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:

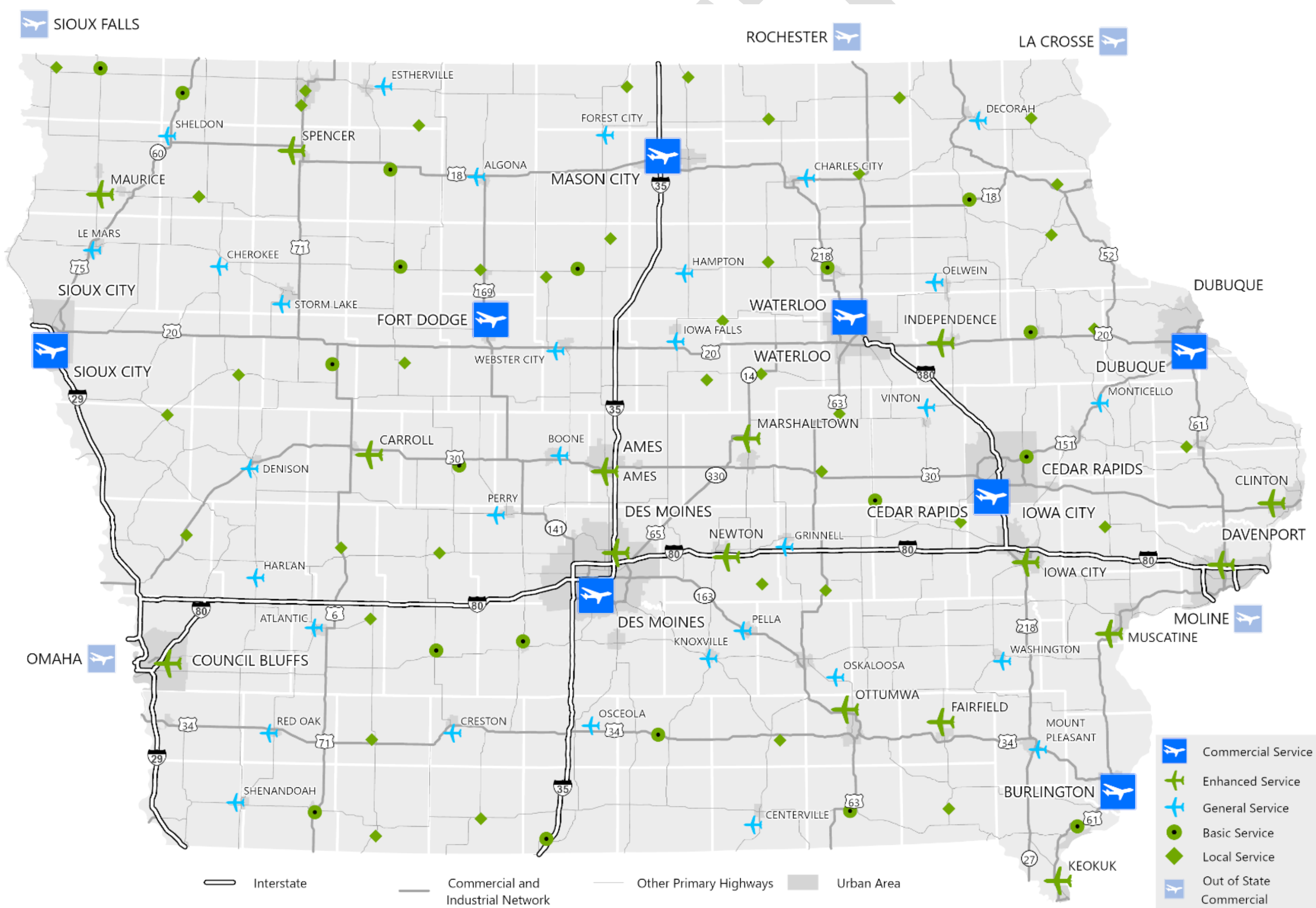
- Administering state and federal aviation funding programs
- Managing the Iowa aircraft registration program
- Inspecting and certifying all public use airports
- Statewide aviation weather reporting
- Communications, outreach, and educational activities
- Aviation system planning, data collection,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

Photo of mode

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



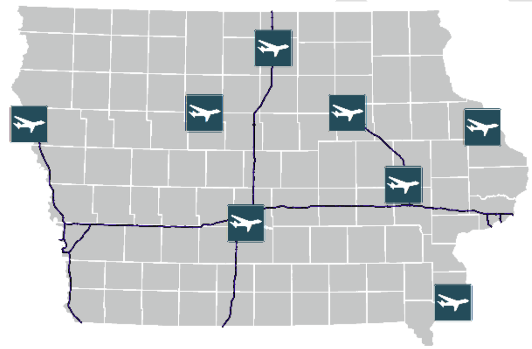
Source: Iowa DOT

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.

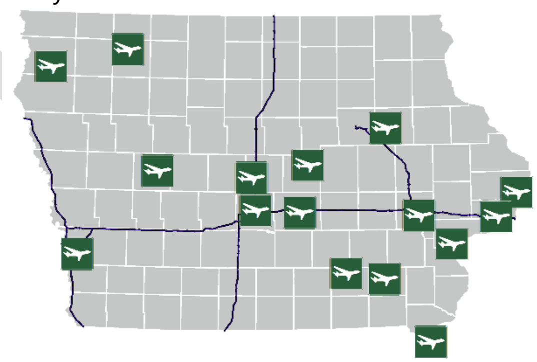
Commercial Service *8 airports*

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.



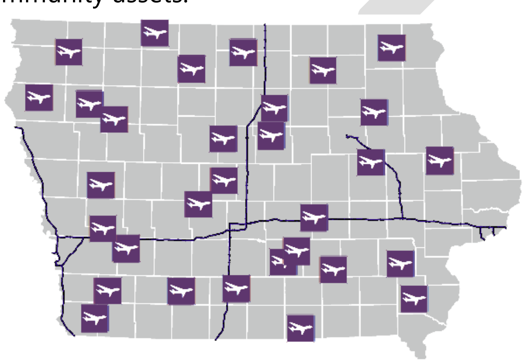
Enhanced Service *16 airports*

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.



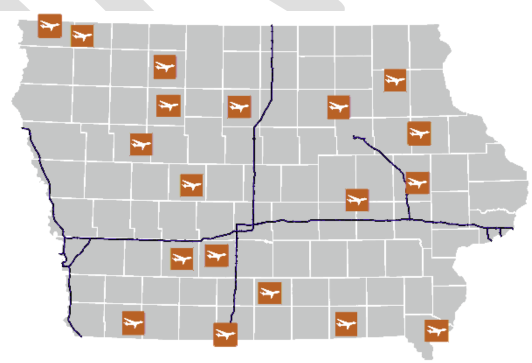
General Service *31 airports*

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.



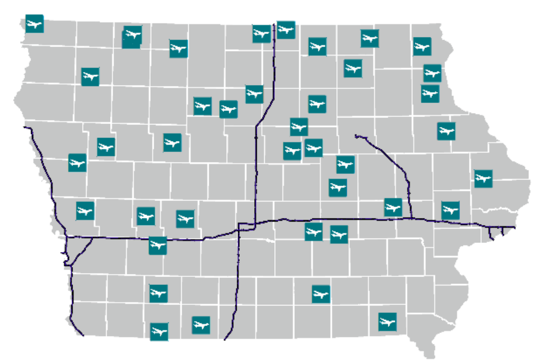
Basic Service *19 airports*

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

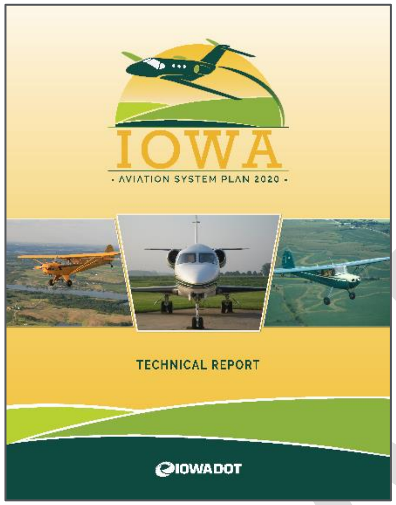


Local Service *40 airports*

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.

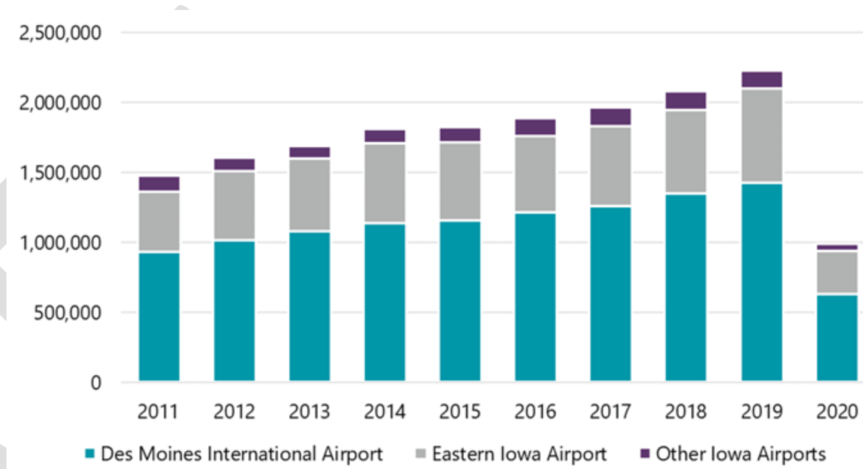
- Evaluated airports across the state and changes made since the prior system plan, then made recommendations on updated airport roles. The recommended system also includes one new airport currently being developed, the South Central Airport, which would result in the closure of the Pella and Oskaloosa 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.

Figure 3.2: Enplanements at Iowa's commercial service airports

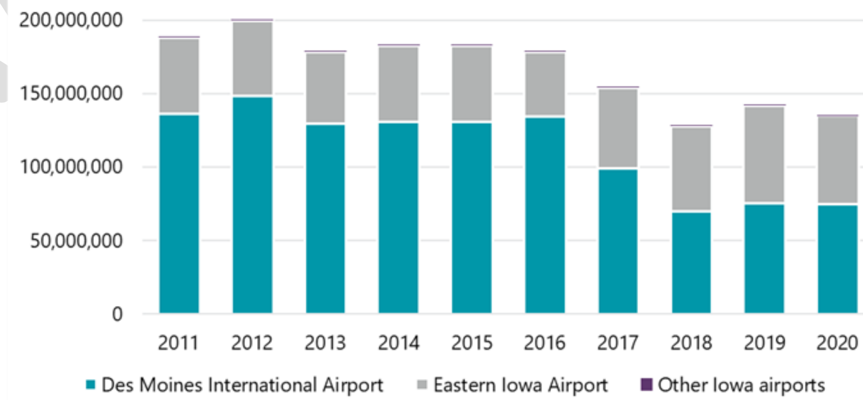


Source: FAA

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 3.3: 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.

Photo of mode

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.

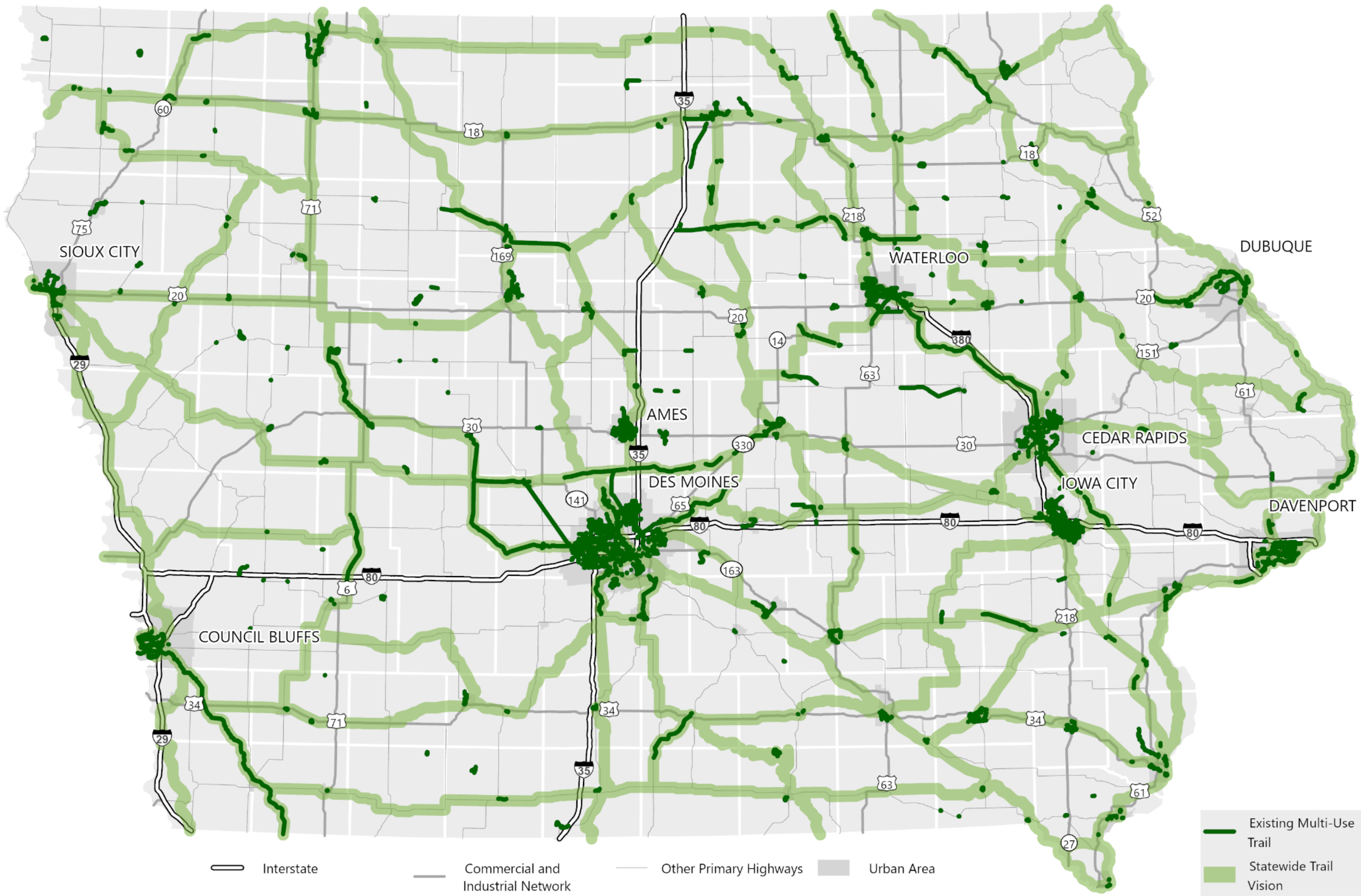
Statewide Network of Multi-Use Trails

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



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.

Photo of mode

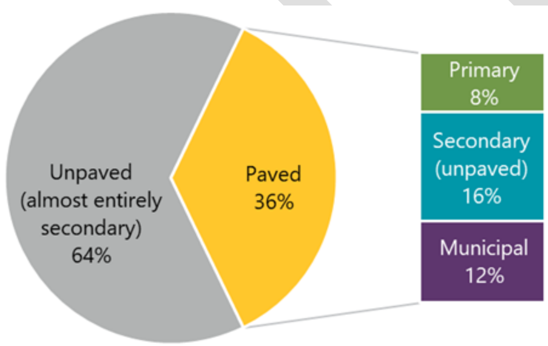
Inventory

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 (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.

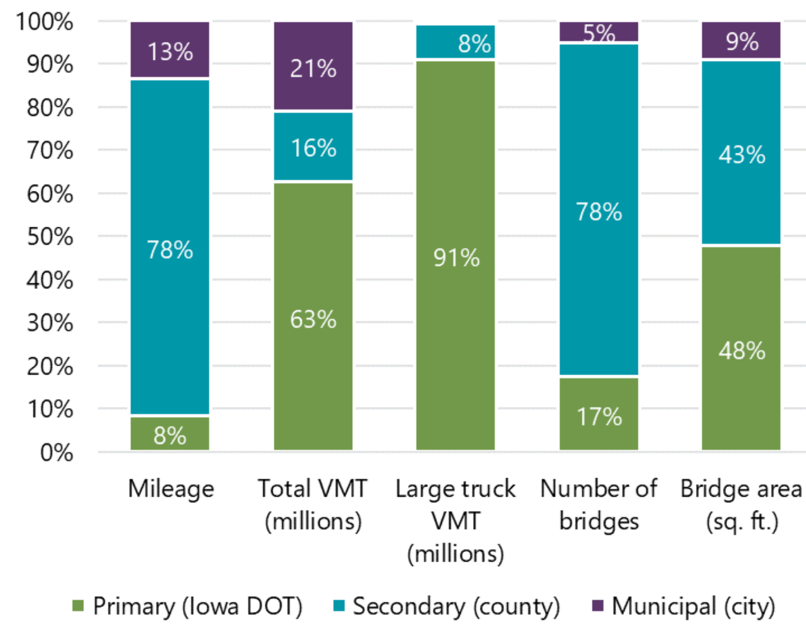
Figure 3.6 Iowa's roadway system mileage



Source: Iowa DOT

Figure 3.5: 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

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.

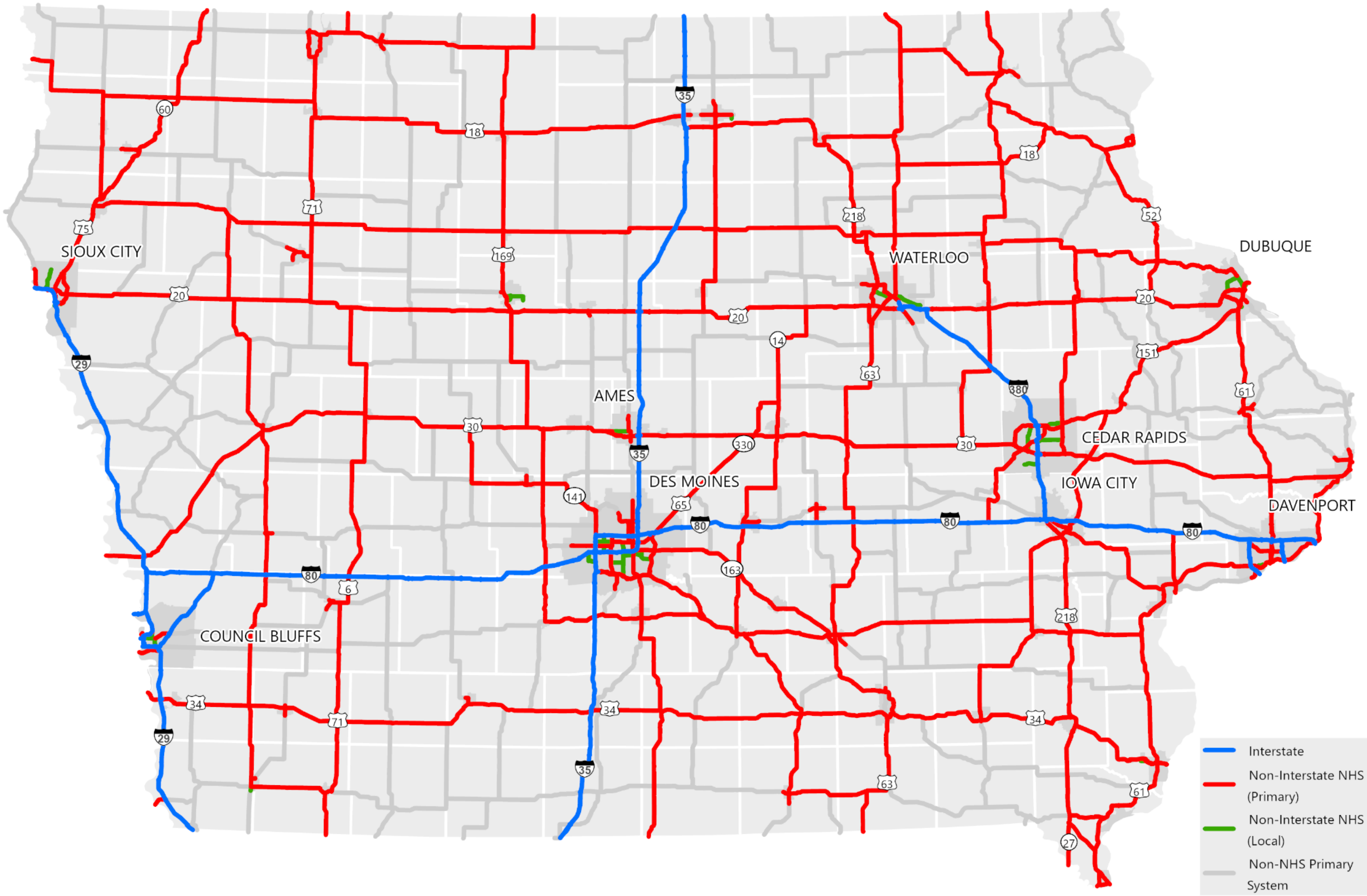
Iowa DOT Planning Class

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.

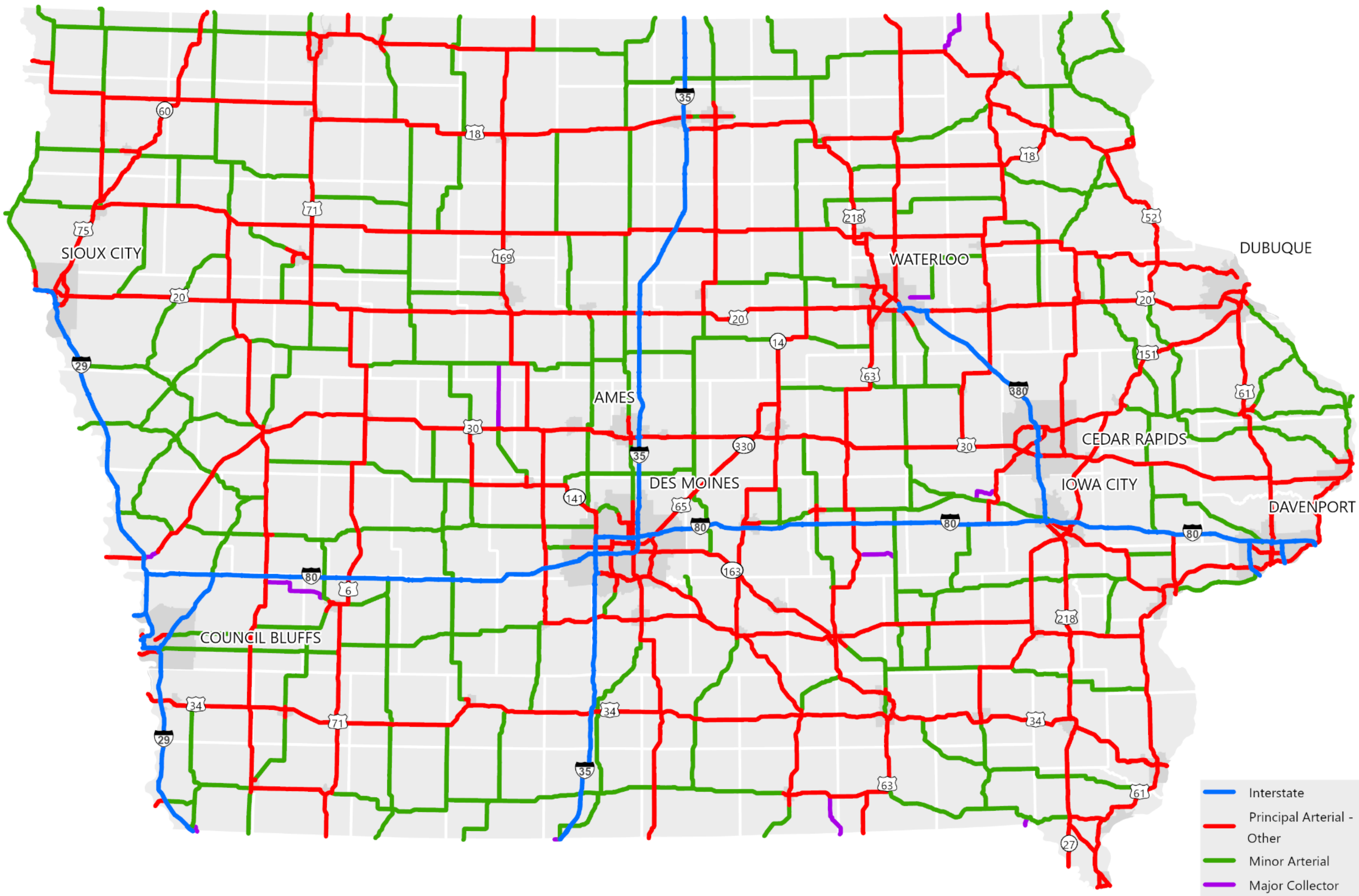
Figure 3.9 shows the planning classes for the Primary Highway System.

Figure 3.7: National Highway System (NHS) in Iowa



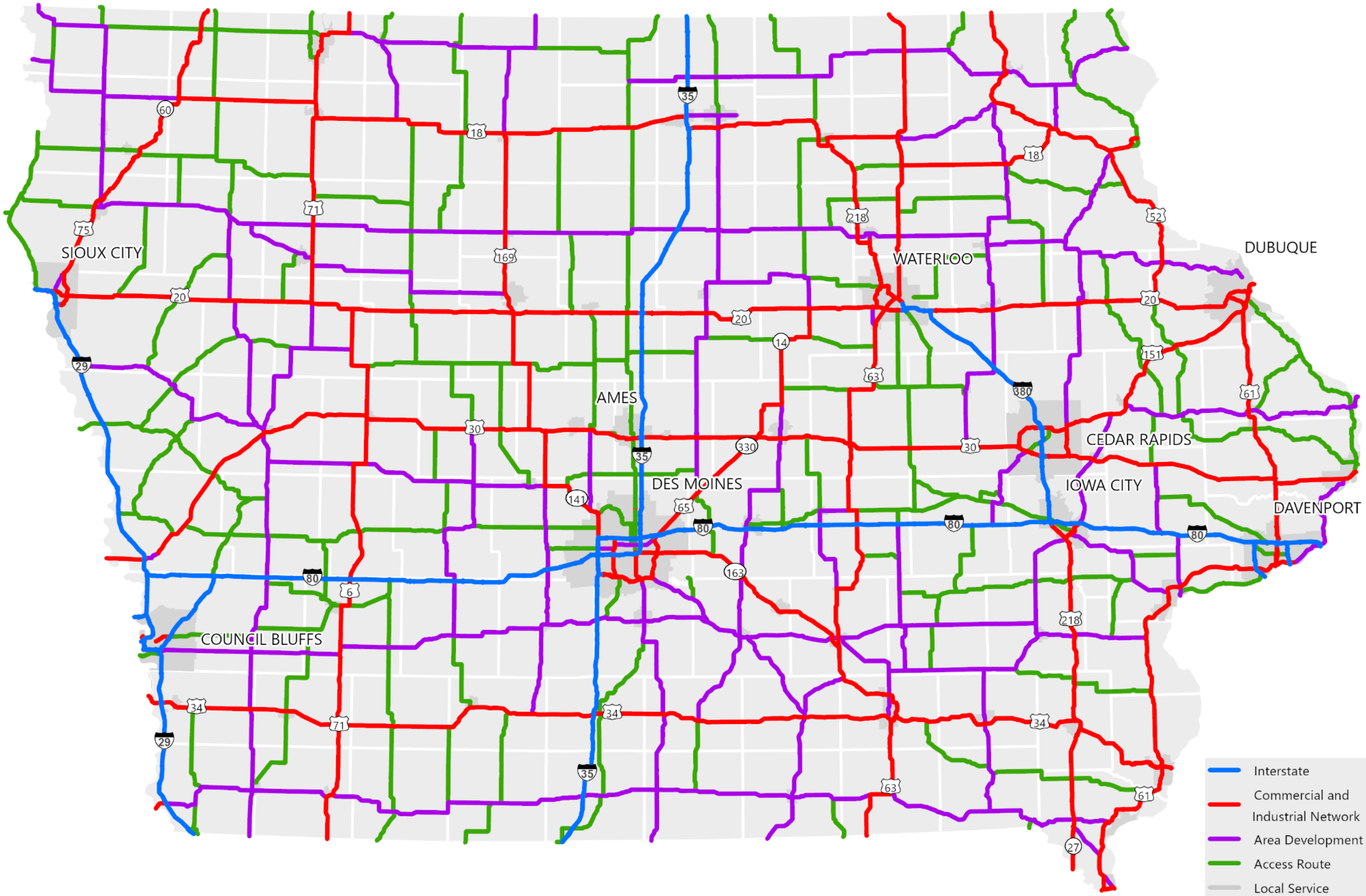
Source: Iowa DOT

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

Photo of cover

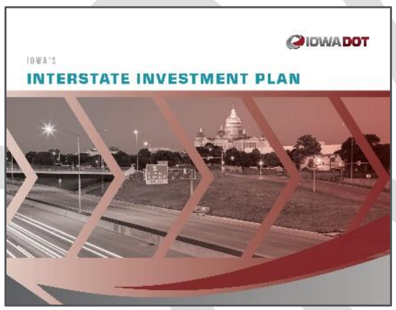
The Iowa DOT's first freight plan was completed in 2016, with the aim of further incorporating freight considerations into the statewide transportation planning and programming process. The multimodal freight plan addresses each of the five modes of the freight transportation system: air, truck, pipeline, 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), which was used as a tiebreaker if locations had the same ranking after the value, condition, and performance evaluation.

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

Iowa 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)

Photo of cover

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

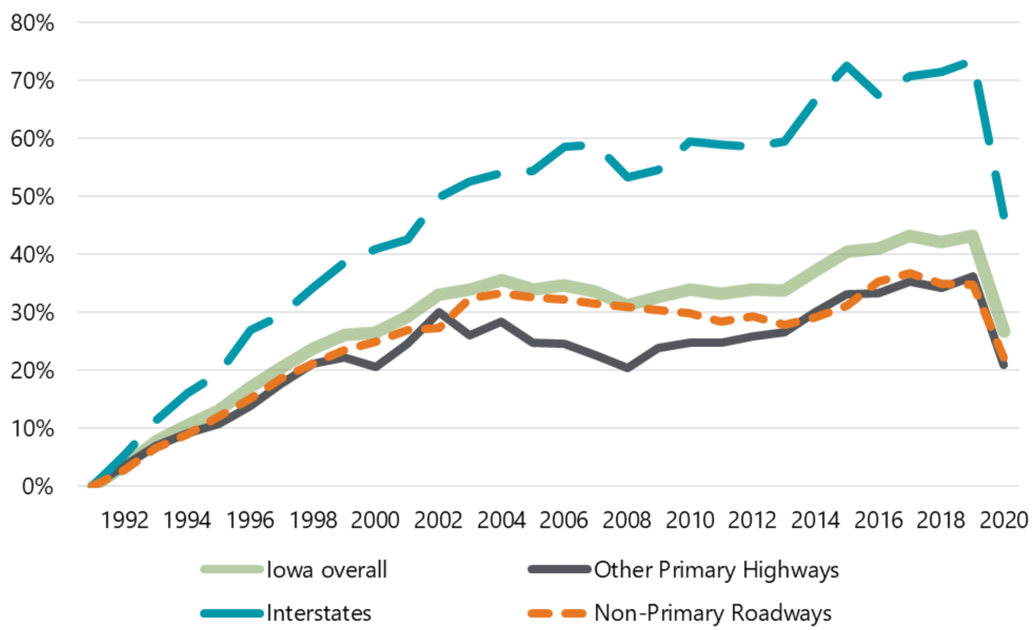
The current planning effort and document involve a detailed analysis of the highway system, identification of corridor-level improvement needs, and a number of specific strategies to help fulfill the vision for the highway component of the state's multimodal transportation network (see Chapter 5).

Trends and Planning Issues

Travel

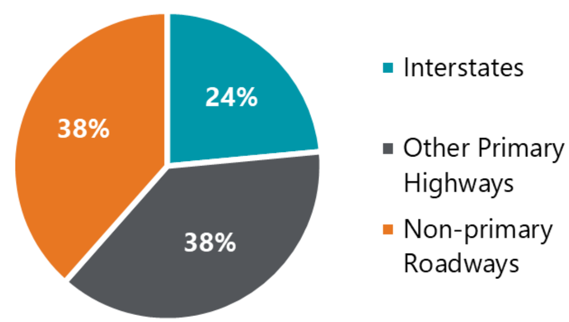
As shown in Figure 3.10, vehicle miles traveled (VMT) in Iowa increased steadily throughout the 1990s. Growth leveled off in the mid-2000s, then increased again in the late 2010s. However, the COVID-19 pandemic in 2020 caused significant drops in VMT. Preliminary 2021 data suggests a return to near pre-pandemic 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

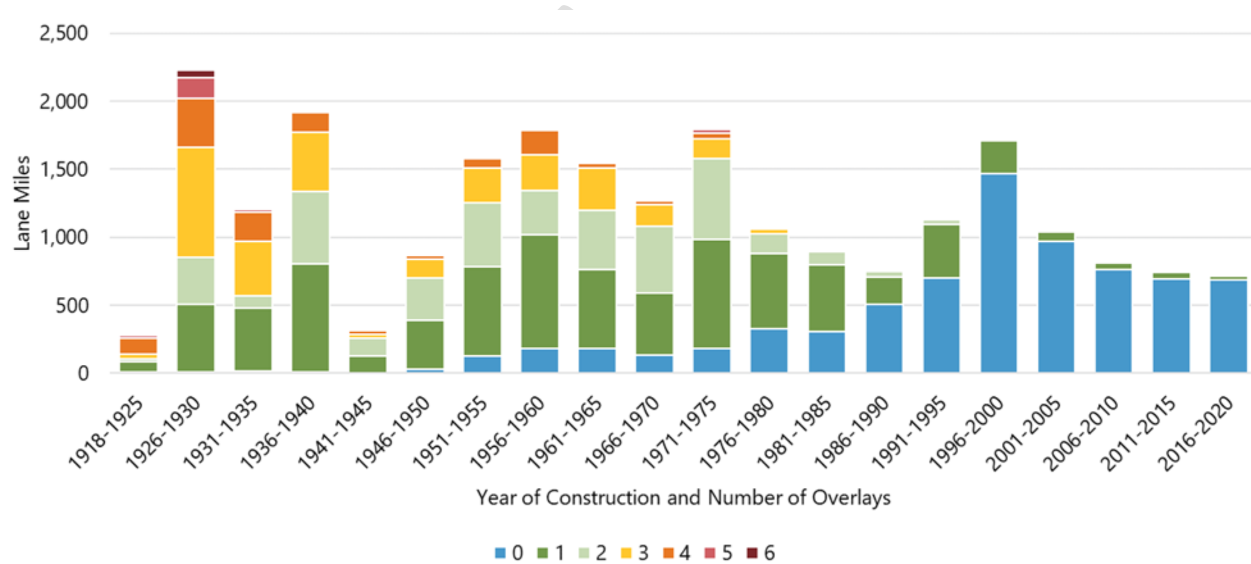


Source: Iowa DOT

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. Figure 3.13 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.

Figure 3.13: 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%

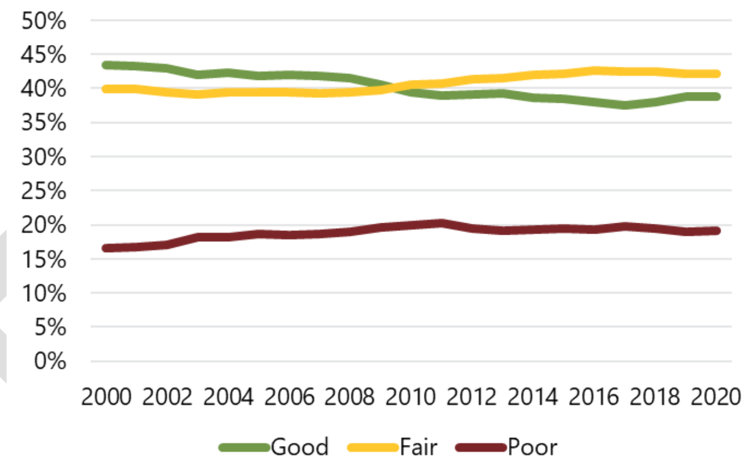
Source: Iowa DOT

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.

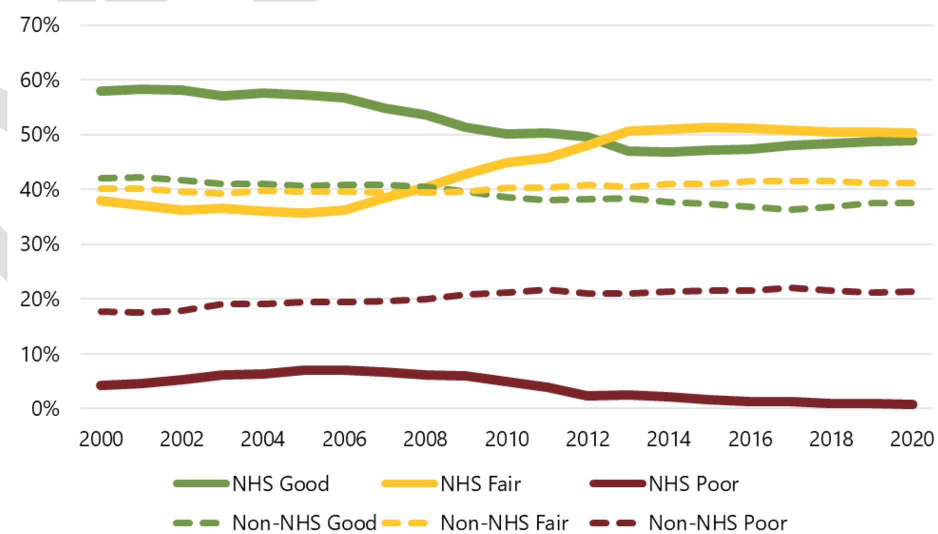
Figure 3.14 shows the condition of Iowa's bridges from 2000 to 2020. Overall, the percentages of poor and fair bridges have increased slightly over time while the percentage of good bridges has decreased. Dividing the system into National Highway System (NHS) bridges and non-NHS bridges (Figure 3.15) 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 3.14: Condition of all Iowa bridges, 2000-2020



Source: Iowa DOT and FHWA

Figure 3.15: Condition of Iowa bridges, NHS and non-NHS, 2000-2020



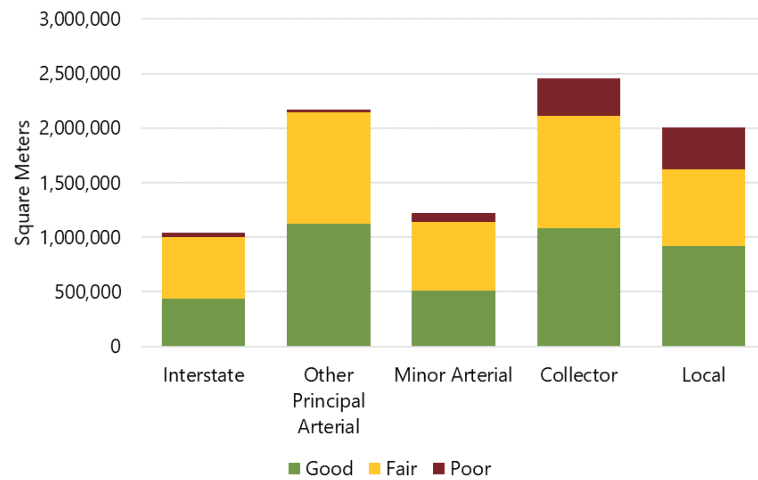
Source: Iowa DOT and FHWA

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 3.16. 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.

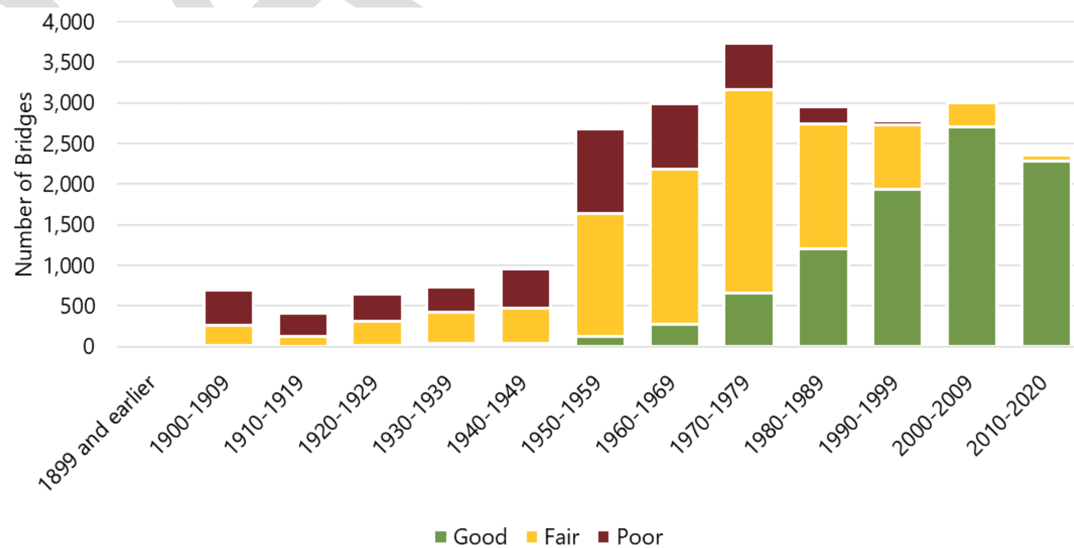
Iowa bridges continue to age, with the majority of existing bridge structures having been built in the 1970s. Figure 3.17 shows the age of Iowa bridges by construction decade. The implications of aging and deteriorating bridges, as well as roadways, can be detrimental to Iowa's transportation network. 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 3.16: Condition of bridges by area by federal functional classification (FFC)



Source: Iowa DOT and FHWA

Figure 3.17: 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.

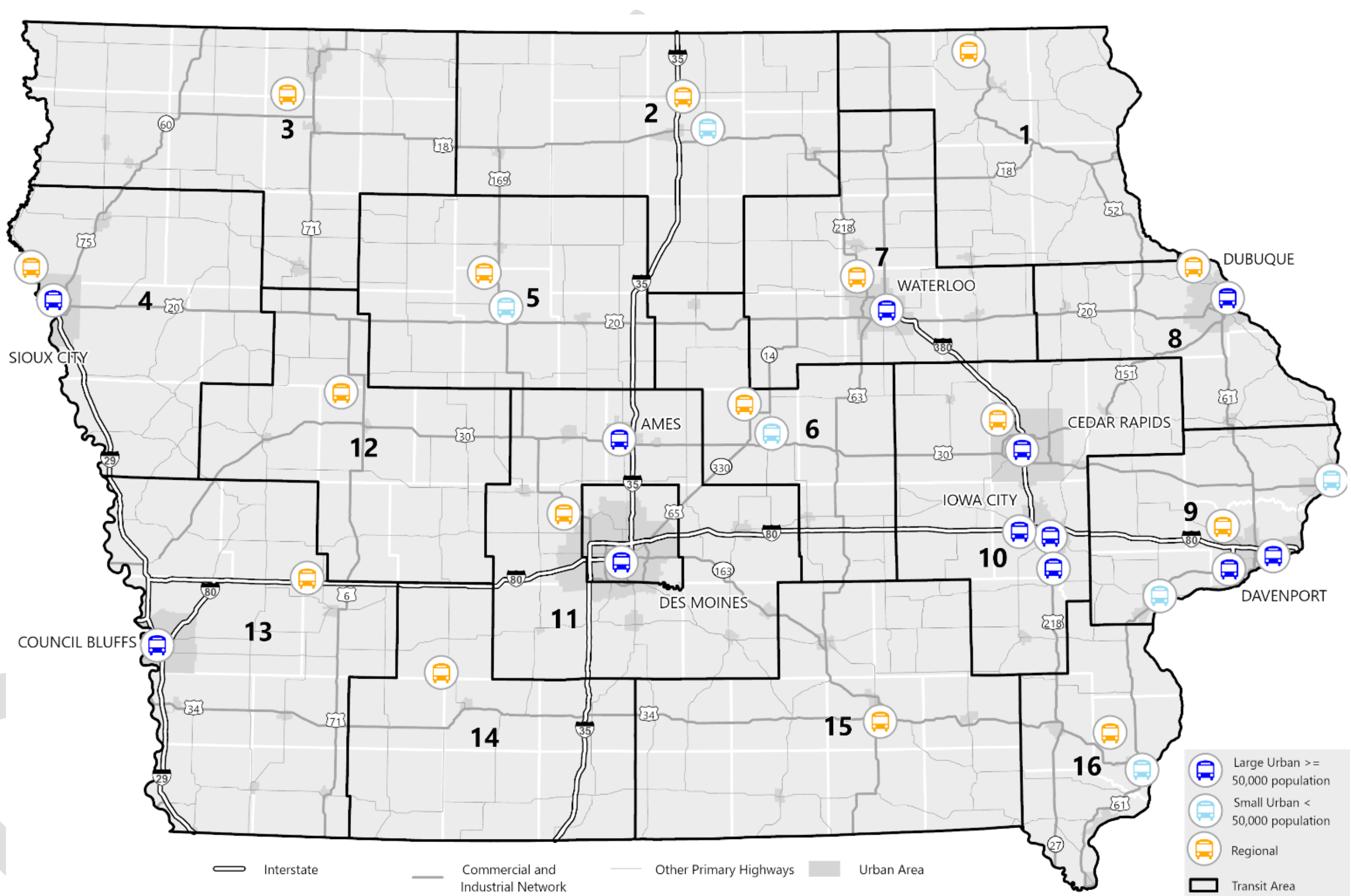
- Administers federal and state transit grants and provides technical assistance to Iowa's 18 urban public transit systems and 16 regional public transit systems.
- Oversees the Public Transit Equipment and Facilities Management System and the programming of state and federal funding programs.
- Provides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

Photo of mode

Inventory

Iowa is served by 12 large urban, six small urban, and 16 regional public transit systems, as shown in Figure 3.18. 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.

Figure 3.18: 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 3.2. 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 3.2: 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:

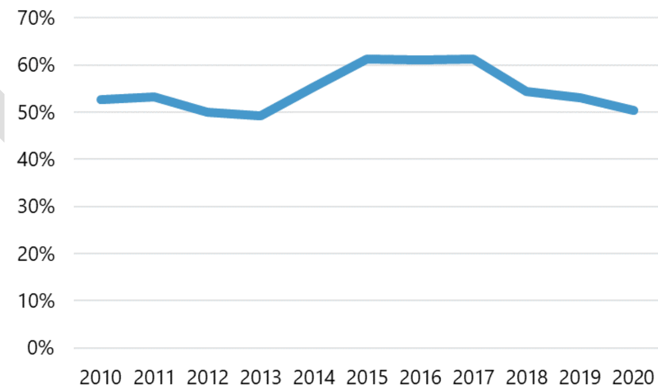
- Public transit is transitioning into a period where services will need to adjust to effectively operate alongside emerging transportation and micromobility options.
- There is a critical funding shortfall that will worsen over time if action is not taken to identify new or additional sustainable financial 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 3.19. 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.

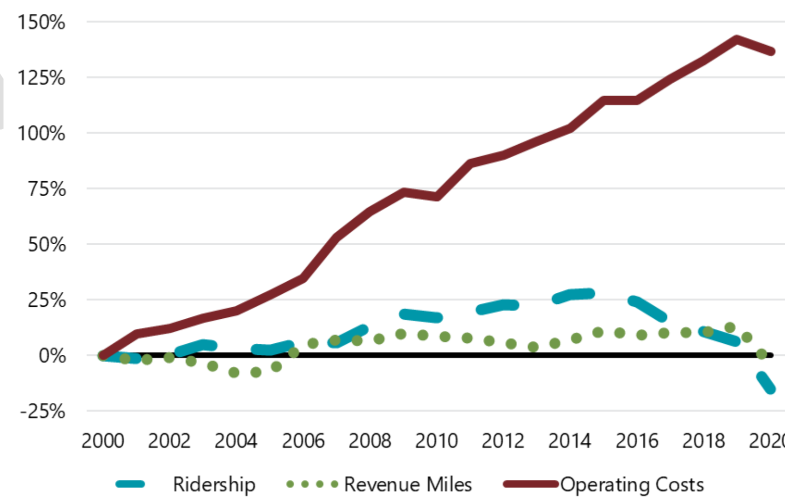
Figure 3.19: Percent of Iowa's transit fleet that is over its useful life threshold



Source: Iowa DOT

Trends in transit operations since 2000 are illustrated in Figure 3.20. 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 3.20: Change in transit operations factors, indexed to 2000



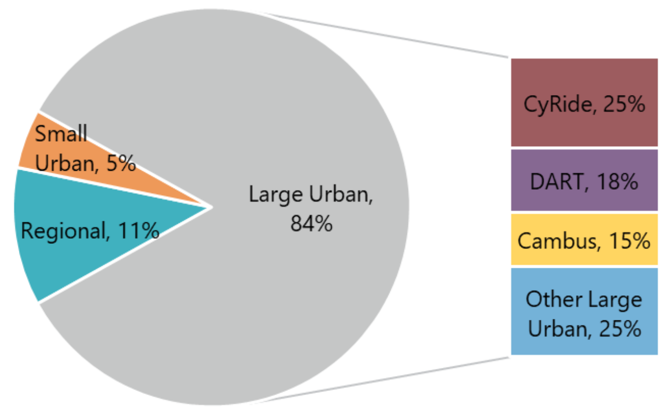
Source: Iowa DOT

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 3.21. 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 3.21: 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.

Photo of mode

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 3.3 and Figure 3.22 show the extent of freight rail operations in Iowa.

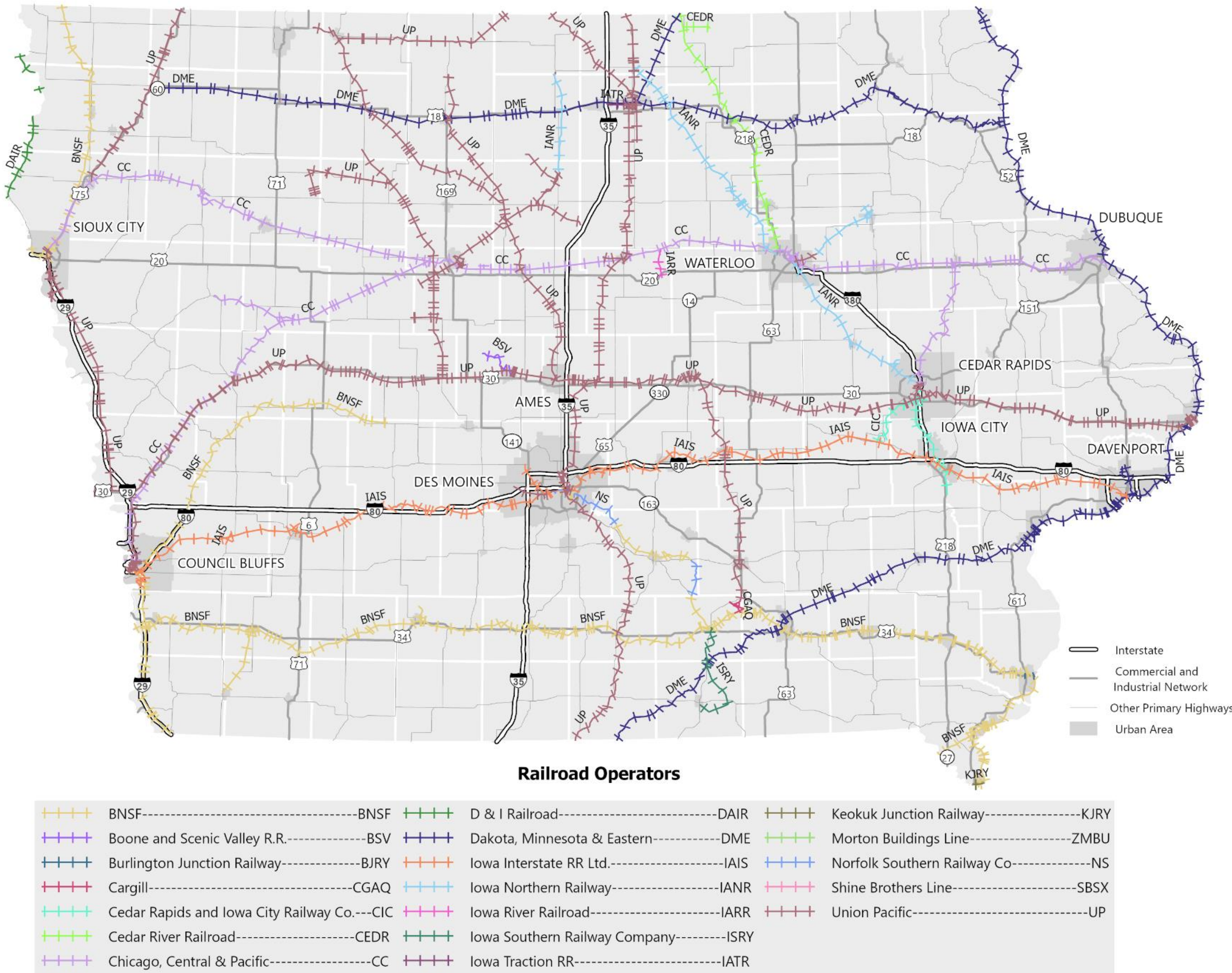
Table 3.3: Iowa railroad mileage by company

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 3.22: Iowa railroad service map

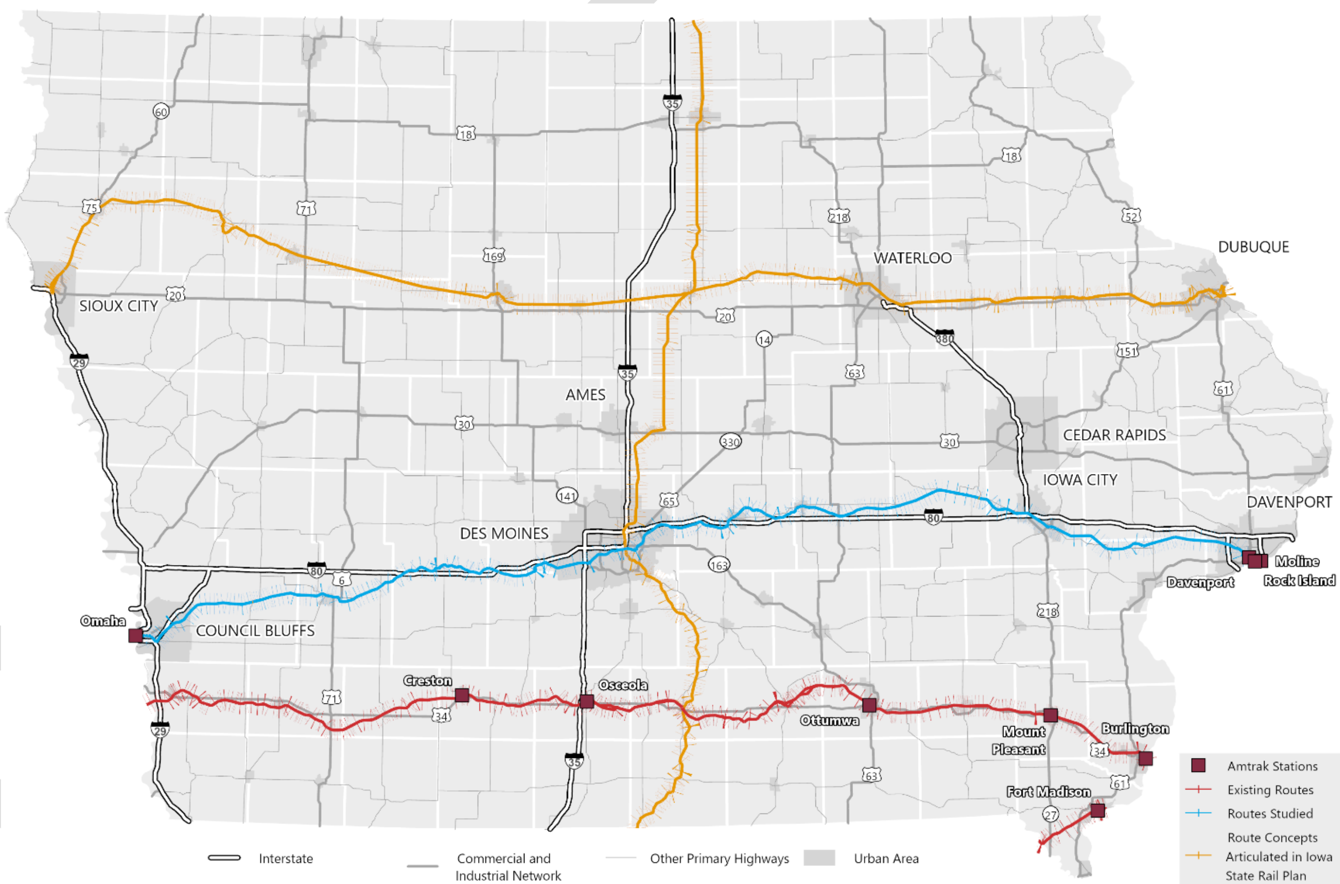


Source: Iowa DOT

Passenger Rail

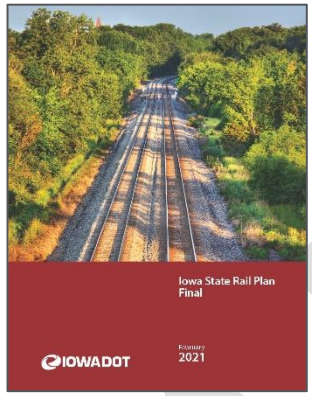
Passenger rail service in Iowa is currently provided by two Amtrak routes, the California Zephyr from Chicago, Illinois to Oakland, California, and the Southwest Chief from Chicago to Los Angeles, California. The California Zephyr operates over the BNSF tracks in southern Iowa providing daily service 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 3.23 shows current service, along with routes where service is being planned or considered for study, which are discussed in the next section.

Figure 3.23: 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 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 3.23. 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.

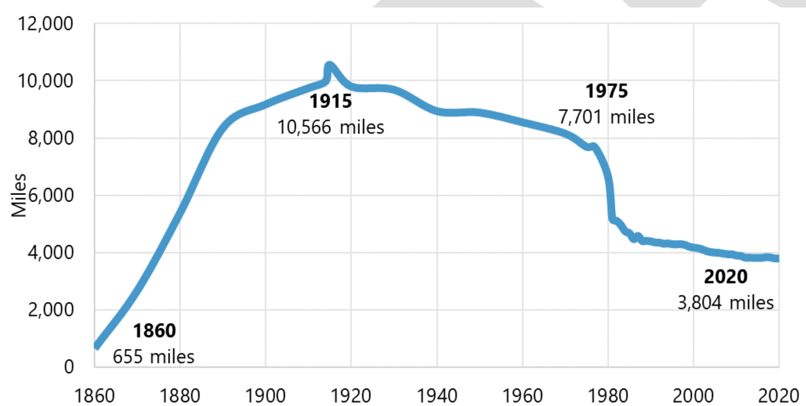
Trends and Planning Issues

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 3.24 shows the amount of rail mileage in Iowa over time, and Figure 3.25 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.

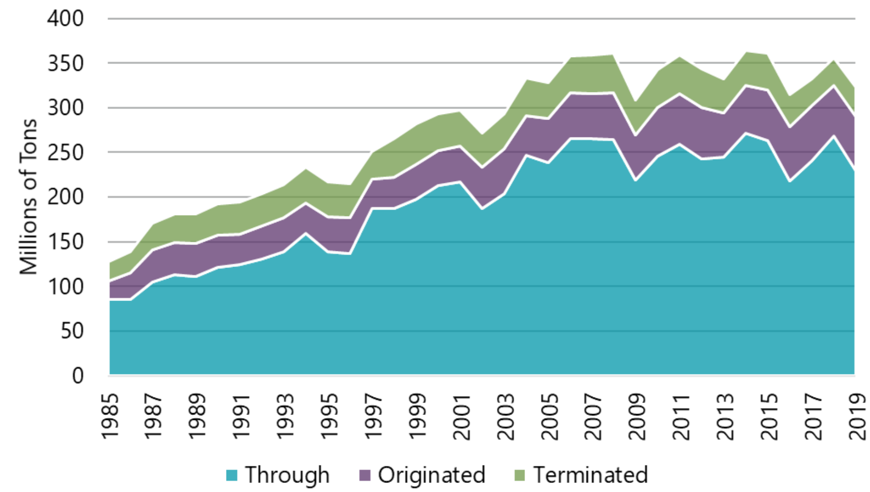
Operating revenues and overall net ton-miles of the railroads are also indicators of the condition and performance of the rail system, both of which have steadily increased over the last 35 years despite the decreasing mileage. These trends are shown on Figure 3.26.

Figure 3.24: Historical rail mileage in Iowa



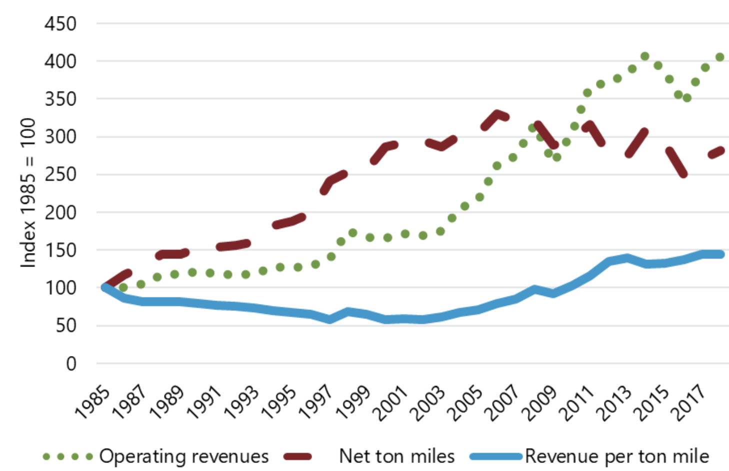
Source: Iowa DOT, Railroad Companies

Figure 3.25: Rail movements in Iowa



Source: Iowa DOT, Railroad Companies

Figure 3.26: Performance of Iowa rail operations



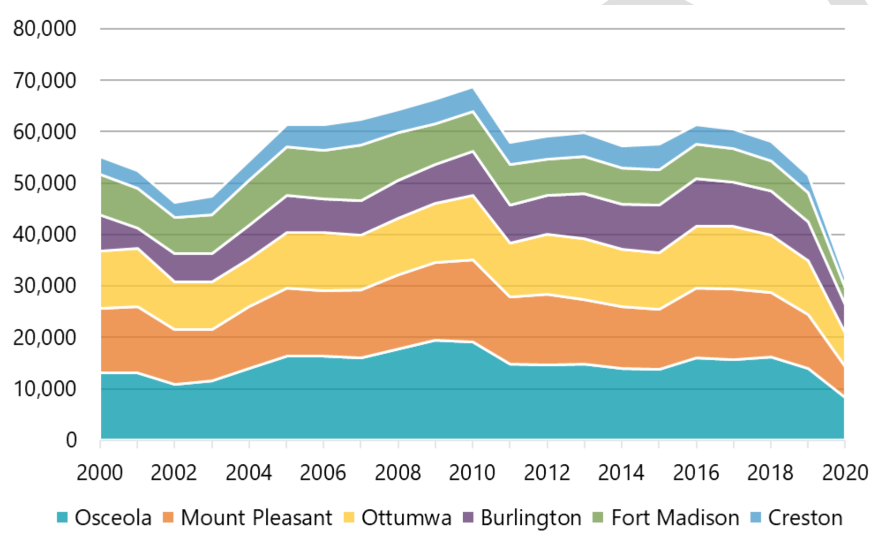
Source: Iowa DOT, Railroad Companies

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 3.27). 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 3.27: 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.

Photo of mode

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 60 barge terminals (55 on the Mississippi, five 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.

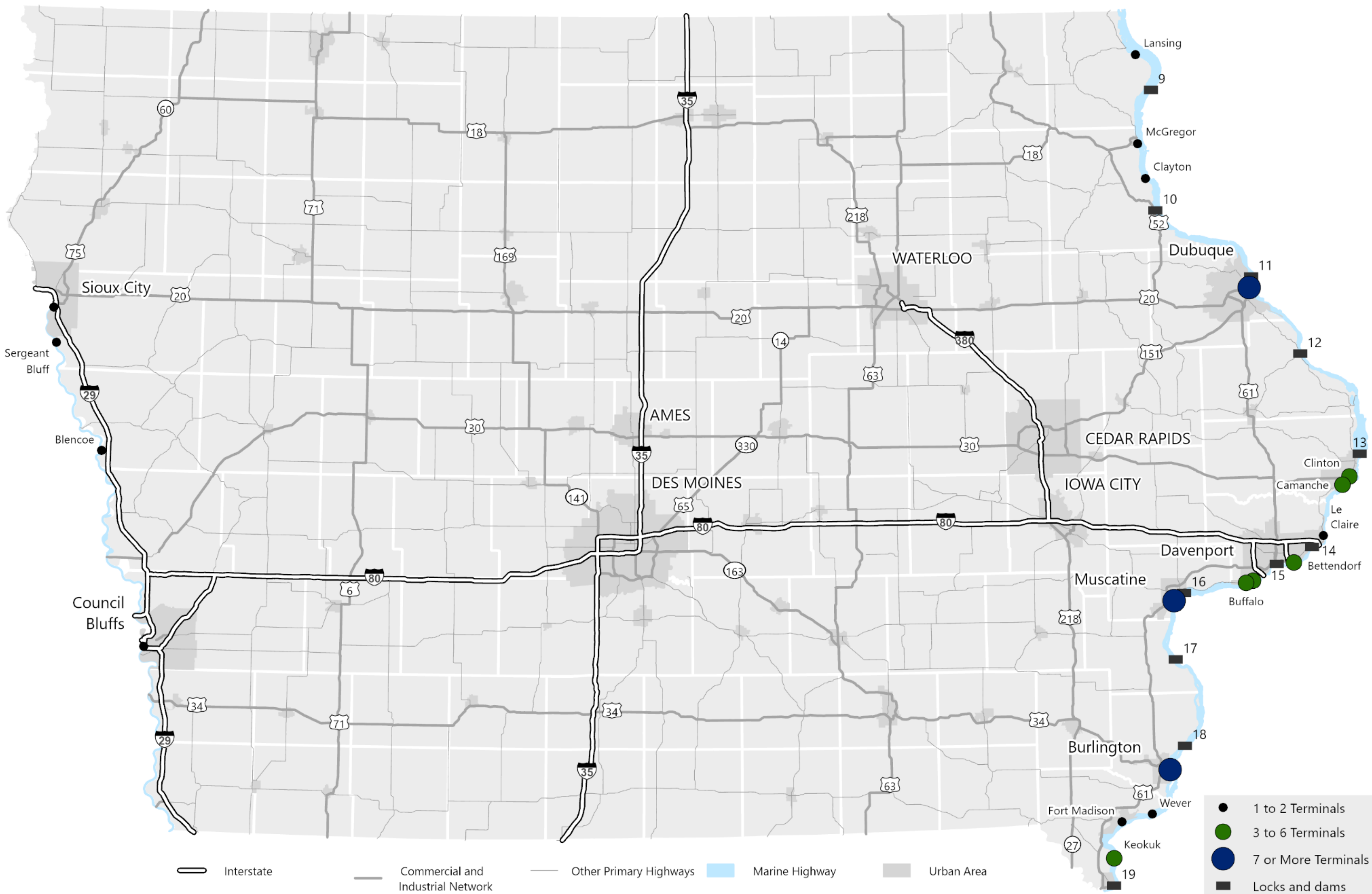
A system of 11 locks and dams (Table 3.4) on the upper Mississippi River, operated by the U.S. Army Corps of Engineers (USACE), helps to maintain adequate water levels for barge operations. The construction of these navigation locks and dams was authorized in 1930 to achieve a 9-foot channel in the upper 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 3.28.

Table 3.4: 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 3.28: Iowa marine highways, locks and dams, and barge facilities



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

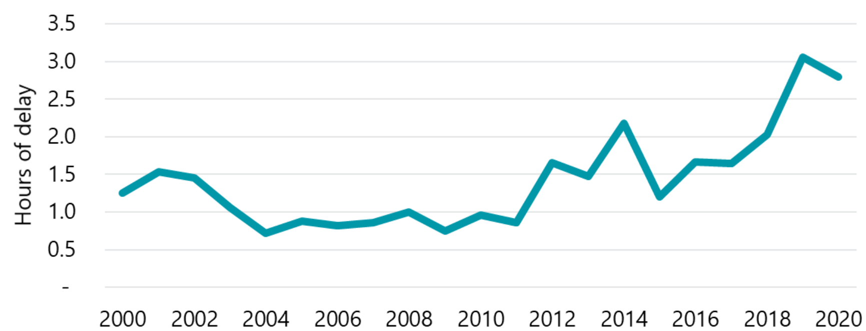
Condition and Delay

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 3.29.

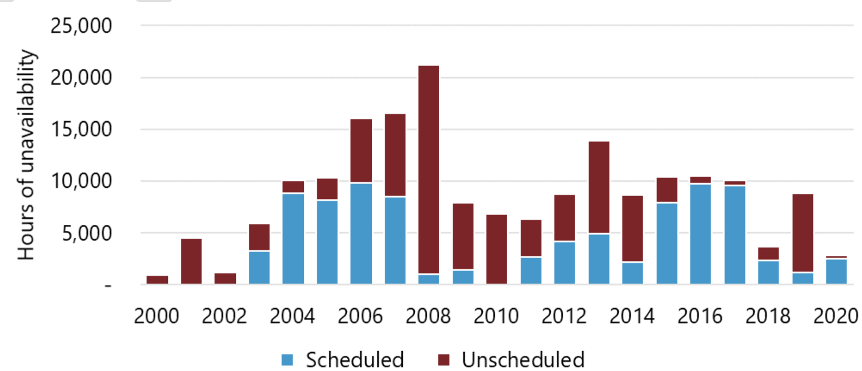
Also contributing to delay times is lock unavailability, both scheduled and unscheduled. Due to the age and condition of the infrastructure, locks and dams must often be closed for maintenance and repairs. On average, unscheduled repairs account for more than 50 percent of lock closures. Delays, congestion, and unavailability due to closures are significant threats to efficient goods movement. Figure 3.30 shows how often locks 9 through 19 were unavailable from 2000 to 2020.

Figure 3.29: Average delay for Iowa Mississippi River locks, 2000-2020



Source: U.S. Army Corps of Engineers

Figure 3.30: Annual unavailability at locks 9-19, 2000-2020



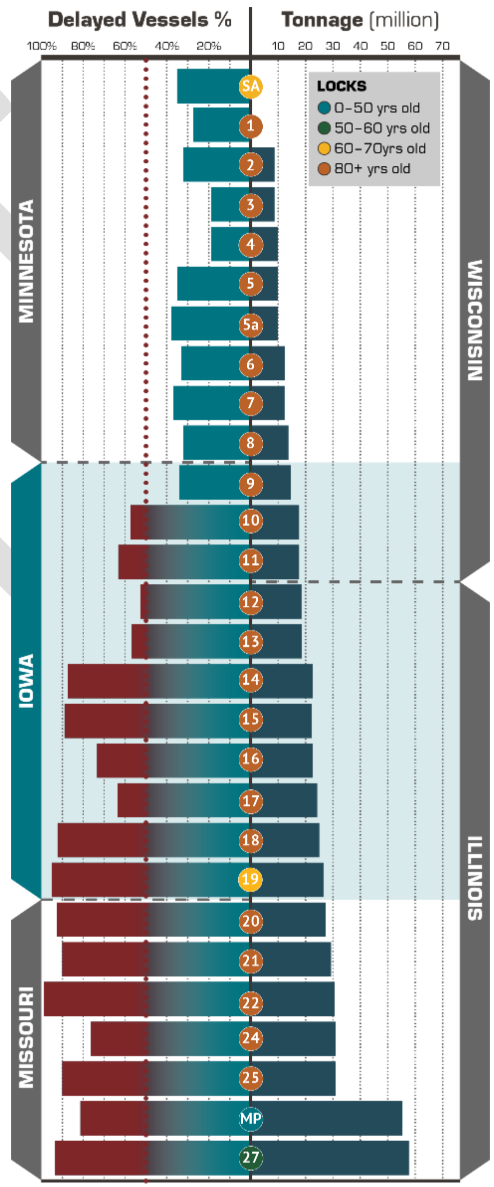
Source: U.S. Army Corps of Engineers

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 3.31. 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 3.31: Upper Mississippi lock performance, 2020



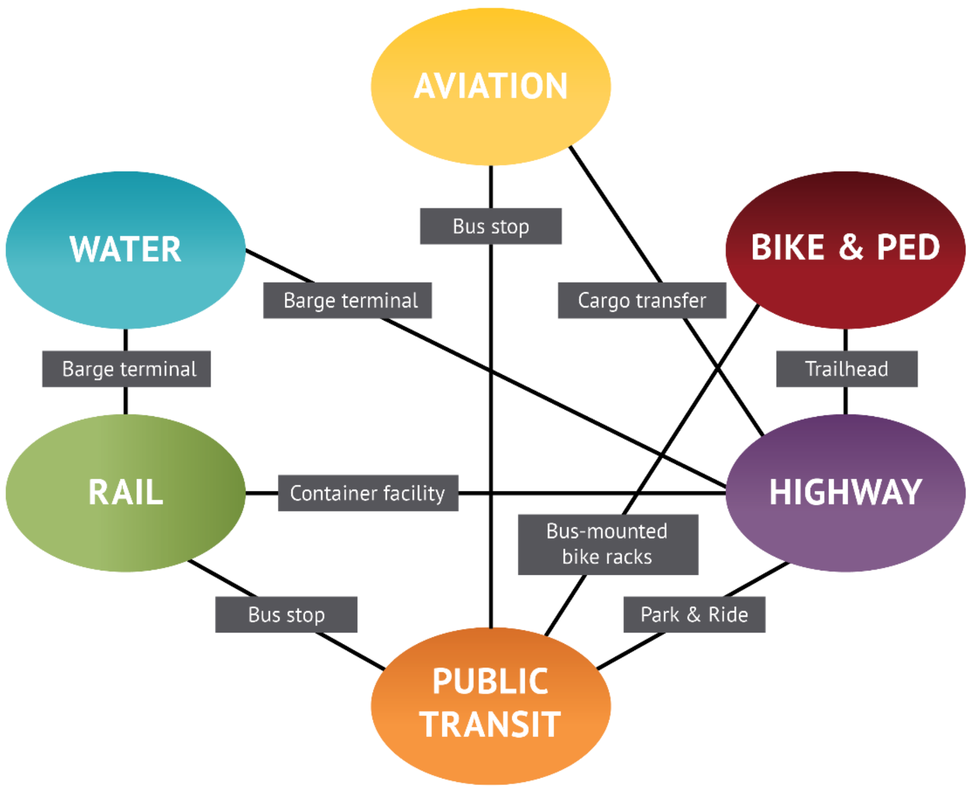
Source: U.S. Army Corps of Engineers

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 3.32 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 3.32: 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 3.33 shows existing and proposed locations of park and ride lots.

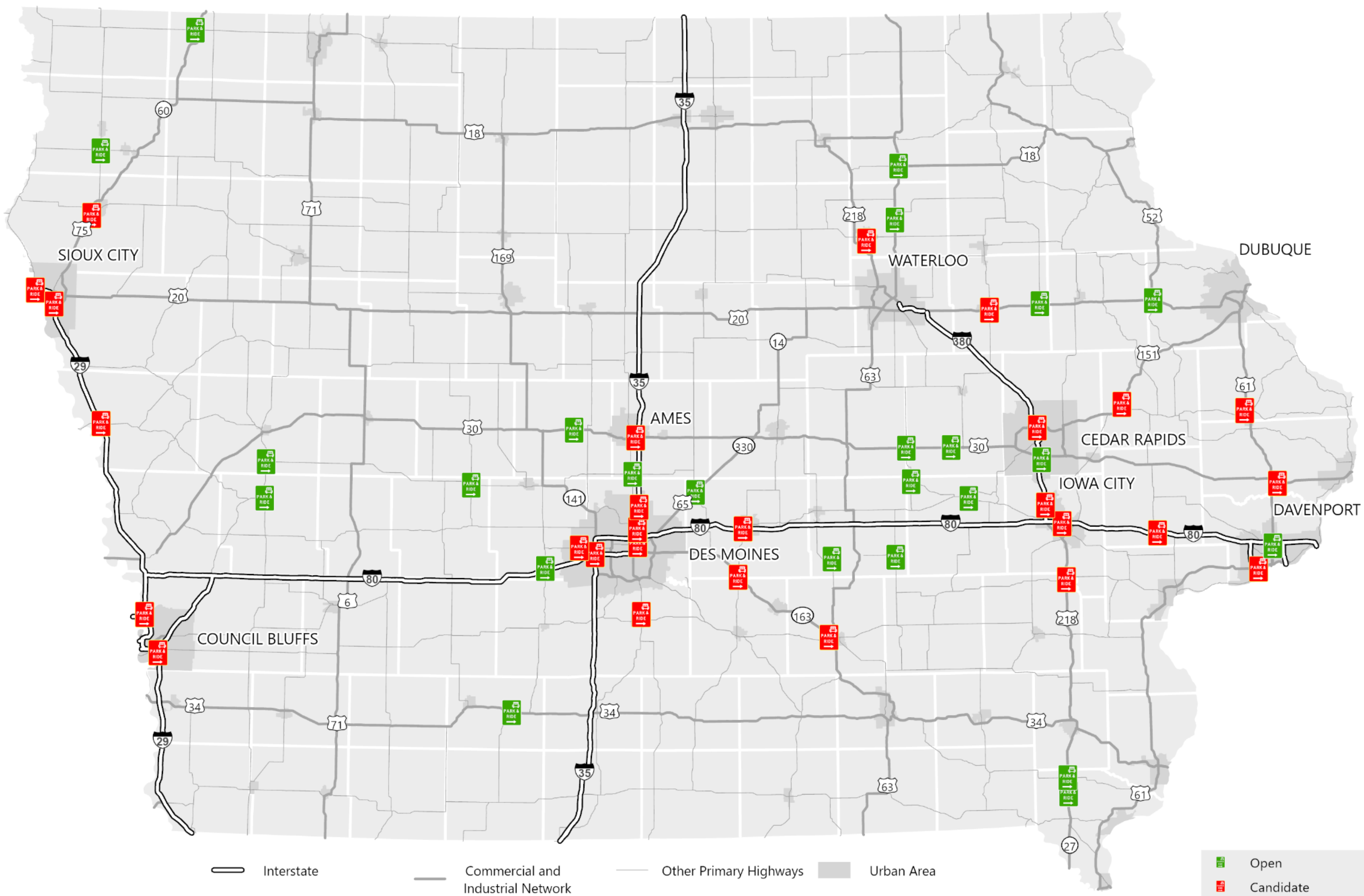
Intercity bus

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 3.34, 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:

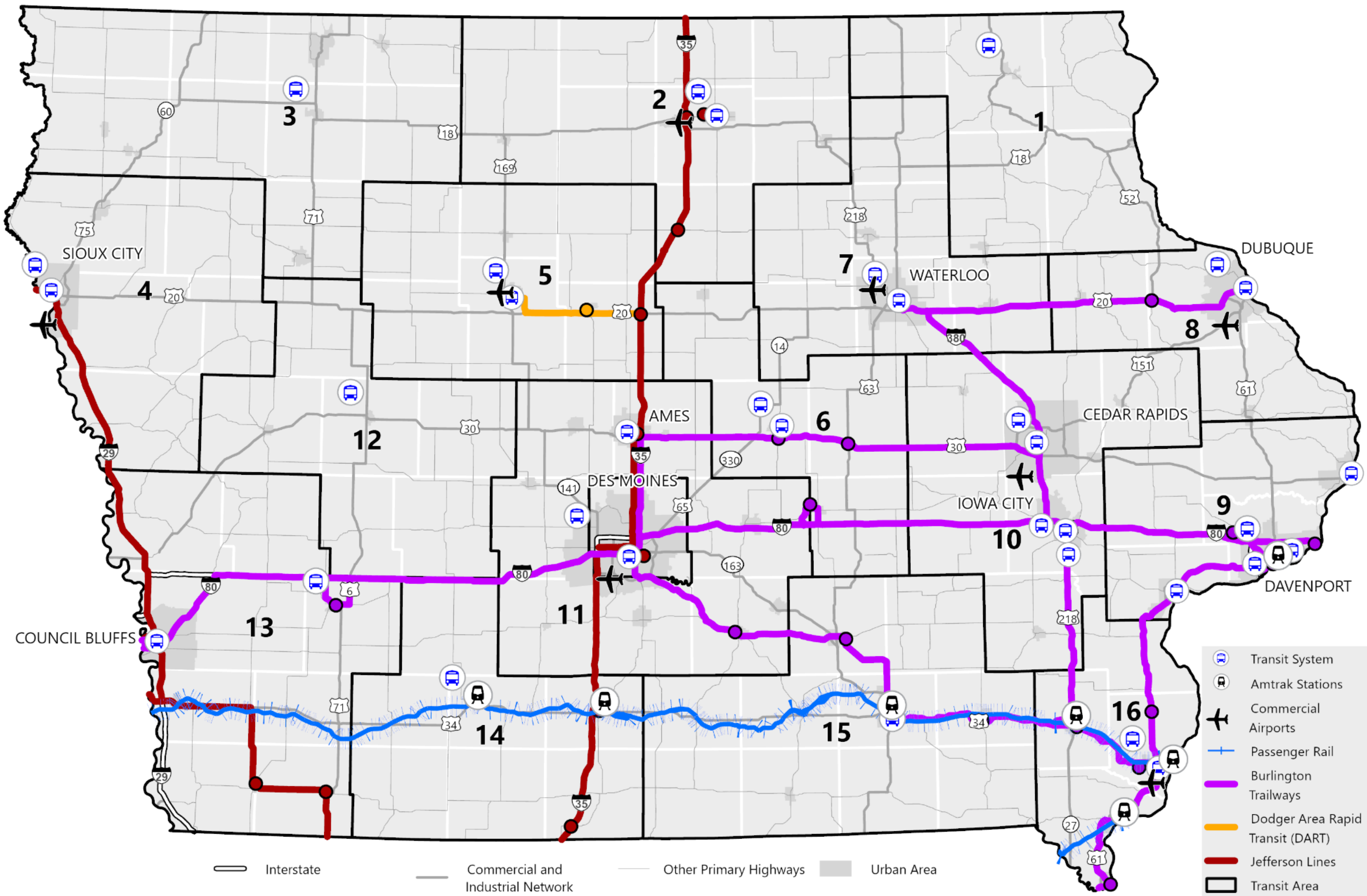
- Base level support of existing services
- Start-up support for new services
- Support for marketing of intercity bus services and interlined service
- Support for intercity bus capital improvements

Figure 3.33: Existing and proposed park and ride lot locations



Source: Iowa DOT

Figure 3.34: 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.

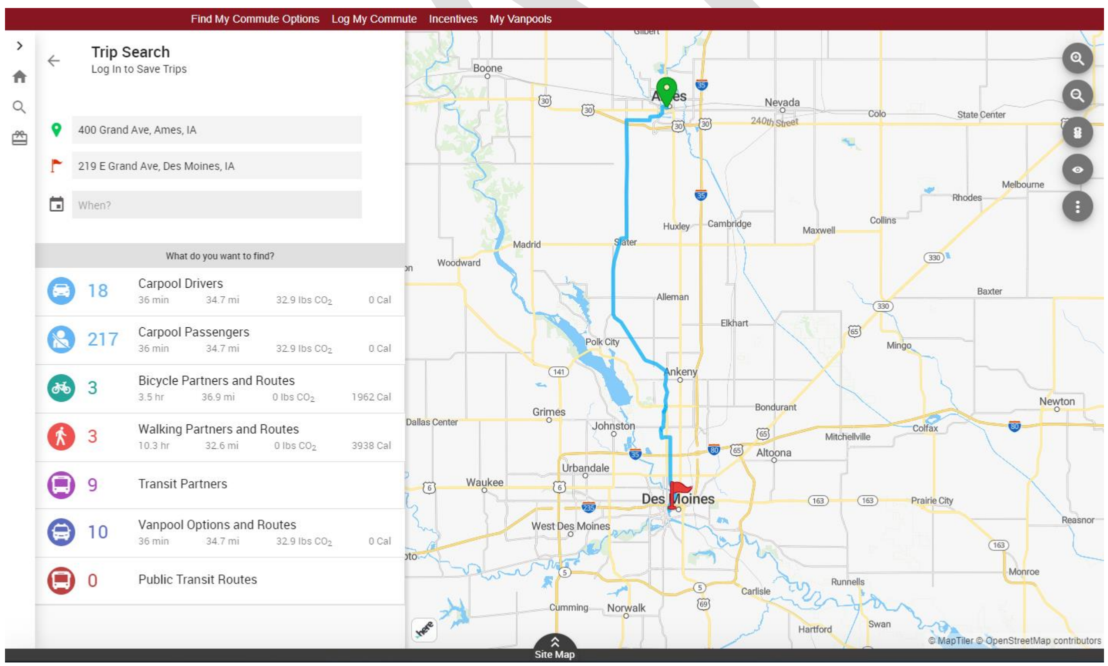
As far as the overall impact of AV on public transit ridership, a study by researchers from North Carolina Department of Transportation and the University of Tennessee found that AVs will likely result in a net decrease in public transit ridership. While they acknowledged that much more research still 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.

IOWA RIDESHARE
save • share • get there

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

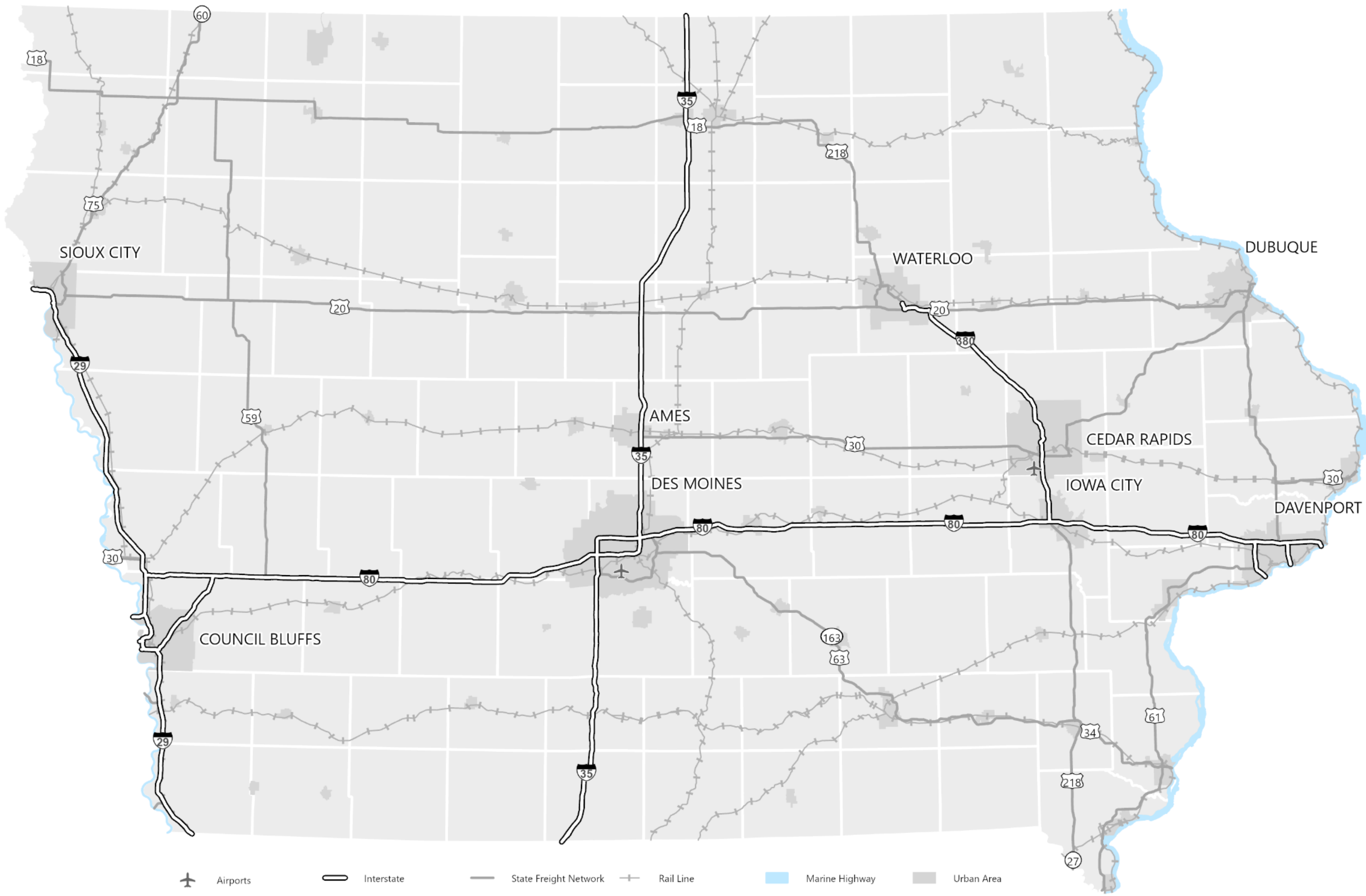
The designation criteria for the IMFN are shown on Table 3.5, and Figure 3.35 provides a map of the network.

Table 3.5: 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 3.35: 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 3.6 and mapped on Figure 3.36.

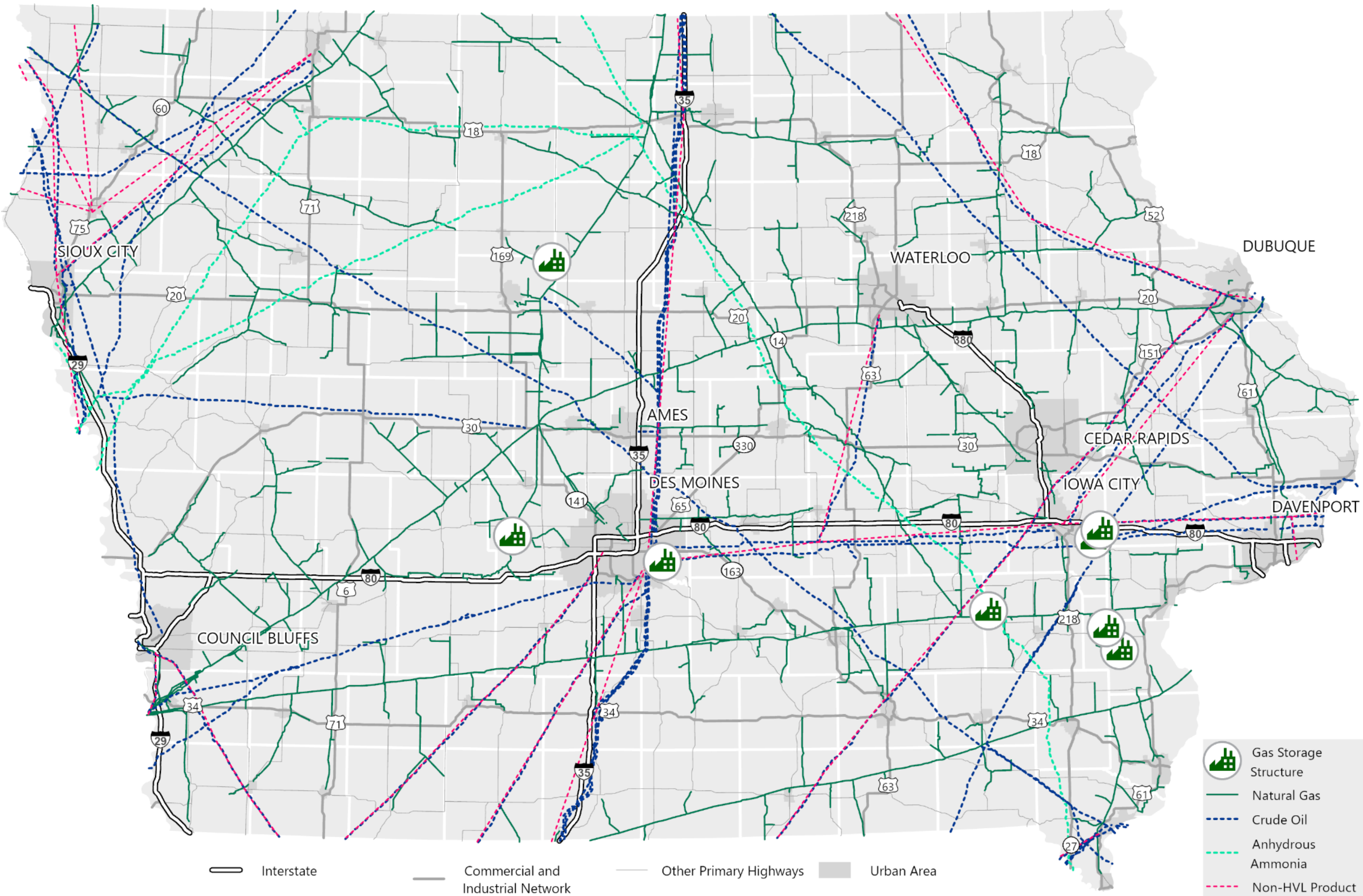
Table 3.6: Iowa pipeline mileage by commodity

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 3.38: Iowa pipelines



Source: Iowa DOT

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 3.39 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 3.37 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.

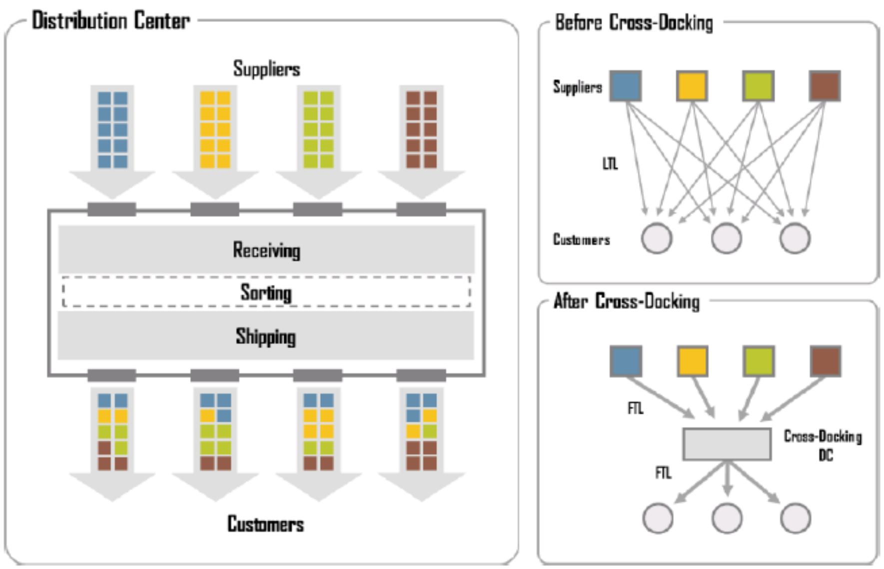
Figure 3.37: Transload process example

Inbound	Process	Outbound	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 3.38 shows a simple example of the cross-docking process.

Figure 3.38: Cross-docking process example



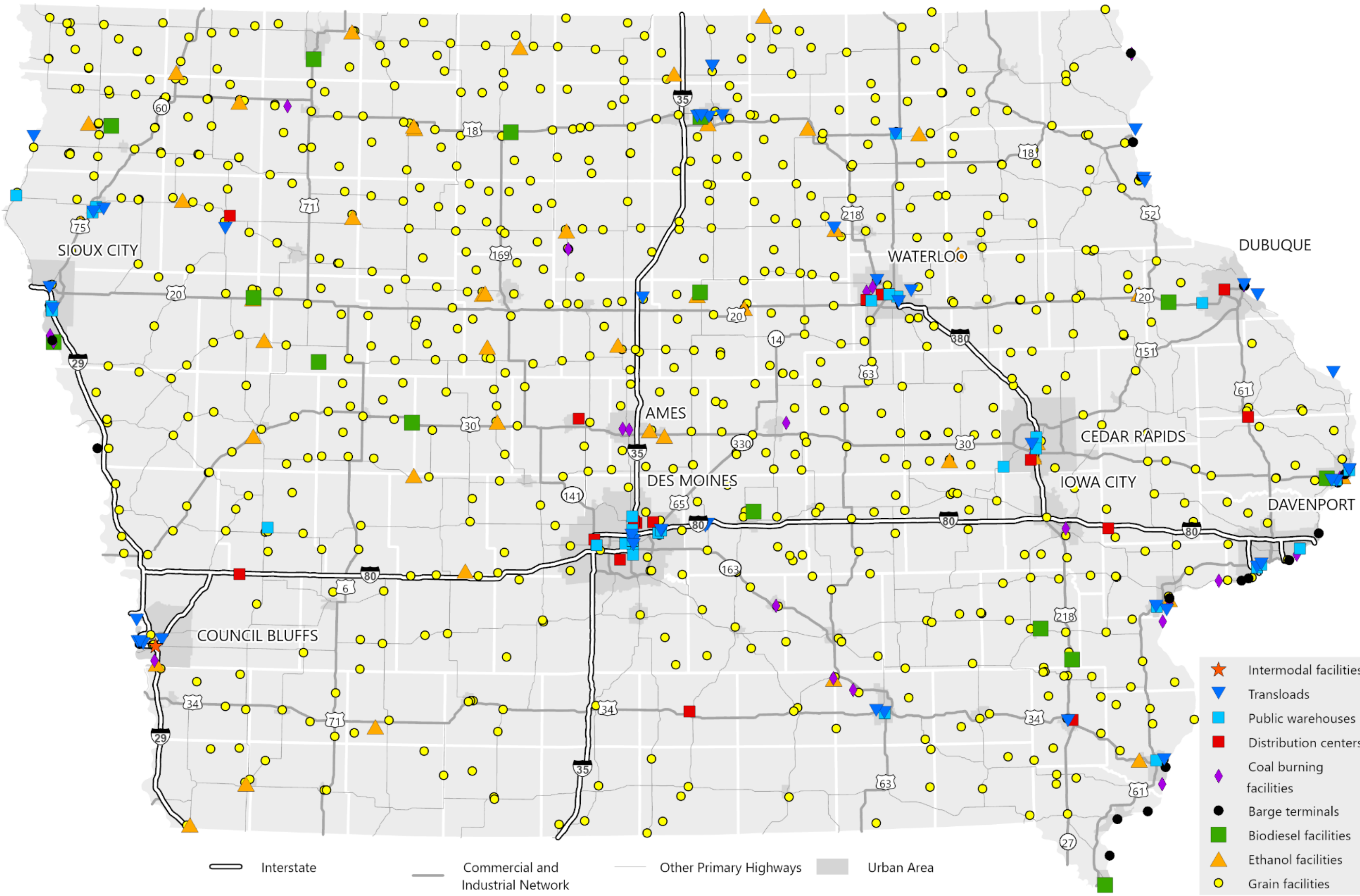
Source: Hofstra University

- **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.

3.39: Freight intermodal facilities



Source: Iowa DOT

Many freight movements by air, rail, and water are intermodal, usually beginning and/or ending with a truck movement. These intermodal connections are critical to Iowa's competitive edge in the marketplace. Table 3.7 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 3.7: 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 3.39 and Table 3.7 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.

Photos

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 3.8 and Figure 3.40.

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.

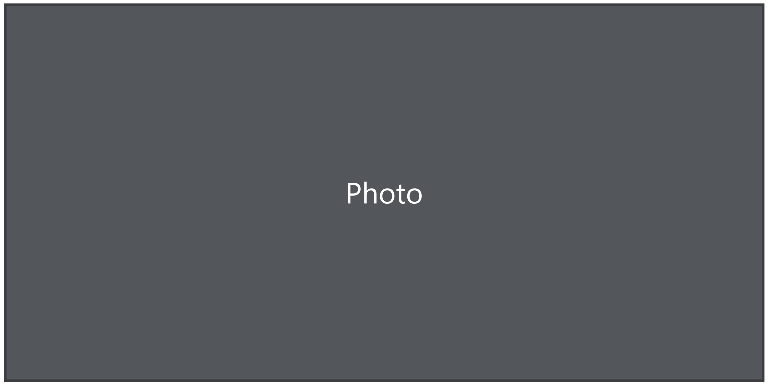
Table 3.8: Iowa Passenger Transportation Trends, 1990 – 2020*

	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.*

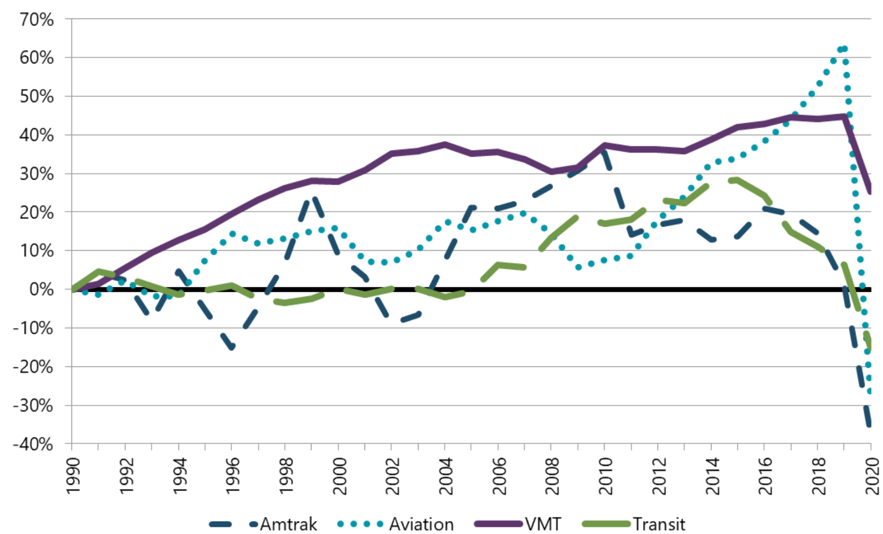
Sources: Iowa DOT, FAA, Amtrak



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

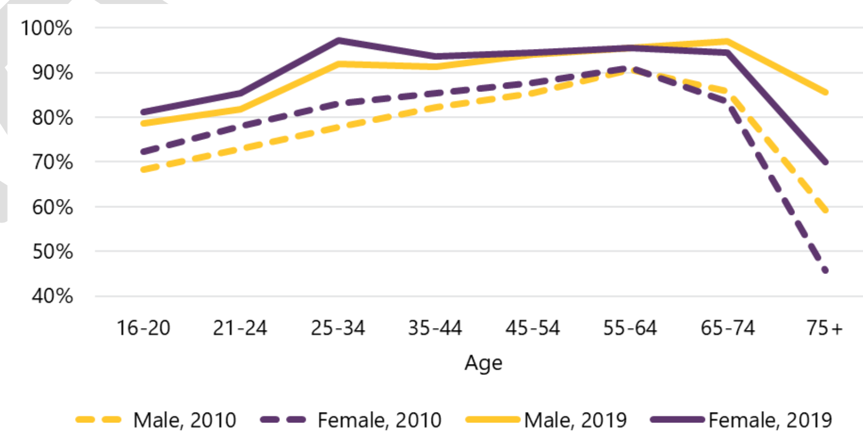
Part of the reason that passenger VMT has increased over time may be that more of the population holds driver's licenses. The percent of the population that is licensed has increased for all age groups between 2010 and 2019; overall, 80% of Iowans 16 and over were licensed in 2010; this increased to 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 3.41. 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: Iowa passenger travel trends by mode, indexed to 1990



Sources: Iowa DOT, FAA, Amtrak

Figure 3.41: 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 3.9, 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.

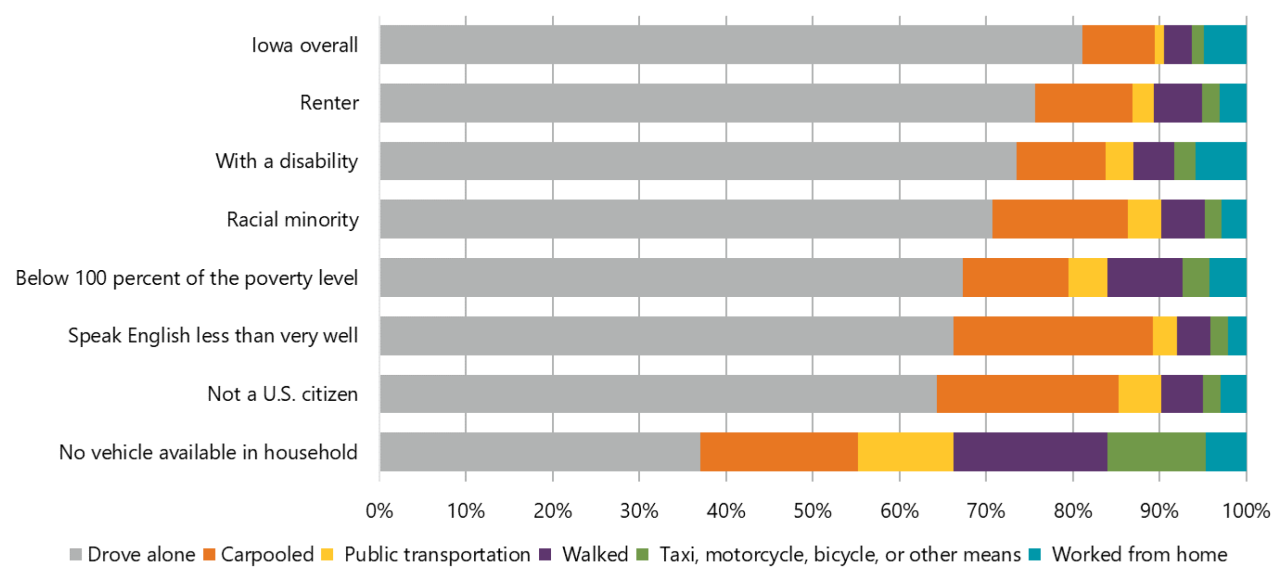
Table 3.9: Iowans' mode of transportation to work, 1990 and 2015-2019

	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 3.42 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 3.42, 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 3.42: How Iowans with various characteristics travel 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 2 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 3.43 and 3.44 illustrate these trends.

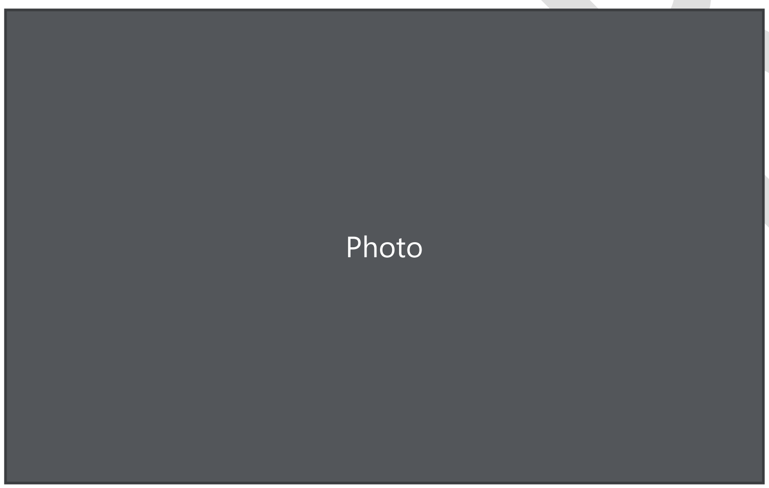


Figure 3.43: Number of vehicles per household in Iowa, 1990 and 2015-2019

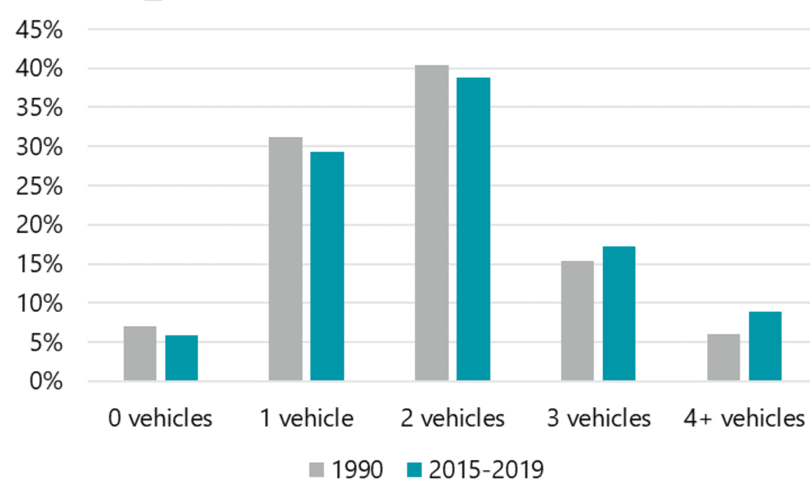
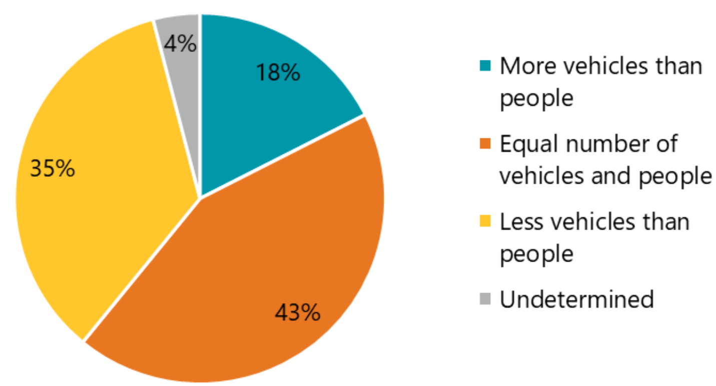


Figure 3.44: Number of vehicles vs. people in Iowa households, 2015-2019

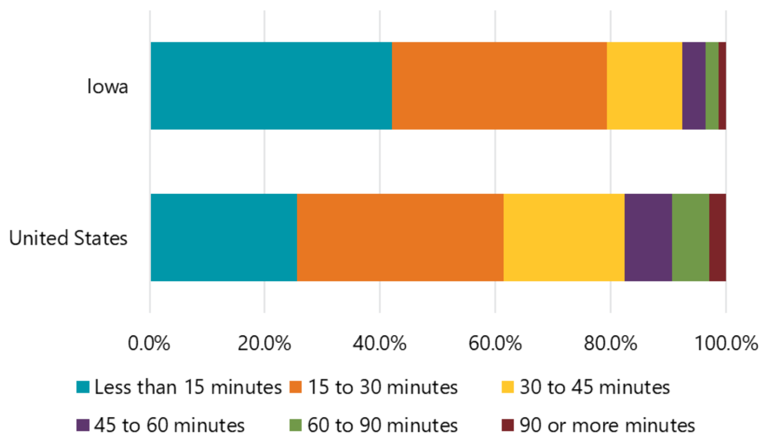


Source: U.S. Census Bureau

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 3.45.

Figure 3.45: Commute times for Iowa and the U.S., 2015-2019



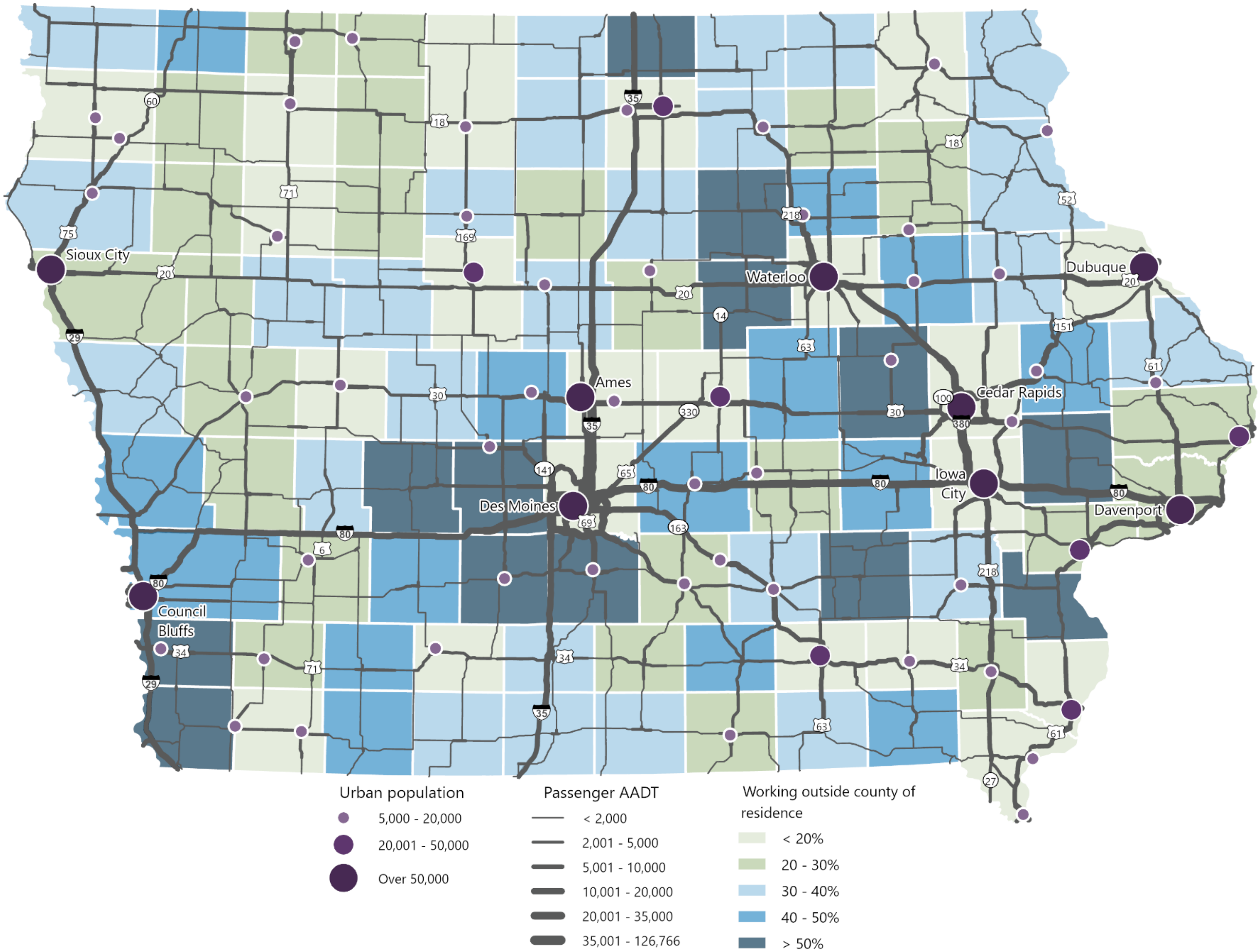
Source: U.S. Census Bureau

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 3.46 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 3.46: 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.

Railroads 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.

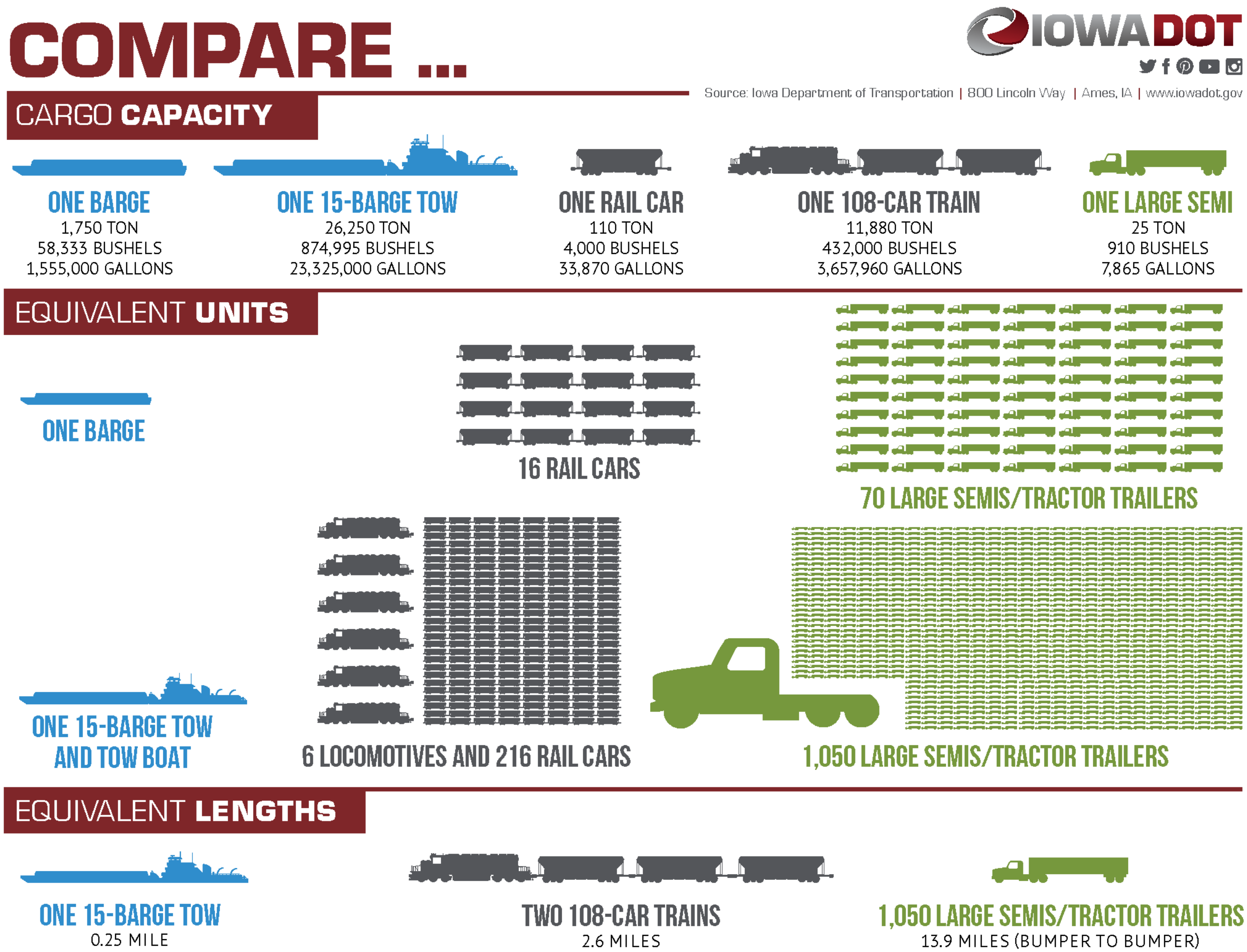
Transporting commodities via **waterway** is the slowest and least flexible of the freight modes. However, it is the most fuel-efficient, cheapest, and can handle the largest volumes per trip. One barge can handle as much as 70 trucks or more than 16 rail cars.

Figure 3.47 shows the general characteristics of various freight modes and Figure 3.48 shows the amount of freight various modes can transport, showing which modes can handle certain types of commodities most efficiently.

Figure 3.47: Freight mode comparison

Source: Iowa DOT

Figure 3.48: Freight tonnage comparison

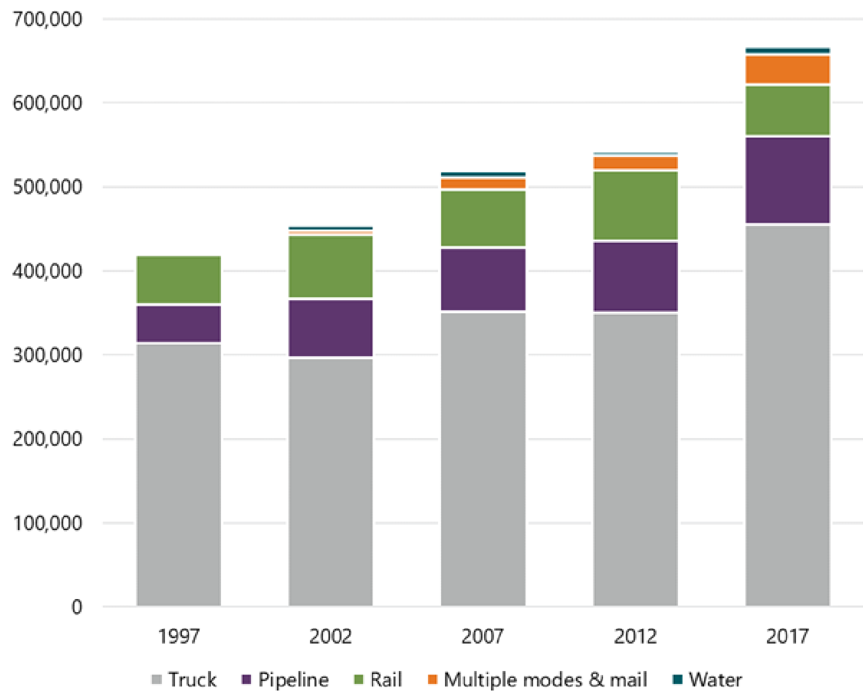


Source: Iowa DOT

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 3.49 shows the historical amounts of freight shipped by mode. Figure 3.50 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.

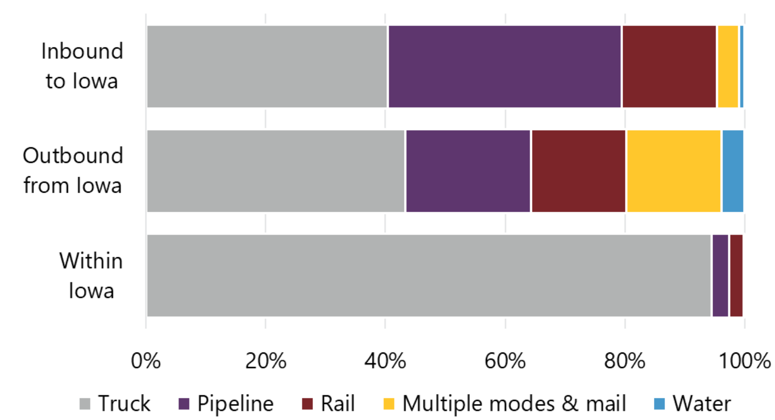
Figure 3.49: Tons of freight shipped within, to, or from Iowa by year and mode*



**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 3.50: 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 3.10 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 3.10: Value, tons, and value of freight per ton moved to, from, or within Iowa in 2017

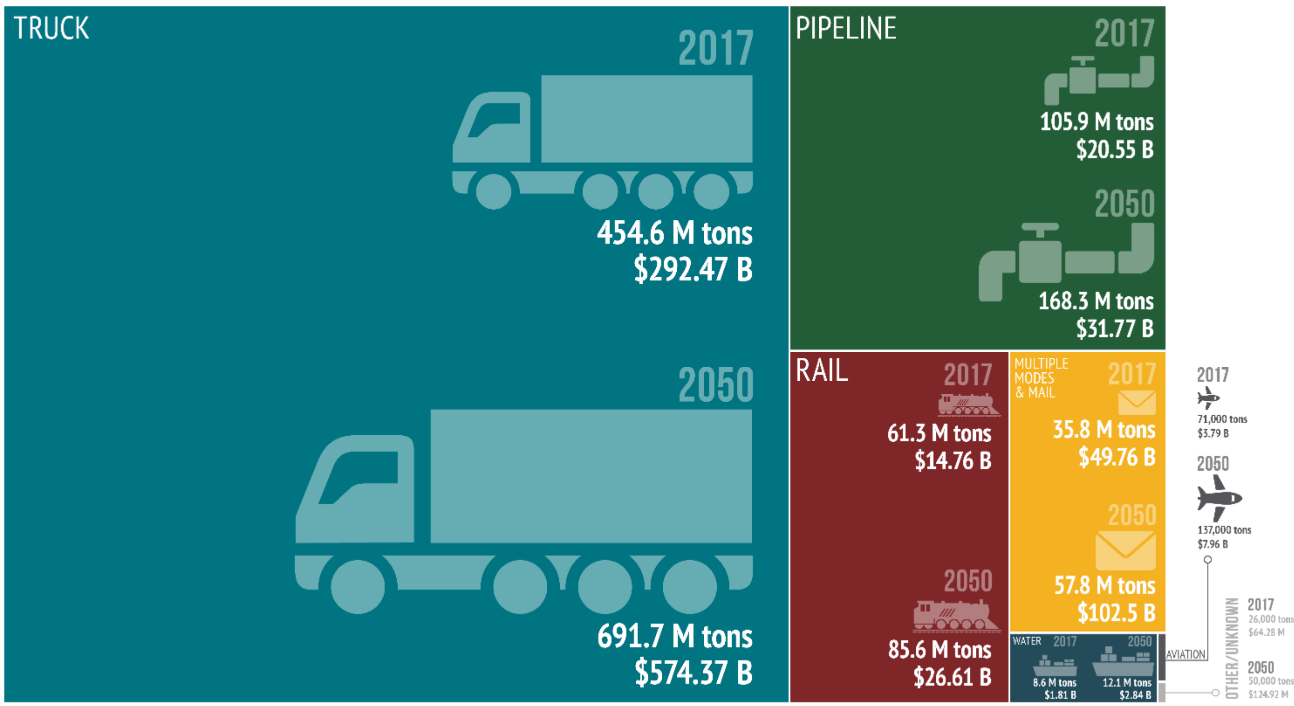
	Value (millions)	Tons (thousands)	Dollars per ton
Air (including truck-air)	$3,791.1	71.0	$53,397
Other and unknown	$64.3	26.1	$2,463
Multiple modes & mail	$49,757.8	35,763.4	$1,391
Truck	$292,470.0	454,629.6	$643
Rail	$14,759.2	61,348.7	$241
Water	$1,809.0	8,593.7	$211
Pipeline	$20,548.4	105,852.2	$194

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 3.51 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 3.51: Projected growth in tonnage and value of Iowa freight by mode, 2017-2050

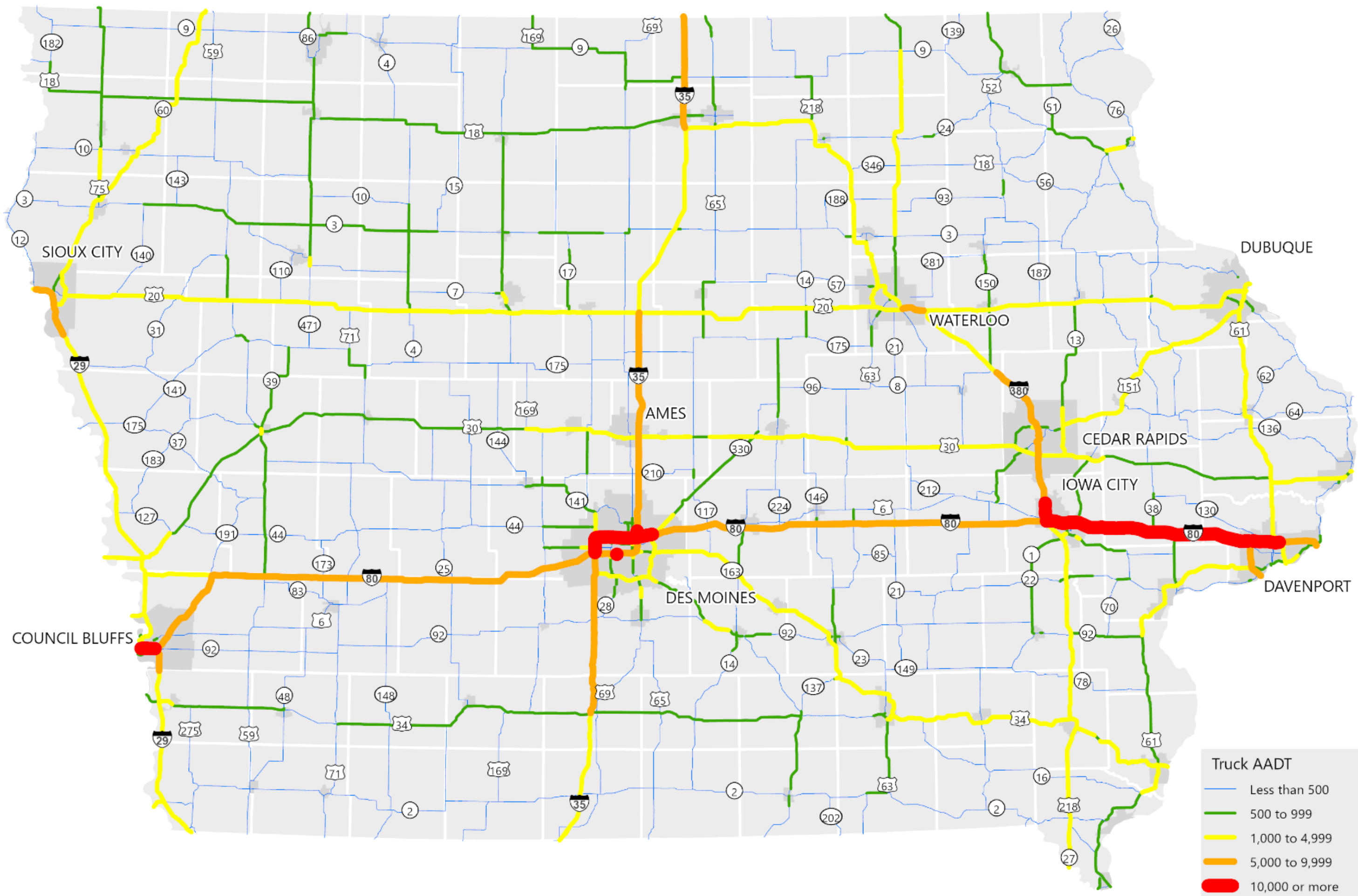


Source: Iowa DOT

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

Figure 3.52: Total annual average daily truck traffic (AADTT)



Source: Iowa DOT

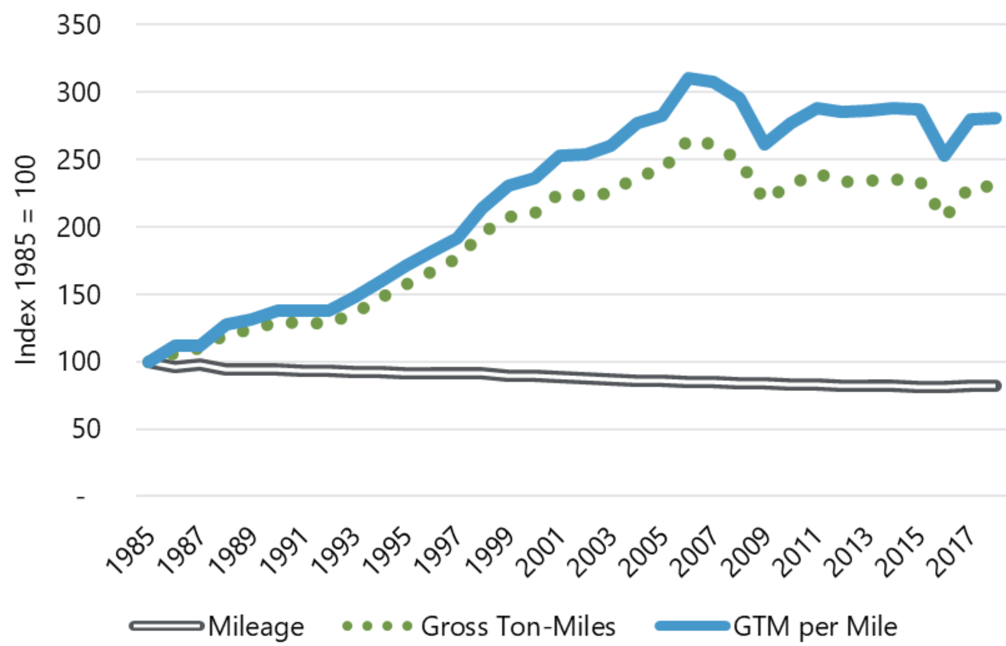
Increasing amounts of freight will move through Iowa via rail main lines

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 3.53 shows how mileage has declined since 1985 while the amount transported has increased; Figure 3.54 shows Iowa's rail traffic density.

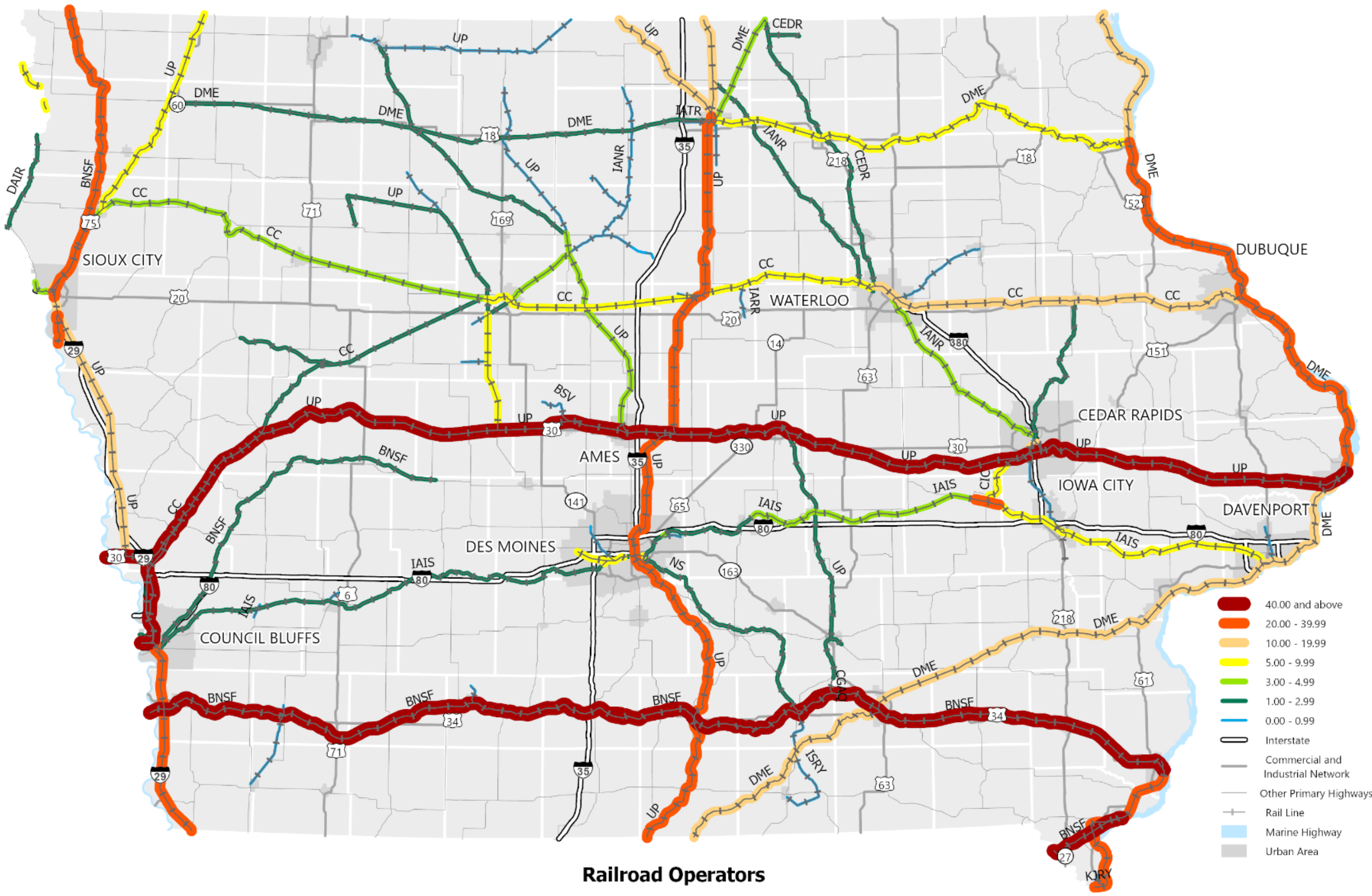
Additionally, railroads continue to focus their attention on heavier axle-load freight equipment and using longer, heavier trains to lower costs. Using larger rail cars in 100-plus car unit trains allows the greatest savings and economic benefits, and keeps would-be truck traffic off the highways, resulting 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 3.53: Mileage and gross ton-miles of Iowa's railroads, indexed to 1985



Source: Iowa DOT, Railroads' annual reports

Figure 3.54: 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

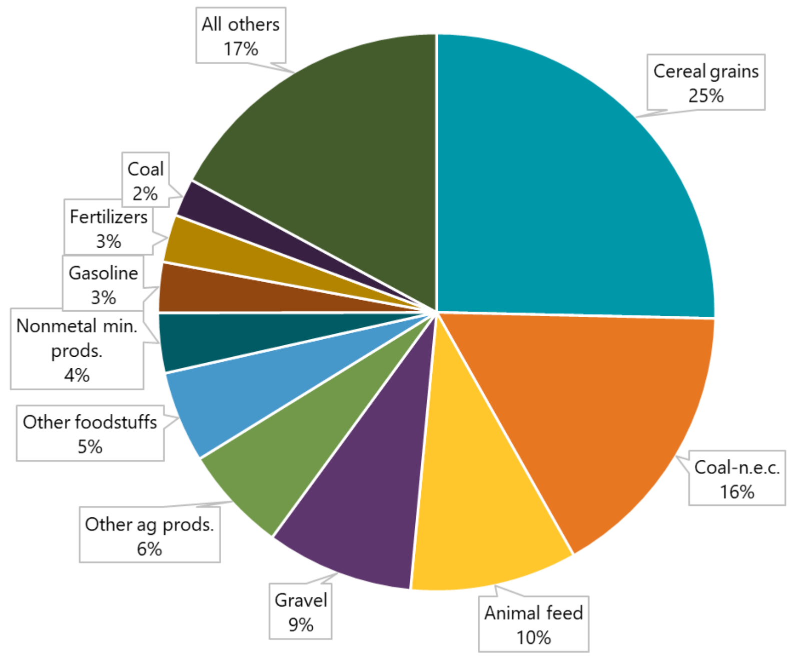
Iowa freight trade will continue to increase

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 3.55.

Figure 3.55: Top commodities moved to, from, or within Iowa by weight, 2017



Source: FWHA Freight Analysis Framework