STATE TRANSPORTATION PLAN

IOWA IN MOTION 2050

Adopted by the Iowa Transportation Commission
May 10, 2022

Last revised April 2024

IOWA DOT

1. LOOKING AHEAD

Just over 100 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. By the mid-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. The Iowa General Assembly also 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. Many experts are predicting that within the next few decades there will be widespread adoption of new technologies that have the potential to revolutionize travel. The transportation system is also recovering from impacts of the COVID-19 pandemic and the disruptions it has wrought since March 2020. While some forms of travel have returned to pre-pandemic levels, many passenger modes have not. Some changes, such as increased teleworking and rapid escalation of online shopping, may be lasting impacts of the pandemic.

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 and an increasing emphasis on accessibility and mobility options for system users. The past century has seen incredible transportation advancements. This document seeks to position the state of Iowa for the coming decades of change.

1.1 What the State Long Range Transportation Plan (SLRTP) is

Iowa's State Long Range Transportation Plan (SLRTP) is a system-level plan that forecasts the demand for transportation infrastructure and services to 2050 based on consideration of social, economic, travel, and technological changes likely to occur during this time. The SLRTP provides the long-range vision, policies, and decision-making framework that will guide investments in Iowa's transportation system over the coming years to meet these needs. Iowa is required to have a long range transportation plan by both federal and state code. The plan covers all modes of transportation in the state, for both people and goods. The SLRTP is not project specific, but provides the foundational framework to help guide Iowa Department of Transportation (DOT) policies, objectives, and investments across modes.

The plan is updated every five years because Iowa's transportation system is ever-changing. Proactively planning for the future of the system is critical to ensure people and goods can get where they need to go in a safe manner. The needs for the system are continually evolving due to changes in demographics, land use, travel patterns, technology, legislation, and available funding. The SLRTP establishes the vision and objectives for the state's multimodal transportation system, identifies existing and emerging needs, risks, and challenges, and recommends strategies to achieve the vision for the transportation system. The SLRTP also supports a continued emphasis on stewardship. The Iowa DOT views stewardship as efficient investment and prudent, responsible management of the existing transportation system.

This SLRTP is the third in the current series of long-range plans. In 2012, a policy level plan was adopted. In 2017, the plan was expanded to identify primary investment areas, categorize future needs across modes, and provide strategies to achieve the system vision. The 2022 SLRTP planning effort and document builds on these past plans with enhancements that include the following.

- Additional focus on emerging planning considerations
- Establishment of system objectives
- Expanded analysis of highway system needs and risks
- Updated strategies to implement the plan
- Development of Iowa DOT's rightsizing policy

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 growing Iowa's economy and supporting Iowans' quality of life.

1.2 What the SLRTP Includes

Key components of the document include the following.

Trends	An analysis of demographic and economic trends and what these trends mean for Iowa's future.
System condition	An overview of each mode within the transportation system as well as passenger and freight trends.
Vision and system objectives	The vision for Iowa's future transportation system and objectives to help achieve it.
Planning considerations	An overview of several issues and factors that influence transportation planning.
Needs and risks	Analysis of current and future needs and risks by mode.
Strategies	Actions and initiatives to help implement the SLRTP and support system objectives.
Financial analysis	Projected annual costs and revenues for each transportation mode and a discussion related to addressing funding shortfalls.
Implementation	Programming future investments and ongoing performance monitoring.

1.3 How the SLRTP was Developed

Development of the SLRTP involved input from a variety of stakeholders and resources. While it is impossible to summarize all the discussions, analysis, research, resources, outreach, and meetings that took place during plan development, the efforts identified below played a critical role in shaping this planning effort and document.

Public Input

The Iowa DOT's current public participation process[1] identifies several steps to be used in developing planning documents to ensure opportunities for public input, review, and comment. The planning process for this effort built off the work and input gathering conducted as part of the 2017 plan update. For the 2022 SLRTP, emphasis was placed on use of a wide-ranging internal steering committee, regular discussions with the Iowa Transportation Commission (Commission) and metropolitan and regional planning partners, a public input survey to gather feedback on a number of key areas, and broad distribution of the draft document to stakeholders, resource agencies, and the public for review and feedback.

Public Survey

In order to gather public input during the planning process, a public survey was conducted during SLRTP development in 2021. The survey is described briefly here, and its results have been integrated into the plan. A summary of survey results can be found in the Appendix.

The survey was made available in May 2021 and advertised through a press release, social media, and extensive stakeholder distribution. Responses were received from all regions of the state, but there was relatively limited feedback overall. The results still provided useful information for SLRTP development.

The survey asked questions about the way individuals traveled, worked, and shopped before and during the COVID-19 pandemic, which helped provide a snapshot of changes due to the pandemic. The survey also asked about people's interest in using various modes or types of infrastructure, as well as their feelings on the safety, condition, ease of access, and amount of delay experienced in doing so. Other questions asked about the impact of fuel prices on travel patterns, interest in electric vehicles, and thoughts on current driver assistance features in vehicles as well as future vehicle automation.

Public Comment Period

The draft SLRTP was released for a 45-day public comment period in February 2022 and advertised through a press release, social media, and extensive stakeholder distribution. During this time, comments were accepted through a comment box on the website, email, standard mail, phone, or fax. All comments were reviewed and applicable changes to the draft SLRTP were considered; follow-up with commenters also occurred to address specific questions. The following statistics summarize the level of public input achieved during the comment period.

- Webpage visitors: 567
- Written comments received: 17

[1] 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.

Stakeholder Input

Iowa Transportation Commission

The Commission sets policy for the department through its approval of the SLRTP and the Iowa Transportation Improvement Program (Five-Year Program). The governor appoints the seven commissioners, with political and gender balance required. Commissioners are confirmed by the Iowa Senate and serve four-year terms on a staggered basis. Meetings occur monthly, with eight of the 12 Commission meetings held in Ames. The other four meetings involve tours and stakeholder input opportunities 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 development of the SLRTP and ask for their feedback. Presentations were made at six Commission workshops between November 2020 and April 2022 prior to the SLRTP being considered for adoption in May 2022. These presentations were also made available online on the project website.

Internal Stakeholders

Individuals representing a diverse cross section of the Iowa DOT were involved in the development of the SLRTP through a combination of topical communication and meetings as well as a formal Internal Planning Steering Committee (IPSC). The IPSC met bimonthly to provide guidance for the planning process and serve as a sounding board for SLRTP development. The IPSC included broad representation from across the department to ensure the inclusion of a wide range of perspectives, and also included a Federal Highway Administration (FHWA) liaison. Staff members from the following Iowa DOT divisions and bureaus participated in the IPSC during SLRTP development.

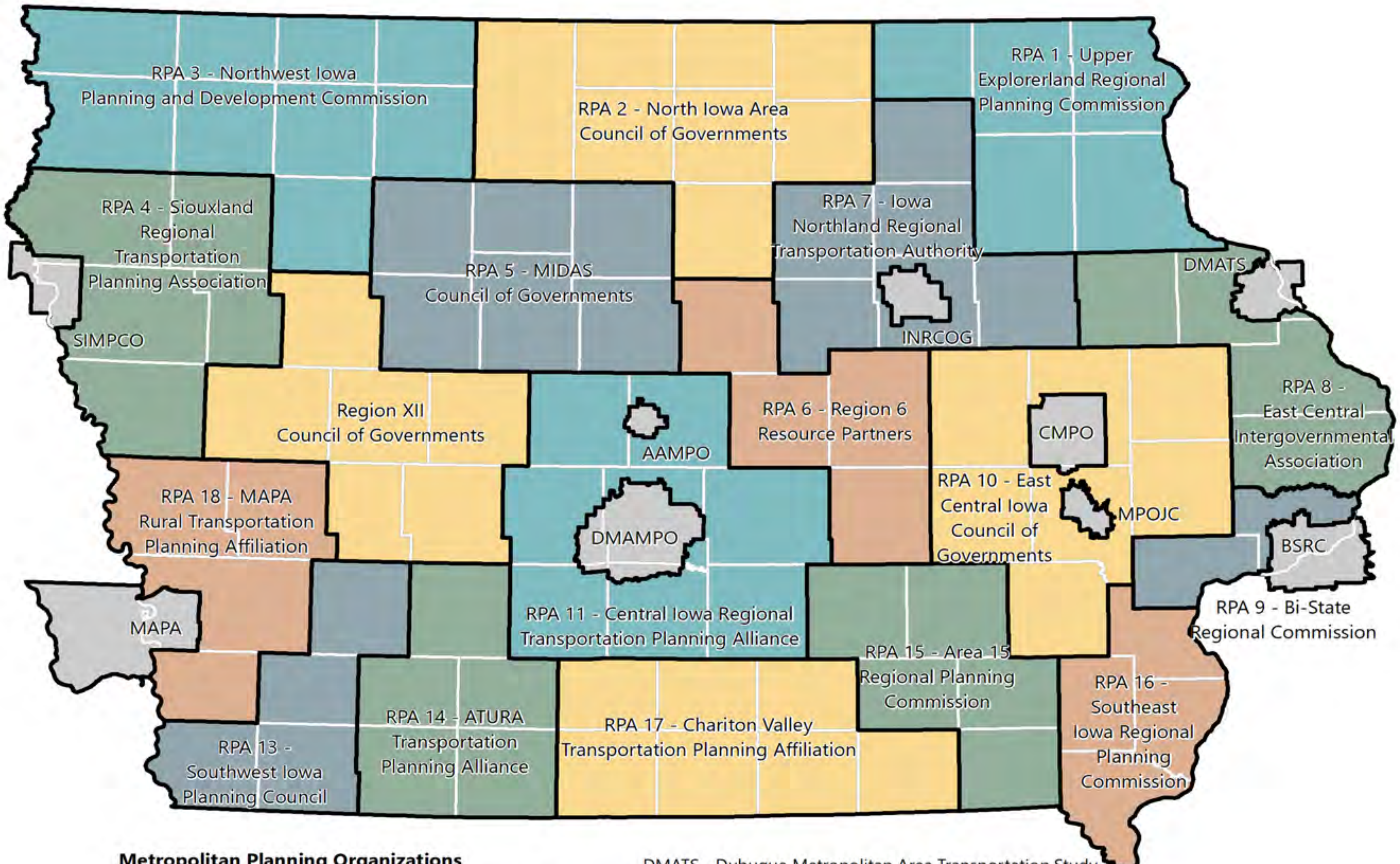
- Design
- Director's staff
- DOT Districts
- Field Operations
- Gov't and Community Relations
- Location and Environment
- Maintenance
- Modal Transportation
- Motor Vehicle
- Organizational Improvement
- Program Management
- Project Development
- Project Management
- Right of Way
- Strategic Communications
- Systems Operations
- Systems Planning
- Traffic & Safety
- Traffic Operations
- Transportation Development

State Planning Agencies

The state's transportation planning agencies, which include metropolitan planning organizations (MPOs) and regional planning affiliations (RPAs), are partners for transportation planning with the Iowa DOT and were coordinated with during the development of the SLRTP. MPOs conduct transportation planning and programming activities in the state's nine urban areas with populations greater than 50,000. 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 regularly throughout plan development at quarterly meetings held between the agencies and the Iowa DOT. In addition, MPO and RPA long-range transportation plans were referenced during the development of the SLRTP. Ultimately, it is anticipated that the SLRTP will be useful to MPOs and RPAs in their transportation planning and programming activities, to help define Iowa DOT needs, risks, strategies, and objectives and integrate them into their processes as applicable.

Figure 1.1: Iowa metropolitan planning organizations (MPOs) and regional planning affiliations (RPAs)



Metropolitan Planning Organizations

AAMPO - Ames Area Metropolitan Planning Organization
BSRC - Bi-State Regional Commission
CMPO - Corridor Metropolitan Planning Organization
DMAMPO - Des Moines Area Metropolitan Planning Organization
DMATS - Dubuque Metropolitan Area Transportation Study
INRCOG - Iowa Northland Regional Council of Governments
MAPA - Metropolitan Area Planning Agency
MPOJC - Metropolitan Planning Organization of Johnson County
SIMPCO - Siouxland Interstate Metropolitan Planning Council

Source: Iowa DOT

Interagency and External Stakeholder Consultation

Another important part of developing the SLRTP 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 by inviting them to review and comment on draft plan content. In addition to government agencies, a variety of modal interest groups were invited to comment on the draft plan. The list of agencies and groups contacted as part of the consultation process is included in the Appendix.

Other Plans and Studies

A large variety of plans, reports, and studies were considered throughout the SLRTP development process. Many of these documents will be referenced throughout the plan; a full list is included in the Appendix. In particular, other Iowa DOT specialized, system, and modal plans are extensively referenced in the plan; future updates to these plans will also involve incorporating material that is new in this SLRTP, such as the system objectives discussed in Chapter 4.

Stakeholder Feedback

Early feedback from stakeholders helped shape the information and strategies included in this plan, particularly the system objectives and planning considerations discussed in Chapter 4 and the strategies discussed in Chapter 5. Early in the planning process, input was sought from the IPSC and MPOs/RPAs on transportation issues and trends that would need to be considered in the SLRTP. The following items were the top general transportation priorities based on this feedback.

- **Funding:** There are concerns with the highway trust fund's long-term solvency; additional long-term funding sources are needed.
- **Resiliency:** We need to increase system resiliency and proactively plan for extreme weather events.
- **Workforce:** We need to plan for and react to teleworking changes at both an organizational level and a transportation system level.
- **Technology:** We need to plan for connected and automated transportation, including human-technology interactions, safety, and related infrastructure needs.
- **Asset management:** Aging infrastructure is a concern, and we need alternative and innovative methods of funding and addressing stewardship needs.
- **Bicycle/pedestrian:** Infrastructure accommodations need to be further incorporated into the planning and project development process.
- **Safety:** We need to address prevalent crash causes.
- **Multimodal:** Multimodal accessibility and connectivity are needed across the state for all road users, particularly for non-drivers.
- **Sustainability:** We need to plan for electric/alternative fuel vehicles of all types and their associated infrastructure needs and funding implications.
- **Rightsizing:** Capacity expansion is not sustainable; we should emphasize travel time reliability and the use of travel demand management and integrated corridor management strategies.
- **Analytical capabilities:** We need asset management data, tools, and strategies to help evaluate our system's needs and prioritize limited funding in an optimal way.

Director's roundtables were also held in 2021 to gather feedback from business, engineering, and technology stakeholders regarding important planning issues to be considered in the short- and long-term. Feedback included the following.

- There is shared appreciation for a truly multimodal system, as it is within a multimodal system that business logistics issues intersect with quality of life and mobility issues. The latter can be a way to begin addressing business concerns, such as attracting and retaining workers.
- There is a need for multijurisdictional planning as many transportation issues cross city, county, and state lines.
- There are short-term challenges with the misuse and misunderstanding of the current technology in vehicles; public education will be key.
- It is necessary to increase the workforce size and skills related to areas experiencing existing shortages, such as truck drivers, and emerging technology areas, such as automated vehicles.
- It is important to apply systemic safety solutions and use technology to reduce crashes.
- The department should continue to utilize flexible designs, integrate performance-based practical design into projects, and implement the Iowa DOT Complete Streets Policy.

1.4 How the SLRTP is Used

The SLRTP is a multimodal transportation planning effort intended to assist the Commission and department 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 needs and risks to be considered. 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 guiding their own investment decisions.

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

Figure 1.2: Generalized transportation planning and programming cycle

Source: Iowa DOT

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 SLRTP serves as a guide for the development of transportation policies, strategies, and improvements between now and 2050. The SLRTP 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 Iowa DOT 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. The SLRTP documents the measures and targets that are federally required. It also provides a performance management framework for the Iowa DOT through its definition of system objectives and areas of measurement.

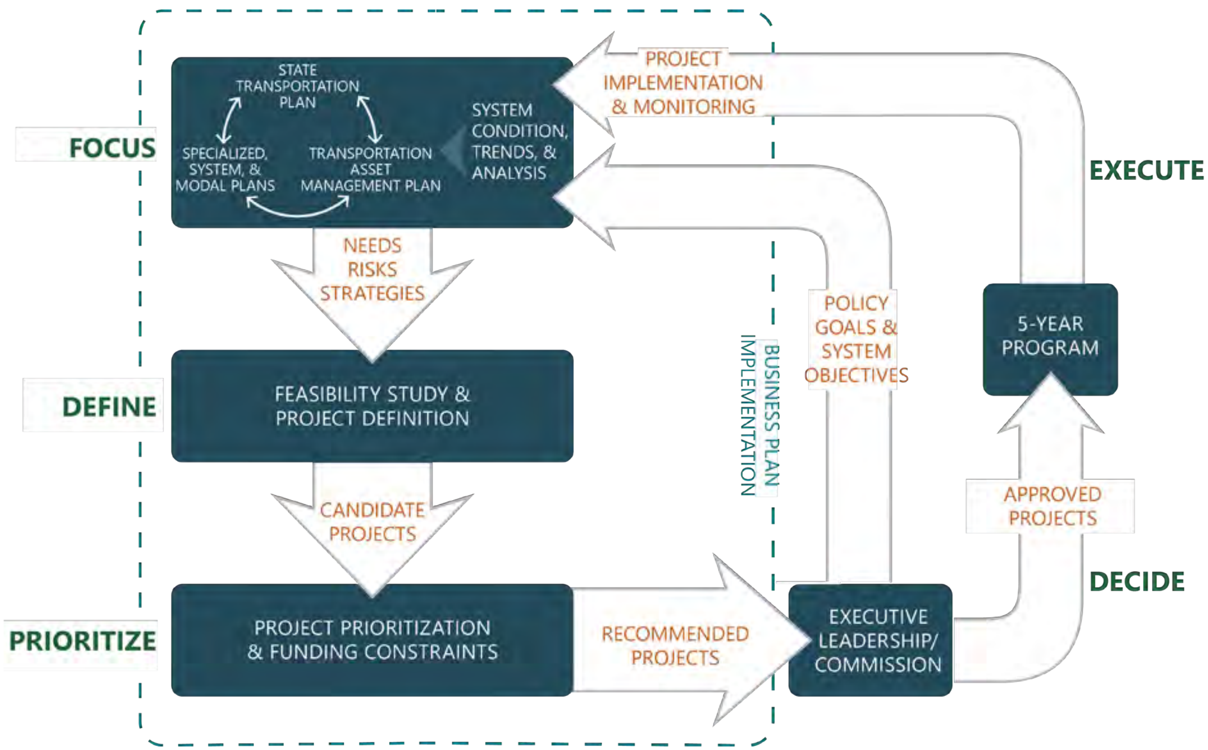
Beyond this generalized four-step cycle, Figure 1.3 helps document the overall planning and programming process. Iowa DOT policy goals and system objectives are established by the Iowa DOT Executive Leadership Team and Commission. These are combined with analysis of system condition and trends to help shape overarching planning documents, including the SLRTP. These planning efforts typically have a 10- to 30-year horizon and help **focus** attention on needs, risks, and strategies to be pursued for the benefit of the system. These broader topics are then further **defined** through efforts such as feasibility studies, which begin to review specific needs at a corridor or similar level, and through the definition of specific projects.

Once candidate projects are developed, they must be **prioritized** based on various factors and funding availability. Recommended projects then move forward to the Iowa DOT Executive Leadership Team and the Commission for consideration. Once it is **decided** what projects to target funds for, they become part of the Five-Year Program and move forward towards **execution**. Following the implementation of projects, monitoring of system performance helps complete the cycle and reinform the overarching planning processes.

The Iowa DOT Business Plan helps with the short-term implementation of the focusing, defining, and prioritizing stages. The 2021-2025 Business Plan identifies a sequence of strategic alignment steps to help lead to implementation of the SLRTP's vision, including documentation of the Iowa DOT's core values and core focus and the establishment of 1-year objectives, 5-year priority goals, and a 10-year target. The 5-year priority goals, listed below, most closely align with the SLRTP update cycle and all relate to themes throughout the plan.

- Goal 1 – Improve transportation system safety and performance
- Goal 2 – Improve customer service
- Goal 3 – Advance workforce for future challenges and opportunities
- Goal 4 – Secure stable and sustainable funding
- Goal 5 – Grow innovation

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



Source: Iowa DOT

2. UNDERSTANDING IOWA

Population

1990	2020	2050
2.8 million	**3.2 million**	**3.4 million**

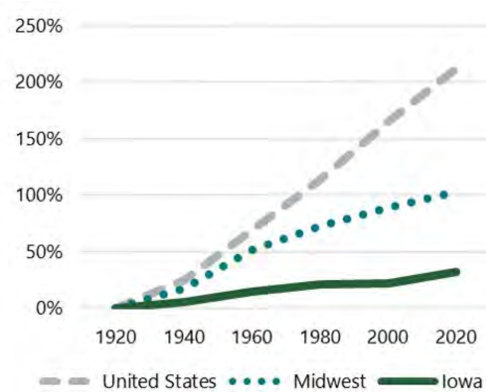
In order to plan for Iowa's future, it is important to understand where we have been and where we are now. This chapter provides an overview of many of the key demographic and economic trends that have affected Iowa and how they are projected to evolve in the future. An understanding of the characteristics that make Iowa's people and economy unique will help in determining the strategies and policies that the Iowa DOT can pursue to ensure Iowa's transportation system can meet the needs of today and the future.

2.1 Demographic Trends

Iowa's population continues to grow, but at a slow pace

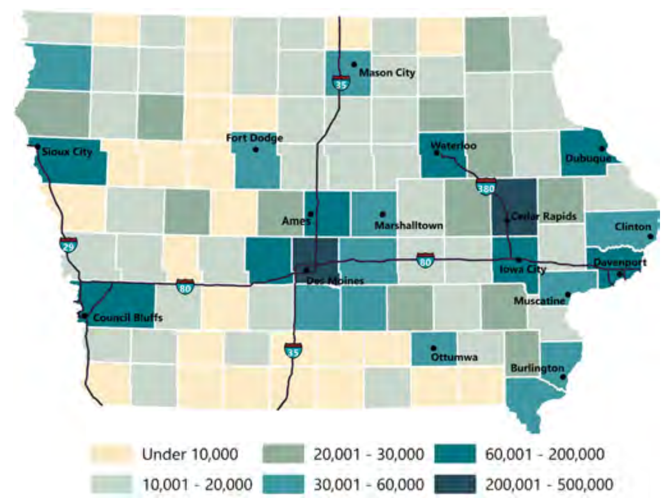
Iowa's population has grown slowly over time. Figure 2.1 shows the magnitude of change for Iowa, the Midwest, and the U.S. over the past 100 years, and how much less Iowa has grown relative to the broader region and country. Iowa's 2020 population was 3,190,369, which is just under 1% of the nation's population; much of this population is concentrated in relatively few counties, as shown in Figure 2.2. Iowa did grow by 4.7% from 2010-2020, which is higher than the Midwest rate of 3.1% but lower than the national rate of 7.4%. Long-term projections have decreased over time. Iowa's 2050 population is projected to be 3.4 million, which is only 6.0% growth from 2020. Slow growth could make it more difficult for transportation revenues to keep up with the growing maintenance and operation needs of the state's transportation system.

Figure 2.1: Population growth indexed to 1920



Source: U.S. Census Bureau Decennial Censuses

Figure 2.2: Iowa's population by county, 2020



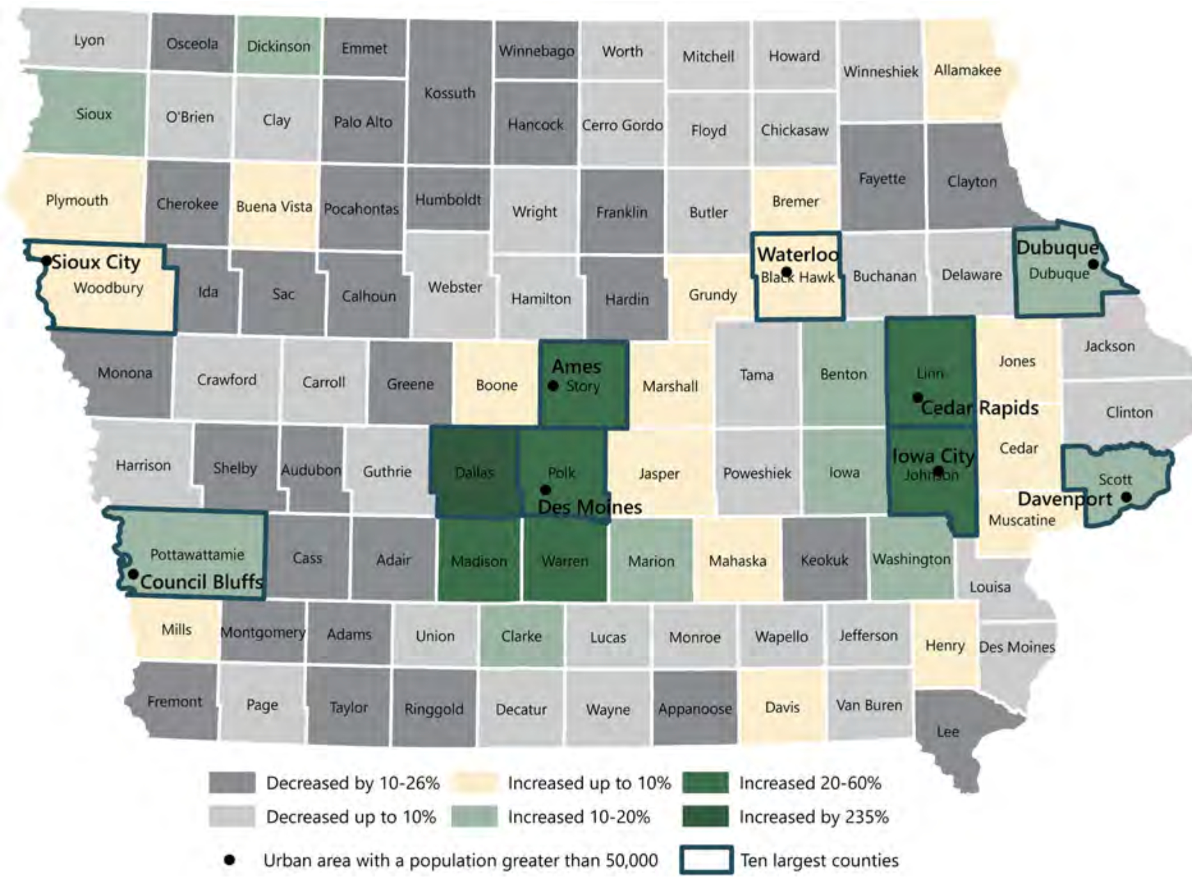
Source: U.S. Census Bureau Decennial Census

Percent living in ten largest counties		
1990	2020	2050
45.4%	**52.7%**	**57.4%**

Where Iowans live and where the population is growing varies across the state

In the last 30 years, Iowa's overall population has grown, but 63 out of 99 Iowa counties have lost population. The largest percentage increase occurred in Dallas County, which grew by over 200%; the largest percentage decrease was in Pocahontas County, which declined by more than 25%. Iowa's population has become increasingly urbanized and population growth has primarily been concentrated around the state's nine metropolitan areas, noted on Figure 2.3. The state's ten largest counties are also noted; since 2011, more than half the state's population has been located in these counties, and that percentage is anticipated to continue to increase. For rural cities and counties with declining population, the loss in local revenue can exacerbate increasing transportation maintenance needs.

Figure 2.3: County population change, 1990-2020

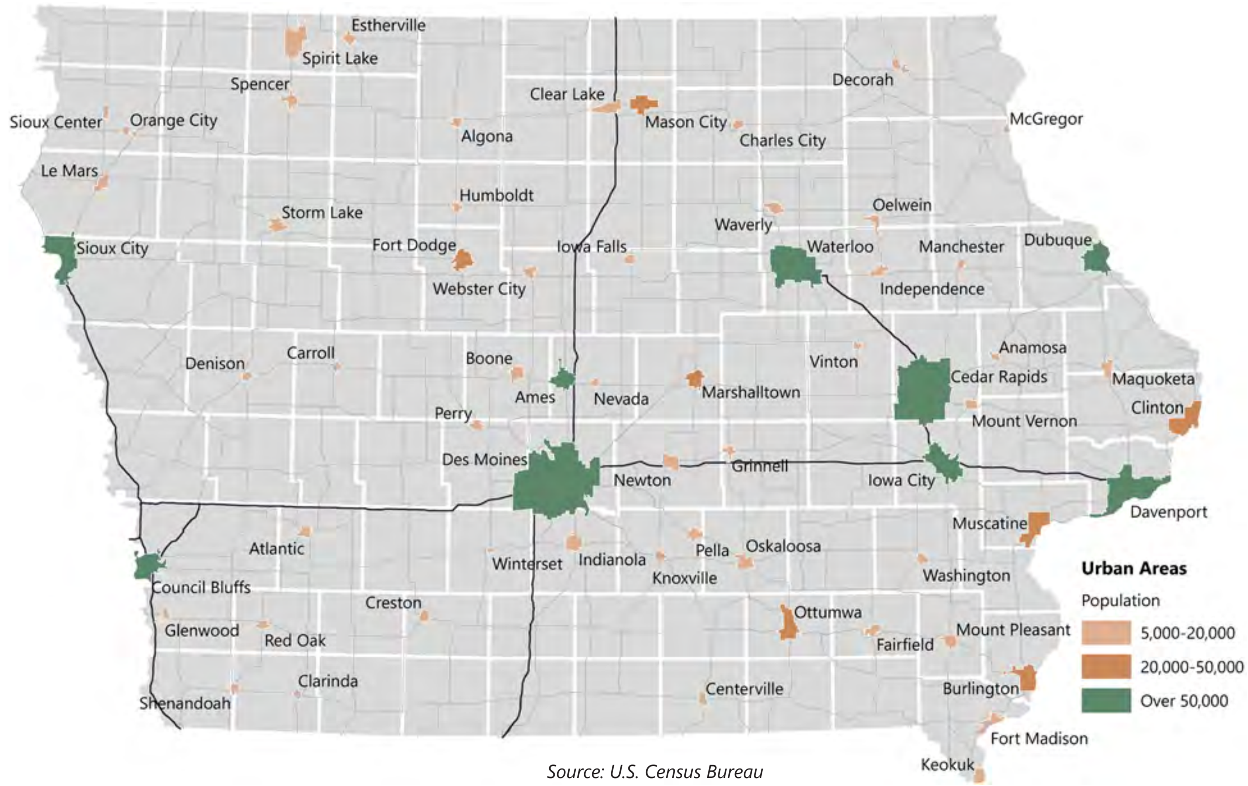


Source: U.S. Census Bureau Decennial Censuses

The U.S Census Bureau designates urban areas based on a population threshold of 2,500. For transportation planning purposes, the Federal Highway Administration (FHWA) defines urban areas as those designated by the U.S. Census Bureau that have a population of 5,000 or more. Urbanized areas are U.S. Census Bureau-designated urban areas with a population of 50,000 or more. Urbanized areas may include many cities, but are referred to in this plan by the name of the principal Iowa city. Iowa's urban areas based on the 2010 Census are shown in Figure 2.4.

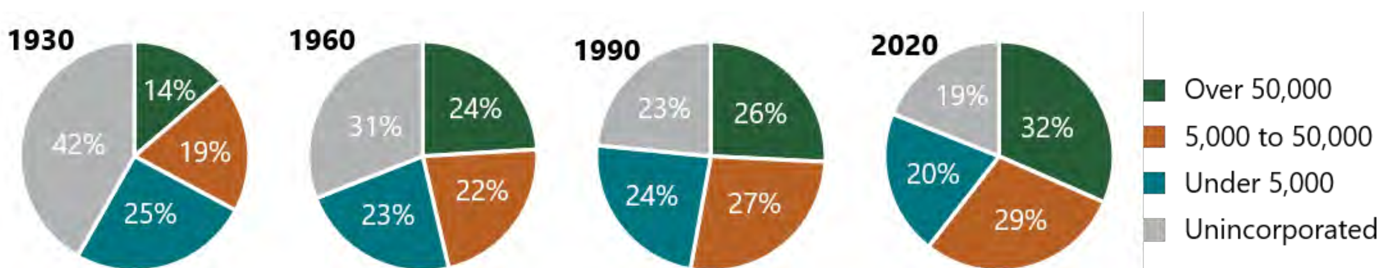
The percent of the population living in incorporated cities overall and in communities that would be defined as urban or urbanized areas has increased steadily over time, from 58% in 1930 to 81% in 2020. This is shown in Figure 2.5. This trend is expected to continue, further concentrating Iowa's population in cities and urban areas.

Figure 2.4: Iowa's urban areas for transportation planning based on 2010 Census



Source: U.S. Census Bureau

Figure 2.5: Percent of population living in various sizes of cities



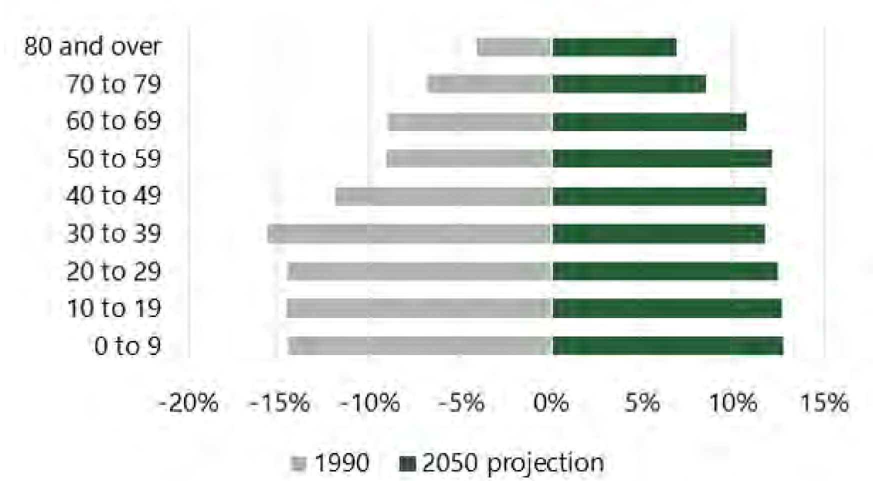
Source: U.S. Census Bureau Decennial Censuses

Iowa's population is aging overall

The percent of Iowa's population that is 65 and older continues to increase, but not as quickly as some other states. Iowa had been in the top ten states for percent of population 65 and older, but is now ranked 16th. The percent of the population that is 19 and younger has dropped over the past few decades but is anticipated to stay relatively stable in the future.

The aging population is evident in Figure 2.6, which shows a population pyramid of Iowa's population 30 years ago compared to the forecasted population in 2050, where the population will become more evenly divided among age groups. While the state is aging overall, in generational terms, the largest percentage of the population is made up of Generation Z and the following generation – those born since 1997 (see Figure 2.7). By the horizon year of this plan, the majority of Iowa's population will be Generation Z and the following generations – most of which are individuals that have not yet been born.

Figure 2.6: Iowa population by age group, 1990 and projected 2050



Source: Woods and Poole Economics, Inc.

Percent 65 and older

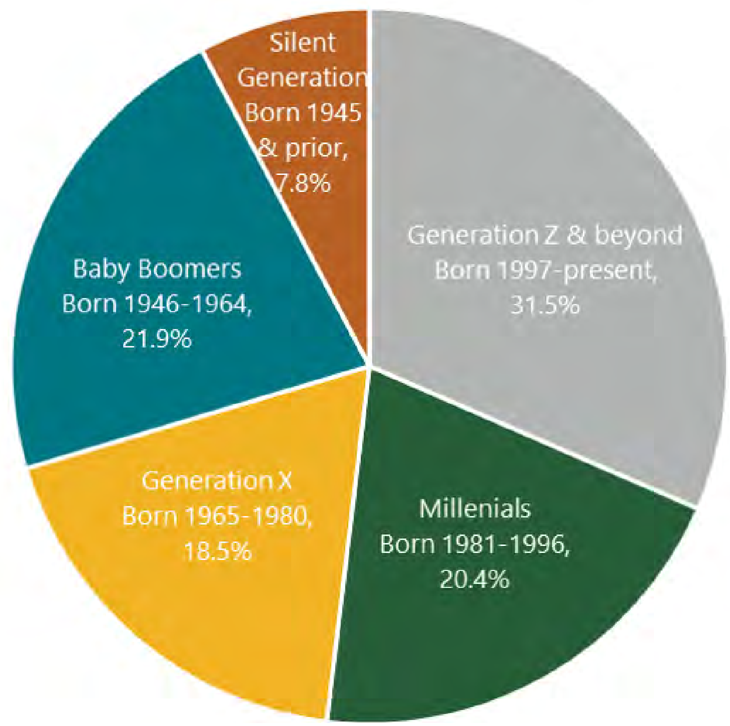
1990	2020	2050
15.4%	**18.0%**	**20.7%**

Percent 19 and younger

1990	2020	2050
29.0%	**25.8%**	**25.5%**

The aging population requires special considerations in transportation planning, from providing infrastructure that is more accommodating to older drivers to providing other modal options. At the same time, younger generations have shown an increased interest in non-driving options, including other modes, use of shared mobility services, and micromobility options.

Figure 2.7: Iowa population in 2020 by generation



Source: Woods and Poole Economics, Inc.

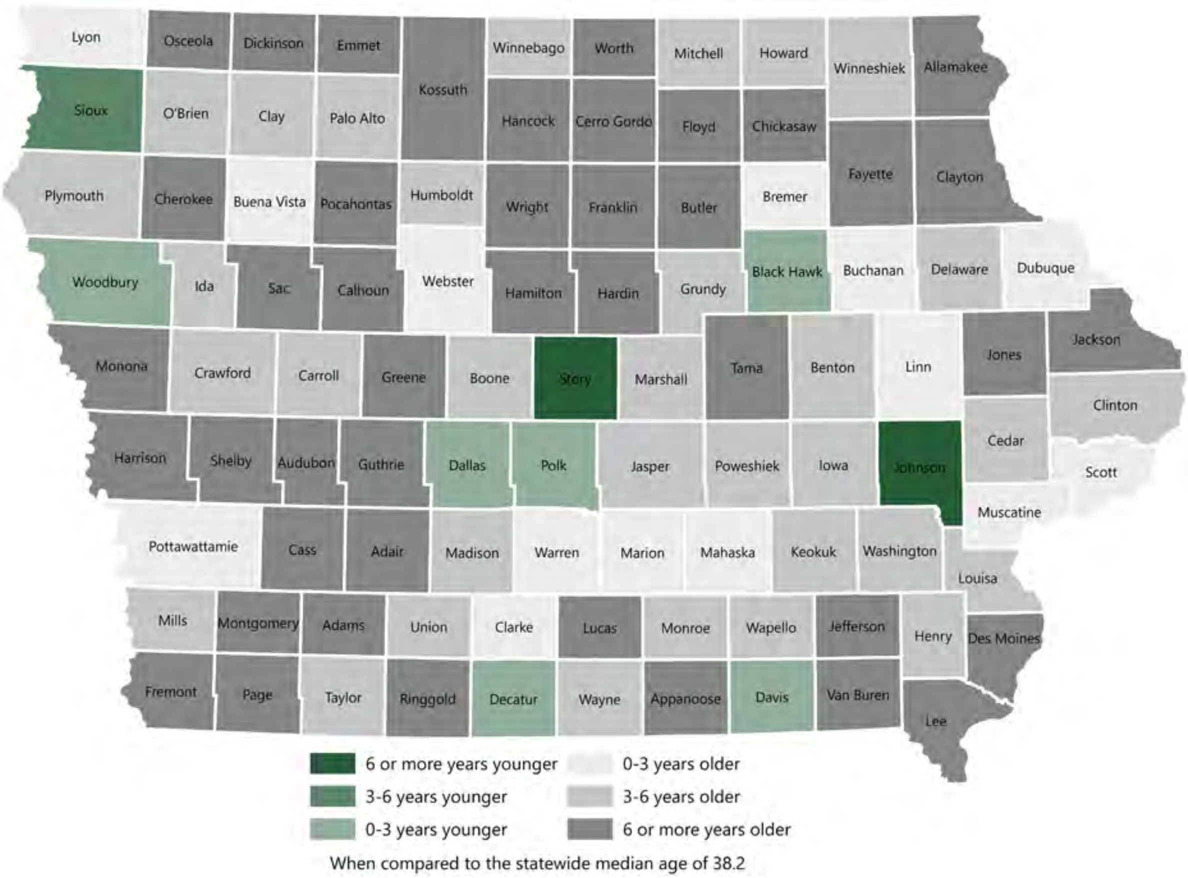
Iowa's population is not aging evenly

Iowa's median age has increased steadily over time to 38.2 in 2020, on par with the national median age of 38.1. The age of the population varies both geographically and by racial and ethnic groups, as shown in Figures 2.8 and 2.9. Rural areas tend to be older and metropolitan areas tend to be younger. Rural areas tend to have less transportation options in general, and as the population continues to age this could exacerbate mobility challenges. When median age is categorized by racial or ethnic group, White individuals have the highest median age and all minority groups have lower median ages.

Median Age

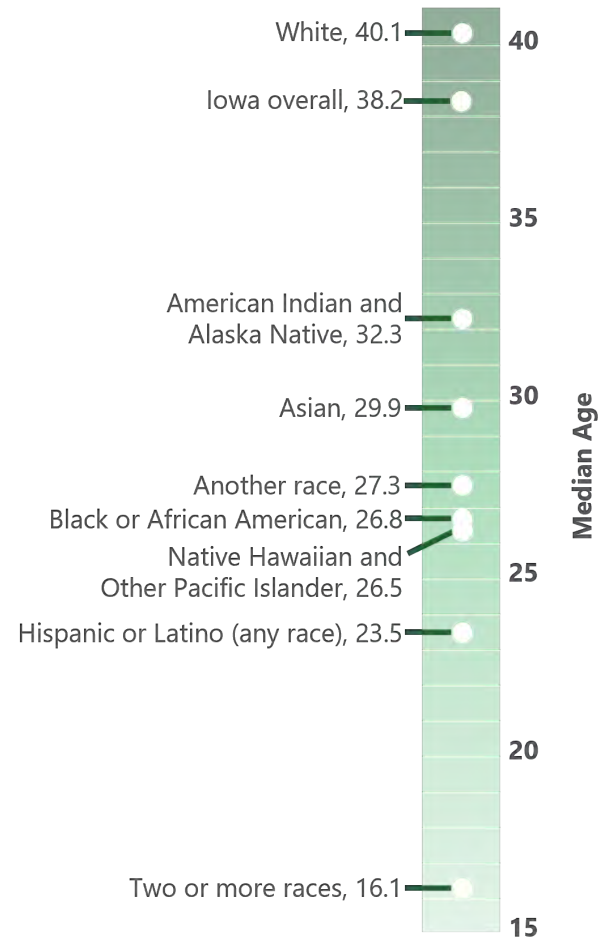
1990	2020	2050
34.1	**38.2**	**40.2**

Figure 2.8: Median age by county



Source: U.S. Census Bureau 2015-2019 American Community Survey Estimates

Figure 2.9: Median age in Iowa by race and ethnicity



Source: U.S. Census Bureau 2015-2019 American Community Survey Estimates

PERCENT MINORITY

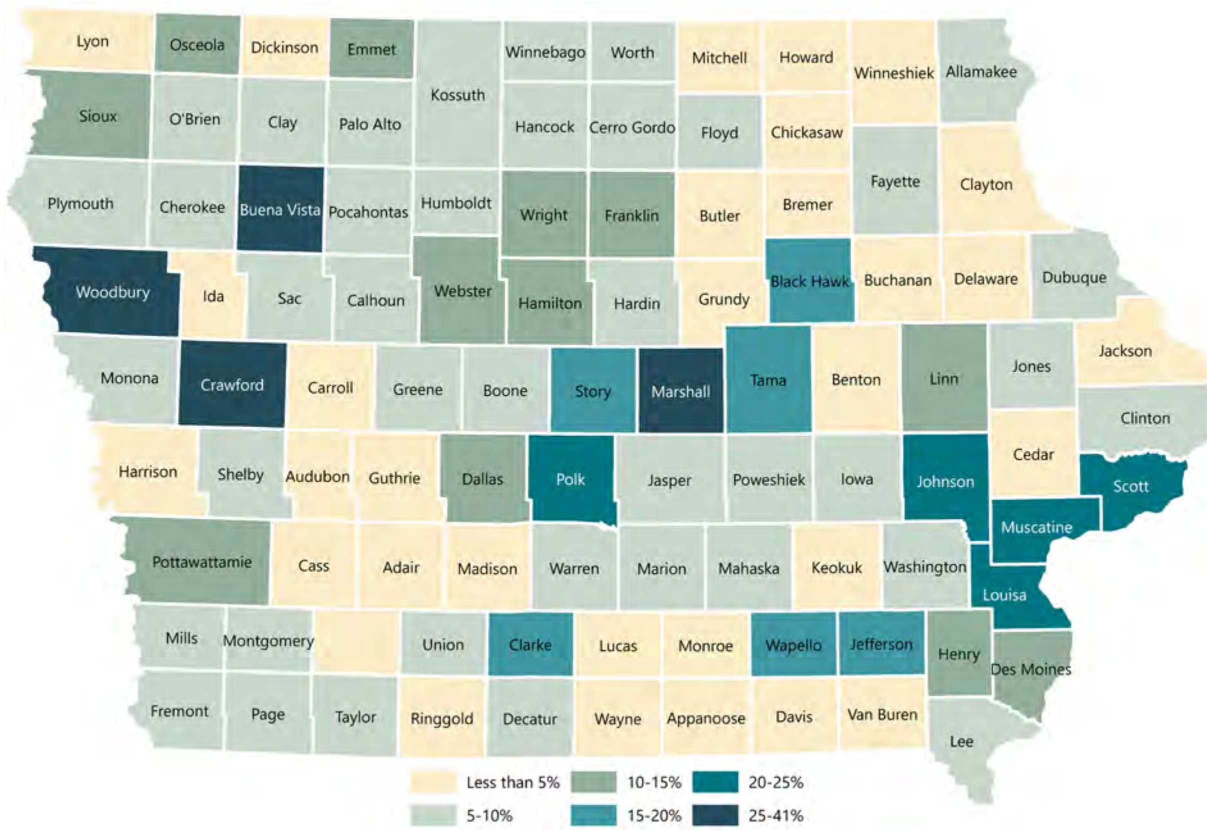
1990	2020	2050
4.0%	**14.4%**	**26.4%**

Iowa is becoming more diverse

Iowa continues to grow more diverse, with increasing percentages of minority individuals, shown in Figure 2.10. This trend will continue into the future, with more than one in four Iowans projected to be a non-White race and/or Hispanic or Latino by 2050. However, this is much lower than the nation overall, where more than half the population will be non-White by 2050.

English is the dominant language in Iowa, and is the sole language of 91.7% of the population. Almost 5% of the population speaks at least one other language as well as English. The remaining 3.4% of the population has limited English proficiency and may need additional consideration or accommodation to fully use the transportation system. Of the dozens of other languages spoken in Iowa, Spanish accounts for over half of the individuals who do not speak English at home. Other top languages include Chinese, German, Arabic, Vietnamese, and Serbo-Croatian.

Figure 2.10: Percent of the population that is a racial minority and/or Hispanic or Latino

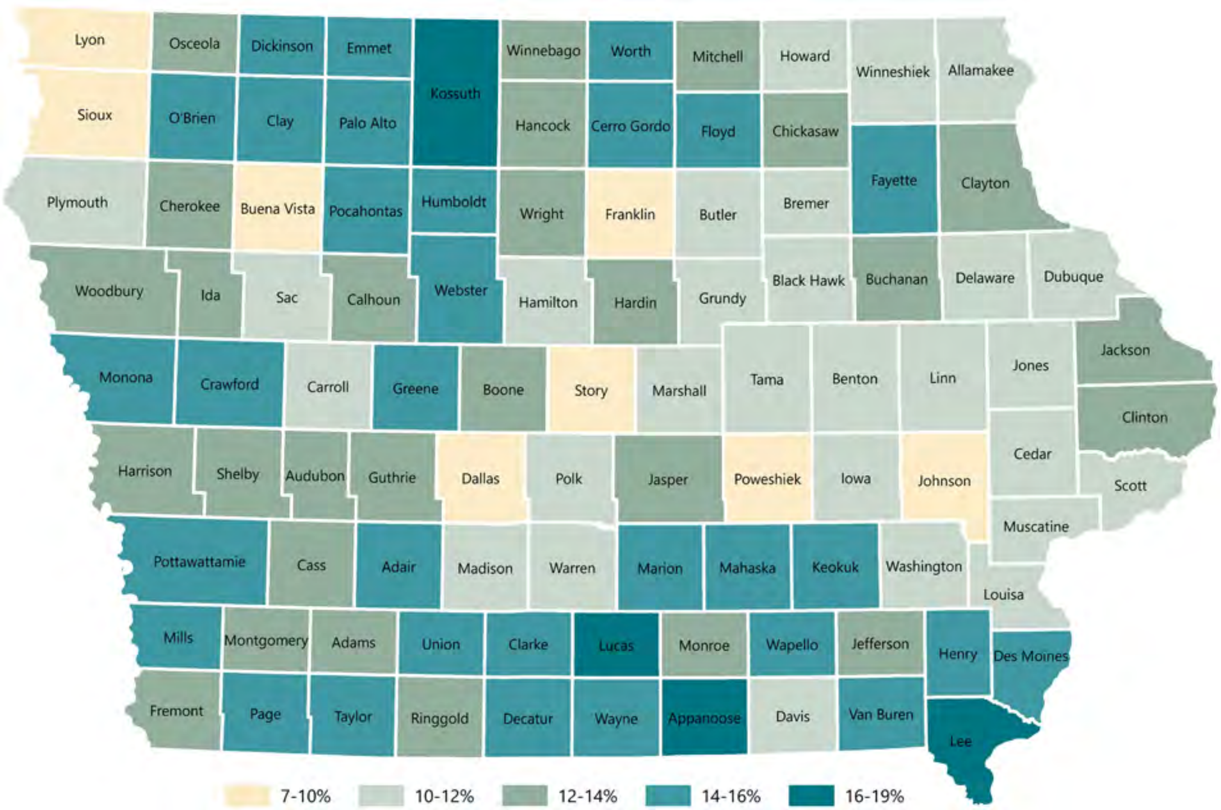


The map is based on U.S. Census Bureau categorizations.
Races include White, Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Another Race, or Two or More Races.
Ethnicity is Hispanic or Latino, or not Hispanic or Latino.
For the purposes of this discussion, minority means all population that is one or more race other than White and/or is Hispanic or Latino.
Source: U.S. Census Bureau 2015-2019 American Community Survey Estimates

A significant number of Iowans have one or more disabilities

More than one in ten Iowans has at least one type of disability, which may impact their ability to fully use the transportation system. As shown in Figure 2.11, in some counties close to one in five individuals have one or more disabilities, representing a sizeable portion of the population. Table 2.1 provides the definitions for the different types of disabilities as well as the percentage of Iowa's population with a particular disability.

Figure 2.11: Percent of the population with one or more disabilities



Source: U.S. Census Bureau 2015-2019 American Community Survey Estimates

Table 2.1: Definitions of disabilities and percent of Iowa's population with a disability

Type	Definition	Percent in Iowa
Hearing	Deaf or having serious difficulty hearing	3.5% of total population
Vision	Blind or having serious difficulty seeing, even when wearing glasses	1.8% of total population
Cognitive	Because of a physical, mental, or emotional problem, having difficulty remembering, concentrating, or making decisions	4.6% of those 5 and older
Ambulatory	Having serious difficulty walking or climbing stairs	5.8% of those 5 and older
Self-care	Having difficulty bathing or dressing	2.1% of those 5 and older
Independent living	Because of a physical, mental, or emotional problem, having difficulty doing errands alone such as visiting a doctor's office or shopping	4.8% of those 18 and older
Overall	At least one of the above disabilities	11.7% of total population

Source: U.S. Census Bureau 2015-2019 American Community Survey Estimates

2.2 Economic Trends

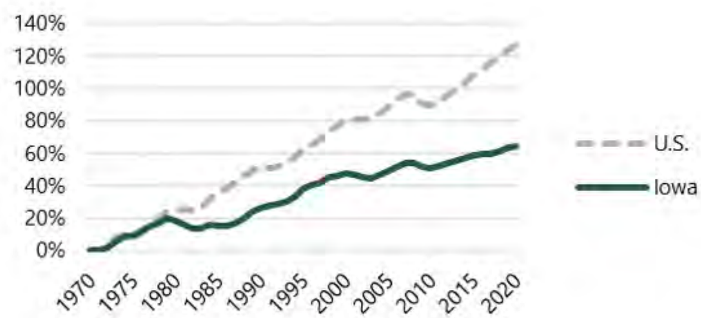
Jobs

1990	2020	2050
1.6 million	**2.1 million**	**2.6 million**

Iowa's total employment continues to increase

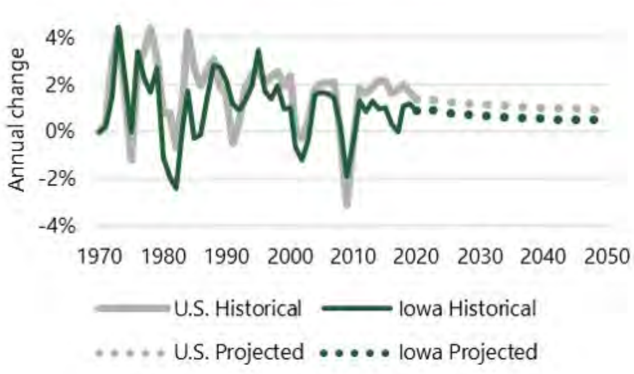
Iowa's employment has grown steadily over time. Figures 2.12 and 2.13 show the magnitude of change for Iowa and the U.S. over the past 50 years, and how jobs in Iowa have increased more slowly than the nation as a whole. The annual change in the number of jobs can vary substantially, but overall has shown a positive but decreasing trend. Figure 2.14 provides a snapshot of the location of jobs in Iowa in 2020. These include part-time and self-employed jobs, which may be part of the reason the number of jobs in the state is growing more quickly than Iowa's population.

Figure 2.12: Employment growth indexed to 1970



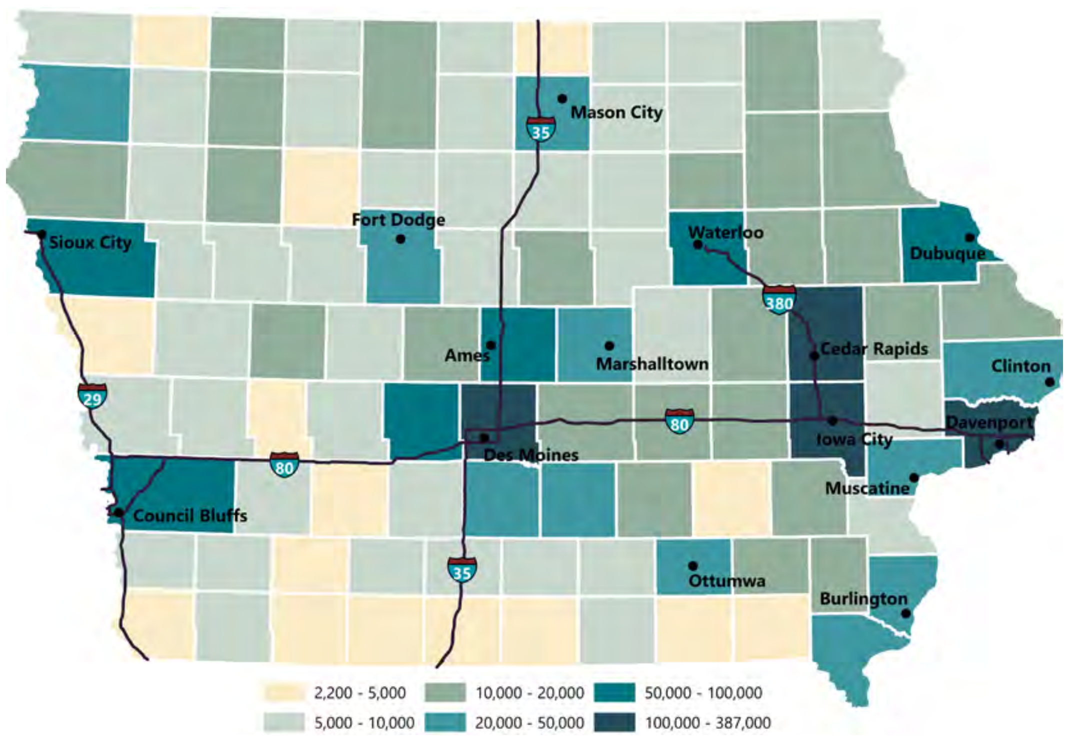
Source: Woods & Poole Economics, Inc.

Figure 2.13: Annual change in number of jobs



Source: Woods & Poole Economics, Inc.

Figure 2.14: Number of jobs per county, 2020



Source: Woods & Poole Economics, Inc.

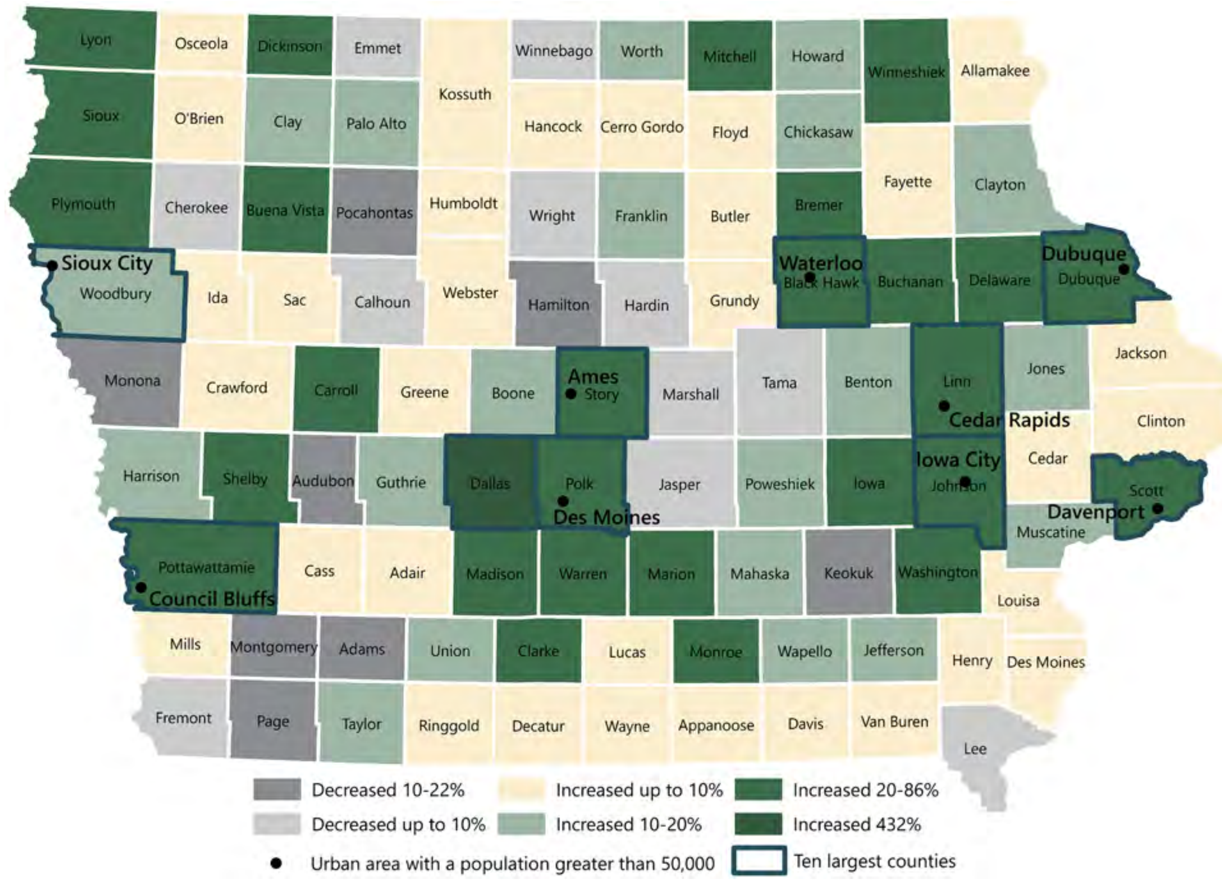
Percent of jobs in ten largest counties

1990	2020	2050
50.4%	**56.8%**	**60.7%**

Where Iowans work and where jobs are being added varies across the state

In the last 30 years, jobs in Iowa have increased steadily. While fewer counties lost jobs compared to population, there were still declines in the number of jobs for 19 out of 99 Iowa counties. Similar to population, the densest employment growth has primarily been concentrated around the state's nine metropolitan areas, noted on Figure 2.15. Dallas County had the highest percentage increase during this time, over 400%; Adams County declined the most, with a decrease of over 21%. Also, similar to population, over half of Iowa's jobs are concentrated in just ten counties. Where people live and work can have significant impacts for the transportation system, as commuters have varying needs for infrastructure and services throughout the state.

Figure 2.15: County employment change, 1990-2020

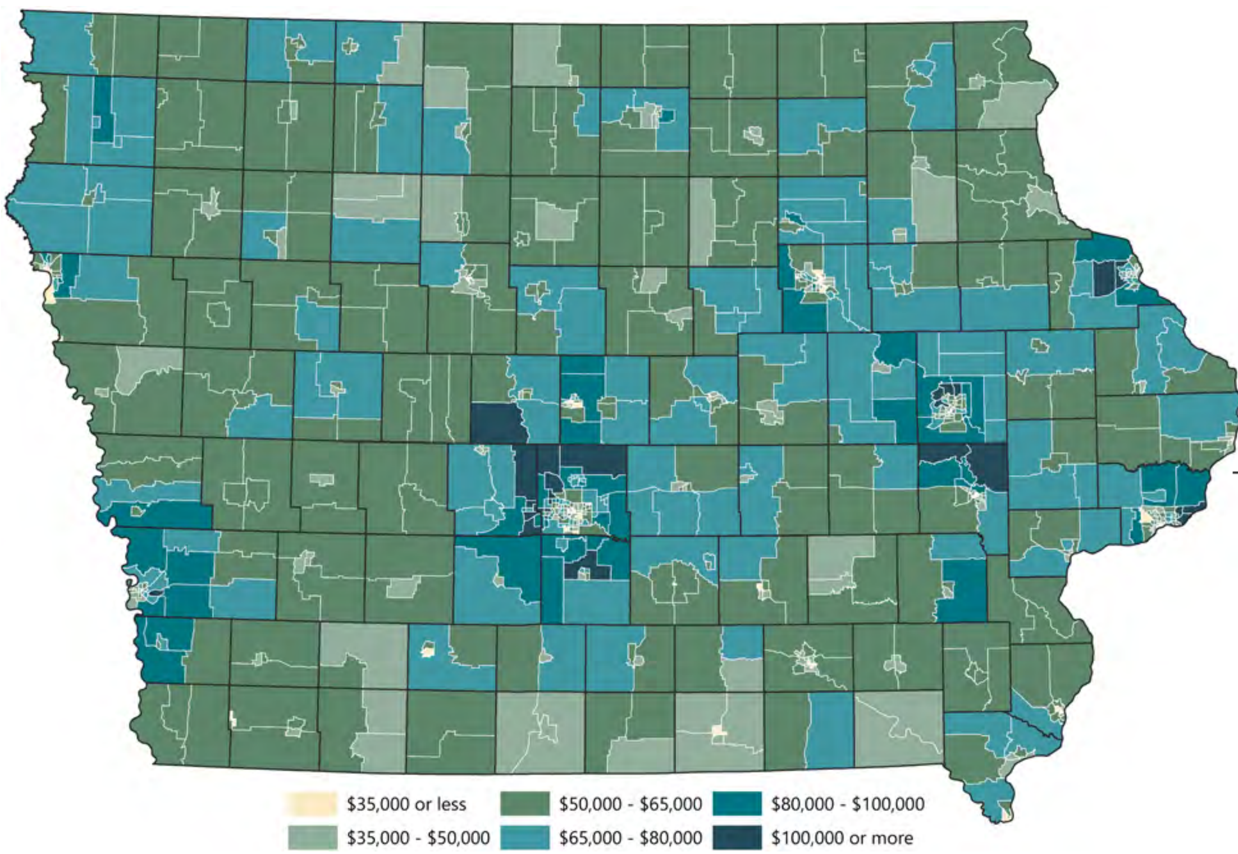


Source: Woods and Poole Economics, Inc.

Iowa's median household income is increasing, but varies considerably

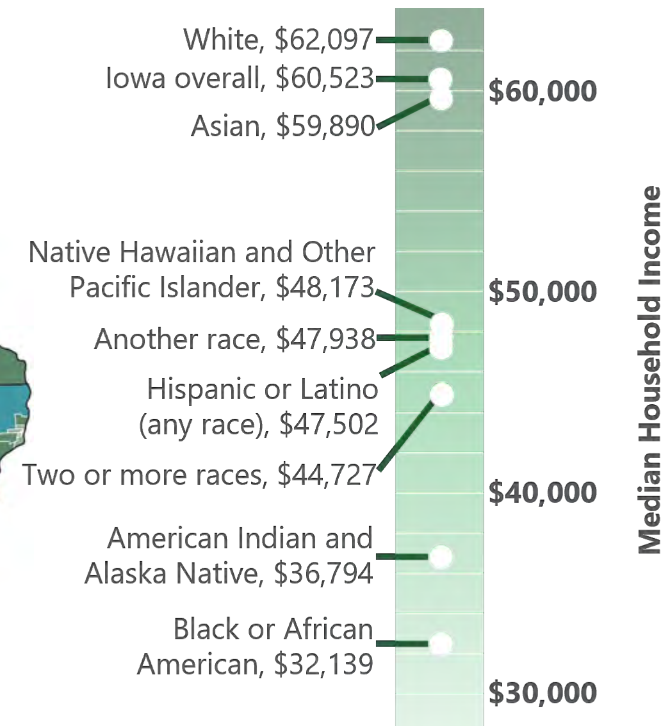
Among Iowa's households, the median income is currently $60,523, slightly less than the national median income of $62,843. While the statewide median household income has been increasing over time, it varies considerably for different areas of the state and for different racial and ethnic groups, as shown in Figures 2.16 and 2.17. In general, the areas with the highest median household income are in or surrounding the state's metropolitan areas, though the core areas of most metropolitan areas tend to have lower median household incomes. Median household income varies substantially by race and ethnicity, with the median household income for Black households being just over half the median income for White households. Areas with lower incomes likely have an increased need for transportation infrastructure and services for modes besides driving.

Figure 2.16: Median household income by census tract



Source: U.S. Census Bureau 2015-2019 American Community Survey Estimates

Figure 2.17: Median household income in Iowa by race and ethnicity



Source: U.S. Census Bureau 2015-2019 American Community Survey Estimates

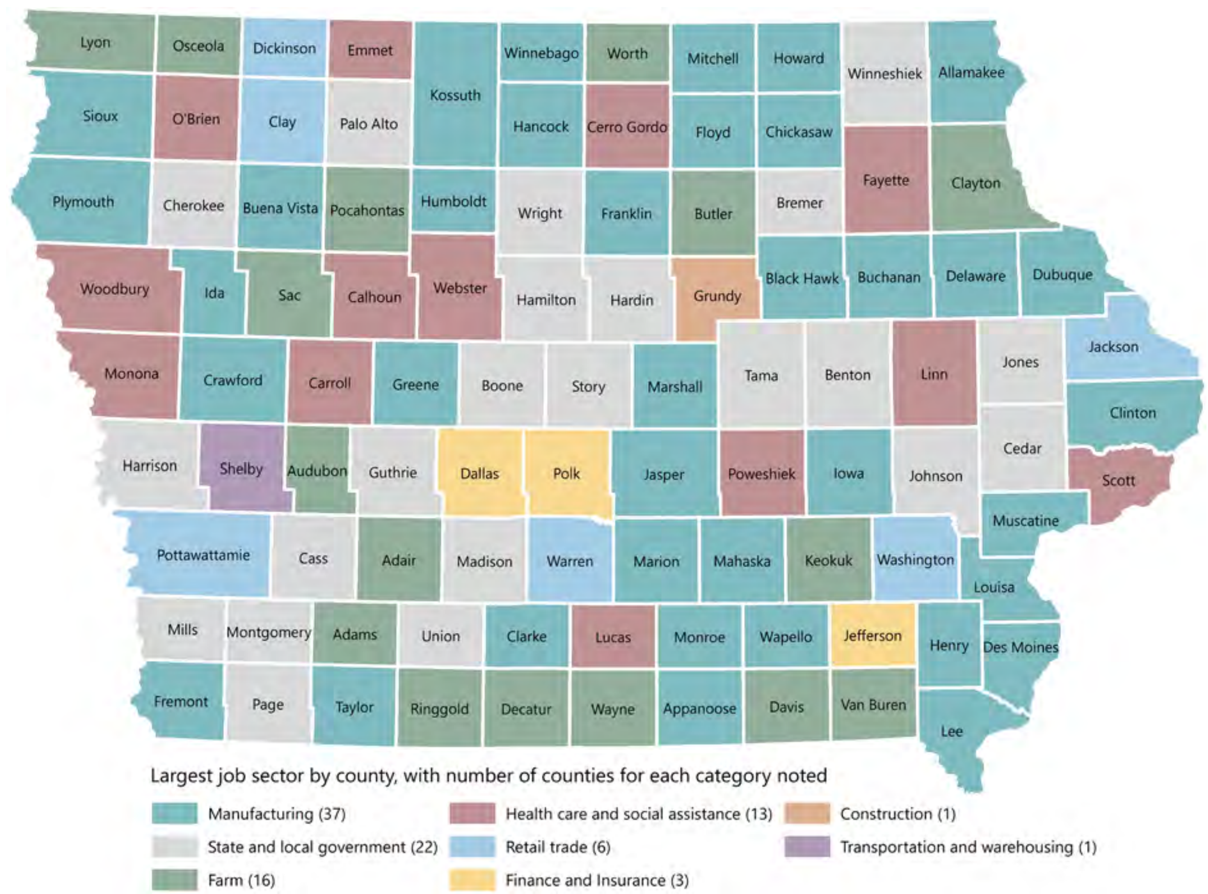
Iowa's traditional employment sectors have changed

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, as shown in Figure 2.18. Since 1990, the farm sector has decreased by more than 40,000 jobs, which represents a decline of 33 percent in total farm employment in Iowa. The number of manufacturing jobs is about the same in 2020 as it was in 1990, but manufacturing's share of jobs has decreased as other categories have increased. Despite these trends, farm and manufacturing jobs remain critical to the state, and account for the largest percentage of jobs in 53 of Iowa's counties (see Figure 2.19). These industries can also have a major impact on the transportation system, as heavy trucks and equipment can cause operational and maintenance issues for the roadway system.

Figure 2.18: Jobs by sector, 1990, 2020, and 2050

Source: Woods & Poole Economics, Inc.

Figure 2.19: Largest job sector by county, 2020



Source: Woods & Poole Economics, Inc.

Iowa's gross domestic product continues to increase

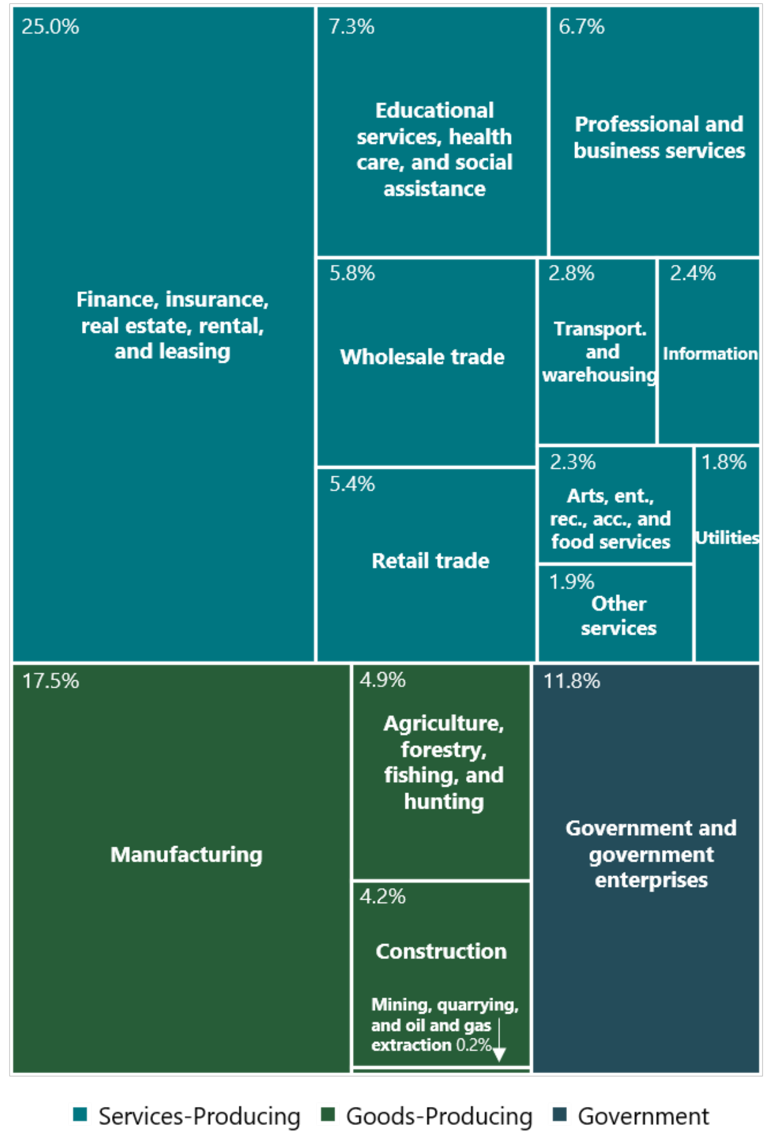
Gross domestic product (GDP) is the total market value of all goods and services produced in the economy. In 2000, Iowa's GDP was $93 billion; by 2020, Iowa's current-dollar GDP had grown by 107% to $193 billion and ranked 30th among states. The real-dollar GDP growth during this time, which accounts for inflation by using constant 2012 dollars, was 38.5%, or less than 2% per year. However, as shown in Figure 2.20, some industries have seen significant growth in real GDP since 2000, including agriculture, information, professional and business services, and finance and real estate. The current breakdown of Iowa's GDP is 61.4% private services-producing, 26.8% private goods-producing, and 11.8% government; the proportions by industry are detailed on Figure 2.21. While the goods-producing sectors are forecast to continue to make up a smaller percentage of Iowa jobs over time, they will continue to have significant transportation infrastructure needs related to moving raw materials and finished products.

Figure 2.20: Change in real GDP by industry from 2000-2020

181%	Agriculture, forestry, fishing and hunting
100%	Information
86%	Professional and business services
77%	Finance, insurance, real estate, rental, and leasing
35%	Wholesale trade
29%	Educational services, health care, and social assistance
27%	Manufacturing
21%	Retail trade
11%	Government and government enterprises
9%	Transportation and warehousing
5%	Utilities
-7%	Construction
-17%	Arts, entertainment, recreation, accommodation, and food services
-28%	Other services (except government and government enterprises)
-29%	Mining, quarrying, and oil and gas extraction

Source: U.S. Bureau of Economic Analysis

Figure 2.21: Iowa's 2020 GDP by industry



Source: U.S. Bureau of Economic Analysis

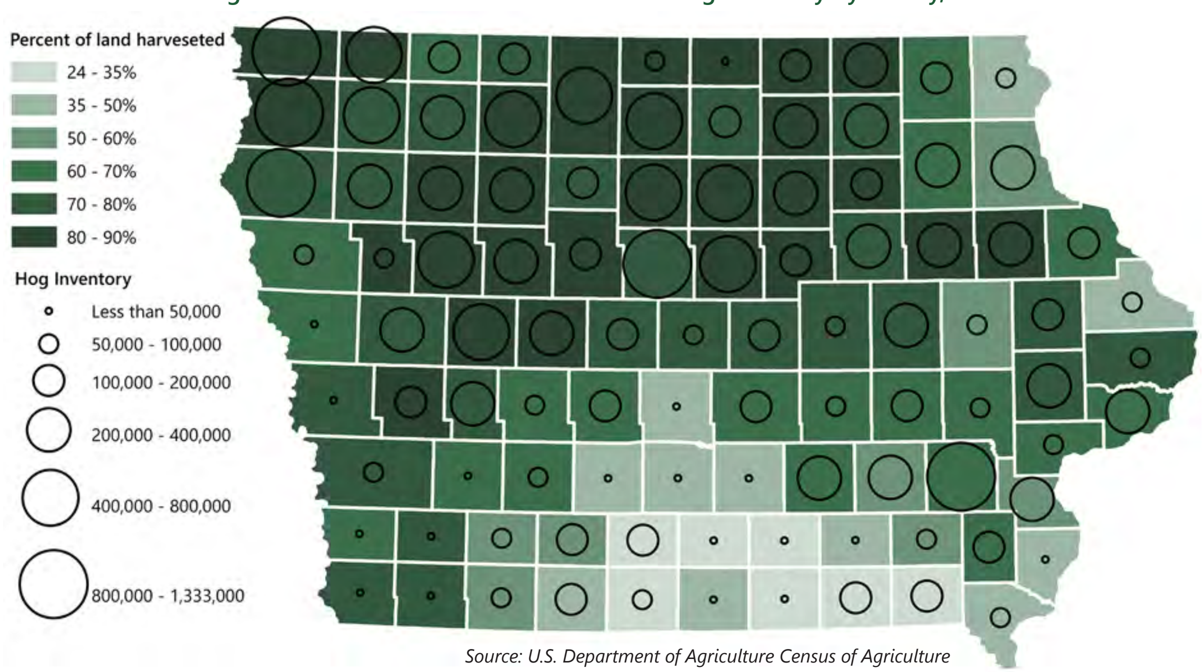
Agricultural output continues to be critical to the state

While the farm sector continues to decrease in terms of employment and the number of farms, the value of Iowa's agricultural output continues to increase. In 2017, 86% of Iowa's land area was part of farms, and 68% of the state's land area was harvested cropland. Figure 2.22 shows that during the past couple decades, overall farm output and products such as corn, soybeans, and hogs have increased, while production of other grains has decreased. As shown in Figure 2.23, the patterns of crop and animal production in Iowa reflect the natural geography of the state, with flatter northern Iowa having larger percentages of land used for crops. This also correlates to larger numbers of hog inventories, likely being fed via the area's corn crops, which are also helping to fuel ethanol production. Growth in agricultural output has a corresponding impact on Iowa's transportation system as products are moved to in-state, interstate, and overseas markets via multiple modes. This highlights the need for sustained investment not only in the roadway system, but in rail facilities, intermodal facilities, and lock and dam infrastructure.

Figure 2.22: Percent change for selected agricultural items, 1997-2017

Source: U.S. Department of Agriculture Census of Agriculture

Figure 2.23: Percent of land harvested and hog inventory by county, 2017



Source: U.S. Department of Agriculture Census of Agriculture

3. SYSTEM OVERVIEW

The last chapter provided an overview of Iowa's demographic and economic characteristics. To help plan for the future, it is also important to understand the current structure and usage of the multimodal transportation system. This chapter provides an overview of each mode of transportation, highlights relationships between modes for both passengers and freight, and provides a snapshot of passenger and freight trends. In combination with Chapter 2, this helps set the stage for developing a vision for Iowa's transportation system and determining what strategies and policies to pursue to implement that vision.

3.1 Aviation

Iowa's air transportation system plays a critical role in the economy 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 3,300 aircraft and 5,500 pilots in the state. With more than one million annual aircraft operations conducted at Iowa's public-use 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. 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.

Aviation is vital to business recruitment and retention for many communities and economic development groups, and it 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. The 2009 Uses and Benefits of Aviation in Iowa study documented the impact of Iowa's aviation system on the state's economy and 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.

Iowa DOT's Role

The Iowa DOT does not own or operate any aviation facilities. However, the Aviation Team of the Iowa DOT's Modal Transportation Bureau advocates for and delivers services that promote and enhance a healthy air transportation system. Emphasis is placed on building cooperative working relationships, advocating for opportunities to strengthen aviation in Iowa, coordinating outreach programs, maintaining a comprehensive data collection system, and managing programs that promote a safe and secure air transportation system in Iowa.

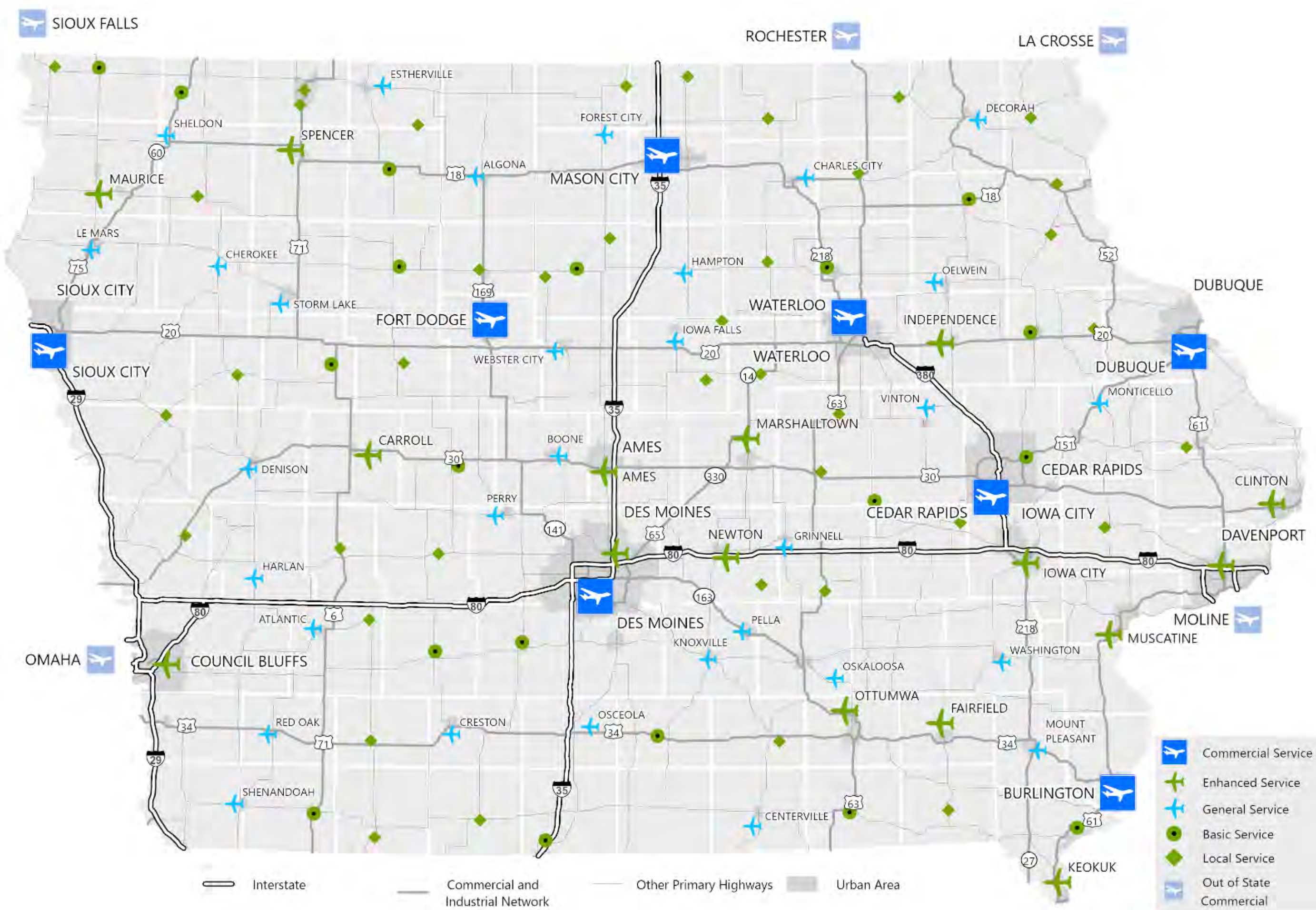
Activities the Aviation Team undertakes to achieve these goals include:

- Administering state and federal aviation funding programs
- Managing the Iowa aircraft registration program
- Inspecting and certifying all public use airports
- Statewide aviation weather reporting
- Communications, outreach, and educational activities
- Aviation system planning, data collection, and analysis and development
- Pavement inspections at federally funded airports

Inventory

Airports in Iowa serve varying types of users and levels of demand. Iowa's airport system has extensive geographic coverage, with over 97% of Iowa's population located within 30 minutes of an airport. Commercial service options for Iowa residents are enhanced by several nearby commercial airports in bordering states, also noted on Figure 3.1.

Figure 3.1: Iowa airports by role and bordering commercial airports



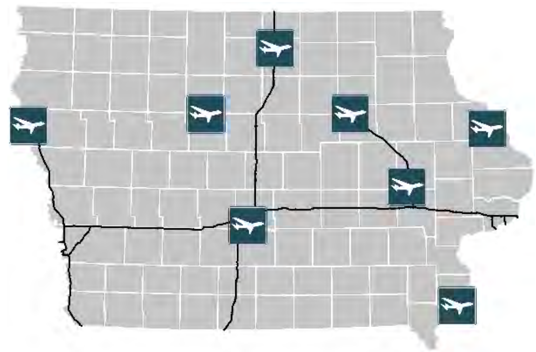
Source: Iowa DOT

Iowa's Airport Roles

Airports serve different roles within Iowa's system. Roles reflect the type of users each airport accommodates and the facilities and services that the airport has in place, as well as an airport's relative importance as it relates to meeting the state's transportation needs and objectives. Also, airport roles are necessary to establish facility and service standards or objectives that are desirable at each level of airport. Assigning roles provides a means of analyzing performance relative to other airports in the state that cater to similar users.

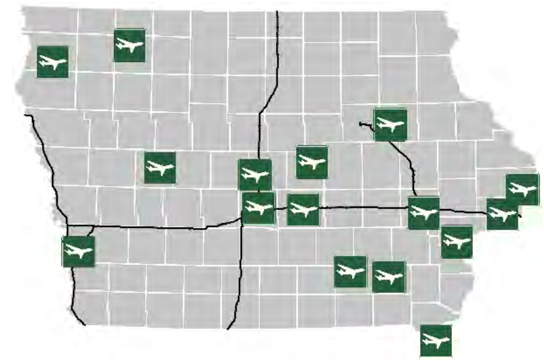
Commercial Service *8 airports*

Airports that support scheduled commercial airline service and provide support for all types of general aviation activity. These airports are essential in the national transportation system and are economic pillars in the state and their communities.



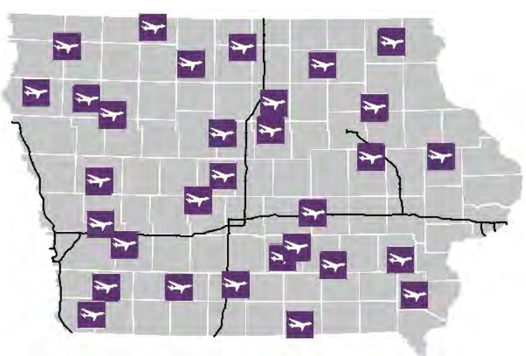
Enhanced Service *16 airports*

Airports that have runways over 5,000 feet and services for a wide range of general aviation activity. Airports in this role serve as economic centers for regions, supporting business jet operations as well as other general aviation activity.



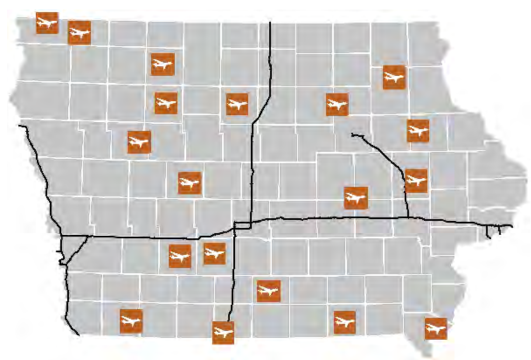
General Service *31 airports*

Airports that have runways over 4,000 feet and services that cater to small and mid-size business jets. The airports in this role are recognized as community assets.



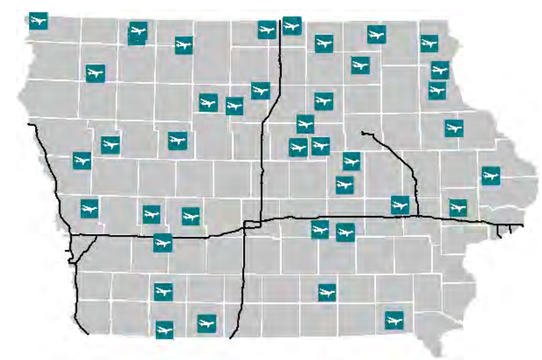
Basic Service *19 airports*

Airports that have runways over 3,000 feet and services that meet recreational general aviation activity.



Local Service *40 airports*

Airports that primarily support local activity and provide limited aircraft services.



Planning Efforts

Aviation planning is guided by its own system plan, the Iowa Statewide Aviation System Plan (IASP), last updated in 2021. It provides a detailed overview of Iowa's aviation system, evaluates existing conditions, and makes recommendations for future development of the air transportation system to meet the needs of users through 2040. The plan can be used as a guide for future investment and decisions to maintain and develop, as necessary, airports in the state of Iowa. The plan includes forecasts for future aviation use in the state, shown in Table 3.1. All sectors are forecast to grow over time, but commercial enplanements are anticipated to outpace other aviation components.

Table 3.1: Projections for various aviation components in Iowa

	2019	2039	CAGR
Based Aircraft	2,520	2,570	0.10%
General Aviation Operations	905,150	959,830	0.29%
Commercial Service Operations	78,690	89,070	0.60%
Commercial Enplanements	2,231,150	3,479,590	2.20%
Air Cargo (pounds)	176,133,870	256,640,400	1.90%

CAGR: Compound Annual Growth Rate

Source: Iowa Aviation System Plan

In addition to forecasting future use of the aviation system in Iowa, development of the IASP involved several important components.

- Evaluated airports across the state and changes made since the prior system plan, then made recommendations on updated airport roles. The recommended system also includes one new airport currently being developed, the South Central Airport, which would result in the closure of the Pella and Oskaloosa airports. Other than the South Central Airport, no new airports were recommended as part of the plan.
- Reviewed service coverage of Iowa's airports for the state's population.
- Identified numerous capital and maintenance projects to allow airports to meet facility and service objectives, and conducted fiscal analysis showing identified project costs greatly exceed funding anticipated to be available.
- Made recommendations to enhance the aviation system; specific areas of concern include funding vertical infrastructure development including terminal buildings and hangars, pavement maintenance, airfield security, and accessibility elements including restroom access and available automobile parking.

Trends and Planning Issues

Commercial Service

Enplanements at Iowa's eight commercial service airports grew regularly to record levels prior to 2020, shown on Figure 3.2. Over 90% of Iowa's commercial passengers utilize the Des Moines International Airport and the Eastern Iowa Airport in Cedar Rapids. Five of Iowa's airports (Burlington, Fort Dodge, Mason City, Sioux City, and Waterloo) are supported by the Essential Air Service (EAS) program, which is a federal program subsidizing a minimal level of commercial air service in smaller communities.

Air Cargo

Most reported air freight in Iowa is moved by scheduled commercial air passenger carriers and dedicated air cargo carriers (e.g., UPS and FedEx) at the eight commercial airports. Although most of the airports in the state handle cargo to some extent, over 99% of reported tonnage moves through the Des Moines International Airport (DSM) and the Eastern Iowa Airport (CID). To a large degree, the movement of air cargo is contingent upon the business decisions of these private carriers. In recent years, increased fuel expenses and changes in business models have resulted in reduced air freight activity in Iowa, shown on Figure 3.3. However, with an expanded UPS facility at CID and the addition of Amazon at DSM, more growth is expected. Also, unlike commercial enplanements, air cargo did not see a significant decline in 2020.

Figure 3.2: Enplanements at Iowa's commercial service airports

Source: FAA

Figure 3.3: Pounds of air cargo transported at Iowa's airports

Source: FAA

General Aviation

General aviation activities such as business aviation, Helicopter Air Ambulance (HAA), and aerial application for agriculture are important services in Iowa. These activities have evolved and grown over time. The number of aircraft in the fleet have remained steady, but the number of pilots have declined and personal and recreational uses have decreased. This decrease is reflected in lower sales of aviation fuel supporting smaller general aviation aircraft. General aviation is expected to see more modest growth over time than commercial service.

Other Trends and Issues

Several national trends are anticipated to impact aviation in Iowa, including the following.

- The single engine piston fleet makes up the largest percentage of the general aviation fleet, and this portion of the fleet is expected to decline.
- Charter activity has been increasing and demand for business aviation is expected to continue to increase, though general aviation operations are expected to see slow growth over the coming decades.
- The number of active private pilots has been decreasing. However, due to increased demand and retirements, flight training has been increasing.

The following emerging technologies are also beginning to impact the industry.

Unmanned Aircraft Systems (UAS)

Unmanned Aircraft Systems (UAS), or drones, typically refer to a pilotless aircraft, remote controller, and control link. UAS technology is becoming more common for business and recreational uses. The Iowa DOT owns and operates several drones for uses such as monitoring construction progress, infrastructure inspections, 3D ground imaging, and aerial photography. The use of UAS for the transport of goods is in development and UAS technology is driving new ways of thinking for advanced air mobility of passenger movement for short-range and regional transportation.

Autonomous Vehicles

Driverless vehicles could change people's travel patterns by providing new travel options, potentially replacing some regional trips that may currently be taken by flying. If their use becomes common, they could also impact airports. Vehicles supporting aviation activities at airports, such as maintenance equipment, baggage or cargo handling, and passenger shuttles could also become autonomous.

Alternative Fuels

Sustainable aviation fuel is already entering the aviation fuel chain as a drop-in fuel with no need for new infrastructure. The Iowa agricultural industry is expected to play a role in supporting those fuels. The advancement of alternative and sustainable fuel options including electricity and hydrogen could require airports to offer the necessary infrastructure to support those operations in the future. Charging stations and other energy alternatives could make it possible for airports to provide additional infrastructure to be sure they can integrate into the supply chain for alternative energies.

3.2 Bicycle and Pedestrian

Bicycling and walking are two of the oldest, simplest, and most efficient forms of transportation available, but they are often overlooked elements in a balanced multimodal 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. Lack of adequate infrastructure, distracted drivers, and fear of crime or unsafe neighborhoods are some of those potential barriers.

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

Health and Fitness

According to the Iowa Department of Public Health, in 2019 more than two in three Iowans were overweight or obese. Although obesity has many factors, having bicycle and walking facilities that are safe and accessible may make it easier for individuals to increase their physical activity levels and improve their overall health.

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 or walk rather than drive a motor vehicle.

Iowa DOT's Role

The Iowa DOT has various roles in supporting bicyclists and pedestrians. As an infrastructure owner, the Iowa DOT constructs, operates, and maintains the Primary Highway System, the vast majority of which can be utilized by bicyclists and pedestrians whether there are dedicated facilities along it or not. Outside of facilities that are part of the roadway itself, such as bicycle lanes or paved shoulders, the Iowa DOT typically would not own other accommodations such as sidewalks or multi-use trails. The majority of bicycle and pedestrian infrastructure in the state is located along roadways owned by other jurisdictions or located off-roadway for recreational use. However, the Iowa DOT has many supporting roles for the overall bicyclist and pedestrian transportation system, including:

- Adopting and incorporating federal policies pertaining to bicycle and pedestrian transportation into the Department's planning, design, and funding policies and practices.
- Implementing its Complete Streets Policy and enhancing the state highway system to accommodate bicycling and walking by improving and increasing crossings and facilitating linear access.
- Encouraging and supporting implementation by other units of government by providing technical assistance and training.
- Ensuring that state and federal funding is being effectively used to improve walking and bicycling in Iowa.
- Partnering with others to improve education and safety.
- Developing and enhancing coordination between the many agencies involved with developing a statewide network of trails and on-road bikeways.

Tourism

A study was completed in fall 2011 by the University of Northern Iowa to evaluate the economic and health impacts of bicycling in Iowa. The report, Economic and Health Benefits of Bicycling in Iowa, 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.

Other significant contributions to the state's economy from bicycling come through planned bicycle events that attract visitors to the state, such as the Register's Annual Great Bicycle Ride Across Iowa (RAGBRAI), Iowa's Ride, and other rides that utilize Iowa's roadways and trails.

In addition to attracting tourists, bicycle and pedestrian facilities are increasingly important to recruitment and retention for Iowa businesses and their employees. Amenities that enhance a region's quality of life are often mentioned by employers as a need in order to attract workers to the area.

Inventory

While bicyclists and pedestrians can legally use the vast majority of Iowa's roadway system, there are also currently more than 3,200 miles of facilities specific to bicyclists and pedestrians in Iowa, excluding standard sidewalks. Of these, over 2,000 miles are off-road, multiuse trails. 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.

Multi-use trails and sidepaths: a two-way facility physically separated from motor vehicle traffic and used by pedestrians, bicyclists, and other non-motorized users.

Paved Shoulder: A paved portion of the roadway to the right of the white pavement marking at the edge of the travel lane of the roadway.

Bike lanes: A portion of the roadway designated by striping, signing, and pavement markings for the exclusive use of bicyclists.

Separated bike lanes: Exclusive bicycle facilities separated from motor vehicle traffic and pedestrians by way of physical barriers (curbs, parked cars, medians, etc.).

Bicycle boulevard: Follows lower volume, lower speed streets designed to prioritize bicycle through travel and calm motor vehicle traffic. They may simply include shared lane markings and "bikes may use full lane" signage or can include traffic calming measures such as street trees, traffic circles, chicanes, or speed humps.

Shared roads and shared lanes: May include shared lane markings (or "sharrows") to indicate preferred bicyclist lane positioning, act as wayfinding aids, and alert drivers to a greater expected presence of bicyclists.

Widened sidewalk: 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.

Planning Efforts

In 2018, Iowa DOT completed its Iowa Bicycle and Pedestrian Long-Range Plan (BPLRP). This plan serves as the primary guide for Iowa DOT decision-making regarding bicycle and pedestrian programs and facilities. The planning process involved stakeholder input through policy and technical steering committees; public meetings and input opportunities; an existing conditions assessment; bicycle and pedestrian facility recommendations; and development of funding and implementation strategies.

One of the most significant components of the plan was its Complete Streets Policy. This policy requires the consideration of accommodations for all users on all Primary Highway System projects, and requires the provision of appropriate bicycle and pedestrian facilities as part of Iowa DOT projects, based on the guidance in the BPLRP.

Statewide Trails Vision

In the past, trails in Iowa were designated as Level 1 (Trails of Statewide Significance), Level 2 (Trails of Regional Significance), and Level 3 (Trails of Local Significance). However, this implied a prioritization of statewide trails over regional and local trails, and may have prioritized trail corridors not yet in demand, or overlooked opportunities to expand existing systems when momentum existed. Beginning with the 2018 BPLRP, the numbered classification system was discontinued and trails are simply referred to as either part of the statewide trail network (which includes regional trails) or local trails that are part of a local trail network.

Two statewide networks for bicycle and pedestrian mobility were identified in the BPLRP.

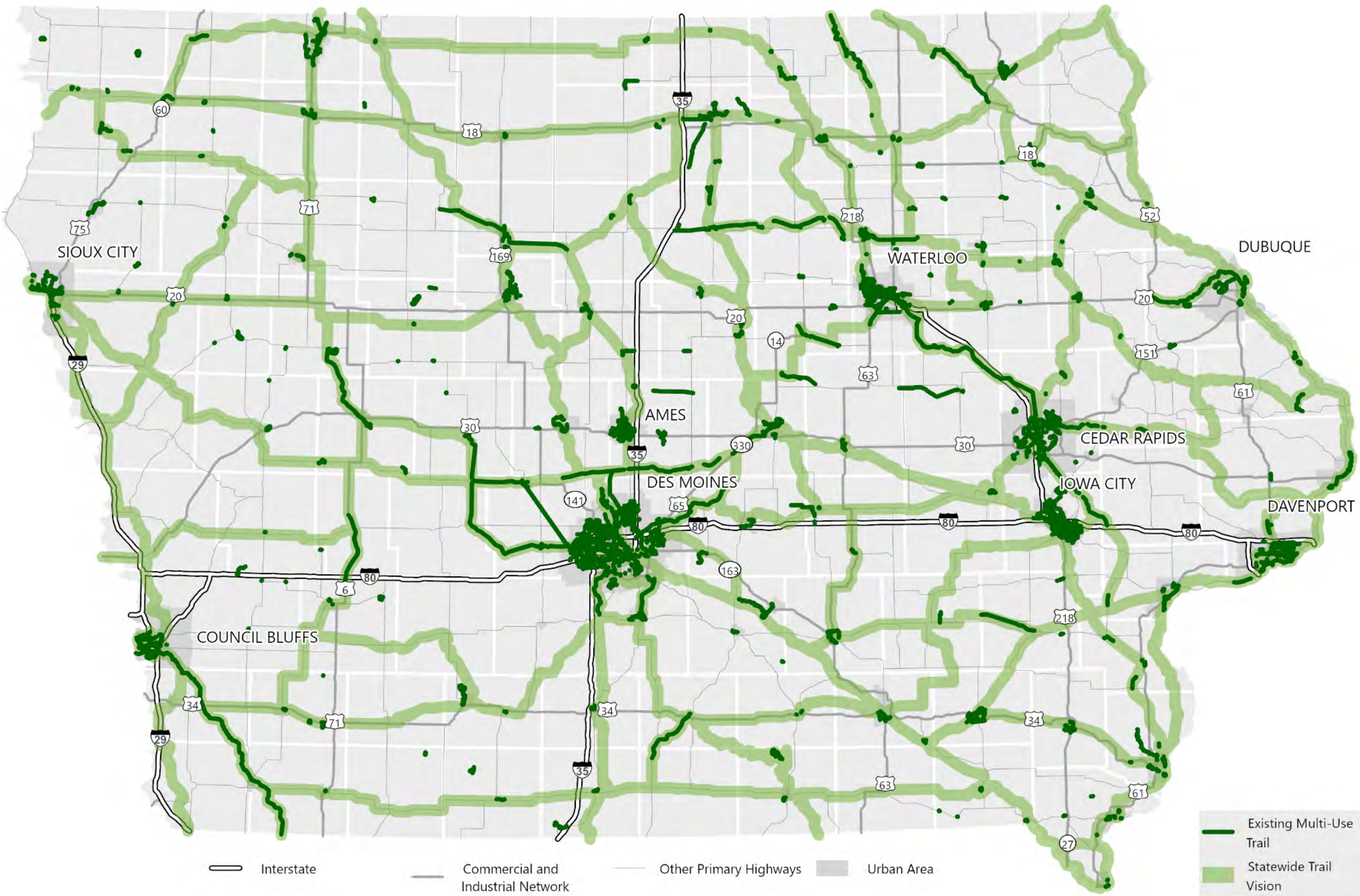
Statewide Network of Multi-Use Trails

The statewide trails vision network has been planned based on historical corridors (such as railroad alignments) and decades of planning and development of separated multi-use trails that connect rural communities, metropolitan areas, state and county parks, and natural amenities. For the purposes of allocating state and federal funding, the Iowa DOT will prioritize trails that make significant contributions to improving state and regional connectivity. As defined in the BPLRP, the vision network would consist of 5,512 miles, of which 36% are complete (see Figure 3.4).

Statewide network of national trails and US Bicycle Routes (USBR)

This network consists of three former Level 1 trails (the American Discovery Trail (ADT), the Mississippi River Trail (USBR 45), and the Lewis and Clark Trail (USBR 55) as well as three USBRs – 36, 40, and 51. The purpose of this network, which will rely heavily on on-road bicycle accommodations, is to coordinate with national plans for interstate routes, encourage bicycle tourism, and improve intercity connectivity. At the time of the BPLRP, 70% of the ADT and 35% of the Mississippi River Trail were completed; the remaining routes had no portions completed. Specific alignments for the USBRs will depend on the involvement and cooperation of local units of government and bordering states.

Figure 3.4: Existing multi-use trails and statewide trails vision



An interactive map of existing bicycle accommodations in Iowa is available at https://iowadot.gov/iowabikes/bikemap/home.aspx
Source: Iowa DOT

Trends and Planning Issues

Usage

Bicycling and walking are commonplace activities for transportation and recreation purposes, but they are difficult to accurately measure or forecast. One source to gauge the share of trips that are taken by these modes is the National Household Travel Survey (NHTS), which was most recently conducted in 2017.

The results of the 2017 NHTS showed that almost one in ten trips made in Iowa is made by bicycling or walking, with bicycling's share being 1% of trips and walking's share being 8.6% of trips. In terms of the total number of annual bicycling and walking trips, the NHTS estimates 3.6 billion and 38.9 billion, respectively. When considering journey to work trips, the NHTS estimates 418 million trips by bicycle (11.6% of all bicycling trips) and 2.9 billion walking trips (7.4% of all walking trips).

Growing Benefits and Needs

The use of multi-use trails has increased over time as the system has continued to expand. As trail usage increases, many of Iowa's communities are seeing increasing economic and social benefits of bicycle and pedestrian facilities. For example, a 2016 report from the Iowa Initiative for Sustainable Communities at the University of Iowa found that the Trout Run Trail in Decorah has an economic impact in the range of $1.6 - $2.4 million for the area.

However, despite rising demand for new bicycle and pedestrian facilities in Iowa, funding for expansion is unreliable. Ongoing maintenance needs of 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.

Complete Streets

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. As noted earlier, the development of the Iowa DOT's 2018 Bicycle and Pedestrian Long-Range Plan included the drafting of a complete streets policy for the Iowa DOT that took effect in 2020, meaning all Iowa DOT projects on the Primary Highway System include consideration of accommodations for all users during planning, design, construction, and reconstruction activities.

3.3 Highway

Highways are the backbone of Iowa's transportation system, providing service to all areas of the state. Iowa's roadways range from eight-lane interstates, four-lane divided facilities, and multi-lane urban streets to paved secondary roads, municipal streets, and gravel roads. Iowa's bridges provide crossings of thousands of streams, rivers, railroads, and trails. These bridges range from 20-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 throughout the state. Almost the entirety of the state's land area is within ten miles of a primary highway.

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 provides 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. Highways support the state's economy 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.

Iowa DOT's Role

The Iowa DOT is associated with highways more than any other mode. The Iowa DOT owns, operates, and maintains the Primary Highway System in Iowa, and provides guidance, oversight, and support to other roadway owners (primarily cities and counties) for federal aid funding and programs. A small sample of the breadth of activities the Iowa DOT undertakes includes system-level planning, project development and programming, construction oversight, traffic monitoring, routine maintenance work, and snow plowing, among many others.

Iowa DOT also has the principal role in administering and enforcing federal and state commercial motor vehicle laws and regulations and oversees the testing and licensing of drivers. Peace officers with Motor Vehicle Enforcement inspect and regulate commercial motor vehicle laws related to their size, weight, and registration.

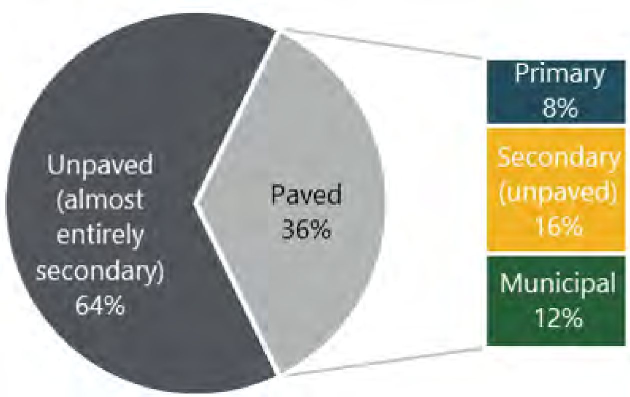
Inventory

Iowa's Roadway System

Iowa is uniquely positioned at the crossroads of two major interstate highways: I-35 and I-80. As shown in Figure 3.5, the state's extensive public roadway system consists of over 114,000 miles and includes roughly 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 7th nationally in number of bridges and 13th in miles of roadway, yet the state ranks just 36th in population density.

This dense network helps support Iowa's significant agricultural output. While the roadway system's overall mileage is dominated by the County-owned secondary road system, a large portion of that system is not paved (Table 3.2; Figure 3.6). In total, just over one third of Iowa's roadway system is paved. The Primary Highway System (Interstates, U.S., and Iowa routes) carries the majority of vehicle miles traveled (VMT) in the state, particularly by large trucks.

Figure 3.5 Iowa's roadway system mileage



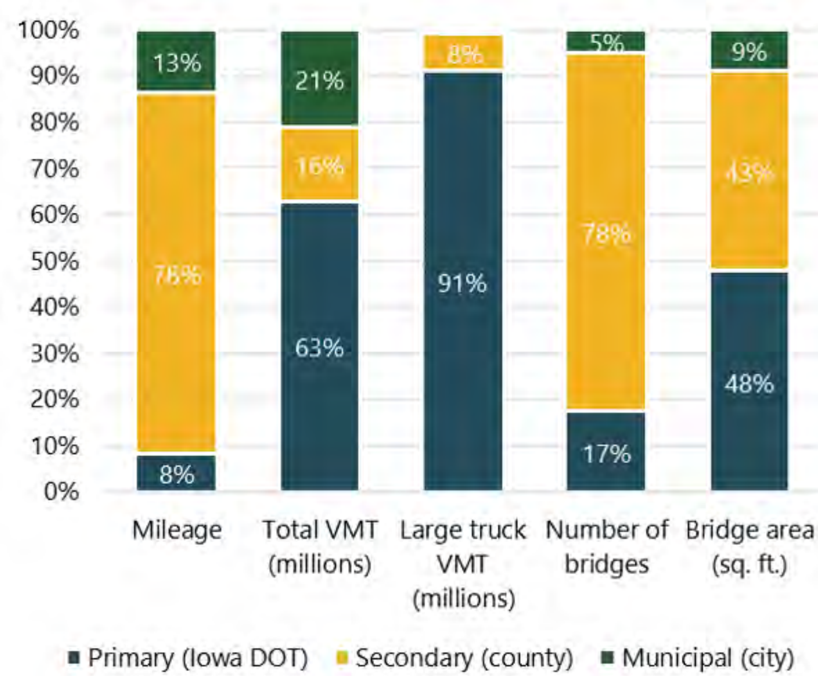
Source: Iowa DOT

Table 3.2: Summary of Iowa's public roadway system, 2019

	Mileage	Total VMT (millions)	Large truck VMT (millions)	Number of bridges	Bridge area (sq. ft.)
Primary (Iowa DOT)	9,617	21,216	2,743	4,178	45,764,228
Secondary (county)	89,698	5,501	248	18,613	41,475,313
Municipal (city)	15,442	7,062	20	1,210	8,492,095
Total	114,757	33,779	3,011	24,001	95,731,636

Source: Iowa DOT

Figure 3.6: Summary of Iowa's public roadway system, 2019



Source: Iowa DOT

Highway Networks

There are many ways that the overall roadway system and the Primary Highway System are classified.

National Highway System (NHS)

The NHS includes roadways that are important to the nation's mobility, economy, and defense. It includes the Interstate system, other principal arterials, the Strategic Highway Network (STRAHNET), major strategic highway network connectors, and intermodal connectors. The NHS includes routes that are owned by other entities than State DOTs, but in Iowa this accounts for less than 3% of NHS roads and bridges. The NHS is a designation used by FHWA for federally required performance measures that all states set targets for. Additionally, management practices for the NHS are required to be documented in each state's Transportation Asset Management Plan. Figure 3.7 shows the NHS in Iowa.

Federal Functional Classification (FFC)

All roadways in the state are classified in the FFC system. Higher classifications of roadways, such as Interstates and Other Principal Arterials, provide connectivity throughout the state and are generally higher speed, lower access facilities. On the other end of the spectrum, collectors and local roads serve shorter trips or the ends of trips and are generally lower speed, higher access facilities. Figure 3.8 shows the FFC of Iowa's Primary Highway System.

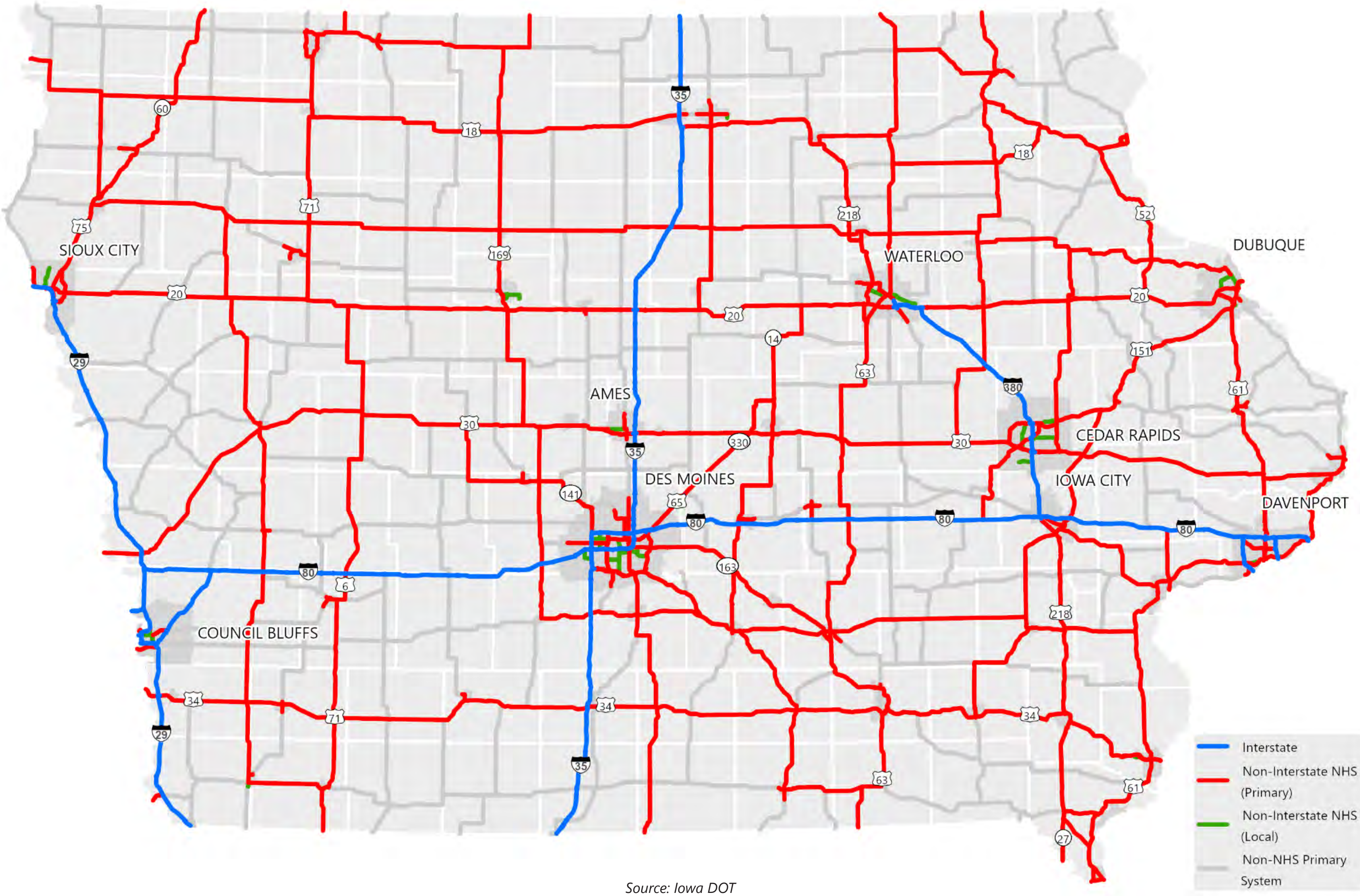
Iowa DOT Planning Class

According to Iowa Code, Iowa's primary system 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 9,600 miles of the public system's over 114,000 miles, is divided into five classifications according to priority.

- **Interstate:** Provides connections to the national transportation network and major metropolitan areas.
- **Commercial and Industrial Network (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.
- **Area development:** Provides connections for cities with populations greater than 5,000 to the CIN and major commercial and industrial centers.
- **Access route:** Provides connections for cities with populations greater than 1,000 to employment, shopping, health care, and education facilities.
- **Local service:** Provides connections for cities with populations less than 1,000 to local commercial and public service. There are only a few local service routes in Iowa.

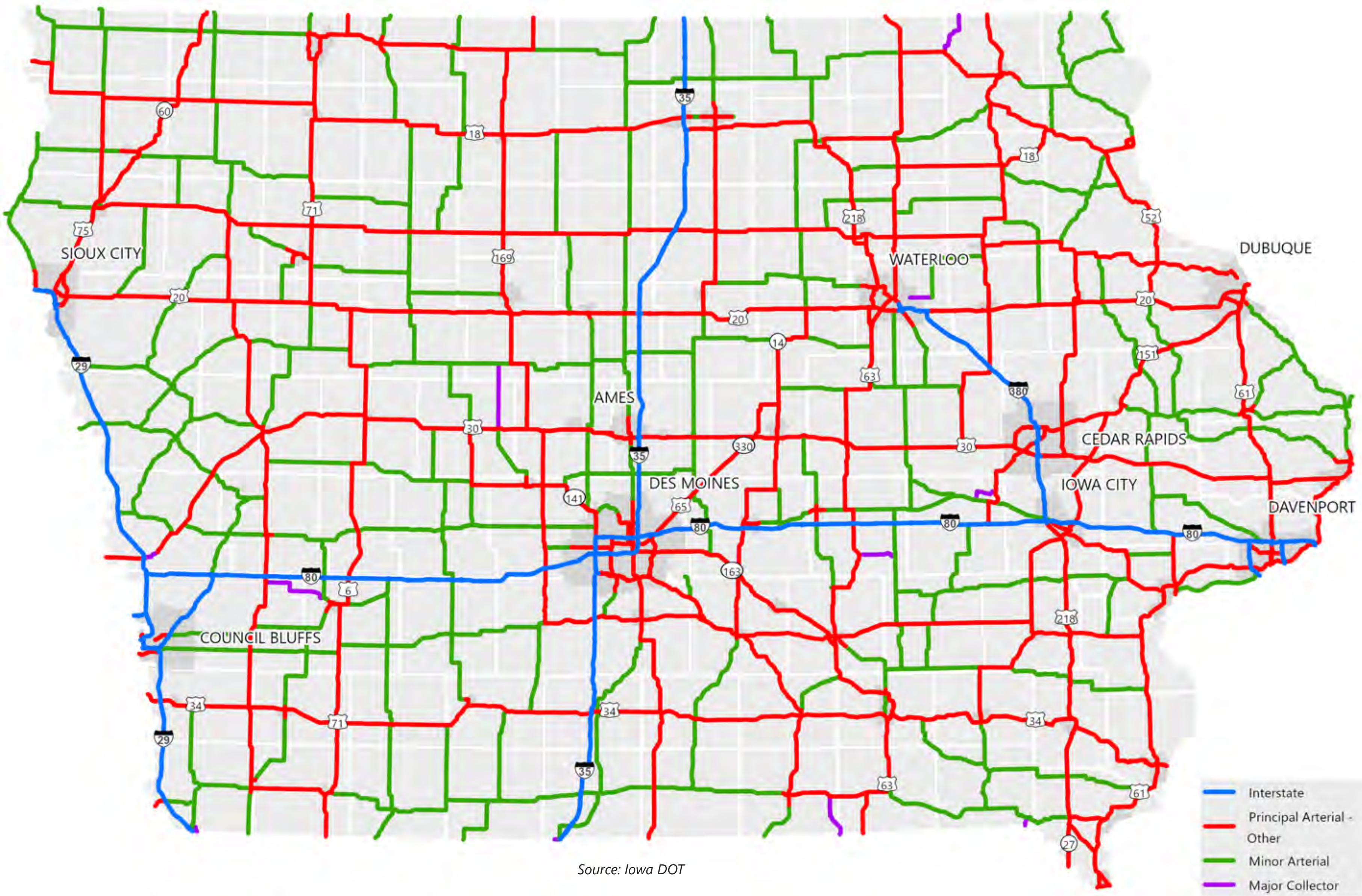
Figure 3.9 shows the planning classes for the Primary Highway System.

Figure 3.7: National Highway System (NHS) in Iowa



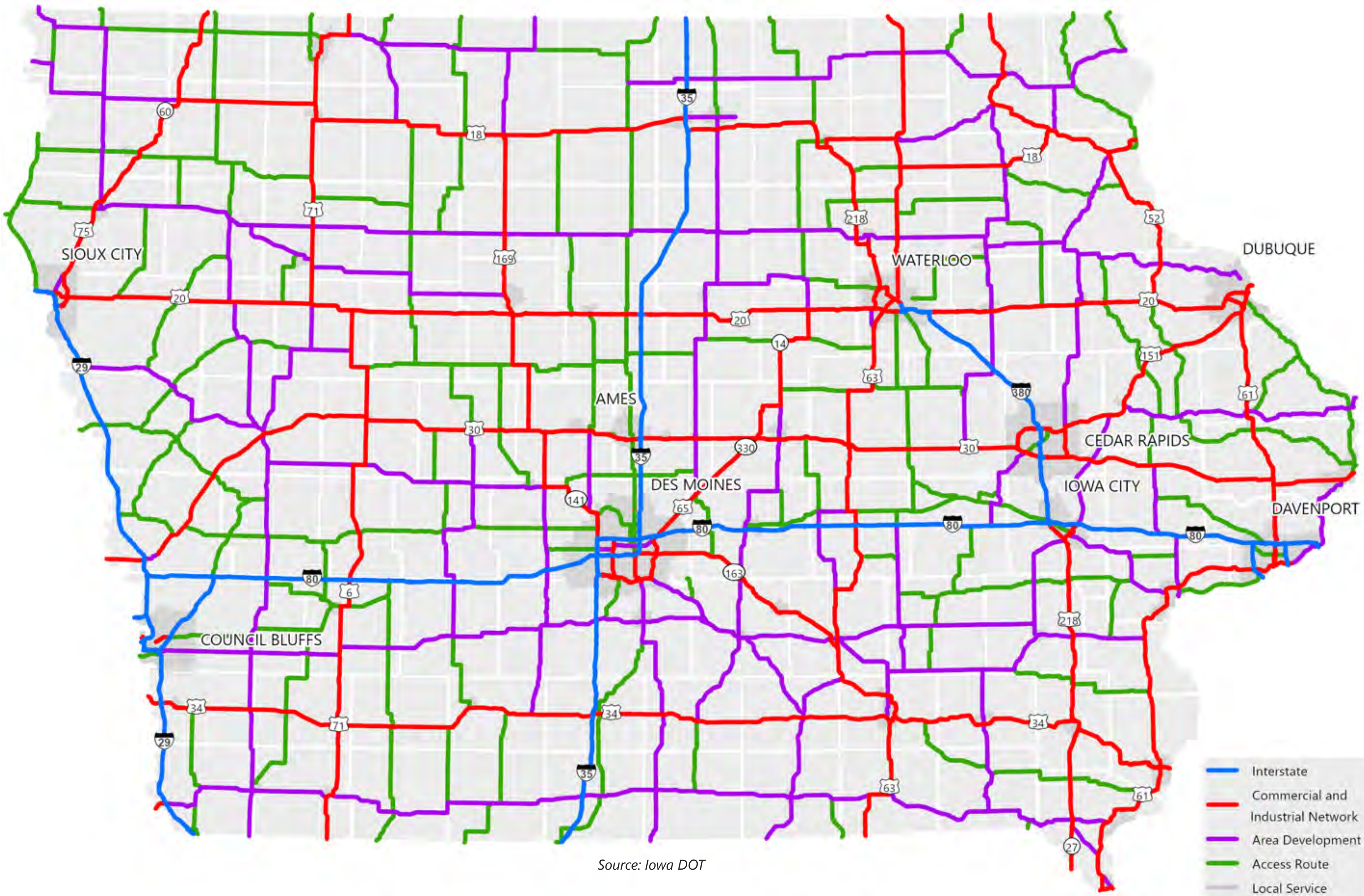
Source: Iowa DOT

Figure 3.8: Federal functional classification (FFC) of the Primary Highway System



Source: Iowa DOT

Figure 3.9: Iowa DOT planning classes for the Primary Highway System

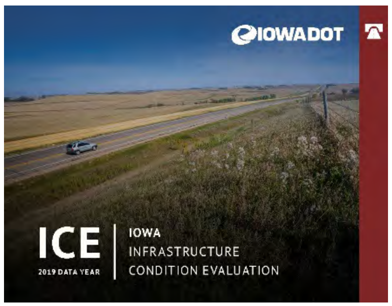


Source: Iowa DOT

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), are discussed in more detail in Chapter 4. Additional highway-related planning efforts include the Infrastructure Condition Evaluation (ICE) tool, the State Freight Plan, the Iowa Interstate Investment Plan, and the planning effort for this document, the State Long Range Transportation.

Infrastructure Condition Evaluation (ICE) Tool



The ICE tool was developed by the Iowa DOT in 2014 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
- Bridge Condition Index (BCI) rating

While each of these individual elements indicates a different component of the system's composition, together they offer 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 ICE composite ratings are recalculated each year and available through an annual report and interactive website, 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. The ICE output is used in the highway condition analysis included in Chapter 5.

State Freight Plan

The Iowa DOT's first freight plan 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.

- The initial list of locations was populated based on INRIX traffic data, then refined with input from the Freight Advisory Council and Iowa DOT districts.
- The Iowa Travel Analysis Model (iTRAM) 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 provided the condition measurement for each location.
- The INRIX bottleneck ranking tool provided the performance component of each location based on how often bottlenecks occur.
- Annual average daily truck traffic (AADTT) 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 Interstate Investment Plan

The Iowa Interstate Investment Plan (I3P) established a long-term statewide vision for Iowa's Interstate highways that can be achieved with available resources. The plan initially detailed the intended purpose and type of work to be performed on every segment of Iowa's Intestates through the year 2040, and has since been expanded to 2050. The investments described in the I3P were identified to maintain the high level of service in terms of safety and overall pavement and bridge conditions while addressing identified capacity issues. By looking forward 30 years, the Interstate Plan ensures projects will address both current and future needs. This supports prioritization of projects by recognizing trends in travel and highway usage to ensure funding is spent where it will provide the most benefit for the longest period of time.

Most of the system will be subject to stewardship treatments aimed at managing the condition and performance of existing highway infrastructure assets (e.g., pavements and bridges) for the lowest achievable life-cycle cost. In development of the I3P, Iowa DOT identified segments of Interstates expected to require capacity improvements based on projections of future traffic levels. The plan addresses these capacity needs on a prioritized basis.

State Long Range Transportation Plan (SLRTP)

This plan is the third in the current series of long-range plans. In 2012, a policy level plan was adopted. In 2017, the plan was expanded to identify primary investment areas, categorize future needs across modes, and provide strategies to achieve the system vision. The 2022 SLRTP is building on these past plans with several notable enhancements that will impact the highway system, including:

- Clearly defined system objectives
- Rightsizing policy guidance
- Expanded consideration and analysis of safety
- Focus on infrastructure resiliency
- Accessibility and equity considerations
- Clarified role in project development

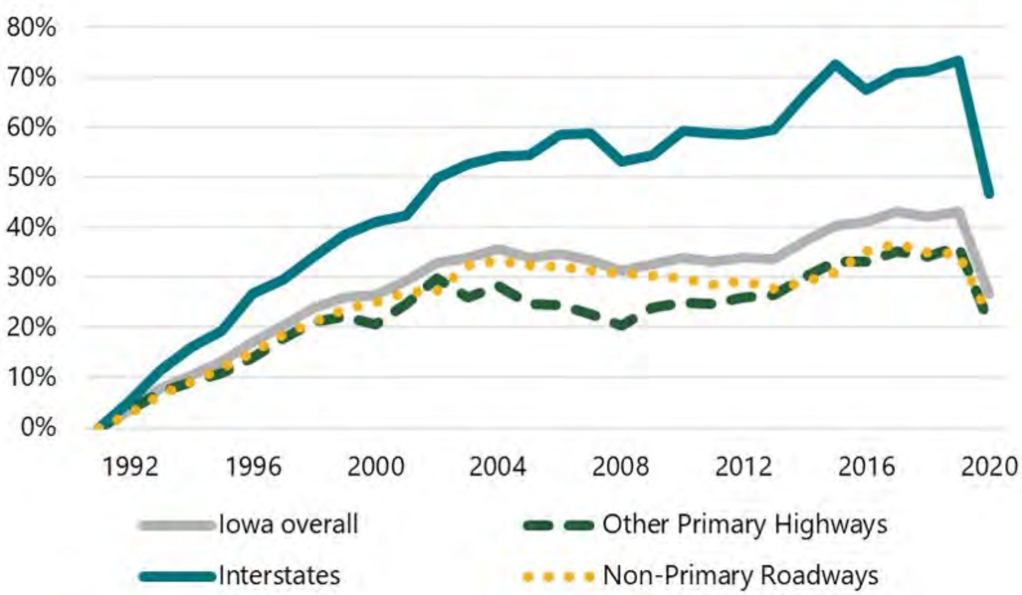
The current planning effort and document involve a detailed analysis of the highway system, identification of corridor-level improvement needs, and a number of specific strategies to help fulfill the vision for the highway component of the state's multimodal transportation network (see Chapter 5).

Trends and Planning Issues

Travel

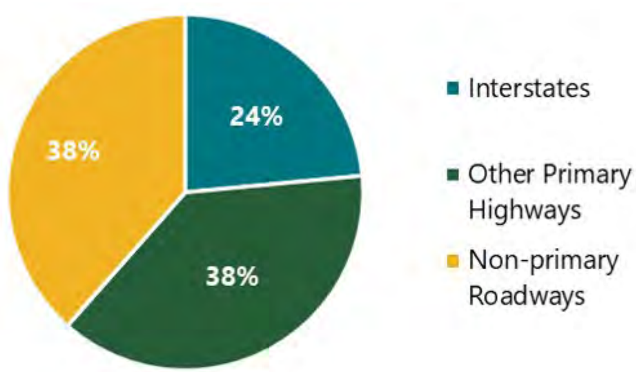
As shown in Figure 3.10, vehicle miles traveled (VMT) in Iowa increased steadily throughout the 1990s. Growth leveled off in the mid-2000s, then increased again in the late 2010s. However, the COVID-19 pandemic in 2020 caused significant drops in VMT. Preliminary 2021 data suggests a return to near pre-pandemic VMT levels, but uncertainty remains as to whether the future trend will stay relatively flat or begin to increase again. VMT growth has not been equal across the system. Overall, Interstate VMT growth has far outpaced the remainder of the system, reflecting the continued importance of these routes for intrastate and interstate freight and passenger traffic. As shown on Figure 3.11, over the last 30 years, Interstates and other primary highways have accounted for 62% of the VMT on Iowa's roadway system, with secondary and municipal highways and roadways accounting for the remainder.

Figure 3.10: Percent change in VMT for Iowa, base year 1991



Source: Iowa DOT

Figure 3.11: Distribution of VMT across Iowa's roadways, 1991-2020

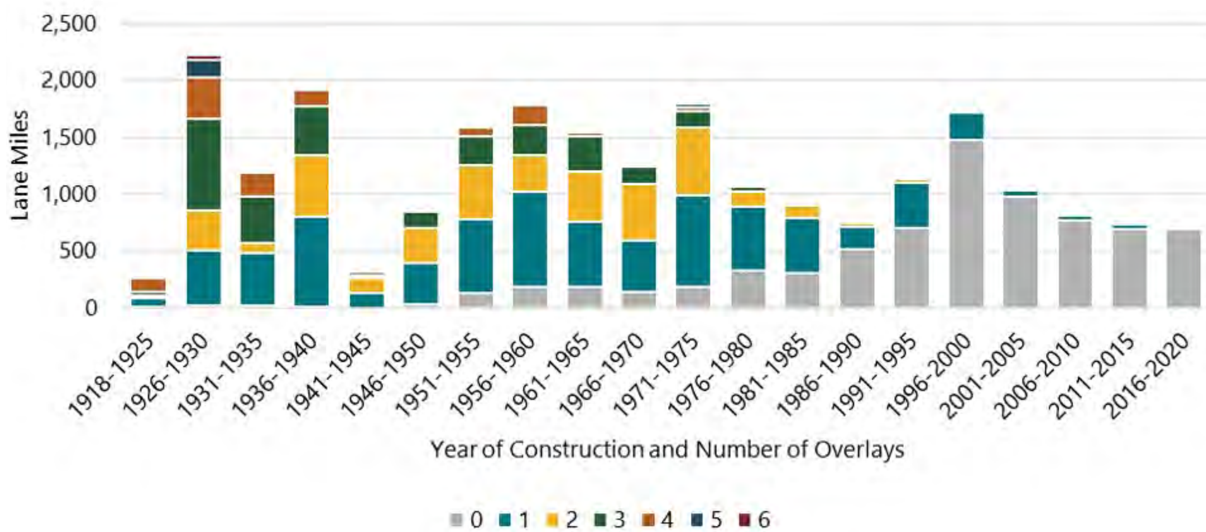


Source: Iowa DOT

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 3.12 shows the age of the primary system's pavements along with the number of overlays they have received. Over half of the primary system's mileage is over 50 years old, and some pavements have received as many as six overlays during their service life. However, continual overlays are not always an option, particularly in areas with subsurface issues or constraints such as curb and gutter. Increasingly, many of these older pavements will require more significant work to address condition issues, including full reconstruction.

Figure 3.12: Year built and number of overlays for primary system pavements



Source: Iowa DOT

The previously-discussed Infrastructure Condition Evaluation (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 to help identify segments and corridors that should be considered for further study. Table 2.3 shows the distribution of ICE scores for primary highways. The composite score is based on a 0 (worst) to 100 (best) scale. The system-wide average is 75.7 and has been relatively stable over the past several years. More detailed results of the most recent ICE analysis are included in Chapter 5.

Table 3.3: ICE Scores for the Primary Highway System

Percent of network by ICE rating				
< 60	60-70	70-80	80-90	> 90
4.4%	21.0%	39.2%	30.9%	4.5%

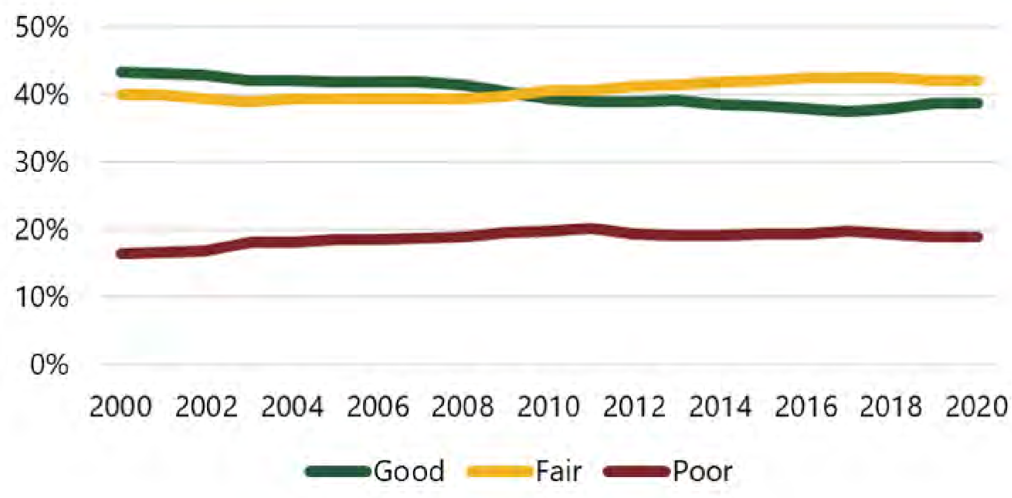
Source: Iowa DOT

Bridge Condition

In 2020, Iowa ranked seventh in the U.S. for overall number of bridges, and second for the highest percent of bridges in poor condition. FHWA has developed condition ratings to describe the overall condition of bridges and culverts nationally. Ratings of good, fair, and poor are used as classifications for bridge condition. A bridge in good condition has no condition problems and no maintenance needs in the near future. A bridge with a poor condition rating is not unsafe, but should be considered for repair, replacement, restriction posting, weight limits, or monitoring on a more frequent basis. Bridges are inspected every 24 months and rated on a 0 (failed) to 9 (excellent) scale. Inspectors record overall ratings for a bridge's deck, superstructure, and substructure. The lowest of the three ratings determines the overall rating of the bridge. If this value is 7 or greater, the bridge is classified as being in good condition. If it is 5 or 6, the bridge is classified as being in fair condition, and if it is 4 or less, the bridge is classified as being in poor condition.

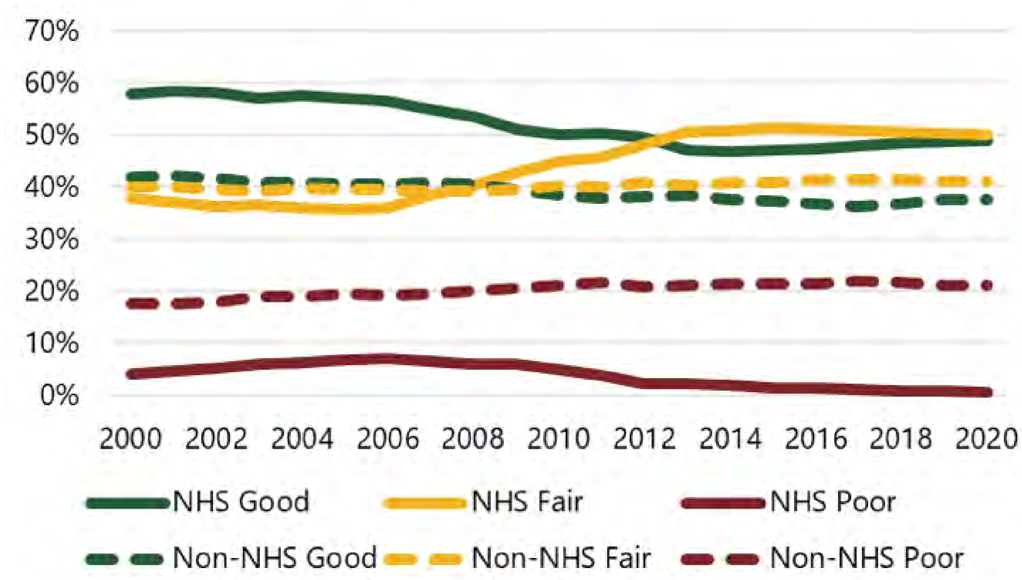
Figure 3.13 shows the condition of Iowa's bridges from 2000 to 2020. Overall, the percentages of poor and fair bridges have increased slightly over time while the percentage of good bridges has decreased. Dividing the system into National Highway System (NHS) bridges and non-NHS bridges (Figure 3.14) shows that NHS bridges are in better condition overall, with far fewer bridges in poor condition. However, the percentage of fair NHS bridges has been growing over time.

Figure 3.13: Condition of all Iowa bridges, 2000-2020



Source: Iowa DOT and FHWA

Figure 3.14: Condition of Iowa bridges, NHS and non-NHS, 2000-2020



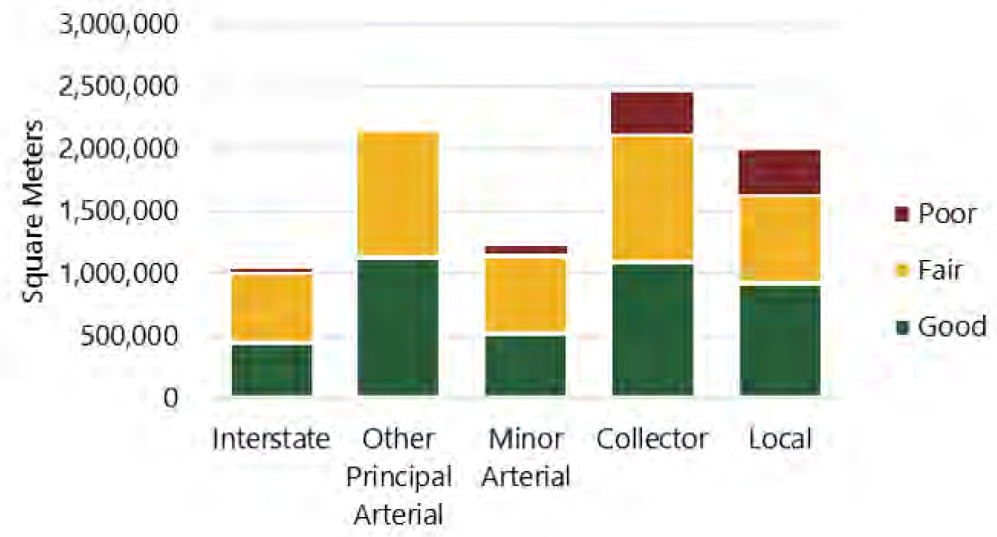
Source: Iowa DOT and FHWA

It is also helpful to look at bridge condition at a more granular level. In general, bridges on heavier traveled routes are larger and in better condition overall than those on lesser traveled routes. While close to 20% of the state's total bridges are in poor condition, only 4% of the state's AADT is traveling on those bridges.

In terms of FFC, while over half the bridges in the state are on local roadways, they represent a much smaller share of the bridge deck area in the state, shown on Figure 3.15. Higher functional classifications tend to have larger structures due to multi-lane roadways and more challenging design environments, such as multiple high-traffic highways meeting in urban areas.

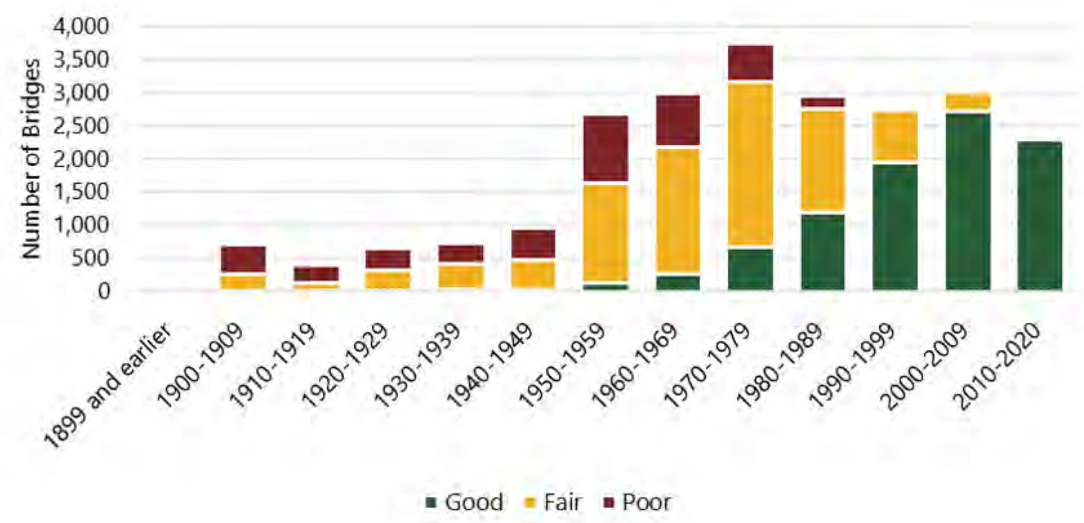
Iowa bridges continue to age, with the majority of existing bridge structures having been built in the 1970s or earlier. Figure 3.16 shows the age of Iowa bridges by construction decade. The implications of aging and deteriorating bridges, as well as roadways, can be detrimental to Iowa's transportation 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.

Figure 3.15: Condition of bridges by area by federal functional classification (FFC)



Source: Iowa DOT and FHWA

Figure 3.16: Year of construction and condition in 2020 for Iowa bridges



Source: Iowa DOT and FHWA

3.4 Public Transit

Iowa's public transit system provides many benefits to its citizens, fulfilling a key alternative transportation role. While available to everyone, the transit market in Iowa generally includes commuters, elderly residents, low-income residents, college students, individuals with disabilities, youth, and those who are unable or choose not to drive. However, especially in metropolitan areas, people are increasingly making the choice to ride public transit for economic, practical, or environmental reasons. Every county in Iowa is served by a regional system to ensure Iowans have a transportation option for getting to work, medical facilities, meal sites, and leisure activities. This contributes to Iowans' quality of life as public transit enables riders who are unable to transport themselves to access vital services, businesses, and activities that they would otherwise be unable to reach.

Public transit services positively impact Iowa's economy. The transit operations themselves provide employment across administrative, maintenance, and driver roles. Public transit provides a low-cost mobility option that can enable people to make trips they may have otherwise foregone due to expense. Transit ridership reduces fuel consumption and demand, as well as costs for passengers and businesses 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 elderly individuals, 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.

Iowa DOT's Role

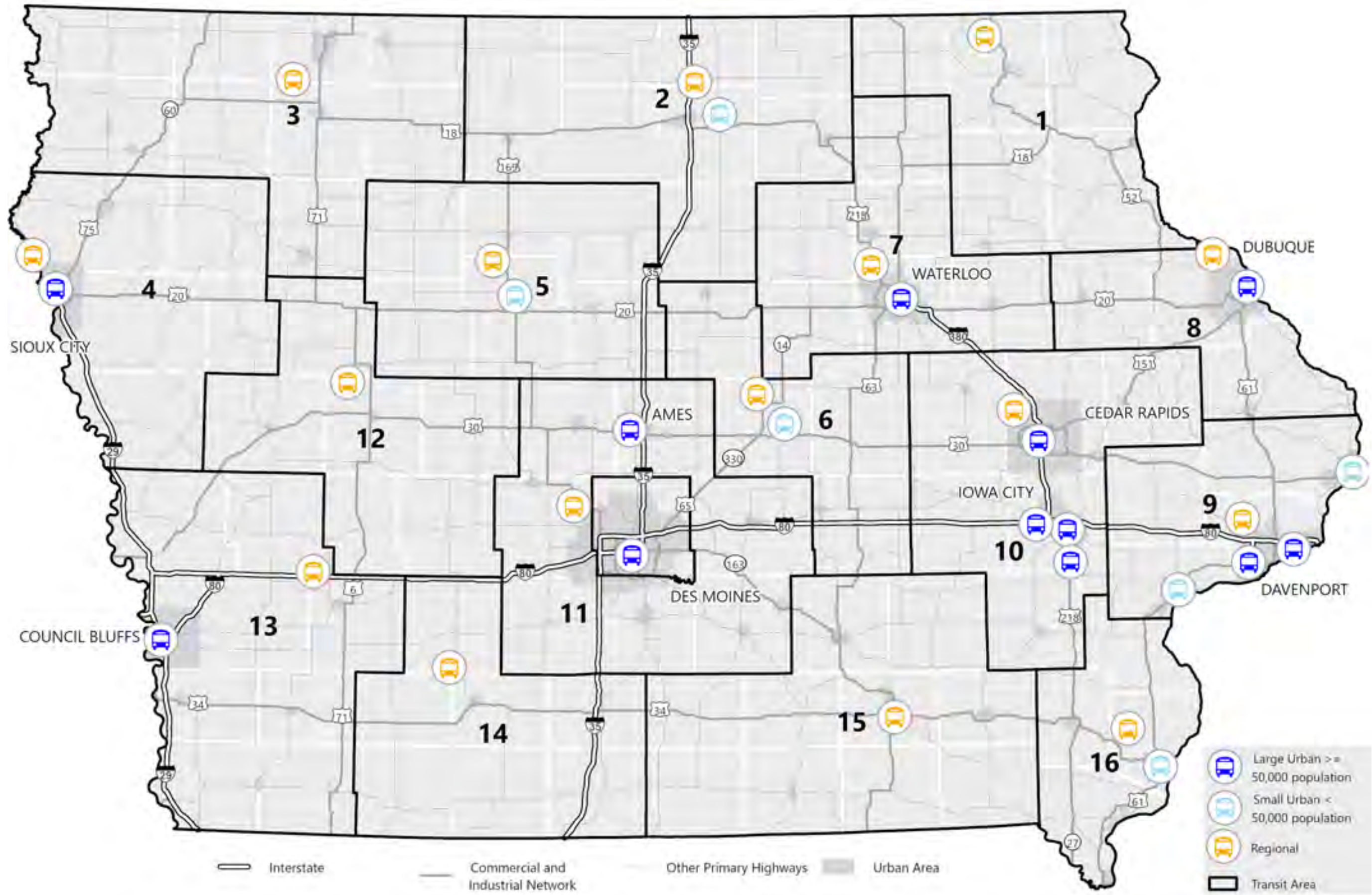
The Iowa DOT does not own or operate public transit vehicles or services, but it plays an important role in supporting the state's 34 public transit agencies. The Modal Transportation Bureau's Public Transit Team's mission is to advocate and deliver services that support and promote a safe and comprehensive transit system in Iowa to enhance access to opportunities and quality of life. Examples of activities the Iowa DOT conducts for public transit in Iowa include the following.

- Administers federal and state transit grants and provides technical assistance to Iowa's 18 urban public transit systems and 16 regional public transit systems.
- Oversees the Public Transit Equipment and Facilities Management System and the programming of state and federal funding programs.
- Provides training for and reviews of Iowa's transit systems.
- Processes reimbursements and assists with procurements.
- Implements special projects and assists with mobility management.

Inventory

Iowa is served by 12 large urban, six small urban, and 16 regional public transit systems, as shown in Figure 3.17. Large urban systems provide service for metropolitan areas with a population of 50,000 or greater, and account for the majority of total transit ridership in Iowa. Small urban systems are located in communities of 20,000 to 50,000 people. Both large and small urban systems operate fixed route public transit services with set routes, stops, and schedules, and also provide Americans with Disabilities Act (ADA) complementary paratransit for qualified individuals with disabilities for, at a minimum, locations within 3/4 mile of a fixed route. The 16 regional transit systems support all 99 counties in Iowa by providing demand response public transit services where riders make reservations in advance. A list of Iowa transit agencies is available in Table 7.7.

Figure 3.17: Iowa's public transit system



Source: Iowa DOT

A few of Iowa's public transit agencies also provide ridesharing, or vanpool, services. They provide vehicles that several passengers, typically commuters with similar origins and destinations, can utilize by paying a monthly fare to participate. Transit agencies also partner or provide connections to other types of passenger transportation, including intercity bus service and private providers such as taxis or Transportation Network Companies (e.g., Uber and Lyft). These entities are discussed further in the Intermodal, Multimodal, and Other Transportation section.

Planning Efforts

The Iowa Public Transit Long Range Plan was completed in 2020. This comprehensive system plan reviewed trends in demographics and passenger transportation usage, forecasted future needs for the public transit system, and developed strategies to improve the public transit system in Iowa. The plan included estimates of various transit components for 2050 based on surveys of transit agencies, shown in Table 3.4. An interesting note is that while additional transit vehicles of all types are anticipated to be needed, there is a much larger increase in smaller vehicles such as vans, rather than larger buses. This aligns with recent trends to rightsize public transit service and use the most efficient vehicle for the individual service area's needs.

Table 3.4: Projections for various public transit components in Iowa

	2019	2050	Growth
Ridership	24.9 million	33.7 million	35.6%
Transit agency personnel	1,769	2,529	43.0%
Transit vehicles (bus/ similar)	1,224	1,478	20.8%
Transit vehicles (van/ similar)	305	596	95.4%

Source: Iowa Public Transit Long-Range Plan

Key findings of the Plan include:

- Public transit is transitioning into a period where services will need to adjust to effectively operate alongside emerging transportation and micromobility options.
- There is a critical funding shortfall that will worsen over time if action is not taken to identify new or additional sustainable financial resources.
- Challenges exist that inhibit the public transit system from achieving its potential, including use of older transit vehicles, having a limited pool of qualified transit vehicle drivers, perceptions of public transit, and rapidly changing technologies such as on-demand ride hailing apps and automated vehicles.
- Iowa's rural transit regions continue to see a decrease in population and an increase in the age of riders, while urban transit regions are experiencing population growth and an increase in population density. This presents unique challenges for ensuring all Iowans have adequate means of getting to work, to medical appointments, or any other destinations.
- There is a net positive return-on-investment for public transit, indicating that net economic benefits are realized for every dollar invested in providing public transit services.
- There exists a current need to address accessibility of the public transit system for all riders, while supporting workforce development by connecting employees with jobs. Recent pandemic responses also show a need to support essential segments of the economy by ensuring a reliable transportation system continues to operate regardless of disruptions.
- As the state emerges from the COVID-19 pandemic, the resulting long-term changes to transportation user preferences will need to be monitored in light of their impact to optimal public transit service.

Trends and Planning Issues

Operations and Usage

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 had been steadily increasing until the past several years, as shown on Figure 3.18. This is primarily due to less federal funding for bus replacement in recent reauthorization bills, along with a large portion of the fleet that was replaced with stimulus funding in 2009 reaching the age threshold at the same time. While recent federal grants from the Bus and Bus Facilities Program have temporarily helped prevent that percentage from increasing further, the overall age of the fleet is still a serious issue for public transit service in Iowa. Older vehicles require more maintenance and repairs, which can be challenging due to limited staff and resources.

Trends in transit operations since 2000 are illustrated in Figure 3.19. Ridership and revenue miles increases have been far outpaced by increases in operating costs. From 2000 through 2015, transit ridership in Iowa grew from 22.4 million annual rides to 28.8 million annual rides. However, ridership began to decrease after 2015 and took a significant dip in 2020 due to the COVID-19 pandemic. During the 2015-2019 time period, Transportation Network Companies (TNCs) such as Uber and Lyft began expanding in Iowa's urban areas, which attracted some ridership from public transit. Additionally, changes in how Medicaid medical transportation is contracted through Iowa's Managed Care Organization (MCO) providers resulted in a significant number of riders being diverted from public transportation to private or alternative means of transportation. Despite the recent decreases, public transit ridership seems likely to increase again in the future as Iowa's population base ages and as trends towards more environmentally friendly transportation options are anticipated to continue.

Figure 3.18: Percent of Iowa's transit fleet that is over its useful life threshold

Source: Iowa DOT

Figure 3.19: Change in transit operations factors, indexed to 2000

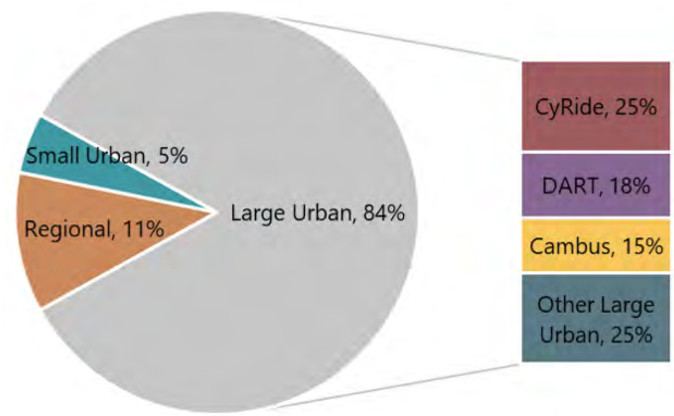
Source: Iowa DOT

Ridership and Accessibility

Ridership is often used as a metric for public transit and is important in understanding the composition of Iowa's public transit system. Large urban systems account for almost 84% of the state's ridership, with three agencies alone (CyRide in Ames, DART in Des Moines, and Cambus in Iowa City) accounting for nearly 59%. Regional systems account for 11%, and small urban systems account for the other 5%. This breakdown is shown in Figure 3.20. While ridership may be concentrated among large urban agencies, the accessibility offered by all transit systems is critical for Iowa, and the service provided by small urban and regional systems provides millions of trips per year that otherwise would have had to be foregone or made by another mode of transportation, which may not have been possible in many cases.

Not all states offer public transit service across their entire area like the state of Iowa does, and its comprehensive coverage is critical for Iowans in all types of settings, from dense metropolitan areas to the state's most rural counties. However, each transit agency faces its own unique challenges with providing maximum accessibility for its service area. Large urban systems offer fixed route service that features regular stops and schedules, which can be advantageous for trip planning. However, they may not operate in the locations or during the times that some individuals may need, and the length of trips taken by public transit may not be competitive with other options, such as driving. Small urban systems face similar challenges on a smaller geographic scale. Regional systems have the challenge of providing expansive geographic coverage and trying to optimize services while potentially having vehicles travel long distances with relatively few riders.

Figure 3.20: Ridership breakdown by agency type, 2016-2020



Source: Iowa DOT

Transit Agency Planning Issues

All transit agencies provided feedback through a survey as part of the development of the 2020 Iowa Public Transit Long Range Plan. The responses helped frame a number of planning issues that agencies will have to address in coming years.

- There is a general lack of long-range or strategic planning efforts for many transit agencies, which makes forecasting future needs difficult.
- Despite recent pre-pandemic declines in ridership, agencies forecasted growth in ridership in the future. Agencies predicted more of an increase between 2018 and 2030 than between 2030 and 2050, perhaps representing some of the long-term uncertainty regarding the evolution of public transit.
- In general, transit agencies are exploring the rightsizing of their fleet in order to have appropriately-sized vehicles for the likely number of riders. In some situations, there may only be one or two riders, so a smaller van would be a more appropriate and comfortable fit than a large bus. On the other hand, fixed-route services or contracted employee transportation services may require a bus that can hold 20 or more people at once.
- Significant facility needs for vehicle maintenance and storage are anticipated in the future across transit agencies. Large urban systems also see a need for additional bus shelters and park and ride lots.
- Personnel shortages exist currently, particularly for bus drivers. A lack of personnel is one of the most limiting factors for a transit agency, as it must have enough qualified and licensed drivers to operate its vehicles and administer its services.
- Transit agencies face challenges in implementing new technology due to funding limitations and uncertainty of its return on investment.

Evolving Service and Coordination

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. These types of options are discussed further in Section 3.7.

Another notable trend is increasing coordination between transit providers and health and human service agencies. This is partially facilitated through efforts like Iowa's Transportation Coordination Council, which involved several statewide organizations, state departments, and federal groups, and meets bi-monthly to discuss issues like mobility management, accessibility of transportation in Iowa, special project proposals, and encouraging local participation in the planning process. This local participation can occur through the Passenger Transportation Plan development process at metropolitan planning organizations and regional planning affiliations. Coordination also occurs at the annual Passenger Transportation Summit, where the public, human service agencies, transit providers, planning agencies, government agencies, and other interested parties gather to discuss current issues for passenger transportation in Iowa.

3.5 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 the state, 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, which are critical to moving bulk commodities produced and consumed in the state.

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. 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, Iowa has two passenger rail routes operated by Amtrak that stop at six stations through the state and serve long-distance destinations between Chicago and two California destinations. As metropolitan areas throughout Iowa continue to grow, the need to consider a diverse network of passenger transportation options that will accommodate this growth will continue to be a factor. Passenger rail contributes significantly to economic growth and can strengthen a state's manufacturing, service, and tourism industries.

Iowa DOT's Role

Iowa DOT does not own or operate rail facilities, but is responsible for coordinating the overall state rail transportation improvement strategy. The department is primarily responsible for rail planning and project development activities, including development of the State Rail Plan.

Iowa DOT is the primary rail regulator within the state of Iowa. However, the Iowa DOT has limited regulatory authority. It participates in the railroad abandonment process and offers comment on federal rail legislation and rulemaking. When applicable, the Iowa DOT can facilitate service disputes between shippers and carriers through the Iowa Department of Inspections and Appeals.

The Iowa DOT is also involved in efforts related to state and federal financing. This can involve loans and grants for construction and maintenance of track, maintenance and safety improvements at highway-rail crossings, and developing new spur tracks to support economic development.

Inventory

Freight Rail

Rail service in Iowa is dominated by five Class I carriers that operate the vast majority of tracks and accrue most of the freight revenues in the state. Of the five Class I railroads, the Union Pacific Railroad and the BNSF Railway carry the largest volume of traffic in the state while operating on approximately 2,000 miles of track combined, including double tracks running east to west across the state.

Class II and III railroads often provide feeder service to the Class I carriers. The only Class II railway in the state, the Iowa Interstate Railroad, maintains over 300 miles of track serving as another major east-to-west corridor traveling from Omaha-Council Bluffs to the Chicago area. Class III railroads consist of two separate operating categories – line haul and switching. Switching railroads operate in urban areas and facilitate the interchange of rail shipments. These switch operators are typically associated with Class I railroads and are common practices within Class III operations. Table 3.5 and Figure 3.21 show the extent of freight rail operations in Iowa.

Table 3.5: Iowa railroad mileage by company

Class	Railroad	Owned/ Leased	Trackage Rights	Total Operated
I	BNSF Railway (BNSF)	624	35	659
	Canadian National Railway (CN) [1]	574	24	598
	Canadian Pacific Railway (CP) [2]	650	23	673
	Norfolk Southern Railway (NS)	6	37	43
	Union Pacific Railroad (UP)	1,281	152	1,433
II	Iowa Interstate Railroad (IAIS)	327	27	354
III	Boone & Scenic Valley Railroad (BSV)	2	0	2
	Burlington Junction Railway (BJRY)	6	0	6
	CBEC Railway (CBRX) [3]	5	0	5
	Cedar Rapids & Iowa City Railway (CIC)	60	23	82
	D&I Railroad (DAIR)	0	39	39
	Iowa Northern Railway (IANR)	174	43	217
	Iowa River Railroad (IARR)	35	0	35
	Iowa Southern Railway (ISRY)	11	0	11
	Iowa Traction Railroad (IATR)	10	0	10
	Keokuk Junction Railway (KJRY)	1	0	1
	State of South Dakota (SD) [4]	39	0	39
	Total	**3,804**	**403**	**4,207**

1 CN operates via subsidiaries Chicago Central & Pacific (CCP) and Cedar River Railroad (CEDR).

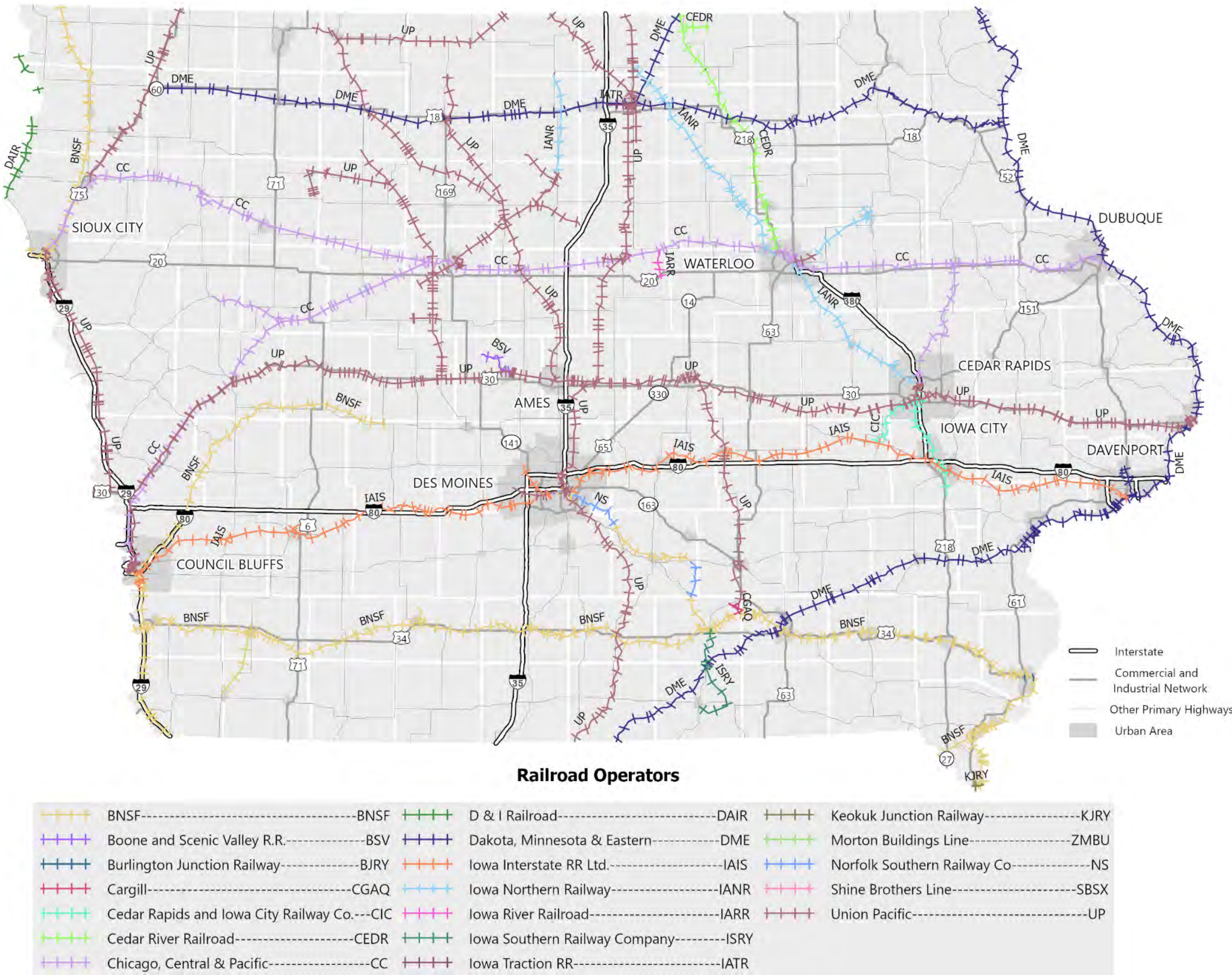
2 CP operates via subsidiary Dakota, Minnesota & Eastern (DME).

3 CBEC trackage is operated by IAIS.

4 SD-owned trackage in Iowa is operated by DAIR.

Source: Railroad companies

Figure 3.21: Iowa railroad service map

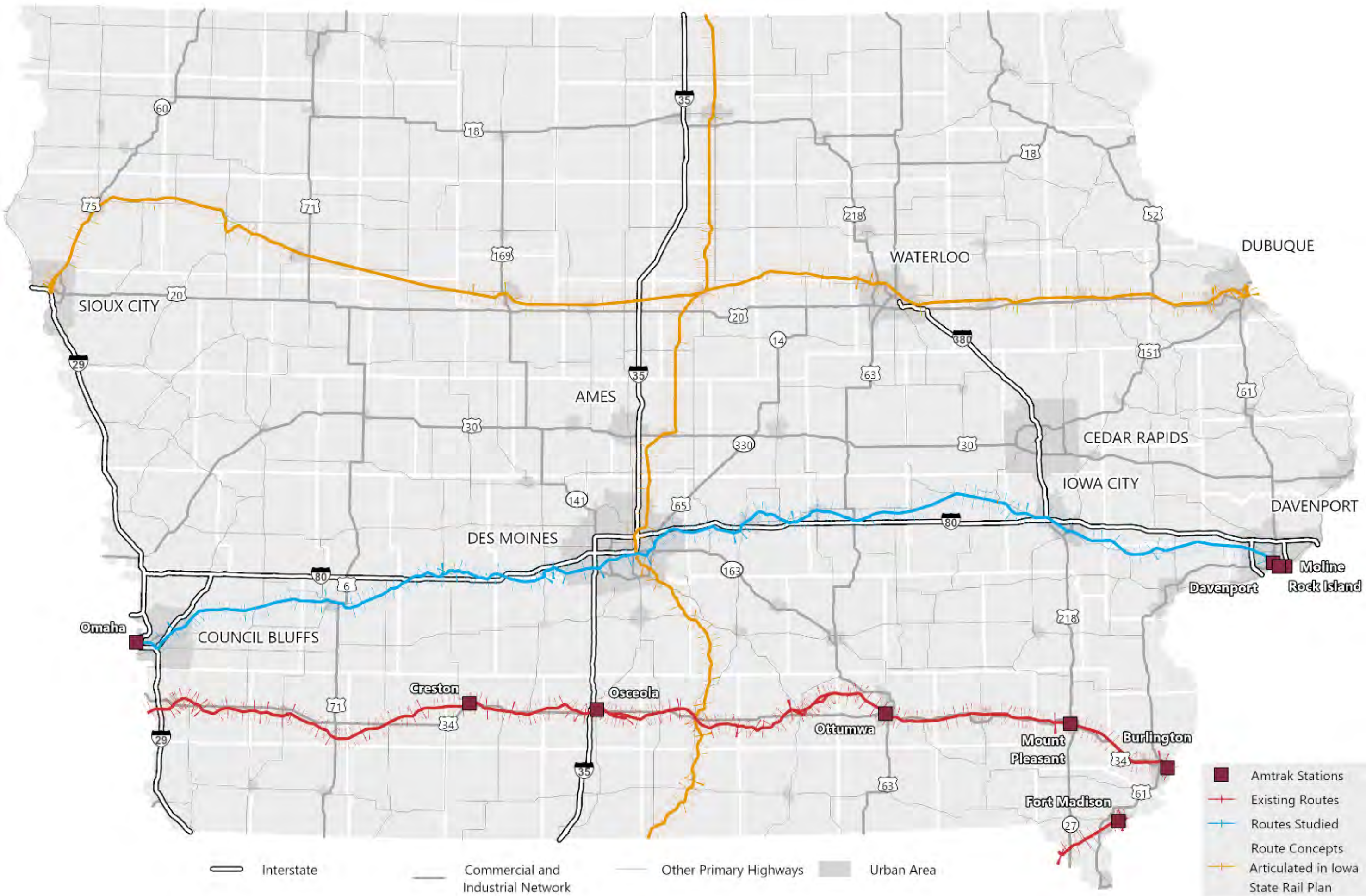


Source: Iowa DOT

Passenger Rail

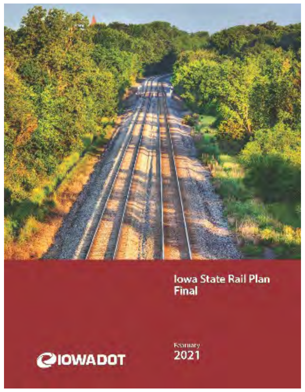
Passenger rail service in Iowa is currently provided by two Amtrak routes, the California Zephyr from Chicago, Illinois to Oakland, California, and the Southwest Chief from Chicago to Los Angeles, California. The California Zephyr operates over the BNSF tracks in southern Iowa providing daily service 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 3.22 shows current service, along with routes where service is being planned or considered for study, which are discussed in the next section.

Figure 3.22: Passenger rail service in Iowa



Source: Iowa DOT

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 that meets specific requirements. Building from the last Iowa State Rail Plan in 2009, the Iowa DOT completed an update in 2017, which helped formulate a vision for railroad transportation in the future and strategies to achieve that vision. That plan served as the foundation for the 2021 Rail Plan update. The plan guides the state's short and long-term rail freight and passenger transportation planning activities. It describes the state's existing rail network and rail-related economic and socioeconomic impacts. It also describes the State Rail Plan process, Iowa's rail vision and supporting goals, proposed short- and long-range capital improvements, studies, and recommended next steps to address the issues identified.

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 State 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 will help the Iowa DOT plan into the future.

Planning efforts also include evaluating additional passenger rail service in the state. The Chicago to Council Bluffs-Omaha Regional Passenger Rail System Planning Study was completed in 2013, which studied routes that would serve some of Iowa's largest metropolitan areas. Implementation of passenger service on the Chicago-Moline, Illinois segment has been under development by Illinois, and as of early 2021, had begun preliminary engineering activities with the route stakeholders. 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. Potential future expansion concepts for the corridor between Rockford, Illinois and Dubuque will continue to be studied.

Additional routes identified in planning documents but remaining to be studied are also shown on Figure 3.22. 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.

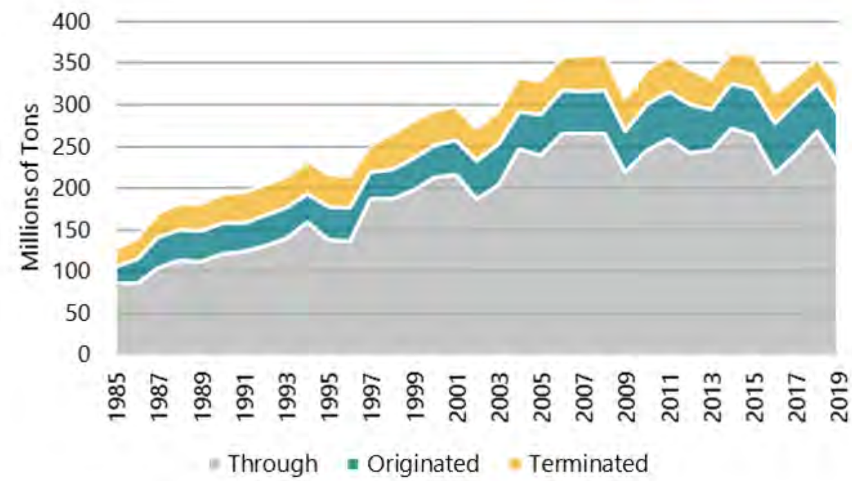
Trends and Planning Issues

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 3.23 shows the amount of rail mileage in Iowa over time, and Figure 3.24 shows historical inbound, outbound, and through tonnage for rail freight. The majority of freight movements are just passing through the state. Regarding freight that originates from or terminates in the state, Iowa produces more goods than it imports; in recent years, this has been by as much as a 2-1 margin.

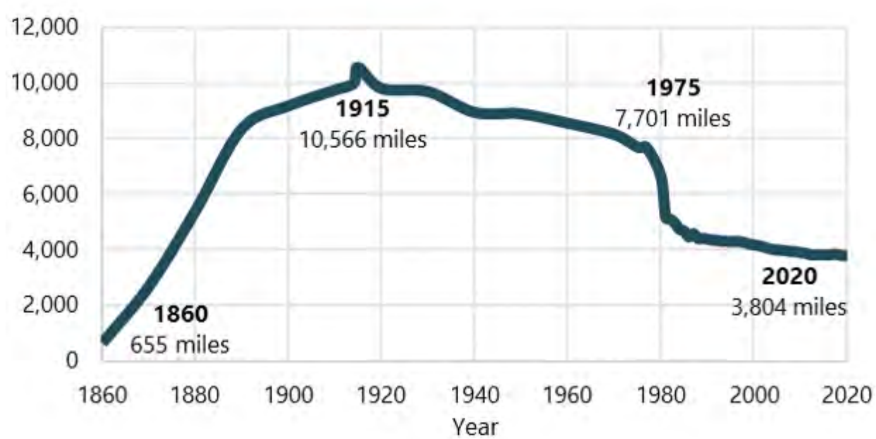
Operating revenues and overall net ton-miles of the railroads are also indicators of the condition and performance of the rail system, both of which have steadily increased over the last 35 years despite the decreasing mileage. These trends are shown on Figure 3.25.

Figure 3.24: Rail movements in Iowa



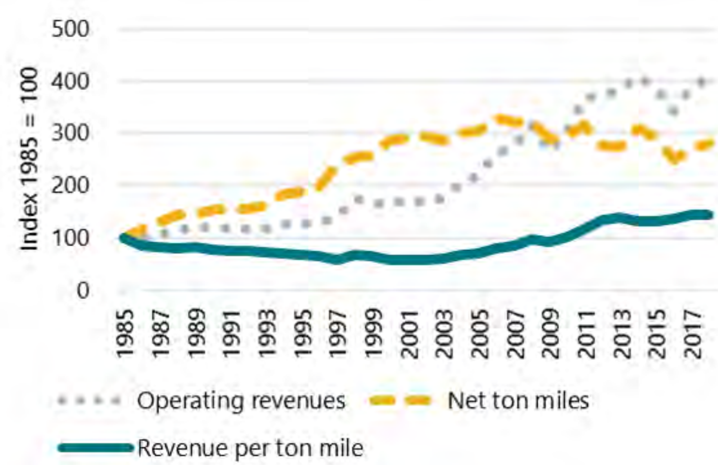
Source: Iowa DOT, Railroad Companies

Figure 3.23: Historical rail mileage in Iowa



Source: Iowa DOT, Railroad Companies

Figure 3.25: Performance of Iowa rail operations



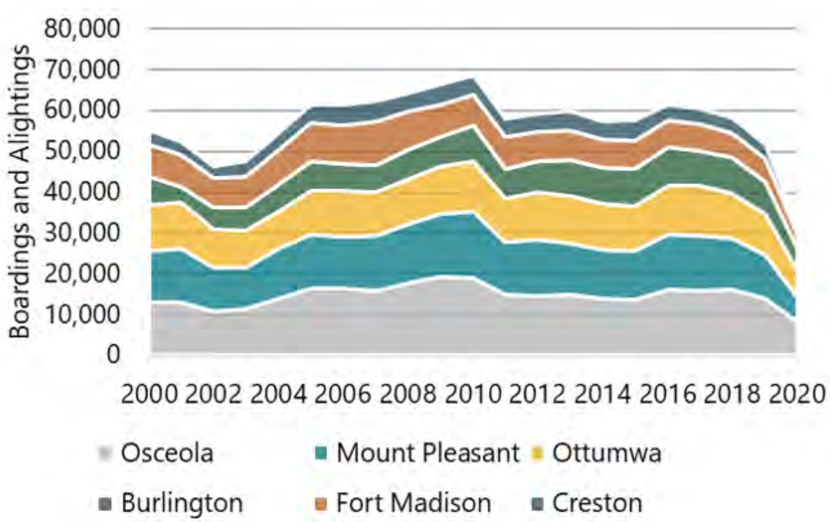
Source: Iowa DOT, Railroad Companies

Amtrak Ridership

Nationwide, passenger rail ridership on Amtrak has increased from 22.5 million in 2000 to 30.7 million in 2019. However, this increase has not been reflected in boardings or alightings at Iowa's six Amtrak stations, which have a relatively flat trend over the same time period (see Figure 3.26). Like other passenger transportation modes, Amtrak ridership experienced a significant decline in 2020 due to the COVID-19 pandemic.

Over time, Osceola's station has consistently had the most ridership of any Iowa stations, accounting for more than 25% of Iowa's ridership between 2000-2020. Mount Pleasant and Ottumwa account for close to 20% each, with the remaining stations seeing less use.

Figure 3.26: Amtrak ridership at Iowa stations, 2000-2020



Source: Amtrak

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% of Iowa's rail-miles are not able to carry the industry-standard 286,000-pound cars (reference Figure 5.7).

U.S. Energy Production

Coal is the primary commodity being shipped to Iowa by rail, accounting for over half of the tonnage terminating in the state. In addition to coal, much of energy freight movements to and from Iowa are by rail due to the fact that oil production has increased at a rate exceeding the capacity of the nation's pipelines. A significant amount of the oil produced in the Bakken Shale formation region is shipped by rail with a portion of that traveling through Iowa. 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 produces nearly 30 percent of the nation's ethanol fuel. Nationally, 60-70 percent of all ethanol produced is transported by rail.

3.6 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. 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 movements for products being shipped into and out of Iowa.

The Mississippi 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 2017, more than 8.5 million tons of commodities (mostly agricultural products and gravel) were shipped to or from Iowa on waterways.

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, Minnesota to the southern points of Missouri and Illinois.

Iowa DOT's Role

The Iowa DOT does not own or operate infrastructure on the Mississippi or Missouri Rivers themselves, though, in conjunction with border states, it does own and maintain highway bridges that cross the rivers. The department has an advisory role with the U.S. Army Corps of Engineers and representation on the Upper Mississippi River Basin Association. The Iowa DOT has also helped sponsor studies of the inland waterway system, modernization needs, and financing scenarios. The department has a vested interest in the system due to its importance in Iowa's overall freight network and its ability to relieve pressure on highways and rail lines.

Historically, the Iowa DOT did not invest directly in the waterway system. This changed recently with the commitment to help fund a mooring cell on the Mississippi River with National Highway Freight Program funding, taking advantage of new funding flexibility offered by the program.

Inventory

Iowa is bordered by two navigable rivers that provide an economical option for moving bulk products to and from the state. The Missouri River (M-29 Marine Highway) on the west and the Mississippi River (M-35 Marine Highway) on the east connect to an extensive national inland waterway system and international deep-sea ocean port facilities on the Gulf Coast.

Both rivers are part of America's Marine Highway Program that is dedicated to expanding the use of the nation's navigable waterways in order to relieve landside congestion, reduce air emissions, and generate other public benefits by increasing the efficiency of the surface transportation system. The M-29 Marine Highway runs from Sioux City, Iowa to Kansas City, Missouri. The M-35 Marine Highway runs from St. Paul, Minnesota to Grafton, Illinois.

Located along these rivers in Iowa are 63 barge terminals (57 on the Mississippi, six on the Missouri) owned and operated by private companies. These terminals transfer commodities between barge, rail, and truck. Freight moving through these facilities on the waterways in Iowa is primarily on the Mississippi River.

A system of 11 locks and dams (Table 3.6) on the upper Mississippi River, operated by the U.S. Army Corps of Engineers (USACE), helps to maintain adequate water levels for barge operations. The construction of these navigation locks and dams was authorized in 1930 to achieve a 9-foot channel in the upper Mississippi River. 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. Iowa's marine highways, locks and dams, and barge facilities are shown on Figure 3.27.

There are also two port statistical areas (PSAs) in Iowa. The Mississippi River Ports of Eastern Iowa and Western Illinois, doing business as Upper Mississippi River Ports PSA, consists of the existing ports and terminals in Dubuque, Jackson, Clinton, Scott, Musctaine, and Louisa counties, as well as others in Illinois. The Mid America Port Commission PSA consists of the existing ports and terminals in Des Moines and Lee counties, as well as others in Illinois and Missouri. The PSAs are shown on Figure 3.27.

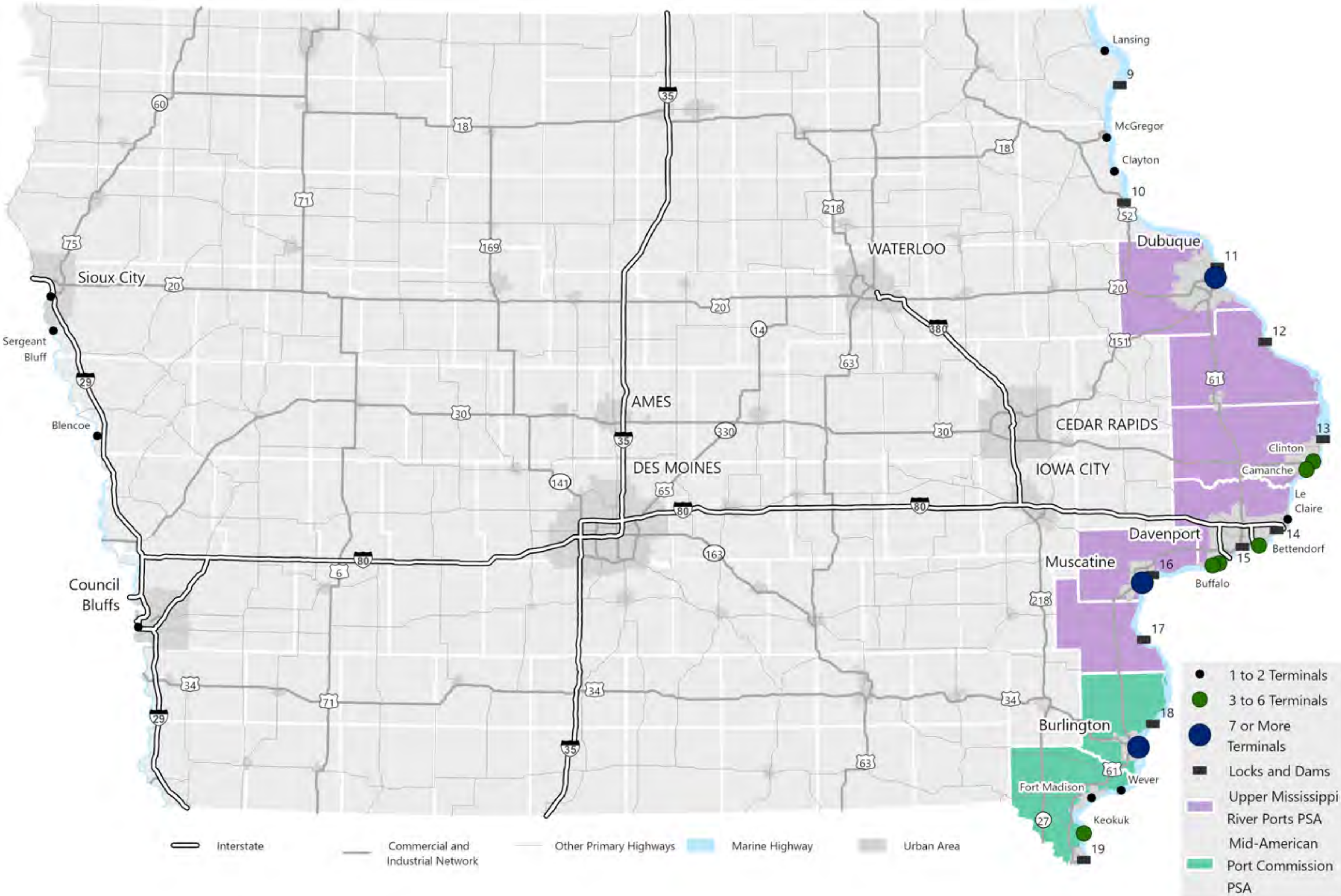
The terminals in the region have been functioning for over 150 years, but were federally recognized as PSAs in 2020. The PSAs will leverage industry partnerships to promote economic opportunities, raise national awareness of their strategic importance for shipping commodities, and recognize the production and movement of freight as a vital economic driver for the region.

Table 3.6: Iowa Mississippi River locks summary

Lock	Location	Chamber type	River mile	Year open	Length (feet)	Width (feet)
9	Harpers Ferry	Main	647.9	1938	600ft	110ft
10	Guttenberg	Main	615.1	1936	600ft	110ft
11	Dubuque	Main	583	1937	600ft	110ft
12	Bellevue	Main	556.7	1939	600ft	110ft
13	Clinton	Main	522.5	1938	600ft	110ft
14	Le Claire	Main	493.0	1922	600ft	110ft
14	Le Claire	Aux 1	493.0	1939	320ft	80ft
15	Rock Island (IL)	Main	482.9	1934	600ft	110ft
15	Rock Island (IL)	Aux 1	482.9	1934	360ft	110ft
16	Muscatine	Main	457.2	1937	600ft	110ft
17	New Boston (IL)	Main	437.1	1939	600ft	110ft
18	Gladstone (IL)	Main	410.5	1937	600ft	110ft
19	Keokuk	Main	364.3	1957	1,200ft	110ft

Source: U.S. Army Corps of Engineers

Figure 3.27: Iowa marine highways, locks and dams, barge facilities, and port statistical areas



Source: Iowa DOT

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 and 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 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, 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.

The waterway system's underfunding seriously affects the nation's potential to participate in the highly competitive global market for exportable commodities. Rehabilitation projects, as well as small- and large-scale improvements to the system are behind due to lack of construction funds. 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.

Upper Mississippi River Inland Waterway Funding Study

Several recommendations of the 2013 Reconnaissance Study have come to fruition, including passage of the Water Resources Reform and Development Act (WRRDA) bill and the Water Infrastructure Improvements for the Nation Act of 2016 (WIIN). The Iowa DOT continues to collaborate with USACE to enhance the performance of the Upper Mississippi River (UMR) lock and dam system. As part of this ongoing collaboration, in 2019 the Iowa DOT conducted an Alternative Financing Evaluation of the UMR Inland Waterway infrastructure to develop a long-term vision for the waterway that serves stakeholders' needs and identify feasible investment strategies for the waterway that recognize the opportunities created by WRRDA 2014 and WIIN 2016. Of special interest are the revised contributed funds programs for USACE water resources projects, such as the UMR Inland Waterway's lock and dam system.

This study discussed three lock and dam system upgrade pilot projects for improving the efficiency, reliability, and capacity of the existing system and investigated the implementation of alternative financing scenarios. One of these involved using a State-Federal contributed funds agreement to construct a mooring cell at lock and dam 14 at Le Claire. Mooring cells allow tows to tie off while waiting to go through a lock, which has environmental and operational benefits. In 2021, Iowa DOT and the USACE began working through a contributed funds agreement for Iowa DOT to provide the full project cost of $2 million.

Trends and Planning Issues

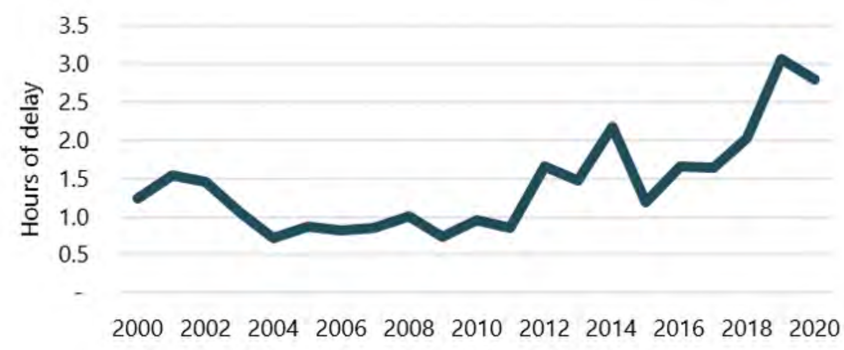
Condition and Delay

The 2021 American Society of Engineers Report Card for America's Infrastructure graded the inland waterway system as a D+, reflecting the age, condition, and reliability of the infrastructure. The system relies primarily on public investment and has suffered from chronic underfunding. Many of the country's locks and dams have reached or even far exceeded design life, resulting in infrastructure deteriorating faster than it is being replaced. With grain exports increasing 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.

The locks and dams bordering Iowa are undersized for modern Upper Mississippi tow lengths and are hindered by unexpected repairs. The average age of these 11 locks and dams is over 80 years, 30 years past the design life. 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. This creates major delays and congestion at each lock and dam, generating a ripple effect of longer delays. The average delay at the locks along Iowa's border is almost 3 hours, and has generally been increasing over the past decade, as shown in Figure 3.28.

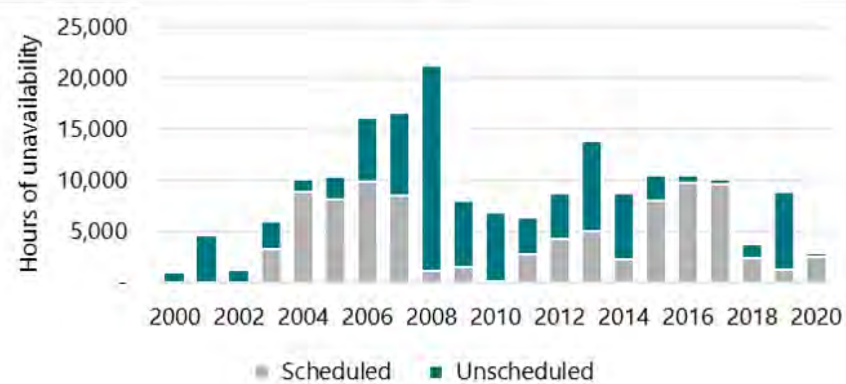
Also contributing to delay times is lock unavailability, both scheduled and unscheduled. Due to the age and condition of the infrastructure, locks and dams must often be closed for maintenance and repairs. On average, unscheduled repairs account for more than 50 percent of lock closures. Delays, congestion, and unavailability due to closures are significant threats to efficient goods movement. Figure 3.29 shows how often locks 9 through 19 were unavailable from 2000 to 2020.

Figure 3.28: Average delay for Iowa Mississippi River locks, 2000-2020



Source: U.S. Army Corps of Engineers

Figure 3.29: Annual unavailability at locks 9-19, 2000-2020



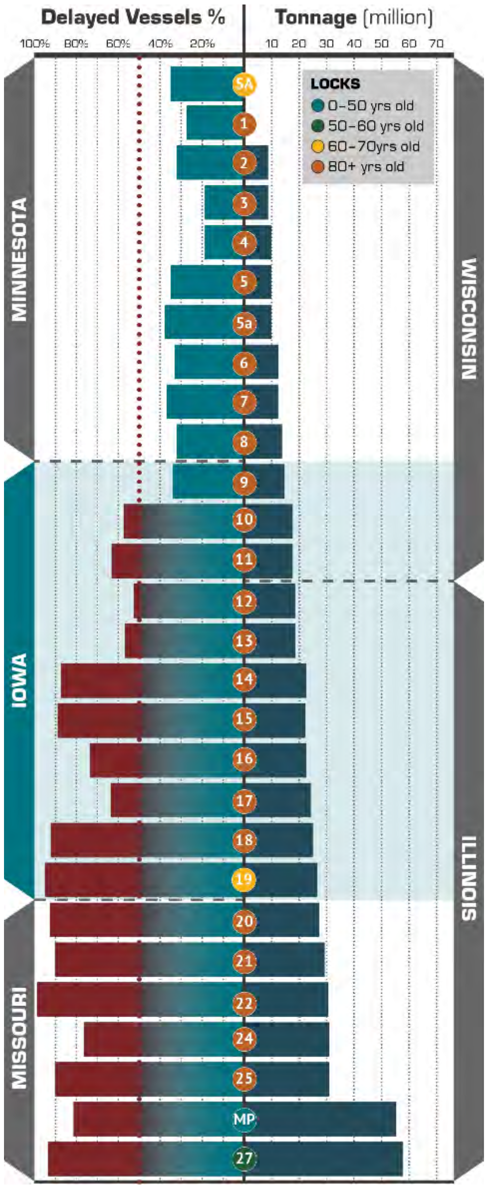
Source: U.S. Army Corps of Engineers

Freight Movements

Iowa's navigable waterways are primarily utilized for moving bulk products such as grain, fertilizer, and coal, with most of the movements being exports out of the state and down the Mississippi River. Barge traffic, total tonnage, and delayed vessels traveling through Iowa's locks all increase as the river flows from north to south, as shown on Figure 3.30. Most of traffic can be attributed to agricultural products being exported. These exports are shipped from Iowa barge terminals down the Mississippi River to the Gulf of Mexico where they are transloaded onto ocean vessels and shipped around the world. 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 has experienced a continual drop in freight tonnages, partly due to inconsistent water releases from upriver dams and controversy over water usage for all Upper Missouri River basin states. However, barge traffic is increasing on the Lower Missouri River and regular traffic is returning as far north as Blencoe, in Monona County in west-central Iowa. In June 2021, the NEW Cooperative Port of Blencoe officially opened, becoming the northernmost port on the Missouri River and enabling barge traffic to regularly return to that portion of the river for the first time in over a decade. The new port is expected to increase western Iowa's transportation options and competitive advantage for shipping grain. Iowa DOT Revitalize Iowa's Sound Economy (RISE) funding assisted with paving a road to connect I-29 to the area of the port, improving the intermodal connection for trucks and barges.

Figure 3.30: Upper Mississippi lock performance, 2020



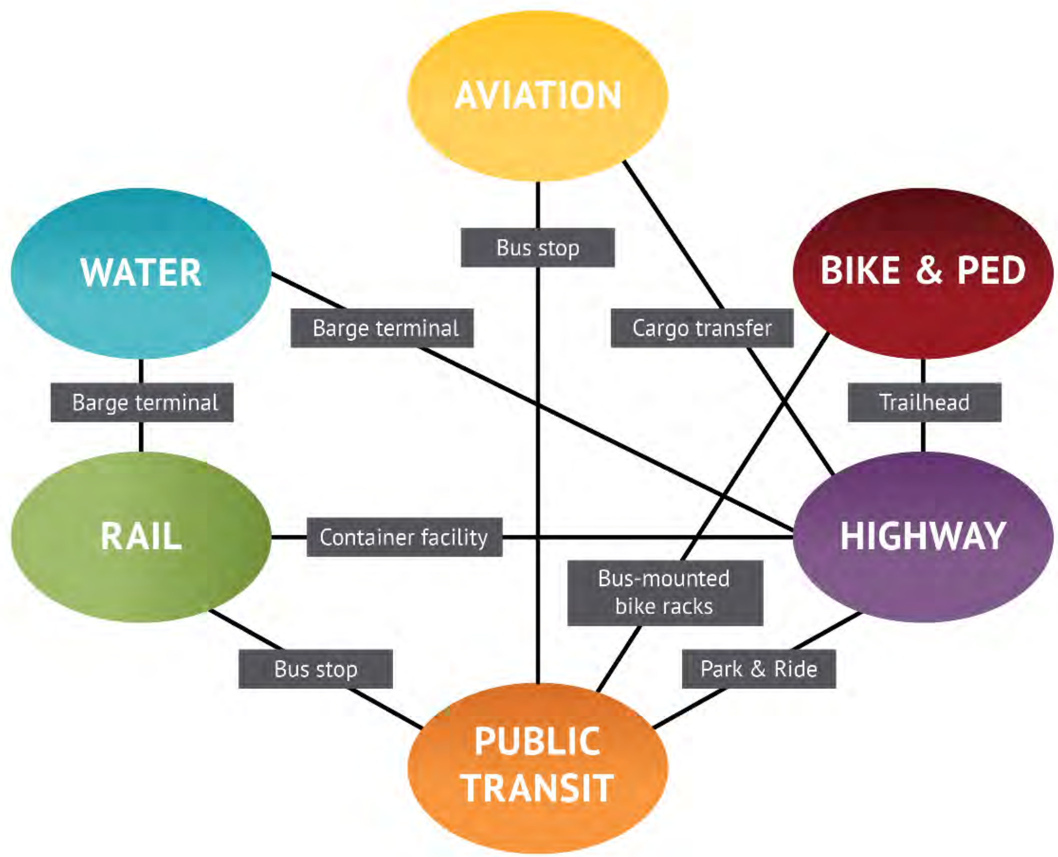
Source: U.S. Army Corps of Engineers

3.7 Intermodal, Multimodal, and Other Transportation Options

The prior section covered the main transportation modes in Iowa that Iowa DOT plans for and invests in. In addition to considering each of those modes individually, it is also important to consider and plan for connections between modes for both passengers and freight, as well as to be cognizant of other modes that are part of the overall transportation system, such as pipelines. The connections between modes 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 3.31 highlights some examples of intermodal facilities commonly found in Iowa that help connect different modes. These connections are an integral part of passenger and freight transportation, as they provide the opportunity for seamless transitions from one mode to another.

Figure 3.31: Examples of intermodal connections and facilities



Source: Iowa DOT

Passenger

There are multiple options and connections for passenger travel other than driving a personal vehicle. Earlier sections covered commercial air service, public transit, and Amtrak; this section will discuss other passenger transportation infrastructure and options.

Park and Ride Lots

A recent planning effort that dealt with a specific type of intermodal facility was the 2014 Iowa Park and Ride System Plan (PRSP). 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 PRSP 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 PRSP 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 3.32 shows existing and proposed locations of park and ride lots.

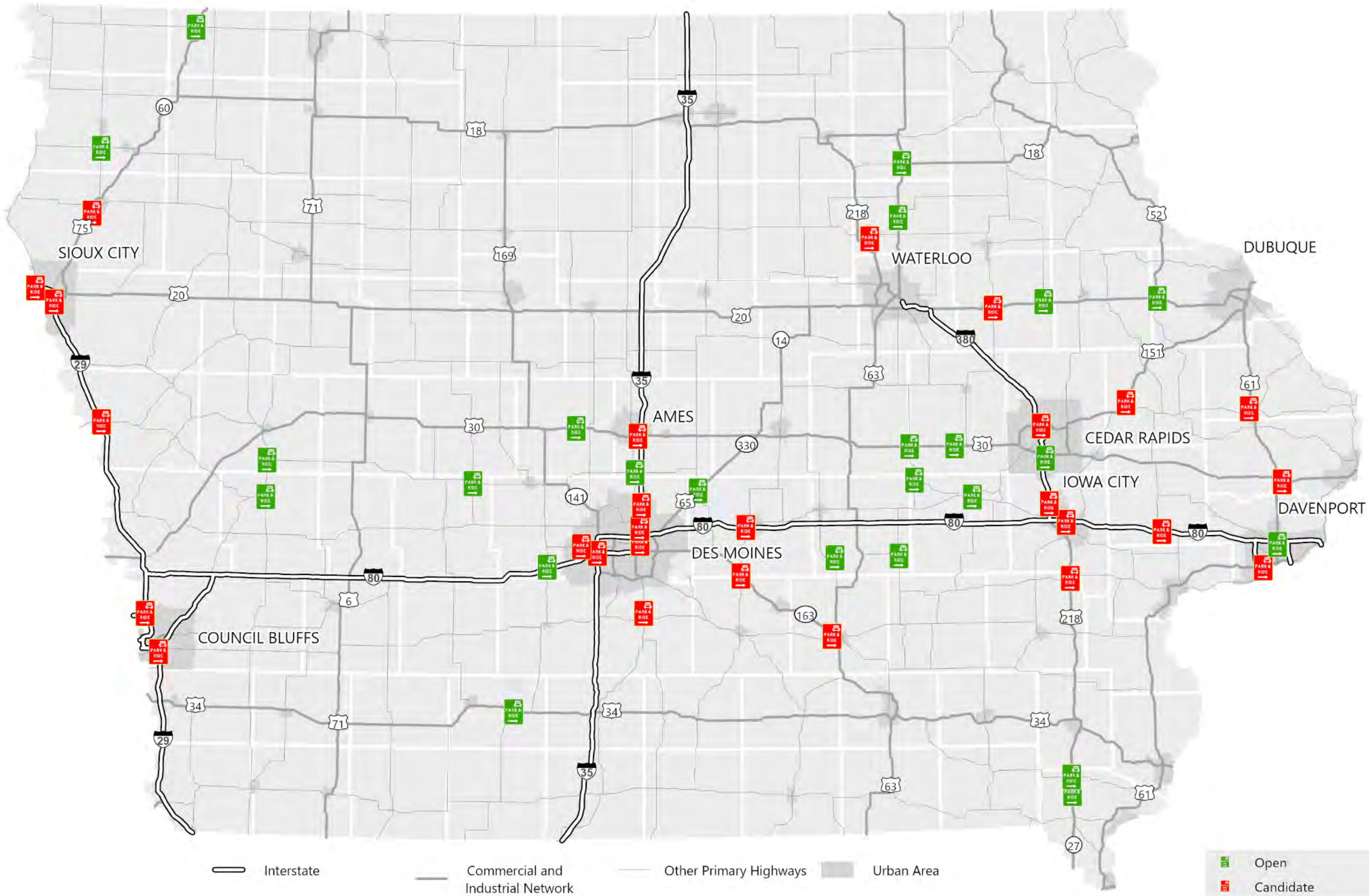
Intercity Bus

Intercity bus service is an extremely valuable transportation resource for Iowa's residents who do not drive or choose not to drive. This service allows them to reach destinations across the country. Intercity bus services include stops at non-urbanized locations and make meaningful connections to nationwide networks. Routes and stops for Iowa's three intercity bus carriers are shown on Figure 3.33, along with the locations of public transit agencies, airports, and Amtrak routes, as intercity bus service can be an important connector to these services. At least 15 percent of state's federal non-urbanized transit funding must be used for support of intercity bus services, unless the governor certifies this need has been met. Eligible participants for the Intercity Bus Program include private intercity bus companies, companies wishing to start intercity bus service, public transit agencies either operating or proposing to operate intercity bus services, or local communities wishing to support intercity bus connections to their community.

Iowa's Intercity Bus Program has four components in priority order:

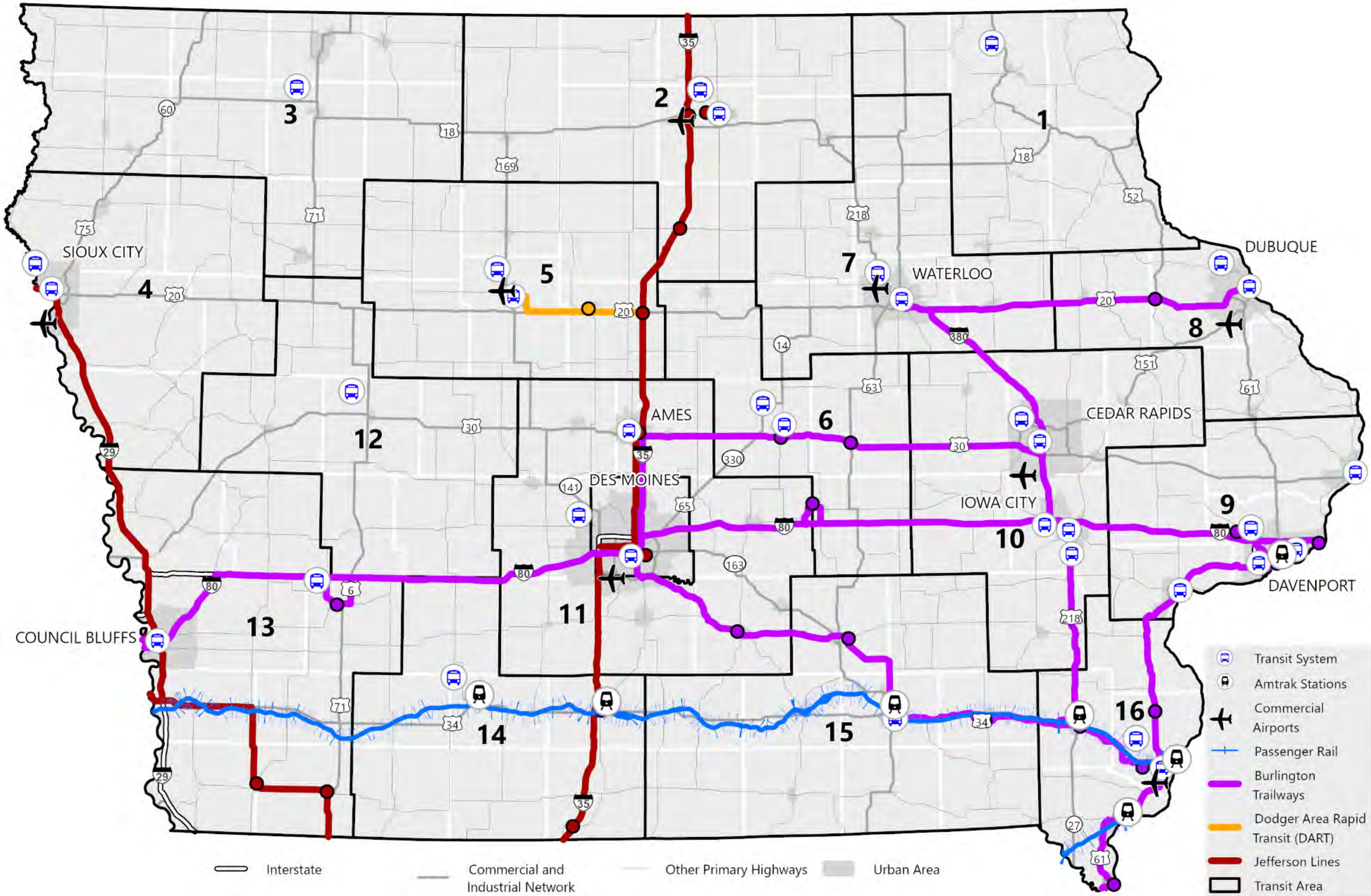
- Base level support of existing services
- Start-up support for new services
- Support for marketing of intercity bus services and interlined service
- Support for intercity bus capital improvements

Figure 3.32: Existing and proposed park and ride lot locations



Source:: Iowa DOT

Figure 3.33: Intercity bus routes and other passenger transportation connections



Source: Iowa DOT

Transportation Network Companies (TNCs)

Transportation Network Companies (TNCs; e.g., Uber and Lyft), are services that involve people, who may have otherwise taken public transit, taxis, or used another mode of transportation, paying to ride in private passenger vehicles. These services are considered "paid rideshares" or for-hire passenger transportation provided by rideshare companies. Iowa defines a rideshare company as a corporation, partnership, sole proprietorship, or other entity that operates in this state and uses a digital network (an online enabled app, internet site, or system offered by a rideshare company) to connect riders to drivers who use their personal vehicles to provide prearranged rides for a fare.

The ride hailing service Lyft began offering service to all of Iowa starting in August 2017. Lyft originally began service in Ames, Cedar Rapids, Davenport, Des Moines, Dubuque, Iowa City, Sioux City and Waterloo earlier in 2017 before expanding service to the rest of the state. Lyft notes that availability of drivers will impact service in rural areas.

In January 2019, Uber announced that its paid rideshare service was available across the entire state of Iowa. While exact average wait times are not available, it is expected that with fewer or potentially no drivers available in some areas, service levels will differ considerably, particularly between urban and rural regions.

While these services may compete with public transit agencies for riders, they can also be complementary services or partners for transit agencies. For example, in 2019, Des Moines Area Regional Transit (DART) began offering a Flex Connect service in Urbandale and Windsor Heights. This service enables riders in a specific zone to book an Uber, Yellow Cab Co. taxi, or DART accessible vehicle to take them to a transfer point where they can connect to DART bus routes. This helps provide first-mile/last-mile type service in a way that is more efficient for DART and more convenient for the rider.

Shared Systems (Bike, Scooter, etc.)

While many people interested in using bicycles or scooters own their own, shared systems for these types of equipment are becoming common, especially in metropolitan areas. These systems have the advantage of being available around the clock, and provide users who live in the area or may have traveled to it via car or bus with a quick and efficient alternative to walking for short trips, or for first-mile/last-mile connections from their primary modes of transportation.

Most shared or electric bicycle (eBike) and scooter services, whether docked at a rack or undocked, are managed at the local jurisdictional level. As such, each location will individually determine if such mobility options are warranted, have sufficient demand from the public, and meet statutory requirements designated for the local area.

Three Iowa communities either have electric scooters or are in the process of considering them. In September of 2019, after amending city code earlier in April, Cedar Rapids formed an agreement with VeoRide to operate and maintain both bike and scooter sharing in the city consisting of 30 scooters and 150 bikes. The electric scooters have a 28-mile range and can reach 12 miles per hour. Likewise, Iowa City also changed its city code to handle electric scooters and bikes the same as non-electric/motorized versions, contracting with Gotcha Mobility to implement dockless bike sharing facilities in the city.

In addition to Cedar Rapids and Iowa City, Des Moines is also exploring allowing electric scooters within its jurisdiction. Des Moines already has an extensive bike share fleet, so the scooters would be an augmentation of that service.

Automated Vehicles

An area of unclear potential influence on passenger transportation is the advancement of automated vehicles (AV). Vehicles that are fully autonomous could potentially operate without the need for a driver, which could revolutionize passenger travel. Many organizations have attempted to project AV adoption rates in order to anticipate how many autonomous vehicles could be on the road in the near and long-term future. Due to the multitude of unknowns and variable factors, forecasted AV adoption rates have decreased and most expect a negligible portion of the overall fleet of vehicles to have AV technology in the near future.

While AV and its potential impacts are discussed further in Chapter 4, for the purposes of this discussion, the potential benefit of AV to mobility is of special importance as it may potentially have significant direct impact on passenger transportation services. While standalone AV services may eventually compete with public transit agencies, these types of vehicles may also be integrated within public transit agencies. From a technical standpoint, the Federal Transit Administration (FTA) has already begun studying the possibility of incorporating autonomous vehicles into transit fleets by evaluating the capability of existing technology and the ability to retrofit new automated technology into buses. While some existing technology will work well with future AV uses, it was found that the configuration of most braking systems will not be sufficient or at least very difficult for automated technology to leverage unless costly upgrades are made. It was noted however, that hybrid and electric buses have a different type of braking system that performs better as an AV.

From an operations standpoint, the American Public Transportation Association (APTA) is investigating types of transit service that would most likely be the earliest adopters of autonomous technology. Among those services, low-speed shuttle AV's are assessed as having potential to replace existing large buses that service low demand routes with infrequent schedules. First-mile/last-mile service is another possible service that might see smaller AV transit vehicles providing rides. According to U.S. DOT research conducted in 2018, of a dozen AV shuttle pilot test projects, all of them utilized electric vehicles with capacities between 10 and 15 transit riders, although most of the testing was limited to closed courses and routes due to safety concerns.

As far as the overall impact of AV on public transit ridership, a study by researchers from North Carolina Department of Transportation and the University of Tennessee found that AVs will likely result in a net decrease in public transit ridership. While they acknowledged that much more research still needs to be done, they concluded that this ridership decrease will be due to factors such as extra comfort and privacy of AVs compared to public transit and the relative utility of AVs. It was also noted that micromobility services such as shared AVs and micro-transit AVs could attract riders from transitional public transit services. Additionally, if full automation is achieved, populations who otherwise could not drive, such as the disabled, elderly, and unlicensed individuals, could potentially transition from public transit to AV usage.

Other Shared Transportation Options

Other technological transportation innovations that could affect passenger transportation 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, etc.), or paying a monthly fee for the access rather than owning a personal vehicle or waiting to ride the bus.

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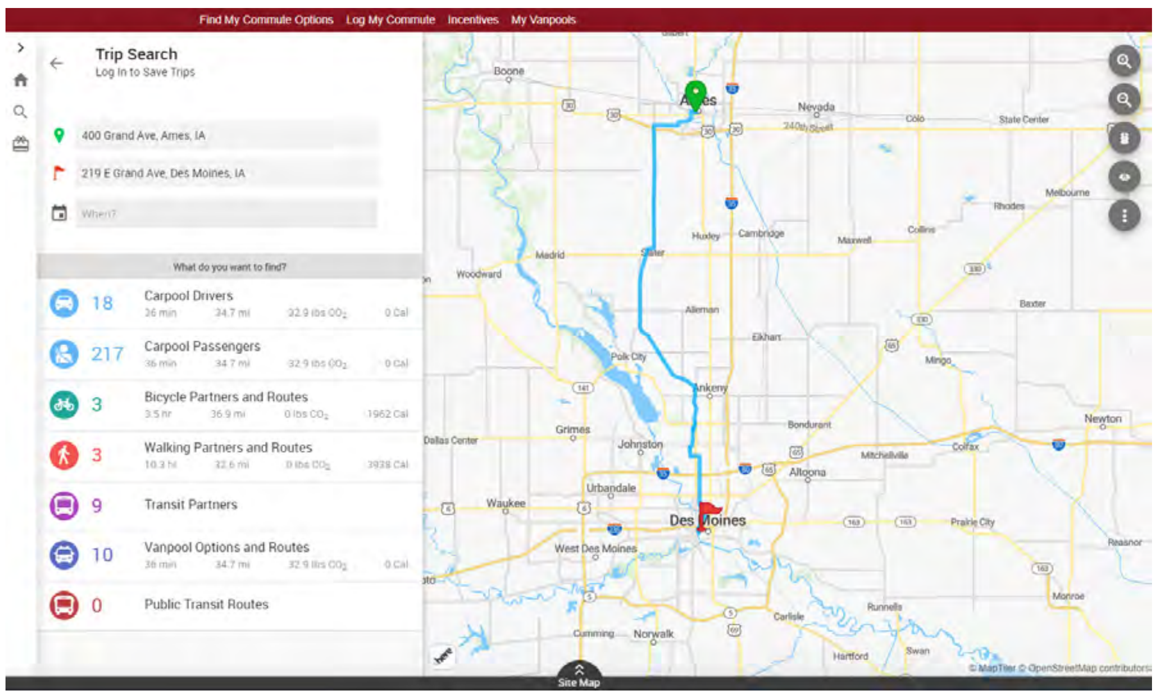
Free alternative transportation options include arranging for carpools or vanpools using the Iowa Rideshare ride matching system that helps to quickly and securely find viable commute options, including carpool partners, vanpool routes, transit routes, cycling buddies, and more. Since its inception in late 2016, more than 5,000 unique users have registered with Iowa Rideshare, resulting in over 2,500 connections between multiple commuters and carpools. Additionally, DART offers its own vanpool program with connections available through the Iowa Rideshare site. DART has nearly 100 vanpools serving an 18-county area. The Iowa Statewide Park and Ride System further supports carpooling and ridesharing by providing free parking for commuters throughout the state, which can be utilized by commuters connecting through Iowa Rideshare or by any carpooling commuter in the state, free of charge.



Freight

Iowa Multimodal Freight Network

While the entire statewide network of airports, highways, rail lines, and waterways are important for freight movement, the most critical facilities and routes are part of two freight networks – the National Multimodal Freight Network (NMFN) and the Iowa Multimodal Freight Network (IMFN). The NMFN consists primarily of infrastructure of national and international significance; Iowa DOT designates the IMFN to compliment the NMFN by also identifying infrastructure critical to state and regional commerce. These networks are used to:

- Inform freight transportation planning
- Develop department policies for these corridors related to design and use
- Recognize corridors to protect and enhance for improved freight movement
- Assist with strategically directing resources and investments to improve performance

The designation criteria for the IMFN are shown on Table 3.7, and Figure 3.34 provides a map of the network.

Table 3.7: IMFN criteria and designations

Mode	Designation Criteria	Designations in Iowa
Aviation	Top cargo airports	Des Moines International Airport (DSM) and Eastern Iowa Airport (CID)
Highway	30% truck traffic, 1,000 average annual daily truck traffic, or 1,000 oversize/overweight permitted loads annually	4,027 miles of Interstate, U.S., and Iowa routes
Railroad	5 million tons per mile or direct connection to intermodal container facility	Roughly 2,400 miles of Class I and II rail lines
Waterway	Marine highways	M-29 Marine Highway (Missouri River) and M-35 Marine Highway (Mississippi River)

Source: Iowa DOT

Figure 3.34: Iowa Multimodal Freight Network

Source: Iowa DOT

Pipelines

While Iowa DOT has little direct involvement in pipelines, they are an important component of the freight transportation system and critical for the state. Pipelines are the dominant mode of transportation for liquid and gaseous energy commodities, typically transporting raw materials from areas of production to refineries and plants or moving finished products to terminals, power plants, and other end users.

There are approximately 42,216 miles of gas (distribution and transmission) and 4,448 miles of liquid pipelines in Iowa. This network supplies commodities such as anhydrous ammonia, crude oil, liquefied petroleum gas, and natural gas for residential and industrial consumption. Nearly all natural gas is delivered by pipeline directly to consumers. Liquefied petroleum/gas and anhydrous ammonia are usually delivered to above ground terminals where the product is shipped by truck to the final point of consumption.

Pipelines comprising the network include large diameter lines carrying energy products to population centers, as well as small diameter lines that deliver natural gas to businesses and households. The energy products carried in pipelines fuel everyday life in the state and nation. They heat homes, power the industrial base, dry crops, and enable our daily commutes. Pipelines are typically labeled as one of the safest modes for transporting energy products because they are usually underground and away from the general public.

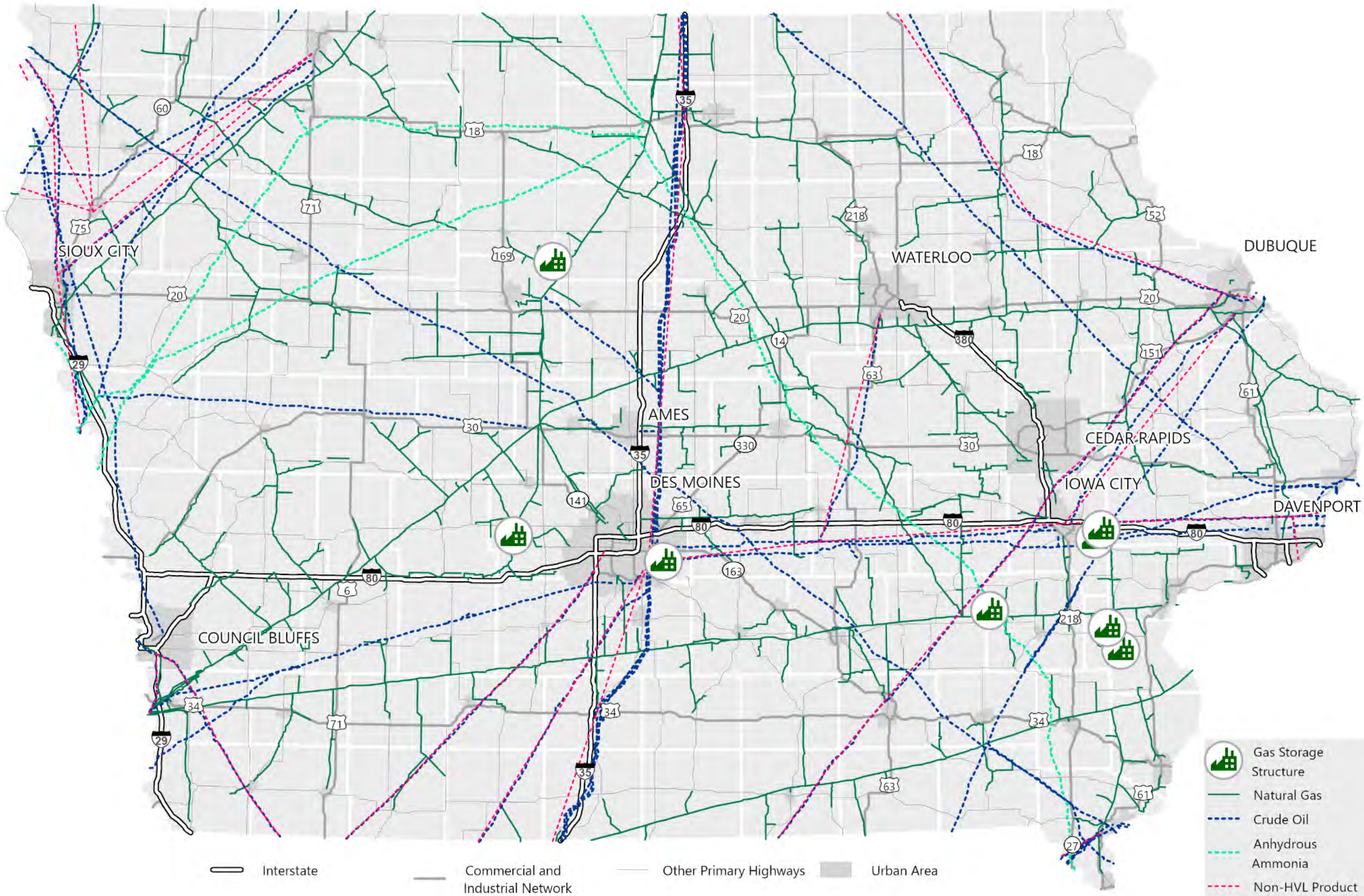
According to the U.S. Energy Information Administration, Iowa ranks fourth in the nation in consumption of liquefied gas in the form of propane, due primarily to the use in drying corn after harvest and heating one in eight households. Iowa is also the only non-crude oil-producing state among the top five energy-consuming states on a per capita basis, mainly due to the state's relatively small population and its energy-intensive industrial sector. Iowa's pipeline inventory is shown on Table 3.8 and mapped on Figure 3.35.

Table 3.8: Iowa pipeline mileage by commodity

System	Main miles	Service miles	Operators
Gas distribution	**18,936**	**15,088**	**60**
Natural gas	18,932	15,087	
Propane	4	1	
Gas transmission	**8,192**	**-**	**46**
Natural gas	8,192		
Liquid	**4,448**	**-**	**13**
Crude oil	672		
HVL flamm toxic	1,901		
Refined PP	1,875		
Total	**31,576**	**15,088**	**119**

HVL flamm toxic includes Highly Volatile Liquids (HVL), flammable, and toxic liquids.
Refined PP are petroleum products obtained by distilling and processing crude oil.
Source: Pipeline and Hazardous Materials Safety Administration

Figure 3.35: Iowa pipelines



Source: Pipeline and Hazardous Materials Safety Administration

Intermodal Facilities

Intermodal transfer facilities are identified in the planning process as critical parts of the state's highway, 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. The following 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 3.38 shows the locations of these types of freight-generating facilities.

Intermodal Container Facilities

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.

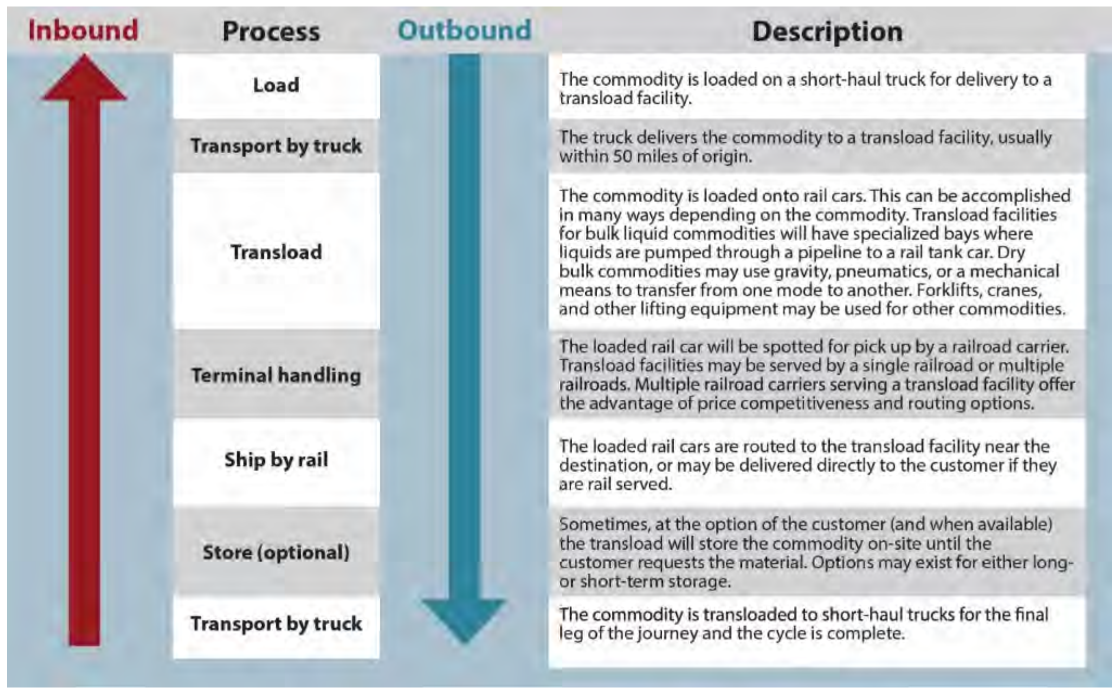
- **Container transfer facilities** handle rail-to-truck and truck-to-rail transfers in sealed units such as trailer-on-flatcar (TOFC) or container-on-flatcar (COFC).

Transload Facilities

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 3.36 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.

Figure 3.36: Transload process example

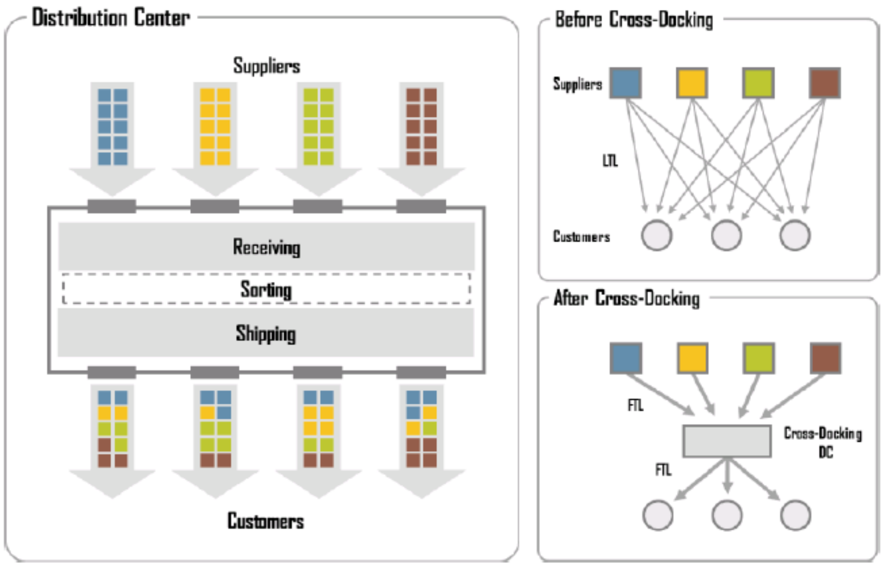


Process	Description
Load	The commodity is loaded on a short-haul truck for delivery to a transload facility.
Transport by truck	The truck delivers the commodity to a transload facility, usually within 50 miles of origin.
Transload	The commodity is loaded onto rail cars. This can be accomplished in many ways depending on the commodity. Transload facilities for bulk liquid commodities will have specialized bays where liquids are pumped through a pipeline to a rail tank car. Dry bulk commodities may use gravity, pneumatics, or a mechanical means to transfer from one mode to another. Forklifts, cranes, and other lifting equipment may be used for other commodities.
Terminal handling	The loaded rail car will be spotted for pick up by a railroad carrier. Transload facilities may be served by a single railroad or multiple railroads. Multiple railroad carriers serving a transload facility offer the advantage of price competitiveness and routing options.
Ship by rail	The loaded rail cars are routed to the transload facility near the destination, or may be delivered directly to the customer if they are rail served.
Store (optional)	Sometimes, at the option of the customer (and when available) the transload will store the commodity on-site until the customer requests the material. Options may exist for either long- or short-term storage.
Transport by truck	The commodity is transloaded to short-haul trucks for the final leg of the journey and the cycle is complete.

Source: Iowa DOT Rail Toolkit

- 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 3.37 shows a simple example of the cross-docking process.

Figure 3.37: Cross-docking process example



Source: Hofstra University

- **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 and heavier freight than both truck and rail.

- **Biodiesel and ethanol plants** are production facilities for renewable fuels made with corn and the byproducts of corn production. These locations typically receive raw materials by truck and ship finished biodiesel or ethanol by truck and/or rail. The opportunity to shift from one mode to another qualifies these locations as transloads.

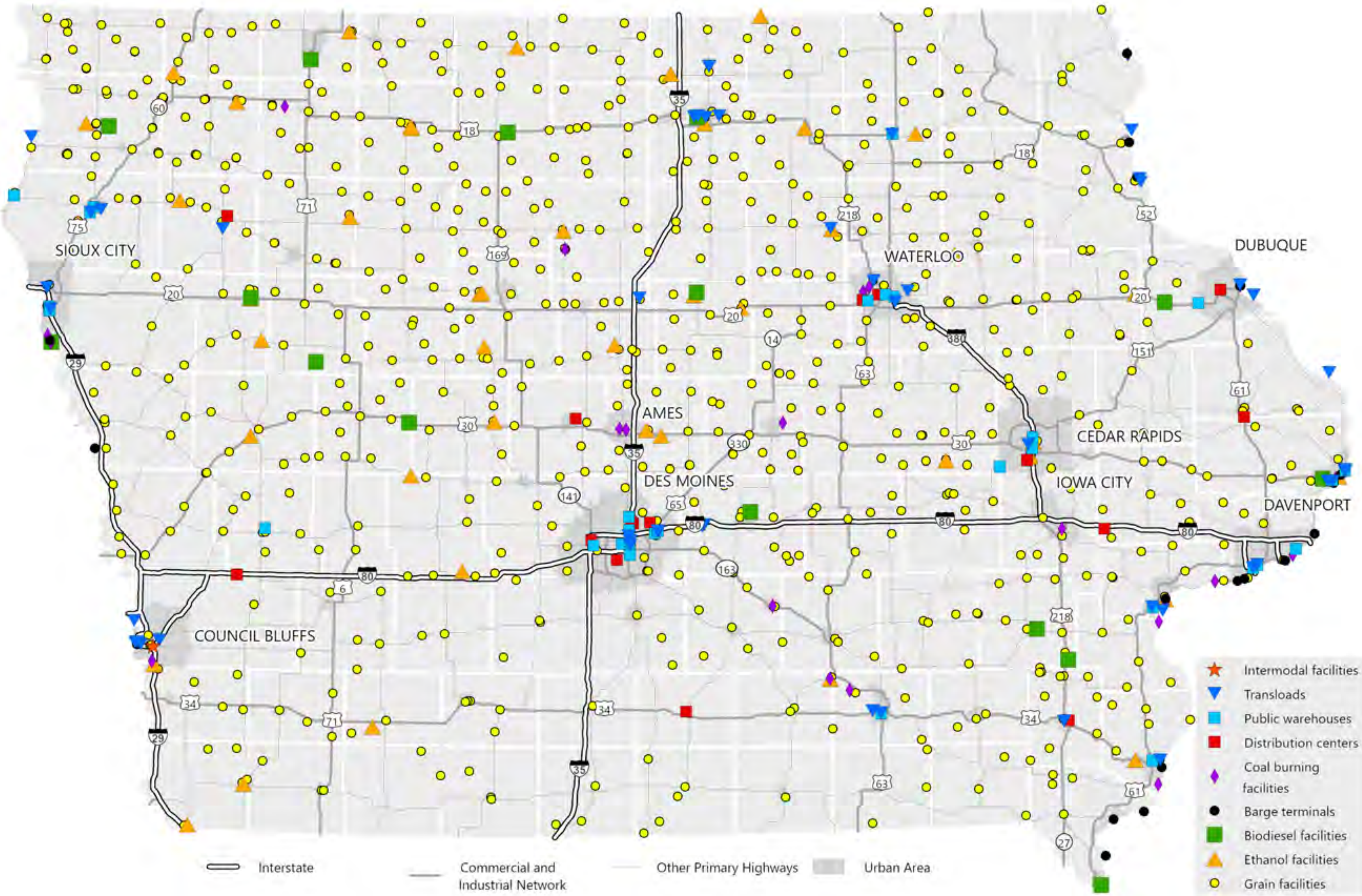
- **Grain elevators** are facilities that collect grain from farmers by tractor and trailer or truck. The grain is then stored and shipped to market via truck and/or rail. Iowa has a vast network of grain elevators to handle the large production of corn and soybeans each year before being transported elsewhere. As is the case with biodiesel and ethanol plants, the multiple transportation options qualify these locations as transloads.

The multimodal options within Iowa include a number of facilities 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; they can include transloading capabilities to offer short- and long-term storage and handling of goods.

- 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.

3.38: Freight intermodal facilities



This map is not a comprehensive representation of all of Iowa's freight-generating facilities Some existing facilities may not be operational and new facilities may not be represented.
Source: Iowa DOT, Leonard's Guide, Rail companies, U.S. Army Corps of Engineers

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 3.9 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 3.9: 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: FHWA

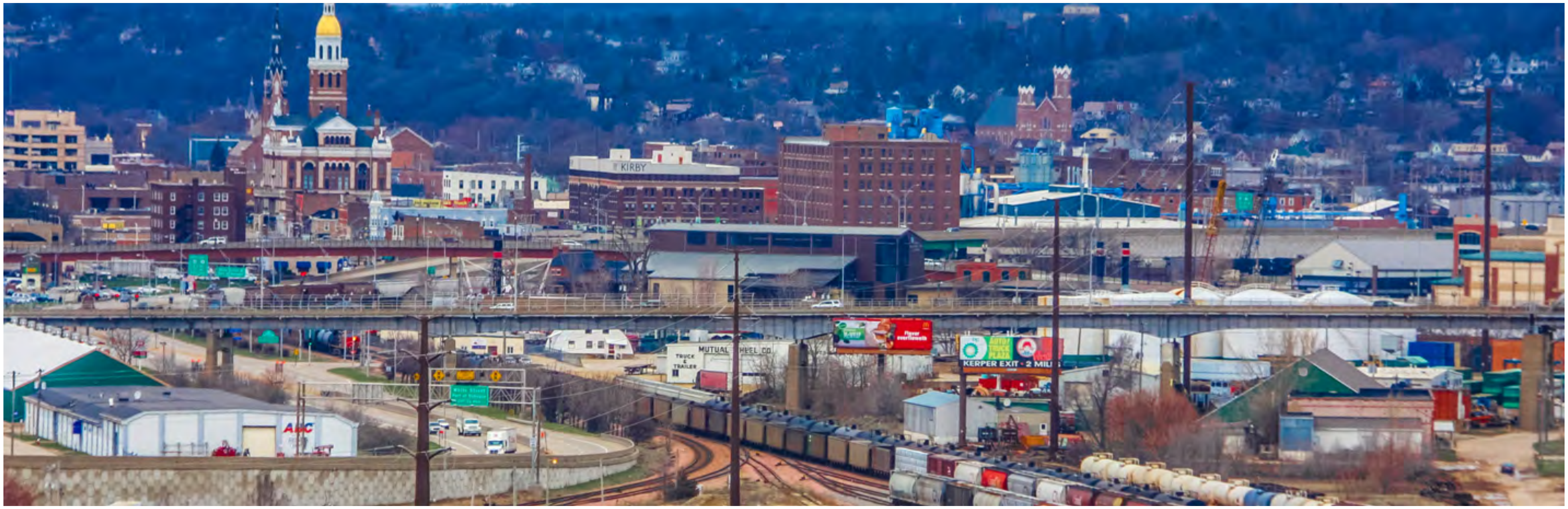
[1] The Quad Cities Container Terminal in Davenport is now closed.

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 efficiencies increased. Intermodal facilities that help interface between transportation modes can provide companies with a cost-competitive way to easily move goods from one mode to another, enabling the optimization of each mode's competitive advantage for the applicable portion of the trip.

While the intermodal facilities and connectors identified in Figure 3.38 and Table 3.9 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 facility known as Logistics Park Cedar Rapids is being developed just north of the Eastern Iowa Airport in southwest Cedar Rapids. The facility is expected to offer services that enable shippers to combine the benefits of rail and trucking. Facility elements that will help facilitate transfers between these modes will include 259,000 square feet of total warehouse space, over three dozen loading docks, and four rail car docks with three transloading tracks on-site.

Another intermodal facility is being developed in downtown Des Moines. A public-private partnership that includes support from a U.S. Department of Transportation BUILD grant, an Iowa DOT Rail Revolving Loan and Grant Program loan, and City of Des Moines tax abatement support is being used to construct the-40 acre terminal. The facility will feature up to 230,000 square feet of warehouse space, 12 loading docks, and rail connections with transloading capability to BNSF, Iowa Interstate Railroad, and Norfolk and Southern Railway.



3.8 Passenger and Commuting Trends

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

From 1990 to 2019, passenger travel increased by varying degrees across Amtrak, aviation, public transit, and highways (gauged by passenger vehicle miles traveled (VMT)). Passenger VMT was the only metric with a relatively consistent increase during those 30 years; the other modes showed more variability. The COVID-19 pandemic in 2020 had significant impacts on all passenger transportation modes, much more so than 9/11 or the Great Recession. Looking at long-term data for the four modes, only passenger VMT was higher in 2020 than it was in 1990. These trends are shown on Table 3.10 and Figure 3.39.

While the length of the recovery period from the COVID-19 pandemic impacts is uncertain, it seems likely that passenger travel modes will continue to increase, but at varying rates. Passenger travel trends are influenced by many factors, which can create some uncertainty in forecasting future travel trends. The price of fuel has perhaps been the most significant of these factors in recent years; for example, when fuel prices exceeded $4 per gallon there was a noticeable decrease in VMT and an increase in public transit ridership. However, other emerging trends will likely become more impactful in coming years and it may not be only the price of fuel that influences travel demand. These trends include increasing market share and use of electric vehicles, changes in travel patterns such as increased telecommuting, shared mobility and Mobility as a Service options, and potentially automated vehicles.

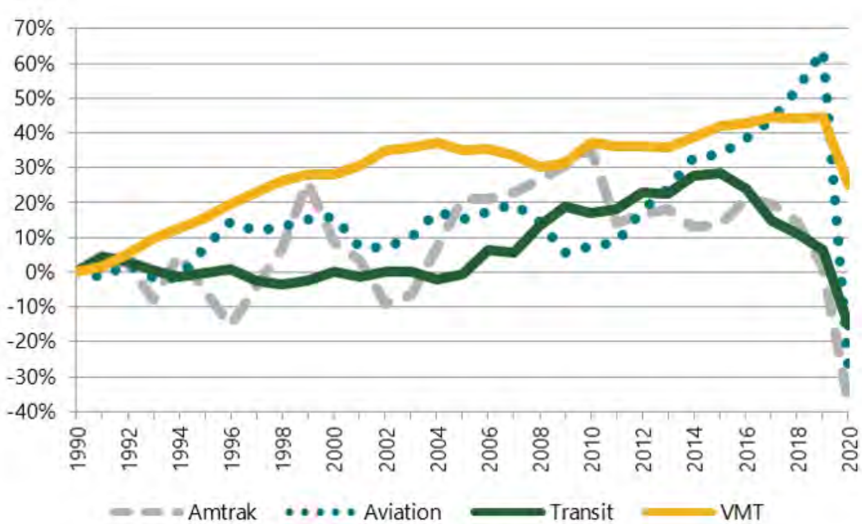
Table 3.10: Iowa Passenger Transportation Trends, 1990 – 2020*

	1990	2000	2010	2019	2020	Change, 2019-2020
Amtrak rides	50,719	55,146	68,744	51,499	31,601	-38.6%
Aviation enplanements	1,363,840	1,581,217	1,468,158	2,232,302	987,527	-55.8%
Passenger VMT** (billions)	20.418	26.128	28.004	29.,543	25.576	-13.4%
Public Transit	22,417,065	22,449,367	26,208,453	23,828,108	19,028,255	-20.1%

**Modes use different years for reporting statistics. Aviation enplanements and passenger VMT are measured for Jan. 1 – Dec. 31; Amtrak is Oct. 1 – Sept. 30; public transit is July 1 – June 30.*
***Passenger VMT includes passenger cars, light trucks, vans, SUVs, motorcycles, and buses over all road systems.*

Sources: Iowa DOT, FAA, Amtrak

Figure 3.39: Iowa passenger travel trends by mode, indexed to 1990

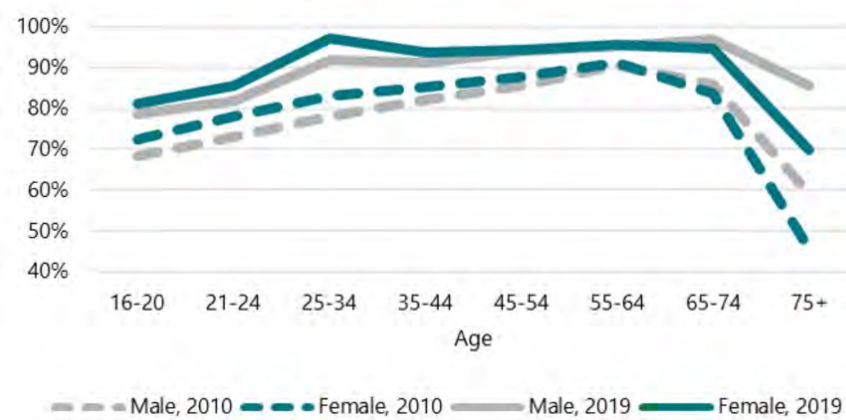


Sources: Iowa DOT, FAA, Amtrak

The percentage of the population with a driver's license has increased over time

Part of the reason that passenger VMT has increased over time may be that more of the population holds driver's licenses. The percent of the population that is licensed has increased for all age groups between 2010 and 2019; overall, 80% of Iowans 16 and over were licensed in 2010; this increased to 90% of Iowans 16 and over in 2019. Comparing driver's license rates for various age groups reveals some interesting trends. Females are licensed at a higher rate than males until after age 55. Licenses peak for both males and females in the 25-34 and 65-74 age groups. These trends are shown on Figure 3.40. During this same timeframe, vehicle registrations for personal vehicles increased by 7% to nearly 2.7 million vehicles. These trends suggest Iowa will continue to see increasing amounts of passenger travel on its highways.

Figure 3.40: Percent with driver's license by age and sex, 2010 vs. 2019



Sources: Iowa DOT, U.S. Census Bureau

Most Iowans drive to work by themselves, but many choose or rely on other modes

The overwhelming majority of Iowans drive to work alone rather than carpooling or using another mode. As shown on Table 3.11, from 1990 to 2015-2019, this trend continued to increase, while carpooling and walking to work saw the largest percentage decreases. Interestingly, the percentage of individuals working from home decreased during this time – a trend that reversed sharply during the COVID-19 pandemic in 2020. It remains to be seen whether the percentage of people working from home will return to closer to a pre-pandemic level or remain substantially higher into the future.

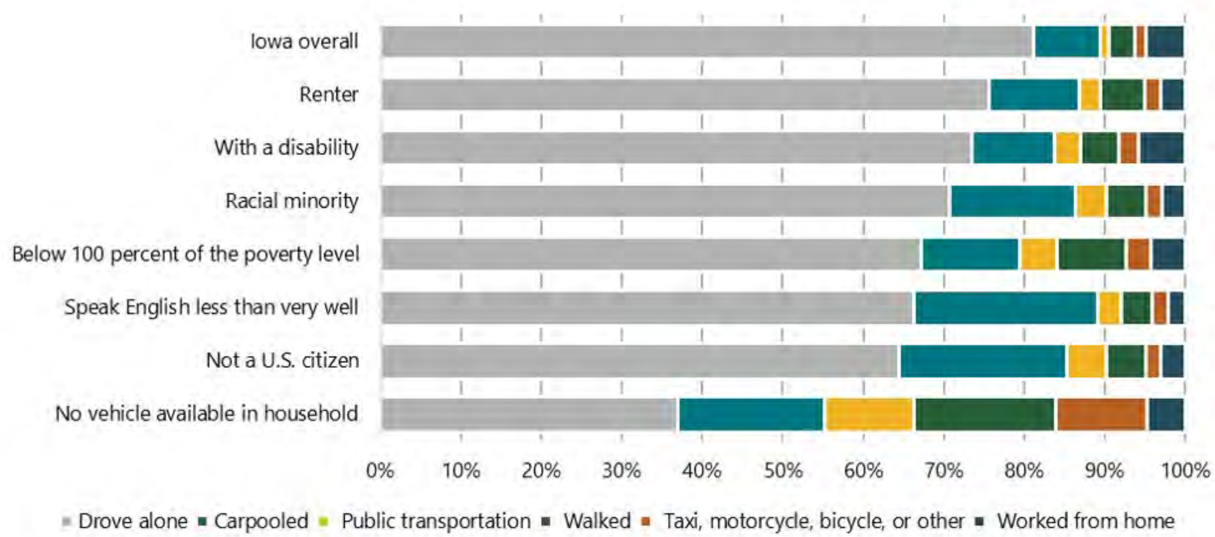
Table 3.11: Iowans' mode of transportation to work, 1990 and 2015-2019

	1990	2015-2019
Drove alone	73.4%	81.1%
Carpooled	11.9%	8.3%
Public transportation	1.2%	1.1%
Bicycle	0.3%	0.5%
Walked	5.8%	3.3%
Other (includes motorcycle and taxi)	0.7%	0.9%
Worked from home	6.7%	4.9%

Source: U.S. Census Bureau

Figure 3.41 breaks down the trip to work for various groups of people. In total, over 81% of Iowans drive themselves to work. Another 13% carpool or work from home. Other modes account for less than 6% of the total. Driving alone has increased and carpooling has decreased over the last few decades, but other modes have remained fairly constant. However, as shown in Figure 3.41, many groups of Iowans have greater usage of and/or dependence on carpooling and other modes. This helps highlight the need for planning for ways to travel other than single occupant vehicles.

Figure 3.41: How Iowans with various characteristics traveled to work, 2015-2019



Source: U.S. Census Bureau

The number of vehicles per household has increased, but not all households have vehicles available

Overall, approximately 6% of Iowa households do not have a vehicle. In some counties, it is as high as 13%, or more than one in ten households; there are also several counties where more than 40% of households have either one or no vehicles. While the statewide percentage of households without vehicles may seem relatively small, it still represents a significant area for multimodal planning. Households with one or no vehicle utilize non-driving modes for travel at a much higher rate than households with two or more vehicles.

Between 1990 and 2015-2019, the number of households with three or more vehicles increased 68%, while the number of households without any vehicles decreased 2%. As in 1990, the majority of households still have one or two vehicles. When comparing the number of vehicles and people in a household, over 60% of households have at least as many vehicles as people (of any age). Figures 3.42 and 3.43 illustrate these trends.

Figure 3.42: Number of vehicles per household in Iowa,1990 and 2015-2019

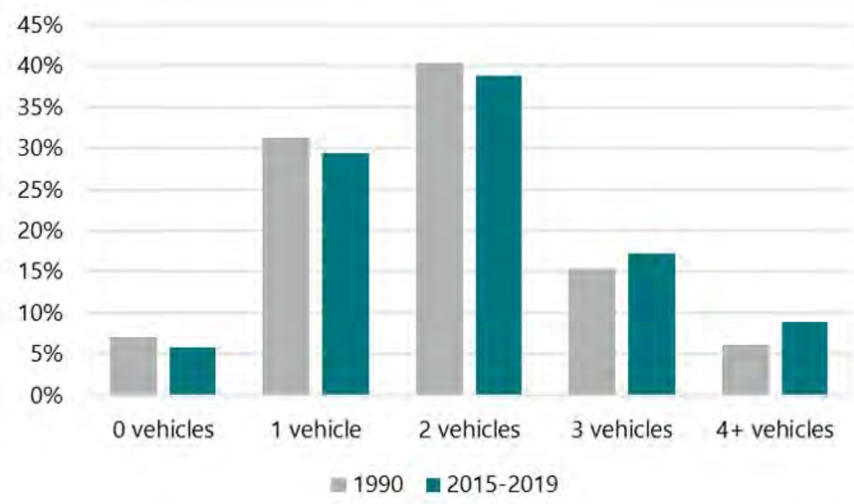
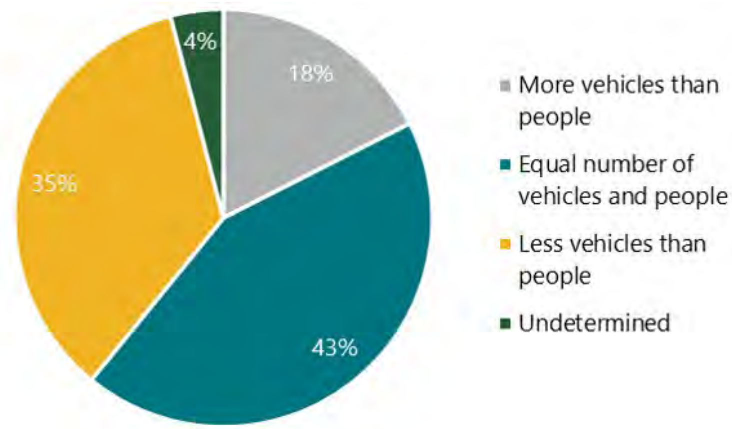


Figure 3.43: Number of vehicles vs. people in Iowa households, 2015-2019

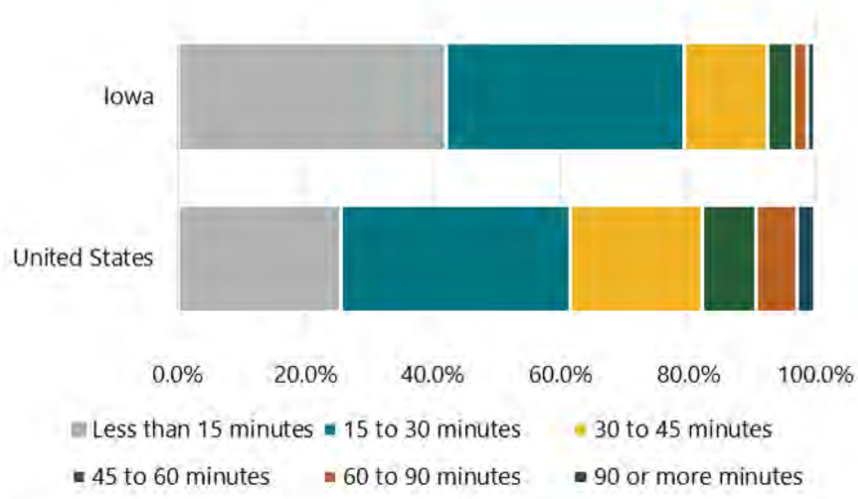


Source: U.S. Census Bureau

Average travel time to work has increased, but Iowans still have one of the lowest 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 21%, while the percentage of workers commuting less than 10 minutes decreased from 30 percent in 1990 to 24 percent in 2015-2019. Iowans' commute times are well below the national average, as shown in Figure 3.44.

Figure 3.44: Commute times for Iowa and the U.S., 2015-2019



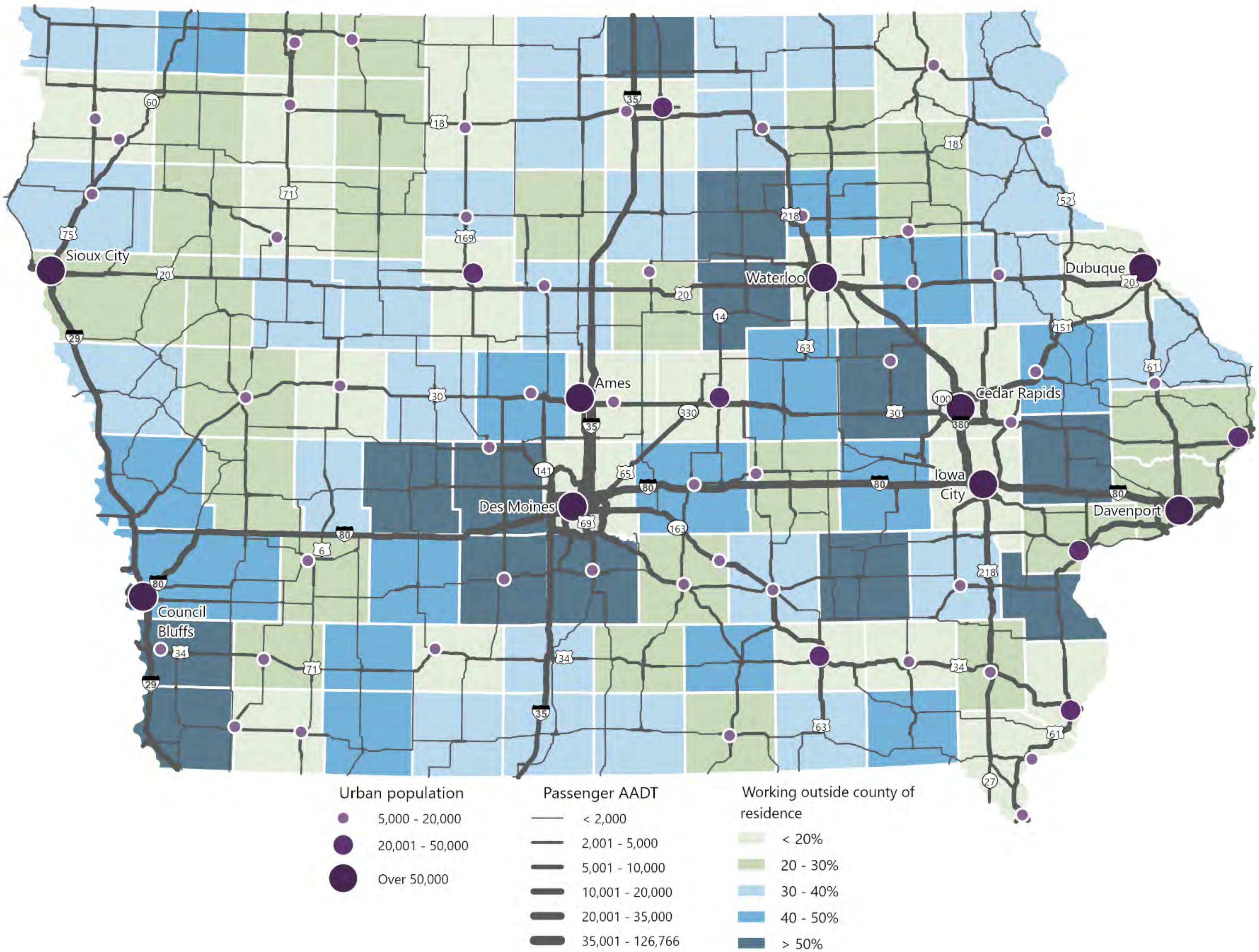
Source: U.S. Census Bureau

Iowans are commuting farther for work

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 2015-2019, this increased to 25 percent. In 2015-2019, more than 50 percent of the residents in 13 Iowa counties traveled to jobs outside their home county, compared to only two counties in 1990. Figure 3.45 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. There is a clear pattern of fewer workers leaving counties with large or medium-sized urban areas, while surrounding counties often have high rates of workers traveling out of county for work. With more Iowans commuting farther to work, it will be increasingly important to identify and maintain commuter routes and provide associated services. These patterns also offer opportunities for enhancing services such as carpool matching, vanpools, park and ride lots, and public transit services.

With jobs continuing to migrate toward Iowa's metropolitan areas, commuting has taken on more of a role to support the labor force needed in 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 2015-2019 American Community Survey estimated Polk County had approximately 253,000 workers age 16 and older, only 12 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 3.45: Commuting trends of passenger AADT and percent of workforce leaving county of residence to work, 2015-2019



Sources: Iowa DOT, U.S. Census Bureau

3.9 Freight Trends

Freight costs and efficiencies vary by mode

Iowa's freight system 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. In order to create the most efficient goods movements for various commodities, facilities to accommodate transfers between modes are vital.

Transportation costs play a large role in the decisions of Iowa shippers. Having various transportation options allows for cost savings and opportunities to optimize supply chains as each mode has different characteristics that may make the efficient transport of certain commodities ideal for one mode but not another.

Aviation handles the most time-sensitive and lowest weight cargo and has the highest shipping costs.

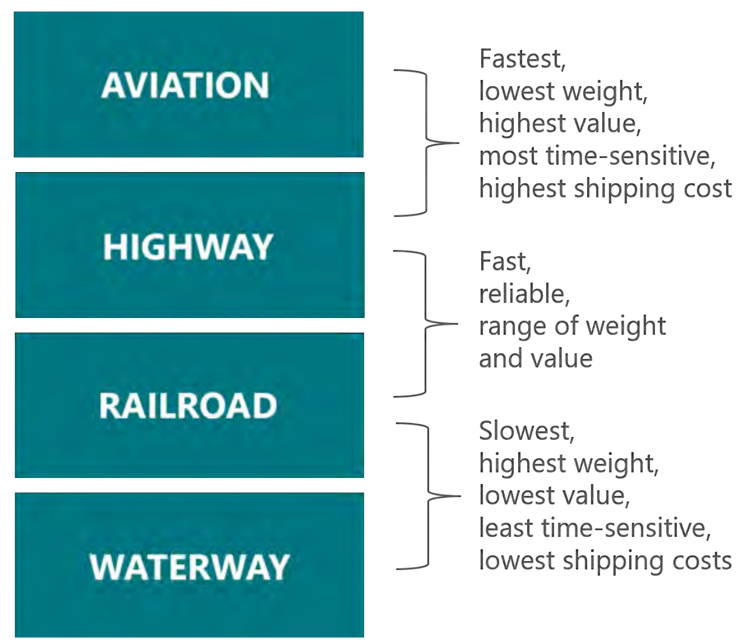
Most freight in Iowa is carried on the **highway system**. Although trucking movements are typically more expensive than rail or water transport, it is the most flexible. Trucks generally move small amounts of a few hundred pounds all the way up to 50,000 pounds per shipment. Truckload service providers move products using equipment such as dry van, flatbed, hopper, and refrigerated trailers.

Railroad movements are generally less expensive than trucking and more fuel-efficient but are 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 the freight modes. However, it is the most fuel-efficient, cheapest, and can handle the largest volumes per trip. One barge can handle as much as 70 trucks or more than 16 rail cars.

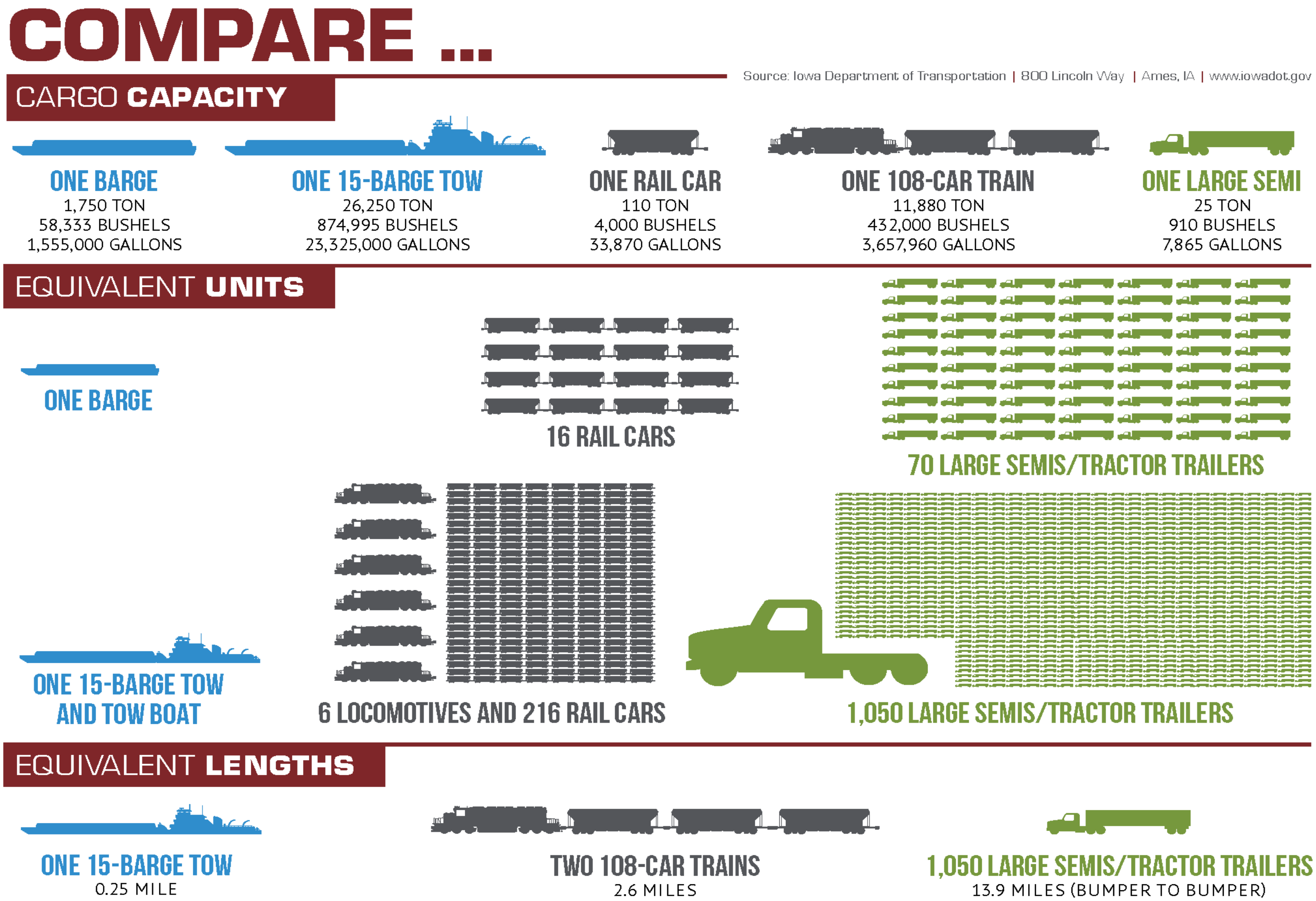
Figure 3.46 shows the general characteristics of various freight modes and Figure 3.47 shows the amount of freight various modes can transport, showing which modes can handle certain types of commodities most efficiently.

Figure 3.46: Freight mode comparison



Source: Iowa DOT

Figure 3.47: Freight tonnage comparison

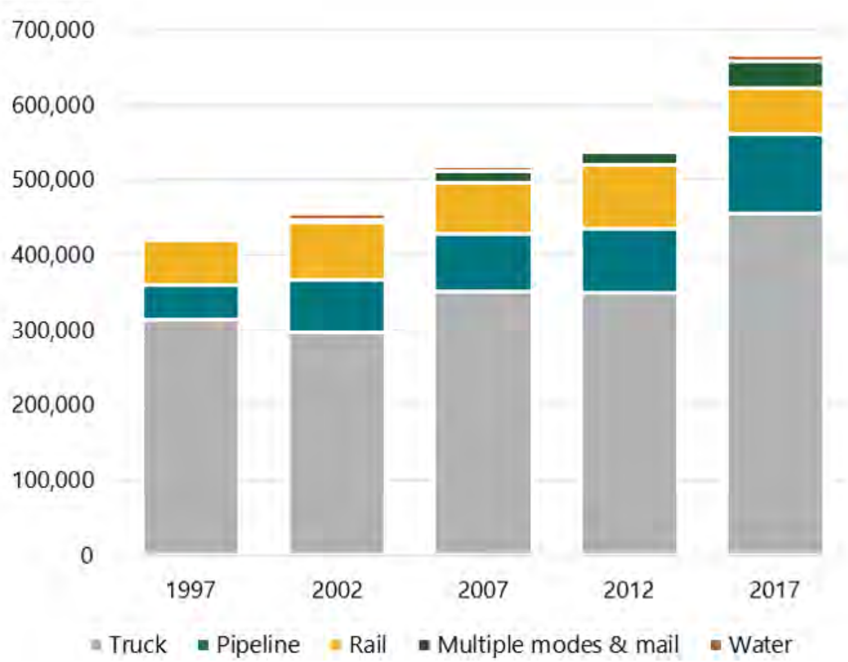


Source: Iowa DOT

Iowa's freight movements and growth varies across modes

Trucks carry the majority of freight that moves to, from, or within Iowa, accounting for 68% of tonnage on average between 1997 and 2017. Figure 3.48 shows the historical amounts of freight shipped by mode. Figure 3.49 separates the movements into inbound to, outbound from, and within Iowa in 2017. Trucks dominate movements that are solely within Iowa, accounting for 95% in 2017. However, pipelines and rail pick up much larger shares of weight that is outbound from or inbound to Iowa; water also has a more significant role for outbound freight due primarily to grain being shipped on the Mississippi River.

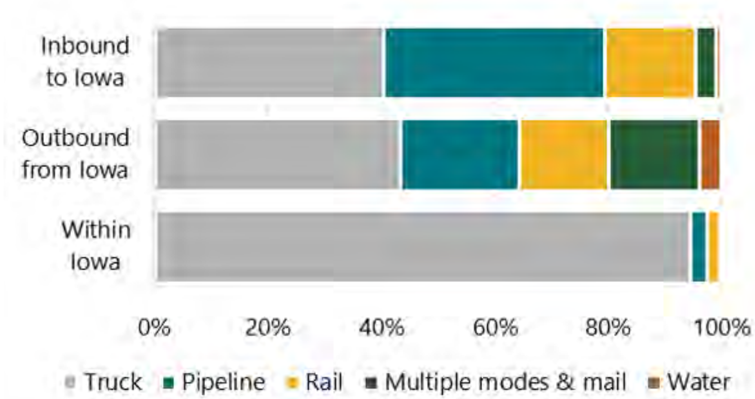
Figure 3.48: Tons of freight shipped within, to, or from Iowa by year and mode*



**The modes of air and other/unknown are excluded from the chart; together they account for less than 1% of freight movements over time*

Source: FHWA Freight Analysis Framework[2]

Figure 3.49: Percent of tons moved by mode*, 2017



**The modes of air and other/unknown are excluded from the chart; together they account for less than 0.2% of freight tonnage in 2017*

Source: FHWA Freight Analysis Framework

[2] Note: For statistics using FHWA Freight Analysis Framework data, the data accounts for trips to, from, or within Iowa, but not for trips that are solely through Iowa.

In terms of value, there is a wide variation among modes. Table 3.12 shows the overall value and weight of goods by mode, along with a dollar per ton figure. Of the four modes moving the most weight, only trucks come in higher than the overall average, which is $575 per ton. Relative to Iowa's population, in 2017 over 212 tons of freight and over $121,000 of goods were shipped per Iowa resident.

Table 3.12: Value, tons, and value of freight per ton moved to, from, or within Iowa in 2017

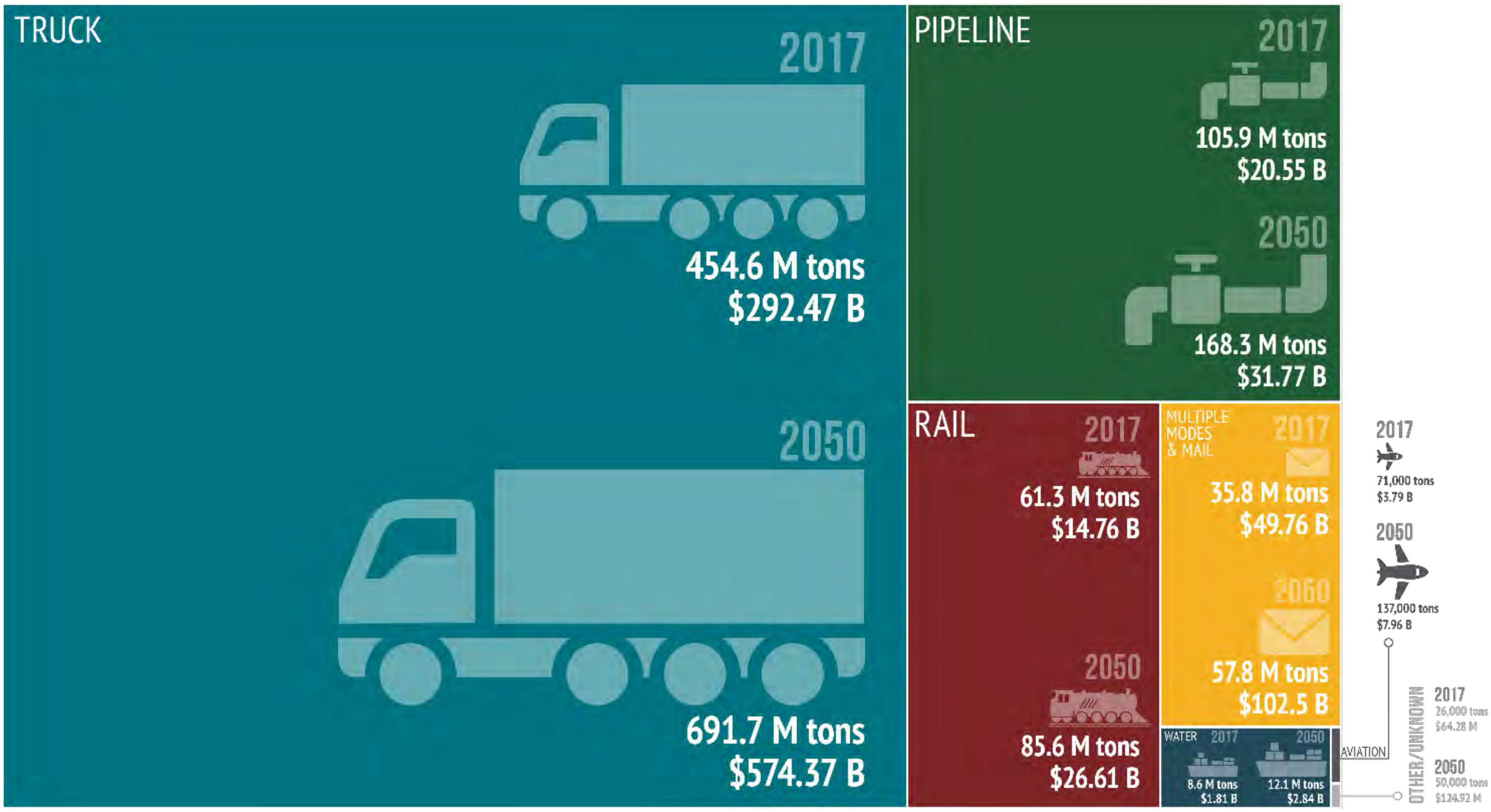
	Value (millions)	Tons (thousands)	Dollars per ton
Air (including truck-air)	$3,791.1	71.0	$53,397
Other and unknown	$64.3	26.1	$2,463
Multiple modes & mail	$49,757.8	35,763.4	$1,391
Truck	$292,470.0	454,629.6	$643
Rail	$14,759.2	61,348.7	$241
Water	$1,809.0	8,593.7	$211
Pipeline	$20,548.4	105,852.2	$194

Source: FHWA Freight Analysis Framework

Iowa's freight is expected to steadily increase

In 2017, Iowa's transportation system facilitated the movement of approximately 666 million tons of freight with an estimated value exceeding $383 billion. These numbers are anticipated to grow to over 1 billion tons of freight with an estimated value exceeding $746 billion in 2050. Figure 3.50 projects the change in tonnage and value between 2017 and 2050. Goods exported from Iowa are projected to grow more than goods imported into the state or moving solely within the state, showing Iowa's continued importance as a producer state.

Figure 3.50: Projected growth in tonnage and value of Iowa freight by mode, 2017-2050

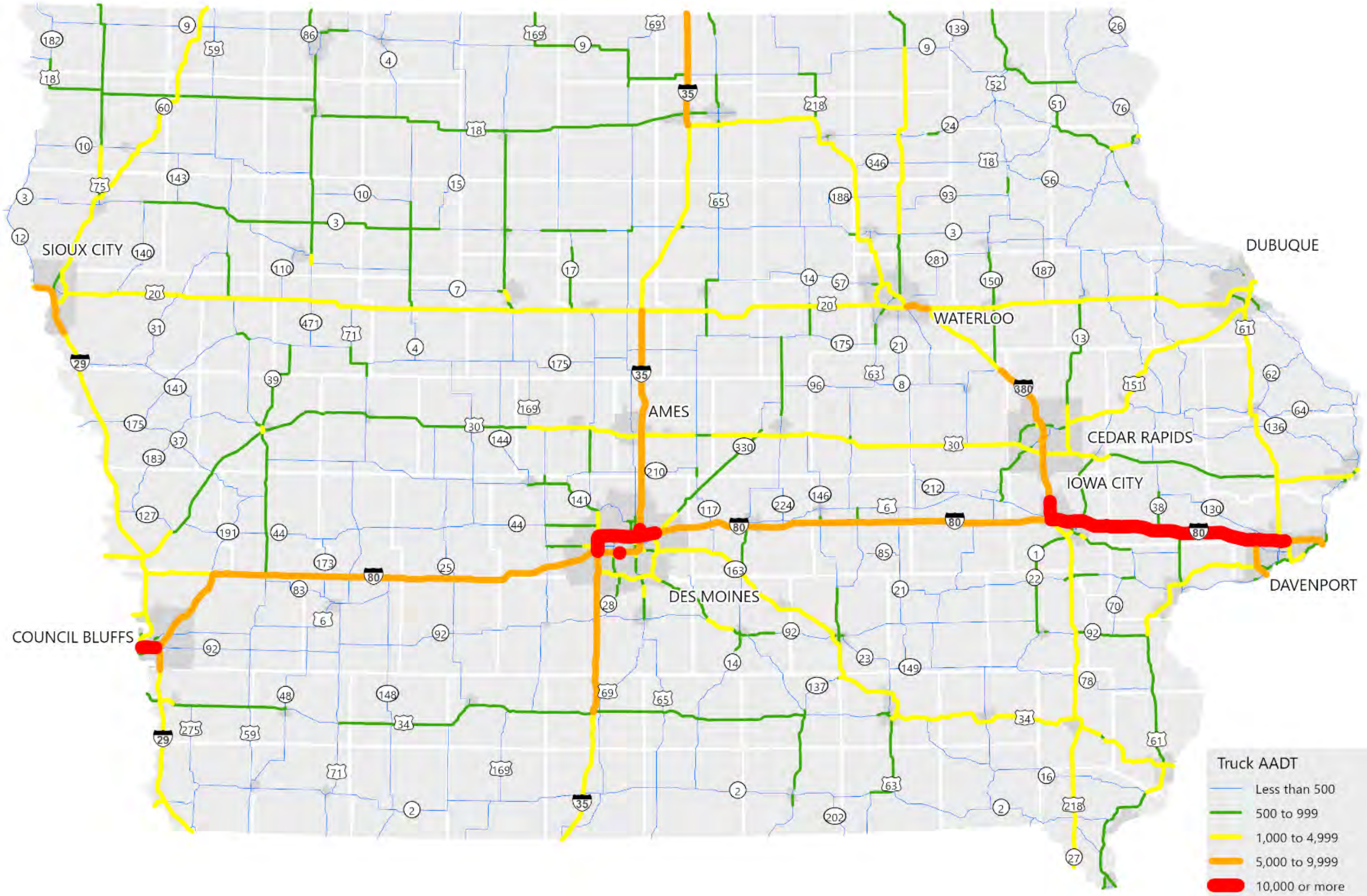


Source: FHWA Freight Analysis Framework

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 3.51). The Interstate System alone carried over 53 percent of the state's total heavy truck traffic in 2019.

Figure 3.51: Total annual average daily truck traffic (AADTT)



Source: Iowa DOT

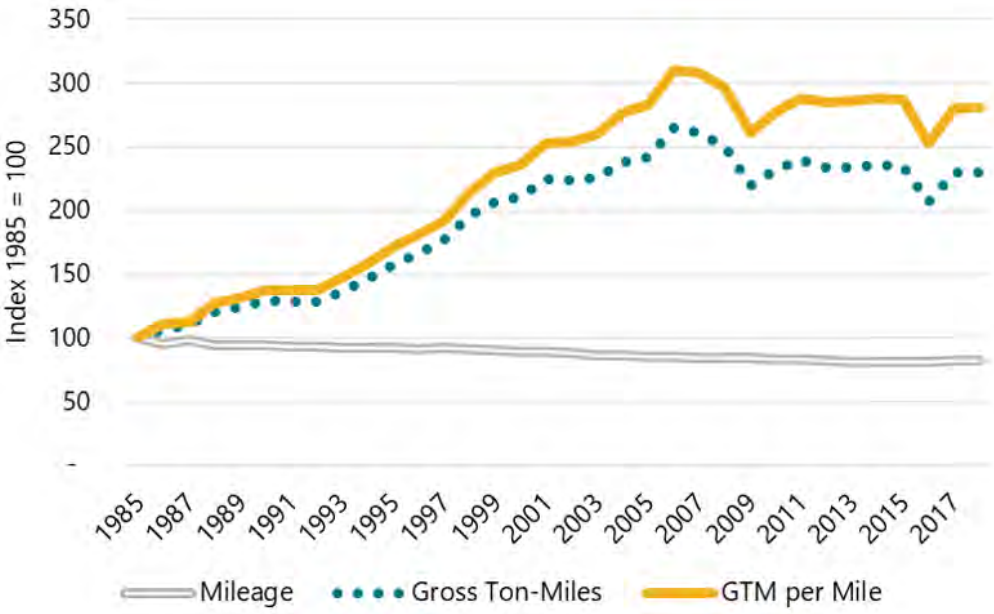
Increasing amounts of freight will move through Iowa via rail main lines

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 2018, gross ton-miles increased by approximately 130 percent while rail miles fell by 18 percent. Average rail line density has nearly tripled over the last three decades, primarily as a result of the increased through traffic moving on Iowa's main lines. As of 2018, the average rail line density in Iowa was 28.8 million gtm. Figure 3.52 shows how mileage has declined since 1985 while the amount transported has increased; Figure 3.53 shows Iowa's rail traffic density.

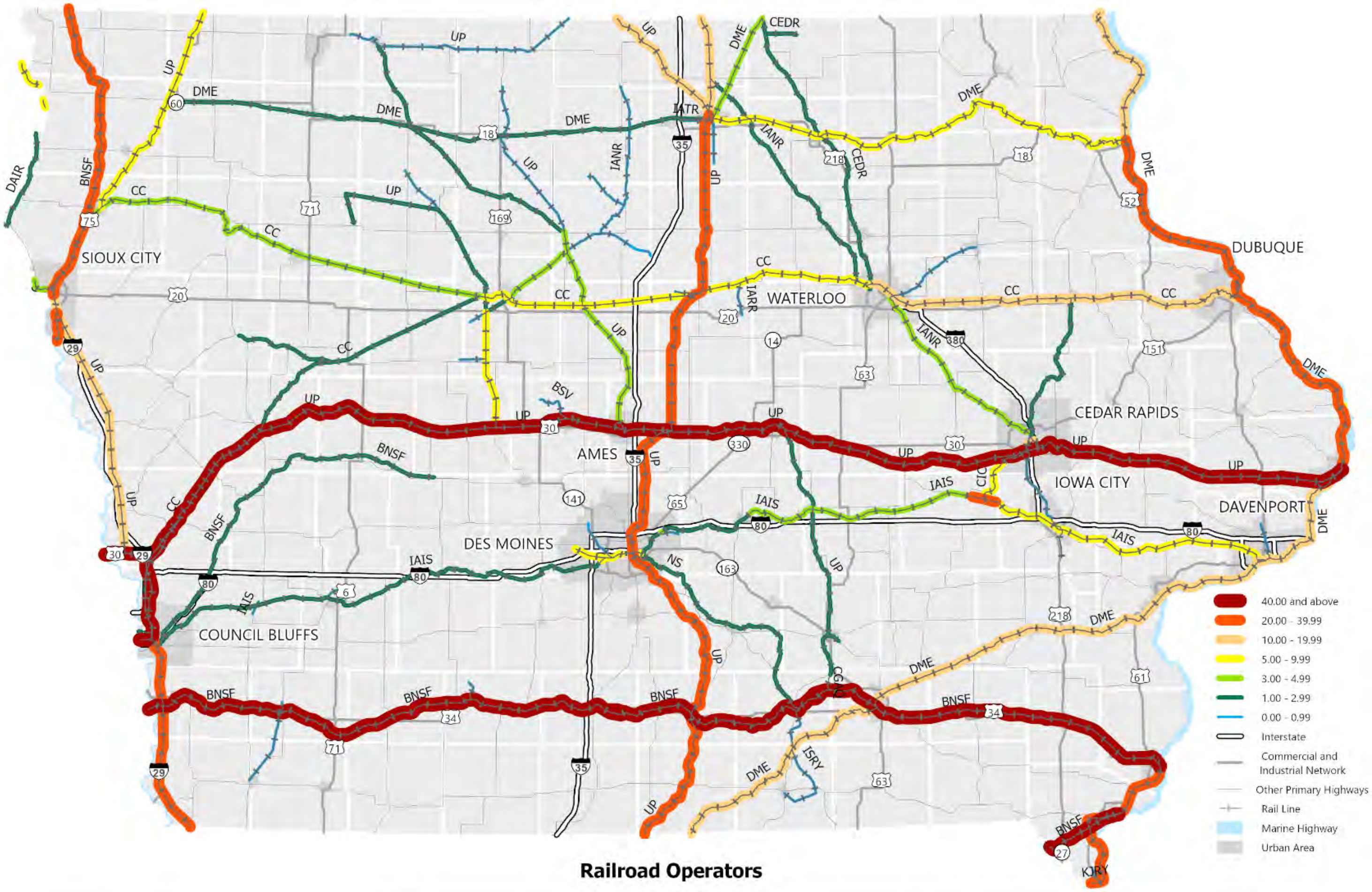
Additionally, railroads continue to focus their attention on heavier axle-load freight equipment and using longer, heavier trains to lower costs. Using larger rail cars in 100-plus car unit trains allows the greatest savings and economic benefits, and keeps would-be truck traffic off the highways, resulting 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 3.52: Mileage and gross ton-miles of Iowa's railroads, indexed to 1985



Source: Iowa DOT, Railroads' annual reports

Figure 3.53: Rail density, gross ton-miles per mile



Railroad Operators

BNSF--------------------------------------BNSF	D & I Railroad----------------------------DAIR	Keokuk Junction Railway-----------------KJRY
Boone and Scenic Valley R.R.--------------BSV	Dakota, Minnesota & Eastern------------DME	Morton Buildings Line------------------ZMBU
Burlington Junction Railway--------------BJRY	Iowa Interstate RR Ltd.--------------------IAIS	Norfolk Southern Railway Co--------------NS
Cargill-----------------------------------CGAQ	Iowa Northern Railway-------------------IANR	Shine Brothers Line---------------------SBSX
Cedar Rapids and Iowa City Railway Co.---CIC	Iowa River Railroad-----------------------IARR	Union Pacific-------------------------------UP
Cedar River Railroad---------------------CEDR	Iowa Southern Railway Company---------ISRY	
Chicago, Central & Pacific-----------------CC	Iowa Traction RR--------------------------IATR	

Source: Iowa DOT

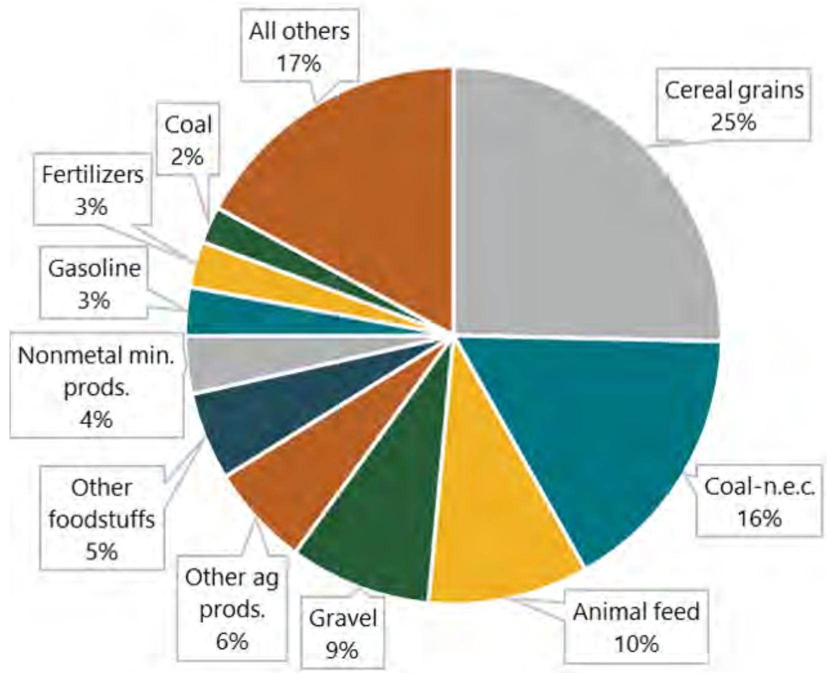
Iowa freight trade will continue to increase

Overall, 64% of the tonnage and 40% of the value of freight produced in Iowa has a destination within the state. For freight being imported or exported from the state, Iowa's regional trading partners provide markets for its producing industries and serve as suppliers to its consuming industries. The majority of Iowa's freight trade occurs with other Midwest states. Illinois, Minnesota, and Nebraska are in Iowa's top five states for both imports and exports. The other top states for exports include Texas and Louisiana, likely reflecting the importance of shipping grain and agricultural products south for overseas markets. The other top states for imports to Iowa are Wyoming, likely reflecting coal, and neighboring Missouri.

From a broader perspective, Iowa typically sends more to other regions in the U.S. than it receives from them, with the exception of the North Plains. This region sends more tonnage to Iowa than it receives from it, a large portion of which 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.

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 169 million tons of the freight that is moved within, to, or from Iowa, far more than any other commodity. This accounts for over 25% of total tonnage. Altogether, Iowa's top ten commodities by weight account for over 82% of the freight shipped to, from, or within the state; they are shown on Figure 3.54.

Figure 3.54: Top commodities moved to, from, or within Iowa by weight, 2017



Source: FWHA Freight Analysis Framework

4. OBJECTIVES AND CONSIDERATIONS

The first three chapters have outlined the need for a long-range plan and its place in the overall planning and programming process; the current characteristics of Iowa's people and economy and the trends likely to shape their future; the inventory, planning efforts, trends, and planning issues for multimodal planning issues for multimodal transportation system; and passenger and freight trends showing how the transportation system is utilized to get people and goods where they need to go. This basis helps form the background for developing a vision for what Iowa's transportation system needs to look like to successfully function into the future.

4.1 Vision

Iowa's multimodal transportation system is one of the foundations of Iowa's economy and society. The decisions made today regarding how to construct, operate, and maintain the system will significantly affect the state's future. This makes it important to have an overall vision for how the current and future transportation system should be managed and operated. The transportation system vision of the Iowa Transportation Commission and Iowa DOT 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 a sustainable manner.

This vision captures the overall intent of what the Iowa DOT is aiming to provide its customers, the traveling public. It is strategic and meant to be specific enough to help target limited financial resources, but it is also adaptable, because change is inevitable and can occur quickly.

The outcome of successful implementation of this vision is what we are calling **mobility**. In this context, mobility means the ability to utilize the transportation system to get where you want to go or to transport something from one place to another. While the department's focus tends to be on the infrastructure and services that facilitate transportation, the value those elements bring to society is the ability to use them as a means to an end – so individuals can get where they need to go.

The vision forms the foundation for the rest of this chapter, which will define how we can achieve it (system objectives) and other important factors (planning considerations). The way the Iowa Transportation Commission and Iowa DOT work towards the vision for the transportation system is ultimately through where investments are made – the activities of the Iowa DOT workforce, the maintenance work and construction projects that the Iowa DOT oversees, the way the system is managed and operated, and the funding that the Iowa Transportation Commission and Iowa DOT passes through or allocates to others for investments in non-primary highways or other modes. The system objectives described next will help guide those investments and activities.

4.2 System Objectives

As noted, the ultimate purpose of the transportation system is to get people and goods where they need to go – mobility. To know whether we are meeting or making progress towards that goal, we need to be able to define outcomes that can be measured. Through this State Long Range Transportation Plan (SLRTP), mobility is being defined through four outcomes – safety, sustainability, accessibility, and flow – which are all critical elements for a well-functioning transportation system. These ***mobility outcomes*** can also be thought of as ***system objectives***, or what we are trying to achieve with the system – that it is the safest, most sustainable, most accessible, and smoothest flowing that it can be for users.

The system objectives help form a framework for decision-making, shown in Figure 4.1. By defining what we are trying to achieve and how to measure whether we are achieving it, we can make better decisions about what projects to fund or which activities to undertake to make progress. This can be applicable at the broad level of the Five-Year Program or the relatively narrow scope of a grant program. The objectives can be woven into activities across the department, including other planning efforts, project evaluation criteria and tools, grant application scoring, and other business units' efforts.

The objectives are being established as part of the SLRTP because this document's role in guiding investment helps formalize them as part of the department's decision-making framework. They are system objectives for the long-term, analogous to the single-year objectives in the Business Plan that help achieve shorter term goals to build towards the vision outlined here. One of the strategies identified in Chapter 5 is integrating these objectives throughout the department's other planning efforts and processes. Chapter 5 helps summarize modal needs identified in other plans and highway needs and risks determined through various tools and analyses. The system objective framework outlines what areas decision-makers should be focusing on to help them prioritize among those needs and risks.

The objectives were developed through extensive work by an internal performance management working group, and they were refined by the Internal Planning Steering Committee that guided SLRTP development. The work was focused on which objectives to include, how to define them, and what areas to identify for monitoring progress. The committees chose not to develop overarching performance measures, but rather to allow business units to do so as they work to integrate the objectives into their work, so that the most appropriate measures can be identified and monitored for the specific function.

Figure 4.1: Iowa DOT system objectives

Source: Iowa DOT

Relationship to Federal Legislation

The current federal surface transportation bill, the Infrastructure Investment and Jobs Act (IIJA), maintained the ten transportation planning factors that were included in the prior bill, the Fixing America's Surface Transportation (FAST) Act. Each state is required to carry out a continuing, cooperative, and comprehensive statewide transportation planning process that provides for consideration and implementation of projects, strategies, and services that will address the planning factors. The system objectives and planning considerations discussed in this chapter are closely aligned with the ten federal planning factors, which are listed to the right. Table 4.1 shows how the system objectives tie to the planning factors.

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.

Table 4.1: Relationship between system objectives and federal planning factors

	Safety	Sustainability	Accessibility	Flow
Economic vitality				
Safety				
Security				
Accessibility and mobility				
Environment, energy, quality of life, and consistency				
Connectivity				
Efficient system management and operation				
System preservation				
Resiliency and reliability				
Travel and tourism				

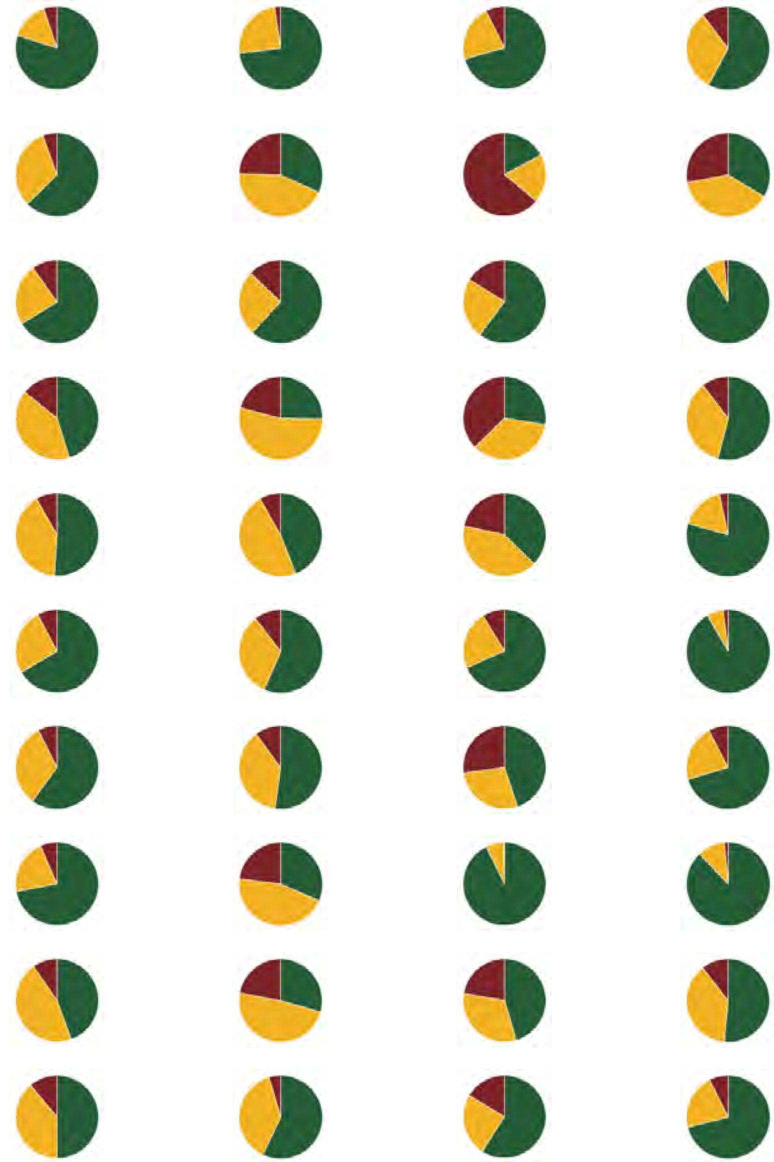
Source: Iowa DOT

Public Input

In 2021, public input was sought on the system objectives relative to various transportation modes and types of infrastructure. The aim was to identify whether individuals felt positive, neutral, or negative towards each transportation element relative to how **safe** they felt using it, how good of condition it was in (**sustainability**), how easy it was to **access**, and how much delay they expected (**flow**). The survey results, while only representing a small portion of Iowans, help show that feelings regarding these attributes vary significantly by mode/infrastructure. This is something to consider as system objectives are implemented across planning efforts. Table 4.2 shows the percentage of positive (green), neutral (yellow), and negative (red) responses for feelings related to the system objectives for the various modes/infrastructure.

Table 4.2: Public input survey results related to system objectives by mode/infrastructure

	Safety	Sustainability	Accessibility	Flow
Airports				
Amtrak				
Bicycle facilities				
Intercity bus				
Park and ride lots				
Pedestrian facilities				
Public transit (bus)				
Roadways				
Taxi service				
Transportation Network Company (Uber, Lyft, etc.)				

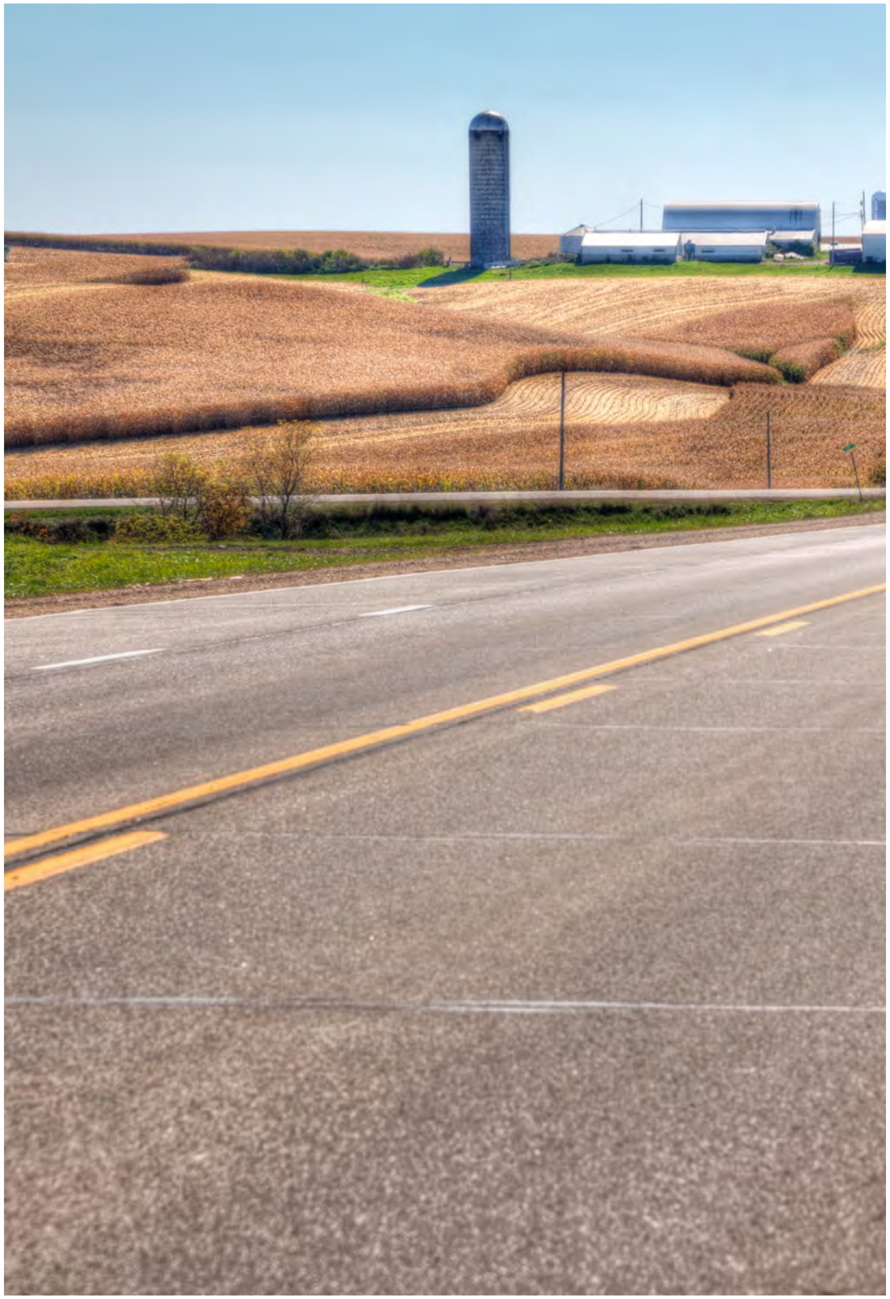


Note: green is the portion of respondents with a positive response; yellow is neutral; red is negative.
Source: Iowa DOT

4.3 Planning Considerations

The vision and system objectives help define the transportation planning decision-making framework and the core areas against which progress will be measured. Chapter 5 will transition to discussing needs across the transportation system and strategies to help implement the plan. Prior to defining needs and strategies, there are many planning considerations that merit discussion. Some of them share a name with a system objective, though all objectives relate to more than one of the planning considerations. Many of them also relate to the ten federal planning factors. These topics have been included based on their importance to the statewide transportation planning process and input from stakeholders. Several are also emerging planning areas that may not have standalone plans or may have relatively new plans.

- Asset management and stewardship
- Economic vitality
- Energy
- Environmental planning
- Equity, accessibility, and civil rights
- Land use, livability, and quality of life
- Resiliency and sustainability
- Safety
- Security
- Technology
- Travel and tourism
- Transportation systems management and operations



Asset Management and Stewardship

Transportation asset management (TAM) is a strategic, comprehensive, and proactive approach to managing transportation infrastructure. The overall goals of asset management are to minimize long-term costs, extend the life of the transportation system, and improve the transportation system's performance.

The Iowa DOT has been implementing TAM across its business practices and processes with increasing emphasis over the past several years. In the past, a combination of preventive maintenance and worst-first approaches were used to manage bridges and highways. In a worst-first approach, agencies rank their assets from worst to best condition and then work down the list repairing assets until they exhaust available funds. Often, the assets in the worst condition require expensive reconstruction. This approach is costly and leaves limited resources for preserving and maintaining other parts of the network. This issue is not confined to roads and bridges – managing assets applies across infrastructure and modes, as well as to capital assets such as transit buses, snowplows, and other equipment.

Asset management provides an alternative approach in which agencies strike a balance between reconstructing poor assets and preserving good assets so that they do not become poor. This balanced approach extends the useful lives of assets and is more cost-effective in the long run. Faced with budgetary constraints and an overwhelming need for investment in infrastructure, Iowa DOT's executive leadership determined that TAM was necessary for the successful long-term operation of Iowa's transportation system.

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.

It is important to note that stewardship 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 (some of which involve entities other than the Iowa DOT) 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, and good stewardship of all these elements is essential to keep the system operational.

Transportation Asset Management (TAM)

TAM is defined by the American Association of State Highway and Transportation Officials (AASHTO) as "a strategic and systematic process focused on business and engineering practices for allocating resources to assets throughout their lifecycles." 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 the Federal Highway Administration (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.

Asset Management Planning

While a variety of asset management activities occur across the Iowa DOT, two specific asset management plans are required by federal law – transit asset management plans and a TAM Plan for National Highway System pavements and bridges.

Transit Asset Management Group Plan

While large urban transit agencies develop their own TAM plans, Iowa DOT oversees a group TAM plan for the other 23 transit agencies in Iowa. The plan was initially developed in 2018 and will be updated every four years. The Iowa DOT sponsored the group plan to aid in the following.

1. Assessing of the current condition of capital assets.
2. Determining the condition and performance of assets.
3. Identifying unacceptable risks.
4. Providing guidance and technical assistance to group participants to balance and prioritize reasonably anticipated funds towards improving asset condition and achieving a sufficient level of performance within those means.

All group plan participants follow Federal Transit Administration (FTA) guidance for buses and bus facilities to ensure they are maintained in good condition and are safe to use. All systems have adopted vehicle maintenance policies that outline the necessary steps to follow.

Most federal assistance for bus replacements comes to the state level, necessitating a process for determining which vehicle replacements to fund across the state. The Iowa DOT uses the Public Transit Management System (PTMS) prioritization process. The Public Transit Bureau maintains an inventory of all existing transit revenue vehicles in the state, which is updated annually. The Iowa DOT prioritizes vehicle replacement and rehabilitation/remanufactured projects annually on a statewide basis based on age and mileage of existing vehicles compared to useful life standards for the specific type of equipment.

Transit facility assessments were also conducted as part of the asset management planning process. The Iowa DOT developed a tablet-based application to collect facility data and automatically calculate the condition assessment based on the Transit Economic Requirements Model (TERM) scale.

Transportation Asset Management Plan (TAMP)

Recent transportation reauthorization bills have included the requirement for states to develop transportation asset management plans for roads and bridges on the National Highway System. The Iowa DOT formed a steering committee in 2014 to oversee the development of the Iowa DOT's first TAMP. The initial TAMP was finalized in 2016, followed by versions in 2018 and 2019. The TAMP will be updated in 2022.

The TAMP describes how the Iowa DOT manages the existing highway system. Preserving and improving this system is critical for achieving the system vision discussed at the beginning of this chapter. The TAMP also helps connect this SLRTP and system/modal plans to the Five-Year Program, which identifies specific investments over the next five years. The TAMP has a 10-year planning horizon and helps align investments in the Five-Year Program to be consistent with Iowa DOT's longer-term vision.

The TAMP outlines the following information.

- **Asset inventory and condition data**: These are the foundation for managing transportation assets, and are needed for supporting asset management processes such as life cycle planning, projecting funding needs, developing projects, and monitoring asset performance.
- **Life cycle planning (LCP)**: This is the process of developing a strategy for managing an asset class to achieve a target level of performance while minimizing life cycle costs. LCP is a network level analysis intended to help lower costs and improve condition. Using its bridge and pavement management systems, the Iowa DOT can estimate the cost of managing its bridges and pavements and determine the optimal mix of treatments to achieve condition goals at the lowest cost.
- **Performance measures and gap analysis**: These are included to measure the current condition of assets, estimated benefits from asset treatments, forecast future asset conditions, and review budget constraints to assist in determining how to best manage bridge and pavement assets over time.
- **Managing risk**: This is an integral part of asset management. By anticipating, identifying, and planning for potential scenarios, the Iowa DOT can reduce uncertainty and mitigate the effects of risks.
- **Financial plan**: This presents the funding picture at the Iowa DOT, identifies revenues needed to maintain asset conditions today and into the future, and identifies any gaps between funding needed to meet condition targets and funding available. Investment strategies shape the DOT's spending to maximize return on investment and make progress towards state and national goals and targets.
- **Process improvements**: These are discussed since TAM is a process of continuous improvement. Each process used to develop the TAMP, whether it be LCP or risk management, needs to be reevaluated on an ongoing basis to keep practices current.

Iowa DOT's TAMP is not a fix for an emergency. It represents a way of doing business. When used effectively, the TAMP will assist Iowa DOT in preventing major problems by prolonging the life of Iowa's most critical assets and by planning for future replacements.

TAM Governance

The Iowa DOT has also established a TAM governance structure, which was identified as a need during the initial TAMP development. A team was assembled to design a process and governance structure for highway program development with the objectives listed below.

- 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 TAMP and long-range transportation plan.
- Propose performance targets, propose funding levels to achieve those performance targets, and coordinate the associated monitoring and reporting.

The TAM governance structure includes system teams for the topics of pavement management, bridge management, safety, and traffic operations; a TAM Technical Committee that brings together the leads from those teams and others in the department to work on asset management initiatives; a TAM Implementation Team that helps guide implementation of initiatives across the department, and a Program Team that incorporates the Executive Leadership Team.

Economic Vitality

The transportation system provides significant value to Iowa's economy, and has great value in and of itself. For example, the amount of funding that would be needed to replace all existing Iowa DOT highways and bridges is estimated to be over $36 billion, and that represents only a small portion of the state's overall multimodal transportation network.

Throughout Iowa's history, economic growth has occurred along transportation networks of all forms, from rivers to railroads to highways. While transportation networks and economic growth have a clear relationship to each other, it is not straightforward in terms of causality and importance. It is important that the potential economic impacts of transportation projects are considered during the planning process; likewise, it is important that areas planning for new developments of any type consider the transportation needs and impacts.

Economic considerations are integrated into the transportation planning process. 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, though these aspects must be balanced with limited resources and various transportation needs, such as safety, condition, connectivity, operations, and accessibility, just to name a few. The following items are a few specific economic-related initiatives the Iowa DOT is involved with.

RISE Program

The Revitalize Iowa's Sound Economy (RISE) program promotes economic development in Iowa through the establishment, construction, and improvement of roads and streets. The RISE program is targeted towards value-adding activities that feed new dollars into the economy and provide maximum economic impact to the state. The RISE Program has funded more than 840 city and county transportation projects and provided nearly $500 million in assistance to support the creation and retention of over 90,000 jobs over the program's 36-year existence.

Freight Network Optimization

This 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.

Certified Sites

The Iowa Certified Site Program was launched by the IEDA in 2012 to address the lack of project-ready industrial sites in the state. It is an independent, third-party certification program that considers a combination of national site location standards as well as Iowa's natural assets and industry needs. Certified sites must meet certain minimum requirements related to infrastructure availability (including transportation networks), environmental clearances, and other items related to being development-ready. Locations certified through this program may be eligible for higher RISE participation in local development projects.

Transportation 4.0

Following SLRTP adoption, the Iowa DOT, in connection with IEDA, developed a new statewide strategy supporting economic development called Transportation 4.0. As described in the plan, "We will target manufacturing, agriculture, and bioscience industries and challenge ourselves to implement technologies and strategies that move products and goods to market safer and more efficiently. With a focus on freight corridors, we will identify the plans and policies from our organizations that will benefit from integration, and we will partner with business stakeholders to refine our strategies and tactics."

Transportation 4.0 contains eight strategies with a series of short-term (1-3 year) action items that could be implemented by Iowa DOT. Strategies cover the areas of artificial intelligence, machine learning, and advanced analytics; advanced highway planning and analysis; transportation system resiliency and sustainability; energy and alternative fuel planning and infrastructure improvement; roadway digital infrastructure and dual-benefit investments; highest and best use of right-of-way (ROW); freight design and superload route compatibility; and emerging freight technologies.

Transportation 4.0 is being incorporated into this SLRTP by reference. Its strategies are included in the SLRTP Appendix.

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

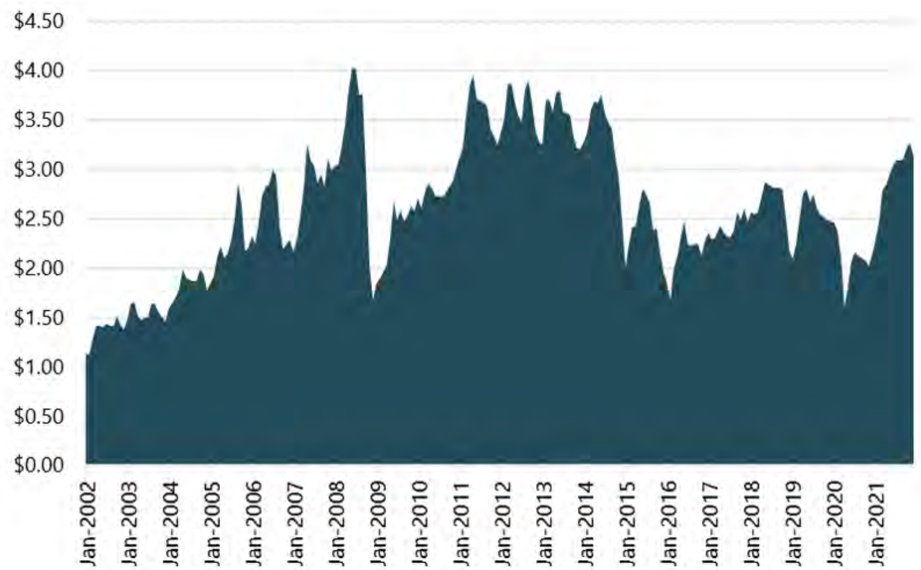
The Iowa Energy Plan was developed in 2016 as a joint initiative between the Iowa DOT and the Iowa Economic Development Authority (IEDA). Iowa's energy plan is a means to set state priorities and provide strategic guidance for decision-making while working to encourage energy, economic, and environmental 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 of the plan's strategies relate specifically to transportation, including expanding the use of alternative fuel vehicles in Iowa and optimizing the movement of freight and people to reduce energy use.

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 4.2 shows the average monthly price for gasoline in the Midwest from 2002-2021. The lowest price during that time was \$1.13 per gallon in February 2002, the highest price was \$4.03 per gallon in June 2008, and the average during the 20-year period was \$2.59 per gallon.

Figure 4.2: Gasoline price per gallon, 2002-2021



Note: based on the Midwest retail average monthly gasoline price per gallon for all grades, all formulations

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 addition to construction costs, the supply and cost of fuel affects the operational costs associated with maintaining Iowa's expansive and aging public roadway system. Volatility in fuel prices can make budgeting difficult, particularly if coupled with extreme weather, such as severe winter storms, which can compound impacts on operational budgets. Increased fuel costs reduce funding available for maintenance, resulting in further deterioration of the system and loss of useful life.

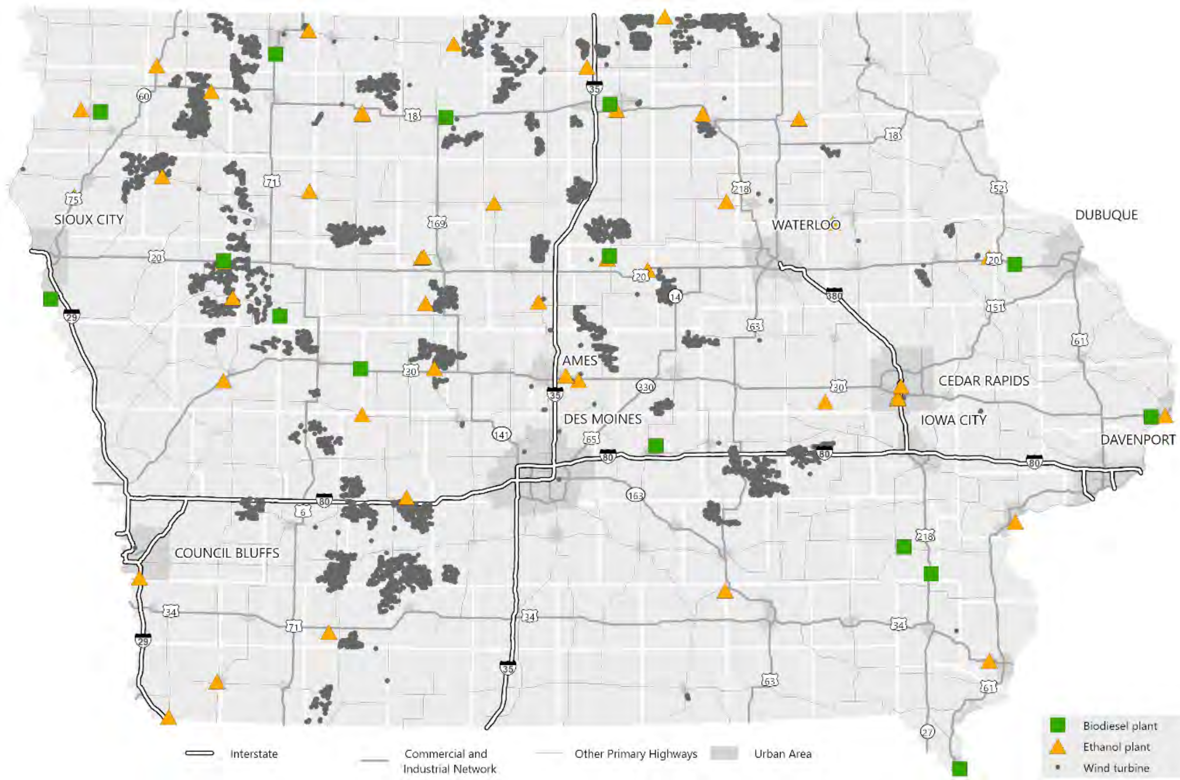
Energy Production and Movement

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 wind turbines or a biofuels plant; with the latter, traffic remains 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 4.3 shows the locations of Iowa's biofuel plants and wind turbines.

Ethanol and biodiesel fuels have become significant value-added products for Iowa's agricultural economy over the past few decades. Iowa produced over a quarter of the nation's ethanol and biodiesel in 2019, the most of any state, with a production capacity of 4.479 billion gallons of ethanol and 445 million gallons of biodiesel.

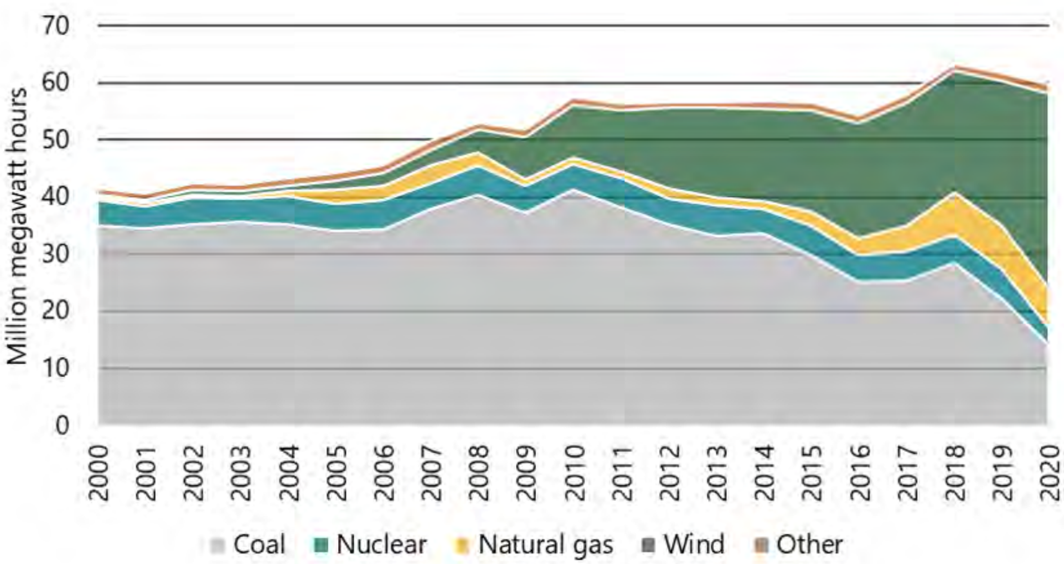
Figure 4.3: Iowa biodiesel plants, ethanol plants, and wind turbine locations



Source: Iowa DOT; U.S. Wind Turbine Database

Iowa has also become a leader in wind energy with 5,590 turbines operating statewide in 2020. A higher percentage of Iowa's electricity is generated by wind than any other state. Figure 4.4 shows trends in Iowa's electricity production since 2000. While overall electricity production has remained fairly level for the past decade, wind has overtaken coal as the source for the majority of Iowa's electrical power. Several manufacturing facilities in Iowa produce parts for the wind industry. 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. The increase in wind energy production also corresponds to a decrease in coal energy production, which results in less coal being shipped into the state, which is typically done via rail lines.

Figure 4.4: Iowa electricity generation by source, 2000-2020



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, and a significant portion of that is shipped through Iowa. 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, other 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 relatively low cost of diesel fuel, 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. In 2021, there were 3,200 battery electric vehicles and 3,183 plug-in hybrid electric vehicles registered in Iowa. While still a relatively small number, electric vehicle registrations have increased significantly over the past several years.

Iowa's Energy Plan outlines several strategies for expanding the use of alternative fuel vehicles in Iowa. Implementing the strategies will be key to ensuring the transportation system is able to evolve along with changes to the vehicle fleet. The strategies include:

- Plan for electric vehicle charging corridors
- Alternative fuel vehicles station code education
- Business model development for the electric vehicle market
- Incentives for alternative vehicle fueling infrastructure

In coordination with the Iowa DOT, the IEDA also led a study in 2019 titled Charging Forward: Iowa's Opportunities for Electric Vehicle Infrastructure Support. The report investigated the infrastructure support needed for electric vehicles, evaluated costs and benefits, and made several recommendations related to clarifying and updating state policies and procedures, advancing planning and development of charging stations, and maximizing benefits for consumers.

Infrastructure has been developing across the state to support alternative fuel vehicles. According to the U.S. Department of Energy's Alternative Fuels Data Center, there are now over 1,000 charging stations in Iowa with alternative fuels. Most are for electric vehicles or ethanol, but there are also stations with biodiesel, CNG, and propane.

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. To help address that, in 2019 the Iowa legislature passed changes in fees for electric vehicles. These include supplemental annual registration fees for passenger electric vehicles, a hydrogen fuel excise tax, and a per kilowatt hour excise tax for charging at non-residential charging locations.

Environmental Planning

National Environmental Policy Act (NEPA)

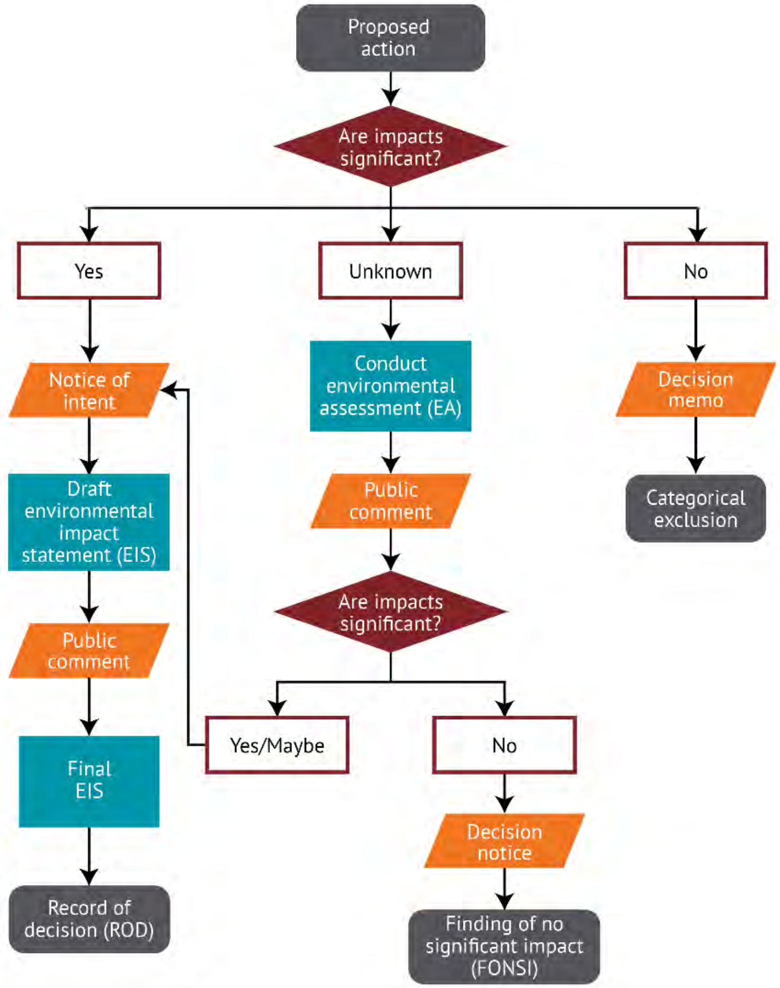
NEPA defines the process used by decision-makers to make informed decisions on proposed federal actions, which includes federally funded Iowa DOT actions. The NEPA process is an approach to balanced transportation decision-making that accounts for the potential impacts on the human and natural environment and the public's need for safe and efficient transportation. For recipients of federal funds, this means that before proceeding with a project, 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.

Levels of Environmental Analysis

Transportation projects vary in type, size, complexity, and potential to affect the environment. Their 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 4.5.

- 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.

Figure 4.5: NEPA document decision process



Source: U.S. Environmental Protection Agency

Planning and Environmental Linkages (PEL)

When possible, it is important to create an early linkage between planning and NEPA to develop early analysis and preliminary decision-making that can be incorporated into the project-level NEPA process. The Federal Highway Administration (FHWA) defines the use of PEL as "a collaborative and integrated approach to transportation decision-making that considers environmental, community, and economic goals early in the transportation planning process and uses the information, analysis, and products 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. This process allows all parties the opportunity to 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 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.

PEL feasibility studies provide the benefit of allowing planning-level decisions to be made for a study area and subsequently adopted into the NEPA process for 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. Also, FHWA notes that "To be viable in NEPA, a PEL study must involve interested State, local, Tribal, and Federal agencies as well as the public, document relevant decisions in a form that is identifiable and available for review during the NEPA scoping process and can be appended to or referenced in the NEPA document, and be accepted by the NEPA lead agencies."

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 PEL feasibility studies that have been vetted through this review process.

Completed PEL studies include:

- I-80 – rural portions statewide
- I-380 – from south of Cedar Rapids to just north of the I-80/380 system interchange
- US 30 – from just east of Lisbon to just west of DeWitt
- US 18 – from Garner to Spencer

Underway PEL studies include:

- US 75 in Hinton

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.

Example mitigation activities could include:

- Replace impacted wetlands at a 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.

Equity, Accessibility, and Civil Rights

Equity, particularly having equitable access the transportation system, is an important component of the transportation planning process. Civil rights laws exist to help ensure there is not intentional discrimination or barriers to system accessibility and use, but achieving a fully accessible and equitable system requires more than just meeting the minimums defined by law. This section will cover these closely related topics.

Equity

Equity is a topic that relates strongly to accessibility and civil rights. Accessibility is required to be able to use the transportation system, but accessibility may not be equitably available to all individuals. In a general transportation planning sense, equity means that the benefits and burdens of transportation are distributed fairly, and individuals have access to affordable and reliable transportation options that help them meet their needs. Fairly does not necessarily mean equally, as there may need to be additional consideration for underserved groups to be able to achieve the same level of access to and benefit from the transportation system as other groups.

Transportation policies and investments can directly or indirectly contribute to disparities; conversely, they can also help reduce the negative effects of existing inequities and improve quality of life. Thus, it is important to consider the ways transportation policies and investments impact equity and develop strategies and tools to support an equitable transportation system. While achieving full equity will require many community-specific and project-level actions, it is an important topic for system-level and long-range planning. Transportation infrastructure can have a lifetime that lasts decades and a significant impact on the land uses that surround it. Inequities that exist today are often the legacy of decisions that were made decades ago; it is important that decisions being made today do not contribute to these inequities or create new ones, but rather help us move towards a fully equitable system.

By necessity, system-level planning is typically conducted at a broad scale, and how the system is functioning is often distilled into singular performance metrics that are highly aggregated and may not accurately represent how the system functions for specific groups or users. It can be more straightforward to focus on the system and usage of it rather than users and their needs for it or access to it. Enhancing the emphasis on user and community perspectives on equity, accessibility, and mobility is an important step to take in order to more effectively integrate these views and needs into planning efforts and projects.

Accessibility

Accessibility can be thought of as an end goal of transportation – being able to get somewhere that you need or want to go – which is part of why it is so strongly related to equity. There are many different ways to view and measure accessibility, and questions such as the following can help in understanding whether a particular transportation mode, infrastructure, or service (all referred to generically as "system") is truly accessible.

- Is the system physically available and accessible by users with different ability levels?
- Is the system easy to use, safe, comfortable, affordable, and timely?
- Are there barriers that make the system more difficult or less desirable to use, such as limited service hours, winter weather, or congestion?
- Does the system provide access to desired destinations?
- Are mobility substitutes available, like telework or obtaining services via the internet?
- Do underserved populations have similar levels of access to the system as other populations?

Accessibility planning at a statewide level can be challenging, as the feasibility of using various modes, infrastructure, and services varies depending on the area being considered. A densely populated metropolitan area with hundreds of thousands of people differs significantly from a rural county with only a few thousand people. In Iowa, the vast majority of travel is conducted by personal vehicle, often with those vehicles only having a single occupant. This fact is unlikely to change in the near future. However, when considering the full population of Iowa (including children), more than 1 in 4 individuals are not licensed drivers. Taking a more people-oriented view, as opposed to traffic-oriented, and continually evaluating multimodal transportation options and including them in planning and project development is essential to continuing to improve accessibility.

These considerations can be implemented through a wide variety of planning efforts and policies. The Complete Streets Policy helped formalize accessibility considerations by requiring consideration of other modes. The policy notes that the Iowa DOT "shall view all transportation improvements as opportunities to improve safety, access, and mobility for all transportation users." In the area of automated transportation, as technology evolves and more use cases develop, it will be critical to ensure that these types of services are equitably accessible. They may be able to help with some commonly cited transportation challenges in Iowa, such as a lack of transportation options for older Iowans in rural areas and the challenges low-income workers that lack personal vehicles face in commuting to work. A recent initiative to improve accessibility of Iowa DOT rest areas has been to install adult changing tables, which helps meet a need for individuals that require assistance attending to their personal care in a restroom. In addition to accessing the transportation system, accessibility of transportation-related services, particularly those offered through the Iowa DOT's Motor Vehicle Division (MVD), is another important consideration. This will be discussed later in this section.

Accessibility/Mobility Analysis

An accessibility/mobility analysis was undertaken as part of SLRTP development. As previously noted, there are several ways to measure accessibility. The approach taken for this analysis was to focus on factors that may limit mobility, ability to access transportation infrastructure, and/or travel via a personal vehicle. The aim was to identify populations that may be more likely to have mobility challenges than the general public. While transportation planning should be conducted through a multimodal lens by default, these populations may be particularly in need of or best served by alternatives to driving. These populations may also be better served by non-traditional public outreach techniques. Future analysis efforts may work to integrate other accessibility considerations, such as availability of different transportation options and how many essential destinations can be reached by them.

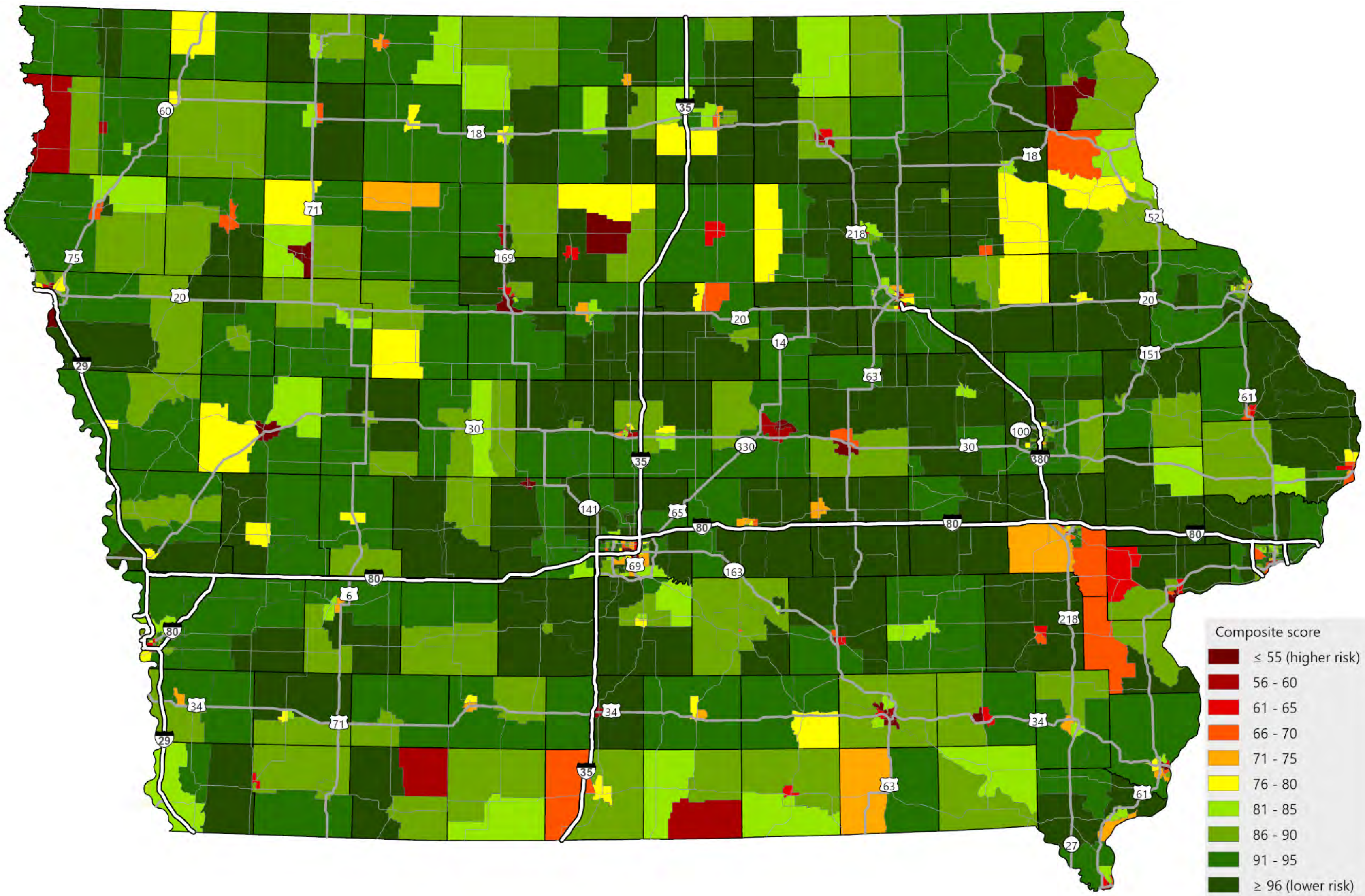
Analysis was conducted by using 2015-2019 American Community Survey data from the U.S. Census Bureau at the census tract level. The following ten attributes were included in the analysis.

- Youth – under 18
- Older adults – 65 and over
- Minority (non-White and/or Hispanic/Latino)
- Foreign-born
- Limited English proficiency
- With a disability
- Households below poverty level
- Zero vehicle households
- College enrolled
- Single parent households

The percentage of a tract's population for each attribute was used in the analysis, which was divided into a rural and urban analysis based on metropolitan planning organization boundaries. For each tract, the value for each attribute was normalized on a 1 (worst) to 10 (best) scale. The ten normalized values were then added together to determine a composite rating for the tract. The composite score had a maximum value of 100, which would mean the highest possible score was assigned for each factor. The higher a tract's score, the fewer mobility challenges its population has relative to other tracts in the state; lower composite scores indicate the most 'risk'.

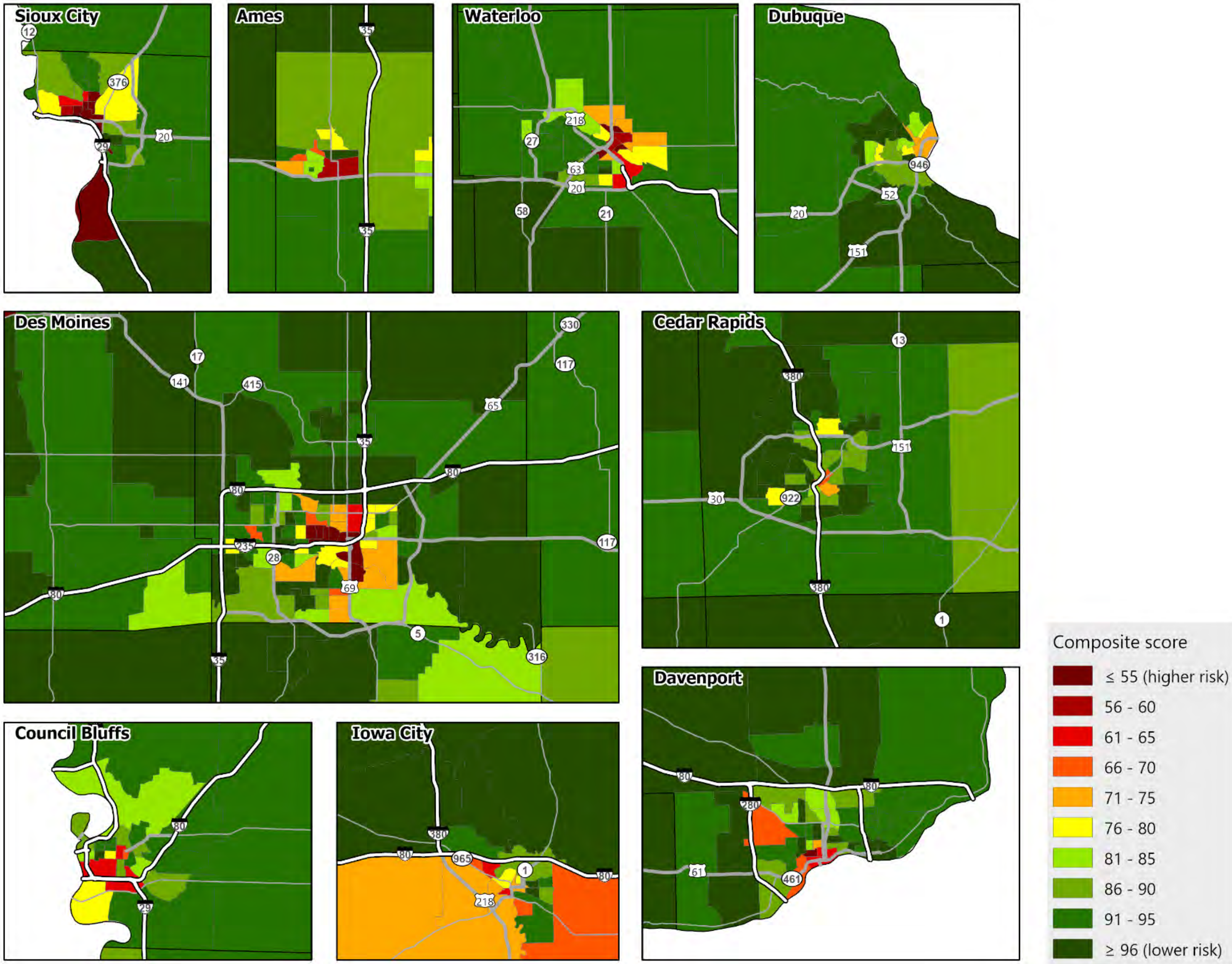
Overall, tracts ranking higher (lower scores) through this analysis tended to occur in the downtowns of large urban areas as well as around some small to medium sized communities around the state. Higher scores tended be associated with suburban and rural areas surrounding larger metros. The analysis helps identify locations where there is a greater risk of accessibility/mobility issues and where strategies related to multimodal transportation options and enhanced public outreach may be most beneficial. Figures 4.6 and 4.7 show the results of the accessibility/mobility analysis. The overall distribution of tract-level composite ratings ranged from 32-100, with an average score of 85.3. The Appendix includes additional information on the methodology and individual maps for each of the attributes in the analysis.

Figure 4.6: Accessibility/mobility analysis composite scores – statewide view



Source: Iowa DOT

Figure 4.7: Accessibility/mobility analysis composite scores – urban insets



Source: Iowa DOT

Motor Vehicle Division Services

To the average Iowan, one of the most visible parts of the Iowa DOT is the Motor Vehicle Division (MVD). MVD plays many roles in providing opportunities to businesses and individuals to have access to transportation. MVD ensures that individuals have proper licenses to safely drive and that vehicles meet safety standards and are legally titled and registered. The division provides services to businesses to ensure safe and efficient freight movements. MVD is focused on providing quality customer service and maintaining accessibility to individuals and businesses.

Driver and Identification Services

Driving lawfully requires a driver's license. MVD is responsible for reviewing and approving the state's driver education curriculum, including behind-the-wheel instruction to ensure new drivers have the skills and knowledge necessary to operate safely. This curriculum needs to be kept up to date to incorporate technology changes in vehicles and new trends in roadway design. MVD is creating a stakeholder group to advance the driver education curriculum to ensure the best preparation for new Iowa drivers. MVD and certain County Treasurers license drivers following the completion of both written and behind-the-wheel tests.

MVD takes special care to ensure that commercial drivers are properly trained, tested, and licensed with credentials that will be recognized across the country as goods flow to, from, and through Iowa.

MVD also ensures that all Iowa driver license and identification products meet federal legal identity needs. Iowa complies with federal REAL ID requirements and MVD is working to ensure that Iowans can have a REAL ID-compliant driver license or identification card that will allow individuals access to federal facilities and commercial air travel once the program takes full effect in 2023.

Vehicle Registration and Titling

MVD oversees the issuance of titles, registrations, and license plates by County Treasurers to more than 4.5 million personal and commercial vehicles. This is important to ensure safety as vehicles must meet federal standards and the title and registration process also informs customers of possible damage or mileage-based issues for vehicles. Proper titling and registration protects ownership status on vehicles, and MVD's dealer licensing program helps protect consumer rights.

The division supports efficient truck freight movements by coordinating Iowa's participation in international registration and fuel tax agreements. MVD issues permits to appropriate oversize/overweight loads that are necessary to handle special bulk commodities, large pieces of equipment, and components of key construction projects, including wind turbine blades.

Motor Carrier Support

MVD helps motor carriers keep freight moving in Iowa by ensuring that truck freight movements in Iowa remain compliant with state and federal law, and that oversize/overweight loads are completed safely by properly routing trucks to minimize adverse impacts to the transportation infrastructure. MVD coordinates Iowa's participation in the International Registration Plan, the International Fuel Tax Agreement, and the Unified Carrier Registration. These programs ensure that trucks moving to, from, and through Iowa are properly registered and that fuel taxes and registration fees are proportionally distributed among all member jurisdictions which contributes to ensuring a safe and efficient highway infrastructure across the United States and Canada. MVD issues special permits to oversize or overweight loads that are necessary to safely route large non-divisible pieces of equipment and components of key construction projects, including wind turbine blades and certain special bulk commodities through Iowa. This permitting process ensures that the loads can be moved safely and that critical infrastructure – especially bridges – is protected and does not experience abnormal degradation. MVD actively works to educate and support motor carrier partners and will be initiating a new program in 2022 to hold periodic in-person meetings with carriers to review the application process and address broad motor carrier issues.

Revenue Collection

MVD collects millions of dollars annually to support the Road Use Tax Fund from titles, vehicle registrations, fuel taxes, electric vehicle registrations, driver license fees, and special license plates. The MVD Accounting section balances, clears, and audits all financial transactions handled by MVD and County Treasurers.

Accessibility

MVD serves persons with disabilities by distributing parking placards and helps non-drivers navigate in society with legal identification cards. The division also issues titles for vehicles owned by government agencies, including for public transit and shared-ride taxi services.

MVD has also expanded its role in helping individuals access the transportation system through the Get There Your Way program, created to improve personal mobility and access to information regarding an individual's options for transportation, whether it be through driving themselves, using public transit, or relying on other services available to them. The MVD has also increased its outreach efforts to ensure its services are accessible to all groups in Iowa's communities. A specific example is the recent addition of an Iowa DOT employee at the Mitchellville Correctional Center and the Newton Correctional Release Center to assist offenders with their transportation options prior to their reintroduction to society. The MVD also has mobility "kits" available to bring licensing services to where people are, whether it be at special events or unplanned circumstances such as a natural disaster.

As technology evolves, the MVD is moving more of its services to easily accessible online options when possible, such as online commercial and noncommercial driver's license renewal. The MVD is also working to roll out mobile ID, which will provide individuals with the option of having an updated driver's license on their smartphone. From an operations perspective, the MVD continually works to improve communication with customers. This includes the recent creation of an Advance Customer Experience (ACE) team consisting of various subject matter experts. The ACE team's function is to take the more complex, difficult cases from frontline teams so that the flow of customer questions and needs can be met more expeditiously. This helps improve answers and responses to customers seeking information about their individual transportation needs.

These examples are just a few of the many ways that the MVD is involved in helping individuals and motor carriers access the system. Continued advancement of these initiatives will be critical to continue to improve the accessibility of transportation in Iowa.

Civil Rights

Equity and accessibility are goals of the transportation planning process that are merited whether they are required or not. However, there are many civil rights-related laws and executive orders (EOs) that the Iowa DOT works to ensure are incorporated into the transportation planning process and its day-to-day operations to safeguard that individuals are not discriminated against. While only a few of these regulations will be discussed in this plan, the department's Civil Rights Bureau works to ensure all civil rights and non-discrimination laws are incorporated into the department's work. To this end, the Iowa DOT assures that no person shall on the grounds of race, color, national origin, sex, age, and disability be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any Iowa DOT service, program, or activity regardless of whether those programs and activities are Federally funded or not.

Title VI and Limited English Proficiency (LEP)

Title VI of the Civil Rights Act of 1964 and its implementing regulations provide that no person shall be subjected to discrimination on the basis of race, color, or national origin under any program or activity that receives Federal financial assistance. The Iowa DOT has a Title VI Plan and Title VI Program and works to ensure its protections are fully implemented in department activities. LEP is a closely related topic. In 2000, EO 13166 was signed, entitled Improving Access to Services for Persons with Limited English Proficiency. It prohibits recipients of Federal financial assistance from discriminating based on national origin by failing to provide meaningful access to services to individuals who are LEP. This protection requires that LEP persons be provided an equal opportunity to benefit from or have access to services that are normally provided in English. The Iowa DOT has an LEP Plan that examines its services and the population it serves, identifies needs related to LEP individuals, and provides examples of providing meaningful access. An example of a commonly used technique is translating public meeting notices into other languages when there is a sizeable portion of the project area that speaks that language.

Environmental Justice

An overlapping but distinct topic from Title VI is environmental justice (EJ). EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, was signed into law in 1994 and requires that "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." The Federal Highway Administration (FHWA) defines EJ as "identifying and addressing disproportionately high and adverse effects of the agency's programs, policies, and activities on minority populations and low-income populations to achieve an equitable distribution of benefits and burdens."

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. 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 considered throughout the transportation planning process, including short- and long-range planning and public participation outreach efforts. Specifically, by identifying the transportation patterns of underserved groups 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 equitably as possible.

Americans with Disabilities Act (ADA) of 1990

Another issue closely tied to EJ under the umbrella of civil rights is compliance with the 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 the ADA. As a result, a transition plan was developed identifying specific steps the Iowa DOT will take to achieve ADA compliance. 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.

To ensure ongoing compliance with ADA requirements, the Iowa DOT will perform periodic reviews of the transition plan and update it as necessary. Implementing the transition plan has involved evaluating and planning for numerous infrastructure assets, including:

- Iowa DOT buildings.
- Public transit facilities (bus stops and shelters) in the state right-of-way.
- Bicycle facilities within the state right-of-way.
- Pedestrian facilities, including curb ramps and traffic signal call buttons, within the state right of way in municipalities with less than 5,000 people. (Those over 5,000 should have their own transition plans.)

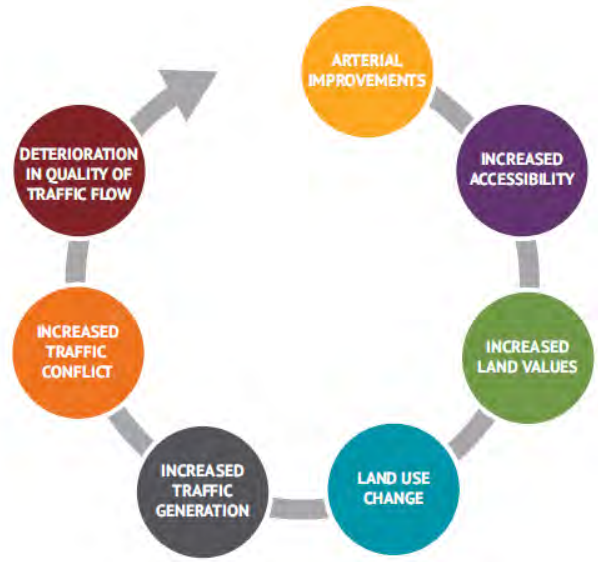
Land Use, Livability, and Quality of Life

Federal surface transportation reauthorization bills have continued to emphasize the need to consider land use and quality of life as one of the ten transportation planning factors. In land use planning, areas are often classified to accommodate a variety of uses, such as residential, commercial, industrial, agricultural, and others. Coordinating land use and transportation planning is essential in creating more sustainable, vibrant, and well-connected communities. Several recent planning initiatives 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 lead to the loss of 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 4.8 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 4.8: Transportation and land use cycle



Source: FHWA

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. Transportation enhances quality of life both by providing these vital connections and options, and also by being an attraction in and of itself, such as a highly developed trail system. These types of features can be key for businesses looking to recruit and retain workers.

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.

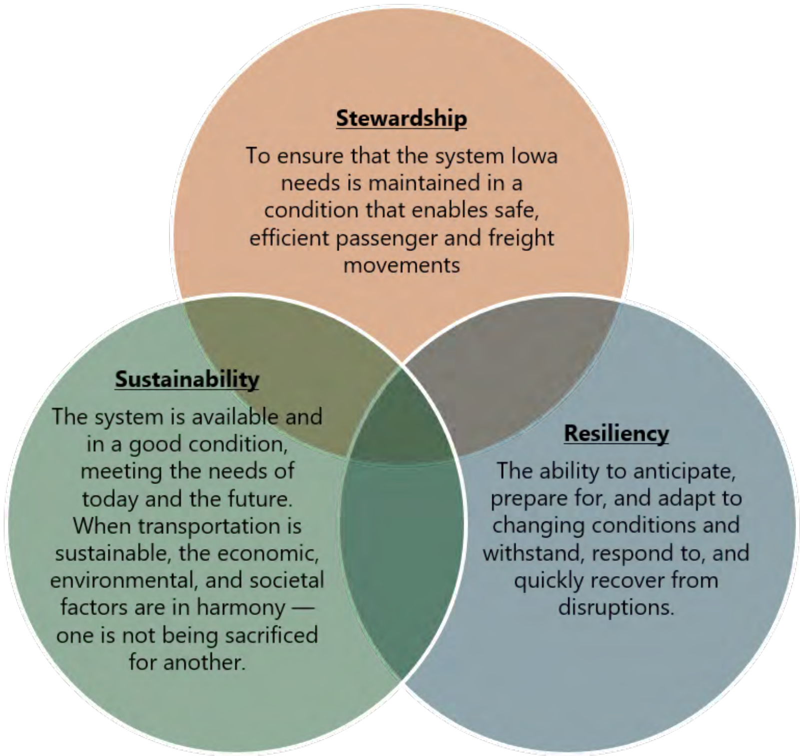
Resiliency and Sustainability

Iowa's extensive transportation system empowers the movement of people and goods throughout the state to reach diverse destinations. This network provides a reliable backbone to the state's economy and serves as a crossroads for economic productivity for the nation. However, this system, like all systems, is vulnerable to disruptions in the form of natural and human-induced events. While resiliency and sustainability activities have been occurring for some time, the focus on them and enhancement of them has increased significantly in recent years. Resiliency and sustainability are building blocks of stewardship. The Iowa DOT has the responsibility not only to meet the expectations of the public to ensure that the system is available and in good condition, but that it will continue to be so in the future, despite pressures from fiscal constraints and increasing natural disasters. Incorporating resiliency and sustainability principles into the decision-making process and project development will further support the Iowa DOT's commitment to stewardship of Iowa's transportation system. Iowa DOT's definitions of these three elements are shown in Figure 4.9.

Over the last couple of decades, Iowa has been increasingly impacted by natural disasters, including historic flooding, snowstorms, tornados, and derechos. This trend is likely to increase as climate data shows strong trends towards increasing temperatures, precipitation, stream flows and flooding. Additionally, awareness of human-induced disruptions has amplified as vigilance for potential terrorism and cyberattacks has increased. Examples of potential disruptions to Iowa's transportation system include the following.

- Human-induced hazards
    - Averse actor physical threat
    - Congestion
    - Crashes
    - Cyberattack
    - Asset failure

Figure 4.9: Stewardship, resiliency, and sustainability



Source: Iowa DOT

- Natural, environmental, and extreme weather events
    - Flooding
    - Erosion
    - High wind
    - Increased precipitation (e.g., rain, snow, ice)
    - Landslide/rockfalls
    - Tornados and derechos
    - Snow/blizzard

While trying to prepare for or mitigate potential disruptions, it is important to recognize that transportation programs and projects serve several different and sometimes competing objectives. With constrained budgets and conflicting priorities, it can oftentimes be difficult to justify making decisions in the short-term, even if they make sense in the long-term. Sustainability is a concept that allows decisionmakers to make balanced decisions while considering the economic, social, and environmental effects of the agency's actions.

Air Quality and Climate Change

Air quality and climate change are two issues closely tied to the subjects of resiliency and sustainability. 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 2012, and the NAAQS for ozone was most recently lowered in 2015. The Environmental Protection Agency anticipates issuing a new rulemaking on the particulate matter NAAQS in 2022-2023. Iowa continues to remain in attainment for both 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. Damage from the 2019 floods topped $1 billion. Climate changes Iowa is already experiencing include increased precipitation, higher temperatures, agricultural challenges, habitat changes, and public health effects.

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.

Current Efforts

Several resiliency and sustainability efforts have been undertaken or are underway. Following the 2019 floods that had severe impacts along the Missouri River and Mississippi River, a flood resiliency analysis was conducted to screen the Primary Highway System to identify locations vulnerable to a 100-year flood event. The analysis also focused on robustness and redundancy elements of the system; the results of this analysis are included the highway analysis section of Chapter 5. Other resiliency efforts have included coordination of Emergency Relief (ER) program items related to the 2019 floods, including completion of detailed damage inspection reports, and defining betterment design standards and guidance for embankment protections, which can help stabilize slopes.

Sustainability efforts have included the long-running Iowa Living Roadway Trust Fund, which was established in 1990 and has provided millions in funding for research and demonstration projects, vegetation inventories, education and training programs, gateway landscaping, snow and erosion control, roadside enhancement, and more. Also, the concept of integrated roadside vegetation management has a long history in Iowa; it integrates the use of native and other select types of vegetation with appropriate management techniques to produce a cost-effective, environmentally sound management alternative for roadsides. This helps reduce mowing and use of herbicides. Another sustainability effort included a pilot study of six bridges to develop a methodology to evaluate their vulnerability to climate change and extreme weather; the lessons learned can then be applied to future bridge designs.

Working Groups

The Iowa DOT has established working groups for both resiliency and sustainability. Both groups have begun meeting regularly, established charters, and are beginning work that will help more fully integrate these themes into Iowa DOT's work.

Resiliency Working Group

The resiliency working group provides guidance, support, and coordination of resiliency efforts within the Iowa DOT. This includes proactive efforts to increase the system resiliency and response efforts to restore the operation of the system after a disruption. The group plans to accomplish this through synthesizing existing efforts, developing standard operating procedures, and strategically planning for future events. The mission of the resiliency working group is to properly prepare for and reduce the impact of future disruptions to Iowa's transportation system.

Underway and planned activities include:

- Research best practices relating to incorporating resiliency into the project development process.
- Develop standard operating procedures relating to incorporating resiliency into Iowa's project development process.
- Establish an internal workflow for applying to FHWA's ER Program and for implementing betterments.
- Identify past projects within Iowa that demonstrate resilient practices in planning or engineering.
- Adopt a statewide network screening to identify areas of greatest vulnerability to disruptions.
- Identify and maintain a listing of engineering countermeasures that increase the resiliency and reduces the vulnerability of the transportation system.
- Develop engineering design standards for select countermeasures.
- Incorporate resiliency into the planning process.

Sustainability Working Group

The sustainability working group aims to provide agency-wide guidance in developing and implementing sustainable practices through the creation of focus areas and agency wide goals. The committee will serve as the sustainability governance body within the department and act as a resource for new sustainability programs. This ongoing support will help ensure that the Iowa DOT considers or adopts new sustainability practices as appropriate. The group will accomplish this through the creation of focus areas with metrics that can be utilized to gauge the department's performance, research of potential opportunities to reduce the department's environmental impact or carbon footprint, and the unification of the Iowa DOT behind these initiatives. Sustainability can be implemented across many facets of the department, including facilities, fleet, roadside management, construction, operations, resiliency, purchasing, indirect infrastructure, planning, workforce, and agencywide areas.

Underway and planned activities include:

- Develop a sustainability strategy, including mission, vision, and key principles.
- Conduct a sustainability assessment.
- Create a structured communication plan for sustainability.
- Document a workflow for sustainability within the agency.
- Develop a Sustainability Plan for the agency.
- Create an initial work plan and recommendations to implement the Sustainability Plan.
- Participate in research projects to improve sustainable transportation infrastructure in Iowa.

New Planning Documents

Two new plans were developed since the SLRTP was adopted that meet federal requirements and help implement SLRTP strategies related to advancing resiliency and sustainability planning.

R*esilience Improvement Plan (RIP)*

Over the course of 2023, the RWG supported the development and review of Iowa DOT's first Resilience Improvement Plan (RIP). Several external partners were also engaged in this effort, including Iowa Department of Homeland Security (HSEMD), Iowa Department of Agriculture and Land Stewardship (IDALS), Iowa Department of Natural Resources (IDNR), Iowa Economic Development Authority (IEDA), Iowa State University, and University of Iowa.

The purpose of this plan is to address surface transportation system resilience to current and future weather events and natural disasters. The RIP is an optional planning activity of the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program, and is not required for the state to receive funding through the PROTECT Formula Program. However, the benefit to Iowa is an authorized reduction in the non-Federal share of the cost of projects carried out using PROTECT Formula Program funds by up to 10 percent (i.e., projects could be funded 90% federal, 10% non-federal).

Key components of the RIP include the following.

- Consideration of Iowa's climate
    - o Review over time and evaluation of billon dollar natural disasters.
    - o Near-term and long-term trends in Iowa's climate and weather.
- Summary and assessment of Iowa's hazards
    - o Natural and other hazards that may impact Iowa's transportation system.
    - o Risk prioritization matrix and priority hazard analysis.
- Iowa's resiliency toolbox
    - o Identification of natural and man-made infrastructure countermeasures to mitigate hazards to Iowa's transportation system.
    - o Discussion of other potential tools including policy, research, and co-beneficial improvements.
    - o Identification of strategies to increase transportation resiliency in Iowa.
- Targeted corridors and segments
    - o Listing of specific corridors and/or segments of Iowa's transportation system with a high risk for flooding or other natural disasters.

Iowa's RIP focuses on strategies, countermeasures, and research efforts for nine natural hazards. The hazards are grouped into three tiers based on priority and preferred mitigation methods.

- **Tier 1: Flooding, winter storms, freeze/thaw**
    - o Take proactive steps to mitigate the risks of these hazards
- **Tier 2: Tornado/windstorm, hail & thunderstorms, drought**
    - o Have strategies in place to quickly react when these events occur
- **Tier 3: Excessive heat, dam/levee failure, landslide**
    - o Monitor and conduct prevention activities as appropriate

The RIP is being incorporated into this SLRTP by reference. Its strategies, countermeasures, and research initiatives are included in the SLRTP Appendix.

Carbon Reduction Strategy (CRS)

On November 15, 2021, President Biden signed the Infrastructure Investment and Jobs Act (IIJA). This law authorized the new Carbon Reduction Program (CRP) with the purpose of reducing transportation emissions through the development of state Carbon Reduction Strategies (CRS) and by funding projects designed to reduce transportation emissions. The following requirements apply to a CRS.

- Developed in consultation with MPOs.
- Support efforts to reduce transportation emissions.
- Identify projects and strategies to reduce transportation emissions.
- Support the reduction of transportation emissions of the state.
- At the discretion of the state, quantify the total carbon emissions from the production, transport, and use of materials used in the construction of transportation facilities within the state.
- Be appropriate to the population density and context of the state, including any MPO designated within the state.

The requirement for states to develop a CRS is new. However, transportation planning at the state and MPO levels has involved the regular development and updating of numerous planning documents, many of which include strategies and initiatives that relate directly or indirectly to reducing transportation emissions. The requirement to develop a CRS provided an opportunity for the Iowa DOT and its partner MPOs to build on these existing planning efforts by compiling relevant strategies and initiatives and synthesizing them into a cohesive statewide strategy. This was achieved through a statewide consultation process that identified many shared priorities and opportunities for future coordination.

Iowa's CRS focuses on strategies in five key areas that will help reduce emissions, often while also addressing other goals such as increasing use of other transportation modes, decreasing congestion, and increasing sustainability of the transportation system.

- **Multimodal Transportation** – public transit, bicyclists and pedestrians, Complete Streets, reduction in single occupant vehicles, passenger and commuter rail.
- **Operational Efficiency** – Transportation Systems Management and Operations (TSMO), state of good repair, Travel Demand Management (TDM).
- **Alternative Fuels** – alternative and renewable fuel infrastructure and vehicles, coordination across sectors.
- **Construction** – sustainable elements or construction practices, cross-sector use of right-of-way, reduce carbon impacts during construction projects.
- **Other** – integrate transportation and land use planning, improve freight efficiency, explore other projects or programs.

The CRS is being incorporated into this SLRTP by reference. Its strategies are included in the SLRTP Appendix.

Safety

Safety is at the heart of the Iowa DOT and the SLRTP. 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 fatalities and injuries, 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

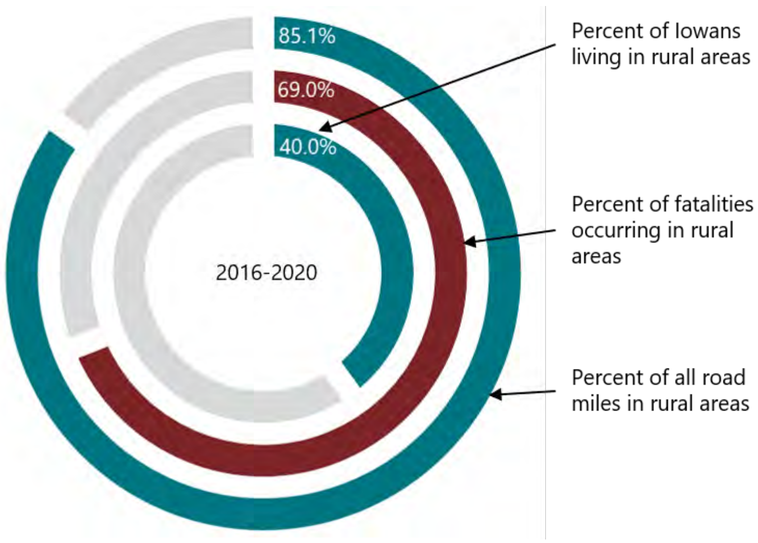
Figure 4.10 shows total crashes by severity between 2016 and 2020. There were over 275,000 crashes including 1,725 fatalities on Iowa roadways. The year 2016 was an outlier for fatalities with 402 fatalities; there have been an average of 331 per year since. While total crashes dropped by about 10,000 from 2019 to 2020, likely due to the COVID-19 pandemic and decreases in travel, the total number of serious (fatal or major injury) crashes only decreased by 2%. The longer-term trend of fatalities in the state has been decreasing, but is still far above zero, which is the only truly acceptable number.

Figure 4.10: Total crashes by severity, 2016-2020

Source Iowa DOT

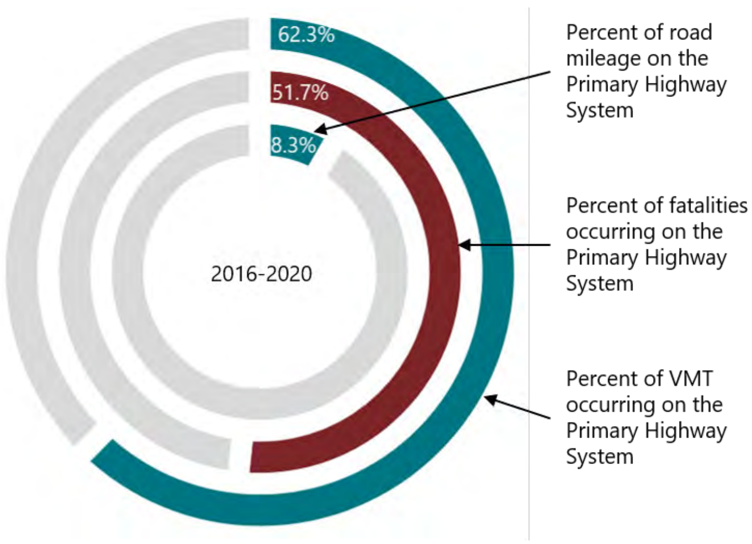
Although the rural population continues to decline in Iowa, roadway fatalities in rural areas continue to represent a higher number of Iowa's fatalities as compared to urban areas, as shown in Figure 4.11. Part of the reason for this is that the majority of Iowa's vast roadway system is in rural areas. Overall, 69% of Iowa fatalities occurred in rural areas during this period. Fatalities are also over-represented on the Primary Highway System relative to its mileage, but not when compared to the amount of vehicle miles traveled (VMT) on the system, as shown in Figure 4.12. In other words, roughly half of fatalities occurred on the Primary Highway System, while it accounts for only 8.3% of the state's road mileage, but 62.3% of the state's VMT.

Figure 4.11: Crash fatalities and rural areas, 2016-2020



Source: Iowa DOT

Figure 4.12: Crash fatalities and the Primary Highway System, 2016-2020



Source: Iowa DOT

Safety Planning Efforts

Strategic Highway Safety Plan

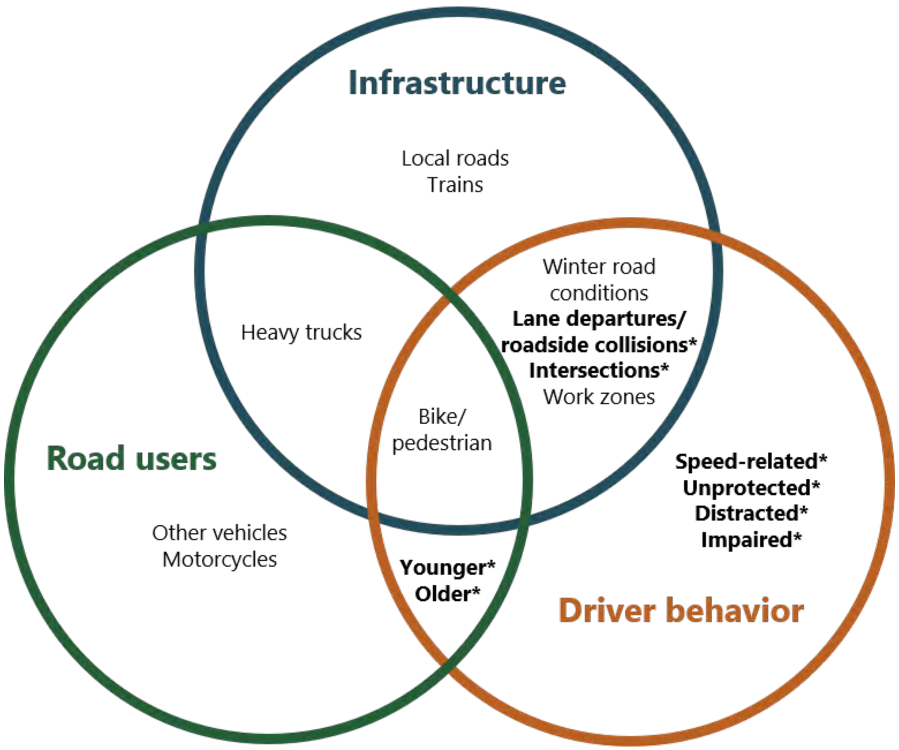
Surface transportation reauthorization bills have continually reinforced the importance of safety. An important federal program is the Highway Safety Improvement Program (HSIP), which includes a requirement for states to develop a Strategic Highway Safety Plan (SHSP). According to the U.S. Department of Transportation, an SHSP is a "statewide coordinated safety plan that provides a comprehensive framework for reducing fatalities and serious injuries on all public roads." The purpose of the SHSP is to identify effective safety strategies to address areas of greatest need to make roadways safer.

The 2019-2023 SHSP is the fourth such planning effort in Iowa since it became a requirement. Iowa's SHSP was developed in consultation with the SHSP Implementation Team, which is composed of individuals representing the E's of safety – education, emergency medical services, enforcement, and engineering. These representatives supported a multidisciplinary approach and provided updates on programs, policies, and educational campaigns for their respective organizations, as well as data on the latest research for their areas of expertise.

An important SHSP component is the evaluation of safety emphasis areas, which involves identifying and attributing crashes to one or more designated emphasis areas to prioritize and develop strategies for the areas that have the greatest opportunities for reducing fatal and serious injury crashes. For this SHSP, the prioritization of Iowa's 18 safety emphasis areas was supported by an analysis of crash data and an extensive statewide input process involving Iowa's traffic safety stakeholders. The result of these efforts was the determination of eight of the areas as priority safety emphasis areas. The Implementation Team identified strategies that provide the greatest opportunity to reduce fatalities and serious injuries for each of the eight areas.

To facilitate the prioritization process, the Implementation Team decided to group the safety emphasis areas into three broad categories: infrastructure, road users, and driver behavior. Figure 4.13 demonstrates the relationships between these categories and the safety emphasis areas analyzed in this plan. This illustration also reveals how strategies related to each of these safety emphasis areas might also have an impact on secondary areas as well.

Figure 4.13: Safety emphasis areas



Note: the eight priority safety emphasis areas are bold and marked with an asterisk.

Source: Iowa DOT

Local and District Road Safety Plans

Another planning effort occurred to take proactive steps for addressing crashes on 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 roadways. The Iowa DOT then developed a District Road Safety Plan (DRSP) for each of its six districts. The DRSPs identified systemic safety improvements along the primary highway network based on a segment and intersection risk factor analysis. The DRSPs included a prioritized list of safety improvement projects for each District, and many of these projects have been implemented.

Modal Safety

Transportation safety is most often thought of in terms of the highway mode and crashes, yet it is an important component of each mode of transportation. The following provides a brief overview of safety considerations for other modes.

Aviation Safety

System planning and aviation programs strive to maintain infrastructure and services promoting safety in Iowa's aviation 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.

Aviation safety measures such as accident rates or statistics are challenging to report for multiple reasons. Many of the aircraft that fly over the state and may have an emergency or incident are not based in Iowa. Also, an aircraft incident in Iowa does not necessarily reflect any infrastructure or service issues with airports in the state.

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; the Complete Streets Policy and design guidance; safety compliance; AASHTO design guidelines; facility compliance; optimization of signal design; and support for bicycle helmet use.

Bicyclists, pedestrians, and individuals using personal conveyances or mobility assistive devices are vulnerable road users. When pedestrians and bicyclists are involved in a crash, they are often more vulnerable because of the effects of speed and lack of physical protection. From 2012-2020, about 6.5% of Iowa's crash fatalities and major injuries each year were non-motorized users. While there is some year-to-year variation, the overall trend has been relatively flat. Bicyclists and pedestrians were included as a safety emphasis area in the 2019-2023 SHSP, and additional planning work has been done since then including the development of the Statewide Bicycle and Pedestrian Systemic Safety Analysis in 2020. This work is the basis of the bicycle/pedestrian analysis discussed in the highway needs and risks section of Chapter 5.

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.

A notable planning requirement that became effective in 2020 is the development of Public Transportation Agency Safety Plans for agencies that receive urbanized area formula funds. In Iowa, that translates to the 12 agencies that are located in urban areas of 50,000 or more. The plans include the agency's safety management systems, including the agency's safety management policy and processes for safety risk management, safety assurance, and safety promotion; an employee reporting program; and performance targets.

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.

Over the last ten years, there were 378 crashes between highway and railroad traffic and 331 train derailments, with a relatively consistent number occurring each year. A total of 85 injuries and 98 fatalities resulted from those crashes and derailments, both with inconsistent trends by year.

Security

Security is an important consideration in the transportation planning process, and received heightened attention following the terrorist attacks of September 11, 2001. Security should not be thought of only in terms of criminal or terrorist attacks, but also for the same vulnerabilities that resiliency efforts are often focused on – natural and manmade incidents, such as floods, tornadoes, and hazardous materials spills. In Iowa, recent flooding, derecho, 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 to implement security and emergency management initiatives.

The Traffic Operations Bureau is responsible for overseeing the Iowa DOT's security and emergency response efforts. Many of the bureau's core functions relate to managing and operating the system and are a key part of these efforts. This includes several intelligent transportation system (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 such as county sheriff and city police departments, which provide critical local enforcement services. Private companies such as rail lines, trucking companies, emergency medical services, and 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 Governor's Traffic Safety Bureau, and the Iowa Department of Homeland Security.

While security of the transportation system is essential at all times to keep people and the economy moving, during emergencies, the transportation network is critical for agencies to be able to respond. When there is a significant incident, disruption, or disaster, transportation is required for emergency responders, equipment, and supplies to travel to affected locations to provide support. The public may need to travel to obtain care or supplies, or to evacuate from an affected area. The highway network is typically the backbone of any emergency response, but other modes may be critical as well, such as moving supplies by air or coordinating with public transit agencies to evacuate vulnerable individuals.

The Iowa DOT's Emergency Management (EM) Service Layer Plan, completed in 2019, provides an overview of emergency management activities and the linkages to other traffic operations activities. Another plan, the Traffic Incident Management Service Layer Plan, addresses management of day-to-day incidents on the transportation system, but the EM Service Layer Plan outlines Iowa DOT's role in large scale emergencies. This includes those that happen commonly, such as winter storms and flooding, as well as other less common but potential events, such as nuclear power plant emergencies, cyber security attacks, and others. The EM Service Layer Plan includes objectives that reflect guidance from the National Incident Management System (NIMS), the National Response Framework (NRF), and other resources. These objectives are focused on minimizing impacts, enhancing safety, improving coordination, reducing risk, and enhancing overall response efforts.

EM at the state level is organized by Emergency Support Functions (ESFs), following the NRF. There are 15 defined ESFs, including transportation, which aid in federal and other agency coordination. When warranted, such as during the severe 2019 flooding in western Iowa, the State Emergency Operations Center (EOC) will be activated and ESFs applicable to the emergency event will report to the EOC to assist with coordination of information and resources to support incident command. Outside of situations like this, there is much ongoing work including planning and training, special event coordination, after action reviews, and EM exercises.

Security in general and emergency management in particular 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.

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 there is paradigm-shifting potential for 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 continue to change, the Iowa DOT will continue to adapt to help ensure Iowa has a safe and reliable transportation system.

Transportation Options

As discussed in Chapter 3, 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. Some public transit services are working with these companies to help riders make the first-mile/last-mile connections to transit routes. 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.

E-commerce

E-commerce is growing significantly and impacting market trends and freight movement, with even more rapid growth experienced over the last two years resulting from the COVID-19 pandemic. According to the U.S. Department of Commerce, e-commerce has grown from less than one percent of total retail in 2000 to close to 14 percent in 2021. This trend is projected to continue in years to come.

This new model of buying and selling has changed the way retailers and consumers interact with each other as purchasing goods online typically means bypassing traditional brick-and-mortar stores and traveling directly from a warehouse or distribution center to consumers' homes, or vice versa when product returns are necessary. Some of this shift represents the last mile trip for consumer goods now being made by a delivery truck rather than store-to-home trips by consumers.

Online sales of most products, from clothing to perishable items like groceries, are experiencing growth. This means an increased emphasis on the reliability and timeliness of truck transportation, changing truck delivery patterns, an increase in shorter trips, and a greater strain on local infrastructure. Other related impacts include an increased demand for air cargo and efficient terminals and changing land use and development patterns such as locating inventory and distribution closer to population centers.

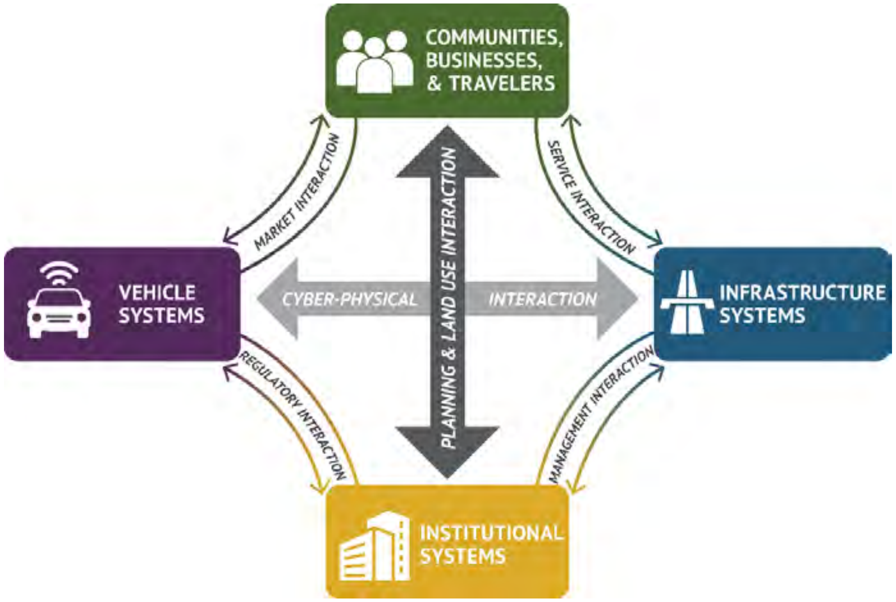
Cooperative Automated Transportation (CAT)

The American Association of State Highway and Transportation Officials (AASHTO) defines Cooperative Automated Transportation (CAT) as: "All modes of transportation working together to improve safety, mobility, equity, and operations efficiency through interdependent vehicle and systems automation and information exchange." CAT systems encompass a broad spectrum of vehicles and devices to support all modes of travel, infrastructure (physical and digital), parties, and regulations, all of which are ever changing. While the industry is rapidly evolving, these technologies stand to have profound impacts on the built and social environments.

As highlighted in Figure 4.14, it is important to realize there is more to roadway automation than enhancements to the vehicle itself. Other systems need to be enabled or upgraded/retrofitted to support one another and the use of these public transportation system by communities, businesses, and travelers. These system interactions will be critical to ensure successful deployment and the safe integration of connected and automated vehicles and infrastructure.

FHWA notes that automated transportation on public roadways is anticipated to occur within specific use cases. These may include freight and package delivery (long haul freight, local freight delivery, and personal delivery devices (PDDs)); transit (automated fixed route, on-demand, or microtransit service, including low-speed shuttles); individual transit and commuting with automated vehicles; and agency operations (e.g., automated street sweepers).

Figure 4.14: Components of cooperative automated transportation



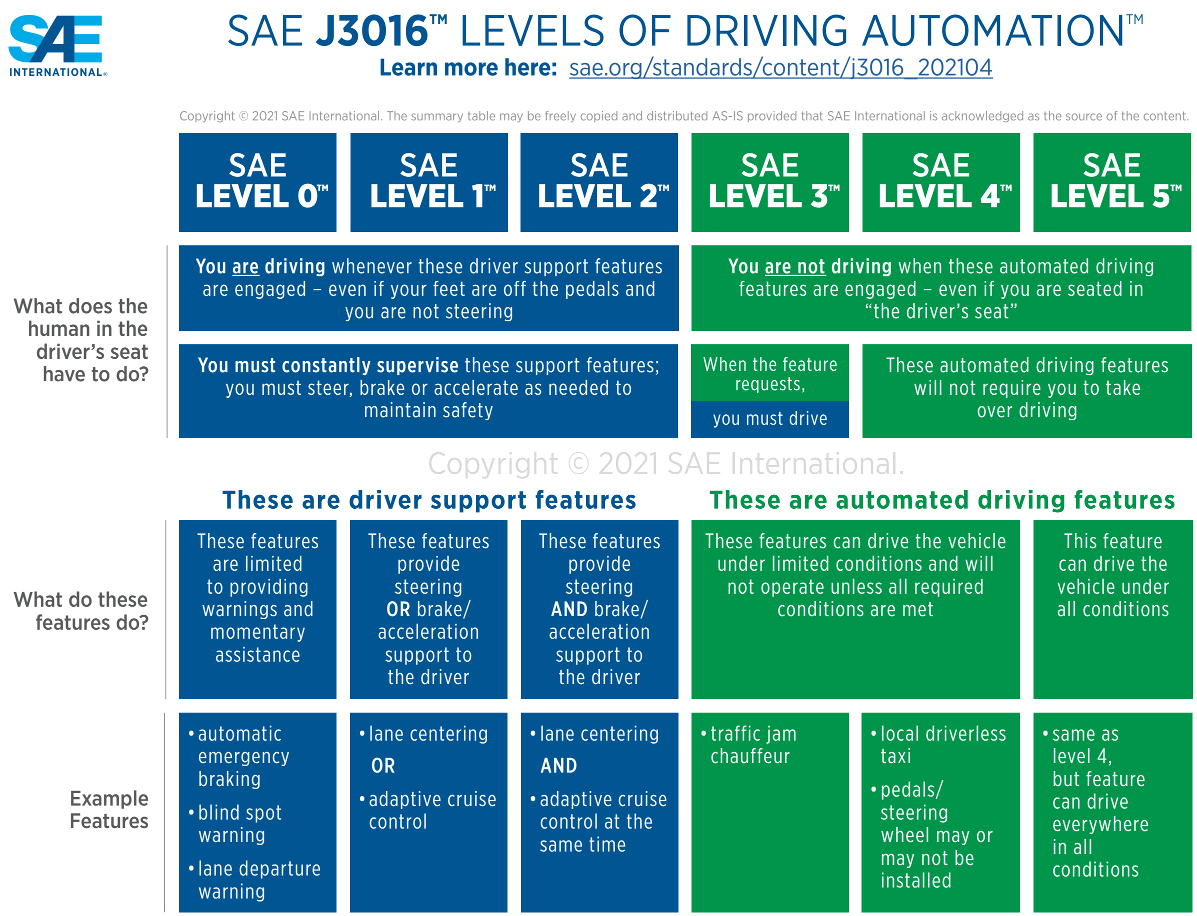
Source: FHWA

These types of use cases will likely be the way initial CAT deployments occur in Iowa and supporting them will be important as Iowa's CAT environment evolves. The impacts of these automation use cases and potential operational needs will vary for the Iowa DOT, local partners, and transportation users across the various roadway system levels. For example, most communities will not be directly impacted by long haul freight automation because this use case will emphasize movements on full access-controlled facilities like the Interstate highway system. Conversely, personal vehicle, robo-taxi, or small automated PDDs are anticipated to have varying impacts on how communities plan, address traffic considerations, and invest in infrastructure, as well as impacts to vulnerable road users, such as pedestrians and bicyclists. The Iowa legislature has begun addressing issues that will help some of these uses, such as removing a specific following distance (which clears the way for truck platooning), passing an ADS framework that makes it possible for driverless capable vehicles to operate in Iowa and provides the Iowa DOT with broad rulemaking authority, and passing legislation related to the operations of personal delivery devices.

Levels of Automation

The Society of Automotive Engineers (SAE) developed a taxonomy of vehicle automation systems, illustrated in Figure 4.15. The taxonomy shows six levels, ranging from no automation at Level 0 to full automation at Level 5, which can be used to understand the spectrum of possibilities when discussing CAT. Broadly, SAE levels 1 and 2 are vehicle safety features known as advanced driver assistance systems (ADAS), many of which are available in vehicles now, while SAE levels 3 to 5 are known as automated driving systems (ADS).

Figure 4.15: Levels of driving automation



Source: Society of Automotive Engineers International

There are many different ADAS features that are available in vehicles today. These advanced vehicle systems vary across vehicles and in terms of how they operate. Broadly speaking, these technologies aim to monitor and warn the driver, or take a more active role by intervening to avoid a collision or provide controlled assistance to the driver. However, it is critically important that drivers understand that ADAS still require the driver of the vehicle to be present, alert, and maintain primary control. Continuous public education, particularly regarding ADAS features currently available in vehicles and what they can and cannot do, is critical. Notable ADAS features include:

- **Collision warning systems**: Blind spot warning; forward collision warning; lane departure warning
- **Collision intervention**: Automatic emergency braking; blind spot intervention; pedestrian automatic emergency braking
- **Driving control assistance**: Adaptive cruise control; lane centering and lane keeping assistance

Given the current availability of ADAS and the potential development of ADS, the Iowa DOT views planning for CAT as a two-pronged approach. This involves supporting the drivers and ADAS of today while also supporting the ADS of tomorrow. When possible and prudent, investments that support both should be pursued.

Anticipated Deployment Timelines

While some companies are beginning to identify deployment of their automated transportation technology solutions in the next three to five years, such as automated truck freight operations on access controlled Interstate facilities from on-ramp to off-ramp, specific timelines for increased market adoption and penetration are not well known. There are a variety of reasons for this, including that the business case for automation is continually developing, it is complex, innovation is continually evolving technology, and there is a patchwork of state policy and legislation with limited federal or national standards, policy, and legislation.

The next decade is anticipated to focus on widespread adoption of ADAS for both commercial and passenger motor vehicles. More advanced ADS deployment timelines are anticipated to vary by the technology use case. Nationally there are deployments and testing areas occurring for a variety of automated transportation use cases.

According to the Iowa DOT CAT Service Layer Plan, the trends, activities, and challenges related to CAT point to the following three parallel transitions that are likely to occur over the coming decades.

1. A progressive increase in the level of automation and connectivity in privately-owned vehicles – the rate of which is difficult to estimate.
2. Increased use of fully autonomous (i.e., no on-board driver controls) shared vehicles for transit, shuttles, rideshare, mobility-on-demand, and commercial vehicles.
3. Increasing enactment of legislation, policies, and regulations by federal, state, and local governments to ensure safe and equitable operations and foster better understanding by all stakeholders.

Within the past several years, a planning study was completed for the rural portions of I-80 across Iowa and included a report on automated transportation. A range of scenarios for CAT adoption rates were studied, which varied significantly from relatively slow and conservative growth to a rapid increase of automated vehicles in the fleet. Given the quickly changing nature of these evolving technologies, there is a great deal of uncertainty regarding the specific timing and composition of the future of CAT and ADS, with recent predictions trending towards more conservative deployment timelines.

Planning for CAT

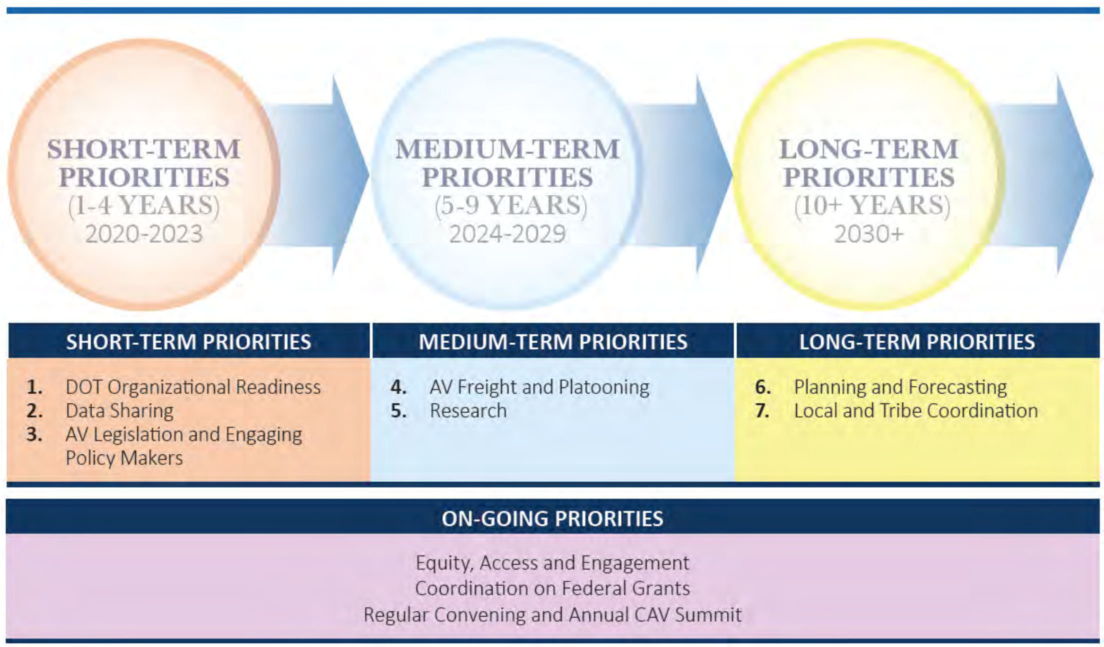
In recent years there has been a significant increase of planning for CAT across government levels. As technology continues to evolve, and in support of other related needs and strategies of the plan, it is important that Iowa DOT coordinates and align with neighboring states and national partners to ensure technology deployment is approached in a coordinated manner.

Nationally, AASHTO released its ten connected and automated vehicle (CAV) policy principles in 2021 to outline its position on policy in this arena, and the Iowa DOT supports integrating these principles into the planning process.

- A National strategy and vision are needed.
- Safety is paramount.
- Support sustainability.
- The future is connected and automated.
- Promote innovative Federal infrastructure investment.
- Advance equity, access, and quality of life.
- Preserve traditional State and Federal roles.
- Uniform national policy is essential to avoid a patchwork approach.
- Strong Federal leadership is crucial to foster industry collaboration and community engagement.
- Promote data sharing that preserves data privacy and security.

At a regional level, the Mid America Association of State Transportation Officials (MAASTO), which includes Iowa, has developed a 2030 CAV Regional Strategy outlining short-, medium-, and long-term priorities, shown in Figure 4.16. Iowa DOT is involved as a lead state on several strategies related to these initiatives.

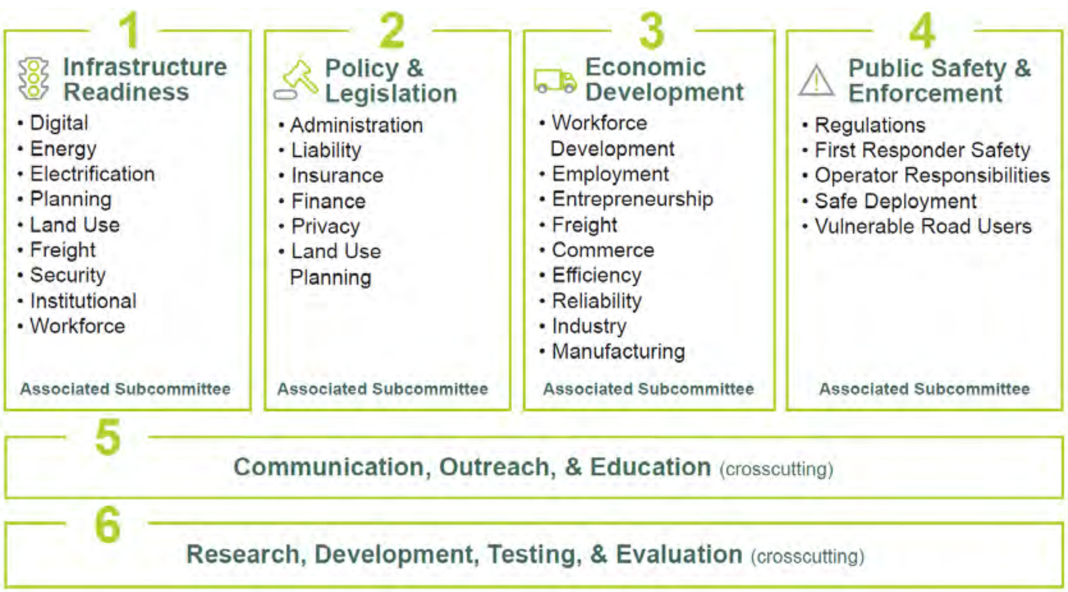
Figure 4.16: MAASTO CAV 10-year strategy



Source: MAASTO CAV Regional Strategy

At the state level, the Iowa Advisory Council on Automated Transportation (ATC) has been established to increase roadway safety, personal mobility, and freight movement within the state of Iowa by advancing highly automated vehicle technologies. Membership includes agencies from local, state, and federal levels, university research partners, and other stakeholders. The ATC provides guidance, recommendations, and strategic oversight of automated transportation activities in the state. The ATC includes several subcommittees to help guide activities for its strategic objective areas, as shown in Figure 4.17.

Figure 4.17: Iowa Advisory Council on Automated Transportation (ATC) strategic objective areas



Source: Iowa ATC

The ATC dedicated a meeting in 2021 to discussing considerations, impacts, and actions the Iowa DOT should be focusing on related to CAT. Some key takeaways included the following.

- There are short-term challenges with the misuse and misunderstanding of the current technology in vehicles; public education will be key.
- Physical, digital, communications, and cyber-security readiness is important for CAT.
- There will be challenges with operating in Iowa's varied weather and rural roadway environments.
- There remains uncertainty over how and by who the needed infrastructure improvements will be paid for, as well as liability concerns.
- It is important to collaborate across jurisdictions for a seamless experience for the public.
- It is necessary to increase the workforce size and skills related to automated vehicles.
- Environmental justice and accessibility are key considerations as CAT is developed and deployed.

Iowa DOT has also developed a CAT Service Layer Plan as part of its overall transportation systems management and operations (TSMO) planning process. This document, released in 2019, describes challenges and opportunities, existing services and conditions, future direction, gaps and actions to bridge them, performance metrics, and estimated costs. The plan includes the following CAT objectives.

- Manage the Iowa digital CAT infrastructure in order to increase Iowa's AV readiness.
- Ease the entry and ongoing operations of connected and automated vehicles in Iowa through appropriate physical infrastructure additions.
- Identify and define the business processes needed to allow and support CAT within Iowa.
- Secure Iowa travelers, transportation providers, residents, and physical and digital infrastructure against intentional or unintentional threats.

As technology progresses and regional plans and national guidance continue to be developed, it is important that Iowa aligns with these efforts and determines how to incorporate these initiatives into modal and system plans and project development processes. An example of this is addressing the impacts of automation on vulnerable road users and incorporating this into the Strategic Highway Safety Plan.

Opportunities, Risks, and Planning Issues

The rise of CAT holds much potential for improving the transportation system, such as reduced crashes and increased mobility and accessibility. Efficiency of operation coupled with clean energy technology could have substantial benefits to the environment. CAT could have significant effects for commercial industries, as it 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. But, as noted in the American Planning Association's (APA) report Planning for Autonomous Mobility, the rise of automated transportation may create new problems. These include the need for more drop-off zones, vehicle storage and/or circulation issues when vehicles are not in use, expensive new infrastructure to maintain, and perhaps even the rise of sprawl due to reduced costs of travel and vehicle ownership. Sound planning will be important to ensure that benefits are supported and potential risks are mitigated.

One of the biggest attractions of CAT 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. Another significant opportunity and risk related to CAT is equity. While CAT holds much potential to assist those facing transportation challenges, if equity, accessibility, and inclusive design are not part of the conversation early on, CAT also carries the risk of exacerbating mobility challenges that some individuals face in accessing equitable transportation options. This will be particularly problematic if CAT develops in ways that are exclusive to those with more financial resources or those without disabilities.

As the CAT Service Layer Plan notes, a wide variety of Iowa DOT services are expected to be impacted by CAT, particularly as ADAS and eventually ADS become more common. These include the following.

- Driver education and training services
- Vehicle registration and licensing
- Roadway and supporting infrastructure design
- Transportation operations
- Information sharing with Iowa residents and travelers

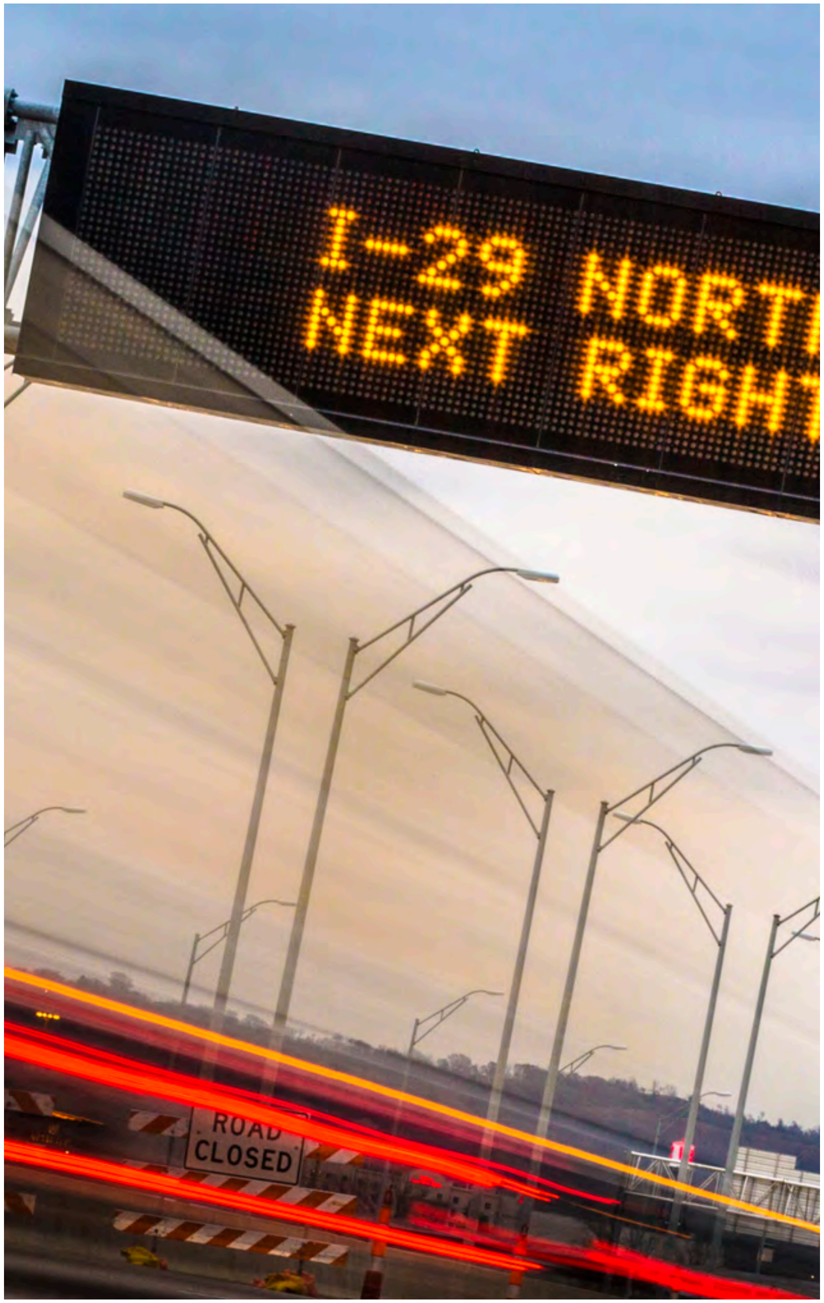
In addition to potential service changes, the CAT Service Layer Plan also notes potential system modifications that may be needed to accommodate CAT, including the following examples.

- Full-depth shoulders to allow for a future CAT-designated lane when reconstructing roadways.
- Strengthening pavement design to accommodate high volumes of vehicles traveling along a more precise wheel path.
- Supporting connected infrastructure networks by installing continuous fiber, wireless communications, and/or power along corridors.
- Adding cameras, sensors, and other roadside equipment for vehicle-to-infrastructure communication.
- Placing Global Positioning Systems (GPS) reference markers along the Interstate medians for AV positioning during unstable satellite connectivity. This could be LIDAR in combination with known points to obtain position information.
- Installing roadside objects (technology based or non-technology based) to support navigation and guidance (e.g. signs that are readable by both AVs and humans).
- Establishing new standards for lane striping frequency, composition, or width.
- Providing pull-out areas for CAVs.

Besides impacts to Iowa DOT services and the transportation system, examples of other impacts of increasing CAT could include changes in patterns of vehicle ownership, the amount of funding generated through traditional transportation revenue mechanisms, 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 CAT being part of the freight and passenger vehicle fleets. The potential impacts of technology and changing travel patterns can 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.

- 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 can take many years 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. It will be important to find the right balance of project elements based on known current needs and benefits and uncertain future needs and benefits. The emerging technologies rightsizing policy statement discussed in Chapter 5 is meant to help the Iowa DOT navigate this issue.



Travel and Tourism

Enhancing travel and tourism was recently added as a federal transportation planning factor. The transportation system has an important role in facilitating travel and tourism. While technology has greatly augmented navigation in recent years, the Iowa DOT still produces critical aids to help individuals plan their trips and find their way. These include items such as the state transportation map and the state bicycle map, as well as resources like Iowa 511, which provides current information on many issues such as road incidents or closures, traffic congestion, and winter driving conditions. Also, having consistent and clear roadway signage is essential to help motorists navigate safely.

The transportation system can also be a tourism feature in and of itself. Many parts of Iowa have well-developed land and water trail systems, which can attract visitors to the state and also act as quality of life amenities to help recruit and retain new residents and employees. Other modes of transportation have special tourism connections as well, such as scenic railroad trips, historic transit trolleys, and river cruises on the Mississippi River. Two transportation system elements that relate strongly to travel and tourism are rest areas and byways.

Rest Areas

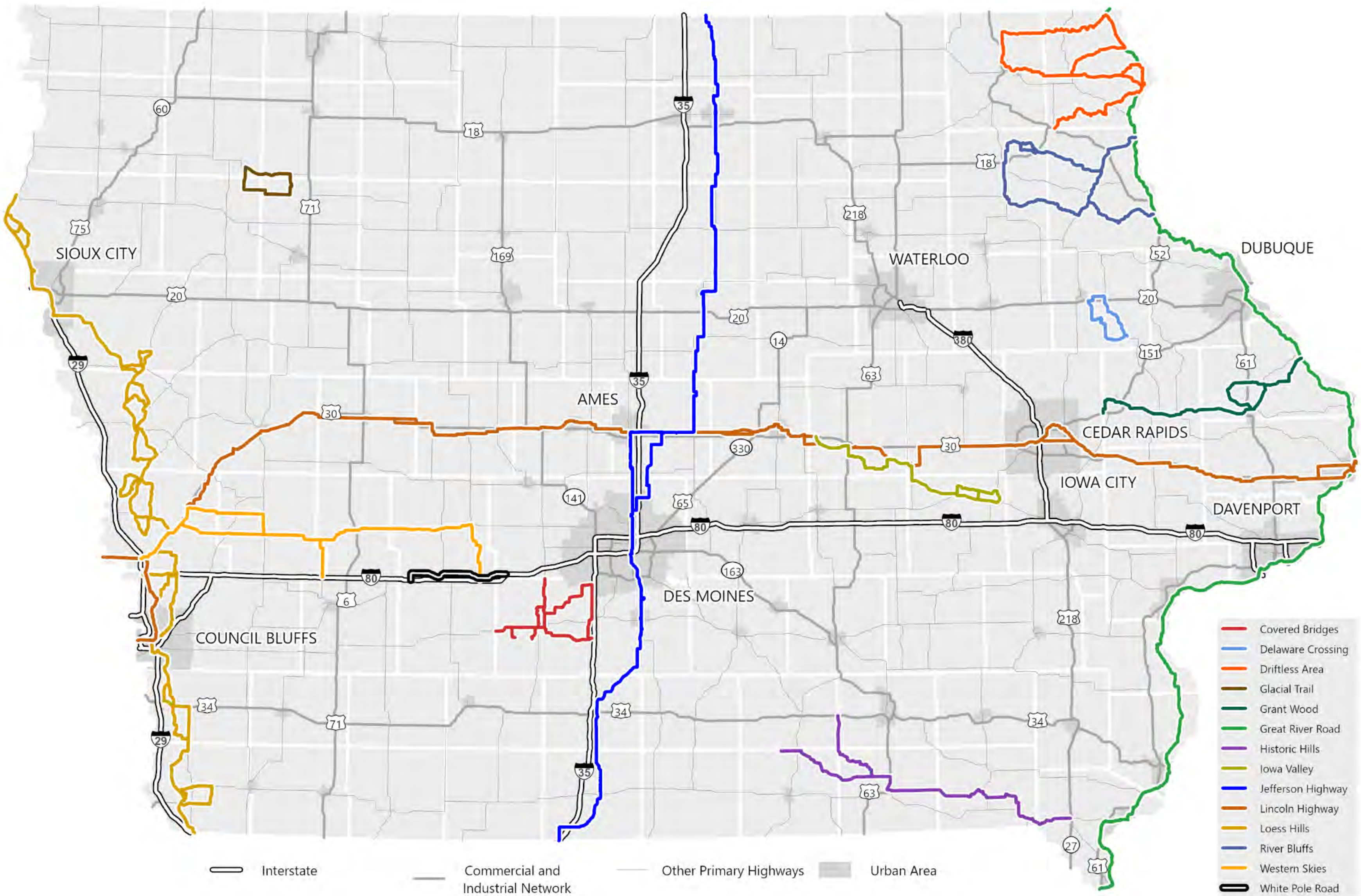
Rest area facilities owned and operated by the Iowa DOT along Interstates in Iowa play an important role in the transportation system. Travelers and freight haulers value the convenient parking and facilities they provide. Many of Iowa's rest areas have been upgraded to include expanded facilities and grounds with unique interpretive themes. In 2020, a study was finalized to develop a management plan for Iowa's 38 full-service and 16 parking-only rest areas. The outcome was a plan that involves managing the rest area system by upgrading buildings and expanding truck parking at some facilities, while closing other lesser used and smaller facilities as they age.

A truck parking study also showed that commercial truck drivers reported a significant need for additional freight truck parking throughout the Interstate system. A project developed to help this issue is the Truck Parking Information Management System (TPIMS), an 8-state effort that provides drivers, fleet managers, and owner-operators with up-to-the-minute parking availability along major freight corridors, including Iowa's Interstates. Continued implementation of TPIMS will help with the truck parking issue, along with expanding truck parking at existing facilities where feasible and exploring partnerships with other public and private entities.

Iowa Byways

Iowa has two national scenic byways and 12 state byways, shown on Figure 4.18. These routes offer a variety of scenic, cultural, and historical features. The Iowa DOT helps ensure routes are signed and administers the byways program, which accepts nominations for new byways or changing existing byways every four years. This program was established to identify, protect, and enhance roadways in Iowa which exemplify the state's scenic and historic resources. This effort is carried out through volunteer work and cooperation between interested citizens, organizations, local governments, and the Iowa DOT. Once the Iowa DOT designates a route as a state byway on the basis of scenic and historic qualities, applicants are then responsible for funding tourism and promotional plans. Byways also have corridor management plans to provide guidance to help preserve, enhance, and promote the byways. Federal grant opportunities may be available in the future for scenic byways for certain infrastructure projects.

Figure 4.18: Iowa's byways



Source: Iowa DOT

Transportation Systems Management and Operations

Traffic on Iowa's roadways has grown steadily 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 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 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, most congestion is of a non-recurring type, such as bad weather, traffic incidents, and work zones, which account for close to three quarters of Iowa's highway delay. Some of these issues can be planned for, such as work zones; others, like traffic incidents, can arise without warning, making monitoring the system and preparedness to respond critical.

Non-recurring congestion can happen anywhere in the state at any time, and the impact of congestion goes well beyond a traffic event. In calendar year 2020, there were an average of approximately 2,740 traffic incidents on state roadways per month. For crashes, there was an average crash clearance time of 75 minutes, while lane blocking incidents involving a tractor trailer had an average clearance time of over 2 hours. These durations are concerning, because 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.

TSMO is about much more than responding to incidents. Cost-effective TSMO strategies are used to improve service by "taking back" the transportation system capacity lost to congestion without necessarily adding lanes. TSMO can involve technological solutions, innovative design, management of peak-hour demand, and usage of other modes besides driving. 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. This helps lead to a more sustainable transportation system than by adding new capacity. In addition to incorporating specific TSMO strategies into project development, key TSMO-related activities include:

- Management of the day-to-day traffic operations on the highway system through the 24-hour statewide Traffic Management Center (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 Intelligent Transportation Systems (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.

TSMO Planning

There has been a significant increase in TSMO planning efforts at the Iowa DOT over the past decade. While TSMO activities were occurring prior to 2013, that year saw the initial Iowa DOT TSMO assessment conducted. In 2016, Iowa DOT's first TSMO Plan was created, with a focus on traffic congestion and other related roadway issues such as incidents, safety, and efficiency. The plan was comprised of a Strategic Plan and Program Plan, both completed in 2016, and a series of Service Level Plans to be developed over the following years. Completed Service Level Plans include:

- Traffic incident management
- Emergency management
- ITS and communication
- Cooperative automated transportation
- Traveler information
- Work zone management
- Traffic management center

Many projects and activities from the Program Plan were also completed or are underway, and Iowa DOT's organizational structure relative to TSMO has continued to grow and evolve. A statewide TIM committee and the TSMO steering committee help promote TSMO in Iowa. They also helped guide an update to the TSMO Plan in 2021, which continues to address congestion and safety and includes a set of TSMO program projects, services, and activities to help advance TSMO in Iowa. The TSMO Plan Update, to be finalized in 2022, builds on existing activities and recognizes the evolution of Iowa's transportation system. The original Plan was entirely internally focused. The TSMO Plan update includes several recommendations based on outreach to Iowa's nine metropolitan areas.

The purpose of Iowa DOT's TSMO Plan is to improve the performance of Iowa's transportation system. TSMO uses and improves upon infrastructure, processes, technology, and other components of the system that Iowa already has and takes a proactive role in system management. A number of TSMO projects, services, and actions are identified in the plan for the following categories.

- **Collaboration**: The effectiveness of TSMO activities depends on the ability of divisions, bureaus, districts, partner agencies, and other stakeholders to work together. Taking advantage of opportunities to build internal and external relationships will help with communication and overcoming challenges in the future.
- **Culture**: Represents the values and beliefs that lead to certain decisions being made. Through a business case or outreach opportunities, TSMO messaging can be communicated to others inside and outside of the agency to gain support.
- **Systems and technology**: Appropriate planning, construction, operations, and maintenance of systems and technology ensures operational needs of an agency are met. By developing standard protocols and an iterative data management process, transportation solutions can be effective in enhancing mobility.
- **Performance measurement**: Used to evaluate the effectiveness of mobility strategies and whether additional changes need to be made to achieve mobility goals. Performance measures are essential for making the business case for TSMO to decisionmakers and the public, and for gauging program success. Furthermore, monitoring performance measures regularly allows the program to be constantly improved and advances institutional continuous improvement.
- **Business processes**: Includes all the planning, budgeting, procurement, and process development required for TSMO programs. To be implemented, TSMO activities and initiatives

must be supported financially and institutionally. Protocols and procedures are necessary for TSMO to become ingrained in agency culture.

- **Organization and staffing**: Technically qualified staff and an organizational structure that unites TSMO activities into an integrated project delivery approach are key to supporting effective TSMO solutions. Through training, identifying TSMO responsibilities, and building relationships across teams, TSMO functions can be ingrained in an agency's day-to-day work efforts.

Integrated Corridor Management (ICM)

A specific type of operations-focused concept that is now being used in Iowa is integrated corridor management (ICM). This provides a framework for coordination among multiple jurisdictions, stakeholders, and modes of transportation in an area to ensure holistic solutions to transportation issues are being evaluated and implemented. ICM strategies that promote integration among freeways, arterials, and transit systems can help balance traffic flow and improve performance of the entire corridor. The benefits of ICM can include:

- Fewer traffic incidents
- Reduced amount of time an incident has the potential to impact traffic, in turn increasing safety and mobility
- More predictable travel times
- The ability to make incident information available more quickly on traveler information sources
- Increased or more complete information about other routes or travel options if an incident or traffic congestion does occur
- Increased use of other routes or travel options to meet the demand of traffic
- Reduced vehicle emissions and fuel consumption resulting from congestion

An ICM project has been underway for the Des Moines metropolitan area since 2018, with the aim of cost-effectively and proactively managing traffic in the area, which is expected to grow substantially in the coming decades. The project has involved consideration of a host of strategies, shown on Figure 4.19.

Strategies that have been studied in more detail for potential near-term implementation include median barrier gates, queue spillback mitigation, signal optimization, and ramp naming conventions. Many of these have involved partnering with local jurisdictions and stakeholders to ensure successful projects. Several advanced freeway management strategies are also being considered for future implementation, including dynamic shoulder use, dynamic speed advisories, lane use control, and ramp metering. These types of strategies help improve roadway capacity, safety, and reliability through real-time traffic detection and control. To be successful, they will require significant coordination between the Iowa DOT, local jurisdictions, and stakeholders. These strategies would be new to both the Iowa DOT and the Des Moines area, and will require not just infrastructure, but changes in how the infrastructure is monitored and managed as well as significant public education efforts.

Figure 4.19: ICM program elements

Source: Iowa DOT

5. NEEDS, RISKS, AND STRATEGIES

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

The chapter is divided into five main components.

- **Modal needs** are highlighted for aviation, bicycle/pedestrian, public transit, rail, and waterway. The needs are a high-level summary of information contained in the relevant system or modal plans.
- **Highway needs and risks** analysis for the Primary Highway System is discussed for nine different analysis layers that make use of various tools and planning processes.
- A **highway needs and risks matrix** provides a comprehensive summary of needs and risks across the entire Primary Highway System by dividing the highway network into 464 analysis corridors.
- **Strategies** are provided to help implement the State Long Range Transportation Plan (SLRTP), address important planning considerations, and target investments to address highway needs and risks identified within the SLRTP.
- The **rightsizing policy** helps begin implementation of the rightsizing strategy by outlining how the Iowa DOT defines rightsizing and ten specific topics where the department will work to incorporate rightsizing principles and practices.

5.1 Modal Needs

Aviation

Needs for the aviation system in Iowa are outlined in the 2020 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.

In order for the aviation system to effectively support the needs of users, it is necessary for airports to have adequate infrastructure and services. As part of the IASP, facility and service objectives are assigned based on airport system roles. Each system role has associated facility and service objectives that represent ideal conditions for an airport to effectively meet the needs of users and fulfill its role in the system. Objectives for each role vary based on the facilities and services an airport of that role would typically be expected to offer. For example, the enhanced service airports have more objectives 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 objectives for local service airports because they serve users with fewer operational requirements.

Table 5.1 shows the percentage of airports meeting objectives by airport role. There are four broad categories of objectives.

- **Airside facility objectives**: focus on infrastructure components that are critical to safe and efficient aircraft operations. Facilities in this grouping largely influence available services at airports, in part because the physical infrastructure determines the type of aircraft capable of using the facility.
- **Landside facility objectives**: focus on aircraft storage capabilities, terminals, and parking and entryway conditions.
- **Service objectives**: help support operations and users at system airports. Examples of key services include fueling and fixed-base operators (FBOs), pilot and visitor amenities, and other components such as snow removal and weather reporting.
- **Planning objectives**: include multiple actions at the local government level to protect and preserve airports and aviation users.

In addition to the needs identified by the IASP, future airport needs also include preventative pavement maintenance and rehabilitation and projects identified in each airport's approved Airport Capital Improvement Program (ACIP). The IASP identified over $1 billion in ACIP costs in Iowa from 2021-2030, including a wide variety of improvements. The largest categories based on costs included in ACIPs are listed below.

- Terminal building
- Runway reconstruction/rehab
- Taxiway/taxilane improvements
- Apron improvements
- Landside roadways
- Hangars
- New airport
- Runway lighting
- Runway extension
- Land acquisition
- Building improvements
- Pavement maintenance/preservation
- Snow removal equipment

Table 5.1: Percent of airports meeting facility and service objectives by airport role

		Commercial Service (8 airports)	Enhanced Service (16 airports)	General Service (31 airports)	Basic Service (19 airports)	Local Service (40 airports)
Airside Facility Objectives	Airport Reference Code	100%	88%	97%	100%	100%
	Primary Runway Length	100%	100%	100%	100%	*
	Primary Runway Width	100%	100%	97%	79%	95%
	Type of Parallel Taxiway	100%	100%	81%	100%	*
	Type of Runway Approach	100%	100%	100%	100%	100%
	Runway Lighting	100%	100%	100%	89%	*
	Taxiway Lighting	100%	100%	100%	*	*
	Visual Guide Slope Indicator	100%	100%	97%	*	*
	Runway End Identifier Lights	100%	100%	100%	*	*
	Rotating Beacon	100%	100%	100%	95%	*
	Lighted Wind Indicator	100%	100%	100%	100%	*
Landside Facility Objectives	Covered Storage	100%	94%	97%	95%	*
	Overnight storage for business aircraft	88%	88%	52%	*	*
	Terminal building	100%	100%	100%	95%	*
	Paved entry/terminal parking	100%	100%	94%	*	*
	Security	100%	31%	74%	53%	90%
Service Objectives	Fixed Base Operator	100%	100%	100%	*	*
	Fuel	100%	88%	100%	100%	*
	Attendance	100%	100%	97%	58%	*
	Ground transportation	100%	100%	100%	*	*
	Wi-Fi	100%	100%	100%	*	*
	Restrooms (24/7 / key code)	88%	88%	94%	84%	*
	Snow removal	100%	88%	100%	100%	*
	Aircraft Maintenance/Repair	100%	88%	90%	*	*
	Flight Instruction	100%	100%	87%	47%	*
	Aircraft Rental	88%	100%	61%	*	*
	Aircraft Charter	63%	81%	19%	*	*
	Weather Reporting	100%	100%	100%	*	*
Planning Objectives	Land Use Plan	100%	100%	77%	63%	33%
	Height Zoning	100%	100%	100%	100%	50%
	Airport Layout Plan	100%	88%	77%	100%	*

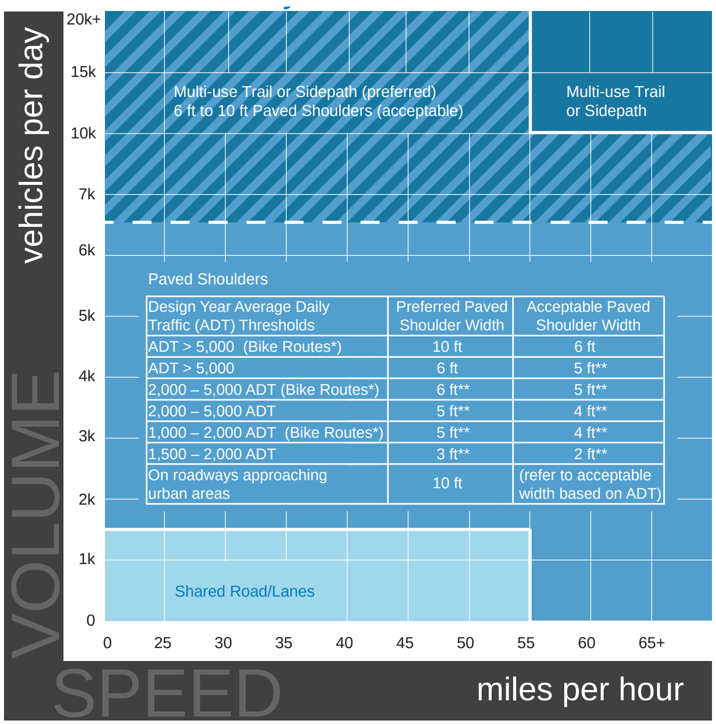
The percentage shown is the percentage of airports of that role meeting that objective.
Cells marked with an asterisk mean no specific objective has been identified for that airport role.

Source: 2020 Iowa Aviation System Plan

Bicycle and Pedestrian

The Iowa DOT's Bicycle and Pedestrian Long Range Plan was adopted in 2018. As part of plan development, a needs assessment was conducted for the entire Primary Highway System, excluding Interstates. Segment ratings of good, moderate, or poor for bicycling were determined 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 bicyclist who would have experience and confidence riding with traffic. Figures 5.1 and 5.2 show the facility selection matrix for rural and urban routes based on traffic volumes and speeds. In conjunction with the Complete Streets Policy, these would be utilized by designers to incorporate appropriate elements into projects on highways identified as having a poor or moderate bicycle compatibility rating (BCR). 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 3.4).

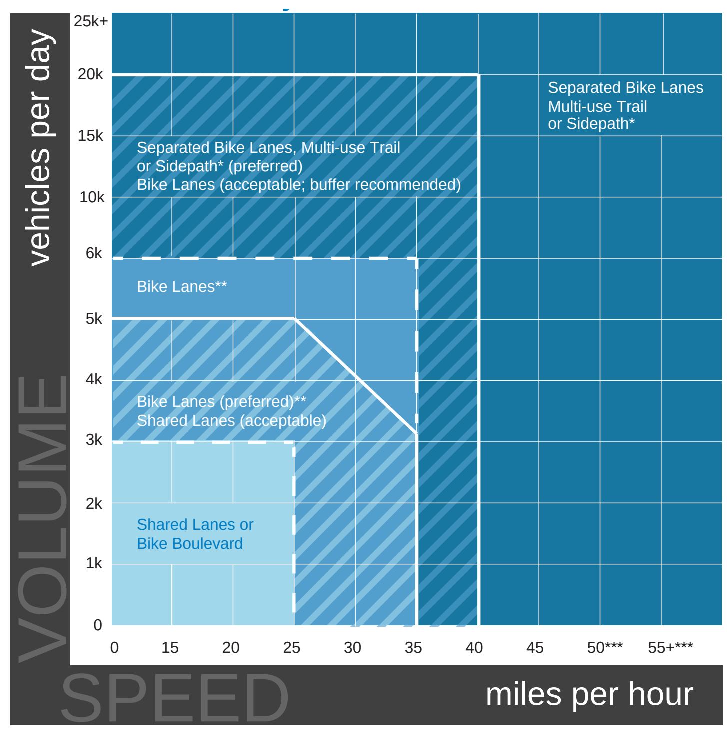
Figure 5.1: Rural facility selection matrix



Design Year Average Daily Traffic (ADT) Thresholds	Preferred Paved Shoulder Width	Acceptable Paved Shoulder Width
ADT > 5,000 (Bike Routes*)	10 ft	6 ft
ADT > 5,000	6 ft	5 ft**
2,000 – 5,000 ADT (Bike Routes*)	6 ft**	5 ft**
2,000 – 5,000 ADT	5 ft**	4 ft**
1,000 – 2,000 ADT (Bike Routes*)	5 ft**	4 ft**
1,500 – 2,000 ADT	3 ft**	2 ft**
On roadways approaching urban areas	10 ft	(refer to acceptable width based on ADT)

*On roadways where a higher level of bicycle traffic is expected (e.g., bike routes identified by cities, counties, RPAs, and MPOs, as well as official US Bicycle Routes and national trails).
**Paved width exclusive of rumble strips.

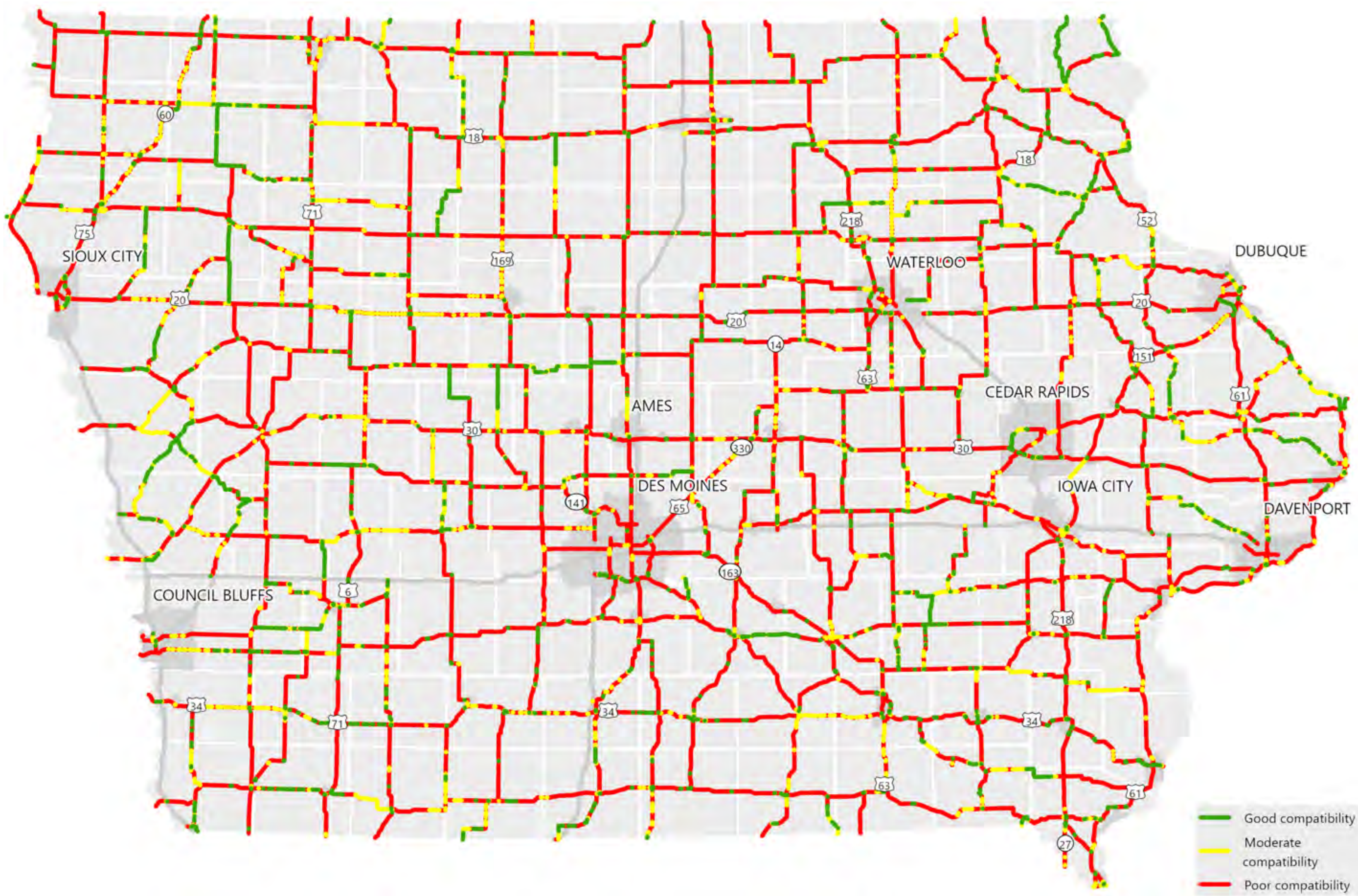
Figure 5.2: Urban and suburban facility selection matrix



*To determine whether to provide a multi-use trail/sidepath or separated bike lane, consider pedestrian and bicycle volumes or, in the absence of volume, consider land use.
**Advisory bike lanes may be an option where traffic volume < 4,000 ADT
***Speeds 50 mph or greater in urban areas are typically found in urban/rural transition areas.

Source: Iowa Bicycle and Pedestrian Long Range Plan

Figure 5.3: Bicycle compatibility rating (BCR) of the Primary Highway System



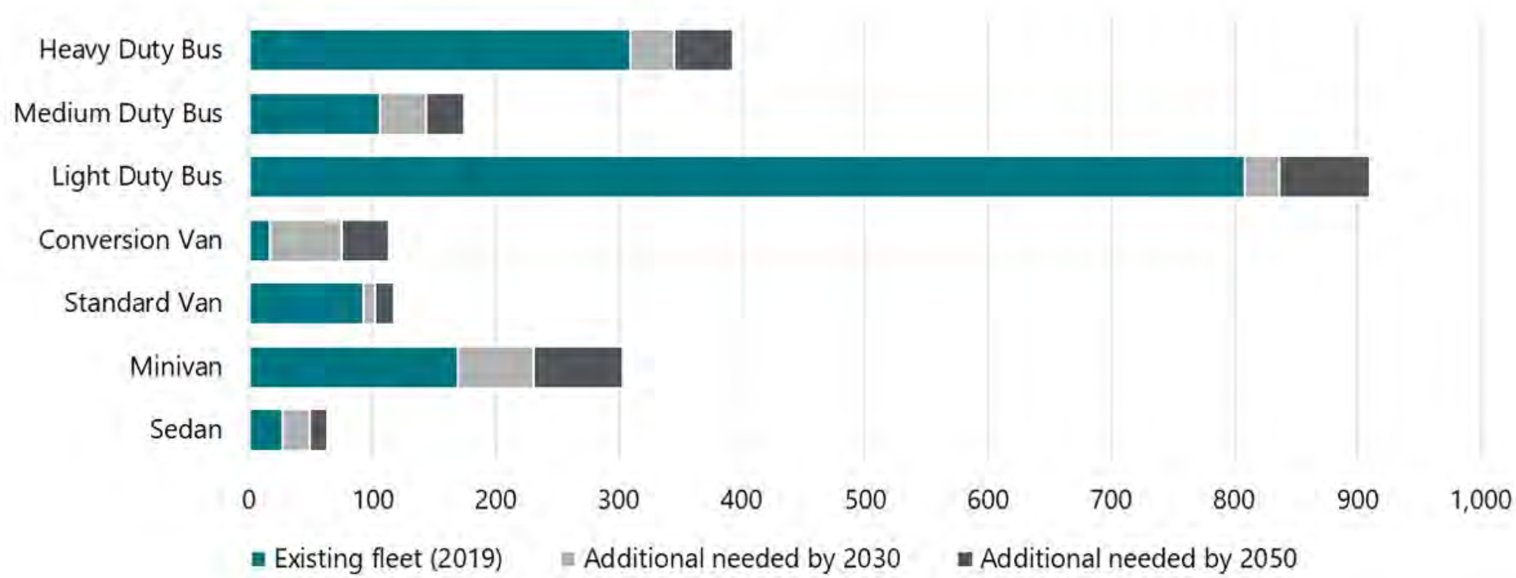
Source: Toole Design Group

Public Transit

Needs for the public transit system in Iowa are expected to grow substantially between now and 2050 and fall under several categories. The needs were calculated based on feedback from Iowa transit agencies as part of the development of the 2020 Public Transit Long Range Plan. Agencies forecasted a steady increase in ridership, anticipating it to grow from 24.9 million in 2019 to 33.7 million in 2050, an increase of 35.6%. To be able to accommodate this increased ridership, there are a variety of fleet, facility, and personnel needs that would need to be addressed.

Fleet needs relate to revenue vehicles, which are a transit agency's bus and van fleet that is utilized to transport riders. This does not include needs for vehicles used by office personnel or for non-public transportation purposes such as maintenance trucks. Vehicle fleet needs represent a constant challenge as this includes replacing existing vehicles that are beyond their useful lives, as well as projecting future needs for additional vehicles, called expansion vehicles since they increase the overall fleet size. In general, transit agencies are exploring the "rightsizing" of their fleet in order to have appropriately sized vehicles for the likely number of riders, and a higher percentage of future expansion vehicles are expected to be vans rather than buses. Figure 5.4 shows the vehicle fleet needs across transit agencies by showing 2019 fleet numbers and the estimated additional vehicles needed by 2030 and by 2050.

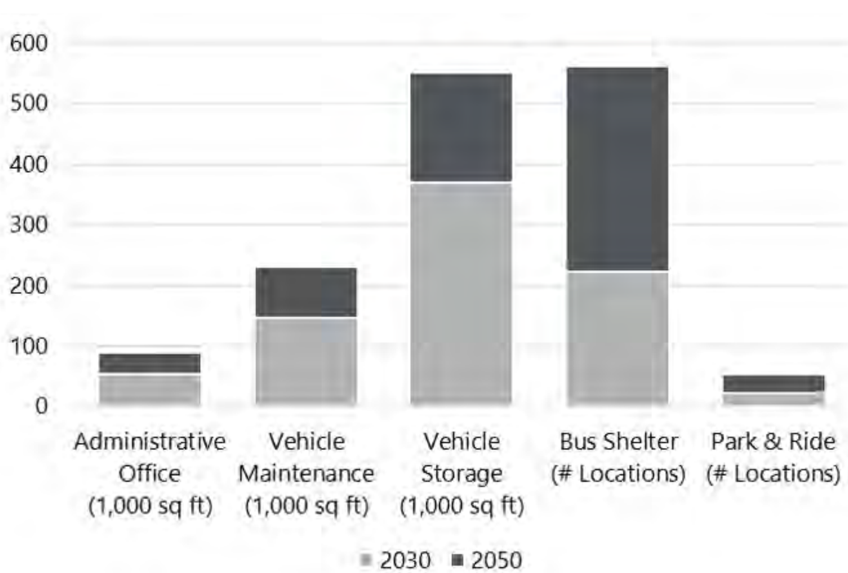
Figure 5.4: Transit agency existing vehicle fleets in 2019 and additional vehicles needed by 2030 and 2050



Source: Transit agency surveys; Iowa DOT

Facility needs relate to several types of infrastructure, including maintenance areas (including wash racks and wash bays), revenue vehicle storage areas, administrative/offices (including building needs such as offices/storage space and site needs such as parking spaces and walkways), bus shelters, and park and ride facilities. Vehicle storage needs were the most often cited infrastructure need – in order to extend the lives of the expensive transit vehicles, it is best to protect them to reduce maintenance costs and wear-and-tear of the buses. Figure 5.5 displays the survey results for facility needs. Besides demonstrating the need for particular types of facilities, the time period in which they are needed showed that nearly two thirds of facility needs were identified for the short-term planning horizon of 2030, with additional facility needs significantly lower in the long-term horizon of 2050. This shows that additional facilities, particularly for vehicle storage, are a high priority and a more immediate need.

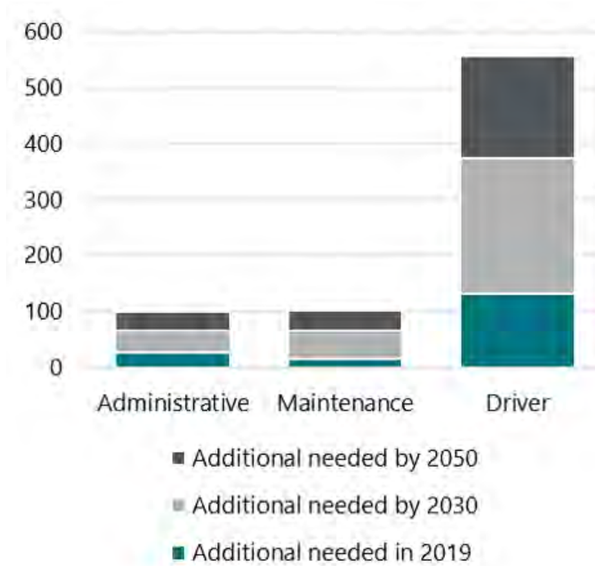
Figure 5.5: Transit agency additional facility needs by 2030 and 2050



Source: Transit agency surveys; Iowa DOT

Personnel needs relate to the workforce of the transit agency. This includes drivers, maintenance, and administrative staff. Transit agencies noted current personnel shortages as well as ongoing needs for additional staff (see Figure 5.6). The need for more bus drivers represents the single greatest personnel need across the state. A lack of drivers will have the effect of limiting the level of transit service that is available in a given region. It does not matter how many buses or vans are available if there are not enough qualified and licensed drivers to operate them. Likewise, a lack of maintenance employees may impact the ability to service and sustain the fleet of vehicles available for transit service, while a lack of office staff could constrain the agency's ability to schedule trips and dispatch vehicles, conduct public outreach, market its services, or perform strategic planning or analyses.

Figure 5.6: Additional personnel needed for transit agencies in 2019, by 2030, and by 2050



Source: Transit agency surveys; Iowa DOT

Rail

The Iowa State Rail Plan (ISRP) was updated in 2021 and outlines specific potential future projects and initiatives Iowa might consider proposing to improve existing services 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 the following.

- Enhancement of existing transload facilities or construction of new transload facilities – 16 projects
- Enhancement of existing rail access or development of new rail access for shippers/receivers – 9 projects
- Improvements to track infrastructure – 9 projects
- Enhancements to the capacity of the state's rail network – 7 projects
- Improvements to bridge infrastructure – 6 projects
- Development of a new intermodal facility – 4 projects
- Address operating bottleneck – 3 projects
- Mitigation measures in flood prone areas – 3 projects
- Grade separation of highway/rail grade crossings – 2 projects

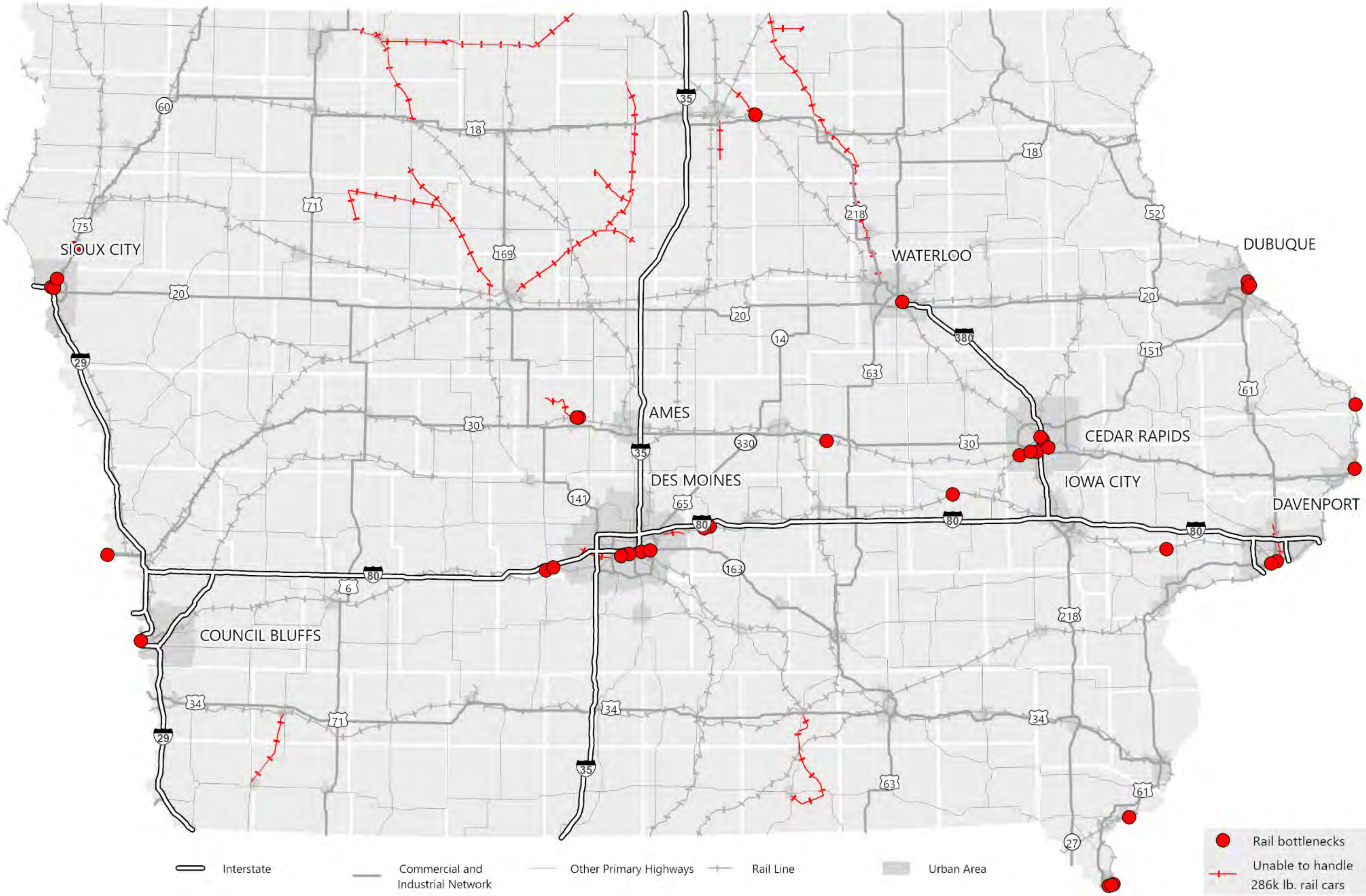
For passenger rail, projects identified include the following.

- 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.
- Implementation of intercity passenger rail service between Council Bluffs and Omaha.
- Improvements to stations and facilities at Amtrak stations in Iowa, including Ottumwa, Fort Madison, and Osceola.
- 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 railroad bottlenecks and rail lines with weight limitations (see Figure 5.7). Railroad bottleneck locations are usually referred to as "choke points" to avoid confusion with the more conventional railroad sector use of "bottleneck" to describe locations served by only one rail carrier (i.e., the "bottleneck carrier"). A total of 38 rail choke points were identified in the Iowa State Freight Plan by surveying the rail companies operating trackage in the state. Locations submitted primarily include structural choke points (e.g., low clearance areas, and bridges with size restrictions), congested choke points (e.g., locations with operational issues), and low-lying areas at risk of flooding during heavy rains or high-water levels.

Additionally, 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. The industry standard for rail car weight, which includes the weight of 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.

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

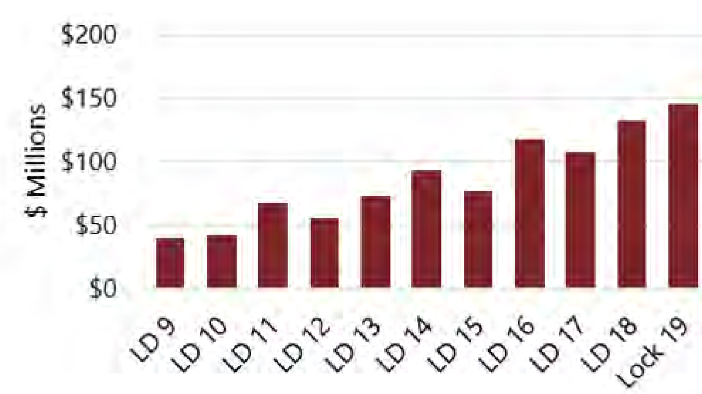


Source: Railroad companies

Water

Regarding the Missouri River, with growing barge traffic it will be important for the U.S. Army Corps of Engineers (USACE) to continue focusing on the Bank Stabilization and Navigation Project (BSNP) with the authorized purpose of providing a reliable, self-scouring navigation channel from St. Louis, Missouri, to Sioux City, Iowa, that is 9 feet deep and not less than 300 feet wide. However, most water-related needs for Iowa are associated with the infrastructure in and along the Mississippi River. Given the condition, size, and average delay of the 11 locks bordering Iowa, all are considered freight bottlenecks. It is clear that a lack of repairs, maintenance, and modernization will continue to have a negative impact on the efficiency and condition of the infrastructure. Failure or closure of a lock could be catastrophic for the region. The USACE has identified over $948 million in deferred/backlog maintenance and major rehabilitation and repair costs for the 11 locks and dams bordering Iowa, shown in Figure 5.8 and Table 5.2. Addressing these needs is essential to ensure continued viability of the Mississippi River for transporting freight to and from Iowa.

Figure 5.8: Deferred/backlog maintenance and major rehabilitation and repair costs for Iowa locks and dams



Source: U.S. Army Corps of Engineers

Table 5.2: Prioritized maintenance projects for Iowa locks and dams

1	Lock 18 Miter Gate Anchorage Replacement
2	Lock 17 Miter Gate Anchorage Replacement
3	Lock 19 PLC System Replacement
4	Lock 17 Upstream Guidewall Sheetpile Transition Wall Repair
5	Lock 13 Filling and Emptying System Replacement
6	Lock 19 Hydraulic Cylinder Rod Replacement
7	Dam 13 Spillway Seepage Cutoff Wall Repairs
8	Lock 14 - Auxiliary Lock/MRPO Guidewall
9	Lock 18 Access Road Repairs
10	6 Sites Dam Gate Trunnion Repairs
11	Lock 16 Filling and Emptying System (Drums and Wire Ropes)
12	Lock & Dam 14 Replace Bridge Crane & Bulkhead Lifter (Prototype)
13	Replace Bridge Crane & Bulkhead Lifter 10 Sites
14	Lock 11 & 12 Replace Miter Gate Anchorages Including A-Frame
15	Lock 13 & 14 Replace Miter Gate Anchorages Including A-Frame
16	Lock 15 & 16 Replace Miter Gate Anchorages Including A-Frame
17	12 Sites Lock & Dam Safety Hand Rail Replacement
18	12 Sites Lock & Dam Safety Signage - Restricted, etc.
19	Lock 13 Pressure Relief Wells
20	Lock 16 Floor Stability "Relief Wells"
21	Lock & Dam 11 - 19 Gates (Various maintenance/replacement)
22	Lock & Dam 12 - 10 Gates (Various maintenance/replacement)
23	Lock & Dam 13 - 13 Gates (Various maintenance/replacement)
24	Lock & Dam 14 - 17 Gates (Various maintenance/replacement)
25	Lock & Dam 15 - 11 Gates (Various maintenance/replacement)
26	Lock & Dam 16 - 19 Gates (Various maintenance/replacement)
27	Lock & Dam 17 - 11 Gates (Various maintenance/replacement)
28	Lock & Dam 18 - 17 Gates (Various maintenance/replacement)
29	Wingdam Repairs Pool 11-22
30	Fairlead Replacement at 6 Lock Sites
31	Lock & Dam 15 Checkposts

Source: U.S. Army Corps of Engineers

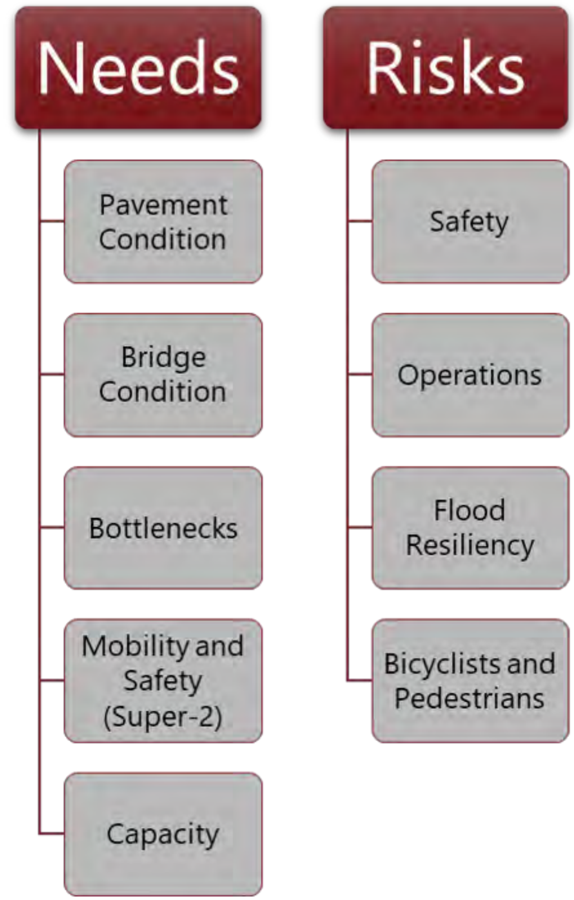
5.2 Highway Needs and Risks

Several layers of needs and risks were examined as part of the analysis conducted for the Primary Highway System for the SLRTP. These are shown in Figure 5.9. Needs are based on measured or estimated data and represent a possible gap. Risks are based on there being the potential for greater risk relative to that area of analysis, and thus greater potential benefit for improvements to address that risk. Each layer used various Iowa DOT data, plans, and tools to analyze different types of needs and risks from a systemwide perspective. In order to make the output more cohesive and usable, data is analyzed at or aggregated to a corridor level. For these purposes, the Primary Highway System is divided into 464 corridors with termini based on features such as major highway crossings and where roadways change from undivided 2-lane routes to multilane divided highways. Most analysis layers identified needs or risks at the corridor level, with only bottleneck and bridge improvement needs being identified for specific locations.

This analysis was conducted to build a comprehensive understanding of various types of needs and risks across the Primary Highway System. While specific corridors or locations have been identified as having needs or risks 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 and risks identified in this SLRTP will subsequently become funded projects, as additional factors help determine when and how a project proceeds. Likewise, corridors without any needs or significant risks noted may still have projects or improvements occur, particularly to address stewardship needs, which exist across the system.

Overall, this comprehensive analysis of the Primary Highway System provides a corridor-level perspective that will be an important consideration as individual projects are developed, and will help ensure identified needs and risks are taken into account during the project scoping process. When the analysis layers are combined, an awareness of the overall needs and risks of individual highway corridors can be developed.

Figure 5.9: Needs and risks analyzed for the Primary Highway System



Source: Iowa DOT

Pavement Condition

The pavement condition analysis utilized the Infrastructure Condition Evaluation (ICE) tool, which was developed to aid in the evaluation of the state's Primary Highway System by calculating a composite rating based on the most recent infrastructure condition and performance data. The ICE tool uses seven different criteria and offers the ability to evaluate the overall structural and service condition of roadway segments with a single composite rating. The following criteria are used in the composite rating; the percentage shown is the weighting that is applied to each factor.

- Pavement Condition Index (PCI) rating (25 percent)
- Bridge Condition Index (BCI) rating (25 percent)
- International Roughness Index (IRI) value (15 percent)
- Annual Average Daily Traffic (AADT), combination truck count (15 percent)
- AADT, single-unit truck count (5 percent)
- AADT, passenger count (5 percent)
- Congestion Index value (10 percent)

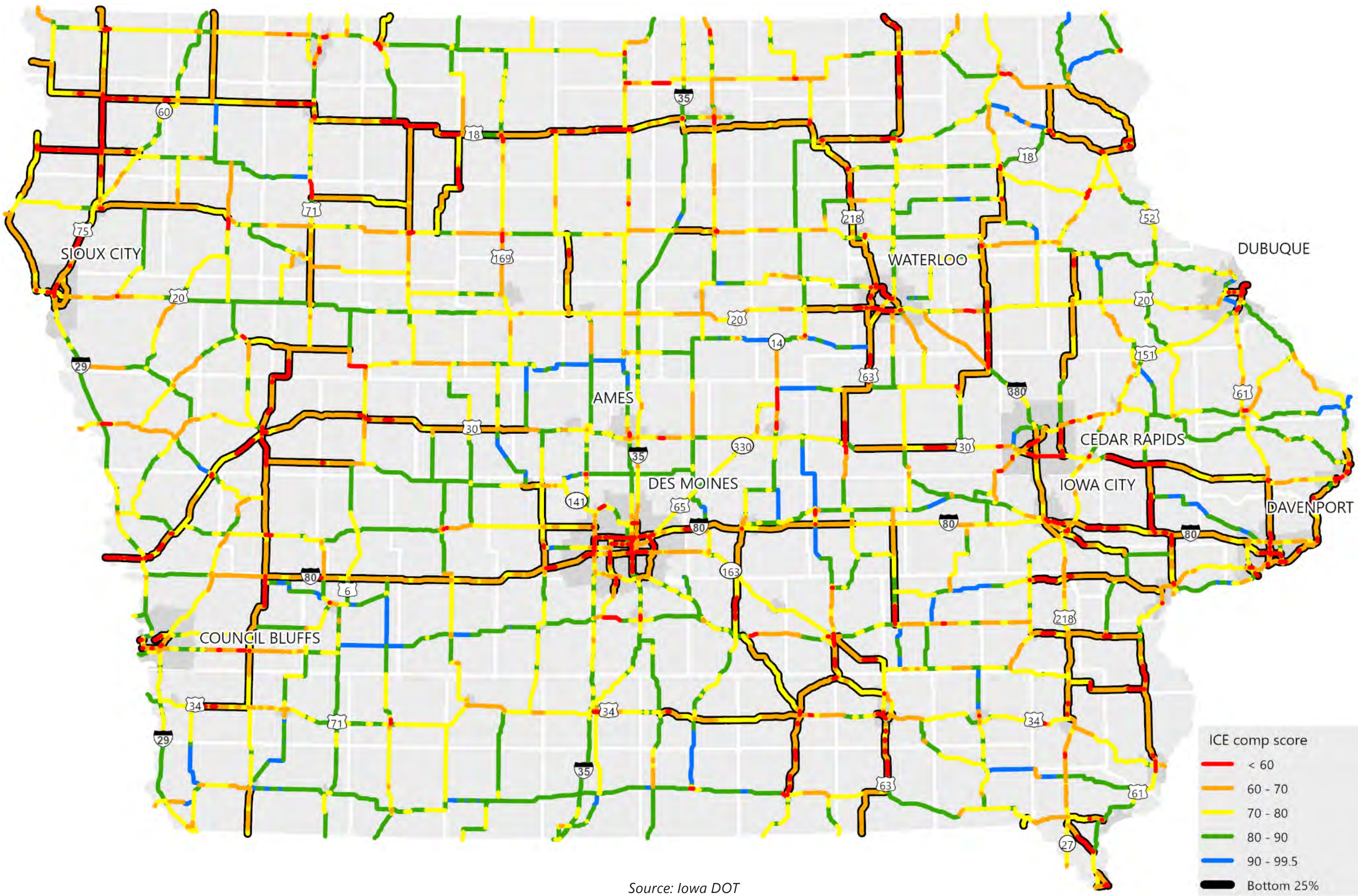
The seven data layers are combined through a linear overlay process, which breaks the highway network into discrete segments at every location where any of the seven data values change. This results in over 40,000 segments for analysis. For each segment, the value for each criterion was normalized on a 1 (worst) to 10 (best) scale. Then the seven normalized values were weighted based on the percentages noted above and added together to determine a composite rating for the segment. The composite score had a maximum value of 100, which would mean the highest possible score was assigned for each factor. The normalization and weighting values and process were determined by input from internal stakeholders when the ICE tool was developed.

The thousands of segments were then aggregated into the 464 analysis corridors. 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 target as condition needs in this SLRTP, 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 SLRTP is updated every five years, applying this annual 5 percent figure to the five-year life of the SLRTP 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. Figures 5.10 and 5.11 show the segment-level ICE output and highlight the bottom 25 percent of primary highway corridors based on the ICE analysis.

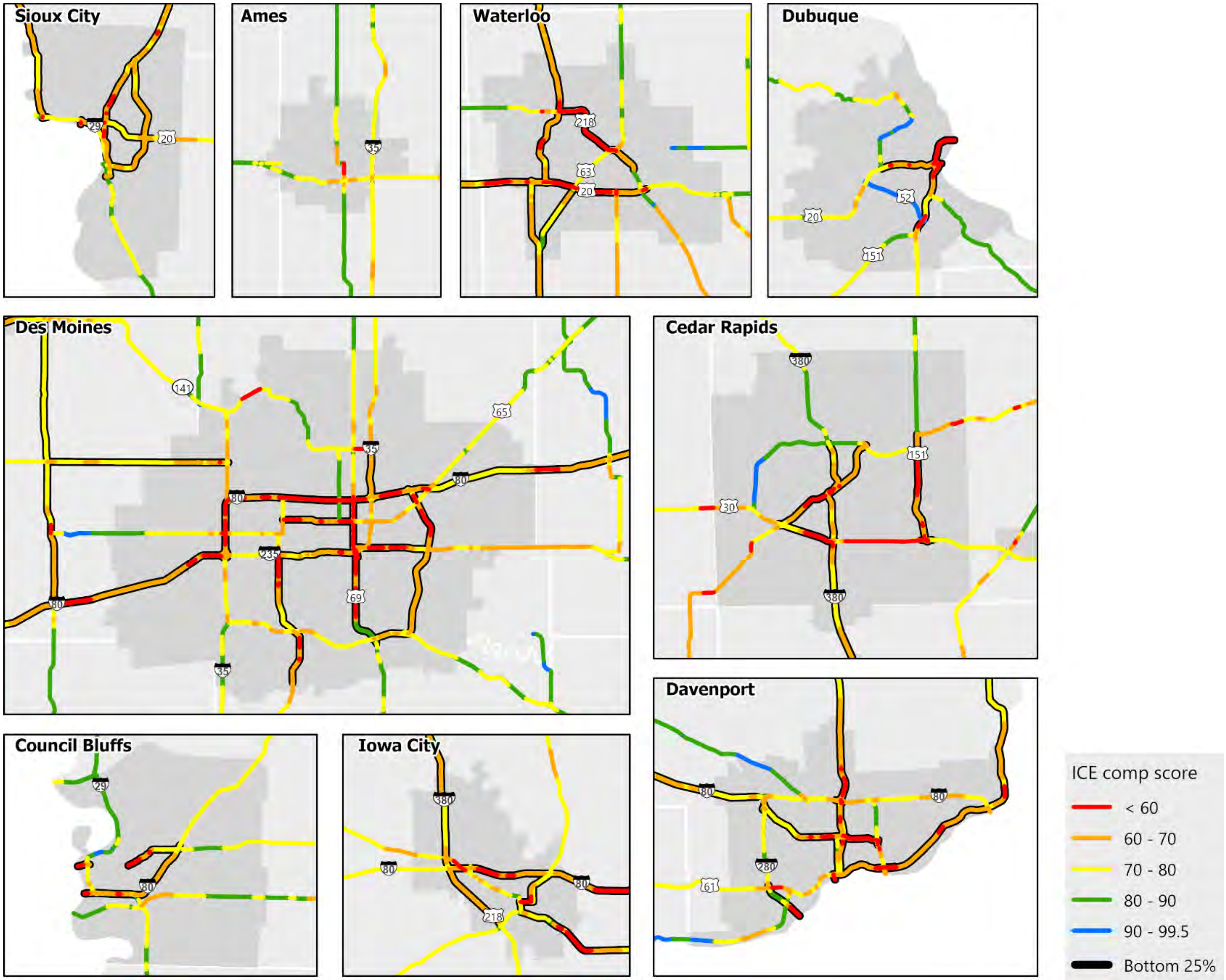
The overall distribution of segment-level ICE composite ratings ranged from a low of 29.5 to 100, with a system-wide average of 76.3. When segments are aggregated to the corridor level, the corridor composite scores range from 43.1 to 92.6, with an average corridor-level composite score of 75.5. The bottom 25 percent of corridors were those that had a score of 71.4 or less.

Figure 5.10: ICE composite ratings and bottom 25 percent of Primary Highway System corridors – statewide view



Source: Iowa DOT

Figure 5.11: ICE composite ratings and bottom 25 percent of Primary Highway System corridors – urban insets



Source: Iowa DOT

Bridge Condition

Bridge condition was measured based on the bridge condition index (BCI). The BCI provides a method of evaluating roadway bridge structures by combining multiple factors to obtain a value that is indicative of a structure's overall condition/sufficiency. These factors include structural condition, load carrying capacity, horizontal and vertical clearances, width, traffic levels, type of roadway served, and the length of out-of-distance travel if the bridge were closed. Reductions for specific vulnerabilities are also factored into the rating. The BCI is measured on a 0-100 scale, with 100 being the best possible rating.

For this analysis, the BCI for the more than 4,000 structures owned and maintained by the Iowa DOT was reviewed, and bridges comprising the lowest-rated 5 percent of the system's bridges were identified. 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 each year to keep up with deterioration. Since this SLRTP is updated every five years, applying this annual figure to the five-year life of the SLRTP results in the 5 percent calculation. The data reviewed for this SLRTP showed the BCI of Iowa DOT bridges ranged from 11.0 to 99.9, with a per-bridge average of 75.1. The bottom 5 percent included bridges with a BCI of 52.5 or less.

Figures 5.12 and 5.13 show the bridges identified as the bottom 5 percent, including two specific sub-categories.

- Structures with an estimated replacement cost of more than $5 million. Multiple projects of this magnitude can quickly use up the funding available for bridge replacements in a given year.
- Structures on routes of over versus under 5,000 annual average daily traffic (AADT). While any individual project's scope will be determined based on its specific circumstances, this visualization is used to represent a higher versus lower traffic threshold, as bridge replacement tends to be a more viable treatment option on higher AADT roadways than a lesser treatment, such as a deck overlay.

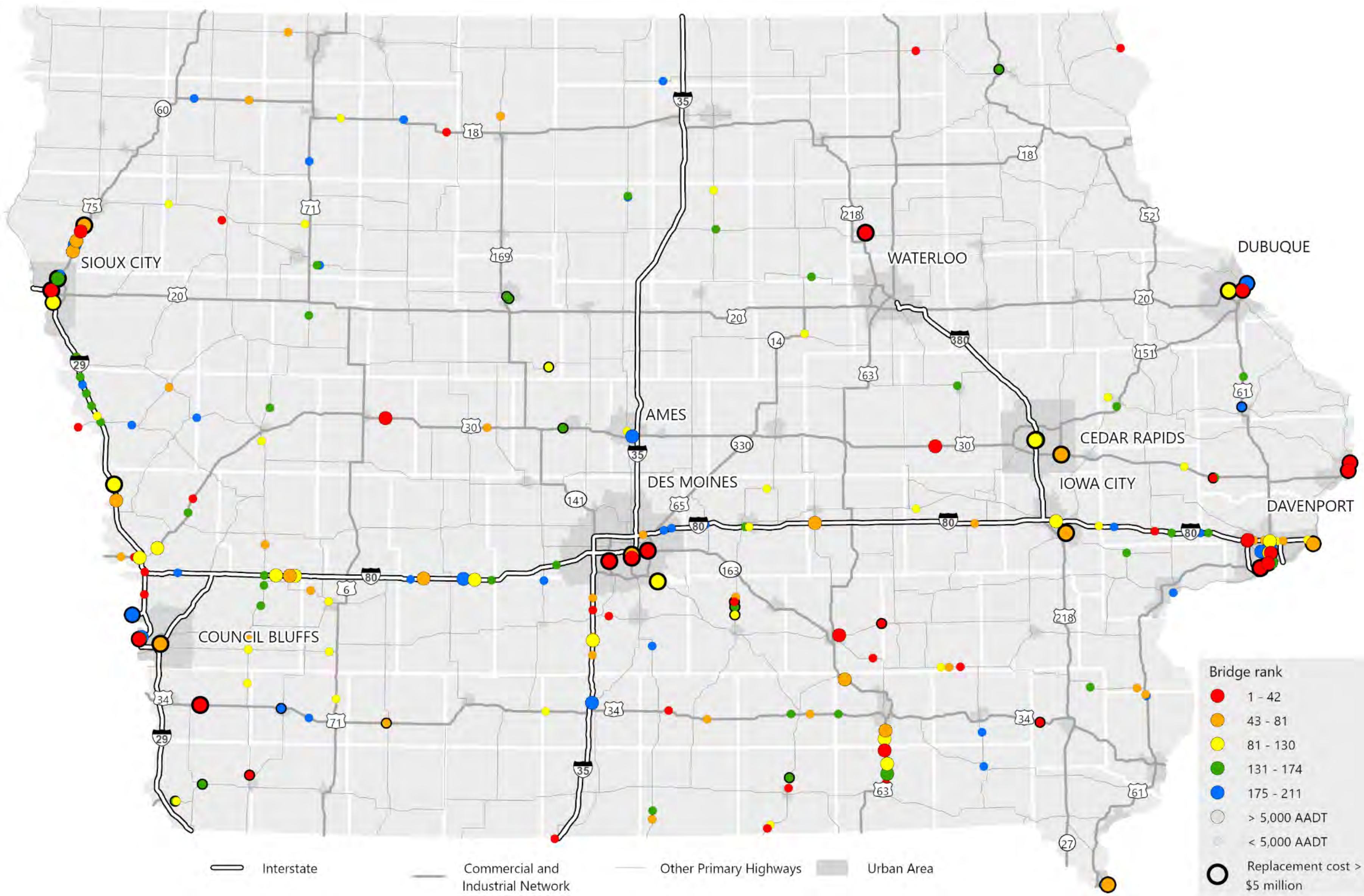
Bridge needs are also shown in the highway needs/risks matrix (see Tables 5.4-5.6). The matrix identifies a bridge's rank (with ties allowed) out of the 216 bridges in the bottom 5 percent, and also notes those bridges that are owned and maintained by the Iowa DOT but are not on the Primary Highway System. A total of 39 of the 216 bridges are located off primary highways, the majority of which are county or municipal roadways that cross an Interstate.

Being included in the bottom 5 percent does not necessarily mean a bridge is in poor condition or will be prioritized for programming, as asset management strategies and many other factors help determine when bridge projects are programmed. However, identifying these structures along with other system-level needs and risks through this SLRTP helps build an awareness of the overall needs and risks a particular highway corridor has.

The Iowa DOT is also responsible for many major bridges, such as border river crossings and large urban viaducts. The ten structures listed below are all likely to need the noted work within the next 20 years; most of them are also in the bottom 5 percent. These projects require special planning due to their financial impact, which can be tens to hundreds of millions of dollars, and their advanced coordination needs, particularly those that are shared with another state.

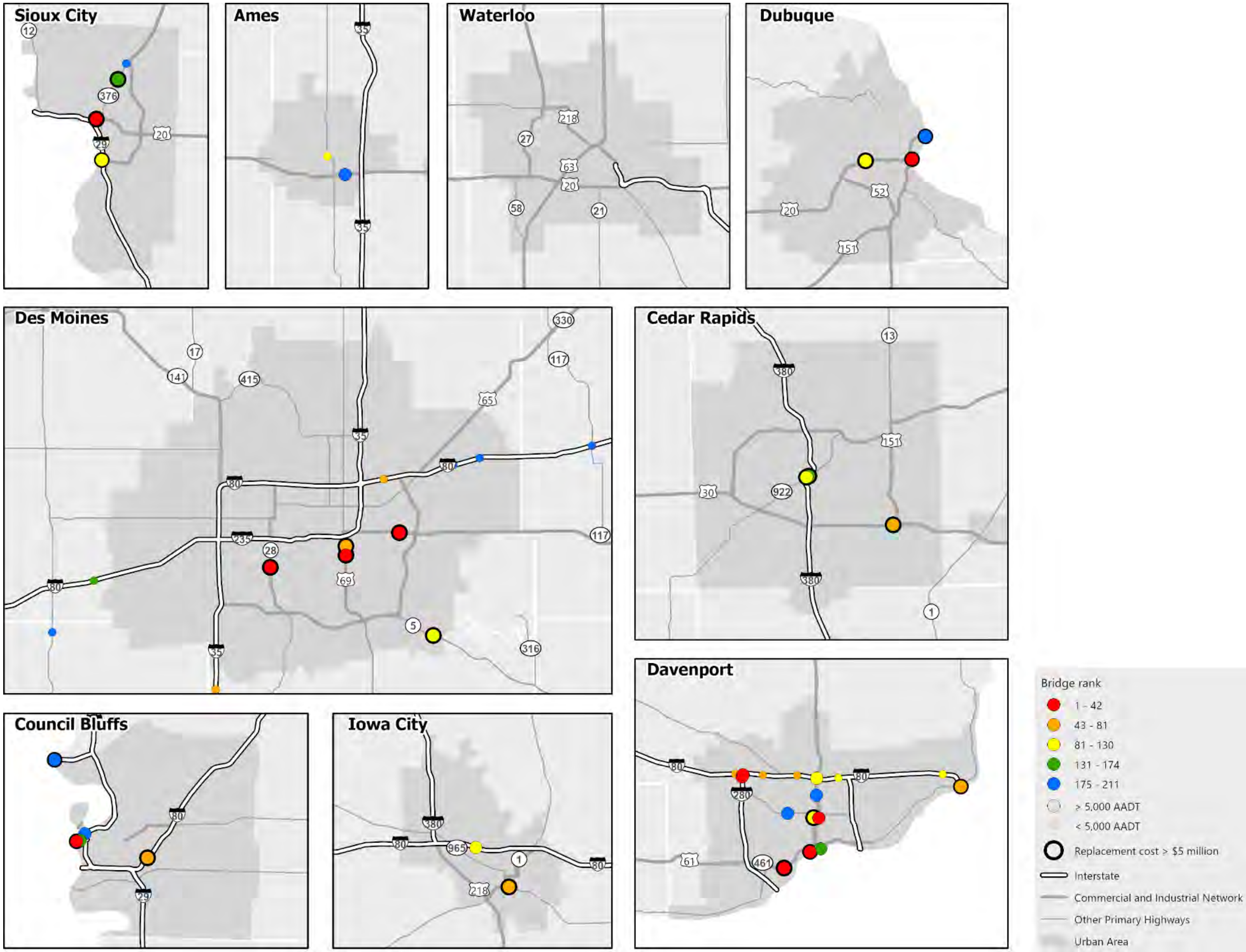
- I-280: Rock Island over the Mississippi River – deck replacement
- I-129: Sioux City over the Missouri River – deck overlay
- IA 9: Lansing over the Mississippi River – replacement
- I-80: Le Claire over the Mississippi River – replacement
- IA 12: Sioux City Gordon Drive Viaduct – replacement
- US 67: Davenport over the Mississippi River – replacement
- IA 175: Decatur over the Missouri River – replacement
- US 20: Dubuque over the Mississippi River – replacement
- US 30: Clinton over the Mississippi River – replacement
- US 63: Ottumwa Viaduct – replacement

Figure 5.12: Bottom 5 percent of Primary Highway System bridges – statewide view



Source: Iowa DOT

Figure 5.13: Bottom 5 percent of Primary Highway System bridges – urban insets



Source: Iowa DOT

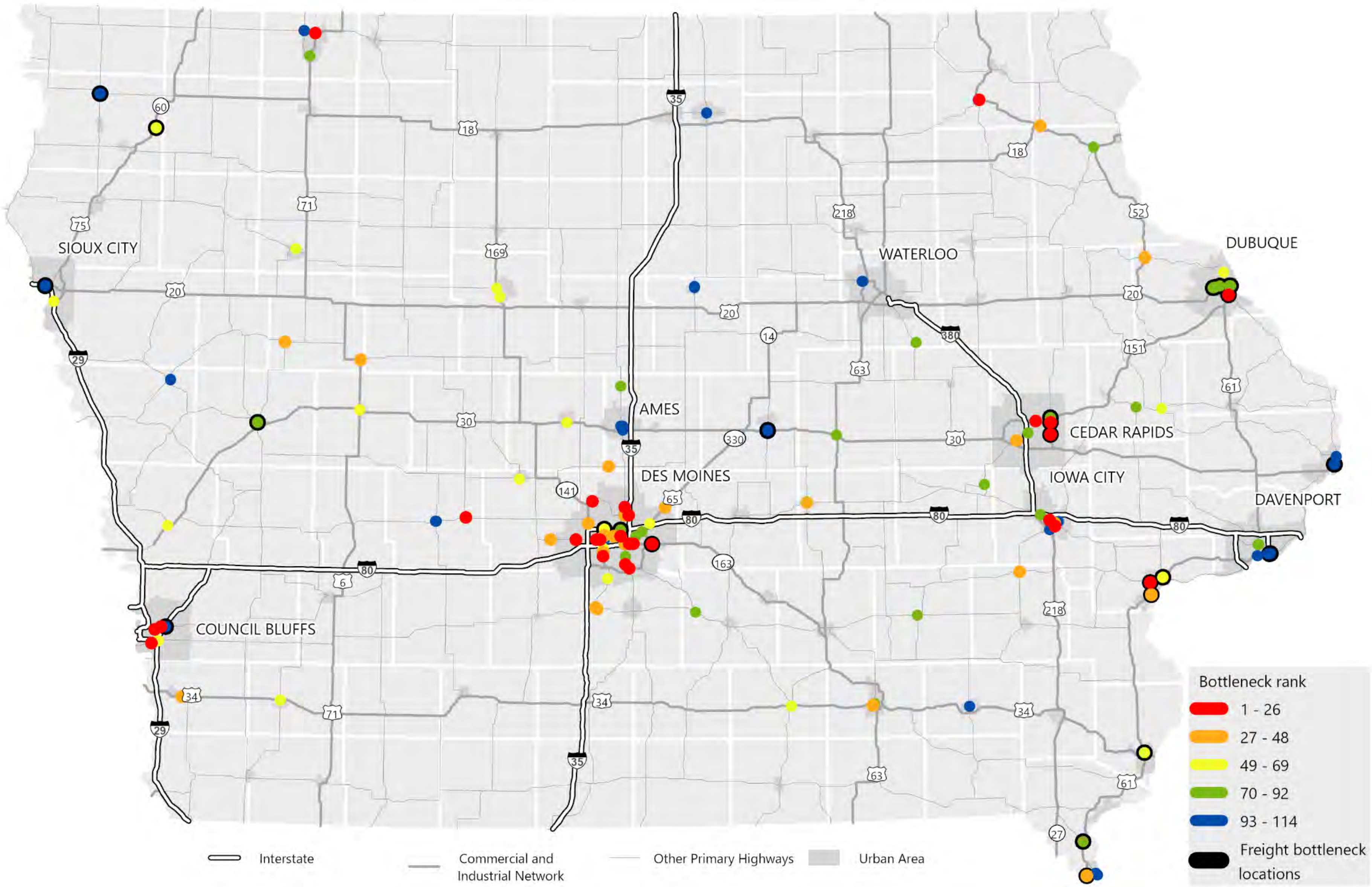
Bottlenecks

Another analysis layer involved reviewing what locations on the Primary Highway System had recurring slow-downs, or bottlenecks. INRIX travel speed data, derived from cellphone and global positioning systems data, was used to identify bottlenecks. Bottleneck conditions were determined by comparing reported speeds to reference speeds for each segment of road. Reference speed values are provided for each segment and represent the 85th percentile observed speed for all time periods, with a maximum value of 65 mph. A bottleneck occurrence is defined in this analysis as a time interval where the average traffic speed is less than or equal to 60 percent of the reference speed. The annual total bottleneck duration per mile was calculated for each segment to represent recurring congestion, and the worst five percent of the overall network was identified. Of those locations among the worst five percent by duration per mile, locations where the duration was one standard deviation or higher than the statewide average were identified as bottleneck needs for the SLRTP.

A total of 114 bottlenecks were identified, shown on Figures 5.14 and 5.15. Bottleneck needs are also shown in the highway needs/risks matrix (see Tables 5.4-5.6). The matrix identifies a bottleneck's rank out of the 114 bottlenecks noted in the plan. A total of 24 bottlenecks are on the Iowa Multimodal Freight Network and of particular concern for freight traffic. These bottlenecks are further analyzed in the State Freight Plan, which prioritizes them based not only on amount of delay but also on condition and value for network efficiency.

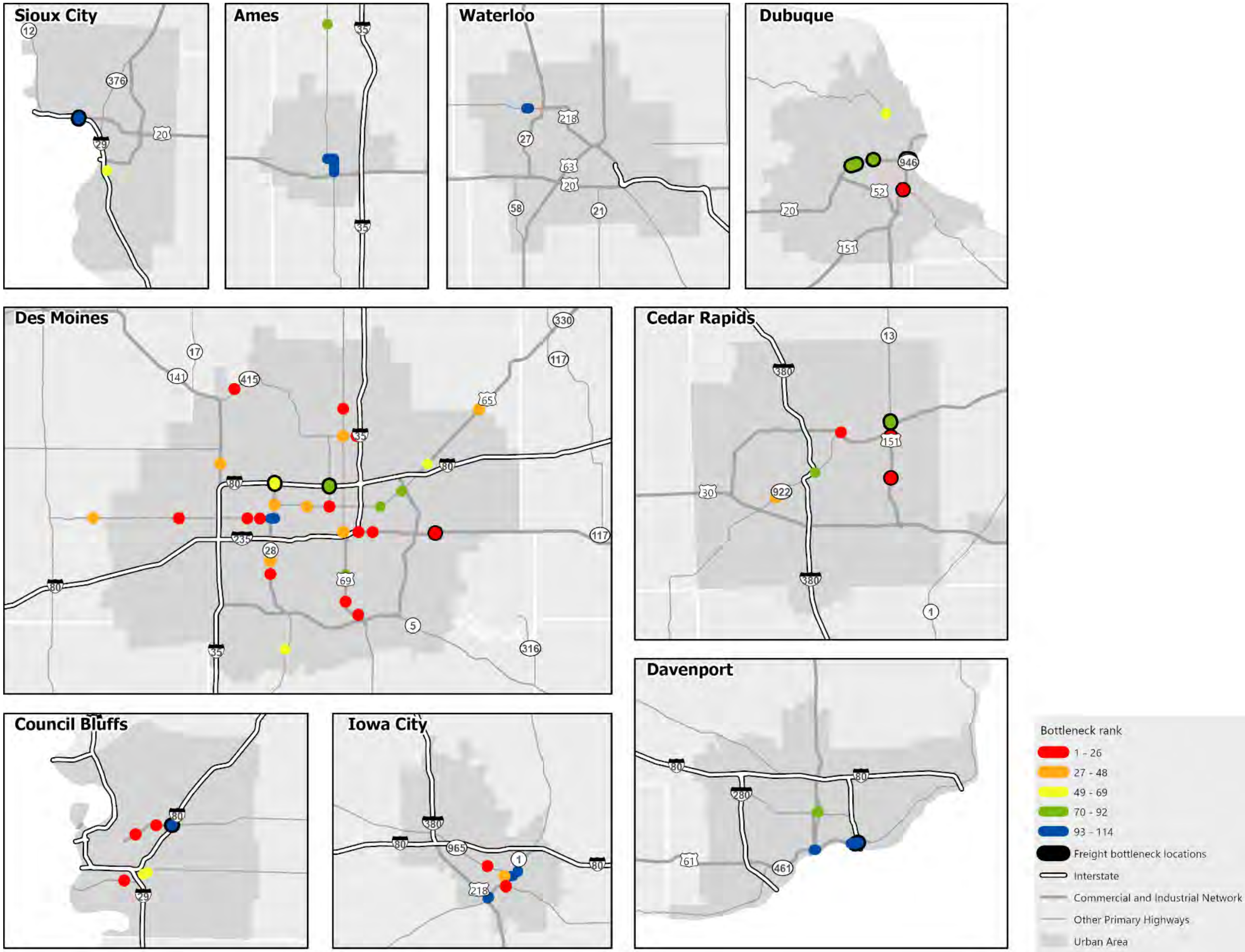
Since this is a very granular segment-level analysis, most bottlenecks occur at intersections, which is to be expected. However, to diagnose the specific issue and best treatment, a broader look at the surrounding network will likely be needed. Bottlenecks may have solutions as simple as retiming stoplights or as complex as access changes or new construction.

Figure 5.14: Bottleneck locations on the Primary Highway System – statewide view



Source: Iowa DOT

Figure 5.15: Bottleneck locations on the Primary Highway System – urban insets



Source: Iowa DOT

Mobility and Safety (Super-2)

As part of the 2017 SLRTP, analysis was conducted to provide a data-driven recommendation for mobility and safety improvements to Primary Highway System corridors. The aim was for these improvements to enhance the operation of the network in particular corridors where capacity expansion needs were not identified, but improvements would help the corridors compliment the state's multilane highway network.

The mobility and safety improvements are realized through the Super-2 concept. As part of the 1997 State Transportation Plan, the Iowa DOT introduced 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 right-of-way needs and 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. A defining feature of Super-2 improvements is the addition of passing lanes, which improve roadway operation by providing opportunities to pass slower-moving vehicles. Other examples of Super-2 design elements include wider paved shoulders, left and right turn lanes, acceleration lanes, limited access, and geometric improvements.

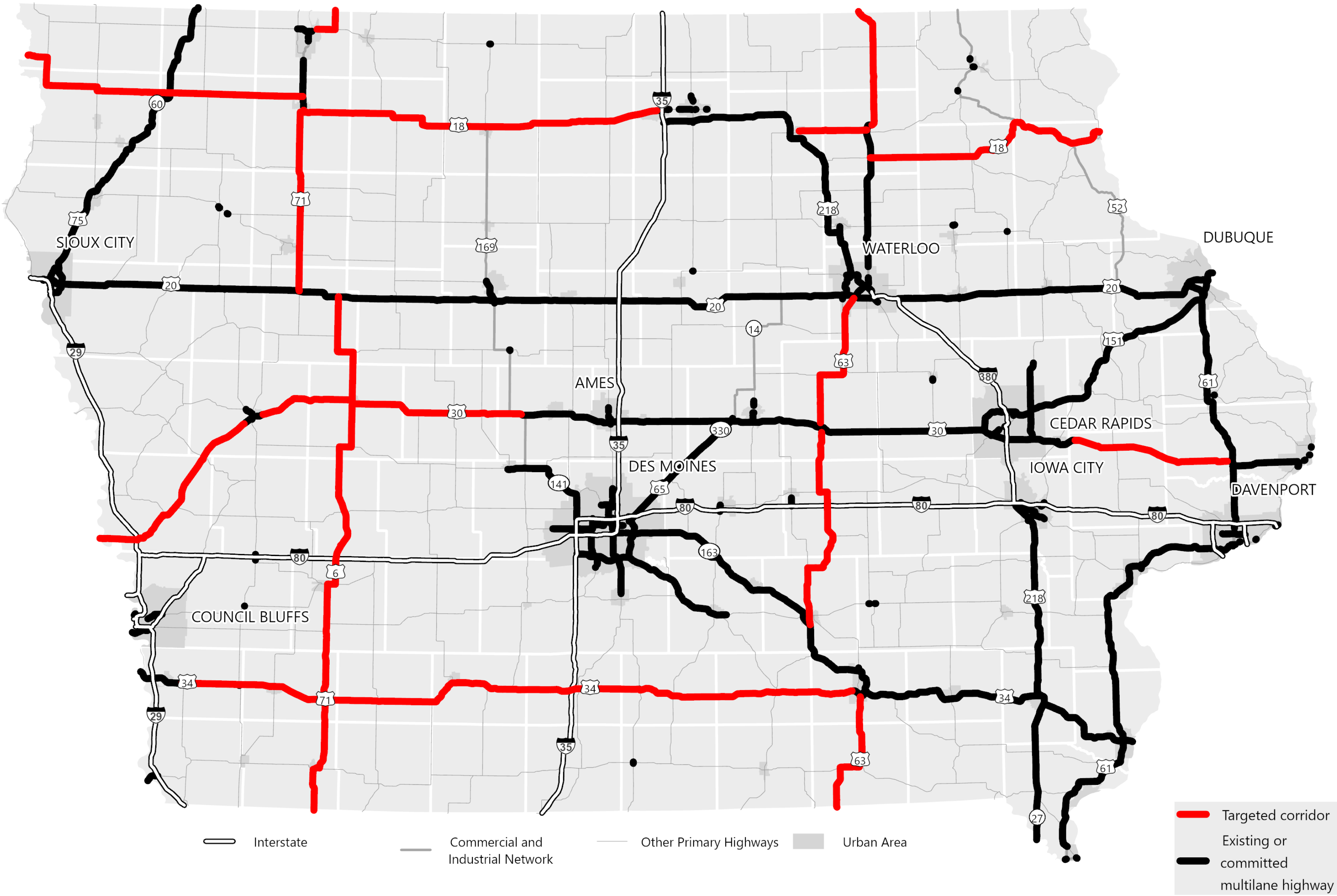
An analysis of two corridors where Super-2 style improvements were constructed during 2008-2011 showed significant safety benefits. The types of improvements included wider paved shoulders, the addition of turn lanes and passing lanes, and access and geometric modifications. The analysis reviewed crashes 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 Highway 169 from Fort Dodge to Humboldt, and a 49 percent reduction in crashes on US Highway 63 from Oskaloosa to New Sharon.

To help determine which corridors to target for Super-2 improvements, several attributes were evaluated, including crash statistics, roadway grades, traffic volumes, average trip lengths, statewide connectivity, and existing network designations. This led to a proposed network for corridor-level Super-2 improvements being adopted as part of the 2017 SLRTP. Over time, these corridors will effectively serve as an enhanced network of two-lane highways providing improved statewide mobility and safety while complementing the existing and committed multilane network. Figure 5.16 shows the corridors targeted for Super-2 improvements, which are the 2-lane portions of US Highways 18, 30, 34, 63, and 71.

The improvements targeted through this effort are a more relaxed application of the Super-2 design, with the appropriate mix of passing lanes and other Super-2 elements being implemented in a targeted and opportunistic fashion when work is being planned for a targeted corridor to address needs such as safety or condition improvements. Implementation of the Super-2 concept began following the 2017 SLRTP's approval. This included the development of design guidelines for the placement, length, and spacing of passing lanes; a high-level analysis of locations suitable to passing lane additions along the five corridors; Planning and Environmental Linkages (PEL) studies for portions of the Super-2 corridors, which have reaffirmed Super-2 as the preferred option rather than multilane capacity expansion; and the programming of initial Super-2 projects on multiple targeted corridors.

Efforts to implement Super-2 improvements should continue on these five corridors as opportunities arise. Also, while these five statewide highways are targeted for Super-2 improvements across their 2-lane portions, this does not preclude the use of these types of treatments in other spot locations to address mobility and safety needs.

Figure 5.16: Corridors targeted for mobility and safety (Super-2) improvements



Source: Iowa DOT

Capacity

Capacity needs were analyzed by using the detailed capacity analysis conducted as part of the development of the last long-range plan in 2017 as a starting point. That analysis included several steps.

- A review of statewide volume-to-capacity (V/C) conditions from the Infrastructure Condition Evaluation (ICE) tool. This provided a congestion index of roadways based on the most recent traffic counts and showed where there were primary highway segments with high V/C ratios, meaning the traffic volumes were approaching the roadway's overall capacity.
- A forecast of future statewide V/C conditions utilizing the Iowa Travel Analysis Model (iTRAM), which is a statewide travel demand model that uses employment, household, and transportation network information to model existing traffic volumes, then forecasts future traffic volumes based on where employment and household growth or decline are anticipated.
- A review of forecasts for future traffic based on Iowa's nine metropolitan planning organization (MPO) travel demand models, which are similar to iTRAM but contain more granularity for the metropolitan areas.

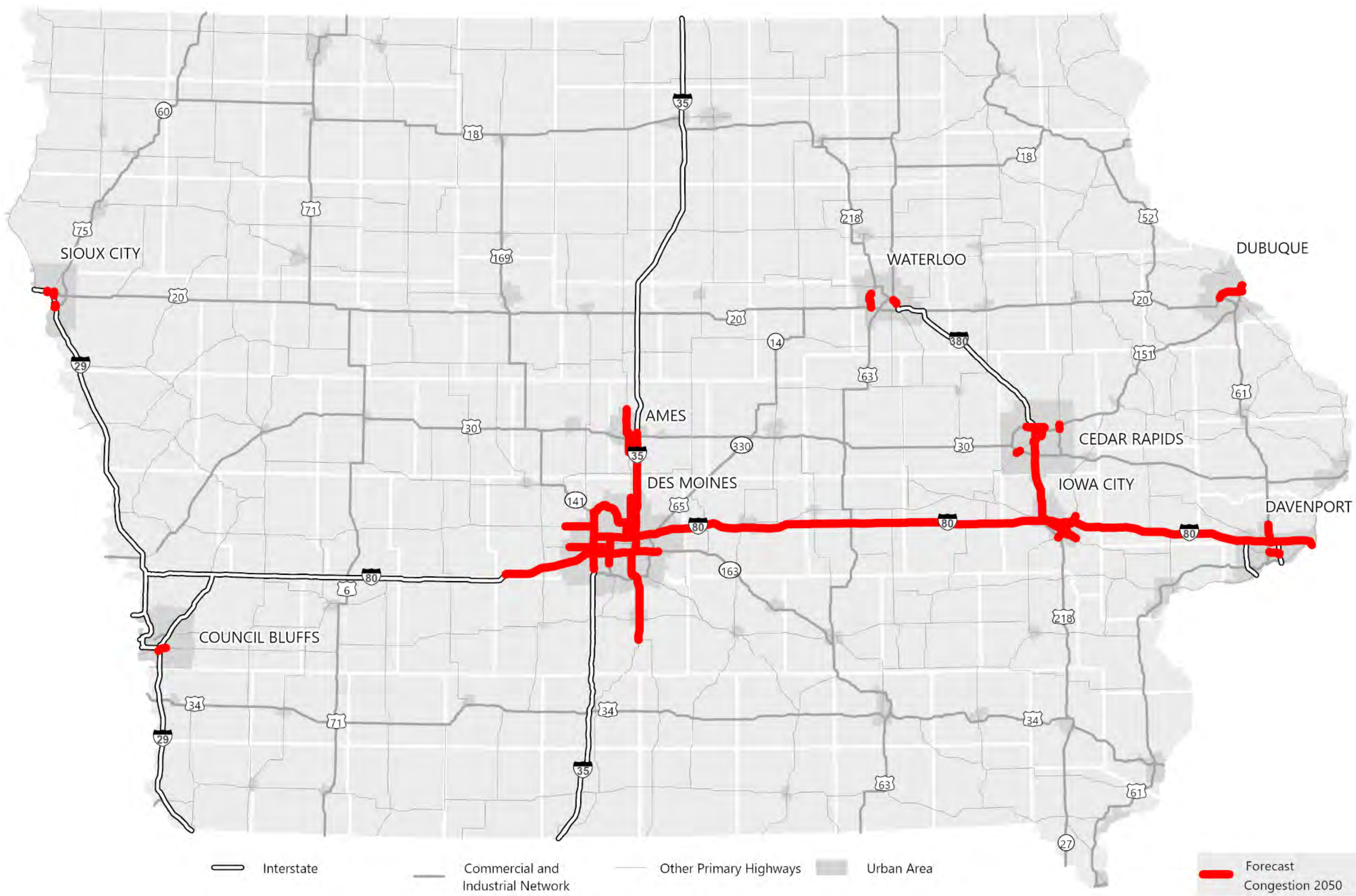
Overall, the base analysis conducted for the 2017 SLRTP showed some primary highway segments with existing V/C ratios that would be approaching, at, or over capacity, most of which were located in metropolitan areas. In rural areas, the higher V/C ratios were on Interstates or near urban areas. In addition 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, as did much of I-80 east of Des Moines. Work has already begun to address some of these Interstate corridors, with significant projects being programmed since the 2017 SLRTP.

The forecast analysis showed that the majority of congestion is forecast to worsen in metropolitan 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 also suggested capacity issues would worsen for the three previously mentioned Interstate corridors if no changes were made. Overall, the results from both analyses were consistent in showing there is limited congestion on Iowa's primary network as a whole.

The analysis conducted for the 2017 SLRTP was used as the baseline for determining capacity needs for this SLRTP. In addition to reviewing the past analysis, several tools and resources were used to evaluate whether any corridors should be added or removed as capacity needs. These included output from an updated version of iTRAM which forecasts traffic to 2050, a review of updated MPO models, and a review of traffic forecasts conducted for corridors or specific locations. This review showed that current tools are very consistent with prior output in terms of what should be identified as a capacity need, and only a small number of changes were made from the 2017 capacity needs.

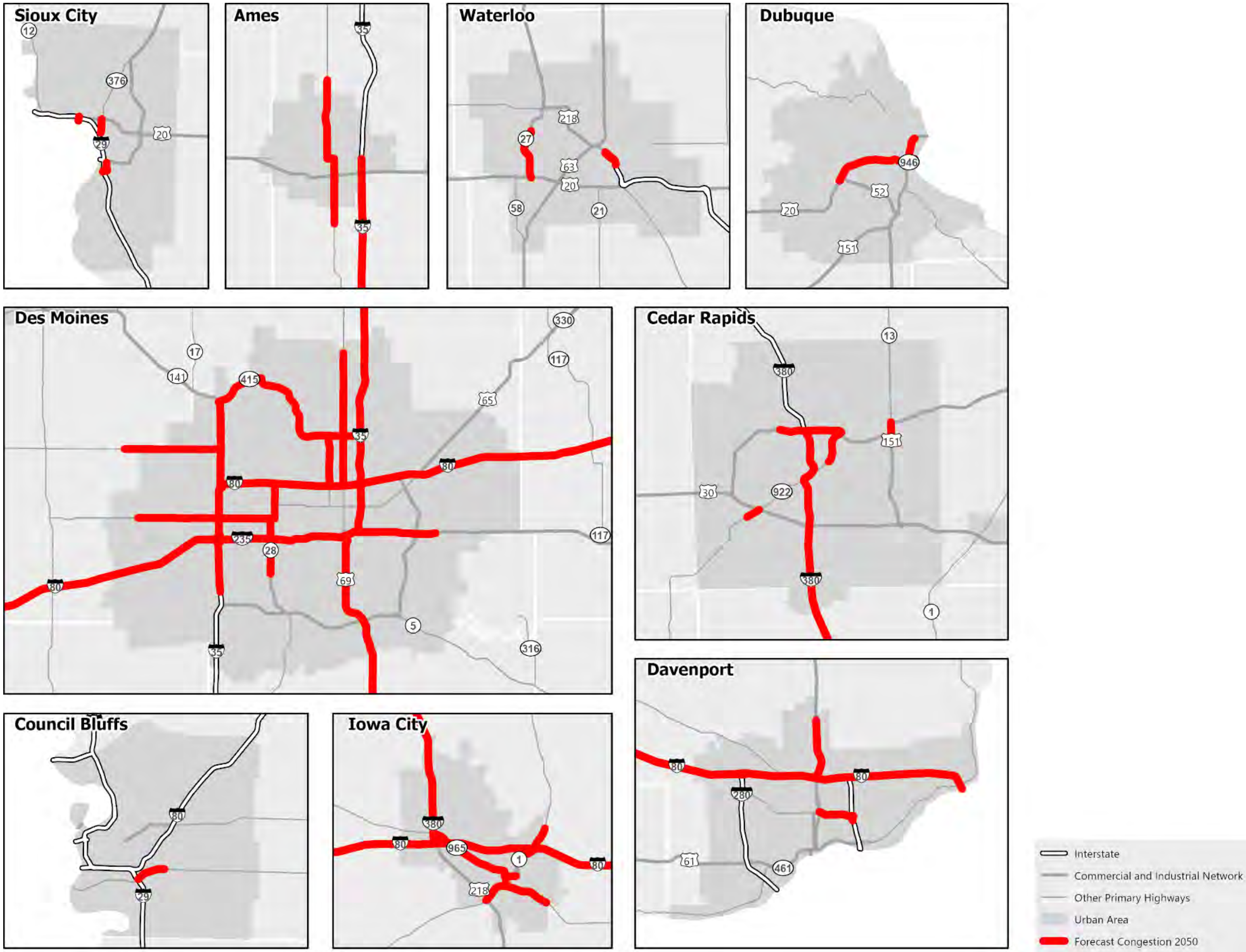
Capacity needs are shown on Figures 5.17 and 5.18. It should be noted that identifying capacity needs at a corridor level involves professional judgment, as the existing or forecasted V/C ratio throughout a corridor may vary substantially. Thus, a corridor being identified as a capacity need does not necessarily mean that it is forecasted to be approaching or over capacity for its entire length; likewise, corridors that have not been identified may have spot locations that are forecast to have congestion issues. Being identified as a capacity need also does not necessarily mean additional lanes will need to be constructed. There are many other strategies and project types that may be appropriate for corridors other than capacity expansion, such as operational strategies, demand management, and intersection/interchange improvements.

Figure 5.17: Corridors projected to be approaching or over capacity by 2050 – statewide view



Source: Iowa DOT

Figure 5.18: Corridors projected to be approaching or over capacity by 2050 – urban insets



Source: Iowa DOT

Safety

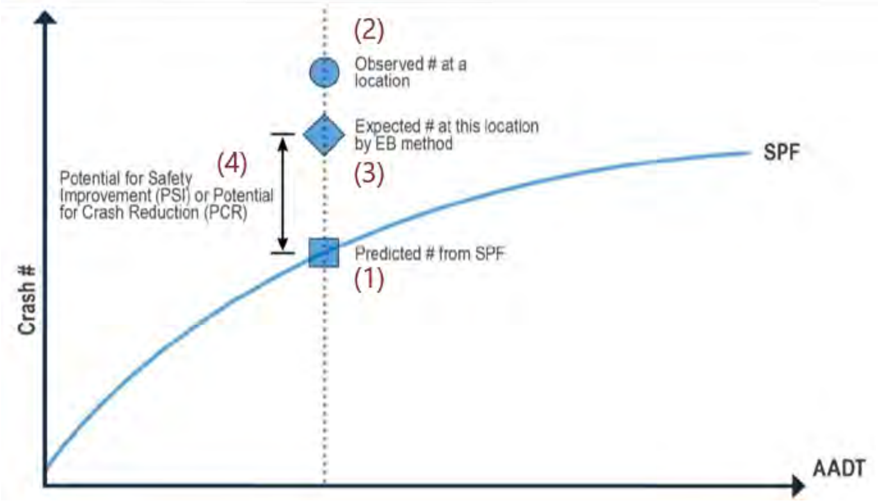
The objective of this analysis was to screen the Primary Highway System for the greatest potential for crash reduction (PCR) on highway segments. The analysis uses a safety performance function (SPF), which is an equation used to predict the average number of crashes per year at a location as a function of exposure and, in some cases, roadway characteristics. SPFs are regression equations that estimate crash frequency as a function of traffic volume and more realistically demonstrate the relationship between crashes and traffic volume.

Figure 5.19 demonstrates how the PCR is calculated. The predicted number of crashes for a given traffic volume is found on the SPF curve (1). For any specific location, the observed number of crashes (2) is likely to be above or below the predicted number calculated by the SPF. The observed crash count is corrected using the Empirical Bayes (EB) method resulting in the expected number of crashes (3) at that location. The difference between the expected number and the predicted number is the PCR (4).

Highway segments were divided into eight classes of roadways for the analysis.

- Divided high speed
- Divided low speed
- Freeway high speed
- Freeway low speed
- Undivided high speed
- Undivided low speed
- Undivided multilane high speed
- Undivided multilane low speed

Figure 5.19: Potential for crash reduction (PCR) calculation

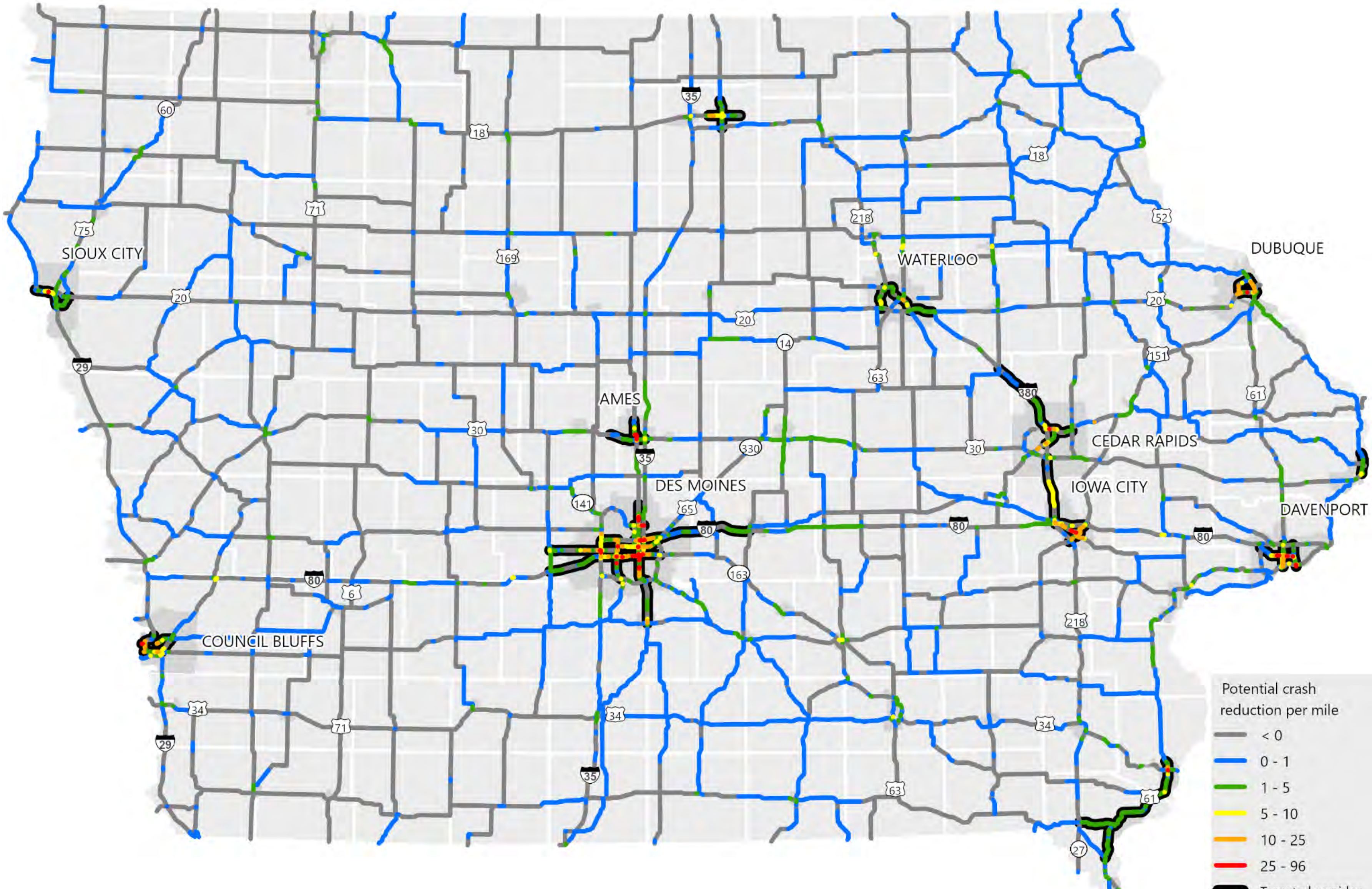


Source: Iowa DOT Safety Analysis Guide

A model was developed for each class of roadway to develop individual SPFs in order to identify the PCR based on the roadway and traffic environment. A high PCR indicates a poorly performing roadway and more potential room for improvement. Segments can have negative PCRs, which suggests that they are performing better than predicted. For the purposes of the plan, positive PCR per mile was used to gauge risk, with higher values equating to higher risks and thus more potential for improvements that could help reduce future crashes.

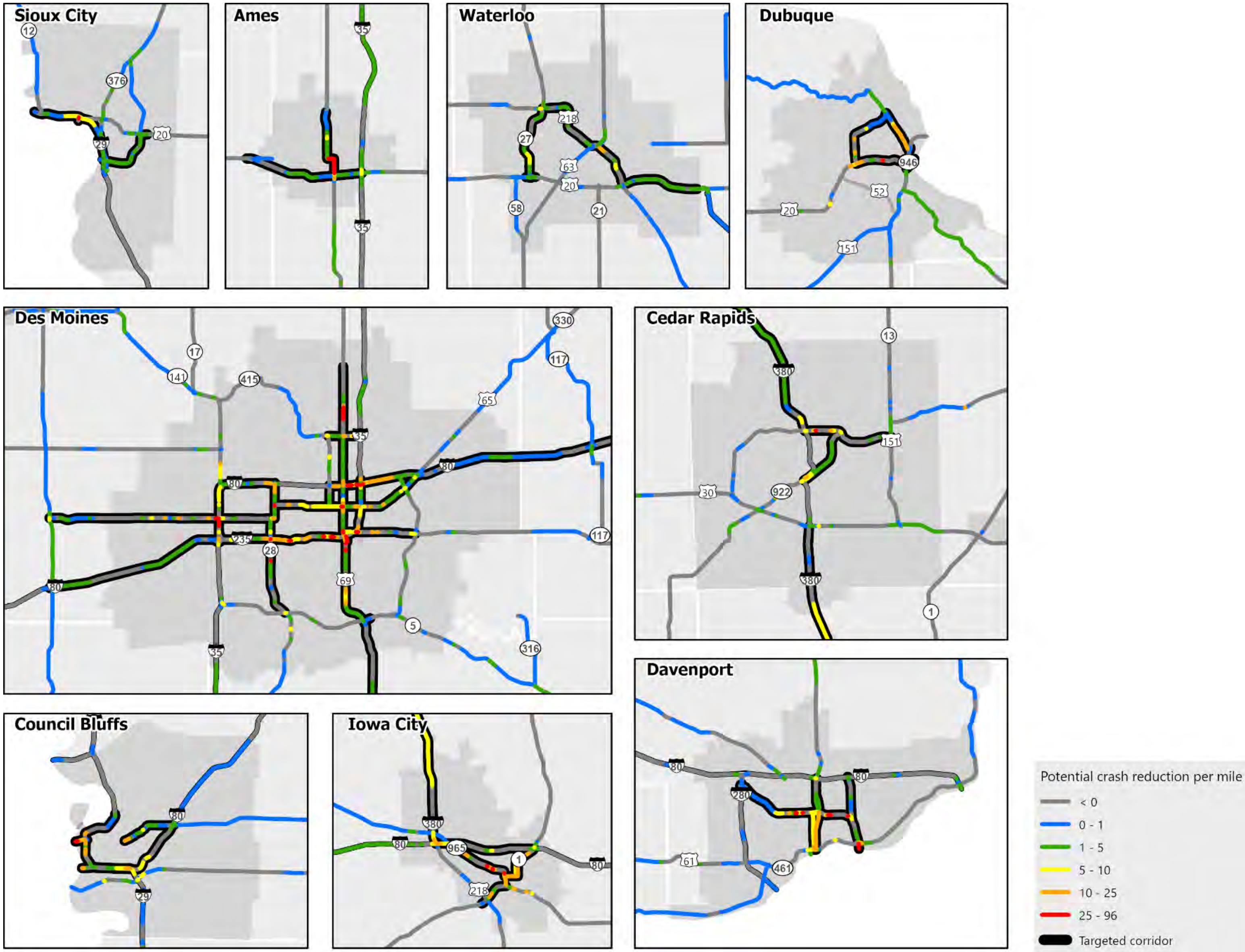
The segment-level PCR output is shown on Figures 5.20 and 5.21. The overall distribution of corridor-level positive PCR per mile ranged from 0.0 to 27.7, with a corridor-level average of 0.7. To identify corridors of most concern from a long-range planning standpoint, corridors that had 1.0 PCR per mile or more were identified, which would mean there is the potential to reduce crashes by at least one per mile throughout the corridor. There are 61 such corridors which are highlighted on Figures 5.20 and 5.21.

Figure 5.20: Potential for crash reduction per mile and corridors targeted for safety improvements – statewide view



Source: Iowa DOT

Figure 5.21: Potential for crash reduction per mile and corridors targeted for safety improvements – urban insets



Source: Iowa DOT

Operations

The operations analysis for the highway system was conducted with the Infrastructure Condition Evaluation-Operations (ICE-OPS) tool. ICE-OPS is a system screening that quantifies the relative risk to the safe and reliable operation of the Primary Highway System. The purpose of this screening was to determine which roadways should be considered priorities for operational enhancements.

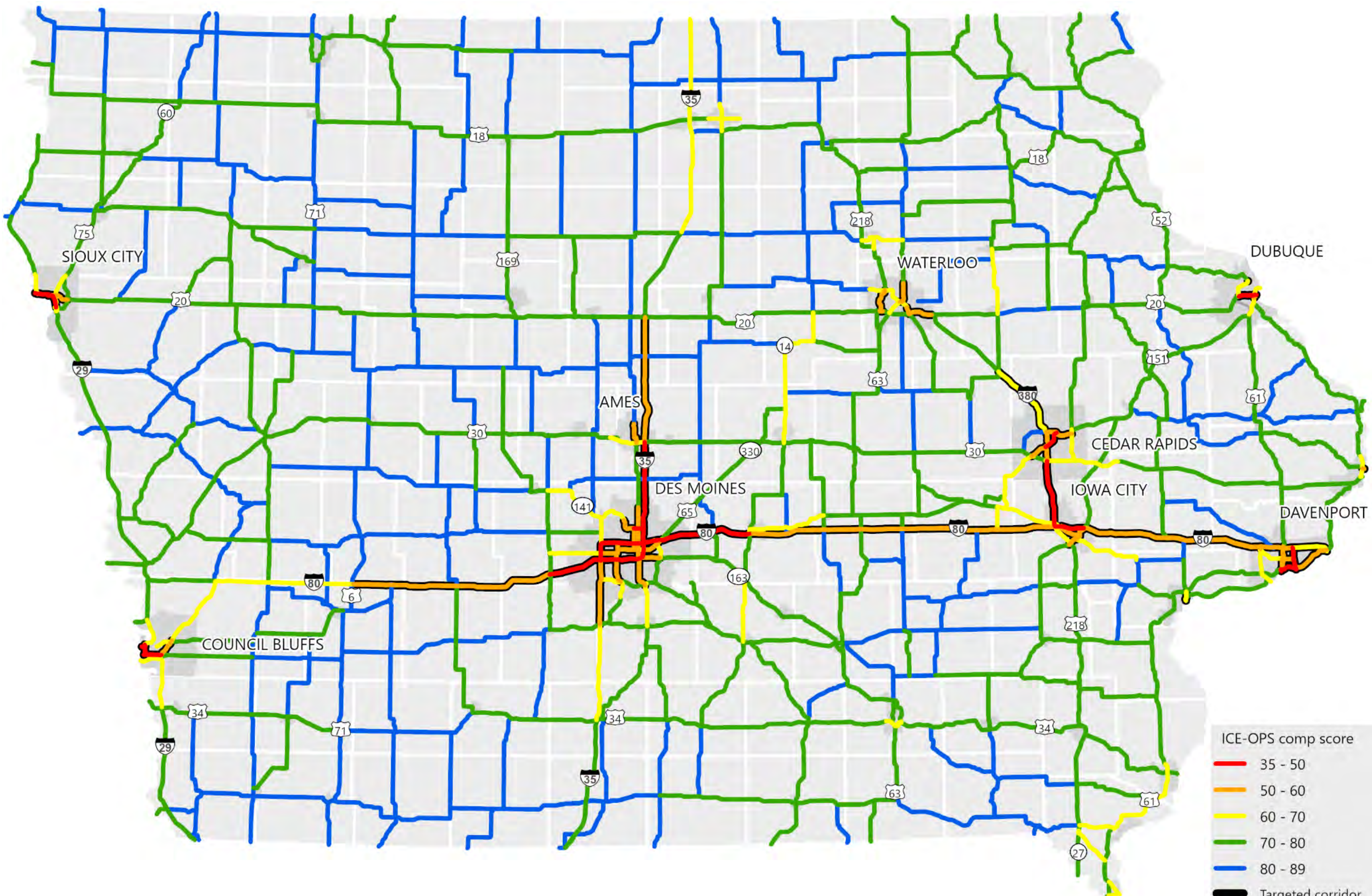
The ICE-OPS tool has a similar structure as the original ICE tool, but with an operations focus. It uses the following ten operations-oriented criteria to rank highway segments.

- Annual average daily traffic (AADT) (20 percent)
- Annual bottleneck duration (15 percent)
- Incident density (15 percent)
- Crash rate (15 percent)
- Buffer time index (10 percent)
- Event center proximity (5 percent)
- Flood event density (5 percent)
- Winter weather sensitive mileage (5 percent)
- Freight network mileage (5 percent)
- ICE infrastructure score (5 percent)

For each segment, the value for each criterion was normalized on a 1 (worst) to 10 (best) scale. Then the ten normalized values were weighted based on the percentages noted above and added together to determine a composite rating for the segment. The composite score had a maximum value of 100, which would mean the highest possible score was assigned for each factor. The normalization and weighting values and process were determined by input from internal stakeholders during the development of the ICE-OPS tool.

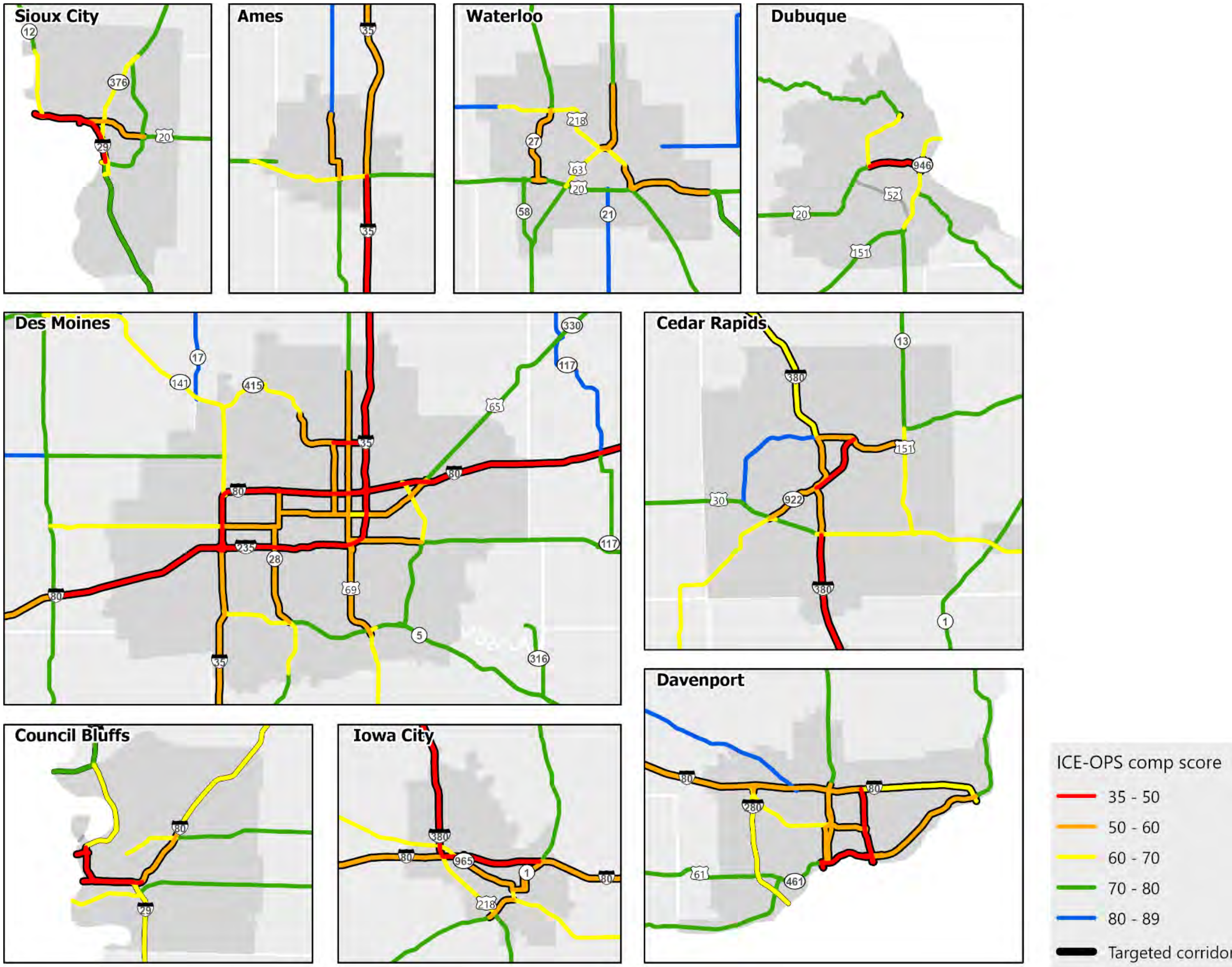
Overall, corridors ranking higher (lower scores) through this analysis are generally in metropolitan areas and along Interstate corridors. The analysis helps identify corridors where there is a greater risk of operational issues and where strategies related to improving the operation of the system may be most beneficial. Figures 5.22 and 5.23 show the results of the ICE-OPS analysis. The overall distribution of corridor-level ICE-OPS composite ratings ranged from 35.6 to 88.2, with a corridor-level average of 73.4. To identify corridors of most concern from a long-range planning standpoint, corridors that had a composite score that was one or more standard deviation below the statewide average were identified. There are 33 such corridors which have a composite score of 51.7 or less and are highlighted on Figures 5.22 and 5.23.

Figure 5.22: ICE-OPS composite scores and corridors targeted for operations improvements – statewide view



Source: Iowa DOT

Figure 5.23: ICE-OPS composite scores and corridors targeted for operations improvements – urban insets



Source: Iowa DOT

Flood Resiliency

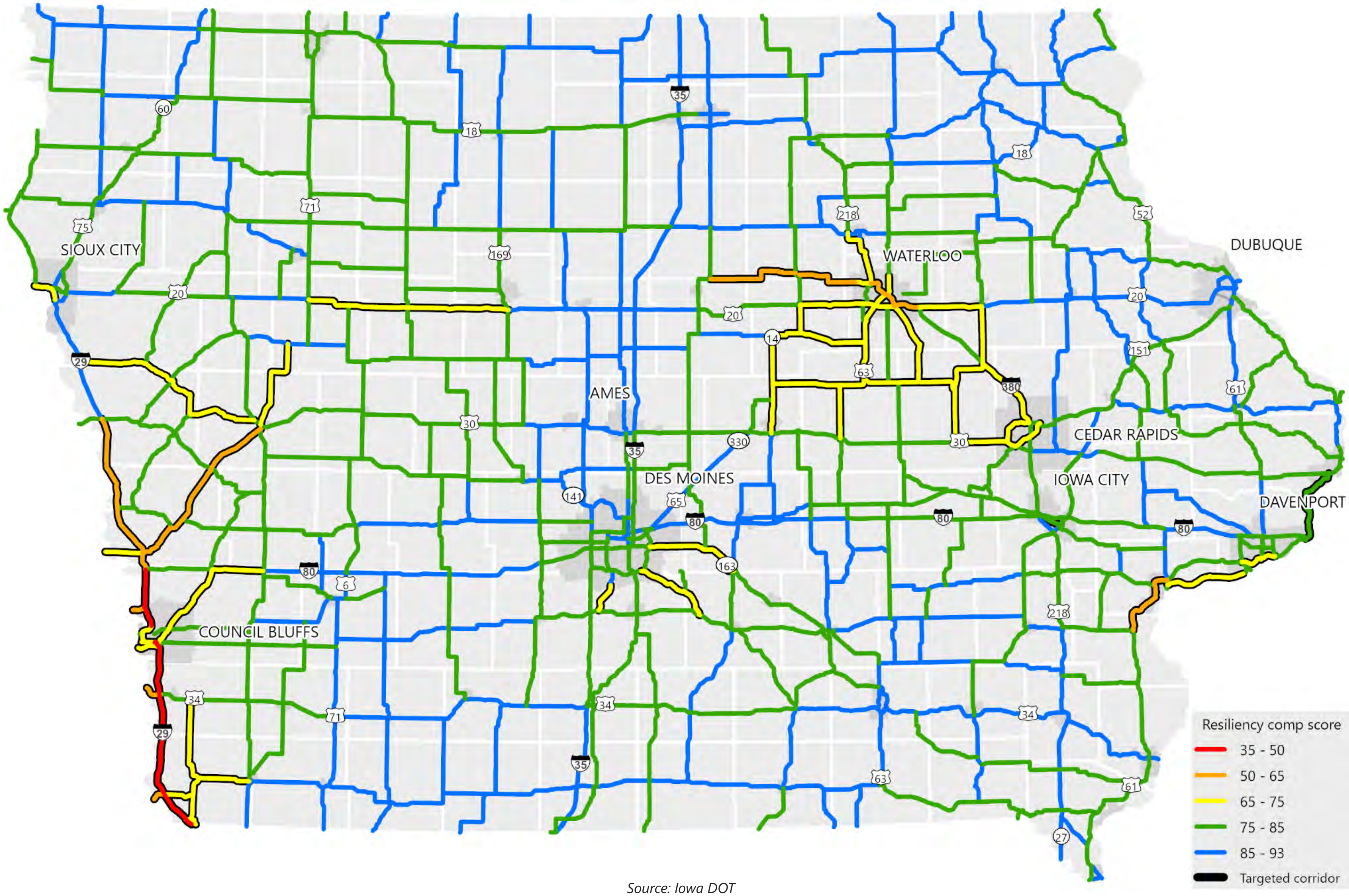
The resiliency analysis focused on screening the Primary Highway System to identify locations vulnerable to a 100-year flood event. The analysis was comprised of three broad components under which seven individual factors were considered, with the goal of developing a composite metric to assess Iowa's vulnerability to flooding.

- **Robustness component**: analyzes the vulnerability of the highway network to a 100-year flood event based on the 100-year floodplain boundary, whether past flooding events have occurred, and roadway shoulder data to estimate how sensitive a specific location may be to flooding.
    - 100-year flood exposure and bridge scour (45 percent)
    - Evaluation of past flood events (15 percent)
    - Roadway resistance (10 percent)
- **Redundancy component**: reviews the extent of alternative routes that can be employed in the event that elements of the system lose function.
    - System availability (20 percent)
- **Criticality component**: identifies the most operationally important assets within the system.
    - Federal functional classification (4 percent)
    - Annual average daily truck traffic (4 percent)
    - Social vulnerability index (2 percent)

The data for each attribute were normalized on a 1 (worst) to 10 (best) scale, then combined based on the weighting identified above. This weighting was determined by the Iowa DOT's Resiliency Working Group. The maximum composite score is 100; higher scores indicate greater resiliency towards a 100-year flood event, whereas lower scores indicate greater vulnerability to those events.

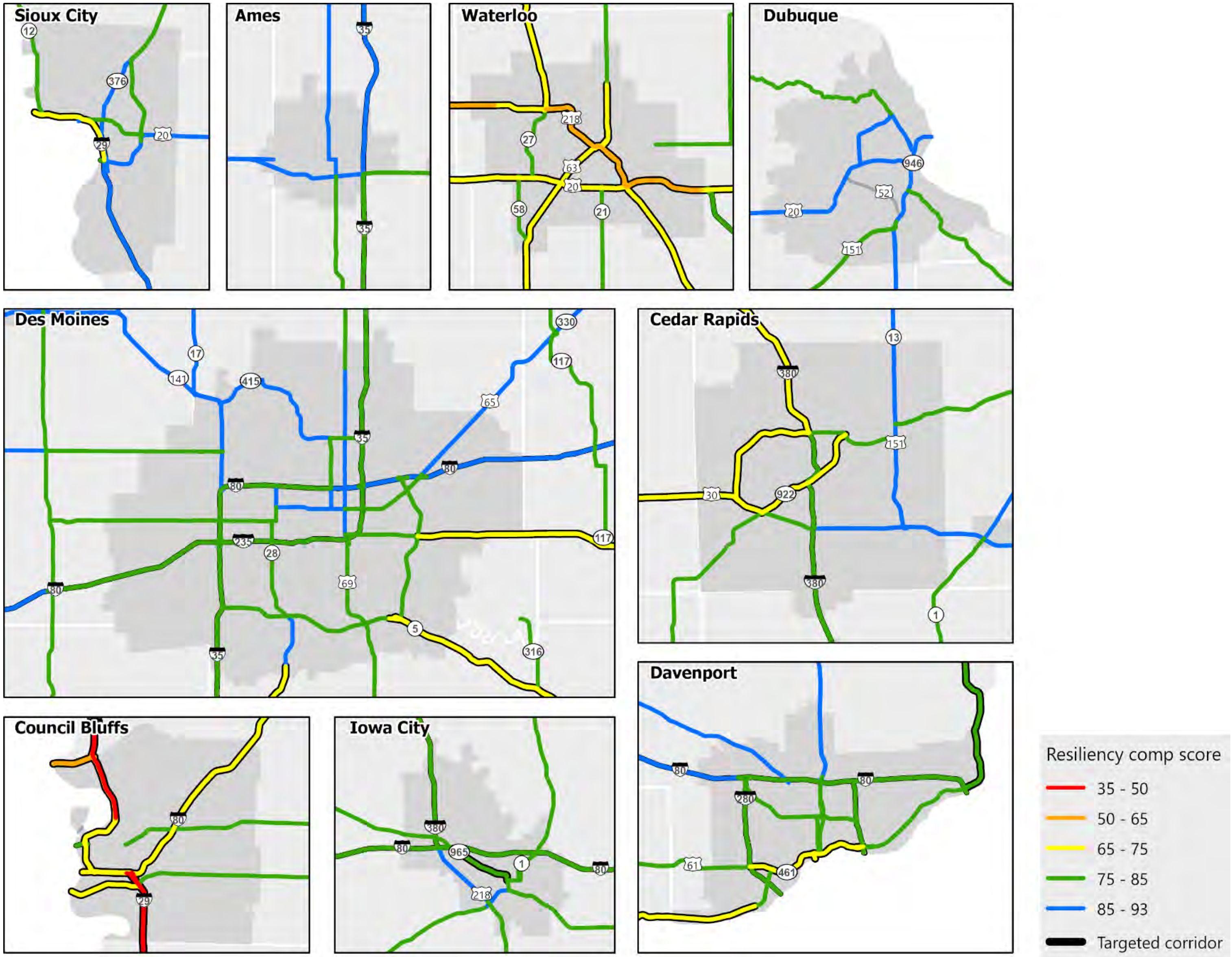
The analysis helps identify corridors where there is a greater risk of flood events and where strategies related to preparedness for possible flooding events and infrastructure improvements to enhance the resiliency of the system may be most beneficial. Figures 5.24 and 5.25 show the results of the flood resiliency analysis. The overall distribution of corridor-level composite ratings ranged from 36.6 to 93.4, with a corridor-level average of 82.4. To identify corridors of most concern from a long-range planning standpoint, corridors that had a composite score that was one or more standard deviation below the statewide average were identified. There are 72 such corridors which have a composite score of 75.1 or less and are highlighted on Figures 5.24 and 5.25.

Figure 5.24: Flood resiliency analysis composite scores and corridors targeted for resiliency improvements – statewide view



Source: Iowa DOT

Figure 5.25: Flood resiliency analysis composite scores and corridors targeted for resiliency improvements – urban insets



Source: Iowa DOT

Bicyclists and Pedestrians

Another safety-oriented analysis focused specifically on bicyclists and pedestrians utilizing the Primary Highway System. The objective of this analysis was to estimate the relative risk to bicyclists and pedestrians associated with roadway features of the Primary Highway System. In contrast to traditional safety analysis, which focuses on identifying locations of high crash frequency, this systemic safety analysis focuses on roadway characteristics that are associated with higher risk of crashes involving a pedestrian or bicyclist. The main reason for this is the underlying assumption that crashes involving pedestrians and bicyclists are infrequent and broadly spread across the network. Therefore, high concentrations of these crashes are very rare, and relying solely on a traditional safety analysis framework would be ineffective.

To conduct the analysis, past crashes involving bicyclists or pedestrians were analyzed to review various roadway characteristics associated with the crash locations. This helped identify attributes that are correlated with a high frequency or rate of that crash type; these risk factors can then be used to identify and prioritize similar roadway locations that have the greatest risk for these types of crashes, whether or not they have a history of bicyclist or pedestrian crashes.

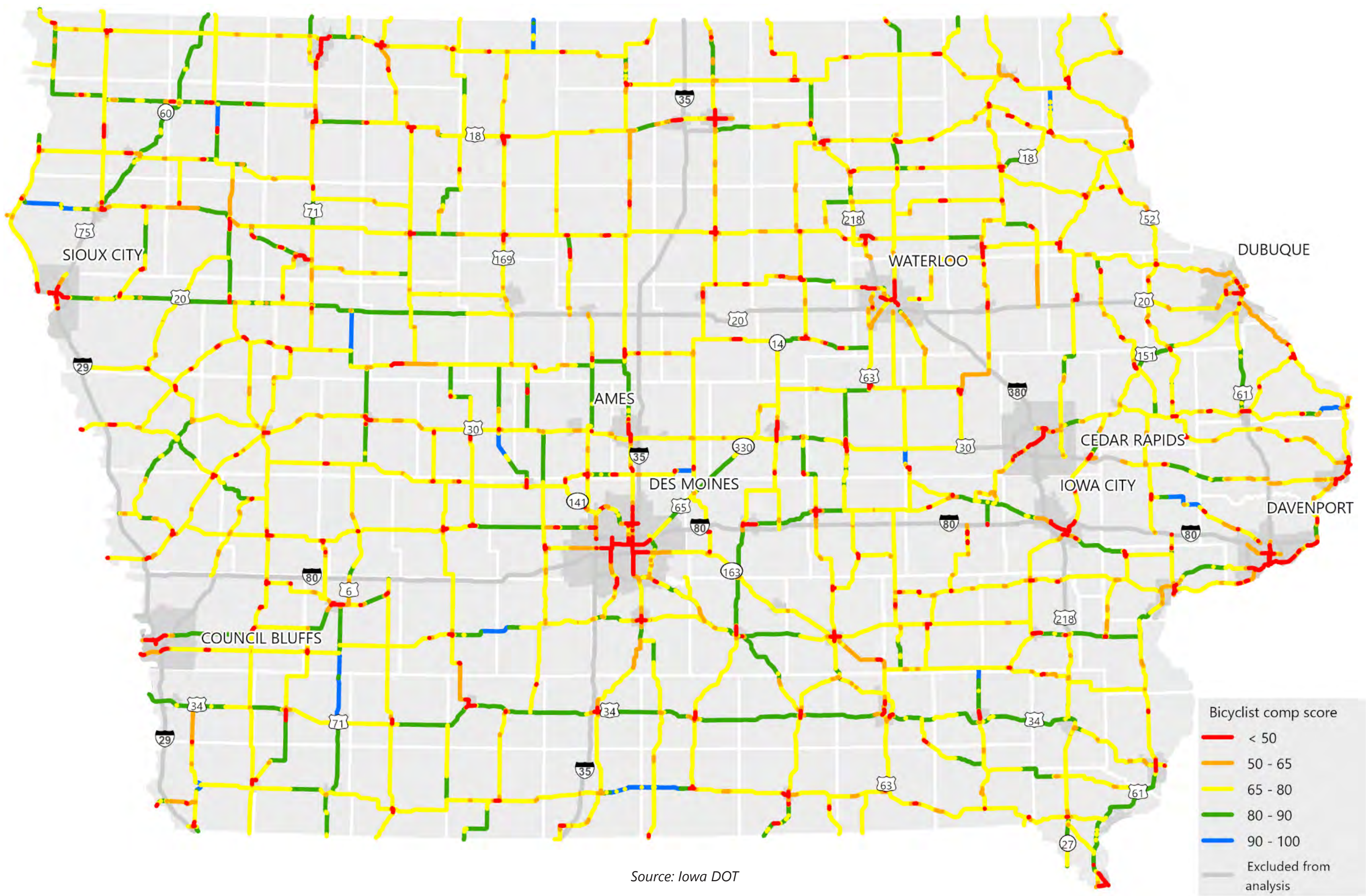
A total of eight attributes were analyzed.

- Annual average daily traffic (AADT)
- Median type
- Number of lanes
- Parking type (only urban)
- Shoulder type
- Shoulder rumble
- Shoulder width
- Speed limit

For each roadway segment, the value for each criterion was normalized on a 1 (worst) to 10 (best) scale. To translate the normalized values to a composite scale, each of the normalized values were weighted equally such that they could be added together to determine a composite rating for the segment. The composite score was designed to have a maximum value of 100, which would mean the highest possible score was assigned for each factor. The lower the composite score, the higher the risk.

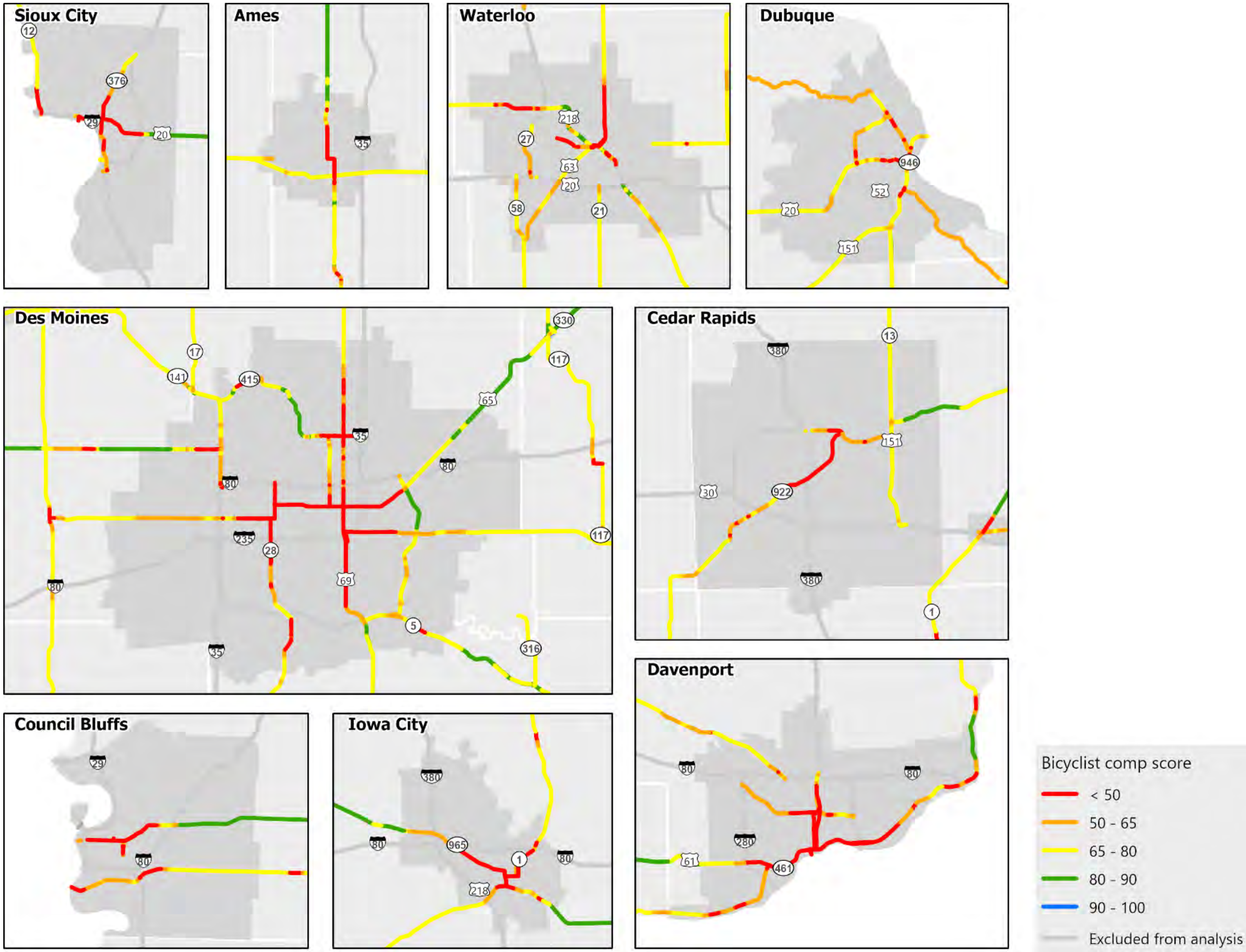
Segment-level output showing composite scores for the bicyclist and pedestrian analysis is shown on Figures 5.26 – 5.29. Interstate highways and minimum-speed corridors are excluded from the analysis. To help provide a sense of corridor-level risk, the segments were also aggregated into the 464 analysis corridors. The matrix shown in Tables 5.4-5.6 identifies the percentage of each corridor's length that is one or more standard deviation below the statewide average for composite scores, calculated separately for bicyclists and pedestrians. For bicyclists, corridor percentages range from 0.0 to 99.7 percent, with an average of 10.0 percent. For pedestrians, corridor percentages also ranged from 0.0 to 99.7 percent, with an average of 12.0 percent. Corridors with higher percentages have more relative length that would be considered higher risk for bicyclists or pedestrians and where improvements may be beneficial in mitigating potential risk.

Figure 5.26: Composite scores for Primary Highway System segments for bicyclist systemic safety analysis – statewide view



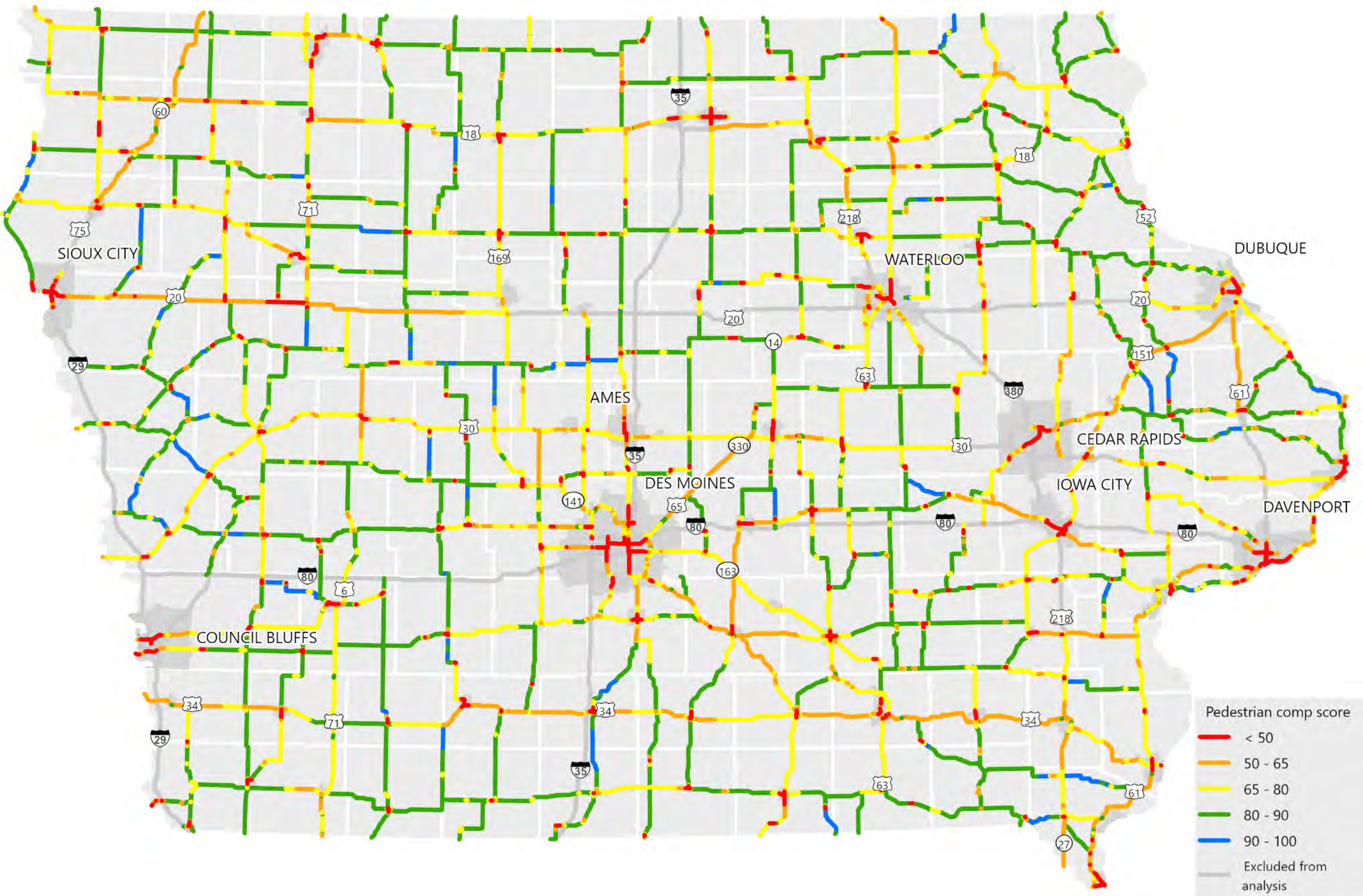
Source: Iowa DOT

Figure 5.27: Composite scores for Primary Highway System segments for bicyclist systemic safety analysis – urban insets



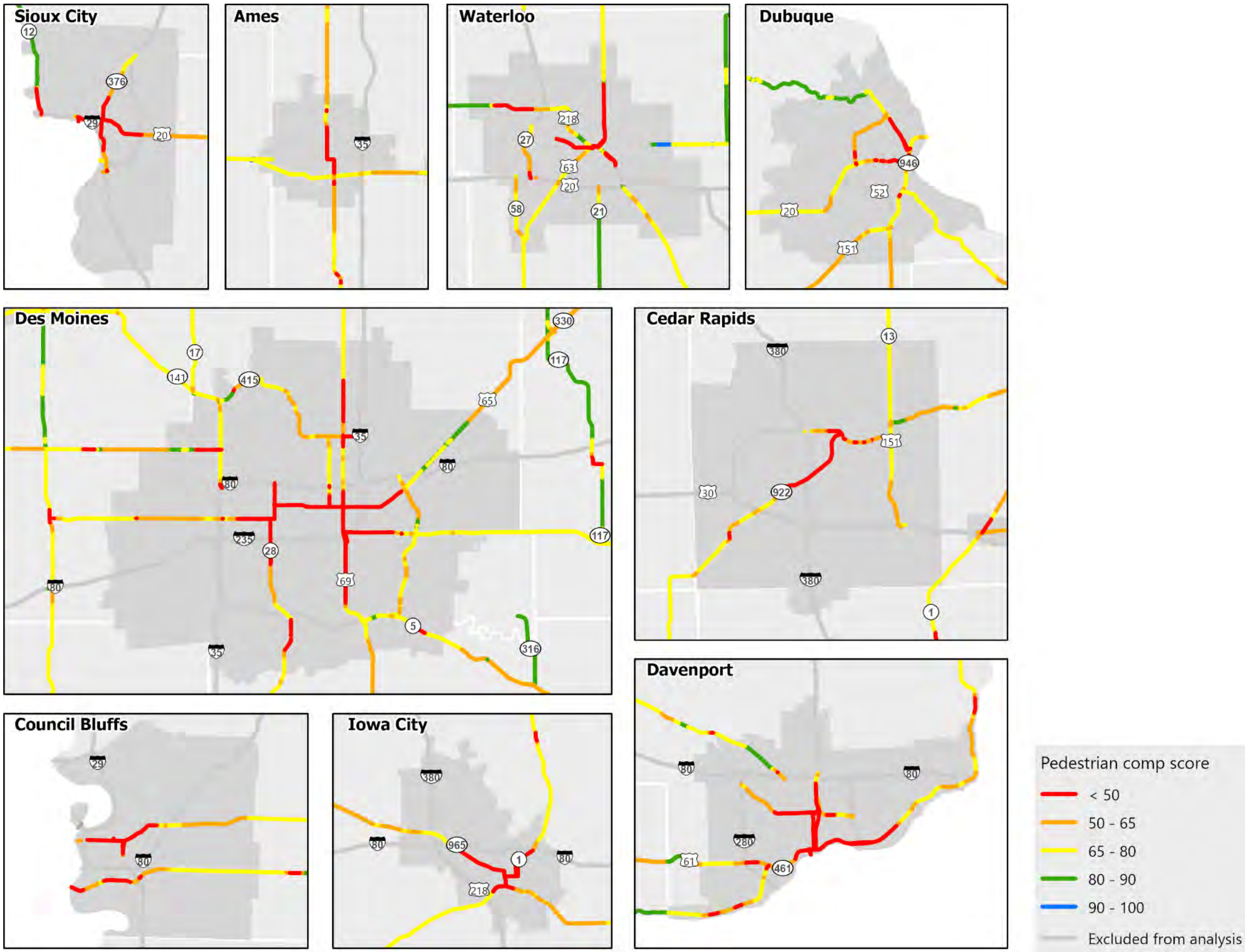
Source: Iowa DOT

Figure 5.28: Composite scores for Primary Highway System segments for pedestrian systemic safety analysis – statewide view



Source: Iowa DOT

Figure 5.29: Composite scores for Primary Highway System segments for pedestrian systemic safety analysis – urban insets



Source: Iowa DOT

5.3 Highway Needs and Risks Matrix

In order to provide a comprehensive view of all analysis layers for the entire Primary Highway System, a highway needs and risks matrix was developed. Highways are categorized by Interstate, US, and Iowa routes. Table 5.3 provides a key to help explain what is shown on the matrix.

Table 5.3: Key to highway needs and risks matrix (Tables 5.4 – 5.6)

Column heading	Description
Route	The highway being referenced. Duplicate routes are represented once in the analysis and matrix. Generally, they are in the grouping for the highest route classification (Interstates > US Highways > Iowa Highways) or for the lowest highway number if classifications are the same.
Corridor	The termini for the specific analysis corridor. Corridors are shown from west-to-east or south-to-north for each route.
County	The county or counties the corridor travels through, listed west-to-east or south-to-north.
IMFN	IMFN = Iowa Multimodal Freight Network. The cell is gray if the corridor is on the network. "Partial" is noted if only a portion is on the network.
CIN	CIN = Commercial and Industrial Network. The cell is gray if the corridor is on the network. "Partial" is noted if only a portion is on the network.
Pavement Condition	The cell is red if the corridor is the bottom 25% of corridors for ICE composite score.
Bridge Condition	The cell is teal if the corridor has one or more bridge in the bottom 5% of bridges by BCI. The numbers are the ranks out of the 216 bridges in the bottom 5%. Numbers appearing in parentheses mean that the two structures are at the same location (e.g., the eastbound and westbound lanes of an Interstate). Numbers followed by "L" mean the structure is owned and maintained by the Iowa DOT but on a local (county or municipal) route. Bridges with the same BCI have the same ranking, meaning some rankings appear multiple times in the matrix.
Bottlenecks	The cell is green if the corridor has one or more bottleneck identified. The numbers are the ranks out of the 114 bottlenecks.
Super-2	The cell is orange if the corridor is on a targeted mobility and safety (Super-2) route. A note of "4LC" means that particular corridor is a 4-lane corridor and would not be targeted for Super-2 improvements.
Capacity	The cell is yellow if the corridor has been identified as a capacity need. "Partial" is noted if only a portion of the corridor was identified as a need.
Safety	The cell is red if the corridor has been identified as a corridor to target for safety improvements, meaning it had a potential for crash reduction (PCR) of at least one crash per mile.
Operations	The cell is teal if the corridor has been identified as a corridor to target for operations improvements, meaning it is one or more standard deviation below the statewide average composite score based on the ICE-OPS tool.
Flood Resiliency	The cell is green if the corridor has been identified as a corridor to target for flood resiliency improvements, meaning it is one or more standard deviation below the statewide average composite score based on the flood resiliency analysis.
Bicyclists	The cell has a percentage in it if the corridor was included in the systemic analysis; the percentage indicates the percent of the corridor that is one or more standard deviation below the statewide average composite score for bicyclists. The orange data bars are proportional to the percentages. "N/A" means the corridor was partially or fully excluded from the analysis (typically Interstates and minimum-speed facilities).
Pedestrians	The cell has a percentage in it if the corridor was included in the systemic analysis; the percentage indicates the percent of the corridor that is one or more standard deviation below the statewide average composite score for pedestrians. The yellow data bars are proportional to the percentages. "N/A" means the corridor was partially or fully excluded from the analysis (typically Interstates and minimum-speed facilities).

Table 5.4: Highway needs and risks matrix, Interstates
(section 1 of 2)

See Table 5.3 for key

Route	Corridor	County	Networks: IMFN	Networks: CIN	Needs: Pavement Condition	Needs: Bridge Condition	Needs: Bottlenecks	Needs: Super-2	Needs: Capacity	Risks: Safety	Risks: Operations	Risks: Flood Resiliency	Risks: Bicyclists	Risks: Pedestrians
I-29	MO border to IA 2	Fremont											N/A	N/A
	IA 2 to US 34	Fremont, Mills											N/A	N/A
	US 34 to I-80	Mills, Pottawattamie											N/A	N/A
	I-80 to I-480/US 6	Pottawattamie											N/A	N/A
	I-480/US 6 to I-680	Pottawattamie				211							N/A	N/A
	I-680 to I-880	Pottawattamie				21L							N/A	N/A
	I-880 to IA 175	Pottawattamie, Harrison, Monona				14L, 94, (60, 136)							N/A	N/A
	IA 175 to US 20/I-129	Monona, Woodbury				96L, 144L, 149L, 151L, 174L, 176L							N/A	N/A
	US 20/I-129 to SD border	Woodbury					109						N/A	N/A
I-35	MO border to US 34	Decatur, Clarke											N/A	N/A
	US 34 to IA 92	Clarke, Warren				66L, 70L, 100, 211							N/A	N/A
	IA 92 to IA 5	Warren, Polk				7L, 68L							N/A	N/A
	IA 5 to W mixmaster	Polk							Partial				N/A	N/A
	E mixmaster to IA 160	Polk											N/A	N/A
	IA 160 to US 30	Polk, Story											N/A	N/A
	US 30 to US 20	Story, Hamilton							Partial				N/A	N/A
	US 20 to IA 3	Hamilton, Wright, Franklin											N/A	N/A
	IA 3 to US 18	Franklin, Cerro Gordo											N/A	N/A
	US 18 to MN border	Cerro Gordo, Worth											N/A	N/A
I-74	IL border to I-80	Scott					110						N/A	N/A

Table 5.4: Highway needs and risks matrix,
Interstates
(section 2 of 2)

See Table 5.3 for key

Route	Corridor	County	Networks: IMFN	Networks: CIN	Needs: Pavement Condition	Needs: Bridge Condition	Needs: Bottlenecks	Needs: Super-2	Needs: Capacity	Risks: Safety	Risks: Operations	Risks: Flood Resiliency	Risks: Bicyclists	Risks: Pedestrians
I-80	NE border to E jct I-29	Pottawattamie											N/A	N/A
	E jct I-29 to US 6	Pottawattamie				55	99						N/A	N/A
	US 6 to US 59	Pottawattamie					99						N/A	N/A
	US 59 to US 6/US 71	Pottawattamie, Cass				55, 96, 104							N/A	N/A
	US 6/US 71 to US 169	Cass, Adair, Madison, Dallas				81, 116, 171L, 182, 211L			Partial				N/A	N/A
	US 169 to W mixmaster	Dallas, Polk				167L							N/A	N/A
	W mixmaster to US 6	Polk											N/A	N/A
	US 6 to IA 141	Polk											N/A	N/A
	IA 141 to IA 28	Polk					68						N/A	N/A
	IA 28 to IA 415	Polk					68, 89						N/A	N/A
	IA 415 to E mixmaster	Polk					89						N/A	N/A
	E mixmaster to IA 14	Polk, Jasper				(81, 191), 81L, 108L, 154L, 188L, 199L							N/A	N/A
	IA 14 to US 63	Jasper, Poweshiek											N/A	N/A
	US 63 to US 151	Poweshiek, Iowa				52L							N/A	N/A
	US 151 to I-380	Iowa, Johnson											N/A	N/A
	I-380 to IA 1	Johnson				93L							N/A	N/A
	IA 1 to US 6	Johnson, Cedar				90L, 179L							N/A	N/A
	US 6 to I-280	Cedar, Scott				47L, 159L, 191L							N/A	N/A
	I-280 to I-74	Scott				52L, 75L, 92L							N/A	N/A
	I-74 to IL border	Scott				45, 80L, 118L							N/A	N/A
I-129	NE border to I-29	Woodbury				120							N/A	N/A
I-235	W mixmaster to IA 28	Polk											N/A	N/A
	IA 28 to US 69	Polk											N/A	N/A
	US 69 to E mixmaster	Polk											N/A	N/A
I-280	IL border to US 61/IA 146	Scott											N/A	N/A
	US 61/IA 146 to I-80	Scott				33, 39, 68							N/A	N/A
I-380	I-80 to US 30	Johnson, Linn											N/A	N/A
	US 30 to IA 100	Linn				120, 147							N/A	N/A
	IA 100 to IA 150	Linn, Benton											N/A	N/A
	IA 150 to E jct US 20	Benton, Buchanan, Black Hawk											N/A	N/A
	E jct US 20 to Mitchell Ave	Black Hawk											N/A	N/A
I-480	NE border to I-29	Pottawattamie				8, 154							N/A	N/A
I-680	NE border to I-29	Pottawattamie				199							N/A	N/A
I-880	I-29 to I-80	Pottawattamie				179							N/A	N/A

Table 5.5: Highway needs and risks matrix,
US routes
(section 1 of 6)

See Table 5.3 for key

Route	Corridor	County	Networks: IMFN	Networks: CIN	Needs: Pavement Condition	Needs: Bridge Condition	Needs: Bottlenecks	Needs: Super-2	Needs: Capacity	Risks: Safety	Risks: Operations	Risks: Flood Resiliency	Risks: Bicyclists	Risks: Pedestrians
US 6	I-80 to US 59	Pottawattamie					99						0.0%	5.9%
	US 59 to US 71	Pottawattamie, Cass											7.8%	7.8%
	US 169 to I-35/80	Dallas, Polk					20, 46		Partial				1.9%	1.9%
	I-35/80 to IA 28	Polk		Partial			1, 11, 37, 102						35.1%	56.9%
	IA 28 to US 69	Polk					15, 37, 43						98.1%	98.1%
	US 69 to I-235	Polk											99.7%	99.7%
	I-235 to I-80	Polk					75, 78						25.6%	39.6%
	I-80 to IA 146	Jasper, Poweshiek					36						9.8%	10.1%
	IA 146 to US 151	Poweshiek, Iowa				111	36						6.7%	4.1%
	US 151 to IA 965	Iowa, Johnson					81		Partial				0.1%	0.1%
	IA 965 to IA 1	Johnson					2, 30, 81						49.3%	56.8%
	IA 1 to IA 70	Johnson, Muscatine		Partial		75	26, 30		Partial				8.8%	7.5%
	IA 70 to IA 38	Muscatine				132							0.1%	0.1%
	IA 38 to I-80	Muscatine, Cedar				147							2.7%	1.5%
	I-280 to IA 461	Scott				191	73						32.9%	34.1%
	IA 461 to I-74	Scott					73						0.8%	2.6%
US 18	SD border to US 75	Lyon, Sioux					101						1.5%	2.4%
	US 75 to IA 60	Sioux, O'Brien					101						4.6%	9.8%
	IA 60 to US 71	O'Brien, Clay				62, 211							4.6%	38.7%
	US 71 to US 169	Clay, Palo Alto, Kossuth				32, 130, 201							6.8%	23.8%
	US 169 to I-35	Kossuth, Hancock, Cerro Gordo											0.2%	3.5%
	I-35 to US 65	Cerro Gordo						4LC					N/A	N/A
	US 65 to US 218	Cerro Gordo, Floyd						4LC					0.3%	53.7%
	US 218 to US 63	Floyd, Chickasaw											11.9%	7.2%
	US 63 to IA 150	Chickasaw, Fayette											1.4%	31.5%
	IA 150 to US 52	Fayette, Clayton, Allamakee											3.2%	3.2%
	US 52 to IA 76	Allamakee, Clayton					27, 85						0.3%	2.9%

Table 5.5: Highway needs and risks matrix, US routes
(section 2 of 6)

See Table 5.3 for key

Route	Corridor	County	Networks: IMFN	Networks: CIN	Needs: Pavement Condition	Needs: Bridge Condition	Needs: Bottlenecks	Needs: Super-2	Needs: Capacity	Risks: Safety	Risks: Operations	Risks: Flood Resiliency	Risks: Bicyclists	Risks: Pedestrians
US 20	I-29 to US 75	Woodbury											N/A	N/A
	US 75 to IA 140	Woodbury											0.0%	63.8%
	IA 140 to US 59	Ida, Woodbury											0.1%	34.0%
	US 59 to US 71	Ida, Sac											0.0%	73.4%
	US 71 to US 169	Sac, Calhoun, Webster											0.0%	77.2%
	US 169 to I-35	Webster, Hamilton											N/A	N/A
	I-35 to US 65	Hamilton, Hardin											N/A	N/A
	US 65 to IA 14	Hardin, Grundy											N/A	N/A
	IA 14 to IA 27	Grundy, Black Hawk											N/A	N/A
	IA 27 to US 218	Black Hawk											N/A	N/A
	I-380 to IA 150	Black Hawk, Buchanan											N/A	N/A
	IA 150 to IA 13	Buchanan, Delaware											N/A	N/A
	IA 13 to IA 136	Delaware, Dubuque											N/A	N/A
	IA 136 to Northwest Arterial	Dubuque					90		Partial				5.3%	8.6%
	Northwest Arterial to IL border	Dubuque				13, 104	70, 84, 90						10.4%	12.1%
US 30	NE border to I-29	Harrison				25, 67, 125							8.1%	1.8%
	I-29 to US 59	Harrison, Crawford				10, 114, 169	52						5.1%	1.6%
	US 59 to US 71	Crawford, Carroll					61						3.2%	4.3%
	US 71 to US 169	Carroll, Greene, Boone				36, 72, 89	61						9.6%	3.8%
	US 169 to IA 930	Boone				(133, 165)	57	4LC					0.9%	0.4%
	IA 930 to I-35	Boone, Story				(176, 184)		4LC					0.4%	0.0%
	I-35 to IA 14	Story, Marshall					95	4LC					0.1%	5.2%
	IA 14 to 3.3 mi E of US 63	Marshall, Tama					95	4LC					0.1%	5.2%
	3.3 mi E of US 63 to US 218	Tama, Benton				11		4LC					0.0%	0.0%
	US 218 to IA 922	Benton, Linn						4LC					N/A	N/A
	IA 922 to I-380	Linn						4LC					N/A	N/A
	I-380 to 5.2 mi E of IA 1	Linn, Cedar	Partial			45		4LC					N/A	N/A
	5.2 mi E of IA 1 to US 61	Cedar, Clinton				15, 122, 171							0.8%	1.6%
	US 61 to IL border	Clinton				4	105	4LC					2.8%	3.5%

Table 5.5: Highway needs and risks matrix,
US routes
(section 3 of 6)

See Table 5.3 for key

Route	Corridor	County	Networks		Needs					Risks				
			IMFN	CIN	Pavement Condition	Bridge Condition	Bottlenecks	Super-2	Capacity	Safety	Operations	Flood Resiliency	Bicyclists	Pedestrians
US 34	NE border to I-29	Mills						4LC					0.0%	52.3%
	I-29 to 0.8 mi W of US 275	Mills					41	4LC					0.0%	86.6%
	0.8 mi W of US 275 to US 59	Mills				15							0.0%	27.6%
	US 59 to US 71	Mills, Montgomery				184, 206, 206	63						2.7%	18.6%
	US 71 to IA 25	Montgomery, Adams, Union				77							2.3%	2.9%
	IA 25 to I-35	Union, Clarke				100							3.8%	18.3%
	I-35 to US 65	Clarke, Lucas											6.9%	7.1%
	US 65 to IA 5	Lucas, Monroe				38, 81, 159	62						1.5%	4.5%
	IA 5 to Ottumwa W CL	Monroe, Wapello				59, 139	62						0.1%	37.7%
	Ottumwa W CL to US 63	Wapello					44	4LC					26.7%	10.8%
	US 63 to IA 1	Wapello, Jefferson						4LC					1.0%	16.1%
	IA 1 to US 218	Jefferson, Henry				22		4LC					0.0%	11.7%
	US 218 to US 61	Henry, Des Moines						4LC					0.7%	4.6%
	US 61 to IL border	Des Moines						4LC					0.0%	0.3%
US 52	IL border to US 61	Jackson, Dubuque					9						43.0%	0.9%
	Jct US 52/61/151 to US 20*	Dubuque												
	US 20 to IA 3/IA 136	Dubuque					48						6.5%	0.8%
	IA 3/IA 136 to E jct US 18	Dubuque, Clayton					48, 85						9.0%	4.9%
	W jct US 18 to IA 9	Allamakee, Winneshiek					8						2.7%	0.3%
	IA 9 to MN border	Winneshiek				159							0.0%	0.0%
US 59	MO border to IA 2	Fremont, Page											0.0%	0.0%
	IA 2 to US 34	Fremont, Page, Mills				27							7.9%	4.9%
	US 34 to I-80	Mills, Pottawattamie				79, 96, 104, 154, 159, (174, 206)							3.7%	4.2%
	I-80 to US 30	Pottawattamie, Shelby, Crawford				77, 129, (174, 206)							0.0%	0.0%
	US 30 to US 20	Crawford, Ida					82						3.5%	2.1%
	US 20 to IA 3	Ida, Cherokee											11.6%	15.3%
	IA 3 to US 18	Cherokee, O'Brien											22.0%	1.3%
	US 18 to MN border	O'Brien, Osceola											0.0%	0.0%

**Due to its recent construction, data was not available to analyze for this corridor.*

Table 5.5: Highway needs and risks matrix, US routes
(section 4 of 6)

See Table 5.3 for key

Route	Corridor	County	Networks: IMFN	Networks: CIN	Needs: Pavement Condition	Needs: Bridge Condition	Needs: Bottlenecks	Needs: Super-2	Needs: Capacity	Risks: Safety	Risks: Operations	Risks: Flood Resiliency	Risks: Bicyclists	Risks: Pedestrians
	MO border to US 218	Lee					40, 71						2.0%	51.8%
	US 218 to IA 2	Lee					71						0.0%	86.5%
	IA 2 to Burlington N CL	Lee, Des Moines					60						0.2%	84.3%
	Burlington N CL to IA 92	Des Moines, Louisa				72, 191							0.8%	0.8%
	IA 92 to IA 38	Louisa, Muscatine					4, 29, 55						0.0%	22.4%
US 61	IA 38 to I-280	Muscatine, Scott					55						3.1%	64.4%
	I-80 to US 30	Scott, Clinton				124			Partial				N/A	N/A
	US 30 to IA 64	Clinton, Jackson											N/A	N/A
	IA 64 to US 151	Jackson, Dubuque				149, 182							0.0%	74.4%
	US 151 to US 20	Dubuque					9						10.5%	6.9%
	US 20 to WI border	Dubuque				201			Partial				11.6%	11.6%
	MO border to US 34	Davis, Wapello				23, 24, 60, 100, 104, 151							2.6%	1.6%
	US 34 to IA 149	Wapello						4LC					0.2%	0.2%
	IA 149 to IA 92	Wapello, Mahaska	Partial			81		4LC					3.5%	6.0%
	IA 92 to I-80	Mahaska, Poweshiek											6.3%	5.6%
	I-80 to US 30	Poweshiek, Tama											6.2%	5.8%
US 63	US 30 to US 20	Tama, Black Hawk					74						4.3%	4.8%
	US 20 to US 218	Black Hawk						4LC					7.8%	12.2%
	US 218 to Waterloo N CL	Black Hawk						4LC					72.1%	68.4%
	Waterloo N CL to IA 3	Black Hawk, Bremer						4LC					1.5%	0.0%
	IA 3 to US 18	Bremer, Chickasaw						4LC					0.2%	5.8%
	US 18 to MN border	Chickasaw, Howard											0.6%	6.0%
	MO border to US 34	Wayne, Lucas				50, 140							0.0%	0.0%
	US 34 to IA 92	Lucas, Warren				211			Partial				2.3%	2.3%
	IA 92 to IA 5	Warren											5.3%	42.9%
	IA 5 to IA 163	Warren, Polk											11.6%	7.9%
	IA 163 to I-80	Polk											0.3%	57.7%
US 65	I-80 to IA 330	Polk, Jasper					33, 56						0.0%	55.6%
	IA 330 to US 30	Jasper, Story											0.0%	1.0%
	US 30 to US 20	Story, Hardin											0.0%	0.0%
	US 20 to IA 3	Hardin, Franklin					112						12.6%	5.6%
	IA 3 to US 18	Franklin, Cerro Gordo				116							6.9%	5.0%
	US 18 to Mason City N CL	Cerro Gordo					96						21.2%	22.1%
	Mason City N CL to MN border	Cerro Gordo, Worth											3.5%	0.0%

Table 5.5: Highway needs and risks matrix,
US routes
(section 5 of 6)

See Table 5.3 for key

Route	Corridor	County	Networks		Needs					Risks				
			IMFN	CIN	Pavement Condition	Bridge Condition	Bottlenecks	Super-2	Capacity	Safety	Operations	Flood Resiliency	Bicyclists	Pedestrians
US 67	IL border to I-74	Scott				2, 136L	93, 107, 110						58.9%	58.9%
	I-74 to I-80	Scott		Partial			110						30.8%	14.6%
	I-80 to US 30	Scott, Clinton											7.1%	4.3%
	US 30 to Clinton N CL	Clinton					98, 105						33.7%	33.7%
	Clinton N CL to US 52	Clinton, Jackson											0.0%	0.0%
US 69	MO border to US 34	Decatur, Clarke				18							4.1%	0.3%
	US 34 to US 65	Clarke, Warren											36.6%	0.6%
	IA 5 to I-235	Warren, Polk				42, 48	6, 25, 91						19.1%	64.9%
	I-235 to I-35/80	Polk					31						91.6%	85.6%
	I-35/80 to Ankeny N CL	Polk					3, 38						41.6%	22.0%
	Ankeny N CL to US 30	Polk, Story							Partial				1.9%	4.5%
	US 30 to Ames N CL	Story				110L	114						61.1%	66.2%
	Ames N CL to US 20	Story, Hamilton					86		Partial				0.3%	20.8%
	US 20 to IA 3	Hamilton, Wright											0.5%	0.0%
	IA 3 to US 18	Wright, Hancock				133, 184							44.1%	3.2%
	US 18 to MN border	Hancock, Winnebago, Worth											2.2%	2.1%
US 71	MO border to US 34	Page, Montgomery											0.0%	0.0%
	US 34 to I-80	Montgomery, Cass				96							8.9%	1.7%
	I-80 to US 30	Cass, Audubon, Carroll					61						0.0%	0.5%
	US 30 to US 20	Carroll, Sac					32, 61						0.0%	0.9%
	US 20 to IA 3	Sac, Buena Vista											13.5%	0.3%
	IA 3 to US 18	Buena Vista, Clay				206							2.1%	3.8%
	US 18 to IA 86	Clay, Dickinson					87	4LC					4.3%	4.3%
	IA 86 to MN border	Dickinson					22, 87						29.2%	26.1%
US 75	US 20 to IA 60	Woodbury, Plymouth				30, 57, 64, 74, 188							N/A	N/A
	IA 60 to US 18	Plymouth, Sioux					101						8.8%	8.4%
	US 18 to MN border	Sioux, Lyon											0.0%	0.0%
US 77	NE border to I-29	Woodbury					109						45.1%	84.5%
US 136	US 61 to IL border	Lee				81, 201	40, 113						39.8%	54.8%
US 151	I-80 to US 30	Iowa, Benton, Linn					83		Partial				10.0%	6.9%
	US 30 to IA 13	Linn					10, 19, 76		Partial				1.6%	18.4%
	IA 13 to US 61	Linn, Jones, Dubuque					76						0.1%	32.0%

Table 5.5: Highway needs and risks matrix,
US routes
(section 6 of 6)

See Table 5.3 for key

Route	Corridor	County	Networks: IMFN	Networks: CIN	Needs: Pavement Condition	Needs: Bridge Condition	Needs: Bottlenecks	Needs: Super-2	Needs: Capacity	Risks: Safety	Risks: Operations	Risks: Flood Resiliency	Risks: Bicyclists	Risks: Pedestrians
US 169	MO border to US 34	Ringgold, Union											1.3%	0.0%
US 169	US 34 to IA 92	Union, Madison											0.0%	0.0%
US 169	IA 92 to I-80	Madison, Dallas				211							0.0%	0.0%
US 169	I-80 to IA 141	Dallas			■								1.8%	1.1%
US 169	IA 141 to US 30	Dallas, Boone		■									0.9%	0.0%
US 169	US 30 to US 20	Boone, Webster		■									1.1%	0.4%
US 169	US 20 to IA 3	Webster, Humboldt		■			65, 67						1.8%	0.3%
US 169	IA 3 to US 18	Humboldt, Kossuth		■									9.6%	6.7%
US 169	US 18 to MN border	Kossuth				52							1.6%	0.0%
US 218	US 136 to IA 27	Lee			■		71, 113						12.1%	12.2%
US 218	IA 27 to US 34	Lee, Henry	■	■									0.1%	27.2%
US 218	US 34 to IA 92	Henry, Washington	■	■	■								0.0%	10.5%
US 218	IA 92 to IA 1	Washington, Johnson	■	■			103						N/A	N/A
US 218	IA 1 to I-80	Johnson	■	■	■		103						N/A	N/A
US 218	US 30 to IA 150	Benton										■	0.1%	0.0%
US 218	IA 150 to S jct I-380	Benton, Black Hawk				151	92					■	4.2%	1.1%
US 218	Mitchell Ave to IA 27	Black Hawk	■	■	■				Partial	■		■	2.6%	6.7%
US 218	IA 27 to IA 3	Black Hawk, Bremer	■	■	■							■	0.5%	0.0%
US 218	IA 3 to US 18	Bremer, Chickasaw, Floyd	■	■	■								0.0%	0.5%
US 218	US 18 to MN border	Floyd, Mitchell											4.5%	2.0%
US 275	MO border to US 34	Fremont, Mills										■	25.1%	0.0%
US 275	I-29 to NE border	Pottawattamie					14					■	13.2%	4.3%

Table 5.6: Highway needs and risks matrix,
IA routes
(section 1 of 7)

See Table 5.3 for key

Route	Corridor	County	Networks		Needs					Risks				
			IMFN	CIN	Pavement Condition	Bridge Condition	Bottlenecks	Super-2	Capacity	Safety	Operations	Flood Resiliency	Bicyclists	Pedestrians
IA 1	IA 2 to US 34	Van Buren, Jefferson				176, 206							1.5%	0.0%
	US 34 to IA 92	Jefferson, Keokuk, Washington					100						3.1%	2.4%
	IA 92 to Iowa City S CL	Washington, Johnson					47						0.0%	0.8%
	Iowa City S CL to US 6	Johnson		■			26, 103		Partial	■	■		19.3%	21.5%
	US 6 to I-80	Johnson		■	■		30, 104, 111		Partial	■	■		9.6%	9.7%
	I-80 to US 30	Johnson, Linn							Partial				3.3%	1.1%
	US 30 to US 151	Linn, Jones											6.7%	6.3%
IA 2	NE border to I-29	Fremont	■	■								■	15.2%	29.9%
	I-29 to US 59	Fremont				122, 154, 159						■	31.3%	2.1%
	US 59 to US 71	Fremont, Page											0.0%	12.7%
	US 71 to US 169	Page, Taylor, Ringgold											0.0%	0.0%
	US 169 to I-35	Ringgold, Decatur											0.5%	0.0%
	I-35 to US 65	Decatur, Wayne											2.7%	0.0%
	US 65 to IA 5	Wayne, Appanoose											9.4%	4.5%
	IA 5 to US 63	Appanoose, Davis											15.5%	0.0%
	US 63 to US 218	Davis, Van Buren, Lee											3.7%	0.7%
	US 218 to US 61	Lee			■					■			5.0%	0.0%
IA 3	NE border to US 75	Plymouth											0.2%	3.9%
	US 75 to US 59	Plymouth, Cherokee			■	100							26.1%	2.5%
	US 59 to US 71	Cherokee, Buena Vista				125							2.3%	0.0%
	US 71 to US 169	Buena Vista, Pocahontas, Humboldt											3.3%	2.0%
	US 169 to I-35	Humboldt, Wright, Franklin											5.5%	5.5%
	I-35 to US 65	Franklin			■								10.7%	10.7%
	US 65 to US 218	Franklin, Butler, Bremer				159							2.8%	0.7%
	US 218 to US 63	Bremer				12							12.8%	12.8%
	US 63 to IA 150	Bremer, Fayette											0.0%	0.0%
	IA 150 to IA 13	Fayette, Clayton											8.2%	6.0%
	IA 13 to IA 136	Clayton, Delaware, Dubuque					48						0.0%	0.0%
	IA 136 to Northwest Arterial	Dubuque					48, 51						43.7%	0.0%

Table 5.6: Highway needs and risks matrix, IA routes
(section 2 of 7)

See Table 5.3 for key

Route	Corridor	County	Networks: IMFN	Networks: CIN	Needs: Pavement Condition	Needs: Bridge Condition	Needs: Bottlenecks	Needs: Super-2	Needs: Capacity	Risks: Safety	Risks: Operations	Risks: Flood Resiliency	Risks: Bicyclists	Risks: Pedestrians
IA 4	IA 44 to IA 141	Guthrie					18						0.0%	0.0%
	IA 141 to US 30	Guthrie, Greene											12.6%	12.6%
	US 30 to US 20	Greene, Calhoun											9.1%	0.0%
	US 20 to IA 3	Calhoun, Pocahontas											4.5%	0.1%
	IA 3 to US 18	Pocahontas, Palo Alto											3.2%	1.7%
	US 18 to IA 9	Palo Alto, Emmet											19.3%	2.8%
	IA 9 to MN border	Emmet											5.8%	5.8%
IA 5	MO border to IA 2	Appanoose				35, 111							9.8%	9.3%
	IA 2 to US 34	Appanoose, Monroe				36, 154	62						6.3%	5.6%
	US 34 to E jct IA 92	Monroe, Marion					62						3.5%	1.2%
	E jct IA 92 to W jct IA 92	Marion					80						2.5%	32.2%
	W jct IA 92 to US 65	Marion, Warren, Polk				125	80						7.9%	39.2%
	US 65 to IA 28	Warren, Polk											N/A	N/A
	IA 28 to I-35	Polk											N/A	N/A
IA 7	IA 3 to US 71	Cherokee, Buena Vista					69						10.6%	12.2%
	US 71 to US 169	Buena Vista, Pocahontas, Calhoun, Webster				165, 184	65						2.1%	0.0%
IA 8	US 63 to US 218	Tama, Benton											0.0%	0.0%
IA 9	SD border to IA 60	Lyon, Osceola											3.9%	2.1%
	IA 60 to US 71	Osceola, Dickinson				62	22, 97						2.4%	1.3%
	US 71 to US 169	Dickinson, Emmet, Kossuth											4.0%	4.5%
	US 169 to I-35	Kossuth, Winnebago, Worth				179							2.8%	1.0%
	I-35 to US 63	Worth, Mitchell, Howard											2.3%	0.4%
	US 63 to Decorah E CL	Howard, Winneshiek				27							6.5%	5.1%
	Decorah E CL to IL border	Winneshiek, Allamakee				3							5.7%	3.5%
IA 10	NE border to IA 60	Sioux											2.5%	2.5%
	IA 60 to US 71	Sioux, O'Brien, Clay											1.3%	0.6%
	US 71 to IA 4	Buena Vista, Pocahontas											0.0%	0.0%
IA 12	US 20/US 75 to I-29	Woodbury				1							38.2%	90.7%
	I-29 to Sioux City N CL	Woodbury											31.5%	31.5%
	Sioux City N CL to IA 10	Woodbury, Plymouth, Sioux											1.1%	0.0%
IA 13	US 151 to E16	Linn					76						1.7%	1.6%
	E16 to US 20	Linn, Delaware											0.0%	4.3%
	US 20 to IA 3	Delaware											8.8%	6.8%
	IA 3 to US 52	Clayton											2.0%	0.0%

Table 5.6: Highway needs and risks matrix, IA routes
(section 3 of 7)

See Table 5.3 for key

Route	Corridor	County	IMFN	CIN	Pavement Condition	Bridge Condition	Bottlenecks	Super-2	Capacity	Safety	Operations	Flood Resiliency	Bicyclists	Pedestrians
			Networks		Needs					Risks				
IA 14	IA 2 to US 34	Wayne, Lucas											2.5%	2.5%
	US 34 to IA 5	Lucas, Marion											3.8%	3.6%
	IA 5 to IA 163	Marion, Jasper				26, 70, 114, 133							12.1%	12.1%
	IA 163 to I-80	Jasper											2.5%	10.3%
	US 6 to US 30	Jasper, Marshall				94	95						2.3%	1.4%
	US 30 to US 20	Marshall, Grundy		Partial		125	95						15.6%	15.5%
	US 20 to IA 3	Grundy, Butler											4.9%	0.0%
	IA 3 to US 18	Butler, Floyd											3.8%	2.5%
IA 15	IA 3 to US 18	Pocahontas, Humboldt, Kossuth											0.0%	0.0%
	US 18 to MN border	Kossuth, Emmet											0.0%	0.0%
IA 16	US 34 to US 218	Wapello, Davis, Van Buren, Lee											0.3%	0.0%
	US 218 to US 61	Lee											1.7%	0.0%
IA 17	IA 141 to US 30	Polk, Boone											6.2%	2.5%
	US 30 to US 20	Boone, Hamilton											3.4%	0.0%
	US 20 to IA 3	Hamilton, Wright											7.9%	4.3%
	IA 3 to US 18	Wright, Hancock											2.8%	0.0%
IA 21	IA 78 to IA 92	Keokuk											0.0%	0.0%
	IA 92 to I-80	Keokuk, Poweshiek											4.3%	0.2%
	I-80 to US 30	Poweshiek, Iowa, Benton											10.2%	5.5%
	US 30 to US 20	Benton, Tama, Black Hawk											1.8%	0.4%
IA 22	IA 21 to IA 1	Keokuk, Washington					47						7.5%	0.0%
	IA 1 to US 218	Washington					47						10.5%	6.4%
	US 218 to IA 70	Washington, Johnson, Muscatine											4.4%	0.0%
	IA 70 to US 61	Muscatine					4						2.8%	0.0%
	IA 38 to Buffalo E CL	Muscatine, Scott											6.5%	1.0%
	Buffalo E CL to IA 461	Scott											0.9%	0.0%
IA 23	IA 149 to IA 92	Keokuk, Mahaska				9							74.3%	0.1%
IA 24	US 63 to US 52	Chickasaw, Winneshiek					8						6.3%	3.6%
IA 25	IA 2 to US 34	Ringgold, Union											0.0%	0.0%
	US 34 to I-80	Union, Adair											32.5%	4.7%
	I-80 to US 30	Adair, Guthrie, Greene					108						1.3%	0.0%
IA 26	IA 9 to MN border	Allamakee											0.3%	0.3%
IA 27	MO border to US 218	Lee											0.0%	78.8%
	US 20 to US 218	Black Hawk							Partial				0.2%	0.5%

Table 5.6: Highway needs and risks matrix, IA routes
(section 4 of 7)

See Table 5.3 for key

Route	Corridor	County	Networks: IMFN	Networks: CIN	Needs: Pavement Condition	Needs: Bridge Condition	Needs: Bottlenecks	Needs: Super-2	Needs: Capacity	Risks: Safety	Risks: Operations	Risks: Flood Resiliency	Risks: Bicyclists	Risks: Pedestrians
IA 28	IA 92 to Norwalk S CL	Warren					45					■	0.9%	0.0%
	Norwalk S CL to IA 5	Warren, Polk			■		53						14.1%	30.6%
	IA 5 to I-235	Polk		■	■	41	12, 35, 59		Partial	■	■		30.0%	30.0%
	I-235 to US 6	Polk		■			102		■	■	■		98.6%	99.0%
	US 6 to I-35/80	Polk		■			37, 68		■	■	■		49.0%	84.8%
IA 31	IA 141 to US 20	Woodbury											1.0%	0.0%
	US 20 to US 59	Woodbury, Ida, Cherokee											0.0%	0.0%
IA 37	IA 175 to US 30	Monona, Crawford, Harrison											0.0%	0.0%
	US 30 to US 59	Harrison, Shelby											0.0%	0.0%
IA 38	US 61 to US 6	Muscatine			■		55						0.0%	0.1%
	I-80 to US 30	Cedar			■	19							4.6%	4.3%
	US 30 to US 151	Cedar, Jones					79						0.0%	0.0%
	US 151 to US 20	Jones, Delaware											9.6%	4.4%
	US 20 to IA 3	Delaware											3.7%	0.0%
IA 39	US 59 to IA 175	Crawford, Sac			■	140	34, 82					■	8.6%	0.2%
IA 44	US 30 to US 59	Harrison, Shelby											0.0%	0.0%
	US 59 to US 71	Shelby, Audubon											5.6%	5.1%
	US 71 to US 169	Audubon, Guthrie, Dallas					18, 108						1.4%	1.4%
	US 169 to IA 141	Dallas, Polk			■				Partial				16.6%	20.2%
IA 48	US 59 to US 34	Page, Montgomery					63						8.8%	5.7%
	US 34 to US 6	Montgomery, Cass					63						2.6%	1.1%
IA 51	US 18 to IA 9	Allamakee			■		27						0.3%	2.1%
IA 56	IA 150 to IA 13	Fayette, Clayton											1.7%	0.0%
IA 57	US 65 to Cedar Falls W CL	Hardin, Butler, Grundy, Black Hawk				140						■	12.3%	0.0%
	Cedar Falls W CL to US 218	Black Hawk					94					■	33.5%	33.5%
IA 58	US 63 to US 20	Black Hawk			■								0.0%	0.4%
IA 60	US 75 to US 18	Plymouth, Sioux, O'Brien	■	■			64						0.1%	10.1%
	US 18 to MN border	O'Brien, Osceola	■	■									0.0%	6.0%
IA 62	IA 64 to US 52	Jackson											0.4%	0.4%
IA 64	US 151 to US 61	Jones, Jackson					54, 79						2.8%	0.0%
	US 61 to US 67	Jackson											4.7%	4.5%
IA 70	IA 92 to IA 22	Louisa, Muscatine											17.4%	0.0%
	IA 22 to US 6	Muscatine											6.5%	4.6%
IA 76	W jct US 18 to S jct IA 9	Clayton, Allamakee			■								21.7%	0.9%
	N jct IA 9 to MN border	Allamakee											0.0%	0.0%

Table 5.6: Highway needs and risks matrix, IA routes
(section 5 of 7)

See Table 5.3 for key

Route	Corridor	County	Networks: IMFN	Networks: CIN	Needs: Pavement Condition	Needs: Bridge Condition	Needs: Bottlenecks	Needs: Super-2	Needs: Capacity	Risks: Safety	Risks: Operations	Risks: Flood Resiliency	Risks: Bicyclists	Risks: Pedestrians
IA 78	IA 149 to IA 1	Keokuk				5, 81, 108							3.9%	0.0%
	IA 1 to US 218	Washington, Jefferson, Henry											9.0%	0.0%
	US 218 to US 61	Henry, Louisa			■	48, 144							0.0%	0.0%
IA 81	MO border to IA 2	Van Buren			■								0.0%	0.0%
IA 83	US 59 to IA 148	Pottawattamie, Cass				64, 118							6.1%	1.8%
IA 85	Montezuma E CL to IA 21	Poweshiek											0.0%	0.0%
IA 86	US 71 to IA 9	Dickinson					87, 97						0.0%	0.0%
	IA 9 to MN border	Dickinson					97						0.0%	0.0%
IA 92	I-29 to US 59	Pottawattamie					50		Partial				13.6%	10.7%
	US 59 to US 71	Pottawattamie, Cass				88							0.0%	0.0%
	US 71 to US 169	Cass, Adair, Madison											0.0%	0.0%
	US 169 to I-35	Madison, Warren											2.0%	0.0%
	I-35 to US 65	Warren				33	45						8.2%	7.4%
	US 65 to IA 5	Warren, Marion					80						5.4%	3.5%
	IA 5 to US 63	Marion, Mahaska											3.6%	59.2%
	US 63 to IA 1	Mahaska, Keokuk, Washington				29, 42	77						3.4%	2.5%
	IA 1 to US 218	Washington			■								8.0%	10.0%
	US 218 to US 61	Washington, Louisa			■								1.8%	3.1%
	US 61 to IL border	Muscatine				191	55				■		89.1%	44.2%
IA 93	US 63 to IA 150	Bremer, Fayette											2.1%	1.3%
IA 96	IA 14 to US 63	Marshall, Tama										■	1.0%	0.0%
IA 100	US 30 to I-380	Linn		■					Partial			■	N/A	N/A
	I-380 to US 151	Linn		■			16, 19		Partial	■	■		19.4%	19.4%
IA 110	US 20 to IA 7	Sac, Buena Vista											2.7%	0.1%
IA 116	US 218 to IA 3	Bremer											14.8%	16.4%
IA 117	IA 163 to I-80	Jasper				191							11.6%	4.2%
	I-80 to US 65	Jasper				191							4.1%	0.0%
IA 122	I-35 to Mason City W CL	Cerro Gordo											3.9%	0.0%
	Mason City W CL to Mason City E CL	Cerro Gordo					96			■			33.3%	33.7%
IA 127	I-29 to US 30	Harrison					52						1.0%	0.0%
IA 128	IA 13 to US 52	Clayton											6.5%	0.0%
IA 130	IA 38 to I-80	Cedar, Scott											11.5%	1.9%
IA 136	IL border to US 67	Clinton			■	17	98				■		81.4%	81.4%
	US 67 to US 61	Clinton											8.3%	0.7%
	US 61 to US 151	Clinton, Jones, Dubuque					54						1.3%	0.8%
	US 151 to US 20	Dubuque											17.1%	0.1%

Table 5.6: Highway needs and risks matrix, IA routes
(section 6 of 7)

See Table 5.3 for key

Route	Corridor	County	Networks: IMFN	Networks: CIN	Needs: Pavement Condition	Needs: Bridge Condition	Needs: Bottlenecks	Needs: Super-2	Needs: Capacity	Risks: Safety	Risks: Operations	Risks: Flood Resiliency	Risks: Bicyclists	Risks: Pedestrians
IA 137	IA 5 to US 63	Monroe, Wapello			■								10.0%	0.1%
IA 139	IA 9 to MN border	Winneshiek											0.0%	0.0%
IA 140	US 20 to IA 3	Woodbury, Plymouth											1.5%	0.0%
IA 141	I-29 to US 59	Woodbury, Monona, Crawford				201, 201	49, 106					■	4.5%	1.6%
	US 59 to US 71	Crawford, Carroll			■								2.6%	2.6%
	US 71 to IA 4	Carroll, Guthrie											6.0%	0.0%
	IA 4 to IA 144	Guthrie, Dallas											0.0%	0.0%
	IA 144 to US 169	Dallas			■		58						7.3%	0.1%
	US 169 to I-35/80	Dallas, Polk		■			28		Partial				0.5%	0.2%
IA 143	IA 3 to IA 10	Cherokee, O'Brien											1.3%	0.0%
IA 144	IA 141 to US 30	Dallas, Boone, Greene					58						7.2%	6.4%
	US 30 to IA 175	Greene, Webster											2.3%	0.0%
IA 146	US 63 to I-80	Mahaska, Poweshiek											0.0%	0.0%
	I-80 to US 30	Poweshiek, Tama, Marshall					36						6.6%	5.6%
IA 148	MO border to US 34	Taylor, Adams											3.4%	3.4%
	US 34 to I-80	Adams, Cass											3.4%	2.7%
IA 149	US 34 to US 63	Wapello					44, 72						0.0%	11.6%
	US 63 to IA 92	Wapello, Keokuk					77						0.4%	0.1%
	IA 92 to I-80	Keokuk, Iowa											2.2%	0.0%
IA 150	US 218 to I-380	Benton			■							■	72.2%	5.0%
	I-380 to US 20	Benton, Buchanan			■							■	6.8%	17.2%
	US 20 to IA 3	Buchanan, Fayette			■								14.9%	13.3%
	IA 3 to US 18	Fayette			■								4.1%	0.3%
	US 18 to US 52	Fayette, Winneshiek					8						6.2%	0.0%
IA 160	IA 415 to I-35	Polk					13, 38		■	■	■		15.1%	19.0%
IA 163	US 69 to US 65	Polk		■	■	(42, 50)	5, 24, 31		■	■	■		50.0%	57.1%
	US 65 to IA 14	Polk, Jasper	■	■			17		Partial			■	0.0%	0.0%
	IA 14 to US 63	Jasper, Marion, Mahaska	■	■									0.2%	0.0%
IA 173	IA 83 to IA 44	Cass, Shelby, Audubon											3.4%	0.0%
IA 175	NE border to US 59	Monona, Woodbury, Ida				30, 57, 167, 188	106						3.3%	1.7%
	US 59 to US 71	Ida, Sac			■		34						5.6%	0.0%
	US 71 to US 169	Sac, Calhoun, Webster					32						15.6%	1.1%
	US 169 to I-35	Webster, Hamilton				130							0.1%	0.1%
	I-35 to IA 14	Hamilton, Hardin, Grundy											3.7%	3.3%
	IA 14 to US 63	Grundy, Black Hawk										■	8.6%	3.1%

Table 5.6: Highway needs and risks matrix, IA routes
(section 7 of 7)

See Table 5.3 for key

Route	Corridor	County	Networks: IMFN	Networks: CIN	Needs: Pavement Condition	Needs: Bridge Condition	Needs: Bottlenecks	Needs: Super-2	Needs: Capacity	Risks: Safety	Risks: Operations	Risks: Flood Resiliency	Risks: Bicyclists	Risks: Pedestrians
IA 182	US 18 to IA 9	Lyon											5.3%	0.0%
IA 183	IA 127 to IA 141	Harrison, Monona											0.0%	0.0%
IA 187	US 20 to IA 3	Buchanan, Fayette											60.9%	0.0%
IA 187	IA 3 to IA 150	Fayette											0.0%	0.0%
IA 188	IA 3 to US 218	Butler, Bremer											0.0%	0.0%
IA 188	US 218 to US 63	Bremer											0.0%	0.0%
IA 191	I-880 to IA 37	Pottawattamie, Harrison, Shelby											0.0%	0.0%
IA 202	MO border to IA 2	Davis, Appanoose											0.0%	0.0%
IA 210	IA 141 to I-35	Dallas, Boone,Story					39						7.4%	1.4%
IA 210	I-35 to US 65	Story											0.0%	0.0%
IA 212	IA 21 to US 6	Iowa											0.0%	0.0%
IA 220	US 6 to US 151	Iowa					83						18.2%	0.0%
IA 224	I-80 to IA 14	Jasper											0.0%	0.1%
IA 281	Waterloo E CL to IA 150	Black Hawk, Buchanan											2.3%	0.0%
IA 316	Runnells E CL to IA 5	Polk, Warren, Marion											0.0%	0.0%
IA 330	US 65 to US 30	Jasper, Story, Marshall		■									0.0%	82.2%
IA 330	US 30 to IA 14	Marshall		■									0.0%	2.4%
IA 346	US 218 to US 63	Chickasaw											6.1%	6.1%
IA 376	I-29 to IA 12	Woodbury			■		66		Partial				4.8%	37.4%
IA 376	IA 12 to US 75	Woodbury			■	171, 191							18.8%	22.9%
IA 404	IA 3 to US 75	Plymouth											45.5%	18.0%
IA 415	US 6 to I-35/80	Polk					15, 89			■	■		87.7%	39.4%
IA 415	I-35/80 to IA 160	Polk					89		■		■		29.2%	0.9%
IA 415	IA 160 to Ankeny W CL	Polk							■		■		0.0%	12.3%
IA 415	Ankeny W CL to IA 141	Polk					23		■				18.0%	25.4%
IA 461	I-280 to US 67	Scott		■		20						■	9.1%	13.5%
IA 461	US 67 to US 6	Scott		■	■	(39, 111)	73, 107			■	■		74.9%	74.9%
IA 461	US 6 to I-80	Scott		■	■	124, 191	73			■	■		5.0%	15.5%
IA 471	IA 175 to US 20	Sac				169							9.4%	0.0%
IA 906	N 6th St to I-80	Pottawattamie		■	■		7, 21, 99			■			58.6%	89.1%
IA 922	US 30 to I-380	Linn			■		42				■	■	35.5%	38.3%
IA 922	I-380 to IA 100	Linn			■		16, 88		Partial	■	■	■	82.1%	82.1%
IA 930	US 30 to 1.1 mi E of US 30	Boone											18.3%	0.0%
IA 946	S jct US 61 to N jct US 61	Dubuque	■	■	■		84			■	■		38.8%	38.8%
IA 965	US 6 to I-80	Johnson					81				■		55.4%	55.4%

5.4 Strategies

In order to achieve the vision for the transportation system, and address the needs and risks identified across the various modes and the Primary Highway System, the Iowa DOT will employ a wide range of strategies. The 30 strategies listed in this section were derived from several sources, including the last long-range plan, stakeholder input, and content developed for this SLRTP update.

Many modal and system plans exist that have more detailed strategies for the areas they cover. Rather than duplicate or only include a selection of those strategies in this SLRTP, they are supported by the first strategy. This allows the SLRTP to highlight strategies that are more unique to this document. Strategies are divided into three broad categories:

- Strategies to support SLRTP implementation
- Strategies to help advance various planning considerations
- Strategies related to highways

Strategies are critical components for the SLRTP. Strategies will guide the implementation of the SLRTP and help relate the broader plan vision and objectives to actions that the department and others can take to achieve them. Each strategy maps back to one or more of the four system objectives (safety, sustainability, accessibility, and flow), and a graphic notes which area(s) the strategy relates to. The strategies consist of an action statement and an explanation of what the strategy entails or how it will be carried out. These strategies will help guide future actions and financial investments across the system.

State Long-Range Transportation Plan (SLRTP) Implementation

1. Support the implementation of modal and system plans.

While the SLRTP is the overarching long-range planning document for the department, there are many other modal and system plans that are routinely developed and updated to examine specific issues, needs, strategies, and in some cases, projects. Rather than duplicate the strategies of those plans as part of the SLRTP, this strategy adopts them by reference and supports the continued implementation of those plans. Strategies from the following plans are included in the Appendix for reference.

- Aviation System Plan
- Bicycle and Pedestrian Long Range Plan
- Public Transit Long Range Plan
- State Freight Plan
- State Rail Plan
- Strategic Highway Safety Plan
- Transportation Asset Management Plan
- Transportation Systems Management and Operations Plan
- Carbon Reduction Strategy
- Resilience Improvement Plan
- Transportation 4.0: Innovative strategies for the transportation revolution

2. Adopt and integrate system objectives into department decision-making, including for planning, programming, and project development activities.

The system objectives of safety, sustainability, accessibility, and flow define the mobility outcomes to be achieved and areas to measure to determine whether they are being achieved (reference chapter 4). Integrating these objectives throughout department activities will help align the SLRTP and other Iowa DOT processes and practices, which will help implement the SLRTP and the vision for the transportation system. Integration of these objectives should be pursued for activities such as modal and system plan development, project prioritization, and grant program administration.

3. Implement the rightsizing policy across planning, programming, and project development activities.

As part of the SLRTP, the Iowa DOT is adopting a rightsizing policy (reference Section 5.5). Several areas will need enhancement in order to fully apply the principles included in the rightsizing policy. This includes continued improvement and use of analysis tools and benefit/cost evaluation tools; enhanced coordination with stakeholders and interested parties; further integration of system-level needs and policies into project-level decisions; and further integration of the rightsizing principles into project development processes and procedures. Development of a workplan that identifies specific tasks and responsibilities for rightsizing implementation will be a key early step.

4. Continue enhancing the relationship between the SLRTP and the Iowa DOT business plan.

The SLRTP has been adopted on a 5-year cycle since 2012, and a new business plan for the Iowa DOT was adopted in 2021. The business plan is seen as the operationalization of the SLRTP. As the business plan and its objectives continue to evolve, the relationship between the two documents will be enhanced.

Planning Considerations

5. Enhance accessibility planning.

The SLRTP includes an accessibility analysis based on factors that may limit a person's mobility, ability to access transportation infrastructure, and/or travel by means of a personal vehicle. There are many other facets of accessibility that merit exploration, including accessibility of infrastructure and service for various modes, as well as accessibility of employment and other key destinations. Additional ways to quantify accessibility at the planning level should be explored in order to support more effective project-level decisions and enhance accessibility of the transportation system.

6. Continue exploring ways to ensure equity in department policies and investments.

Different people and populations have varying levels of need when it comes to fully accessing and using the transportation system. Additional consideration may be required to ensure underserved individuals are able to achieve an equitable level of access to affordable and reliable transportation options, and to ensure that the impacts of transportation projects are equitably distributed. The department should advance efforts to study how transportation policies and investments affect equity and adopt tools and strategies to advance equity. The department should also enhance its emphasis on the user, as opposed to the system, and user perspectives on mobility, accessibility, and equity.

7. Continue to explore sustainable funding sources to increase investment in the transportation system.

Transportation needs have continually outpaced transportation revenues, and this is anticipated to continue despite some recent revenue increases. New or innovative sources of revenue should continue to be sought to ensure stable transportation funding for stewardship needs. Creative funding solutions and coordination with other entities may be required to address significant projects, such as large border bridges. Where appropriate project needs exist, the Iowa DOT should also work to take advantage of the many discretionary programs that were created or enhanced through the Infrastructure Investment and Jobs Act (IIJA). One way to help achieve this would be to enhance internal capacity for evaluating economic impacts of projects and to develop additional tools to evaluate project costs and benefits, including those that may not fit well into a traditional benefit/cost analysis. Methods to prioritize among competing needs and priorities such as the use of multi-objective decision analysis (MODA) tools should also continue to be advanced.

8. Continue advancing resiliency planning at the Iowa DOT.

Resiliency is an increasingly important planning area. Proactive analysis and planning efforts, including the work of the Resiliency Working Group, should continue to be enhanced, as should disaster response planning. Resiliency considerations should also continue to be integrated into project scoping, prioritization, and design, as well as maintenance and operations, to make assets less susceptible to disruptions.

9. Continue advancing sustainability planning at the Iowa DOT.

Sustainability is an increasingly important planning area. Analysis and planning efforts, including the work of the Sustainability Working Group, should continue to be enhanced. Sustainability considerations should also continue to be integrated into department activities and project designs to help address economic, social, and environmental effects. This will help in making balanced decisions that meet the needs of today without jeopardizing the ability of future generations to meet the needs of tomorrow.

10. Ensure that the highest and best use of Iowa DOT right-of-way is considered in planning efforts.

As Iowa's demographic and economic landscape evolves, there may need to be consideration of system alterations, including contractions. The multimodal transportation system as it exists today has developed over many decades and reflects the progression of population and employment growth, travel patterns, and advances in transportation. The decisions made today regarding transportation investments need to be done with the social, economic, and technological patterns of the future in mind, and that may not necessarily equate to future traffic levels that are equal to or higher than current levels. If system contractions such as lane reductions occur, the highest and best use of Iowa DOT-owned right-of-way should be considered, particularly if there may be opportunities to convert vehicle lanes into conduits for other modes of transportation or utility purposes such as energy production or transport.

11. Continually evaluate and enhance education and licensing practices for new and existing drivers.

The Iowa DOT's Motor Vehicle Division (MVD) oversees driver licensing processes that evaluate key skills of drivers to obtain a first license, to retain a license, or to add privileges to an existing license (such as motorcycle or Commercial Driver operation). MVD and its stakeholders need to continually ensure that driver education materials reflect changing state and federal requirements and national guidelines and best practices. Driver education needs to be a life-long activity. Education materials and techniques should prepare new and existing drivers for developments in vehicle technology such as advanced driver assistance systems and the growth of electric vehicles; roadway changes, such as roundabouts or other design elements; and new signs and traffic control features, such as flashing yellow turn signals or active pedestrian beacons. It is equally important to provided targeted education to licensed drivers identified as habitual or serious violators of traffic laws in order to correct risky driving habits, reduce human error, and maximize safety.

12. Continue to enhance accessibility of Motor Vehicle Division services.

The Iowa DOT's Motor Vehicle Division (MVD) provides individual users of the roadway system the necessary permissions to use the system, such as drivers' licenses, vehicle registration and ownership records, and travel or fuel permits for motor carriers. The MVD also provides a variety of other direct services to customers and stakeholders, including motor carrier titles, oversize/overweight permits, business licenses, and parking products for persons with disabilities; it is also continuing to develop a system for vehicle dealers to electronically submit title and registration applications on behalf of customers. The MVD is focused on being easily accessible to individual end-users so that services can be obtained without delay. The department should continue to build off recent successes, such as changing to an appointment system for driver's license stations and making more license-related services available online. Ongoing and planned initiatives include enhancements to the driver education program, use of mobile ID, exploring customer feedback opportunities, and creating an Advanced Customer Experience team to address more complex queries in order to improve responses to customers about their individual transportation needs. The department should continually work with stakeholder groups to improve transaction delivery and support businesses and individuals in Iowa. The MVD will also continue to focus on compliance requirements and ensuring customer awareness, which will continue to strengthen its commitment to overall highway safety.

13. Continue to improve monitoring of financial transactions and ensure ease of collection.

The MVD balances, clears, and audits vehicle and driver transactions which are ultimately deposited into the state's Road Use Tax Fund (RUTF). This may include fees from driver licensing and identification services, fuel taxes, vehicle titles, first-time vehicle registrations, annual vehicle registrations (individual and commercial), special and personal license plate sales, and electric and plug-in hybrid vehicle registrations. Many of these fees are collected directly by county treasurers and MVD supports this work through a statewide license, title, and registration system as well as by providing ongoing policy support, training, and instruction. It is important to continue to provide this technological and administrative support for the collection of registration fees by counties. MVD staff and county treasurers are well-trained in fraud prevention, but further investigation or legal action is sometimes needed to ensure consistency and to capture all appropriate revenue for the RUTF.

14. Continue to enhance efforts that improve personal accessibility and mobility options for all users and reduce barriers to using the transportation system.

Initiatives like Get There Your Way, which helps inform an individual of options for transportation, as well as those that target specific underserved groups of individuals should continue to be developed and enhanced. Community partnerships can help advance driving and transportation options for specific groups of individuals, such as having mobility managers work with correctional facilities to assist offenders with their transportation options prior to their reintroduction to society; partnering with non-profit entities to lend vehicles for driving tests; and having mobile license issuance kits deployable for special events or unplanned circumstances such as natural disasters. These efforts should be continued and enhanced, potentially by adding additional special positions such as the correctional facility mobility manager.

15. 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 should modify its internal project development and programming processes to consider technological disruptions and minimize risk. Pause points can allow more focused and intentional consideration of automated transportation at critical milestones within policies and procedures, and ensure that those policies and procedures can adapt and change along with technology. 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.

16. Seek policies and investments that are dual benefit, supporting today's users with tomorrow's technology needs.

Infrastructure elements are typically built to address current system needs and assets such as pavements and bridges have an intended lifespan of decades. Many investments are initially scoped or could be modified to address multiple needs and provide a diversity of benefits. Consideration should be given to opportunities to meet current needs for human users while supporting rapidly changing technologies into the future. Along these lines, making investments in infrastructure that can be easily modified, while possibly more expensive in the short term, could have long-term benefits in allowing the existing infrastructure to be "future-proofed." The Iowa DOT should work to navigate this complex landscape of uncertain needs by implementing the emerging technology rightsizing policy statement and other actions necessary to achieve the best possible balance of policies and investments.

17. Continue to monitor and support research and planning initiatives related to specific automated transportation use cases.

While widespread cooperative automated transportation (CAT) adoption may be far in the future, there are a number of research studies and deployment pilots underway to examine use cases that may have success with CAT in the near future, such as freight movement, parcel delivery, and small scale transit activities. These efforts should be supported to help ensure CAT advancements can be integrated with Iowa's multimodal transportation system and that the needs of various user groups are considered, so that technology enhancements can benefit system users in an equitable and safe manner.

18. Continue to leverage the Iowa Advisory Council on Automated Transportation (ATC) and support the Iowa Automated Transportation (AT) Vision to advance AT readiness in Iowa.

The ATC involves public and private stakeholders and serves as an important venue for engagement, education, and advancement related to CAT in Iowa. As part of the Iowa AT Vision, work should continue to be supported for the strategic objective areas of infrastructure readiness; policy and legislation; economic development; public safety and enforcement; communication, outreach, and education; and research, development, testing, and evaluation.

19. Continue to work with local governments, state agencies, utilities, and other stakeholders to advance energy-related planning efforts and alternative fuel infrastructure improvements in Iowa.

Several recent initiatives have related to energy and alternative fuel and electric vehicles, including the Iowa Energy Plan, studies related to infrastructure needs for alternative fuel vehicles, administration of the Volkswagen Settlement, and the I-80 Mid America Alternative Fuel Corridor planning study. As efforts in these areas continue to advance and funding opportunities arise, additional collaboration and coordination will be necessary to help implement the strategies identified through these efforts and support the infrastructure environment for alternative fuel vehicles in Iowa.

20. Advance workforce adaptation and planning.

Changes in the technology of how to do business as well as the technology used in transportation itself will require continued evolution. Telework is more common and worker preferences are changing. Amounts of data being collected and processed continue to increase exponentially. The transportation industry faces shortages in the workforce necessary to meet current needs, such as truck drivers and data analysts, and for future needs, such as automated transportation. New programs, recruitment initiatives, and upskilling current workforces will be needed to help address these gaps.

Highway

21. Continue to advance highway planning and analysis efforts.

System level highway planning and analysis has evolved over time, and it is important to continue to advance these efforts. The system's current and forecasted use and performance are measured by multiple highway analysis tools and the outputs of those efforts have increasingly been incorporated into the SLRTP and project scoping tool to guide corridor-level planning. The Iowa Interstate Investment Plan (I3P) was created to help guide programming decisions for that network's stewardship and enhancement. Highway system stratification is being discussed as part of the rightsizing policy framework and could lead to additional planning efforts. These tools and plans need to continue to be advanced and incorporated into the planning, programming, and project development process.

Strategies Based on Primary Highway System Analysis

The SLRTP includes system level analysis of various needs and risks for the Primary Highway System. The following strategies relate to targeting planning initiatives and investments to address the locations identified as the most critical needs or risks. It should be noted that identifying a specific need or risk does not automatically mean the way to address that need or risk is known or defined or that a project will necessarily be programmed. Planning efforts, asset management strategies, funding, stakeholder priorities, and other issues all factor into if, when, and how projects proceed.

Strategies are included related to:

- Pavement Condition
- Bridge Condition
- Bottlenecks
- Mobility and Safety (Super-2)
- Capacity
- Safety
- Operations
- Flood Resiliency
- Bicyclists and Pedestrians

22. Target investment to address pavement condition needs at locations with measured structural and service issues.

Candidate condition improvement locations were identified by using the Infrastructure Condition Evaluation (ICE) tool, which provides a composite rating based on the most recent infrastructure condition and performance data. For the purposes of the SLRTP, 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, should be used to focus consideration of pavement condition improvements.

23. Target investment to address bridges with measured condition needs.

Candidate condition improvement locations were identified using the bridge condition index (BCI). The BCI is calculated based on structural adequacy and safety; serviceability and functional obsolescence; essentiality for public use; and special vulnerabilities. For the purposes of the SLRTP, the BCI was used to identify bridges that comprise the lowest-rated five percent of the system's structures. These locations, in conjunction with other bridge and asset management tools, should be used to focus consideration of bridge condition improvements.

24. Target investment to address needs at locations with measured bottlenecks.

Candidate bottleneck improvement locations were identified by a system screening that used traffic speed data to identify segments categorized as bottlenecks due to recurring traffic slow-downs. For the purposes of the SLRTP, the worst five percent of bottlenecks were considered most severe; of those, bottlenecks that were one or more standard deviation above the mean for total delay were identified as needs. These locations should be used to help focus consideration of spot operational improvements. Bottlenecks on the Iowa Multimodal Freight Network are of particular importance from a freight perspective.

25. Target investment to address mobility and safety needs on Super-2 routes.

No congestion is forecast for the 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 application of the Super-2 concept. Elements of this concept that should continue to be applied in a targeted and opportunistic fashion include passing lanes, wider paved shoulders, left- and right-turn lanes, acceleration lanes, limited access, and geometric improvements. The Iowa DOT is focusing its consideration of such corridor-level enhancements on US Highways 18, 30, 34, 63, and 71, which serve as a compliment to the multilane highway network. While these corridors are being specifically targeted, these types of treatments should also be considered in other locations when appropriate to address mobility and safety needs.

26. Target investment to address capacity needs.

Candidate capacity improvement locations were identified through a statewide volume-to-capacity (V/C) analysis. Future statewide V/C conditions were analyzed based on past and current versions of the statewide travel demand model, MPO travel demand models, and traffic forecasts completed for studies and projects. The analyses showed congestion is primarily forecast to occur on routes in metropolitan areas and three key Interstate corridors. These locations should be used to help focus consideration of capacity improvements.

27. Target investment to address locations with the most potential to improve safety through crash reduction.

Locations with the greatest potential for crash reduction (PCR) were identified based on a statewide analysis that calculated the PCR by examining the predicted numbers of crashes based on the roadway and traffic environment. For the purposes of the SLRTP, corridors that had an average of one or more PCR per mile were identified as the highest priority corridors from a safety perspective. These locations should be used to help focus consideration of safety improvements.

28. Target investment to address corridors with higher risks from an operations perspective.

Corridors considered to be higher risk from an operations perspective were identified by using the Infrastructure Condition Evaluation for Operations (ICE-OPS) tool, which is a system screening tool that quantifies the relative risk to the safe and reliable operation of the system. For the purposes of the SLRTP, corridors that were one or more standard deviation below the ICE-OPS statewide average composite score were identified as the highest priority corridors from an operations perspective. These locations should be used to help focus consideration of corridor operational improvements.

29. Target investment to address corridors with higher risks from a flood resiliency perspective.

Locations vulnerable to a 100-year flood event were identified by using a resiliency metric that includes robustness, redundancy, and criticality components. For the purposes of the SLRTP, corridors that were one or more standard deviation below the statewide average score were identified as the highest priority corridors from a flood resiliency perspective. These locations should be used to help focus consideration of flood resiliency improvements.

30. Target investment to address locations with higher risks for bicyclists and/or pedestrians.

Locations considered to be higher risk for bicyclists and pedestrians were identified based on a statewide analysis that developed composite scores for locations by considering several roadway factors related to the likelihood for risks to bicyclists and pedestrians. For the purposes of the SLRTP, the percentage of a corridor's mileage that was one or more standard deviation below the average composite score was identified for both bicyclists and pedestrians; corridors with higher percentages have more relative length that may need improvement. These locations should be used to help focus consideration of bicyclist and pedestrian improvements.

5.5 Rightsizing Policy

Background

The purpose of this policy is to clarify Iowa DOT's definition of rightsizing and to document policy statements in several topical areas to help further formalize and institutionalize rightsizing practices. The context of this discussion is primarily the state-owned highway network, and the rightsizing philosophy applies to Iowa DOT projects. While the highway network may typically be thought of in terms of vehicular traffic, it is also an important conduit for other modes of transportation such as public transit users, bicyclists, and pedestrians, and most rightsizing concepts can be applied across transportation modes.

While this is the first adoption of a rightsizing definition and policy statements as part of the long-range plan, rightsizing is not new. Rightsizing aligns with other planning frameworks such as context sensitive solutions and performance-based practical design, and many of the concepts discussed in this policy are already being implemented.

At its essence, rightsizing is about trying to make the best choices for the overall transportation system when developing individual projects.

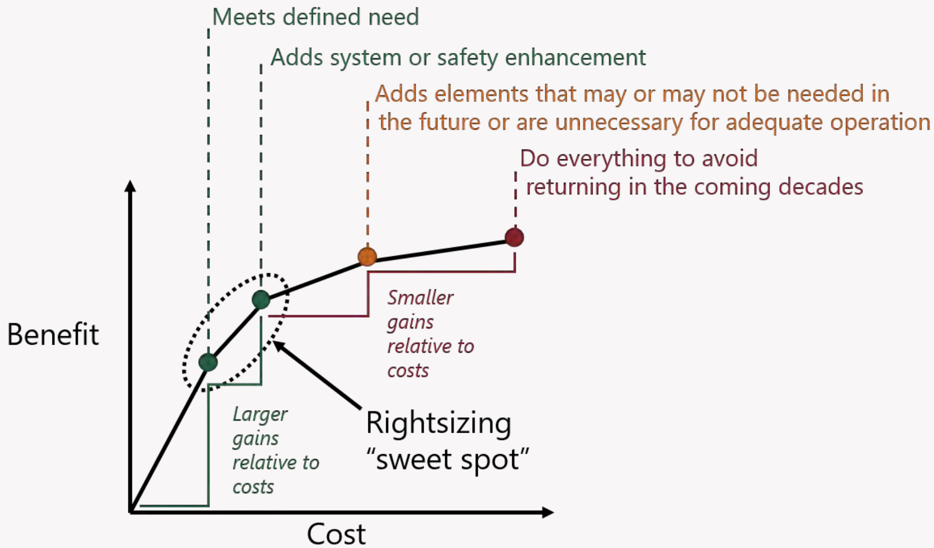
- Rightsizing is about ensuring **individual projects** are appropriately scoped. When a project is being developed, there is always something else that can be added to it, but it is neither practical nor feasible to add elements indefinitely.
- At the **broader program level**, rightsizing ties in with efforts to prioritize among projects in order to select the best projects to carry forward. Given the realities of constrained budgets, competing priorities, and varying preferred outcomes among user groups, there are always more improvements to the transportation system that are needed or desired. Defining transportation needs appropriately is the first step in rightsizing and can help ensure that well-scoped projects rise to the top.

These concepts are especially important since budgets are limited and we know we do not have enough funding to make all needed improvements to the system. Making a choice to complete a project in one location means not completing a project in another location, so every incremental cost increase means we have less capacity to address needs elsewhere. Also, every addition to the system's infrastructure now is a commitment to increased future maintenance needs. However, rightsizing does not always mean choosing a lower-cost option or eliminating project elements – as discussed in this policy, some rightsizing decisions involve considering context or needs that may broaden a project's scope or cost.

The aim with rightsizing is to find the right balance of addressing an individual project's needs versus the benefit gained to that location and the system overall. This is illustrated in Figure 5.30. The preferred location for a rightsized project on the benefit/cost curve is when the project is meeting the location's defined needs and, if applicable, adding system or safety enhancements that are appropriate for the location. However, if project elements are added beyond this without appropriate justification, the increase in benefit relative to the increase in cost degrades substantially.

It is understandable why some projects start creeping towards the top of the curve. For example, there may be interest in adding any elements that may be needed in the coming decades while work is being done, rather than potentially needing to come back in the relatively near future for additional work. However, given the limited budget for the transportation system, it is not prudent to take this approach for unnecessary enhancements or when future needs are relatively uncertain. Once the defined need for the project is met, designers must weigh the decreasing return on investment that additional project elements would have relative to the benefit that would be gained.

Figure 5.30: Rightsizing "sweet spot"



Source: Iowa DOT

Rightsizing does not replace the use of engineering judgment; input from the public, user groups, or communities; required guidelines, parameters, or laws; or other important elements of the project selection and development process. The policies are meant to provide guidance on achieving a rightsized transportation system for Iowa, which is defined in the next section.

Definition

The Iowa DOT defines rightsizing as the following:

> Rightsizing means seeking an appropriate level and type of investment that avoids overinvesting or underinvesting, overbuilding or underbuilding, and overserving or underserving the market based on user and system needs.
>
> The department's role in rightsizing should be viewed as leveraging existing assets and limited resources to maximize the returns for users of the multimodal transportation system, with operating, maintaining, and constructing this system as a means to this end.

Rightsizing is incremental and applies at various points during planning, programming, and project delivery activities, as well as during ongoing operation and maintenance of the transportation system. While the policy statements provide guidance, to be successful the rightsizing concepts need to be integrated through implementable actions across these stages. Decisions made at each level of development should build upon each other to result in the best solutions to support the quality and financial sustainability of the transportation system. It is anticipated that a rightsizing workplan will be developed to outline activities and responsibilities to implement rightsizing. Many of the possible implementation activities discussed for the policy statements throughout this section would likely be addressed through the workplan.

Policy Statements

To support rightsizing implementation, a number of policy statements have been developed to help guide investment decisions for Iowa DOT projects. Some of these topics are already considered in the planning and project development process, but many of these statements will require further work, such as research, analysis, incorporating new elements or checks into the project development process, and modifications to guidance documents and manuals.

The ten rightsizing topic areas are:

- Project needs
- Comprehensive needs
- Stewardship priority
- Stratification of the system
- Equity
- Resiliency
- Congestion or operational issues
- Emerging technologies
- Speculative development
- New or revised interchange access

Project Needs

All improvements shall address a measured transportation need based on current or forecasted conditions. Improvements addressing a current need should be prioritized over improvements addressing a forecasted need.

What does this mean?

- Every project requires a clearly defined transportation need or needs. While wholly unneeded projects may not be occurring, the specific need for a project is not always clearly defined. Projects can also suffer from scope creep, where additional enhancements or elements are added that are not directly related to defined needs. These choices can accumulate until many small, seemingly good decisions have resulted in losing sight of the big picture and the specific need(s) the project is addressing.
- Project needs can be adjusted or redefined, but this should be merited based the planning or design process. The benefits and costs of addressing needs may vary depending on project staging and scheduling, particularly in locations with significant needs resulting in large-scale projects.
- Current, known needs are to be prioritized over future, potential needs. This applies both when determining the elements to include in a specific project and when prioritizing among projects. Addressing a future need, or something that is not currently an issue but is expected to become one, involves estimation and judgment related to the likelihood for the future need. Implementing a project to address a future need that is relatively uncertain should be done strategically and carefully.
- The defined need referenced in this statement is not meant to be equivalent to the purpose and need required by NEPA, though they would likely be very similar.

How might this be implemented?

- Clear definition of need in all project concept statements.
- If new project elements are identified after projects are concepted, reevaluation of those elements relative to the identified needs.
- If elements are incorporated to address future needs, those potential needs are clearly quantified through data-driven evaluation.
- Continue improving analysis tools and benefit/cost evaluation tools and integrating them into the planning, programming, and project development process.
- Consider how the staging or scheduling of projects may impact project benefits/costs.

Comprehensive Needs

Broader system, corridor, and modal needs shall be considered as individual projects are developed. To identify such needs, project sponsors should consult the state transportation plan, relevant system and modal plans, and planning studies. Decisions should emphasize maximum benefit to the system, rather than maximum benefit to the project location.

What does this mean?

- While an individual project may have a clear extent, it should not be developed in isolation. Individual road segments and bridges are parts of larger highway corridors, multimodal routes, regions, and the overall transportation network. Project development needs to involve consideration of what is planned in the broader corridor and nearby areas; needs and policies that have been documented in statewide system and modal plans, studies, and policies; and systemic and location-specific safety improvements.
- This is an example of rightsizing that may result in a project that is broader in scope than the originally defined need. For example, application of the Complete Streets policy may help identify the need and justification for wider paved shoulders than the original project design included. In another example, consideration of Super-2 strategies on a targeted Super-2 corridor may result in the inclusion of additional passing and/or turn lanes as part of the project's design.

How might this be implemented?

- Continued development of system, modal, and systemic safety plans, identification of strategies, and adoption of policies to help meet needs.
- Coordination with stakeholders, including local jurisdictions, public transit agencies and modal partners, and other interested parties.
- Continued use of Planning and Environmental Linkages (PEL) feasibility studies to define the vision, goals, and strategies for study areas and analyze engineering and environmental conditions.
- Integration of strategies and policies into the project development process, such as the Complete Streets policy, Super-2 targeted corridors, and SLRTP-identified needs in concept statements.
- Development of tools to evaluate project benefits and costs, as well as benefits and costs of policies or system-level strategies that may not fit well into a traditional benefit/cost analysis.

Stewardship Priority

Program-level investment strategies and all improvements shall prioritize maintaining a state of good repair. Decisions should apply appropriate asset management techniques, including life cycle planning, and consider relevant state of good repair targets to maintain transportation infrastructure in sufficient condition.

What does this mean?

- This statement is important documentation of our asset management approach for investments. Asset management is about applying the right treatment at the right time to achieve the ideal balance of asset condition and whole-life costs. When planning projects, it can be easy to focus only on up-front costs and choose the option that is cheaper now, even if it is more expensive in the long run. Similarly, it can also be tempting to put off a costlier treatment or rehabilitation in favor for a cheaper one, to save money now at the longer-term detriment of the system. Making investment decisions through an asset management lens helps ensure these tradeoffs are evaluated as part of the project development process.
- The definition of a state of good repair may vary by mode, asset, or other classifications, and may be quantified by a condition target. In general, a state of good repair means that assets are functioning as designed at an acceptable level of performance within their useful service lives and are sustained through regular maintenance, rehabilitation, and replacement programs.

How might this be implemented?

- Specific policies may be developed that outline state of good repair targets. For example, the Transportation Asset Management Plan (TAMP) identifies system-level state of good repair targets for pavement condition on the Interstate system and non-Interstate National Highway System (NHS), and for bridge condition on the NHS. Another rightsizing policy suggests further stratifying the system for purposes such as these.
- Integrate evaluation of whole life costs into project planning and development.
- Apply appropriate asset management techniques to projects.
- Continue to research and refine asset management systems, practices, and treatments.

Stratification of the System

The department shall evaluate and consider implementing an approach to stratify the Primary Highway System for the purpose of defining corresponding state of good repair targets and informing investment decisions. Such stratification should consider existing designations, including the National Highway System and Commercial and Industrial Network, functional classification, current and forecasted use, and network redundancy.

What does this mean?

- The state-owned highway system is diverse and complex. It ranges from urban multilane Interstates with over 130,000 vehicles per day to rural two-lane roads with less than 1,000 vehicles per day. Different roadways have different contexts, users, and needs, such as freight routes, commuter corridors, community access, and so on. These purposes may need to be managed differently and to a different level. For example, it may be appropriate to target a higher level of service or condition level on a busy freight route than on a less utilized highway that primarily provides access for local traffic. Stratification could inform condition targets as well as the types of treatments that would be considered for particular roadways.
- While state of good repair targets are identified at the Interstate and non-Interstate primary highway system levels for pavements and bridges, this does not provide adequate delineation given the wide range of characteristics seen on non-Interstate highways. The proposed type of stratification would provide further context to asset management planning and investment decisions.

How might this be implemented?

- Review existing and potential stratification classifications.
- Consider adoption of unique state of good repair targets based on a preferred system stratification.
- Consider adoption of policies or strategies related to the range of treatment types that will be considered based on stratification.

Equity

The department shall evaluate the ways transportation policies and investments impact equity and consider strategies to support an equitable transportation system. Such consideration should include reviewing sociodemographic and socioeconomic disparities and barriers that inhibit underserved communities from fully accessing and utilizing the transportation system.

What does this mean?

- Different people and populations have different levels of need when it comes to fully accessing and using the transportation system. In particular, additional consideration may be required to ensure underserved individuals are able to achieve an equitable level of access to affordable and reliable transportation options. This applies to transportation infrastructure and services that already exist along with those that may develop or become common in the future as technology advances.
- This is an example of rightsizing that could result in adding project elements in order to address community-specific needs and/or to ensure the impacts of transportation projects are distributed fairly.
- Examples of underserved groups include, but are not limited to, individuals who are low income, minority, limited English proficient, elderly, children, or persons with disabilities.
- In some cases, legacy highway construction was built in a manner disruptive to communities, particularly low-income communities and communities of color. Enhanced engagement with local communities should be conducted to ensure these types of impacts do not occur due to transportation projects and, where appropriate, to remove or retrofit infrastructure barriers that disrupt community connectivity.

How might this be implemented?

- Continue to apply environmental justice, Title VI, and nondiscrimination policies in all investment decisions to achieve an equitable distribution of benefits and burdens, including ensuring that there are not disproportionately high and adverse human health or environmental effects on underserved populations.
- Ensure that driver license and identification issuance reflects nondiscrimination and Civil Rights policies and enables all populations to have the same opportunity for mobility.
- Analysis of the transportation needs of underserved populations.
- Consideration of non-drivers in investment decisions.
- Adoption of strategies to ensure equity.
- Development of tools to evaluate projects from an equity perspective, which may not fit well into a traditional benefit/cost analysis.
- Enhanced public involvement efforts.
- Coordination with stakeholders, including local jurisdictions, public transit agencies and modal partners, underserved community representatives, and other interested parties.

Resiliency

The department shall assess, plan for, and invest in the resiliency of the multimodal transportation system to mitigate against natural and human-made disruptions. Such activities should consider proactive and reactive measures that are proportional to existing and potential threats.

What does this mean?

- Resiliency is the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and quickly recover from disruptions. Extreme weather and natural disasters have happened with increasing frequency and can lead to devastating consequences for the transportation system, not to mention people's homes, businesses, and lives.
- Flooding is likely Iowa's greatest ongoing threat to resiliency, but climate change and a wide range of natural disasters and human-made disruptions threaten the usability and condition of the highway network. Planning and project development should consider the risk of disruptions to the system and whether proactive steps can be taken to construct more resilient transportation assets.
- Resiliency also means being prepared to react when disruptions or disasters occur, including making continued improvements to activities such as traffic incident management protocols, diversion routes, and preparedness and recovery planning. This is necessary not just for large-scale disaster planning, but also for addressing short-term disruptions to the transportation system or IT infrastructure. These disruptions can be unplanned, such as crashes, a severe storm, or cyberattack, or planned, such as work zones or closures for construction or traffic management for special events.

How might this be implemented?

- Conduct resiliency analyses that consider the criticality of the transportation system and its vulnerability to climate change and various natural disasters and human disruptions.
- Enhance disaster mitigation and response planning and coordination.
- Improve department cybersecurity to protect IT assets by addressing vulnerabilities, ensuring critical systems are protected, and incorporating redundancy where needed.
- Consider innovative project design to make assets more resilient to disasters.
- Routinely conduct risk management activities at the planning and project levels.
- Evaluate policies related to transportation system disruptions, such as how traffic is managed during construction projects.

Congestion or Operational Issues

Improvements proposed to address current or forecasted congestion shall consider increased use of technology and operational improvements. Decisions should emphasize maximizing the capacity of the existing multimodal transportation network and managing demand for the system, rather than investing in capacity expansion.

What does this mean?

- Iowa has a mature and reliable transportation system. There is little congestion or delay on the system as a whole; when these issues are experienced, they are typically confined to specific locations and to peak hours. While there may be instances where building additional capacity is the necessary solution to a congestion issue, this is becoming the exception rather than the rule. Strategies that better utilize existing infrastructure are preferable to adding lanes to the highway system, which results in increased right of way needs, construction costs, and long-term maintenance commitments.
- There is an increasing necessity to consider other options for improving operations, including technological solutions, innovative design, managing peak-hour demand, and use of public transit, carpool/vanpool, or other modes besides single occupant vehicles. Before any capacity expansion project proceeds, alternatives to capacity expansion should be considered first and eliminated as being less prudent options.

How might this be implemented?

- Continue to implement Integrated Corridor Management (ICM) studies and solutions in areas with congestion or operational issues.
- Continue advancement of Transportation Systems Management and Operations (TSMO) planning and inclusion of feasible TSMO solutions in planning studies and project development.
- For capacity expansion projects, demonstrate that capacity expansion is the only feasible or most practicable option before proceeding.
- Enhance transportation and land use planning coordination with metropolitan and regional planning agencies and communities.
- Conduct comprehensive planning for deployment of operations-focused strategies, including initial implementation costs as well as ongoing operations and maintenance needs.

Emerging Technologies

All improvements shall consider the impact of underestimating or overestimating the influence of emerging technologies on the intended benefit of the improvement over its useful life. In considering such impacts, the department should evaluate probable rates of technological deployment/adoption, projected impacts of technologies on the performance of the multimodal transportation system, and the sensitivity of return-on-investment to various deployment/adoption scenarios.

What does this mean?

- Change is inevitable. Some of the clearest examples include the increasing use of electric vehicles, growing micromobility options, and advancements in automated transportation and personal delivery devices. Although broader adoption of these types of changes may be on the horizon, we cannot say with certainty how close that horizon is, how widespread adoption of these technologies will be, or whether these changes will be equitably available to all users of the transportation system.
- While we are working to support the advanced driver assistance systems of today and the automated driving systems of tomorrow, projects that include decisions that assume advancements in technology should include thorough evaluation of the likelihood of that technological advancement occurring in the near-term future and the degree to which the project's success or need is tied to that. This should be considered strategically and carefully when:
    - Considering whether to include project elements that have limited current benefits due to the assumption that they will be needed for technological advancements in the future.
    - Considering whether to exclude project elements that have current benefits due to the assumption that they will not be needed in the future.
    - Making choices that are tied to a single future scenario with an uncertain likelihood.
    - Making choices that exacerbate inequities or mobility limitations among various groups.
- Advances in mobile technology will lead to more opportunities for documents and credentials to be held and transacted directly by the individual user. This may include mobile driver license or identification applications and fully electronic vehicle titles. There will be challenges to ensure that such documents are accurate in real-time, secure, legally accepted, and made accessible to all users.

How might this be implemented?

- Incorporate pause points into the project development and programming processes to consider the evolving impacts of disruptive technologies.
- Monitor technological advancements, likely deployment scenarios, and impacts to various groups.
- Conduct risk analysis relative to the tradeoffs of including or not including project elements due to technological change.
- Strategize how and when to participate in pilot deployments or to act as a lead adopter among states for key advancements in technology.

Speculative Development

Improvements proposed primarily in support of speculative development shall not be considered unless a transportation need is also being addressed. This shall not apply to improvements proposed to address transportation needs associated with planned development.

What does this mean?

- The department's top priority is stewardship of the transportation system and ensuring that the system Iowa needs is maintained in a condition that enables safe and efficient passenger and freight movements. There is not adequate funding to complete all needed transportation improvements, so we cannot afford projects that do not have a demonstrated transportation need.
- Speculative development means there is no defined or imminent development planned.
- To help address economic development, Iowa DOT administers the Revitalizing Iowa's Sound Economy (RISE) grant program, to which this policy does not apply. That program helps support both immediate needs and speculative development for business and industrial growth.

How might this be implemented?

- Ensuring that all projects have a defined transportation need.
- Ensuring that associated planned development, which may factor into project decisions, meets conditions that would indicate more certain or imminent progress.

New or Revised Interchange Access

The department shall provide for a consistent approach in determining financial participation between the Iowa DOT and local governments for new or revised interchange access. For new or revised service level interchanges proposed primarily in support of local development, or in cases where local development traffic would degrade the performance of a systems interchange, the department should seek a proportional cost sharing agreement with the local government(s).

What does this mean?

- Similar to speculative development, building interchanges without a transportation need is not necessarily in the Iowa DOT's interest from a system perspective. Being more consistent in how we approach situations where new or revised interchange access is proposed would be beneficial.
- While some degree of flexibility is always needed at a project level, clear parameters should be established at the department level to help guide conversations related to cost sharing.

How might this be implemented?

- Develop guidelines for how interchange access projects are typically funded in various scenarios.

6. PAYING OUR WAY

The past few chapters have identified the vision for the transportation system, system objectives and planning considerations, needs and risks across modes, and strategies to make progress towards the system vision. However, this vision will not be achievable if adequate funding is not available to invest into the system. This chapter highlights the financial reality of transportation funding, projections for costs and revenues across modes, potential shortfalls and implications, and possible ways to generate additional revenue.

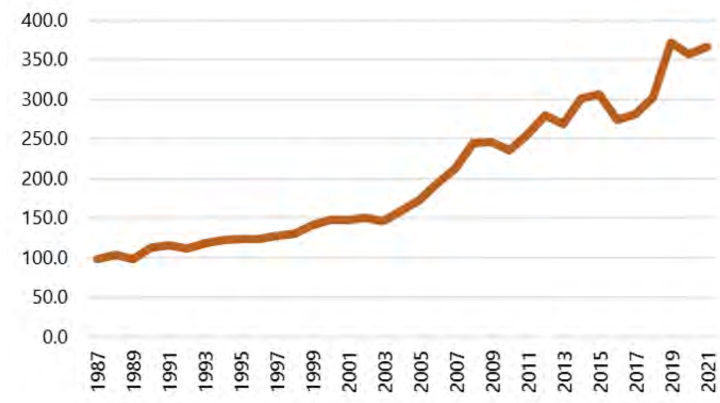
6.1 Introduction

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 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 understand the impacts of this inflation, consider that a $1 million project in 1987 cost approximately $3.67 million in 2021.

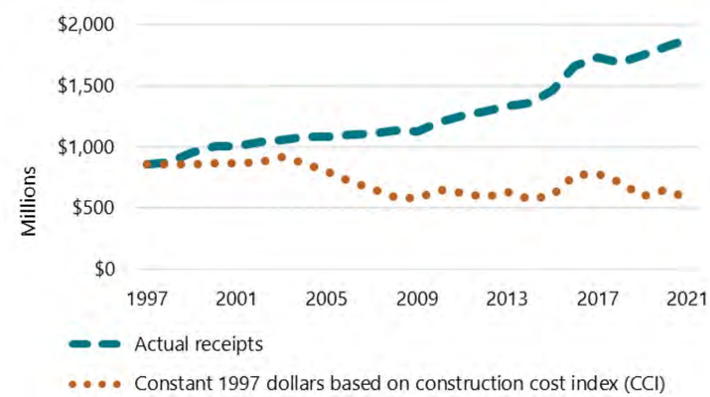
Over time, the effects of cost inflation erode the buying power of available revenue. An example of this is illustrated in Figure 6.2, which shows Iowa Road Use Tax Fund (RUTF) revenue history adjusted to constant 1997 dollars based on the Iowa CCI.

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, 1997-2021



Source: Iowa DOT

State revenues for transportation primarily come from Iowa's RUTF and TIME-21 Fund. Combined, those two funds consist of revenues from fuel taxes, registration fees, use taxes, driver's license fees, and other miscellaneous sources. After remaining at the same level for more than two decades, in 2015 the legislature increased the fuel tax rate by 10 cents per gallon. However, as shown on Figure 6.2, inflation has already negated that increase in terms of constant dollars.

Most of the federal revenue that the Iowa DOT receives for transportation is generated by the federal fuel tax. The Fixing America's Surface Transportation (FAST) Act expired on September 30, 2021 after a one-year extension, and its successor, the Infrastructure and Investment Jobs Act (IIJA), was passed through Congress and signed into law on November 15, 2021. Over the five-year life of IIJA, the bill provides an increase in federal funds of approximately 30 percent over 2021 amounts, as well as year-over-year increases through 2026. While this is a significant increase over past funding levels, it is unknown whether that increase will be sustained beyond the timeframe of IIJA.

The additional revenue will provide a significant boost. However, since transportation costs have outpaced revenues over time, Iowa's transportation system has been and will continue to be subject to deterioration. Also, future revenues are not guaranteed. The level of revenues received is affected by a number of factors, including, but not limited to, the amount of federal dollars actually appropriated and available to obligate, vehicle miles traveled, vehicle fuel efficiency, and the use of alternative fuels (e.g., ethanol, biodiesel, natural gas, and 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 2000-2022	SFY 2022
Highway	$826.76	$1,174.86
Aviation	$4.29	$6.27
Bike/pedestrian (trails)*	$1.95	$1.50
Public transit	$13.08	$17.75
Railroad	$3.19	$2.60
General services**	$82.28	$97.25
Motor vehicle	$36.46	$32.35
Total	**$968.01**	**$1,332.59**

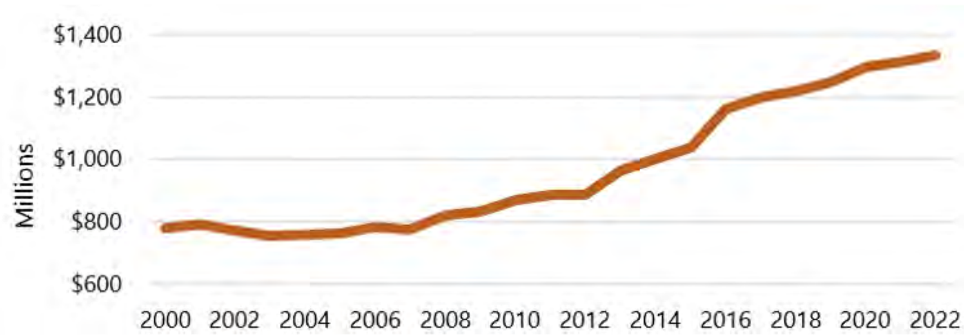
**Trails funding does not include Federal Recreational Trails Program or Statewide Transportation Alternatives Program funding.*

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

Source: Iowa DOT

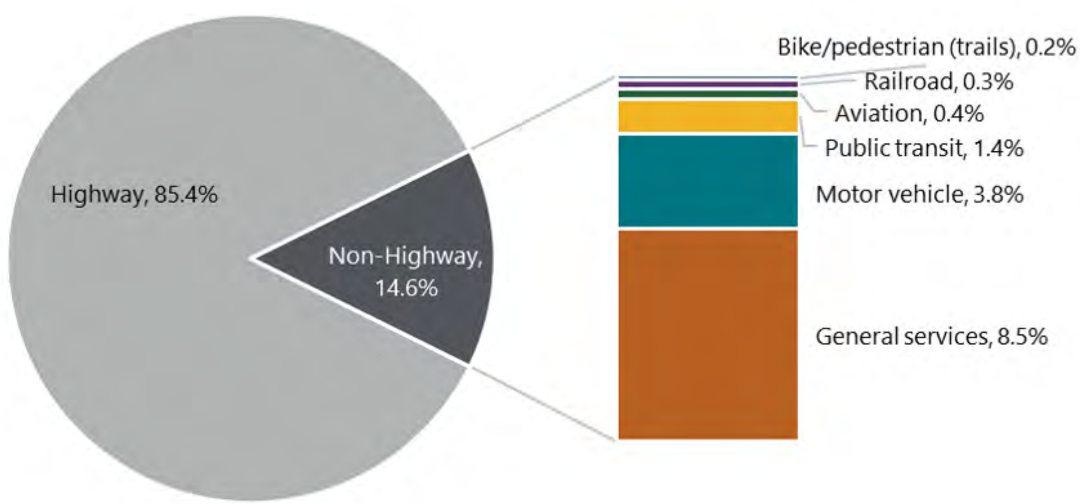
Figure 6.3 illustrates the recent history of total Iowa DOT-programmed transportation funding. While this total has increased at a steady pace in recent years, it has not kept up with inflation and cannot fully address the growing list of needs and escalating costs associated with meeting those needs. 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, SFY 2000-2022



Source: Iowa DOT

Figure 6.4: Distribution of Iowa DOT-programmed transportation funding (SFY 2000-2022)



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, for estimating purposes, 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 State Long Range Transportation Plan (SLRTP) 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 2020 Iowa Aviation System Plan (IASP). The IASP identified System Plan objective costs, Airport Capital Improvement Program costs, and pavement maintenance and rehabilitation costs totaling nearly $1.182 billion over the 10-year planning period, or $118.2 million annually in 2021 dollars. The 2021-2030 costs include significant terminal improvements at the Des Moines International Airport and Eastern Iowa Airport in Cedar Rapids, so to extrapolate costs for the 2031-2050 time period, the average annual amount was reduced to a $87.7 million annually in 2021 dollars. These annual amounts were inflated from 2021 dollars based on an annual inflation rate of 4.0 percent, which was based on the growth of Iowa's CCI. **Average annual total costs** over the life of the SLRTP 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 2012 and 2021, this percentage varied from year to year and averaged 9.6 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.

Table 6.2: Average annual aviation costs, 2022-2050 ($ millions)

Average annual total costs	Average annual Iowa DOT costs
$151.654	$14.599

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 SLRTP, 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 SLRTP were then calculated.

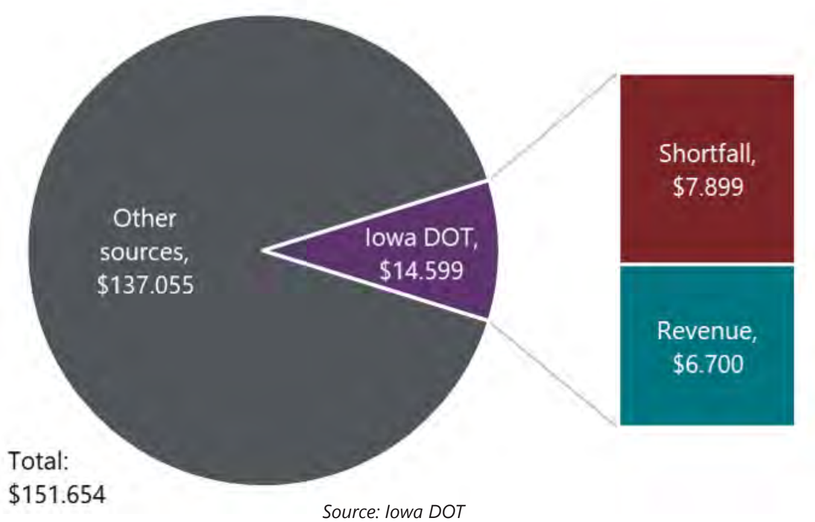
Table 6.3: Average annual aviation revenues, 2022-2050 ($ millions)

Average annual Iowa DOT revenues
$6.700

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 46 percent of the anticipated Iowa DOT costs.

Figure 6.5: Aviation average annual total costs, Iowa DOT share, revenue, and shortfall, 2022-2050 ($ 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, such as covered storage for aircraft, could be limited.

Bicycle and Pedestrian

Costs

The 2017 SLRTP bicycle and pedestrian financial methodology for the on-road needs of the primary system was based on analysis that was conducted as part of the Bicycle and Pedestrian Long Range Plan, which was completed in 2018. This included an assessment of needs for the entire Primary Highway System, excluding Interstates. This analysis is being used again as the basis for bicycle and pedestrian costs. It is anticipated that this analysis will be updated prior to the next SLRTP update.

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. 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 Highway System costs, which are spread across the timeframe of the plan. Costs were developed in 2016 dollars, and then inflated to 2050 using an annual inflation rate of 4.0 percent, which was based on the growth of Iowa's CCI. **Average annual total costs** over the life of the SLRTP were then calculated (see Table 6.4).

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 System. 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.

Table 6.4: Average annual bicycle and pedestrian accommodation costs, 2022-2050 ($ millions)

	Average annual total costs
Rural Primary Highway System	$32.336
Urban Primary Highway System	$12.651
Total	**$44.987**

Source: 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 available for bicycle/pedestrian improvements. However, it is important to note that some of these sources can be spent on non-infrastructure 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 2012 through 2021 was averaged, then projected out to 2050 to calculate **average annual Iowa DOT revenues** over the life of the SLRTP (see Table 6.5).

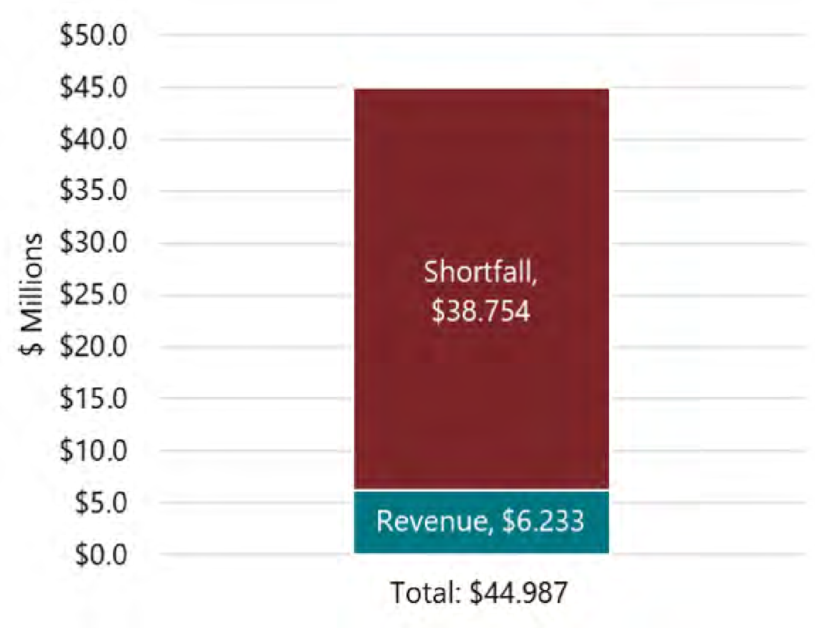
Table 6.5: Average annual bicycle and pedestrian revenues, 2022-2050 ($ millions)

Average annual Iowa DOT revenues
$6.233

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 on-road accommodations on the Primary Highway System using the maximum amount of current funding sources used specifically 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. A strategy discussed in the Bicycle and Pedestrian Long Range Plan, same-source funding for bicycle and pedestrian accommodations as part of road projects, is a potential option to help address the shortfall. Through the implementation of the Complete Streets Policy, this is expected to occur more frequently and may mean that the shortfall is not as significant as shown in Figure 6.6.

Figure 6.6: Bicycle and pedestrian average annual total costs for Primary Highway System, revenue, and shortfall, 2022-2050 ($ millions)



Note: See preceding discussion.

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 2021 RUTF Study. The study identified total needs across the city, county, and state systems. To prioritize these needs, costs to maintain the public roadway system in its current form have been highlighted as stewardship needs This would reflect only future investments in stewardship, or projects that extend the life and modernize existing infrastructure without adding capacity. While maintaining the existing public roadway system is most critical, an inability to deliver capacity improvements where needed would limit the efficiency and reliability of the transportation system and its ability to support the state's economy.

The RUTF Study had a horizon of 2040. Its costs were extrapolated to the SLRTP horizon of 2050, then **average annual costs** for Iowa's entire public roadway system were calculated. 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 were separated out as the **average annual Iowa DOT costs.** Table 6.6 shows the statewide and Iowa DOT portions of total highway costs (including capacity increases) while Table 6.7 shows only the stewardship portions of these costs.

Table 6.6: Average annual total highway costs, 2022-2050 ($ millions)

Average annual total costs	Average annual Iowa DOT costs
$4,950.347	$1,789.296

Source: Iowa DOT

Table 6.7: Average annual stewardship highway costs, 2022-2050 ($ millions)

Average annual stewardship costs	Average annual Iowa DOT costs
$4,445.011	$1,642.599

Source: Iowa DOT

Revenues

Revenues for highway were also derived from extrapolating the revenue forecast used for the Iowa DOT's 2021 RUTF Study. The following assumptions were used for federal and state revenue increases.

- After accounting for the increases in federal revenue from the IIJA, federal funding will increase slightly (0.5 percent annually) over the remaining years of the forecast period, resulting in a continuing loss of buying power.
- State revenue will grow about one percent annually, which will result in a continuing loss of buying power.

Revenues were forecast for 2022-2050. **Average annual Iowa DOT revenues** (Table 6.8) over the life of the SLRTP were then calculated.

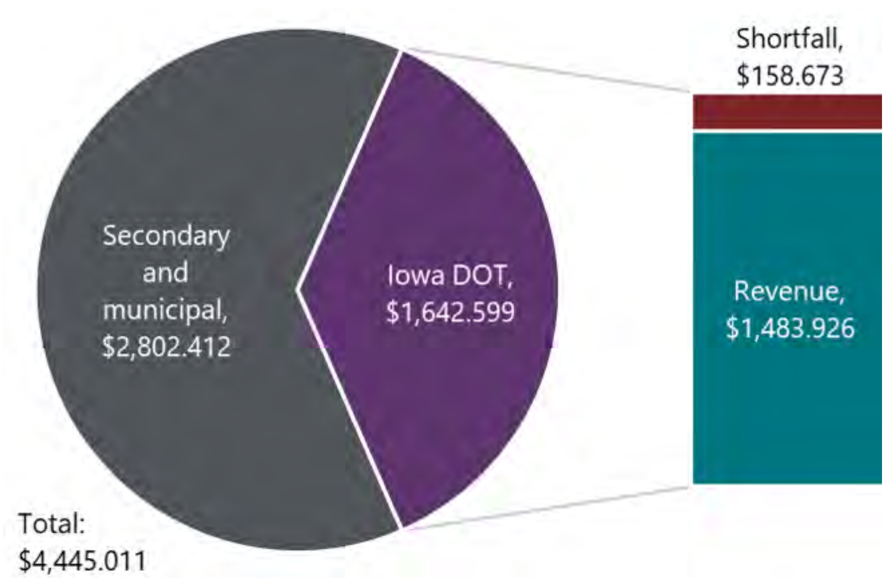
Table 6.8: Average annual highway revenues, 2022-2050 ($ millions)

Average annual Iowa DOT revenues
$1,483.926

Source: Iowa DOT

The total amount of stewardship needs and the difference between average annual stewardship costs and revenues for the Iowa DOT is illustrated in Figure 6.7. It is estimated that anticipated revenues would cover approximately 90 percent of the anticipated Iowa DOT stewardship costs. As illustrated, with projected inflation outpacing projected revenue growth, there will be a shortfall in addressing stewardship needs; also, this does not take into account the capacity needs identified as part of the totals in Table 6.6.

Figure 6.7: Highway average annual stewardship needs, Iowa DOT share, revenue, and shortfall, 2022-2050 ($ millions)



Source: Iowa DOT

Implications of the Shortfall

- Some stewardship needs may not be addressed, which could lead to decreasing pavement and bridge conditions.
- Some improvements on the Interstate system may not be addressed, which could lead to poorer pavement conditions and increased congestion and travel times.
- Some improvements on the Commercial and Industrial Network (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 Public Transit Long Range Plan (PTLRP) that was completed in 2020. The plan 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 needs. Operating expenses were forecast based on historical expenditures on operations, which resulted in an inflation rate of 4.95 percent per year. Unmet needs for additional staff, vehicles, and facilities were identified through a survey of public transit providers. These additional needs were then added to future operating needs by using the following indices for inflation. **Average annual total costs** over the life of the SLRTP were then calculated.

- Facility needs – Producer Price Index for non-residential building construction (2.14 percent per year)
- Vehicle needs – Producer Price Index for truck and bus bodies (2.41 percent per year)
- Personnel needs – Employment Cost Index (2.20 percent per year)

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 2011 and 2020, this portion was about 10.9 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, 2022-2050 ($ millions)

	Average annual total costs	Average annual Iowa DOT costs
Capital	$58.621	-
Operating	$270.999	-
Total	**$329.620**	**$36.016**

Source: Iowa DOT

Revenues

Revenues for public transit were derived from historical funding identified in the transit element of the Five-Year Program plus a portion of Iowa's Clean Air Attainment Program (ICAAP) funding that has routinely been allocated to bus replacements. A linear trend line was applied to the historical data from SFY 2012 through 2021 and then projected out to 2050. **Average annual Iowa DOT revenues** (Table 6.10) over the life of the SLRTP were then calculated.

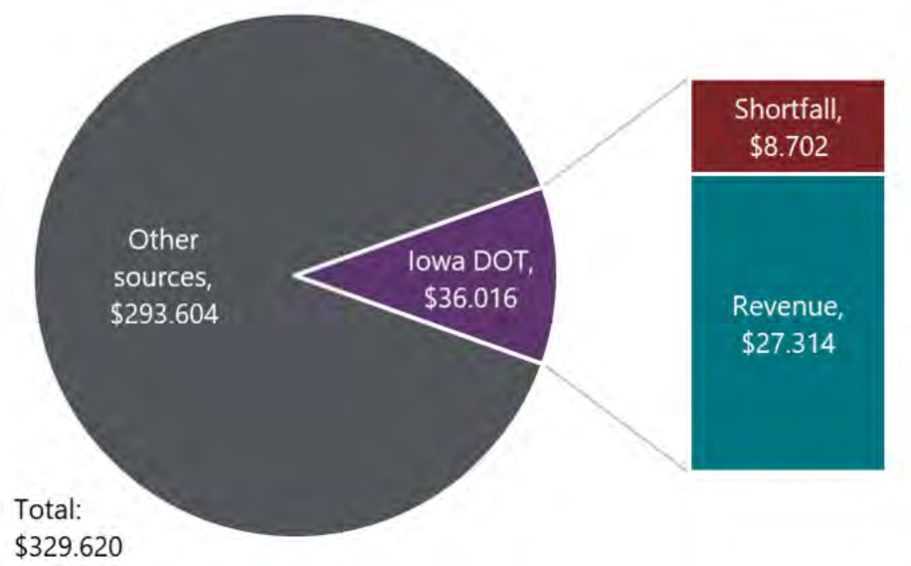
Table 6.10: Average annual public transit revenues, 2022-2050 ($ millions)

Average annual Iowa DOT revenues
$27.314

Source: Iowa DOT

The difference between average annual costs and revenues is illustrated in Figure 6.8. It is estimated that anticipated revenues would cover approximately 76 percent of the anticipated Iowa DOT costs.

Figure 6.8: Public transit average annual total costs, Iowa DOT share, revenue, and shortfall



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 enhancements may be delayed, and some existing services may be eliminated.
- Transit facilities may not be repaired or improved in a timely manner.

Freight Rail Costs

Costs for freight rail were derived from the Iowa State Rail Plan, which was updated in 2021. 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 inflated to the mid-years of the short- and long-range planning periods using an annual inflation rate of 2 percent. **Average annual total costs** over the life of the SLRTP 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, 2022-2050 ($ millions)

Average annual total costs
$118.447

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 Modal Transportation Bureau. 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 2012 through 2021 and then projected out to 2050. **Average annual Iowa DOT revenues** (Table 6.12) over the life of the SLRTP were then calculated.

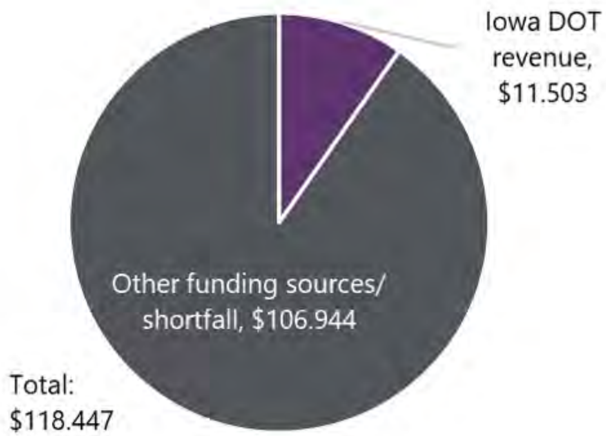
Table 6.12: Average annual freight rail revenues, 2022-2050 ($ millions)

Average annual Iowa DOT revenues
$11.503

Source: Iowa DOT

The difference between average annual freight rail costs and revenues is illustrated in Figure 6.9. It is estimated that anticipated revenues would cover approximately 10 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.

Figure 6.9: Freight rail average annual total costs, Iowa DOT revenue, and other funding sources/shortfall, 2022-2050 ($ millions)



Source: Iowa DOT

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 inflated to the mid-years of the short- and long-range periods using an annual inflation rate of 2 percent. **Average annual total costs** over the life of the SLRTP 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, 2022-2050 ($ millions)

Average annual total costs
$218.982

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.
- 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, businesses 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).

6.4 Addressing the Shortfall

As shown in the prior sections, funding shortfalls are projected across transportation modes. With limited resources, making efficient investment actions through the Five-Year Program is extremely important to support the stewardship of Iowa's existing transportation system. Difficult decisions must be made in dealing with Iowa's funding shortfall. Prioritizing projects, emphasizing stewardship, and achieving the right blend of projects to meet system objectives will be critical to ensure limited dollars are spent in the most beneficial way.

Past funding increases, including the establishment of the TIME-21 fund and the 2015 fuel tax increase, have helped make up some of the ground lost due to construction cost increases, but as Figure 6.2 showed, the buying power of the RUTF is continuing to decrease. Similarly, while the increased funding levels beginning in 2022 due to the IIJA will certainly help the situation, they are also not enough to address all needs and, if increases are not sustained over time, the same issue of losing ground to inflation is likely to occur.

The Appendix identifies various options for addressing the funding shortfalls, including some mechanisms that may be more applicable to a single mode, and others that could be used to generate revenue for various modes. 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 funding mechanisms, the following principles should be considered. These were publicly expressed during the Governor's Transportation 2020 Citizen Advisory Commission's input gathering process, which was part of the development of the 2011 RUTF Study.

These concepts have continued to resonate as appropriate considerations for sustainable revenue funding mechanisms.

- 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 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 2016 RUTF Study included three specific areas that were recommended for monitoring and potential action to address future shortfalls. Two of these, indexing fuel tax rates and studying mileage-based user fees, have not had any legislative action occur. However, action has been taken regarding the other area, which was to implement an alternative fuel vehicle registration fee. In 2019, House File 767 was signed into law to create supplemental registration fees on certain electric vehicles, with a phased implementation from 2020-2022. Two excise taxes were also approved. An excise tax on electricity used to fuel electric vehicles at nonresidential locations will begin in 2023. Also, an excise tax on hydrogen used as a special fuel was implemented in 2020.

The 2021 RUTF Study[1] was submitted to the legislature in December 2021. The study concluded with the findings and recommendations shown below for addressing projected needs, which carried forward the two areas from 2016 that have not been addressed. Additional background information on the projected shortfall and these recommendations can be found in the study report.

2021 RUTF Study Findings and Recommendations

The conclusion of the 2021 RUTF Study is that current revenue levels are not sufficient for meeting the projected needs of the public roadway system in Iowa. The 20-year projected total needs for the city, county, and state systems is $87.649 billion, with projected revenues over that time totaling $72.029 billion. This amounts to a total shortfall of $15.620 billion, or an average annual shortfall of $781 million.

To mitigate this shortfall and growing financial challenges posed by construction cost inflation, alternative fuel vehicles, and increasing fuel efficiency, the Iowa DOT recommends the following.

[1] http://publications.iowa.gov/39691/

Recommendation 1: Indexing Fuel Tax Rates

The Iowa DOT recommends the legislature consider implementing indexing of state fuel tax rates based on the national Consumer Price Index for all urban consumers (CPI-U). To ensure that reasonable revenue forecasts can be produced, the Iowa DOT recommends that indexing be implemented with minimum fuel tax rates (no negative adjustments), but also recommends capping annual inflation adjustments at 3 percent. Implementing a cap on annual increases will ensure that fuel tax rates do not increase excessively in any one year in the future.

Recommendation 2: Monitor Mileage-Based User Fee Mechanism

A mileage-based user fee (MBUF) continues to be the best long-term solution to addressing transportation revenue challenges. However, given the challenges of implementation and need for interoperability between states, a national level MBUF is required. The Iowa DOT will continue to monitor the development of MBUFs nationally as solutions to implementation challenges are addressed moving forward.

7. MAKING IT HAPPEN

Chapter 6 showed that funding shortfalls are anticipated across modes and discussed potential revenue generating mechanisms to address those needs. This chapter rounds out the plan by discussing how specific investments are programmed and how performance is monitored.

7.1 Programming

The Five-Year Program, which is approved annually by the Iowa Transportation Commission (Commission), lists the investments that translate planning into projects. This document is used to inform Iowans of planned investments across the state's multimodal transportation system. The Five-Year Program is 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 a robust programming process. Over the past several years, the Iowa DOT has transitioned to an enhanced programming process in an effort to improve transparency, align available tools and plans, and better incorporate appropriate stakeholders. The major steps in that process include:

1. Problem/need statement development
2. Project scoping and charter development
3. Project advancement
4. Project prioritization
5. Program synthesis
6. Program approval

Problem/Need 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, operations, resilience, or many other factors. The first step in the process is to clearly state and document the original problem or need such that solutions can be evaluated against the issue as stated.

Project Scoping and Charter Development

Once a problem or need has been identified, the next step is to scope the project and initial solutions. The current system that supports the scoping process is the Project Prioritization/ Scoping tool maintained through the Iowa DOT's Location and Environment Bureau. 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. Authority to approve the project charter is assigned to various individuals or work units depending on project type and estimated cost.

Project Advancement

Once a project has been chartered, it is assigned a project number and becomes a candidate for further prioritization and development. While simple projects may quickly advance through this step, it is intended to provide "pause points" to ensure the proposed project still aligns with the stated problem or need. If the proposed project advances through these checks, it is allowed to proceed towards possible program consideration.

Project Prioritization

During prioritization, the focus shifts from examining individual problems and projects to examining the best mix of projects to achieve documented objectives for the system. Parallel to some project development activities, chartered projects will be periodically evaluated using the Project Prioritization/Scoping tool, which will compare the benefits and costs of each project and allow for comparisons and ranking of projects against system-level targets and objectives. In this step, development resources will be balanced with system objectives, resulting in a portfolio of priority projects that will optimize investment.

Program Synthesis

In this step, the Iowa DOT's Program Management Bureau 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 a recommendation from the Transportation Asset Management Implementation Team (TAMIT) to the Program Team for inclusion in the proposed Five-Year Program to be presented to the Commission.

Program Approval

The Program Team will review the recommended program and consider any necessary changes to the draft program. They will then finalize the draft program with the Program Management Bureau and prepare it 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 in the prior section is most 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 non-water modes discussed in the State Long Range Transportation Plan (SLRTP).

- Aviation Program
- Transit Program
- Railroad Program
- State and Federal Trails programs
- Revitalize Iowa's 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. The Five-Year Program is available on the Iowa DOT's website: https://iowadot.gov/program_management/five-year-program.

7.2 Performance Monitoring

Monitoring system performance is what enables us to know if the investments that are made are impacting the system in the way they were intended. Performance monitoring also 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 Figures 1.2 and 1.3), 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.

Part of this SLRTP update has involved the adoption of the system performance objectives of safety, sustainability, accessibility, and flow. As Figure 4.1 showed, while these objectives and areas of measurement are being defined as part of the SLRTP, specific performance measures for them will be developed as appropriate by individual business units. This enables the performance measures to be tailored to specific purposes and activities, rather than the SLRTP defining measures that may or may not be appropriate in unique applications.

An area of performance monitoring that this SLRTP does address is those metrics that are federally required. Performance-based planning and programming 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 Fixing America's Surface Transportation (FAST) Act and 2021 Infrastructure Investment and Jobs Act (IIJA). 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, states, metropolitan planning organizations (MPOs) and public transit providers are required to establish performance targets for a number of federally defined measures. States are also required to describe these measures, targets, and associated performance in their long-range plans as part of a system performance report. This is the first iteration of a system performance report in the SLRTP. The following sections will discuss the different performance measures that are required along with the target setting process and specific targets that have been set. State DOT targets are set in coordination with Iowa's MPOs; likewise, when MPOs are setting targets, they coordinate with the Iowa DOT. Coordination agreements for target-setting and other performance-based planning related items are included annually in each MPO's Transportation Planning Work Program (TPWP).

Federal Highway Administration (FHWA) Performance Measures

FHWA has established performance measures in the areas of safety, pavement condition, bridge condition, performance, freight movement, traffic congestion, and on-road mobile source emissions. The specific performance measures are shown in Table 7.1. The traffic congestion and on-road mobile source emissions measures are not currently applicable in Iowa as they only apply to areas that are designated as nonattainment or maintenance for ozone (O_3), carbon monoxide (CO), or particulate matter (PM_{10} and $PM_{2.5}$) National Ambient Air Quality Standards (NAAQS). Iowa is fully in attainment for these pollutants, so the measures are not currently required of the state or any of its MPOs.

Table 7.1: FHWA performance measures

Area	Performance measure	Applicability	State cycle	MPO cycle
Safety (targets set as 5-year rolling averages)	Number of fatalities	All public roads	Due as part of HSIP annual report each year on August 31.	MPOs report targets to Iowa DOT by February 27 annually.
	Rate of fatalities	All public roads		
	Number of serious injuries	All public roads		
	Rate of serious injuries	All public roads		
	Number of nonmotorized fatalities and nonmotorized serious injuries	All public roads		
Pavement condition	Percent of Interstate pavements in Good condition	Interstate System	Initial target setting: State two-year and four-year targets were due 5/20/18. Next targets due 10/1/22; every four years afterwards.	MPOs report 4-year targets to Iowa DOT within 180 days of Iowa DOT targets being set.
	Percent of Interstate pavements in Poor condition	Interstate System		
	Percent of non-Interstate NHS pavements in Good condition	Non-Interstate NHS		
	Percent of non-Interstate NHS pavements in Poor condition	Non-Interstate NHS		
Bridge condition	Percent of NHS bridges classified as in Good condition	NHS		
	Percent of NHS bridges classified as in Poor condition	NHS		
Performance	Percent of the person-miles traveled on the Interstate that are reliable	Interstate System		
	Percent of the person-miles traveled on the non-Interstate NHS that are reliable	Non-Interstate NHS		
Freight	Truck travel time reliability index	Interstate System		
Traffic congestion	Annual hours of peak hour excessive delay (PHED) per capita	NHS, urbanized area	*Not currently applicable in Iowa*	
	Percent of non-single occupant vehicle (SOV) travel	NHS, urbanized area		
Emissions	Total tons of emissions reduced from CMAQ projects for applicable criteria pollutants and precursors	NHS, urbanized area	*Not currently applicable in Iowa*	

HSIP = Highway Safety Improvement Program; MPO = Metropolitan Planning Organization; NHS = National Highway System
Source: 23 CFR 490

Safety

Safety targets, also known as "PM1," have been required annually since 2017, when targets for 2014-2018 were set. The targets are set based on a rolling five-year average; the most recent targets were set for the years 2018-2022 on August 31, 2021. Because of the relatively short-term nature of the targets, the Iowa DOT's methodology has focused on historical information and creating a forecast based on trends. The approach relies on the use of prediction intervals around a trend model forecast to inform a "risk-based" target setting method. More information on the safety target setting process can be found on the department's federal performance management website.[1] Table 7.2 shows the historical 5-year averages along with the safety targets that have been established each year. Data is shown through the most recent reporting cycle.

Starting in 2020, safety targets from the initial target setting period of 2014-2018 were assessed by FHWA; this assessment is repeated annually for the next oldest set of targets. A state DOT is considered to have met or made significant progress toward meeting its safety performance targets when at least four of the five safety performance targets have been met or the actual outcome is better than the baseline performance. In the 2020 assessment, the actual performance was based on a 5-year average ending in 2018 (i.e., 2014-2018). The baseline performance was the 5-year average ending with the year prior to the establishment of the targets (i.e., 2012-2016).

Through the first two assessment cycles, the Iowa DOT has met or made significant progress toward achieving its safety performance targets. These targets are shown in green on Table 7.2.

Table 7.2: Iowa DOT safety performance data and targets

Time period	Fatalities	Fatality rate	Serious injuries	Serious injury rate	Non-motorized injuries and fatalities	Fatalities	Fatality rate	Serious injuries	Serious injury rate	Non-motorized injuries and fatalities
	Actual 5-Year average for time period					Targets set for time period				
2012-2016	345.2	1.066	1,532.6	4.741	132.2					
2013-2017	338.8	1.033	1,506.2	4.596	129.6					
2014-2018	339.2	1.022	1,459.6	4.400	128.0	367.9	1.080	1,562.2	4.587	150.7
2015-2019	342.0	1.022	1,424.8	4.257	130.4	353.6	1.047	1,483.7	4.391	149.8
2016-2020	345.2	1.053	1,391.6	4.241	128.6	345.8	1.011	1,396.2	4.083	138.1
2017-2021						336.8	0.983	1,370.8	4.002	131.0
2018-2022						337.8	1.037	1,327.2	4.073	129.8

Green = target met or significant progress made

Source: Iowa DOT

[1] https://iowadot.gov/systems_planning/planning/federal-performance-management-and-asset-management

MPOs are also required to set safety targets annually within 180 days of the Iowa DOT's targets being set. MPOs have the option to set their own targets or to support the Iowa DOT targets. For multistate MPOs that set their own targets, they are required to set them for the entire metropolitan area. MPOs report their targets to the Iowa DOT, and are also required to incorporate them into their long-range transportation plans (LRTPs). MPO LRTPs are updated on a five-year cycle. Most MPOs have now integrated their most recent targets into their LRTPs, but it will be another planning cycle before they are able to begin reporting performance relative to their targets. Links to MPO LRTPs can be found on the Iowa DOT website.[2] Table 7.3 shows the action MPOs have taken for safety targets each year.

Table 7.3: MPO safety target-setting selection by year

Time period	AAMPO Ames	BSRC Davenport	CMPO Cedar Rapids	DMAMPO Des Moines	DMATS Dubuque	INRCOG Waterloo	MAPA Council Bluffs	MPOJC Iowa City	SIMPCO Sioux City
2014-2018	Support state	Support state	Support state	**MPO-specific**	Support state	Support state	**MPO-specific**	Support state	Support state
2015-2019	Support state	Support state	Support state	**MPO-specific**	Support state	Support state	**MPO-specific**	Support state	Support state
2016-2020	Support state	Support state	Support state	**MPO-specific**	Support state	Support state	**MPO-specific**	Support state	Support state
2017-2021	Support state	Support state	Support state	**MPO-specific**	Support state	Support state	**MPO-specific**	Support state	Support state
2018-2022	Support state	Support state	Support state	Support state	Support state	Support state	**MPO-specific**	Support state	Support state

See Figure 1.1 for MPO acronyms
Source: Iowa MPOs

[2] https://iowadot.gov/systems_planning/planning-resource-guide#26634637-long-range-transportation-plan-lrtp

Pavement, Bridge, Performance, and Freight

Pavement and bridge targets are also known as "PM2", and performance and freight measures are also known as "PM3." Both PM2 and PM3 targets are required to be set as 2- and 4-year targets for 4-year performance periods. The initial 4-year performance period was from January 1, 2018 to December 31, 2021. States report their targets and progress through three required reports to FHWA.

- The baseline period performance report (BPPR) is due October 1 of the initial year of the performance period. Targets are established through this reporting.
- The mid-performance period progress report (MPPPR) is due October 1 of the third year of the performance period. Performance of the 2-year targets is discussed, and the state has the opportunity to adjust the 4-year targets. FHWA assesses progress of the 2-year targets after the report is submitted.
- The full performance period progress report (FPPPR) is due October 1 of the year after the performance period. Performance of the 4-year targets is discussed, and FHWA assesses progress of the 4-year targets after the report is submitted. This report is submitted concurrently to the baseline period performance report for the next reporting period.

While the methodology for each set of targets will be described briefly here, additional data and information on the target-setting process can be found on the department's federal performance management website.[3]

Pavement

Pavement targets are set based on 0.1-mile sections of the through travel lanes of mainline highways on the applicable highway systems. The FHWA definitions of good, fair, and poor for pavement are determined based on the condition of three attributes – the pavement section's International Roughness Index (IRI), the pavement's cracking condition, and the pavement's rutting rating (concrete) or faulting rating (asphalt). Per FHWA's definitions, a pavement section is considered "poor" if two of these three ratings are poor. A pavement section is considered "good" if all three ratings are good. Otherwise, it is considered "fair." As part of the phase-in requirements for the FHWA rules, the first 4-year performance period used an alternate measure for non-Interstate NHS pavement condition, and based the condition solely on the IRI measure. Pavement that is part of a bridge deck is excluded from metric calculations. Missing, invalid, or unresolved data is also excluded from the calculations and is not to exceed five percent of the system's mileage.

Iowa DOT has a long history of collecting pavement condition data and has used a state-developed pavement condition index for measuring condition for some time. However, the federal performance measure requires measuring condition based on a different segmentation of the network than used previously and on a federally defined scale of good, fair, and poor, which includes data elements that were not historically collected. This made developing a data-driven approach to target forecasting a challenge for the first performance period.

[3] https://iowadot.gov/systems_planning/planning/federal-performance-management-and-asset-management

For Interstates, output from the pavement management system was used to forecast pavements in good, fair and poor condition annually; this was then augmented with information about the observed variability in annual measures in order to account for uncertainty in future values. A similar process was used for the non-Interstate NHS targets, which was based solely on IRI for the first performance period. Future performance periods will use the full FHWA definition, which will likely result in a substantial difference of the good, fair, and poor performance and targets for the non-Interstate NHS between the first two performance periods.

Table 7.4 shows data through the most recent reporting cycle, the 2020 MPPPR for the first performance period. This includes targets that were established in the BPPR as well as the actual performance of the 2-year targets at the time of the MPPPR. The 4-year targets for pavement condition were not adjusted as part of the MPPPR submittal. FHWA has assessed the initial 2-year targets and found that the Iowa DOT met or made significant progress towards meeting all 2-year pavement targets. These targets are shown in green on Table 7.4.

In addition to setting pavement targets, state DOTs are subject to a minimum condition level for Interstate pavements that was established as part of MAP-21. The percentage of the lane-miles of the Interstate System classified as poor condition is not to exceed 5.0 percent. If a state's percentage of poor condition Interstate lane-miles exceeds 5.0 percent in a given year, funding flexibility restrictions may apply. The percentage of Iowa's Interstate lane-miles in poor condition is currently below the 5.0 percent threshold, and is forecast to remain below that threshold through the first performance period.

Bridge

As part of the National Bridge Inventory (NBI) program, condition is rated for each bridge's deck, superstructure, and substructure using a scale of zero to nine. Per FHWA's definitions, a bridge is considered "poor" if one of the ratings is less than or equal to four. A bridge is considered "good" if all the three ratings are greater than or equal to seven; otherwise it is considered "fair." The metrics are calculated based on the deck area for all bridges carrying the NHS, including highway bridges on ramps connected to the NHS and bridges that cross state borders, which count toward both states' totals.

The Iowa DOT's bridge target-setting methodology focused on historical information and creating a forecast based on trends. The approach relied on the use of prediction intervals around a trend model forecast to inform a "risk-based" target setting method. Table 7.4 shows data through the most recent reporting cycle, the 2020 MPPPR for the first performance period. This includes targets that were established in the BPPR as well as the actual performance of the 2-year targets at the time of the MPPPR. The 4-year targets for bridge condition were not adjusted as part of the MPPPR submittal. FHWA has assessed the initial 2-year targets and found that the Iowa DOT met or made significant progress towards meeting both bridge targets. These targets are shown in green on Table 7.4.

In addition to setting bridge targets, state DOTs are subject to a minimum condition level for NHS bridges that was established as part of MAP-21. The percentage of the deck area of NHS bridges classified as poor condition is not to exceed 10.0 percent. If, for three consecutive years, a state's percentage of NHS bridge deck area in poor condition exceeds 10.0 percent, funding flexibility restrictions may apply. The percentage of Iowa's NHS bridges in poor condition is currently below the 10.0 percent threshold, and is forecast to remain below that threshold through the first performance period.

Performance and Freight

Data for these measures is provided by FHWA through the National Performance Management Research Data Set (NPMRDS). This is a national data set of average travel times on the NHS. Since February 2017, speed and travel time data from INRIX has been used for the NPMRDS, which is hosted by the University of Maryland Center for Advanced Transportation Technology Laboratory (CATT Lab). States and MPOs can access the raw data at no cost. CATT Lab has also developed a MAP-21 tool to assist states and MPOs in calculating PM3 measures. This tool is available through a pooled fund effort led by the American Association of State Highway and Transportation Officials (AASHTO). Iowa DOT joined the pooled fund for its initial five-year period.

The performance targets for the Interstate and non-Interstate NHS are based on the level of travel time reliability (LOTTR), which is calculated for a roadway segment based on vehicle travel times. Data for an entire year is aggregated into 15-minute time groupings for four different time of day/day of week periods, then the ratio of the 80th percentile travel time to the 50th percentile travel time is calculated for each time period. If the ratio of any of those time periods is 1.5 or higher, the roadway segment is considered unreliable. For the first performance period, a 2-year target was not required for non-Interstate NHS performance.

The freight target is based on truck travel time reliability (TTTR). The TTTR is calculated similarly to the LOTTR, but is calculated for trucks only, across five time periods instead of four, and uses the ratio of the 95th percentile to the 50th percentile for its calculation. Lower ratios are more reliable than higher ratios, but there is not an established threshold for what constitutes reliable for this measure.

NPMRDS data has been collected for several years, but due to a change in vendor, only one full year of consistently-formatted data was available from NPMRDS during development of the initial targets, which created challenges in setting targets because there was not enough information to create trends or understand variability in the annual measure. As a proxy for annual variation, the monthly variance of each measure in 2017 was used and was assumed to follow a normal distribution. For each measure, the standard deviation of the 2017 monthly data was calculated, and the cumulative distribution properties of a normal distribution were used to derive probabilistic (risk-based) targets.

Table 7.4 shows data through the most recent reporting cycle, the 2020 MPPPR for the first performance period. This includes the targets that were established in the BPPR as well as the actual performance of the 2-year targets at the time of the MPPPR. Both the Interstate performance measure and the freight measure showed poorer performance at the 2-year mark than the targets or baselines. However, FHWA assessed the freight target as "progress not determined" as a case for extenuating circumstances was made due to issues caused by severe flooding in 2019. FHWA determined that Iowa DOT did not meet or make significant progress towards its Interstate performance target. These targets are shown in gray and red respectively on Table 7.4. There will be additional reporting as part of the FPPPR for the first performance period to discuss efforts Iowa DOT is making to improve its performance in this area. It is worth noting that the performance of the Interstate system was still over 99 percent reliable per the metric; nationally, Iowa has one of the most reliable Interstate systems per the performance and freight metrics.

The 4-year targets for Interstate performance and freight were reevaluated and adjusted as part of the MPPPR submittal. Having two additional years of historical data helped in adjusting the distribution models used in calculating targets.

Table 7.4: Iowa DOT pavement, bridge, performance, and freight performance data and targets for the 2018-2021 performance period

Area	Performance measure	Baseline	2-year target	2-year performance	Original 4-year target	Adjusted 4-year target
Pavement condition	Percent of Interstate pavements in Good condition*	N/A	N/A	66.4%	49.4%	N/A
	Percent of Interstate pavements in Poor condition*	N/A	N/A	0.4%	2.7%	N/A
	Percent of non-Interstate NHS pavements in Good condition	50.9%	48.8%	55.4%	46.9%	N/A
	Percent of non-Interstate NHS pavements in Poor condition	10.6%	13.2%	9.3%	14.5%	N/A
Bridge condition	Percent of NHS bridges classified as in Good condition	48.9%	45.7%	48.7%	44.6%	N/A
	Percent of NHS bridges classified as in Poor condition	2.3%	3.7%	2.2%	3.2%	N/A
Performance	Percent of the person-miles traveled on the Interstate that are reliable	100.0%	99.5%	99.3%	99.5%	98.5%
	Percent of the person-miles traveled on the non-Interstate NHS that are reliable*	N/A	N/A	96.3%	95.0%	N/A
Freight	Truck Travel Time Reliability (TTTR) Index	1.12	1.14	1.19	1.14	1.21

**2-year target not required for first performance period.*
Green = target met or significant progress made; gray = progress not determined; red = significant progress not made

Source: Iowa DOT

MPOs are required to set 4-year PM2 and PM3 targets within 180 days of the Iowa DOT's targets being set or adjusted. MPOs have the option to set their own targets or to support the Iowa DOT targets. For multistate MPOs that set their own targets, they support the state targets or set their own targets for each portion of the MPO in a different state. MPOs report their targets to the Iowa DOT, and are also required to incorporate them into their LRTPs. MPO LRTPs are updated on a five-year cycle. Most MPOs have now integrated their most recent targets into their LRTPs, but it will be another planning cycle before they are able to begin reporting performance relative to their targets. Links to MPO LRTPs can be found on the Iowa DOT website.[4] Table 7.5 shows the action MPOs have taken for PM2 and PM3 performance targets for the first performance period.

Table 7.5: MPO pavement, bridge, performance, and freight target-setting selections for the first performance period

Area	Performance measure	AAMPO Ames	BSRC Davenport	CMPO Cedar Rapids	DMAMPO Des Moines	DMATS Dubuque	INRCOG Waterloo	MAPA Council Bluffs	MPOJC Iowa City	SIMPCO Sioux City
Pavement condition	Percent of Interstate pavements in Good condition*	Support state	Support state	Support state	**MPO-specific**	Support state	Support state	Support state	Support state	Support state
	Percent of Interstate pavements in Poor condition*	Support state	Support state	Support state	**MPO-specific**	Support state	Support state	Support state	Support state	Support state
	Percent of non-Interstate NHS pavements in Good condition	Support state	Support state	Support state	**MPO-specific**	Support state	Support state	Support state	Support state	Support state
	Percent of non-Interstate NHS pavements in Poor condition	Support state	Support state	Support state	**MPO-specific**	Support state	Support state	Support state	Support state	Support state
Bridge condition	Percent of NHS bridges classified as in Good condition	Support state	Support state	Support state	**MPO-specific**	Support state	Support state	Support state	Support state	Support state
	Percent of NHS bridges classified as in Poor condition	Support state	Support state	Support state	**MPO-specific**	Support state	Support state	Support state	Support state	Support state
Performance	Percent of the person-miles traveled on the Interstate that are reliable*	Support state	Support state	Support state	Support state	Support state	Support state	**MPO-specific**	Support state	Support state
	Percent of the person-miles traveled on the non-Interstate NHS that are reliable	Support state	Support state	Support state	Support state	Support state	Support state	**MPO-specific**	Support state	Support state
Freight	Truck Travel Time Reliability (TTTR) Index*	Support state	Support state	Support state	Support state	Support state	Support state	**MPO-specific**	Support state	Support state

**Iowa DOT adjusted its 4-year targets for two measures in 2020. In both cases, all MPOs chose to take the same action they had on Iowa DOT's initial 4-year targets.*

Source: Iowa MPOs

[4] https://iowadot.gov/systems_planning/planning-resource-guide#26634637-long-range-transportation-plan-lrtp

Federal Transit Administration (FTA) Performance Measures

FTA has established performance measures in the areas of asset management and safety. The specific performance measures and their applicability are shown in Table 7.6.

Table 7.6: FTA performance measures applicable in Iowa

Area	Performance measure	Applicability
Asset management	Rolling stock: percent of revenue vehicles (by asset class) that have met or exceeded their useful life benchmark (ULB)	Tier I providers (large urban systems in Iowa) set their own targets. Tier II providers (small urban and regional systems in Iowa) participate in a group asset management plan and annual target-setting process sponsored by the Iowa DOT. MPOs are required to set targets within 180 days of their transit providers' initial target setting.
	Equipment: percent of non-revenue vehicles (by asset class) that have met or exceeded their ULB	
	Facilities: percent of facilities (by group) that are rated less than 3.0 on the TERM Scale	
Safety	Number of fatalities	Recipients of 5307 funding (large urban systems in Iowa) set their own targets. Iowa's small urban and regional systems are not required to set safety targets at this time. MPOs are required to set targets within 180 days of their transit providers' initial target setting.
	Fatalities per 100 thousand vehicle revenue miles	
	Number of injuries	
	Injuries per 100 thousand vehicle revenue miles	
	Number of safety events (accidents, injuries, or occurrences)	
	Safety events per 100 thousand vehicle revenue miles	
	System reliability – vehicle revenue miles/failures	

MPO = Metropolitan Planning Organization; TERM = Transit Economic Requirements Model; ULB = useful life benchmark

Source: FTA

FTA performance measures differ from FHWA measures in that the primary entities setting targets are public transit providers and MPOs. Iowa DOT does not set targets itself, but does assist in providing technical guidance in both areas and in administering a group target-setting process for asset management. Table 7.7 lists the 34 public transit agencies in Iowa and notes their performance target setting responsibilities. Large urban systems should be consulted directly for information on their target-setting processes and current targets; contact information can be found on Iowa DOT's Public Transit Bureau website.[5]

[5] https://iowadot.gov/transit/Iowa-Transit-services/Transit-agency-maps-and-listings

Table 7.7: Iowa public transit agencies and applicability of performance metrics

Type	Agency	Agency Targets or Group TAM Plan	Safety targets
Large urban	Ames Transit Agency/CyRide	Agency-specific	Agency-specific
	City of Bettendorf		
	University of Iowa, Cambus		
	Cedar Rapids Transit		
	Coralville Transit System		
	City of Council Bluffs		
	Davenport Public Transit (CitiBus)		
	Des Moines Area Regional Transit Authority (DART)		
	City of Dubuque, The Jule		
	Iowa City Transit		
	Sioux City Transit System		
	Metropolitan Transit System of Black Hawk County/Waterloo MET		
Small urban	Burlington Urban Service	Group TAM Plan	Not required
	City of Clinton Municipal Transit Administration		
	City of Fort Dodge (DART)		
	Marshalltown Municipal Transit		
	City of Mason City		
	City of Muscatine		
Regional	Northeast Iowa Community Action Corporation - Transit/NEICAC-T		
	North Iowa Area Council of Governments/Region 2 Transit		
	Regional Transit Authority/RIDES		
	Siouxland Regional Transit System		
	MIDAS Council of Governments		
	Region Six Resource Partners/PeopleRides		
	Iowa Northland Regional Council of Governments/Regional Transit Commission		
	Region 8 Regional Transit Authority (RTA)		
	River Bend Transit		
	CorridorRides		
	Heart of Iowa Regional Transit Agency		
	Region XII Council of Governments/Western Iowa Transit System		
	Southwest Iowa Planning Council/Southwest Iowa Transit Agency		
	Southern Iowa Trolley		
	10-15 Regional Transit Agency		
	South East Iowa Regional Planning Commission/SEIBUS		

Source: Iowa DOT

Transit Asset Management (TAM)

Iowa's public transit agencies are required to develop TAM plans and set TAM targets. Tier I providers (large urban systems in Iowa) are required to develop their own plans and targets, while tier II providers (small urban and regional systems in Iowa) can participate in a group plan and target setting process sponsored by the Iowa DOT. Initial TAM Plans were due in October 2018 and must be updated every four years. TAM targets are submitted annually to FTA's National Transit Database (NTD). Large urban systems are required to share their TAM Plans and TAM targets with their area's MPO. MPOs are also required to set targets within 180 days of their transit agencies' initial target-setting; they are not required to update targets annually but are required to integrate them into their planning and programming processes.

Most federal assistance for bus replacements comes to the state level, necessitating a process for determining which vehicle replacements to fund across the state. The Iowa DOT uses the Public Transit Management System (PTMS) prioritization process. The Modal Transportation Bureau maintains an inventory of all existing transit revenue vehicles in the state, which is updated annually. The Iowa DOT prioritizes vehicle replacement and rehabilitation/remanufactured projects annually on a statewide basis based on age and mileage of existing vehicles compared to useful life standards for the specific type of equipment. All group plan participants follow FTA guidance for buses and bus facilities to insure they are maintained in good condition and are safe to use. All systems have adopted vehicle maintenance policies that outline the necessary steps to follow.

The required performance targets relate to what percent of revenue vehicles and equipment will exceed their useful life benchmarks (ULBs) by the end of the year, as well as what facilities will be rated at 3.0 or lower on FTA's Transit Economic Requirements Model (TERM), meaning they have moderately deteriorated or defective components; but have not exceeded their useful life. The long-term goal is to use good asset management practices to reduce these numbers in the future.

Facility assessments were conducted in the summer of 2018 to establish existing conditions based on the TERM scale, which ranges from 1 (poor) to 5 (excellent). Vehicles are evaluated based on ULBs, which are the number of years before an asset reaches the end of its useful life. Most of the ULBs are the FTA-suggested default ULBs; the only change was the ULB for cutaway buses. Group plan members provided input that the FTA default of 10 years was too long for cutaways in Iowa's driving conditions and suggested a change to 8 years. To determine targets, the ULBs were used in conjunction with the following:

- All vehicles in the active fleet that have been funded for replacement, with some estimates for delays, as not all of these will be delivered in the target year.
- Vehicles that will exceed ULB in the target year.
- Individual transit agency input to Iowa DOT on what equipment is planned for replacement in the target year using local funds.

Table 7.8 shows the most recent group plan targets that were established in 2022. Large urban system targets can be obtained directly from the applicable transit agencies. MPOs report their targets to the Iowa DOT, and are also required to incorporate them into their LRTPs. MPO LRTPs are updated on a five-year cycle. Most MPOs have now integrated their most recent targets into their LRTPs, but it will be another planning cycle before they are able to begin reporting performance relative to their targets. Links to MPO LRTPs can be found on the Iowa DOT website.[6] All Iowa MPOs have chosen to support their local transit agency targets rather than setting MPO-specific targets.

[6] https://iowadot.gov/systems_planning/planning-resource-guide#26634637-long-range-transportation-plan-lrtp

Table 7.8: Group Transit Asset Management (TAM) Plan participant targets for 2022

Category	Performance measure	2021 Status	2022 Target
Rolling stock	Automobile	58% of fleet exceeds ULB of 8	20%
	Bus	20% of fleet exceeds ULB of 14	17%
	Cutaway bus	56% of fleet exceeds ULB of 8	25%
	Trolley	0% of fleet exceeds ULB of 13	0%
	Van	60% of fleet exceeds ULB of 8	56%
	Minivan	36% of fleet exceeds ULB of 8	32%
Equipment	Automobile	20% of non-revenue service vehicles exceeds ULB of 8	20%
	Other rubber tire vehicle (tractor)	29% of fleet exceeds ULB of 14	65%
Facility	Administrative/maintenance facility	0% of facilities rated under 3.0 on TERM scale	0%

Source: Iowa DOT

Transit Safety

In 2020, rules were finalized regarding the development of Public Transportation Agency Safety Plans (PTASPs) for public transit agencies that receive urbanized area formula funds. In Iowa, that translates to the 12 large urban agencies that are located in urban areas of 50,000 or more. The plans include the documented processes of the agency's safety management systems, including the agency's safety management policy and processes for safety risk management, safety assurance, and safety promotion; an employee reporting program; and performance targets based on the safety performance measures established in the National Public Transportation Safety Plan. Initial plans were due by July 20, 2021.

Seven targets are required to be set as part of the PTASP:

- Number of fatalities
- Fatalities per 100 thousand vehicle revenue miles
- Number of injuries
- Injuries per 100 thousand vehicle revenue miles
- Number of safety events (accidents, injuries, or occurrences)
- Safety events per 100 thousand vehicle revenue miles
- System reliability – vehicle revenue miles/failures

Once transit agencies adopt their PTASPs, they are required to share them with their area's MPO. Large urban system targets can be obtained directly from the applicable transit agencies. MPOs report their targets to the Iowa DOT, and are also required to incorporate them into their LRTPs. MPO LRTPs are updated on a five-year cycle. Most MPOs have now integrated their most recent targets into their LRTPs, but it will be another planning cycle before they are able to begin reporting performance relative to their targets. Links to MPO LRTPs can be found on the Iowa DOT website.[7] All Iowa MPOs have chosen to support their local transit agency targets rather than setting MPO-specific targets.

[7] https://iowadot.gov/systems_planning/planning-resource-guide#26634637-long-range-transportation-plan-lrtp

7.3 Moving Forward

This SLRTP provides a framework for the Commission and the Iowa DOT to identify, prioritize, and select investments that will help maintain and shape the transportation system envisioned for the state. The examination and analysis conducted throughout development of the SLRTP has led to the following general conclusions.

- The state is completing a transition from building the system to efficiently managing the existing system through an emphasis on stewardship and rightsizing.
- The state's transportation system functions well 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 SLRTP will be a significant effort across and beyond the Iowa DOT. Some of the key actions to help implement the plan include the following.

- Continuing to support the development and implementation of other modal and system plans, including integrating the system objectives of safety, sustainability, accessibility, and flow into their planning frameworks.
- Implementing the rightsizing policy across planning, programming, and project development activities.
- Advancing planning for areas of new or enhanced focus, including accessibility, emerging technology, equity, resiliency, and sustainability.
- Integrating highway system needs and risks analyses into project planning and investment decisions.
- Enhancing partnerships with metropolitan and regional planning partners and other transportation stakeholders.

As noted in Chapter 4, the vision for Iowa's transportation system 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 a sustainable manner. While the transportation system fulfills many of these attributes today, there is still work to be done. Achieving the system vision is possible. Implementing the system objectives and strategies, emphasizing critical planning considerations, addressing needs and risks, and integrating the themes of this SLRTP throughout the department's activities can put us on the path for success.

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8. APPENDICES

Appendices

Several appendices are included to provide additional information for topics discussed throughout the plan.

Appendix 1
Federal requirements

Appendix 2
Supplemental information for Chapter 1: Public input survey results, plans/studies used in document development, and resource agencies contacted

Appendix 3
Supplemental information for Chapter 4: Overview of the accessibility/mobility analysis methodology and output

Appendix 4
Supplemental information for Chapter 5: Strategies from other system, specialized, and modal plans

Appendix 5
Supplemental information for Chapter 6: Revenue generating mechanisms described in the 2021 Road Use Tax Fund (RUTF) Study

Appendix 1

Federal Requirements

Table A.1 provides the code of federal regulations (CFR) language related to state transportation plans and points to sections of the state long-range transportation plan (SLRTP) that address the CFR language. 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.

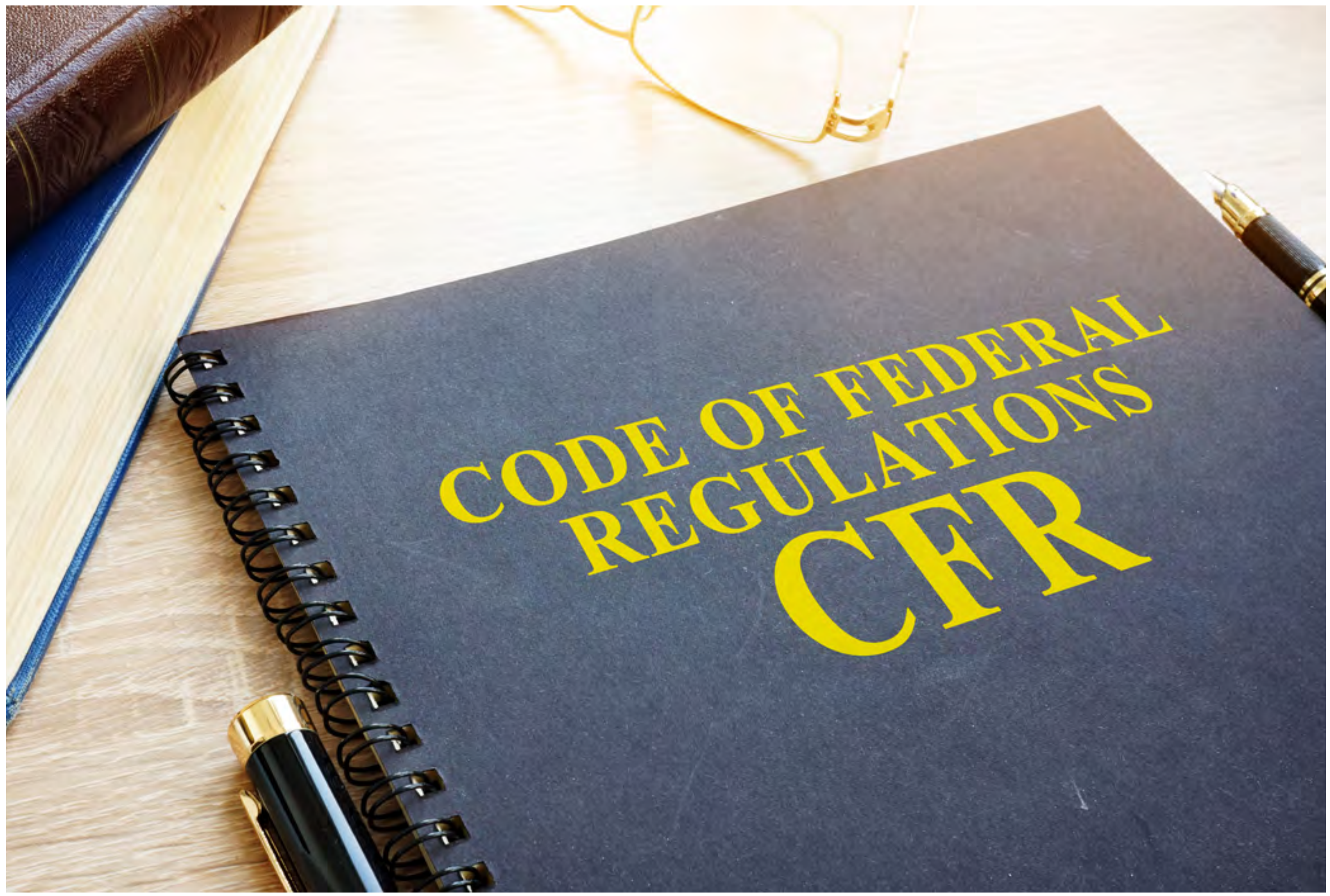


Table A.1: Federal requirements for state transportation plans and references to plan sections that relate to the requirements

23 CFR 450.216 Development and content of the long-range statewide transportation plan	SLRTP 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 SLRTP is a multimodal planning document with a horizon year of 2050.
(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 4, Section 4.3 and throughout Chapter 5.
(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.
(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 4, Section 4.3.
(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 4, Section 4.3.
(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, targets, and performance are discussed included in Chapter 7, section 7.2.
(g) Within each metropolitan area of the State, the State shall develop the long-range statewide transportation plan in cooperation with the affected MPOs. (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). (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). (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.	Cooperation and consultation efforts with Iowa's metropolitan planning organizations (MPOs), regional planning affiliations (RPAs),Tribal governments, resource agencies, and external stakeholders is discussed in Chapter 1, Section 1.3.

23 CFR 450.216 Development and content of the long-range statewide transportation plan	SLRTP references and notes
(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 4, Section 4.3.
(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.
(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, https://iowadot.gov/iowainmotion, will house the final SLRTP.
(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. (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.	The SLRTP is currently on a 5-year update cycle and will be revisited and revised as necessary. Final copies of the SLRTP will be provided to FHWA and FTA.

Source: 23 CFR 450 and Iowa DOT

Appendix 2

This appendix provides supplemental information for Chapter 1, including public input survey results, plans and studies used in the development of the State Long Range Transportation Plan (SLRTP), and resource agencies that were contacted.

Public Input Survey Results

A public input survey was made available in May 2021. A total of 281 people provided data through the survey. Results are summarized here, and were used to help inform various components of the SLRTP.

Changes in travel, working, and shopping habits related to the COVID-19 pandemic

Since the public input survey was conducted a little over a year into the COVID-19 pandemic, a few questions were asked related to how the pandemic was influencing behavior. Individuals were asked how often they used various modes of transportation before and during the COVID-19 pandemic, as well as how often they thought they would use the modes one year after the pandemic's end. Table A.2 compares the responses for pre-pandemic usage of various modes versus their usage during the pandemic. As shown, driving a vehicle as an everyday occurrence decreased substantially. Also, occasional use of various passenger modes, such as flying, public transit, using Amtrak, and using a taxi or transportation network company (TNC) all decreased, with much larger percentages of respondents reporting not using those modes at all during the pandemic.

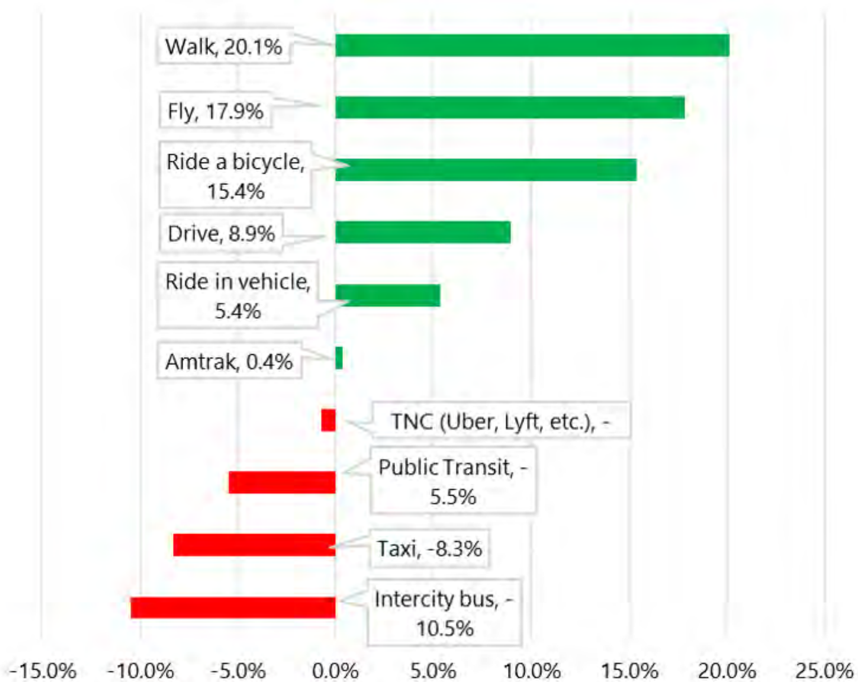
Table A.2: Net change in responses for how often modes of transportation were used, during the COVID-19 pandemic compared to pre-pandemic

	Most days of the week	One to three days a week	A few times a month	A few times a year	Less than that	Never
Ride a bicycle	0.7%	3.6%	1.0%	-8.0%	-0.8%	3.5%
Walk	5.5%	-2.9%	0.6%	-4.9%	1.9%	-0.2%
Use public transit (bus)	-2.2%	-1.1%	-2.2%	-3.7%	-6.6%	15.8%
Use an intercity bus (Burlington Trailways, Jefferson Lines, etc.)	0.0%	0.4%	-0.4%	-1.8%	-6.1%	7.9%
Fly	0.0%	-0.7%	-2.5%	-26.9%	-21.2%	51.3%
Use Amtrak	0.0%	0.0%	0.0%	-1.5%	-13.4%	14.9%
Drive a vehicle	-22.0%	16.6%	4.3%	0.0%	0.0%	1.1%
Passenger in vehicle (such as riding with family or carpooling)	-2.7%	-0.2%	1.6%	-1.5%	-0.4%	3.2%
Use a taxi service	0.0%	0.0%	-0.4%	-5.7%	-12.5%	18.6%
Use a transportation network company (Uber, Lyft, etc.)	0.0%	0.4%	-4.3%	-17.7%	-10.8%	32.5%

Source: 2021 Public Input Survey

Figure A.1 shows individuals' thoughts on their likely post-pandemic travel patterns. Many of the same passenger modes that saw decreased frequency during the pandemic were also seen as less likely to be used after the pandemic, with the exception of flying.

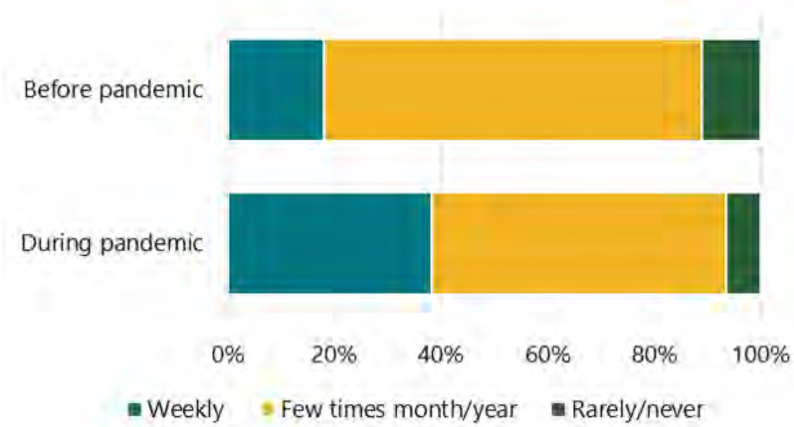
Figure A.1: Net change in responses for how travel habits one year after the COVID-19 pandemic ends will compare to travel habits pre-pandemic



Source: 2021 Public Input Survey

Individuals were also asked how often they had items, excluding food ordered from restaurants, delivered to their home both pre-pandemic and during the pandemic. There was a notable increase in the number of individuals having items delivered at least weekly, as shown in Figure A.2. Individuals were also asked how often they worked from home before and during the pandemic. Pre-pandemic, less than 20% of people were working from home any days of the week. During the pandemic, 57% were working from home at least one day a week, with over 30% working from home full-time. However, it should be noted that demographic/ economic information collected with the survey suggested respondents may have skewed towards professions which are more likely to be able to work from home.

Figure A.2: Frequency of deliveries to home (other than food from restaurants), before and during COVID-19 pandemic



Source: 2021 Public Input Survey

System objectives

At the time of the public survey, system objectives were being refined for the State Long Range Transportation Plan (SLRTP). The public was asked to provide their opinions related to how safe, sustainable, accessible, and free flowing they felt the transportation system was as it pertained to specific modes or types of infrastructure. To avoid confusion regarding the primary meaning of the system objectives, sustainability was asked about in terms of how good of condition the system was in, and flow was asked about in terms of the amount of delay experienced. Positive, neutral, and negative feelings for each were highlighted in Table 4.2 in Chapter 4.

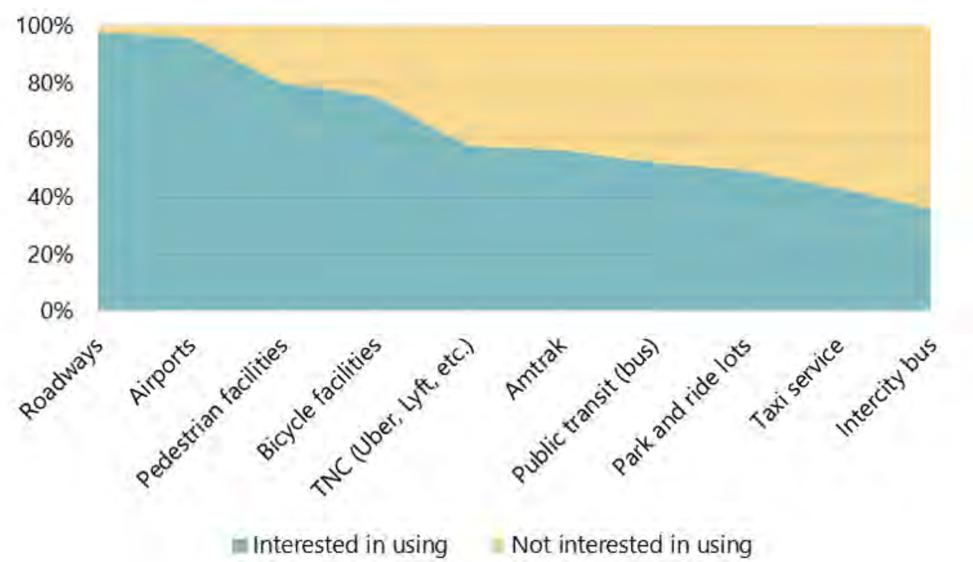
Table A.3 provides a combined view of the various attributes by showing the ranking of modes/infrastructure for each system objective based on positive rankings, as well as an overall composite. Of note is that roadways were among the top three modes/infrastructure for all areas except sustainability, where they ranked eighth. This means there was a smaller percentage of positive responses regarding roadway condition than the condition of most other modes. Respondents were asked to rank the infrastructure or mode if they used it or were interested in using it. Figure A.3 shows that interest levels varied substantially across modes, from 98% of respondents being interested in using roadways to less than 40% of respondents being interested in using intercity bus.

Table A.3: Ranking of various modes and infrastructure, based on percentage of positive responses for system objectives

	Safety	Sustainability	Accessibility	Flow	Average rank
Airports	1	1	2	7	2.75
Pedestrian facilities	3	4	3	1	2.75
Bicycle facilities	4	2	4	2	3
Roadways	2	8	1	3	3.5
TNC (Uber, Lyft, etc.)	8	3	5	5	5.25
Public transit (bus)	6	5	7	6	6
Park and ride lots	7	6	8	4	6.25
Amtrak	5	7	10	10	8
Taxi service	10	9	6	9	8.5
Intercity bus	9	10	9	8	9

Source: 2021 Public Input Survey

Figure A.3: Level of interest in using various modes and infrastructure



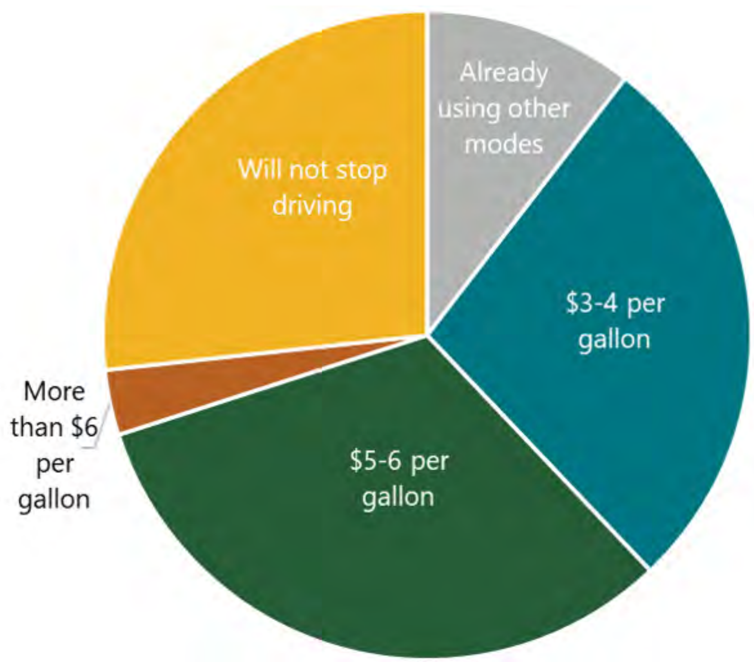
Source: 2021 Public Input Survey

Fuel prices, electric vehicles, and technology

Respondents that were drivers were asked about the impact of fuel prices on their driving habits, and at what point they would look to shift to other modes, if they were not already using them. Figure A.4. shows the results. While the majority of individuals would consider other modes at a price between $3 and $6 per gallon, over a quarter said that it did not matter how expensive fuel became, they would continue driving. Another question asked if individuals owned or were interested in purchasing an electric vehicle. As shown in Figure A.5, over half of respondents said they were interested in a hybrid or fully electric vehicle within ten years, while over a third were not interested in an electric vehicle.

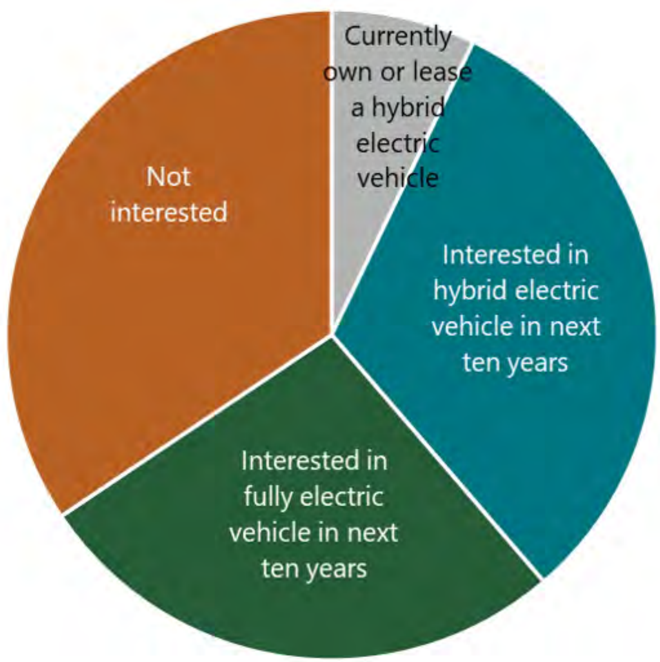
Individuals were also asked about their interest in micromobility or shared mobility options, such as owning or renting electric scooters or bicycles or using a carshare program. The highest rated of these options was a personal electric bike, with a quarter of respondents expressing interest. Over 60% of respondents were not interested in any micromobility or shared mobility options. Of those that were interested, most reported they would use the options for recreation or replacing entire trips they would have made by another mode; a smaller percentage showed interest in using these options for first-mile/last-mile connections for trips made by public transit or car.

Figure A.4: How expensive fuel would need to be to shift to a mode other than driving



Source: 2021 Public Input Survey

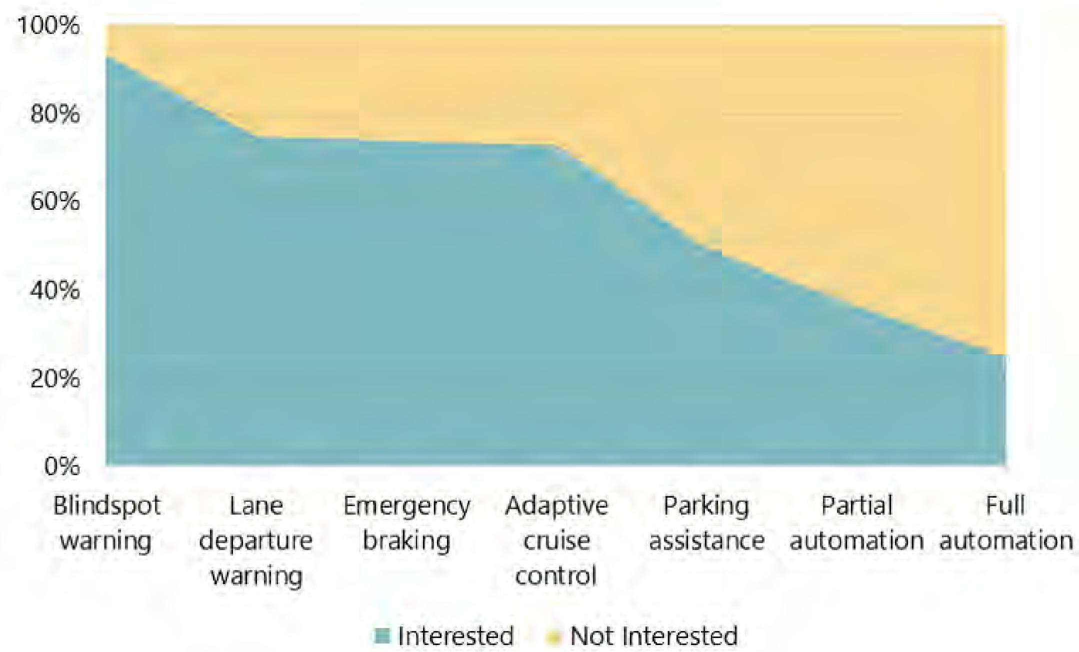
Figure A.5: Interest in electric vehicles



Source: 2021 Public Input Survey

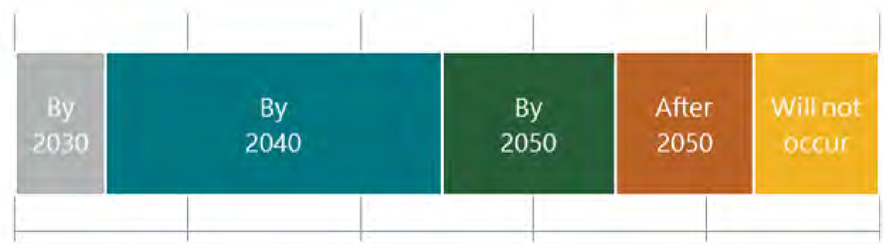
Respondents were also asked a few questions about technology advancements. One question focused on advanced driver assistance systems (ADAS) that are available in vehicles now, as well as advanced automation levels that may be available in the future. Individuals that drive were asked which ADAS they have available in their vehicle or have an interest in having available. Figure A.6 shows the responses. While the majority of individuals were interested in features such as blindspot warnings, lane departure warnings, emergency braking, and adaptive cruise control, less than 40% were interested in partial automation features, and less than 25% were interested in fully automated vehicles. Individuals who already have ADAS features in their vehicles were also asked whether they utilize them. Almost half of respondents indicated their vehicles do not have these features or they are not drivers. Over a third of respondents reported having ADAS features and using most or all of the features, while over 15% reported disabling some or all of them. Finally, individuals were asked whether they think highly automated vehicles (in which the vehicle is in full control for a portion or all of the driving task) will account for the majority of the cars on the road someday, and, if so, when. Figure A.7 shows that roughly half of individuals think this will occur by 2040, while about 30% think it will be after 2050 or not at all.

Figure A.6: Interest in advanced driver assistance systems and vehicle automation



Source: 2021 Public Input Survey

Figure A.7: Year by which individuals believe highly automated vehicles will account for the majority of cars on the road

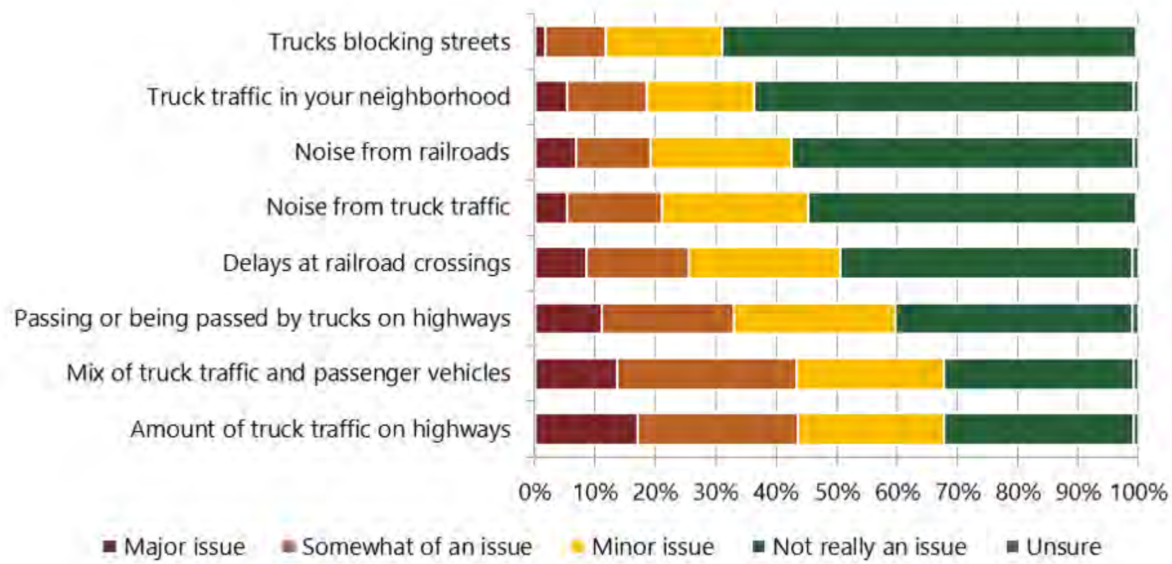


Source: 2021 Public Input Survey

Freight

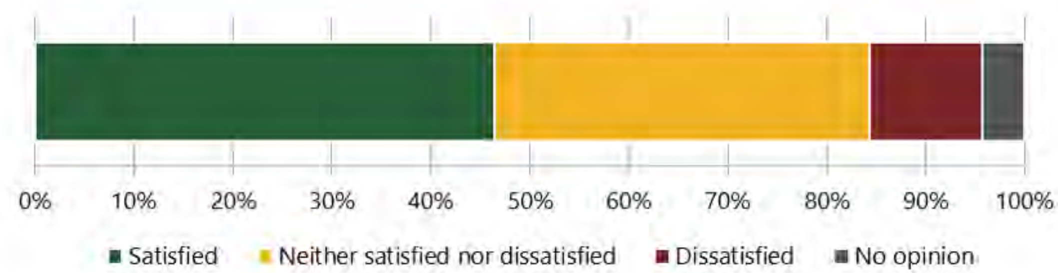
Two freight-related questions were asked as part of the survey. The first asked whether various freight-related issues impacted people's daily lives. Figure A.8 shows the responses to this question. The freight-related items the were reported most frequently as somewhat or major issues primarily related to truck traffic on highways – the overall amount, the mix of truck traffic with passenger vehicles, and passing or being passed by trucks on highways. Individuals were also asked about their satisfaction with how their community's roadways accommodate freight movements; results for that question are shown in Figure A.9. Most respondents reported being satisfied or neutral.

Figure A.8: Responses to whether various freight-related items cause issues in daily life



Source: 2021 Public Input Survey

Figure A.9: Level of satisfaction with how roadways handle freight movements

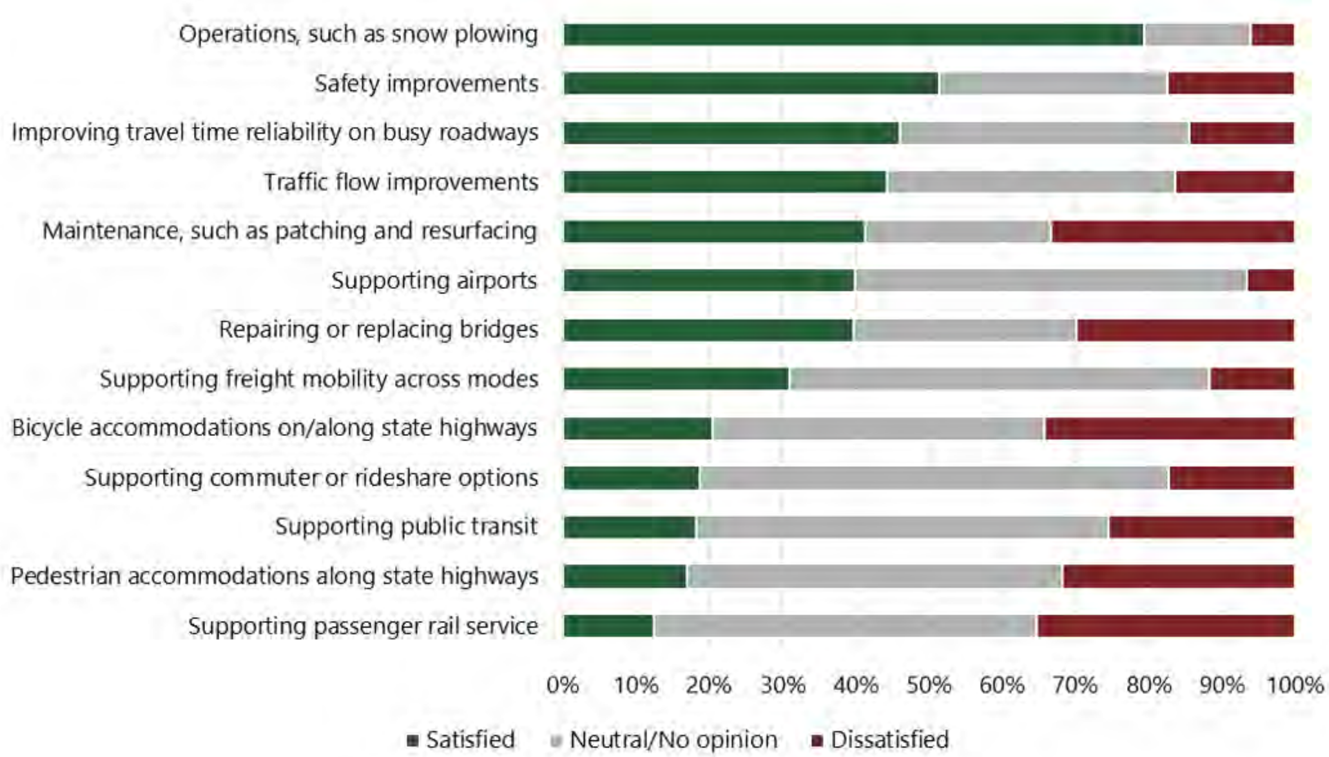


Source: 2021 Public Input Survey

Iowa DOT

Based on how they felt the state transportation system was operating, respondents were asked what their level of satisfaction was with Iowa DOT's efforts in several areas. Figure A.10 shows the responses. Overall, operations-focused items such as snow plowing and roadway operational improvements had higher satisfaction ratings. Condition improvements efforts for roadways and bridges ranked in the middle of the pack with roughly equal portions of satisfied and dissatisfied ratings. Most modal-related items had higher percentages responding as dissatisfied than satisfied. These results were also echoed in a question about how an individual would allocate funding among three highway categories (maintenance, operations enhancements, lane additions) and five modal categories (aviation, bicycle accommodations, passenger rail, pedestrian accommodations, public transit). The overall split of funding was just over 60% to the three highway categories and just under 40% to the modal categories. This is a much higher percentage of Iowa DOT's funding than is spent on those modal categories currently.

Figure A.10: Level of satisfaction with Iowa DOT's efforts in various areas

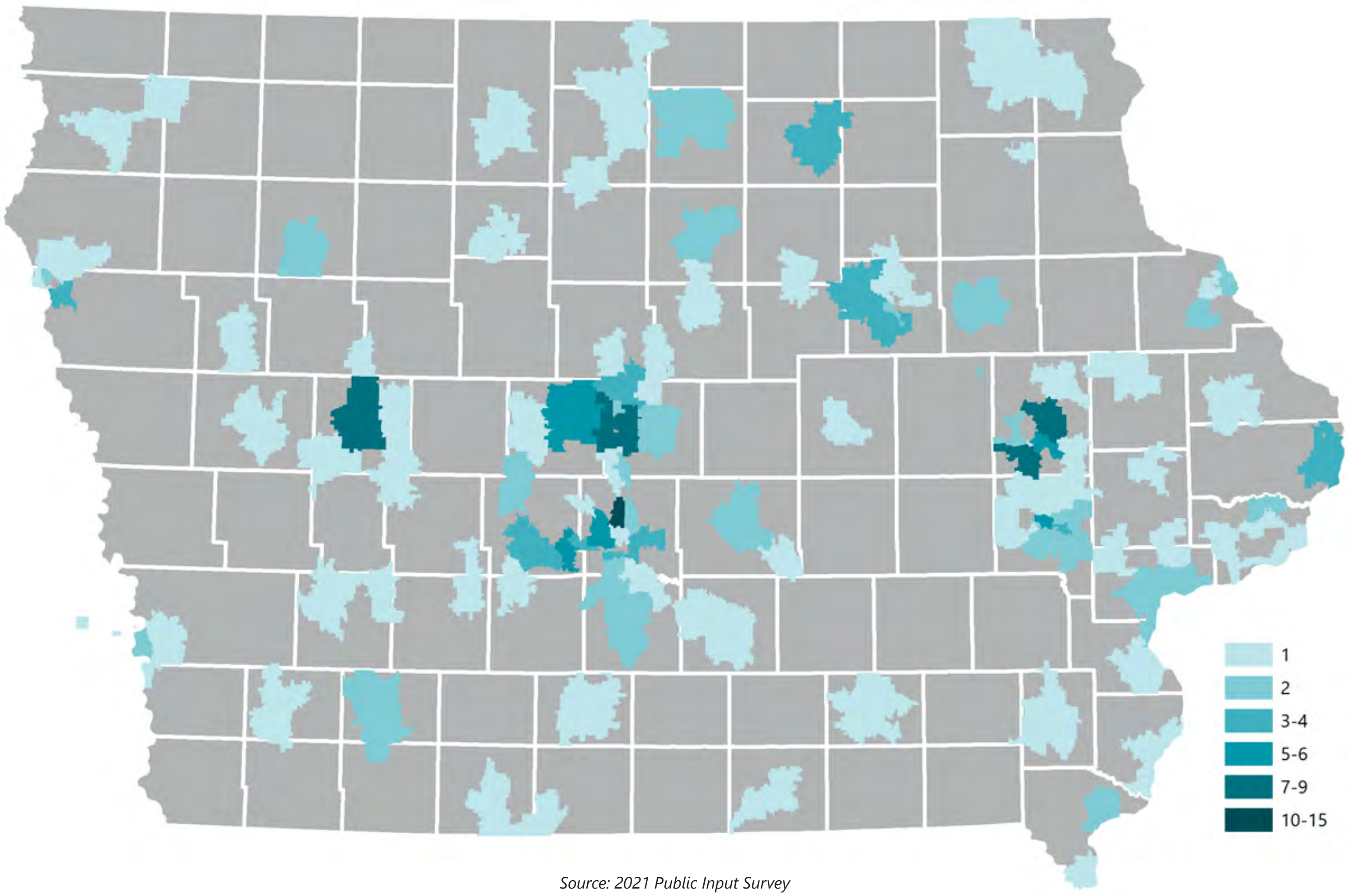


Source: 2021 Public Input Survey

Location of respondents

Figure A.11 shows the distribution of responses based on zip codes. As shown, while there were a limited number of responses overall, there were responses from across the state.

Figure A.11: Number of responses by zip code



Source: 2021 Public Input Survey

Stakeholder Consultation

As mentioned in Chapter 1, an important part of developing the State Long Range Transportation Plan (SLRTP) is consulting with various other 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. The agencies listed below were contacted for this purpose. In addition to government agencies, a variety of modal interest groups were invited to comment on the draft plan, also listed below.

Resource/governmental agencies

- Iowa Department for the Blind
- Iowa Department of Agriculture & Land Stewardship
- Iowa Department of Cultural Affairs
- Iowa Economic Development Authority
- 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 Homeland Security & Emergency Management
- Iowa Tourism
- Iowa Utilities Board
- Iowa Workforce Development
- Office of the State Archaeologist at U Iowa
- State Historical Society
- FHWA, Iowa Division
- FTA, Region 7
- U.S. Army Corps of Engineers, Rock Island District
- U.S. EPA, Region 7
- U.S. Fish & Wildlife Service
- USDA NRCS: Iowa
- Meskwaki Tribe

External stakeholders

- Bicycle and Pedestrian Advisory Committee
- Freight Advisory Committee
- Intercity bus companies
- Iowa Transportation Coordination Council
- Metropolitan Planning Organizations
- Passenger Rail Advisory Committee
- Public Transit Providers
- Rail Advisory Committee
- Regional Planning Affiliations
- Strategic Highway Safety Plan Implementation Team

Plans and Studies

As mentioned in Chapter 1, a large variety of plans, reports, and studies were considered throughout the SLRTP development process. This list is not exhaustive, but captures many of the documents used in plan development; as most are Iowa DOT documents, it also helps provide an idea of the breadth of planning efforts that occur throughout the department. When multiple years are listed, that indicates various updates of the document that have taken place over time.

Multimodal system plans

- State Long Range Transportation Plan (2017; 2012; 1997)
- State Freight Plan (2022; 2017; 2016)

Aviation

- Iowa Aviation System Plan (2021; 2011)
- Uses and Benefits of Aviation in Iowa (2009)
- Iowa Air Service Study (2008)

Bicycle/pedestrian

- Iowa Bicycle and Pedestrian Long-Range Plan (2018)
- Economic and Health Benefits of Bicycling in Iowa (2012)
- Lewis and Clark Multiuse Trail Study (2010)
- Iowa's Mississippi River Trail Plan (2003)
- Iowa Trails 2000 (2000)

Highway

- Iowa Infrastructure Condition Evaluation Highway Planning Report (2021; 2020)
- Iowa Interstate Investment Plan (2019)
- Transportation Asset Management Plan (2019; 2018; 2016)
- Iowa Interstate Corridor Plan (2013)
- The Fix We're In For: The State of Our Nation's Bridges (2013)

Public transit/passenger

- Iowa Public Transit Long-Range Plan (2020)
- Transportation Coordination in Iowa (2020)
- Iowa Park and Ride System Plan (2014)
- Iowa Passenger Transportation Funding Study (2009)

Rail

- Iowa State Rail Plan (2021; 2017)
- Iowa Crude Oil and Biofuels Rail Transportation Study (2016)

Funding

- Road Use Tax Fund (RUTF) Study (2021; 2016; 2011; 2006)
- Report on the Impact of Electric Vehicles to the RUTF (2018)
- Governor's Transportation 2020 Citizens' Advisory Committee Report (2011)

Operations

- TSMO Plan Update (Draft; 2022)
- Iowa's Automated Transportation Vision (2020)
- TSMO Service Layer Plans (2017-2020)
- TSMO Program Plan (2016)
- TSMO Strategic Plan (2016)

Safety

- Statewide Bicycle and Pedestrian Systemic Safety Analysis (2020)
- Iowa Strategic Highway Safety Plan (2019; 2017; 2013)
- District Road Safety Plans (2017)
- Statewide Screening for Potential Lane Reconfiguration (2017)
- Iowa Comprehensive Highway Safety Plan (2006)

Miscellaneous

- Rest Area Management Plan (2020)
- Charging Forward: Iowa's Opportunities for Electric Vehicle Infrastructure Support (2019)
- ADA Transition Plan (2019; 2016)
- Iowa Energy Plan (2016)
- Climate Change Impacts on Iowa (2010)
- Livability in Transportation Guidebook (2010)
- Iowa's Renewable Energy and Infrastructure Impacts (2010)
- Transportation Planning and the Environment (2009)
- Policy Strategies for Iowa in Making Major Road Investments (2002)

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Appendix 3

Accessibility/Mobility Analysis

Chapter 4 included a brief overview of accessibility/mobility analysis conducted for the State Long Range Transportation Plan (SLRTP). This appendix provides a detailed discussion of the methodology along with maps for each of the individual components that were analyzed.

The approach for this analysis was to focus on factors that may limit mobility, ability to access transportation infrastructure, and/or travel via a personal vehicle. The aim was to identify populations that may be more at risk of having mobility challenges than the general public. While transportation planning should be conducted through a multimodal lens by default, these populations may be particularly in need of or best served by alternatives to driving. These populations may also be better served by non-traditional public outreach techniques. Future analysis efforts may work to integrate other accessibility considerations, such as availability of different transportation options and how many essential destinations can be reached by them.

Geographic analysis level

There were multiple options to consider for the level of geography used in the analysis. Since most data was anticipated to come from the U.S. Census Bureau's American Community Survey (ACS), the main options were counties, census tracts, or census block groups. Counties were determined to be too large for the analysis, as that geography level would not provide detailed enough location-specific information. The smallest geographic unit considered, census block groups, did not have data available for all attributes being considered; when the data was available, it was often less reliable than larger geographic areas since the ACS is sample-based and there would be less samples for smaller geographic areas. Census tracts were chosen as the best balance of geographic size and data reliability. There were 825 census tracts in Iowa at the time of the analysis; two of them had no population and were excluded from the analysis.

Data analyzed

Analysis was conducted by using 2015-2019 ACS 5-year estimates from the U.S. Census Bureau, which were the most currently available 5-year estimates at the time of the analysis. The following ten person and household attributes were included in the analysis.

- Youth – under 18
- Older adults – 65 and over
- Minority (non-White and/or Hispanic/Latino)
- Foreign-born
- Limited English proficiency
- With a disability
- Households below poverty level
- Zero vehicle households
- College enrolled
- Single parent households

These attributes were chosen as they were felt to be the most likely attributes to impact a person's ability to fully access the transportation system. Several additional attributes were considered but not ultimately included in the analysis because they were too duplicative with other factors. Factors were also excluded if it was believed there would be no discernable impact that the presence or absence of a population with that attribute would have on people's ability to access the transportation system, how a project would be developed, or how public input efforts would be conducted. The percentage of a census tract's population was analyzed rather than the number of people in the tract, as tracts varied greatly in population.

Analysis structure

A single, statewide analysis of all census tracts was considered, as was dividing the state into rural and urban tracts and analyzing those groups together. The latter was preferred, as several of the attributes are relatively concentrated in urban areas, so using a statewide analysis would result in fewer non-urban areas being identified as being at higher risk for accessibility issues, even though the population in question may be significant relative to the area's size and characteristics.

Several options for defining rural versus urban census tracts were considered. Ultimately, metropolitan planning organization (MPO) planning area boundaries were used. These boundaries encompass areas that are urbanized or likely to be urbanized in the next 20 years, as defined by the MPOs. Census tract boundaries do not always align with the MPO planning area boundaries; a review of tracts that cross MPO borders led to labeling a tract as urban if more than ten percent of the tract's area was within the MPO boundary. This ensured all incorporated areas and growth areas of MPOs were included in the urban analysis while some very large rural tracts that only had a small portion of area in the MPO were grouped with the rural analysis. The end result was a relatively even split of Iowa's population, while the vast majority of land area was assigned to the rural analysis, as shown in Table A.4 and Figure A.12.

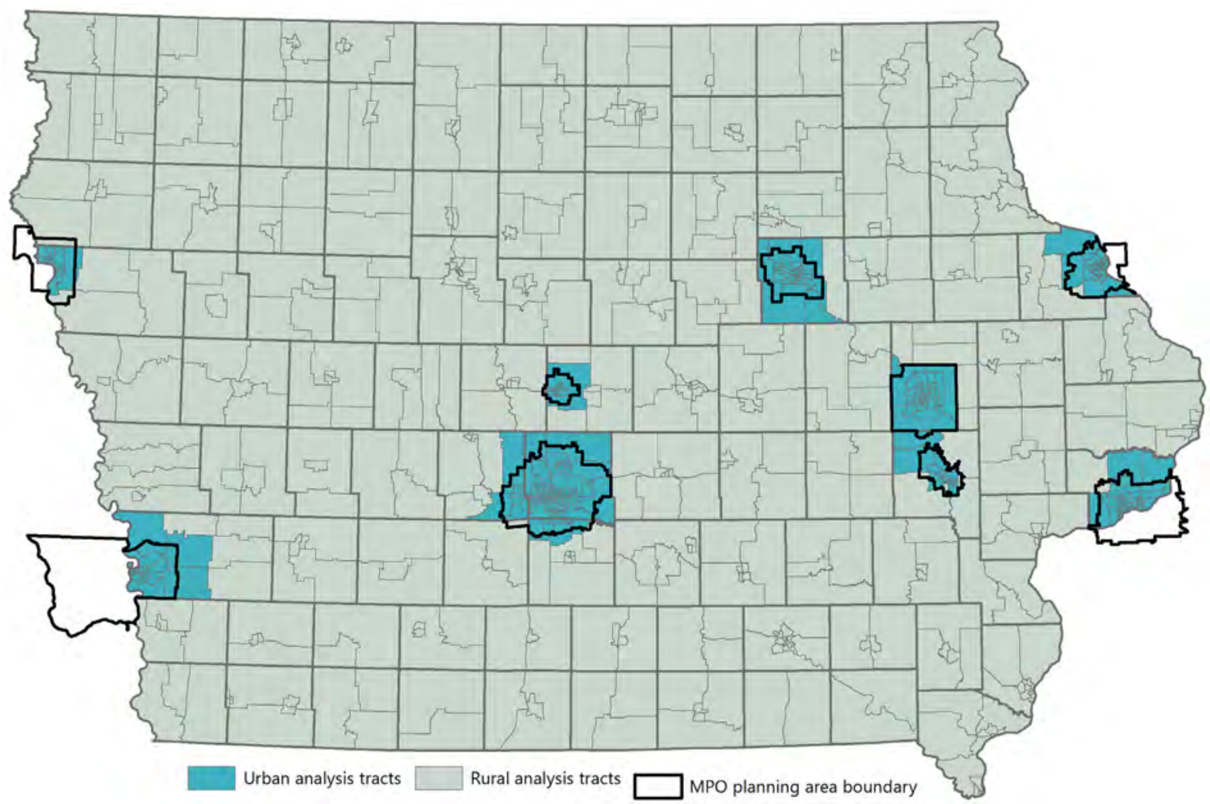
Table A.4: Statistics for urban and rural tracts for accessibility/mobility analysis

	Urban analysis	Rural analysis
Tracts	339*	486*
Population	1,519,424 *(48.4%)*	1,620,084 *(51.6%)*
Square miles	3,127 *(5.6%)*	52,726 *(94.4%)*

**1 tract in each analysis had no population and was excluded from the analysis.*

Source: Iowa DOT

Figure A.12: Census tract assignments for accessibility/mobility analysis



Source: Iowa DOT

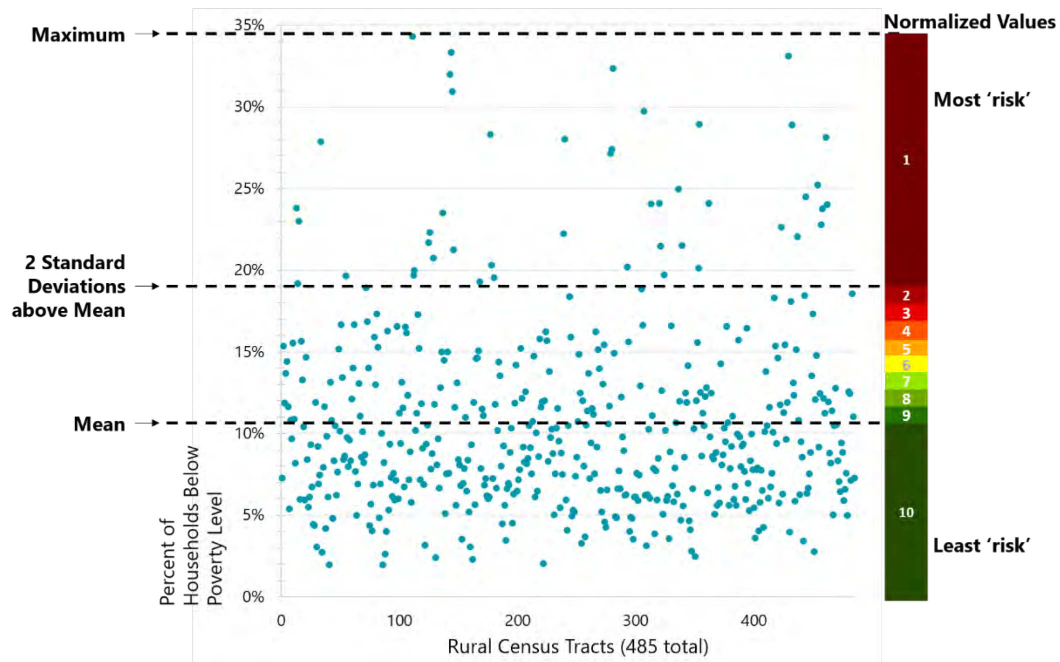
Analysis method

Several options were considered for how to analyze the census tracts, including focusing on standard deviation from the mean for the attribute or using various percentile thresholds to define an area as more ‘at risk’ from an accessibility perspective. Ultimately, a method similar to that used in several of the highway needs and risks discussed in Chapter 5 was used. This method focuses on data that is higher than the statewide average and develops a ten-point normalized scale for each attribute, which then allows for the aggregation of those attributes into a single composite score.

Figure A.13 helps illustrate the normalization process. All steps of the analysis were completed separately for the urban analysis and rural analysis. Each attribute was analyzed individually, and the mean for the attribute across census tracts was calculated. Tracts at or below the mean were assigned a normalized value of 10, meaning there is less risk relative to that attribute in those tracts compared to all urban or rural tracts in the state. The remainder of the census tracts that were above the statewide mean were assigned normalized values of 1-9. To determine the values to assign to each tract, a threshold of two standard deviations above the mean was used to calculate the cutoff for which tracts would be assigned a 1. The remainder of the range between those values and the mean was divided equally among the values of 2-9. This method was used because in many cases there were a few very high percentage census tracts that would stretch the range of values out, and using another method, such as assigning the same number of tracts to each normalized value, would not do as good of job of highlighting the relative severity of the level of risk based on that attribute’s value.

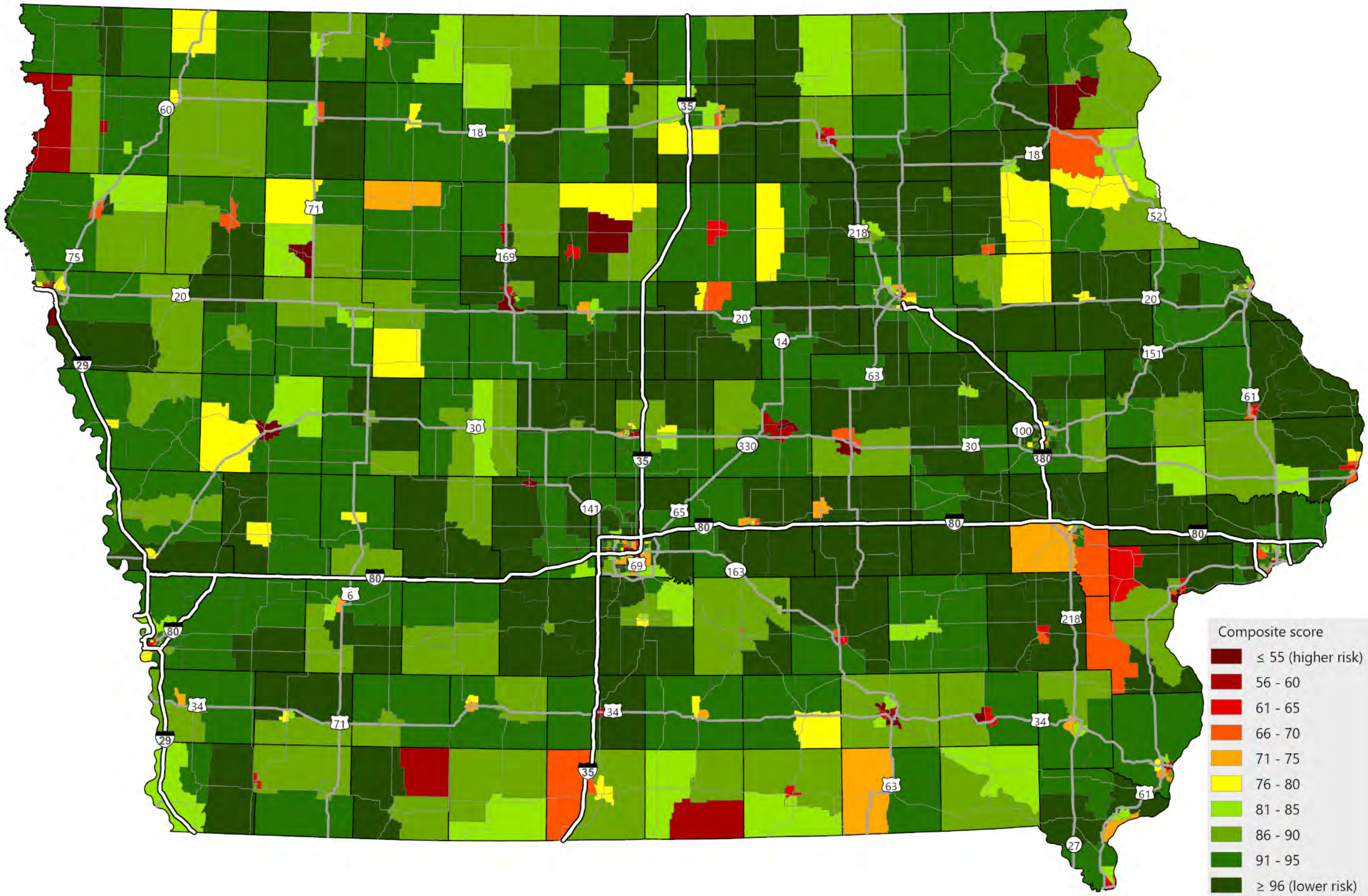
Once the normalized values were determined for all ten attributes, they were added together to determine a composite score for the tract. The composite score had a maximum value of 100, which would mean the highest possible score was assigned for each factor, or that the tract was below the statewide average for all attributes. The higher a tract’s score, the fewer mobility challenges its population has relative to other tracts in the state; lower composite scores indicate a higher risk for accessibility issues. The following pages include statewide and urban inset maps of the composite scores and each individual attribute’s normalized scores. While urban and rural tracts are mapped together, they were analyzed separately as previously described.

Figure A.13: Example of normalization process for attributes used in accessibility/mobility analysis



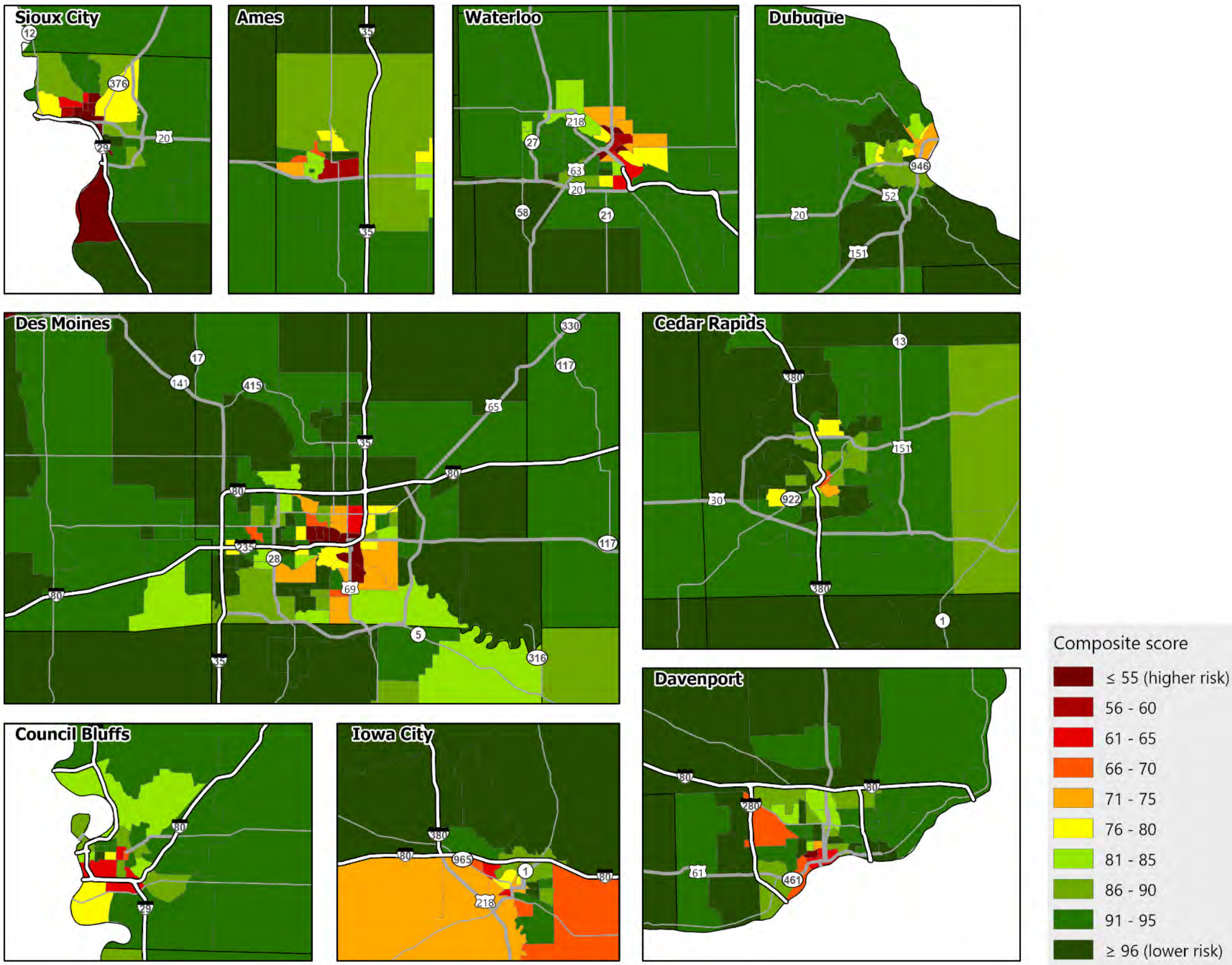
Source: Iowa DOT

Figure A.14: Accessibility/mobility analysis composite scores – statewide view



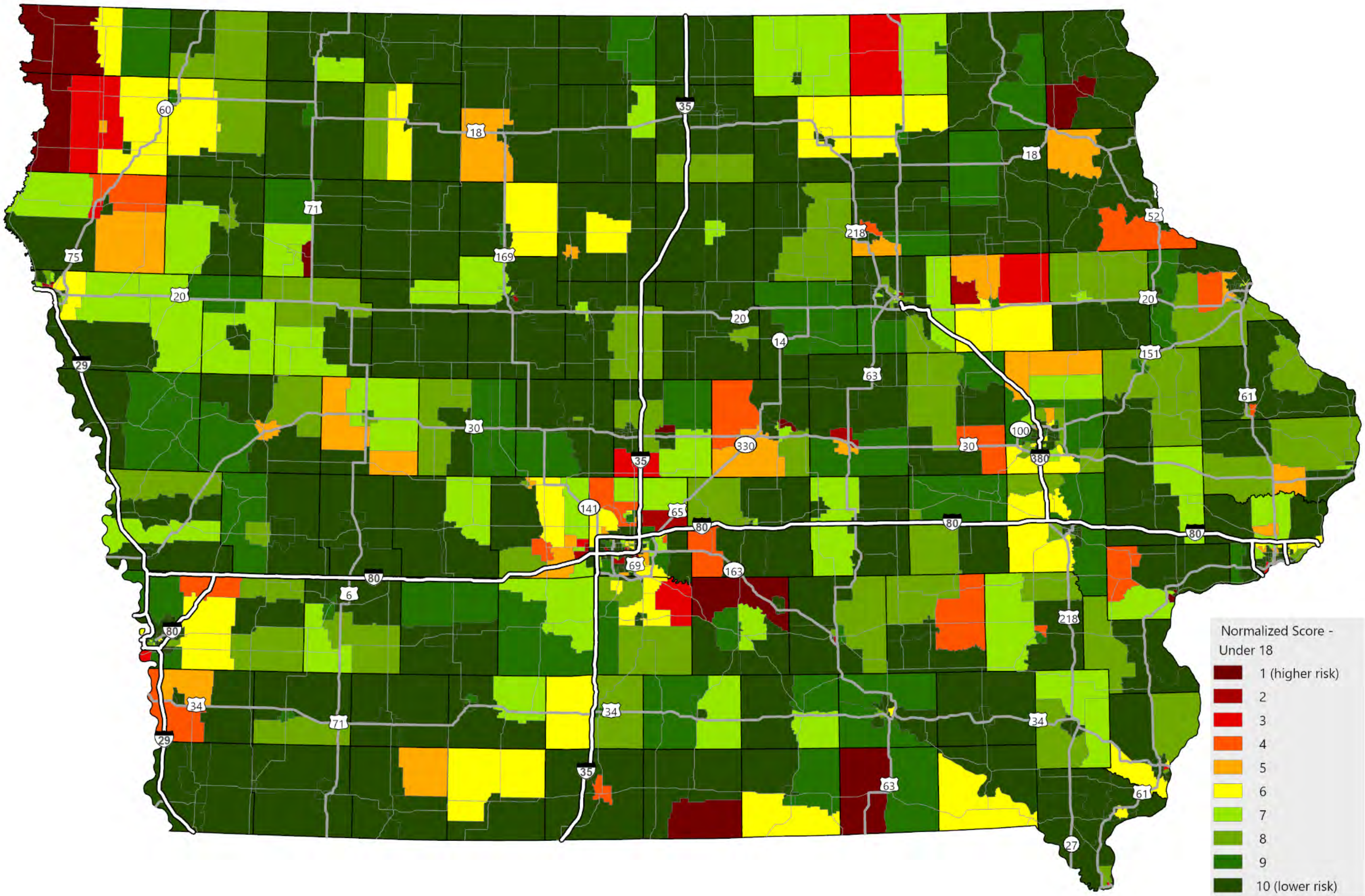
Source: Iowa DOT

Figure A.15: Accessibility/mobility analysis composite scores – urban insets



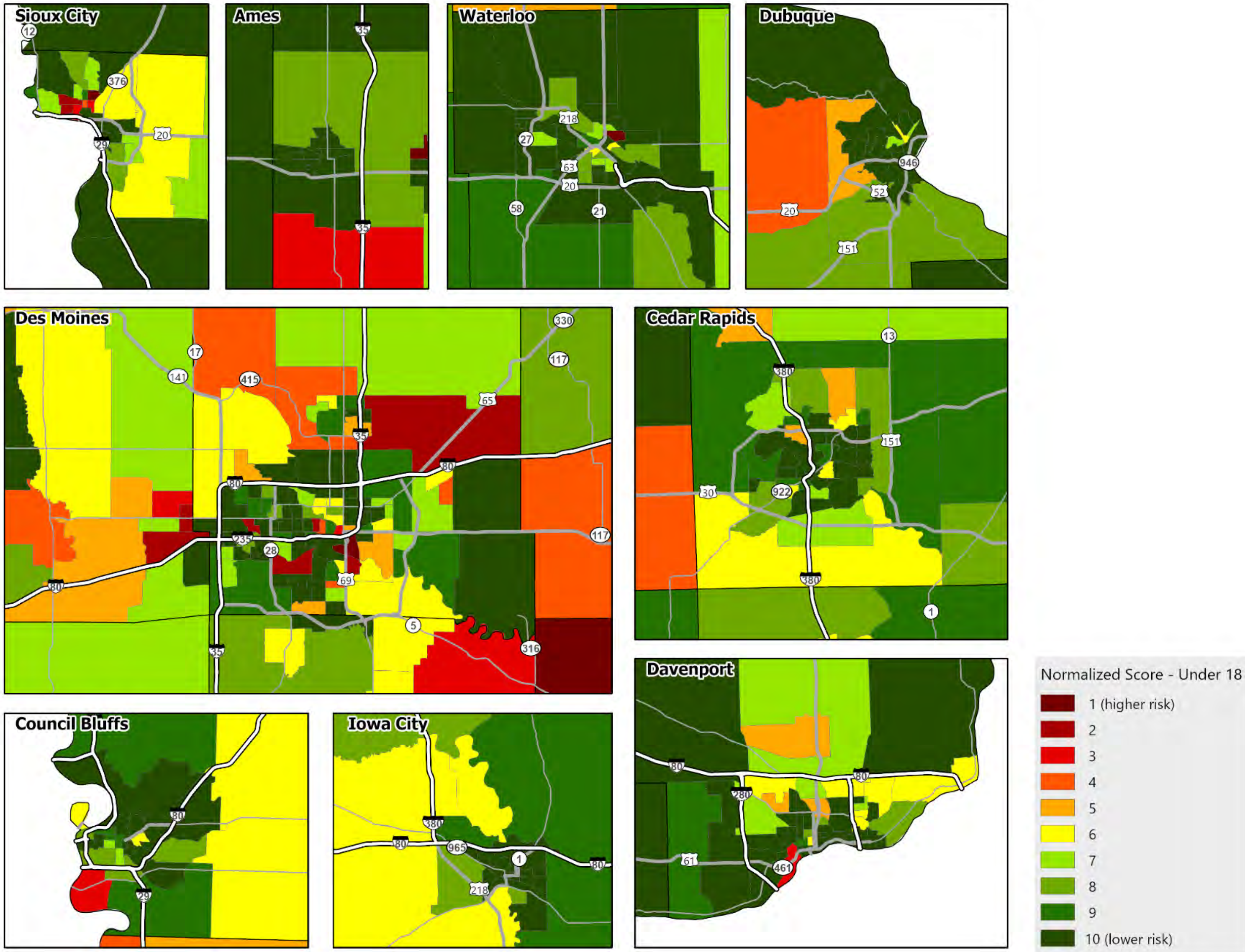
Source: Iowa DOT

Figure A.16: Accessibility/mobility analysis normalized scores for population that is under 18 – statewide view



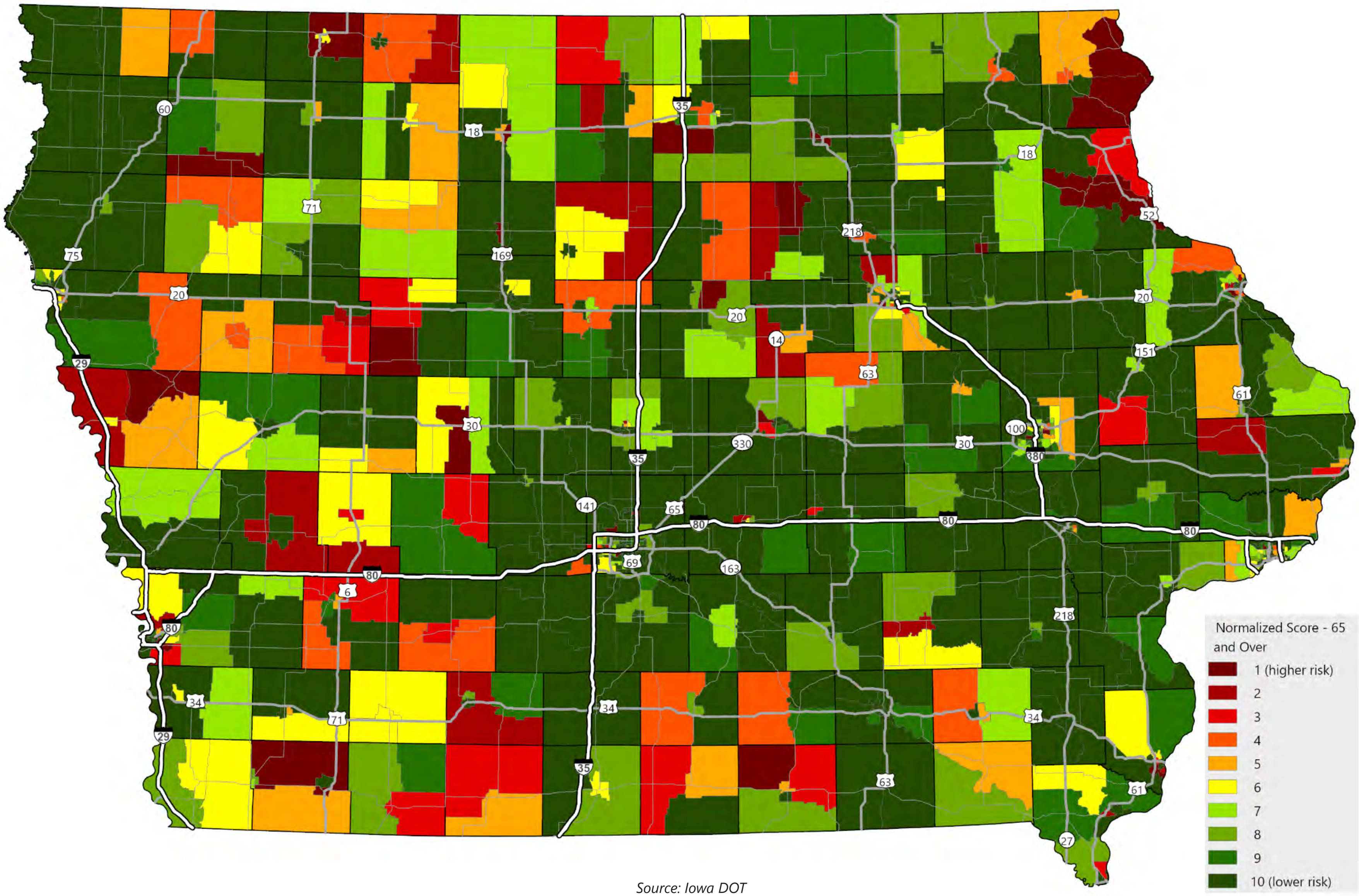
Source: Iowa DOT

Figure A.17: Accessibility/mobility analysis normalized scores for population that is under 18 – urban insets



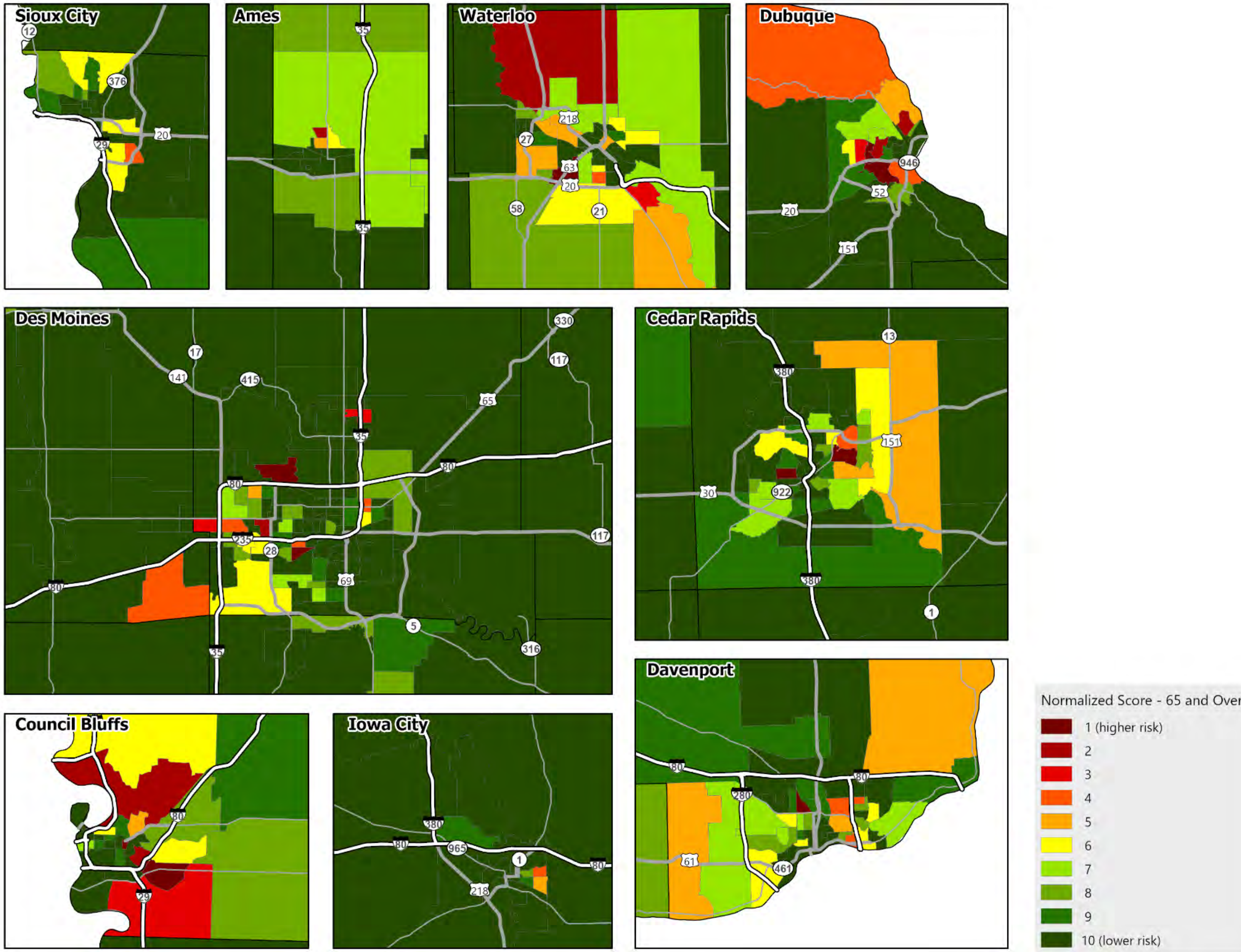
Source: Iowa DOT

Figure A.18: Accessibility/mobility analysis normalized scores for population that is 65 and over – statewide view



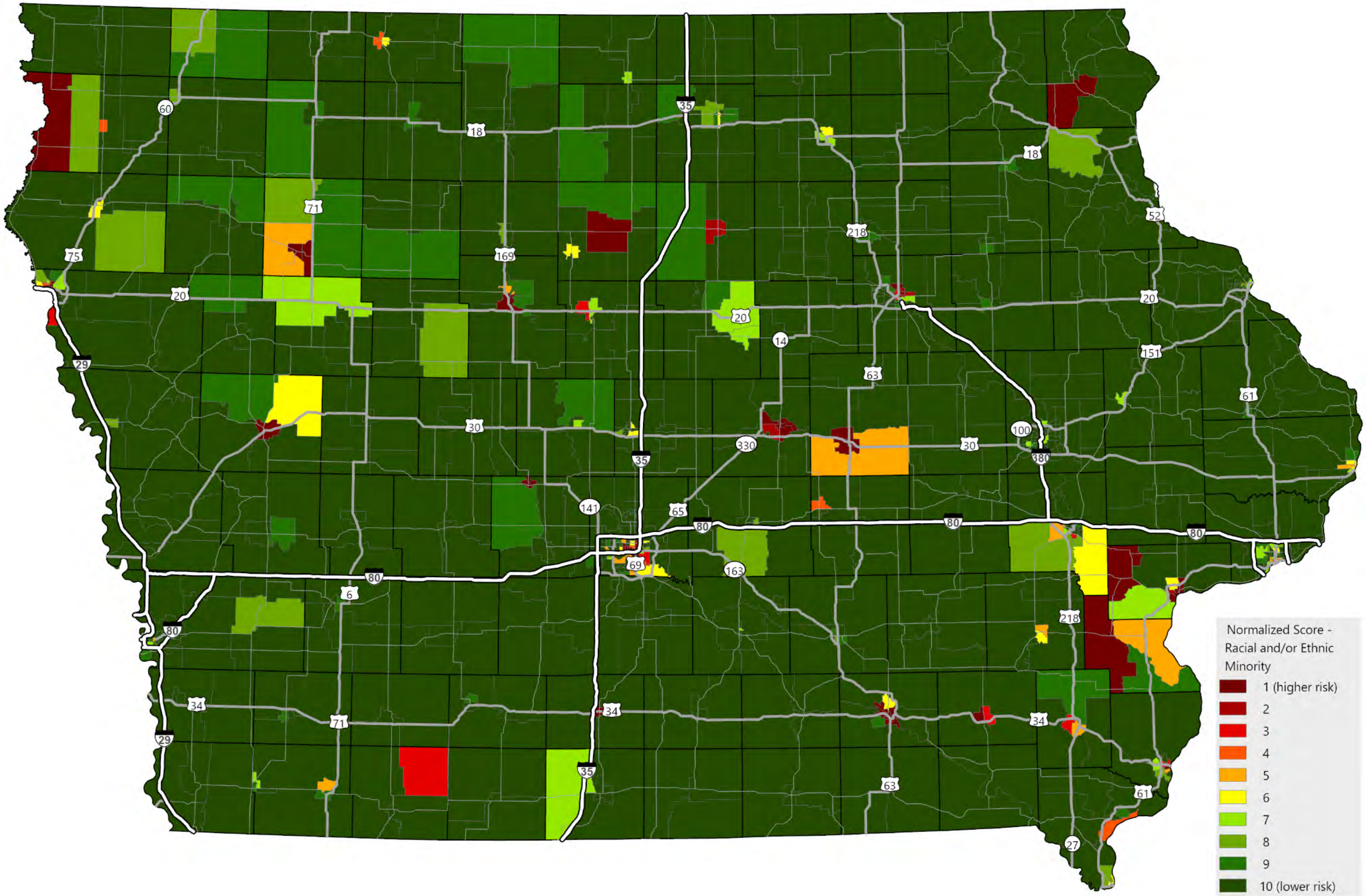
Source: Iowa DOT

Figure A.19: Accessibility/mobility analysis normalized scores for population that is 65 and over – urban insets



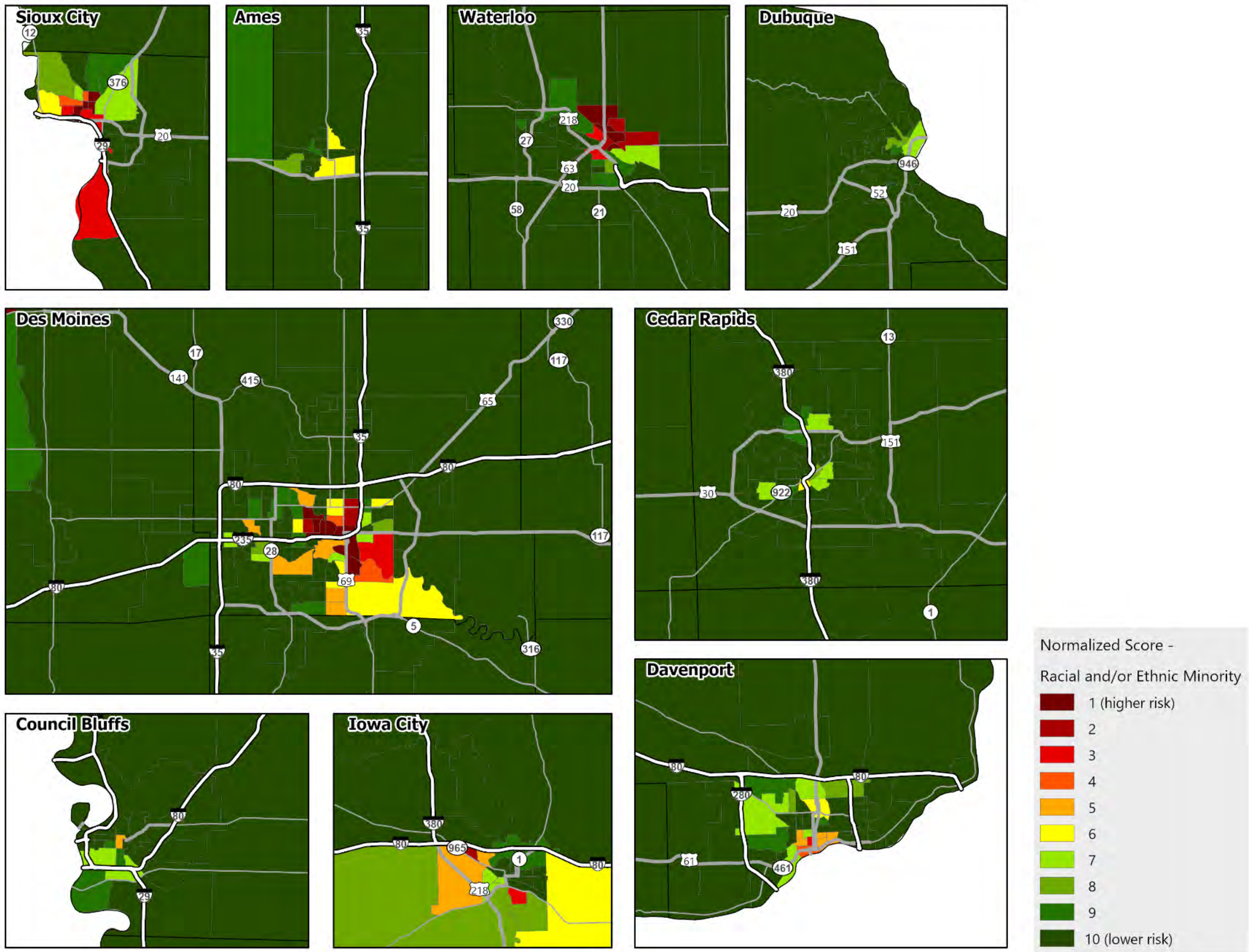
Source: Iowa DOT

Figure A.20: Accessibility/mobility analysis normalized scores for population that is a racial and/or ethnic minority – statewide view



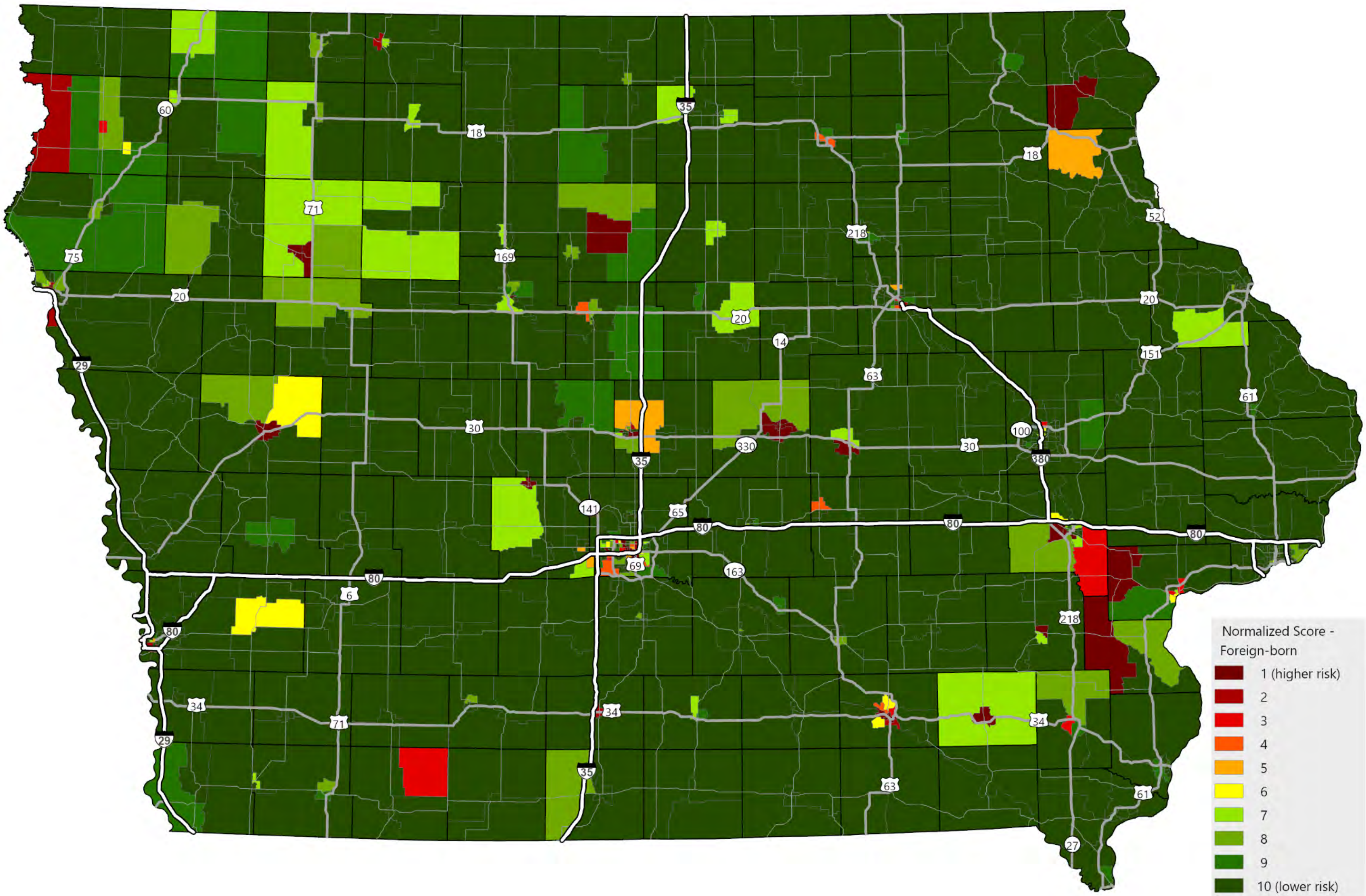
Source: Iowa DOT

Figure A.21: Accessibility/mobility analysis normalized scores for population that is a racial and/or ethnic minority – urban insets



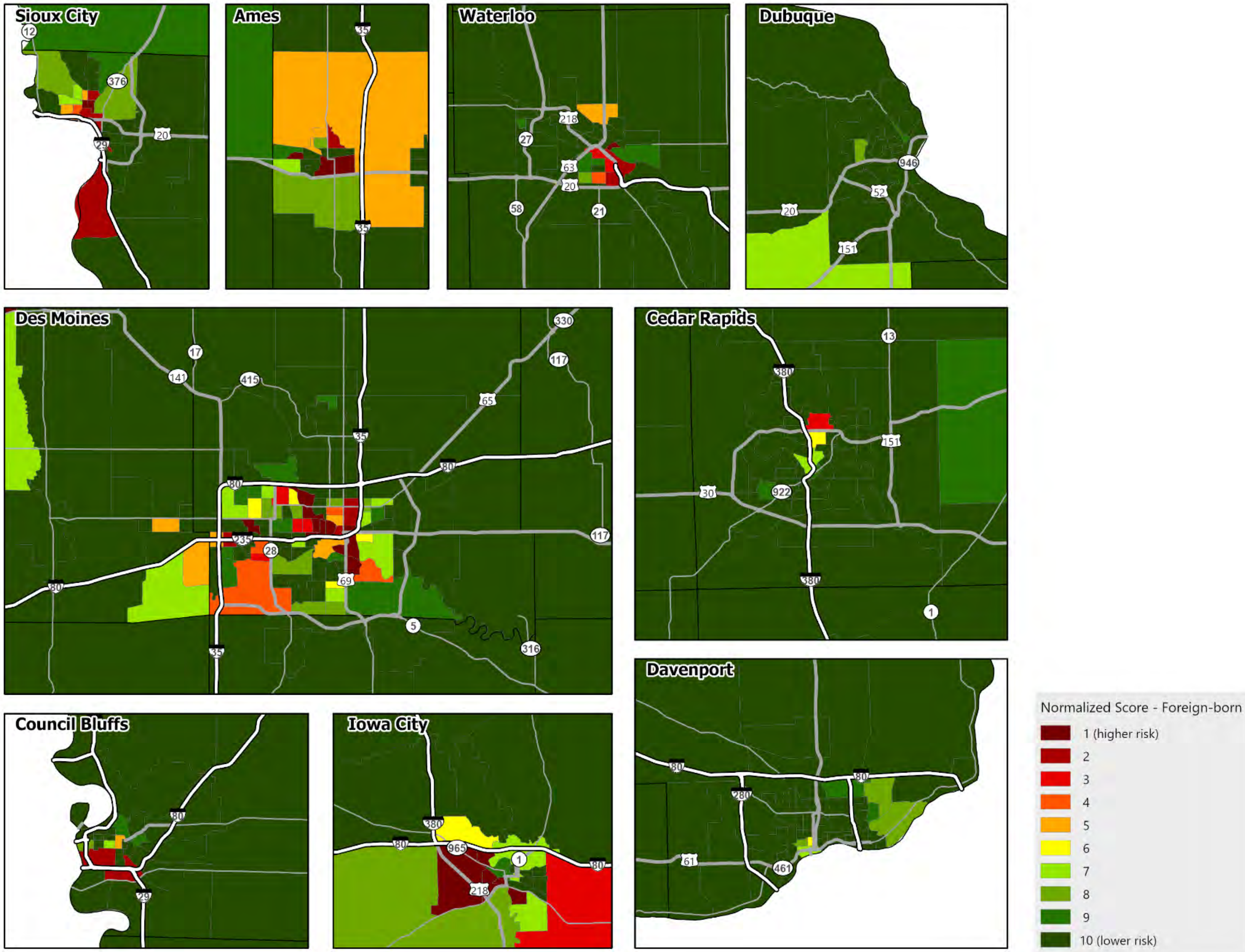
Source: Iowa DOT

Figure A.22: Accessibility/mobility analysis normalized scores for population that is foreign-born – statewide view



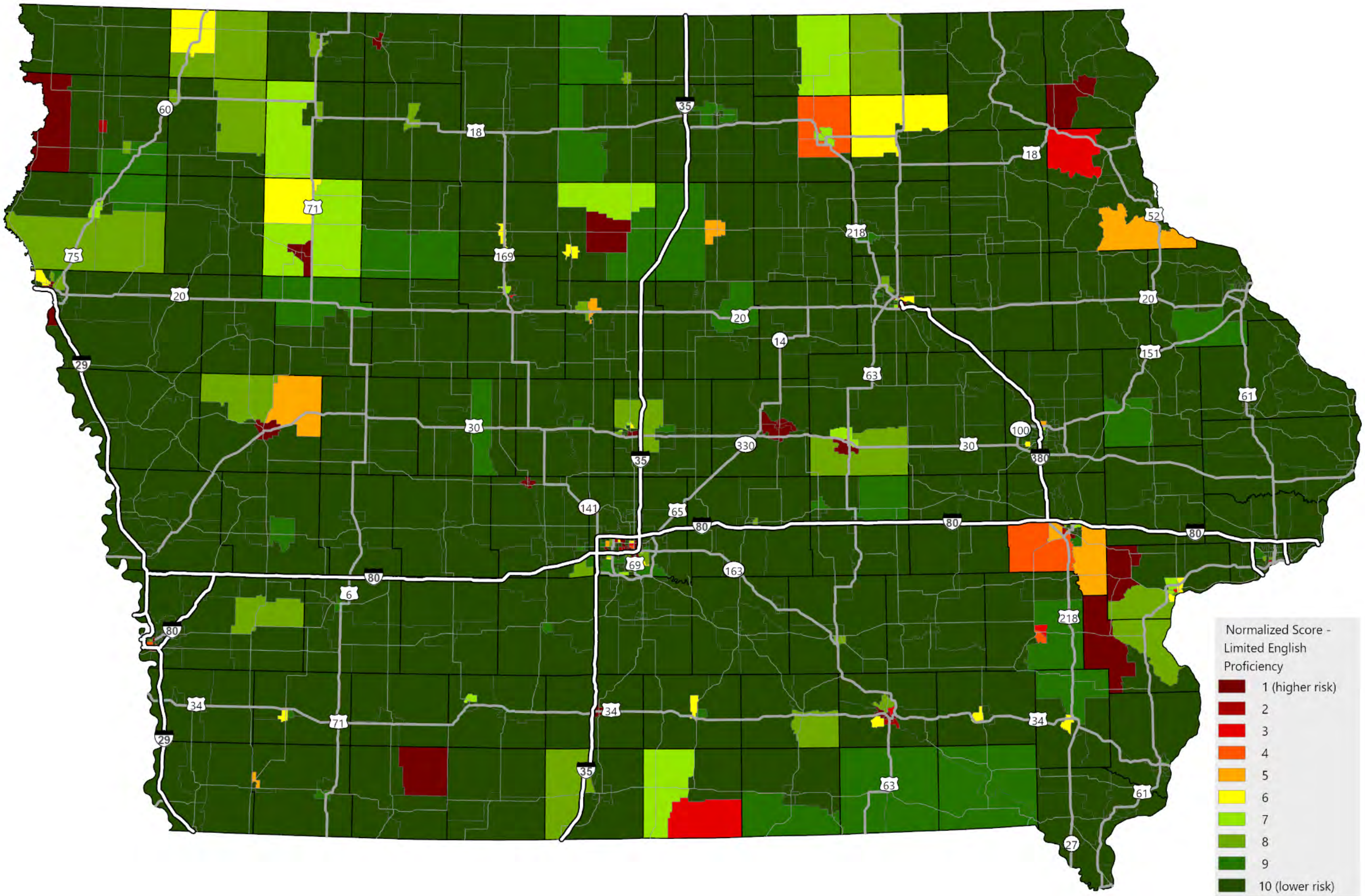
Source: Iowa DOT

Figure A.23: Accessibility/mobility analysis normalized scores for population that is foreign-born – urban insets



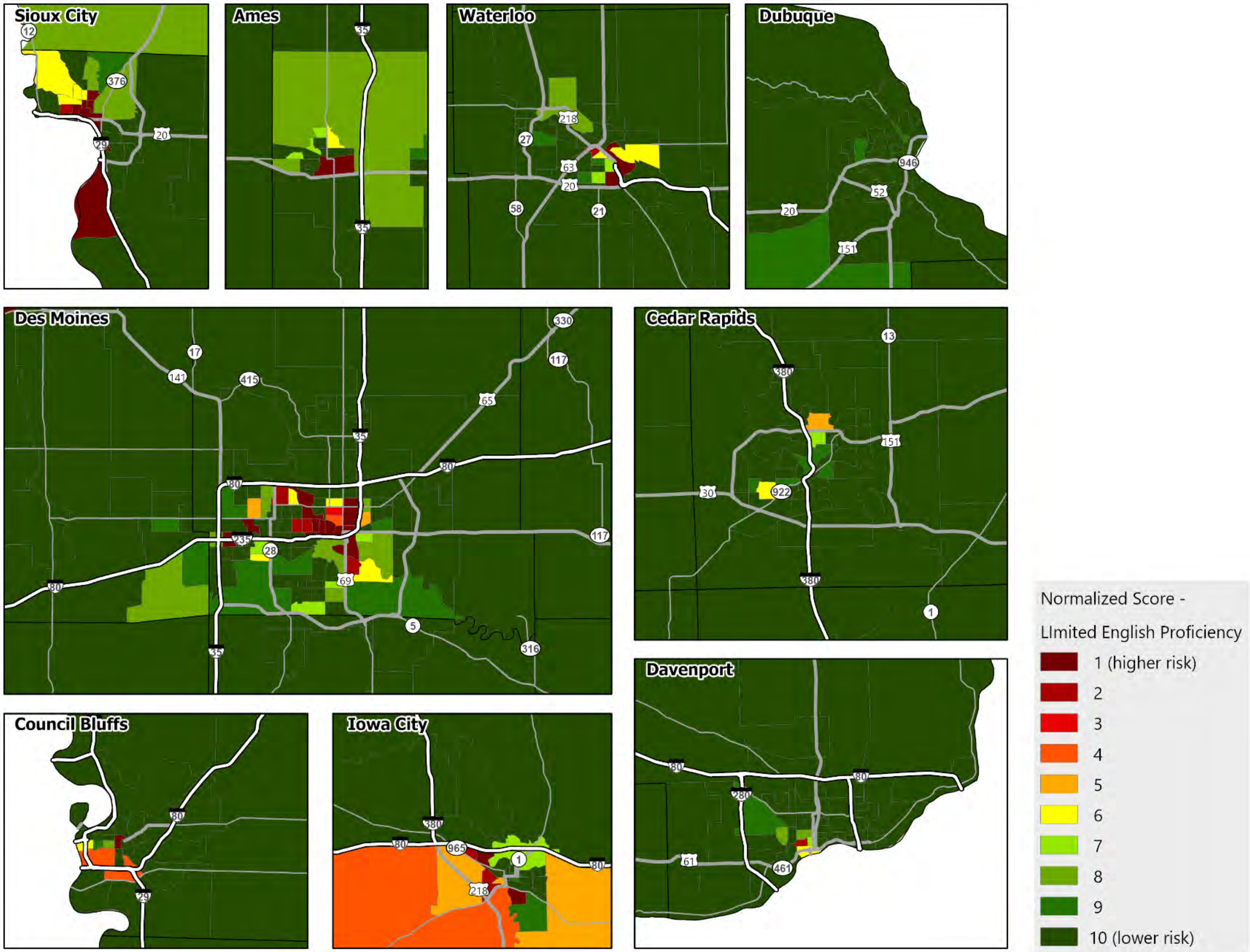
Source: Iowa DOT

Figure A.24: Accessibility/mobility analysis normalized scores for population that has limited English proficiency – statewide view



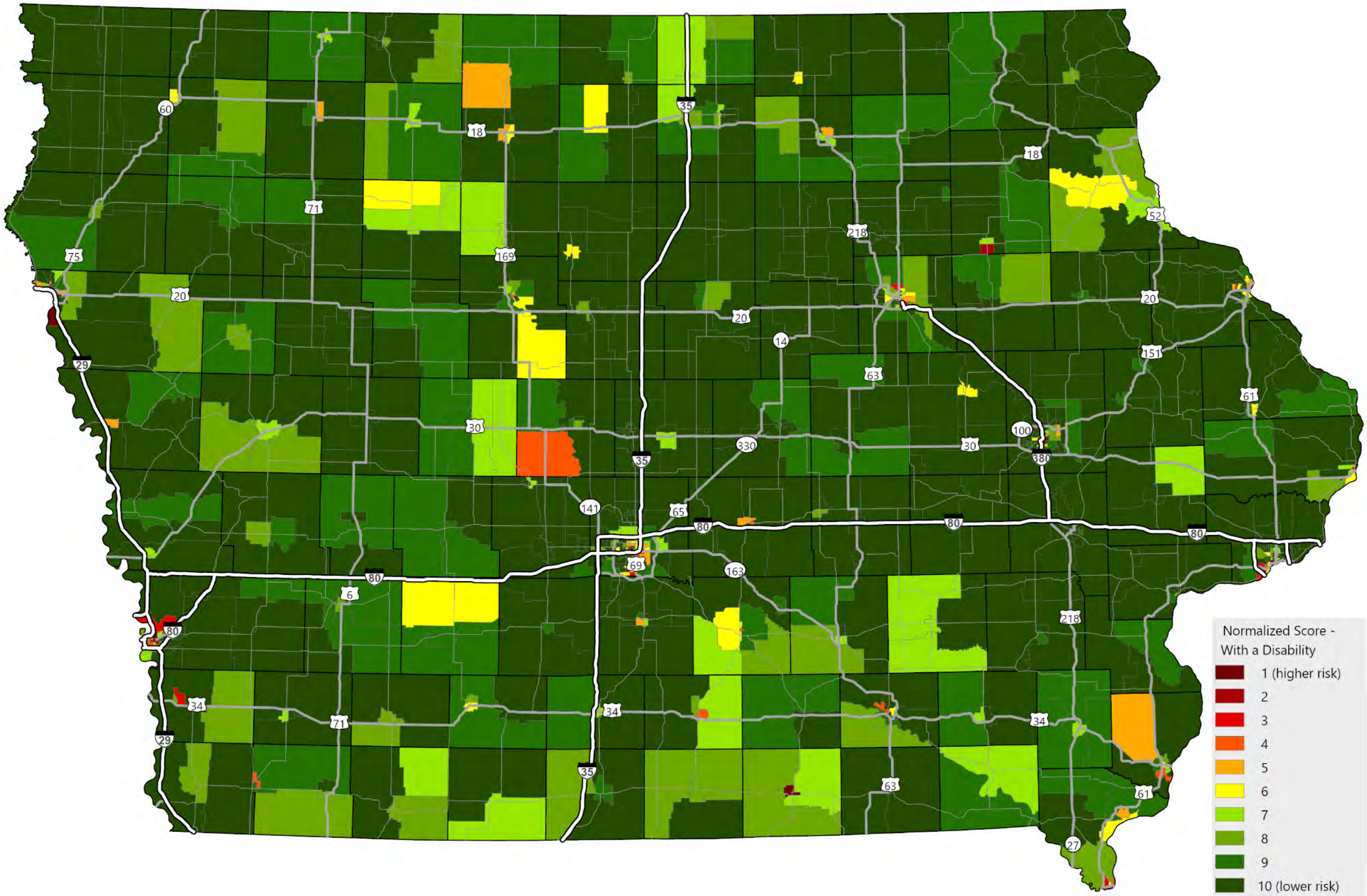
Source: Iowa DOT

Figure A.25: Accessibility/mobility analysis normalized scores for population that has limited English proficiency – urban insets



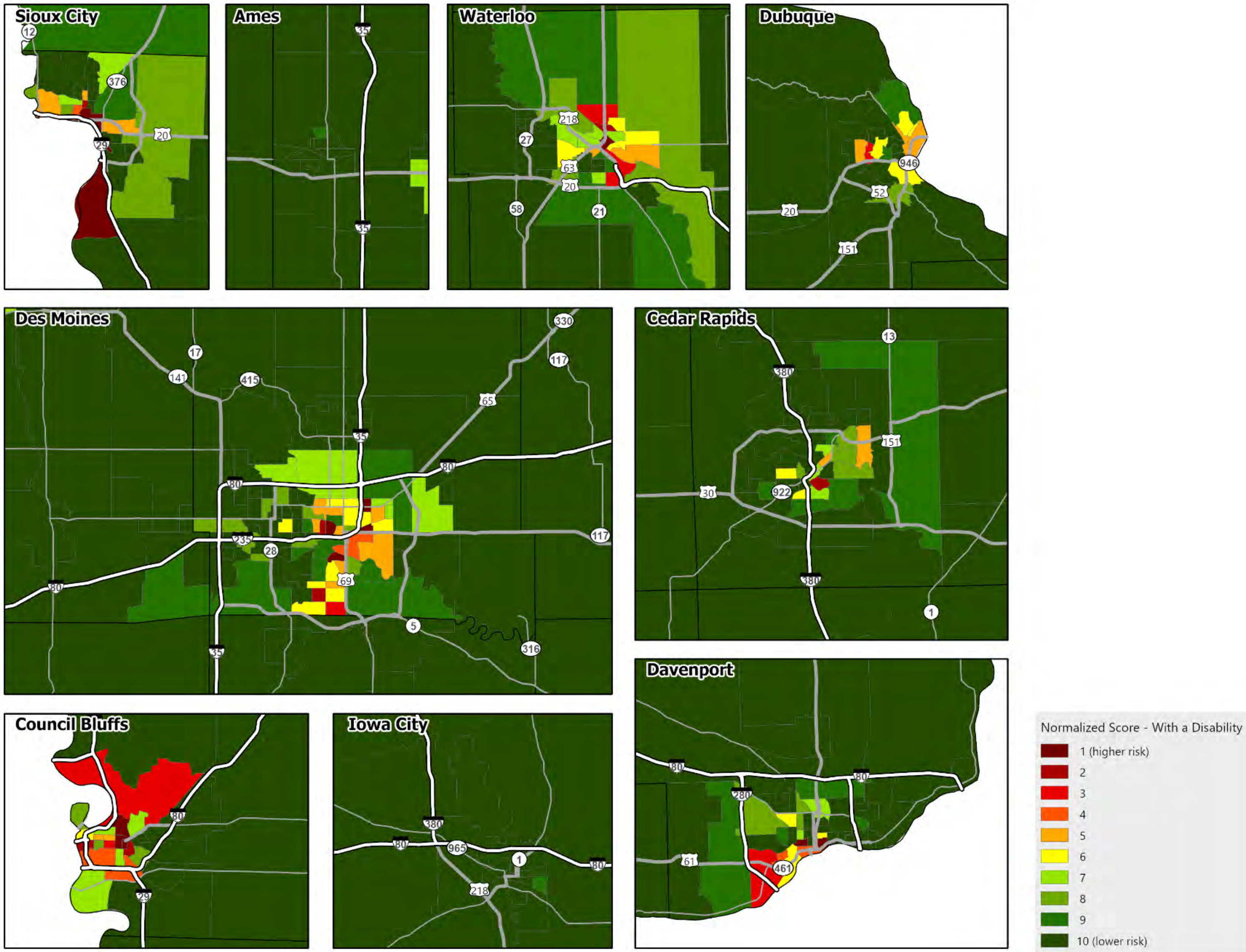
Source: Iowa DOT

Figure A.26: Accessibility/mobility analysis normalized scores for population with a disability – statewide view



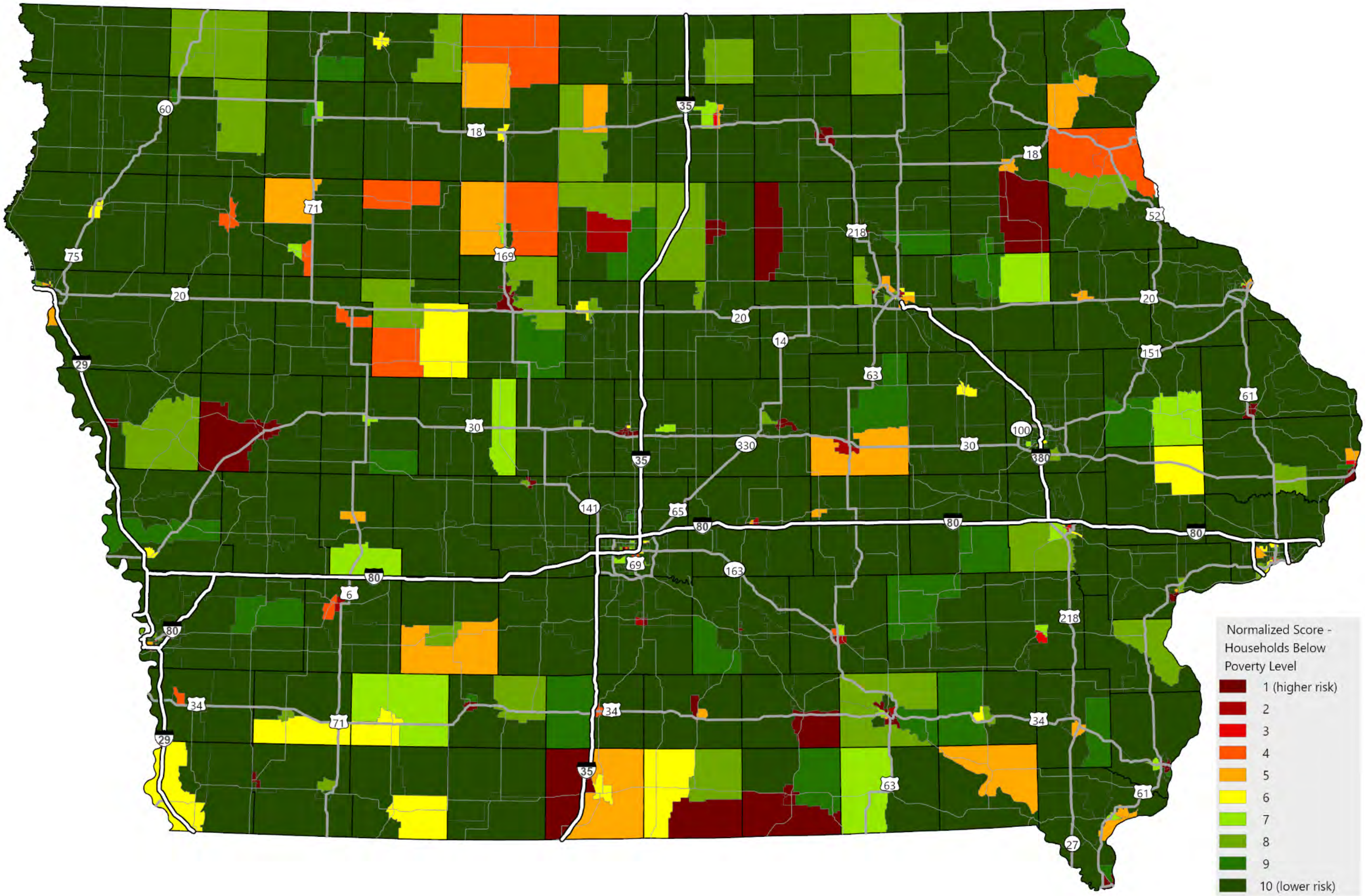
Source: Iowa DOT

Figure A.27: Accessibility/mobility analysis normalized scores for population with a disability – urban insets



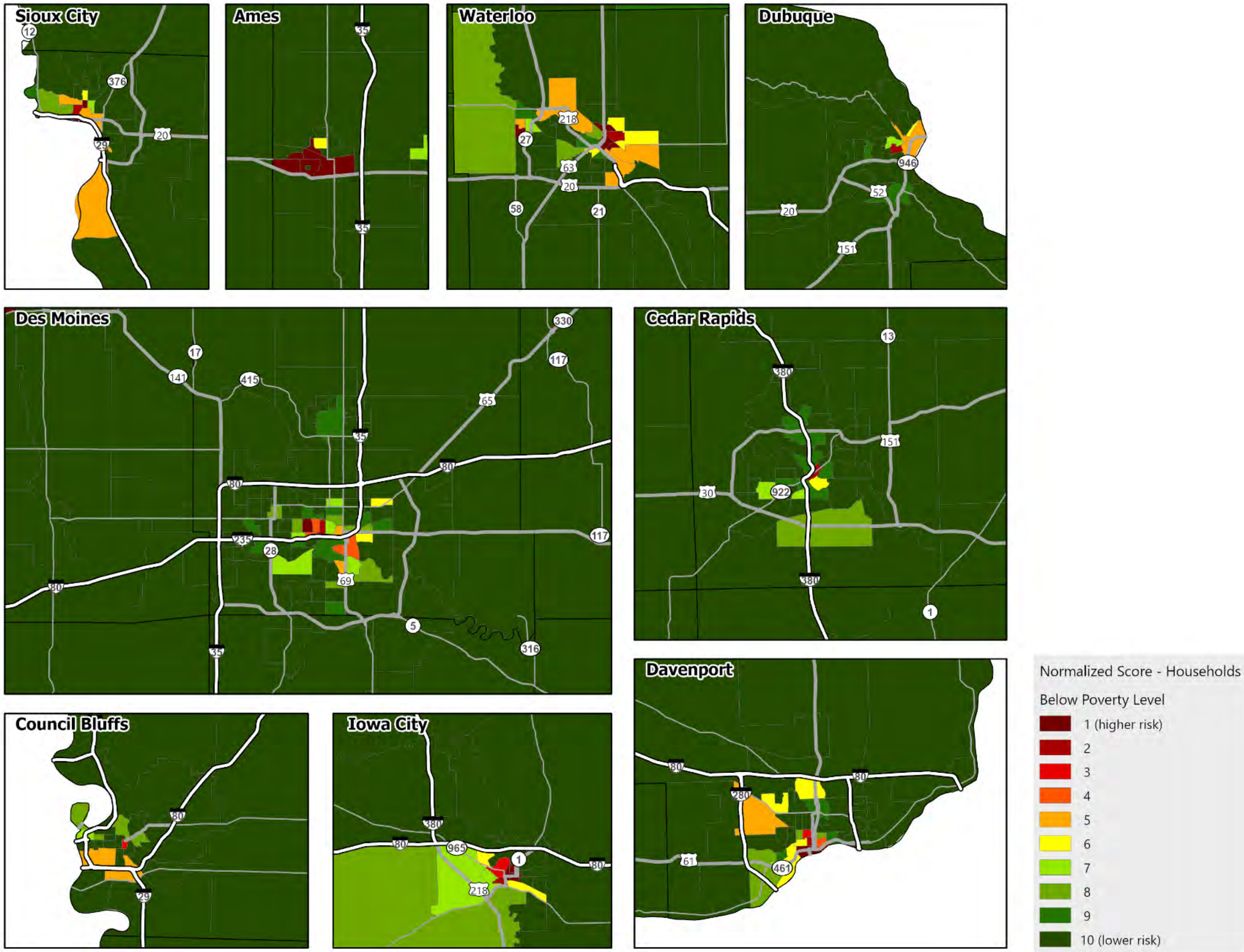
Source: Iowa DOT

Figure A.28: Accessibility/mobility analysis normalized scores for households below poverty level – statewide view



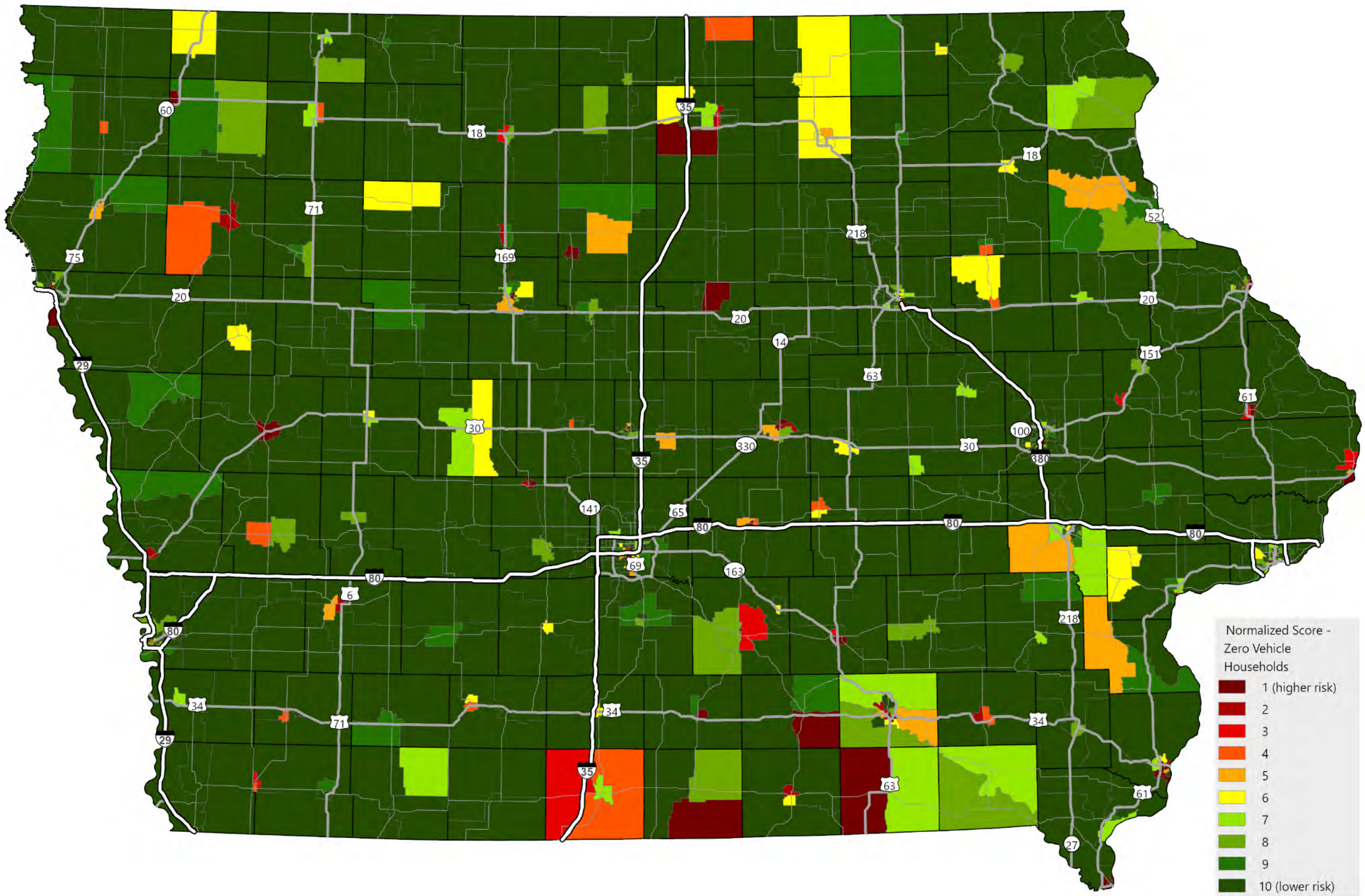
Source: Iowa DOT

Figure A.29: Accessibility/mobility analysis normalized scores for households below poverty level – urban insets



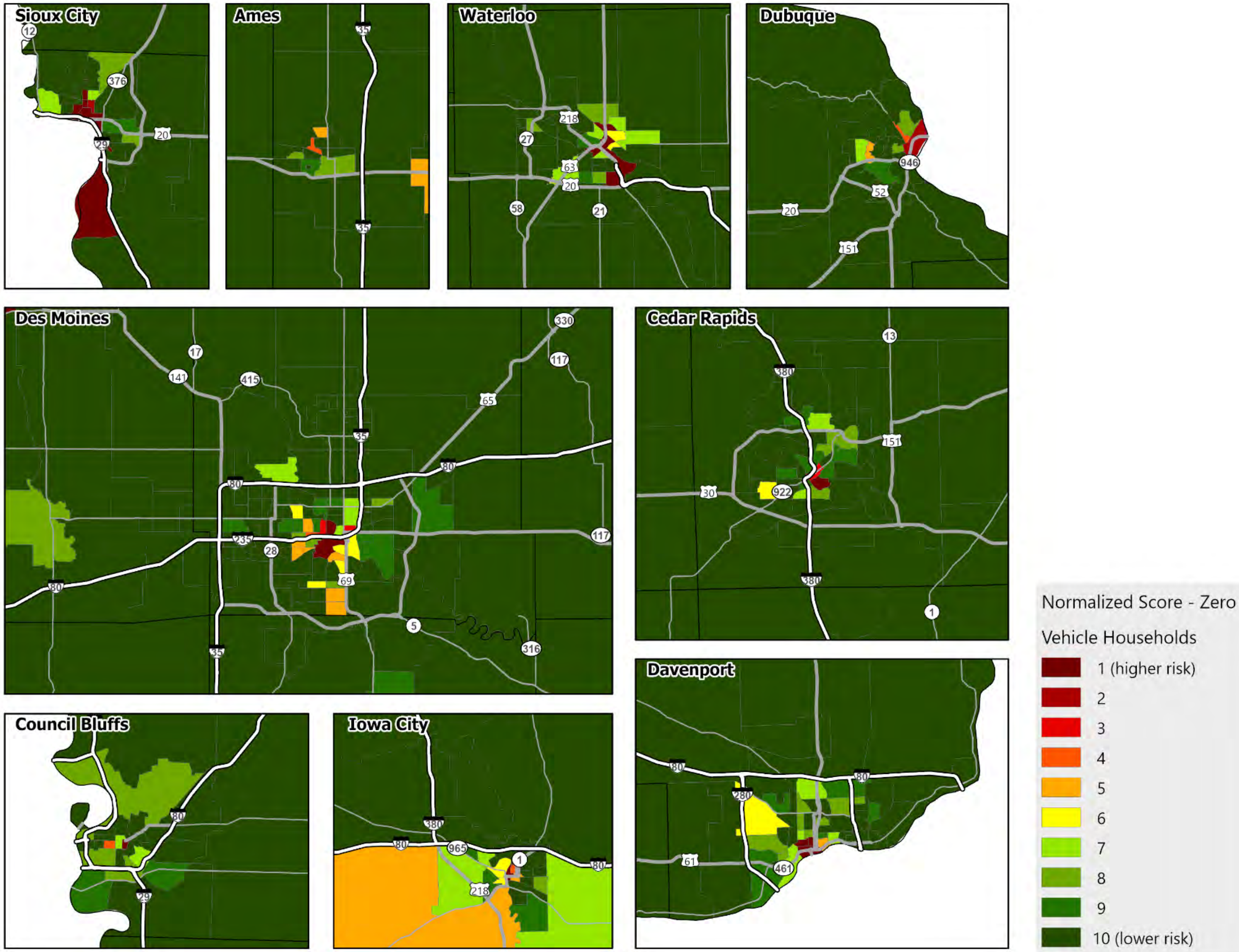
Source: Iowa DOT

Figure A.30: Accessibility/mobility analysis normalized scores for zero vehicle households – statewide view



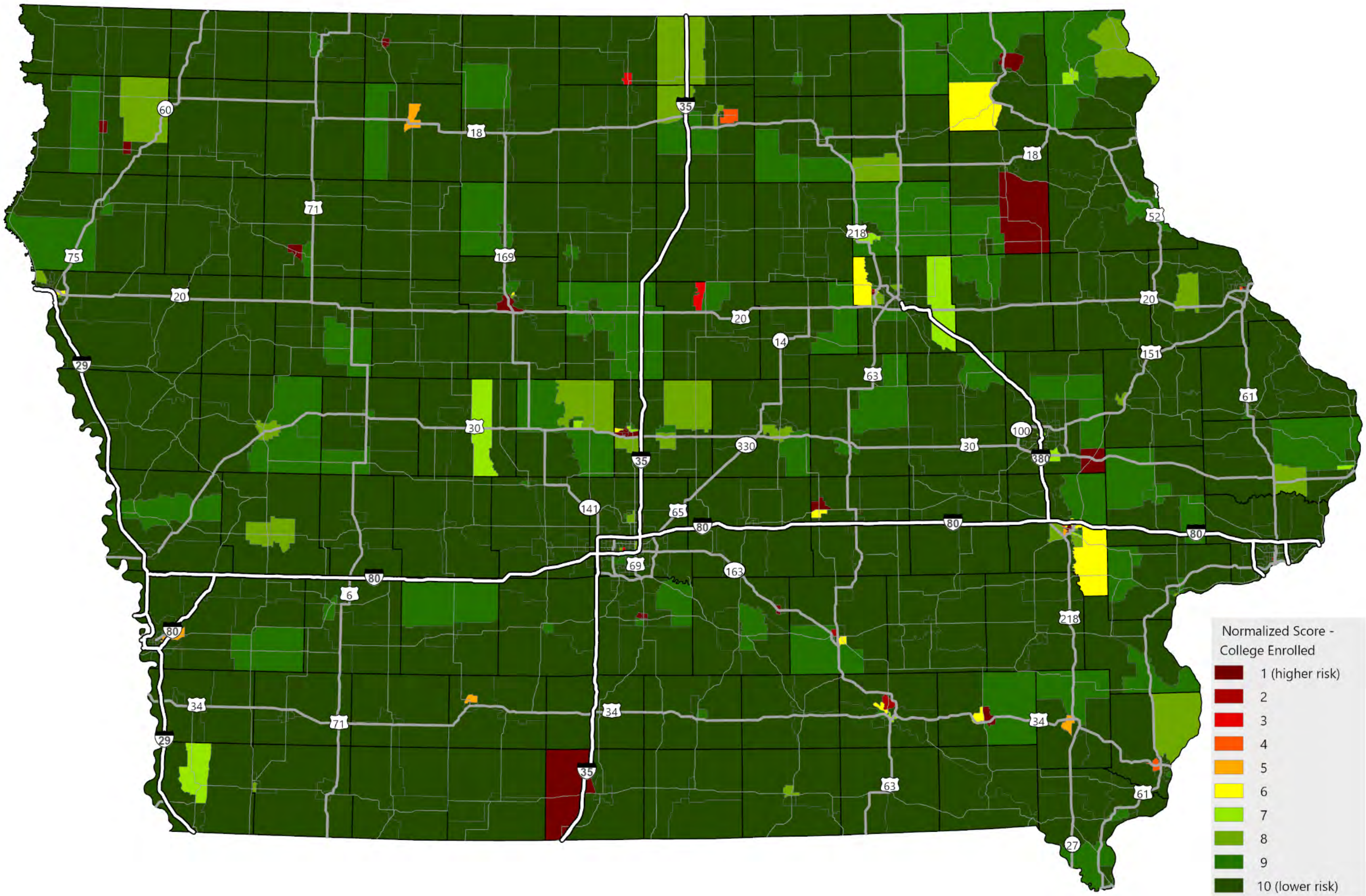
Source: Iowa DOT

Figure A.31: Accessibility/mobility analysis normalized scores for zero vehicle households – urban insets



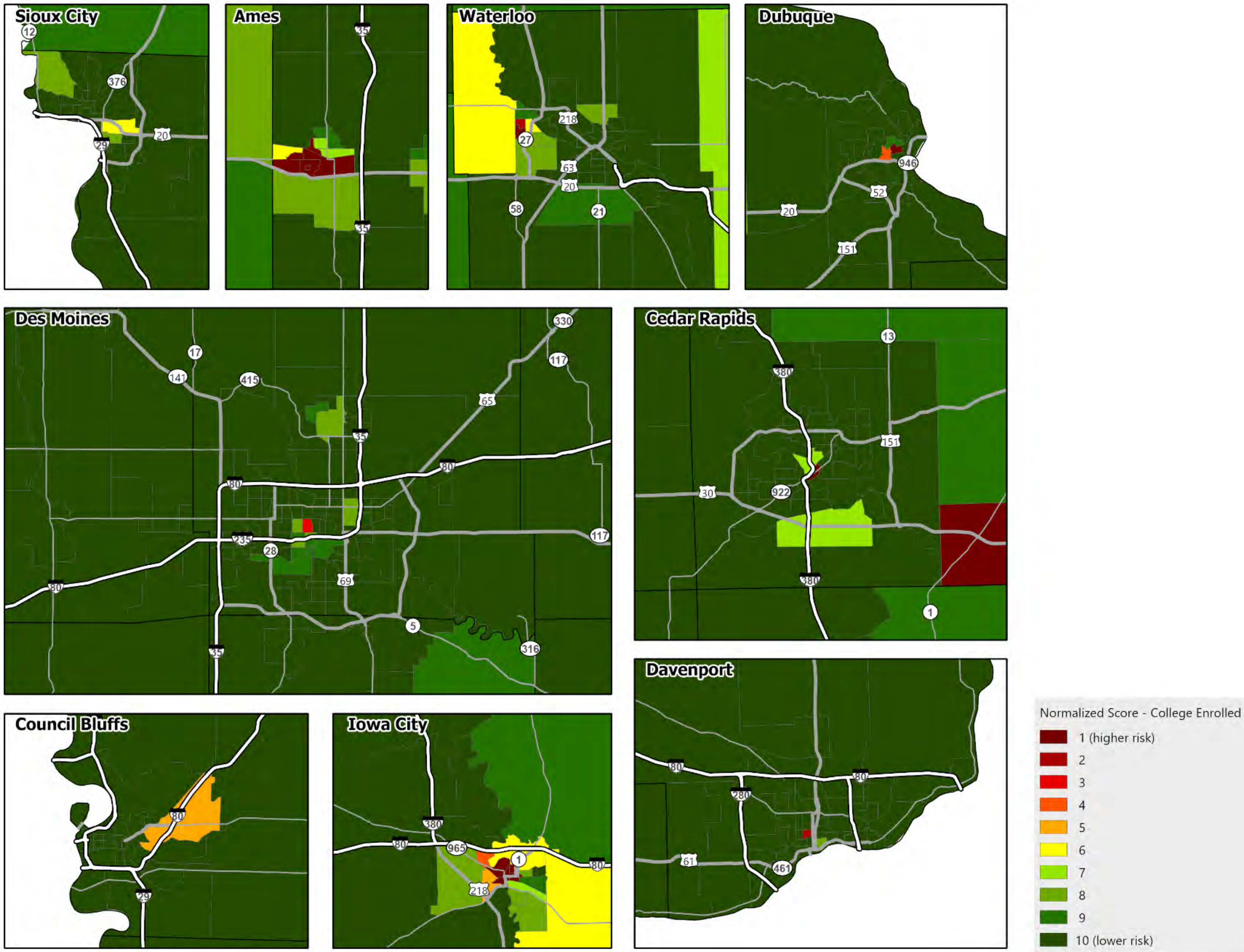
Source: Iowa DOT

Figure A.32: Accessibility/mobility analysis normalized scores for population that is college enrolled – statewide view



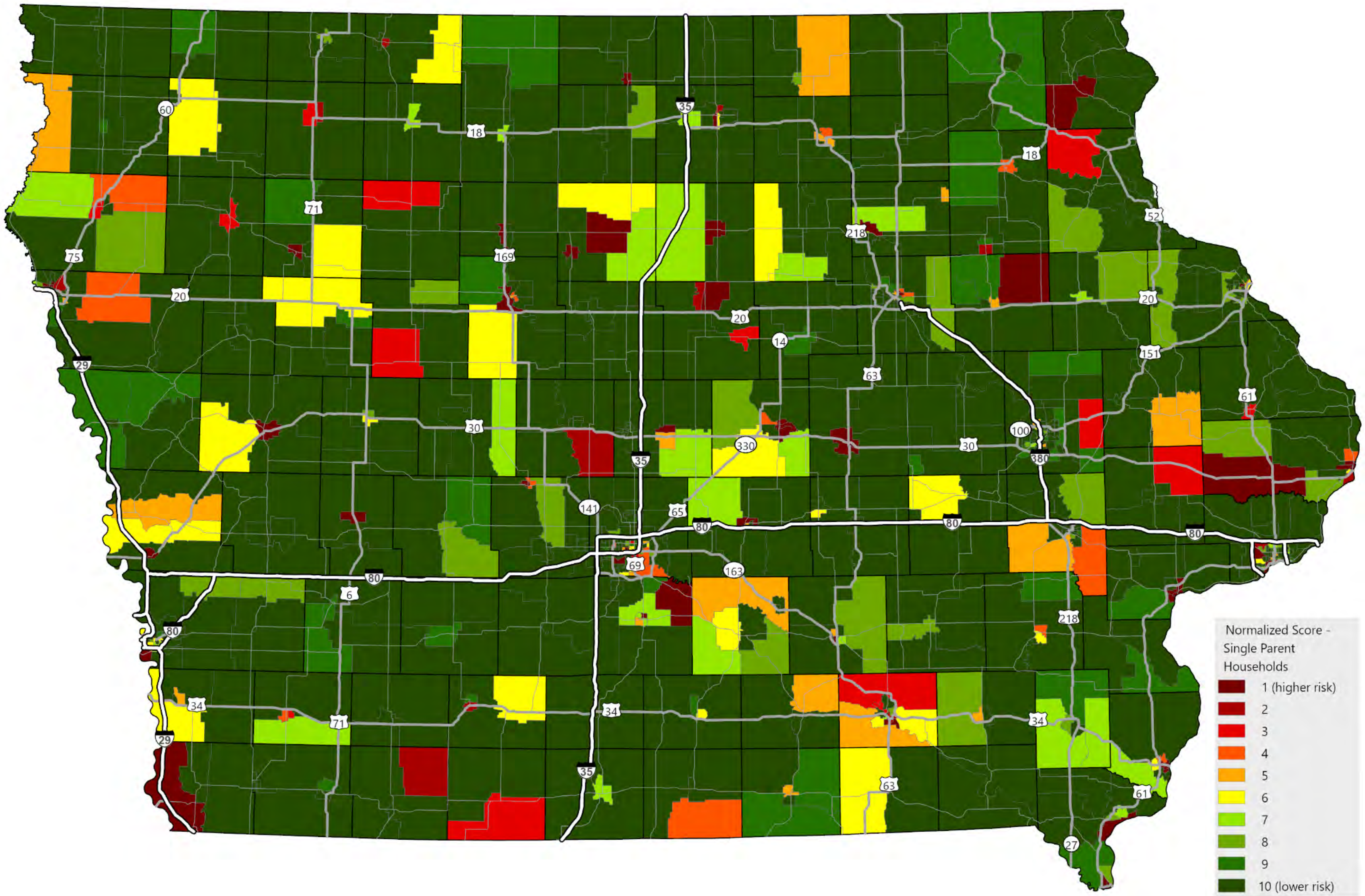
Source: Iowa DOT

Figure A.33: Accessibility/mobility analysis normalized scores for population that is college enrolled – urban insets



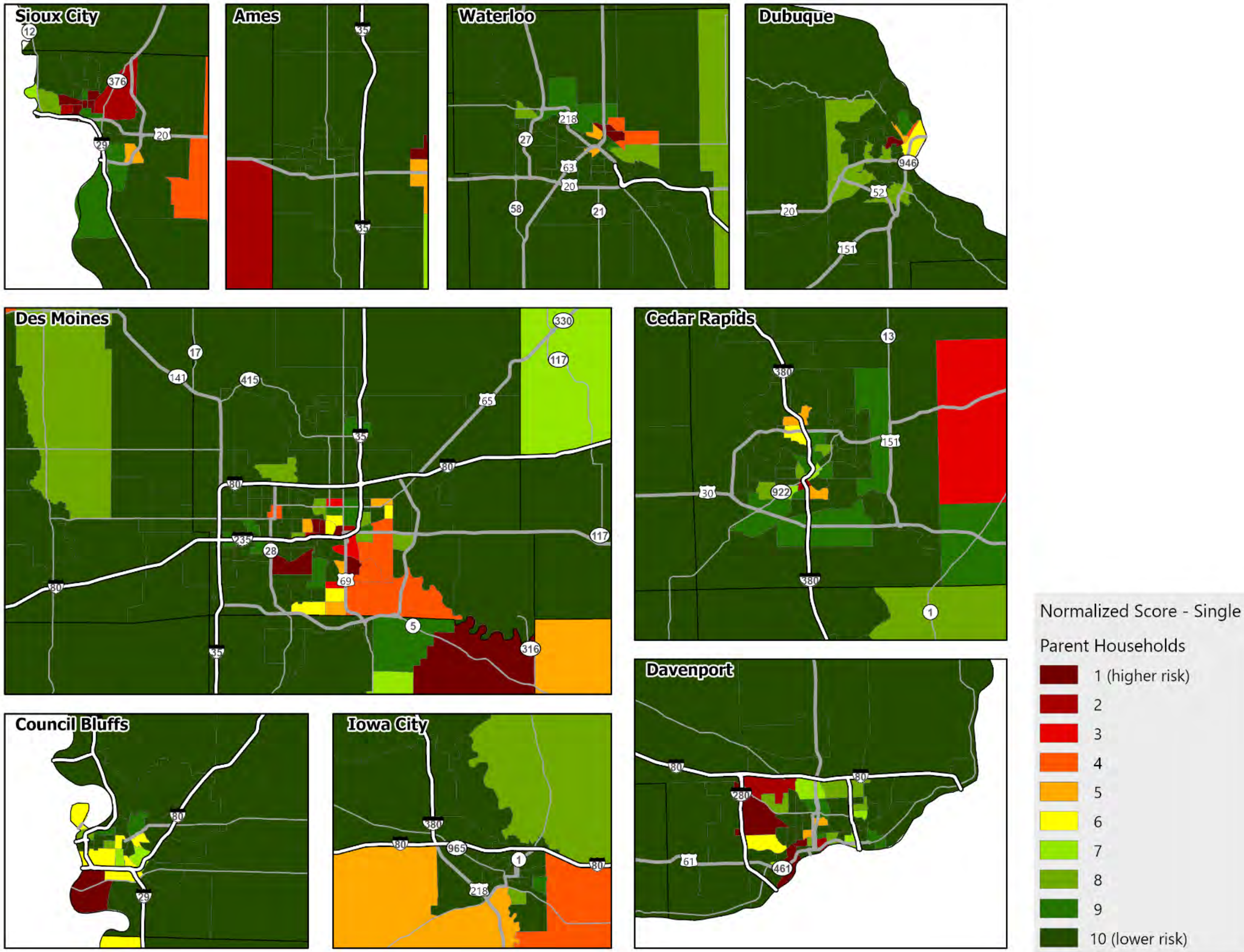
Source: Iowa DOT

Figure A.34: Accessibility/mobility analysis normalized scores for single parent households – statewide view



Source: Iowa DOT

Figure A.35: Accessibility/mobility analysis normalized scores for single parent households – urban insets



Source: Iowa DOT

Appendix 4

Strategies from Other Plans

Chapter 5 included strategies to help achieve the vision for the transportation system and address the needs and risks identified across various modes and the Primary Highway System. The first strategy was to support the implementation of modal and system plans. While the State Long Range Transportation Plan (SLRTP) is the overarching long-range planning document for the department, there are many other modal and system plans that are routinely developed and updated to examine specific issues, needs, strategies, and in some cases, projects. Rather than duplicate the strategies form those plans as part of the SLRTP, they are being incorporated here by reference. Strategies from the following plans are included in this Appendix.

- 2020-2040 Iowa Aviation System Plan (2021)
- Iowa Bicycle and Pedestrian Long Range Plan (2018)
- Iowa Public Transit 2050 Long Range Plan (2020)
- Iowa State Freight Plan (Draft; 2022)
- Iowa State Rail Plan (2021)
- 2019-2023 Iowa Strategic Highway Safety Plan (2019)
- 2019-2028 Transportation Asset Management Plan (2019)
- Transportation Systems Management and Operations Plan Update (Draft; 2022)
- Carbon Reduction Strategy (2024)
- Resilience Improvement Plan (2024)
- Transportation 4.0: Innovative strategies for the transportation revolution (2023)

Most of these plans are updated on a regular cycle, and many of them will be updated prior to the next iteration of the SLRTP. There is a symbiotic relationship between these plans and the SLRTP, as noted in Figure 1.3. Also, while these are the major modal, system, and specialized plans the department produces, they are not an exhaustive list of Iowa DOT plans that are shaped by the direction provided in the SLRTP or that guide activities that help implement the system vision included in the SLRTP.

2020-2040 Iowa Aviation System Plan (2021)

The Iowa Aviation System Plan 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 next 20 years. Federal, state and local decision makers use the plan as a guide for future investment and activity decisions to maintain and develop, as necessary, airports in the state of Iowa. The plan is available at https://iowadot.gov/aviation/studiesreports/systemplanreports.

Strategies

Vertical infrastructure

Support continued vertical infrastructure improvements by maintaining existing funding and identify additional funding sources for maintaining and improving terminal buildings and hangar infrastructure. Maintain coordination with airport sponsors regarding terminal building and hangar existing conditions and future need.

Airport Attendance

Encourage attendance at Enhanced and General Service airports. Identify an airport contact at Basic and Local Service airports without after-hours arrangements, or that are unattended or maintain irregular hours.

Planning Measures

Continue supporting the development and implementation of zoning ordinances and land use plans that protect Iowa airports.

Security and Fencing

Prioritize airfield fencing for security and wildlife with 8-foot perimeter fencing at all Commercial and Enhanced Service airports. If an airport is planning to update or replace fencing, encourage 8-foot height.

24/7 Restroom Access

Incorporate 24/7 airside access to a restroom via a keypad. Many airports already have a restroom but lack the keypad technology required to make the facility fully accessible 24/7. Consider agreements with private operators if improvements at terminal buildings or other public facilities are not viable.

Aircraft Services

Continue to support aviation services at system airports that will promote a strong aviation system including maintenance, flight instruction and aircraft rental services.

Entryway and Parking Conditions

Encourage signage and adequate entrances and parking facilities.

Environmental Sustainability

Encourage integration of environmentally sustainable practices into capital improvements and airport operations throughout the Iowa system.

Pavement Maintenance

Encourage improved routine pavement maintenance practices and educate airport officials on the benefits of pavement maintenance and the existing PCI program.

Iowa Bicycle and Pedestrian Long Range Plan (2018)

This plan serves as the primary guide for Iowa DOT decision-making regarding bicycle and pedestrian programs and facilities. The planning process involved stakeholder input through policy and technical steering committees; public meetings and input opportunities; an existing conditions assessment; bicycle and pedestrian facility recommendations; and development of funding and implementation strategies. One of the most significant components of the plan is its Complete Streets Policy. This policy requires the consideration of accommodations for all users on all Primary Highway System projects, and requires the provision of appropriate bicycle and pedestrian facilities on Iowa DOT projects. The plan is available at https://iowadot.gov/iowainmotion/Modal-Plans/Bicycle-Pedestrian-Plan.

Strategies

Short-term implementation actions

- Implement the Complete Streets Policy.
- Modify Iowa DOT's project scoping process in accordance with the Complete Streets Policy.
- Modify the Design Manual to uniformly comply with the latest version of national standards and best practices (American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities, AASHTO Pedestrian Guide, and National Association of City Transportation Officials (NACTO) Urban Street Design Guide).
- Modify the Bridge Design Manual to uniformly comply with the latest version of national standards and best practices (AASHTO Guide for the Development of Bicycle Facilities and NACTO Urban Street Design Guide).
- Encourage modifications to Iowa Statewide Urban Design and Specifications (SUDAS) to uniformly comply with the latest version of national standards and best practices (AASHTO Guide for the Development of Bicycle Facilities, NACTO Urban Bikeway Design Guide, NACTO Urban Street Design Guide).
- Develop Complete Streets training for Iowa DOT staff as well as interested local and regional staff.
- Hold accessibility workshops designed to train local officials, agency staff, and professional engineers to effectively meet accessibility requirements on state, county, and local road projects.
- Designate one licensed engineer in the Iowa DOT Central Office to be dedicated to providing technical assistance on bicycle and pedestrian facility design.
- Develop methodology for bicycle and pedestrian safety audits of high crash corridors and intersections to identify adequate countermeasures.
- Incorporate bicycle and pedestrian safety into the Strategic Highway Safety Plan (SHSP) and consider the interrelated impacts of projects funded by the Highway Safety Improvement Program (HSIP).
- Enhance law enforcement curriculum for bicycle safety-related training.
- Develop and implement a Bicycle Awareness and Traffic Safety public relations campaign via web, billboards, dynamic message signs, bus advertisements, and other media.
- Support safety and skills training courses annually for adults and youth.
- Identify the primary urban and rural crash types occurring in Iowa and develop strategies for reducing crashes.
- Review road project prioritization criteria to consider the project's potential benefits to bicycling and walking.
- Develop clear and consistent criteria to prioritize funding for stand-alone bicycle and pedestrian projects, consistent with the Complete Streets Policy.
- Apply for US Bicycle Route (BR) Designation for USBR 36, 40, 44, 51, and 55 (applications submitted to AASHTO).

Mid-term actions

- Encourage and work with cities, counties, and metropolitan planning organizations (MPOs) and regional planning affiliations (RPAs) across the state to adopt Complete Streets policies using the Iowa DOT's Complete Streets Policy as a model.
- Support MPOs and RPAs in the development and adoption of bicycle and pedestrian plans that are coordinated with the statewide Long-Range Plan.
- Identify barriers and gaps in the state highway system for bicycling and walking that will not be corrected by planned reconstruction/3R activities and develop alternatives for providing adequate interim connections, especially in cities and metro areas.
- Explore options for increasing the amount of dedicated funding allocated to bicycle and pedestrian projects and programs.
- Develop and implement statewide maintenance and work zone guidelines to address bicyclist and pedestrian needs. These guidelines should be adaptable to city, county, and Iowa DOT maintenance and work zone responsibilities.
- Work with transit agencies across the state to provide bike racks on all compatible buses. This may include identifying a funding source for this relatively inexpensive action and/or developing product and operational guidelines to assist agencies with implementation.
- Develop encouragement programs and events to get more people walking and bicycling. This includes designing safety and how-to materials, training courses, maps, and other education efforts that espouse the health, safety, environmental, and economic benefits of biking and walking.
- Recommend a safe passing law that requires drivers to change lanes when passing another vehicle (including cars, bicycles, agricultural equipment, construction equipment, etc.).
- Recommend a vulnerable road user law that increases penalties beyond the current penalties for a motorist that injures or kills a bicyclist, pedestrian, construction worker, law enforcement officer, or any other vulnerable roadway user.
- Continually revisit driver's education curriculum to include the rights of bicyclists and pedestrians, as well as current and future vulnerable road user laws (subsequent to adoption of new laws).
- Annually or biennially recalculate the On-Road Bicycle Compatibility Rating for all rural and metro area periphery paved roads in order to identify segments with poor conditions for biking. Coordinate gap elimination efforts with opportunities in upcoming projects.
- Update the Bicycle and Pedestrian Long-Range Plan in 5 to 10 years.

Long-term actions

- Implement current plans for the US Bicycle Route and National Trails systems (which include the Mississippi River Trail, American Discovery Trail, and Lewis & Clark Trail). Revisit these plans every 5 to 10 years until each segment is completely implemented.
- Implement the Statewide Trails Vision plan discussed in Chapter 5 of the Bicycle and Pedestrian Long-Range Plan in an opportunity-based manner. This means constructing trails along the vision plan's alignment as right-of-way and funds become available. While the Iowa DOT has a role in providing funding for this purpose, implementation will primarily be the responsibility of cities, counties, MPOs/RPAs, the Department of Natural Resources, and nonprofit groups.
- Encourage every unit of government in Iowa that has jurisdiction of streets and roads to adopt a Complete Streets policy in order to accommodate bicyclists and pedestrians across the state.
- Continue to identify barriers and gaps in the state highway system for bicycling and walking that have not been corrected by reconstruction/3R activities and develop alternatives for providing adequate interim connections, especially in cities and metro areas.
- Continue to analyze crash data and develop strategies for increasing road safety for all users.
- Continue to expand education and encouragement programs to teach safe bicycling skills, educate road users on the rights and responsibilities of bicyclists and pedestrians, and encourage more people to ride and walk (since greater numbers of people biking has an inverse correlation with bicyclist crash rates).

Iowa Public Transit 2050 Long Range Plan (2020)

This comprehensive system plan reviewed trends in demographics and passenger transportation usage, forecasted future needs for the public transit system, and developed strategies to improve the public transit system in Iowa. The plan is available at https://iowadot.gov/iowainmotion/Modal-Plans/Public-Transit-Plan.

Strategies

Goal Area 1: Service

- Examine the effects of offering fare-free statewide bus service.
- Examine bus service hours for people who work nights and weekends.
- Prioritize funding applications for communities that improve transit service or access.
- Examine the effects of creating more urban transit services in areas that are currently covered by regional transit services.
- Continue existing services and establish new inter-regional services along commuter routes (such as Interstate 380 between Cedar Rapids and Iowa City, Interstate 35 between Ames and Des Moines, and Interstate 74 between Davenport and Illinois).
- Start a subscription price service that works across all bus services in Iowa and includes bikes, scooter sharing, and parking facilities.
- Enable all buses and transit agencies in the state to accept digital fares or electronic payment formats, while still allowing for cash payments.
- Improve accessibility of all transit information, service notifications, and bus route information to ensure they are easy to understand for older adults, multilingual riders, and riders with audio, visual, or cognitive impairments.
- Establish standardized data collection and reporting requirements to better understand ridership.
- Study how to most effectively implement intercity transit bus systems in Iowa.
- Study and define a statewide minimum level of essential transit service necessary to meet critical needs, particularly in the event of severe and sustained disruptions to demand or service.

Goal Area 2: Partnering

- Improve bus transfers between regions and counties in order to support longer and more efficient trips across the state.
- Partner with companies (such as taxis, Uber, Lyft) in order to support city bus routes and provide more transportation options.
- Improve workforce development by partnering with businesses to help employees get to work.
- Partner with non-profit organizations (such as American Cancer Society, Veteran's Affairs, and hospitals) to help people get to their medical appointments on time.
- Partner with other government organizations to increase the number of transportation options for traveling long distances.
- Work with businesses to create transportation options for their employees by offering subsides, bus passes, or incentives such as tax breaks.
- Improve sidewalks and connecting infrastructure by working with state agencies, local government, and private organizations to improve access to bus stops and transit services.

Goal Area 3: Facility, Fleet, and Personnel

- Develop a rightsizing strategy for transit agency bus fleets to decrease costs and better match vehicle sizes to the number of people taking the bus.
- Decrease fuel costs for transit agencies by adopting electric, hybrid, or flex-fuel efficient vehicles.
- Prioritize transit facilities that are evaluated as being in marginal or poor condition for reconstruction or repair.
- Save costs by encouraging transit agencies and local governments to share facilities and staff.
- Address the bus driver shortage by targeting non-traditional candidates to expand the pool of potential applicants.
- Increase training for bus drivers to better serve mobility, hearing or visually impaired riders, children, older adults, immigrant, and refugee populations.
- Identify minimum technology needs for all transit agencies and develop a technology implementation plan.
- Update the Park and Ride System Plan to determine ideal locations for carpooling and ridesharing to support commuting activities.
- Improve the coordination of transportation services between transit agencies and other transportation providers by promoting and hiring mobility manager positions to provide statewide coverage.

Goal Area 4: Funding

- Decrease maintenance costs by focusing resources on replacing transit vehicles that are beyond their useful life.
- Examine alternative ways of funding public transit that do not rely only on existing federal and state sources.
- Conduct a benefit-cost analysis or economic impact study of transit services and projects in order to measure the impact and overall benefit to social welfare.

Iowa State Freight Plan (2022)

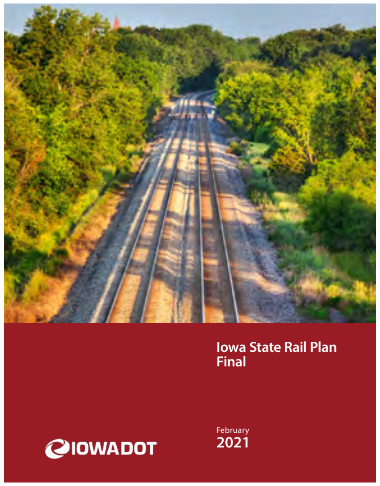
This plan weaves together Iowa DOT's freight planning activities to help achieve the goal of optimal freight transportation in the state. Additionally, the plan guides Iowa DOT's investment decisions to maintain and improve the freight transportation system. The plan is available at

https://iowadot.gov/iowainmotion/Specialized-System-plans/2022-State-Freight-Plan

Strategies

1. Explore additional sustainable funding sources to increase investment in the freight transportation system.
2. Support the development and adoption of emerging freight technologies to increase safety and efficiency.
3. Partner with freight stakeholders to find innovative ways to address labor shortages across industry sectors.
4. Advance a 21st century Farm-to-Market System that moves products seamlessly across road, rail, and water to global marketplaces.
5. Streamline and align freight-related regulations and minimize unintended consequences.
6. Explore opportunities for increasing value-added production within the state.
7. Improve freight transportation system resiliency.
8. Collaborate with railroad operators to provide Iowa companies with increased access and capacity to accommodate additional Iowa freight shipments.
9. Support opportunities to develop new intermodal freight facilities in the state.
10. Target investment to address mobility issues that impact freight movements.
11. Continually monitor international trade deals and negotiations.
12. Advocate for the funding and improvement of the inland waterway system and explore ways to expand Iowa's role.
13. Optimize the availability and use of freight shipping containers, including exploring other options for repositioning empty containers.
14. Partner with law enforcement and the trucking industry to combat human trafficking.
15. Mitigate the impacts of freight transportation on the environment and communities.
16. Target investment in the Iowa Multimodal Freight Network (IMFN) at a level that reflects the importance of this system for moving freight.
17. Rightsize the highway system and apply cost-effective solutions to locations with existing and anticipated issues.
18. Enhance planning and asset management practices for the IMFN by utilizing designs and treatments that are compatible with significant freight movements.
19. Work with partners to address increasing truck parking demand.

Iowa State Rail Plan (2021)



The State Rail Plan is intended to guide the Iowa DOT in its activities of promoting access to rail transportation, helping to improve the freight railroad transportation system, expanding passenger rail service, and promoting improved safety both on the rail system and where the rail system interacts with people and other transportation modes. The plan is available at https://iowadot.gov/iowainmotion/Modal-Plans/Rail-Transportation-Plan.

Strategies

- Increase the movement of goods by rail and emphasize rail-related intermodal, transloading, and other rail improvements to ensure a diverse and robust rail network and multimodal connectivity, while maintaining economic competitiveness and community and environmental stewardship.
- Continue efforts to preserve strategic rail rights-of-way and support the development of rail spurs, intermodal and transload facilities, and other infrastructure projects required to maintain a state of good repair, enhance efficiency, and bolster economic development through support for the establishment of additional federal and state public rail assistance programs.
- Continue to promote and enhance rail safety through continued safety education programs, additional coordination with the state's railroads, and enhancements to the public grade crossing improvement programs and state track inspection program.
- Expand rail-related data collection efforts including data on hazardous material movements, grade crossing hazards, rail volume and commodity flows, and rail freight originating/terminating data.
- Preserve, protect, improve, and expand, as necessary, intercity passenger rail service through station facility and access improvements; and continue to study implementation of additional intercity passenger services and commuter rail services where transportation and other public benefits merit.
- Enable strategic and prioritized investments in passenger / freight rail to optimize positive economic impacts.
- Further collaborate with neighboring states on regional issues and solutions to freight and passenger rail needs through regional multi-state coordination.

2019-2023 Iowa Strategic Highway Safety Plan (2019)

The Strategic Highway Safety Plan (SHSP) is a statewide-coordinated safety plan that provides a comprehensive framework for reducing highway fatalities and serious injuries on all public roads. The SHSP establishes statewide goals, objectives and key emphasis areas developed in consultation with federal, state, local and private sector safety stakeholders. The plan is available at https://iowadot.gov/traffic/shsp/home.

Strategies

Lane departures and roadside collisions

- Enforcement: Evaluate high lane departure crash corridors for two-lane highways and deploy road safety audit (RSA) teams to evaluate.
- Engineering: Evaluate high-friction surface treatments (HFST) at targeted locations on state-owned and local systems.
- Engineering: Place centerline and/or shoulder rumble strips on rural two-lane highways on state-owned and local systems. Where necessary, install or widen paved shoulders.
- Engineering: Continue median cable barrier installations on the Interstate system. Initiate median cable barrier installations on multi-lane divided highways.
- Everyone: Focus on the road, don't over-correct or veer for objects or animals in the roadway.

Speed-related

- Education: Educate drivers on the importance of controlling and managing vehicle speed.
- Enforcement: Identify corridors with a high frequency of speed-related crashes and implement high-visibility enforcement campaigns.
- Engineering: Evaluate and implement signing and geometric design strategies to moderate speeds and enhance safety.
- Engineering: Implement speed feedback signs at targeted locations.
- Everyone: Give yourself enough time to reach your destination. Be patient, slow down, and don't engage with aggressive drivers.

Unprotected persons

- Education: Conduct public awareness campaigns focused on generating awareness of the risks associated with unprotected persons.
- Emergency medical services (EMS): Include medical professionals in educational efforts.
- Enforcement: Conduct highly publicized enforcement campaigns focused on restraint use.
- Everyone: Buckle up everyone and every time.

Young drivers

- Education: Improve content and delivery of driver education curriculum.
- Education: Continue educating young drivers in school-based settings using various training techniques, including those that simulate impairment.
- Education: Support a broad-based coalition to plan for addressing age-based transportation needs.
- Everyone: Support young drivers to avoid distractions and impairment.

Intersections

- Education: Develop educational resources informing the public of alternative intersection types, traffic signals, and laws.
- Enforcement: Conduct enforcement campaigns related to bicycle and pedestrian awareness at targeted intersections.
- Engineering: Use systemic approaches to improve visibility and awareness of intersections.
- Engineering: Implement alternative intersection designs that reduce conflict points and enhance safety and mobility.
- Engineering: Develop an intersection configuration/evaluation tool to aid planners and designers in selecting appropriate intersection types.
- Everyone: Approach intersections with caution and get familiar with new designs in your community.

Impairment involved

- Education: Educate drivers on the different types of impairments and their effects on driving.
- EMS: Employ screening and brief interventions in healthcare settings.
- Enforcement: Support trainings for 60 new drug recognition expert (DRE) officers and 500 new advanced roadside impaired driving enforcement (ARIDE) officers.
- Enforcement: Develop and implement a standardized approach for law enforcement to identify impaired drivers.
- Enforcement: Expand 24/7 program, place of last drink program, and ignition interlock program.
- Enforcement: Enhance detection through special OWI patrols and related traffic enforcement.
- Engineering: Implement countermeasures at access locations to reduce wrong-way driving on multi-lane divided highways.
- Everyone: Designate a driver, call a cab, but don’t risk driving impaired.

Older drivers

- Education: Support a broad-based coalition to plan for addressing age-based transportation needs.
- Education: Provide educational and training opportunities for mature drivers that address driver safety, road engineering and signage, vehicle technology, driver licensing, health and vision concerns, and alternative transportation options.
- Education: Update publications and web resources for older drivers and their families to include safety strategies, warning signs, and planning for driving retirement.
- EMS: Update procedures for assessing medical fitness to drive.
- Everyone: Know when to put the keys down, or when to have a conversation with family members who may pose a hazard to others on the road.

Distracted or inattentive drivers

- Education: Develop targeted interventions and education programs for high-risk populations.
- Enforcement: Support high-visibility enforcement campaigns for hands-free cell phone law.
- Everyone: Put the cell phone down, avoid distractions, be alert, and focus on the roadway.

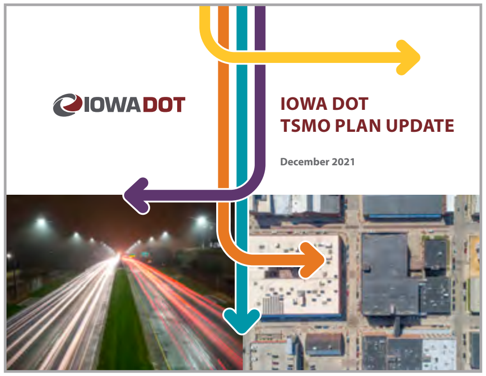
2019-2028 Transportation Asset Management Plan (2019)

The Transportation Asset Management Plan (TAMP) is required for pavements and bridges on the National Highway System; Iowa's TAMP describes these as well as how the Iowa DOT manages the existing Primary Highway System. It includes the following information: asset inventory and condition data; life cycle planning; performance measures and gap analysis; risk analysis; financial plan; and process improvements. The plan is available at https://iowadot.gov/systems_planning/fpmam/IowaDOT-TAMP-2019.pdf

Strategies

- Address asset management (AM) in the statewide transportation plan.
- Continue to advance the interstate capacity improvement projects
- Develop corridor plans that identify how AM and capacity improvement projects will be coordinated.
- Evaluate the highway system, and identify priority rural assets that should take precedence if AM funding decreases.
- Implement a formal communication plan that defines who to communicate with, what to communicate to them, and how to communicate to them.
- Continue efforts to educate the Iowa Transportation Commission about AM.
- Continue to implement data collection and analytics enhancements.
- Develop a plan for data and system coordination and integration.
- Continue to form and institutionalize the Asset Management Governance Structure.
- Develop an AM staffing plan, and include contingency plans in case staffing levels decrease. Examples include reallocating staff or exploring contracting alternatives.
- Develop an AM training plan.

Iowa DOT Transportation Systems Management and Operations Plan Update (Draft; 2022)



The purpose of Iowa DOT's Transportation Systems Management and Operations (TSMO) Plan is to improve the performance of Iowa's transportation system. TSMO uses and improves upon infrastructure, processes, technology, and other components of the system that Iowa already has and takes a proactive role in system management. The plan will be available at https://iowadot.gov/tsmo/.

Strategies

Collaboration

- Integrate TSMO into Multi-Disciplinary Safety Team (MDST) meetings
- Enhance multi-disciplinary/multiagency TSMO training and capacity building
- Integrate TSMO into Metropolitan Planning Organization (MPO) and Regional Planning Affiliation (RPA) plans
- Enhance joint traffic operations performance agreements
- Enhance TSMO communication with local organizations
- Establish TSMO policy stakeholder group with external partners
- Develop and maintain open contracts clearinghouse

Performance measurement

- Develop operations-oriented resiliency index
- Develop benefit/cost estimates for key TSMO applications
- Increase frequency of performance reporting

Culture

- Add access management to TSMO processes
- Add maintenance operations to TSMO processes
- Share TSMO and Intelligent Transportation System (ITS) benefits within and beyond the Iowa DOT
- Integrate TSMO into existing Iowa DOT meetings

Systems and technology

- Improve traveler info for transit and rideshare
- Improve connectivity and interoperability between state and locally managed systems
- Establish ITS configuration control board
- Establish systems engineering guidelines and repository
- Develop approaches to better leverage operations data
- Implement Integrated Corridor Management (ICM) concepts
- Expand statewide video sharing strategy

Business processes

- Integrate TSMO into Iowa DOT policies and guidance
- Integrate TSMO deployment planning and the Five-Year Transportation Improvement Program
- Develop district-level TSMO plans
- Ensure adequate access to funding for TSMO projects through existing and/or new budget categories
- Streamline TSMO procurement processes
- Establish innovative funding team

Organization and staffing

- Increase direct Iowa DOT staffing in Traffic Management Center
- Develop a TSMO training rotation program
- Conduct Systems Operations Division staffing assessment
- Enhance geographic information systems (GIS) capabilities and resources to support Operations

Iowa Carbon Reduction Strategy (2024)

The 2021 Infrastructure Investment and Jobs Act (IIJA) included the requirement for each state to develop a Carbon Reduction Strategy (CRS). Iowa's CRS was developed in consultation with the state's Metropolitan Planning Organizations (MPOs) and synthesized strategies and initiatives from across the state into a cohesive statewide strategy for reducing transportation emissions. The CRS is available at https://iowadot.gov/iowainmotion/Long-Range-Transportation-Plans/2022-State-Transportation-Plan.

Strategies

Multimodal Transportation

Objective: Support multimodal travel options that enable people to travel by less carbon-intensive modes than single-occupant vehicles.

- Invest in projects related to public transit fleets, facilities, infrastructure, services, and communications to reduce emissions directly through more efficient vehicles and facilities and indirectly through expanding service, access, intermodal connections, and education to increase the utilization of public transit.
- Invest in projects related to bicyclists and pedestrians, including constructing on- and off-road facilities, enhancing bicycle and pedestrian networks, creating intermodal connections, and facilitating education and encouragement activities to reduce emissions through increased utilization of bicycling and walking.
- Adopt and implement Complete Streets policies to ensure roadways serve all users, not just motorists.
- Support alternatives that reduce the number of single-occupant vehicles on the road, such as carpooling and vanpooling, as well as shared mobility and micromobility options such as mobility hubs and shared fleets of cars, bikes, and scooters.
- Support passenger and commuter rail planning and development efforts, including intermodal connections for existing and potential service.

Operational Efficiency

Objective: Reduce emissions by improving the efficiency of transportation system operations through strategies that improve flow and reliability by reducing congestion and managing demand rather than the construction of new capacity.

- Use Transportation Systems Management and Operations (TSMO) strategies to monitor and manage the transportation system by utilizing equipment, technology, and infrastructure improvements to improve traffic flow and reduce delays from recurring and non-recurring congestion.
- Maintain the transportation system in a state of good repair to prevent or mitigate congestion and bottlenecks through infrastructure improvements.
- Utilize and promote Travel Demand Management (TDM) strategies that shift trips to less carbon intensive modes, increase vehicle occupancy rates, or reduce demand, especially during peak hours.

Alternative Fuels

Objective: Reduce emissions by utilizing and supporting alternative and renewable fuel vehicles across modes, particularly cars, commercial vehicles, and transit vehicles.

- Invest in alternative and renewable fuel infrastructure that supports low or no emission vehicles.
- Transition to low or no emission vehicles, such as hybrid or electric vehicles or vehicles that utilize alternative and renewable fuels.
- Coordinate with governmental agencies, utilities, industry partners, and other stakeholders to advance efforts such as reducing the carbon intensity of fuels, increasing the fuel efficiency of vehicles, encouraging the use of lower emission fuels and vehicles, encouraging the use of alternative and renewable fuel vehicles, and ensuring the necessary utility and fueling infrastructure is in place.

Construction

Objective: Reduce emissions during the design, construction, operation, and maintenance of the transportation system.

- Incorporate sustainable elements or construction practices that utilize lower carbon materials or support carbon reduction into infrastructure design.
- Utilize transportation right-of-way for cross-sector purposes, such as renewable energy infrastructure or generation.
- Reduce carbon impacts during construction projects by utilizing alternative modes, implementing operational strategies, and staging projects to minimize emissions from traffic delays and vehicle miles traveled.

Other

Objective: Consider other methods to reduce transportation emissions, either directly or through coordination with other entities.

- Integrate transportation and land use planning across jurisdictions to ensure that multimodal options are accessible, safe, and efficient modes to utilize for transportation.
- Improve freight efficiency through infrastructure improvements that facilitate the use of less carbon intensive modes, such as developing intermodal connections and upgrading rail and water infrastructure.
- Explore other projects or programs that could help reduce carbon emissions, potentially including carbon sequestration, carbon trading programs, or offsetting carbon emissions.

Iowa Resilience Improvement Plan (2024)

The 2021 IIJA included the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program, which provides states the option to develop a Resilience Improvement Plan (RIP). The Resiliency Working Group oversaw the development of Iowa's first RIP in 2023. The RIP addresses surface transportation resilience to current and future weather events and natural disasters, and includes a toolbox of strategies, countermeasures, and research initiatives to help mitigate these hazards. The RIP is available at https://iowadot.gov/iowainmotion/Specialized-System-plans/Reslience-Improvement-Plan.

Strategies (S), Countermeasures (C), and Research (R)

Flooding

- S1. Approve resiliency policy in the Bridge Design Manual and plan for increased precipitation events, water elevations, and flow.
- S2. Engage internal and external stakeholders regarding watershed management, flood preparation, and emergency protocols.
- S3. Allow more ponding at certain "control" structures.
- S4. Determine critical routes for emergency routing during flood events at known areas of vulnerability.
- S5. Develop a Flood Operations Plan to support in the response of future flood events.
- S6. Proactively stockpile flood fighting material and assets including AquaDam and wrapped revetment bags.
- S7. Partner with the Iowa Department of Homeland Security and Emergency Management (HSEMD) on projects that reduce road damage from flooding and erosion through stream channel improvements.
- S8. Partner with HSEMD and local jurisdictions on comprehensive flood mitigation planning that considers watershed approach or green infrastructure options, then implement planned projects to mitigate flood damage to roads by installing watershed approach practices (e.g. upstream detention), retrofitting bridges, elevating roads, or installing culverts.
- S9. Develop a comprehensive statewide flood mitigation strategy that considers flood buy-outs, watershed approach flood mitigation, levees, and other solutions and outlines where, and under what, conditions these different strategies are best applied.
- S10. Evaluate key locations to increase waterway capability including widening upstream bench and channelization of the waterway.
- C1. Roadside and waterway erosion protection – Use engineered (e.g., concrete blocking or Flexamat) or natural (e.g., bio-retention or native planting) materials to control or stop the movement of soil along slopes.
- C2. Native plantings on roadsides – Certain native grasses and plants have deep roots that make them drought-resistant and can reduce soil erosion and flooding.
- C3. Bridge pier scour protection – Bridge scour is the removal of sediment from around bridge abutments. Countermeasures can include concrete armoring, spurs, revetments, wire enclosed riprap, etc.
- C4. Bridge/culvert conveyance improvements – Adequate sizing of bridges and culverts to ensure the proper conveyance of water through the channel and floodplain with the consideration of future increased precipitation.
- C5. Dikes/levees – Embankments of stone, cement, or soil that protect roadways and land during significant rainfalls and flooding.
- C6. Roadway/bridge grade raise – Increasing the elevation grade of a roadway or bridge to reduce overtopping due to flooding conditions.

- C7. Shoulder improvements – Increasing the width or improving the type of shoulder can mitigate the impacts of flowing water across roadways in low-lying areas.
- C8. Median crossover – Add median crossovers at key locations to allow for continued operations during flood events.
- R1. Develop and populate a Riverine Infrastructure Database that supports real time flood flow and levels across Iowa.
- R2. Develop a benefit/cost analysis tool to evaluate cost effectiveness of resilience improvements.
- R3. Research how native plantings can support flood mitigation for Iowa's transportation system.

Winter Storms

- S11. Design roadways that are less prone to blowing/drifting snow and winter drainage issues.
- S12. Plan for operational impacts of significant winter and ice events.
- S13. Plan a winter operations peer exchange or summit with neighboring states to share best practices and coordinate responses.
- S14. Develop internal guidance or policies for pre-staging winter operations assets in advance of storms.
- S15. Proactively remove vegetation along the Primary Highway System that could break during winter or ice storms.
- S16. Consider bridge design methods that mitigate the impact of ice accumulation on bridges and structures.
- S17. Evaluate recruitment strategies for part-time snowplow drivers to fill critical vacancies.
- C9. Snow fencing – Installation of engineered or natural materials that serve as windbreaks from blowing and drifting snow.
- C10. Anti-icing applications – The use of salt and water in precise concentrations known as brine to prevent ice formation on roadways.
- C11. Median crossover – Adding median crossovers at key locations to allow for improved snowplow operations during winter events.
- R4. Research low visibility navigation technology for Iowa's snowplows.
- R5. Continue to research the best material use and products for ice mitigation (melt).

Freeze/Thaw

- S18. Develop methods to better maintain pavement joints during intense freeze/thaw cycles.
- S19. Continue to monitor pavement condition throughout the state and implement asset management techniques to minimize the impacts of freeze and thaw cycles.
- S20. Monitor subdrain performance and placement to ensure proper drainage during freeze and thaw cycles.
- C12. Crack and joint cleaning and sealing – Cleaning and sealing with joint sealer to ensure water does not enter and undermine the integrity of pavement or asphalt during freeze and thaw cycles.
- C13. Improve subgrades and subdrains – Improving subgrades and subdrains in key locations supports the facilitation and movement of excess water away from the roadway and minimizes damage.
- C14. Integral bridge abutments – Integral bridges contain no expansion joints and span monolithically from abutment to abutment. This allows thermal expansion without damage to the structure.
- R6. Research how freeze/thaw cycles have changed and what we can anticipate in the future.

Tornado/Windstorm

- S21. Ensure Iowa DOT owned structures and signs are designed to withstand high wind events.
- S22. Develop internal guidance or policies on clearing or trimming trees that could fall on the roadway.
- S23. Purchase vegetation management equipment specifically for debris removal on the Primary Highway System.
- S24. Develop internal plan to pre-stage Iowa DOT assets in support of debris and vegetation removal following tornados or windstorms.
- S25. Engage with local communities regarding the resources and assets the Iowa DOT possesses to support debris removal and cleanup after significant events.
- C15. Underground utilities – Storage and coordination of utilities underground to ensure continued service during significant tornados and windstorms.
- C16. Solar as primary or backup electrical – Installation of solar arrays for traffic controls or facilities as a primary or backup energy source.
- C17. Generator backup – Purchase of backup generators to provide energy for traffic controls or facilities during major tornados or windstorms.

Hail/Thunderstorms

- S26. Improve roadway design to accommodate increased precipitation events.
- S27. Plan for operational impacts of severe weather and continue to enhance communication of rapid weather changes to the public.

Drought

- S28. Develop regulations or waivers to ease in the transport of water, livestock feed, etc. during drought conditions.
- S29. Coordinate across public and private sectors during times of low water levels to help facilitate shifts of bulk transportation from rivers to railroads or highways.

Excessive Heat

- S30. Consider strategies to reduce the impacts of excessive heat on vulnerable transportation users.
- S31. Consider strategies to mitigate the effects of excessive heat on construction workers.
- S32. Be prepared to address issues such as pavement buckling during heatwaves throughout the state.

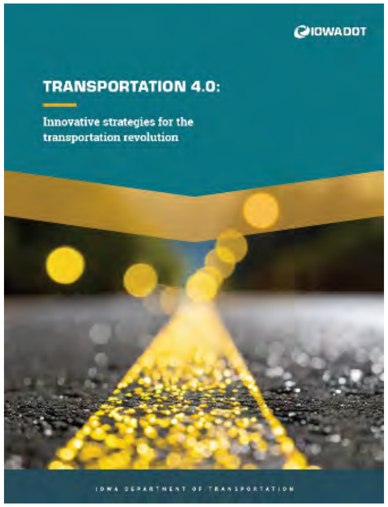
Dam/Levee Failure

- S33. Coordinate with the new Office of Levee Safety within HSEMD to plan for and support the levees throughout Iowa.
- S34. Regularly review traffic incident management plans and detour routing plans around critical assets.

Landslide

- S35. Develop internal guidance for land management practices (e.g., removing bluffs, terracing, etc.) that prevent landslides.
- S36. Stage equipment strategically if conditions such as an area’s topography and recent weather result in an increased likelihood of rockfalls or landslides.

Transportation 4.0: Innovative strategies for the transportation revolution



Following SLRTP adoption, in connection with IEDA, Iowa DOT developed a new statewide strategy supporting economic development called Transportation 4.0. The plan targets manufacturing, agriculture, and bioscience industries and challenges Iowa DOT to implement technologies and strategies that move products and goods to market safer and more efficiently. The plan is available at

https://iowadot.gov/iowainmotion/Long-Range-Transportation-Plans/2022-State-Transportation-Plan.

Strategies

- Advance artificial intelligence, machine learning, data analytics, data science, and economic analysis for transportation planning and operations.
- Continue to advance highway planning and analysis efforts.
- Continue to advance resiliency and sustainability planning and improve freight transportation system resiliency.
- Continue to work with local governments, state agencies, utilities, and other stakeholders to advance energy-related planning efforts and alternative fuel infrastructure improvements in Iowa.
- Support roadway digital infrastructure and seek dual-benefit investments.
- Ensure that the highest and best use of Iowa DOT ROW is considered.
- Enhance planning and asset management practices for the freight network by utilizing designs and treatments that are compatible with significant freight movements, and support superload route identification and enhancement.
- Support the development and adoption of emerging freight technologies to increase safety and efficiency.

Appendix 5

This appendix contains supplemental information for Chapter 6, including existing and potential revenue generating mechanisms as described in the 2021 Road Use Tax Fund (RUTF) Study.

Table A.5: Existing funding 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, 2021): • Gasoline: 30.0 cents per gallon • Ethanol-blended gasoline E10-E14: 30.0 cents per gallon • Ethanol-blended gasoline E15 or higher: 24.0 cents per gallon • Diesel (B10 and lower): 32.5 cents per gallon • Diesel (B11 and higher): 30.4 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 20 percent of large truck travel in Iowa is from out-of-state trucks and 13 percent of passenger car/small truck travel in Iowa is from out-of-state drivers. In total, approximately 8 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 $20.75 million per year.	• Automatically addresses loss of buying power.	• Makes forecasting for programming difficult.	

Type of Financing	Description/Mechanism	Estimated Amount Generated	Advantages	Disadvantages	Collected from out-of-state drivers?
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 $75 million per year	• Brings fee in line with state sales tax rate.		
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 $18 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.
	Mechanism: Increase registration fees by 10 percent.	Approximately $65 million per year			

Source: 2021 Road Use Tax Fund Study

Table A.6: Alternative funding 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 $49 million per year based on 2020 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 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 2020 data, a severance tax of one cent per gallon would have generated $40.5 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

Type of Financing	Description	Advantages	Disadvantages	Collected from out-of-state drivers?
Per-Mile Tax	Tax based on the vehicle miles traveled within a state. Based on the vehicle miles traveled in Iowa in 2019, a one cent per-mile fee would generate $338 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.
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

Type of Financing	Description	Advantages	Disadvantages	Collected from out-of-state drivers?
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.

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

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
Agriculture Bushel Tax	A tax charged on each bushel of agriculture based products. Based on estimated 2020 production levels a $0.01 per bushel tax would generate approximately $28 million.	• 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

Type of Financing	Description	Advantages	Disadvantages	Collected from out-of-state drivers?
Tax on Taxi and Ride Hailing Services	Sales tax or fee levied on taxi or ride hailing services. Iowa currently collects a 6% sales tax on taxi and ride hailing services.	• Clear link exists between these services and system usage. • Collection and administration process already in place. • Paid by all users.	• May be seen as an equity issue.	Yes
	Mechanism: Place revenue generated on taxi and ride hailing services in RUTF. Revenue potential varies.			
Increase Oversize/ Overweight Load Fees	Iowa currently charges fees on vehicles or loads that exceed statutory limits.	• Strong link between vehicle weight and system wear. • Paid by all users.		Yes
	Mechanism: Double Iowa's oversize and overweight fees. Based on 2020 permit information doubling the fees would generate approximately $4.5 million			
Truck Mileage Tax	A tax charged on each mile driven by trucks within a state. Per mile fee can vary according to vehicle weight. Revenue potential varies upon a number of factors including miles traveled and rate schedules.	• Creates new source of sustainable revenues. • Strong link between vehicle weight and system wear.	• Requires enabling legislation. • Subject to high levels of evasion • Administration and collection system would need to be implemented. • Costly to administer for state and companies	Yes

Source: 2021 Road Use Tax Fund Study

2024 Administrative Modification

This administrative modification incorporates by reference three implementation activities that have occurred since the adoption of the 2022 SLRTP. These activities were developed from the Iowa DOT Strategic Plan and programs in the 2021 Infrastructure Investment and Jobs Act and help implement strategies in the SLRTP. The plans being incorporated into the SLRTP are the Carbon Reduction Strategy, Resilience Improvement Plan, and Transportation 4.0: Innovative strategies for the transportation revolution.

Changes made to the 2022 SLRTP to incorporate these plans include the following.

- Discussion of Transportation 4.0 in the Economic Vitality portion of Section 4.3.
- Discussion of the Resilience Improvement Plan and Carbon Reduction Strategy in the Resiliency and Sustainability portion of Section 4.3.
- The inclusion of the three plans under Strategy 1 in Section 5.4.
- The inclusion of the three plans' strategies in Appendix 4.

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MM951 04/11/2024