2. SYSTEM INVENTORY & PERFORMANCE

2.1 Mode comparison | 2.2 Freight networks | 2.3 Inventory and performance by mode

Figure 2.1: Iowa freight transportation system

8 commercial airports

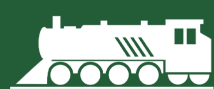
106 other service airports

9,621-mile Primary Highway System

115,509 total miles of roadways

46,664 miles of pipelines

Multiple pipeline operators



17 railroad companies operating in the state

3,804 miles of rail lines

63 barge terminals

491 miles of navigable waterways

Freight shippers have the convenience of multiple modal options for moving goods and material in the state of Iowa. The 160,000-mile multimodal freight transportation system is comprised of multiple air cargo facilities, a well-developed highway system, a large web of pipelines, an extensive rail network, two bordering navigable waterways, and hundreds of freight-related facilities to assist in the movement of freight.

The most critical freight infrastructure in Iowa is designated as part of multiple freight networks. However, there are additional components of the air, highway, pipeline, railroad, and waterway networks that complement these designated freight networks, acting as first-mile/last-mile connections.

The following section will provide an inventory of the infrastructure and facilities that make up this freight system and how they interact to increase the efficiency of goods movement through the state, region, nation, and world. Numerous metrics will be reviewed to summarize the performance of each. Note that an inventory of pipelines in Iowa is included, but due to the nature of the mode and availability of information, pipelines are not compared to other modes and there is limited reporting on performance.

2.1 Mode comparison

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

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

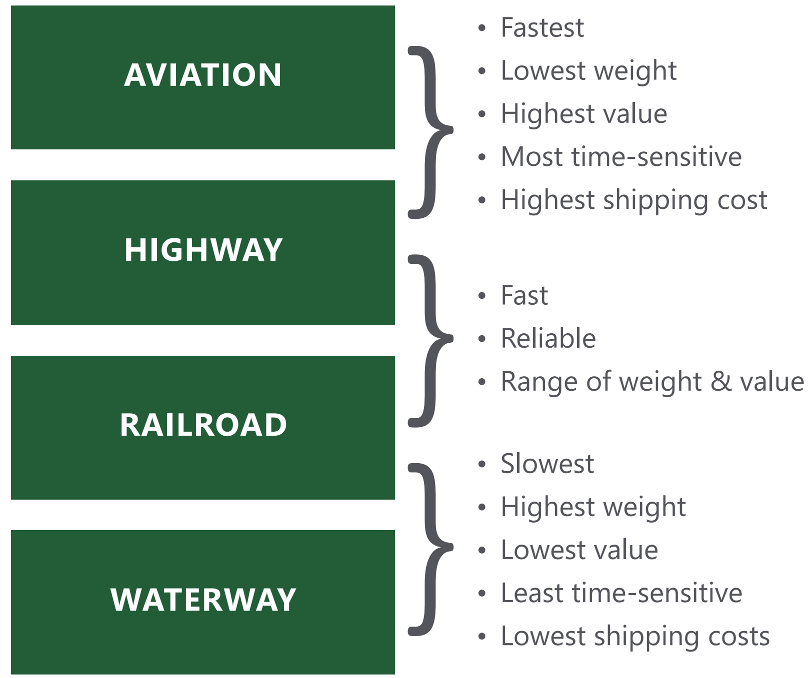
Most freight in Iowa is carried on the **Highway** system. Although trucking movements are typically more expensive than rail or water transport, it is the most flexible. Trucks generally move small amounts of a few hundred pounds all the way up to 50,000 pounds per shipment. Truckload service providers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

Railroad movements are generally less expensive than trucking and more fuel-efficient but are more restricted by the privately-owned networks the trains move on. This mode is well suited for moving large volumes of freight between two shipping points and, like trucks, uses dry car, flatbed, hopper, and refrigerated equipment.

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

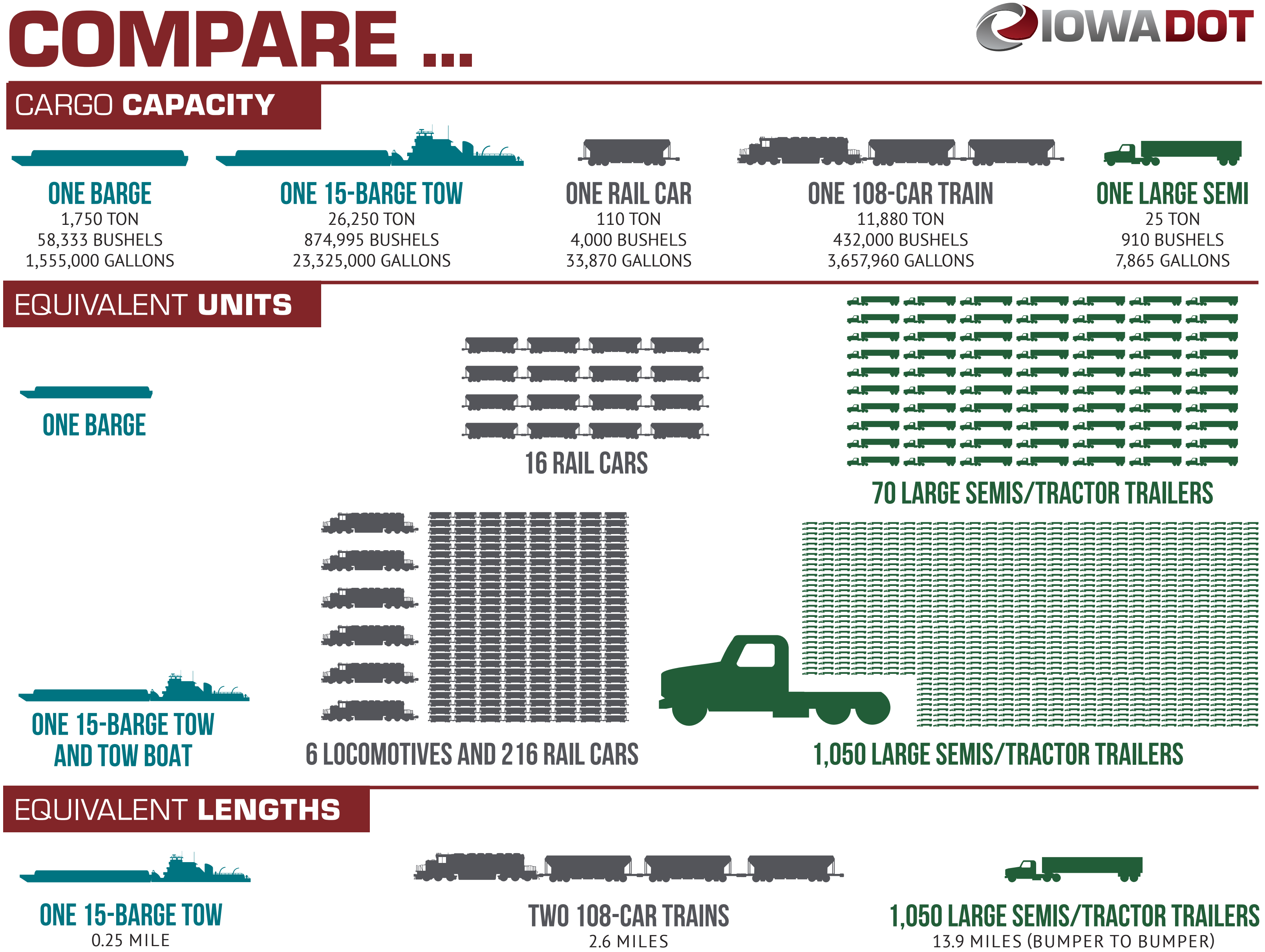
Figure 2.2 and Figure 2.3 compare the different freight modes by price and tonnage capacity, showing which modes can handle certain types of commodities most efficiently.

Figure 2.2: Freight price comparisons



Source: Iowa DOT

Figure 2.3: Freight tonnage comparisons



Source: Iowa DOT

Purpose of Designating Freight Networks

The most critical freight infrastructure in Iowa is designated as part of two freight networks - the National Multimodal Freight Network (NMFN), designated at the federal level, and the Iowa Multimodal Freight Network (IMFN), designated at the state level.

The NMFN consists primarily of infrastructure of national and international significance and the IMFN consists of infrastructure critical to state and regional commerce.

Strategic military networks, specifically the Strategic Highway Network (STRAHNET) and Strategic Rail Corridor Network (STRACNET), are also designated to prioritize infrastructure and connectivity needs for national defense.

These different freight networks are used to:

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

2.2 Freight networks

IMFN

Iowa DOT designated the IMFN to compliment the NMFN by also identifying infrastructure critical to the state and region, including airports, highways, railroads, and inland waterways.

Table 2.1: Iowa Multimodal Freight Network criteria and designations

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

Source: Iowa DOT

Figure 2.4: Iowa Multimodal Freight Network

Source: Iowa DOT

The National Highway Freight Network (NHFN) is the highway portion of the NMFN and the system eligible for National Highway Freight Program (NHFP) funds distributed to the states annually. The NHFN includes the following four subsystems of roadways.

Primary Highway Freight System (PHFS)

A network of highways designated at the federal level and identified as the most critical highway portions of the U.S. freight transportation system.

Other Interstates Not On PHFS

These highways consist of the remaining portion of Interstate roads not included in the PHFS. These routes provide important continuity and access to freight transportation facilities.

Critical Rural Freight Corridors (CRFC)

Public roads not in an urbanized area that provide access and connection to the PHFS and the Interstate from other important ports, public transportation facilities, or other intermodal freight facilities.

Critical Urban Freight Corridors (CUFC)

Public roads in urbanized areas that provide access and connection to the PHFS and the Interstate from other ports, public transportation facilities, or other intermodal freight facilities.

NMFN

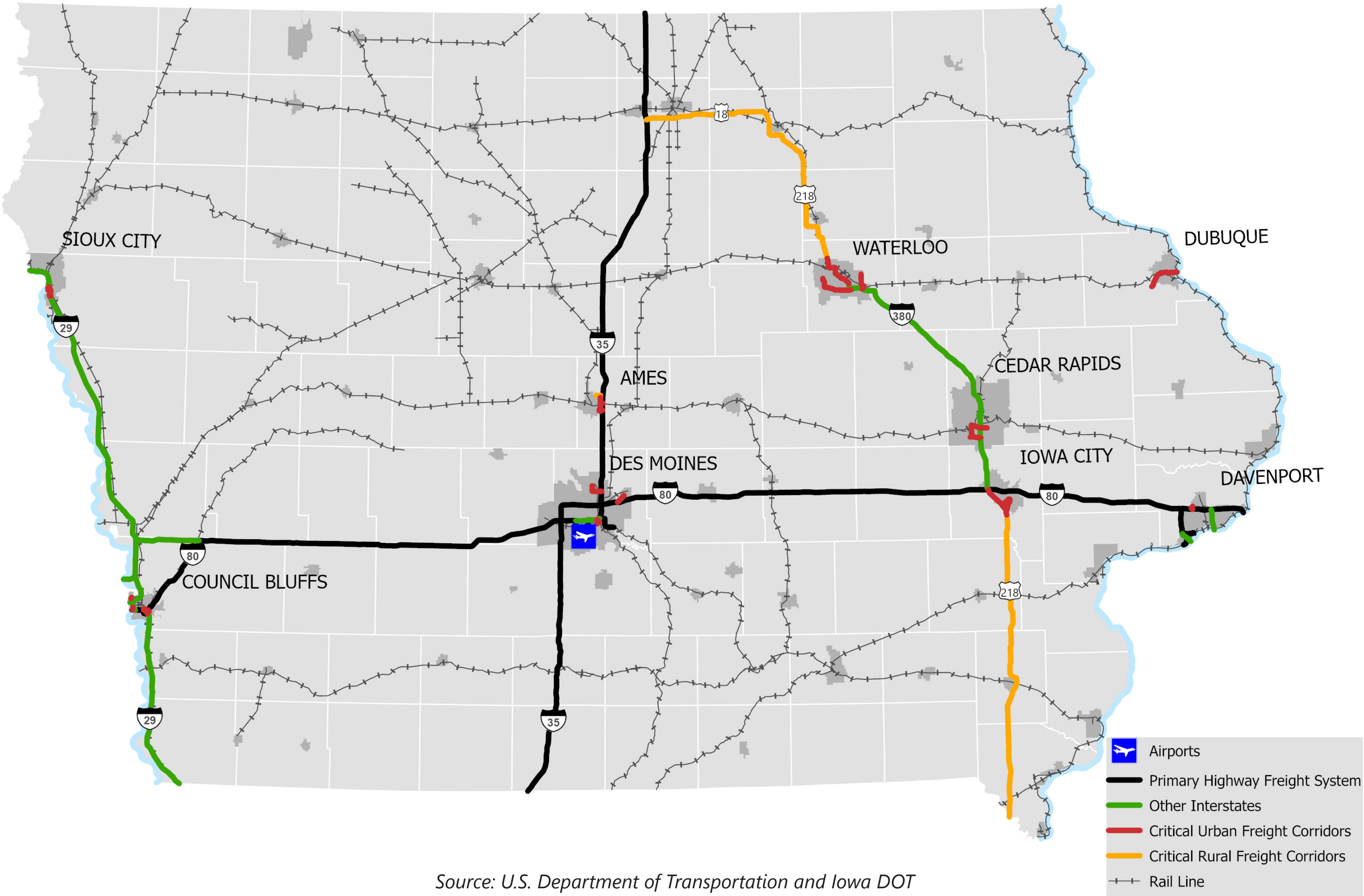
The Fixing America's Surface Transportation (FAST) Act formed the NMFN with the intent of strengthening the contribution of this network to the economic competitiveness of the country. It includes air, highway, railroad, and waterway infrastructure critical to freight movement.

Table. 2.2: National Multimodal Freight Network criteria and designations

Mode	Designation requirement(s)	Iowa designations
Aviation	Top 50 cargo airports	• Des Moines International Airport
Highway	National Highway Freight Network	• 1,005 miles of the Primary Highway Freight System • Critical Rural and Critical Urban Freight Corridors and other Interstates
Railroad	Class I railroads and other strategic Class II and III railroads	• 3,324 miles of Class I rail lines
Waterway	Major coastal ports, inland and intercoastal waterways, Great Lakes, St. Lawrence Seaway, and coastal and ocean routes	• M-29 Marine Highway (Missouri River) • M-35 Marine Highway (Mississippi River)

Source: U.S. Department of Transportation and Iowa DOT

Figure 2.5: National Multimodal Freight Network



Source: U.S. Department of Transportation and Iowa DOT

Table 2.3: Primary Highway Freight System in Iowa

Route	Start Point	End Point	Miles
I-29	I-80	I-80	2.9
I-35	Missouri/Iowa Line	Iowa/Minnesota Line	218.6
I-80	Nebraska/Iowa Line	I-29	0.9
I-80	I-29	I-35	119.4
I-80	I-35	Iowa/Illinois Line	169.0
I-235	I-35	Iowa 28	3.8
I-235	Iowa 163	I-80	3.7
I-280	US 61	I-81	6.5
U.S. 61	IA4R (local)	I-280	1.6
Iowa 28	IA7A (local)	I-235	2.6
Iowa 163	IA9L (local)	I-235	1.4
		Total	**530.4**

Source: U.S. Department of Transportation

Table 2.4: Other Interstate routes in Iowa

Route	Start Point	End Point	Miles
I-29	Missouri/Iowa Line	I-80 (East)	48.6
I-29	I-80 (West)	Iowa/South Dakota Line	100.5
I-74	I-80	Iowa/Illinois Line	5.4
I-129	Nebraska/Iowa Line	I-29	0.3
I-235	Iowa 28	Iowa 163	6.3
I-280	U.S. 61	Iowa/Illinois Line	3.0
I-380	U.S. 218	I-80	73.3
I-480	Nebraska/Iowa Line	I-29	0.7
I-680	Nebraska/Iowa Line	I-29 (South)	16.5
I-880	I-29 (North)	I-80	3.0
		Total	**257.6**

Source: U.S. Department of Transportation

The National Highway Freight Network (NHFN) is the system eligible for National Highway Freight Program (NHFP) funds distributed to the states annually. The NHFN includes the following four subsystems of roadways.

- Primary Highway Freight System (PHFS)
- Other interstates not on PHFS
- Critical Rural Freight Corridors (CRFC)
- Critical Urban Freight Corridors (CUFC)

Table 2.5: Intermodal Connectors included in the Primary Highway Freight System

ID	Facility Name	Facility Description	Miles
IA4R	Quad Cities Container Terminal (Davenport)	S. Rolff St, Rockingham Rd (Iowa 22), between the Terminal and I-280	2.7
IA5P	Harvest States Peavey (Davenport)	Iowa 22 between the Terminal and I-280	2.2
IA6L	Amoco Pipeline Distribution Center (Council Bluffs)	U.S. 275 (eastern ramp termini I-29 to South Expressway), then North to the Westbound ramp terminus of I-29/80	1.9
IA7A	Des Moines International Airport	Fleur Dr between MLK Jr Pkwy and relocated Iowa 5 and Park Ave (63rd to Fleur Dr)	8.1
IA9L	Vandalia Rd Pipeline (Des Moines)	E. 30th St/Vandalia Rd (Iowa 163 to U.S. 65)	4.3
		Total	**19.2**

Source: U.S. Department of Transportation

Table 2.6: Critical Rural and Critical Urban Freight Corridors in Iowa

Urban Area	Route	Start Point	End Point	Miles
Critical Rural Freight Corridors				
-	U.S. 18, U.S. 218	I-35	Waterloo urbanized area boundary	78.5
-	U.S. 218	Poweshiek St	IA/MO Border	80.7
-	N. Dayton Ave, Riverside Rd	Old Bloomington Rd	Stagecoach Rd	1.5
			Total CRFC	**160.7**
Critical Urban Freight Corridors				
Sioux City	S. Patton St	I-29	Blvd of Champions	1.2
Sioux City	Blvd of Champions	S. Patton St	Harbor Dr.	0.5
Sioux City	Harbor Dr.	S. Patton St	Discovery Blvd	2.1
Sioux City	Discovery Blvd	Harbor Dr.	Aviation Blvd	0.6
Sioux City	Aviation Blvd	I-29	Discovery Blvd	0.4
Council Bluffs	S. Expressway, 23rd Ave, 29th Ave	I-29/I-80	Grain elevators	1.7
Council Bluffs	Nebraska Ave, River Rd	I-29	Cargill AG Horizons	0.7
Council Bluffs	Iowa 92, Harry Langdon Blvd, South Ave	I-29	IAIS intermodal yard	1.3
Council Bluffs	Iowa 165 (Abbott Dr)	NE State Line	NE State Line	0.5
Ames	E. 13th St, N. Dayton Ave	I-35	Old Bloomington Rd	2.2
Ames	Dayton Ave	U.S. 30	E. 13th St	2
Ames	U.S. 30, S. Dayton Ave, SE 18th St	I-35	S. Dayton Ave	1.3
Des Moines	U.S. 69, Maury St, SE 15th, E. MLK Jr Pkwy, SE 18th St	I-235	Dean Ave	3.2
Des Moines (Ankeny)	Iowa 160, SW State St	I-35	SW Ordnance Rd	3.9
Des Moines	U.S. 65	I-80	Grant St South	2.6
Cedar Falls/Waterloo	U.S. 218	I-380	Waterloo urbanized area boundary	10.7
Waterloo	Plaza Dr, Dubuque Rd, Elk Run Rd	I-380	Newell St	4.6
Cedar Falls/Waterloo	U.S. 20, Iowa 58	I-380	Greenhill Rd	9.4
Cedar Rapids	Edgewood Rd SW	U.S. 30	Wright Bros Blvd SW	3.2
Cedar Rapids	U.S. 30	C Street SW	Edgewood Rd SW	4.3
Cedar Rapids	Wright Bros Blvd SW	I-380	Cessna Pl SW	2.8
Iowa City	U.S. 218	I-80	Poweshiek St	8.5
Iowa City	Old Highway 218 S	U.S. 218	Gringer Ag	1.5
Iowa City	Iowa 1, U.S. 6, Gilbert St, Court St	U.S. 218	Front St	3.7
Dubuque	U.S. 20	Iowa/Illinois Line	Swiss Valley Rd	8.6
Davenport	Iowa 130, Hillandale Rd, Enterprise Way	I-80	Davenport Transload Facility	1.1
			Total CUFC	**82.6**

Source: Iowa DOT

STRAHNET

The Highways for National Defense (HND) program identifies highway infrastructure needed by DOT to fulfill its mission and ensures the readiness capability of this infrastructure. HND monitors the 64,200-mile STRAHNET system, which consists of public highways that provide access, continuity, and emergency transportation of personnel and equipment in times of peace and war. It includes the entire 48,482 miles of the Dwight D. Eisenhower National System of Interstate and Defense Highways and 14,000 miles of other non-Interstate public highways on the National Highway System. The STRAHNET also contains roughly 1,800 miles of connector routes, linking over 200 military installations and ports to the primary highway system.

STRACNET

The Railroads for National Defense Program (RND) ensures the readiness capability of the national railroad network to support defense deployment and peacetime needs. The RND Program established the STRACNET, an interconnected and continuous rail line network consisting of over 36,000 miles of track serving over 120 defense installations. These lines provide main line corridor throughput capability as well as access to major defense contractors, logistics sites, and military facilities critical to national defense.

Strategic military networks

It is important to prioritize infrastructure and connectivity needs for strategic routes and other corridors that connect to U.S. Department of Defense (DOD) facilities and handle military freight.

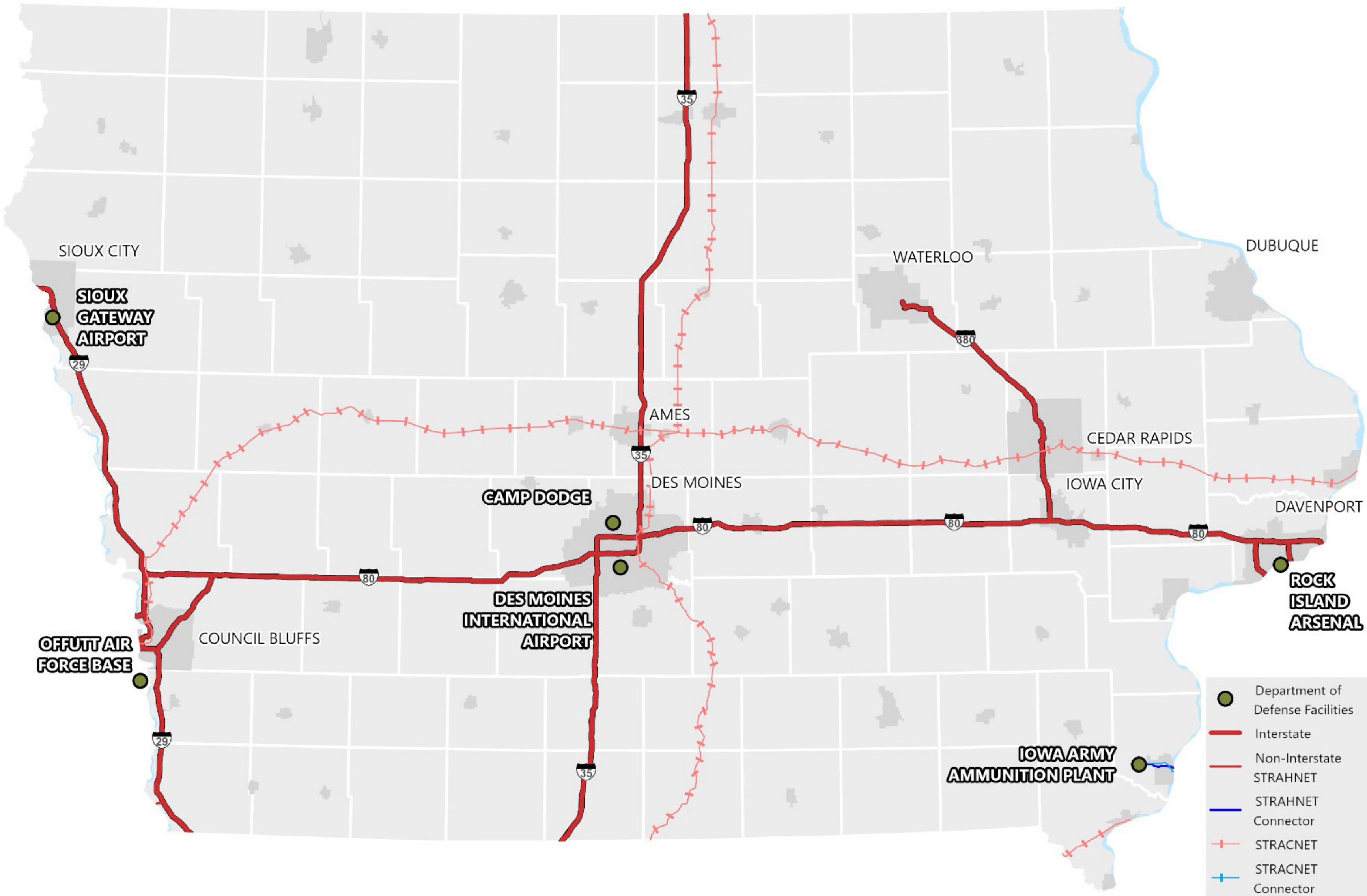
DOD facilities include military bases, ports, and depots. The road and rail networks (e.g., STRAHNET and STRACNET) that provide access and connections to these facilities are essential to national security as they support the quick logistics movement of vehicles and materials by allowing for large loads that are common to military freight.

Table. 2.7: Iowa strategic military networks and installations

Component	Iowa designations
Strategic Highway Network (STRAHNET) routes	• Interstate Highway System (all routes) • Iowa 2 (NE border to I-29)
STRAHNET connectors	• U.S. 34 (Iowa Army Ammunition Plant to IL border)
Strategic Rail Corridor Network (STRACNET) routes	• Union Pacific (NE border at Council Bluffs to IL border at Clinton) • Union Pacific (MO border at Lineville to MN border at Northwood) • BNSF (MO border near Argyle to IL border at Fort Madison)
Military installations	• Iowa Army Ammunition Plant (Middletown) • Camp Dodge (Johnston) • Des Moines International Airport • Sioux Gateway Airport • Rock Island Arsenal (IL) • Offutt Air Force Base (NE)

Source: U.S. Military Surface Deployment and Distribution Command Transportation Engineering Agency

Figure 2.6: Iowa strategic military networks and installations



Source: U.S. Military Surface Deployment and Distribution Command Transportation Engineering Agency

2.3 Inventory and performance by mode

In this section, an inventory will be provided for freight transportation modes and freight-generating facilities. The following metrics will be used to summarize the performance of each.

- Condition
- Utilization
- Safety
- Reliability

Although the different modes making up Iowa's transportation system can be classified by multiple different national and state "networks," the IMFN will be the primary focus of the system inventory and performance reporting.

Intermodal containers at Iowa facility. (Source: Iowa DOT)

Aviation

From larger air cargo facilities at commercial airports to point deliveries by smaller aircraft at other airports throughout Iowa, air cargo service provides fast and reliable movement of time-sensitive freight. An airport's role in the aviation system depends on the type of facilities and services provided, as well as the aviation demand. Commercial airports provide regularly scheduled commercial airline service and have the services/ facilities to support a full range of general aviation activity.

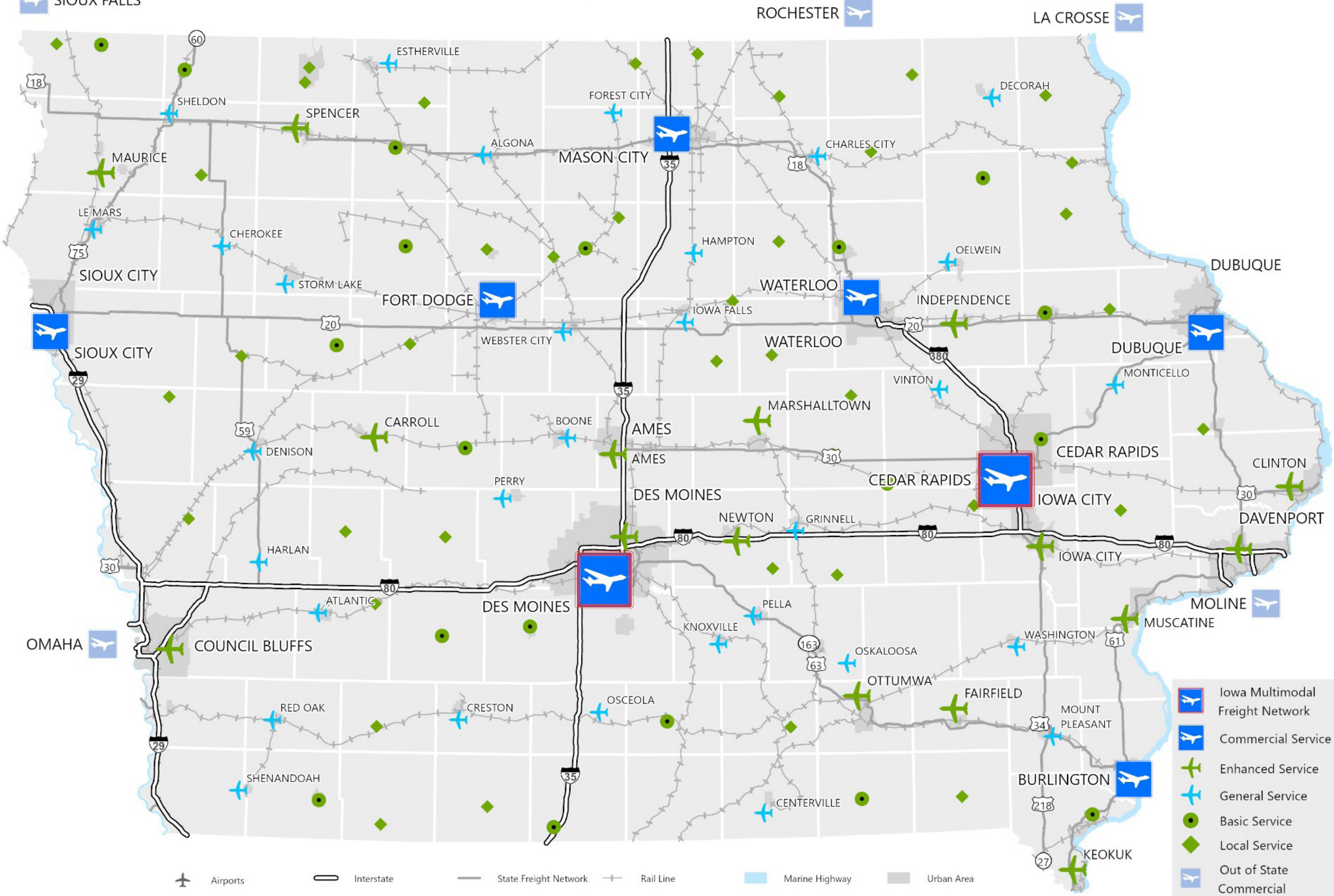
Nearly all aviation freight reported in Iowa is moved by scheduled commercial air passenger carriers and dedicated air cargo carriers (e.g., Amazon, FedEx, and UPS) at the eight commercial airports. Although most of the airports in the state handle cargo to some extent, over 99% of reported tonnage moves through the Des Moines International Airport (DSM) and the Eastern Iowa Airport (CID).

Table 2.8: Iowa commercial airports

FAA ID	City	Name
BRL	Burlington	Southeast Iowa Regional
CID	Cedar Rapids	Eastern Iowa
DSM	Des Moines	Des Moines International
DBQ	Dubuque	Dubuque Regional
FOD	Fort Dodge	Fort Dodge Regional
MCW	Mason City	Mason City Municipal
SUX	Sioux City	Sioux Gateway
ALO	Waterloo	Waterloo Regional

Source: Iowa DOT

Figure 2.7: Iowa airports



Source: Iowa DOT

Condition

One of the goals identified in the Iowa Statewide Aviation System Plan (2021) is to provide an airport system that meets existing and future user needs. More specifically, the goal highlights maintaining adequate infrastructure (e.g., runway pavement, terminal buildings, storage buildings, etc.) to allow for continued use by a variety of users. Pavement inspections tracking Pavement Condition Index (PCI) regularly take place at all paved airports.

Utilization

Over 130 million pounds of air cargo is moved through airports in Iowa every year. Aviation freight services are used primarily for the timely transportation of cargo into and out of Iowa.

More than 99 percent of Iowa's air cargo travels through two commercial airports (DSM and CID). The other six commercial airports (Burlington, Dubuque, Fort Dodge, Mason City, Sioux City, and Waterloo) share the less than 1 percent remaining.

Express carriers such as FedEx and UPS Inc. hold the major aviation freight presence in Iowa. To a large degree, the movement of air cargo is contingent upon the business decisions of these private carriers. In recent years, increased fuel expenses and changes in business models have resulted in reduced aviation freight activity in Iowa. However, with an expanded UPS facility at CID, and a new FedEx facility and the addition of Amazon at DSM, more growth is expected.

Safety

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

Reliability

Air cargo coming into and out of the state is not limited at any Iowa airports, and capacity exists to accommodate growth of freight in the future. Therefore, no air cargo bottlenecks were identified.

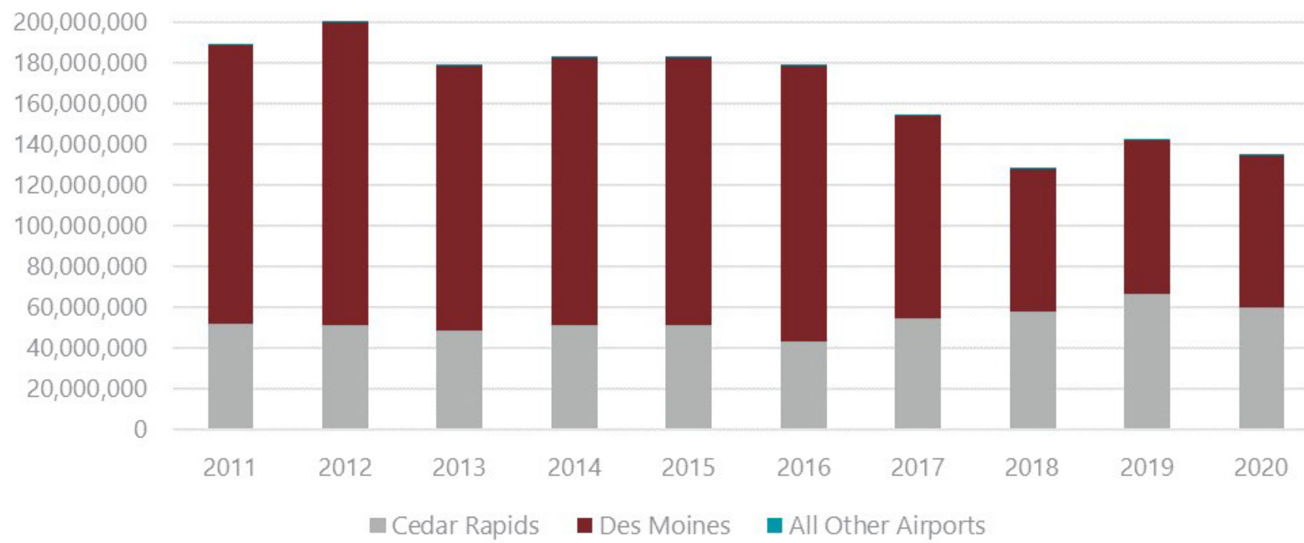
Additionally, the state's eight commercial service airports provide adequate coverage to potential air cargo shippers. When nearby out-of-state commercial airports (e.g., Omaha, Sioux Falls, Rochester, La Crosse, and Moline) are considered, nearly the entire state has access to a commercial airport within a 90-minute drive.

UPS freight aircraft (Source: IanDewarPhotography - stock.adobe.com)

Aviation Bottlenecks

Air cargo coming into and out of the state is not limited at any Iowa airports, and capacity exists to accommodate growth of freight in the future. Therefore, no air cargo bottlenecks were identified.

Figure 2.8: Total air cargo (tons), 2011-2020



Sources: Iowa airports

Table 2.9: Total air cargo (tons) by commercial airport, 2011-2020

	Burlington	Cedar Rapids	Des Moines	Dubuque	Fort Dodge	Mason City	Sioux City	Waterloo	Total
2011	0	52,321,653	135,797,823	100,948	47,499	4,733	0	0	**188,272,656**
2012	0	51,434,903	148,241,365	74,741	7,763	2,768	369	300	**199,762,209**
2013	0	48,812,039	129,470,911	73,788	1,016	1,155	2,421	2,453	**178,363,783**
2014	0	51,698,793	130,790,339	2,712	0	32	1,596	850	**182,494,322**
2015	0	51,609,506	130,817,962	5,373	0	0	1,188	559	**182,434,588**
2016	0	43,663,080	134,551,878	934	0	0	7,589	650	**178,224,131**
2017	0	54,768,529	99,052,046	15,010	0	0	2,557	4,627	**153,842,769**
2018	0	57,852,712	69,972,176	170	0	0	3,919	1,508	**127,830,485**
2019	0	66,863,002	74,972,162	0	0	0	6,699	348	**141,842,211**
2020	0	59,844,805	74,871,567	0	0	0	2,076	354	**134,718,802**

Sources: Iowa airports

Highway

The state's public roadway system is comprised of more than 115,000 miles with approximately 25,000 bridge structures, offering an extremely accessible network that provides a high level of mobility for freight movement. Additionally, Iowa has truck parking spaces located at rest areas, weigh stations, and alternative service locations (e.g., truck stops) around the state to improve safety and efficiency of the trucking industry.

While the size of the state's roadway system has not increased considerably in recent years, the infrastructure burden remains significant. Freight tonnage in Iowa is moved primarily by truck and most commodity movements by aviation, pipeline, rail, and water are intermodal in nature and usually begin and/or end with a truck movement.

Iowa's highway system can be classified by multiple different highway networks such as the Primary Highway System that includes the Interstate System, as shown in Table 2.10, as well as networks not shown such as the Commercial and Industrial Network, National Highway System, Federal Highway Administration Intermodal Connectors, etc. However, the highway portion of the IMFN, which includes 4,027 miles of the Primary Highway System, will be the focus of the system inventory and performance reporting.

The condition and performance of these roadways, first mile/last mile connections, and service locations is critical to the overall efficiency of supply chains and the entire freight system.

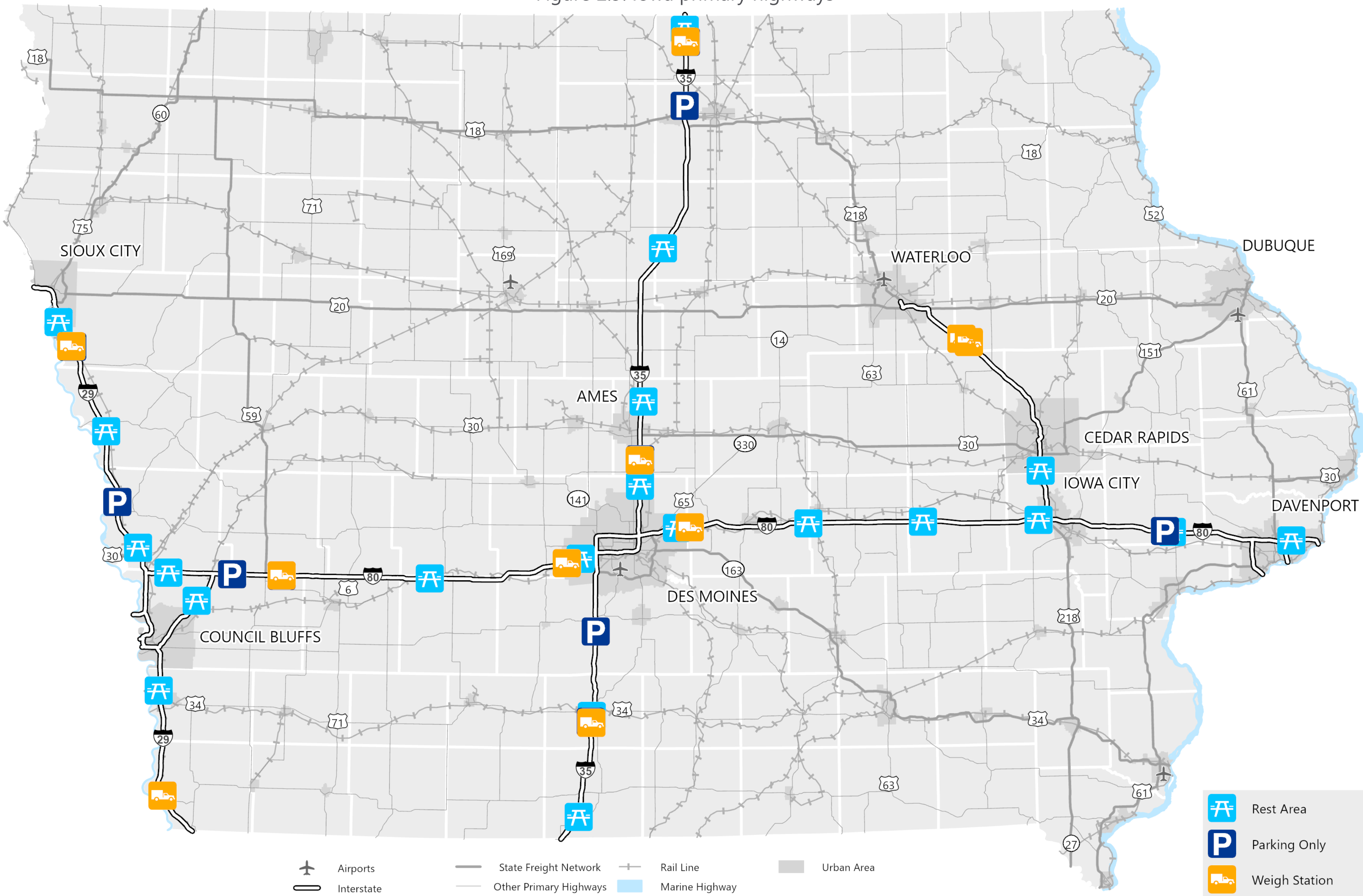
Table 2.10: Iowa primary roadway system by classification

Classification	Miles	Description
Public roadways	115,509	All roadways ranging from eight-lane Interstates and four-lane divided facilities, to paved secondary roads, gravel roads, and municipal streets
Primary highways	9,621	Roads such as Interstate system, U.S. and State routes that are under the jurisdiction of Iowa DOT
Interstate System	1,157	Primary highways providing connections to the national transportation network and major metropolitan areas
Iowa Multimodal Freight Network	4,027	Primary highways critical to state and regional commerce to be protected and enhanced for efficient freight movement

Source: Iowa DOT

Trucks at road check. (Source: Iowa DOT)

Figure 2.9: Iowa primary highways



Source: Iowa DOT

Condition

The Infrastructure Condition Evaluation (ICE) tool was developed by the Iowa DOT to aid in the evaluation of the state's Primary Highway System by using a composite rating calculated from seven different criteria – passenger, single-unit truck, and combination truck annual average daily traffic; congestion index value, International Roughness Index; PCI; and Bridge Condition Index.

While each of these individual criteria indicates a different component, the collective offers the ability to evaluate the service and structural condition of roadway segments with a single composite rating. This composite rating was calculated for each road segment by applying a standardized normalization and weighting process.

Utilization

The overwhelming majority of freight tonnage in Iowa is moved by trucks on the state's highway system. Truck traffic in the state is primarily concentrated on the Interstates and IMFN, with the heaviest being on I-80 between Iowa City and Davenport, I-35/80 through the Des Moines metro area, and I-29/80 through Council Bluffs.

Iowa also issues a significant number of oversize/overweight (OSOW) permits each year. This traffic is mostly concentrated across the Interstate system as well, with the heaviest being on I-80. One of the major non-Interstate OSOW routes in the state is U.S. 59 that runs north/south in western Iowa. This is the result of multiple height-restricting overhead structures on I-29, which forces larger loads to utilize U.S. 59, a road with few overhead structures.

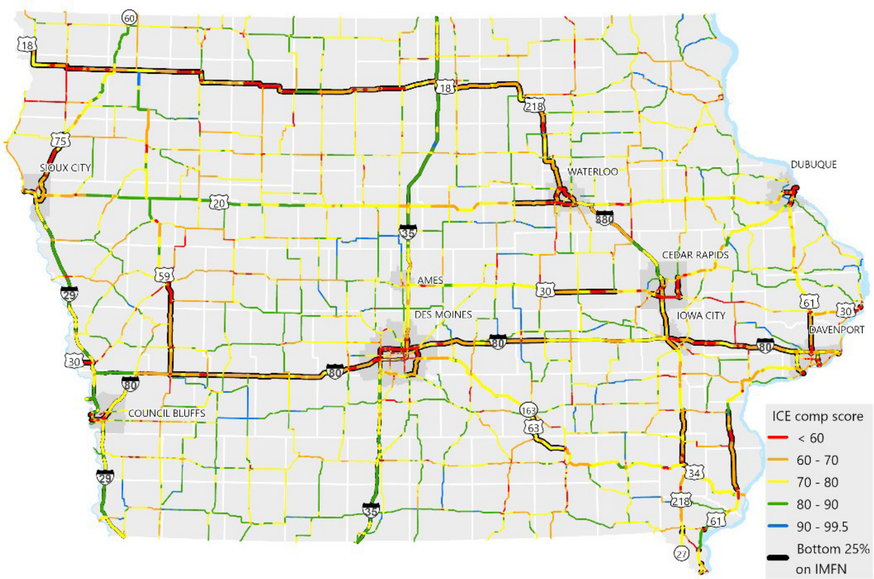
Due to their overall size and weight, traditionally sized and OSOW trucks have more of an impact on the condition and operations of the roadways than personal vehicles and these numbers must be monitored so solutions can be considered as traffic volumes increase.

Safety

Highway freight-related crashes include those that involve single-unit trucks, combination trucks, and/or trains. Freight-related crashes consistently represent around eight percent of all highway crashes, but the resulting fatalities are typically 20 percent of total fatalities resulting from all highway crashes.

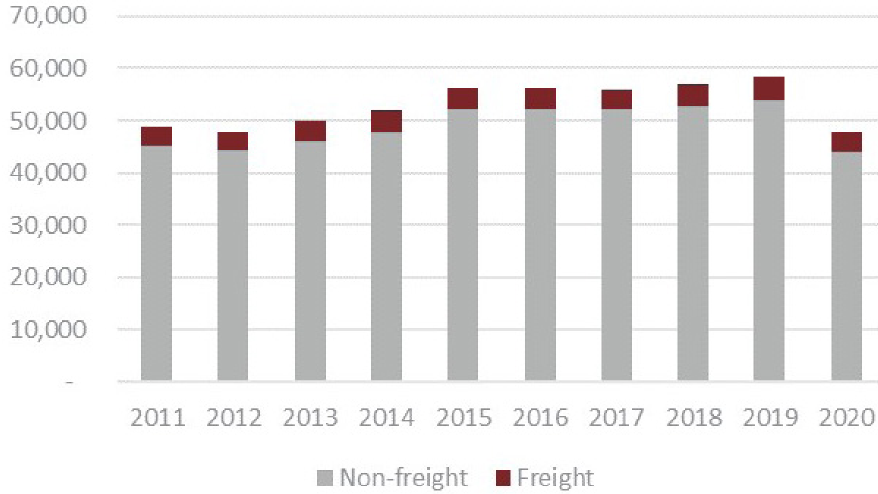
On average, freight-related crashes are evenly divided between rural and urban areas. However, 70 to 80 percent of fatalities resulting from freight-related crashes are in rural areas versus 20 to 30 percent in urban areas.

Figure 2.10: Infrastructure Condition Evaluation rating



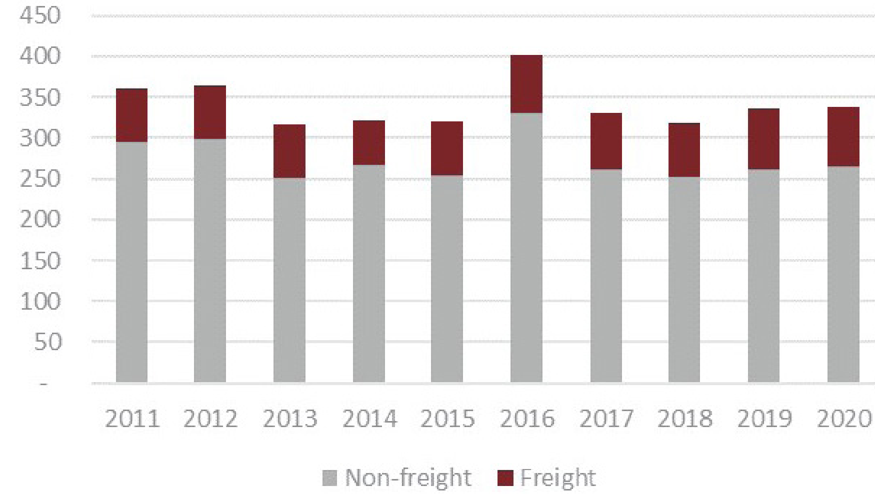
Source: Iowa DOT

Figure 2.11: Highway crashes, 2011-2020



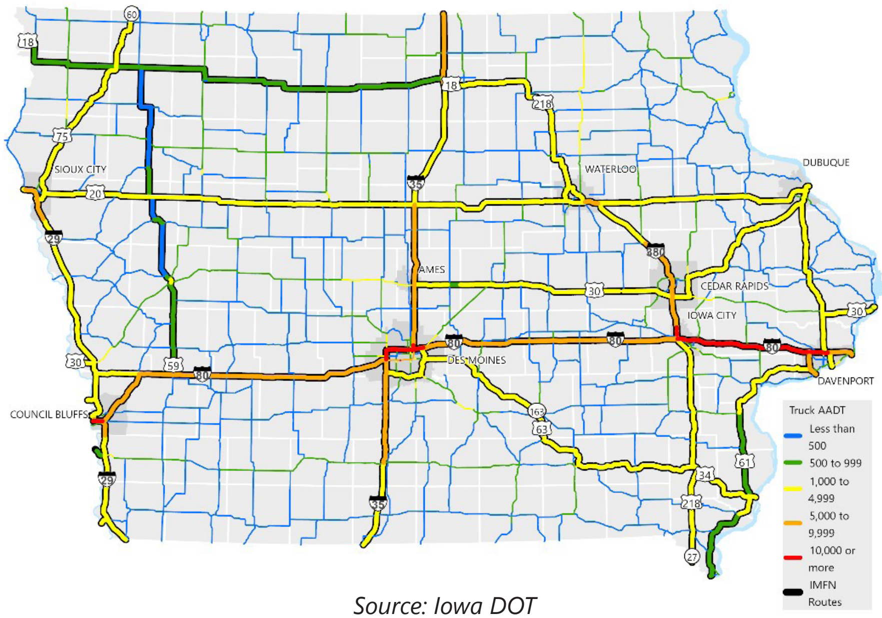
Source: Iowa DOT

Figure 2.12: Highway fatalities, 2011-2020



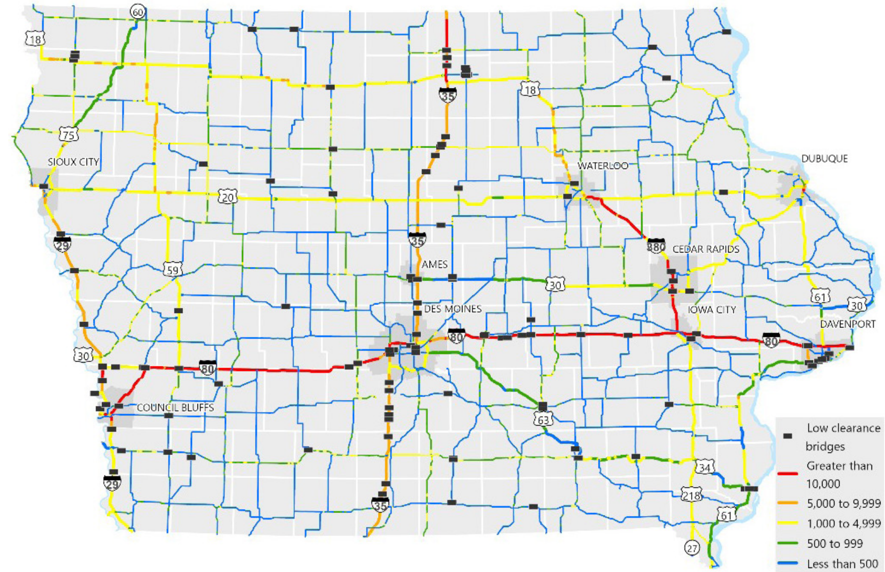
Source: Iowa DOT

Figure 2.13: Truck traffic



Source: Iowa DOT

Figure 2.14: Oversize/overweight truck traffic



Source: Iowa DOT

Reliability

INRIX travel speed data, acquired by cellphone and global positioning systems data, was used to identify highway bottlenecks. Bottleneck conditions are determined by comparing current reported speeds to reference speeds for each segment of road. Reference speed values are provided for each segment and represent the 85th percentile observed speed for all time periods with a maximum value of 65 mph. A bottleneck occurrence is defined in this analysis as a time interval where the average traffic speed is less than or equal to 60 percent of the reference speed. The annual total bottleneck duration per mile is calculated for each segment to represent recurring congestion, and the worst five percent of the overall network is identified. Of those locations among the worst five percent (by duration per mile), locations where the duration is one standard deviation or higher were initially identified as a bottleneck. The 27 locations on the highway portion of the IMFN were identified as highway freight bottlenecks. These locations were verified by Iowa DOT District Transportation Planners and the Iowa Freight Advisory Council.

Capacity needs at the statewide level were also evaluated based on current conditions and anticipated future traffic. For both time frames, a volume-to-capacity (V/C) ratio was used, which estimates how much capacity remains on a roadway based on how much traffic it carries and how much traffic it could carry. A roadway's capacity varies based on factors such as the number of lanes, classification of the roadway, number and frequency of accesses, and surrounding land use. The V/C ratio is an indicator of highway capacity sufficiency.

Figure 2.15: Highway freight bottlenecks

Source: INRIX traffic data and Iowa DOT traffic counts

Table 2.11: Highway freight bottlenecks

	City	Location	Segment length (miles)	Bottleneck minutes/mile
1	Hull	U.S. 18 at U.S. 75	0.39	576,743
2	Hospers	400th Street at Iowa 60	1.37	2,212,836
3	Hinton	U.S. 75 at C60*	0.45	298
4	Sioux City	U.S. 77 at I-29	0.01	322,172
5	Council Bluffs	U.S. 6/Kanesville Boulevard at I-80	0.32	681,358
6	Denison	U.S. 59 at Iowa 39	0.01	1,318,122
7	Des Moines	Iowa 28/Merle Hay Road at I-80/35	0.11	2,074,782
8	Des Moines	Iowa 415/NW 2nd Avenue at I-80/35	0.17	1,087,158
9	Altoona	NE 70th Street at Iowa 163	0.03	8,354,943
10	Marshalltown	Iowa 14 at U.S. 30	0.04	748,215
11	Marion	U.S. 151 at Iowa 13	0.06	1,741,501
12	Marion	U.S. 151/Iowa 13 at Iowa 100	0.14	8,145,963
13	Cedar Rapids	U.S. 151/Iowa 13 at Mt Vernon Road	0.66	13,541,271
14	Dubuque	U.S. 20 at NW Arterial	0.03	1,165,967
15	Dubuque	U.S. 20 at John F Kennedy Road	0.02	1,965,023
16	Dubuque	U.S. 20 at U.S. 61/U.S. 151	0.01	1,268,577
17	Dubuque	U.S. 52 at U.S. 61/U.S. 151	0.01	14,357,435
18	Clinton	U.S. 30 at U.S. 67	0.12	512,472
19	Davenport	U.S. 61 at I-80*	0.13	2,382
20	Davenport	U.S. 67 at I-74	0.16	296,664
21	Muscatine	U.S. 61 at Iowa 38	0.10	2,648,475
22	Muscatine	Iowa 22 at U.S. 61	0.02	19,002,289
23	Muscatine	U.S. 61 at Grandview Ave and Dick Drake Way	0.09	6,061,731
24	Burlington	Mt Pleasant Street at U.S. 61	0.13	2,286,496
25	Keokuk	U.S. 218 at U.S. 61	0.11	1,917,954
26	Keokuk	U.S. 61 at U.S. 218 and Wirtz Lane*	0.02	556,611
27	Keokuk	U.S. 61 at U.S. 136	0.01	4,269,800

*Location added due to operational issues not reflected in bottleneck minutes/mile

Source: Iowa DOT

Pipeline

Pipelines are the dominant mode of transportation for liquid and gaseous energy commodities, typically transporting raw materials from areas of production to refineries and plants or moving finished products to terminals, power plants, and other end users.

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

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

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

Condition

Specific condition information was not available. However, pipelines are regularly inspected and all leaks or incidents are investigated.

Utilization

Utilization numbers were not available.

Safety

From 2011 to 2020, there were a total of 84 pipeline incidents in Iowa, resulting in 3 injuries and $24,827,158 in repair fees.

Reliability

Despite the construction of new pipeline capacity in some parts of the country, energy infrastructure bottlenecks still exist. Limitations in Iowa are typically related to propane terminals and storage areas during high-demand seasons. Specific pipeline bottlenecks were not identified.

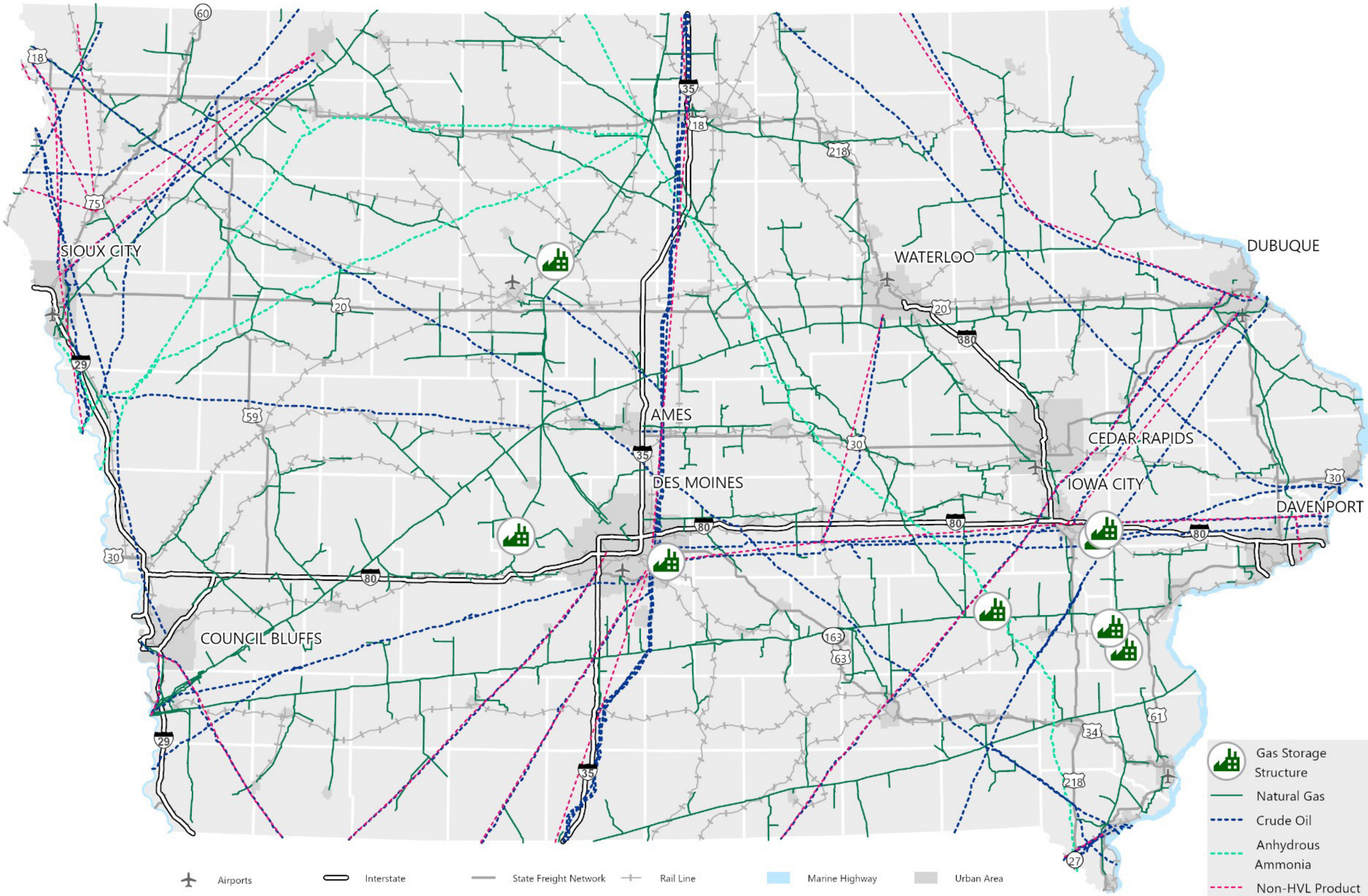
Table 2.12: Iowa pipeline mileage by commodity

System	Main miles	Service miles
Gas distribution	**18,936**	**15,088**
Natural gas	18,932	15,087
Propane	4	1
Gas transmission	**8,192**	-
Natural gas	8,192	
Liquid	**4,448**	-
Crude oil	672	
Highly Volatile Liquids*	1,901	
Refined petroleum products**	1,875	
Total	**31,576**	**15,088**

**Highly Volatile Liquids includes flammable and toxic liquids.*
***Refined petroleum products are obtained by distilling and processing crude oil.*

Source: Pipeline and Hazardous Materials Safety Administration

Figure 2.16: Iowa pipelines



Source: Pipeline and Hazardous Materials Safety Administration

Railroad

Iowa has an extensive rail transportation system with the ability to haul large volumes of freight in a safe, energy-efficient, and environmentally sound manner. Rail service in Iowa is dominated by five Class I carriers that operate most tracks and accrue most of the freight revenues in the state. Of the five Class I's, Union Pacific Railroad and BNSF Railway carry the largest volume of traffic in the state, operating on approximately 2,000 miles of track combined, including double tracks running east to west across the state.

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

IAIS train in Iowa (Source: Iowa DOT)

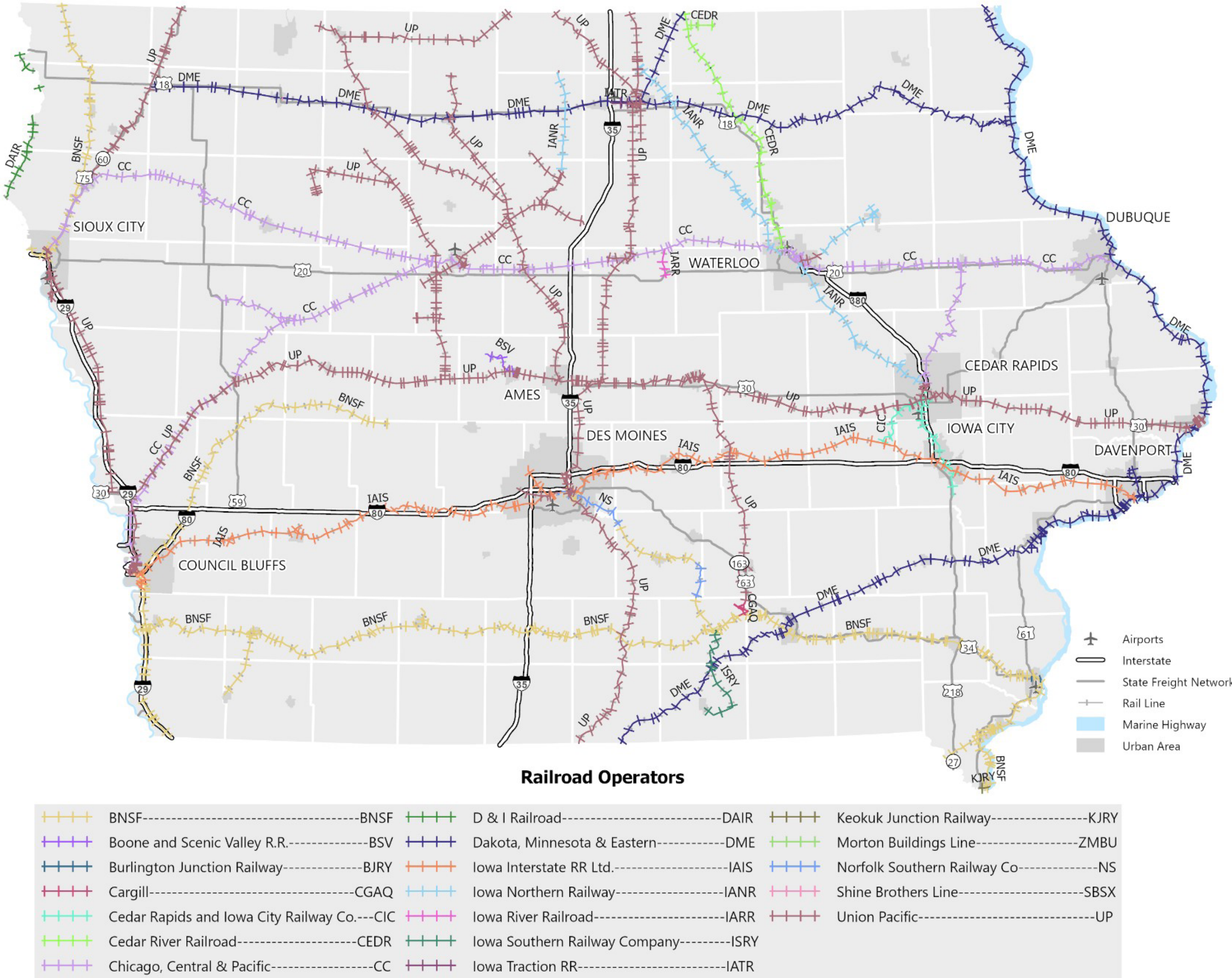
Table 2.13: Iowa railroad mileage by company

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

[1] CN operates via subsidiaries Chicago Central & Pacific (CCP) and Cedar River Railroad (CEDR).
[2] CP operates via subsidiary Dakota, Minnesota & Eastern (DME).
[3] CBEC trackage is operated by IAIS.
[4] SD-owned trackage in Iowa is operated by DAIR.

Source: Railroad companies

Figure 2.17: Iowa railroads



Source: Railroad companies

Condition

Operating revenues and overall net ton-miles of the railroads are indicators of the condition and performance of the rail system, both of which have steadily increased over the last 35 years.

Railroads in Iowa have been steadily increasing the amount of funds spent on maintenance and improvements of rail infrastructure in the state. This includes $166.7 million in 2019 and over $1 billion in the last five years. Infrastructure maintenance and improvements are estimated to make up 11 percent of total operating expenses.

Utilization

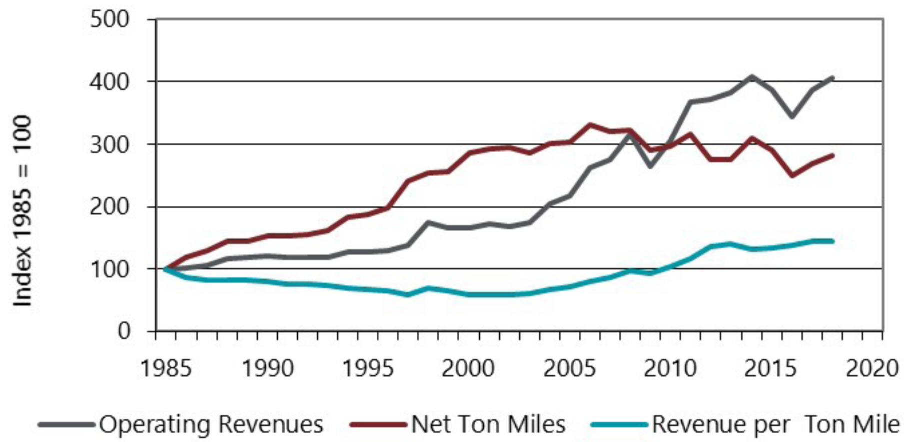
The activity on individual rail lines is measured in terms of density or gross ton-miles per mile. Gross ton-miles are defined as the total weight of all freight traveling on the rail line including the weight of freight-train cars and locomotives. While Iowa's rail miles have decreased slightly, the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

Class I carriers operate a majority of the rail mileage in the state and generate the most ton-miles. Iowa's two busiest rail lines are Union Pacific Railroad's Overland Route, an east-west double-track route passing through the center of Iowa (Clinton to Council Bluffs), and the BNSF Railway's line in southern Iowa, an east-west route that is partially double tracked (Burlington to west of Pacific Junction). The Class II and III railroads often provide feeder service to the Class I carriers, which results in smaller allocations of mileage and ton-miles.

Safety

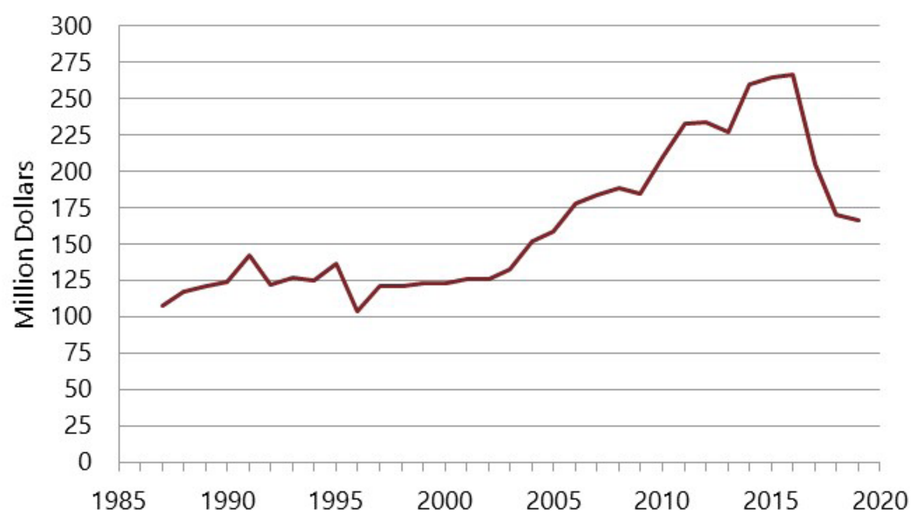
Over the last ten years, there were 378 crashes between highway and railroad traffic and 331 train derailments, with a relatively consistent number occurring each year. A total of 85 injuries and 98 fatalities resulting from those crashes and derailments, both with inconsistent trends by year.

Figure 2.18: Performance of Iowa rail operations, 1985-2018



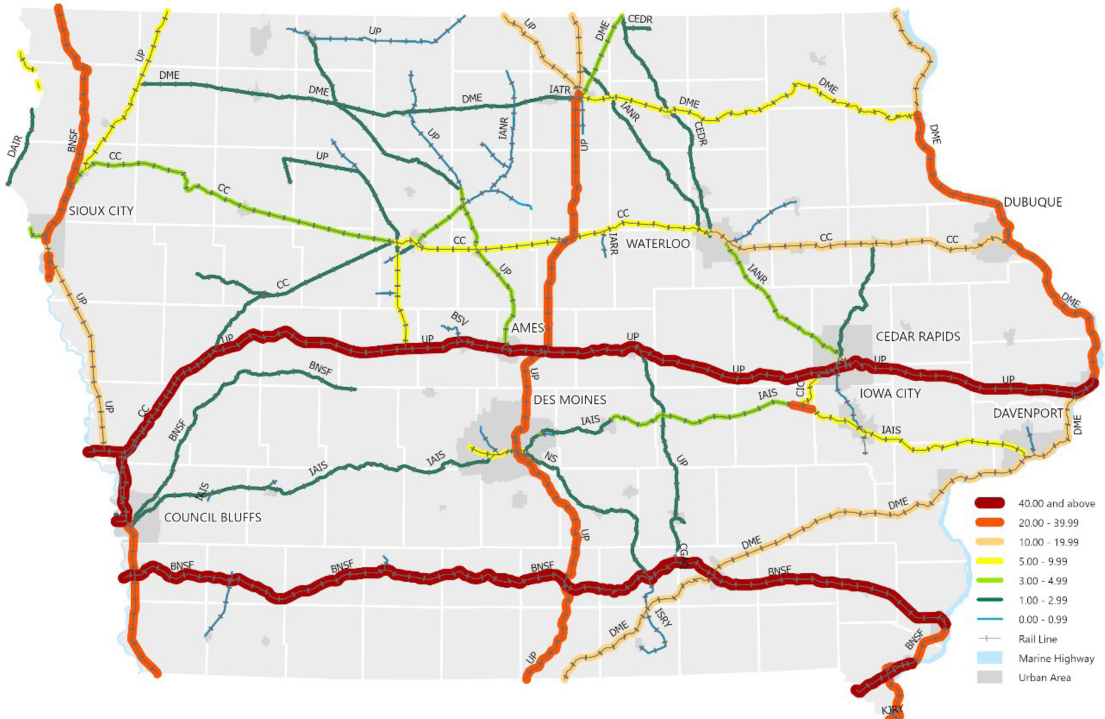
Source: Railroad companies

Figure 2.19: Iowa railroad maintenance investments, 1987-2019



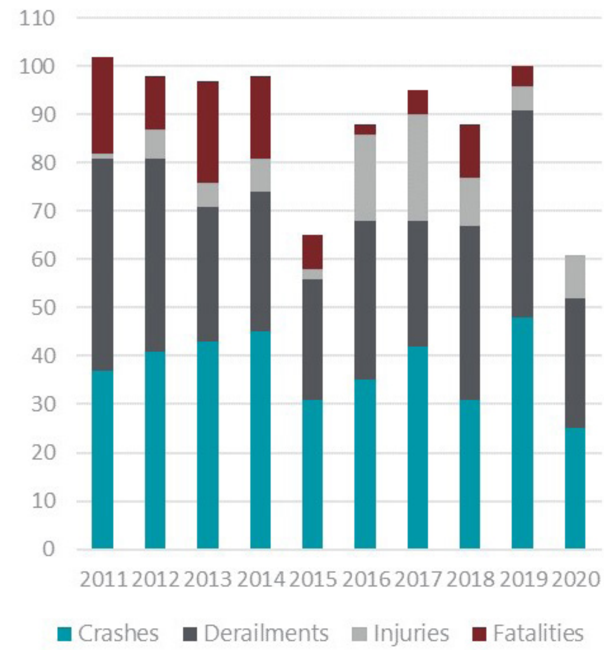
Source: Railroad companies

Figure 2.20: Freight railroad traffic density, 2020 (gross tons per mile)



Source: Railroad companies

Figure 2.21: Freight railroad-related safety statistics, 2011-2020



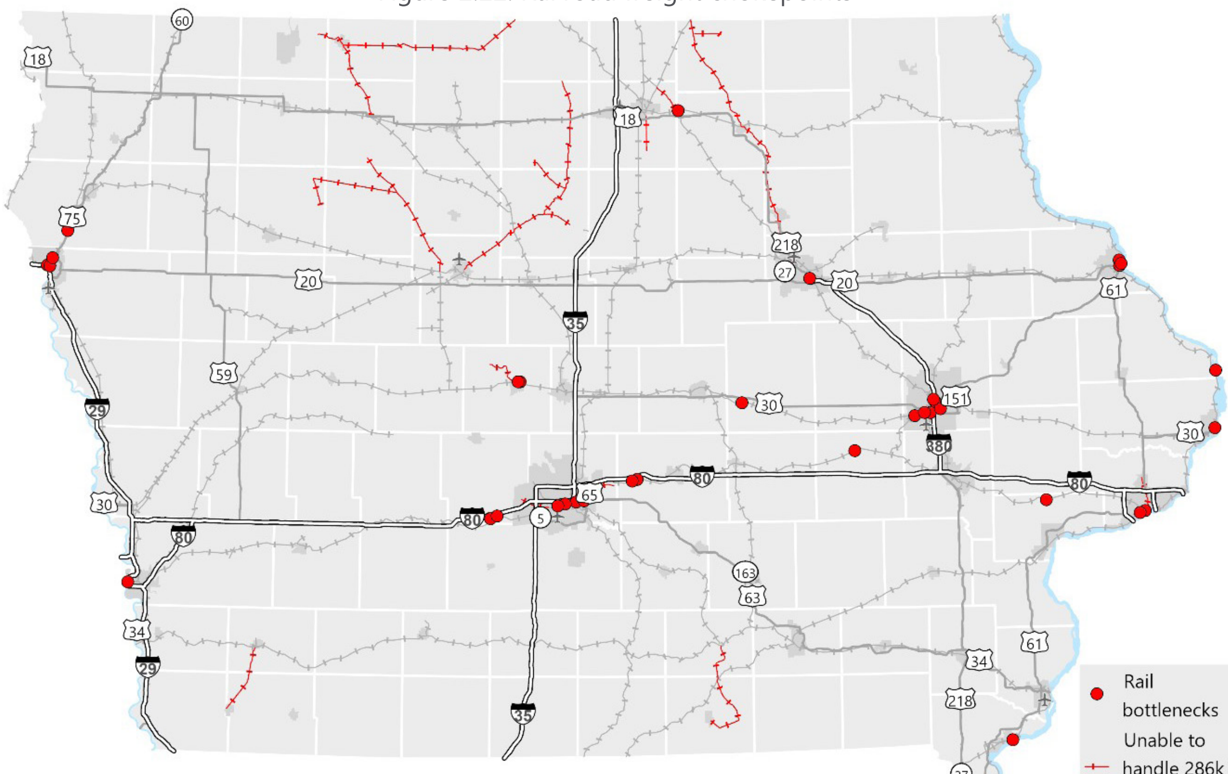
Source: Federal Railroad Administration

Reliability

Railroad bottleneck locations are usually referred to as “choke points” to avoid confusion with the more conventional railroad sector use of “bottleneck” to describe locations served by only one rail carrier (i.e., the “bottleneck carrier”). These choke points were identified by surveying each of the rail companies operating trackage in the state. Locations submitted primarily include structural choke points (e.g., low clearance areas and bridges with size restrictions), congested choke points (e.g., locations with operational issues or shared-use corridors), and low-lying areas at risk of flooding during heavy rains or high-water levels.

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

Figure 2.22: Railroad freight chokepoints



Source: Railroad companies

Table 2.14: Railroad freight chokepoints

	Railroad(s)	Location	Freight mobility issue
1	CN and UP	Mainline between Sioux City and Le Mars	**Track congestion** exists from multiple rail companies operating over the same line.
2	BNSF	31st Street Rail Crossing at Sioux City	This highway-railroad crossing is located on the edge of a rail yard resulting in the **roadway being regularly blocked** by trains and disrupting commercial and residential traffic. A coordinated crossings analysis and mitigation plan is needed.
3	BNSF, CN, DAIR, and UP	Terminal and Interchange Area at Sioux City	**Operational issues** exist where four railroads intersect at a major at-grade crossing of rail lines with trains operating at slow speeds with no designated interchange locations and many carriers operating on each other's yards to interchange cars.
4	BNSF	Gordon Drive viaduct at Sioux City	The Gordon Drive viaduct has a vertical clearance of 17' 6" above top of rail that **does not allow for the passage of double stack container trains.**
5	UP	West of Missouri Valley	**Flood prone area** is at risk of closure due to Missouri River flooding (e.g. 2011).
6	CN	UP rail bridge at Council Bluffs	CN uses a UP bridge over the Missouri River at Council Bluffs to reach a customer in Omaha, NE **causing delay** for some UP trains.
7	BSV and UP	Interchange at Boone	Interchange regularly serves more cars than originally designed resulting in significantly **increased time for sorting and coordination** between railroads to accommodate.
8	BSV	Industrial park at Boone	**Improved infrastructure** with additional siding, storage, and sorting capacity is needed.
9	IAIS	Bridge 380.4 near DeSoto	This **bridge restricts the movement of high-wide loads** (e.g. wind tower components) due to the truss construction.
10	IAIS	Bridge 378.1 near Van Meter	This **bridge restricts the movement of high-wide loads** (e.g. wind tower components) due to the truss construction.
11	IAIS	Des Moines	**Flood prone area** from MP359.04 to MP362.25 near Edwards Avenue is at risk of closure due to Raccoon River flooding anytime the Fleur Drive flood gates close.
12	IAIS	Track conditions at Des Moines	The **density of crossings** in downtown Des Moines limits speeds to 10 mph for westward bound trains. To alleviate, crossing consolidations or track upgrades need to be considered.
13	IAIS and UP	UP Short Line Yard at Des Moines	There is currently **no dedicated through route** for IAIS along the UP-owned trackage and yard. A dedicated separate track to allow IAIS through movements to pass without restriction is needed.
14	IAIS	Pleasant Hill	**Flood prone area** from MP352.25 to MP353 near Fairview Drive is at risk of closure due to Four Mile Creek flooding.
15	IAIS	Bridge 329.1 near Colfax	This **bridge restricts the ability to carry high-wide loads** (e.g. wind tower components). Need to replace structure with through plate girder bridge.

	Railroad(s)	Location	Freight mobility issue
16	IAIS	Colfax	**Flood prone area** from MP334.25 to MP336 near Walnut Street is at risk of closure due to Skunk River flooding.
17	CP and IANR	Interchange at Nora	Increased traffic volumes at the interchange results in **insufficient track capacity.**
18	IANR	Bryant Yard at Waterloo	Convergence of traffic from three subdivisions results in **insufficient classification space.**
19	UP	Montour	**Flood prone area** is at risk of closure due to large rain events (e.g. 2014).
20	IAIS	Bridge 268.6 near Marengo	This **bridge restricts the movement of high-wide loads** (e.g. wind tower components) due to the truss construction.
21	CIC and UP	Fairfax 3 at Cedar Rapids	UP can only deliver one train at a time at this location due to **insufficient interchange track.**
22	UP	Cedar Rapids	**Flood prone area** where main line and UP Beverly Yard are at risk of closure due to Prairie Creek and area drainage ditches flooding (e.g. 2014).
23	CIC	Cedar Rapids bypass at Cedar Rapids	**Rail traffic currently moves through the ADM plant** greatly affecting services. A new single line that bypasses ADM would allow trains to travel around the plant more efficiently and minimize potential operating conflicts between trains.
24	CIC	OR bypass at Cedar Rapids	**Insufficient capacity to accommodate the interchange space** for IANR and CN corn traffic while facilitating other yard switching activities. Bypass would provide additional capacity and efficiency of railroad operations.
25	CIC	Eighth Avenue curve at Cedar Rapids	The **current 13-degree 55 ft. curve limits train size and motive power options for train operations**, increasing the number of trains and causing vehicular and rail congestion downtown.
26	UP	Cedar Rapids	**Flood prone area** where the entire industrial lead is at risk of closure due to Cedar River flooding (e.g. 2008).
27	IAIS	Moscow	**Flood prone area** from MP211.75 to MP 212.75 near Noble Avenue at risk of closure due to Cedar River flooding.
28	CP	Garfield Avenue at Dubuque, Iowa	**Lack of rail yard capacity.**
29	CN*	CN rail bridge at Dubuque	**Swing-span bridge over Mississippi River closes to rail traffic to accommodate barge passage on the river during navigation season.** The time required to stop trains, open the bridge for river traffic, return the bridge to its original position, and restore normal railroad operations causes delays.

	Railroad(s)	Location	Freight mobility issue
30	CN	South Port at Dubuque	**Lack of rail yard capacity.**
31	CP*	CP rail bridge at Sabula	**Swing-span bridge over Mississippi River closes to rail traffic to accommodate barge passage on the river during navigation season.** The time required to stop trains, open the bridge for river traffic, return the bridge to its original position, and restore normal railroad operations causes delays.
32	UP*	UP rail bridge at Clinton	**Swing-span bridge over Mississippi River closes to rail traffic to accommodate barge passage on the river during navigation season.** The time required to stop trains, open the bridge for river traffic, return the bridge to its original position, and restore normal railroad operations causes delays.
33	BNSF and CP*	Crescent Bridge at Davenport	**Swing-span bridge over Mississippi River closes to rail traffic to accommodate barge passage on the river during navigation season**, and the bridge is functionally obsolete. The time required to stop trains, open the bridge for river traffic, return the bridge to its original position, and restore normal railroad operations causes delays.
34	BNSF, CP, and IAIS*	Government Bridge at Davenport	**Swing-span bridge over Mississippi River closes to rail traffic to accommodate barge passage on the river during navigation season**, and capacity is marginal for rail cars with a maximum allowable gross weight of 286,000 lb. The time required to stop trains, open the bridge for river traffic, return the bridge to its original position, and restore normal railroad operations causes delays.
35	BNSF*	BNSF rail bridge at Fort Madison	**Swing-span bridge over Mississippi River closes to rail traffic to accommodate barge passage on the river during navigation season.** The time required to stop trains, open the bridge for river traffic, return the bridge to its original position, and restore normal railroad operations causes delays to rail and highway traffic that share the bridge.
36	KJRY	Twin Rivers Yard at Keokuk	**Insufficient storage and switching capacity**, as well as the inability to block rail traffic properly, exists at this location. In order to alleviate, an increase in yard capacity is necessary.
37	KJRY	Keokuk	**Flood prone area** is at risk of closure due to Mississippi River flooding (e.g. 2008).
38	KJRY*	KJRY rail bridge at Keokuk	**Swing-span bridge over Mississippi River closes to rail traffic to accommodate barge passage on the river during navigation season.** The time required to stop trains, open the bridge for river traffic, return the bridge to its original position, and restore normal railroad operations cause delays.

**Location also listed as a waterway bottleneck*

Source: Railroad companies

Waterway

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

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

Located along these rivers are 63 barge terminals (57 on the Mississippi, six on the Missouri) in Iowa, owned and operated by private companies (see Appendix 1). These terminals transfer commodities between barge, rail, and truck. Freight moving via waterway in Iowa is primarily moving through facilities on the Mississippi River, within the boundaries of either the Upper Mississippi River Ports or Mid America Port Commission port statistical areas, or PSAs (see description on page 53).

A system of locks and dams (Table 2.15) on the upper Mississippi River, operated by the U.S. Army Corps of Engineers, helps to maintain adequate water levels for barge operations. The construction of these locks and dams was authorized in 1930 to achieve a 9-foot navigation channel in the upper Mississippi River. Dams are built on rivers to hold back water and form deeper navigation pools, allowing river vessels to use a series of locks to "step" up or down the river from one water level to another.

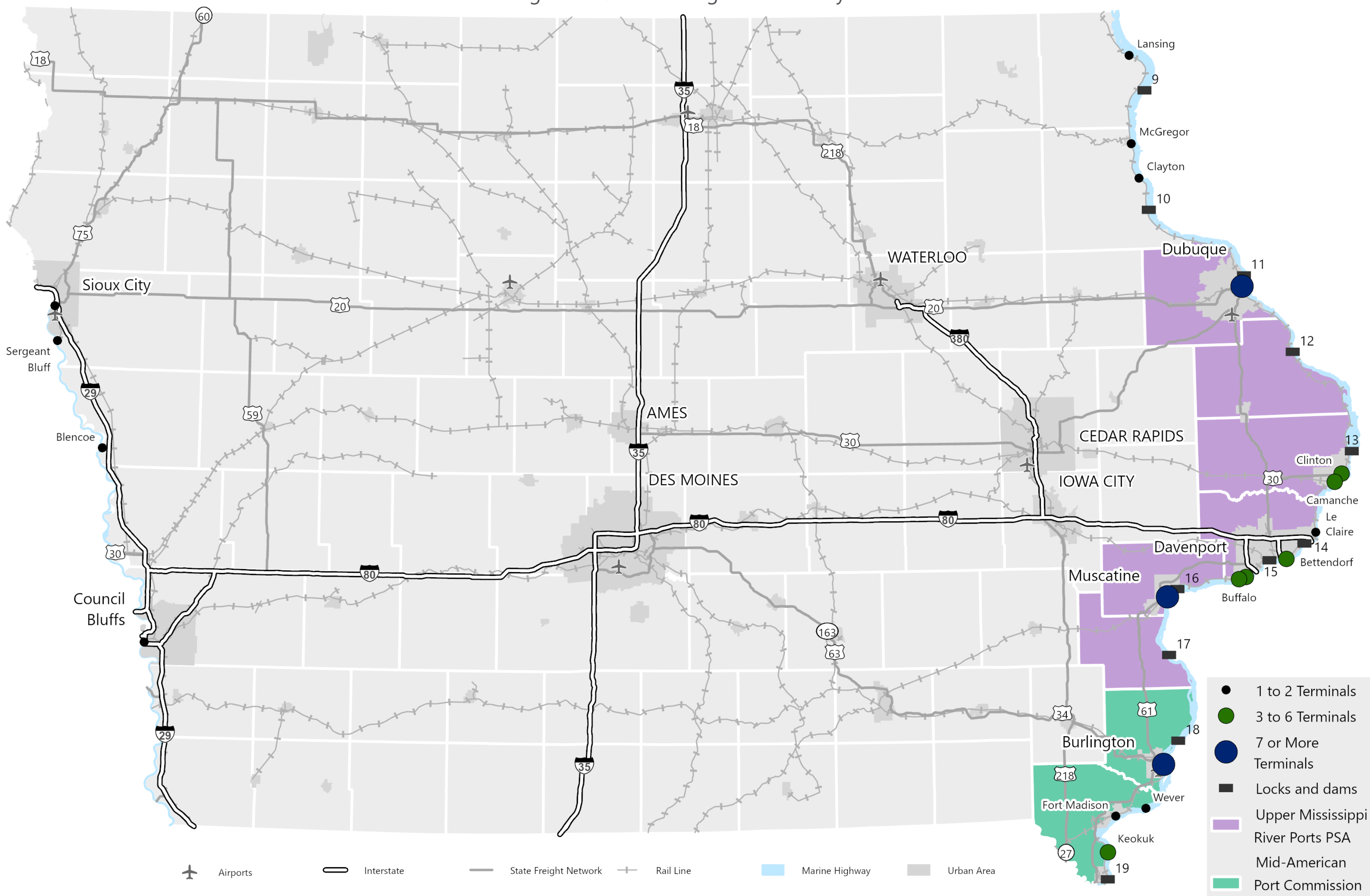
Table 2.15: Iowa Mississippi River locks summary

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

Source: U.S. Army Corps of Engineers

Tug and barges at Lock 12 (Source: Iowa DOT)

Figure 2.23: Iowa navigable waterways



Source: U.S. Army Corps of Engineers

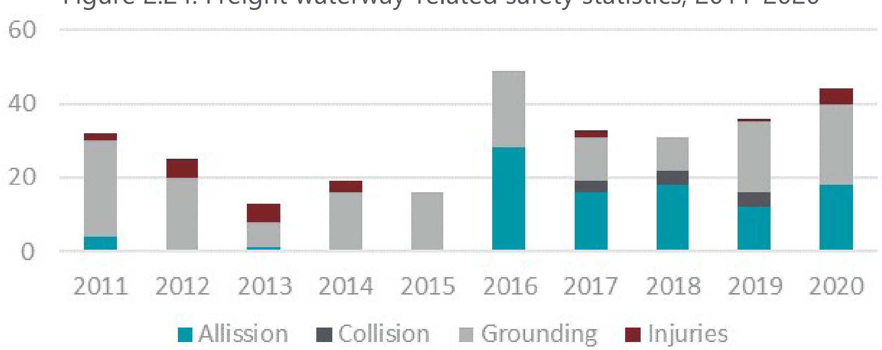
Condition

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

The locks and dams bordering Iowa are undersized for modern Upper Mississippi tow lengths and are hindered by unscheduled repairs. The average age of these 11 locks and dams is over 80 years, 30 years past their design life. Only one lock bordering Iowa is long enough to accommodate a modern 1,200-foot barge tow. The remaining 10 are 600 feet long, which means barge operators must split the tow in half, lock through multiple times, and resecure the barges together before continuing. This creates major delays and congestion at each lock and dam, generating a ripple effect and longer delays throughout the rest of the system.

Also contributing to delay times is lock unavailability, both scheduled and unscheduled. Due to the age and condition of the infrastructure, locks and dams often must be closed for maintenance and repairs. On average, unscheduled repairs account for more than 50 percent of lock closures.

Figure 2.24: Freight waterway-related safety statistics, 2011-2020



Source: U.S. Coast Guard

Utilization

Barge traffic through Upper Midwest locks increases as the river flows from north to south. Iowa's navigable waterways are primarily utilized for moving bulk products such as grain, fertilizer, and coal, with most of the movements being agricultural exports out of the state and down the Mississippi River. These exports are shipped from Iowa barge terminals to the Gulf of Mexico where they are transloaded onto ocean vessels and shipped around the world.

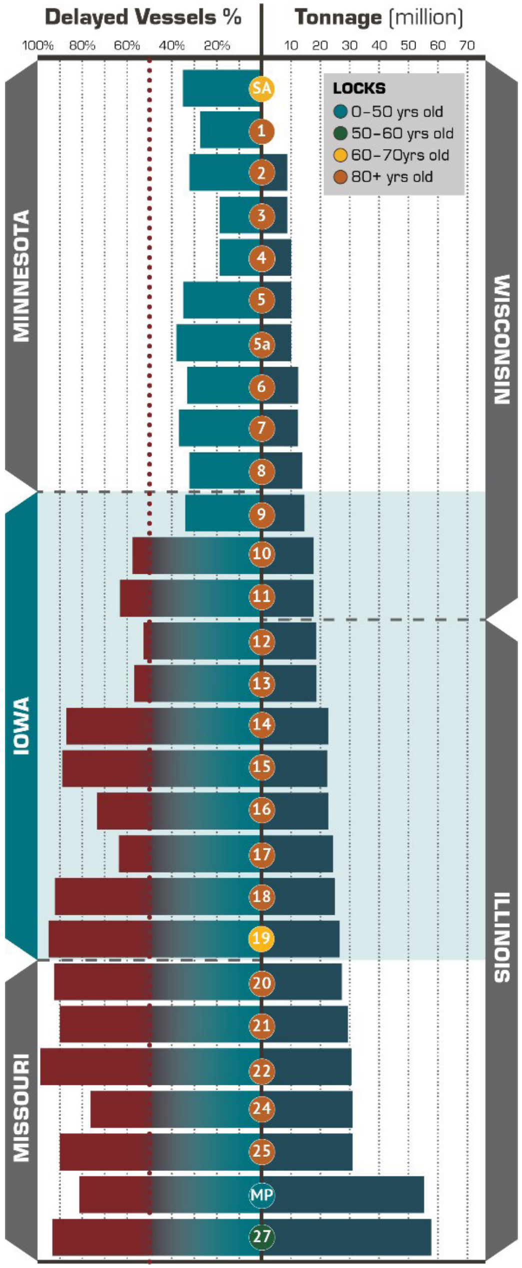
In the past, the Missouri River experienced a continual drop in freight tonnages, partly due to inconsistent water releases from upriver dams and controversy over water usage for all Upper Missouri River basin states. However, barge traffic is increasing on the Lower Missouri River and regular traffic is expected as far north as Blencoe, Iowa due to the opening of a new barge terminal in 2021 (see description on page 53).

Safety

There was a total of 276 freight-related allisions, collisions, and groundings on the Mississippi (270) and Missouri (6) rivers along Iowa's borders in the last ten years. There were no fatalities or missing crew members aboard towing vessels or barges along Iowa's border over that same period. However, there were 22 crew members injured – 21 on the Mississippi River and one on the Missouri River.

An **allision** is an event where a breakaway barge or navigating vessel makes contact with a stationary object (e.g., bridge, pier, dock, buoy, or moored vessel). A **collision** is an event where two objects underway or navigating vessels make contact. A **grounding** is an unintentional contact with the shore or bottom of the river, including unknown submerged objects.

Figure 2.25: Upper Mississippi River lock performance, 2020



Source: U.S. Army Corps of Engineers

Port statistical areas in Iowa

The Mississippi River Ports of Eastern Iowa and Western Illinois, doing business as Upper Mississippi River Ports PSA, consists of the existing ports and terminals in Dubuque, Jackson, Clinton, Scott, Muscatine, and Louisa counties, as well as others in Illinois. The Mid America Port Commission PSA consists of the existing ports and terminals in Des Moines and Lee Counties, as well as others in Illinois and Missouri.

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

Port of Blencoe

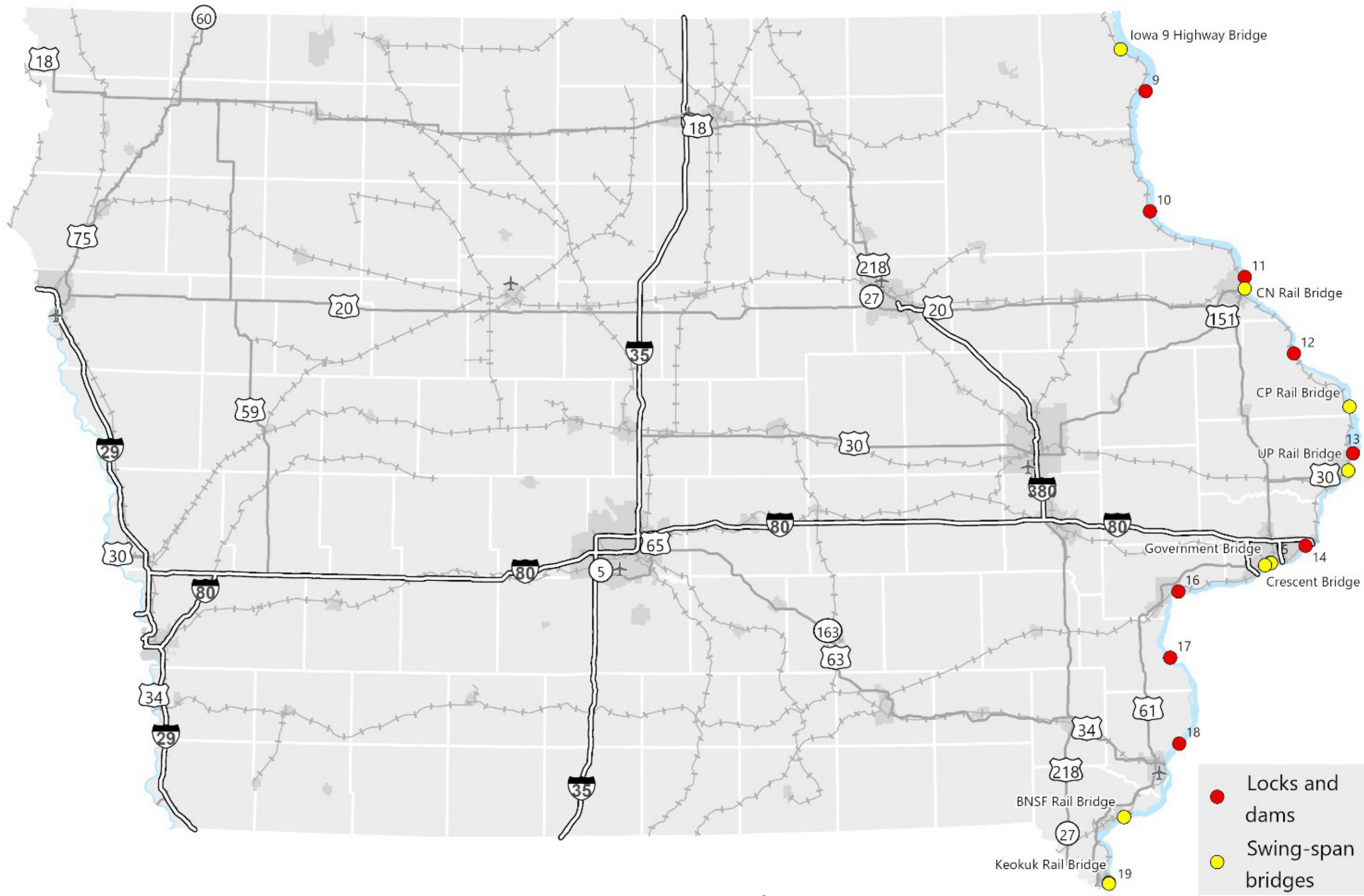
Located halfway between Council Bluffs and Sioux City, the NEW Cooperative Port of Blencoe serves as the northernmost gateway to the world market from the Missouri River. NEW Cooperative originally initiated the development of this terminal as a solution to growing transportation needs and a way to increase soybean basis for area farmers. The company was moving 36,000 tons of fertilizer via truck from the Mississippi River at Dubuque each year. Utilizing the Port of Blencoe now saves an estimated 248,000 truck miles and 58,000 gallons of fuel annually, significantly reducing carbon emissions.

The facility, which started moving traffic in early 2021, now handles corn, soybeans, dry fertilizers, soybean meal, dried distillers grains, and rock. There are multiple expansion projects planned (as of December 2021) to improve the performance and efficiency of the terminal, as well as a number of inquiries to move additional commodities such as wind turbine blades.

Reliability

Given the condition, size, and average delay of the 11 locks bordering Iowa, all are considered freight bottlenecks. It is clear that a lack of repairs, maintenance, and modernization will continue to have a negative impact on the efficiency and condition of the infrastructure. Failure or closure of a lock could be catastrophic for the region as there aren't any alternative routes. Seven swing-span bridges over the Mississippi River in Iowa are also considered bottlenecks. These bridges must "swing" open to allow for barge traffic to pass on the river before returning to the original placement for trains and vehicular traffic to cross. Although rail and highway traffic may not create an obstruction to marine traffic, delays can still occur due to rail operations. The Iowa 9 highway bridge over the Mississippi River was also identified due to the physical challenges it causes marine traffic.

Figure 2.26: Waterway freight bottlenecks



Source: U.S. Army Corps of Engineers

Table 2.16: Waterway freight bottlenecks

	Description	Location	Freight mobility issue
1	Iowa 9 highway bridge	Lansing	Curve of the river, dolphin protectors, and bridge piers cause barge delays.
2	Lock and Dam 9	Harpers Ferry	Age (1938), chamber size (600 ft.), delay (1.3 hours), annual closures (9)
3	Lock and Dam 10	Guttenberg	Age (1936), chamber size (600 ft.), delay (2.5 hours), annual closures (7)
4	Lock and Dam 11	Dubuque	Age (1937), chamber size (600 ft.), delay (2.5 hours), annual closures (19)
5	CN rail bridge*	Dubuque	Swing-span rail bridge must be opened to accommodate barge traffic.
6	Lock and Dam 12	Bellevue	Age (1939), chamber size (600 ft.), delay (2.1 hours), annual closures (3)
7	CP rail bridge*	Sabula	Swing-span rail bridge must be opened to accommodate barge traffic
8	Lock and Dam 13	Clinton	Age (1938), chamber size (600 ft.), delay (1 hour), annual closures (11)
9	UP rail bridge*	Clinton	Swing-span rail bridge must be opened to accommodate barge traffic.
10	Lock and Dam 14	Le Claire	Age (1922), chamber size (600 ft.), delay (1.7 hours), annual closures (15)
11	Government Bridge*	Davenport	Swing-span rail bridge must be opened to accommodate barge traffic.
12	Lock and Dam 15	Rock Island (IL)	Age (1934), chamber size (600 ft.), delay (2 hours), annual closures (29)
13	Crescent Bridge*	Davenport	Swing-span rail bridge must be opened to accommodate barge traffic.
14	Lock and Dam 16	Muscatine	Age (1937), chamber size (600 ft.), delay (2.6 hours), annual closures (11)
15	Lock and Dam 17	New Boston (IL)	Age (1939), chamber size (600 ft.), delay (1.8 hours), annual closures (17)
16	Lock and Dam 18	Gladstone (IL)	Age (1937), chamber size (600 ft.), delay (1.3 hours), annual closures (8)
17	BNSF rail bridge*	Fort Madison	Swing-span rail bridge must be opened to accommodate barge traffic.
18	Lock and Dam 19	Keokuk	Age (1957), delay (1.4 hours), annual closures (17)
19	KJRY rail bridge*	Keokuk	Swing-span rail bridge must be opened to accommodate barge traffic.

**location also listed as a railroad bottleneck*

Source: U.S. Army Corps of Engineers

Freight-generating facilities

Iowa's freight system includes a number of facilities that enable the smooth transfer of goods from one mode to another. These allow shippers to take advantage of the cost, speed, and capabilities of multiple modes.

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 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 an 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.

These intermodal transfer facilities are identified in the planning process as vital parts to the state's rail and water freight networks because they rely on trucking for pickup and delivery, which can produce significant freight traffic flowing to and from these locations.

Intermodal container facility

An **intermodal container facility** refers to the transfer of freight using an intermodal container or trailer through multiple modes of transportation (rail, barge, and/or truck) without the handling of the freight itself when changing modes. This method improves security and transportation speed while reducing the damage and loss of goods.

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

Transload facility

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, bulk goods, etc.

- A **team track** is the most basic and common type of transload facility in Iowa. It is a simple siding or spur track where rail cars 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.

- 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.

- **Barge terminals** are locations where commodities are transferred from barges to trucks and/or rail cars (or vice versa). These terminals are a staple of industries moving bulk products by river or inland waterway. Barges can be loaded and unloaded much more rapidly than packaging a bulk product and putting it in a truck and can handle a larger amount of freight and heavier freight than both truck and rail.

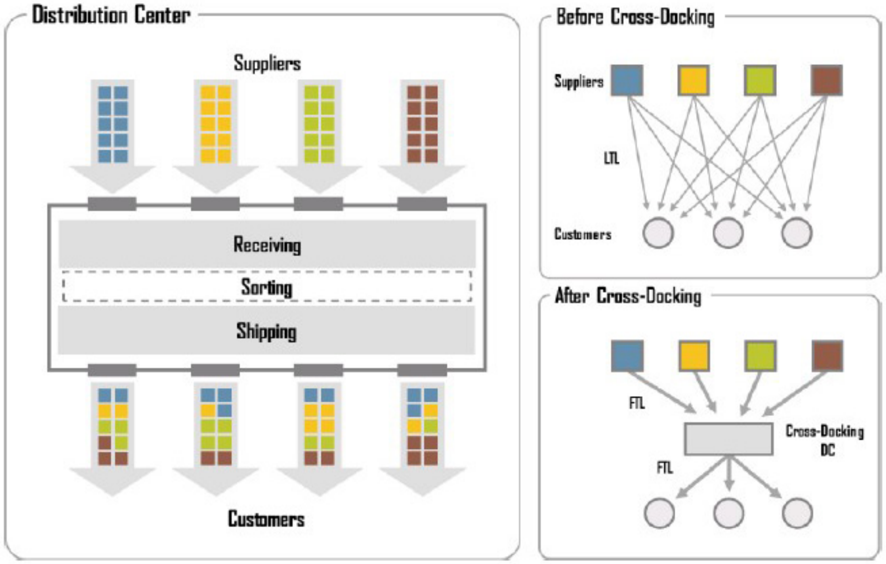
- **Biodiesel and ethanol plants** are production facilities for renewable fuels made with corn and the byproducts of corn production. These locations typically receive raw materials by truck and ship finished biodiesel/ethanol by truck and/or rail. The opportunity to shift from one mode to another qualifies these locations as transloads.
- **Grain elevators** are facilities that collect grain from farmers by tractor and trailer or truck. The grain is then stored and shipped to market via truck and/or rail. Iowa has a vast network of grain elevators to handle the large production of corn and soybeans each year before being transported elsewhere. As is the case with biodiesel and ethanol plants, the multiple transportation options qualify these locations as transloads.

Figure 2.27: Transload process example

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

Source: Iowa DOT

Figure 2.28: Cross-docking process example



Source: Hofstra University

Other freight-generating facilities

The multimodal 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 products and commodities, which makes these facilities an important part of the planning process.

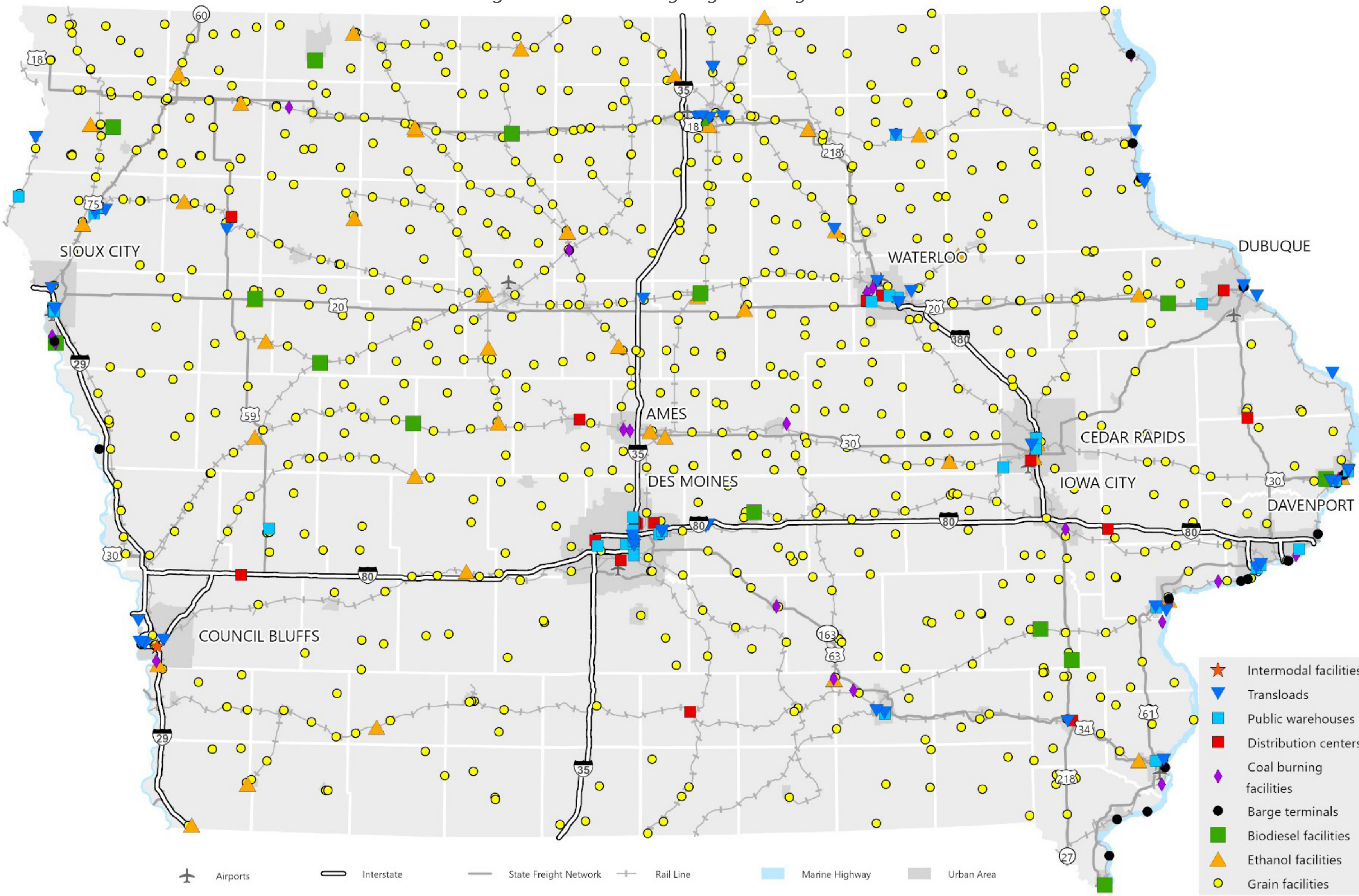
- **Warehouse** refers to a commercial building for storage of goods, which can include any raw materials, packing materials, spare parts, components, or finished goods associated with agriculture, manufacturing, and production. Warehouses are used by manufacturers, importers, exporters, wholesalers,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

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

Appendix 1 includes an inventory of Iowa freight-generating facilities. These lists of freight-generating facilities included in Appendix 1 are not exhaustive. Some existing facilities may not be operational and new facilities may not be represented.

Intermodal container transfer facility in Iowa. (Source: Iowa DOT)

Figure 2.29: Iowa freight-generating facilities



This map is not a comprehensive representation of all of Iowa's freight-generating facilities Some existing facilities may not be operational and new facilities may not be represented.

Source: Iowa DOT, Leonard's Guide, Rail companies, U.S. Army Corps of Engineers