positive image for Dallas County, increased visitation, community pride, and improvements to the local economy.

However, despite rising demand for new bicycle and pedestrian facilities in Iowa, there is limited funding for expansion. Ongoing maintenance needs on the existing system often go unfunded as well. Taking these constraints into consideration, there has been a growing effort to stretch available funds by coordinating trail projects and creating well-connected trail networks.

In some cities and regions in Iowa, there has been a push to better accommodate more modes of transportation on the existing and future roadway system. These "complete streets," as defined by the National Complete Streets Coalition, are "designed and operated to enable safe access for all users." Pedestrians, bicyclists, motorists, and transit riders of all ages and abilities should be able to safely move along and across a complete street. Elements of a complete street may include items such as bicycle lanes, widened sidewalks, special bus lanes, median islands, roundabouts, and/or other components to facilitate safe movements.

In Iowa, complete streets policies or resolutions have been adopted by many cities, counties, and planning agencies. For bicyclists and pedestrians, these policies help ensure that all road users are considered in the development and redevelopment of Iowa's roadways. The development of the Iowa DOT's updated bicycle and pedestrian plan has included the drafting of a complete streets policy for consideration. A strategy related to adoption of a complete streets policy is included in the action plan in Chapter 5, along with several other bicycle and pedestrian-related strategies.

Key issues

- Additional funding is needed for system expansion and maintenance.
- Many communities are not bicycle- and pedestrian-friendly, which could be partially addressed through the expansion of complete streets policies at the local and state level.
- Infrastructure improvements are needed to address deficiencies and ongoing maintenance problems.
- Bicycle and pedestrian fatalities and injuries are too prevalent.
- Improved coordination and cooperation is needed to better connect Iowa's trail systems.
- Additional education is needed, including safety programs for bicyclists and pedestrians and training on the health benefits of bicycling and walking.
- Legislative issues continue to be debated, such as safe passing laws.

4.3 Highway

Highways are the backbone of Iowa's transportation system, providing service to all areas of the state. Iowa's roadways range from six-lane interstates, four-lane divided facilities, and multi-lane urban streets to paved secondary roads, gravel roads, and municipal streets. Iowa's bridges provide crossings of thousands of streams, rivers, railroads, and trails. These bridges range from 10-foot structures to multi-span major river crossings. This combination of roadways and bridge structures has created an extremely accessible network that provides a high level of mobility.

Impact of highway transportation on Iowa's economy

While it is difficult to assign a dollar figure to the far-reaching economic impacts of Iowa's highways, the system is clearly the key link in connecting all modes of transportation and is the fuel for the state's economic engine. Construction projects lead to immediate job opportunities for workers representing a wide variety of professions. Businesses and industries locate near the highway network due to the ease of travel for both people and goods, bringing with them new jobs and increased tax revenues. On a regional level, highways can help reduce economic disadvantages by increasing connectivity and transportation efficiency. The highway system also supports the state's growing biofuels and wind energy industries, which are critical to Iowa's economic competitiveness.

Highlights

Iowa has 114,880 miles of roadways.

There are 9,403 miles in Iowa's Primary Highway System.

There are 2,521 miles in Iowa's Commercial & Industrial Network (CIN).

Two transcontinental interstate highways cross Iowa.

Iowa has more than 24,000 bridge structures.

Nearly 20,000 trucking companies operate in Iowa.

Motor vehicles travel more than 30 billion miles on Iowa's public roads each year.

Iowa's road system facilitates the movement of over 1.1 billion tons of freight annually.

The weighted average daily traffic on the Interstate Highway System in municipal areas is more than double that in rural areas.

Approximately 216,300 acres of roadside right of way is maintained by the state.

Iowa DOT maintenance crews plow approximately 24,500 lane-miles with each winter storm event, nearly equivalent to one trip around the earth.

Highway planning efforts

There are a number of planning efforts related to highways. Two of these, transportation systems management and operations (TSMO) and transportation asset management (TAM) were discussed in Chapter 3. Additional highway-related planning efforts include the Infrastructure Condition Evaluation (ICE) tool, the State Freight Plan, and the planning effort for this document, Iowa in Motion 2045.

ICE tool

The ICE tool was developed by the Iowa DOT to aid in the evaluation of the state's Primary Highway System by using a single composite rating calculated from the following seven traffic and condition criteria.

- Annual average daily traffic (AADT), combination truck count
- AADT, passenger count
- AADT, single-unit truck count
- Congestion Index value
- International Roughness Index (IRI) value
- Pavement Condition Index (PCI) rating
- Structure Inventory and Appraisal (SIA) sufficiency rating

While each of these individual elements indicates a different component of the system's composition, the collective offers the ability to evaluate the structural and service condition of roadway segments with a single composite rating. This composite rating was created for each road segment by applying normalization and weighting processes. The tool was initially developed for the interstate system, and expanded to the entire primary system in 2014. The ICE composite ratings are recalculated each year, enabling the tracking of roadway conditions at segment, corridor, and system levels. The core goal of ICE is to serve as an initial screening and prioritization tool to assist the Iowa DOT in identifying areas that should be considered for further study, though it does not identify specific projects or alternatives that could be directly considered as part of the programming process.

State Freight Plan

The Iowa DOT's first freight plan[6] was completed in 2016, with the aim of further incorporating freight considerations into the statewide transportation planning and programming process. The multimodal freight plan addresses each of the five modes of the freight transportation system: air, truck, pipeline, rail, and water.

The freight plan includes a robust overview of the highway network from a freight transportation standpoint. The plan also includes an analysis of highway bottlenecks. In order to identify and prioritize these candidate locations for highway freight improvements, the Iowa DOT utilized the value, condition, and performance (VCAP) matrix. This approach takes advantage of multiple tools available at the Iowa DOT, and includes the following steps.

- A Freight Mobility Issues Survey, which populated the initial list of locations based on INRIX traffic data and input from the Freight Advisory Council, Iowa DOT districts, and planning agencies.
- The Iowa Travel Analysis Model (iTRAM), which was used to provide a measure of value for each location based on how much it improves the efficiency of the statewide network.
- The ICE tool, which provided the condition measurement for each location.

6 http://www.iowadot.gov/iowainmotion/freight.html

- The INRIX bottleneck ranking tool, which provided the performance component of each location based on how often bottlenecks occur.
- Annual average daily truck traffic (AADTT), which was used as a tiebreaker if locations had the same ranking after the value, condition, and performance evaluation.

In addition to the specific locations identified and prioritized through the VCAP method, a number of strategies were developed to outline how the Iowa DOT is addressing or will address freight mobility issues. All strategies relate to the areas of capital investments, operational improvements, policy changes, and/or the expanded use of innovative technologies.

Iowa in Motion 2045

The planning effort for this long-range plan, Iowa in Motion 2045, is a significant step forward for highway planning at the Iowa DOT. The most recent state transportation plan, adopted in 2012, was a policy-level document; the last long-range plan to include highway corridor-level strategies was the 1997 Iowa in Motion plan. The current planning effort and document involve a detailed analysis of the highway system, identification of corridor-level improvement needs, and a number of specific strategies to help fulfill the vision for the highway component of the state's multimodal transportation network (see Chapter 5).

Inventory

Iowa's highway system

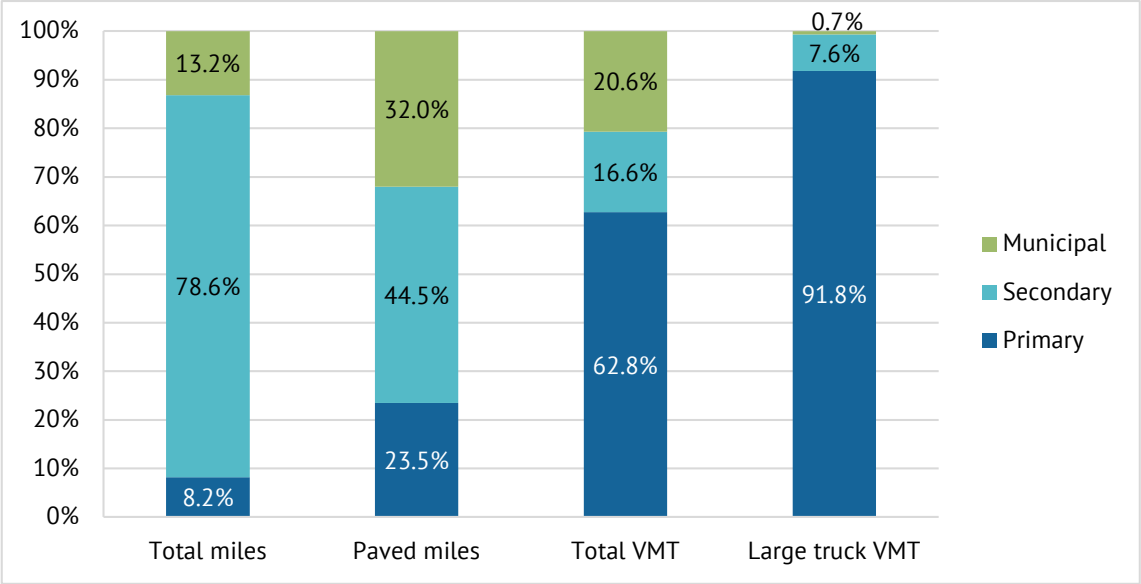
Iowa is uniquely positioned at the crossroads of two major interstate highways: I-35 and I-80. As shown in Table 4.1 and Figure 4.5, the state's public roadway system is comprised of over 114,000 miles and includes more than 24,000 bridge structures. While the size of the state's roadway system has not increased considerably in recent years, the infrastructure burden remains significant. Iowa ranks fifth nationally in number of bridges and 13th in miles of roadway, yet the state ranked just 36th in population density in 2015.

Table 4.1: Summary of Iowa's public roadway system*, 2015

	Mileage	Percent of total mileage	Total VMT (millions)	Percent of total VMT	Large truck VMT (millions)	Percent of total large truck VMT	Number of bridges
Primary (Iowa DOT)	9,402.85	8.23%	20,293	62.76%	2,656	91.78%	4,101
Secondary (county)	89,817.79	78.61%	5,365	16.59%	219	7.57%	18,927
Municipal (city)	15,036.76	13.16%	6,674	20.64%	19	0.66%	1,151
Total	114,257.39		32,332		2,894		24,197

**The table does not include roadways or bridges in the state that are owned by other entities, such as other state agencies or the federal government.*
VMT = vehicle miles traveled
Source: Iowa DOT

Figure 4.5: Mileage and VMT by highway jurisdiction* (Jan. 1, 2015)



**Mileage does not include park and institutional roads. Mileage does include ramps.*
Source: Iowa DOT

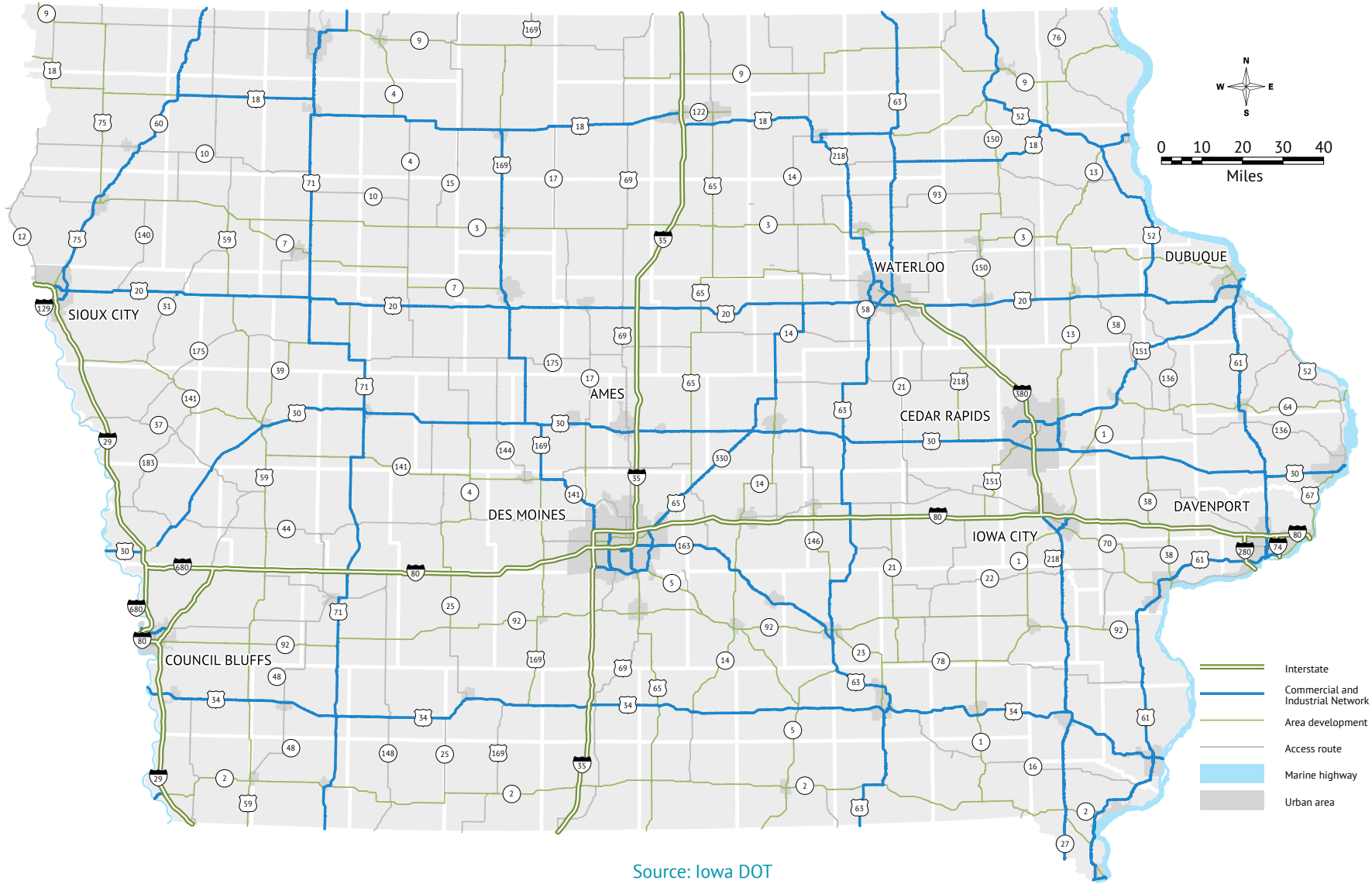
According to Iowa Code, Iowa's primary system (see Figure 4.6) is defined as "those roads and streets both inside and outside the boundaries of municipalities which are under Iowa DOT jurisdiction." This system, which totals just over 9,400 miles of the public system's over 114,000 miles, is divided into five classifications according to priority.

- ***Interstate***: Comprised of 1,059 center line miles, the Interstate Highway System provides connections to the national transportation network and major metropolitan areas.
- ***CIN***: Comprised of 2,521 center line miles, the CIN provides connections for Iowa cities with a population greater than 20,000 to major metropolitan areas, and was identified by the state legislature to enhance opportunities for the development and diversification of the state's economy.

Other primary highways comprise the remaining 5,829 miles, and include the following routes.

- ***Area development***: Provide connections for cities with populations greater than 5,000 to the CIN and major commercial and industrial centers.
- ***Access route***: Provide connections for cities with populations greater than 1,000 to employment, shopping, health care, and education facilities.
- ***Local service***: Provide connections for cities with populations less than 1,000 to local commercial and public service.

Figure 4.6: Iowa's primary highways by classification, 2015



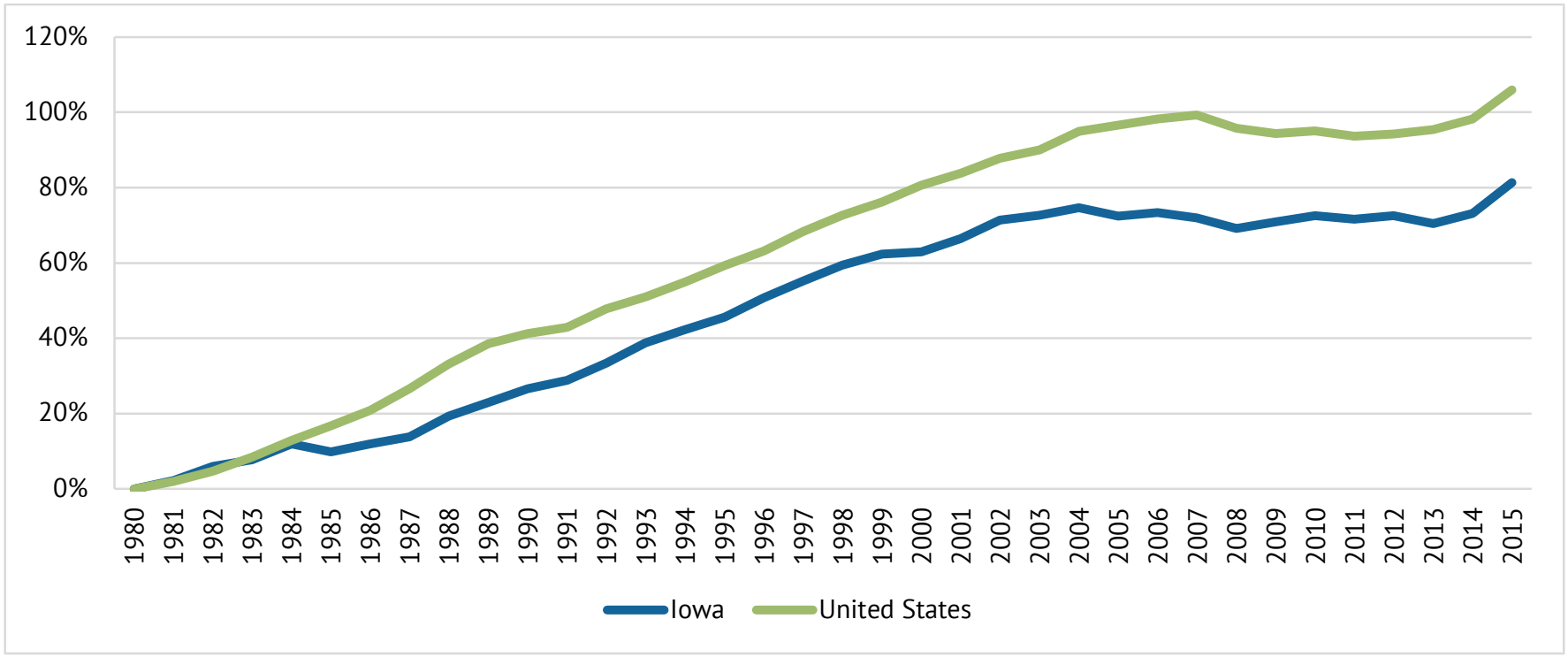
Source: Iowa DOT

Current trends

Travel

Following some recent declines due to a variety of economic factors, statewide travel is again trending upward (see Figure 4.7). Iowans are commuting longer distances and more goods are moving through the state by truck. The estimated statewide VMT in 2015 was more than 33 billion miles, with more than 63 percent of that travel occurring on the state's Primary Highway System.

Figure 4.7: Percent change in traffic, base year 1980

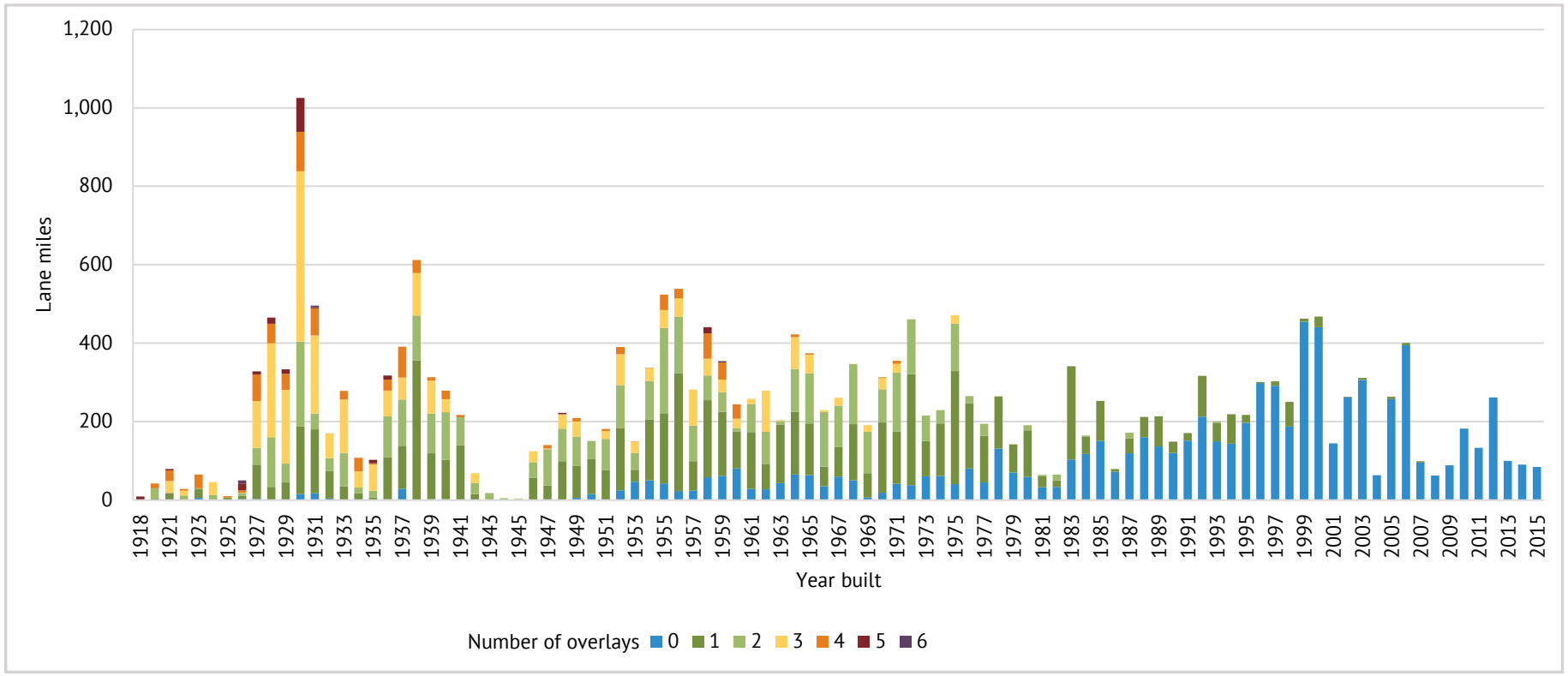


Source: Iowa DOT

Roadway condition

Iowa's roadways have been built over the past century, and thousands of miles of the primary system have had significant resurfacing or overlay work to keep them in serviceable condition. Figure 4.8 shows the age of the primary system's pavements along with the number of overlays pavements have received.

Figure 4.8: Year built and number of overlays for primary system pavements



Source: Iowa DOT

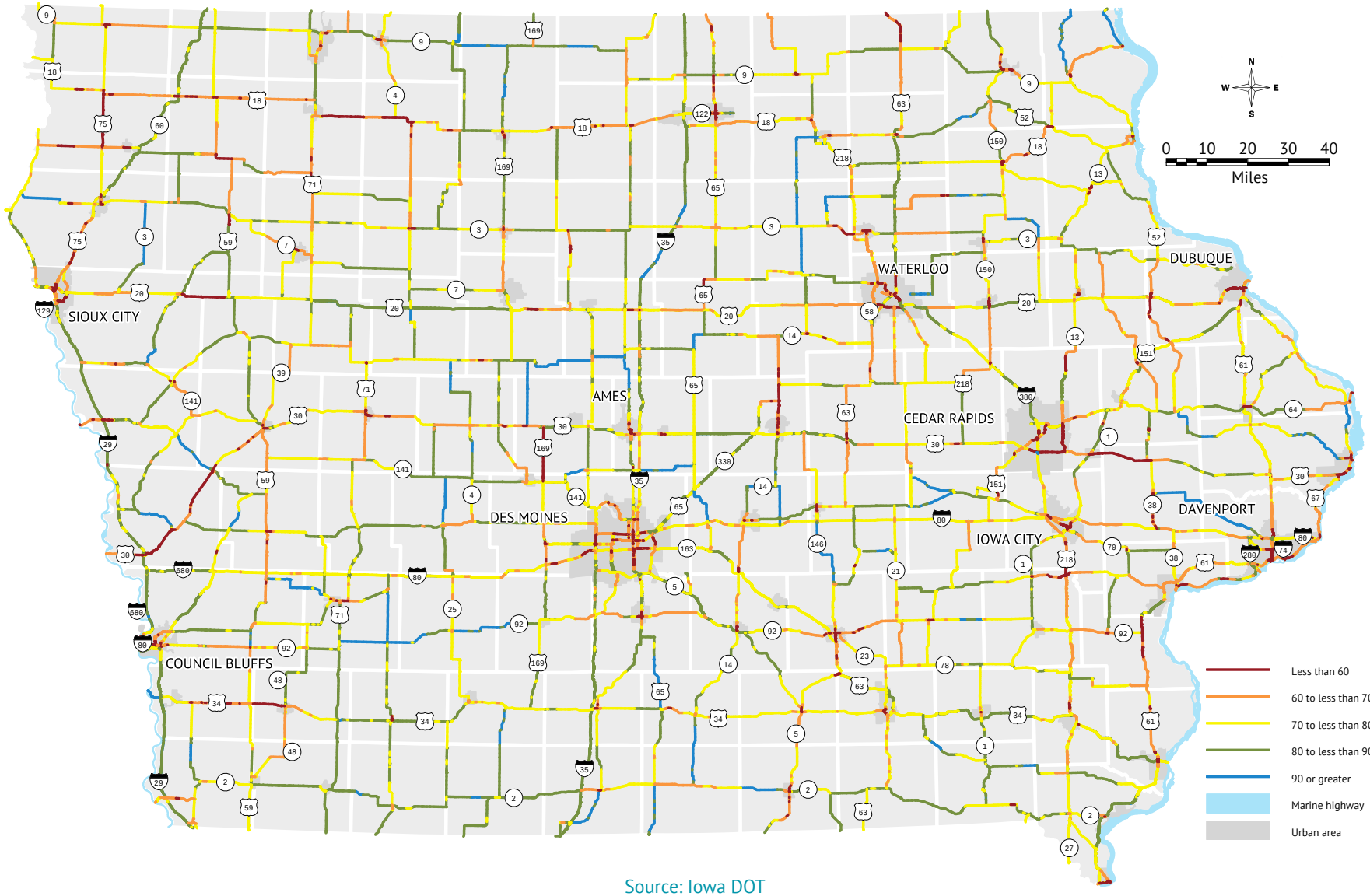
As discussed previously, the ICE tool can be used to evaluate the condition of the Primary Highway System in the state by providing a composite score of roadway and traffic conditions, and help identify corridors that should be considered for further study. Table 4.2 shows the percentage of Iowa roadways that make up the different highway systems based on the ICE rating categories. This includes the National Highway System, Interstate Highway System, CIN, and the overall Primary Highway System. ICE ratings across the primary system range from a low of 45 to a high of 100, with the system average being 75. Figure 4.9 shows the 2015 composite ICE rating for primary roadways in the state.

Table 4.2: Highway condition by ICE rating and system designation, 2015

		Percent of network by ICE rating				
	Percent of system	< 60	60-70	70-80	80-90	> 90
Interstates	14%	1%	9%	42%	43%	6%
Commercial and Industrial Network	35%	8%	20%	43%	29%	1%
Other primary highways	51%	5%	20%	37%	30%	8%
Overall Primary Highway System	100%	5%	16%	41%	34%	5%

Source: Iowa DOT

Figure 4.9: 2015 ICE composite rating

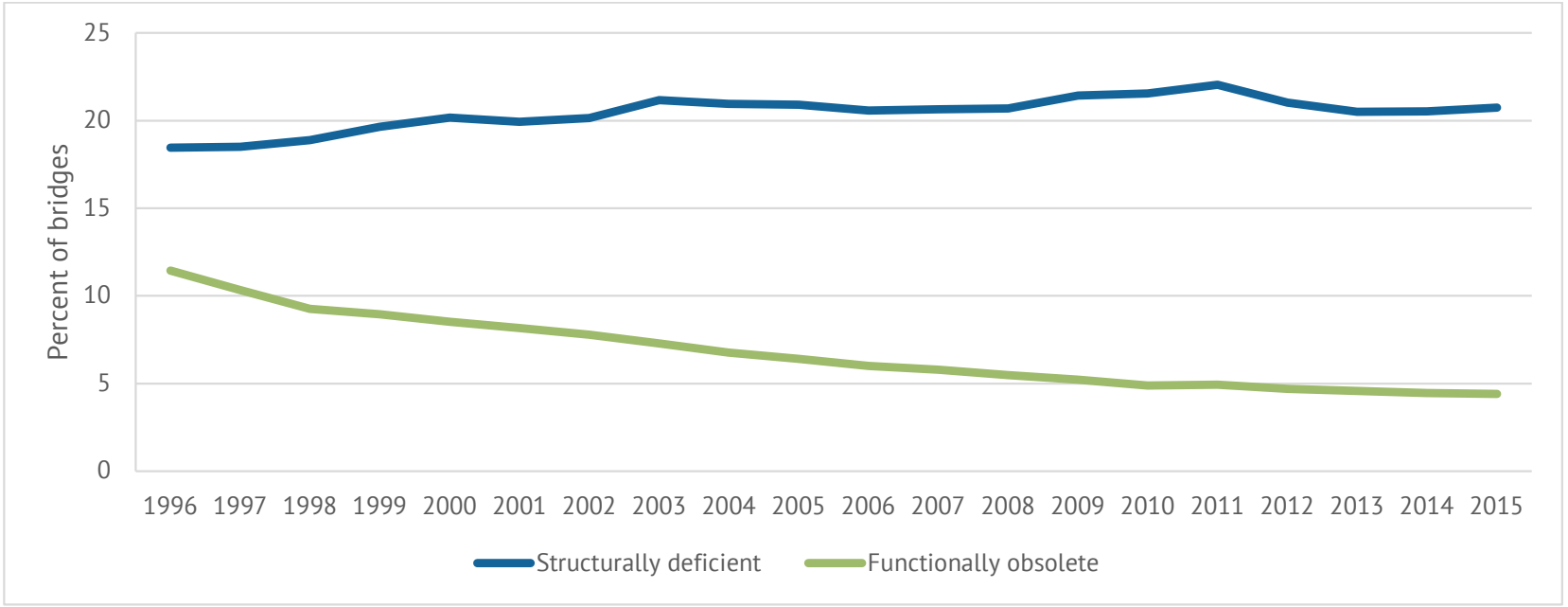


Source: Iowa DOT

Bridge condition

The percent of bridge structures considered structurally deficient has been increasing over time. A 2013 report by Transportation for America, The Fix We're In For: The State of Our Nation's Bridges[7], found that Iowa had the third-highest percentage of structurally deficient bridges in the nation at 21.2 percent. The Federal Highway Administration's National Bridge Inventory ranks bridges on a scale of zero (bridge closed) to nine (superior to present desirable criteria). Structurally deficient bridges are categorized as having a condition rating of four or less, with four being defined as "meeting minimum tolerable limits to be left in place as is." Functionally obsolete bridges have a condition rating of three or less, with three being defined as "basically intolerable requiring high priority of corrective action." Figure 4.10 shows the percentage of Iowa's structurally deficient and functionally obsolete bridges since 1996. Figure 4.11 breaks these numbers out by primary, secondary, and municipal systems for 2015. This shows the large portion of Iowa's bridge structures that are county-owned.

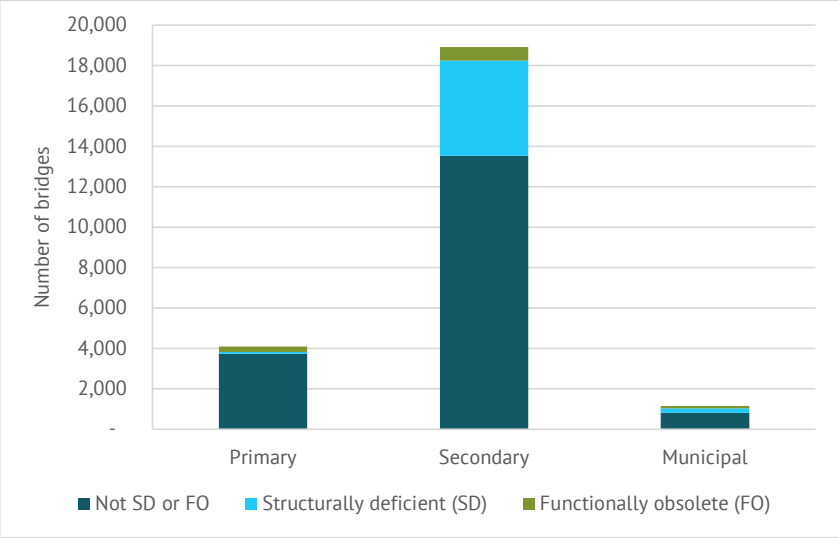
Figure 4.10: Percent of bridge structures in Iowa considered structurally deficient or functionally obsolete, 1996-2015



Source: Iowa DOT

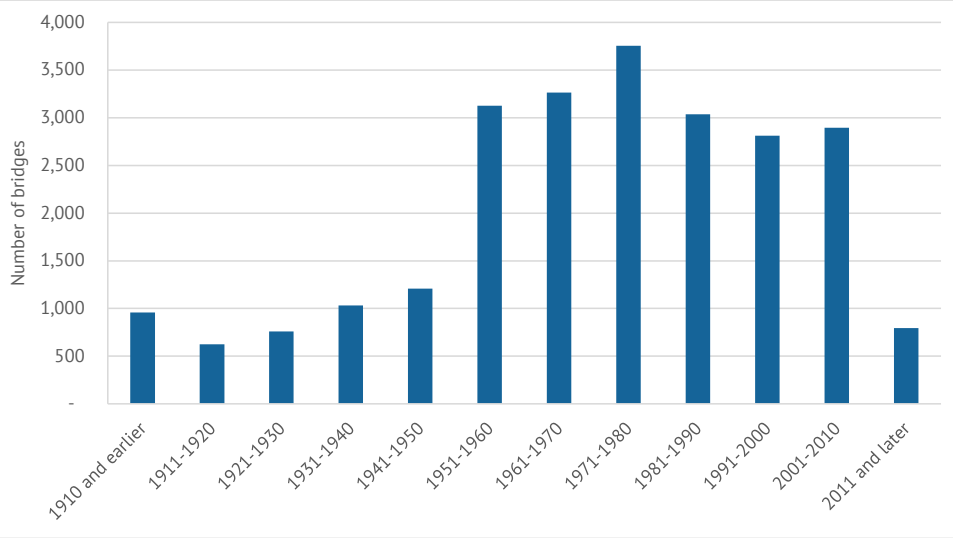
7 http://t4america.org/docs/bridgereport2013/2013BridgeReport.pdf

Figure 4.11: Structurally deficient and functionally obsolete bridges by system, 2015



Source: Iowa DOT

Figure 4.12: Iowa bridges by decade constructed



Source: Iowa DOT

Iowa bridges also continue to age, with the majority of existing bridge structures having been built in the 1970s. Figure 4.12 shows the age of Iowa bridges by decade. The implications of aging and deteriorating bridges, as well as roadways, can be detrimental to Iowa's transportation network. If travel and condition trends continue, travelers will experience additional congestion, delays, and safety-related hazards resulting from increasing traffic volumes on an obsolete system. Additionally, the coming "wave" of bridges and pavements reaching the end of their useful lives and requiring replacement will further strain resources.

Key issues

- Many high-cost bridge structures have major deficiencies.
- Urban and commuter route congestion is growing.
- Rural and urban interstate congestion is becoming more prevalent.
- Safety needs exist on the system.
- Additional on-road accommodations are needed for bicycle and pedestrian trips.
- Sustainable funding is needed to maintain acceptable condition ratings for roadways and bridge structures.

4.4 Public transit

Iowa's public transit system provides many benefits to its citizens, fulfilling a key alternative transportation role. In general, the transit market in Iowa includes commuters, elderly residents, low-income residents, college students, disabled residents, and youth. However, especially in metropolitan areas, people are increasingly making the choice to ride public transit for economic, practical, or environmental reasons.

Impact of public transit services on Iowa's economy

Public transit services positively impact Iowa's economy. Transit ridership reduces fuel consumption and demand, as well as costs for passenger, business, and commuter trips such as automobile insurance and vehicle upkeep. Additionally, public transit services provide transit-dependent workers with reliable and essential access to employment opportunities.

Availability of public transit services in all 99 Iowa counties also enables the elderly, who are no longer able to drive but in good health otherwise, to remain in their own homes longer. This increases their quality of life and reduces assisted living or nursing home costs.

Highlights

Serves all Iowa counties and cities.

Vital to the quality of life for all citizens by providing access to community services, as well as making communities stronger and more vibrant.

Provides more than 24.2 million rides annually from large urban systems, 3.2 million rides from regional systems, and 1.4 million rides from small urban systems.

Provides access to work, school, medical, retail, and community resources that utilize connections between modes.

Allows individuals to maintain independence.

Provides commuters and others with choice of transportation.

Public transit planning efforts

The Iowa Passenger Transportation Funding Study[8] was completed in 2009, and provides the most comprehensive overview of Iowa's public transit services and needs. The study had four main objectives:

- Quantify current revenue available to support public transit.
- Determine whether current revenues are sufficient to meet future needs.
- Assess how well the state's public transit network supports the current and expanding mobility needs of the state's senior population.
- Identify the transit improvements needed to meet the state's energy independence goals.

The study evaluated need from two perspectives. Baseline demand is the level of travel reflective of the needs of Iowans that are transit dependent. Choice demand is the level of ridership possible if passenger transportation system trip travel times were more competitive with auto travel times. The study identified where shortfalls exist in meeting baseline demand, and also the level of resources that would be required to fully meet baseline demand and choice demand.

Findings of the study include that there is public demand for additional transit services in Iowa. The service needs include additional off-peak hours, greater frequency between trips, weekend services, expanded service areas, more intercity connections, increased coordination between adjacent transit systems and human service agencies, consideration of new public transportation modes (rail), and increased marketing and education of passenger transportation services.

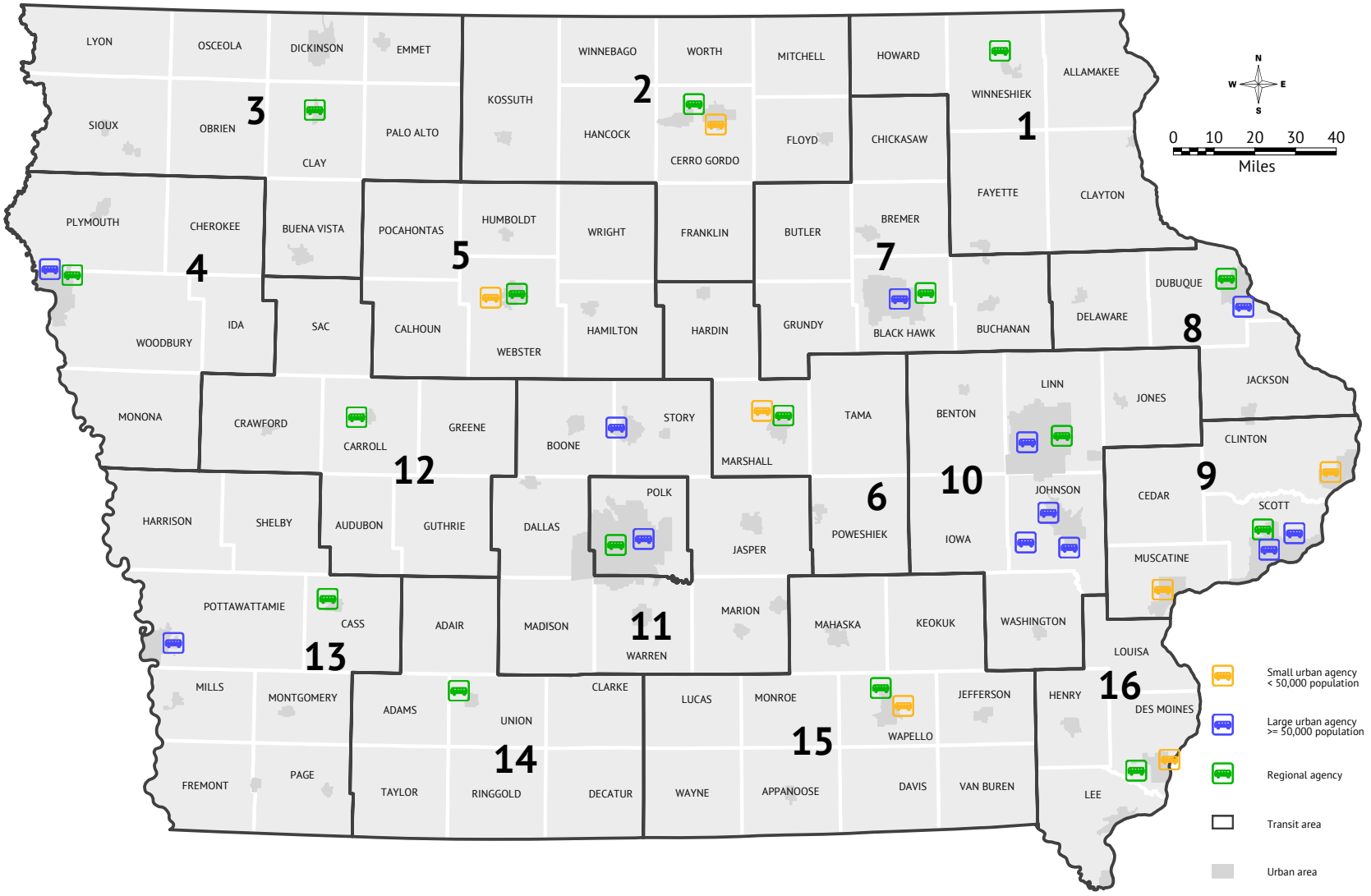
In addition to operations needs, maintenance and administrative facilities are essential to deliver reliable and safe public transit services. Regarding facilities, the 2008 Iowa Statewide Transit Facility Needs Analysis showed that Iowa's public transit systems were in need of 186,000 square feet of maintenance space, 14,000 square feet of operations area needs, and 660,000 square feet of indoor vehicle storage space. An updated survey of administrative, vehicle storage, and vehicle maintenance needs was conducted as part of this Plan effort, and results can be seen on Figure 5.6 in Chapter 5.

Inventory

Iowa is served by 12 large urban, seven small urban, 16 regional, and four intercity transportation bus services. Large urban systems provide service for metropolitan areas with a population of 50,000 or greater, and account for approximately 84 percent of total transit ridership in Iowa. Small urban systems are located in communities of 20,000 to 50,000 people. The 16 regional transit systems support all 99 counties in Iowa. The state's transit system also includes vanpools, carpools, bus charter companies, and taxis that allow travel within Iowa between urban areas or regions, as well as connections to destinations across the country. A map of Iowa's large urban, small urban, and regional transit systems is shown in Figure 4.13.

8 http://www.iowadot.gov/transit/publications.html

Figure 4.13: Large urban, small urban, and regional transit systems

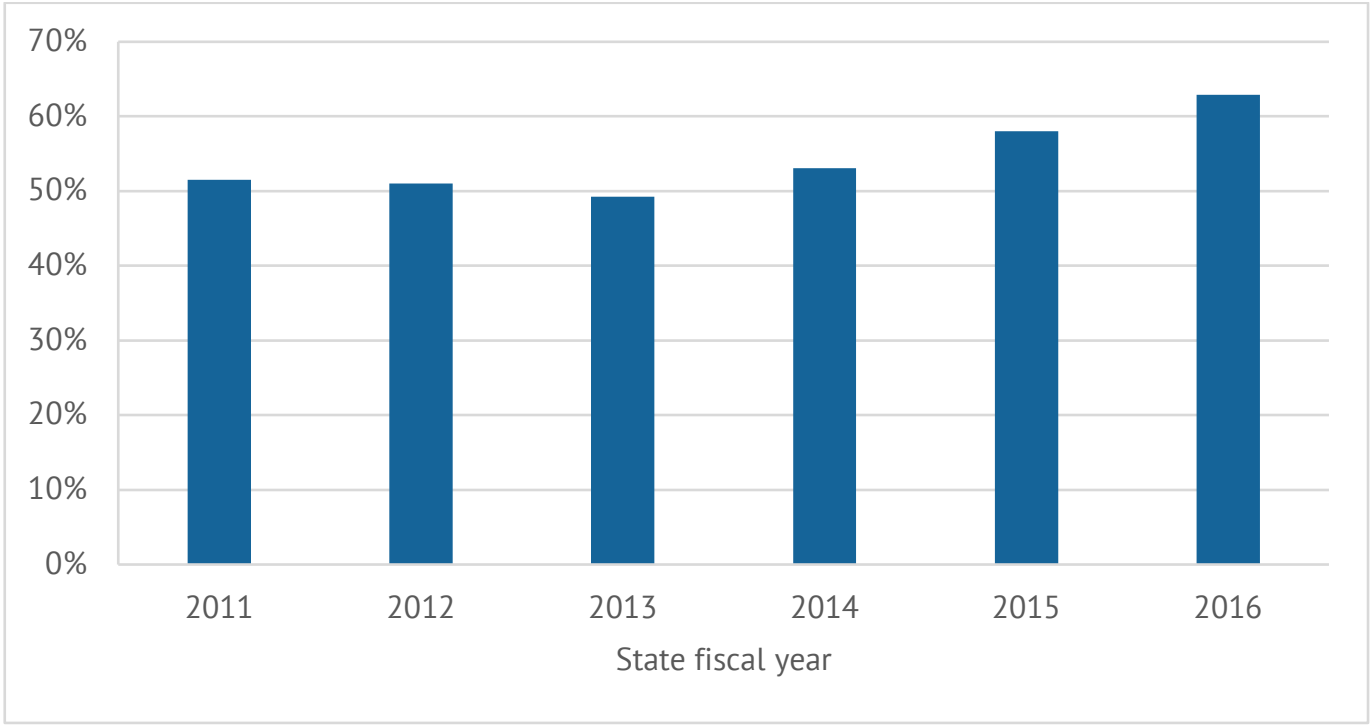


Source: Iowa DOT

Current trends

In recent years, operation and maintenance costs for transit services in Iowa have been increasing much faster than revenues. Consequently, it has been difficult to pay for necessary improvements (e.g., facility upgrades, bus replacements, fleet expansions). The percent of Iowa's public transit vehicles exceeding the age threshold for replacement has been steadily increasing over the past several years, as shown on Figure 4.14. This is primarily due to less federal funding for bus replacement in recent reauthorization bills, along with a large portion of the fleet replaced with stimulus funding in 2009 reaching the age threshold at the same time. While a 2016 federal grant from the Bus and Bus Facilities Program should temporarily help prevent that percentage from increasing further, the overall age of the fleet is still a serious issue for public transit service in Iowa. According to the Federal Transit Administration's National Transit Database, for the most recent available reporting year of 2014, Iowa as a state ranked second in the nation for oldest rural bus fleet with an average age of 9.97 years. Only South Dakota ranked higher with an average bus fleet age of 10.15 years. Iowa's urban systems ranked 15th oldest, with an average bus fleet age of 7.18 years. The oldest state for urban system fleet age is Pennsylvania at 12.03 years.

Figure 4.14: Percentage of Iowa's public transit vehicles over FTA's age threshold

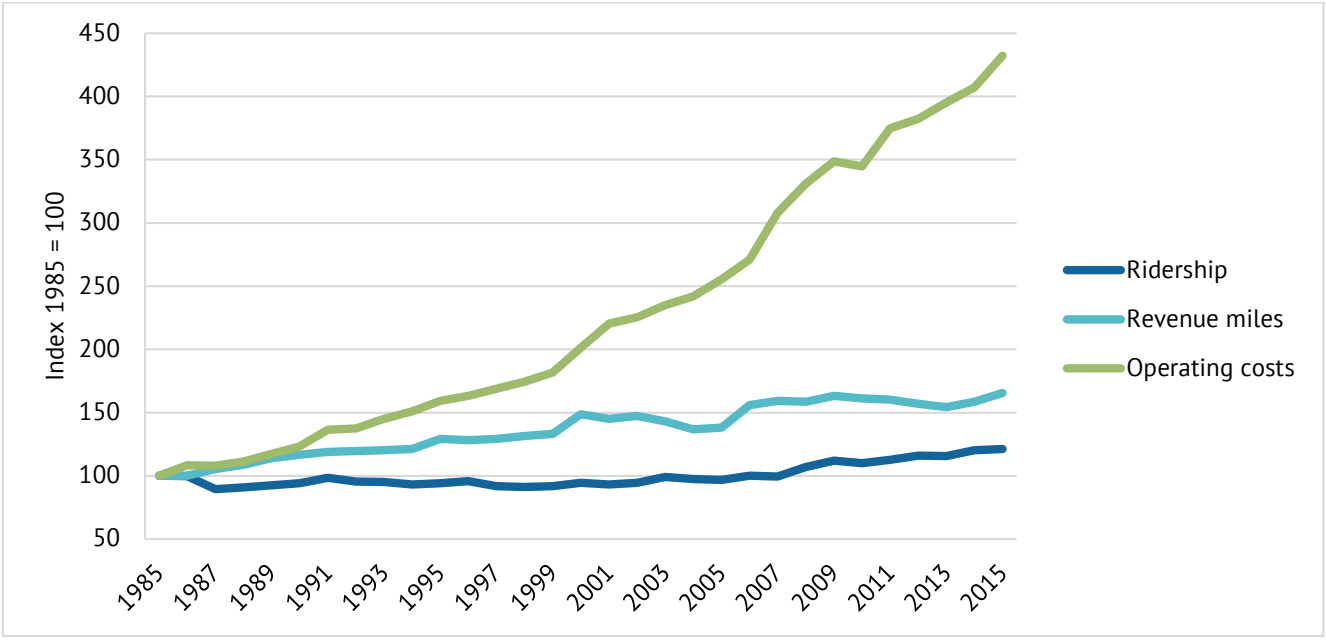


Source: Iowa DOT

From 1985 through 2015, transit ridership in Iowa has grown from 23.8 million annual rides to 28.8 million annual rides. Ridership is likely to continue increasing in the future as Iowa's population base ages and as more people embrace environmentally friendly transportation options. Trends in transit operations are illustrated in Figure 4.15. As is evident, ridership increases have been far outpaced by increases in operating costs.

One area of yet unknown influence on public transit ridership is the use of rideshare applications such as Uber and Lyft. These services involve people who may have otherwise taken public transit instead paying to ride in private passenger vehicles. Other technological transportation innovations that could affect public transit include transportation subscription services, where an individual pays for access to multiple modes of transportation to serve their needs at any time (e.g., rental cars, bike, vanpool, passenger rail pass), or paying a monthly fee for the access rather than owning a personal vehicle or waiting to ride the bus.

Figure 4.15: Trend in public transit operations index (1985 = 100)



Source: Iowa DOT

Other notable trends include increasing coordination between transit providers and health and human service agencies (especially through the Passenger Transportation Plan development process at metropolitan planning organizations and regional planning affiliations), more employment outside of core business hours, increasing awareness of the transportation needs of Iowa's working poor, and a heightened emphasis on security needs.

Key issues

- Additional operational and capital funding is needed.
- Older buses require more maintenance and repairs.
- Transit ridership cost per trip is increasing.
- Seamless transfers are needed between the 35 transit systems and intercity bus service.
- Expanded transit services, including additional hours and weekend service, are needed.
- More coordination is needed between transit systems, human service organizations, and school districts.
- Indoor bus parking facilities are needed.
- The public is generally reluctant to use transit services.

4.5 Rail

Railroads are a vital part of Iowa's overall transportation system, helping to move both freight and passengers safely and efficiently. Iowa has an extensive rail transportation system that transports goods throughout Iowa, the United States, and to foreign markets. The ability of rail transportation to haul large volumes of freight in a safe, energy-efficient, and environmentally sound manner is a major factor in Iowa's economy. While rail competes with other modes, it also cooperates with those modes to provide intermodal and transload services to Iowans, critical to moving bulk commodities produced and consumed in the state.

In addition to freight rail transportation, Iowa has two passenger rail routes through Amtrak that serve long-distance destinations between Chicago and two California destinations, the San Francisco Bay Area and Los Angeles, and stop at six various stations throughout the state. As metropolitan areas throughout Iowa continue to grow, the need to invest in a diverse network of passenger transportation options that will accommodate this growth will continue to be a factor.

Highlights

Iowa's railroads serve 90 of 99 counties and nearly half of Iowa's cities.

Railroads transported 56.1 million tons originating and 41.1 million tons terminating in Iowa in 2015.

Since 1985, the tons of rail originating, terminating, and traveling through Iowa has more than doubled.

Farm, food and kindred products, and chemicals accounted for 81 percent of the originated goods in 2015.

Coal continues to be the largest terminating commodity in Iowa at approximately 23 million tons in 2015.

Since 2008, crude petroleum by rail through Iowa has increased to more than 2 billion tons.

In 2015, 4 billion gallons of ethanol were produced in Iowa; 70 percent was shipped by rail.

Two 100-car trains can carry the load of approximately 870 trucks.

Each ton-mile of freight moved by rail rather than highway reduces greenhouse gas emissions by two-thirds or more.

Railroads move a ton of freight an average of 484 miles for each gallon of fuel consumed – close to four times as far as it could be moved by truck.

More than 57,000 Amtrak passenger rail riders used an Iowa station in 2015.

Impact of rail transportation on Iowa's economy

Iowa's rail industry employs more than 3,000 workers and accounts for $2.1 billion in gross operating revenue. In 2015, the value of freight exported by all railroads operating in Iowa was an estimated $24.4 billion, and this number is projected to increase by more than 100 percent by 2045. Without efficient railroad transportation, the state's economy would suffer greatly. Railroads are critical for many of Iowa's freight commodities, including corn, soybeans, chemicals, machinery, wood and paper products, minerals and ores, coal, and biofuels. The railroad's ability to haul large volumes over long distances at low costs will continue to be a major factor in moving freight and improving the economy of Iowa.

Rail has many cost advantages when shipping sizable quantities or commodities in bulk. Those shippers looking to move oversize/overweight truckloads may be able to use rail to avoid or reduce issues with highway clearances and permitting. In a competitive transportation market, service providers usually compete on a cost per mile basis. However, equally important is the ability of a carrier to make information available on the status and location of in-transit shipments to mitigate the impact of potentially longer transit times and travel time variability, which is one of rail's strengths. For long hauls, rail service remains the more cost-competitive transportation option.

In addition to being an integral component of the freight transportation network, rail usage provides a number of benefits important to the state of Iowa. Some of these benefits include cost and fuel savings, enhanced safety of movements, congestion mitigation, reduced oil dependency, and reduced pavement deterioration.

In addition to freight rail transportation, passenger rail provides a number of benefits to Iowa's economy. In an economy greatly impacted by rising oil prices, passenger rail offers an energy-efficient and cost-effective alternative to automobile and air travel, and can connect businesses and individuals in cities across the Midwest. Passenger rail contributes significantly to economic growth and can strengthen a state's manufacturing, service, and tourism industries. Along with economic benefits, passenger rail also provides environmental benefits, including reduced air pollutant emissions, fewer land use requirements, and fewer habitat and water resource disturbances.

Rail planning efforts

In 2008, the U.S. Congress passed the Passenger Rail Investment and Improvement Act (PRIIA) with the expressed intent of improving passenger rail service in the United States. One of the features of the legislation is the requirement that any state seeking federal assistance for either passenger or freight improvements have an updated state rail plan. The legislation further stipulated the minimum content of the rail plans, which was codified in Public Law 110-432.

Building from the last Iowa State Rail Plan in 2009, the Iowa DOT completed an update in 2017, which helps formulate a vision for railroad transportation in the future and strategies to achieve that vision. The overarching goals are to accomplish the following.

- Create a state rail vision and a supporting program of proposed public rail investments and improvements that will result in quantifiable economic benefits to Iowa.
- Enable Iowa to implement an efficient and effective approach for merging passenger and freight rail elements into the larger multimodal and intermodal transportation framework.
- Incorporate initiatives from the federal and state level, aligning the priorities of Iowa rail stakeholders.
- Provide a vision for integrated freight and passenger rail planning in the state, unifying the common interests of the various stakeholders within Iowa.
- Coordinate with the development of the Iowa Freight Plan and the Iowa State Transportation Plan.

- Ensure an open and inclusive process.
- Provide an outline to educate the public on Iowa's rail system.

As the rail industry in the state of Iowa continues to evolve, the strategies and recommendations set forth in the updated State Rail Plan[9] will help the Iowa DOT plan into the future.

Inventory

Iowa has a robust and thriving rail transportation system consisting of 3,825 miles of mainline track. The rail system is owned by 18 private, for-profit railroad companies with a mixture of regional and national coverage. Through connections with the national rail system, Iowa's railroads can send or receive shipments throughout the world.

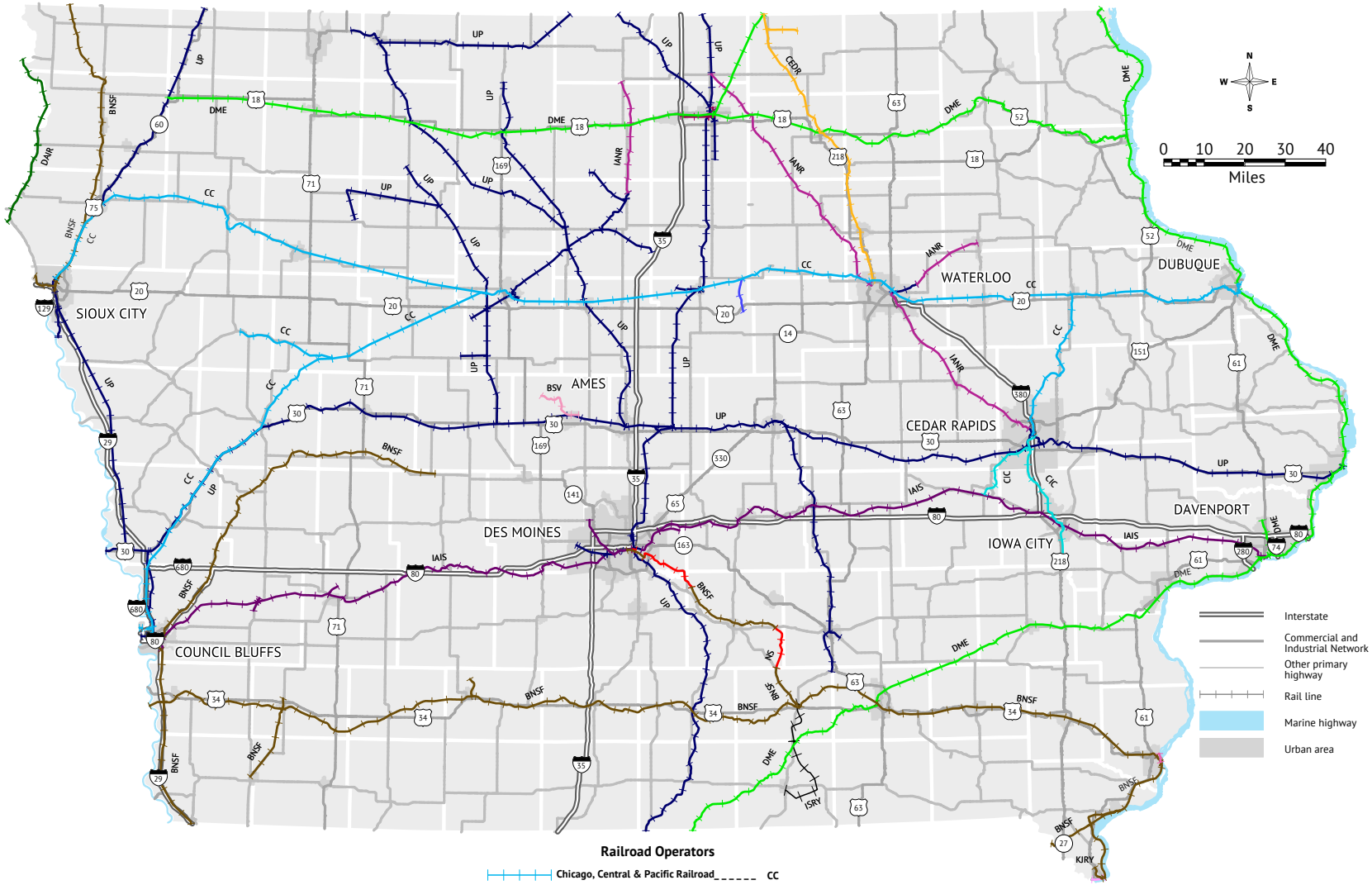
Freight rail

Freight rail service in Iowa is dominated by six Class I carriers. Union Pacific Railroad (UP) and BNSF Railway (BNSF) carry the largest volume of traffic in the state, operating over 1,900 miles of track combined, including double tracks running east- west across the state. The Class I carriers operate the vast majority of tracks and accrue most of the freight revenues in Iowa while financing the vast majority of rail infrastructure maintenance and improvement, which provides significant public benefit with limited public investment. Class II and III railroads often provide feeder service to the Class I carriers. Figure 4.16 shows Iowa's current railroad service map.

While rail accounts for only 3 percent of Iowa's 130,000-mile freight system, it carries nearly 14 percent of the state's freight tonnage, consisting mostly of bulk commodities, such as grain, grain products, coal, biofuels, and fertilizers. These goods are typically moved in 100 to 110-ton cars and in trains that are often 100-plus cars long.

9 www.iowadot.gov/iowainmotion/rail.html

Figure 4.16: Iowa railroad service map



Source: Iowa DOT

Passenger rail

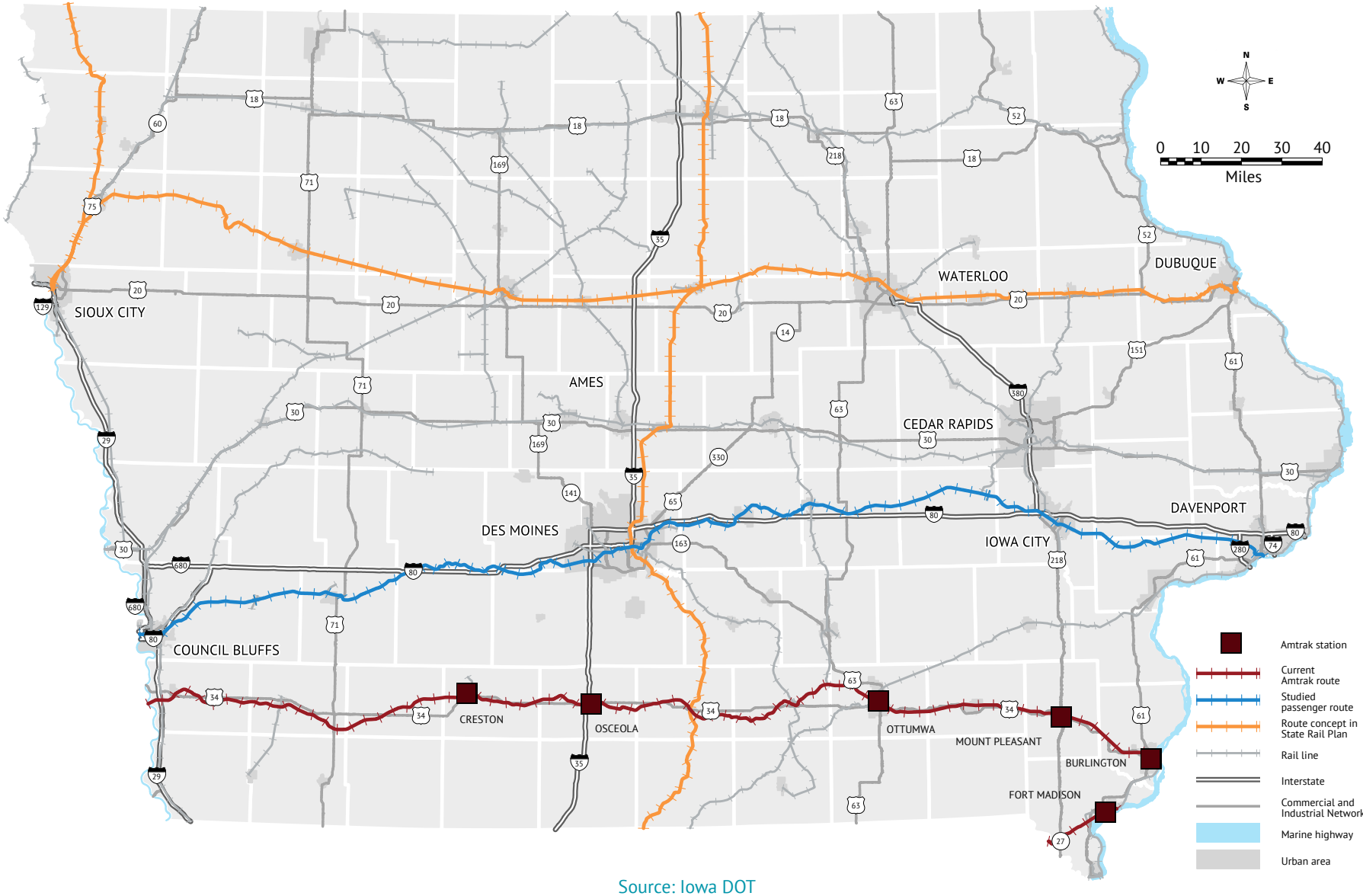
Passenger rail service in Iowa is currently provided by two Amtrak routes, the California Zephyr from Chicago, Ill. to Oakland, Calif., and the Southwest Chief from Chicago to Los Angeles, Calif. The California Zephyr operates over the BNSF tracks in southern Iowa providing daily service in both directions. Stations in Iowa include Burlington, Mount Pleasant, Ottumwa, Osceola, and Creston. The Southwest Chief also operates daily in both directions over the BNSF tracks in extreme southeast Iowa with one stop in Fort Madison. Figure 4.17 shows current service and routes where service is being planned or considered for study.

While these two lines are a tremendous asset for the state, there is concern that most of Iowa's largest communities do not have convenient passenger rail connections to Chicago, Omaha, Neb., Minneapolis, Minn., or Kansas City, Mo. The Iowa DOT's 10-Year Strategic Passenger Rail Plan envisions a network that provides service connecting Iowans to major cities, regional destinations, and many other communities not currently served by commercial air service or passenger rail.

Iowa is also currently pursuing additional passenger rail service in the state. The Chicago to Council Bluffs-Omaha Regional Passenger Rail System Planning Study was completed in 2013. Implementation of passenger service on the Chicago-Moline, Ill. segment has been under development by Illinois, but development of the project is on hold as it has been under administrative review. Iowa DOT commenced additional study of the Moline-Iowa City segment of the corridor for implementation. The Iowa DOT and Illinois DOT have also begun the first phase of the Chicago to Dubuque rail plan, which would add service between the two cities. The first phase of the project received funding in Illinois in 2014, but, similar to the Chicago to Moline project, is currently on hold and under administrative review. The Iowa DOT will continue coordination with Illinois DOT as these projects progress.

Additional routes identified in planning documents but remaining to be studied are also shown on Figure 4.17. These include the extension of the Chicago to Dubuque service west to Sioux City and a north-south route through the state that could potentially connect the Twin Cities, Des Moines, and Kansas City.

Figure 4.17: Passenger rail service in Iowa



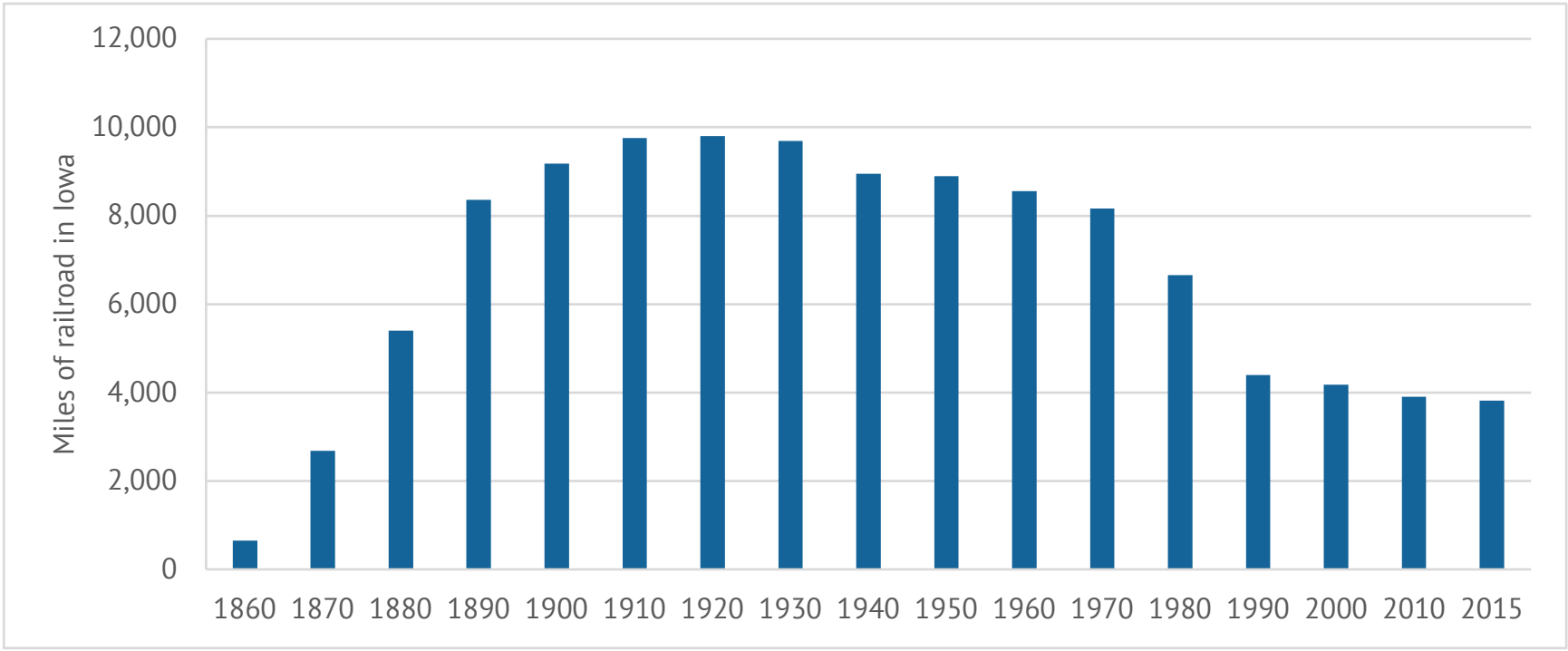
Source: Iowa DOT

Current trends

System size and tonnage

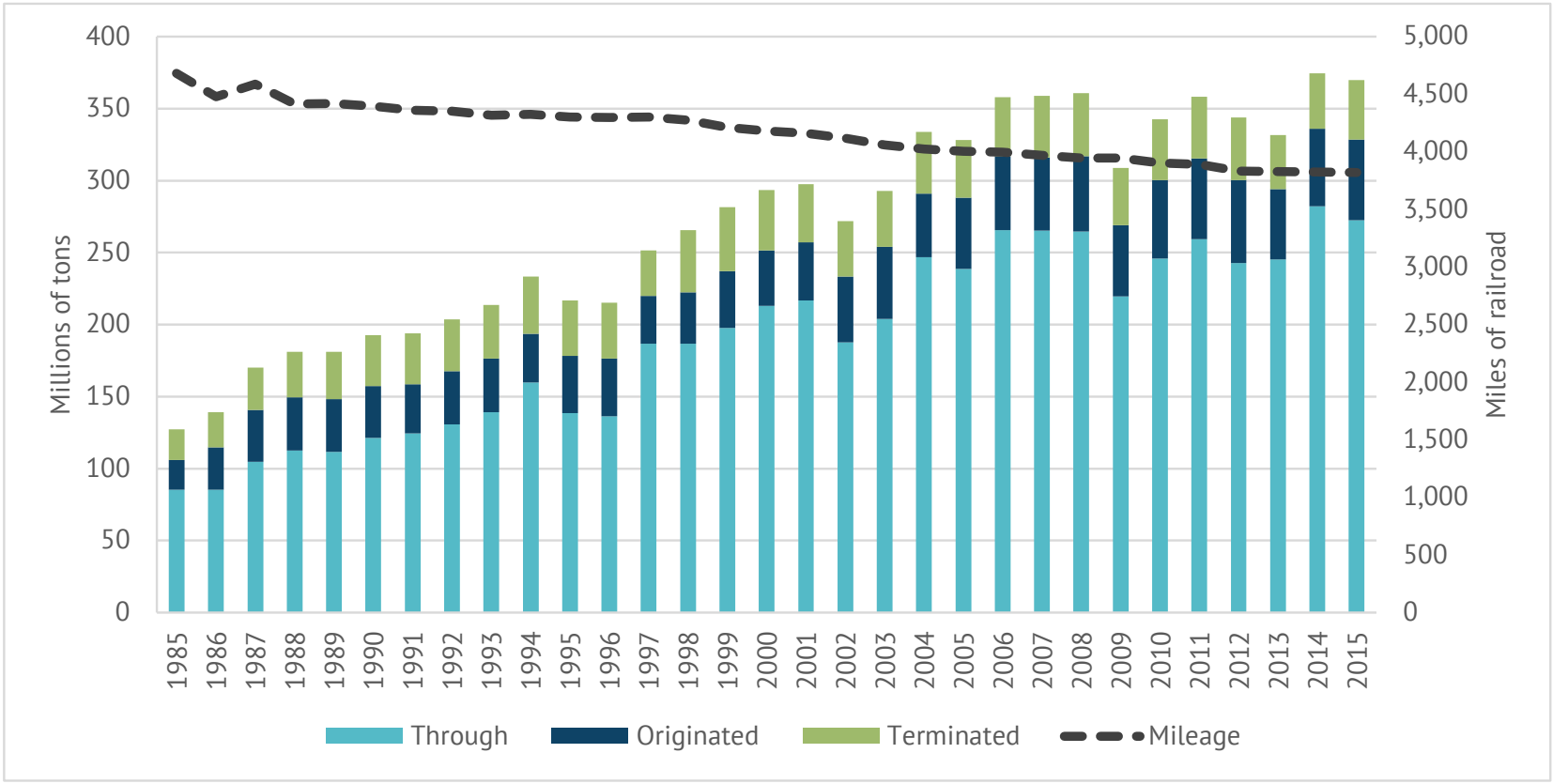
The mileage of the rail system has decreased significantly over time, from a peak of more than 10,000 miles in 1915 to its current level of just over 3,800 miles. Despite the reduction in railroad mileage in the state, the amount of freight being shipped to, from, and through Iowa has continued to rise. Figure 4.18 shows the historical rail mileage in Iowa. Figure 4.19 shows inbound, outbound, and through tonnage for rail freight from 1985-2015, along with the mileage of the rail system.

Figure 4.18: Historical rail mileage, Iowa



Source: Iowa DOT

Figure 4.19: Rail movements in Iowa, 1985-2015

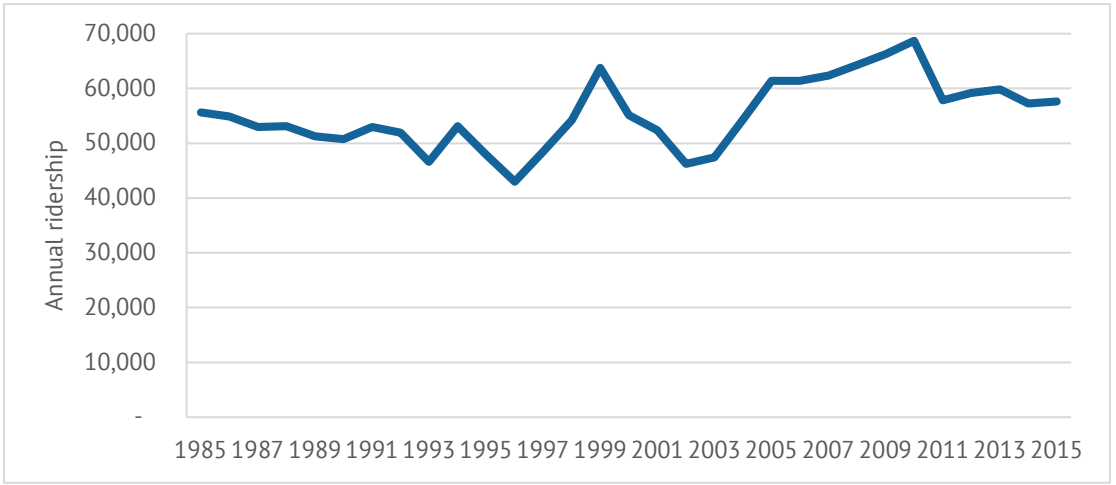


Source: Iowa DOT

Amtrak ridership

Nationwide, passenger rail ridership on Amtrak has increased from 20.8 million in 1985 to 30.8 million in 2015. This increase has not been reflected in boardings or alightings at Iowa Amtrak stations, which are at relatively the same level that they were in 1985 (see Figure 4.20).

Figure 4.20: Amtrak ridership at Iowa stations, 1985-2015



Source: Iowa DOT

Size of shipments

Recent growth in freight demand has impacted rail service and equipment needs, yet a variety of issues, including financial constraints, have limited the ability to expand capacity. Manufacturers of large commodities, including wind turbines, are looking to locate along rail lines in Iowa. These developments may result in increased freight traffic in some parts of Iowa, and may lead to changes in the infrastructure needed. As a result of this growing demand and changes in the rail freight industry, rail cars are growing in size and trains are getting longer. Improvements are necessary to meet these capacity needs as over 10 percent of Iowa's rail-miles are not able to carry the industry-standard 286,000-pound cars.

Transload and intermodal opportunities

For many years freight producers in Iowa have experienced a continuing trend of increasing difficulty and costs related to the shipment of export products. Long-haul carriers can move products by rail, truck, and barge. When producers have a choice of modes and can combine modes for the most efficient transportation, costs can be lowered and efficiency increased.

Although these and many other factors may have contributed to current conditions, the Iowa Freight Advisory Council has identified three opportunities for further examination.

- Examine strategies that provide more local rail connections and transload or intermodal centers to decrease the distance exports must be trucked to get to a transload or intermodal facility.
- Evaluate ways to make it feasible and cost-effective to invest in rail transfer facilities within Iowa to reduce transportation costs for Iowa's producers and receivers of goods.
- Investigate ways to address the container imbalance, which creates added transportation costs due to the need to haul empty containers into Iowa.

Growth in U.S. energy production

Much of energy freight movements to and from Iowa are by rail due to the fact production has increased at a rate exceeding the capacity of the nation's pipelines. The products are then moved by truck within the region. Of all the oil produced in the Bakken Shale formation region, roughly 63 percent is shipped by rail with a portion of that traveling through Iowa. Since 2008, oil shipments carried by two Class I railroads in Iowa have increased by nearly 3 million tons. Destinations include oil refineries on the East Coast (Pennsylvania, Delaware) and Gulf Coast (Louisiana, Texas).

As production in the Bakken region and across the country continues, more freight railroads operating in Iowa are anticipating the accommodation of crude by rail shipments. Additionally, ethanol and biodiesel fuels have become significant value-added products for Iowa's agricultural economy over the past few decades. As the largest producer in the United States, Iowa produced 28 percent of the nation's ethanol fuel in 2014. Nationally, 70 percent of all ethanol produced is transported by rail.

Key issues

- Additional funding is needed to support necessary capital expenditures.
- The network has steadily decreased in miles, and additional rail capacity is needed to meet future demand.
- Rail improvements will be needed to accommodate heavier rail cars.
- Additional rail spurs are needed to accommodate businesses and industries wanting to locate or expand in Iowa.
- There is a need for enhanced rail access throughout Iowa.
- There are operational, regulatory, and infrastructure bottlenecks to be addressed for the rail system.
- Growing highway and rail traffic is increasing delays and conflicts.
- There are safety concerns related to rail infrastructure and highway-railroad crossings.
- Passenger rail service is limited, with no service to Iowa's larger population centers.
- Energy production and transport is changing.

4.6 Waterway

Iowa's waterway system plays a key role in moving grain and bulk commodities to and from Iowa. This system provides Iowans with a gateway to an extensive inland waterway network that has access to international ports. While the Iowa DOT has not directly invested in this system, the department does have an advisory role with representation on the Upper Mississippi River Basin Association and the State Interagency Missouri River Authority.

A system of locks and dams on the upper Mississippi River, operated by the U.S. Army Corps of Engineers, helps to maintain adequate water levels for barge operations. To achieve a 9-foot channel in the upper Mississippi River, the construction of these navigation locks and dams was authorized in 1930. Dams are built on rivers to hold back water and form deeper navigation pools, allowing river vessels to use a series of locks to "step" up or down the river from one water level to another.

Water transport fills an important role in freight movement as it has the ability to carry the most weight while offering the lowest shipping cost per ton of commodity. Although they rely on truck and rail to deliver goods, private barge terminals on the Mississippi and Missouri Rivers are a key part of grain and commodity movement for products moving into and out of Iowa. The Iowa DOT maintains a River Barge Terminal Directory[10] that contains key information about these terminals.

Highlights

Iowa is the only state in the nation bordered by two navigable rivers, the Mississippi and Missouri.

Both rivers are part of America's Marine Highway Program. The M-29 Marine Highway Connector runs from Sioux City to Kansas City, Mo.; and the M-35 Marine Highway Corridor runs from St. Paul, Minn. to Grafton, Ill.

Keokuk is the northern most port on the Mississippi River that is open to barge traffic throughout the winter.

Located along these rivers are 60 barge terminals (55 on the Mississippi, five on the Missouri) owned and operated by private companies.

One barge carries the equivalent of 16 train hopper cars or 70 large semitrucks.

Water transport is more energy efficient than rail and truck movements.

10 http://www.iowadot.gov/barge.htm

Impact of waterway transportation on Iowa's economy

The Mississippi River and Missouri River waterway systems create a substantial impact on Iowa's economy. Some of the areas of impact created by or directly related to these waterways include commercial navigation, recreation, tourism, energy production, commodity transfer, manufacturing, and mineral resources. In 2015, more than 7 million tons of commodities (mostly agricultural products and gravel) moved to, from, and within Iowa on waterways. Other agricultural products comprised the largest quantity of this tonnage, totaling nearly 56 percent overall. Cereal grains followed as the second largest commodity, totaling nearly 37 percent of the tonnage.

Iowa borders 312 miles of the Upper Mississippi River. This area is a vital segment of the Inland Waterway System, providing an economic transportation link from the Upper Midwest to the Lower Mississippi Valley and the Gulf of Mexico. An economic profile study for the Upper Mississippi River system illustrated this impact, concluding that this river system contributes $345 billion in revenue to businesses in the corridor, supporting more than 1 million jobs associated with this economic activity. Iowa counties account for much of this corridor, which runs from Minneapolis/St. Paul to the southern points of Missouri and Illinois.

Waterway planning efforts

M-35 Marine Highway Corridor

The M-35 Marine Highway Corridor, also known as the "Waterway of the Saints," extends from St. Paul to just north of St. Louis at Grafton. Under this designation, the state transportation departments in Iowa, Illinois, Minnesota, Missouri, and Wisconsin work with industry and other regional partners to improve freight mobility through innovative, integrated strategic approaches, as well as to promote the inland waterways as a means to relieve land-side transportation congestion and improve the nation's overall transportation system. The M-35 designation offers new opportunities for ports, terminals, and operators to access federal funding, technical support, and other resources to expand or develop new shipping services and make the river a more cost-effective and self-sustaining transportation route. A stronger Upper Mississippi River will require coordinated efforts related to advocacy, marketing, and ongoing planning.

U.S. Inland Waterway Modernization Study

A 2013 study, U.S. Inland Waterway Modernization: A Reconnaissance Study[11], examined alternatives to the U.S. Army Corps of Engineers' traditional approach to funding and implementing projects to help modernize and improve the inland waterway navigation system on the Upper Mississippi River System. This study concluded that new approaches to fund operations, maintenance, and infrastructure replacement are needed to keep water transportation viable. The study outlined several actions for Iowa to consider taking, including recommendations to make to Congress related to waterway funding and programs.

This system relies primarily on public investment and has suffered from chronic underfunding, seriously affecting the nation's potential to participate in the highly competitive global market for exportable commodities. The required operations and maintenance of the locks and dams are currently only 35 to 40 percent funded (U.S. Army Corps of Engineers, Rock Island District). Rehabilitation projects, as well as small- and large-scale improvements to the system are behind due to lack of construction funds.

No long-term funding source has been identified for the modernization of the inland waterway system that will help keep Iowa and the U.S. competitive in the global economy. International competitiveness depends on being able to ship goods at low cost. If the inland waterway system continues to deteriorate and become less reliable, shippers will be forced to use other modes with increased transportation costs. An increase in costs means a decrease in competitive advantage.

11 http://www.iowadot.gov/systems_planning/waterway.html

Inventory

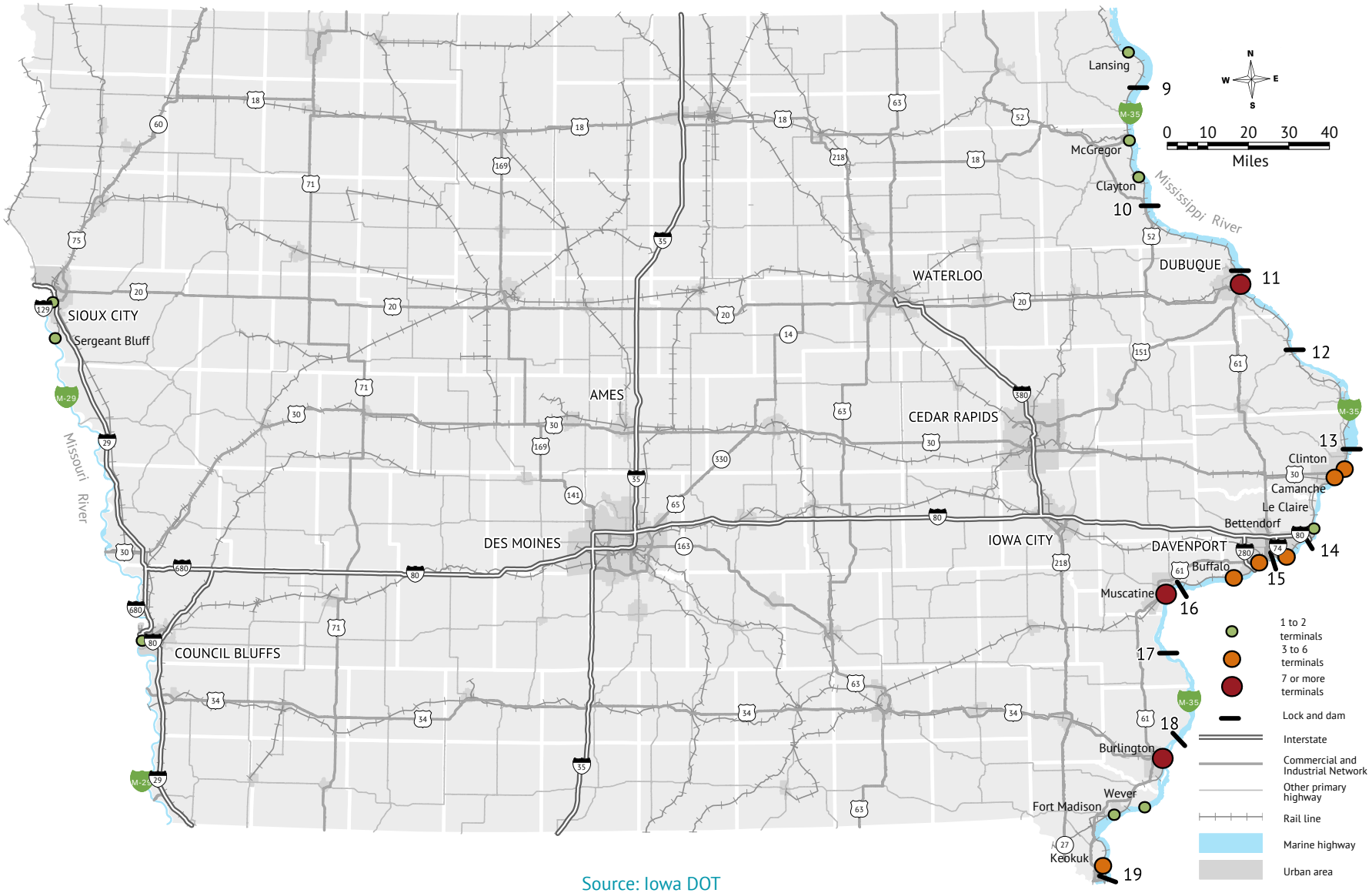
There are 11 lock and dams located on the Mississippi River bordering Iowa, along with 60 barge terminals between the Mississippi and Missouri Rivers. Table 4.3 lists the lock locations and provides information about each lock. Figure 4.21 shows the location of Iowa's two marine highways, 11 lock and dams, and 60 barge terminals.

Table 4.3: Iowa Mississippi River locks summary

Lock	Location	Chamber	River mile	Year open	Length (feet)	Width (feet)	Owner/ Operator	Gate type
9	Harpers Ferry, Iowa	Main	647.9	1938	600	110	Corps	Miter
10	Guttenberg, Iowa	Main	615.1	1936	600	110	Corps	Miter
11	Dubuque, Iowa	Main	583	1937	600	110	Corps	Miter
12	Bellevue, Iowa	Main	556.7	1939	600	110	Corps	Miter
13	Clinton, Iowa	Main	522.5	1938	600	110	Corps	Miter
14	Le Claire, Iowa	Main	493	1922	600	110	Corps	Miter
14	Le Claire, Iowa	Aux 1	493	1939	320	80	Corps	Miter
15	Rock Island, Ill.	Main	482.9	1934	600	110	Corps	Miter
15	Rock Island, Ill.	Aux 1	482.9	1934	360	110	Corps	Miter
16	Muscatine, Iowa	Main	457.2	1937	600	110	Corps	Miter
17	New Boston, Ill.	Main	437.1	1939	600	110	Corps	Miter
18	Gladstone, Ill.	Main	410.5	1937	600	110	Corps	Miter
19	Keokuk, Iowa	Main	364.3	1957	1,200	110	Corps	Vertical

Source: Iowa DOT

Figure 4.21: Iowa marine highways, locks and dams, and barge facilities



Source: Iowa DOT

Current trends

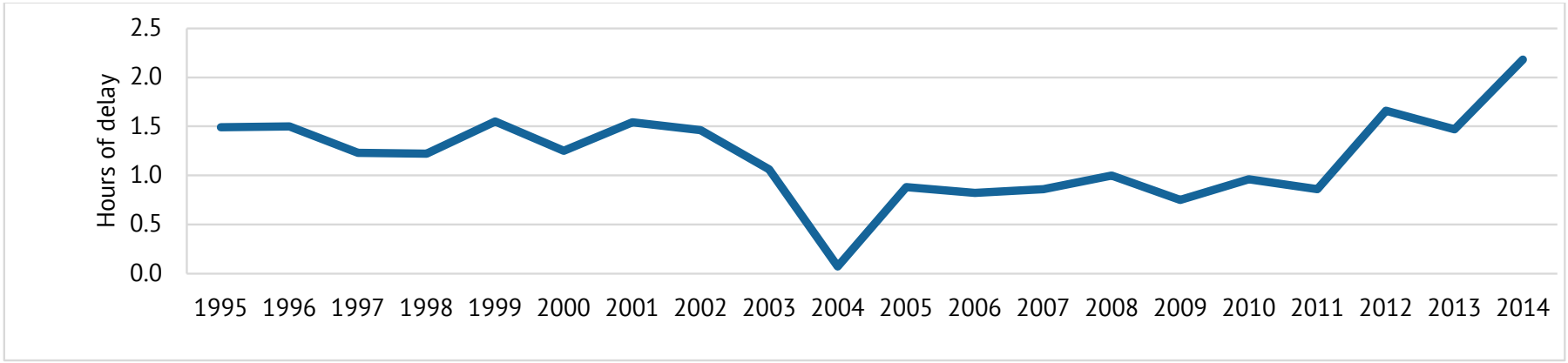
In 2013, the American Society of Engineers' Report Card for America's Infrastructure gave the following grades for maritime infrastructure: ports, C; dams, D; levees, D-; and inland waterways, D-. These grades reflect the poor condition that much of the nation's system is in, raising concerns about the reliability of waterborne freight movement. With grain exports expected to increase and the expansion of the Panama Canal expected to shift the amount of goods that can be shipped to Asia via ports on the Gulf of Mexico, Iowa has a sincere interest in the condition of its inland waterway infrastructure.

Lock and dam infrastructure is aging and deteriorating

Many of the country's locks and dams have reached or far exceeded their designed life cycle, resulting in infrastructure deteriorating and wearing out faster than facilities are being replaced. The lock and dams bordering Iowa are operating long past design life, undersized for modern Upper Mississippi tow lengths, and hindered by unexpected repairs. The average age of these lock and dams is nearly 80 years old, close to 30 years past the design life, and the majority have original miter gates and mechanical and electrical systems.

Only one lock bordering Iowa is long enough to accommodate a modern 1,200-foot barge tow. The remaining 10 are 600 feet long, which means barge operators must split the tow in half, lock through multiple times, and resecure the barges together before continuing on the river. This creates major delays and congestion for the barge tows behind, creating a ripple effect and longer delays throughout the rest of the system. The average delay at the locks along Iowa's border is approximately two hours (see Figure 4.22), which limits the efficiency of barge transport. This is due to multiple factors such as lock maintenance, other vessels disassembling tows to fit through the smaller locks, and unexpected closures. Table 4.4 shows the percent of vessels delayed at Iowa's locks and the average delay time.

Figure 4.22: Average delay for Iowa Mississippi River locks, 1995-2014



Source: U.S. Army Corps of Engineers

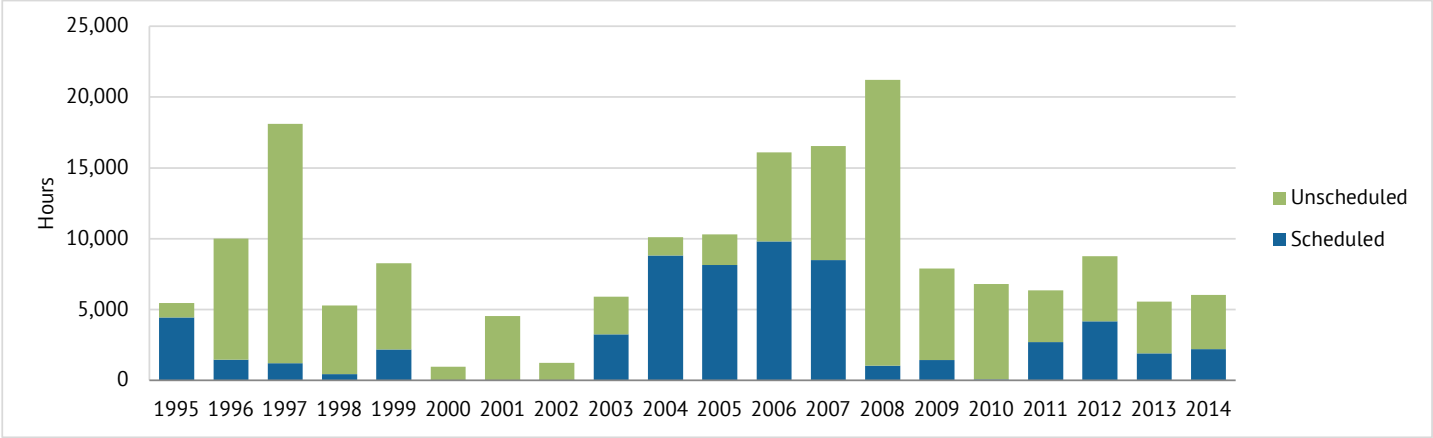
Table 4.4: Percent of vessels delayed and average delay time by lock, average from 1995-2014

Lock	Location	Percent of vessels delayed	Average delay time (hours)
9	Harpers Ferry, Iowa	14.0%	0.60
10	Guttenberg, Iowa	10.6%	0.60
11	Dubuque, Iowa	18.3%	0.98
12	Bellevue, Iowa	22.1%	1.05
13	Clinton, Iowa	23.8%	1.06
14	Le Claire, Iowa	24.1%	2.06
15	Rock Island, Ill.	27.0%	1.65
16	Muscatine, Iowa	45.3%	1.21
17	New Boston, Ill.	49.4%	1.76
18	Gladstone, Ill.	46.7%	1.62
19	Keokuk, Iowa	44.1%	0.87

Source: U.S. Army Corps of Engineers

Also contributing to delay times is lock unavailability, both scheduled and unscheduled. Due to the age and condition of the infrastructure, locks and dams must be closed for maintenance and repairs. On average, unscheduled repairs account for more than 50 percent of lock closures. Delays, congestion, and unavailability due to closures are significant threats to efficient goods movement. Figure 4.23 shows the number of hours that locks 9 through 19 were unavailable from 1994 to 2014.

Figure 4.23: Annual unavailability[12] at locks 9-19 from 1995-2014 (hours)



Source: U.S. Army Corps of Engineers

Freight movement remains steady on the Mississippi River but demand is declining on the Missouri River

Demand for shipping on the Mississippi River has remained stable, primarily consisting of bulk materials. This includes grain going down the river to be exported and fertilizer, sand, and salt being brought up the river. The Missouri River, on the other hand, has experienced a continual drop in freight tonnages. Today, barge traffic typically goes only as far north as Omaha-Council Bluffs on the Missouri, although a few trips were made to Sioux City in 2014 for the first time in 11 years. These were shipments of equipment for the construction of a fertilizer plant, and most likely will not result in ongoing trips.

Key issues

- Higher funding levels for river infrastructure are necessary.
- Improving system reliability through infrastructure maintenance is needed.
- Capacity improvements are needed on the Mississippi River.
- Demand for freight movement on the Missouri River is limited.

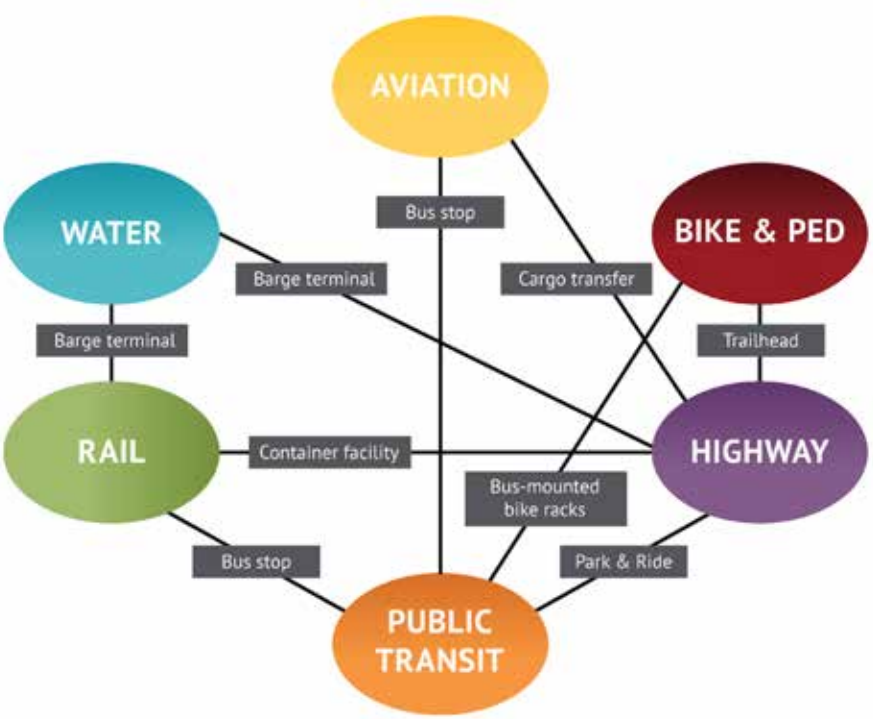
12 Unavailability hours can be higher due to maintenance on auxiliary locks. This means that the main lock could still be open when the auxiliary lock is unavailable.

4.7 Intermodalism

In addition to considering each mode individually, it is important to consider and plan for connections between modes for both passengers and freight. These connections are the basis for intermodalism. The terms "intermodal" and "multimodal" are often used interchangeably, yet they can have entirely different meanings. Multimodal focuses on the different modal options that could be utilized to move people and goods from one place to another. Intermodal focuses on how two or more of these modes can connect at what typically amounts to a transfer point, such as a bus stop, intermodal container facility, or transload location. To put it another way, multimodal options provide the links in the transportation system, while intermodal connections are the nodes.

The Iowa DOT understands the importance of these connections, and supports a number of planning efforts and funding options that can be used to finance intermodal projects. Figure 4.24 highlights some examples of intermodal facilities commonly found in Iowa. These connections or facilities are an integral part of passenger and freight transportation, as they provide the opportunity for seamless transitions from one mode to another.

Figure 4.24: Examples of intermodal connections and facilities

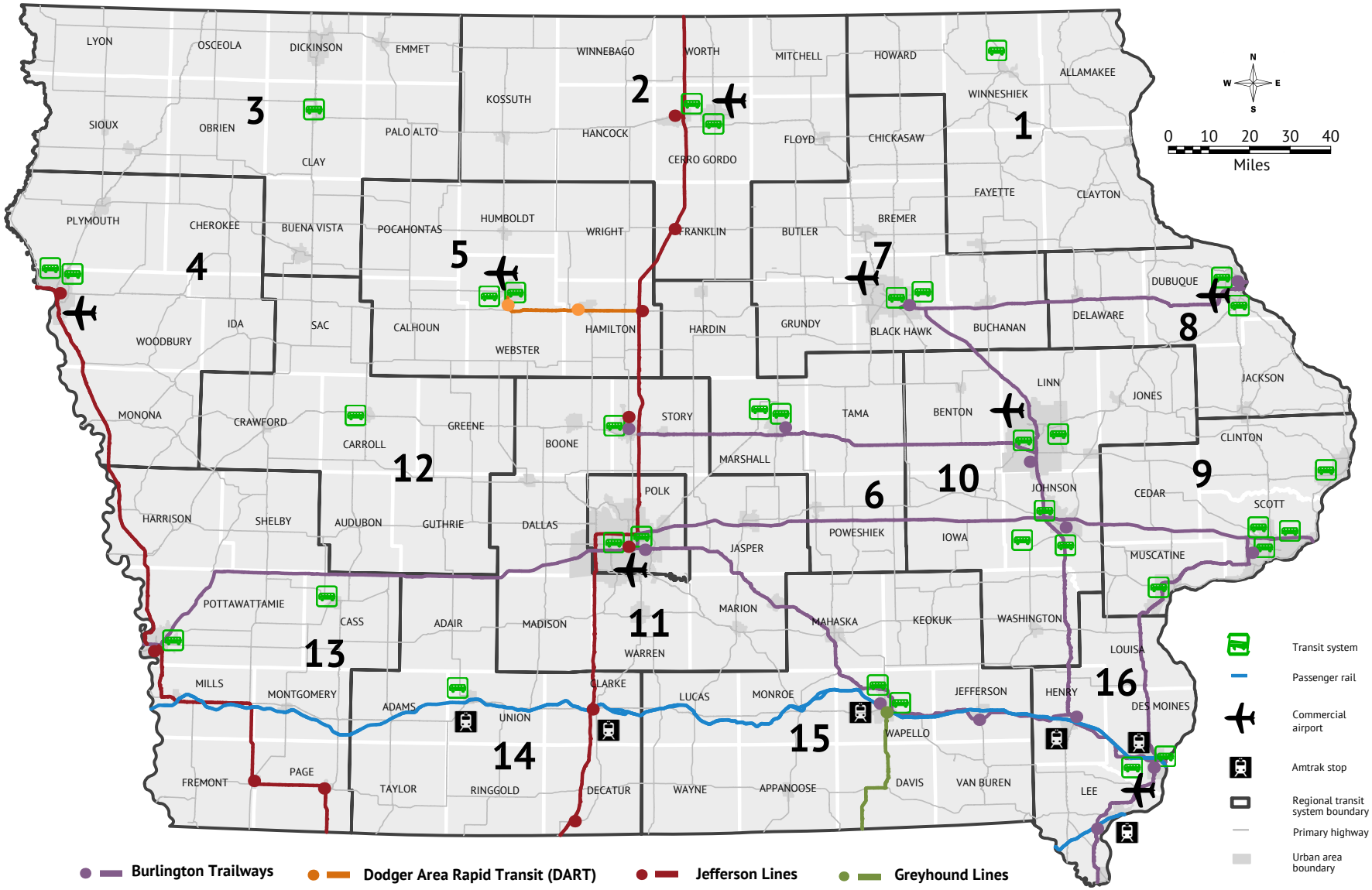


Source: Iowa DOT

Passenger

There are multiple options and connections for passenger travel other than driving a passenger vehicle. Iowa's passenger transportation system includes two Amtrak routes and a well-developed road system, as well as commercial air, intercity bus, and city and regional transit services. Figure 4.13 showed the locations of public transit in the state. Figure 4.25 shows these along with the station locations and routes of Amtrak and intercity bus service.

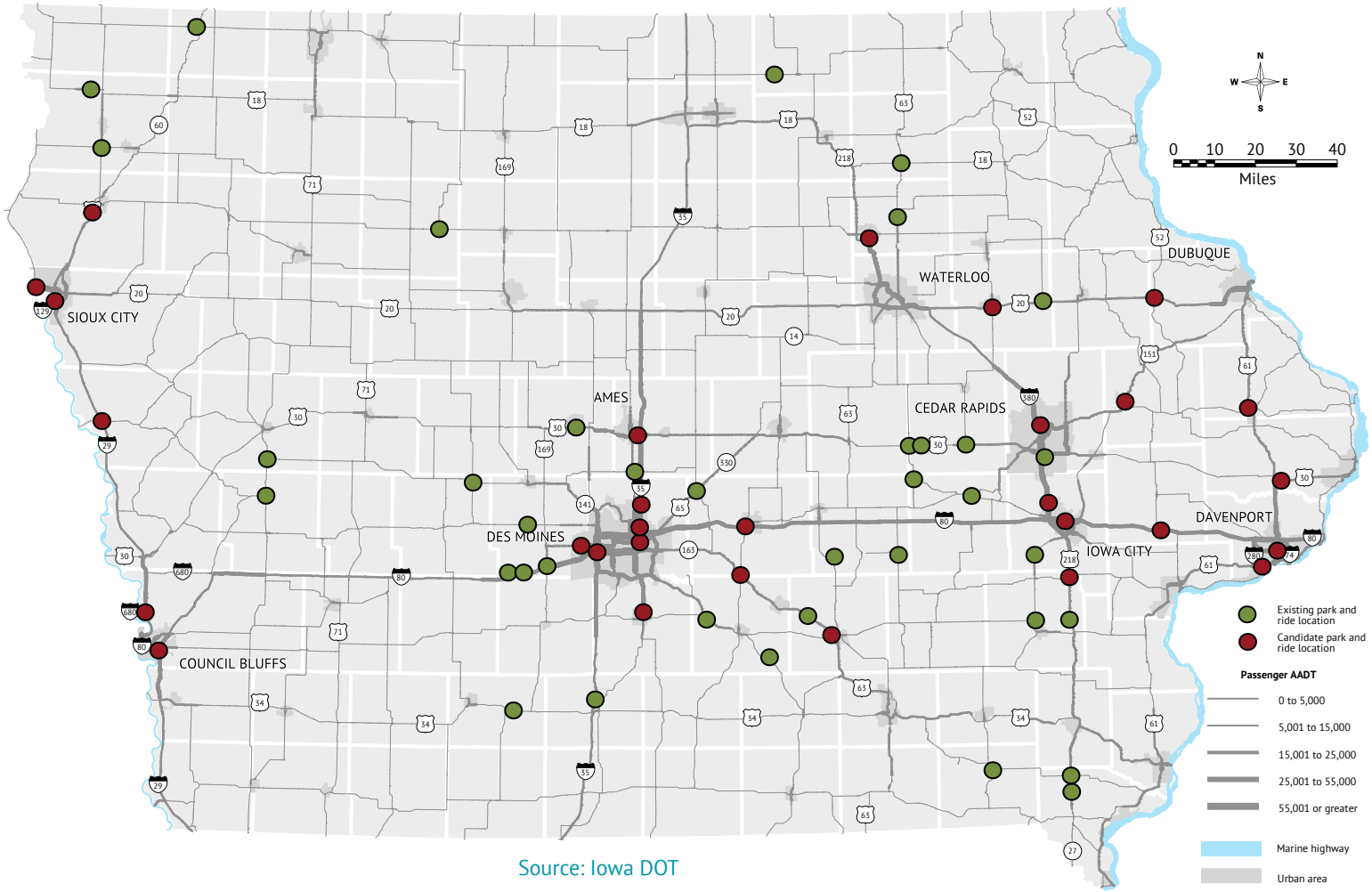
Figure 4.25: Iowa passenger transportation services



Source: Iowa DOT

A recent planning effort that dealt with a specific type of intermodal facility was the 2014 Iowa Park and Ride System Plan[13] (IPRSP). Park and ride lots offer an opportunity for drivers to transition from single-occupant vehicles to carpools, vanpools, or, in some cases, public transit. The IPRSP included an update of the existing inventory of park and ride lots, an identification of additional locations suitable for park and ride facilities, and strategies for implementation. The primary objective of the IPRSP was to provide a location-specific, priority-based park and ride system that allows for coordinated planning and implementation of park and ride facilities. Figure 4.26 shows existing and proposed locations of park and ride lots.

Figure 4.26: Existing and proposed park and ride locations



Source: Iowa DOT

13 http://www.iowadot.gov/iowainmotion/park_ride.html

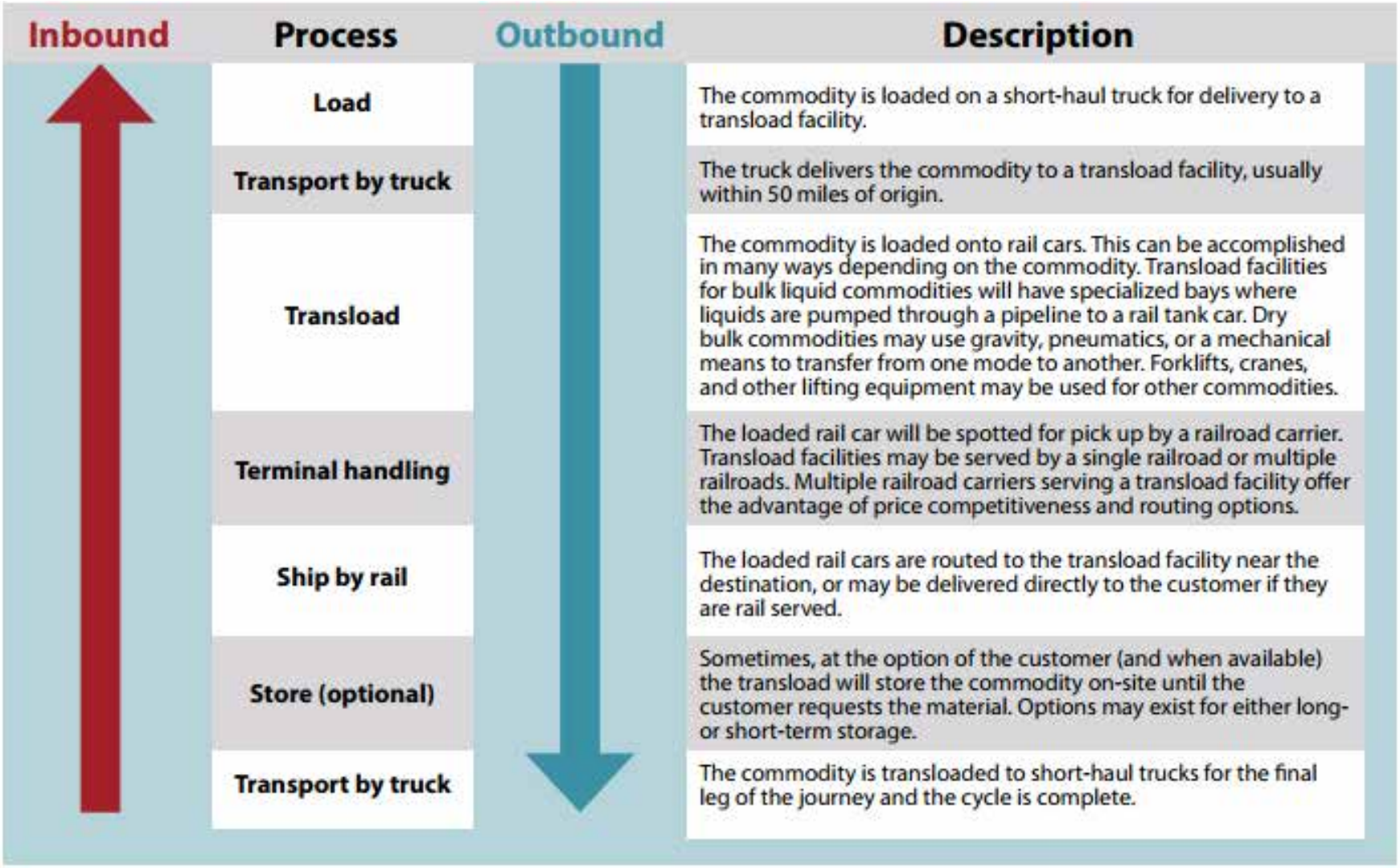
Freight

Iowa's freight system also includes a number of facilities that enable the smooth transfer of goods from one mode to another. These allow shippers to take advantage of the cost, speed, and capabilities of more than one mode. Figures 2.17 and 2.18 showed the freight price comparison across modes and the amount of freight various modes can transport. In order to create the most efficient goods movements for various commodities, facilities to accommodate transfers between modes are vital.

Intermodal transfer facilities are identified in the planning process as critical parts of the state's rail and water freight networks. As they rely on trucking for pickup and delivery, they can produce significant freight traffic flowing to and from these locations. Types of transfer facilities include the following.

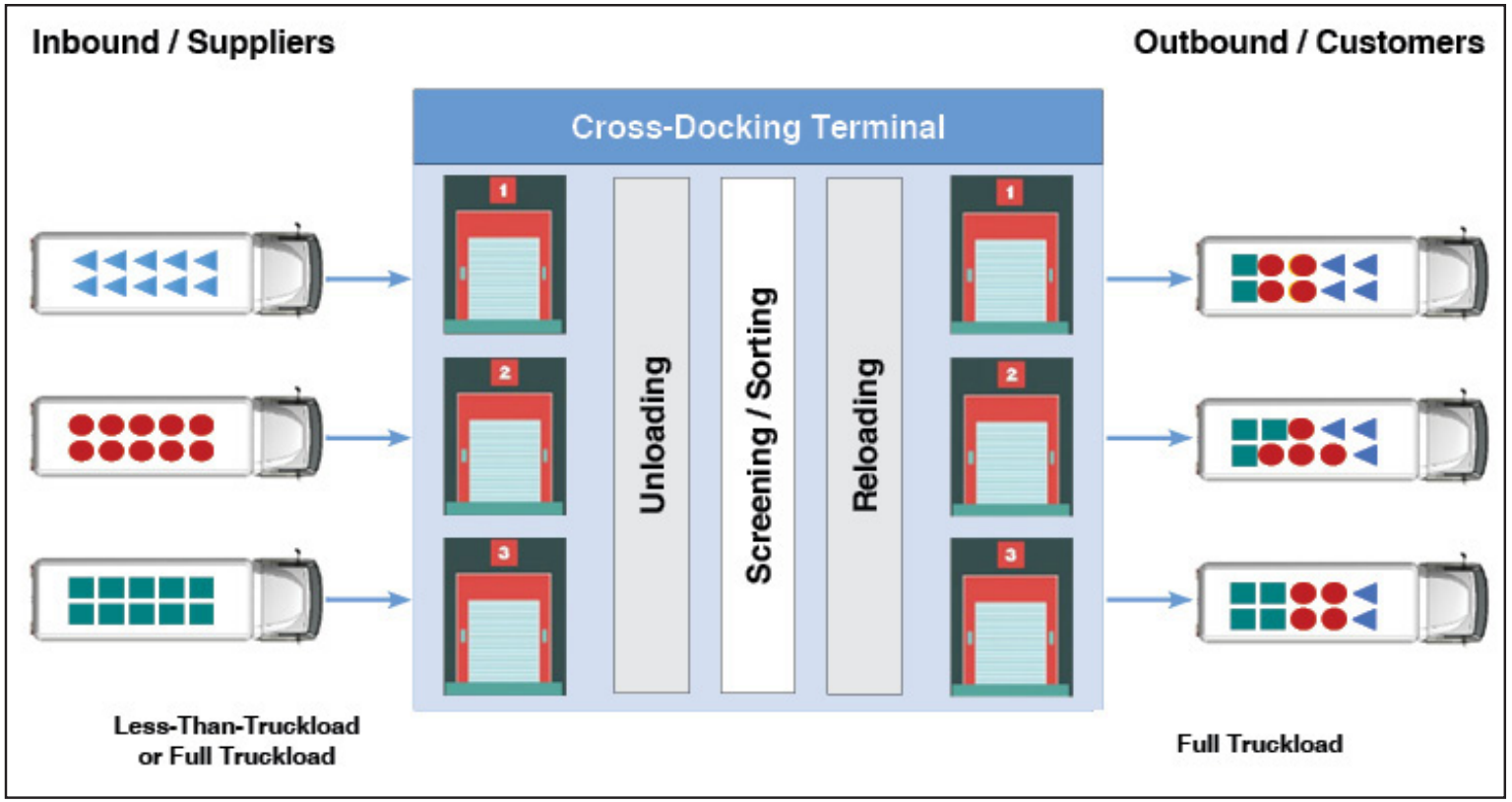
- An **intermodal container facility** refers to the transfer of freight using an intermodal container or trailer through multiple modes of transportation (rail, barge, and/or truck) without the handling of the freight itself when changing modes. This method improves security and transportation speed while reducing the damage and loss of goods.
    - **Container transfer facilities** handle rail-to-truck and truck-to-rail transfers in sealed units such as trailer-on-flatcar (TOFC) or container-on-flatcar (COFC). There is only one TOFC/COFC located in Iowa, which is in Council Bluffs. Other options for Iowa shippers and receivers are outside the state at facilities located in Chicago, Kansas City, and Minneapolis-St Paul.
- A **transload facility** refers to the transfer of freight shipments, typically bulk, from the vehicle/container of one mode to that of another at a terminal interchange point. Transloading works for a variety of commodities, including finished and unfinished goods, fresh food, lumber, and bulk goods. Figure 4.27 shows a simple example of the transloading process with a facility at both ends of the movement.
    - A **team track** is the most basic and common type of transload facility in Iowa. It is a simple siding or spur track where railcars are placed and available for use to load and unload freight. Once the cars are loaded, the railroad is notified to pick them up. Team tracks can be owned by a railroad or a business served by the railroad such as an industrial park, public agency, or freight terminal operator.
    - At a **cross-dock** transload facility, cargo is unloaded from an incoming truck or rail car and is reloaded directly into outbound trucks, trailers, containers, or rail cars. A cross dock typically allows level loading between modes. This process improves the efficiency of commodity movement by utilizing as much of a container/vehicle as possible. Figure 4.28 shows a simple example of the cross-docking process.

Figure 4.27: Example of transload process



Source: Iowa DOT, Iowa Rail Toolkit

Figure 4.28 Example of cross-docking process



Note: DC = distribution center; FTL = full truckload; LTL = less than truckload
Source: Quetica, LLC

- **Coal-burning facilities** are locations in the state that utilize coal as a power source. A large amount of Iowa electricity is generated by coal. These facilities are significant because they typically receive and distribute great quantities of coal by train and/or truck.
- **Barge terminals** are locations where commodities are transferred from barges to trucks and/or rail cars. These terminals are a staple of industries moving bulk products by river or inland waterway. Barges can be loaded and unloaded much more rapidly than packaging a bulk product and putting it in a truck, and can handle a larger amount of freight than both truck and rail. Iowa has a total of 60 barge terminals located along the Mississippi (55) and Missouri (five) rivers to transfer goods between truck, rail, and barge.

- **Biodiesel and ethanol plants** are production facilities for renewable fuels made with corn and soybeans and byproducts of corn and soybean production. These locations typically receive raw materials by truck and ship finished biodiesel/ethanol by truck and/or rail. As is the case with grain elevators, the multiple transportation options qualify these locations as transloads.

- **Grain elevators** are facilities that collect grain from farmers by tractor or truck. The grain is then stored and shipped to market via truck and/or rail. The opportunity to shift from one mode to another qualifies these locations as transloads. Iowa has a vast network of grain elevators to handle the large production of corn and soybeans each year before being transported to users.

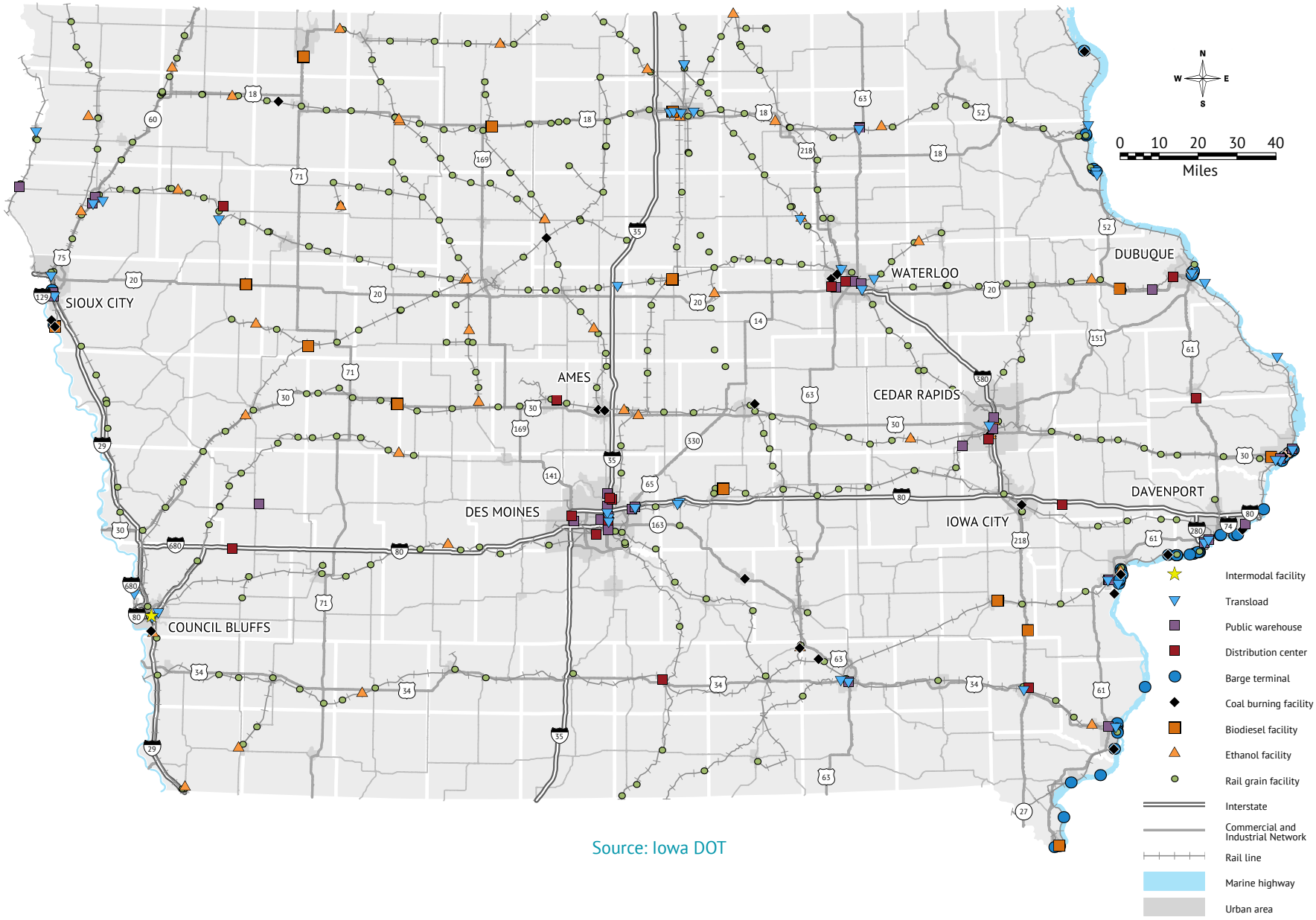
The intermodal options within Iowa include a number of warehouses and distribution centers that collect and distribute freight. These locations can generate many truck trips from the shipping and receiving of commodities, which makes the facilities an important part of the planning process.

- **Warehouse** refers to a commercial building for storage of goods that can include any raw materials, packing materials, spare parts, components, or finished goods associated with agriculture, manufacturing, and production. Warehouses are used by manufacturers, importers, exporters, wholesalers, and transport businesses. Some warehouses include transloading capabilities to offer short- and long-term storage and handling of goods to give shippers a competitive advantage.

- A **distribution center** is a warehouse or other specialized building, often with refrigeration or air conditioning, stocked with products to be redistributed to retailers, to wholesalers, or directly to consumers. A distribution center can also be called a warehouse and serve as the foundation of a supply network as they equip a single location with a large variety of goods.

The preceding summary of intermodal, transload, and other freight-generating facilities is not exhaustive, but provides a glimpse of the major nodes and connecting points that make up the multimodal freight transportation network. Figure 4.29 shows the location of these types of freight-generating facilities.

Figure 4.29: Freight intermodal facilities



Source: Iowa DOT

Many freight movements by air, rail, and water are intermodal, usually beginning and/or ending with a truck movement. These intermodal connections are critical to Iowa's competitive edge in the marketplace. Table 4.5 identifies locations where roadway connectors provide access between major intermodal facilities and the National Highway System. The primary criteria for connectors are based on annual passenger volumes, annual freight volumes, or daily vehicular traffic on one or more principal routes that serve an intermodal facility.

Table 4.5: Iowa intermodal connectors

Facility	Type	Connector	Owner
AGRI Grain Marketing, McGregor	Port Terminal	IA 76, B St between terminal and US 18	State
Amoco Pipeline Distribution Center, Council Bluffs	Truck/Pipeline Terminal	US 275 (eastern ramp termini I-29 to South Expressway), north to WB ramp terminus of I-29/80.	State
Big Soo Terminal, Sioux City	Port Terminal	Harbor Dr and Industrial Rd between terminal and I-29	Local
Continental Grain Co., Dubuque	Port Terminal	Kerper Blvd, E 16th St, E 11th St, E 9th St, 9th-11th W Conn, between terminal and US 61/151	Local
Des Moines International Airport	Airport	Fleur Dr between ML King Blvd and relocated IA 5	Local
Des Moines International Airport	Airport	Park Ave (63rd to Fleur Dr)	Local
Determann Industries, Camanche	Port Terminal	Washington Blvd, US 67 between terminal and US 30	State
Harvest States Peavey, Davenport	Port Terminal	IA 22 between terminal and I-280	State
Harvest States Peavey, Dubuque	Port Terminal	E 7th St, Central Ave and White St between terminal and Commercial	Local
Quad Cities Container Terminal, Davenport [1]	Truck/Rail Facility	S Rolff St, Rockingham Rd (IA 22), between terminal and I-280	Local
The Eastern Iowa Airport, Cedar Rapids	Airport	Wright Brothers Blvd between I-380 and Cherry Valley Rd	Local
Vandalia Rd Pipeline, Des Moines (Pleasant Hill)	Truck/Pipeline Terminal	E. 30th St/Vandalia Rd (IA 163 to US 65)	Local
Williams Pipeline Co., Sioux City	Truck/Pipeline Terminal	41st St & 46th St & Business US 75 (Lewis Blvd) Between terminal and US 75	State

Source: Intermodal Connector Assessment Tool (ICAT), FHWA

14 The Quad Cities Container Terminal in Davenport is now closed.

While the intermodal facilities and connectors identified in Figure 4.29 and Table 4.5 are critical for freight movements in Iowa, an additional need for a full-service intermodal and logistics terminal in east-central Iowa was identified through recent planning efforts, including a freight optimization study prepared for the Iowa DOT. A planned facility known as the Cedar Rapids Logistics Park (CRLP) will provide this service from a 75-acre location north of the Eastern Iowa Airport in southwest Cedar Rapids. The facility is expected to include the following elements with the ability to expand as needed.

- Integrated facilities for a container intermodal terminal.
- A rail-to-truck transload facility for bulk commodities.
- Cross-dock facility for consolidating and redistributing truck loads, as well as loading and unloading containers.

The purpose of the intermodal element is to provide Iowa and the surrounding states with access to a high-capacity, efficient, and cost-competitive facility to move goods from truck to rail and vice versa. The transload element would consist of tracks separate from the intermodal facility with storage, loading aprons, and support equipment sufficient to load and unload any material between multiple railcars and trucks at grade. The cross-dock element would increase transportation efficiencies by combining partially loaded trucks into full loads, hence reducing vehicle miles traveled and the number of truck trips. These project elements are illustrated in Figure 4.30.

The need for this project was reinforced through the identification of a private partner and a grant award of $25.6 million from the U.S. DOT's Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE) Program. It is expected that this public-private partnership will lead to the successful opening of this new terminal within 2-3 years.

Figure 4.30: Cedar Rapids Logistics Park conceptual layout

Source: Iowa DOT, SRF Consulting

5. CHOOSING OUR PATH

The prior chapters have helped lay the foundation of what issues face Iowa's multimodal transportation system. Data on the existing system, input from the public and stakeholders, various planning considerations, and key issues must all be considered as the Iowa Department of Transportation (DOT) and Iowa Transportation Commission (Commission) determine what investment actions to take to help shape the transportation system needed over the coming decades. This information has helped shape the vision for Iowa's transportation system. This chapter outlines the investment areas, strategies, and improvement needs the Iowa DOT plans to pursue to help achieve that vision.

5.1 Vision

Iowa's multimodal transportation system is one of the foundations of Iowa's economy. The decisions made today regarding funding allocations and specific improvements will significantly affect what the transportation system looks like for decades to come. This requires having an overall vision for how the current and future transportation system should be managed and operated. The vision of the Iowa DOT and Commission is:

A safe and efficient multimodal transportation system that enables the social and economic wellbeing of all Iowans, provides enhanced access and mobility for people and freight, and accommodates the unique needs of urban and rural areas in an environmentally conscious manner.

This vision was crafted to meet several criteria. It is all-encompassing, capturing the overall intent of what the Iowa DOT is aiming to provide its customers, the traveling public. It also captures elements woven throughout strategies and improvement needs and across passenger and freight modes, such as safety and quality of life. It is strategic, and meant to be specific enough to help target funding, because financial resources are limited. Finally, the vision is flexible, because change is inevitable and can occur quickly, especially when it comes to technology. The vision and this Plan are an adaptable framework.

5.2 Investment areas

The way the system vision will be realized is through the investment decisions made by the Iowa DOT and Commission. To help translate this vision into meaningful actions, an overall structure has been set up with the following components.

- A broad **vision statement** that captures the overall vision for Iowa's future transportation system.
- Overarching **investment areas** within which actions will be defined to implement the system vision.
- A fiscally responsible **action plan** that defines how the vision will be implemented, through two broad categories.
  - Specific **strategies** that will be utilized by the department that fit within one or more of the investment areas.
  - Where appropriate, specific **improvement needs** the department feels are necessary to help achieve the overall system vision.

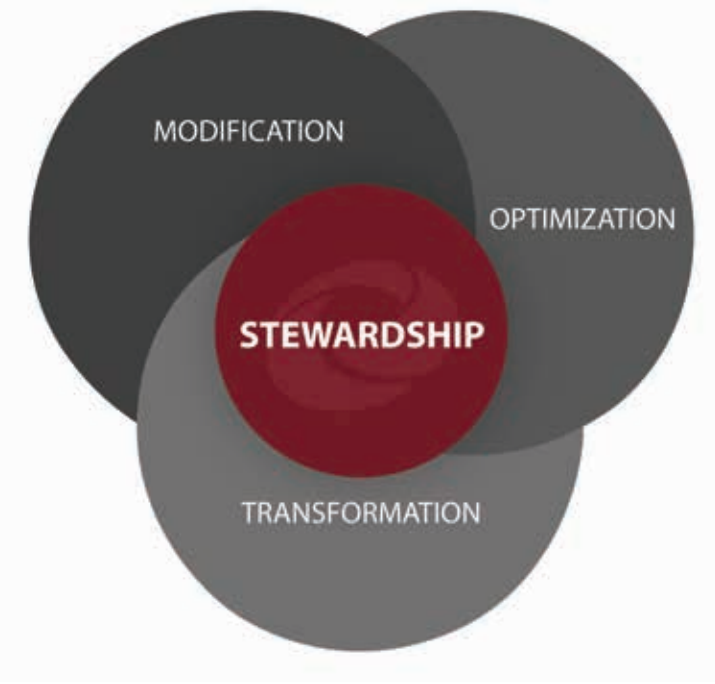
Ultimately, each identified strategy and improvement need relates back to one or more investment areas and the overall vision.

Vision → **Investment Areas** → **Strategies/Improvement Needs**

Four principal investment areas were identified to help achieve the system vision:

- ***Stewardship*** through maintaining a state of good repair
- ***Modification*** through rightsizing the system
- ***Optimization*** through improving operational efficiency and resiliency
- ***Transformation*** through increasing mobility and travel choices

Each of these investment areas are supported by specific strategies and improvement types, which are summarized in the following section and detailed in the action plan. The investment areas are not mutually exclusive categories. For example, safety is implied throughout all investment areas, and strategies and improvement types may align with more than one investment area. Together these four investment areas encompass the range of strategies and improvement types to be utilized to ensure the Iowa DOT and Commission continue to create, manage, and operate the transportation system Iowa needs.



Stewardship – maintaining a state of good repair

The bulk of the existing multimodal transportation system will likely need to be managed and maintained similarly to how it is today, though there may be some changes to the composition of the system because of anticipated social, economic, and technological trends. Part of maintaining a state of good repair involves applying appropriate asset management techniques to keep transportation infrastructure in adequate condition. This includes recognizing that it can be more cost-effective in the long run to invest in assets before they wear out completely – in other words, avoiding a worst-first approach to system maintenance and modernization. This also means replacing assets such as roads, guardrails, transit vehicles, and snowplows when they have exceeded their useful lives. Maintaining the system also involves operational maintenance, such as plowing snow and grading shoulders, and making needed investments to address specific issues, such as safety enhancements, Americans with Disabilities Act compliance improvements, and access modifications. The aim of stewardship is to ensure that the system Iowa needs is maintained in a condition that enables safe, efficient passenger and freight movements.

Modification – rightsizing the system

The multimodal transportation system as it exists today has developed over many decades, and reflects the progression of population and employment growth and advances in transportation. Rightsizing the system and the service it provides means ensuring that the decisions we make today regarding transportation investments are done with the social, economic, and technological patterns of the future in mind. Our role is not to continually rebuild the system as it was built decades ago, but rather to implement a system that will meet the needs of the 21st century. This will require significant investment in stewardship, some focused capacity expansion as resources allow, and perhaps even some contraction of the system. Future capacity expansion should be limited, strategic, and prioritized. Nontraditional capacity improvements should be considered where appropriate, including managed lanes (high-occupancy vehicle, bus, truck-only), operations improvements such as intelligent transportation systems (ITS) components, and highway design elements that help improve roadway operation, such as turning lanes, passing/climbing lanes, access modifications, and geometric improvements.

Optimization – improving operational efficiency and resiliency

In addition to building and maintaining the multimodal transportation system, it is also important to work continually to improve the system and how it is utilized by passenger and freight traffic. The answers to decreasing commute times, routing freight more efficiently, or improving system reliability may lie in optimizing the existing system rather than in additional pavement. This means investing in efforts such as utilizing ever-increasing amounts of complex data to monitor the system, improving response efforts when managing incidents to lessen the disruption to traffic, and enhancing the two-way communication between the department and system users.

Transformation – increasing mobility and travel choices

Iowa is changing in a number of ways. Overall, its population is growing older, becoming more diverse, and is increasingly urbanized. City centers with mixed land use and complete streets are developing, but suburbs also continue to expand and small towns remain vital to the state. While the number of individual farms is decreasing, the value of Iowa agriculture to the economy continues to increase. In order to provide a multimodal transportation system that accommodates all aspects of Iowa's population and development patterns, it is important to have a diverse menu of travel choices enabling mobility across different demographics and land uses. This can involve investments beyond the typical highway system that target moving people by other modes of transportation, such as public transit, bicycle, pedestrian, air, and rail. It can also include investments aimed at decreasing single-occupant vehicles.

Public input on investment areas

In February 2016, public input was sought on the four investment areas identified for the Plan, as well as a number of draft strategies. The input helped reinforce the concept of the four investment areas as primary focus areas for the Plan. Also, there were a number of key takeaways from the input that helped shape the action plan.

- The dominant theme among responses was interest in maintaining an appropriately sized system that meets the needs of all users and grows when and where it is necessary.
- It was preferred that the Iowa DOT focus on maintaining the current system and ensure expansion is only done when there is significant need.
- There was interest in increasing the efficiency of the department and increasing communication between the Iowa DOT and the public and stakeholder groups.
- There was interest in the Iowa DOT ensuring the appropriate materials are used and the right repairs are done the first time for projects to reduce costs associated with future improvements and ensure the system lasts longer.
- Support was expressed for alternative modes of transportation as a way to reduce the need to increase capacity and ensure everyone has the ability to travel within the state.

Fixing America's Surface Transportation (FAST) Act

The current federal surface transportation bill is the FAST Act. Being compliant with the FAST Act is an important consideration in the transportation planning process. The vision and four investment areas identified above are tied very closely to the 10 FAST Act planning factors, which are the following.

1. Support economic vitality, especially by enabling global competitiveness, productivity, and efficiency.
2. Increase the safety of the transportation system for motorized and nonmotorized users.
3. Increase the security of the transportation system for motorized and nonmotorized users.
4. Increase the accessibility and mobility of people and for freight.
5. Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and state and local planned growth and economic development patterns.
6. Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight.
7. Promote efficient system management and operation.
8. Emphasize the preservation of the existing transportation system.
9. Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation.
10. Enhance travel and tourism.

The relationships between the Plan's investment areas and the FAST Act planning factors are outlined in Table 5.1.

Table 5.1: Relationship between Plan investment areas and FAST Act planning factors

	Stewardship	Modification	Optimization	Transformation
Economic vitality	X	X	X	X
Safety	X	X	X	X
Security	X		X	
Accessibility and mobility	X	X	X	X
Environment, energy, quality of life, and consistency	X		X	X
Connectivity	X			X
Efficient system management and operation	X		X	
System preservation	X		X	
Resiliency and reliability	X		X	
Travel and tourism	X			X

Source: Iowa DOT

5.3 Action plan

The strategies and improvement needs identified through this action plan are ways the department will take actions to implement the system vision. To help determine improvement needs that exist across the multimodal transportation system, a multi-pronged approach was developed. For highway needs, a seven-layer analysis was conducted to analyze multiple types of needs. Needs were identified in different ways for the other modes – aviation, bicycle/pedestrian, public transit, rail, and water. Most of the needs were derived from existing system plans for those modes and, in a couple cases, updated analysis was conducted. This action plan discusses the analysis and sources of improvement needs for each mode, then delves into strategies the Iowa DOT and Commission will pursue to help address those needs and meet the system vision.

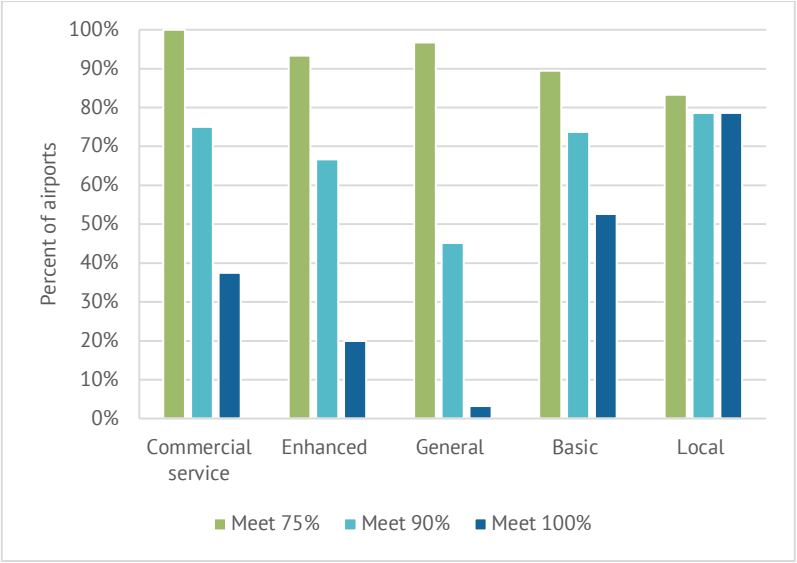
Aviation needs

Needs for the aviation system in Iowa are outlined in the 2010-2030 Iowa Aviation System Plan (IASP), which provides a detailed overview of the Iowa aviation system. It evaluates existing conditions and makes recommendations for future development of the air transportation system to meet the needs of users. The IASP can be used by federal, state, and local decision-makers as a guide for future investment and activity decisions to maintain and develop, as necessary, airports in the state of Iowa.

Airports that have adequate infrastructure and services are necessary for the aviation system to effectively support the demands of users. Measuring how well the system is meeting this goal depends on defined infrastructure conditions and levels of services at each airport. As outlined in the IASP, facility and service targets have been established for each airport role (see Figure 4.1) to reflect what is desirable for airports to effectively meet the aviation system goals and user needs. Targets for each role vary based on facilities and services beneficial for airports to meet the needs of aviation users for that role. For example, the enhanced service airports have more targets because they need to meet the service and facility needs of a wide range of aviation users, including larger business aircraft and corporate jets. There are fewer targets for local service airports because they serve users with fewer operational requirements.

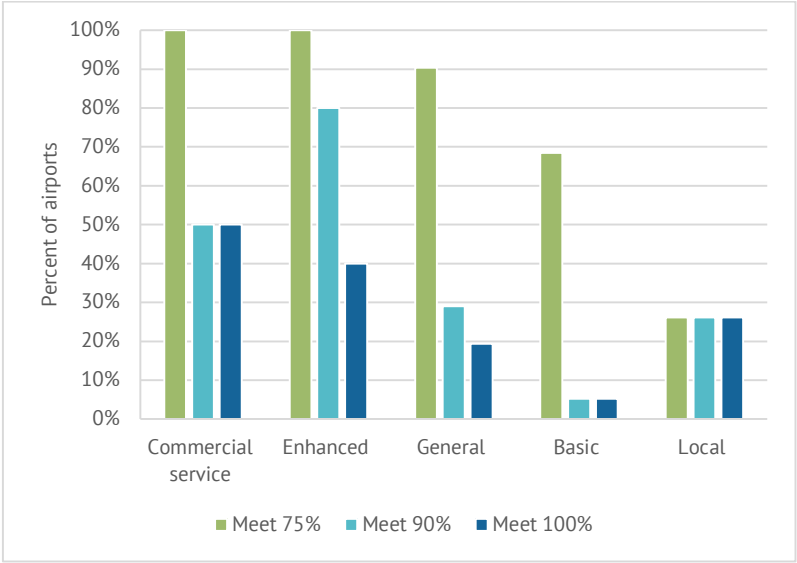
Figures 5.1 and 5.2 show the percentage of airports meeting facility and service targets by airport role. Facility targets focus on the physical infrastructure of the airport. Facility target categories include primary runway length, primary runway width, runway lighting, taxiway lighting, covered aircraft storage, and terminal parking. Service targets reflect the types of services necessary to meet typical user needs. Service target categories include fuel type and hours of availability; weather reporting; airport staffing; flight training; aircraft maintenance; availability of ground transportation; snow removal; and features available to airport users, such as concessions, restrooms, and internet. While not all airports are meeting 100 percent of targets, this does not equate to the airports being substandard. In some cases, long-range projects may be underway to address targets, and some targets involve factors beyond the control of the airports.

Figure 5.1: Percent of facility targets met by airport role



Source: Iowa DOT

Figure 5.2: Percent of service targets met by airport role



Source: Iowa DOT

Bicycle and pedestrian needs

The Iowa DOT has been updating its bicycle and pedestrian plan, and anticipates completing the plan following the completion of Iowa in Motion 2045. As part of that plan development, an initial needs assessment has been conducted for the entire Primary Highway System, excluding interstates. Segment ratings of good, moderate, or poor for bicycling were determined using different methodologies for rural and urban roadways. For rural roadways, segment ratings were based on factors such as total annual average daily traffic (AADT), percent truck traffic, total pavement width, and percent where passing is not allowed. Treatment types were recommended based on these factors and the needs of a typical rural bicyclist who would have experience and confidence riding with higher speed traffic. Table 5.2 shows a generalized version of this system, based on roadway width and traffic.

Table 5.2: Generalized rural roadway conditions and bikeway treatment recommendations

Annual Average Daily Traffic	Existing paved roadway width: ⩽22’	23’ - 24’	25’ - 28’	29’ - 30’ (may include 4’ paved shoulders)	⩾31’ (may include 5-6’ paved shoulders)	Any width (with adjacent path)
Less than 1,000	Suitable as is	Suitable as is	Suitable as is	Suitable as is	Suitable as is	Suitable as is
1,000 to 1,500	3’ paved shoulder on higher use corridors	3’ paved shoulder on higher use corridors	3’ paved shoulder (add or widen existing) on higher use corridors	Suitable as is	Suitable as is	Suitable as is
1,500 to 2,000	3’ paved shoulder	3’ paved shoulder	3’ paved shoulder (add or widen existing	Suitable as is	Suitable as is	Suitable as is
2,000 to 3,000	4’ paved shoulder	4’ paved shoulder	4’ paved shoulder (add or widen existing)	4’ paved shoulder (widen existing)	Suitable as is	Suitable as is
3,000 to 5,000	4’ paved shoulder	4’ paved shoulder	4’ paved shoulder (add or widen existing)	4’ paved shoulder (widen existing)	4’ paved shoulder (widen existing)	Suitable as is
5,000 to 6,500	6’ paved shoulder	6’ paved shoulder	6’ paved shoulder (add or widen existing)	6’ paved shoulder (widen existing)	6’ paved shoulder (widen existing)	Suitable as is
Over 6,500	10’ paved shoulder	10’ paved shoulder	10’ paved shoulder (add or widen existing) or separate path	10’ paved shoulder (add or widen existing) or separate path	10’ paved shoulder (add or widen existing) or separate path	Suitable as is

Good | Moderate | Poor

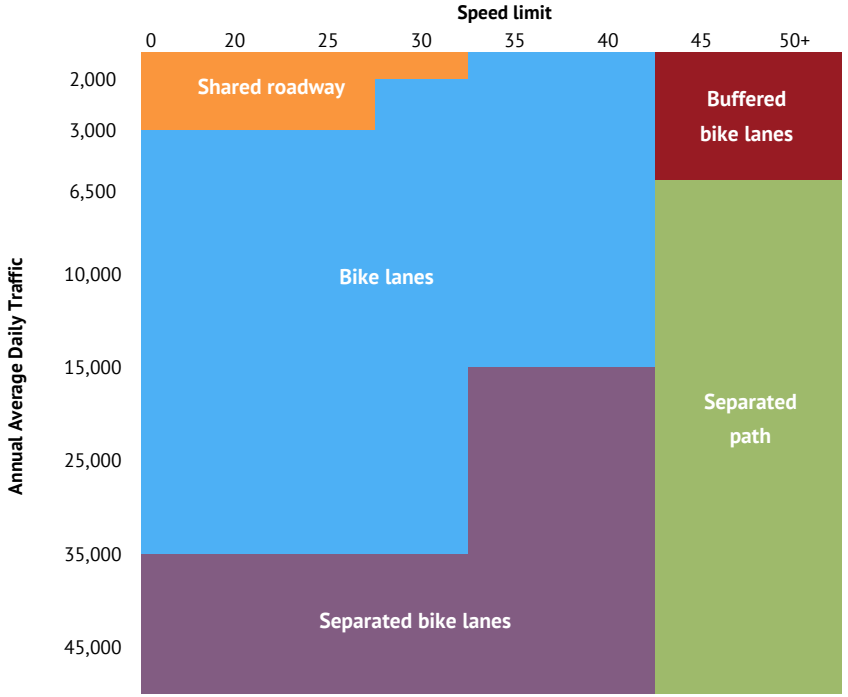
Note: All recommended paved shoulder widths are exclusive of rumble strips.

Source: Toole Design Group

For urban roadways, bicycle needs were determined based on AADT and speed limits. In general, additional separation is recommended for bicyclists as traffic volumes and speeds increase. Treatment types were recommended based on these factors and the needs of a typical urban bicyclist, who would be confident interacting with low-speed, low-volume traffic but prefers separation from higher-speed and higher-volume traffic. Table 5.3 shows a generalized version of recommended treatments in urban areas.

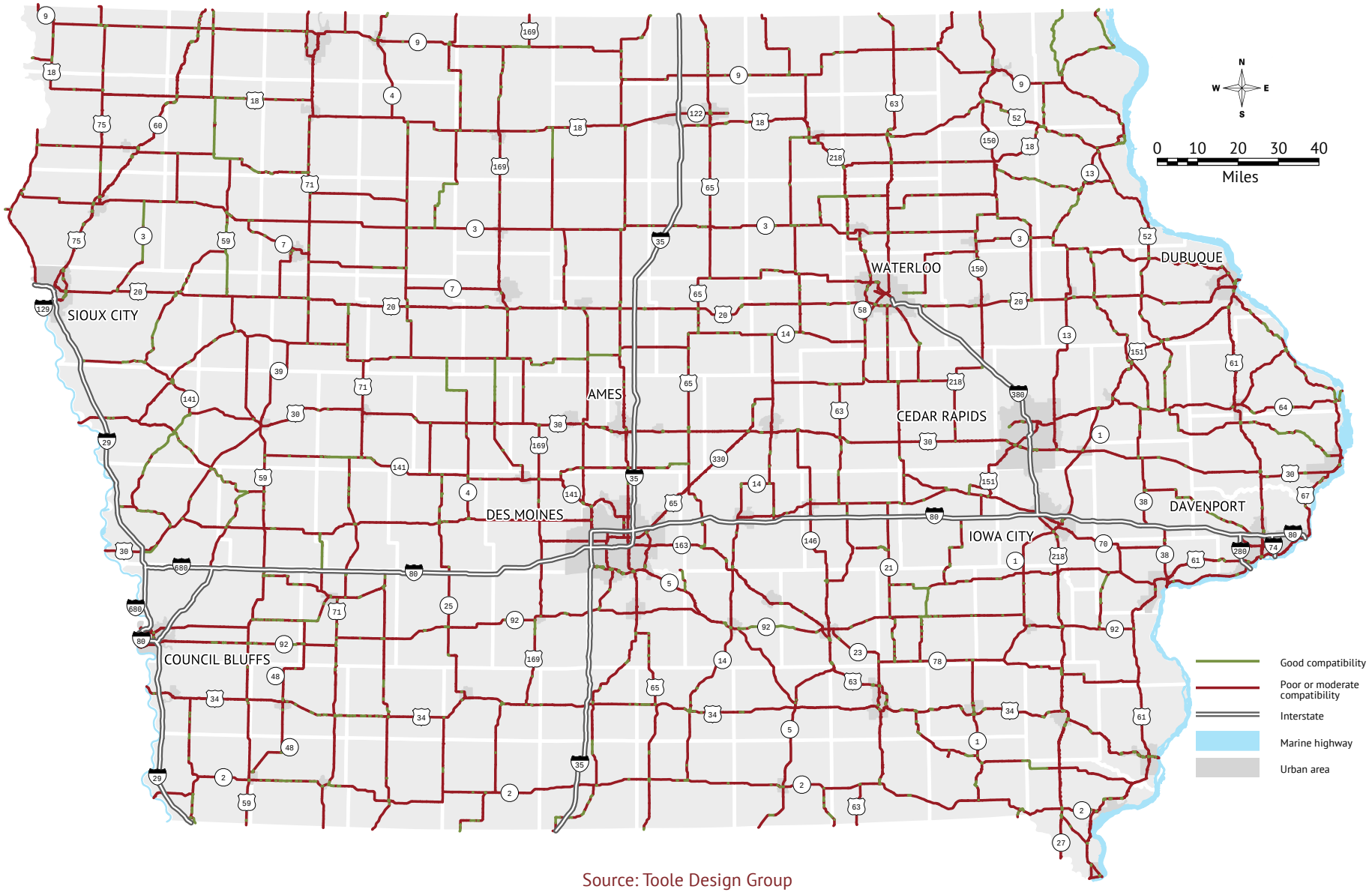
Figure 5.3 shows highway segments based on whether they were rated good, moderate, or poor for bicycling through the analysis. This analysis complements the development of the network proposed in the statewide trails vision (see Figure 4.3).

Table 5.3: Generalized urban roadway conditions and bikeway treatment recommendations



Source: Toole Design Group

Figure 5.3: Bicycle compatibility rating of Primary Highway System

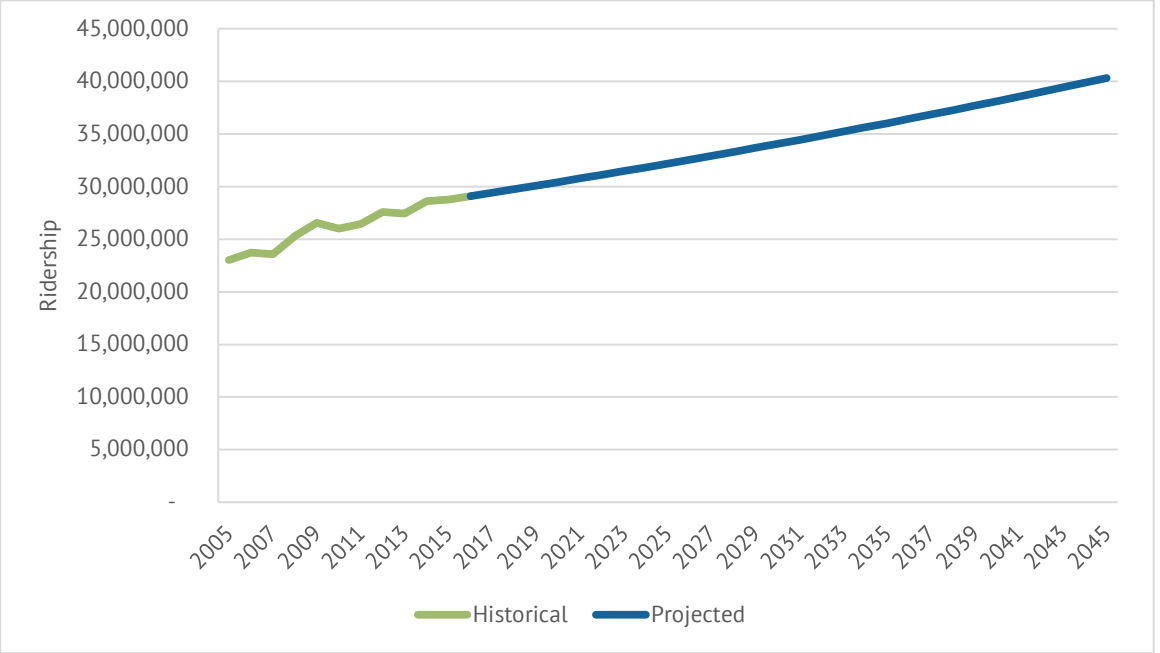


Source: Toole Design Group

Public transit needs

Needs for the public transit system in Iowa are expected to grow substantially between now and 2045 and fall under several categories. Service needs are based on what will be required to provide the level of public transit service needed in the state. The 2009 Iowa Passenger Transportation Funding Study reviewed demand versus ridership to gauge whether needs were being met. The study found that to meet baseline demand, defined as the level of travel reflective of the needs of Iowans that are transit dependent, ridership across the state's transit systems would need to increase by 54 percent, or an additional 38,000 trips per day. Despite the gap in meeting baseline demand, ridership among the state's large urban, small urban, and regional systems (see Figure 4.13) has grown steadily and is anticipated to continue to grow. Ridership projections show growth from 28.77 million trips in 2015 to 40.33 million trips in 2045, an increase of 40 percent (see Figure 5.4).

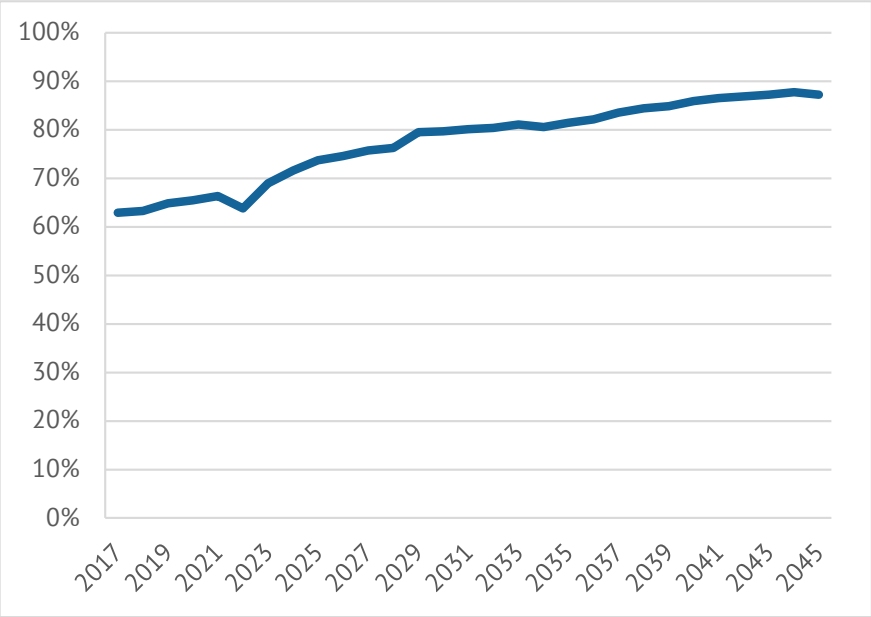
Figure 5.4: Statewide transit ridership, 2005-2045



Source: Iowa DOT

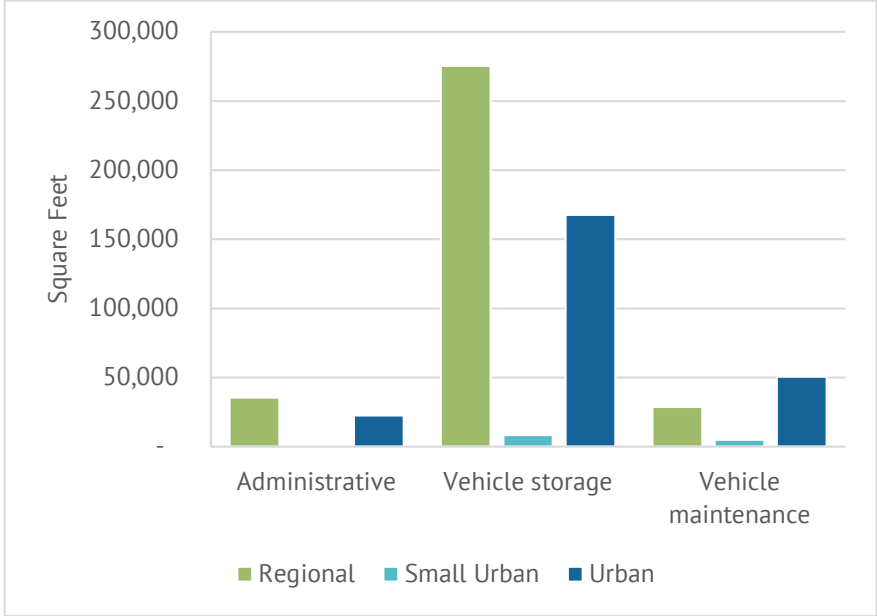
The combination of growing ridership with existing needs for vehicle replacement and facilities underscores the importance of public transit funding. In Iowa, 63 percent of all public transit revenue vehicles in the state currently exceed their useful life thresholds. If funding stays static, this number would quickly grow to 80 percent by 2030, and will be approaching 90 percent by 2045 (see Figure 5.5). In addition to vehicles, transit agencies have needs related to facilities, including administrative space, vehicle storage space, and vehicle maintenance space. Agencies were surveyed in fall 2016 and asked about needs for additional square footage in these categories by 2045. Figure 5.6 shows the survey results, presented by type of space needed and the type of transit system.

Figure 5.5: Percent of statewide fleet that would exceed useful life based on current annual funding levels, 2017-2045



Source: Iowa DOT

Figure 5.6: Additional space needed by public transit agencies by 2045



Source: Iowa DOT

Rail needs

The Iowa State Rail Plan (ISRP) completed in 2017 outlines specific potential future projects and initiatives Iowa might consider proposing to improve existing intercity services (see Figure 4.16) in the state. This includes possible future railroad improvements and investments that could address passenger rail, freight rail, and rail safety needs of Iowa, as identified through railroad company and stakeholder outreach and internal Iowa DOT coordination during development of the ISRP.

The ISRP identifies, describes, and prioritizes specific potential future rail projects for short-term and long-term implementation. Types of freight rail projects identified include:

- Enhancements to the capacity of the state's rail network (22 projects).
- Enhancement of existing transload facilities or construction of new transload facilities (15 projects).
- Enhancement of existing rail access or development of new rail access for shippers/receivers (nine projects).
- Development of new intermodal facilities (four projects).
- Improvements to bridge infrastructure (four projects).
- Improvements to track infrastructure (four projects).
- Improvements to flood mitigation measures (three projects).
- Grade separation of highway/rail grade crossings (two projects).
- Improve traffic congestion and enhance safety in urban rail corridors (one project).

Projects identified for passenger rail include:

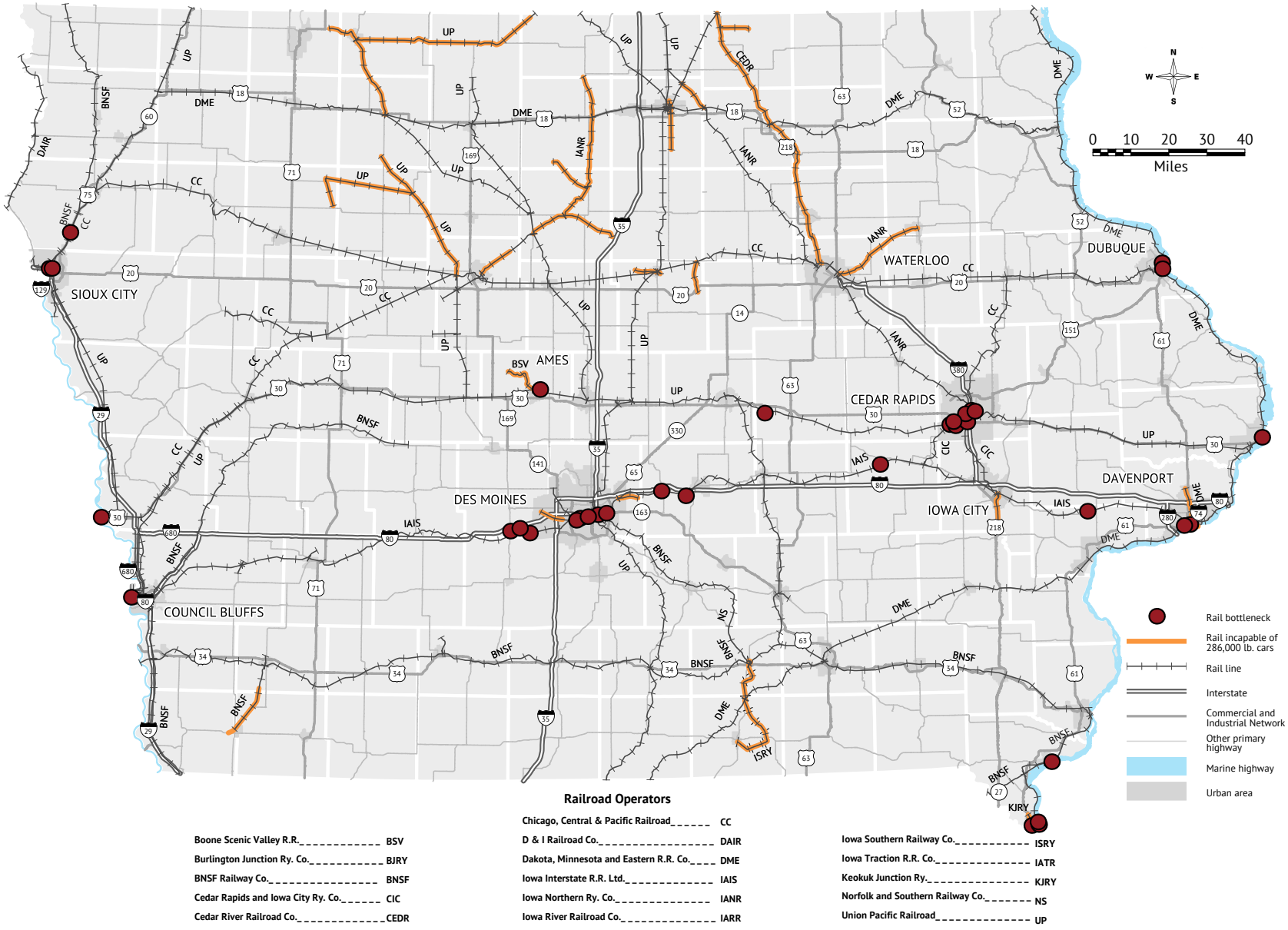
- Implementation of a bus service connecting the Chicago - Quad Cities intercity passenger rail service to Iowa City once the State of Illinois fully implements the Chicago - Quad Cities service.
- Implementation of intercity passenger rail service between the Quad Cities and Iowa City.
- Advancement of the proposed phased implementation of intercity passenger rail service in the Chicago-Omaha corridor from Iowa City west to Des Moines and Council Bluffs.
- Improvements to stations and facilities at existing Amtrak stations in Iowa, including Creston, Osceola, and Fort Madison.
- Implementation of intercity passenger rail service between Council Bluffs and Omaha.
- Implementation of intercity passenger rail services in the Chicago-Dubuque and the Minneapolis/St. Paul-Des Moines-Kansas City corridors.
- Implementation of commuter rail services in the Des Moines area and in the Iowa City-Cedar Rapids area.

In addition to projects identified in the ISRP, two specific types of issues to be addressed across the rail system include rail bottlenecks and rail lines with weight limitations (see Figure 5.7). Rail bottlenecks were identified in the State Freight Plan, and were based on input from rail companies, the Iowa Rail Advisory Committee, metropolitan planning organizations (MPOs), regional planning affiliations (RPAs), and Iowa DOT districts. Types of bottlenecks identified included the following.

- Track congestion and delays
- Size and capacity limitations of rail lines
- Lack of passing and siding opportunities
- Flood prone areas
- Bridge restrictions
- Limited speed areas
- Lack of rail yard capacity

Along with freight bottlenecks, Iowa has several rail lines that are unable to carry 286,000 pounds of railroad equipment, which is the current industry standard for rail car weight (commodities and rail car combined). This is a challenge for Iowa's rail service, as railroads continue to focus their attention on heavier axle-load freight equipment and longer, heavier trains to lower costs. Using larger rail cars in 100-plus car unit trains allows the greatest savings and economic benefits, as well as keeping would-be truck traffic off the highways.

Figure 5.7: Rail bottlenecks and rail lines incapable of handling 286,000-pound rail car weights



Source: Iowa DOT

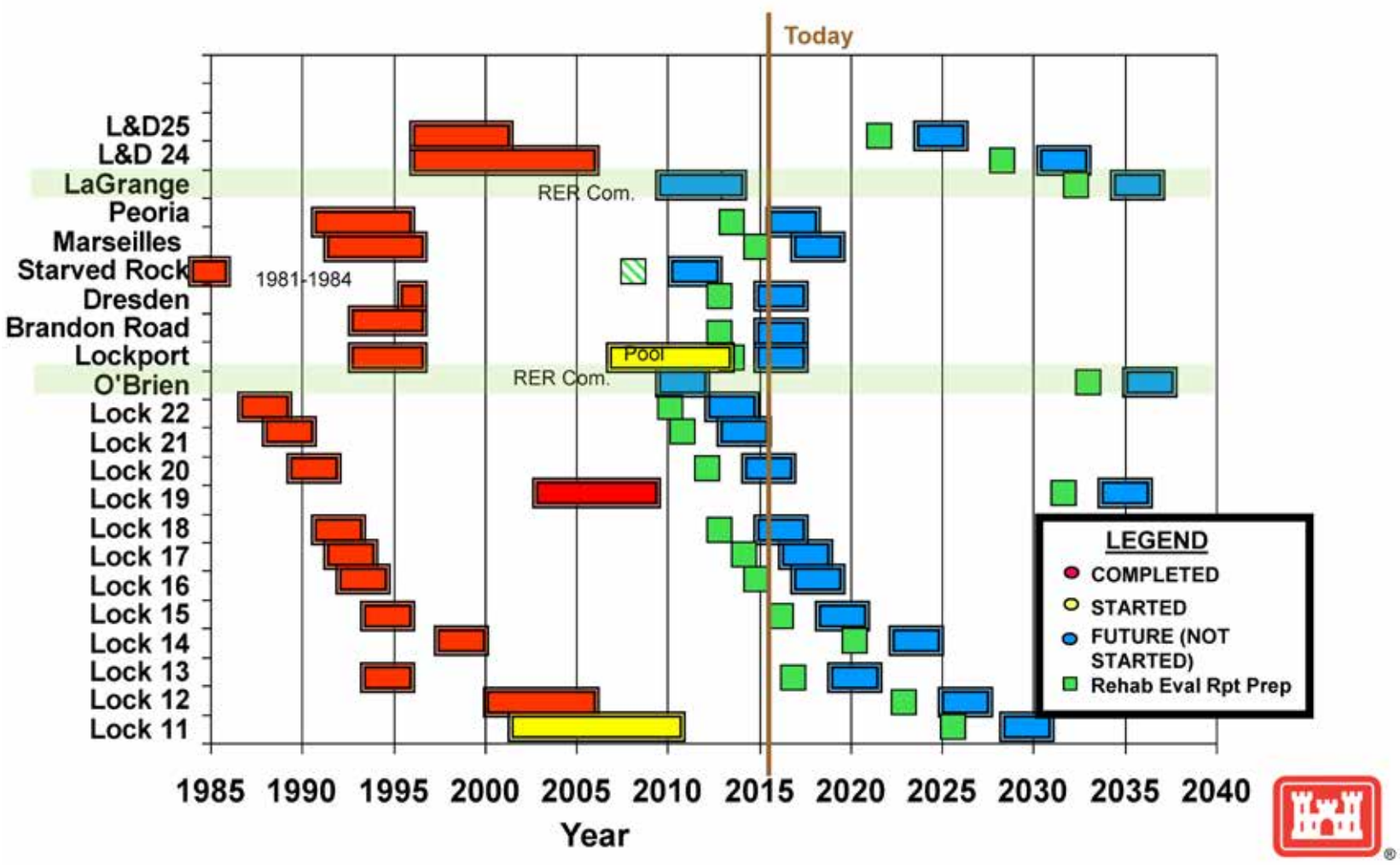
Water needs

The 2016 Iowa State Freight Plan outlines needed waterway freight improvements, as provided to the Iowa DOT by the U.S. Army Corps of Engineers (USACE), which is responsible for all inland waterway navigation projects in the United States. Types of infrastructure priorities include operations and maintenance, major rehabilitation, and improvements (small- and large-scale). Completing tasks in these three areas depends on whether or not funding is allocated by Congress. The status of the three types of navigation projects in the USACE, Rock Island District, which is responsible for locks and dams 11-19 in Iowa (see Figure 4.21), is outlined below.

- Operations and maintenance: Currently funded at 35 to 40 percent of what is needed each year, which has led to nearly $1 billion of unfunded maintenance requirements.
- Major rehabilitation: Currently, 14 major rehabilitation projects are behind schedule across the 20 lock and dams that fall within the Rock Island District. These require construction funding that is tied to the Inland Waterway Trust Fund, which has not been allocated for the last 15 years.
- Improvements (small- and large-scale): The authorization for improvements is the Navigation and Ecosystem Sustainment Program, which was authorized in 2007. No construction funds have been appropriated to date. Several small-scale measures, which would improve river traffic efficiency, are ready to construct.

The 14 major rehabilitation projects that are yet to be started on the Mississippi River are shown in Figure 5.8. Most of the locks bordering Iowa (locks 11 through 19) are currently in the Rehabilitation Evaluation Report (RER) preparation stage and are set to begin in the near future. An RER must be completed and approved prior to funding a project for construction. This spells out the cost, scope, urgency, and objectives of the rehabilitation project. Currently, none of the Iowa locks' RERs have been funded. Rehabilitation was recently started on Lock and Dam 11, but the project was not funded to completion.

Figure 5.8: Schedule of major rehabilitations on the Upper Mississippi River, Rock Island District



Source: U.S. Army Corps of Engineers, Rock Island District

Additional information regarding recent focal points for the USACE districts on waterways bordering Iowa can be found in the freight plan. The plan also discusses efforts to expand locks between Iowa and St. Louis from 600 to 1,200 feet, which would have impacts on Iowa waterway shipping.

Highway needs

Several layers of needs (shown to the right) were examined as part of the highway improvement needs analysis conducted for the Plan. Each layer involved using various Iowa DOT plans and tools to analyze different types of needs from a systemwide perspective. Most layers identified needs at the corridor level, with only freight and bridge improvement needs being identified for specific locations.

This analysis was conducted to build a comprehensive understanding of various types of needs across the Primary Highway System. While specific locations have been identified for each layer of analysis, this process does not define the types of treatments to be implemented or identify specific projects or alternatives. It also does not mean that needs identified here will subsequently become funded projects, as additional factors help determine when and how a project proceeds. However, this analysis does help provide a corridor level perspective that will be an important consideration as individual projects are developed, and will help ensure identified needs are taken into account during the project scoping process.

Statewide capacity analysis

Capacity needs at the statewide level were evaluated based on current conditions and anticipated future traffic. For both timeframes, a volume-to-capacity (V/C) ratio was used, which estimates how much capacity remains on a roadway based on how much traffic it carries and how much traffic it could carry. A roadway's capacity varies based on factors such as the number of lanes, classification of the roadway, number and frequency of accesses, and surrounding land use. The V/C ratio is an indicator of highway capacity sufficiency, where it is estimated that a facility is congesting as V/C approaches a value of 1.0. Values above 0.7 were considered to be approaching capacity, and values greater than 1.0 were considered over capacity.

Current V/C conditions were derived from the Infrastructure Condition Evaluation (ICE) tool. The ICE tool combines seven traffic and condition criteria to develop a composite score for each segment of the Primary Highway System. One of those seven elements is a congestion index based on the V/C ratio. The traffic volume data used within the ratio was based on observed and estimated traffic count information from the year 2014.

Overall, the analysis showed there are some primary highway segments with V/C ratios above 0.7, most of which are located in urban areas. Of the primary highways examined, few congested areas were located outside of urban areas, and overall the higher V/C ratios among rural corridors are on interstates or within close proximity to urban areas. In addition to the prevalence of urban corridors, interurban commuter corridors such as I-35 from Des Moines to Ames and I-380 from Iowa City to Cedar Rapids showed higher than average V/C ratios. Also, much of I-80 east of Des Moines had a V/C ratio above 0.5.

Future V/C conditions were forecast with the Iowa Travel Analysis Model (iTRAM), which is a statewide travel demand model utilizing existing socioeconomic data (e.g., employment, households, population information) to estimate travel activity. The goal is to calibrate a base-year model so estimated traffic volumes match observed traffic count information. Once a travel demand model is calibrated to a reasonable level, the input socioeconomic data can be forecast for future years to estimate what the effect of future employment, household, and population growth would be on the transportation system, particularly the Primary Highway System in Iowa. The iTRAM model includes the future year 2040, and estimates traffic conditions for 2040 based on the location and amount of forecast employment, household, and population information. The trips generated by this activity are allocated to a highway network that includes the existing highway network plus projects currently programmed in the Iowa DOT Five-Year Program. This enables an analysis of what traffic would be like in 2040 if no additional improvements were made beyond those currently funded.

Similar to the ICE V/C analysis for current conditions, the iTRAM V/C analysis for future conditions shows that the majority of congestion is forecast to worsen in urban areas including Des Moines, Iowa City, Cedar Rapids, and Davenport, with more isolated congestion occurring in some of the state's other urban areas. The forecast year also shows I-80 as approaching, at, or over capacity from west of Des Moines to Iowa City, and entirely at or over capacity from Iowa City to Davenport. In addition to I-80 east of Des Moines, two interurban corridors are highlighted. I-35 from Des Moines to Ames is forecast to be approaching capacity. I-380 from Iowa City to Cedar Rapids is forecast to be at or over the capacity threshold. These results are consistent with the base-year analysis and show that interurban commuter corridors and urban corridors will continue to show higher congestion ratios than the rest of the primary system.

Overall, the results from both analyses were consistent in showing there is limited congestion on Iowa's primary network as a whole. For both current conditions in 2014 and forecast conditions in 2040, locations showing V/C ratios that are approaching or over capacity are primarily within urban areas or are key interurban interstate corridors. Output from this analysis was combined with a more detailed analysis of urban area congestion.

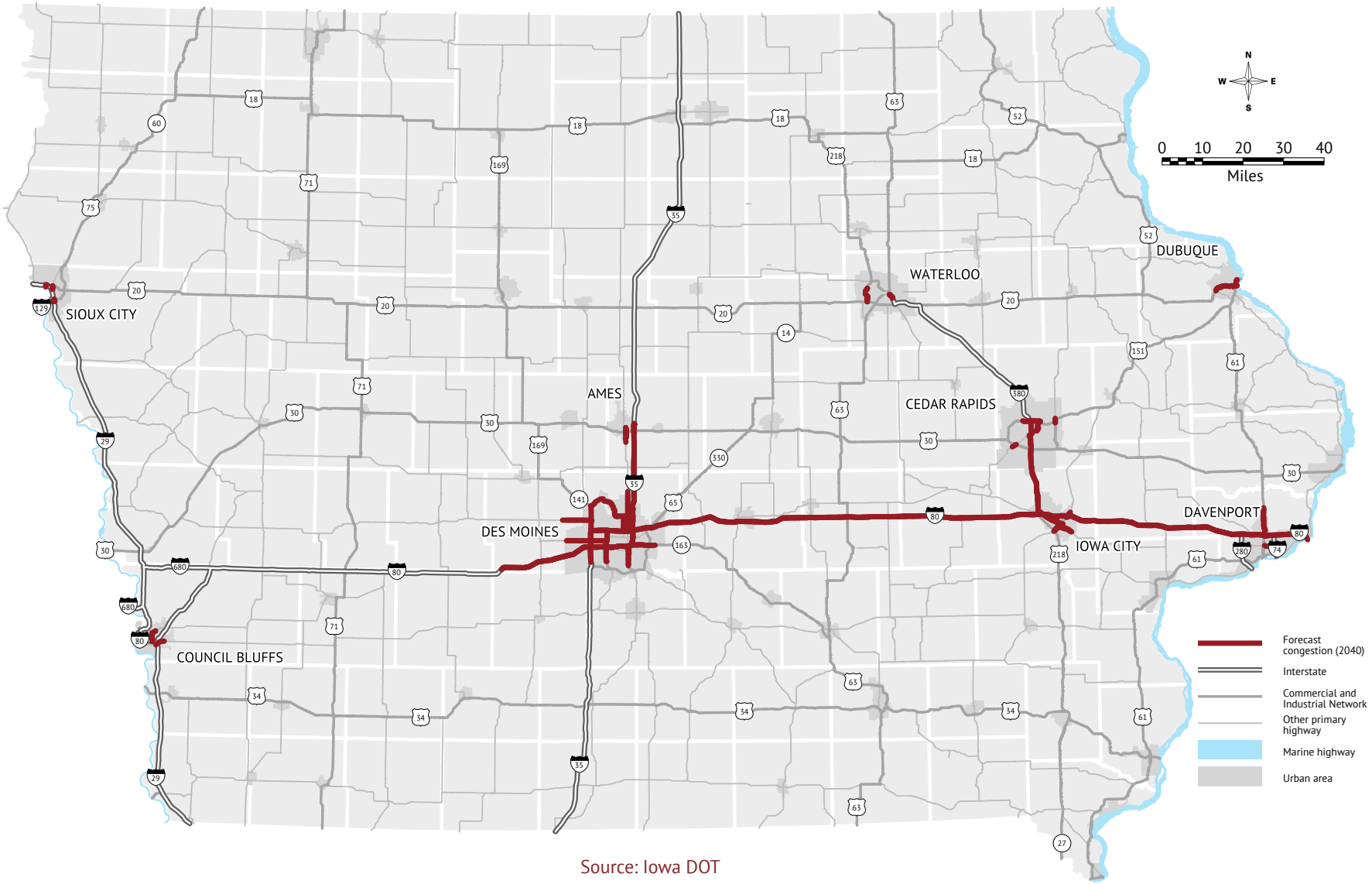
Urban capacity analysis

All of Iowa's MPOs have their own travel demand models. The models operate in a similar manner to iTRAM, but utilize more granular socioeconomic data and road networks for their metropolitan areas. MPOs also develop their own socioeconomic forecasts for their long-range plans, which may vary from the estimates developed from the statewide perspective of iTRAM. Thus, the nine MPO models were used to supplement iTRAM to analyze forecast congestion in urban areas in order to incorporate metropolitan socioeconomic forecasts and provide additional refinement to the V/C analysis for urban corridors.

The MPO models had variations in terms of base and forecast years, and in the nuances of how they were built. Thus, the analysis of urban capacity needs began by determining a standard analysis process to provide consistency across the nine MPO models and with the statewide analysis done previously. The future models used geographic highway networks that included projects currently programmed in the Iowa DOT Five-Year Program for primary routes, and each MPO's committed and planned projects included in their long-range transportation plan for nonprimary routes. This enabled review of needs on the primary system in urban areas if planned projects off the primary system are completed.

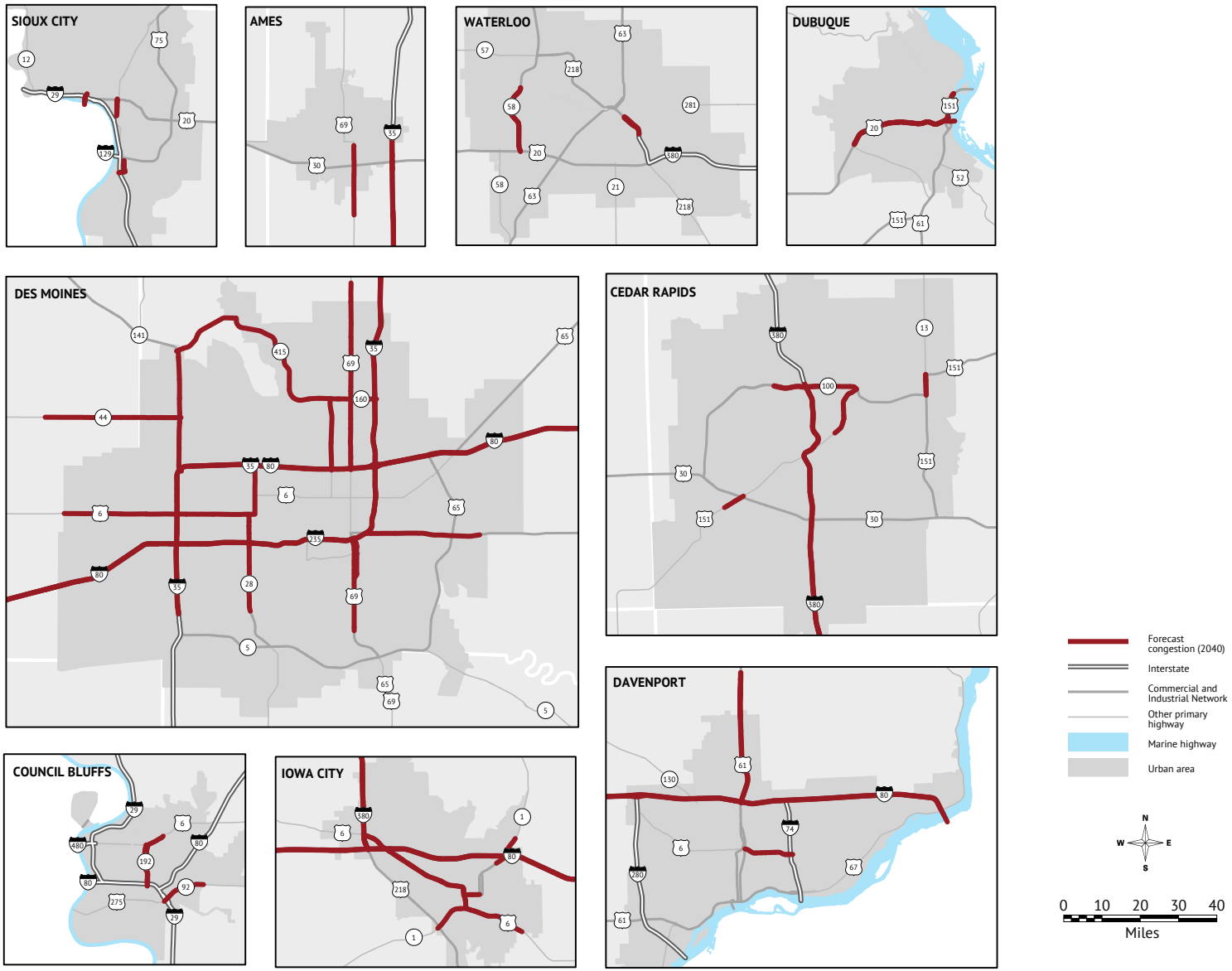
The V/C results for each urban area were reviewed to identify corridors where traffic volumes in 2040 were forecast to be approaching, at, or over capacity. Corridors where the year 2040 V/C was congesting or congested were delineated, with beginning and ending termini determined based on continuity of V/C concerns, major intersecting routes, and connectivity to other areas with V/C values over the defined thresholds. Spot locations, generally defined as areas less than 0.5 mile in length, were not included as corridors. Figures 5.9 and 5.10 show the urban corridors along with the interstate corridors identified through the statewide capacity analysis.

Figure 5.9: Statewide and urban corridors projected to be approaching or over capacity in 2040



Source: Iowa DOT

Figure 5.10: Urban insets, statewide and urban corridors projected to be approaching or over capacity in 2040



Source: Iowa DOT

Mobility and safety analysis

The objective of this layer of analysis was to provide a data-driven recommendation for mobility and safety improvements to Primary Highway System corridors. These improvements would enhance the operation of the network in particular corridors where capacity expansion needs were not identified, and would serve as a complimentary network to the state's multilane highway network.

The statewide and urban capacity analysis showed a lack of current and future capacity needs on the majority of the Primary Highway System. There were not current or forecast corridor-level capacity needs identified in rural areas outside of the three interstate corridors previously identified. However, there is a desire to continue to improve the statewide system's operation by addressing mobility and safety needs on the two-lane Primary Highway System. Over time, these enhanced corridors would effectively serve as a network of two-lane highways that provide improved statewide mobility and complement the existing and committed multilane network.

As part of the 1997 Iowa in Motion State Transportation Plan, the Iowa DOT introduced the idea of Super-2 style roadways with the basic goals of maximizing the benefits of two-lane roadways through improved roadway safety, capacity, and mobility, while reinforcing the growing importance of lowering construction and maintenance costs. Super-2 improvements serve as alternatives to four-lane capacity expansion projects and can aid in uninterrupted flow of traffic and the accommodation for slower traffic when necessary. Specific examples of Super-2 design elements include wider paved shoulders, limited access, geometric improvements, left- and right-turn lanes, acceleration lanes, and climbing/passing lanes. The improvements targeted through this analysis would be a more relaxed application of the Super-2 design, with the appropriate mix of elements being implemented on a corridor when work is being done for safety or condition improvements.

An analysis of two corridors where Super-2 style improvements were constructed during 2008-2011 showed significant safety benefits.

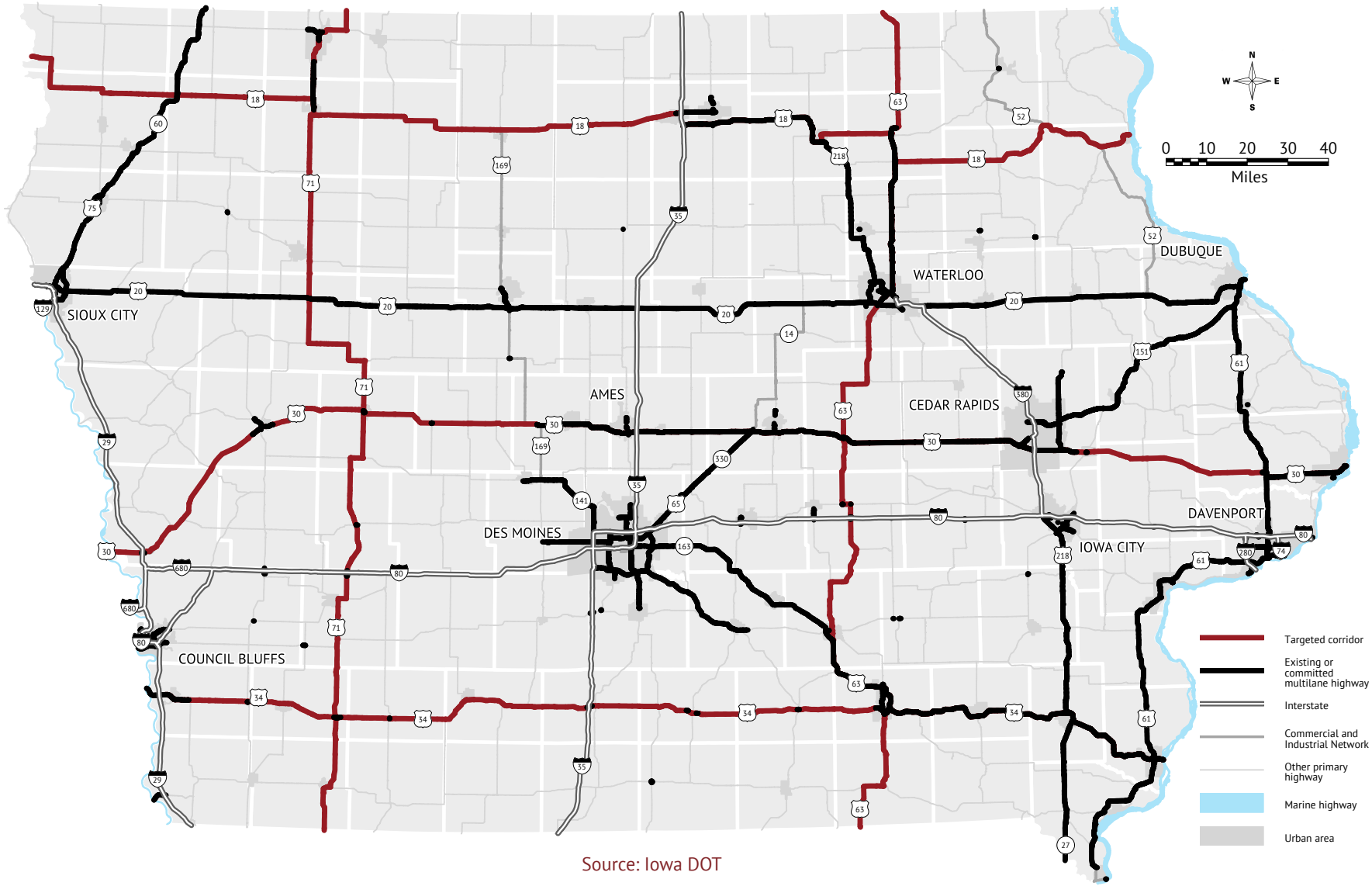
The types of improvements added include wider paved shoulders, the addition of turn lanes and passing lanes, and access and geometric modifications. The analysis reviewed crashes in the several years prior to construction and after construction. With animal crashes excluded, the analysis showed a 67 percent reduction in crashes on US 169 from Fort Dodge to Humboldt, and a 49 percent reduction in crashes on US 63 from Oskaloosa to New Sharon.

In order to analyze needs across the network and help target corridors for improvement, the following attributes were evaluated.

- Identification of existing climbing lanes/passing lanes
- Crash statistics from 2010-2014
- Roadway grade
- 2014 Annual Average Daily Traffic (AADT) and percent truck traffic
- Average trip length on corridors

Information from each of the five datasets was merged to form a database of potential candidate locations on the two-lane highway network. Initially, the data was evaluated to see if a rough network would emerge from the combined datasets. However, the data distribution lacked obvious patterns or consistency on a statewide level, which necessitated further filtering. The filtering process emphasized statewide connectivity and geographic access, while considering existing network designations. This led to a proposed network of corridor-level mobility and safety improvements. Over time, these corridors would effectively serve as an enhanced network of two-lane highways providing improved statewide mobility and complementing the existing and committed multilane network. Figure 5.11 shows the corridors targeted for mobility and safety improvements, which include US 18, 30, 34, 63, and 71.

Figure 5.11: Corridors targeted for mobility and safety improvements



Source: Iowa DOT

Freight analysis

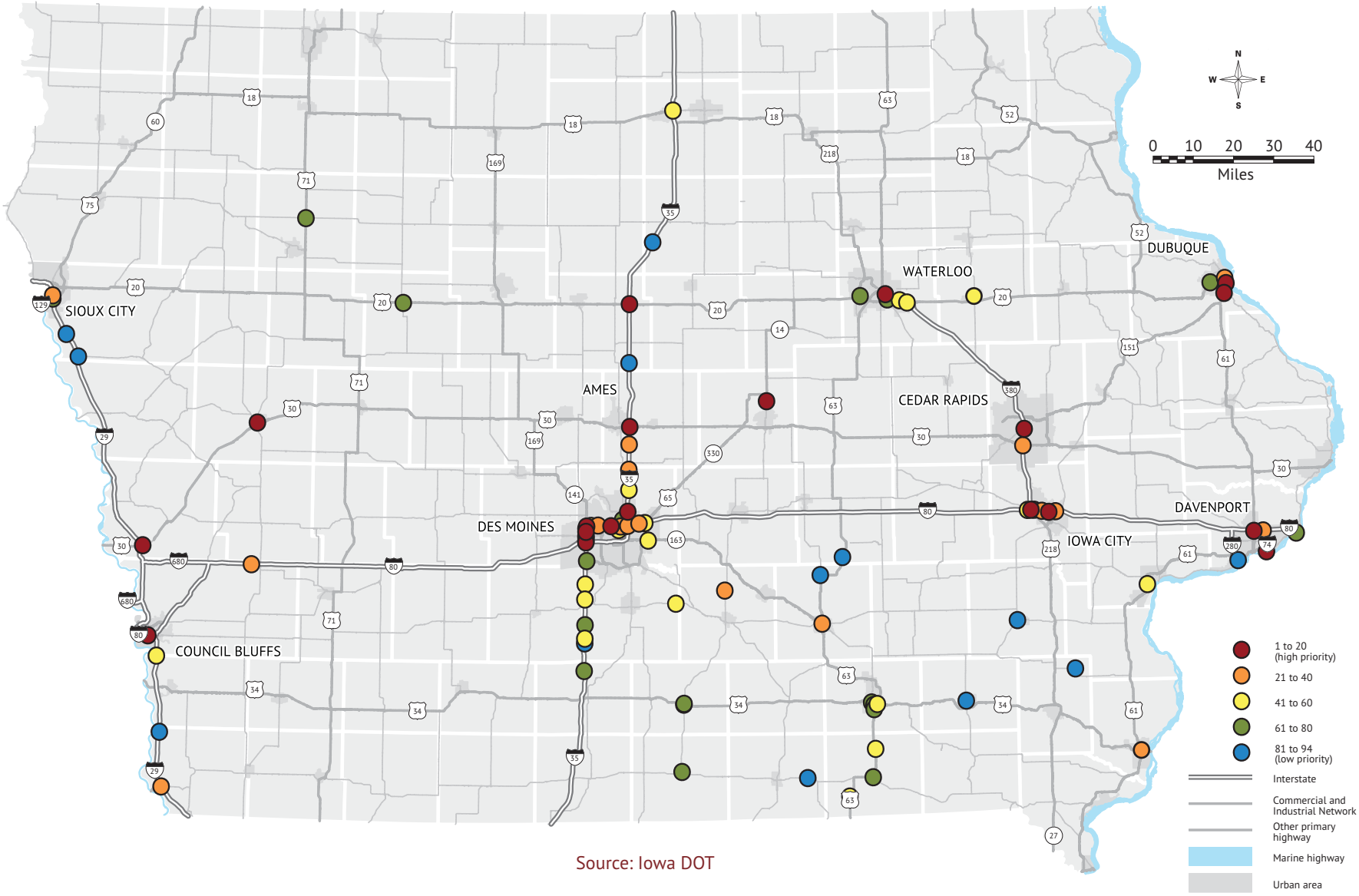
The Iowa State Freight Plan was finalized in 2016. The planning effort involved an analysis called VCAP, which stands for value, condition, and performance, to evaluate and prioritize freight bottlenecks on the Primary Highway System. This analysis and its results were incorporated into the highway analysis for this Plan. The results represent locations on the highway system where freight movement may be hindered and improvements to facilitate more efficient freight flow should be considered.

The VCAP analysis takes advantage of multiple tools available at the Iowa DOT and includes the following steps.

- A Freight Mobility Issues Survey populated the initial list of locations based on INRIX traffic data and input from the Freight Advisory Council, Iowa DOT districts, and planning agencies. The traffic data allowed the identification of highway segments that had recurring slowed speeds throughout the year and significant truck volumes. The input from stakeholders helped expand this list to include other locations of concern.
- iTRAM was used to provide a measure of value for each location based on how much it improves the efficiency of the statewide network. This value was provided by comparing how truck traffic typically moves on the roadway network to how truck traffic moves on the roadway network if each particular location cannot be used, and traffic has to reroute. A larger decrease in efficiency, measured by truck travel time across the network, means a higher value for the location.
- The ICE tool provided the condition measurement for each location based on ICE's composite rating of seven condition and traffic criteria. The ICE composite rating was based on a weighted average of the highway segments making up each location, with a poorer condition score meaning a higher ranking for the location.
- The INRIX bottleneck ranking tool provided the performance component of each location based on how often bottlenecks occur. Bottlenecks are flagged based on speeds being below a particular threshold for more than five minutes, with a higher number of bottlenecks meaning a higher ranking for the location.

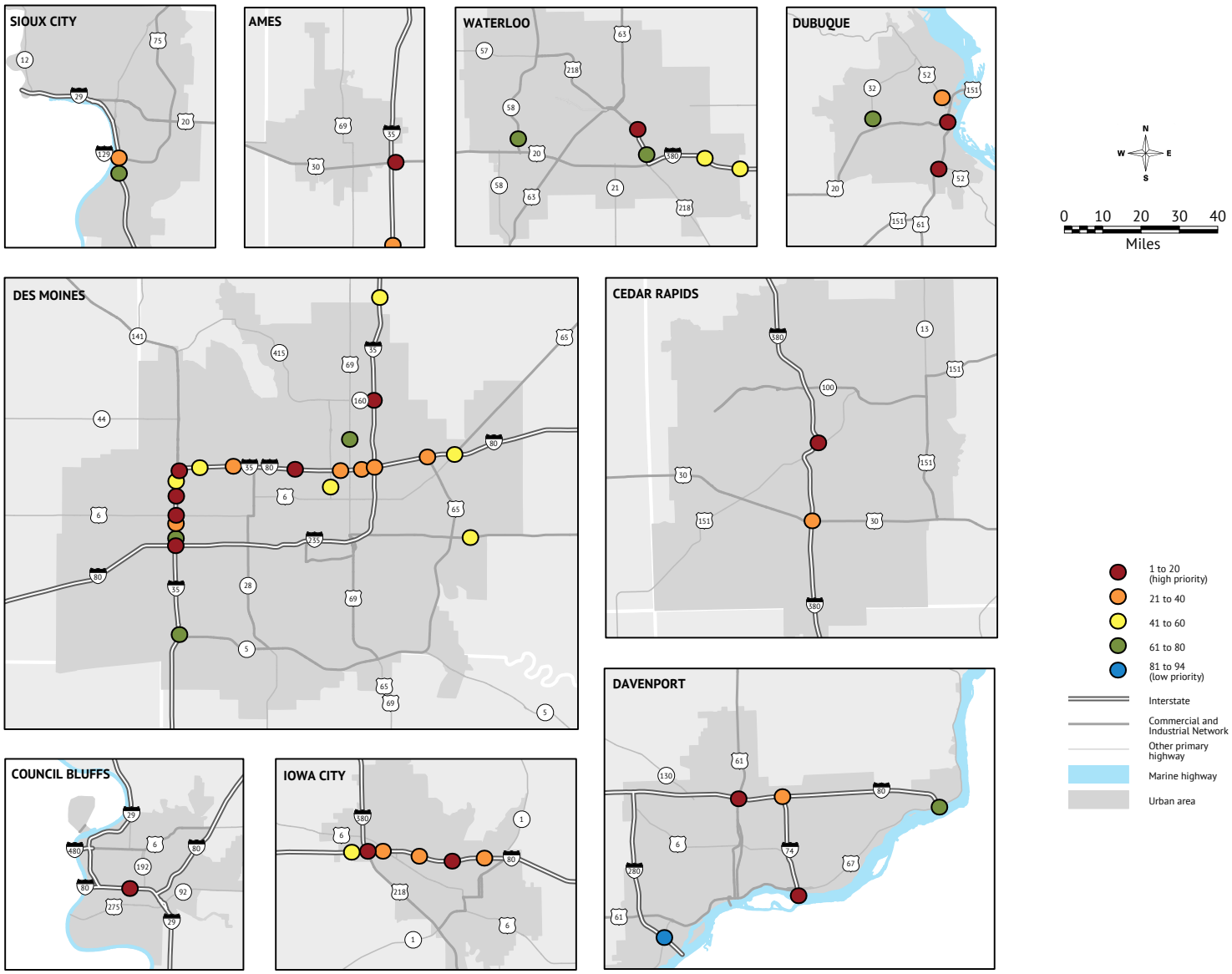
For each VCAP category, all candidate locations were ordered and ranked based on their values for that attribute. Then, the average of these three rankings was calculated and the candidate locations were assigned an overall priority rank. If two locations had the same average ranking, the annual average daily truck traffic (AADTT) at the locations was used as a tiebreaker. Figures 5.12 and 5.13 show the location and priority ranking of freight bottleneck locations.

Figure 5.12: Freight bottleneck locations on the Primary Highway System



Source: Iowa DOT

Figure 5.13: Urban insets, freight bottleneck locations on the Primary Highway System



Source: Iowa DOT

Condition analysis

The primary basis for the condition analysis was the Infrastructure Condition Evaluation (ICE) tool, which was developed to aid in the evaluation of the state's Primary Highway System by using a composite rating calculated from seven different criteria. The tool offers the ability to evaluate the overall structural and service condition of roadway segments with this single composite rating. The following criteria are used in the composite rating.

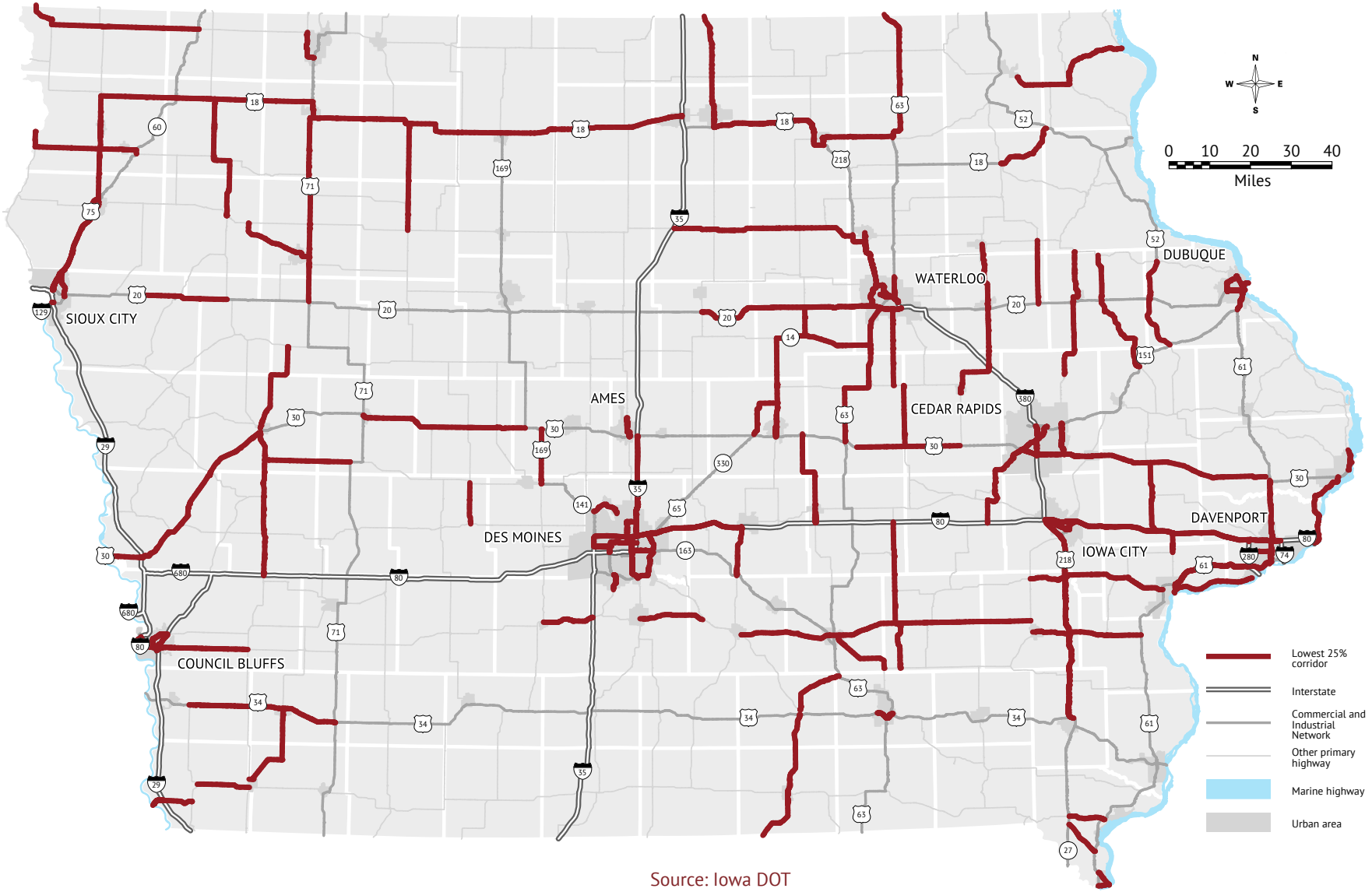
- Pavement Condition Index (PCI) rating (25 percent)
- International Roughness Index (IRI) value (15 percent)
- Structure Inventory and Appraisal (SIA) sufficiency rating (25 percent)
- AADT, combination truck count (15 percent)
- AADT, single-unit truck count (5 percent)
- AADT, passenger count (5 percent)
- Congestion Index value (10 percent)

The primary system is comprised of a total of 27,141 segments that were analyzed. For each segment, the value for each criterion was normalized. Then the seven normalized values were weighted by a formula and added together to determine a composite rating for the segment. The normalization and weighting values and process were determined by input from internal stakeholders during the development of the ICE tool.

To make analysis more manageable, the thousands of segments were aggregated into 464 analysis corridors, with termini based on major road crossings, geographic features, and incorporated boundaries. Each corridor was assigned a composite ICE rating based on a weighted average of the composite ratings for the individual segments within it. To identify a subset of corridors to represent condition improvement candidates in this Plan, the 464 corridors were sorted based on their overall composite rating. Corridors making up the lowest-rated 25 percent of the system by mileage were selected. This threshold was based on an assumed pavement design life of 20-40 years, depending on the surface material. Using 20 years as a conservative basis means approximately 5 percent of the system's surface would need to be improved in some fashion each year to keep up with deterioration. Since this Plan is updated every five years, applying this annual 5 percent figure to the five-year life of the Plan results in the 25 percent calculation.

Since condition information is aggregated, there may be corridors identified in the bottom 25 percent of the system that have segments in good condition within them, and vice versa. Identification of these corridors also does not mean they will automatically be targeted for improvement, as asset management strategies and other elements factor into when projects proceed. Figure 5.14 shows the bottom 25 percent of primary highway corridors based on the ICE analysis.

Figure 5.14: Bottom 25 percent of primary highway corridors based on ICE composite rating



Source: Iowa DOT

Operations analysis

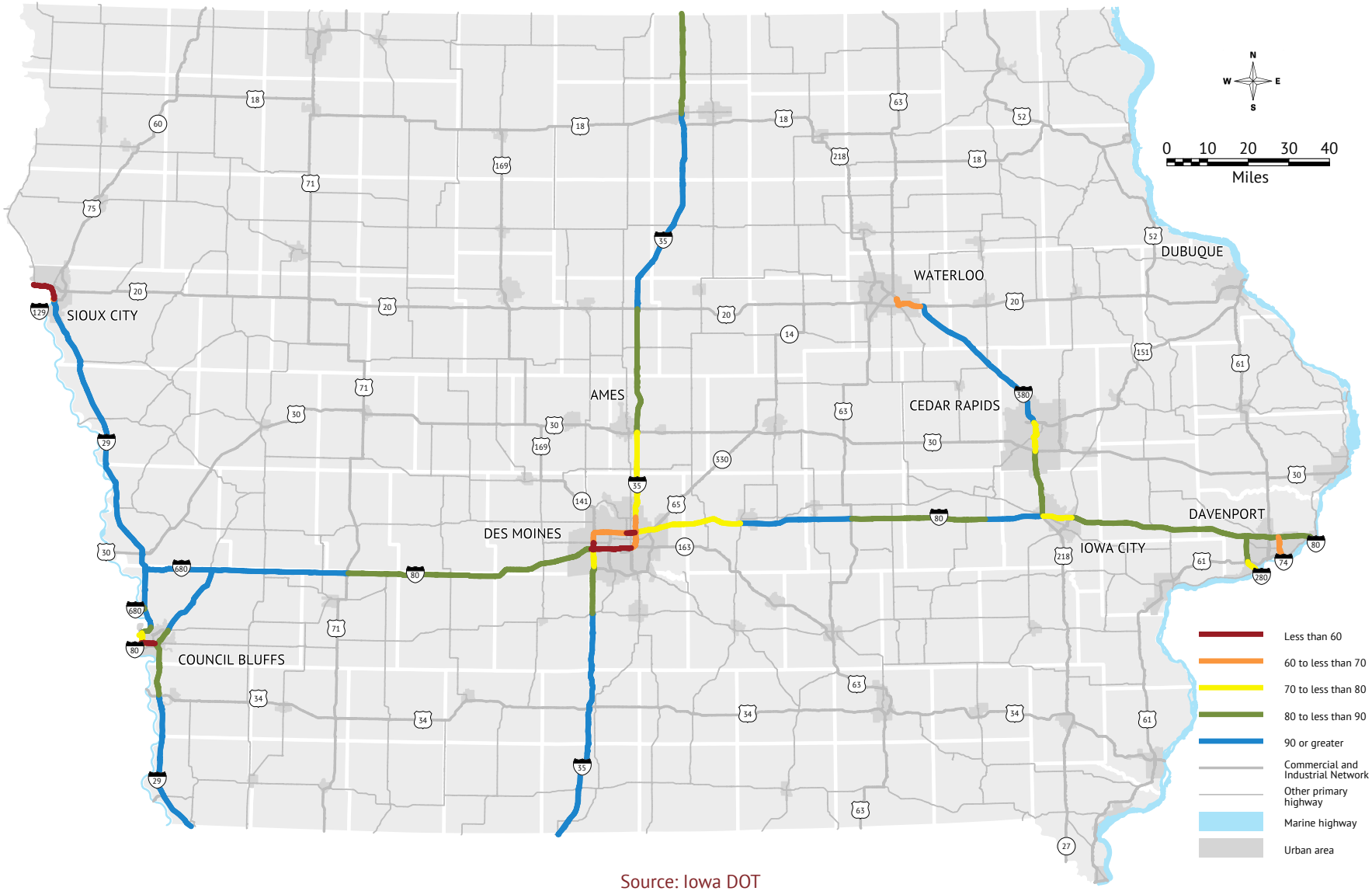
The operations analysis for the highway system was conducted for the interstate system, with the Infrastructure Condition Evaluation-Operations (ICE-OPS) tool used to evaluate and rank 54 interstate corridors from an operations perspective. Much of the data used in ICE-OPS is only reliable for the interstate system, and becomes less reliable or non-existent for much of the remainder of the primary system. Thus, operations for the noninterstate primary system are addressed at a programmatic rather than corridor level, and the action plan identifies several system-level transportation system management and operations (TSMO) strategies derived from the TSMO plan.

The ICE-OPS tool has a similar structure as the original ICE tool, but with an operations focus. It uses the following nine operations-oriented criteria to rank highway segments.

- All bottleneck occurrences per mile (10 percent)
- Freight bottleneck occurrences per mile (10 percent)
- Traffic incident frequency per mile (15 percent)
- Crash rate (15 percent)
- Reliability index (10 percent)
- Event center buffer index (5 percent)
- Weather-sensitive corridor mileage (10 percent)
- AADT (20 percent)
- ICE rating (5 percent)

Each element is assigned a normalized value (1-10 scale) based on the range of observed values, and a composite score is calculated after applying weighting to each normalized value. Overall, corridors ranking higher (lower scores) through this analysis are generally in metropolitan areas. The analysis helps identify corridors where strategies related to improving the operation of the system may be most beneficial. Figure 5.15 shows the results of the ICE-OPS analysis.

Figure 5.15: ICE-OPS composite ratings for the interstate system



Source: Iowa DOT

Bridge analysis

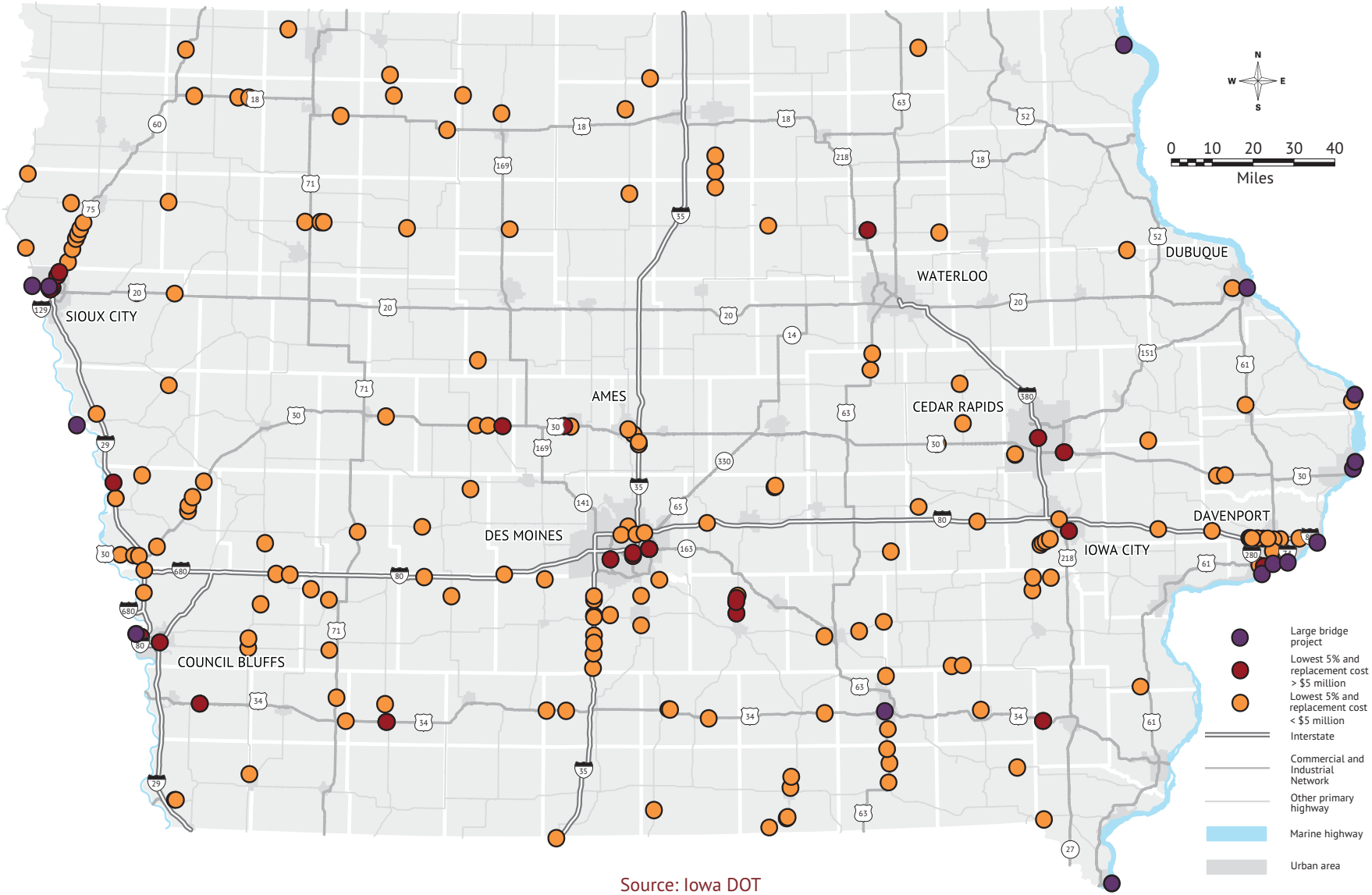
The bridge analysis and addressing bridge needs were approached in multiple ways. There are several major bridge projects that have been identified by the department as needing to occur over the next couple of decades. These projects, most of which are border river crossings, can be very expensive projects that require significant resources and coordination among states. These projects include the following.

- I-74 over the Mississippi River – replacement
- I-80 over the Mississippi River – replacement
- IA 9 over the Mississippi River – replacement
- US 67 over the Mississippi River – replacement
- I-280 over the Mississippi River – deck replacement
- I-129 over the Missouri River – deck overlay
- IA 12 Gordon Drive viaduct, Sioux City – replacement
- IA 175 over the Missouri River – replacement
- US 20 over the Mississippi River – replacement
- US 30 over the Mississippi River – replacement
- US 63 Ottumwa viaduct, Ottumwa – replacement

In addition to awareness of these significant bridge needs, a condition analysis was conducted for bridges, similar to the condition analysis completed for highway corridors. For this analysis, the bridge condition index for the 4,355 structures on the primary system was reviewed, and bridges making up the lowest-rated 5 percent of the system's bridges were selected. This threshold was based on an assumed bridge design life of 100 years, which would mean that approximately 1 percent of the system's bridges would need to be improved in some fashion each year to keep up with deterioration. Since this Plan is updated every five years, applying this annual 1 percent figure to the five-year life of the Plan results in the 5 percent calculation.

Within this set of lowest-ranking bridges, those that would cost more than $5 million to replace are also highlighted. Multiple projects of this magnitude can quickly use up the funding available for bridge replacements in a given year. Identification of these bridges does not mean they will automatically be targeted for improvement, as asset management strategies and other elements factor into when projects proceed. Figure 5.16 shows the major bridge projects listed above and the bottom 5 percent of bridges by condition across the system.

Figure 5.16: Major bridge needs and bottom five percent of bridges by condition



Source: Iowa DOT

Highway improvements matrix

In order to provide a comprehensive view of all analysis layers for the entire primary system, a highway improvements matrix was developed. Roadways are divided into interstate, US, and Iowa routes. Corridors are shown from west to east or south to north for each route. The corridor termini were based on the ICE corridors used in several analysis layers. Several items should be kept in mind when reviewing the matrix.

- Duplicate routes are represented once in the table. Generally, they are in the grouping for the highest route classification or in the lowest highway number if classifications are the same.
- Improvement needs are noted with solid red if they were identified for that corridor through the analysis discussed in this chapter.
- Some capacity improvement needs were confined to smaller termini than the corridor represented on the matrix. These locations include an asterisk, and mean that the capacity improvement need was not identified across the full-length of the corridor.
- The operations column only appears for interstates, and the number refers to that corridor's ranking out of 54 interstate corridors.
- The mobility and safety column only appears for the US route grouping, as the targeted corridors for this improvement need are all US routes. Current four-lane corridors are noted, as the mobility and safety improvements would be targeted toward two-lane portions of the route.
- In the bridge and freight columns, the numbers represent the ranking of the bridge improvement(s) (out of 216) and the freight improvement(s) (out of 94) within that corridor.
- Bridge numbers represent one structure. Numbers appearing in parentheses mean that the two structures are at the same location (e.g., the northbound and southbound lanes of an interstate).
- Corridors that did not have specific improvement needs identified for them through the analysis are targeted for stewardship.

Table 5.4: Highway improvements matrix, interstates

Route	Counties	Corridor	Capacity	Freight (out of 94)	Condition	Operations (out of 54)	Bridge (out of 216)
I-29	Fremont	MO border to IA 2		29		51	
	Fremont, Mills	IA 2 to US 34		94, 29		54	
	Mills, Pottawattamie	US 34 to I-80		54		37	
	Pottawattamie	I-80 to I-480/US 6				17	
	Pottawattamie	I-480/US 6 to IA 192				30	
	Pottawattamie	IA 192 to I-680		81		49	56
	Harrison, Monona	US 30 to IA 175				52	23, (104, 212),160
	Monona, Woodbury	IA 175 to US 20/I-129		38, 63, 92, 85		43	90
	Woodbury	US 20/I-129 to SD border		38		5	55
I-35	Decatur, Clarke	MO border to US 34				48	
	Clarke, Warren	US 34 to IA 92		80, 58, 83, 72		45	22, 117, 175, 182, 198
	Warren, Polk	IA 92 to IA 5		60, 57, 67		35	177, 186
	Polk	IA 5 to I-80/I-235		13, 70		15	
	Polk	I-80/I-235 to IA 160		10, 22		9	
	Polk, Story	IA 160 to US 30		17, 23, 25, 44, 10		17	(129, 140), 203
	Story, Hamilton	US 30 to US 20	*	8, 87, 17		27	
	Hamilton, Wright, Franklin	US 20 to IA 3		90, 8		39	
	Franklin, Cerro Gordo	IA 3 to US 18		51		53	
	Cerro Gordo, Worth	US 18 to MN border		51		35	
I-35/80	Polk	W mixmaster to US 6		13, 70, 35, 19		2	
	Polk	US 6 to IA 141		19, 9, 42, 4		13	
	Polk	IA 141 to IA 28		4, 53, 24		8	
	Polk	IA 28 to IA 415		18		11	42
	Polk	IA 415 to E mixmaster		33, 34, 22		6	178
I-74	Scott	IL border to I-80		30, 3		11	46, 50, 103, 148, 191

Table 5.4: Highway improvements matrix, interstates *(continued)*

Route	Counties	Corridor	Capacity	Freight (out of 94)	Condition	Operations (out of 54)	Bridge (out of 216)
I-80	Pottawattamie	NE border to E jct of I-29		1		4	
	Pottawattamie	I-29 to US 6				24	97
	Pottawattamie	US 6 to US 59		36		45	
	Pottawattamie, Cass	US 59 to US 6/US 71				47	77, 190
	Cass, Adair, Madison, Dallas	US 6/US 71 to US 169	*			31	113, 142
	Dallas, Polk	US 169 to W mixmaster		13		31	
	Polk, Jasper	E mixmaster to IA 14		22, 28, 43		16	84
	Jasper, Poweshiek	IA 14 to US 63				39	
	Poweshiek, Iowa	US 63 to US 151				31	91
	Iowa, Johnson	US 151 to I-380		48, 7		42	
	Johnson	I-380 to IA 1		7, 32, 27, 20, 26		22	170
	Johnson, Cedar	IA 1 to US 6				28	
	Cedar, Scott	US 6 to I-280				25	197
	Scott	I-280 to I-74		12, 30		25	76, 80, 95, 128, 153, 171
	Scott	I-74 to IL border		30, 62		34	86
I-129	Woodbury	NE border to I-29		38		7	192
I-235	Polk	W mixmaster to IA 28		13		3	
	Polk	IA 28 to US 69				1	
	Polk	US 69 to E mixmaster		22		10	
I-280	Scott	IL border to US 61/IA 146		82		21	215
	Scott	US 61/IA 146 to I-80				28	106
I-380	Johnson, Linn	I-80 to US 30		37, 7		23	
	Linn	US 30 to IA 100		5, 37		20	75
	Linn, Benton	IA 100 to IA 150				43	
	Benton, Buchanan, Black Hawk	IA 150 to US 20				49	
	Black Hawk	US 20 to end of route		14, 78, 61, 59, 52		14	
I-480	Pottawattamie	NE border to I-29				19	8, 163, 179
I-680	Pottawattamie	NE border to I-29				37	
	Pottawattamie	I-29 to I-80				39	

Source: Iowa DOT

Table 5.5: Highway improvements matrix, US routes

Route	Counties	Corridor	Capacity	Mobility and safety	Freight (out of 94)	Condition	Bridge (out of 216)
US 6	Pottawattamie	IA 192 to I-80	*				
	Pottawattamie	I-80 to US 59	Corridor targeted for stewardship				
	Pottawattamie, Cass	US 59 to US 71	Corridor targeted for stewardship				
	Dallas, Polk	US 169 to I-35/80	*		19		
	Polk	I-35/80 to IA 28			19		
	Polk	IA 28 to US 69					
	Polk	US 69 to I-235					
	Polk	I-235 to I-80			43		
	Jasper, Poweshiek	I-80 to IA 146	Corridor targeted for stewardship				
	Poweshiek, Iowa	IA 146 to US 151					87
	Iowa, Johnson	US 151 to IA 965	*		32		
	Johnson	IA 965 to IA 1					
	Johnson, Muscatine	IA 1 to IA 70	*				187
	Muscatine	IA 70 to IA 38	Corridor targeted for stewardship				
	Muscatine, Cedar	IA 38 to I-80					
	Scott	I-280 to IA 461					
	Scott	IA 461 to I-74					
US 18	Lyon, Sioux	SD border to US 75					
	Sioux, O'Brien	US 75 to IA 60					
	O'Brien, Clay	IA 60 to US 71					7, 13, 169
	Clay, Palo Alto, Kossuth	US 71 to US 169					48, 199
	Kossuth, Hancock, Cerro Gordo	US 169 to I-35			51		
	Cerro Gordo	I-35 to US 65		current 4-lane corridor			
	Cerro Gordo, Floyd	US 65 to US 218		current 4-lane corridor			
	Floyd, Chickasaw	IA 14 to US 63					
	Chickasaw, Fayette	US 63 to IA 150					
	Fayette, Clayton, Allamakee	IA 150 to US 52					
	Allamakee, Clayton	US 52 to IA 76					

Table 5.5: Highway improvements matrix, US routes *(continued)*

Route	Counties	Corridor	Capacity	Mobility and safety	Freight (out of 94)	Condition	Bridge (out of 216)
US 20	Woodbury	I-29 to US 75			38		
	Woodbury	US 75 to IA 140	Corridor targeted for stewardship				
	Woodbury, Ida	IA 140 to US 59					16, 141
	Ida, Sac	US 59 to US 71	Corridor targeted for stewardship				
	Sac, Calhoun, Webster	US 71 to US 169			75		
	Webster, Hamilton	US 169 to I-35			8		
	Hamilton, Hardin	I-35 to US 65			8		
	Hardin, Grundy	US 65 to IA 14					
	Grundy, Black Hawk	IA 14 to IA 27					
	Black Hawk	IA 27 to US 218			61		
	Black Hawk, Buchanan	I-380 to IA 150	Corridor targeted for stewardship				
	Buchanan, Delaware	IA 150 to IA 13	Corridor targeted for stewardship				
	Delaware, Dubuque	IA 13 to IA 136	Corridor targeted for stewardship				
	Dubuque	IA 136 to IA 32	*				
	Dubuque	IA 32 to IL border			15		19, 176
US 30	Harrison	NE border to I-29					36, 120, 200
	Harrison, Crawford	I-29 to US 59			6, 11		9, 15, 39, 144, 189
	Crawford, Carroll	US 59 to US 71			11		
	Carroll, Greene, Boone	US 71 to US 169					14, 66, 72, 119
	Boone	US 169 to IA 930		current 4-lane corridor			114, (154, 201)
	Boone, Story	IA 930 to I-35		current 4-lane corridor	17		(139, 180)
	Story, Marshall	I-35 to IA 14		current 4-lane corridor	17		
	Marshall, Tama	IA 14 to 3.3 mi E of US 63		current 4-lane corridor			
	Tama, Benton	3.3 mi E of US 63 to US 218		committed 4-lane corridor			29
	Benton, Linn	US 218 to IA 922		current 4-lane corridor			
	Linn	IA 922 to I-380		current 4-lane corridor	37		
	Linn	I-380 to 2.4 mi W of IA 1		current 4-lane corridor	37		136
	Linn, Cedar, Clinton	2.4 mi W of IA 1 to US 61					27, 118
	Clinton	US 61 to IL border		current 4-lane corridor			30

Table 5.5: Highway improvements matrix, US routes *(continued)*

Route	Counties	Corridor	Capacity	Mobility and safety	Freight (out of 94)	Condition	Bridge (out of 216)
US 34	Mills	NE border to I-29		current 4-lane corridor			
	Mills	I-29 to 0.8 mi W of US 275		current 4-lane corridor			
	Mills	0.8 mi W of US 275 to US 59					17
	Mills, Montgomery	US 59 to US 71					
	Montgomery, Adams, Union	US 71 to IA 25					126, 208
	Union, Clarke	IA 25 to I-35					172, 173
	Clarke, Lucas	I-35 to US 65					
	Lucas, Monroe	US 65 to IA 5			79		21, 78, 145
	Monroe, Wapello	IA 5 to Ottumwa W CL					121
	Wapello	Ottumwa W CL to US 63		current 4-lane corridor	71, 66, 55		
	Wapello, Jefferson	US 63 to IA 1		current 4-lane corridor			
	Jefferson, Henry	IA 1 to US 218		current 4-lane corridor			74
	Henry, Des Moines	US 218 to US 61		current 4-lane corridor	21		
	Des Moines	US 61 to IL border		current 4-lane corridor	21		
US 52	Jackson, Dubuque	IL border to US 20					3, 20
	Dubuque	US 151 to US 20			2		
	Dubuque	IA 32 to IA 3/IA 136		Corridor targeted for stewardship			
	Dubuque, Clayton	IA 3/IA 136 to US 18		Corridor targeted for stewardship			
	Allamakee, Winneshiek	US 18 to IA 9		Corridor targeted for stewardship			
	Winneshiek	IA 9 to MN border		Corridor targeted for stewardship			
US 59	Fremont, Page	MO border to IA 2		Corridor targeted for stewardship			
	Fremont, Page, Mills	IA 2 to US 34					47
	Mills, Pottawattamie	US 34 to I-80					125, 184, 213
	Pottawattamie, Shelby, Crawford	I-80 to US 30			11		130
	Crawford, Ida	US 30 to US 20			11		
	Ida, Cherokee	US 20 to IA 3		Corridor targeted for stewardship			
	Cherokee, O'Brien	IA 3 to US 18					
	O'Brien, Osceola	US 18 to MN border		Corridor targeted for stewardship			

Table 5.5: Highway improvements matrix, US routes *(continued)*

Route	Counties	Corridor	Capacity	Mobility and safety	Freight (out of 94)	Condition	Bridge (out of 216)
US 61	Lee	MO border to US 218	Corridor targeted for stewardship				
	Lee	US 218 to IA 2	Corridor targeted for stewardship				
	Lee, Des Moines	IA 2 to Burlington N CL			21		
	Des Moines, Louisa	Burlington N CL to IA 92	Corridor targeted for stewardship				
	Louisa, Muscatine	IA 92 to IA 38			49		
	Muscatine, Scott	IA 38 to I-280					
	Scott, Clinton	I-80 to US 30	*		12		
	Clinton, Jackson	US 30 to IA 64	Corridor targeted for stewardship				
	Jackson, Dubuque	IA 64 to US 151					205
	Dubuque	US 20 to WI border	*				
US 63	Davis, Wapello	MO border to US 34			66, 69, 46, 64, 47		33, 34, 68, 174
	Wapello	US 34 to IA 149		current 4-lane corridor			
	Wapello, Mahaska	IA 149 to IA 92		current 4-lane corridor	31		
	Mahaska, Poweshiek	IA 92 to I-80			88, 91, 31		
	Poweshiek, Tama	I-80 to US 30					
	Tama, Black Hawk	US 30 to US 20					67, 71
	Black Hawk	US 20 to US 218		current 4-lane corridor			
	Black Hawk	US 218 to Waterloo N CL		current 4-lane corridor			
	Black Hawk, Bremer	Waterloo N CL to IA 3		current 4-lane corridor			
	Bremer, Chickasaw	IA 3 to US 18		current 4-lane corridor			
	Chickasaw, Howard	US 18 to MN border					
US 65	Wayne, Lucas	MO border to US 34					194
	Lucas, Warren	US 34 to IA 92					167
	Warren	IA 92 to IA 5					155
	Warren, Polk	IA 5 to IA 163					
	Polk	IA 163 to I-80			28		
	Polk, Jasper	I-80 to IA 330			43		
	Jasper, Story	IA 330 to US 30	Corridor targeted for stewardship				
	Story, Hardin	US 30 to US 20	Corridor targeted for stewardship				
	Hardin, Franklin	US 20 to IA 3	Corridor targeted for stewardship				
	Franklin, Cerro Gordo	IA 3 to US 18					101, 107, 122
	Cerro Gordo	US 18 to Mason City N CL					
	Cerro Gordo, Worth	Mason City N CL to MN border					

Table 5.5: Highway improvements matrix, US routes *(continued)*

Route	Counties	Corridor	Capacity	Mobility and safety	Freight (out of 94)	Condition	Bridge (out of 216)
US 67	Scott	US 61 to I-74			3		2, 214
	Scott	I-74 to I-80			3, 62		
	Scott, Clinton	I-80 to US 30			62		
	Clinton	US 30 to Clinton N CL					
	Clinton, Jackson	Clinton N CL to US 52	Corridor targeted for stewardship				
US 69	Decatur, Clarke	MO border to US 34					161
	Clarke, Warren	US 34 to US 65	Corridor targeted for stewardship				
	Warren, Polk	IA 5 to I-235	*				52, 166
	Polk	I-235 to I-35/80					
	Polk	I-35/80 to Ankeny N CL			68		
	Polk, Story	Ankeny N CL to US 30	*				
	Story	US 30 to Ames N CL	*				159
	Story, Hamilton	Ames N CL to US 20	Corridor targeted for stewardship				
	Hamilton, Wright	US 20 to IA 3	Corridor targeted for stewardship				
	Wright, Hancock	IA 3 to US 18					210
	Hancock, Winnebago, Worth	US 18 to MN border					195
US 71	Page, Montgomery	MO border to US 34					
	Montgomery, Cass	US 34 to I-80					70
	Cass, Audubon, Carroll	I-80 to US 30					111
	Carroll, Sac	US 30 to US 20					
	Sac, Buena Vista	US 20 to IA 3					
	Buena Vista, Clay	IA 3 to US 18			65		
	Clay, Dickinson	US 18 to IA 86		current 4-lane corridor			
	Dickinson	IA 86 to MN border					
US 75	Woodbury, Plymouth	US 20 to IA 60					44, 54, 110, 116, 162, 188
	Plymouth, Sioux	IA 60 to US 18					
	Sioux, Lyon	US 18 to MN border	Corridor targeted for stewardship				
US 77	Woodbury	NE border to I-29					
US 136	Lee	US 61 to IL border					147
US 151	Iowa, Benton, Linn	I-80 to US 30	*				57, 135
	Linn	US 30 to IA 13	*				
	Linn, Jones, Dubuque	IA 13 to US 61	Corridor targeted for stewardship				

Table 5.5: Highway improvements matrix, US routes *(continued)*

Route	Counties	Corridor	Capacity	Mobility and safety	Freight (out of 94)	Condition	Bridge (out of 216)
	Ringgold, Union	MO border to US 34	Corridor targeted for stewardship				
	Union, Madison	US 34 to IA 92	Corridor targeted for stewardship				
	Madison, Dallas	IA 92 to I-80					25
	Dallas	I-80 to IA 141	Corridor targeted for stewardship				
US 169	Dallas, Boone	IA 141 to US 30					
	Boone, Webster	US 30 to US 20	Corridor targeted for stewardship				
	Webster, Humboldt	US 20 to IA 3	Corridor targeted for stewardship				
	Humboldt, Kossuth	IA 3 to US 18	Corridor targeted for stewardship				
	Kossuth	US 18 to MN border					156
	Lee	US 61 to IA 27					
	Lee, Henry	IA 27 to US 34	Corridor targeted for stewardship				
	Henry, Washington	US 34 to IA 92					
	Washington, Johnson	IA 92 to IA 1					
	Johnson	IA 1 to I-80			7		
US 218	Benton	US 30 to IA 150					98
	Benton, Black Hawk	IA 150 to I-380			61		99
	Black Hawk	I-380 terminus to IA 27	*		14		
	Black Hawk, Bremer	IA 57 to IA 3					
	Bremer, Chickasaw, Floyd	IA 3 to US 18	Corridor targeted for stewardship				
	Floyd, Mitchell	US 18 to MN border	Corridor targeted for stewardship				
US 275	Fremont, Mills	MO border to US 34	Corridor targeted for stewardship				
	Pottawattamie	I-29 to NE border	Corridor targeted for stewardship				

Source: Iowa DOT

Table 5.6: Highway improvements matrix, Iowa routes

Route	Counties	Corridor	Capacity	Freight (out of 94)	Condition	Bridge (out of 216)
IA 1	Van Buren, Jefferson	IA 2 to US 34		Corridor targeted for stewardship		
	Jefferson, Keokuk, Washington	US 34 to IA 92		84		133
	Washington, Johnson	IA 92 to Iowa City S CL		89		49, 58, 88, 102, 196
	Johnson	Iowa City S CL to US 6				
	Johnson	US 6 to I-80	*			
	Johnson, Linn	I-80 to US 30	*			
	Linn, Jones	US 30 to US 151		Corridor targeted for stewardship		
IA 2	Fremont	NE border to I-29				
	Fremont	I-29 to US 59		29		138, 211
	Fremont, Page	US 59 to US 71		Corridor targeted for stewardship		
	Page, Taylor, Ringgold	US 71 to US 169		Corridor targeted for stewardship		
	Ringgold, Decatur	US 169 to I-35		Corridor targeted for stewardship		
	Decatur, Wayne	I-35 to US 65		Corridor targeted for stewardship		
	Wayne, Appanoose	US 65 to IA 5		Corridor targeted for stewardship		
	Appanoose, Davis	IA 5 to US 63		86		
	Davis, Van Buren, Lee	US 63 to US 218				35
	Lee	US 218 to US 61				
IA 3	Plymouth	NE border to US 75				149
	Plymouth, Cherokee	US 75 to US 59				181
	Cherokee, Buena Vista	US 59 to US 71		65		202
	Buena Vista, Pocahontas, Humboldt	US 71 to US 169		65		51, 89, 108
	Humboldt, Wright, Franklin	US 169 to I-35				82
	Franklin	I-35 to US 65				
	Franklin, Butler, Bremer	US 65 to US 218				209
	Bremer	US 218 to US 63				10
	Bremer, Fayette	US 63 to IA 150				124
	Fayette, Clayton, Delaware	IA 150 to IA 13		Corridor targeted for stewardship		
	Delaware, Dubuque	IA 13 to IA 136				157

Table 5.6: Highway improvements matrix, Iowa routes (*continued*)

Route	Counties	Corridor	Capacity	Freight (out of 94)	Condition	Bridge (out of 216)
IA 4	Guthrie	IA 44 to IA 141				143
	Guthrie, Greene	IA 141 to US 30		Corridor targeted for stewardship		
	Greene, Calhoun	US 30 to US 20		75		
	Calhoun, Pocahontas	US 20 to IA 3		75		
	Pocahontas, Palo Alto	IA 3 to US 18				
	Palo Alto, Emmet	US 18 to IA 9				53, 207
	Emmet	IA 9 to MN border		Corridor targeted for stewardship		
IA 5	Appanoose	MO border to IA 2				60, 63, 164
	Appanoose, Monroe	IA 2 to US 34				38, 193
	Monroe, Marion	US 34 to E jct of IA 92		Corridor targeted for stewardship		
	Marion	E jct of IA 92 to W jct of IA 92		Corridor targeted for stewardship		
	Marion, Warren, Polk	W jct of IA 92 to US 65				79
	Warren, Polk	US 65 to IA 28		Corridor targeted for stewardship		
	Polk	IA 28 to I-35		67		
IA 7	Cherokee, Buena Vista	IA 3 to US 71				
	Buena Vista, Pocahontas, Calhoun, Webster	US 71 to US 169		Corridor targeted for stewardship		
IA 8	Tama, Benton	US 63 to US 218		Corridor targeted for stewardship		
IA 9	Lyon, Osceola	SD border to IA 60				
	Osceola, Dickinson	IA 60 to US 71				109
	Dickinson, Emmet, Kossuth	US 71 to US 169		Corridor targeted for stewardship		
	Kossuth, Winnebago, Worth	US 169 to I-35				94
	Worth, Mitchell, Howard	I-35 to US 63		Corridor targeted for stewardship		
	Howard, Winneshiek	US 63 to Decorah E CL				45
	Winneshiek, Allamakee	Decorah E CL to IL border				
IA 10	Sioux	NE border to IA 60				
	Sioux, O'Brien, Clay	IA 60 to US 71		Corridor targeted for stewardship		
	Buena Vista, Pocahontas	US 71 to IA 4		Corridor targeted for stewardship		
IA 12	Woodbury	US 20/US 75 to I-29				1
	Woodbury	I-29 to Sioux City N CL		Corridor targeted for stewardship		
	Plymouth, Sioux	Sioux City N CL to IA 10				132, 151

Table 5.6: Highway improvements matrix, Iowa routes (*continued*)

Route	Counties	Corridor	Capacity	Freight (out of 94)	Condition	Bridge (out of 216)
IA 13	Linn	US 151 to E16		Corridor targeted for stewardship		
	Linn, Delaware	E16 to US 20				
	Delaware	US 20 to IA 3				
	Clayton	IA 3 to US 52		Corridor targeted for stewardship		
IA 14	Wayne, Lucas	IA 2 to US 34		74		
	Lucas, Marion	US 34 to IA 5		77		
	Marion, Jasper	IA 5 to IA 163		39		43, 115, 123
	Jasper	IA 163 to I-80				
	Jasper, Marshall	US 6 to US 30				62, 81
	Marshall, Grundy	US 30 to US 20		16		
	Grundy, Butler	US 20 to IA 3		Corridor targeted for stewardship		
	Butler, Floyd	IA 3 to US 18		Corridor targeted for stewardship		
IA 15	Pocahontas, Humboldt, Kossuth	IA 3 to US 18		Corridor targeted for stewardship		
	Kossuth, Emmet	US 18 to MN border				137
IA 16	Lee	US 61 to US 218		Corridor targeted for stewardship		
	Lee, Van Buren, Davis, Wapello	US 218 to US 34				131
IA 17	Polk, Dallas, Boone	IA 141 to US 30		Corridor targeted for stewardship		
	Boone, Hamilton	US 30 to US 20		Corridor targeted for stewardship		
	Hamilton, Wright	US 20 to IA 3		Corridor targeted for stewardship		
	Wright, Hancock	IA 3 to US 18		Corridor targeted for stewardship		
IA 21	Keokuk	IA 78 to IA 92				
	Keokuk, Poweshiek	IA 92 to I-80				
	Poweshiek, Iowa, Benton	I-80 to US 30		Corridor targeted for stewardship		
	Benton, Tama, Black Hawk	US 30 to US 20				
IA 22	Keokuk, Washington	IA 21 to IA 1		Corridor targeted for stewardship		
	Washington	IA 1 to US 218				24, 152
	Washington, Johnson, Muscatine	US 218 to IA 70				
	Muscatine	IA 70 to US 61				
	Muscatine, Scott	IA 38 to Buffalo E CL				
	Scott	Buffalo E CL to US 61		82		
IA 23	Keokuk, Mahaska	IA 149 to IA 92				
IA 24	Chickasaw, Winneshiek	US 63 to US 52		Corridor targeted for stewardship		

Table 5.6: Highway improvements matrix, Iowa routes (*continued*)

Route	Counties	Corridor	Capacity	Freight (out of 94)	Condition	Bridge (out of 216)
IA 25	Ringgold, Union	IA 2 to US 34		Corridor targeted for stewardship		
	Union, Adair	US 34 to I-80				61
	Adair, Guthrie, Greene	I-80 to US 30		Corridor targeted for stewardship		
IA 26	Allamakee	IA 9 to MN border				18
IA 27	Lee	MO border to US 218		Corridor targeted for stewardship		
	Black Hawk	US 20 to US 218	*	76		
IA 28	Warren	IA 92 to Norwalk S CL		Corridor targeted for stewardship		
	Warren, Polk	Norwalk S CL to IA 5				
	Polk	IA 5 to I-235	*			69
	Polk	I-235 to US 6				
	Polk	US 6 to I-35/80				
IA 31	Woodbury	IA 141 to US 20		Corridor targeted for stewardship		
	Woodbury, Ida, Cherokee	US 20 to US 59		Corridor targeted for stewardship		
IA 37	Shelby, Harrison	US 59 to US 30		Corridor targeted for stewardship		
	Harrison, Crawford, Monona	US 30 to IA 175		Corridor targeted for stewardship		
IA 38	Muscatine	IL border to US 61				
	Muscatine	US 61 to US 6		Corridor targeted for stewardship		
	Cedar	I-80 to US 30				4
	Cedar, Jones	US 30 to US 151				206
	Jones, Delaware	US 151 to US 20				
	Delaware	US 20 to IA 3				
IA 39	Crawford, Sac	US 59 to IA 175				
IA 44	Harrison, Shelby	US 30 to US 59		Corridor targeted for stewardship		
	Shelby, Audubon	US 59 to US 71		Corridor targeted for stewardship		
	Audubon, Guthrie, Dallas	US 71 to US 169				11
	Dallas, Polk	US 169 to IA 141	*			
IA 48	Page, Montgomery	US 59 to US 34				
	Montgomery, Cass	US 34 to US 6		Corridor targeted for stewardship		
IA 51	Allamakee	US 18 to IA 9		Corridor targeted for stewardship		
IA 56	Fayette, Clayton	IA 150 to IA 13		Corridor targeted for stewardship		

Table 5.6: Highway improvements matrix, Iowa routes (*continued*)

Route	Counties	Corridor	Capacity	Freight (out of 94)	Condition	Bridge (out of 216)
IA 57	Hardin, Butler, Grundy, Black Hawk	US 65 to Cedar Falls W CL		Corridor targeted for stewardship		
	Black Hawk	Cedar Falls W CL to US 218		Corridor targeted for stewardship		
IA 58	Black Hawk	US 63 to US 20		Corridor targeted for stewardship		
IA 60	Plymouth, Sioux, O'Brien	US 75 to US 18		Corridor targeted for stewardship		
	O'Brien, Osceola	US 18 to MN border				204
IA 62	Jackson	IA 64 to US 52		Corridor targeted for stewardship		
IA 64	Jones, Jackson	US 151 to US 61		Corridor targeted for stewardship		
	Jackson	US 61 to US 67		Corridor targeted for stewardship		
IA 70	Louisa, Muscatine	IA 92 to IA 22		Corridor targeted for stewardship		
	Muscatine	IA 22 to US 6		Corridor targeted for stewardship		
IA 76	Clayton	W jct of US 18 to S jct of IA 9		Corridor targeted for stewardship		
	Clayton, Allamakee	N jct of IA 9 to MN border		Corridor targeted for stewardship		
IA 78	Keokuk	IA 149 to IA 1				28, 105
	Washington, Jefferson, Henry	IA 1 to US 218		Corridor targeted for stewardship		
	Henry, Louisa	US 218 to US 61		93		64
IA 81	Van Buren	MO border to IA 2		Corridor targeted for stewardship		
IA 83	Pottawattamie, Cass	US 59 to IA 148				112, 185
IA 85	Poweshiek	Montezuma E CL to IA 21				37
IA 86	Dickinson	US 71 to IA 9				
	Dickinson	IA 9 to MN border		Corridor targeted for stewardship		
IA 92	Pottawattamie	I-29 to US 59	*			
	Pottawattamie, Cass	US 59 to US 71				127
	Cass, Adair, Madison	US 71 to US 169		Corridor targeted for stewardship		
	Madison, Warren	US 169 to I-35				93
	Warren	I-35 to US 65				134
	Warren, Marion	US 65 to IA 5		45		
	Marion, Mahaska	IA 5 to US 63		31		146
	Mahaska, Keokuk, Washington	US 63 to IA 1		31		40, 65
	Washington	IA 1 to US 218				
	Washington, Louisa	US 218 to US 61				
IA 93	Bremer, Fayette	US 63 to IA 150		Corridor targeted for stewardship		

Table 5.6: Highway improvements matrix, Iowa routes (*continued*)

Route	Counties	Corridor	Capacity	Freight (out of 94)	Condition	Bridge (out of 216)
IA 96	Marshall, Tama	IA 14 to US 63		Corridor targeted for stewardship		
IA 100	Linn	1.4 mi W of I-380 to I-380				
	Linn	I-380 to US 151	*			
IA 110	Sac, Buena Vista	US 20 to IA 7		Corridor targeted for stewardship		
IA 116	Bremer	US 218 to IA 3				
IA 117	Jasper	IA 163 to I-80		Corridor targeted for stewardship		
	Jasper	I-80 to US 65				158
IA 122	Cerro Gordo	I-35 to Mason City W CL		51		
	Cerro Gordo	Mason City W CL to Mason City E CL		Corridor targeted for stewardship		
IA 127	Harrison	I-29 to US 30		Corridor targeted for stewardship		
IA 128	Clayton	IA 13 to US 52		Corridor targeted for stewardship		
IA 130	Cedar, Scott	IA 38 to I-80				150
IA 136	Clinton	IL border to US 67				26
	Clinton	US 67 to US 61		Corridor targeted for stewardship		
	Clinton, Jones, Dubuque	US 61 to US 151		Corridor targeted for stewardship		
	Dubuque	US 151 to US 20				
	Dubuque	US 20 to US 52				
IA 137	Monroe, Wapello	IA 5 to US 63				
IA 139	Winneshiek	IA 9 to MN border		Corridor targeted for stewardship		
IA 140	Woodbury, Plymouth	US 20 to IA 3		Corridor targeted for stewardship		
IA 141	Woodbury, Monona, Crawford	I-29 to US 59		85		
	Crawford, Carroll	US 59 to US 71				
	Carroll, Guthrie	US 71 to IA 4		Corridor targeted for stewardship		
	Guthrie, Dallas	IA 4 to IA 144		Corridor targeted for stewardship		
	Dallas	IA 144 to US 169		Corridor targeted for stewardship		
	Dallas, Polk	US 169 to I-35/80	*	4		
IA 143	Cherokee, O'Brien	IA 3 to IA 10		Corridor targeted for stewardship		
IA 144	Dallas, Boone, Greene	IA 141 to US 30		Corridor targeted for stewardship		
	Greene, Webster	US 30 to IA 175		Corridor targeted for stewardship		

Table 5.6: Highway improvements matrix, Iowa routes (*continued*)

Route	Counties	Corridor	Capacity	Freight (out of 94)	Condition	Bridge (out of 216)
IA 146	Mahaska, Poweshiek	US 63 to I-80		91		
	Poweshiek, Tama, Marshall	I-80 to US 30				
IA 148	Taylor, Adams	MO border to US 34		Corridor targeted for stewardship		
	Adams, Cass	US 34 to I-80				96
IA 149	Wapello	US 34 to US 63		71		216
	Wapello, Keokuk	US 63 to IA 92				32
	Keokuk, Iowa	IA 92 to I-80		Corridor targeted for stewardship		
IA 150	Benton	US 218 to I-380				
	Benton, Buchanan	I-380 to US 20				
	Buchanan, Fayette	US 20 to IA 3		41		
	Fayette	IA 3 to US 18		Corridor targeted for stewardship		
	Fayette, Winneshiek	US 18 to US 52		Corridor targeted for stewardship		
IA 160	Polk	IA 415 to I-35		10		
IA 163	Polk	US 69 to US 65				59, 85
	Polk, Jasper	US 65 to IA 14	*	56		
	Marion, Mahaska	IA 14 to US 63		Corridor targeted for stewardship		
IA 173	Cass, Shelby, Audubon	IA 83 to IA 44		Corridor targeted for stewardship		
IA 175	Monona, Woodbury, Ida	NE border to US 59				5, 168
	Ida, Sac	US 59 to US 71		Corridor targeted for stewardship		
	Sac, Calhoun, Webster	US 71 to US 169				100
	Webster, Hamilton	US 169 to I-35		Corridor targeted for stewardship		
	Hamilton, Hardin, Grundy	I-35 to IA 14		Corridor targeted for stewardship		
	Grundy, Black Hawk	IA 14 to US 63				
IA 182	Lyon	US 18 to IA 9		Corridor targeted for stewardship		
IA 183	Harrison, Monona	IA 127 to IA 141				73
IA 187	Buchanan, Fayette	US 20 to IA 3				
	Fayette	IA 3 to IA 150		Corridor targeted for stewardship		
IA 188	Butler, Bremer	IA 3 to US 218		Corridor targeted for stewardship		
	Bremer	US 218 to US 63		Corridor targeted for stewardship		
IA 191	Pottawattamie, Harrison, Shelby	I-680 to IA 37		Corridor targeted for stewardship		

Table 5.6: Highway improvements matrix, Iowa routes (*continued*)

Route	Counties	Corridor	Capacity	Freight (out of 94)	Condition	Bridge (out of 216)
IA 192	Pottawattamie	I-80 to US 6				
IA 196	Sac	US 71 to US 20	Corridor targeted for stewardship			
IA 202	Davis, Appanoose	MO border to IA 2	Corridor targeted for stewardship			
IA 210	Dallas, Boone, Story	IA 141 to I-35	Corridor targeted for stewardship			
	Story	I-35 to US 65	Corridor targeted for stewardship			
IA 212	Iowa	IA 21 to US 6	Corridor targeted for stewardship			
IA 220	Iowa	US 6 to US 151	Corridor targeted for stewardship			
IA 224	Jasper	I-80 to IA 14	Corridor targeted for stewardship			
IA 281	Black Hawk, Buchanan	Waterloo E CL to IA 150	Corridor targeted for stewardship			
IA 316	Polk, Warren, Marion	Runnells E CL to IA 5	Corridor targeted for stewardship			
IA 330	Jasper, Story, Marshall	US 65 to US 30	Corridor targeted for stewardship			
	Marshall	US 30 to IA 14				
IA 346	Chickasaw	US 218 to US 63	Corridor targeted for stewardship			
IA 376	Woodbury	I-29 to IA 12	*	63		
	Woodbury	IA 12 to US 75				6, 92
IA 404	Plymouth	IA 3 to US 75				
IA 415	Polk	IA 141 to Ankeny W CL				
	Polk	Ankeny W CL to IA 160				
	Polk	IA 160 to I-35/80				12
	Polk	I-35/80 to US 6		50		
IA 461	Scott	I-280 to US 67				31, 41
	Scott	US 67 to US 6				(83, 183)
	Scott	US 6 to I-80		12		165
IA 922	Linn	US 30 to I-380				
	Linn	I-380 to IA 100				
IA 930	Boone	US 30 to 1.1 mi E of US 30	Corridor targeted for stewardship			
IA 946	Dubuque	US 52 to US 61	*	15		
IA 965	Johnson	US 6 to I-80	Corridor targeted for stewardship			

Source: Iowa DOT

Feasibility Studies – Linking Planning and the National Environmental Policy Act (NEPA)

In addition to the improvement needs identified for the highway system, another category of planning related to needs analysis is linking planning and NEPA through feasibility studies. This linkage enables environmental resource and regulatory agencies, as well as the general public, to become effective players in the transportation decision-making process. This process allows all parties the opportunity to the get involved in the early stages of planning to help shape transportation projects, and minimizes duplication of work in the planning and NEPA processes for the large projects.

During the environmental review process, known environmental constraints are identified and potential and known impacts are (to the extent practicable) quantified and avoided, minimized, or mitigated so that a project can proceed towards further development. Within this process, feasibility studies can be used to outline the environmental setting and define the vision, goals, and strategies for a study area. Analysis at this stage of planning can include a range of possible engineering solutions, traffic analysis, cost analysis, and a review of potential project-stopping issues within the human and natural environment.

Feasibility studies provide the benefit of allowing planning-level decisions to be made for a larger study area and subsequently adopted into the NEPA process for smaller projects within the study area as those needs arise. However, for these planning-level decisions to be used in the NEPA process, the planning study must include public input and (among other conditions) be approved or validated no more than five years prior to the date on which the information is adopted.

In order to maintain these planning-level decisions, the Iowa DOT intends to review and update/reaffirm active feasibility studies in conjunction with the state transportation plan update, which is on a five-year cycle. This section serves as documentation of active feasibility studies that have been vetted through this review process. In addition, this section enhances public transparency into the department's planning and environmental review processes.

Active feasibility studies include:

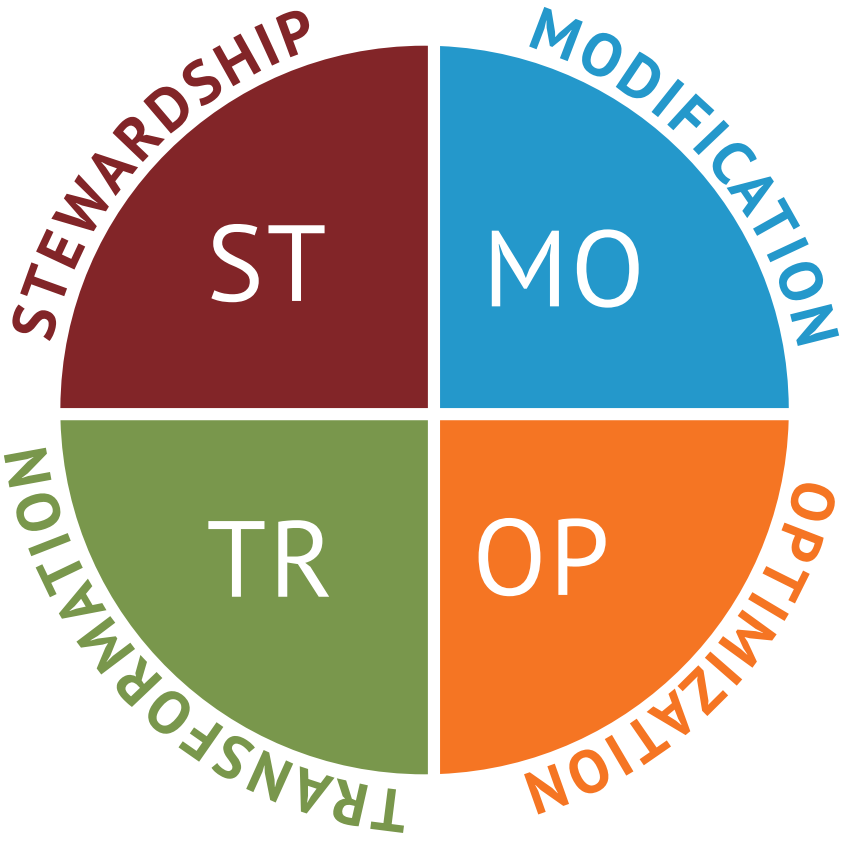
- I-80 – rural portions statewide
- I-380 – from south of Cedar Rapids to just north of the I-80/380 system interchange

Strategies

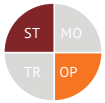
In order to achieve the vision for the transportation system, and address the improvement needs identified across the various modes and the highway system, the Iowa DOT will employ a wide range of strategies. The strategies listed in this section were derived from a variety of sources, including ongoing activities, existing plans, and stakeholder and public input. Strategies are presented by mode or topic area, and fall into the following categories.

- Asset management
- Aviation
- Bicycle/pedestrian
- Bridge
- Energy
- Freight
- Highway
- Public transit
- Rail
- Safety
- Technology
- Transportation system management and operation (TSMO)

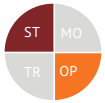
Each strategy maps back to one or more of the four investment areas (stewardship, modification, optimization, and transformation), and a graphic notes which area(s) the strategy falls under. The strategies consist of an action statement and an explanation of what the strategy entails or how it will be carried out. A summary table of all strategies is provided at the end of the chapter. These strategies will help guide future actions and financial investments across the system.



Asset Management

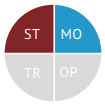


1. Develop an asset management governance structure to improve the effectiveness and transparency of the project selection process. Systematic delivery of sub-optimal pavement and bridge projects leads to deteriorating conditions and increases future costs. A governance structure that defines an effective process around the appropriate subject matter experts and state of the art management systems will improve project selection.

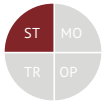


2. Improve the efficiency and accuracy of data collection and access to enhance data available for decision-making. This will be achieved by continuing to implement data collection enhancements, developing a plan for data and system coordination/integration, exploring opportunities for enhanced data analytics, and institutionalizing the asset management governance structure.

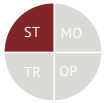
3. Adequately communicate the benefits of asset management to ensure the Iowa DOT's program is sufficiently funded and properly implemented. Communications will be enhanced through the development of a communications plan that defines the targeted audiences, message, and delivery mechanism. In addition, the department will continue efforts to educate the Commission about the topic, and consider developing an internal training plan.



4. Continue to advance targeted capacity improvement projects on key Interstate Highway System corridors. Delayed capacity improvement projects on the Interstate Highway System will further exacerbate overall condition deficiencies on this system. Associated corridor studies should identify how asset management and capacity improvement projects will be coordinated.

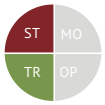


5. Ensure asset management and other program delivery functions can be properly implemented regardless of staffing constraints. The development of an asset management-staffing plan will address contingencies related to decreased staffing levels. Such contingencies could include reassigning existing staff and exploring contracting opportunities.



6. Monitor continued population shift toward the state's urban areas and associated implications for the level of funding available for statewide asset management activities. If Iowa's population continues to shift to urban areas, then additional capacity needs in these areas may arise creating additional investment demands. The highway system should be continually evaluated to identify rural assets that should be a priority if asset management funding were to decrease.

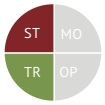
Aviation



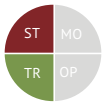
7. Maintain adequate accessibility to airports with an appropriate range of services. The Iowa aviation system ranges from grass strips to busy commercial service airports with multiple paved runways. Similarly, there are a wide variety of aviation system users who require an adequate level of facilities and services to meet their diverse needs. These needs include access to commercial airline service, current weather reporting, instrument approach procedures, access for agricultural aircraft, access for emergency medical service aircraft, cargo handling infrastructure, and many more. The Iowa DOT's Office of Aviation, in conjunction with the Federal Aviation Administration and Iowa's airport owners and operators, will continue to work to maintain a safe, efficient, and effective aviation system accessible to users. The Iowa Aviation System Plan, in addition to other studies and planning efforts, provides systems guidance to meet users' needs.

8. Encourage airport planning. Airports of all sizes are encouraged to undertake planning efforts to help improve airport operations. Planning efforts could include developing airport layout plans, airport master plans, business plans, strategic plans, and other planning initiatives. In addition to conducting its own ongoing statewide planning efforts, the Iowa DOT supports these and other planning efforts at airports of all levels.

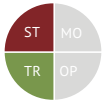
9. Promote the implementation of compatible land use guidelines near airports. Preservation of airports from the possible encroachment of incompatible land use is an important goal for protection of local, state, and federal investments. Incompatible land uses present a real and significant threat to airports today, causing concerns for public safety and potential conflicts between and within communities. The Iowa DOT developed the Iowa Airport Land Use Guidebook and encourages airports to implement comprehensive land use planning.



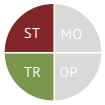
10. Maintain and enhance airside facilities. The runway, taxiway, and apron infrastructure of an airport is the connection between an airport and the rest of the air transportation system. Many airports were originally designed and constructed prior to the 1970s with modifications made as aircraft fleet mix, design standards, and local demand for air transportation have changed. These changes will only continue with new aircraft and new technologies being developed. The Iowa DOT works to stay at the forefront of airside needs at Iowa airports, and the Office of Aviation closely collaborates with interested stakeholders to ensure that the programs and services offered match future airside needs.



11. Maintain and enhance aviation vertical infrastructure needs. Airport terminal buildings and hangars are the gateway to many communities, and the first and last impressions for air travelers. Improvements to these costly assets are typically challenging to fund from federal and local sources. In addition to age, security changes, building systems, technology, heating, ventilation, and air conditioning system changes have caused many of the original structures at Iowa airports to become outdated and costly to operate.



12. Improve runway approaches through obstruction removal and mitigation funding. Clear approaches to an airport runway are essential for public use. Over time, natural and man-made obstructions can develop that severely impact the usability of a runway and ultimately the viability of the airport. In conjunction with sound land-use planning that limits obstructions in critical surrounding areas, airports should develop and implement obstruction management plans to routinely inspect and prevent or remove any approach penetrations. The Iowa DOT will continue to provide support of obstruction removal and prevention.



13. Maintain and enhance the statewide network of aviation weather observing systems. The Iowa DOT provides for 43 automated weather observing stations located strategically throughout the state that, in conjunction with the federal airport weather reporting stations, provide for a statewide network of accurate, timely, and reliable weather information for aircraft utilizing Iowa airports. The Iowa DOT will continue to provide ongoing maintenance to ensure reliability.

14. Promote and assist in active wildlife management at airports. Wildlife is a significant safety concern that exists at public-use airports. The airport environment is attractive to a variety of mammals and birds. Airport sponsors should take a proactive role to mitigate wildlife concerns to the extent possible. The Iowa DOT supports local airport efforts with a supplemental agreement with the U.S. Department of Agriculture's Wildlife Services to conduct spot mitigation as needed, as well as to assist in the development of wildlife mitigation plans for airports with mitigation needs.

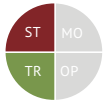
15. Evaluate implementation of new and emerging aviation technologies. New technologies continually transform the way the air transportation system operates. Web-based platforms, the implementation of the new NextGen satellite-based navigation system, and the significant growth of unmanned aircraft systems are some examples of new technologies that will continue to change the air transportation system in Iowa. These new technologies should continue to be closely monitored to ensure Iowa is realizing the full benefit to users of this system.

Bicycle and pedestrian

16. Complete a comprehensive bicycle and pedestrian plan for the state. The Iowa DOT is committed to expanding opportunities and improving conditions for bicycling and walking across the state. A bicycle and pedestrian plan would have, at a minimum, three key objectives, including improving policies and practices for development of this system; expanding the system and prioritizing the completion of segments of national and statewide significance; and facilitating implementation through encouraging enhanced design practices and directed funding.

17. Adopt and implement a complete streets policy that applies to all Iowa DOT projects. The Iowa DOT recognizes complete streets is a process, not a specific outcome, and is therefore sensitive to the context in which the project occurs. A complete streets policy to encourage consideration of all roadway users in project design should be adopted as part of a bicycle and pedestrian plan that applies to projects on Iowa DOT roadways. Iowa's MPOs, RPAs, counties, and municipalities that have not adopted their own policies would be encouraged to consider the Iowa DOT policy as a basis.

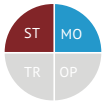
18. Increase the quality and consistency of the design of bicycle and pedestrian accommodations across the state. The Iowa DOT's Office of Design and Office of Bridges and Structures should modify the Iowa DOT's Design Manual and Bridge Design Manual to reflect national best practices regarding the design of bicycle and pedestrian accommodations in order to provide clear and thorough standards and guidance for Iowa DOT's districts' use. Best practice resources would include the American Association of State Highway Transportation Officials' (AASHTO) Guide for the Development of Bicycle Facilities and the National Association of City Transportation Officials' (NACTO) Urban Street Design Guide. The Iowa DOT's Paved Shoulder Policy and the Statewide Urban Design and Specifications (SUDAS) manual — the local equivalent of the Iowa DOT Design Manual — should also be updated to coordinate with the Iowa DOT's Design Manual.



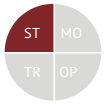
19. Consider same-source funding to build bicycle and pedestrian accommodations as part of road projects. In conjunction with a complete streets policy, the Iowa DOT should consider funding bicycle and pedestrian accommodations that are built as incidental parts of road projects from the same funding source as the rest of the road project. In addition, when Iowa DOT grant program funds are used to construct or reconstruct roads, opportunities for bicycle and pedestrian improvements should be considered and funded from the same source if accommodations are warranted and eligible.

20. Evaluate key safety challenges pertaining to bicycling and walking and develop crash reduction strategies. The development and implementation of Iowa's Strategic Highway Safety Plan (SHSP) is the state's primary method for identifying, quantifying, and developing countermeasures for safety problems on Iowa roads. In the past this document has not explicitly considered the safety of bicyclists, pedestrians, and other vulnerable users. With future updates, the SHSP should include an analysis of crashes involving such users, as well as strategies for reducing and ultimately eliminating these crashes.

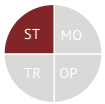
Bridge



21. Secure additional funding and develop more refined management systems to address the approaching wave of bridge replacement needs. Overall, state-owned bridges are in relatively good condition. However, a large number of bridges were constructed in the 1960s and 70s, which will be nearing the end of their service life. The average age of state-owned bridges is nearly 40 years, and a decade from now nearly half the state's bridges will be more than 50 years old. Additional resources must be secured in order to "flatten" the coming wave of bridge replacement needs and avoid compromising the Iowa DOT's ability to manage the system effectively.

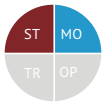


22. Consider creative financing as part of coordinated planning and programming efforts to address future large bridge projects. The Iowa DOT has targeted nearly a dozen large bridge projects, primarily border bridges, for replacement within the next 20 years. Most of these projects are estimated to cost well over $50 million. Along with these large projects, there are additional bridge replacement projects that are more than $5 million each, which are challenging from a program management perspective. Due to budget limitations, a few bridge projects of this magnitude can severely limit funding available for improvements on the overall highway system. To help address these projects, early multistate coordination is critical for border bridges, and other financing options, including targeting federal discretionary funds, should be considered.

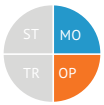


23. Target investment to address bridges with condition needs. Candidate condition improvement locations were identified primarily using the bridge condition index (BCI). The BCI is calculated for all bridges in the state's inventory, based on data collected for the National Bridge Inventory (NBI). For the purposes of this plan, the BCI was used to identify bridges that comprise the lowest-rated 5 percent of the system's structures. These locations, in conjunction with other bridge and asset management tools, will be used by the Iowa DOT to focus its consideration of condition improvements.

Energy

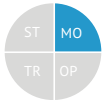


24. Support the safe rail transport of crude oil and biofuels. With the completion of the Iowa Crude Oil and Biofuels Rail Transportation Study, the Iowa DOT and other stakeholders should move forward with implementation of the action steps identified. Priority action steps include working with local emergency managers to better develop response plans, working with emergency response personnel to ensure adequate training, and reducing conflict points by eliminating redundant at-grade railroad-highway crossings.



25. Optimize the propane supply chain to better predict and proactively respond to propane shortages. The Iowa DOT and other stakeholders will implement the recommendations and action steps from the study Optimizing the Propane Supply Chain in the State of Iowa. Initial implementation activities will be addressed through a joint working group of state agencies and industry participants to encourage ongoing knowledge sharing and communication. Additional activities will include identifying solutions at bulk terminals to ease long wait times to fill transports, and encouraging users to fill storage during the summer prior to the heavy grain drying and heating seasons. Other activities include encouraging transport companies to run multiple driver shifts rather than extending hours of service, and implementing systemic monitoring and use of performance metrics that indicate the need for action.

26. Support the expanded use of alternative fuel vehicles in Iowa. The Iowa DOT will coordinate with the Iowa Economic Development Authority (IEDA) on a detailed plan for the development of alternative vehicle fueling corridors along interstate highways. This would enable alternative fuel vehicle owners, both residents and those traveling through Iowa, to charge/refuel their vehicles more quickly and facilitate longer distance travel. This strategy would relate to other efforts involving alternative fuel infrastructure incentives.

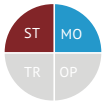


27. Explore incentives for alternative vehicle fueling infrastructure. Building upon the success of the Iowa Renewable Fuels Infrastructure Program, and recognizing the importance of alternative fuel vehicles to Iowa, the Iowa DOT should coordinate with the IEDA to investigate a financial incentive for businesses and individuals to offset a portion of equipment and installation costs for electric vehicle charging stations, compressed natural gas stations, and liquefied propane stations. The financial incentive could be in the form of a tax credit or a rebate.

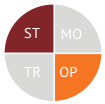
28. Optimize the passenger transportation system to provide more opportunities and improve mobility. The Iowa DOT will partner with other state agencies, public transit agencies, and stakeholders to identify and implement initiatives to provide passenger transportation options that reduce single-occupant vehicle travel. Ongoing and new initiatives will include making federal Congestion Mitigation and Air Quality Improvement Program (CMAQ) funds available for public transit; coordinating transportation services through the Iowa Transportation Coordination Council; operating a new web-based statewide rideshare program (iowarideshare.org); seeking opportunities to address commuting needs along heavily traveled corridors to reduce the need for highway investments and mitigate traffic challenges during construction; developing a new bicycle and pedestrian plan to support improved accommodations along the Primary Highway System; and establishing a task force to ensure Iowa is prepared for the shift in how passengers travel with the advent of connected and automated vehicles and new models for accessing transportation services.

Freight

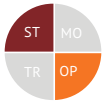
29. Target investment on the interstate system at a level that reflects the importance of this system for moving people and freight. Iowa's interstate system consists of 782 centerline miles and 271 miles of ramps, supporting nearly 8 billion vehicle-miles traveled (VMT) annually. While the interstate system comprises just eight percent of the length of Iowa's Primary Highway System, it carries 40 percent of total VMT and 62 percent of large truck VMT. Both the Iowa Interstate Corridor Plan and Iowa State Freight Plan emphasized the importance of the interstate system. In order to ensure that the interstate system can continue to support growing demand, future investment must be focused accordingly.



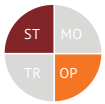
30. Advance a 21st century Farm-to-Market System that moves products seamlessly across road, rail, and water to global marketplaces. This Farm-to-Market System is currently comprised of approximately 30,500 miles that are part of a nearly 90,000-mile Secondary Road System, which is the result of the 1-mile by 1-mile sectioning of land in the state. Roads were created around these sections to provide access to farmland. The nature of this system was last evaluated through a 2002 effort by Iowa's Road Use Tax Fund Committee. Given the rapidly changing agricultural landscape and the diminishing buying power of existing transportation resources, the size of the Farm-to-Market System demands that this issue be re-examined with interested stakeholders.



31. Optimize the freight transportation network to minimize cost and travel time, improve supply chain efficiency, and reduce energy use. The vision of the department's report Development of Iowa Statewide Freight Transportation Network Optimization Strategy is to effectively identify and prioritize investment opportunities for an optimized freight transportation network to lower transportation costs for Iowa businesses and promote business growth in Iowa. To achieve this, the department must analyze network demand and capacity to identify constraints, design optimization strategies based on quantitative and qualitative analysis of costs and benefits, prioritize investment opportunities and develop short- and long-term financial models, and develop business cases to reduce transportation costs.

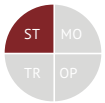


32. Continue to advance efforts on the M-35 Marine Highway Corridor. The states of Iowa, Illinois, Minnesota, Missouri, and Wisconsin have a vision of a modern, reliable, and cost-effective M-35 Marine Highway that connects seamlessly into the existing Midwest and national transportation networks, generates regional and national economic growth, and sustains the Mississippi River's multiple uses. The states are working on numerous initiatives, such as promoting the value of the river, advocating for infrastructure investments, facilitating regional dialogue, marketing current services, and seeking out new tools. These efforts will improve the economic competitiveness of the Midwest and nation, relieve landside congestion on highways and railroads, reduce air emissions, and increase the efficiency of other surface transportation modes.

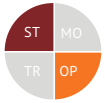


33. Promote freight movement on the M-29 Marine Highway Connector. The M-29 Marine Highway Connector is designated on the Missouri River from Kansas City, Mo. to Sioux City, Iowa. Although commodity movement is relatively low, the M-29 serves as a viable shipping alternative to other freight transportation modes and provides a valuable link to the rest of the marine highway system. The Iowa DOT will continue to work with stakeholders to make the M-29 a more reliable waterway and promote the corridor for freight movement. Much like the M-35, strengthening the M-29 will improve economic competitiveness of the region, relieve landside congestion on highways and railroads, reduce air emissions, and increase the efficiency of other surface transportation modes.

34. Leverage and disseminate real-time information on system conditions to support improved mobility. Iowa's transportation system is in demand 24/7, regardless of the weather or other factors affecting the condition of the system. Transportation information has become as important as the transportation infrastructure itself, which represents a shift in how state transportation departments view their core responsibilities. Providing real-time information on system conditions will become increasingly important, and such information should be made directly available to personal devices and vehicles. In addition, social media provides the opportunity for users to have a direct role in providing information regarding the transportation system, and state transportation departments should consider more actively absorbing and utilizing social media information in addition to more traditional sources.

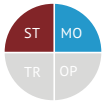


35. Provide measured, clear, nontechnical performance results for the transportation system. The Moving Ahead for Progress in the 21st Century (MAP-21) Act and the Fixing America's Surface Transportation (FAST) Act placed an increased emphasis on performance measurement, requiring the establishment of national performance measures for which states are to develop targets. While these national measures will help the Iowa DOT evaluate the effectiveness of transportation investments, there may be other measures that better communicate the performance of Iowa's transportation system to the public. For public communications, the department should develop performance measures that are both clear and nontechnical.



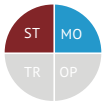
36. Streamline and align freight-related regulations and minimize unintended consequences. Since freight movements are often multistate in nature, there is a need for improved reciprocity between states regarding issues not standardized at the federal level. These include regulations related to items such as fuel, trips, vehicle registration, etc. Potential short-term changes could include streamlining the permitting process; providing easier access to information regarding Iowa's trucking regulations; and improving coordination and education among the interested parties, including neighboring states, regarding these regulations. The Iowa DOT should also work with other state departments to attempt to minimize any unintended consequences of regulation that may hinder freight movement and/or discourage businesses from investing in the state.

Highway

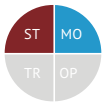


37. Rightsize the highway system and apply cost-effective solutions to locations with existing and anticipated issues. The existing highway system has taken shape over several decades and, while forecast demand was considered, it was largely built to suit the needs of the time. Over the years, those needs have evolved, along with technology, the economy, and the traveling public. As a result, the Iowa DOT's role is not to rebuild the system as it was built decades ago, but rather to implement a system that will meet the demands of the 21st century. This will require significant investment in stewardship, prudent capacity expansion as resources allow, and some contraction of the system. Examples of contraction activities include evaluating the necessity of interstate overhead bridges and rest areas as they need replaced, and strategies such as four- to three-lane conversions.

38. Target investment to address capacity needs at locations with forecast congestion issues. Candidate capacity improvement locations were identified through a statewide volume-to-capacity (V/C) analysis. Future statewide V/C conditions were measured using a combination of iTRAM and each of the state's nine MPO travel demand models. The analysis showed that a majority of congestion is forecast to occur in urban areas and along three key interstate corridors. The Iowa DOT will focus its consideration of capacity expansion alternatives at these locations. Operational improvements will also be considered as an alternative to capacity expansion when appropriate.

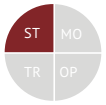


39. Consider targeted anticipatory investments at locations with potential congestion issues beyond the planning horizon. While the consideration of capacity expansion alternatives will be focused at locations with forecast congestion, anticipatory investments should be evaluated in light of long-term implications for corridors where congestion is likely beyond the planning horizon. Anticipatory investments could include strategies such as right of way preservation, grading, construction of full-depth shoulders, and increased bridge capacity. Such investments should be considered along corridors that may indicate future congestion and a need for route-level continuity of service, such as I-80 west of Dallas County.



40. Target investment to address mobility and safety needs on critical two-lane routes. The statewide V/C analysis showed a lack of forecast congestion on a majority of the Primary Highway System. However, overall operation of the system can be improved by addressing mobility and safety needs on critical two-lane routes through a more conservative application of the Super-2 concept. Elements of this concept that could be applied in a targeted and opportunistic fashion include wider paved shoulders, left- and right-turn lanes, acceleration lanes, climbing/passing lanes, limited access, and geometric improvements. This strategy will balance mobility needs with revenue limitations and the need to rightsize the system, while also having more favorable long-term asset management implications. The Iowa DOT will focus its consideration of such corridor-level enhancements on five targeted US highways, which would serve as a compliment to the multilane highway network. While specific corridors will be targeted, this does not preclude the use of these types of treatments in other spot locations to address mobility and safety needs.

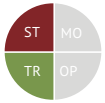
41. Target investment to address freight needs at locations with measured mobility issues. Candidate freight improvement locations identified in the Iowa State Freight Plan have been incorporated into this Plan, and investments that target the elimination or reduction of freight mobility issues are a key element of the Iowa DOT's freight improvement strategy. This includes addressing capacity and operational needs and increasing connectivity of modes through transload and intermodal facilities. It is also important to acknowledge that congestion in surrounding areas outside of the state's borders may have an effect on Iowa freight movement. Collaboration with other states is critical to maximize the effectiveness of investments made within Iowa. The Iowa DOT will focus its consideration of freight mobility improvements at these locations.



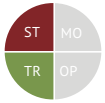
42. Target investment to address condition needs at locations with measured structural and service issues. Candidate condition improvement locations were identified primarily using the ICE tool. This tool, which is based on seven individual criteria, provides the ability to evaluate the overall structural and service condition of primary highway segments with a single composite rating. For the purposes of this plan, the composite rating was used to identify corridors that comprise the lowest-rated 25 percent of the system by mileage. These locations, in conjunction with other pavement and asset management tools, will be used by the Iowa DOT to focus its consideration of condition improvements.

43. Prioritize active operations management of the interstate highways, followed by primary municipal highways, primary rural highways, and border bridges. According to TSMO's roadway facility hierarchy, interstate highways are the most important facilities to actively manage due to the large volumes of traffic that they carry. The hierarchy defined in the TSMO Program Plan will help drive TSMO-related decisions ranging from real-time traffic management strategies to resource planning. Within the interstate system, the ICE-OPS tool prioritized 54 corridors that comprise this system, which will be used by the Iowa DOT to further focus its consideration of TSMO strategies.

Public transit



44. Replace aging public transit vehicles. The Iowa DOT's Office of Public Transit maintains an extensive inventory of all public transit vehicles in the state, and prioritizes statewide vehicle replacement and rehabilitation projects annually based on age and mileage of public transit vehicles compared to useful life standards. Currently, only 37 percent of Iowa's approximately 1,600 public transit vehicles are within the Federal Transit Administration's federal useful life standards, and it is estimated to cost more than $140 million to bring all vehicles within these standards. The Commission recognized the public transit agencies' need for replacement vehicles, and in fiscal year 2013 began committing $3 million annually in Congestion Mitigation Air Quality (CMAQ) funding for bus replacement. To further prioritize the replacement of vehicles, the Iowa DOT will work closely with public transit agencies to develop a Transit Asset Management Plan.



45. Improve public transit infrastructure. Adequate transit facilities are necessary to deliver reliable, safe, and efficient public transit services. The Iowa DOT funds improvement of vertical infrastructure through the Public Transit Infrastructure Grant Program, making approximately $1.5 million available annually to public transit agencies for these types of projects. Additionally, the Iowa Statewide Transit Facility Needs Analysis was completed in 2008, which reviewed existing facilities, developed transit facility standards and design criteria, and outlined a list of facility needs. The Iowa DOT will update this analysis to assist local jurisdictions in making transit facility investment decisions.

46. Support affordable passenger transit service. Passenger transit must be affordable, particularly for people who are transit dependent. This includes seniors, low-income individuals, and persons with disabilities that rely on passenger transit in order to access work, health care, education, shopping, and other quality of life activities. There are multiple federal, state, and local funding sources available to support public transit; however, these resources are often not enough. The Iowa DOT will provide public transit agencies with tools and support to better coordinate affordable passenger transportation services, such as volunteer transportation programs and carpool and vanpool programs, in order to increase the efficiency and effectiveness of the passenger transportation system.

47. Pursue new funding opportunities for public transit. Maintaining and improving Iowa's public transit system relies heavily on available funding. Capital and operating expenses for public transit services have been increasing while much of Iowa's existing revenue stream has remained either unchanged or has slightly diminished. Exploring other funding mechanisms, or even creating new ones, would be extremely beneficial for public transit in Iowa. The Iowa DOT will support this effort by applying for federal discretionary funding as it becomes available to improve the public transit system's vehicles and facilities.

48. Improve interagency coordination between public transit agencies and human service providers. It is essential that public transit agencies and human service providers coordinate to maximize efficiency, reduce duplication of services, and provide clients with increased access to transportation. It is also important to coordinate land use decisions with passenger transit to avoid creating obstructions to passenger transportation services. The Iowa DOT is an important partner in improving interagency coordination. The Iowa DOT will continue its efforts in this area, including acting as chair of the Iowa Transportation Coordination Council (ITCC), overseeing the MPO and RPA Passenger Transportation Planning (PTP) process, providing support for mobility coordinators, sponsoring an annual Passenger Transportation Summit, and generally advocating for the benefits of coordination between public transit and various organizations.

49. Increase awareness of public transit through marketing and education. Robust marketing of passenger transit services is needed to retain existing riders, attract new riders, and secure financial support. A critical component of the marketing strategy is educating the public on available options and how passenger transit systems operate. The Iowa DOT will continue to provide funding assistance to public transit agencies for marketing and public education.

50. Improve efficiency, effectiveness, and quality of public transit service. Establishing passenger transit service that is easy to use, affordable, provides competitive travel times and desired connections, and achieves high customer satisfaction will result in increased transit ridership. Technology has opened the door to shared modes, which has led to increased mobility options. Public transit agencies should seize opportunities to improve mobility for all users through collaboration and public-private partnerships. The Iowa DOT will help transit agencies by providing support for Mobility Coordinators, converting fixed-route systems to General Transit Feed Specifications (GTFS), promoting LifeLong Links and Iowa Rideshare, assisting agencies with ITS applications, providing training opportunities, and conducting compliance reviews.

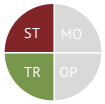
51. Continue to implement the Iowa Park and Ride System Plan through examination of the associated statewide candidate locations. The Iowa DOT district offices should continue to be consulted to identify available state-owned right of way in close proximity to candidate locations. If state-owned right of way is not available for park and ride functions, other public and private partnerships should be explored. In addition, park and ride system activities should be continually coordinated with Iowa Rideshare and other commuter services as appropriate.

52. Identify new public transit service and expansion opportunities. Identification and expansion of passenger transit services is essential to reduce the gap between services provided and services needed. However, startup costs are a major barrier to providing new service, and funding assistance is often necessary. The Iowa DOT will support continued State Transit Assistance (STA) Special Projects funding and Iowa's Clean Air Attainment Program funding, which are sources that can help agencies implement new passenger transit services.

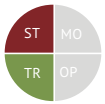
53. Improve the safety and security of the public transit system. In order to protect passengers, pedestrians, employees, and property, it is important that the Iowa DOT support transit agencies in taking a proactive approach to safety and security. Safety can be increased with driver trainings, drug and alcohol testing, adequate transit design measures for roadways and buildings, and proper maintenance of vehicles and equipment. Public transit agencies can improve security with vehicle security systems, lighting around transit assets, controlled access to facilities, and installation of emergency phones or help points.

54. Improve intercity bus service. Intercity bus service is a valuable transportation resource that allows Iowa residents to reach destinations across the country. Intercity bus providers are eligible to receive 15 percent of the state's FTA 5311 funding (approximately $2 million) as long as they include nonurbanized stops and connect to a nationwide network. In order to expand intercity bus ridership the Iowa DOT encourages intercity bus providers to develop targeted stops in rural locations and increase service frequency, and also advises local transit systems to provide feeder services to intercity bus lines.

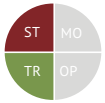
Rail



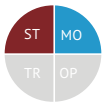
55. Enhance the safety and security of the rail system through crossing safety, monitoring, and promotional efforts. The Iowa DOT will improve crossing safety through crossing repair and upgrade programs, rehabilitation of crossing surfaces, encouraging closure of unnecessary crossings, and construction of grade separations where appropriate. Safety efforts will be enhanced through promotion of Operation Lifesaver, education and marketing, and coordination with law enforcement. Security will be enhanced through continued track inspection and hazardous materials monitoring programs.



56. Improve the physical infrastructure of the rail system. Infrastructure improvements will be pursued in partnership with Iowa's shippers and railroads. Such improvements include branch line rehabilitation and construction or improvement of spur tracks, transfer facilities, rail yards, terminals, sidings, connections, and passing tracks. In addition, the Iowa DOT will serve as a source of information and advocate for federal programs that benefit rail transportation.



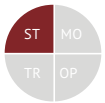
57. Preserve existing rail service. Equally important to improving physical infrastructure, the Iowa DOT will support activities seeking to preserve existing service provided by the rail system. Such activities include support for developments that are served by rail, acquisition of rail rights of way for future rail use, and advising communities and shippers of options when rail service is at risk.



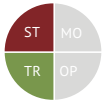
58. Enhance access and connectivity to freight rail service. The Iowa DOT will support activities that improve rail-shipping options for new and existing customers. Such activities include improving coordination between rail users and service providers, improving access to the national rail network via new or enhanced industrial leads and spurs, promoting research opportunities for intermodal and transload facilities, and providing tools to assist shippers in using railroads.

59. Enhance access and connectivity to passenger rail service. The Iowa DOT will support activities that improve passenger rail options for new and existing customers. Such activities include encouraging integration with other modes of travel, studying implementation of passenger rail service on intercity corridors, supporting federal funding programs for passenger rail initiatives, and continuing outreach with stakeholders.

60. Improve the efficiency of the rail system. Rail efficiency will benefit from safety and security enhancements, as well as specific efficiency-related activities. These include capacity improvements on short lines, promoting yard and interchange improvements, promoting new business opportunities, and providing tools that allow the railroads to be more efficient.

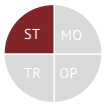


61. Encourage economic development in Iowa through investment in the rail system. The Iowa DOT will support activities that enhance economic competitiveness and development. Such activities include encouraging new and enhanced industrial spurs or industrial parks when suitable, supporting efforts that attract and sustain business in Iowa, and promoting rail as a viable transportation option. More broadly, the Iowa DOT will serve as a source of information and advocate regarding use of the rail system.

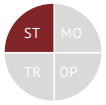


62. Reduce transportation-related congestion and emissions through investment in and use of the rail system. The Iowa DOT will promote the system efficiency and environmental benefits of rail transportation. Specific environment-related activities include promoting the use of emission reduction technologies, encouraging shippers to use more environmentally conscious transport when practical, and encouraging travelers to consider rail transportation when available.

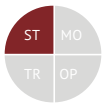
Safety



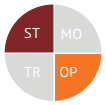
63. Sustain the multimedia Zero Fatalities program and identify new partners in each of the five safety emphasis areas. Given the success of the program, safety stakeholders have committed to maintaining Zero Fatalities and adding 10 new partners that are willing to share the campaign message. This will involve the development of new partner engagement materials, further distribution of engagement materials, and development and delivery of new safety messages.



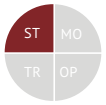
64. Support the enhancement of driver education programs and increase public outreach and education regarding unsafe driver behaviors. Safety stakeholders will seek to enhance driver education programs throughout the state by providing them with educational materials and offering them access to tools that track student progress. Additionally, driver education curriculum should be updated to include how drivers can navigate different types of roadway facilities such as roundabouts, specialized traffic signals, and bike lanes. Safety stakeholders also plan to enhance their public reach regarding the dangers of drowsy and distracted driving through expanded partnering and airing public service announcements about these unsafe behaviors.



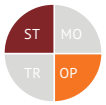
65. Support additional officer hours on roadways and encourage special enforcement campaigns. High-visibility enforcement strategies can effectively increase seat belt compliance, and present an opportunity to increase proper child passenger restraint. This may involve additional hours of high-visibility enforcement deployments, additional motor vehicle inspections, and ongoing annual special enforcement events targeting specific corridors and/or work zones.



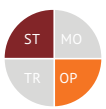
66. Support equipping law enforcement with state-of-the-art technology. Safety stakeholders remain committed to increasing the percentage of Iowa State Patrol and Iowa DOT enforcement vehicles with light detection and ranging (LIDAR) equipment. In addition, sustained support for the Iowa Department of Public Safety's Governor's Traffic Safety Bureau (GTSB) equipment upgrade program for cities and counties will allow for the purchase of critical enforcement units such as speed trailers, in-car cameras, preliminary breath testers, and impairment simulation goggles.



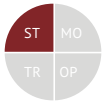
67. Support expanded law enforcement training to effectively identify impaired drivers. Training and certifying more enforcement officers through the appropriate impairment recognition programs, and ensuring that trained officers maintain those certifications, is a priority for safety stakeholders. In addition, support for 100 percent blood alcohol concentration and drug testing for individuals involved in fatality-related crashes will provide a clearer picture of the magnitude of impaired driving in the state.



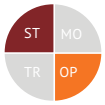
68. Support evidence-based decision-making and the installation of engineering countermeasures. Safety stakeholders support data-driven transportation planning and the incorporation of safety analysis into project development and prioritization. Pursuing such practices in combination with the installation of proven safety countermeasures, such as centerline and edgeline rumble strips, curve delineation, shoulder treatments, and median cable barrier, will bolster Iowa's strategic approach to making roadways safer.



69. Implement appropriate and cost-effective engineering solutions at intersections. Advances in design and traffic engineering have expanded the range of improvement alternatives to enhance safety for all users. Innovative intersection designs, traffic signal modifications, lighting modifications, and mode-specific improvements have increased the design options possible at both urban and rural intersections. To support the expanded use of such improvements, safety stakeholders will seek to identify an intersection evaluation tool for communities to use in project development.



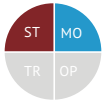
70. Inform and support legislation that enhances transportation safety. By providing research opportunities, educational programs, and support for national and state initiatives, safety stakeholders can inform lawmakers and the public about the benefits of safety-related legislation. This will include support for primary seat belt legislation for all positions, modification of Iowa law to include distracted driving as a primary offense, and a review of impaired driving tolerances and penalties.



71. Facilitate access to and track usage of traffic safety records data. Critical safety research and programming is reliant upon analyses that integrate multiple data areas. This requires standardized definitions, procedures, and fields that assist researchers with summarizing and analyzing information. To address this, safety stakeholders will facilitate access to crash records data and integration between the various entities involved in transportation safety, including justice, public health, public safety, engineering, licensing and registration, and education.

Technology

72. Plan for the transition to and implementation of connected and automated vehicle technology. The Iowa DOT, in partnership with the University of Iowa, Iowa State University, local jurisdictions, planning agencies, and the private sector, will develop an implementation-ready platform for connecting and guiding automated vehicles. This platform will be based on high-definition dynamic mapping, predictive travel modeling, and a cloud-based communication network. The effort will initially deploy technologies supporting autonomous vehicles regionally in the Iowa City-Cedar Rapids transportation network. Additional deployments are planned for the Des Moines-Ames metropolitan areas, as well as I-35 and I-80 across Iowa.



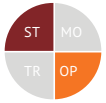
73. Incorporate pause points into the project development and programming processes to consider the evolving impacts of disruptive technologies. In addition to planning and implementation activities related to various new technologies, particularly connected and automated vehicles, the Iowa DOT will modify its internal project development and programming processes to consider technological disruptions and minimize risk. This will be achieved through a new governance structure that defines an effective program development process around the appropriate subject matter experts and state-of-the-art management systems. The incorporation of pause points into this process will allow the Iowa DOT to revisit a project at various points during development to ensure its scope is still appropriate within the context of these evolving technologies.

TSMO

74. Reduce the number of overall major crashes and the number of secondary crashes. Transportation system safety, reliability, and efficiency is improved by minimizing the frequency and severity of crashes. Secondary crashes also present a significant safety problem. Often these crashes can be more severe than the original incident, posing safety risks to incident responders, other travelers, and those involved in the initial incident. Rapid response and quick, safe clearance, as articulated in the National Unified Goal for Traffic Incident Management, support the Iowa DOT's traffic incident management objectives.

75. Increase the resilience of the transportation system to floods, winter weather, and other extreme weather events. System resiliency requires a proactive approach to extreme weather events and other large scale incidents that threaten the continuity of system operations. The Iowa DOT seeks to minimize the impact of extreme weather by intentionally designing and managing certain routes to be resistant to extreme weather, and to move people and goods throughout the state both during and after extreme weather events.

76. Implement critical emergency transportation operations (ETO) strategies as identified in the ETO Plan. The ETO Plan identified strategies to address all types of hazards and incidents that may seriously threaten or disrupt the operation and resiliency of the transportation system. Preparedness strategies represent efforts by Iowa ETO program partners to identify threats, determine vulnerabilities, and identify required resources, policies, and procedures. Response strategies represent efforts that address the direct, usually short-term effects of an event. Recovery strategies address the execution of restoration plans, evaluation and reporting of the event, and development of mitigation initiatives.



77. Maximize the use of existing roadway capacity. TSMO strategies support the Iowa DOT's ability to utilize existing roadway capacity more efficiently by actively managing traffic flow and identifying congestion hotspots for operational improvements. This increases system efficiency and reliability, reducing or postponing the need for major construction investments, and supporting targeted capacity improvements in critical corridors.

78. Work with special event generators to actively manage traffic during large scale events that impact the highway network. The state of Iowa hosts a significant number of special events that generate large volumes of traffic over a fairly brief duration. Such events can negatively affect system efficiency and reliability. By working with event coordinators in advance, the Iowa DOT can support active traffic management during the event, which also enhances traveler information accuracy before and during the event.

79. Coordinate responses to large scale traffic incidents with adjacent states. Regional planning for and response to large scale traffic incidents is an important component of interagency coordination and corridor management. Limited access points along interstates and major corridors, specifically where border bridge crossings are involved, require a coordinated response between state transportation agencies.

80. Use integration and big data mining strategies to improve decision making and performance management. As new and expanded sources of data become available, data sharing and data mining offer new opportunities for planning and TSMO strategies for actively managing the system. The Iowa DOT's integration of big data and expanded data analytics will improve decision support activities and performance management, which will enhance overall system operations. Future systems operations will also be enhanced through anticipatory infrastructure investments that would proactively enable "smart" highway corridors with data and communications capacity.

Table 5.7 provides a summary list of all strategies. The Iowa DOT's Internal Steering Committee for this Plan evaluated each strategy based on the anticipated level of impact it could have and the anticipated level of effort it would require to implement. The ranking of each strategy relative to the other strategies is listed. Rankings do not necessarily correlate to priority for implementation.

Table 5.7: Summary of strategies

Area	ID	Strategy	Impact rank (out of 80) *1 = highest impact 80 = lowest impact*	Effort rank (out of 80) *1 = lowest effort 80 = highest effort*
Asset Management	4	Continue to advance targeted capacity improvement projects on key Interstate Highway System corridors.	5	50
	1	Develop an asset management governance structure to improve the effectiveness and transparency of the project selection process.	21	48
	2	Improve the efficiency and accuracy of data collection and access to enhance data available for decision-making.	27	53
	3	Adequately communicate the benefits of asset management to ensure the Iowa DOT's program is sufficiently funded and properly implemented.	39	18
	6	Monitor continued population shift toward the state's urban areas and associated implications for the level of funding available for statewide asset management activities.	40	4
	5	Ensure asset management and other program delivery functions can be properly implemented regardless of staffing constraints.	41	32
Aviation	13	Maintain and enhance the statewide network of aviation weather observing systems.	23	22
	15	Evaluate implementation of new and emerging aviation technologies.	26	26
	7	Maintain adequate accessibility to airports with an appropriate range of services.	52	9
	9	Promote the implementation of compatible land use guidelines near airports.	69	2
	12	Improve runway approaches through obstruction removal and mitigation funding.	70	8
	8	Encourage airport planning.	71	1
	11	Maintain and enhance aviation vertical infrastructure needs.	75	57
	14	Promote and assist in active wildlife management at airports.	75	5
	10	Maintain and enhance airside facilities.	77	14
Bicycle and pedestrian	20	Evaluate key safety challenges pertaining to bicycling and walking and develop crash reduction strategies.	41	11
	17	Adopt and implement a complete streets policy that applies to all Iowa DOT projects.	48	40
	19	Consider same-source funding to build bicycle and pedestrian accommodations as part of road projects.	50	18
	16	Complete a comprehensive bicycle and pedestrian plan for the state.	52	12
	18	Increase the quality and consistency of the design of bicycle and pedestrian accommodations across the state.	61	23
Bridge	21	Secure additional funding and develop more refined management systems to address the approaching wave of bridge replacement needs.	5	75
	23	Target investment to address bridges with condition needs.	13	32
	22	Consider creative financing as part of coordinated planning and programming efforts to address future large bridge projects.	20	72
Energy	28	Optimize the passenger transportation system to provide more opportunities and improve mobility.	45	61
	26	Support the expanded use of alternative fuel vehicles in Iowa.	57	41
	24	Support the safe rail transport of crude oil and biofuels.	60	18
	27	Explore incentives for alternative vehicle fueling infrastructure.	61	36
	25	Optimize the propane supply chain to better predict and proactively respond to propane shortages.	63	26

Table 5.7: Summary of strategies *(continued)*

Area	ID	Strategy	Impact rank (out of 80) *1 = highest impact 80 = lowest impact*	Effort rank (out of 80) *1 = lowest effort 80 = highest effort*
Freight	29	Target investment on the interstate system at a level that reflects the importance of this system for moving people and freight.	3	50
	34	Leverage and disseminate real-time information on system conditions to support improved mobility.	13	56
	31	Optimize the freight transportation network to minimize cost and travel time, improve supply chain efficiency, and reduce energy use.	28	70
	32	Continue to advance efforts on the M-35 Marine Highway Corridor.	29	63
	30	Advance a 21st century Farm-to-Market System that moves products seamlessly across road, rail, and water to global marketplaces.	30	75
	36	Streamline and align freight-related regulations and minimize unintended consequences.	30	41
	35	Provide measured, clear, nontechnical performance results for the transportation system.	52	14
	33	Promote freight movement on the M-29 Marine Highway Connector.	80	35
Highway	38	Target investment to address capacity needs at locations with forecast congestion issues.	2	50
	37	Rightsize the highway system and apply cost-effective solutions to locations with existing and anticipated issues.	5	77
	40	Target investment to address mobility and safety needs on critical two-lane routes.	8	61
	42	Target investment to address condition needs at locations with measured structural and service issues.	16	46
	43	Prioritize active operations management of the interstate highways, followed by primary municipal highways, primary rural highways, and border bridges.	17	36
	41	Target investment to address freight needs at locations with measured mobility issues.	18	63
	39	Consider targeted anticipatory investments at locations with potential congestion issues beyond the planning horizon.	32	36
Public transit	44	Replace aging public transit vehicles.	44	65
	47	Pursue new funding opportunities for public transit.	45	57
	50	Improve efficiency, effectiveness, and quality of public transit service.	50	53
	48	Improve interagency coordination between public transit agencies and human service providers.	52	13
	52	Identify new public transit service and expansion opportunities.	57	32
	53	Improve the safety and security of the public transit system.	63	14
	46	Support affordable passenger transit service.	71	26
	51	Continue to implement the Iowa Park and Ride System Plan through examination of the associated statewide candidate locations.	71	3
	54	Improve intercity bus service.	71	18
	49	Increase awareness of public transit through marketing and education.	78	6
	45	Improve public transit infrastructure.	79	26

Table 5.7: Summary of strategies *(continued)*

Area	ID	Strategy	Impact rank (out of 80) *1 = highest impact 80 = lowest impact*	Effort rank (out of 80) *1 = lowest effort 80 = highest effort*
Rail	58	Enhance access and connectivity to freight rail service.	34	49
	57	Preserve existing rail service.	48	31
	55	Enhance the safety and security of the rail system through crossing safety, monitoring, and promotional efforts.	56	26
	61	Encourage economic development in Iowa through investment in the rail system.	57	24
	56	Improve the physical infrastructure of the rail system.	63	57
	62	Reduce transportation-related congestion and emissions through investment in and use of the rail system.	63	47
	59	Enhance access and connectivity to passenger rail service.	67	65
	60	Improve the efficiency of the rail system.	68	36
Safety	68	Support evidence-based decision-making and the installation of engineering countermeasures.	4	70
	69	Implement appropriate and cost-effective engineering solutions at intersections.	10	69
	70	Inform and support legislation that enhances transportation safety.	12	41
	63	Sustain the multimedia Zero Fatalities program and identify new partners in each of the five safety emphasis areas.	18	24
	64	Support the enhancement of driver education programs and increase public outreach and education regarding unsafe driver behaviors.	22	65
	65	Support additional officer hours on roadways and encourage special enforcement campaigns.	25	72
	67	Support expanded law enforcement training to effectively identify impaired drivers.	33	53
	71	Facilitate access to and track usage of traffic safety records data.	35	41
	66	Support equipping law enforcement with state-of-the-art technology.	41	57
Technology	72	Plan for the transition to and implementation of connected and automated vehicle technology.	13	78
	73	Incorporate pause points into the project development and programming processes to consider the evolving impacts of disruptive technologies.	35	7
TSMO	74	Reduce the number of overall major crashes and the number of secondary crashes.	1	79
	77	Maximize the use of existing roadway capacity.	9	74
	75	Increase the resilience of the transportation system to floods, winter weather, and other extreme weather events.	10	80
	76	Implement critical emergency transportation operations (ETO) strategies as identified in the ETO Plan.	23	68
	78	Work with special event generators to actively manage traffic during large scale events that impact the highway network.	35	17
	80	Use integration and big data mining strategies to improve decision making and performance management.	35	41
	79	Coordinate responses to large scale traffic incidents with adjacent states.	45	10

Source: Iowa DOT

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6. PAYING OUR WAY

This chapter highlights the financial implications of investing in the actions previously identified in chapter 5. The discussion includes the following information for each mode through 2045.

- Cost to maintain and improve the system
- Anticipated future revenues
- Potential shortfall and its implications

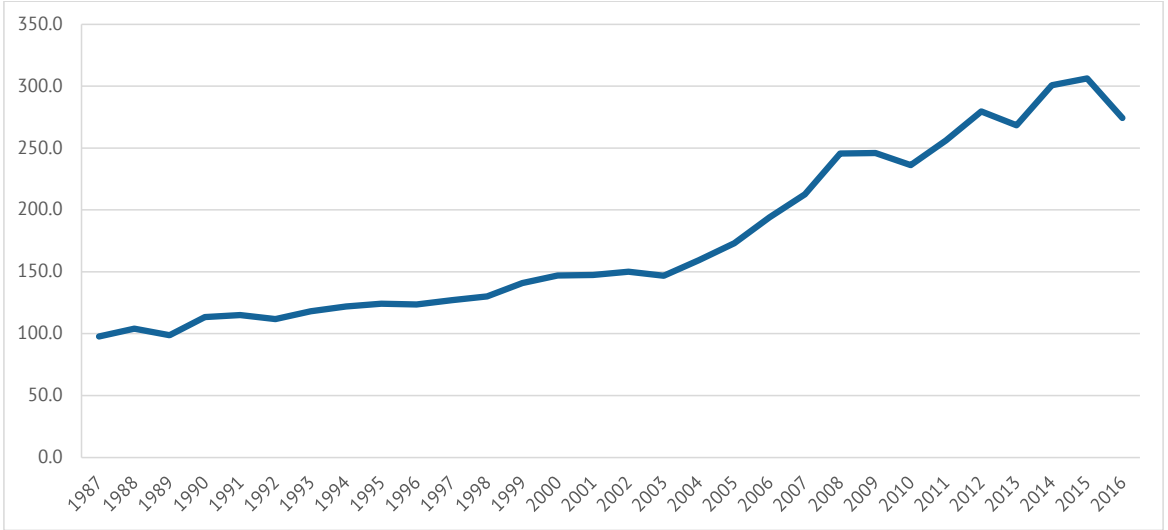
6.1 Introduction

The costs and revenues discussion in this chapter is framed primarily within the context of the Iowa Department of Transportation (DOT) Five-Year Program, which is the basis for the terms "Iowa DOT costs" and "Iowa DOT revenues" used in this chapter. Both costs and revenues are presented in average annual future year dollars. The most critical piece of information presented in this chapter is the shortfall between anticipated future costs and revenues.

The costs associated with nearly all goods and services typically increase over time, including those in transportation. The term for this increase in costs over time is inflation, which is often expressed as a rate or index. An oft-referenced index in the transportation industry is the Construction Cost Index (CCI), which is shown using Iowa data in Figure 6.1.

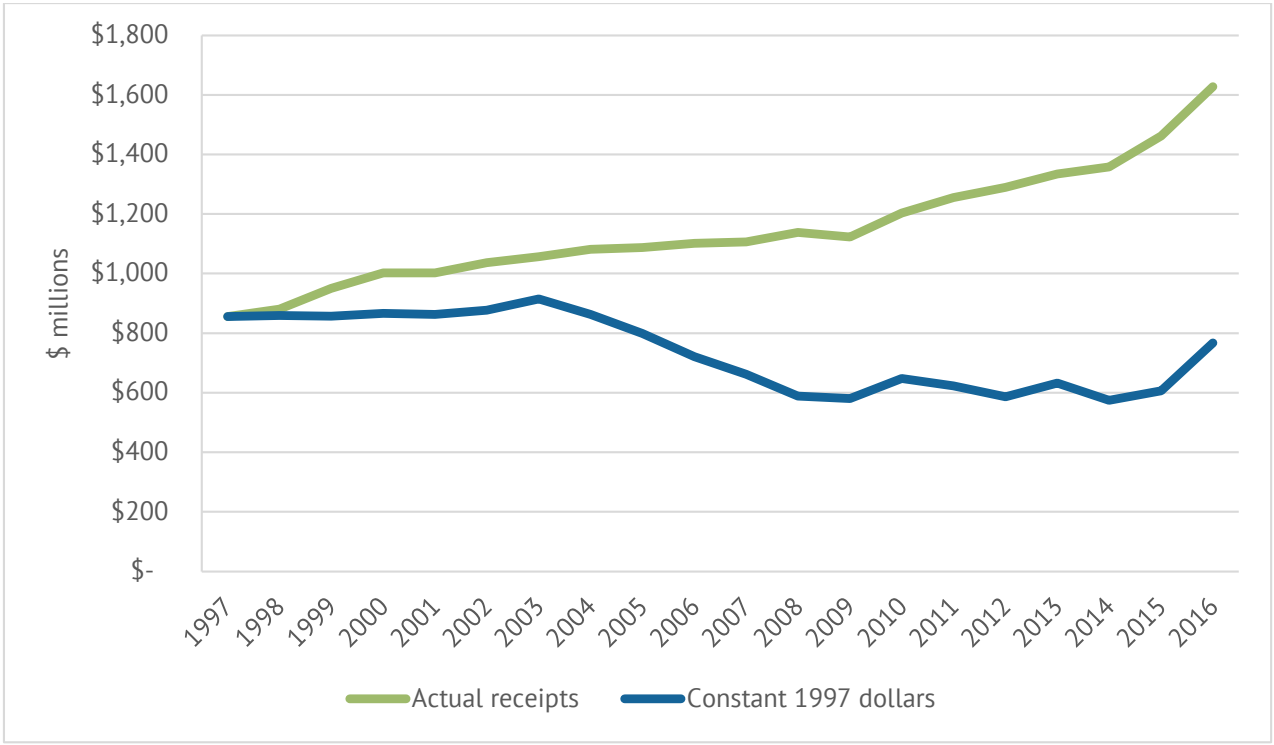
To better illustrate the impacts of this inflation, consider that a $1 million project in 1987 cost approximately $2.74 million in 2016. Over time, the effects of cost inflation erode the buying power of available revenue. An example of this is illustrated in Figure 6.2, which shows Road Use Tax Fund (RUTF) revenue history adjusted to constant 1997 dollars based on the Iowa CCI.

Figure 6.1: Construction Cost Index trend for Iowa highway construction (percent of 1987 base)



Source: Iowa DOT

Figure 6.2: History of Road Use Tax Fund revenue, 1997-2016



Source: Iowa DOT

The impact of increasing costs has been compounded in the past by the fact that much of Iowa's revenue stream for transportation construction, maintenance, and operations remained relatively stagnant over time. Iowa in Motion 2040 noted that Iowa's motor fuel tax had remained the same for more than two decades while highway construction costs had increased by nearly 140 percent. This particular issue was partially addressed by the 2015 passage of Senate File 257, which increased the fuel tax rate by 10 cents per gallon, along with other miscellaneous provisions. The 2015 federal Fixing America's Surface Transportation (FAST) Act also authorized five years of federal funding at slightly higher levels than prior funding bills.

While the additional revenue has provided a significant boost, and largely addressed critical needs on the highway system (see section 6.3), transportation costs have outpaced revenues over time, and Iowa's transportation system will continue to be subject to deterioration. The level of revenues received is affected by a number of factors, including, but not limited to, the amount of federal dollars appropriated, vehicle miles traveled, vehicle fuel efficiency, and the use of alternative fuels (e.g., ethanol, biodiesel, natural gas, electricity). Regardless, an adequate level of revenue is necessary to support the state's future transportation system and keep Iowa competitive in an ever-changing economy.

6.2 Annual transportation funding

Table 6.1 highlights the budgeted distribution of transportation funding by the Iowa DOT by state fiscal year (SFY). Note that these figures do not include federal highway or transit funds administered by the Iowa DOT but transferred to local jurisdictions for local programming authority.

Table 6.1: Annual Iowa DOT transportation funding ($ millions)

	Annual average, SFY 2000-2017	SFY 2017
Highway	$745.54	$1,040.75
Aviation	$3.87	$4.92
Bike/Pedestrian (trails)*	$2.16	$2.50
Public transit	$12.14	$15.92
Railroad	$3.38	$3.10
General services**	$76.36	$88.54
Motor vehicle	$37.35	$41.07
Total	**$880.80**	**$1,196.80**

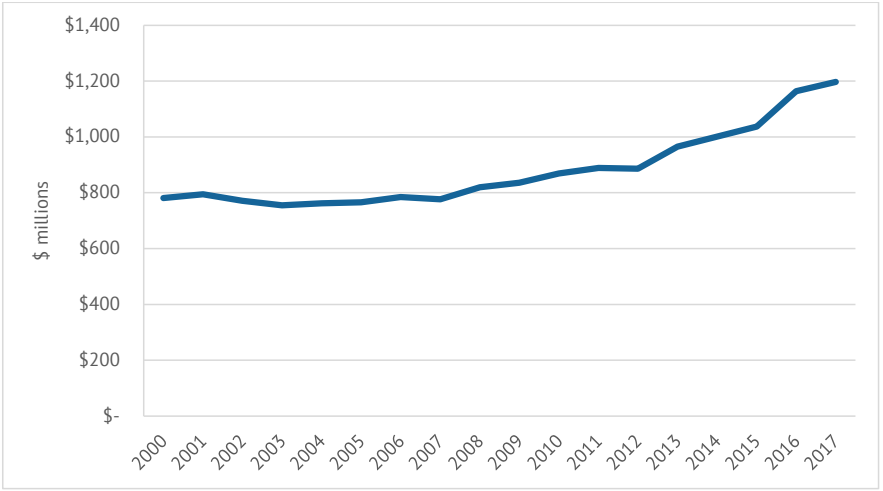
**Trails funding does not include Federal Recreational Trails Program or Statewide Transportation Alternatives Program funding.*

***General services include various special purpose operations and capital funding.*

Source: Iowa DOT

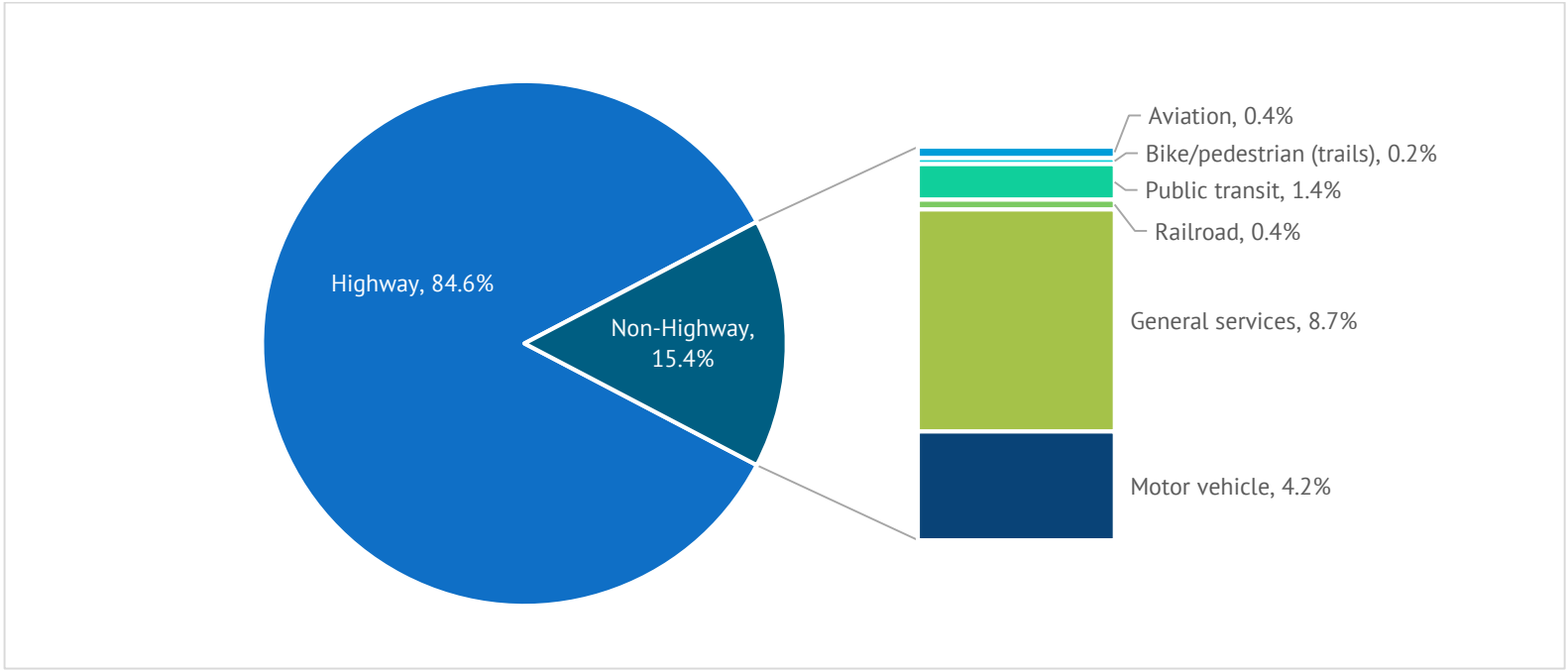
Figure 6.3 illustrates the recent history of total Iowa DOT-programmed transportation funding. While this total has increased at a steady pace in recent years, it cannot fully address the growing list of needs and escalating costs associated with meeting those needs. Figure 6.4 highlights the distribution of funds to highways and various nonhighway categories.

Figure 6.3: History of total Iowa DOT-programmed transportation funding, 2000-2017



Source: Iowa DOT

Figure 6.4: Distribution of Iowa DOT-programmed transportation funding (2000-2017)



Source: Iowa DOT

6.3 Future costs and revenues by mode

The following pages highlight the cost of future investment in the state's transportation system versus anticipated Iowa DOT revenues. As was previously mentioned, where possible, this discussion is framed within the context of the Iowa DOT's Five-Year Program, which is the basis for the terms "Iowa DOT costs" and "Iowa DOT revenues" used in this section. These amounts represent the portion of the modal costs that can be considered the Iowa DOT's share, and the portion of modal revenues that can be anticipated through the Iowa DOT. Where detailed forecasts are unavailable, these figures are based on recent historical trends. Both costs and revenues are presented in average annual future year dollars.

It is important to note that the costs identified in this chapter may not align directly with the improvement needs highlighted in Chapter 5. While the needs identified in this Plan help serve as a general guide for the Iowa DOT's future transportation investments, specific costs for each mode were developed from the investment needs identified by individual modal plans and studies. These plans and studies are referenced in the following sections.

Also, while the focus of this chapter is on Iowa DOT revenues, it should be noted that there are significant sources of revenue for each mode that can be applied toward those costs that exceed or are not eligible for Iowa DOT-programmed funds. Some examples of these revenue sources include, but are not limited to, the following.

- **Aviation** – bonding, Federal Aviation Administration Airport Improvement Program, passenger facility charges, property tax levy
- **Bicycle and pedestrian** – local jurisdiction funds, private investment, Resource Enhancement and Protection Fund, Rebuild Iowa Infrastructure Fund
- **Highway** – Farm-to-Market Road Fund, Secondary Road Fund, Street Construction Fund, federal discretionary funds, local option sales tax
- **Public transit** – fare box revenue, federal discretionary funds, property tax levy
- **Rail** – federal discretionary funds, private investment, Railroad Rehabilitation & Improvement Financing program

Aviation

Costs

Costs for aviation were derived from the 2010-2030 Iowa Aviation System Plan. The system plan identified statewide maintenance and improvement needs that totaled approximately $816 million over the 20-year planning period, or nearly $41 million annually in 2010 dollars. This annual amount was inflated to a total of $49.8 million in 2016 dollars. The annual costs for meeting these needs were projected to 2045 using an annual inflation rate of 3.67 percent, which was based on the growth of Iowa's CCI. **Average annual total costs** over the life of the Plan were then calculated.

To bring these costs into the context of the Five-Year Program, the portion of total aviation costs statewide that has historically been addressed through the aviation element of the Five-Year Program was examined. The aviation element of the Five-Year Program has included State Aviation Fund, Rebuild Iowa Infrastructure Fund, and annual appropriation funds. Between 2006 and 2015, this portion steadily increased and averaged nearly 8.8 percent. This percentage was then applied to the average annual total costs mentioned above to estimate **average annual Iowa DOT costs** shown in Table 6.2. The percentage attributed to annual Iowa DOT costs was trended over time, due to the steady increase in the state share of costs over the prior decade.

Table 6.2: Average annual aviation costs, 2017-2045 ($ millions)

	Average annual total costs	Average annual Iowa DOT costs
Total	$77.179	$14.659

Source: Iowa DOT

Revenues

Revenues for aviation were derived based on historical and anticipated funding identified in the aviation element of the Five-Year Program. Aviation revenue was held constant throughout the life of the Plan, due to a flat long-term trend in aviation revenue, which is largely dependent upon annual legislative appropriations, aircraft registrations, and fuel sales. **Average annual Iowa DOT revenues** (Table 6.3) over the life of the Plan were then calculated.

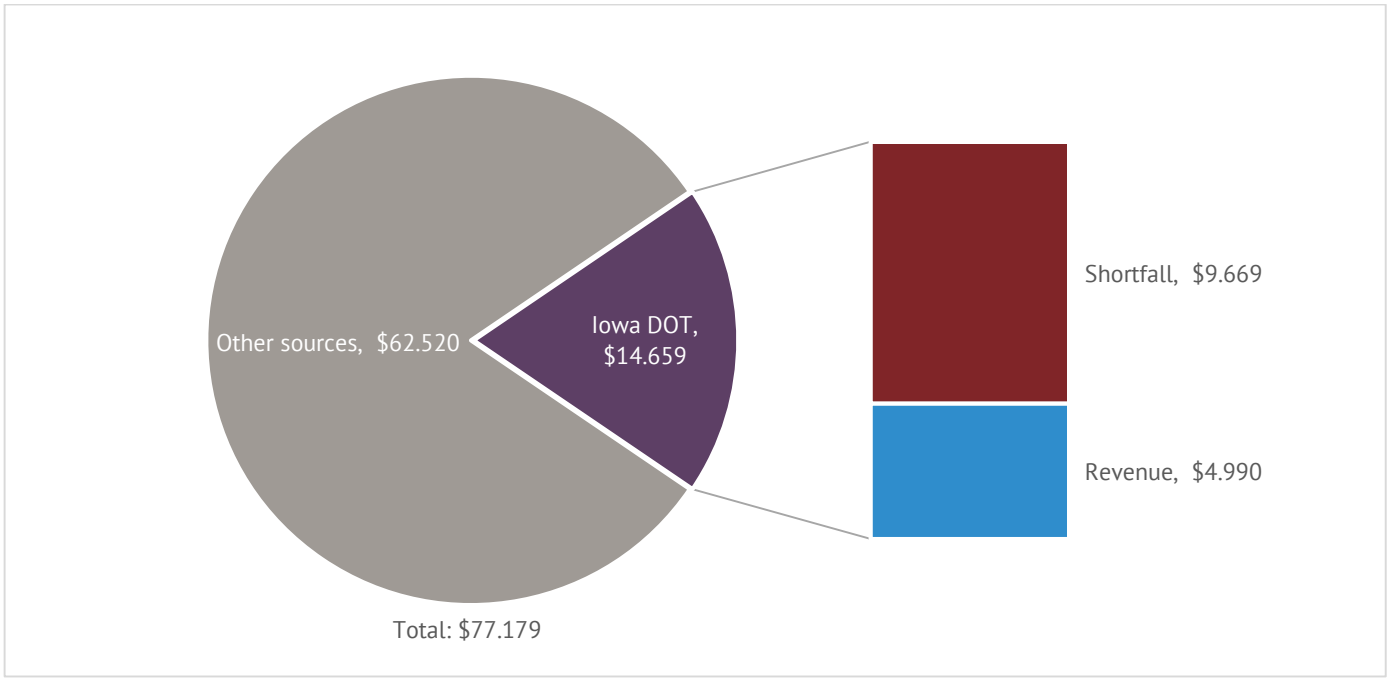
Table 6.3: Average annual aviation revenues, 2017-2045 ($ millions)

	Average annual Iowa DOT revenues
Total	$4.990

Source: Iowa DOT

The average annual costs for aviation, Iowa DOT share, and difference between Iowa DOT average annual costs and revenues is illustrated in Figure 6.5. It is estimated that anticipated revenues would cover approximately 34 percent of the anticipated Iowa DOT costs.

Figure 6.5: Aviation average annual total costs, Iowa DOT share, revenue, and shortfall, 2017-2045 ($ millions)



Source: Iowa DOT

Implications of the shortfall

- All objectives related to infrastructure and services may not be met, affecting the ability to address the needs of aviation users.
- Access to aviation services may not be maintained or enhanced.
- Planning for infrastructure, air space protection, and other key planning initiatives to ensure the most efficient and safe system may be inadequate.
- Protection of existing investments could be limited.

Bicycle and pedestrian

Costs

Iowa in Motion 2040 based its cost analysis for bicycle and pedestrian on completion of the statewide trails vision. For this Plan, an updated methodology based on the on-road needs of the primary system was utilized, as much of the statewide trails vision will be funded and completed by entities other than the Iowa DOT. As mentioned in Chapter 5, the Iowa DOT has been in the process of developing an updated bicycle and pedestrian plan, and staff anticipates completing the plan following the completion of Iowa in Motion 2045. As part of that plan development, an initial assessment of needs has been conducted for the entire Primary Highway System, excluding interstates.

Costs were based on providing the recommended type of treatment for roadways, which is determined based primarily on annual average daily traffic (AADT), roadway width, and speed (see Tables 5.2 and 5.3). In general, the treatments would improve the bicycle compatibility rating of the roadway from poor or moderate to good, though a rating of moderate was deemed acceptable for a portion of four-lane highways and higher AADT two-lane highways. It was assumed that accommodations would be constructed in conjunction with other highway work rather than as standalone projects, which reduces their cost. Costs also are only for the portion of the accommodation that would not be addressed through standard highway work (e.g., in many cases the recommended accommodation would involve a slight widening of the paved shoulder that would typically be installed).

This analysis includes the full primary system costs, which are spread across the timeframe of the plan. Costs were developed in 2016 dollars, and then inflated to 2045 using an annual inflation rate of 3.67 percent, which was based on the growth of Iowa's CCI. **Average annual total costs** over the life of the Plan were then calculated.

These costs represent improvements to the primary system, and do not include the cost to improve the secondary or municipal systems, or to complete portions of the statewide trail vision that are not aligned with the primary highway network. These costs would represent a full "build-out" of bicycle accommodations, which may not occur as other factors such as percentage of highway project cost, connectivity, and potential usage could factor into whether or not accommodations are built (see Table 6.4).

Table 6.4: Average annual bicycle and pedestrian accommodation costs, 2017-2045 ($ millions)

	Average annual total costs
Rural primary system	$27.854
Urban primary system	$10.897
Total	**$38.751**

Source: Toole Design Group; Iowa DOT

Revenues

Revenues for bicycle and pedestrian were derived from historical funding identified in the trail element of the Five-Year Program, which includes only the State Recreational Trails Program, plus funding from the Federal Recreational Trails Program, Statewide Transportation Enhancement Program/Statewide Transportation Alternatives Program, and Primary Road Fund used for on-road accommodations. This represents the total funding currently available for bicycle/pedestrian improvements. However, it is important to note that some of these sources can be spent on noninfrastructure uses, and many of these sources are awarded to other entities and spent on projects off the Primary Highway System. The actual amount of these sources spent on Primary Highway System bicycle and pedestrian accommodations will

vary from year to year, and will generally be substantially less than the average annual amount. Historical data from SFY 2006 through 2015 was used to develop a linear trend, and then projected out to 2045. **Average annual Iowa DOT revenues** (Table 6.5) over the life of the Plan were then calculated.

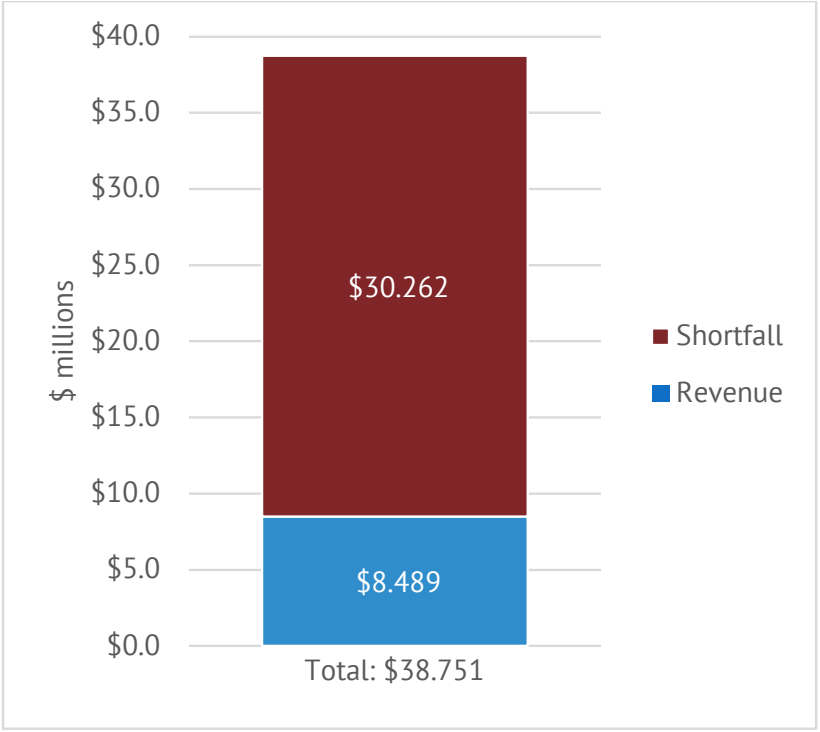
Table 6.5: Average annual bicycle and pedestrian revenues, 2017-2045 ($ millions)

	Annual average Iowa DOT revenues
Total	$8.489

Source: Iowa DOT

The difference between average annual costs and revenues is illustrated in Figure 6.6. As discussed previously, this would represent construction of the maximum on-road accommodations on the Primary Highway System, and the maximum use of current funding sources for bicycle/pedestrian improvements. Since much of that funding may be distributed to other entities for non-Primary Highway System projects, or spent on developing the statewide trails vision, this funding analysis helps show the significant need for additional sources of funding for bicycle and pedestrian projects. As discussed in strategy 19 in Chapter 5, same-source funding for bicycle and pedestrian accommodations as part of road projects could be one potential option to help address the shortfall.

Figure 6.6: Bicycle and pedestrian average annual total costs for primary system, revenue, and shortfall, 2017-2045 ($ millions)



Note: Per the preceding discussion, this represents the maximum amount of revenue available for primary system improvements, much of which is currently directed to other entities and projects. The actual amount of this revenue spent on Primary Highway System bicycle and pedestrian accommodations will vary from year to year, and will generally be substantially less than the average annual amount noted here.

Source: Iowa DOT

Implications of the shortfall

- Bicycle and pedestrian accommodations may not be able to be constructed for primary highway projects when warranted.
- Some trails, including trails of statewide significance, may not be built, creating a disconnected and segmented system.
- Some existing facilities may not be adequately maintained.
- There may be fewer facilities available to accommodate potential bicyclists and pedestrians for transportation and recreational opportunities, adversely impacting health, quality of life, and the state's tourism economy.

Highway

Costs

Costs for highway were derived from the Iowa DOT's 2011 and 2016 Road Use Tax Fund (RUTF) studies. The 2011 study identified both total statewide needs and critical statewide needs, with the latter being the amount of funding necessary to meet the most critical pavement and bridge preservation needs on Iowa's roadways. In addition, the critical need level would partially support the following categories of needs.

- Capacity improvements on high-volume Commercial and Industrial Network (CIN) roads.
- Reconstruction of high-volume roads with poor pavement.
- Repair/Replacement of functionally obsolete bridges on high-volume roads.
- Repair/Replacement of structurally deficient bridges on low-volume roads.
- Resurfacing of low-volume roads.

Each category of needs (i.e., costs) was provided as both a 20-year total and as an average annual figure. These **average annual costs** for Iowa's entire public roadway system were then projected over the life of the Plan. To bring these costs into the context of the Five-Year Program, the portion of statewide needs that could be attributed to the Primary Highway System was examined. This percentage was then applied to the average annual total and critical costs mentioned above to estimate **average annual Iowa DOT costs** shown in Table 6.6 and Table 6.7.

Table 6.6: Average annual total highway costs, 2017-2045 ($ millions)

	Average annual total costs	Average annual Iowa DOT total costs
Total	$3,990.000	$1,911.594

Source: Iowa DOT

Table 6.7: Average annual critical highway costs, 2017-2045 ($ millions)

	Average annual critical costs	Average annual Iowa DOT critical costs
Total	$2,580.000	$1,236.068

Source: Iowa DOT

Revenues

Revenues for highway were also derived from the Iowa DOT's 2011 and 2016 studies of roadway needs and RUTF revenues. Revenues saw a significant increase following the 2015 passage of Senate File 257, which included several funding provisions, most notably a 10 cents per gallon fuel tax rate increase. Future revenue assumptions for federal formula funds, RUTF revenues, and Transportation Investment Moves the Economy in the Twenty-First Century (TIME-21) Fund revenues were applied to fiscal year 2017 funding levels for each of these sources and then projected out to 2045. **Average annual Iowa DOT revenues** (Table 6.8) over the life of the Plan were then calculated.

Table 6.8: Average annual highway revenues, 2017-2045 ($ millions)

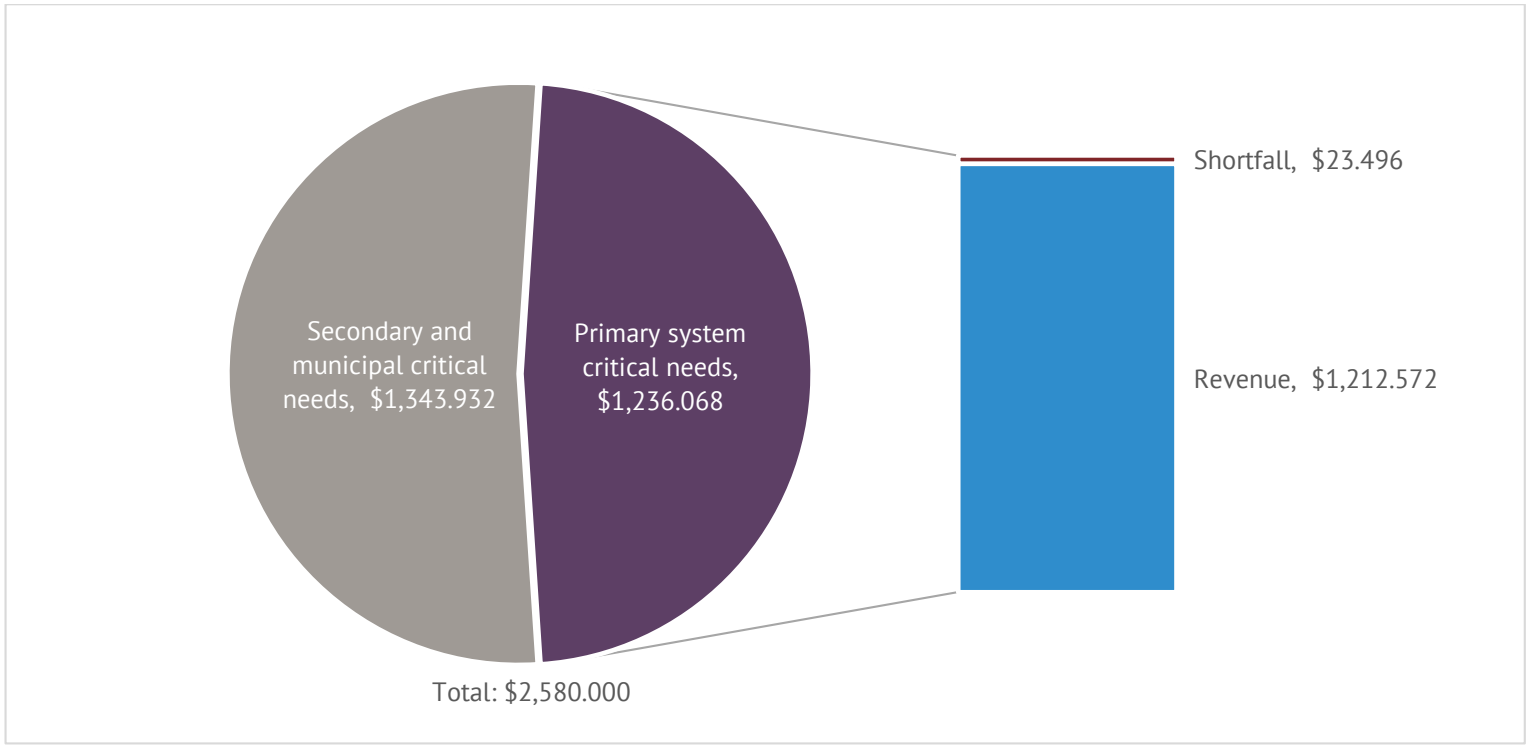
	Average annual Iowa DOT revenues
Total	$1,212.572

Source: Iowa DOT

The difference between average annual critical costs and revenues is illustrated in Figure 6.7. As illustrated, anticipated revenues largely address the critical funding shortfall identified in the 2011 study.

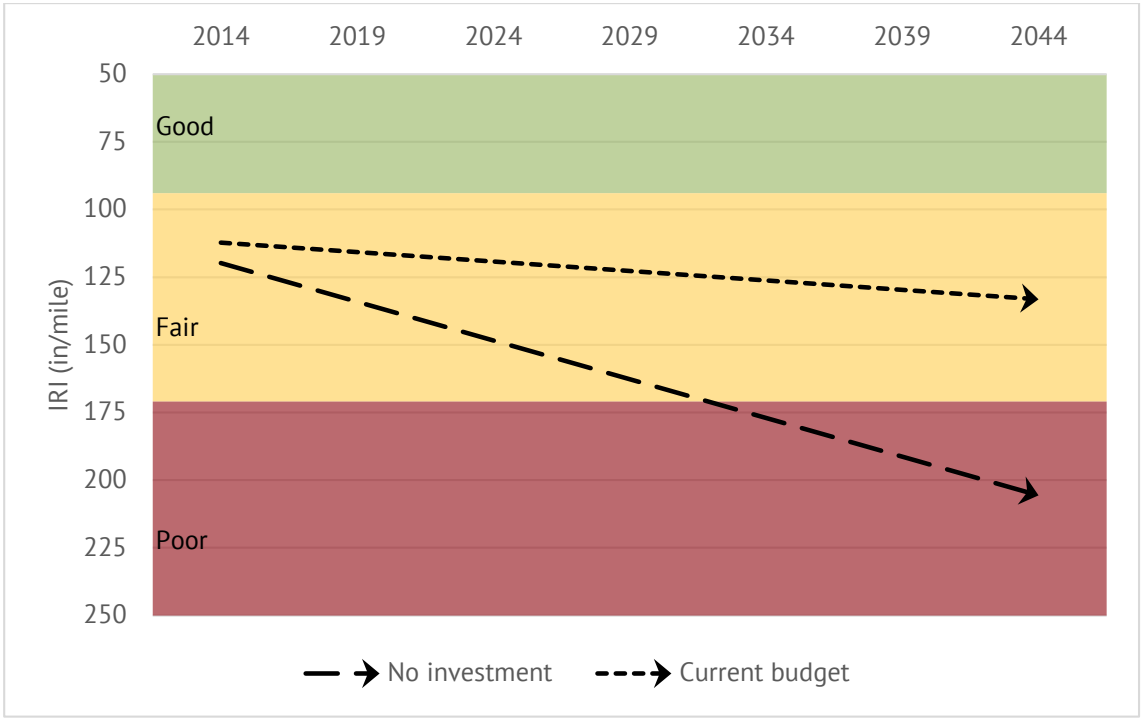
However, it is important to note that large portions of the system will continue to experience deteriorating pavement and bridge conditions at the projected funding levels. Figure 6.8 highlights the results of an analysis performed with the Federal Highway Administration (FHWA) resource Highway Economic Requirements System – State Version (HERS-ST). The analysis forecasts the primary highway system's average international roughness index (IRI), which is a common measurement of road roughness, from a base year of 2014 through 2044. As shown, current investment levels will slow the rate of deterioration but still result in a worsening IRI over time.

Figure 6.7: Highway average annual critical needs, Iowa DOT share, revenue, and shortfall, 2017-2045 ($ millions)



Source: Iowa DOT

Figure 6.8: Forecast trend for primary highway system pavement condition, current budget versus no investment



Source: HERS-ST

Implications of the shortfall

- Some improvements on the urban interstate system may not be addressed, which could lead to increased congestion and travel times.
- Some improvements on the rural interstate system may not be addressed, which could lead to poorer pavement conditions and congestion.
- Some improvements on the CIN may not be addressed, which could lead to fewer economic development opportunities and slower job growth.
- Some corridor improvements and work on other major projects, including major bridge structures, may not be addressed.
- Future modernization of the existing system will be a challenge.

Public transit

Costs

Costs for public transit were derived from the Iowa Passenger Transportation Funding Study that was completed in 2009. The funding study identified annual operating and capital costs for current services offered by the state's 35 public transit providers, as well as annual incremental costs associated with addressing unmet "baseline" and "choice" demand. For the purposes of the Plan, the costs for meeting the baseline demand were used, which would support both current services and the following statewide improvements.

- Increase service frequency for small and large urban fixed-route systems.
- Expand daily service hours for large urban systems.
- Expand daily regional paratransit trips.

The total annual costs for meeting baseline demand were identified in the funding study in 2009 dollars. These costs were inflated to 2016 dollars, and then projected to 2045 using an annual inflation rate of 3 percent, which aligns with typical annual inflation in public transit costs. **Average annual total costs** over the life of the Plan were then calculated.

To bring these costs into the context of the Five-Year Program, the portion of total public transit costs statewide that has historically been addressed through the transit element of the Five-Year Program was examined. The transit element of the Five-Year Program includes State Transit Assistance funds and Public Transit Infrastructure Grant Program funds. Between 2006 and 2015, this portion was just more than 11 percent of costs. This percentage was then applied to the average annual total costs mentioned above to estimate **average annual Iowa DOT costs** shown in Table 6.9.

Table 6.9: Average annual public transit costs, 2017-2045 ($ millions)

	Average annual total costs	Average annual Iowa DOT costs
Capital	$43.654	-
Operating	$367.498	-
Total	**$411.152**	**$45.640**

Source: Iowa DOT

Revenues

Revenues for public transit were derived from historical funding identified in the transit element of the Five-Year Program plus an average annual amount of Iowa's Clean Air Attainment Program (ICAAP) funding that has been awarded to transit projects over the life of the program. A linear trend line was applied to the historical data from SFY 2006 through 2015 and then projected out to 2045. **Average annual Iowa DOT revenues** (Table 6.10) over the life of the Plan were then calculated.

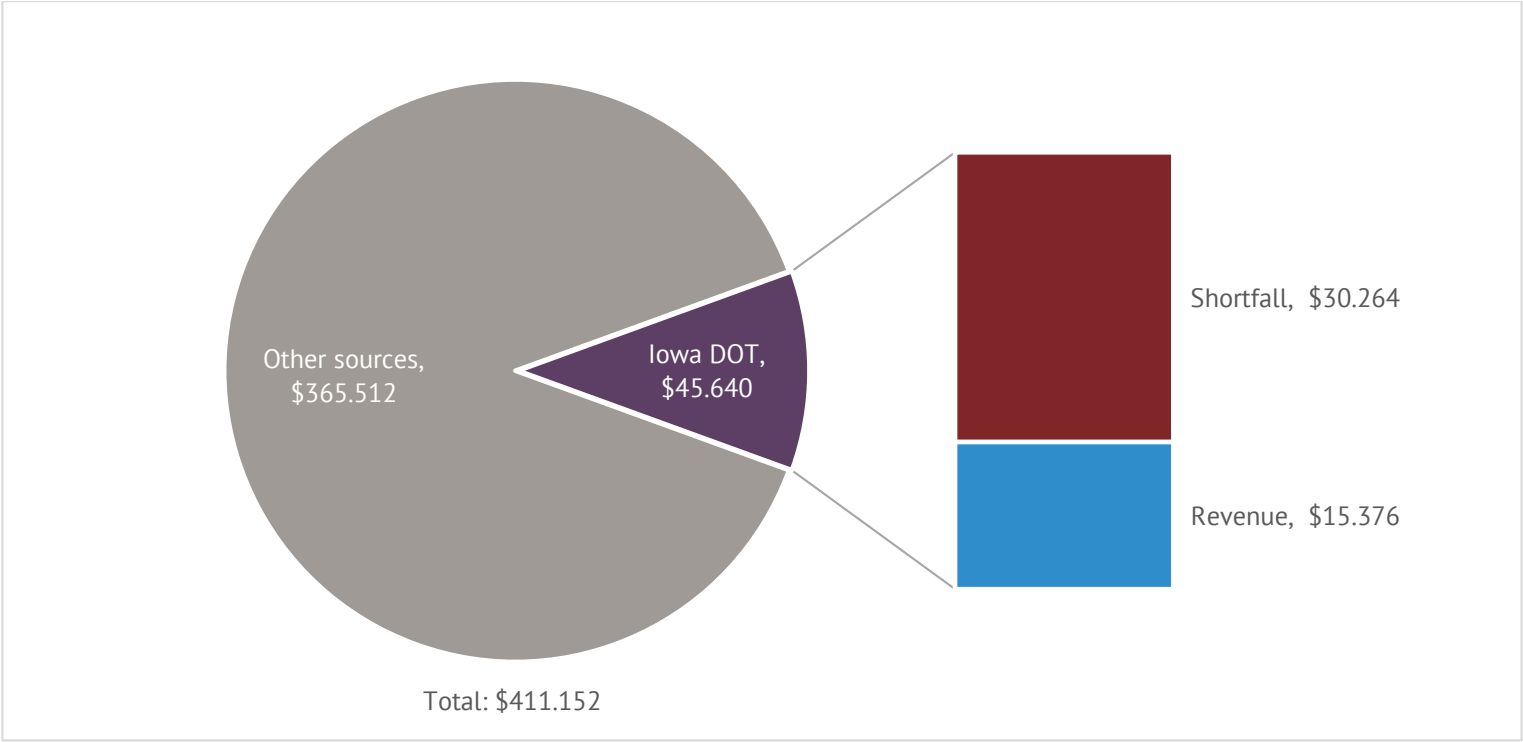
Table 6.10: Average annual public transit revenues, 2017-2045 ($ millions)

	Average annual Iowa DOT revenues
Total	$15.376

Source: Iowa DOT

The difference between average annual costs and revenues is illustrated in Figure 6.9. It is estimated that anticipated revenues would cover approximately 34 percent of the anticipated Iowa DOT costs.

Figure 6.9: Public transit average annual total costs, Iowa DOT share, revenue, and shortfall, 2017-2045 ($ millions)



Source: Iowa DOT

Implications of the shortfall

- Slow bus replacement will accelerate aging of the bus fleet, already well beyond useful life standards, and increase maintenance costs.
- Transit operational funding may need to be used to replace aging vehicles in disrepair, which could decrease service.
- Future plans for service expansions may be delayed, and some existing services may be eliminated.
- Transit facilities may not be repaired or improved in a timely manner.

Rail

Freight rail costs

Costs for freight rail were derived from the Iowa State Rail Plan, which was completed in 2017. The plan identifies, describes, and prioritizes specific potential rail projects for short- and long-term implementation. The proposed projects are based largely on increasing the efficiency of rail operations of Iowa's railroads; enhancing rail access and expanding or constructing multimodal facilities for handling freight more economically and efficiently; and enhancing safety at crossings. Focus areas for these potential projects include enhancing access to the state's rail network for shippers; fixing rail service gaps; improving infrastructure and the capacity, safety, and efficiency of rail service and operations; adapting for climate change and environmental sustainability; and economic development.

Costs were provided for projects in 2016 dollars, and inflated to the midyear of the short- and long-range periods using an annual inflation rate of 2 percent. **Average annual total costs** over the life of the Plan were then calculated (see Table 6.11). These costs would be divided amongst a range of entities – the Iowa DOT, other federal funding sources, local funding sources, and the railroad companies or other private funding sources.

Table 6.11: Average annual freight rail costs, 2017-2045 ($ millions)

	Average annual total costs
Total	$105.359

Source: Iowa DOT

Freight rail revenues

Revenues for freight rail were derived from historical funding for five funding programs managed by the Iowa DOT's Office of Rail Transportation. Programs includes the federal Highway Rail Grade Crossing Safety Fund, Highway-Railroad Crossing Surface Repair Fund, Primary Road Highway-Railroad Crossing Surface Improvements, Signal Maintenance, and the Railroad Revolving Loan and Grant Program. A linear trend line was applied to the historical data from SFY 2006 through 2015 and then projected out to 2045. **Average annual Iowa DOT revenues** (Table 6.12) over the life of the Plan were then calculated.

Table 6.12: Average annual freight rail revenues, 2017-2045 ($ millions)

	Average annual Iowa DOT revenues
Total	**$15.941**

Source: Iowa DOT

The difference between average annual freight rail costs and revenues is illustrated in Figure 6.10. It is estimated that anticipated revenues would cover approximately 15 percent of the total anticipated costs. As previously mentioned, the remaining costs would be divided among a range of entities, including other federal funding sources, local funding sources, and the railroad companies or other private funding sources.

Passenger rail costs

Costs for passenger rail were also derived from the Iowa State Rail Plan. The plan identifies, describes, and prioritizes specific potential future rail projects for short- and long-term implementation. The proposed projects are based largely on upgrading existing passenger rail stations and the potential for expanding intercity passenger rail services. Capital projects that may provide opportunities for improved coordination, integration, and operations of passenger rail services in the state were also identified.

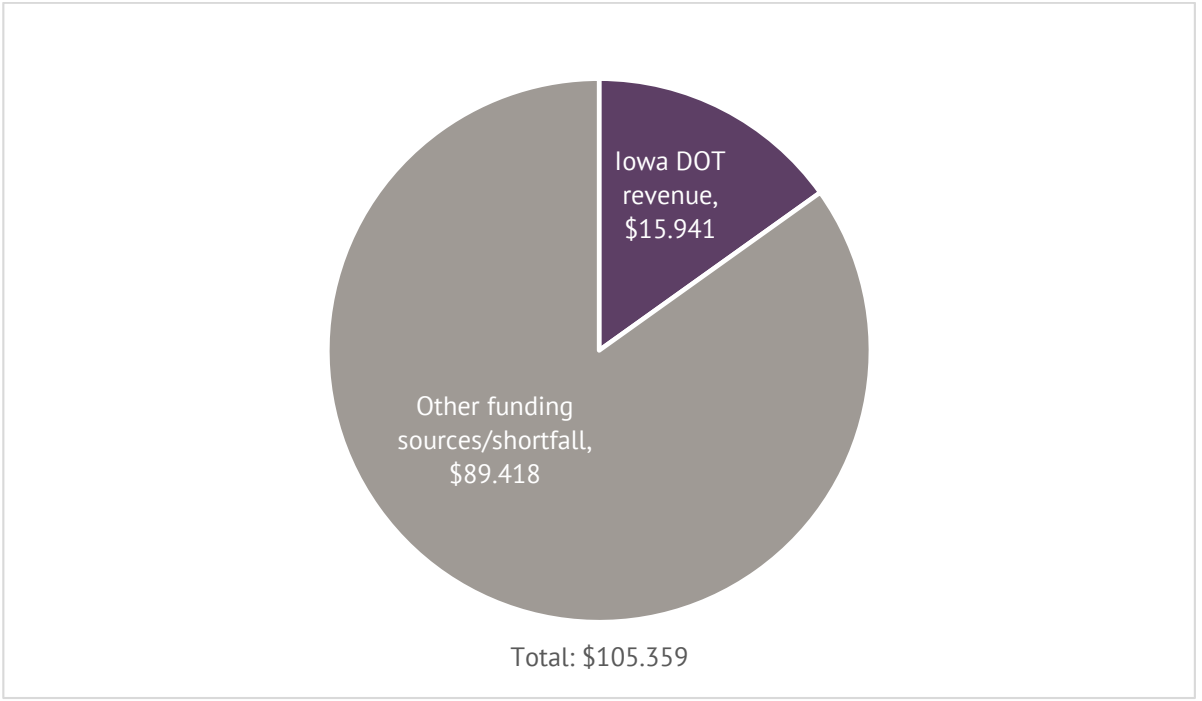
Costs were provided for projects in 2016 dollars, and inflated to the midyear of the short- and long-range periods using an annual inflation rate of 2. percent. **Average annual total costs** over the life of the Plan were then calculated (see Table 6.13). These costs would be divided amongst a range of entities – the Iowa DOT, other federal funding sources, local funding sources, and the railroad companies or other private funding sources.

Table 6.13: Average annual passenger rail costs, 2017-2045 ($ millions)

	Average annual total costs
Total	$199.344

Source: Iowa DOT

Figure 6.10: Freight rail average annual total costs, Iowa DOT revenue, and other funding sources/shortfall, 2017-2045 ($ millions)



Source: Iowa DOT

Passenger rail revenues

Federal funding sources have enabled initial study of passenger rail from Chicago westward to Omaha. Federal funding will likely continue to be needed to advance many of the proposed passenger rail projects. An average annual Iowa DOT revenue figure is not provided, because there is not a substantial enough funding history of passenger rail initiatives by the state.

Implications of the shortfall

- Rail safety and service may be affected if rail revenue is not sufficient for needed infrastructure improvements.
- Some highway-railroad crossings may not receive timely improvements, which could lead to potential safety hazards for railroad and roadway travel.
- Inadequate funding for spur tracks to new or expanding industries may affect future economic development and job creation opportunities.
- Some industries and communities may lose access to rail service if preservation of abandoned lines is unavailable, causing industries to close or relocate.
- Rail service may be impacted if railroads are unable to recover, without financial assistance, from natural disasters that cause infrastructure damage.
- Without adequate intermodal connections to rail, business and industry may not be able to take advantage of competitive rail rates for shipments.
- New passenger rail service may not be initiated, delaying the potential for multimodal system benefits (e.g., lower transportation costs due to alternative passenger options and improved freight infrastructure, reduced highway usage).

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7. MAKING IT HAPPEN

Implementing the Plan will require three important steps, which include addressing the funding shortfalls identified in the previous chapter, programming future investments, and continuous performance monitoring.

7.1 Addressing the shortfall

The first step in implementation involves gathering the resources necessary to make much-needed investments in Iowa's transportation system. With limited resources, efficient investment actions made through the Five-Year Program are extremely important to support the stewardship of Iowa's existing transportation system.

Chapter 6 showed that the 2015 fuel tax increase helped meet the critical shortfall in highway funding Iowa had been facing, but an overall funding shortfall remains. Each mode also faces a shortfall, which will limit implementation of the projects and services that would fully meet the needs identified in Chapter 5 unless additional financial resources are available. Difficult decisions must be made in dealing with Iowa's funding shortfall. Prioritizing projects, emphasizing stewardship, and achieving the right blend of modification, optimization, and transformation of the multimodal system will be critical to ensure limited dollars are spent in the most beneficial way.

Appendix 3 identifies various options for addressing the funding shortfalls identified in Chapter 6, including some mechanisms that may be more applicable to a single mode, and others that could be used to generate revenue for various modes as discussed at the end of this section. It should be noted that some of these mechanisms are already in place, and additional revenue would need to be generated through some adjustment to how the mechanism is applied. In addition, while various advantages and disadvantages are identified in the table, the purpose of this information is not to advocate for any specific revenue generating mechanism(s).

In evaluating these mechanisms, the following principles should be considered. These were publically expressed during the Governor's Transportation 2020 Citizen Advisory Commission's input gathering process, which was an input for the 2011 Road Use Tax Fund (RUTF) Study.

- The user fee concept should be preserved, where those who use the system pay for the system, including nonresidents.
- Revenue-generating mechanisms should be fair and equitable across users.
- Implement revenue-generating mechanisms that are viable now, but also begin to implement and set the stage for longer-term solutions that bring equity and stability to funding.
- Continue Iowa's long-standing tradition of pay-as-you-go financing.

RUTF Study

The Iowa Department of Transportation (DOT) has conducted the RUTF Study every five years since 2006. Iowa Code requires the department to review the current levels of the RUTF and the sufficiency of those revenues for projected construction and maintenance needs of city, county, and state governments; make funding recommendations if needed; and evaluate alternative funding sources for road maintenance and construction. The 2011 RUTF Study identified an average annual funding shortfall of $1.625 billion, part of which was a critical funding shortfall of $215 million. As discussed in Chapter 5, that critical funding shortfall was largely addressed through increases in road and bridge funding at the state and federal levels.

The 2016 RUTF Study was completed just one full construction season after the state and federal funding increases, which made the full impact on future roadway needs difficult to estimate at that time. Due to this, along with the elimination of the critical funding shortfall, the study did not include any recommendations for changes to funding mechanisms, but rather focused on the actions taken since the 2011 RUTF Study and on alternative-funding mechanisms, as well as an updated analysis of existing and potential revenue sources.

As the study notes, there are challenges with existing funding mechanisms, including the ability to keep pace with construction cost inflation, changes occurring with alternative fuel vehicles, and increasing vehicle fuel efficiency. These challenges are not unique to Iowa; therefore, there are ongoing efforts nationally and in other states to study the issue. The study highlighted three areas that are being increasingly studied and/or implemented across the country.

Indexing fuel tax rates

In addition to increasing fuel economy and increased use of alternative fuel vehicles, transportation revenues are also being further strained due to inflation. To address this issue, some states have implemented legislation that indexes fuel tax rates to inflation or the wholesale price of fuel. These adjustments are typically applied on an annual basis and boost fuel tax revenues to account for increases in construction costs. Seven states currently have laws in place, or will in the future, that adjust fuel tax rates based on the Consumer Price Index. An eighth state has indexed fuel tax rates in two counties, with an upcoming ballot measure that could enable indexing to be allowed in all counties on a county-by-county basis. An additional four states and the District of Columbia have passed legislation indexing fuel tax rates to the wholesale price of fuel. It is important to note that with either of these indexing methods, most states have included language that sets a baseline level to ensure revenues are not subject to deflation or declines in the price of fuel.

Alternative fuel vehicle registration fee

The largest component of federal and state transportation revenue is derived from excise taxes on motor fuel. Reliance on this source of funds is challenging for many reasons, including the expected transition from fossil fuel vehicles to alternative fuel vehicles. Alternative fuel vehicles, (e.g., electric, plug-in hybrid) use no, or very little, motor fuel upon which excise taxes are levied.

An alternative fuel vehicle registration fee is meant to capture a user fee from alternative fuel vehicles to help replace the reduced or eliminated fuel tax revenue. Multiple states have, or are considering implementing, an alternative fuel vehicle registration fee that is in addition to annual registration fees. As of the end of 2015, a total of 10 states have passed legislation that implemented an additional fee on electric vehicles. Most fees are levied on an annual basis and range from $50 to $200.

Per mile tax

The fuel tax was first implemented to act as a user fee where those who most used the transportation network were most responsible for paying for its maintenance and construction. Over time, this link between system use and tax paid has diminished because of alternatively fueled vehicles and increases in fuel economy. This issue is likely to continue to increase in the future as alternative fuel vehicles continue to gain market share and as corporate average fuel economy (CAFE) standards are set to require an increase of more than 50 percent in passenger vehicle fuel economy between 2014 and 2025.

As a result, many states have given consideration to implementing a new transportation user fee. These states are most interested in a system that would charge a tax on the number of vehicle-miles traveled (VMT) rather than a fixed amount of tax per gallon of fuel. By levying a tax upon the number of miles traveled, issues such as alternative fuel vehicle technology and increases in fuel economy no longer pose a risk to transportation revenues. As such, a per mile tax could provide a more stable source of transportation revenue for the future.

While the benefits of a per mile tax are clear, significant challenges exist surrounding the implementation of such a tax. Some collection options for a per mile tax involve the tracking of a vehicle's location. While this could facilitate revenue distribution and varying policy options, it raises serious concerns regarding privacy and security. Another challenge is the cost of implementing and administering the per mile tax. Transitioning from the fuel tax to a per mile tax would involve transitioning from collecting fuel tax from relatively few fuel distribution facilities to collecting mileage information from unique vehicles or drivers. This change would result in an increase in the cost of administering the tax.

As part of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) transportation bill passed in 2005, Congress authorized researchers from the University of Iowa to conduct a field test for implementing mileage-based highway user fees. The study tested more than 2,600 vehicles over the span of two years and concentrated on the technical feasibility and user acceptance of implementing a per mile tax. The study found that both global positioning systems (GPS) and onboard diagnostics systems measured approximately 92.5 percent of all miles driven. In addition, the study found that upon conclusion, 71 percent of survey participants had a highly or somewhat positive view of the per mile tax.

In addition to the University of Iowa study, across the country a number of other studies have been completed that have focused on a per mile tax and associated issues, such as evaluating implementation technology, payment options, enforcement, willingness to change travel patterns based on variable per mile tax rates, urban versus rural issues, and privacy concerns. Oregon, in particular, has completed a number of studies and pilot programs, leading to the implementation of a fully functional road-usage charge program for up to 5,000 vehicles.

Interest in implementing a per mile tax continues to expand throughout the country. Authorized as part of the Fixing America's Surface Transportation (FAST) Act, the Surface Transportation System Funding Alternatives grant program provides funding to states or groups of states to demonstrate user-based alternative revenue mechanisms. The FAST Act authorized a total of $95 million over the five-year period of 2016-2020. Eight studies were awarded in fiscal year 2016. The Iowa DOT is following these studies closely and participating in regional and national efforts to monitor impacts on roadway revenues.

While the content of the RUTF study is certainly focused on Iowa's roadway system, the intent of this section and Appendix 1 is to identify options for addressing the funding shortfalls associated with each of the modes. As previously mentioned, some of the mechanisms noted in Appendix 1 may be more applicable to a single mode. However, there are several options that could be used to generate revenue for various modes. Some examples include gaming/lottery tax, public-private partnerships, sales tax, and transportation improvement districts. While these mechanisms represent those that are more clearly multimodal in their possible application, it should be noted that the legislation associated with all revenue generating mechanisms could be structured in such a way to direct funds to any transportation mode(s).

7.2 Programming

The second step in implementation involves the development of the Five-Year Program, which is completed by the Iowa Transportation Commission (Commission) and the Iowa DOT. This document is used to inform Iowans of planned investments in our state's multimodal transportation system. The Five-Year Program is typically updated and approved each year in June, and encompasses investments in aviation, transit, railroads, trails, and highways.

Program development and management

Each day some facet of the complex transportation system affects Iowans. The process of making the critical decisions about what investments will be made to manage the state-owned system is also complex. It involves input from a wide range of individuals and organizations, and is based on an expansive programming process. As of the adoption of this Plan, the Iowa DOT is transitioning to an enhanced programming process that will improve transparency, align available tools and plans, and better incorporate appropriate stakeholders. The major steps in that process include:

1. Problem statement development
2. Scoping
3. Project advancement
4. Project prioritization
5. Program synthesis
6. Final programming

Problem statement development

The initial step in the process is a recognition that all projects should result from an original problem or need identified on the transportation system. Those problems could be related to mobility, safety, infrastructure condition, resilience, or many other factors. The first step in the process is to clearly state and document the original problem such that solutions can be evaluated against the problem as stated.

Scoping

Once a problem has been identified, the next step is to scope the problem and initial solutions. At present, there is no single system to support the scoping process; however, one is currently being developed through the Iowa DOT's Office of Location and Environment. After the project is checked for consistency with the Plan, the final stage of the scoping process will result in the development of a project charter. The project charter will contain relevant information necessary to initiate the development of a project.

Project advancement

Once a project has been chartered, it is a candidate for further development. While most simple projects will quickly advance through this step, it is intended to serve as a "pause point" to consider the problem statement, the proposed solution, and have a determination made about the assignment of resources to develop the project. If the proposed project is selected for prioritization and possible development, the project location will be set, and a project number assigned.

Project prioritization

At this point, the process shifts from examining individual problems and projects to examining the best mix of projects to achieve documented objectives for the system. Chartered projects will flow into a process that will use a prioritization tool currently being developed through the Office of Location and Environment, which will compare the benefits and costs of each proposed solution and allow for comparisons and ranking of projects against system-level targets and objectives. In this step, available resources will be balanced with system objectives, resulting in a portfolio of projects that will optimize investment.

Program synthesis

In this step, the Iowa DOT's Office of Program Management will manage the development of the draft Five-Year Program, incorporating information from the portfolio optimization process. Schedule and funding constraints will be evaluated and used to inform recommendations to the Highway Program Team for inclusion in the proposed Five-Year Program to be presented to the Commission.

Final programming

The Highway Program Team will review the recommended program and the performance levels projected to be achieved by the proposed program. They will then finalize the draft program for presentation to the Commission, or refer it back through the program development process for modification as necessary.

Multimodal programming

It should be noted that the programming process described on the preceding pages is more directly applicable to the highway portion of the Five-Year Program. As previously mentioned, the document is multimodal in nature, and contains the following program sections that are directly related to one of the five nonwater modes discussed in the Plan.

- Aviation Program
- Transit Program
- Railroad Program
- State and Federal Trails programs
- Revitalize Iowa Sound Economy (RISE) Program
- Iowa Statewide Transportation Alternatives Program
- Iowa's Clean Air Attainment Program
- Traffic Safety Improvement Program
- Highway Program

With few exceptions, the funding for the nonhighway programs is associated with an application-based process in which applications are solicited, typically on a defined schedule, by Iowa DOT staff. Staff and/or a standing committee evaluates eligible applications against a set of established criteria. Following the evaluation process, a funding recommendation is developed and presented to the Commission for its review. The Commission then holds final approval authority for each of the individual programs contained in the Five-Year Program.

The funding cycle and program monitoring

The transportation programming process is a continuous, year-round effort. The Iowa DOT's contracting and revenue experiences are closely monitored and monthly updates are reviewed by the Commission. Because Iowa uses a "pay-as-you-go" investment model, adjustments to the Five-Year Program may be warranted throughout the year to ensure the investment plan remains balanced and expenses do not exceed revenues. If revenues or expenses significantly exceed projections, projects may be added or removed accordingly.

A copy of the Five-Year Transportation Improvement Program is available on the Iowa DOT's website: http://www.iowadot.gov/program_management/five_year.html.

7.3 Performance monitoring

The third step in implementation is the process of performance monitoring. This process allows a public agency to demonstrate how well the transportation system is performing relative to stated goals and expectations. The transportation planning process is cyclical (see Figure 1.2), and performance monitoring has long been a key component of the process. Evaluating the performance of the system helps determine what impacts have been achieved by investments, and where new or additional investments may be needed. Performance management was formalized for federal-aid programs with the 2012 Moving Ahead for Progress in the 21st Century (MAP-21) Act, which established seven national goals for the federal-aid highway program. These goals were affirmed in the 2015 FAST Act. The goals are:

- **Safety**: To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
- **Infrastructure condition**: To maintain the highway infrastructure asset system in a state of good repair.
- **Congestion reduction**: To achieve a significant reduction in congestion on the National Highway System.
- **System reliability**: To improve the efficiency of the surface transportation system.
- **Freight movement and economic vitality**: To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.
- **Environmental sustainability**: To enhance the performance of the transportation system while protecting and enhancing the natural environment.
- **Reduced project delivery delays**: To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.

In order to monitor progress towards these goals, MAP-21 and the FAST Act require the establishment of a number of performance measures and targets by states, public transit providers, and metropolitan planning organizations (MPOs). These measures are outlined in Tables 7.1-7.5. States and MPOs will be required to evaluate conditions for these measures; set targets; describe how the projects included in the Statewide Transportation Improvement Program (STIP) and each MPO's Transportation Improvement Program (TIP) will help achieve progress towards the targets; and report on actual results and whether targets were met. In some cases, if the state does not meet its targets, there will be restrictions on how certain funding programs can be used or additional planning efforts may be required.

Several offices across the Iowa DOT will be working together to implement the required performance measures, target setting, and reporting. The performance measures and targets will be integrated throughout the planning and programming process. The Iowa DOT will also coordinate with the state's public transit providers and MPOs on target setting. In early 2017, coordination began among the Iowa DOT, Iowa Department of Public Safety, and MPOs for safety-related targets. Coordination will continue for other performance measures as rulemakings are finalized.

Table 7.1: Performance measures established for safety for States and MPOs

Performance measure	Measure Applicability	State deadline	MPO deadline
Number of fatalities	All public roads	CY 2018 targets due for NHTSA HSP by 7/1/17; targets due in HSIP annual report by 8/31/17	MPO reports targets to Iowa DOT by 2/27/18
Rate of fatalities	All public roads		
Number of serious injuries	All public roads		
Rate of serious injuries	All public roads	CY 2018 targets due in HSIP annual report by 8/31/17	
Number of nonmotorized fatalities and nonmotorized serious injuries	All public roads		

Source: FHWA final rule:
National Performance Management Measures: Highway Safety Improvement Program

Table 7.2: Performance measures established* for pavement and bridge condition for States and MPOs

Performance measure	Measure Applicability
Percentage of pavements of the Interstate System in Good condition	The Interstate System
Percentage of pavements of the Interstate System in in Poor condition	The Interstate System
Percentage of pavements of the non-Interstate NHS in Good condition	The non-Interstate NHS
Percentage of pavements of the non-Interstate NHS in Poor condition	The non-Interstate NHS
Percentage of NHS bridges classified as in Good condition	NHS
Percentage of NHS bridges classified as in Poor condition	NHS

**The final rule for these measures was initially issued on January 18, 2017. At the time of this document's publication, the effective date had been delayed to May 20, 2017.*
Source: FHWA final rule: National Performance Management Measures; Assessing Pavement Condition for the National Highway Performance Program and Bridge Condition for the National Highway Performance Program

Table 7.3: Performance measures established* for system performance, freight movement, and congestion for States and MPOs

Performance measure	Measure Applicability
Percent of the person-miles traveled on the Interstate that are reliable	The Interstate System
Percent of the person-miles traveled on the non-Interstate NHS that are reliable	The non-Interstate NHS
Percent change in tailpipe CO2 emissions on the NHS compared to the calendar year 2017 level	The NHS
Truck travel time reliability index	The Interstate System
Annual hours of peak hour excessive delay per capita**	Mainline of NHS in urbanized areas with a population over 1M/200k in nonattainment or maintenance for any of the criteria pollutants under the CMAQ program.
Percent of non-SOV travel**	Urbanized areas with a population over 1M/200k in nonattainment or maintenance for any of the criteria pollutants under the CMAQ program.
Total emissions reduction**	All nonattainment and maintenance areas for CMAQ criteria pollutants.

** The final rule for these measures was initially issued on January 18, 2017. At the time of this document's publication, the effective date had been delayed to May 20, 2017*

***Measure not currently applicable to Iowa or any of its MPOs*

Source: FHWA final rule: National Performance Management Measures; Assessing Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program

Table 7.4: Performance measures established for transit asset management for States, public transit providers, and MPOs

Performance measure	Measure Applicability
Percentage of non-revenue vehicles met or exceeded Useful Life Benchmark	Equipment: Non-revenue support-service and maintenance vehicles
Percentage of revenue vehicles met or exceeded Useful Life Benchmark	Rolling stock: Revenue vehicles by mode
Percentage of track segments with performance restrictions	Infrastructure: Rail fixed-guideway, track, signals, and systems
Percentage of assets with condition rating below 3.0 on FTA TERM Scale	Facilities: Maintenance and administrative facilities; and passenger stations (buildings) and parking facilities

Source: FTA final rule: Transit Asset Management; National Transit Database

Table 7.5: Performance measures proposed for transit safety for States, public transit providers, and MPOs

Performance measure	Description
Fatalities	Total number of reportable fatalities and rate per total vehicle review miles by mode
Injuries	Total number of reportable injuries and rate per total vehicle revenue miles by mode
Safety events	Total number of reportable events and rate per total vehicle revenue miles by mode
System reliability	Mean distance between major mechanical failures by mode

Sources: FTA notice of proposed rulemaking: Public Transportation Agency Safety Plans; National Public Transportation Safety Plan

In addition to required reporting for MAP-21/FAST Act measures, the Iowa DOT has identified a number of performance measures to help track system status across modes. Performance measures are helpful in Plan implementation as a way to identify specific measures that monitor progress toward achieving the Plan's vision. Measures have been identified in Table 7.4 for three general categories:

- System performance – measurements that help gauge the usage of the mode, or its availability
- Safety – measurements related to crashes, fatalities, and/or incidents for that mode
- System condition – measurements that provide a view of the condition of the mode's infrastructure

These measures will help enhance understanding of trends across modes, and were developed in consultation with modal offices. Among other things, system performance measures should be specific, measurable, relevant, and meaningful. Some are tracking measures, meaning that they may be items that are not directly influenced by the Iowa DOT or its investments, but still help provide an understanding of the mode's usage and impact.

Table 7.6: Iowa DOT performance measures

Mode	System performance	Safety	System condition
Aviation	Annual number of commercial passenger enplanements 2010: 1,468,158 2015: 1,826,127	Number of airports certified for public use 2010: 116 2016: 114	Percentage of airports that meet all facility targets for their role 2010: 61% 2016: 68%
	Aviation fuel dispensed (gallons) 2010: 36,527,471 2015: 39,310,446		Percentage of airports with a Pavement Condition Index (PCI) of 70 or higher on paved runways 2010: 87% 2016: 78%
Bicycle and pedestrian	Miles of off-road trails 2011: 1,780 2016: 1,866	*Bicycle fatalities – will align with required MAP-21/FAST PM* *Bicycle and pedestrian fatalities 2010: 27; 2016: 26*	Miles of non-interstate Primary Highway System rated as good for on-road bicycle compatibility 2016: 749.5
		Annual number of on-road, reported bicycle and pedestrian crashes 2010: 909 2016: 868	
Highway	Total annual vehicle-miles traveled (VMT) 2010: 31,579,356,000 2015: 33,108,942,000	*Crash rate – will align with required MAP-21/FAST PM*	*Pavement condition – will align with required MAP-21/FAST PM*
		Fatalities – will align with required MAP-21/FAST PM	*Bridge condition – will align with required MAP-21/FAST PM*
Public transit	Annual statewide transit ridership 2010: 26,209,999 2016: 27,838,603	Public transit crash rate per 100 million VMT 2010: 6.28 crashes 2015: 4.61 crashes	Percentage of public transit fleet operating within Federal Transit Administration's normal useful life standards 2010: 51% 2016: 37%
Rail	Total freight tonnage moved by rail (million tons) 2010: 342.5 2015: 360.6	Total crashes involving a train 2010: 42 2016: 27	Percentage of track-miles able to operate at 40 mph or higher 2010: 69.8% 2016: 86.3%
	Annual passenger rail boardings and alightings 2010: 68,744 2016: 57,611	Derailments per million net ton-miles 2010: 0.00074 2016: 0.00061	Percentage of track-miles able to handle 286,000-pound cars 2010: 82.0% 2016: 89.4%

Source: Iowa DOT

Measures will be monitored and reviewed over time. The purpose of a periodic review of these performance measures is to bring the Plan into a more focused short-term perspective while providing more detailed information to decision-makers. The review will function as a planning tool that can alert decision-makers to potential adjustments that could be considered. This assessment can consider all elements affecting transportation investment, including guidance for activities such as design, programming, and location studies. When done in advance of programming activities, the review can provide direction and guidance for including specific investment actions in the Five-Year Program.

7.4 Moving forward

Iowa in Motion 2045 provides a framework for the Iowa DOT and the Commission to identify, prioritize, and select investments that will help maintain and create the transportation system envisioned for the state. The investigation and analysis conducted throughout development of the Plan has led to the following general conclusions.

- The state is completing a transition from building the system to efficiently managing the existing system through a philosophy of stewardship.
- The state has a good transportation system overall, but additional improvements are needed.
- Across modes, there is a funding shortfall that will dramatically worsen over time if action is not taken to identify new or additional sustainable financial resources.

Implementing the Plan will be a significant effort across and beyond the Iowa DOT. Outside of the three important steps identified earlier in this chapter, there are additional keys to implementing the plan that should be noted. One such key is to maintain and strengthen the Iowa DOT's partnership with the state's MPOs and regional planning affiliations (RPAs). This partnership is cultivated both through day-to-day interactions and more formalized interactions, such as the quarterly meetings of these agencies that are hosted by the Iowa DOT. The state's MPOs and RPAs will be critical in the development and implementation of future statewide transportation plans.

Another key to "making it happen" will be to diligently update the Plan as needed given recent developments and progress toward implementation. It is possible that future federal legislation could require statewide transportation plans to be updated on a specific schedule. In the meantime, it is important that the Plan be continuously evaluated, revised, and updated in accordance with federal regulations, and continue to utilize a five-year update cycle.

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APPENDIX 1: **FEDERAL REQUIREMENTS**

The table below provides the code of federal regulations (CFR) language related to state transportation plans. This CFR language was included in the Statewide and Nonmetropolitan Transportation Planning; Metropolitan Transportation Planning rule issued by the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) on May 27, 2016. The rule has a 2-year phase-in, meaning that state transportation plans adopted or amended after May 27, 2018 will need to be in compliance with these regulations.

Iowa in Motion 2045 has been developed during the timeframe of 2015-2017. It follows the CFR requirements that have been in effect during that time, but includes some of the new elements and requirements of this rule.

23 CFR 450.216 Development and content of the long-range statewide transportation plan	Plan references and notes
(a) The State shall develop a long-range statewide transportation plan, with a minimum 20-year forecast period at the time of adoption, that provides for the development and implementation of the multimodal transportation system for the State. The long-range statewide transportation plan shall consider and include, as applicable, elements and connections between public transportation, non-motorized modes, rail, commercial motor vehicle, waterway, and aviation facilities, particularly with respect to intercity travel.	The state transportation plan (Plan) is a multimodal planning document with a horizon year of 2045.
(b) The long-range statewide transportation plan should include capital, operations and management strategies, investments, procedures, and other measures to ensure the preservation and most efficient use of the existing transportation system including consideration of the role that intercity buses may play in reducing congestion, pollution, and energy consumption in a cost-effective manner and strategies and investments that preserve and enhance intercity bus systems, including systems that are privately owned and operated. The long-range statewide transportation plan may consider projects and strategies that address areas or corridors where current or projected congestion threatens the efficient functioning of key elements of the State's transportation system.	Strategies related to these areas are discussed in Chapter 5, Sections 5.2 and 5.3, and Chapter 6.
(c) The long-range statewide transportation plan shall reference, summarize, or contain any applicable short-range planning studies; strategic planning and/or policy studies; transportation needs studies; management systems reports; emergency relief and disaster preparedness plans; and any statements of policies, goals, and objectives on issues (e.g., transportation, safety, economic development, social and environmental effects, or energy), as appropriate, that were relevant to the development of the long-range statewide transportation plan.	Referencing of other plans, reports, and studies is discussed in Chapter 1, Section 1.3. Related planning efforts are also discussed throughout Chapters 3, 4, and 5.

23 CFR 450.216 Development and content of the long-range statewide transportation plan	Plan references and notes
(d) The long-range statewide transportation plan should integrate the priorities, goals, countermeasures, strategies, or projects contained in the HSIP, including the SHSP, required under 23 U.S.C. 148, the Public Transportation Agency Safety Plan required under 49 U.S.C. 5329(d), or an Interim Agency Safety Plan in accordance with 49 CFR part 659, as in effect until completion of the Public Transportation Agency Safety Plan.	Safety planning efforts, including the SHSP and modal safety, are discussed in Chapter 3, Section 3.8. Associated strategies are included in Chapter 5, Section 5.3.
(e) The long-range statewide transportation plan should include a security element that incorporates or summarizes the priorities, goals, or projects set forth in other transit safety and security planning and review processes, plans, and programs, as appropriate.	Security planning efforts are discussed in Chapter 3, Section 3.9. Associated strategies are included in Chapter 5, Section 5.3.
(f) The statewide transportation plan shall include: (1) A description of the performance measures and performance targets used in assessing the performance of the transportation system in accordance with §450.206(c); and (2) A system performance report and subsequent updates evaluating the condition and performance of the transportation system with respect to the performance targets described in §450.206(c), including progress achieved by the MPO(s) in meeting the performance targets in comparison with system performance recorded in previous reports.	Performance measures and deadlines associated with target setting are discussed in Chapter 7, Section 7.3.
(g) Within each metropolitan area of the State, the State shall develop the long-range statewide transportation plan in cooperation with the affected MPOs.	Cooperation with Iowa's metropolitan planning organizations (MPOs) is discussed in Chapter 1, Section 1.3.
(h) For nonmetropolitan areas, the State shall develop the long-range statewide transportation plan in cooperation with affected nonmetropolitan local officials with responsibility for transportation or, if applicable, through RTPOs described in §450.210(d) using the State's cooperative process(es) established under §450.210(b).	Cooperation with Iowa's regional planning affiliations (RPAs) is discussed in Chapter 1, Section 1.3.
(i) For each area of the State under the jurisdiction of an Indian Tribal government, the State shall develop the long-range statewide transportation plan in consultation with the Tribal government and the Secretary of the Interior consistent with §450.210(c).	Consultation with tribal governments is discussed in Chapter 1, Section 1.3.

23 CFR 450.216 Development and content of the long-range statewide transportation plan	Plan references and notes
(j) The State shall develop the long-range statewide transportation plan, as appropriate, in consultation with State, Tribal, and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation. This consultation shall involve comparison of transportation plans to State and Tribal conservation plans or maps, if available, and comparison of transportation plans to inventories of natural or historic resources, if available.	Consultation with resource agencies is discussed in Chapter 1, Section 1.3.
(k) A long-range statewide transportation plan shall include a discussion of potential environmental mitigation activities and potential areas to carry out these activities, including activities that may have the greatest potential to restore and maintain the environmental functions affected by the long-range statewide transportation plan. The discussion may focus on policies, programs, or strategies, rather than at the project level. The State shall develop the discussion in consultation with applicable Federal, State, regional, local and Tribal land management, wildlife, and regulatory agencies. The State may establish reasonable timeframes for performing this consultation.	Consultation with resource agencies is discussed in Chapter 1, Section 1.3. Environmental planning is discussed in Chapter 3, Section 3.4.
(l) In developing and updating the long-range statewide transportation plan, the State shall provide: (1) To nonmetropolitan local elected officials, or, if applicable, through RTPOs described in §450.210(d), an opportunity to participate in accordance with §450.216(h); and (2) To individuals, affected public agencies, representatives of public transportation employees, public ports, freight shippers, private providers of transportation (including intercity bus operators, employer-based cash-out program, shuttle program, or telework program), representatives of users of public transportation, representatives of users of pedestrian walkways and bicycle transportation facilities, representatives of the disabled, providers of freight transportation services, and other interested parties with a reasonable opportunity to comment on the proposed long-range statewide transportation plan. In carrying out these requirements, the State shall use the public involvement process described under §450.210(a).	Public input efforts are discussed in Chapter 1, Section 1.3.

23 CFR 450.216 Development and content of the long-range statewide transportation plan	Plan references and notes
(m) The long-range statewide transportation plan may include a financial plan that demonstrates how the adopted long-range statewide transportation plan can be implemented, indicates resources from public and private sources that are reasonably expected to be made available to carry out the plan, and recommends any additional financing strategies for needed projects and programs. In addition, for illustrative purposes, the financial plan may include additional projects that the State would include in the adopted long-range statewide transportation plan if additional resources beyond those identified in the financial plan were to become available. The financial plan may include an assessment of the appropriateness of innovative finance techniques (for example, tolling, pricing, bonding, public-private partnerships, or other strategies) as revenue sources. (n) The State is not required to select any project from the illustrative list of additional projects included in the financial plan described in paragraph (m) of this section.	Historical and forecasted costs and revenues are discussed at a modal level in Chapter 6.
(o) The State shall publish or otherwise make available the long-range statewide transportation plan for public review, including (to the maximum extent practicable) in electronically accessible formats and means, such as the World Wide Web, as described in §450.210(a).	The project website, http://www.iowadot.gov/iowainmotion/index.html, has included draft content throughout plan development and will also house the final Plan.
(p) The State shall continually evaluate, revise, and periodically update the long-range statewide transportation plan, as appropriate, using the procedures in this section for development and establishment of the long-range statewide transportation plan.	Iowa is currently on a 5-year update cycle for its state transportation plan. The Plan will be revisited and revised as necessary.
(q) The State shall provide copies of any new or amended long-range statewide transportation plan documents to the FHWA and the FTA for informational purposes.	Final copies of the Plan will be provided to FHWA and FTA.

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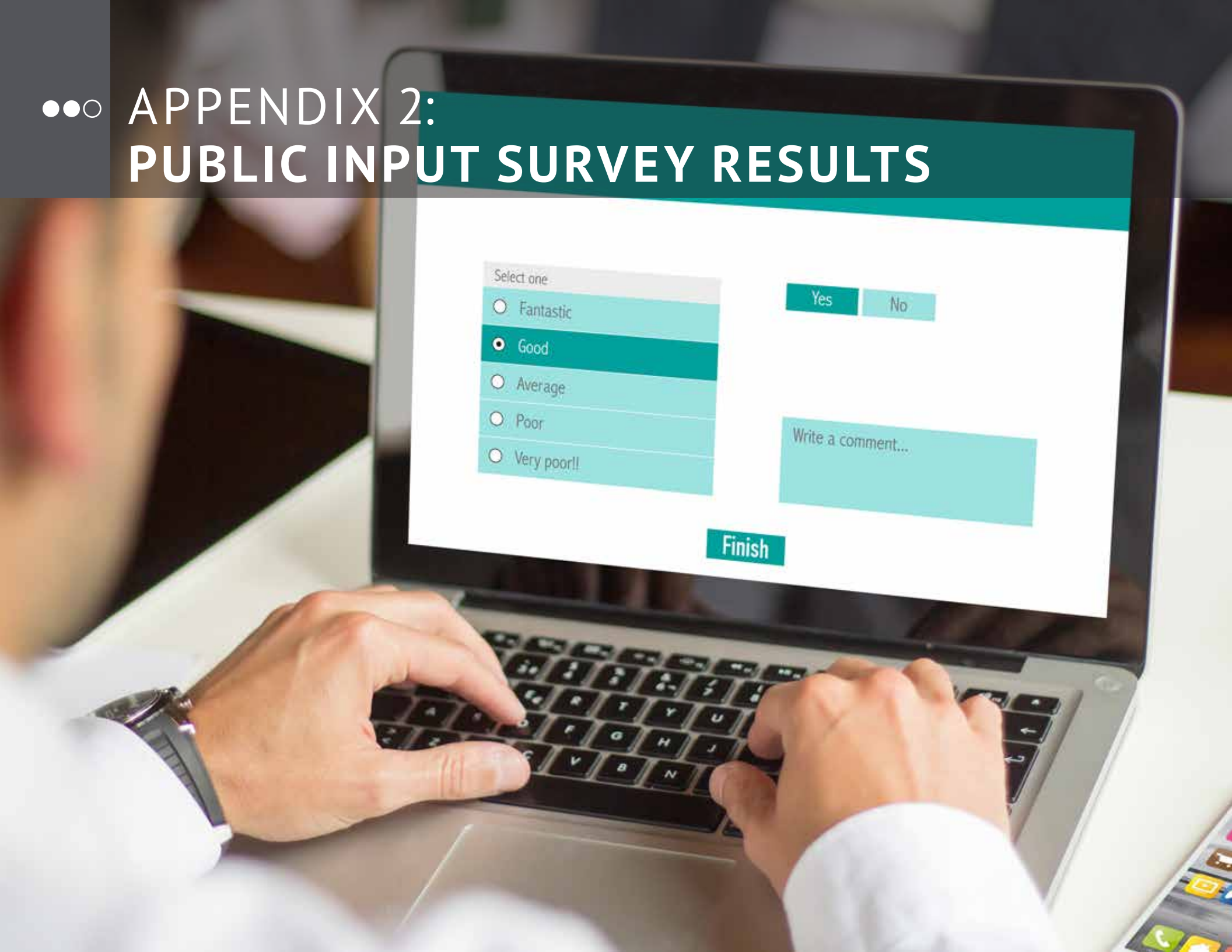
APPENDIX 2:
PUBLIC INPUT SURVEY RESULTS



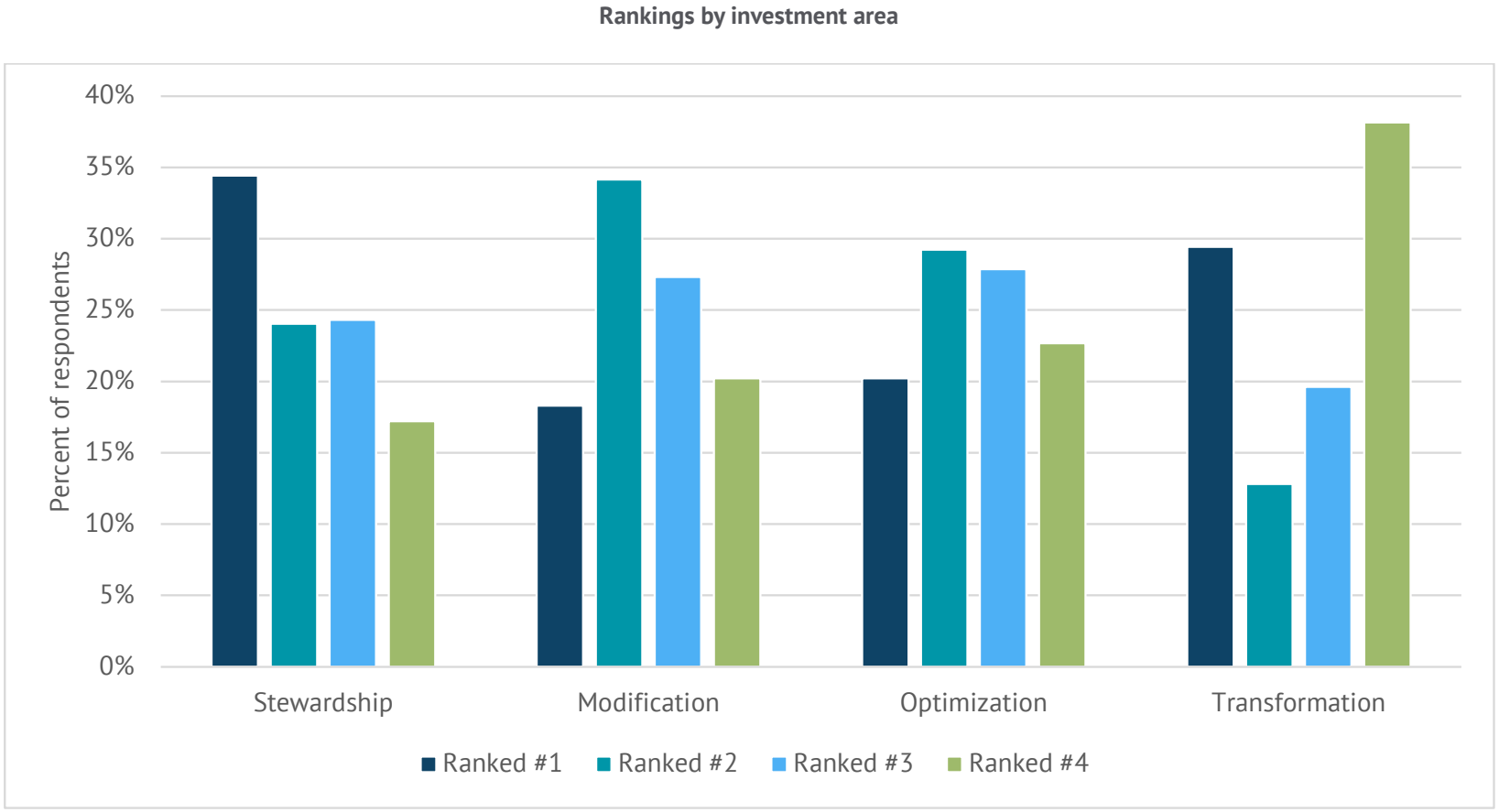
First public input survey

The first public input survey for the state transportation plan (Plan) was conducted in February, 2016. A total of 520 people provided data through the survey. Results are summarized here, and were used to inform the vision, investment areas, and action plan.

Investment areas exercise

Respondents were asked to prioritize four draft investment areas by ordering from 1 (highest priority) to 4 (lowest priority), and were also asked to provide comments or suggest additional investment areas. The following table and chart provide the draft investment areas, average rankings, and a breakdown of the rankings by investment area.

Investment area	Description	Average priority ranking
Stewardship	**Maintaining a state of good repair**: Much of the existing multimodal system will likely need to be managed and maintained similarly to how it is today. This includes applying asset management techniques to keep the system in adequate condition, and making safety enhancements as needed.	2.24
Modification	**Right-sizing the system**: Right-sizing means building the multimodal system of the future, not rebuilding the system of today. This will require significant investment in stewardship, some focused capacity expansion as resources allow, and perhaps some system contraction.	2.49
Optimization	**Improving system efficiency and resiliency**: Improving efficiency and resiliency means optimizing the current multimodal system, not just adding pavement. This includes using data to monitor the system, improving response when managing incidents, and enhancing communication with system users.	2.53
Transformation	**Increasing mobility and travel choices**: Providing a multimodal system that accommodates everyone includes investments beyond the typical highway system that enhance other modes (public transit, bicycle, pedestrian, air, rail), and investments aimed at decreasing single-occupant vehicles.	2.66



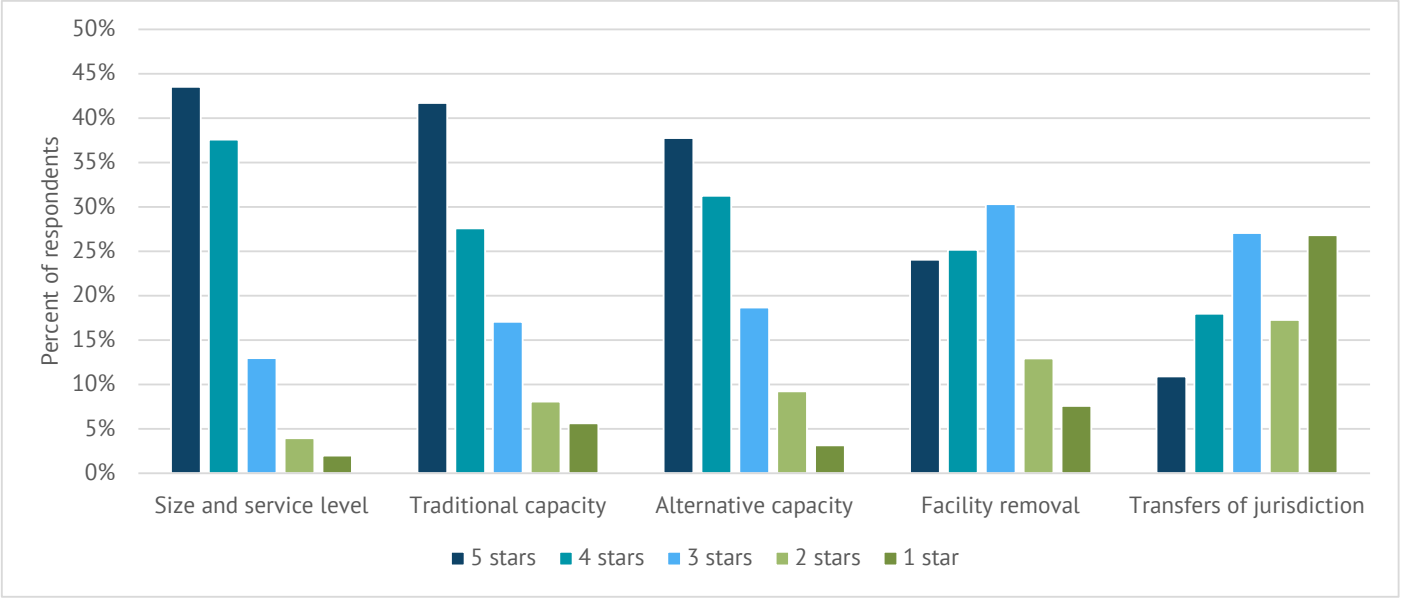
Strategies exercise

Respondents were asked to evaluate five draft strategies for each investment area (modification, stewardship, optimization, and transformation) by ranking them with 1 (low) to 5 (high) stars, and were also asked to provide comments or suggest additional strategies. The following sections provide the draft strategies, average rankings, and a breakdown of the rankings by strategy.

Modification strategies

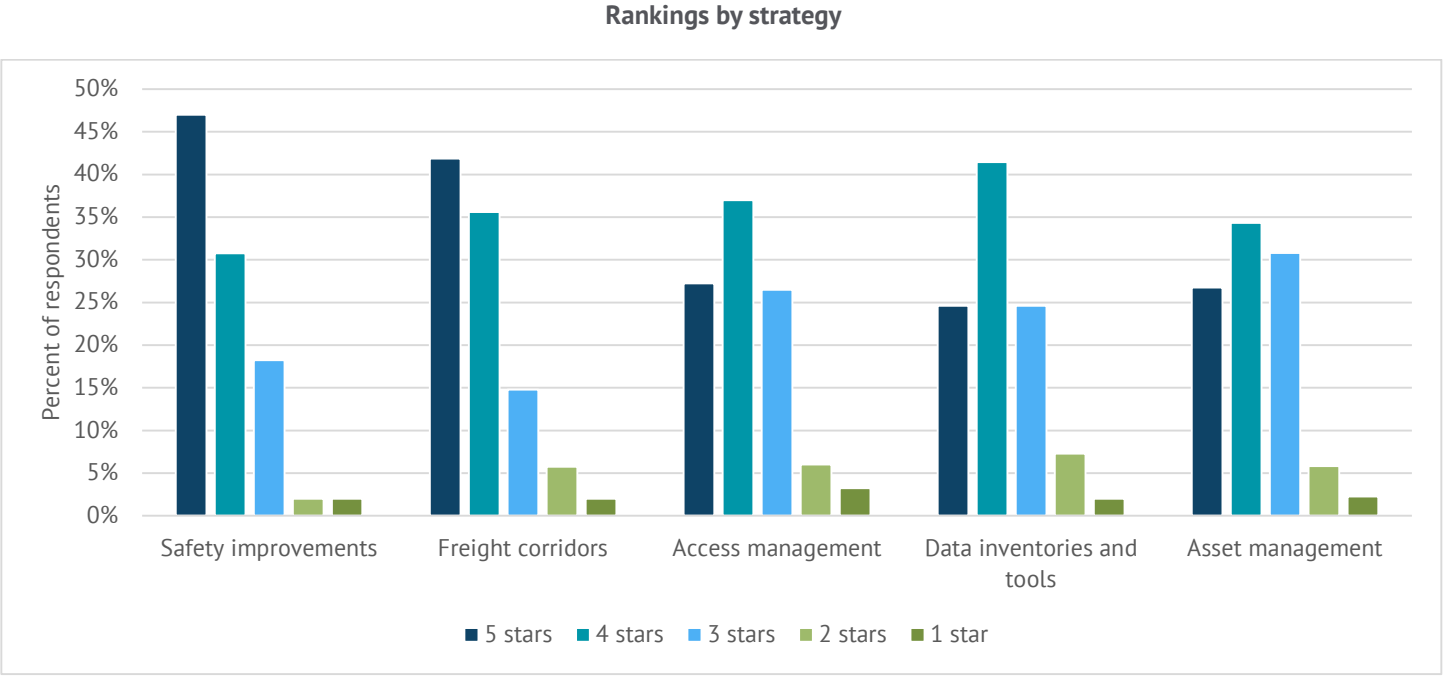
Draft strategy	Average ranking
Size and service level: Ensure the system size and service level is appropriate and consider modifications to assets where appropriate.	4.17
Traditional capacity: Consider traditional capacity improvements (adding lanes) on critical routes that are projected to be at or near capacity.	3.92
Alternative capacity: Consider alternative capacity improvements, such as other modes or travel options, dedicated lanes, 2-lane enhancements, etc.	3.91
Facility removal: Consider facility or asset abandonment or removal where appropriate.	3.45
Transfers of jurisdiction: Consider transferring ownership of road segments in a strategic manner where appropriate and beneficial to the overall system.	2.69

Rankings by strategy



Stewardship strategies

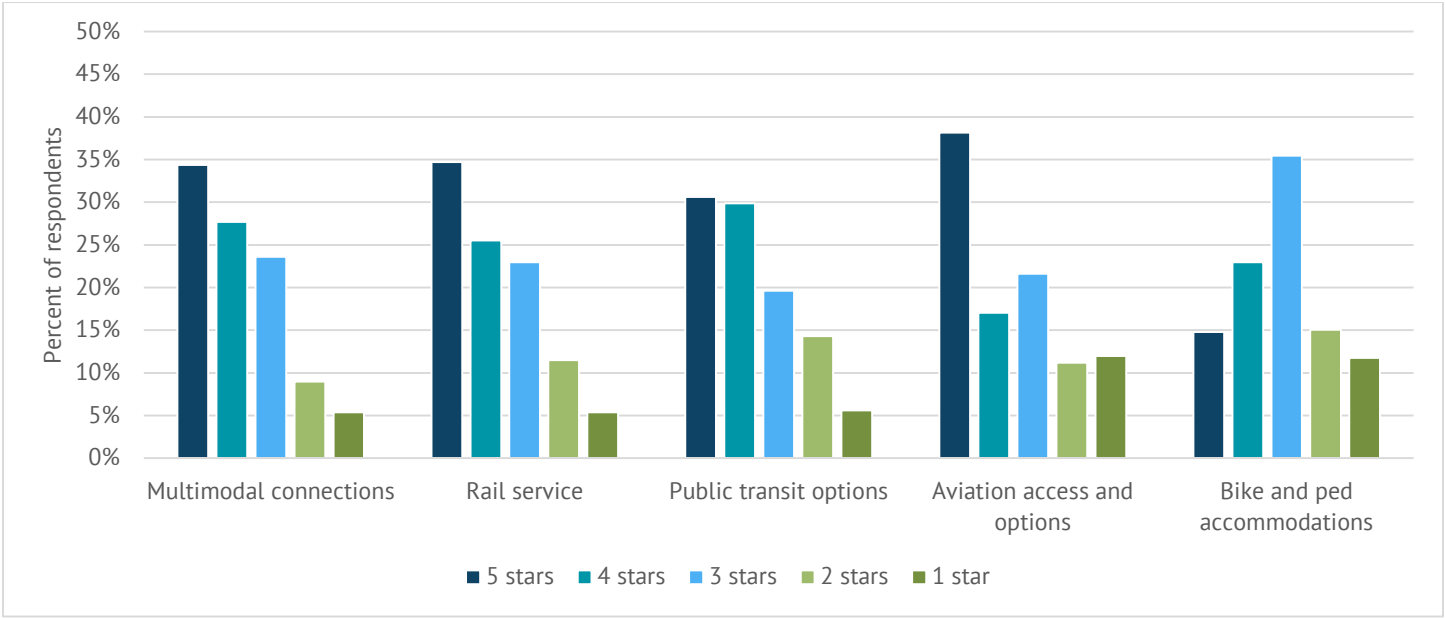
Draft strategy	Average ranking
Safety improvements: Apply targeted safety improvements to reduce the likelihood of crashes.	4.19
Freight corridors: Use strategic route planning for freight corridors and ensure there is appropriate infrastructure for increased freight traffic.	4.10
Access management: Utilize access management techniques to ensure system accesses are only added or modified where appropriate.	3.79
Data inventories and tools: Develop and utilize asset data inventories and analysis/ prioritization tools to evaluate the system's condition.	3.79
Asset management: Utilize transportation asset management strategies to achieve desired system condition and avoid worst-first style approaches.	3.78



Transformation strategies

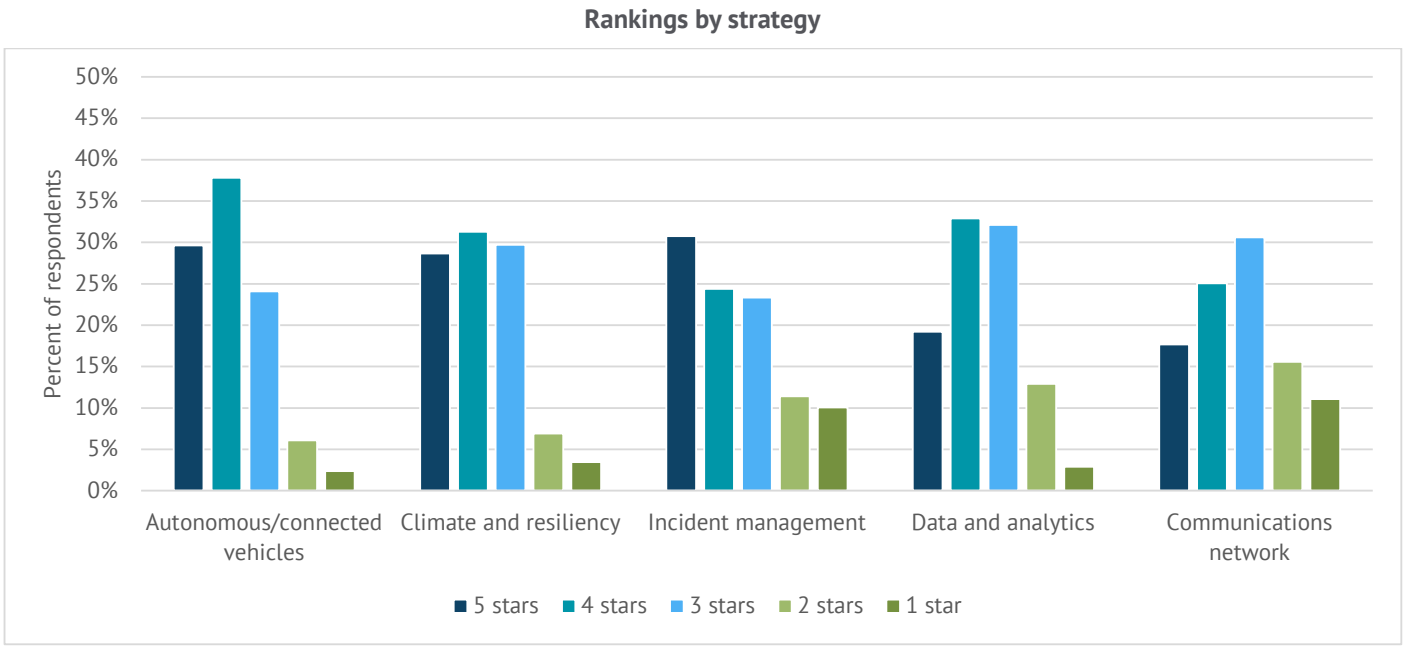
Draft strategy	Average ranking
Multimodal connections: Support the creation of multimodal connections for freight and passenger traffic.	3.77
Rail service: Work with rail companies to ensure they are able to meet future freight and passenger needs.	3.73
Public transit options: Support the state's public transit systems and the development of interregional/ commuter transit and ridesharing options.	3.66
Aviation access and options: Ensure there is adequate access to airports and support options such as more specialized, charter service at smaller airports.	3.58
Bike and ped accommodations: Support the provision of bicycle and pedestrian accommodations that are appropriate to their context.	3.14

Rankings by strategy



Optimization strategies

Draft strategy	Average ranking
Autonomous/connected vehicles: Adapt planning and project development practices based on self-driving and connected vehicle advancements.	3.86
Climate and resiliency: Integrate climate change adaptation and resiliency efforts into the planning process, and utilize weather information systems.	3.75
Incident management: Support improved incident management, including response time, efficient traffic control, and clearance time for incidents.	3.54
Data and analytics: Utilize traveler/vehicle information to better understand traffic dynamics and improve system planning and management efforts.	3.53
Communications network: Enhance the reliability of the system through efforts to improve and fully utilize the communications and monitoring network.	3.23



General questions

Three general survey questions asked respondents to identify what the Iowa DOT is doing now that it should continue or enhance; what the Iowa DOT is doing now that it should discontinue; and what the Iowa DOT needs to start doing that it is not doing already. General takeaways from the responses to these questions included the following.

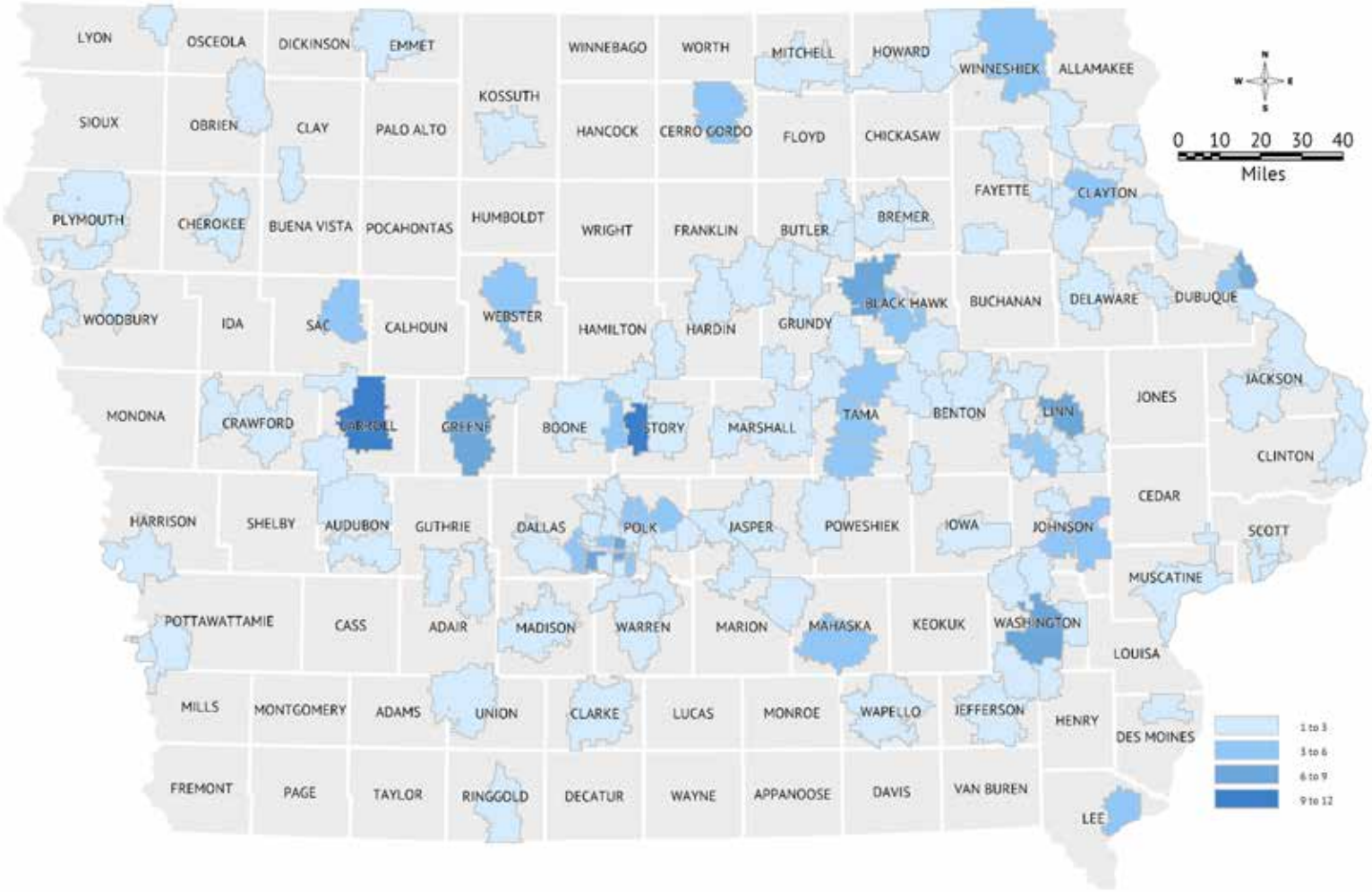
- The dominant theme among responses was interest in maintaining an appropriately sized system that meets the needs of all users and grows when and where it is necessary.
- It was preferred the Iowa DOT focus on maintaining the current system and ensuring expansion is only done when there is significant need.
- There was interest in increasing the efficiency of the department and increasing communication between the Iowa DOT and the public and stakeholder groups.
- There was interest in the Iowa DOT ensuring the appropriate materials are used and the right repairs are done the first time for projects to reduce costs associated with future improvements and ensure the system lasts longer.
- Support was expressed for alternative modes of transportation as a way to reduce the need to increase capacity and ensure everyone has the ability to travel within the state.

Demographic information

Gender and age of respondents

Male	Female	24 or under	25-34	35-44	45-54	55-64	65-74	75-84	85 or over
66.7%	33.3%	2.5%	27.6%	20.6%	23.4%	19.2%	5.6%	1.1%	0.0%

Number of respondents by zip code

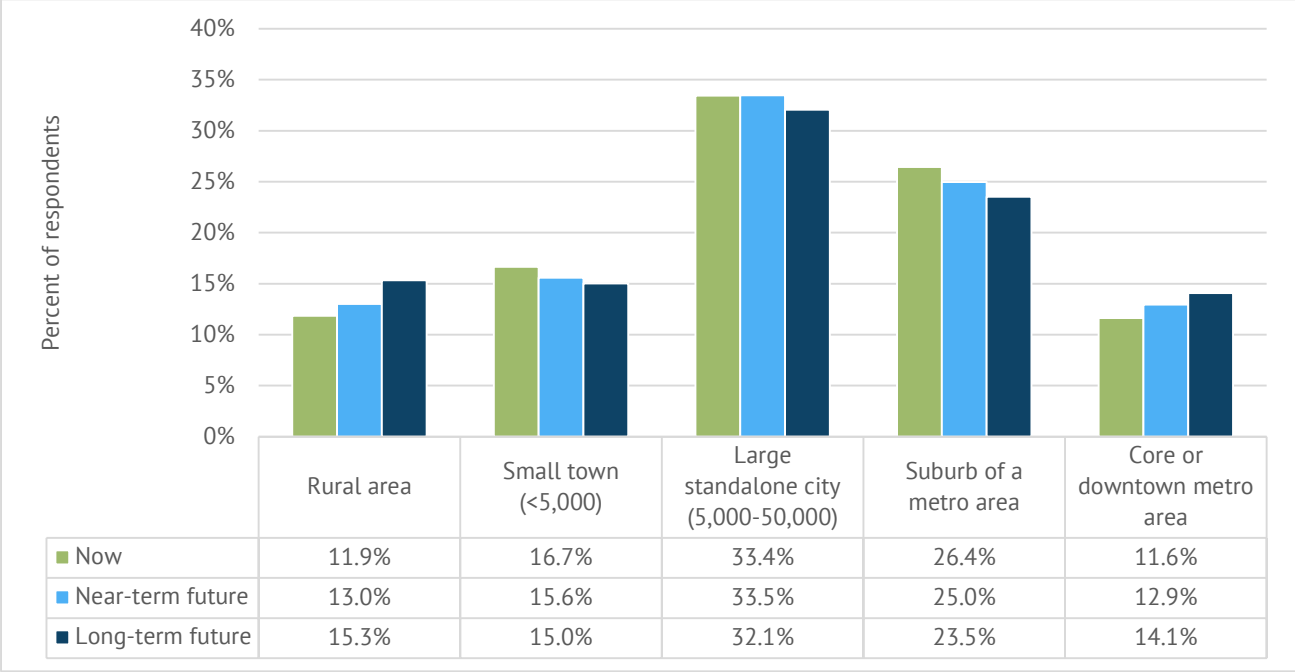


Second public input survey

The second public input survey for the Plan was conducted in August and September, 2016. A total of 1,646 people provided data through the survey. Results are summarized here, and were used to inform the strategies in the action plan. Questions fell under the general topic areas of current and future preferences, highly automated vehicles, highway improvement alternatives, and funding.

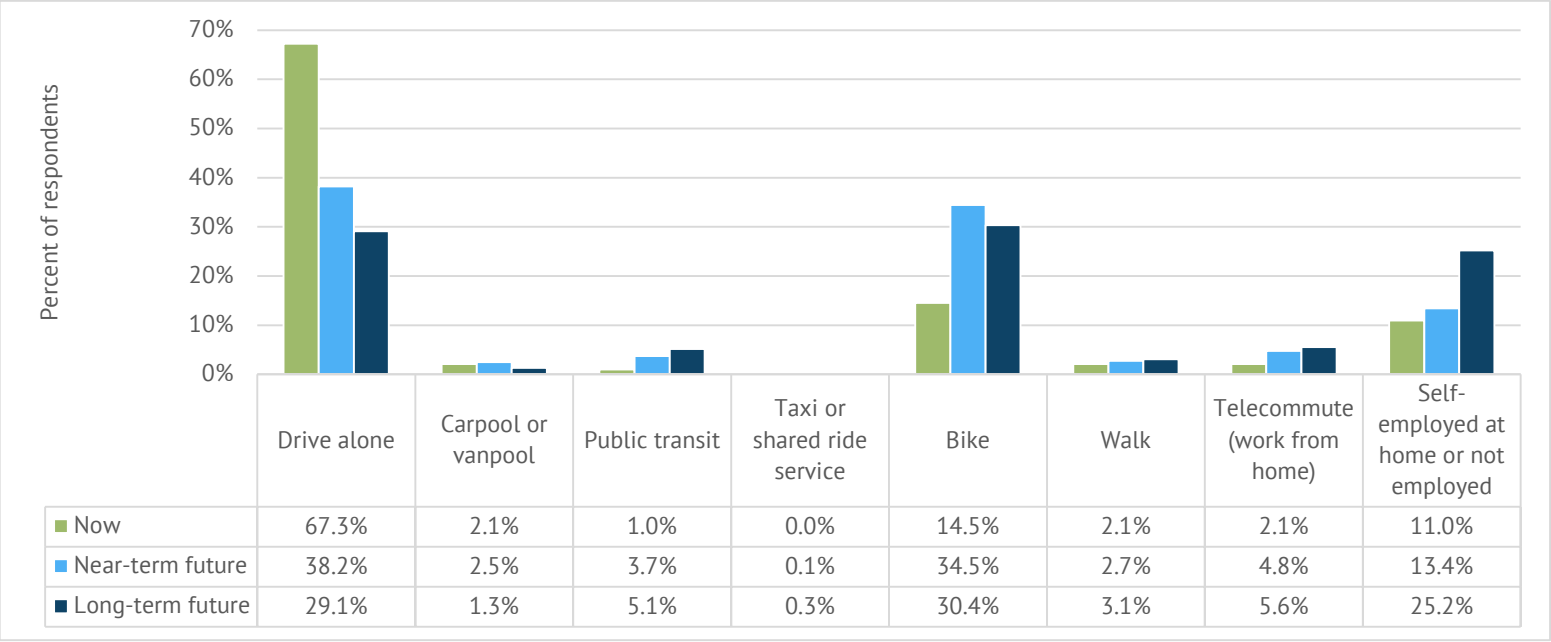
Topic area: Current and future preferences

1. Which of these best describes where you live now, and where you would prefer to live in the future?



	Rural area	Small town (<5,000)	Large standalone city (5,000-50,000)	Suburb of a metro area	Core or downtown metro area
Now	11.9%	16.7%	33.4%	26.4%	11.6%
Near-term future	13.0%	15.6%	33.5%	25.0%	12.9%
Long-term future	15.3%	15.0%	32.1%	23.5%	14.1%

2. Which of these best describes how you typically travel to work, and how you would prefer to travel to work in the future?



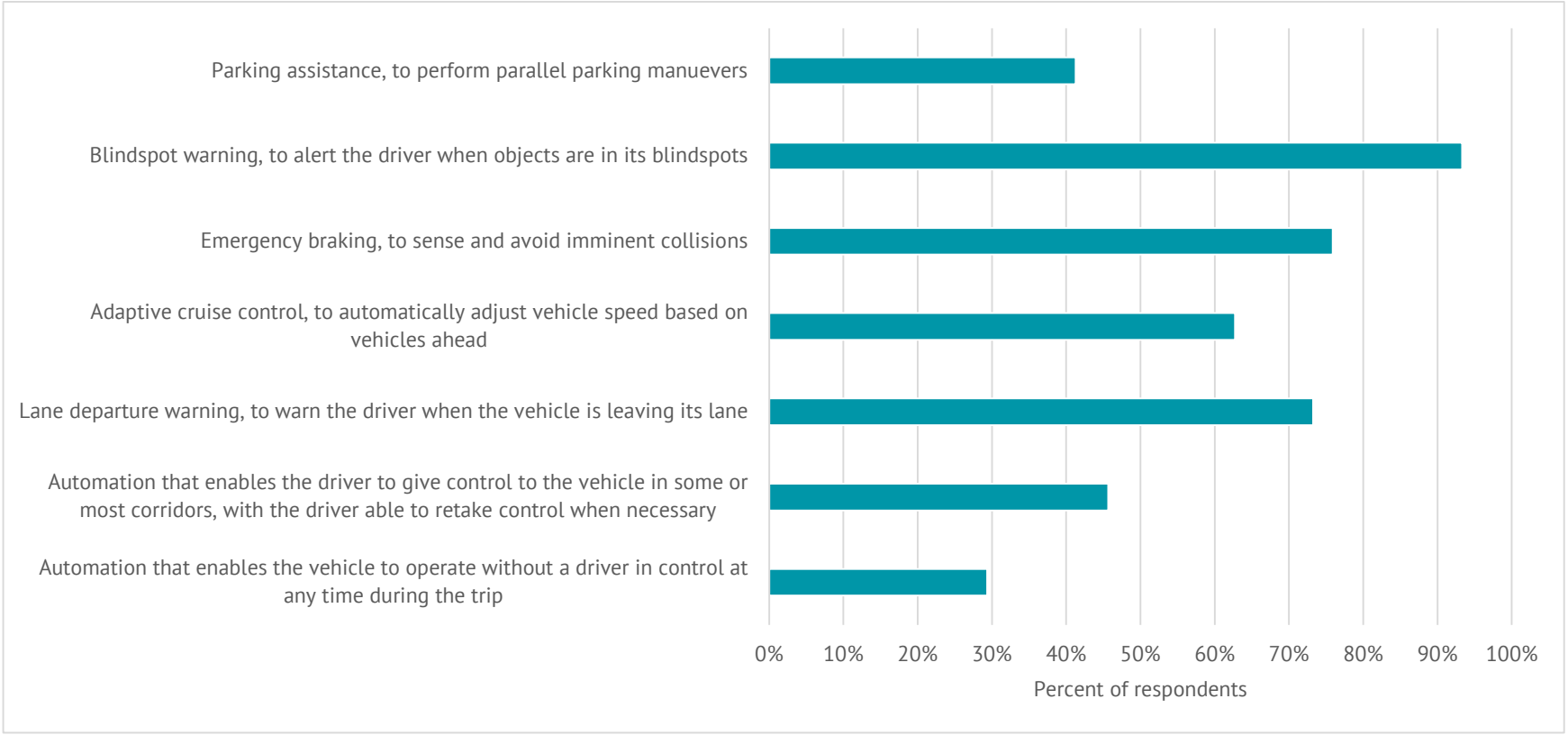
	Drive alone	Carpool or vanpool	Public transit	Taxi or shared ride service	Bike	Walk	Telecommute (work from home)	Self-employed at home or not employed
Now	67.3%	2.1%	1.0%	0.0%	14.5%	2.1%	2.1%	11.0%
Near-term future	38.2%	2.5%	3.7%	0.1%	34.5%	2.7%	4.8%	13.4%
Long-term future	29.1%	1.3%	5.1%	0.3%	30.4%	3.1%	5.6%	25.2%

3. How often do you use each of the following modes of transportation to get somewhere?

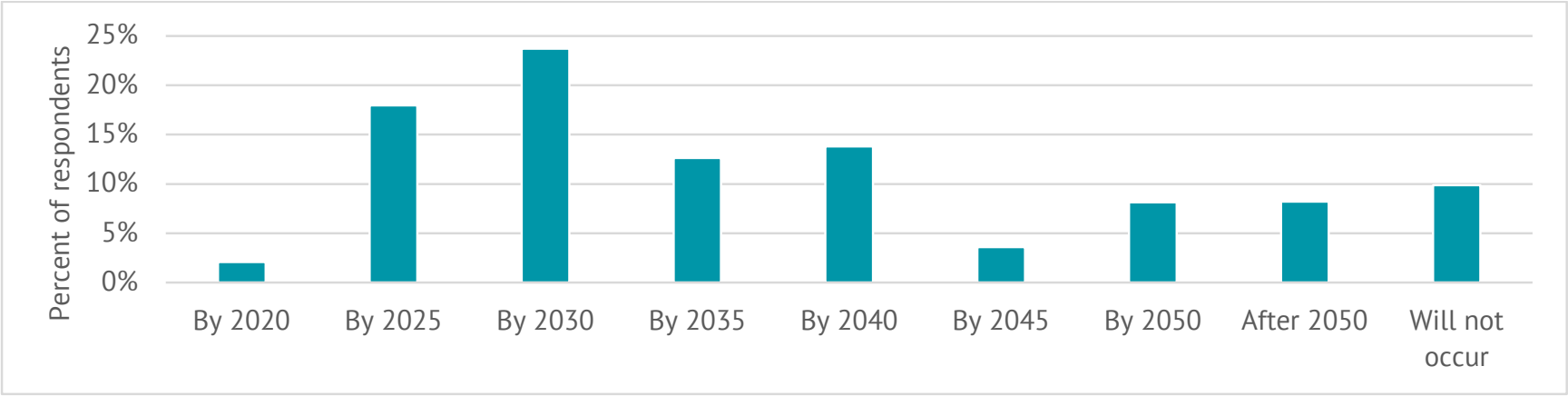
	Daily	Weekly	Monthly	Semi-annually	Rarely	Never
Ride a bicycle	22.7%	35.1%	11.0%	4.1%	11.7%	15.4%
Walk	31.1%	27.8%	11.8%	2.8%	18.0%	8.5%
Ride the bus	1.3%	1.7%	3.7%	3.8%	19.2%	70.4%
Use an intercity bus (Jefferson Lines, Megabus, etc.)	0.0%	0.1%	0.1%	2.5%	11.4%	85.8%
Fly	0.1%	0.6%	7.5%	44.6%	36.9%	10.3%
Use Amtrak	0.1%	0.1%	0.1%	3.6%	22.5%	73.7%
Drive own vehicle	82.2%	14.9%	1.3%	0.2%	0.1%	1.3%
Ride with others	4.6%	32.5%	22.7%	6.5%	25.8%	7.9%
Use a transportation network company (Uber, Lyft, etc.)	0.1%	1.3%	9.7%	8.9%	19.6%	60.4%

Topic area: Highly automated vehicles

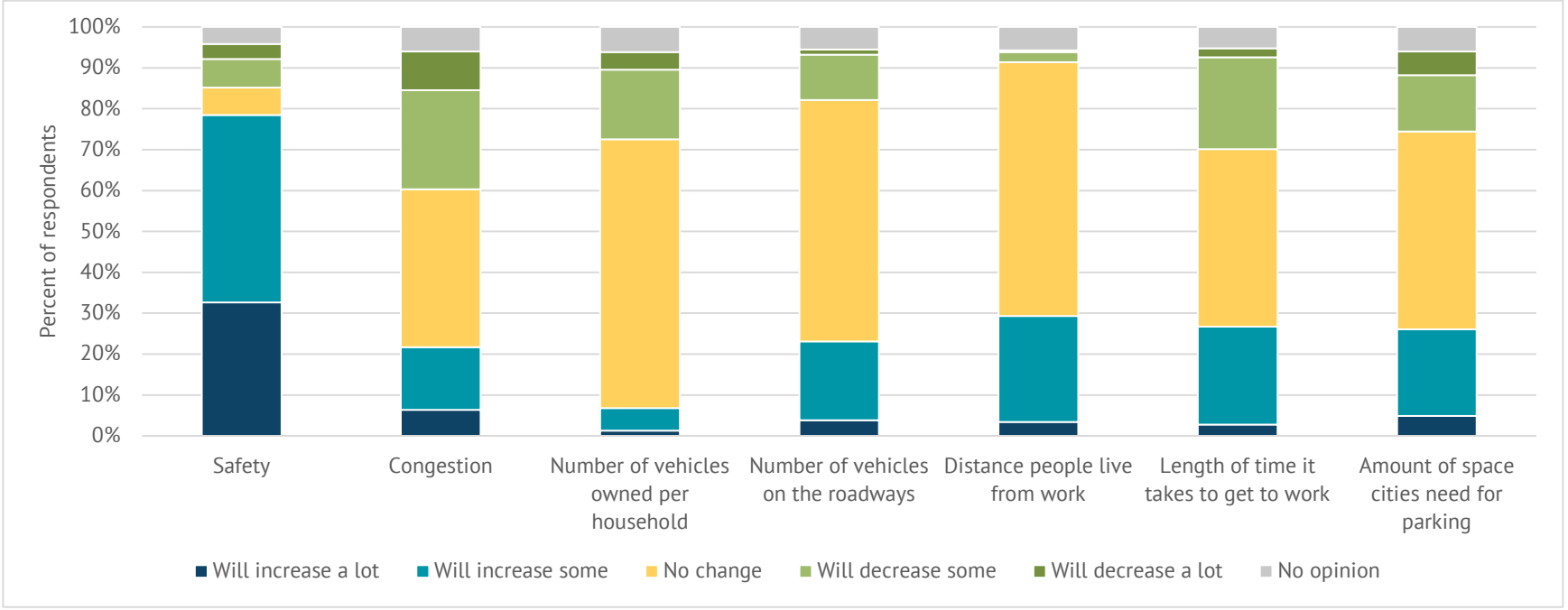
4. Highly automated vehicles are being developed, and some automated features are available in vehicles now. Improved safety is a major potential benefit of these vehicles, along with other potential effects. Which of these automated features would you be interested in having in your vehicle? Select all that apply.



5. Do you think highly automated vehicles will account for the majority of the cars on the road someday? If so, when do you think this will occur?

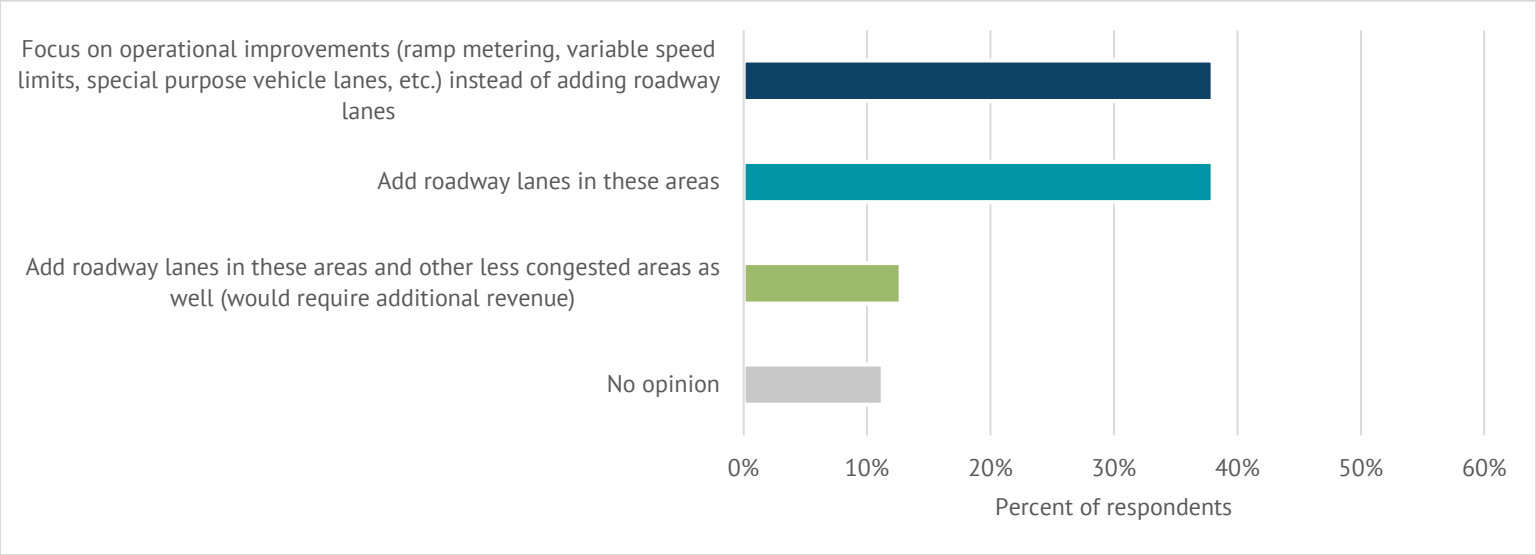


6. If highly automated vehicles become common, what do you think their impacts would be in each of these areas?

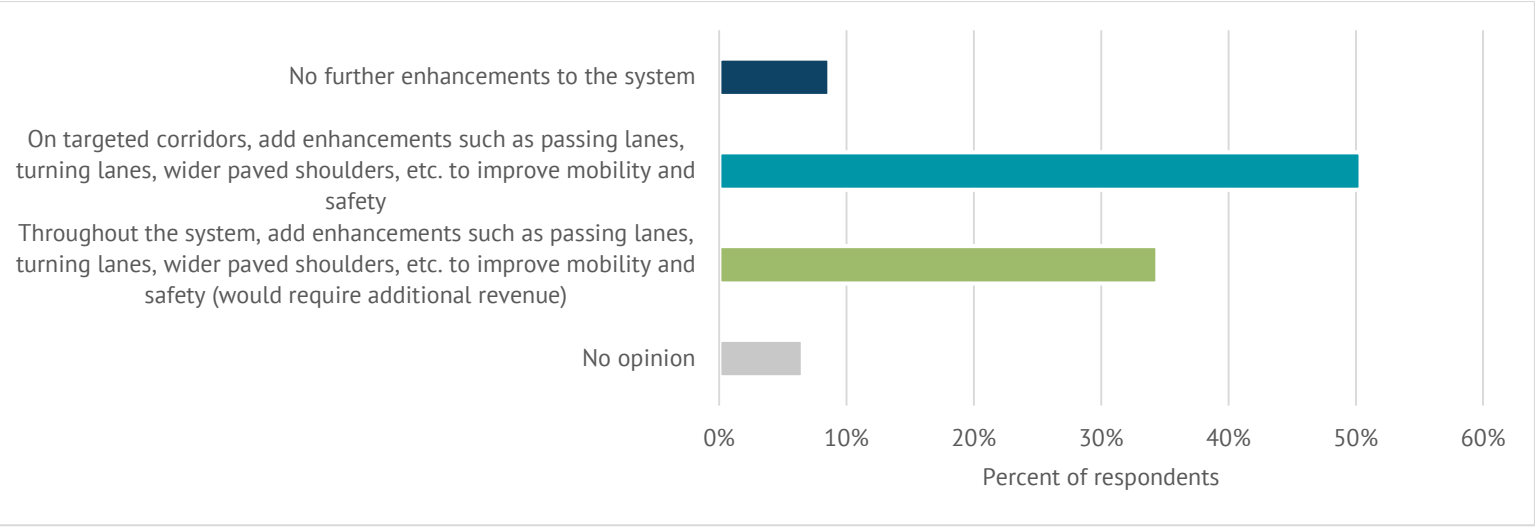


Topic area: Highway improvement alternatives

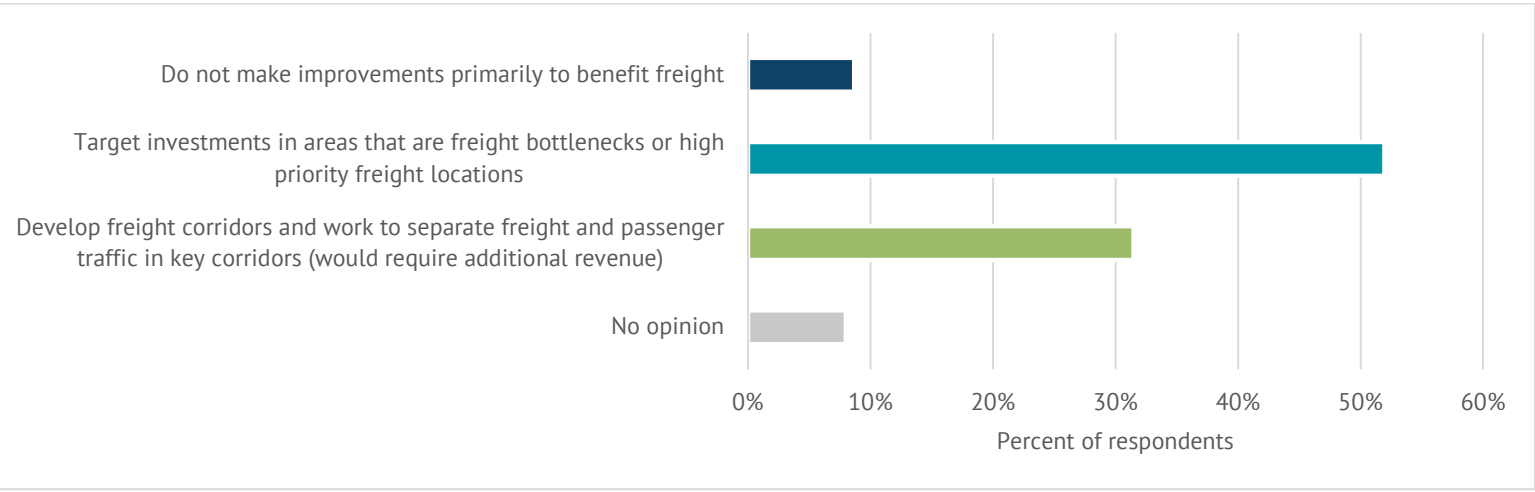
7. In areas where we have or expect to have significant traffic congestion (such as urban areas and three rural interstate corridors (I-35 from Des Moines to Ames, I-80 from Des Moines to Davenport, and I-380 from Iowa City to Cedar Rapids)), which approach would you favor most?



8. For roads where we do not expect significant congestion, in addition to stewardship (aiming to keep roads in a state of good repair), which approach would you favor most?

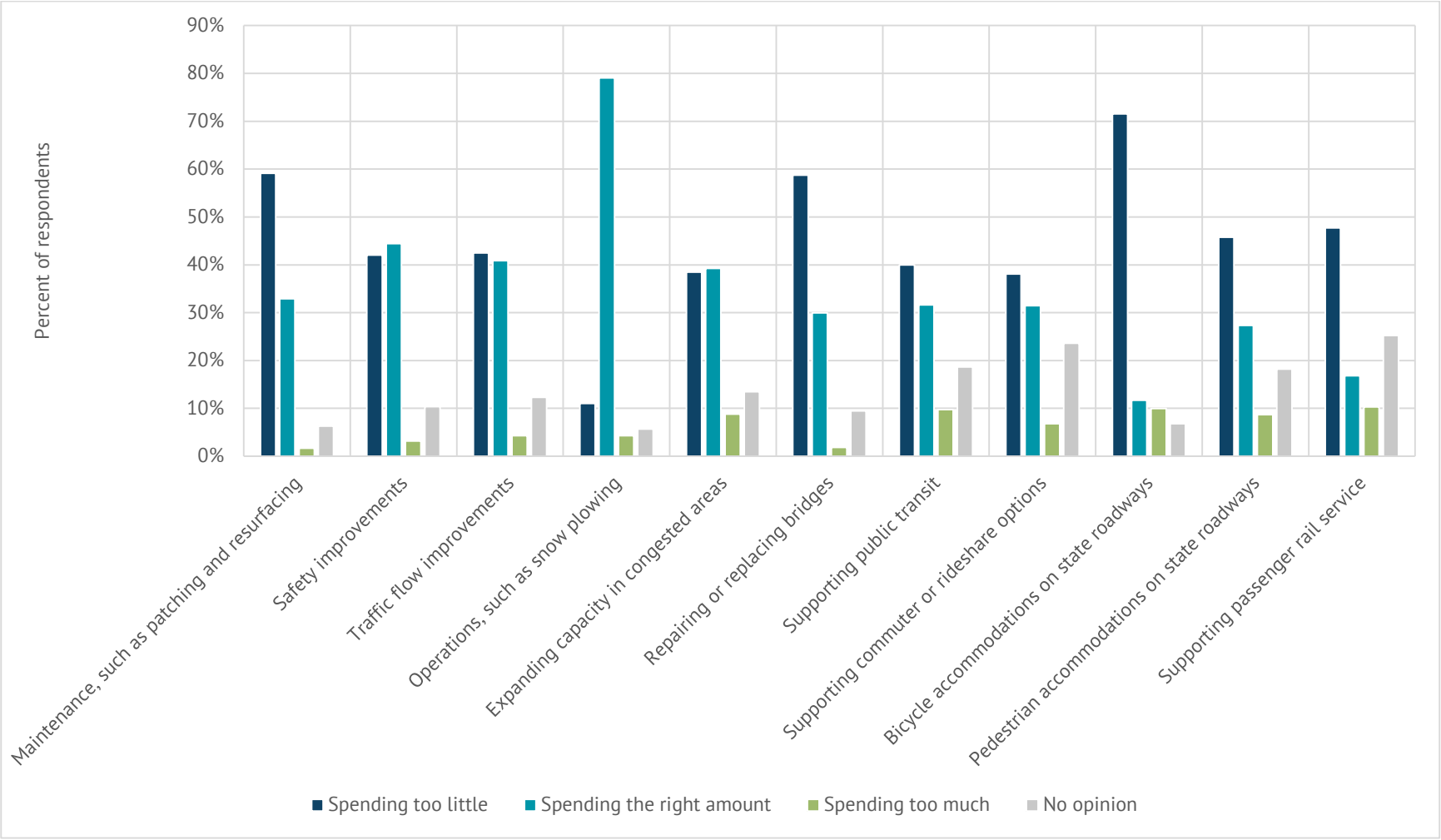


9. Freight movements will continue to increase in the future. What approach to freight-related highway improvements would you favor most?



Topic area: Funding

10. Based on how you feel the state transportation system operates today, are we spending too much, too little, or the right amount of funding on the system in each of these areas?



Demographic information

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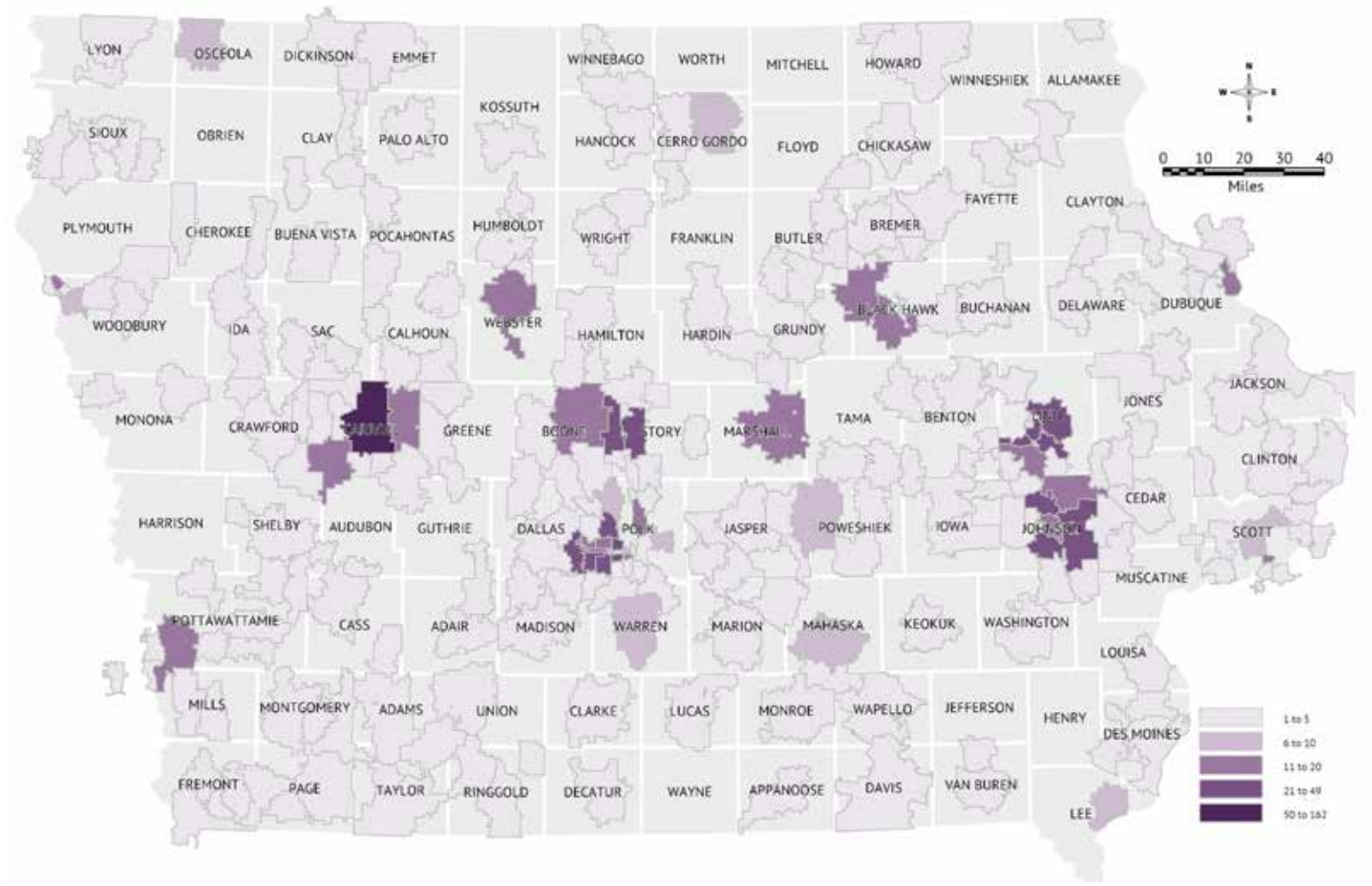
Number of respondents by zip code



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APPENDIX 3:
REVENUE GENERATING MECHANISMS

The following tables were included as part of the 2016 Road Use Tax Fund (RUTF) Study.[1]

Existing revenue sources

Type of Financing	Description/Mechanism	Estimated Amount Generated	Advantages	Disadvantages	Collected from out-of-state drivers?
Fuel Tax (452A.3)	Cents per gallon tax on motor fuels, including some alternative fuels. Current rate (as of July 1, 2016): not including the one cent per gallon fee for underground storage tanks. • Gasoline: 30.7 cents per gallon • Ethanol-blended gasoline: 29.0 cents per gallon • Diesel (B10 and lower): 32.5 cents per gallon • Diesel (B11 and higher): 29.5 cents per gallon The fuel tax is the only significant current source of RUTF revenue that is applied to out-of-state drivers as well as Iowans. The Iowa DOT has estimated that 35 percent of large truck travel in Iowa is from out-of-state trucks and 15 percent of passenger car/small truck travel in Iowa is from out-of-state drivers. In total, approximately 13 percent of RUTF revenue is estimated to be paid by out-of-state drivers primarily due to fuel tax payments.		• Collection and administration process already in place. • Generally proportional to system usage. • Generates revenue from out-of-state drivers. • Paid by all users of the highway system.	• Increased fuel efficiency results in lower revenue. • Higher fuel prices lead to reduced driving and reduced fuel tax collections. • Fees are fixed and do not adjust for inflation.	• Yes (see description)
	Mechanism: Add automatic annual adjustment to fuel tax rates based on an inflation index such as the Consumer Price Index or Iowa's Construction Cost Index Amount of additional revenue generated is dependent on rate of inflation.	• Variable. A three percent adjustment would generate $19.5 million per year.	• Automatically addresses loss of buying power.	• Could result in significant revenue variations as fuel price changes. • Makes forecasting for programming difficult.	
Fee for New Registration (321.105A)	Five percent fee that is imposed on the sale of new and used motor vehicles and trailers		• Collection and administration process already in place. • Provides revenue source based on ability to pay. • Proportional to cost of vehicle.	• Not proportional to system usage. • May discourage sales of motor vehicles. • Fluctuates with economic cycles.	• No
	Mechanism: Increase to six percent.	• Approximately $70 million per year	• Brings fee in line with state sales tax rate.		

1. http://publications.iowa.gov/23228

Existing revenue sources (cont.)

Type of Financing	Description/Mechanism	Estimated Amount Generated	Advantages	Disadvantages	Collected from out-of-state drivers?
Driver's License Fee (321.191)	A fee charged for the privilege to operate a motor vehicle. $4 per year (non-commercial) $8 per year (commercial)		• Collection and administration process already in place. • Does not fluctuate with economic cycles.	• Not proportional to system usage.	• No
	Mechanism: Double driver's license fee	• Approximately $13 million per year on average			
Registration Fees	Fees charged to register and license vehicles and trailers Fees vary according to the weight and value of the vehicle.		• Collection and administration process already in place.	• Not proportional to system usage. • Higher administrative and enforcement costs. • Encourages retention of older vehicles.	• Only commercial vehicles that pay a prorated fee based on travel within Iowa.

Potential revenue sources

Type of Financing	Description	Advantages	Disadvantages	Collected from out-of-state drivers?
Local Option Vehicle Tax	A vehicle registration fee approved and levied at the local level in addition to vehicle registration fees levied by the state. Amount collected would vary based on the registration fee amount and jurisdictions in which the tax was applied.	• Enabling legislation already in place. • Revenue generated locally and available for local transportation priorities.	• Not proportional to system usage.	• No
Sales Tax	Assess sales tax on fuel purchases. A one percent sales tax on fuel would generate approximately $57 million per year based on 2015 fuel usage and prices.	• Provides a mechanism to apply local option sales tax on the purchase of fuel. • Requires less frequent legislative action on fuel tax because revenues will increase as the price of fuel increases.	• Requires enabling legislation. • Administration and collection system would need to be developed. • Because tax is tied to the price of fuel, the amount of tax could change significantly if fuel prices experience large fluctuations.	• Yes
Severance Tax on Ethanol	A tax collected by the state either based on a percent of value or a volume-based fee on resources extracted from the earth. Typically charged to producer or first purchaser. To minimize the impact on Iowa drivers, the added cost of the severance tax could be offset with a reduction in fuel tax rate on ethanol-blended fuel. Potential revenue is dependent on rate set and volume produced. Assuming the fuel tax rate is lowered for ethanol-blended fuels to offset the addition of a severance tax, an estimate can be developed. Based on 2015 data, a severance tax of one cent per gallon would have generated $42 million.	• Creates opportunity to generate revenue from sources outside of Iowa. • Compensates for roadway deterioration resulting from usage of system for the production of ethanol.	• Requires enabling legislation. • Administration and collection system would need to be developed. • Potential regulatory issues. • Could put the producer at competitive disadvantage.	• Yes
Per-Mile Tax	Tax based on the vehicle miles traveled within a state. Based on the vehicle miles traveled in Iowa in 2015, a one cent per-mile fee would generate $331 million per year.	• Direct measure of actual costs incurred. • Highly related to needs for capacity and system preservation because as travel and revenue increases, the need for capacity and preservation improvements increase. • May be graduated based on vehicle size, weight, emissions or other characteristics.	• Requires enabling legislation. • Administration and collection system would need to be developed. • Potentially high administrative, compliance and infrastructure costs. • Technology needs to mature. • Privacy concerns.	• Yes
Transportation Improvement District	Geographic areas are defined and tax imposed within the area to fund transportation improvements with voter approval. Revenue potential varies.	• Satisfies urgent infrastructure needs, which exceed available finances. • Encourages state, local and private-sector partnerships. • Users of the system decide to implement.	• Requires enabling legislation. • Administration and collection system would need to be developed. • May be seen as an equity issue.	• Yes, if out-of-state driver makes taxable purchases within geographic area.

Potential revenue sources (cont.)

Type of Financing	Description	Advantages	Disadvantages	Collected from out-of-state drivers?
Tolling	Implementing fees to travel on road segments. Revenue potential varies based on length of tolled segment and toll rate, but a typical rate is seven cents per mile.	• Specific road segments/corridors generate their own revenue.	• Requires enabling legislation. • Expensive to initiate due to needed capital investment. • Ongoing administrative costs. • Requires sufficient traffic levels to generate enough revenue to pay for the costs of tolling, along with the maintenance and construction cost; Iowa may not have any reasonable corridors meeting requirements. • Public resistance may lead to adjustments in travel patterns to avoid tolls. • There are federal restrictions in some cases.	• Yes
Development Impact Fees	A fee charged to developers for off-site infrastructure needs that arise as a result of new development.	• Additional source of funding to off-set increased needs due to new development. • Places the cost of improvement on the development that caused the need.	• Typically a local jurisdiction fee and is difficult to apply statewide. • Potential negative impact on future development. • Can be difficult to establish and administer. • Can be an equity issue when costs are passed on to homeowners in the case of a housing development.	• No
Bonds for Primary Road System Improvements	A written promise to repay borrowed money at a fixed rate on a fixed schedule. Can be limited to very specific situations, such as projects that exceed a certain dollar threshold, projects that cannot easily be phased over time (border bridges) and/or projects that can reasonably generate sufficient revenue (tolls) to service their own bond debts. Revenue potential varies.	• Allows earlier and faster construction of some facilities. • Satisfies urgent infrastructure need, which exceeds available finances. • Avoids inflationary construction costs.	• Requires enabling legislation. • Requires state or community to extend payments for long periods of time. • Does not generate new money. • May cost more over time due to bond interest. • Requires existing annual resources be used for debt service rather than new needs. • May have a negative impact on statewide transportation decision-making. • Poses staffing issues for government road agencies and road consultants/contractors due to significantly changing annual project expenditure levels and cyclical nature.	• Depends on funding mechanism that funds bond repayments.

Potential revenue sources (cont.)

Type of Financing	Description	Advantages	Disadvantages	Collected from out-of-state drivers?
Public-Private Partnerships (PPPs)	Contractual agreements formed between a public agency and private sector entity that allow private participation in the delivery of transportation projects in one or more of the following areas: project design, construction, finance, operations, and maintenance. Can either be user-fee based (tolls) or non-user-fee based. The non-user-fee based types of PPPs are most viable in Iowa and include design-build and design-build-finance. Revenue potential varies.	• Expedited completion compared to conventional delivery methods. • Avoids inflationary construction costs. • Delivery of new technology developed by private entities. • Purchase of private resources and personnel instead of using constrained public resources.	• Requires enabling legislation. • May be less efficient. • If user-fee based, could lead to higher tolling than under a public-only project. • May limit ability for in-state contractors to participate in construction depending on type of project.	• Depends on mechanism implemented by private owner but would likely generate funding from out-of-state drivers
	Mechanism: Privatization of infrastructure. Typically involves the long-term leasing of toll roads to private sector for up-front payment. Revenue potential varies.	• Influx of one-time capital. • Shifts responsibility to contractor.	• Requires enabling legislation. • Administrative process needed to let, execute, contract, and monitor performance. • Requires high-usage corridor to be marketable; Iowa may not have any candidates. • Built-in toll increases. • Potentially higher tolls to make project profitable. These tolls may result in system inefficiencies as traffic utilizes non-toll roads in lieu of using toll roads. • Requires very long-term decision that removes flexibility. • Very limited ability for in-state contractors to participate in construction.	• Depends on funding mechanism implemented by private owner but would likely generate funding from out-of-state drivers.
	Mechanism: Enable design-build contracting. Design-build involves contractual agreements whereby a single bid is accepted for both the design and construction of a project. A variation of this is the design-build-operate-maintain contract whereby a private contractor is also responsible for operation and future maintenance. 45 states have statutory or administrative provisions that authorize design-build fully or with certain limitations.	• Intended to accelerate construction schedule since some activities can occur simultaneously. • Intended to allow construction to begin sooner • Reduces administrative burden by having one contract and point-of-contact. • Can result in reduced construction costs.	• Requires enabling legislation. • May impact ability of in-state contractors to participate in construction. • Not appropriate for all types of projects. • Potential for cost overruns if scope of work is not properly defined up front.	• N/A

Potential revenue sources (cont.)

Type of Financing	Description	Advantages	Disadvantages	Collected from out-of-state drivers?
Container Tax	Fee imposed on containers moving through a designated geographic area. Revenue potential varies based on chosen rate and transportation modes to which the container tax would be applied.	• Creates opportunity to generate revenue on shipments passing through the state.	• Requires enabling legislation. • Does little to promote efficiency • Ongoing administrative costs.	• Yes
Imported Oil Tax	A tax charged on imported oil based on either the volume or value of the imported oil. Revenue potential varies.	• Could help promote U.S. energy production.	• Requires enabling legislation. • Imported oil can be used for purposes other than transportation. • Could result in larger free trade issues.	• Yes
Tire Tax on Light Duty Vehicles	A tax on light-duty vehicle tires. Could be applied to both new vehicle tires and replacement tires. Revenue potential varies.	• Sustainable source of funds. • Under normal circumstance, a strong link exists between tire wear and system usage.	• Requires enabling legislation. • Would not generate significant revenues. • May have safety ramifications by discouraging the replacement of worn tires.	• Yes
Alternative Fuel/ High Fuel Efficiency Vehicle Tax	A tax or additional registration fee charged on alternatively fueled vehicles, plug-in hybrids, and/or high-fuel efficiency vehicles. Replaces lost fuel tax revenues associated with the use of these vehicles. A $150 fee charged on electric vehicles and plug-in hybrid vehicles would generate approximately $175,000 based on 2016 vehicle registration data.	• Ensures that electric vehicles and high fuel efficiency vehicles pay towards operations and maintenance of the highway system.	• Requires enabling legislation. • Potentially discourages the use of emerging efficient vehicle technologies.	• No
Interstate Logo Sign Fees	Annual fee charged for logo signs paid for by businesses advertising their location off an interstate interchange. A 100 percent increase in annual fees, from $230 to $460, would generate approximately $700,000 in additional funds.	• Would be easily implemented.	• Would require enabling legislation for funds to be placed in the road use tax fund. • No link to highway use. • Signs are intended to be a service to drivers rather than a source of revenue	• No
Agriculture Bushel Tax	A tax charged on each bushel of agriculture based products. Based on estimated 2015 production levels and on-farm grain usage, a $0.01 a bushel tax would generate approximately $30,000,000.	• Creates new source of sustainable revenues. • If products are shipped by road, a strong link exists between agriculture production and system usage.	• Requires enabling legislation. • Revenues would fluctuate based on production levels. • Administration and collection system would need to be implemented.	• No

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Technical corrections – October 17, 2018

Added freight bottleneck locations to the map on page 164
- US 61 N/S through Burlington (priority #21)
- Iowa 150 N/S through Independence (priority #41)

Added bridge need locations to the map on page 171
- I-480 over the Missouri River in Pottawattamie County (priority #8)
- US 52 over the Mississippi River in Jackson County (priority #20)
- US 136 over the Mississippi River in Lee County (priority #147)
- IA 136 over the Mississippi River in Clinton County (priority #26)

Changed corridor termini for IA 12 from "US 20/US 75 to IA 29" to "US 20/US 75 to I-29"

Technical corrections – February 18, 2020

Corrections to the highway improvements matrix, pages 173-188
- Removed mileage column
- I-80, changed corridor termini from "NE border to I-29" to "NE border to E jct of I-29"
- US 18, changed corridor termini from "SD state line to US 75" to "SD border to US 75"
- US 20, changed corridor termini from "US 75 to 3.5 mi E of IA 140" to "US 75 to IA 140"
- US 20, changed corridor termini from "3.5 mi E of IA 140 to US 59" to "IA 140 to US 59"
- US 20, changed corridor termini from "IA 32 to US 52/US 61" to "IA 32 to IL border"
- US 30, changed corridor termini from "US 61 to IL state line" to "US 61 to IL border"
- US 52, changed corridor termini from "IA 64 to US 20" to "IL border to US 20"; added bridge priority needs #3 and #20
- US 61, changed corridor termini from "Burlington N CL to Muscatine Co line" to "Burlington N CL to IA 92"
- US 61, changed corridor termini from "Louisa Co line to IA 38" to "IA 92 to IA 38"; added Louisa County
- US 63, changed corridor termini from "IA 163 to I-80" to "IA 92 to I-80"
- US 136, changed corridor termini from "US 61 to US 218" to "US 61 to IL border"; added bridge priority need #147
- US 218, from US 61 to IA 27, removed bridge priority need #147
- IA 5, changed corridor termini from "W jct of IA 92 to US 65/US 69" to "W jct of IA 92 to US 65"; added Polk County
- IA 5, changed corridor termini from "US 65/US 69 to IA 28" to "US 65 to IA 28"
- IA 12, changed corridor termini from "IA 29 to Sioux City N CL" to "I-29 to Sioux City N CL"
- IA 15, changed corridor termini from "US 20 to US 18" to "IA 3 to US 18"
- IA 64, changed corridor termini from "US 61 to IL border" to "US 61 to US 67"; removed bridge priority needs #3 and #20
- IA 76, changed corridor termini from "US 18 to IA 9" to "W jct of US 18 to S jct of IA 9"
- IA 76, changed corridor termini from "IA 9 to MN border" to "N jct of IA 9 to MN border"
- IA 85, changed corridor termini from "US 63 to IA 21" to "Montezuma E CL to IA 21"; removed freight bottleneck priority need #88

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