4. SYSTEM OVERVIEW

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

4.1 Aviation

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

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

Highlights

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

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

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

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

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

Impact of aviation on Iowa's economy

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

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

Aviation planning efforts

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

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

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

Inventory

Iowa's airports

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

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

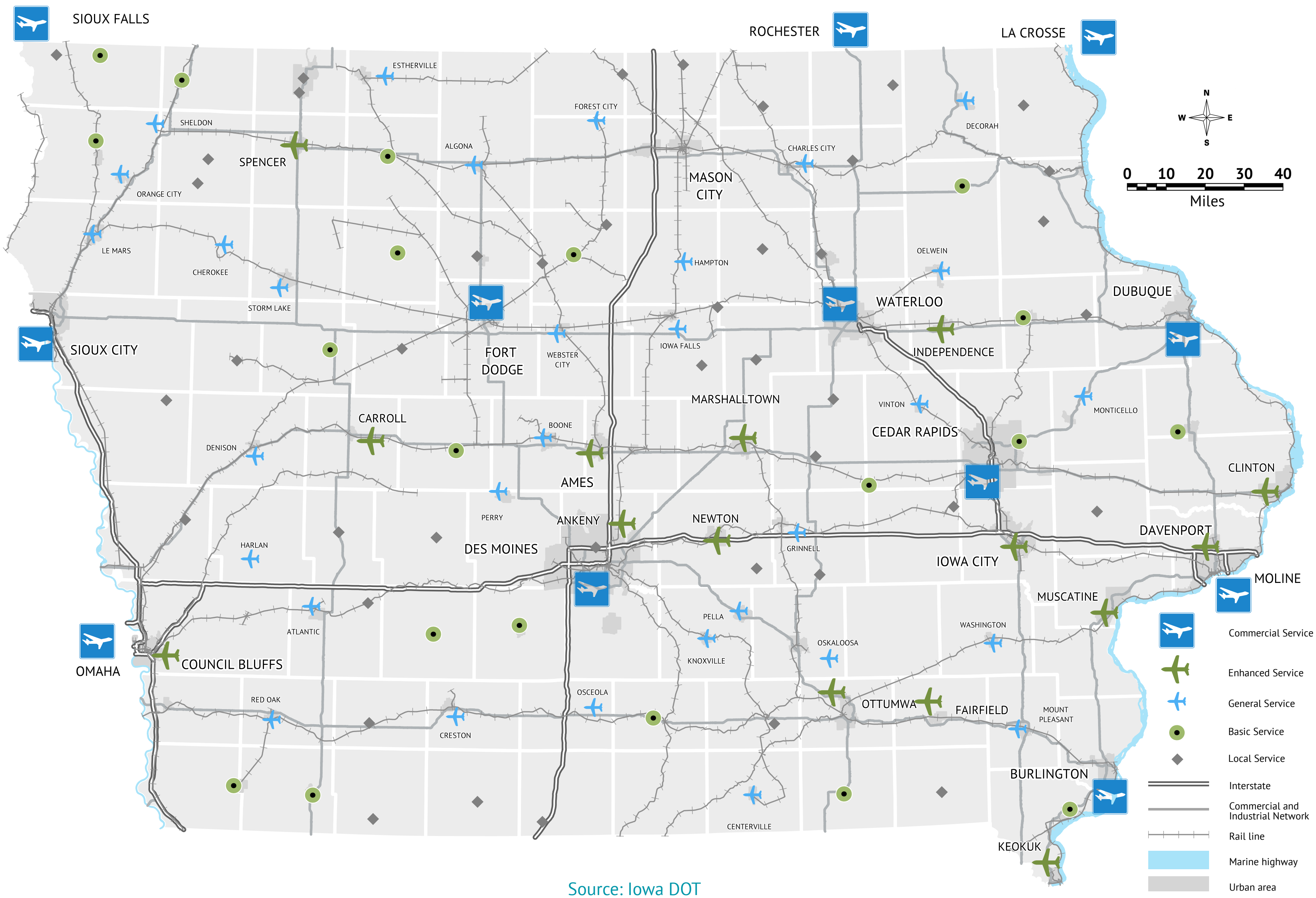
Enhanced service
Airports with a paved runway 5,000 feet or longer with facilities and services to support most general aviation aircraft, including business jets, and have weather observation equipment. Enhanced service airports serve business aviation and are regional transportation centers. There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

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

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

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

Figure 4.1: Iowa airports by role and bordering commercial airports



Source: Iowa DOT

Current trends

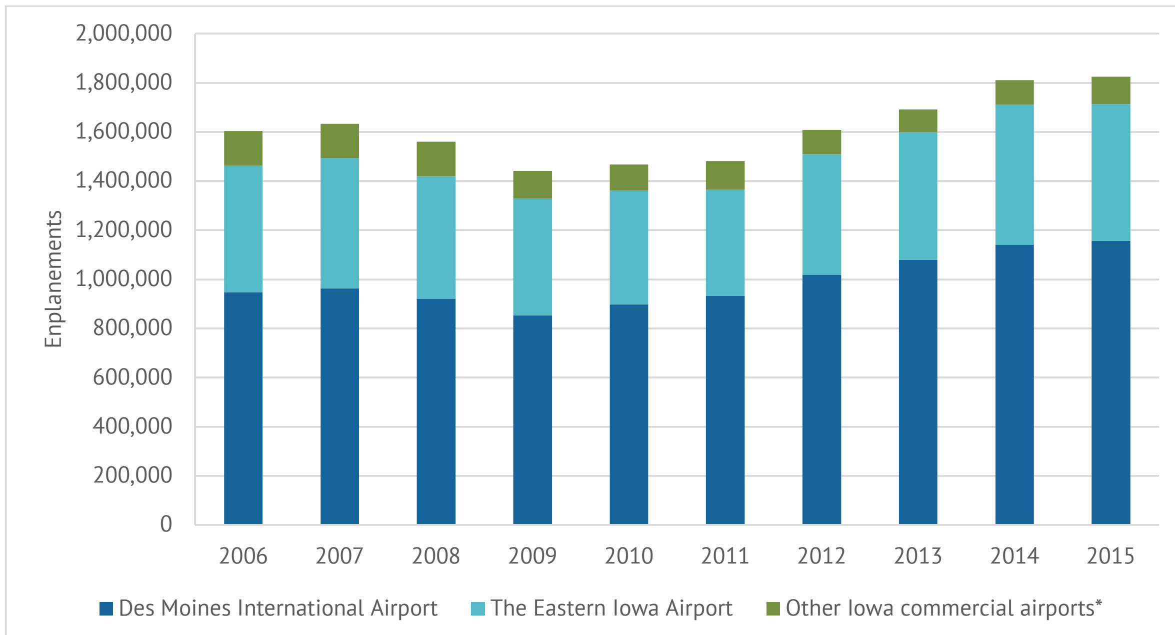
In recent years, the aviation industry has experienced changes related to the economy, new technologies, security, and regulatory impacts. In Iowa, commercial air service has returned to record highs. While overall cargo activity is down in recent years, this has more to do with changes in UPS Inc. and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

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

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

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

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



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

Source: FAA

Key issues

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

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

4.2 Bicycle and pedestrian

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

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

Highlights

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

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

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

Trail use is increasing.

Bicycle helmet use is rising.

Businesses have identified local trails as an aid in recruitment.

Demand for urban sidewalks has increased.

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

Impact of bicycle and pedestrian transportation on Iowa's economy

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

Health and fitness

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

Tourism

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

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

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

Environment

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

Bicycle and pedestrian planning efforts

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

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

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

Statewide trails vision

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

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

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

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

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

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

Future implementation of statewide trails vision

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

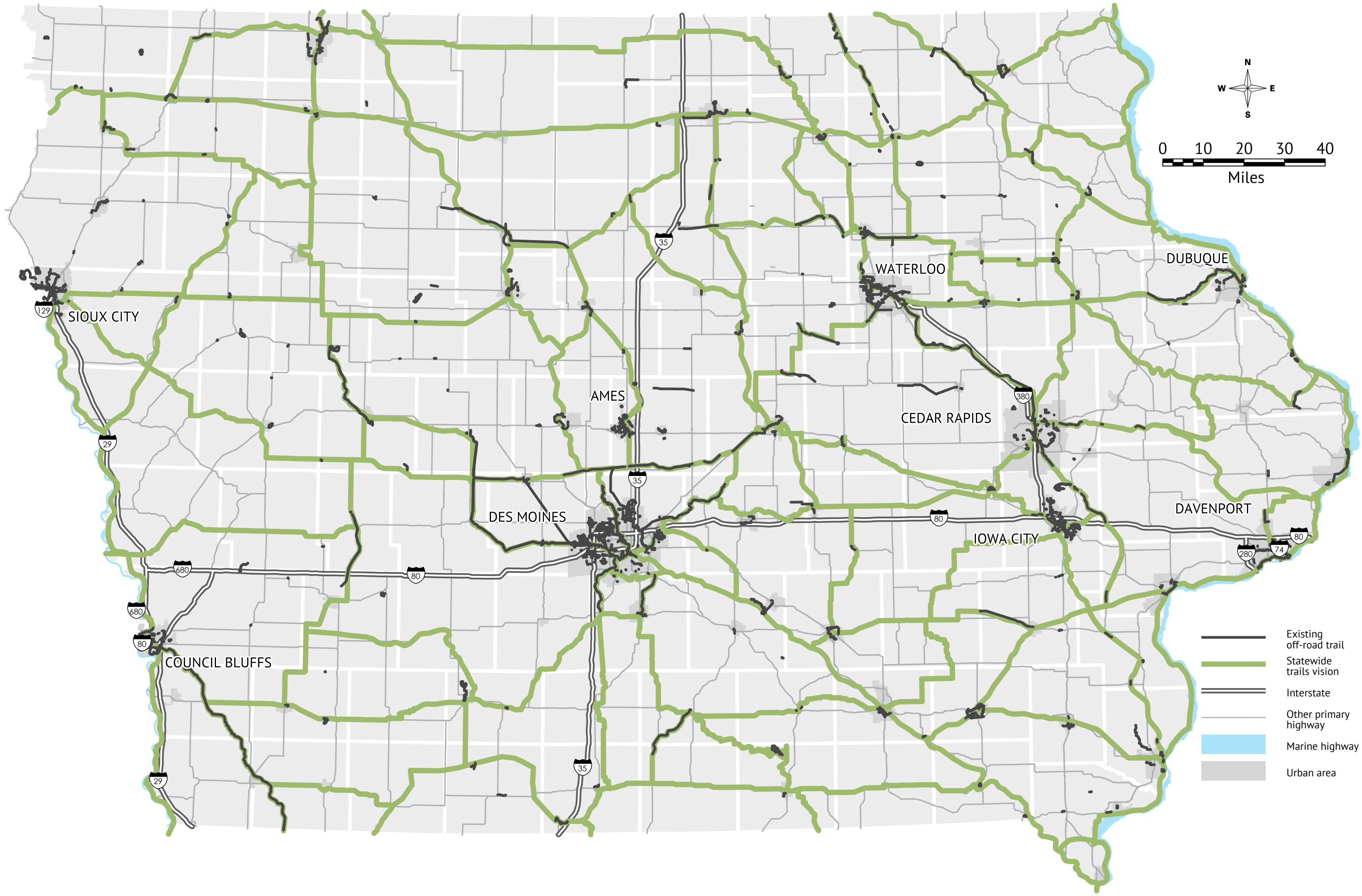
Furthermore, there is an expectation that a "trail" is a paved bicycle and pedestrian path separated from motor vehicle traffic. While the continued development of national "trail" routes (e.g., the Mississippi River Trail that is primarily composed of on-road routes) remains important, the consensus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

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

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

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

Figure 4.3: Statewide trails vision



Source: Iowa DOT

Inventory

Types of facilities

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

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

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

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

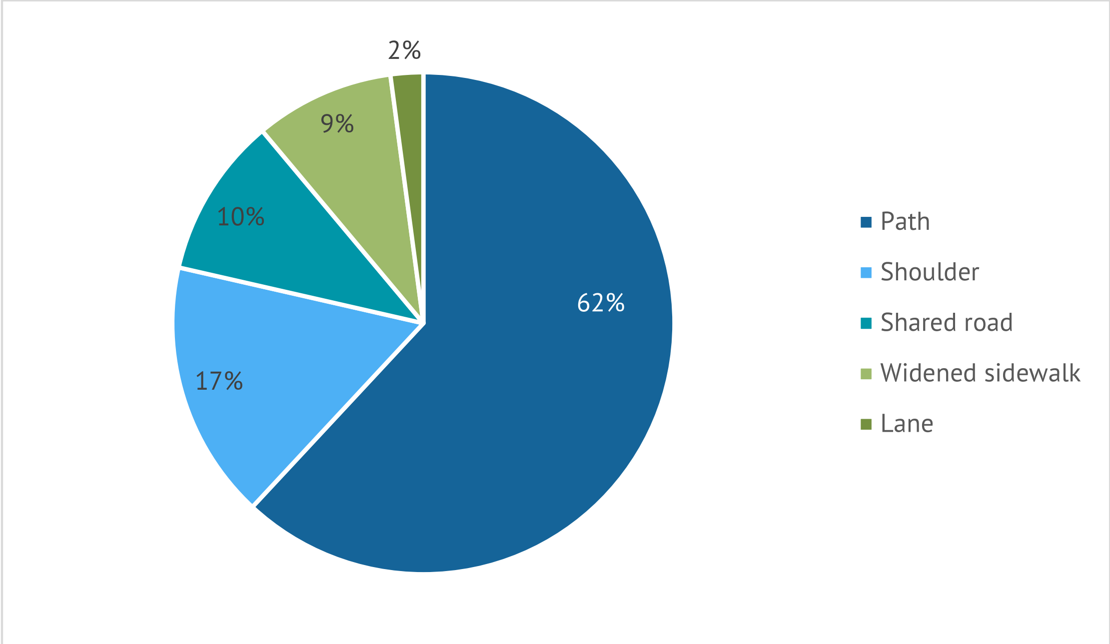
Sharrow
Pavement markings placed in the roadway lane, indicating that motorists should expect to see and share the road with bicyclists.

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

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

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

Figure 4.4: Iowa bicycle and pedestrian facilities by type



Source: Iowa DOT

Current trends

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

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

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

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

Key issues

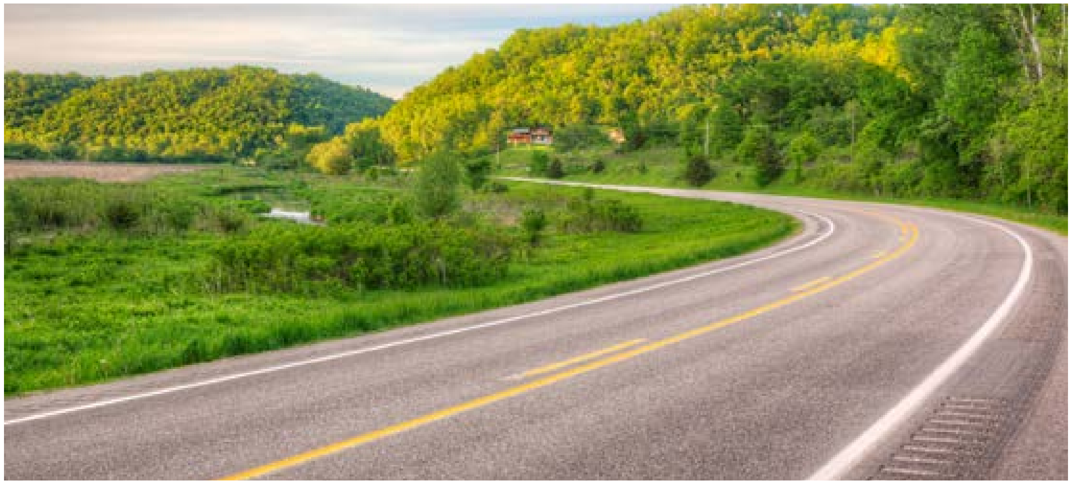
- Additional funding is needed for system expansion and maintenance.
- Many communities are not bicycle- and pedestrian-friendly, which could be partially addressed through the expansion of complete streets policies at the local and state level.
- Infrastructure improvements are needed to address deficiencies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

4.3 Highway

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

Impact of highway transportation on Iowa's economy

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



Highlights

Iowa has 114,880 miles of roadways.

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

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

Two transcontinental interstate highways cross Iowa.

Iowa has more than 24,000 bridge structures.

Nearly 20,000 trucking companies operate in Iowa.

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

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

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

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

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

Highway planning efforts

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

ICE tool

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

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

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

State Freight Plan

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

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

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

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

- The INRIX bottleneck ranking tool, which provided the performance component of each location based on how often bottlenecks occur.

- Annual average daily truck traffic (AADTT), which was used as a tiebreaker if locations had the same ranking after the value, condition, and performance evaluation.

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

Iowa in Motion 2045

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

Inventory

Iowa's highway system

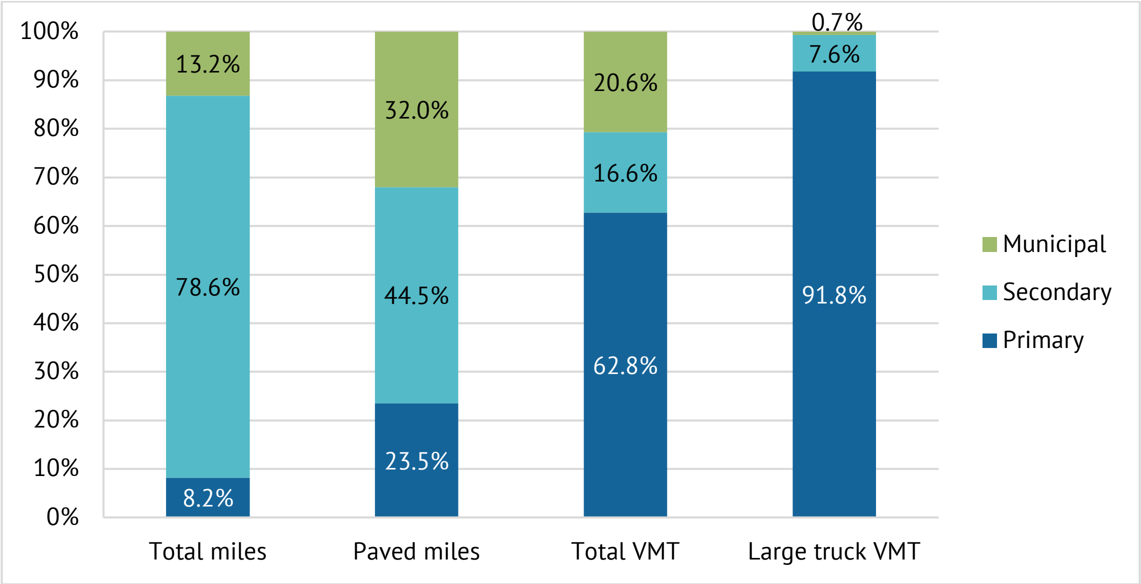
Iowa is uniquely positioned at the crossroads of two major interstate highways: I-35 and I-80. As shown in Table 4.1 and Figure 4.5, the state's public roadway system is comprised of over 114,000 miles and includes more than 24,000 bridge structures. While the size of the state's roadway system has not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

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

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

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

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



**Mileage does not include park and institutional roads. Mileage does include ramps.*

Source: Iowa DOT

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

- ***Interstate***: Comprised of 1,059 center line miles, the Interstate Highway System provides connections to the national transportation network and major metropolitan areas.

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

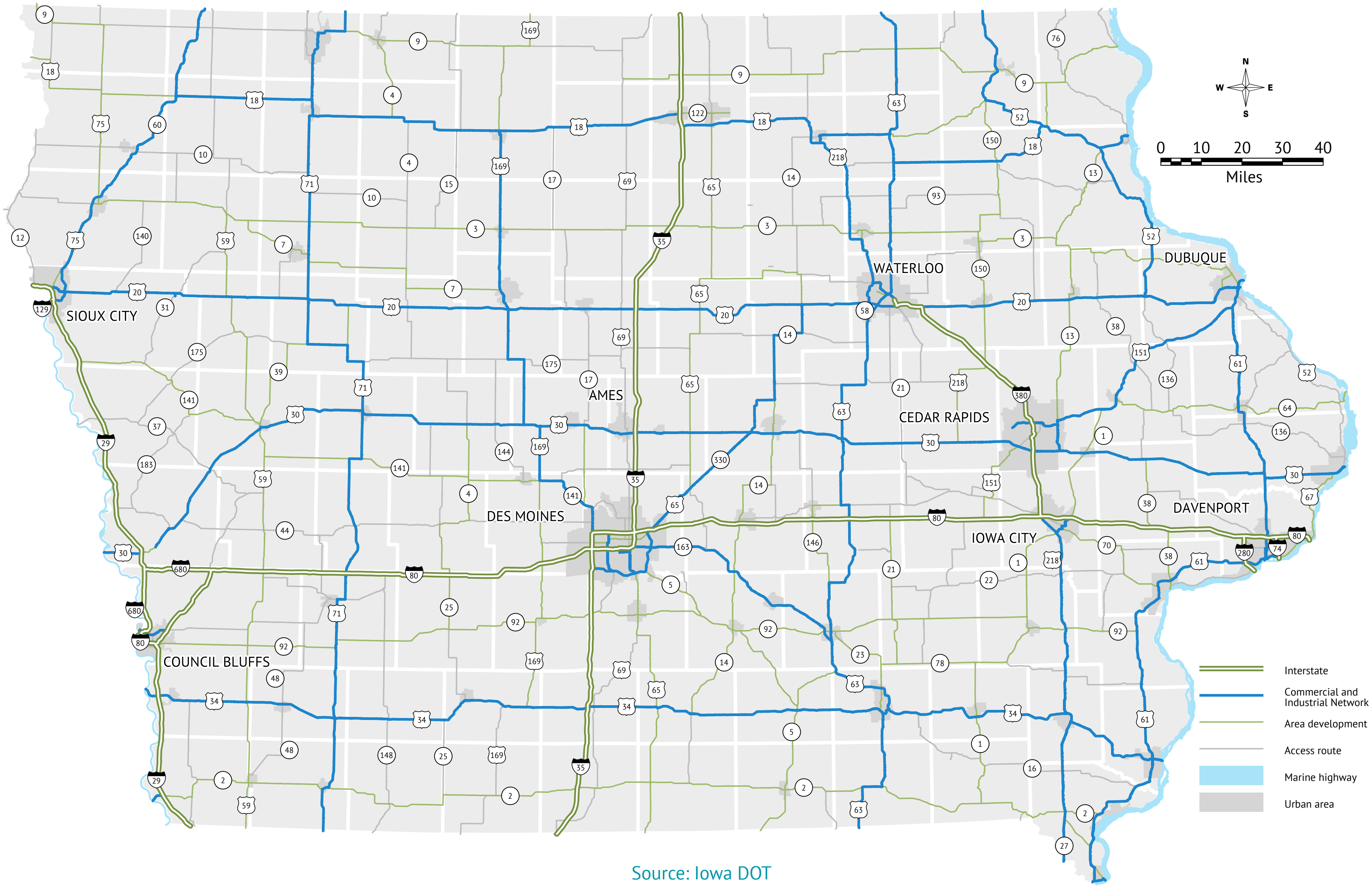
Other primary highways comprise the remaining 5,829 miles, and include the following routes.

- ***Area development***: Provide connections for cities with populations greater than 5,000 to the CIN and major commercial and industrial centers.

- ***Access route***: Provide connections for cities with populations greater than 1,000 to employment, shopping, health care, and education facilities.

- ***Local service***: Provide connections for cities with populations less than 1,000 to local commercial and public service.

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



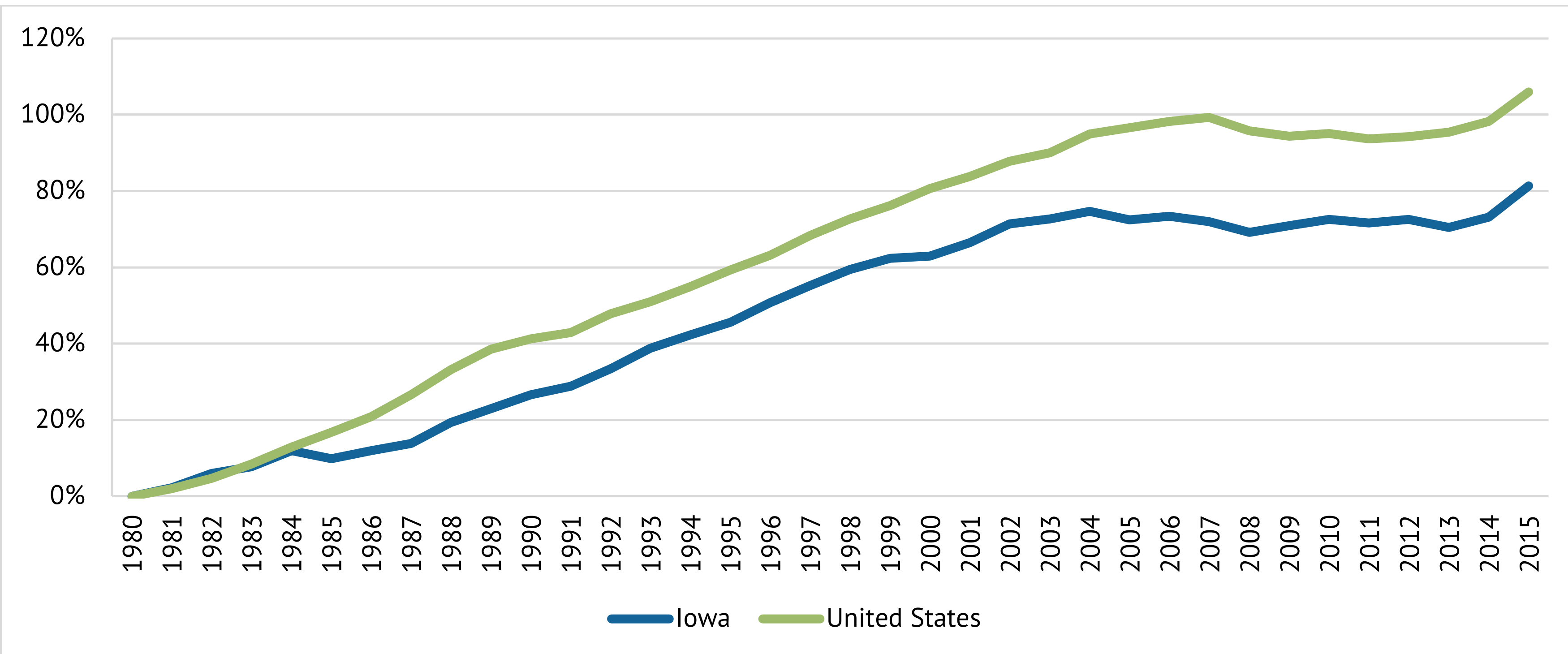
Source: Iowa DOT

Current trends

Travel

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

Figure 4.7: Percent change in traffic, base year 1980

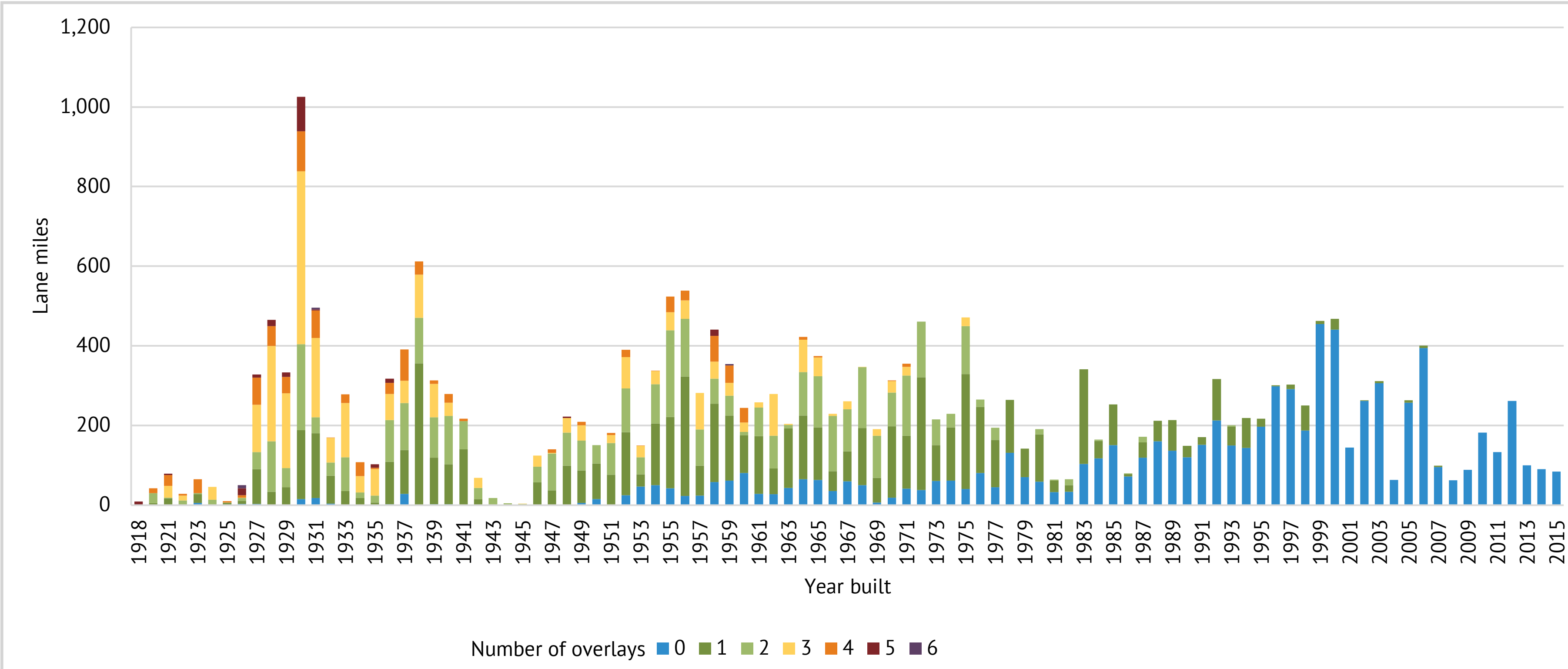


Source: Iowa DOT

Roadway condition

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

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



Source: Iowa DOT

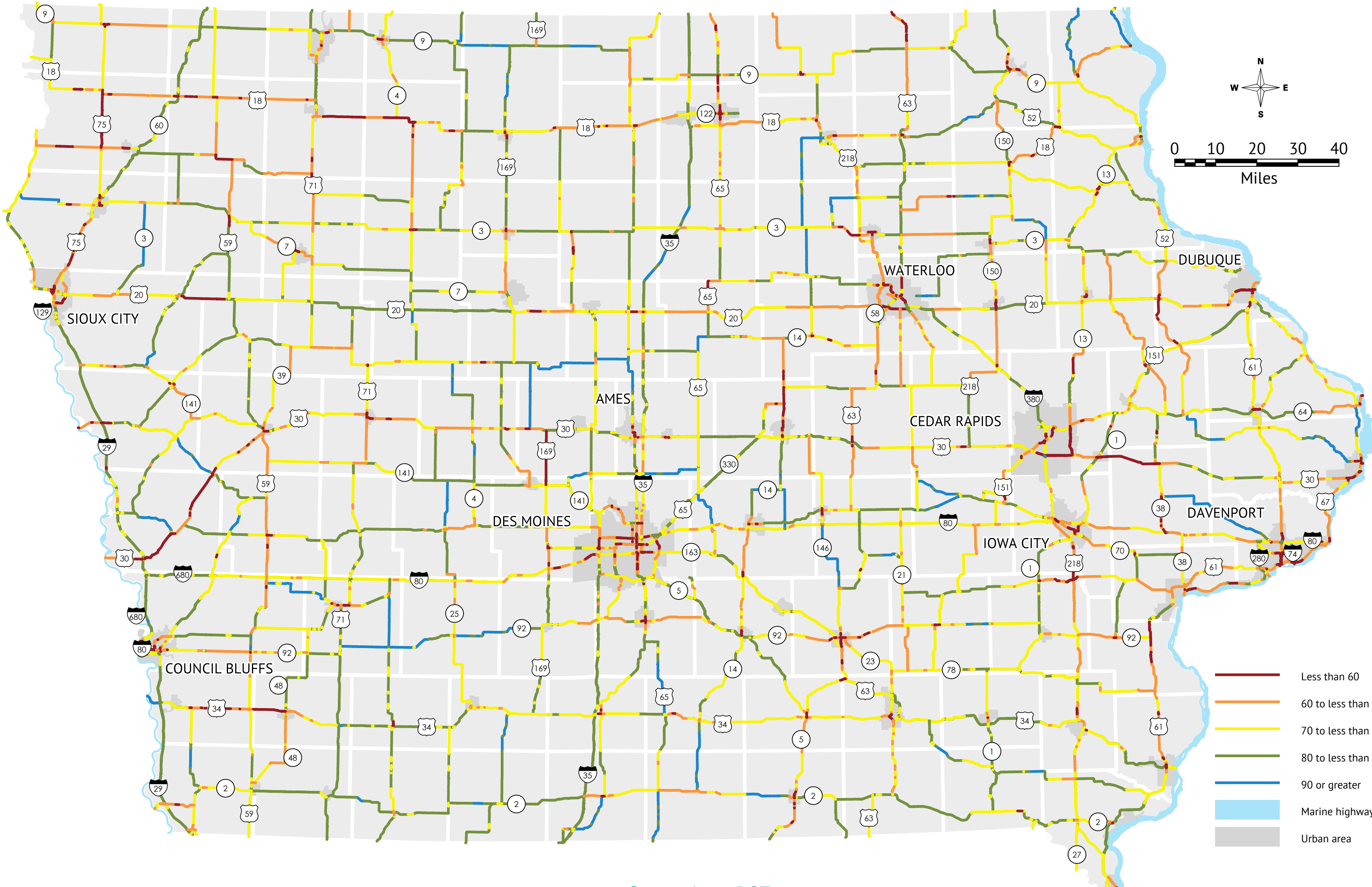
As discussed previously, the ICE tool can be used to evaluate the condition of the Primary Highway System in the state by providing a composite score of roadway and traffic conditions, and help identify corridors that should be considered for further study. Table 4.2 shows the percentage of Iowa roadways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

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

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

Source: Iowa DOT

Figure 4.9: 2015 ICE composite rating

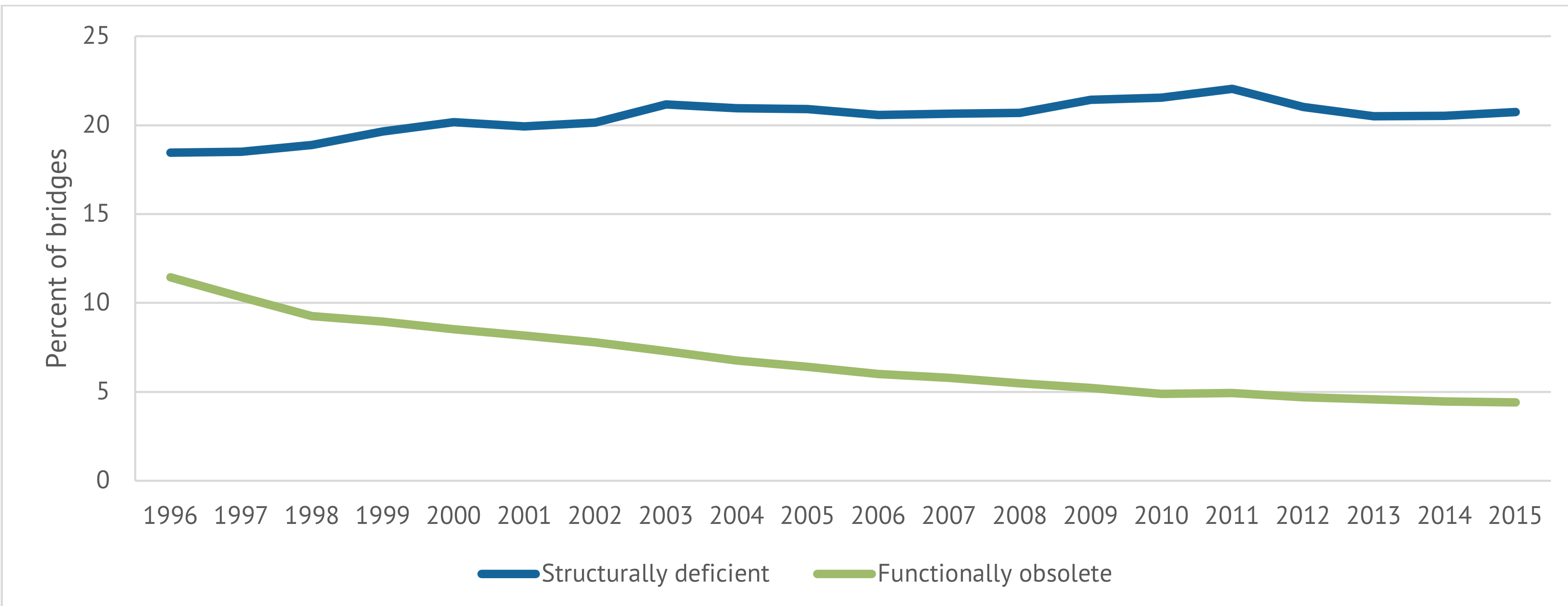


Source: Iowa DOT

Bridge condition

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

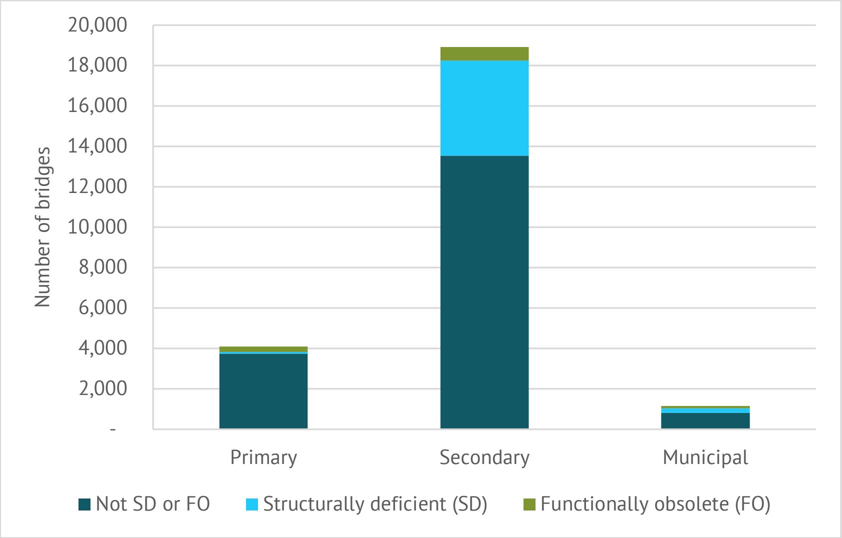
Figure 4.10: Percent of bridge structures in Iowa considered structurally deficient or functionally obsolete, 1996-2015



Source: Iowa DOT

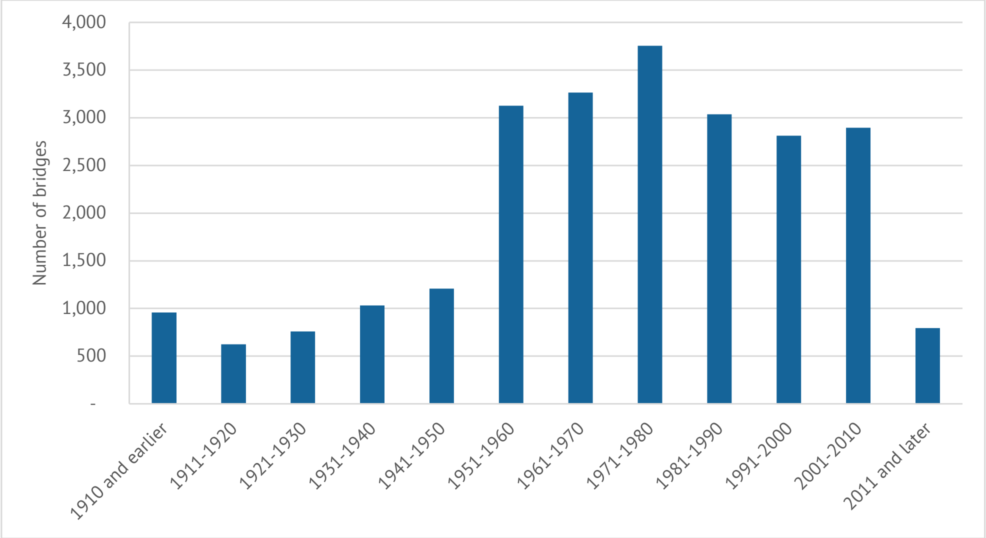
7 http://t4america.org/docs/bridgereport2013/2013BridgeReport.pdf

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



Source: Iowa DOT

Figure 4.12: Iowa bridges by decade constructed



Source: Iowa DOT

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

Key issues

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

4.4 Public transit

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

Impact of public transit services on Iowa's economy

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

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

Highlights

Serves all Iowa counties and cities.

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

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

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

Allows individuals to maintain independence.

Provides commuters and others with choice of transportation.

Public transit planning efforts

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

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

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

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

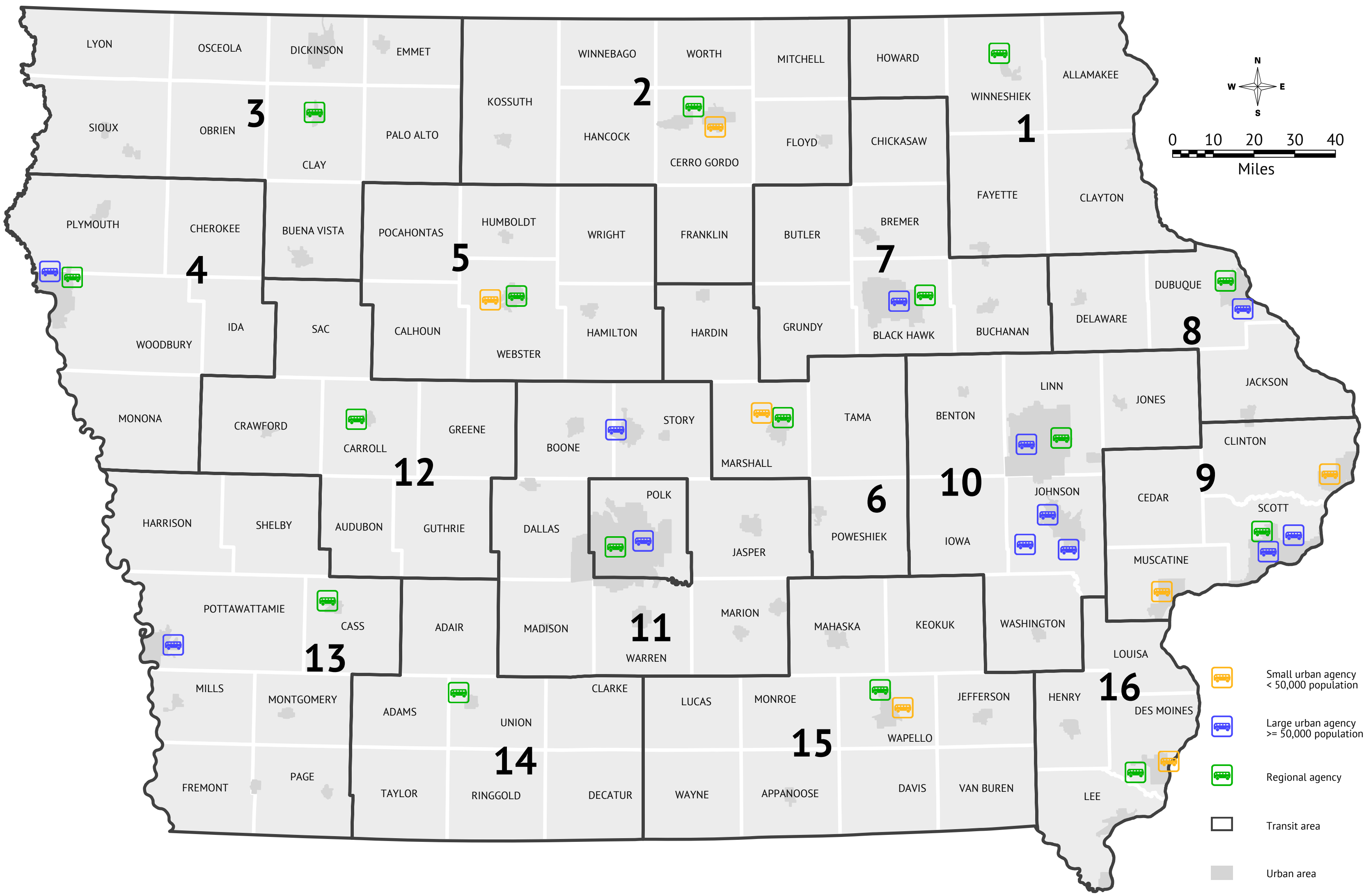
In addition to operations needs, maintenance and administrative facilities are essential to deliver reliable and safe public transit services. Regarding facilities, the 2008 Iowa Statewide Transit Facility Needs Analysis showed that Iowa's public transit systems were in need of 186,000 square feet of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

Inventory

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

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

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

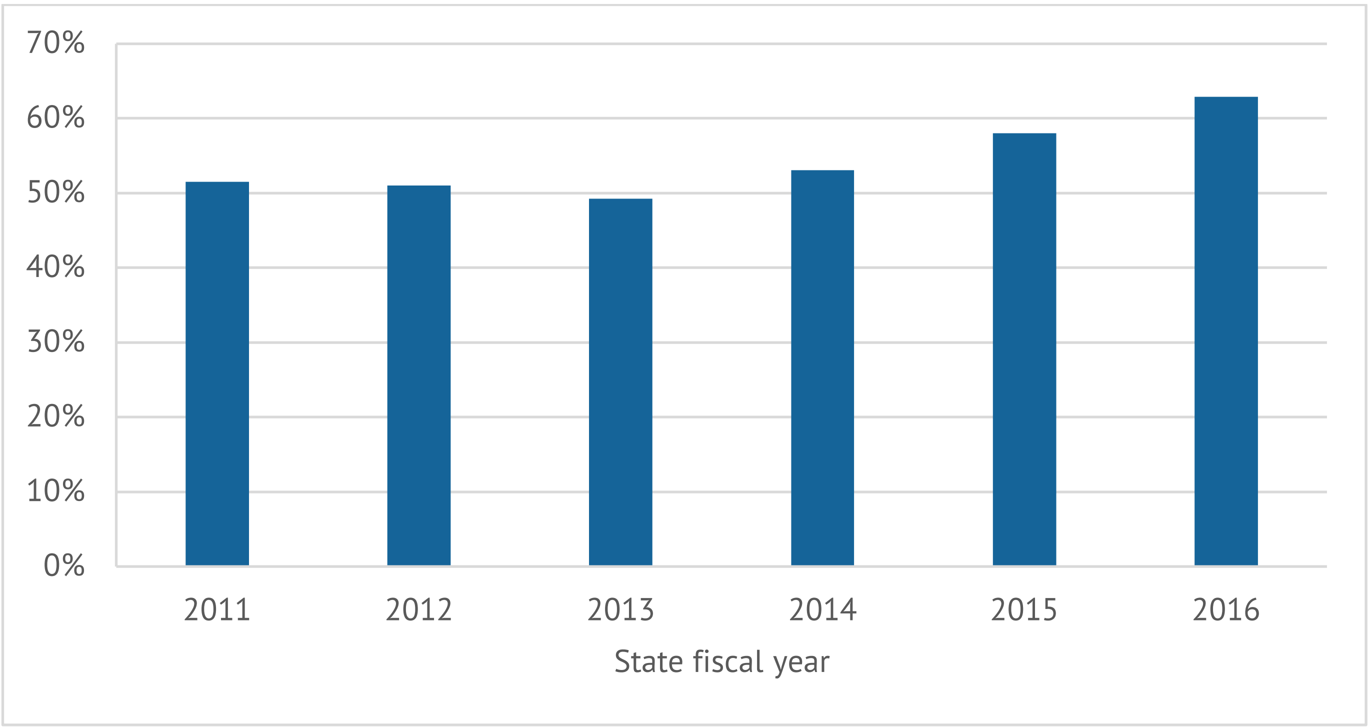


Source: Iowa DOT

Current trends

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

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

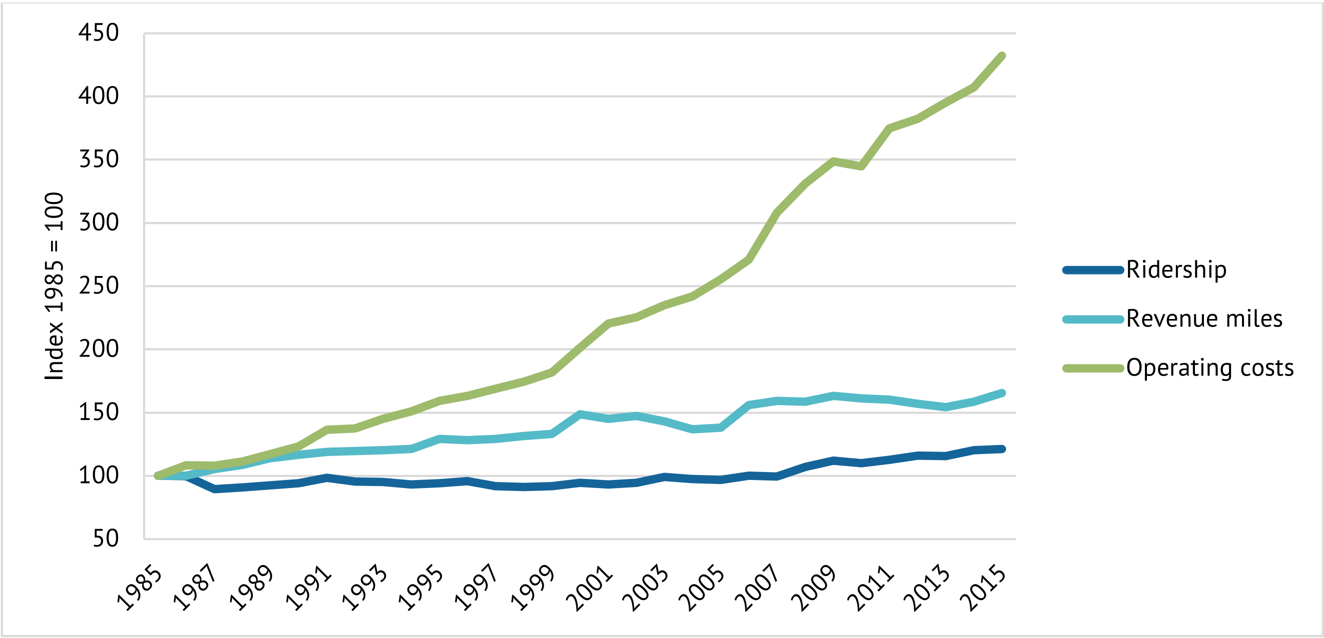


Source: Iowa DOT

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

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

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



Source: Iowa DOT

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

Key issues

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

4.5 Rail

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

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

Highlights

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

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

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

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

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

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

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

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

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

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

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

Impact of rail transportation on Iowa's economy

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

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

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

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

Rail planning efforts

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

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

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

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

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

Inventory

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

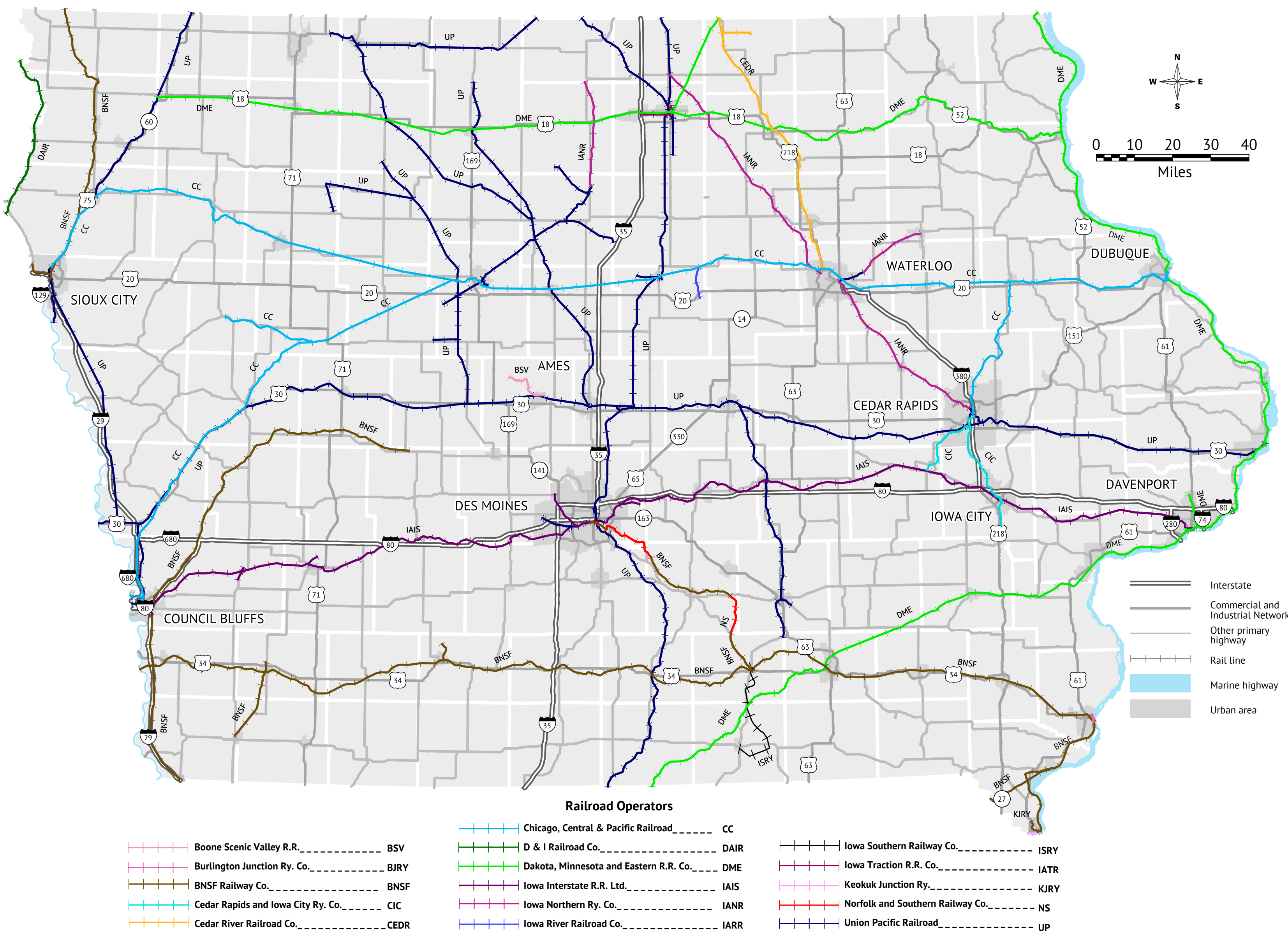
Freight rail

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

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

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

Figure 4.16: Iowa railroad service map



Source: Iowa DOT

Passenger rail

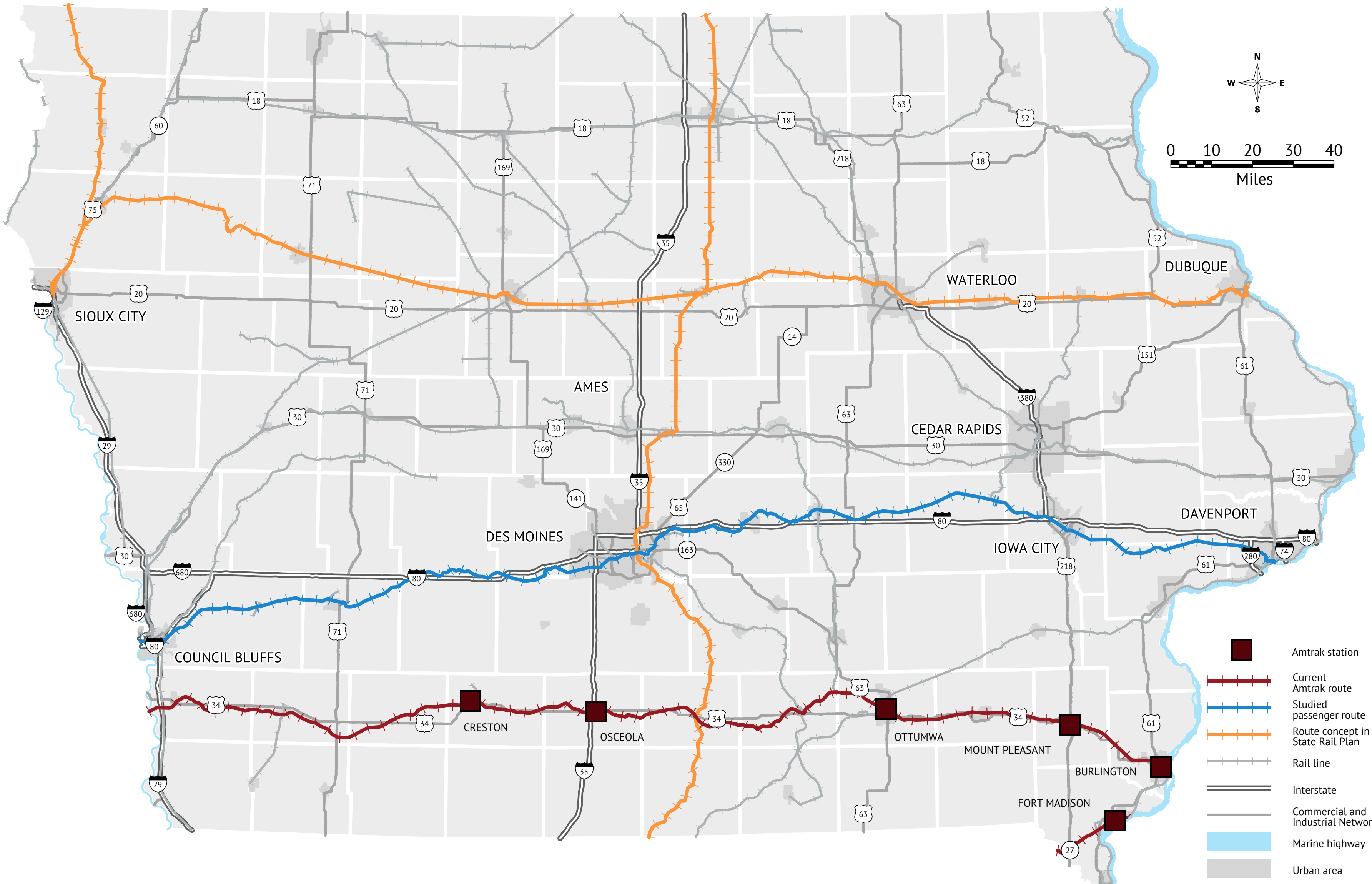
Passenger rail service in Iowa is currently provided by two Amtrak routes, the California Zephyr from Chicago, Ill. to Oakland, Calif., and the Southwest Chief from Chicago to Los Angeles, Calif. The California Zephyr operates over the BNSF tracks in southern Iowa providing daily service in both directions.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

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

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

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

Figure 4.17: Passenger rail service in Iowa



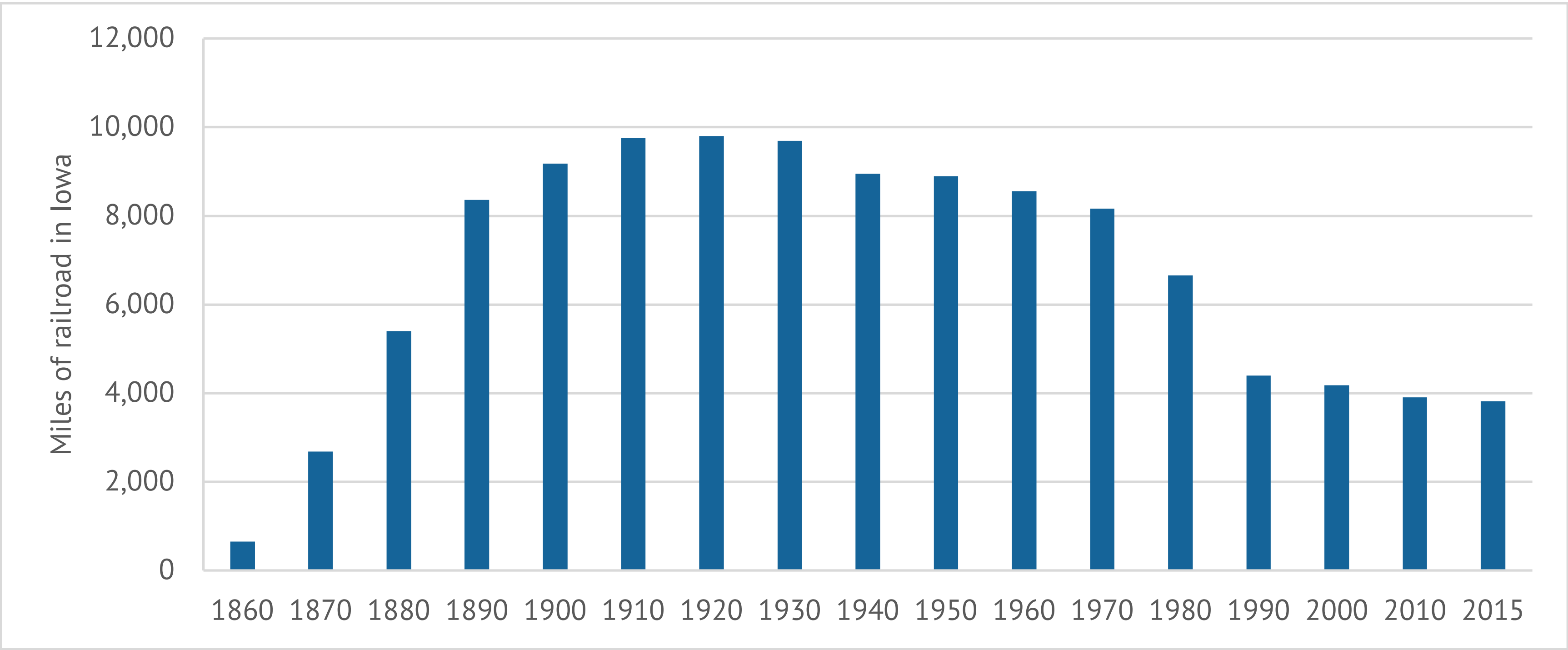
Source: Iowa DOT

Current trends

System size and tonnage

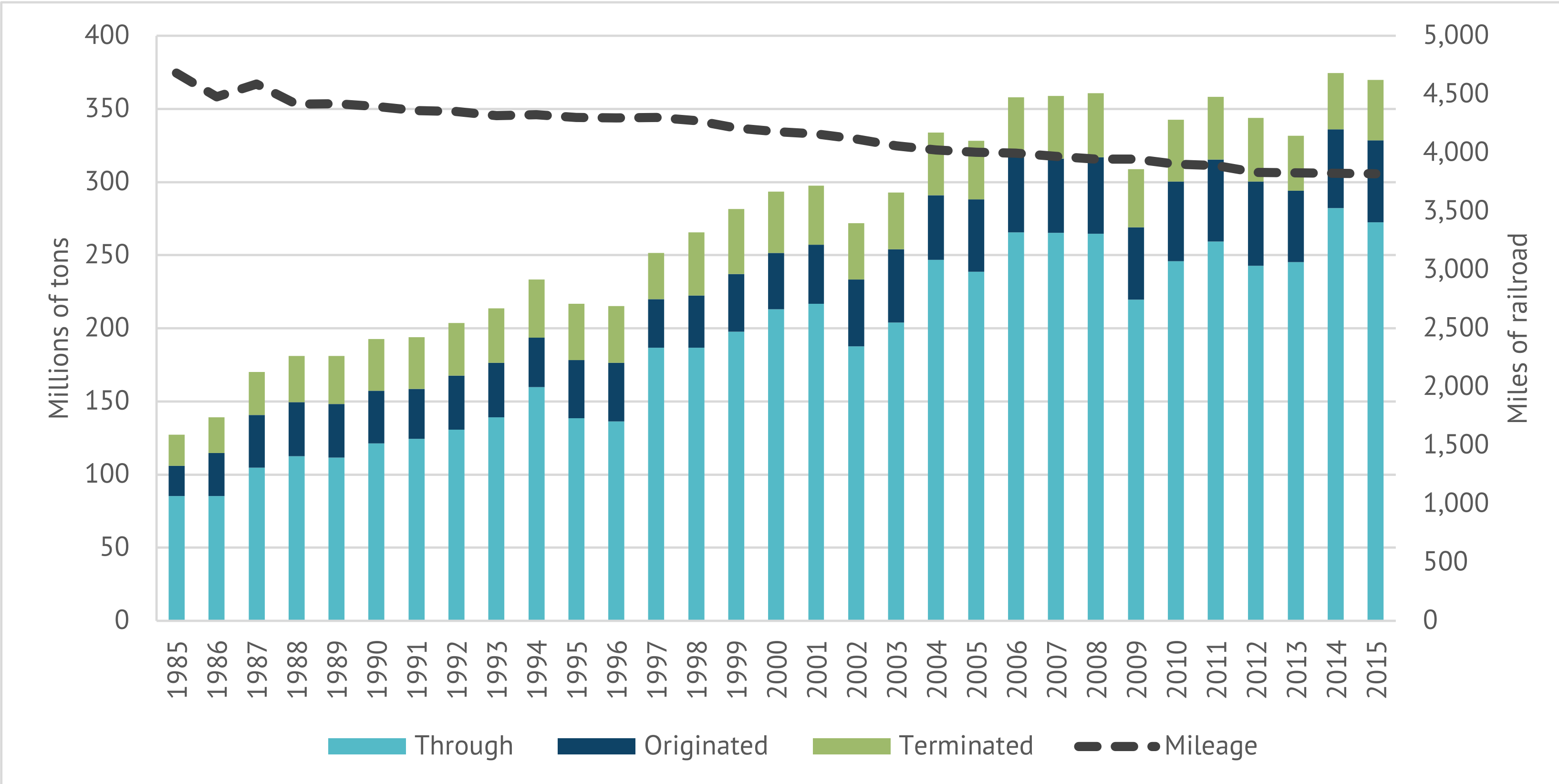
The mileage of the rail system has decreased significantly over time, from a peak of more than 10,000 miles in 1915 to its current level of just over 3,800 miles. Despite the reduction in railroad mileage in the state, the amount of freight being shipped to, from, and through Iowa has continued to rise.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

Figure 4.18: Historical rail mileage, Iowa



Source: Iowa DOT

Figure 4.19: Rail movements in Iowa, 1985-2015

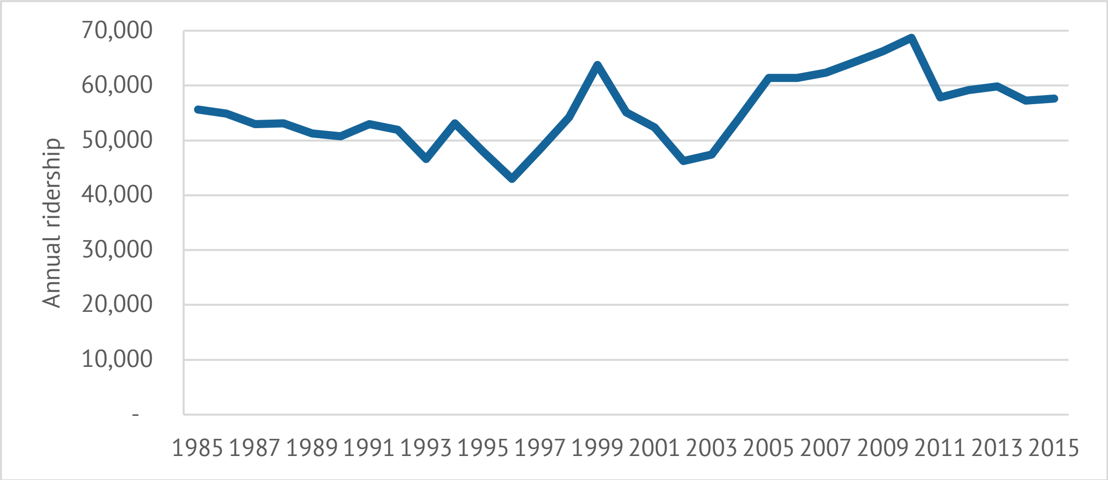


Source: Iowa DOT

Amtrak ridership

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

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



Source: Iowa DOT

Size of shipments

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

Transload and intermodal opportunities

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

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

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

Growth in U.S. energy production

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

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

Key issues

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

4.6 Waterway

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

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

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

Highlights

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

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

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

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

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

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

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

Impact of waterway transportation on Iowa's economy

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

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

Waterway planning efforts

M-35 Marine Highway Corridor

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

U.S. Inland Waterway Modernization Study

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

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

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

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

Inventory

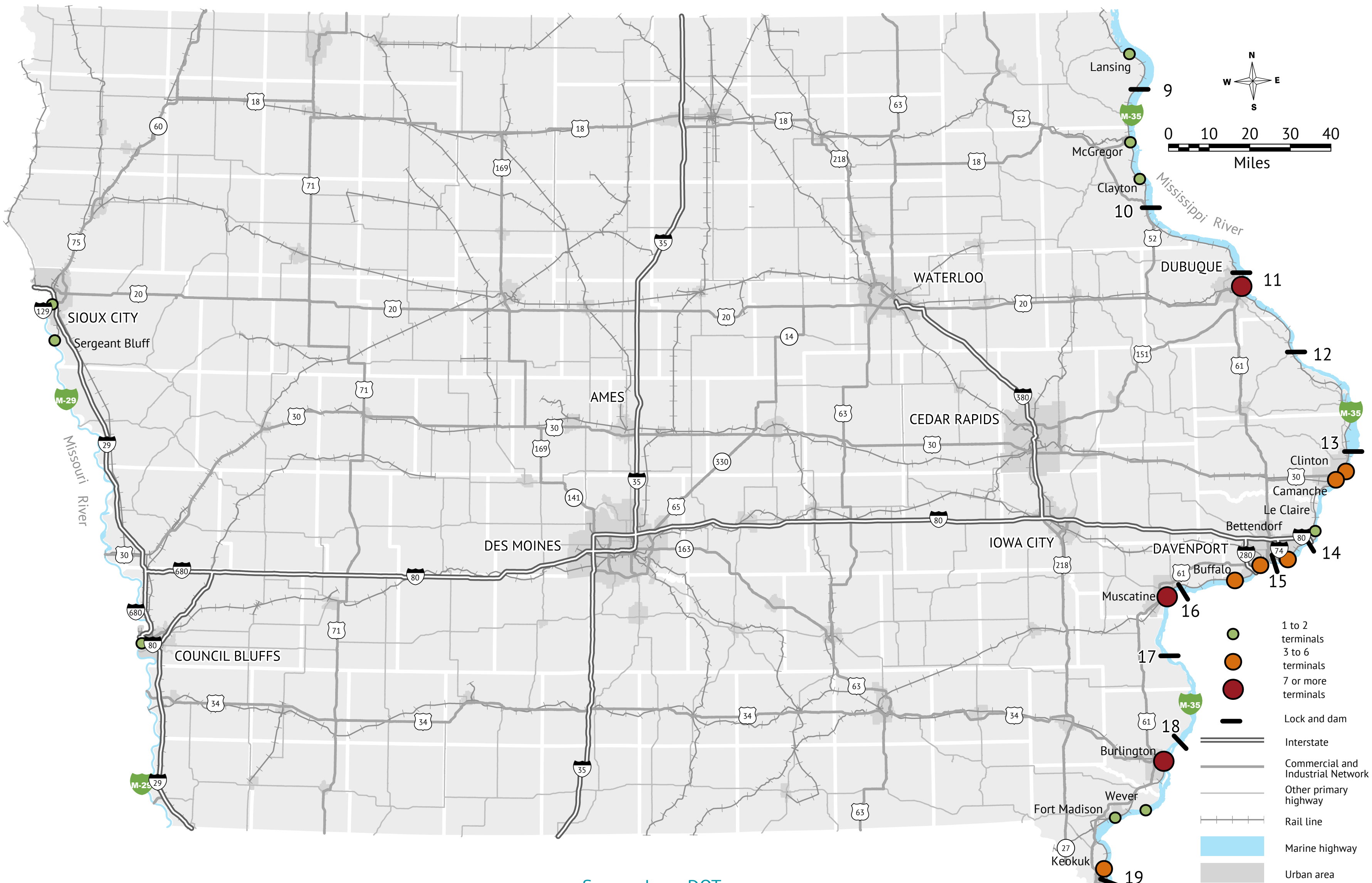
There are 11 lock and dams located on the Mississippi River bordering Iowa, along with 60 barge terminals between the Mississippi and Missouri Rivers. Table 4.3 lists the lock locations and provides information about each lock. Figure 4.21 shows the location of Iowa's two marine highways, 11 lock and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

Table 4.3: Iowa Mississippi River locks summary

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

Source: Iowa DOT

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



Source: Iowa DOT

Current trends

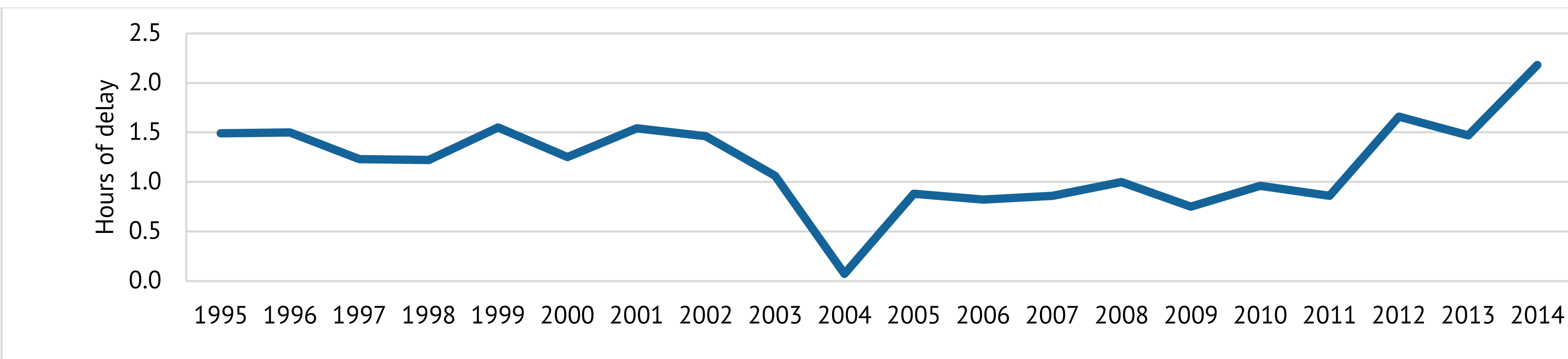
In 2013, the American Society of Engineers' Report Card for America's Infrastructure gave the following grades for maritime infrastructure: ports, C; dams, D; levees, D-; and inland waterways, D-. These grades reflect the poor condition that much of the nation's system is in, raising concerns about the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

Lock and dam infrastructure is aging and deteriorating

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

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

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



Source: U.S. Army Corps of Engineers

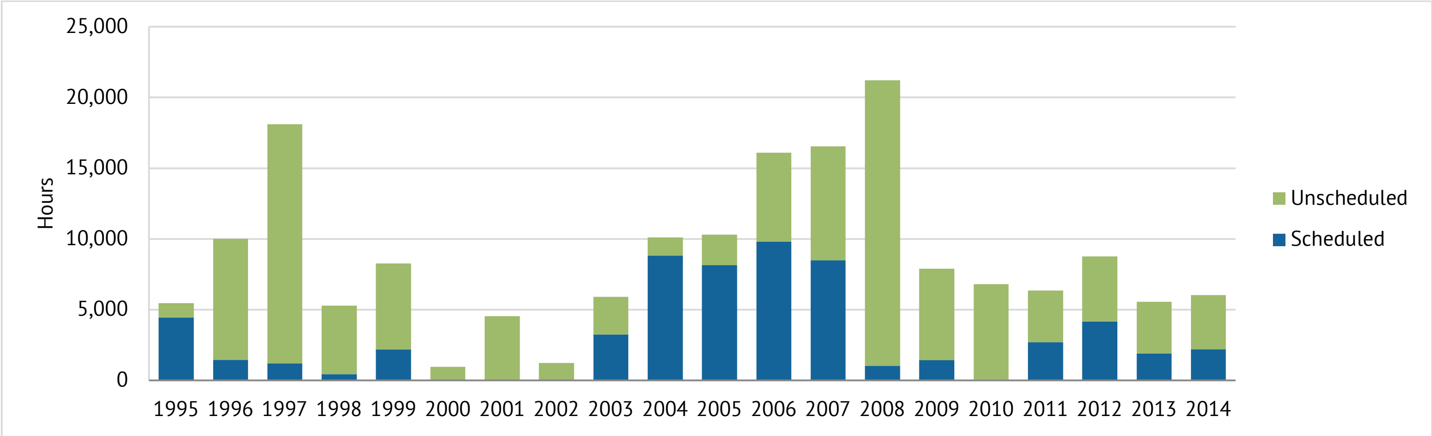
Table 4.4: Percent of vessels delayed and average delay time by lock, average from 1995-2014

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

Source: U.S. Army Corps of Engineers

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

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



Source: U.S. Army Corps of Engineers

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

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

Key issues

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

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

4.7 Intermodalism

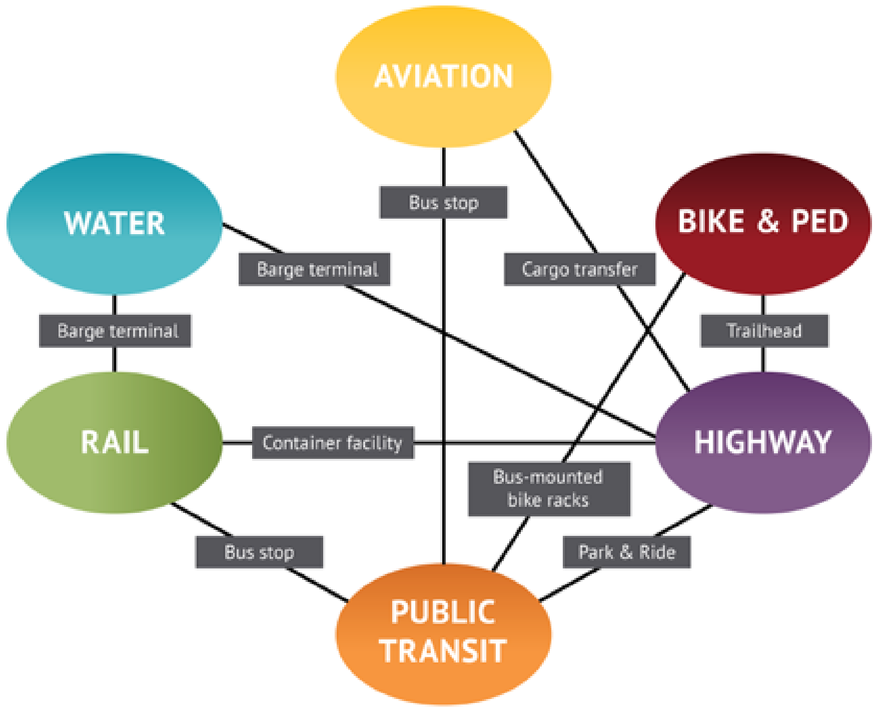
In addition to considering each mode individually, it is important to consider and plan for connections between modes for both passengers and freight. These connections are the basis for intermodalism. The terms "intermodal" and "multimodal" are often used interchangeably, yet they can have entirely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

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

Passenger

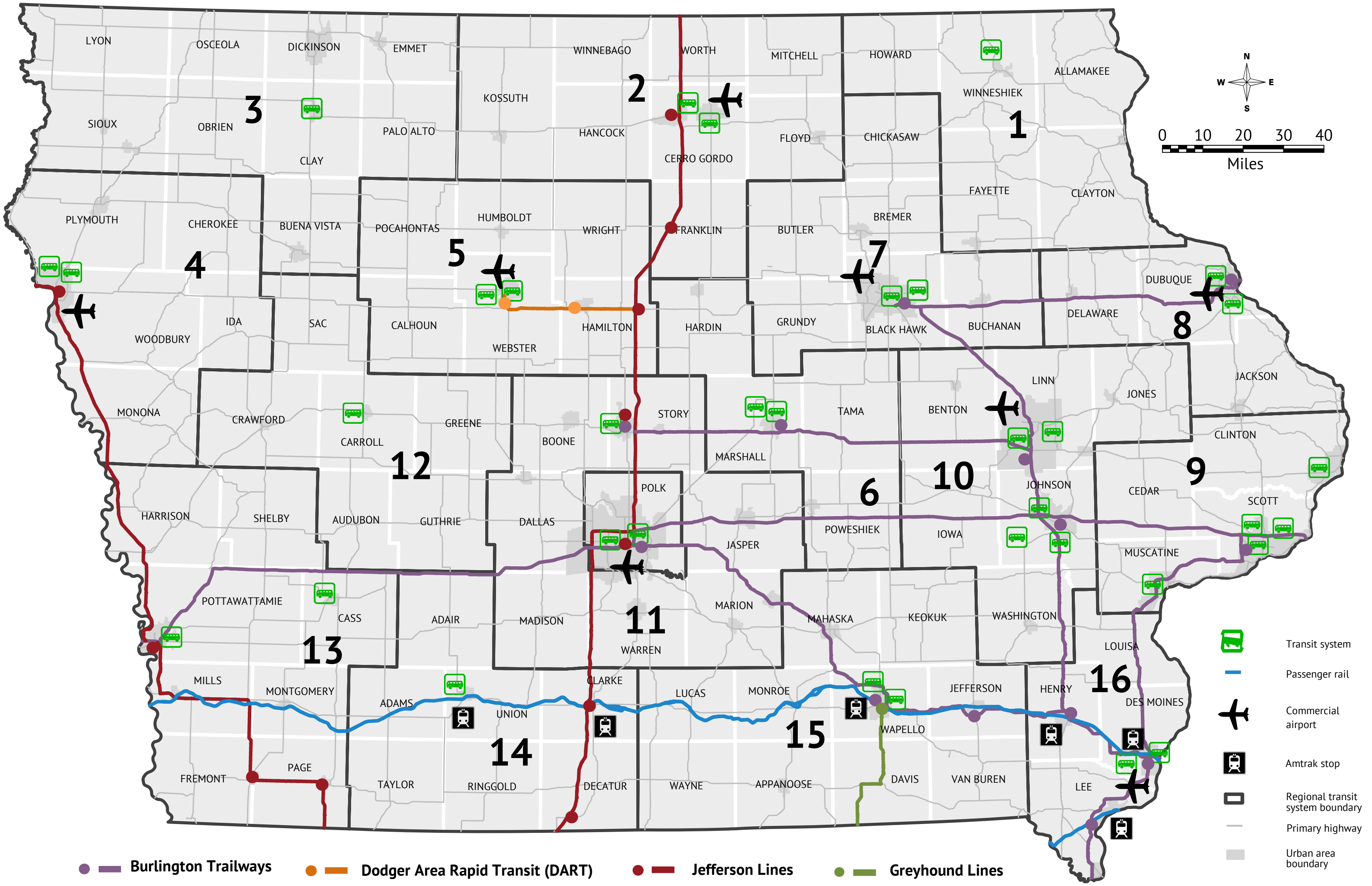
There are multiple options and connections for passenger travel other than driving a passenger vehicle. Iowa's passenger transportation system includes two Amtrak routes and a well-developed road system, as well as commercial air, intercity bus, and city and regional transit services. Figure 4.13 showed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

Figure 4.24: Examples of intermodal connections and facilities



Source: Iowa DOT

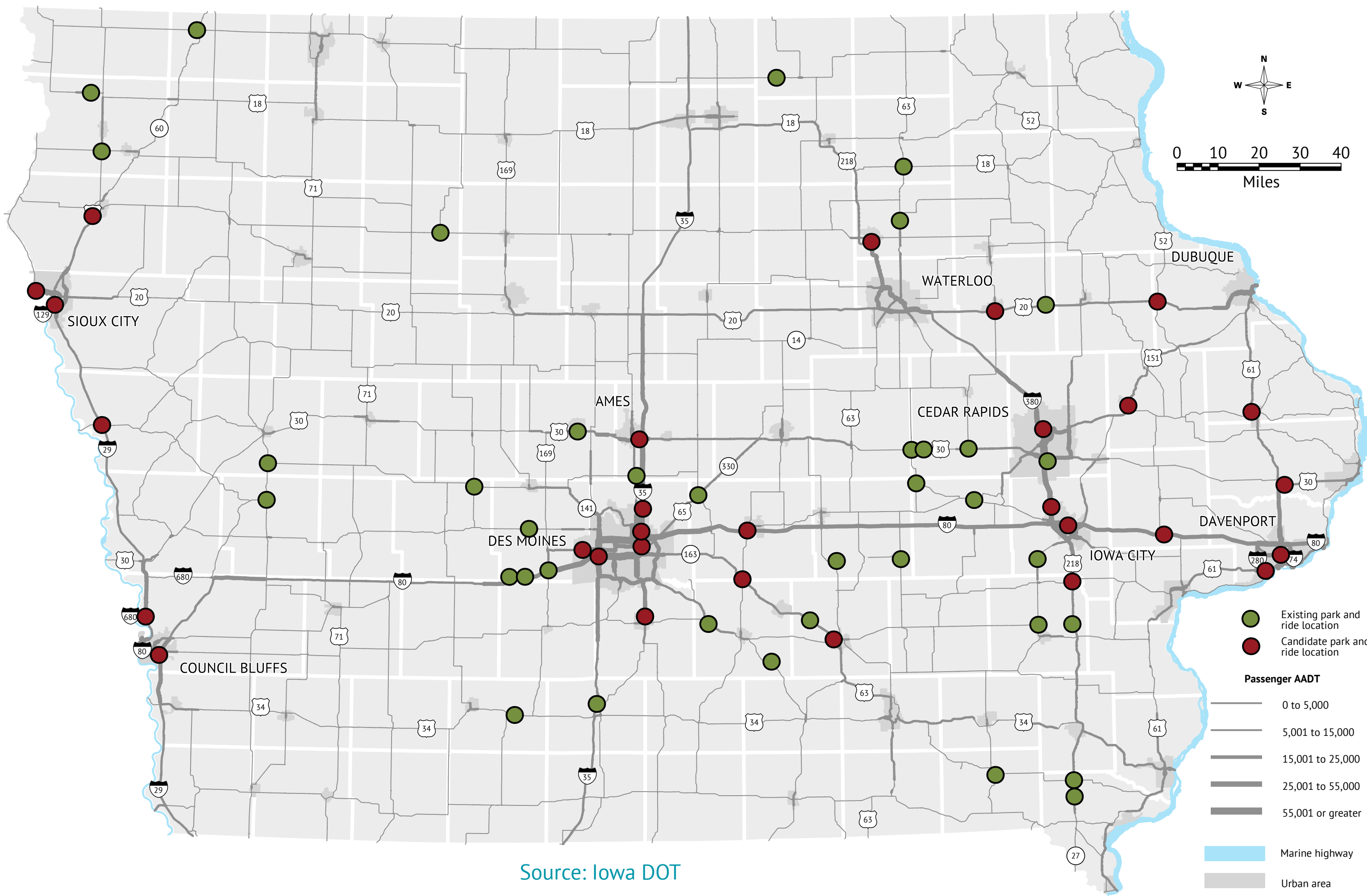
Figure 4.25: Iowa passenger transportation services



Source: Iowa DOT

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

Figure 4.26: Existing and proposed park and ride locations



Source: Iowa DOT

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

Freight

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

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

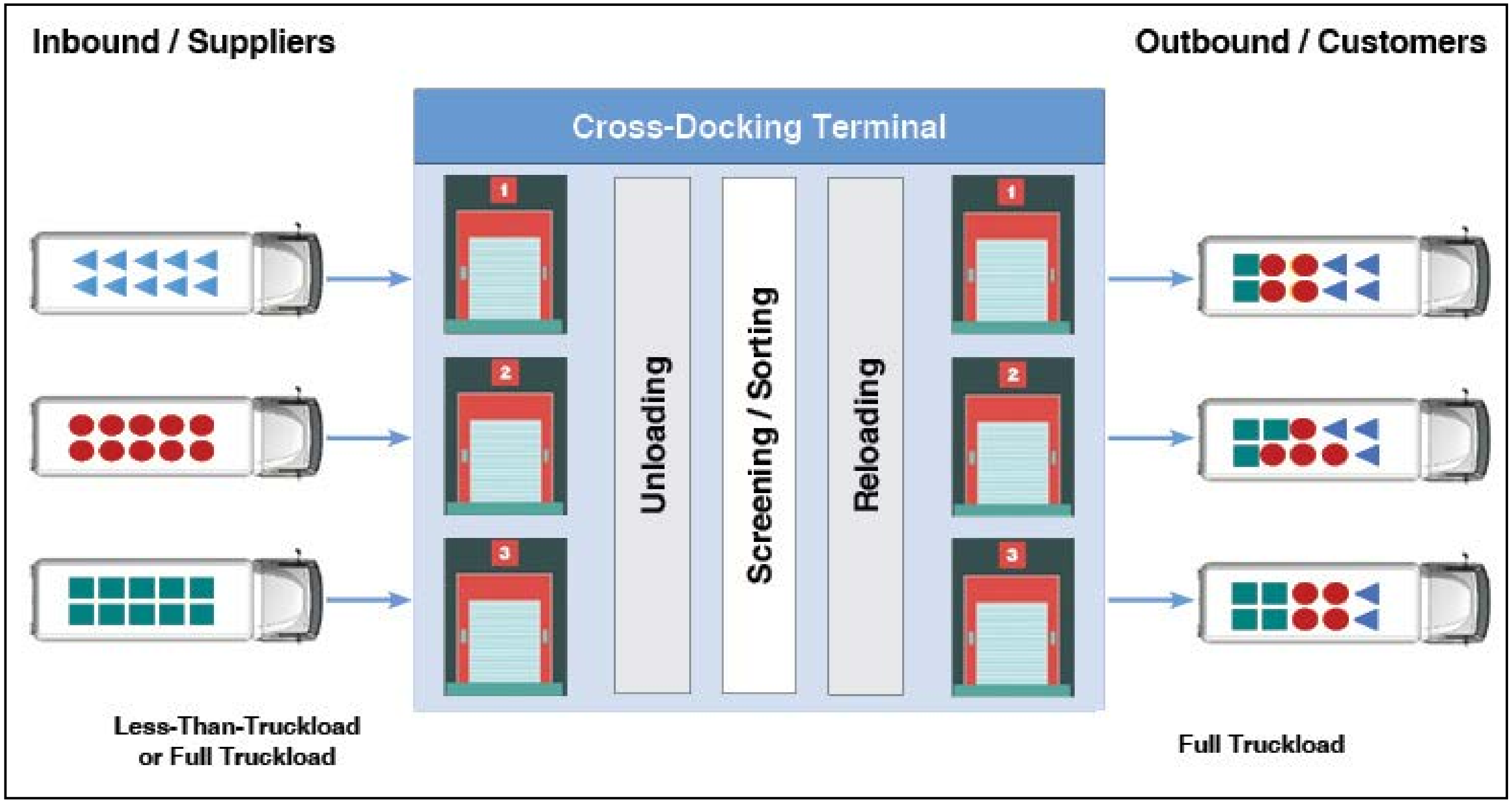
- An **intermodal container facility** refers to the transfer of freight using an intermodal container or trailer through multiple modes of transportation (rail, barge, and/or truck) without the handling of the freight itself when changing modes. This method improves security and transportation speed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

Figure 4.27: Example of transload process

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, Iowa Rail Toolkit

Figure 4.28 Example of cross-docking process



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

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

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

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

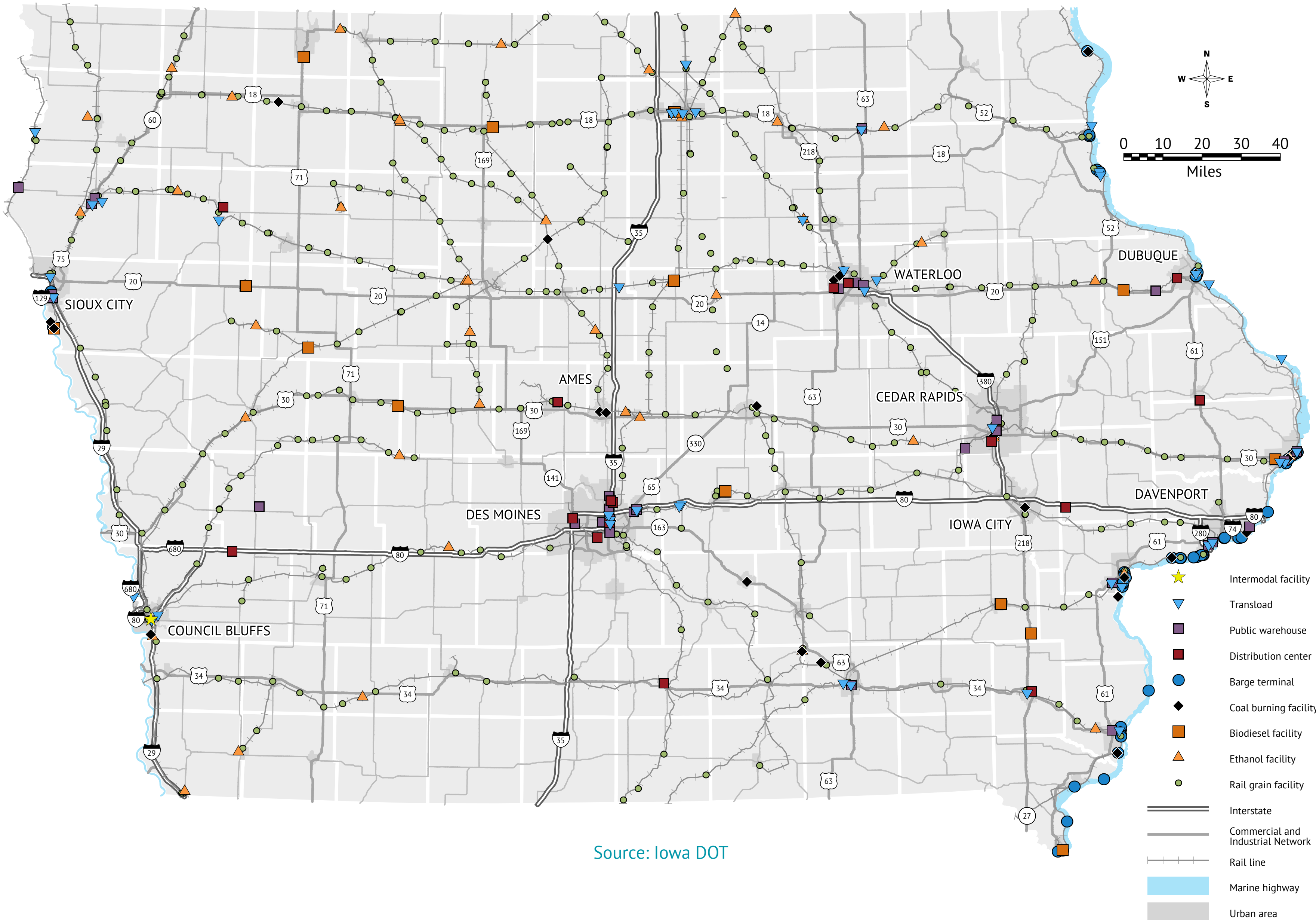
The intermodal options within Iowa include a number of warehouses and distribution centers that collect and distribute freight. These locations can generate many truck trips from the shipping and receiving of commodities, which makes the facilities an important part of the planning process.

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

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

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

Figure 4.29: Freight intermodal facilities



Source: Iowa DOT

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

Table 4.5: Iowa intermodal connectors

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

Source: Intermodal Connector Assessment Tool (ICAT), FHWA

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

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

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

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

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

Figure 4.30: Cedar Rapids Logistics Park conceptual layout

Source: Iowa DOT, SRF Consulting