Minnesota Department of Transportation District 7 Freight Plan

Working Paper 3: Freight System Profile – Economy, Inventory, Demand, and Performance

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Acronyms and Abbreviations

Abbreviation	Definition
AADT	Annual Average Daily Traffic
BEA	US Bureau of Economic Analysis
BLS	US Bureau of Labor Statistics
BNSF	Burlington Northern Santa Fe Railway
BRRRA	Buffalo Ridge Regional Rail Authority
BTS	US Bureau of Transportation Statistics
CFS	Commodity Flow Survey
CP	Canadian Pacific Railroad
DIV	Digital Inspection Vehicles
DME	Dakota, Minnesota, and Eastern Railroad
DOT	Department of Transportation
E&E	Ellis & Eastern Railroad
EIA	US Energy Information Administration
ELDs	Electronic Logging Devices
FAF	Freight Analysis Framework
FFF	Free Flow Factors
GDP	Gross Domestic Product
GPS	Global Positioning System
HGL	Hydrocarbon Gas Liquids
LQ	Location Quotient
MnDOT	Minnesota Department of Transportation
MPH	Miles Per Hour
MPL	Minnesota Prairie Line Railroad
MSAs	Metropolitan Statistical Areas
MVRRA	Minnesota Valley Regional Rail Authority
NAICS	North American Industry Classification System
QCEW	Quarterly Census of Employment and Wages
OSOW	Oversize-Overweight
RQI	Ride Quality Index
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TAZs	Transportation Analysis Zones
TTI	Travel Time Index
TTR	Travel Time Reliability
UP	Union Pacific Railroad

Executive Summary

Minnesota Department of Transportation (MnDOT) District 7 is located in South-Central Minnesota and is made up of 13 counties: Blue Earth, Brown, Cottonwood, Faribault, Jackson, Le Sueur, Martin, Nicollet, Nobles, Rock, Sibley, Waseca, and Watonwan. Together, these counties make up 14.9 percent of Minnesota's area and are home to about 5 percent of Minnesota's population. The District is also home to significant agricultural and manufacturing industries and is connected to other parts of Minnesota, Iowa, and South Dakota by highways such as I-90, US-169, US-14, and MN-60. Railroads are also important transportation links for the area, as they support grain and heavy commodity movements.

Working Paper 3 contributes to the ongoing District 7 Freight Plan, which intends to provide MnDOT with a clear understanding of the regional multimodal freight assets, performance, and connection to the District's economy.

District 7's Economic Context

District 7's freight transportation system is a critical component, driver, and facilitator of its economy. 37 percent of the District's employment and 39 percent of the District's GDP are provided by "freight-related" industries, which are industries that depend on freight transportation to support their core operations. The largest freight-related industries in District 7 are manufacturing and agriculture. Figure ES-1 displays District 7's freight-related employment broken down by industry.

Figure ES-1: District 7's Employment in Freight Related Industries (2019)

Note: BEA data masked for multiple industries to avoid disclosure of confidential information. Estimates of total industry employment are included in higher-level totals. Source: CPCS analysis of Full-Time and Part-Time Employment by NAICS Industry 2019, Bureau of Economic Analysis; 2019 Census of Agriculture. 2021.

While freight-related industries are generally continuing to thrive in the District, an aging workforce combined with decreasing employment in some freight-dependent industries, minimal labor force growth, and limited in-migration poses a potential workforce threat to these industries in the future. However, educational attainment in District 7 continues to rise, which may provide freight-related industry employers with qualified workers for

high-skilled, middle-class jobs, but also may draw potential employees into professional services jobs instead of freight-related industries.

District 7's Freight Transportation System

As seen in Figure ES-2, District 7's multimodal freight transportation system is extensive and includes major highways, railroads, and pipelines. The trucking network in District 7 primarily runs along I-90, US-169, and US-14, with a few other highways supporting trucking operations, including US-71, MN-60, MN-22, MN-15, MN-68, MN-4, and MN-13.

District 7's rail network includes three Class I and two Class III (also referred to as short line) operators. The Class I operators are Union Pacific Railroad, Canadian Pacific Railroad, and BNSF Railway, and the short line operators are Ellis & Eastern Railroad (trackage owned by Buffalo Ridge Regional Rail Authority) and the Minnesota Prairie Line (trackage owned by the Minnesota Valley Regional Rail Authority). The District's railroad operators tend to operate along the major highways in the District and serve manufacturing and agriculture establishments. While District 7 has many small-to-medium-sized rail transload facilities, stakeholders consulted in the 2019 District 7 Manufacturers' Perspective Study and the previous MnDOT statewide freight plan indicated a desire for more rail intermodal services in the District.

Additionally, District 7 has 879 miles of pipeline that carry natural gas, refined petroleum products, gasoline, and other products to consumers and businesses in District 7, statewide, and through to other neighboring states. Four commercial airports and 13 intermediate airports (facilities for general aviation up to small jets) provide air cargo service to local industries.

District 7's Freight System Safety, Condition, and Performance

This Working Paper analyzed District 7's freight system's performance in three broad categories: safety, condition, and mobility. Regarding safety, District 7 had the third-highest count of truck-involved crashes among Districts in Greater Minnesota (not including the Metro District). However, District 7's count of crashes was one-third lower than the second-highest District. In particular, truck-related crashes are a potential concern in dense locations with high traffic volumes, such as I-90, US-169, and US-14. Additionally, between 2010 and 2019, there were 51 crashes at railroad grade crossings in District 7.

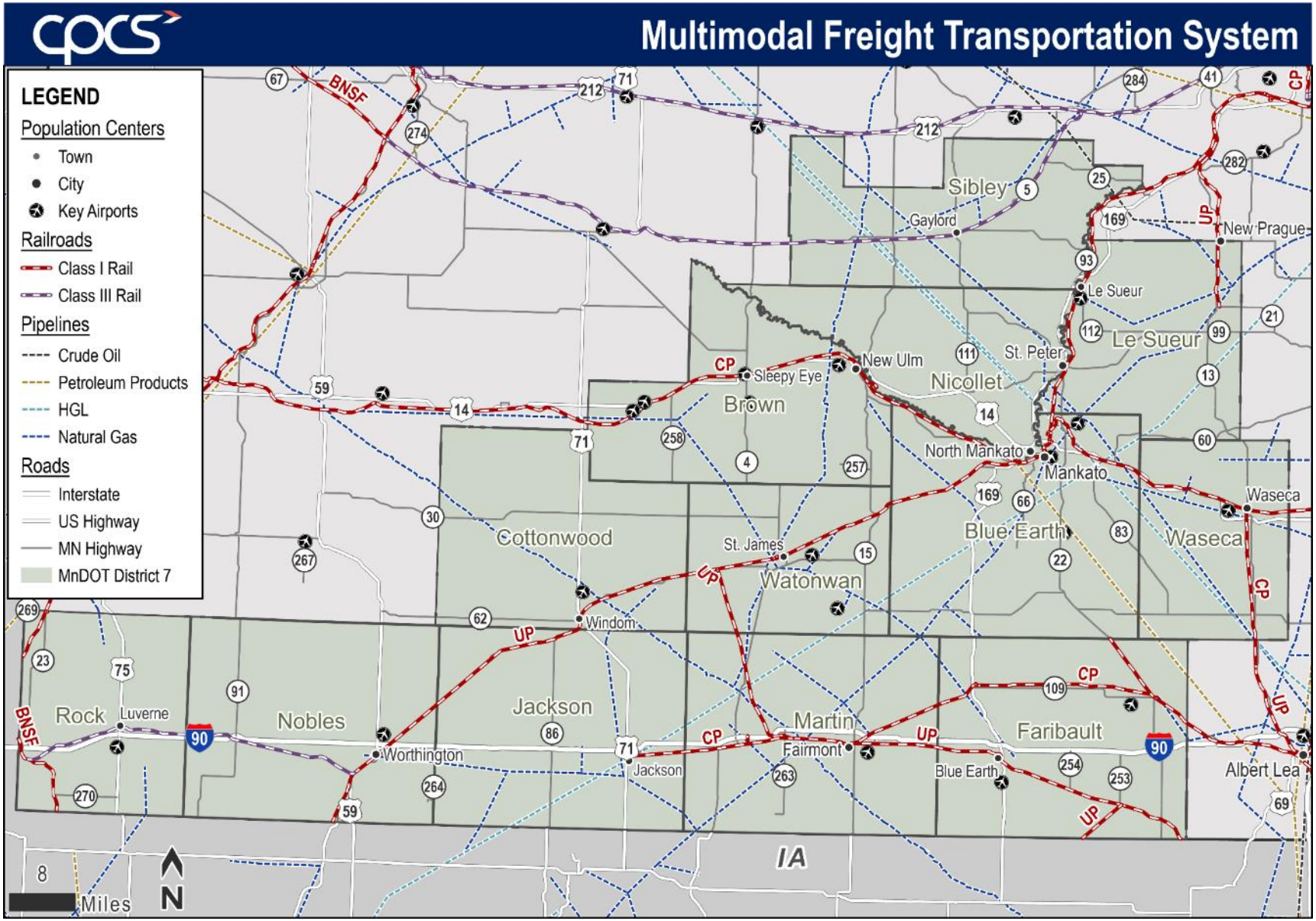
While truck congestion can cause safety concerns, truck speed reduction, and supply chain delays, congestion is rarely an issue in District 7. Some congestion can occur during peak times in Mankato and other northern parts of the District that are located closer to the Twin Cities.

The majority of District 7's pavement is in "good" or "fair" condition. District 7 has 126 bridges that are considered deficient, which comprise approximately 4.3 percent of all bridges in the District. Bridge conditions on the trunk highway system are generally better than on county-owned or locally-owned road networks in the District.

Next Steps for the District 7 Freight Plan

This Working Paper outlines the past and current state of District 7's freight transportation system. This paper will be updated following feedback and further insights provided by District staff, Advisory Committee, Technical Team, and stakeholder consultations. It will also serve as foundational context information for further work on the District 7 Freight Plan. The next deliverable will be Working Paper 4, which is a comprehensive analysis of the District's freight-related strengths, weaknesses, opportunities, and threats in addition to an inventory of critical freight needs and issues.

Figure ES-2: MnDOT District 7 Multimodal Freight System



Source: CPCS analysis of National Transportation Atlas Database. 2021.

1 District 7 Economic Context

Key Findings:

District 7's freight-related economy is primarily driven by agriculture and manufacturing. As of 2019, 35 percent of the District's employment and 39 percent of the District's GDP were associated with freight-related industries, or industries that rely on freight transportation to support their operations. While freight-related industries continue to flourish in District 7, the District experienced only slight growth in its total labor force over the past decade, and many of the industries that saw decreasing employment are freight-related. This is a potential cause for concern as District 7 also has an aging workforce and minimal in-migration. National BLS detailed industry and age statistics show that the U.S. is experiencing a similar increase in the number of older workers (age 55 and above) year-over-year since 2015.

The District's population increased by about 6 percent from 1990 to 2019. Most of this growth happened in and around Mankato as the area's industries, such as manufacturing, warehousing, and oilseed farming, continued to grow.

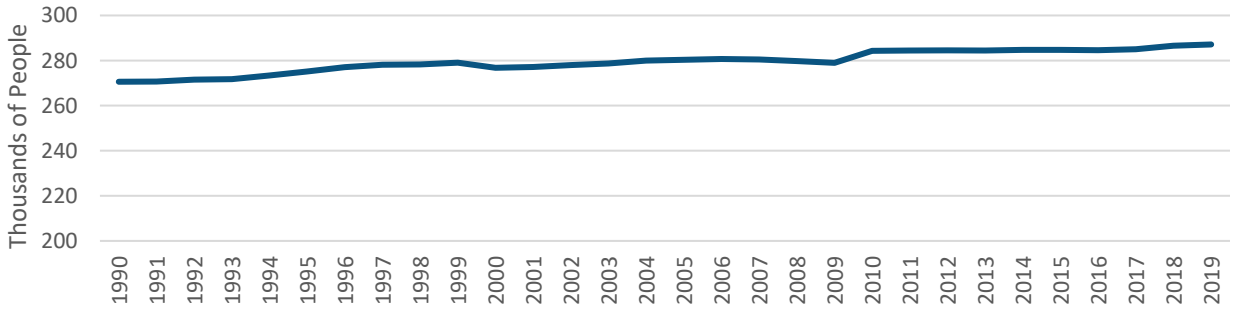
1.1 District 7's Economy

This chapter focuses on the economic characteristics of District 7. It highlights social aspects, such as population, education, income, and employment in industries that support freight movements. This economic background will provide further context to the importance of freight transportation in the District and informs current and future needs related to freight.

Population

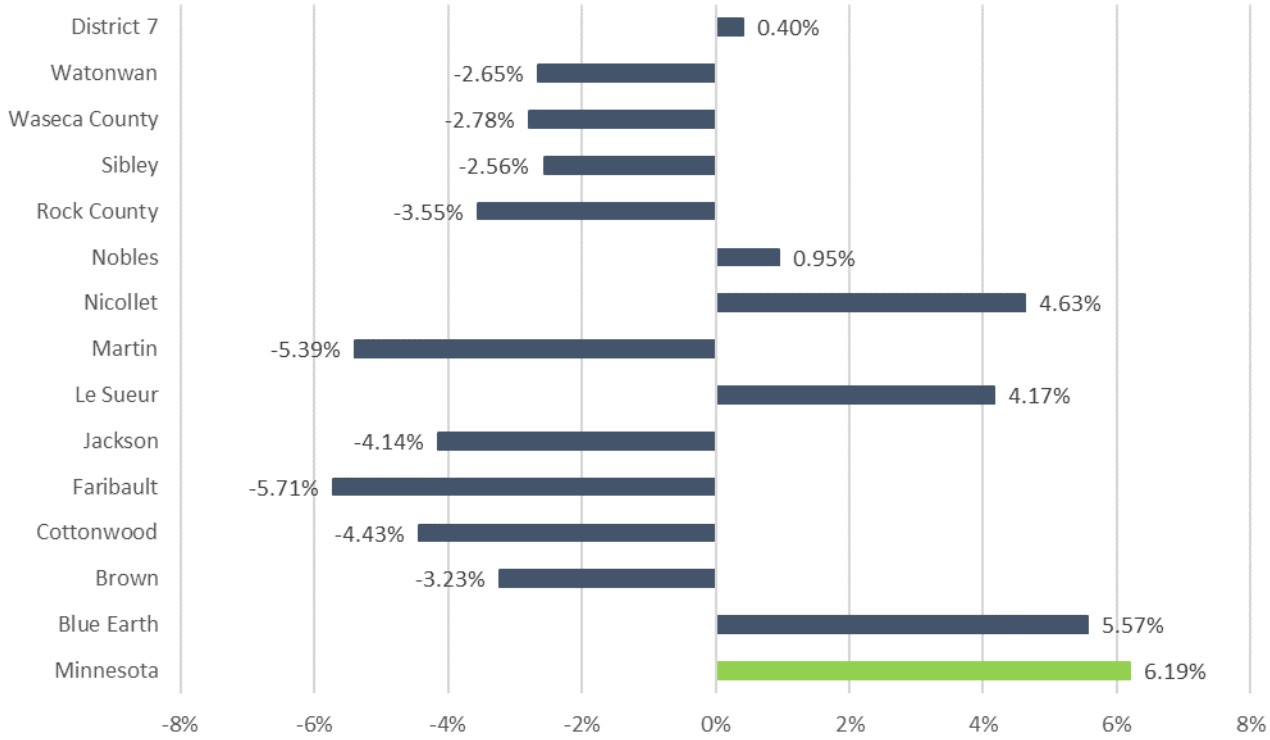
Understanding population trends is a critical component of freight transportation planning, as population trends provide insight into current and future workforce availability and demand for freight transportation services. From 1990 to 2019, District 7's population increased by 6 percent, which is less than the statewide population growth during this time (30 percent). District 7's increase stems from growth in and around Mankato, particularly in Blue Earth (6 percent), Nicollet (5 percent), and Le Sueur (4 percent) Counties. By comparison, the population in Brown, Cottonwood, Faribault, Jackson, Martin, Rock, Sibley, Waseca, and Watonwan Counties all dropped during the same time. Figure 1 displays the population levels between 1990 and 2019 in District 7, and Figure 2 depicts county-level trends over the past 10 years.

Figure 1: District 7 Population Trend (1990-2019)



Source: CPCS analysis of 2020 Minnesota State Demographic Center data. 2021.

Figure 2: County Population Trends (2010-2019)



Source: CPCS analysis of US Census Bureau Population Estimates for July 1, 2021. 2021.

In 2019, District 7 had a population of 285,518 people. Over one-third of the population lived in Blue Earth and Nicollet counties, which had 24 percent and 12 percent of the population, respectively. Rock County was the least populous county, making up approximately 3.3 percent of the population. Between 2010 and 2019, the share of District 7's population age 65 and over increased from 15.8 percent to 17.3 percent of the population.[1]

Based on US Census migration flow analysis, migration into District 7 was minimal between 2014 and 2018.[2] During that time, 7.5 percent of the population growth that occurred in District 7 was attributed to in-migration from other states and countries, while 7.1 percent out-migrated to other states or countries. A lack of in-migration and an increasingly aging labor force can lead to workforce shortages, reduction in labor productivity, and increased social costs (due to delayed retirements), which are all significant concerns for economic development. An independent study completed by the Rand Corporation indicated that a 10 percent increase in the fraction of the population aged 65 and older can lead to a near 5.5 percent decrease in GDP growth rate per capita.[3]

A shrinking workforce could pose a challenge for District 7's industries and transportation system in the future.

[1] US Census County Population by Characteristics, 2010-2019.
[2] US Census County Population by Characteristics, 2010-2019.
[3] Maestas et al., (2016) "The Effect of Population Aging on Economic Growth, the Labor Force and Productivity" Rand Corporation.

Educational Attainment and Household Income

The level of educational attainment (high school, college, etc.) can influence the career opportunities and earning potential of the District's population. At a larger scale, analysis of educational attainment of the District's population provides insight into the District's workforce's ability to support relatively higher-paid medium- and high-skill jobs. A workforce with both medium and high-skilled labor may be necessary to support some freight-related industries like advanced manufacturing. A workforce with both medium and high-skilled labor may be necessary to support some freight-related industries like advanced manufacturing.

The District's population has become increasingly educated and its population experienced a 3.1 percent increase in the number of individuals with bachelor's degrees or higher per capita between 2010 and 2019. As Figure 3 shows, the District's share of the population over 25 years old with the educational attainment of a high school degree or an associate degree is higher than the state and the country and has increased over the period. This increase may provide freight employers with the ability to hire more skilled workers. Additionally, a smaller share of the District's population has attained a bachelor's degree or higher compared to statewide and nationwide populations. Between 2010 and 2019, the percentage of residents 25 and older without a high school degree dropped from 11.4 to 8.3 percent. Meanwhile, the percentage of residents 25 and older with some college or associate degree had a slight increase from 32.3 to 34.1 percent.

The majority of District 7's residents have an education of at least high school or some college degree, which may be relevant for higher-tech manufacturing or transportation careers.

The District's relatively high level of mid-range educational attainment shows that the labor market in District 7 can be suitable for middle-income jobs that require specialized training or experience, many of which are concentrated in freight-related industries such as agriculture and manufacturing.

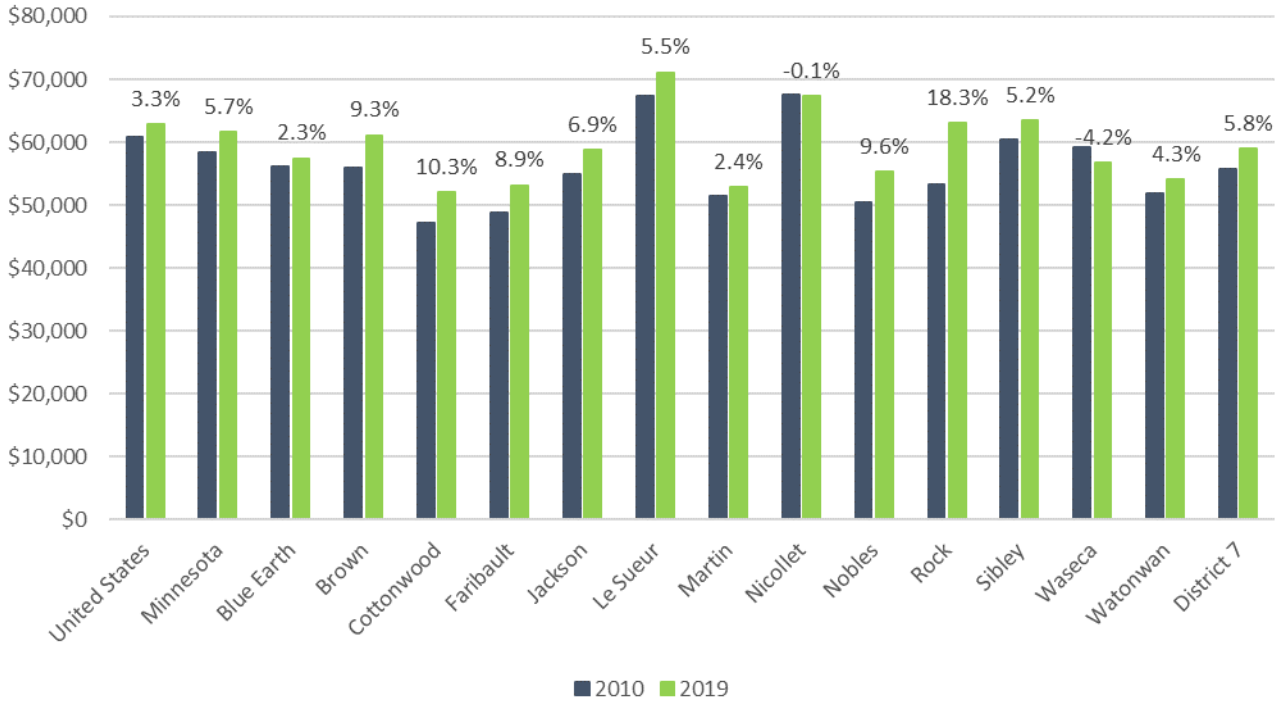
Figure 3: Educational Attainment (2010 and 2019)

Highest Level of Education Attained	D7 2010	D7 2019	Minnesota 2019	US 2019
No high school diploma	11.4%	8.3%	6.9%	12.0%
High school graduate (includes equivalency)	34.8%	32.8%	24.6%	27.0%
Some college, or an associate degree	32.3%	34.1%	32.4%	28.9%
Bachelor's degree or higher	21.5%	24.8%	36.1%	32.1%

Source: CPCS analysis of 2006-2010 and 2015-2019 American Community Survey Data, US Census Bureau. 2021.

Figure 4 shows the estimated median household income trends for each county within District 7. In both 2010 and 2019, the average household income of District 7 was below the national and statewide averages, which suggests that demand for consumer goods (and corresponding consumer freight traffic) in the area could be relatively lower than other communities in Minnesota or the United States. However, median household income in the District increased by 5.8 percent between 2010 and 2019, compared to a 3.25 percent nationwide and a 5.7 percent statewide growth during the same period. Rock County saw the highest increase in the average household income (18 percent) between 2010 and 2019, followed by Brown (9 percent), Cottonwood (10 percent), and Nobles (9 percent) Counties.

Figure 4: Median Household Income (2010 and 2019 Census Estimates - Presented in 2019 Dollars)



Source: CPCS analysis of 2006-2010 and 2015-2019 American Community Survey Data, US Census Bureau. 2021

1.2 Employment and Industries

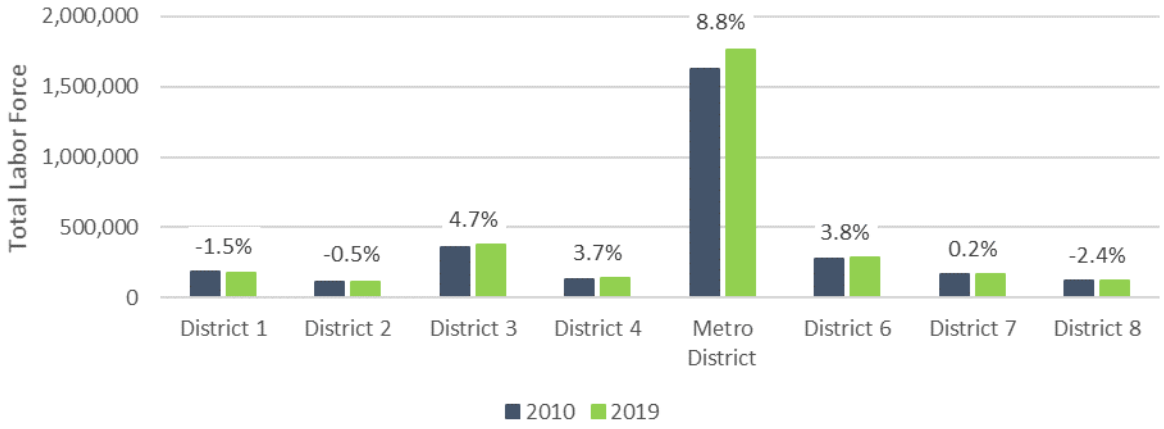
Employment provides insights into economic well-being as shown through the relative strength and impact of the industries located in the region. It can also highlight the relative importance of freight-related industries, or industries that rely on the physical movement of goods to support their operations. District 7's unemployment rate was 6.9 percent in 2010, but by 2019, this number decreased to about 3.4 percent. According to the Federal Reserve, District 7's current unemployment rate is considered a normal rate in the absence of economic shocks.[4] The significant decrease in District 7's unemployment between 2010 and 2019 (about 51 percent) is primarily associated with an increase in hiring. By comparison, some other MnDOT Districts have experienced unemployment decreases driven not by growth, but by out-migration and individuals leaving the labor force.

Labor Force

Figure 5 shows the changes in the size of the labor force in MnDOT's Districts between 2010 and 2019. As the graph shows, over the past decade, the District's labor force only increased 0.2 percent (285 people). During the same period, the number of employed residents increased by 7,982 people, and the number of the unemployed population decreased by more than 4,290 people.

[4] Congressional Budget Office. Budget and Economic Outlook - Noncyclical Rate of Unemployment. Updated Feb 1, 2021. https://fred.stlouisfed.org/series/NROU

Figure 5: Labor Force Changes between 2010 and 2019 in MnDOT Districts



Source: CPCS Analysis of Local Area Statistics, Bureau of Labor Statistics. 2021.

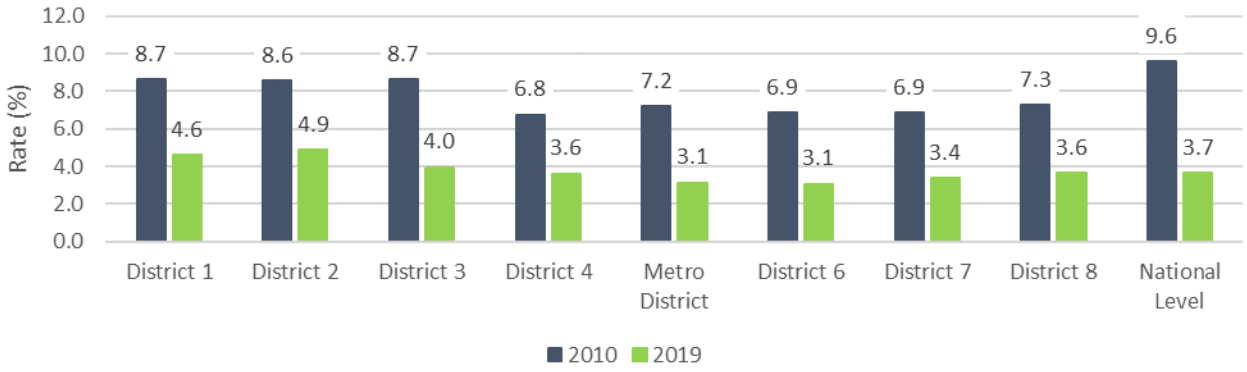
District 7's very small increase in its total labor force from 2010 to 2019 presents a potential threat to future workforce availability, as the District has an aging population and minimal in-migration. Additionally, a reduction or minimal increase in the total labor force may further aggravate the existing truck driver shortage in District 7.

Minimal increases in total labor force combined with an aging population and limited in-migration pose a threat to District 7's future workforce availability.

Unemployment

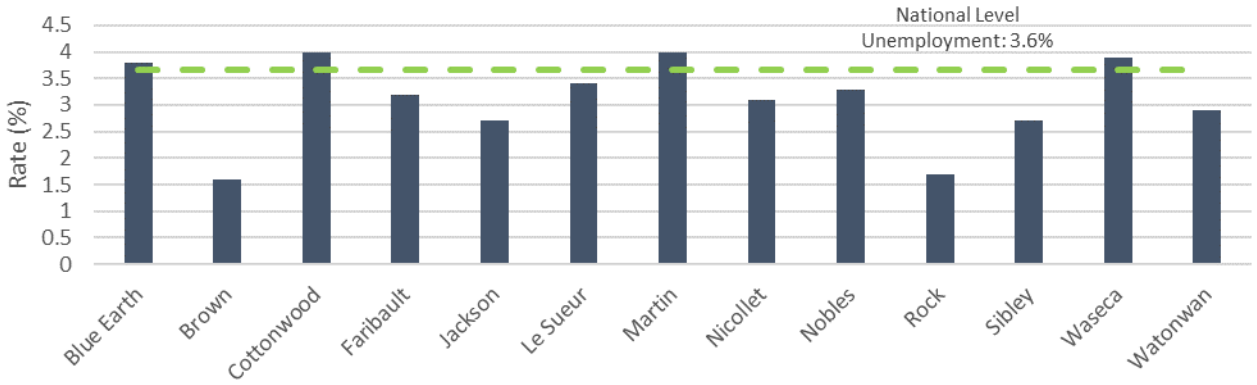
District 7's average unemployment rate in 2019 was 3.4 percent which was slightly lower than the national average. This means that the District was not economically distressed (Figure 6). As Figure 7 shows, four individual counties in the District had unemployment rates higher than the national average and thus were economically distressed. These counties include Cottonwood (4.0 percent), Martin (4.0 percent), Waseca (3.9 percent), and Blue Earth (3.8 percent).

Figure 6: Minnesota District Unemployment Rates for 2010 and 2019



Source: CPCS analysis of Local Area Statistics, Bureau of Labor Statistics. 2021.

Figure 7: District 7 County-Level Unemployment Rates (2019)



Source: CPCS analysis of Local Area Statistics, Bureau of Labor Statistics. 2021.

1.3 Gross Domestic Product

Gross Domestic Product (GDP) is a monetary measure of the value of the goods and services produced in a given area. Analysis of GDP trends and GDP share associated with specific industries provides insight into the health of an economy and helps identify the most influential or productive industries. This section provides an overview of the GDP trends in Minnesota and District 7 relevant to freight transportation.

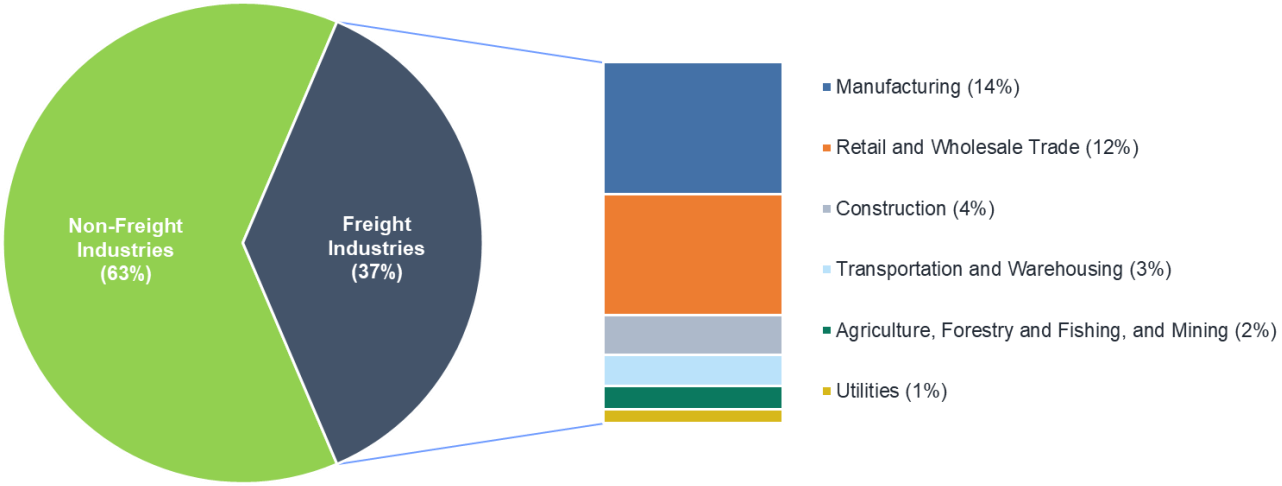
Minnesota's Gross Domestic Product

Figure 8 presents Minnesota's GDP by industry. As shown in the chart, non-freight industries represent 63 percent of the state's GDP, while freight-related industries represent 37 percent of GDP. Within the freight-related industry category, manufacturing holds the highest share of the statewide GDP (14 percent), followed by retail and wholesale trade (12 percent).

District 7 Gross Domestic Product

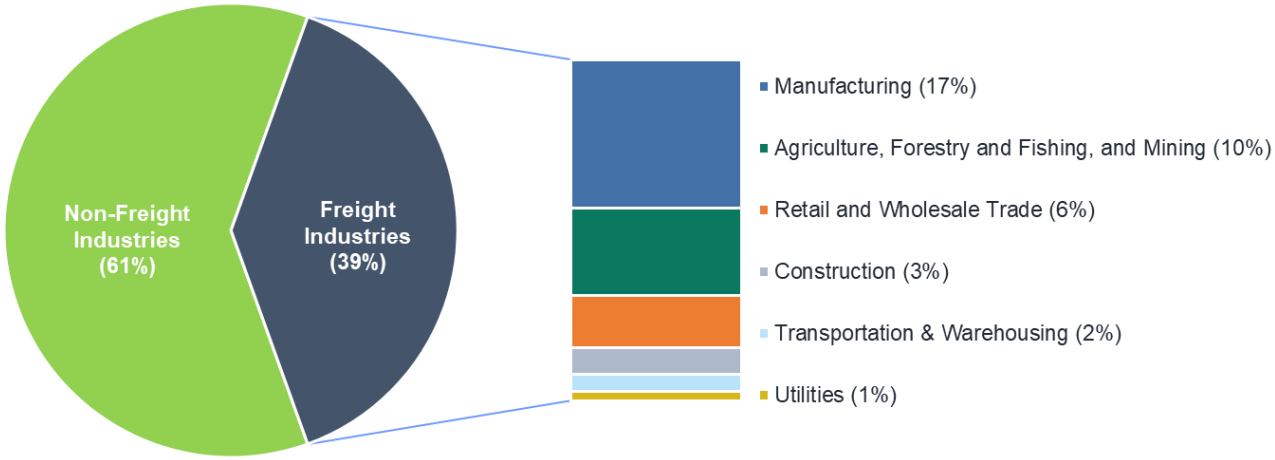
Figure 9 shows how freight-related industries represent 39 percent of District 7's GDP. Manufacturing (14 percent) and agriculture, forestry, fishing, and mining (12 percent) are significant contributors to the freight-related GDP of the District. The freight-related share of GDP in District 7 (39%) is higher than Minnesota's overall freight-related share of GDP (37%), and this fact further emphasizes the foundational economic role that freight transportation plays in District 7.

Figure 8: Minnesota GDP Share by Industry (2019)



Source: CPCS analysis of GDP by State in Current Dollars by NAICS Industry 2019, Bureau of Economic Analysis. 2021.

Figure 9: District 7's GDP by Industry (2019)

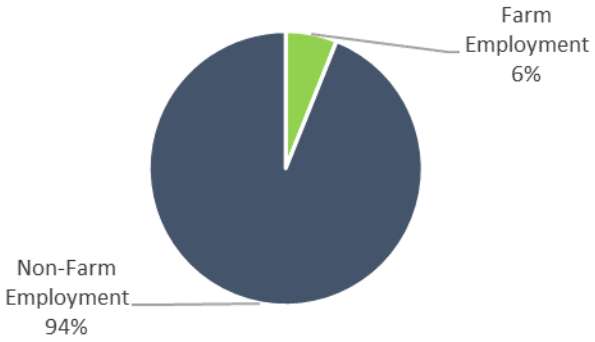


Source: CPCS analysis of GDP by County in Current Dollars by NAICS Industry, Bureau of Economic Analysis. 2021.

Freight-Related Employment

The Quarterly Census of Employment and Wages (QCEW) program provides data on employment by industry, which enables an assessment of the count of jobs associated with specific industries at the county and state level. Figure 10 shows the District's employment in the farm and non-farm industries. About 94 percent of District 7's employment is in the non-farm sector. Manufacturing, retail trade, and healthcare, and social assistance are the primary contributors to the District's employment. While the QCEW database provides employment data by 2-digit North American Industry Classification System (NAICS) sectors as well as a count of proprietors of both farm and non-farm businesses, Agricultural Census data is used to supplement farm employment information where employment data coverage is insufficient.

Figure 10: District 7's Farm and Non-Farm Employment (2019)



Source: CPCS analysis of Full-Time and Part-Time Employment by NAICS Industry 2019, Bureau of Economic Analysis for non-farm employment and 2019 Census of Agriculture for farm employment. 2021.

Figure 11 shows the District's non-farm employment by county and industry. The highlighted rows are the primary industries that are considered "freight-related" in this Working Paper. These freight-related industries are heavily reliant on the transportation network for shipping and receiving goods to support their operations, and include forestry, fishing, and related activities, mining, quarrying, and fossil fuel extraction, manufacturing, retail and wholesale trade, construction, transportation and warehousing, and utilities. These industries are generally location-dependent, meaning that their competitiveness is directly linked to the performance of the freight system. In particular, mining, quarrying, and agriculture are location-dependent, as farm fields, mines, and other natural resource sites cannot be moved like factories. Figure 12 indicates the relative employment by industry for District 7, based on freight-related and non-freight-related jobs.

Over 37 percent of District 7's workers are employed in freight-related industries.

Figure 11: District 7's Non-Farm Employment by Industry (2019)

Industry		Total Employment	% of Total
Private Non-Farm	Forestry, fishing, and related activities	888	0.5%
	Mining, quarrying, and oil and gas extraction	103	0.1%
	Utilities	267	0.2%
	Construction	9,445	5.5%
	Manufacturing	26,037	15.2%
	Wholesale trade	3,968	2.3%
	Retail trade	18,173	10.6%
	Transportation and warehousing	5,022	2.9%
	Information	2,279	1.3%
	Finance and insurance	7,834	4.6%
	Real estate and rental and leasing	6,474	3.8%
	Professional, scientific and technical services	4,760	2.8%
	Management of companies and enterprises	516	0.3%

Industry		Total Employment	% of Total
	Administrative & support & waste management & remediation services	4,289	2.5%
	Educational services	1,913	1.1%
	Health care and social assistance	19,025	11.1%
	Arts, entertainment, and recreation	2,739	1.6%
	Accommodation and food services	9,496	5.6%
	Other services (except government and government enterprises	10,335	6.4%
Government and government enterprises		21,973	12.8%
Total Non-Farm Employment		171,077	100%

NOTE: BEA data masked for multiple industries to avoid disclosure of confidential information. Estimates of total industry employment are included in higher-level totals.
Source: CPCS analysis of Full-Time and Part-Time Employment by NAICS Industry, Bureau of Economic Analysis. 2021.

Figure 12: District 7's Employment in Freight Related Industries (2019)

Note: BEA data masked for multiple industries to avoid disclosure of confidential information. Estimates of total industry employment are included in higher-level totals. Source: CPCS analysis of Full-Time and Part-Time Employment by NAICS Industry, Bureau of Economic Analysis, Census of Agriculture. 2021.

Freight-Related Industry Specialization

Location Quotient (LQ) analysis provides insights into the region's economic base specialization relative to the national norm. The LQ of an industry indicates the proportion of the workforce employed in that industry relative to other geographic areas or industries. Industries that have higher LQ values are typically more export-oriented[5] and, therefore, have a relatively greater contribution to the regional economy. Studies show that an LQ value of greater than 1.3 shows relatively high regional employment compared to national-level employment in a certain industry.[6]

[5] EMSI Resource Library "Understanding Location Quotient", 2007. https://www.economicmodeling.com/wp-content/uploads/2007/10/emsi_understandinglq.pdf

[6] MnDOT "Transportation Planning to Support Economic Development: An Exploratory Study of Competitive Industry Clusters and Transportation in Minnesota" (2015). http://www.cts.umn.edu/Publications/ResearchReports/reportdetail.html?id=2400

Figure 13 summarizes the District's annual average employment LQs based on QCEW 2019 data. As the table shows, District 7 is most highly specialized in manufacturing, agriculture, transportation & warehousing, and wholesale trade. For more information on the LQ method and assumptions, refer to Appendix A.

Figure 13: Aggregated Location Quotients for Freight-Related Industries in District 7 (2019)

Freight-Related Industry Group (2-Digit NAICS Code)	D7 Location Quotient
Manufacturing (31-33)	5.46
Agriculture, Forestry, Fishing and Hunting (11)	2.60
Transportation & Warehousing (48-49)	2.43
Wholesale Trade (42)	2.28
Retail Trade (44-45)	1.80
Construction (23)	1.72
Utilities (22)	0.71
Mining (21)	0.04

Source: CPCS analysis of Bureau of Labor Statistics, 2021.
Location Quotients reflect annual averages based on employment level.

Among the freight-related industries in District 7, manufacturing, agriculture, and transportation & warehousing have the highest degree of specialization compared to the nation.

Figure 14 lists some of the most competitive industries for the 13 counties in the District. Cells with "NC" indicate areas where data was not available due to confidentiality restrictions. As shown in the table, Jackson, Watonwan, Martin, and Blue Earth Counties are highly specialized in the agriculture industry and, in particular, the animal production sector. Also, Cottonwood, Nobles, and Jackson Counties are specialized in hog and pig farming, while Le Sueur, Nicollet, and Jackson Counties show more specialization in the manufacturing sector.

Figure 14: Location Quotients of Freight-Related Businesses in the District 7 Counties (2019)

Industry Group (2 to 4 Digit NAICS Code)	Blue Earth	Brown	Cottonwood	Faribault	Jackson	Le Sueur	Martin	Nicollet	Nobles	Rock	Sibley	Waseca	Watonwan
Agriculture, Forestry, Fishing and Hunting (11)	3.15	0.66	1.36	1.18	4.75	1.49	3.19	0.72	1.74	1.78	2.62	3.09	3.34
Crop Production	0.49	0.54	NC	NC	2.91	0.56	1.25	0.28	NC	1.55	3.93	2.07	0.81
Animal Production	3.04	26.76	18.7	12.2	9.16	2.11	20.79	11.59	15.48	11.77	93.84	11.68	7.15
Oilseed and Grain Farming	3.50	5.42	12.66	NC	12.16	3.41	11.17	2.81	NC	NC	28.48	NC	NC
Other Crop Farming	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Vegetable & Melon Farming	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Hog and Pig Farming	NC	NC	142.28	NC	45.68	NC	NC	NC	50.66	NC	NC	NC	NC
Poultry and Egg Production	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mining (21)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Non-metallic mineral mining and quarrying	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Utilities (22)	1.33	NC	NC	4.54	NC	NC	1.72	NC	NC	NC	NC	NC	NC
Construction (23)	1.02	0.93	0.86	0.89	0.46	1.37	0.66	0.45	0.46	0.65	0.75	0.93	1.15
Manufacturing (31-33)	1.20	2.29	3.19	2.61	3.32	4.14	1.27	3.01	3.47	0.62	1.80	2.10	3.30
Food Processing	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Printing & Support Activities	1.24	NC	NC	NC	NC	0.64	NC	49.24	NC	1.26	NC	0.58	NC
Fabricated Metal Product Manufacturing	1.68	NC	NC	1.90	NC	3.30	0.21	0.23	NC	NC	NC	NC	NC
Machinery Manufacturing	0.92	NC	NC	NC	NC	NC	1.75	1.27	NC	NC	NC	NC	NC
Wholesale Trade (42)	0.78	NC	1.66	0.93	1.31	NC	2.18	NC	NC	1.71	1.08	0.72	NC
Farm Product Raw Material	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Petroleum and Petroleum Products	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Miscellaneous Nondurable Goods	NC	NC	NC	NC	NC	NC	1.21	NC	NC	NC	NC	NC	NC
Direct Selling Establishment	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Industry Group (2 to 4 Digit NAICS Code)	Blue Earth	Brown	Cottonwood	Faribault	Jackson	Le Sueur	Martin	Nicollet	Nobles	Rock	Sibley	Waseca	Watonwan
Retail Trade (44-45)	1.34	1.03	0.80	0.85	0.49	0.85	1.26	0.70	1.19	1.10	0.60	0.86	0.68
Transportation & Warehousing (48-49)	0.88	1.75	1.30	2.39	1.16	0.87	0.69	0.43	1.04	1.37	1.56	1.62	2.07
Truck Transportation	0.84	5.05	0.70	1.81	NC	1.42	1.14	NC	2.10	2.19	2.65	1.42	1.75
Transit and Ground Passenger Transportation	2.26	2.84	NC	NC	NC	NC	2.00	3.40	2.90	NC	NC	NC	14.07
General Freight Trucking	1.42	3.82	NC	3.43	NC	NC	0.19	NC	0.68	1.16	8.62	4.93	1.76
School and Employee Bus Transportation	2.24	NC	NC	NC	NC	NC	NC	8.11	NC	NC	NC	NC	NC

(NC) Not Calculable, the data does not exist, or it is zero.
Source: CPCS analysis of Bureau of Labor Statistics. 2021.
Location Quotients reflect annual averages based on employment level

Freight-Related Industry Competitiveness

The county-level LQ analysis provides insights into the competitiveness of regional industries compared to the national averages. The shift-share analysis provides a more dynamic economic indication of the changes in a region's industrial competitiveness over time compared to the national norm. The shift-share analysis estimates regional job growth based on the following three factors:

- **Industrial mix effect:** the growth of a specific industry at the national level. This effect is calculated through the analysis of industry-level employment data for the desired time frame.
- **National growth effect:** the regional industry growth impacted by the national level growth rates for the desired time frame.
- **Regional competitive effect:** the growth (or any change) in regional industry employment due to the unique characteristics of that region.

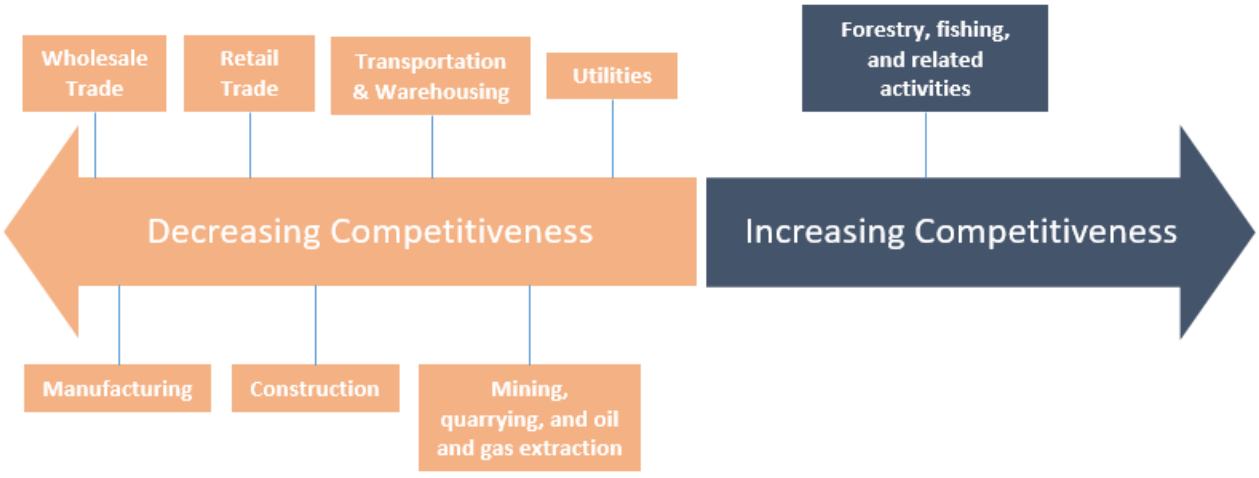
The resulting shift-share analysis is based on the following formula:

Actual Employment Change = National Share + Industrial Mix + Regional Shift

While the LQ analysis in the previous section indicated that agriculture, manufacturing, transportation & warehousing, and wholesale trade are important to the District's economy, the shift-share analysis adds another layer to this understanding by highlighting the increasing competitiveness of the forestry, fishing, and related activities sectors have made in District 7.

Figure 15 illustrates the relative competitiveness over time (between 2010 and 2019) in freight-related industries in District 7. As shown, many freight-related industries are decreasing their competitiveness in District 7, with forestry, fishing, and related activities (including agriculture) being the outlier as an increasingly competitive sector in the District. It is important to note that while many of the industries are technically decreasing in their competitiveness, they are still vital to District 7's economy (i.e. manufacturing and construction).

Figure 15: Freight-Related Industry Regional Shift (2010-2019)

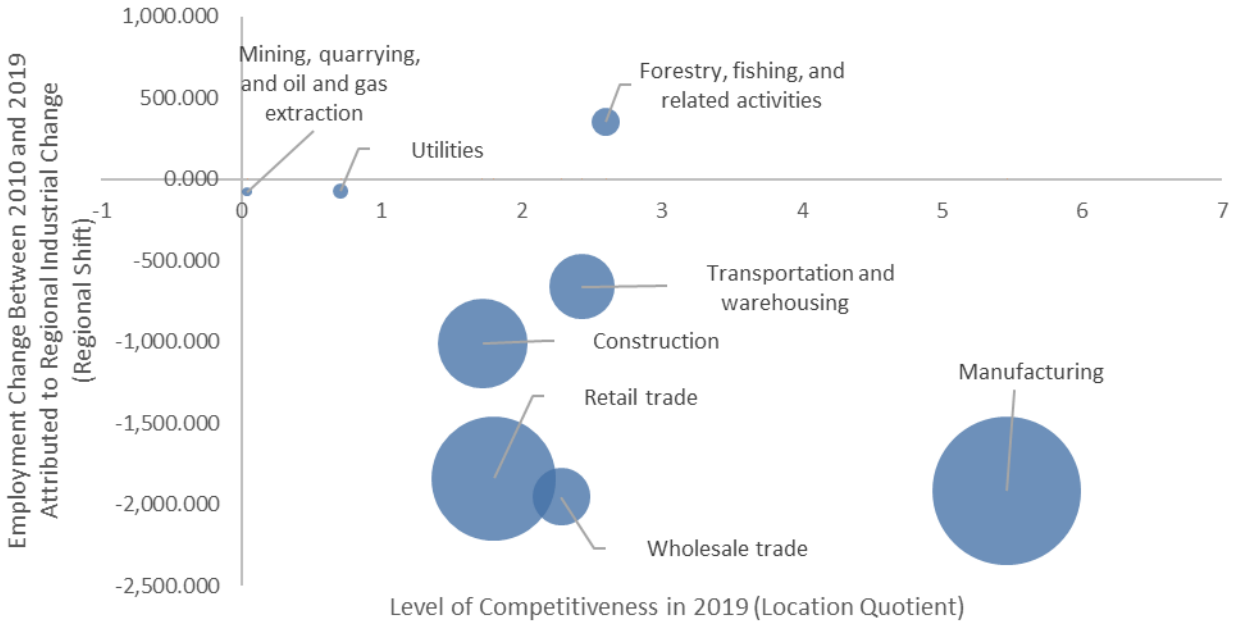


Source: CPCS analysis of county-level industry employment data provided by the Bureau of Economic Analysis. 2021.

Figure 16 presents the District's freight-related industry competitiveness (X-axis) against the increase or decline in employment due to regional effects (Y-axis). Industries with a Location Quotient greater than 1.0 on the X-axis are relatively more competitive than the US average in 2019, while industries lower than 1.0 on the X-axis were less competitive. On the Y-axis, positive values indicate that the industry has improved in competitiveness

between 2010 and 2019, while the employment size of each industry in the District is indicated by the size of the circle for each industry. Appendix A provides additional detailed results of District 7's shift-share analysis.

Figure 16: Regional Competitiveness in Freight-Related Industries (2010 – 2019)



Source: CPCS analysis of county-level industry employment data provided by the Bureau of Economic Analysis, 2021

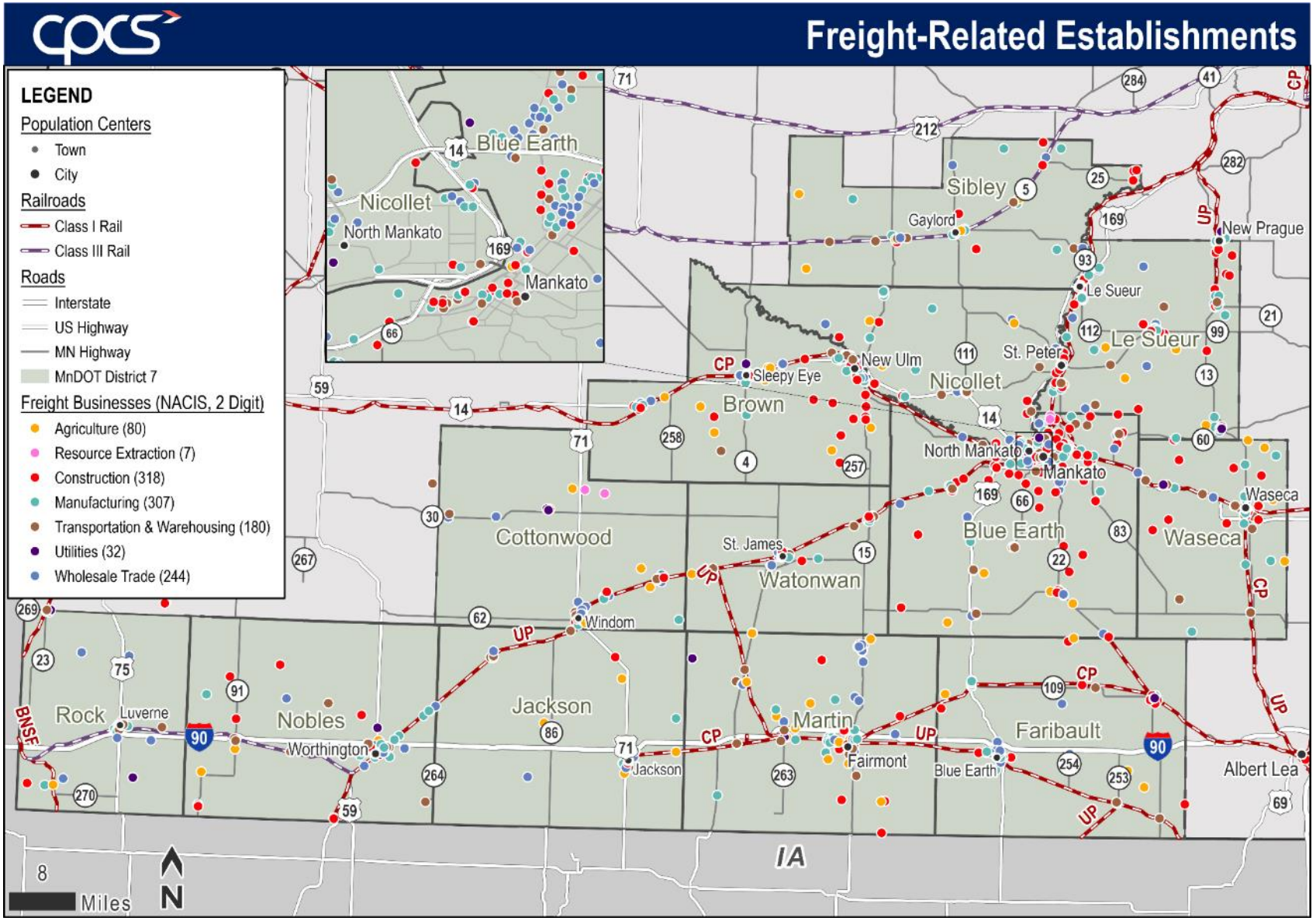
Between 2010 and 2019, there were significant employment declines in many freight-dependent industries, including construction, manufacturing, retail and wholesale trade, and transportation & warehousing.

1.4 District 7 Industrial Profile

District 7 Freight-Related Industry Locations

Figure 17 displays the locations of freight-related businesses and establishments with 20 or more employees in District 7. Many of the establishments are positioned along key highway corridors, particularly along US-169 that provides access to I-90 and the Twin Cities, and US-14, which runs east-west across the District. Additionally, many of the businesses are located along rail lines, including the east-west Union Pacific line running from south Nobles County through to Mankato.

Figure 17: Freight-Related Industry Clusters in District 7 (2019)

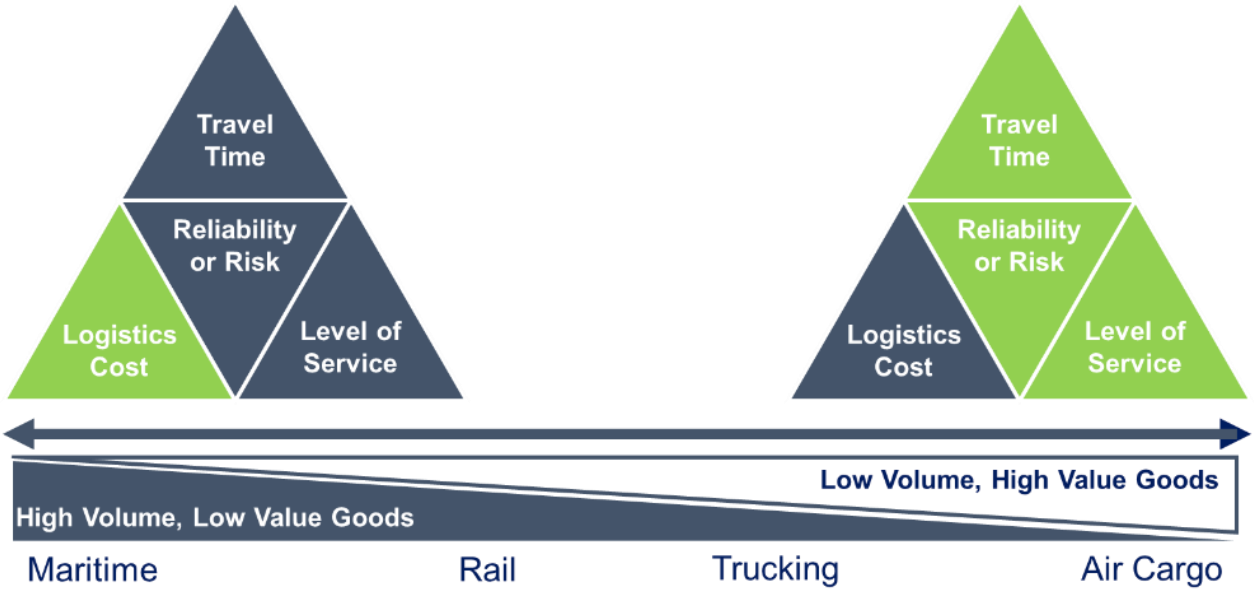


Source: CPCS analysis of ReferenceUSA data, 2021.

Freight-Related Industry Transportation Requirements

Shippers may have a range of transportation options to consider when moving their goods, such as trucks, railroads, air freight, and barge or ship service. However, the true range of choices is limited by the availability of these modes, and the characteristics of the cargo being moved. In addition to availability, shippers must balance a set of trade-offs between shipping cost, and shipping speed, level of service, and reliability when selecting freight modes and routes. Each mode of transportation has its own set of characteristics, and together, modes make up a "spectrum" of logistics trade-offs, which is illustrated in Figure 18.

Figure 18: The Modal "Spectrum" of Trade-Offs



Source: CPCS. 2021.

As shown in the spectrum, for higher-value goods such as pharmaceuticals and electronics, the cost of shipping often makes up a relatively small portion of the good's cost, increasing the shippers' willingness to pay for a faster and more reliable freight option such as air cargo or truck. On the other hand, for goods with relatively low per-ton values (such as oil, grain, aggregate, and other minerals), high logistics costs can significantly affect the market prices, therefore, forcing the shippers to prioritize low shipping costs over fast and reliable delivery. Goods like these are often moved by rail, barge, or ship, which can carry higher volumes of heavier goods at relatively lower prices.

Freight shippers must balance shipping costs against needs for faster or more reliable service.

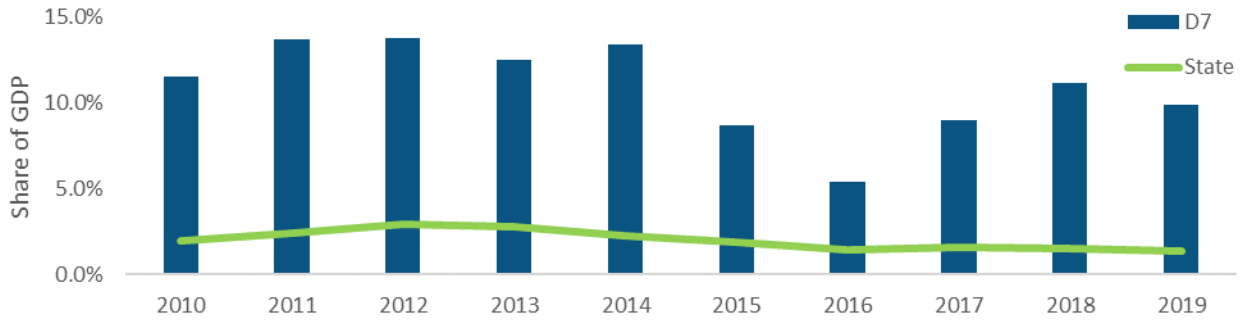
An example of modal considerations can be seen in District 7's agriculture and manufacturing industries. While moving agricultural products by rail provides the District's businesses with a cost-effective shipping option, access to intermodal facilities to transfer containerized cargo between truck and rail modes is limited. This limited access may affect the cost-competitiveness of manufacturing businesses within the District as they must have containers trucked to and from the Twin Cities to access intermodal yards.

Agriculture

Minnesota is the fifth most productive state in terms of total agricultural production ($16.7 B in 2019). About 26 percent of the cash receipts in the state's agricultural market are associated with corn, 19 percent with soybean production, and 16 percent with hog farm activities.[7] The majority of the corn and soybean farms in the state are in central, southern, and western Minnesota.

As Figure 19 shows, the agricultural industry's share of District 7's GDP is greater than agriculture's share of Minnesota's overall GDP, suggesting that agriculture is especially important to the economy of District 7. The agricultural industry became increasingly important for Minnesota's and District 7's economy between 2010 and 2014. This was due to a continuing rise in the production of certain commodities, such as soybeans, hogs and pigs, and milk. However, the industry saw a decline in contribution to GDP in 2015 and 2016 but has slowly risen through 2019.

Figure 19: Agriculture Industry Share of GDP (2010-2019)



Source: CPCS analysis of Bureau of Economic Analysis GDP data. 2021.

Minnesota is ranked second in corn, and third in soybean production across the nation.[8] Agriculture is a major industry in District 7, with corn, soybeans, and dry beans as the top produced and processed crops. Figure 20 shows the concentration of farmlands across District 7. Corn production is spread across District 7 with a large portion of it occurring in Martin, Faribault, Jackson, Nobles, Blue Earth, and Cottonwood Counties. Additionally, soybean and oilseed production and harvesting are key industries in District 7.

Corn

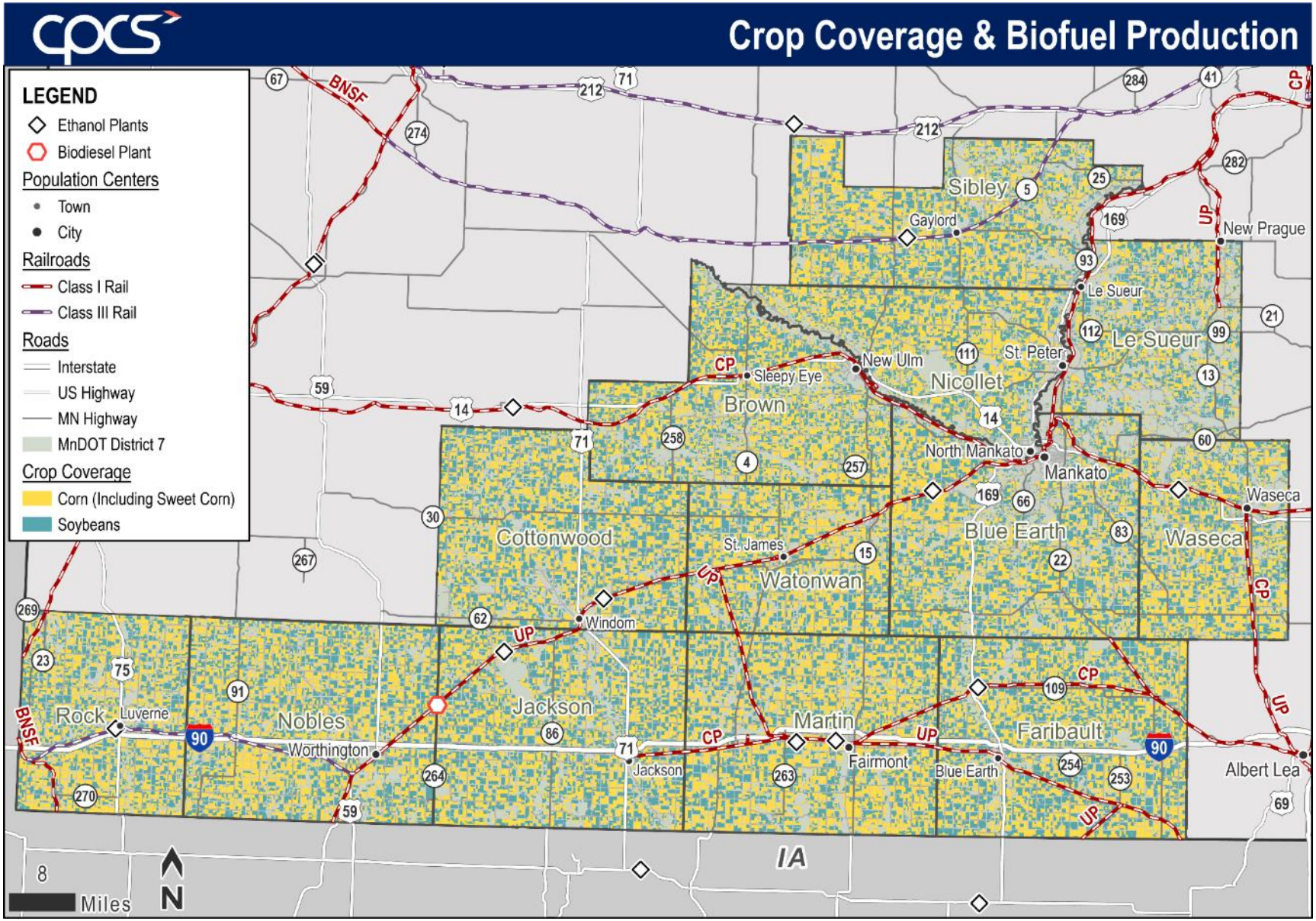
As of 2020, nearly 17 percent of the corn production land in Minnesota is in District 7, with nearly 27 percent of the state's harvested area producing more than 409 million bushels of corn and over 550,000 tons of silage corn on an annual basis.[9]

Acres Planted in District 7	Acres Harvested in District 7	Production, Measured in Bushels in District 7
2,092,400	2,026,200	409,513,000

Source: USDA National Agricultural Statistics Service. 2020.

[7] The state's soybean production share has declined by 2% since 2017. Source: Minnesota Agricultural Profile, Minnesota Department of Agriculture, 2019: https://minnesota.agclassroom.org/educator/materials/profile.pdf
[8] USDA Crop Production Report 2018-19. https://www.usda.gov/topics/farming/crop-production
[9] Source: USDA National Agricultural Statistics Service, 2020.

Figure 20: Crop Production Locations and Biofuel Production Plants in District 7 (2019)



Source: USDA Cropscape, 2019; US Energy Information Administration Biofuels Atlas. 2021.

An average of 85 percent of corn crops is processed for food, animal feed, and industrial manufacturing. Also, a wide variety of food products use corn as a base ingredient, such as cereals, corn oil, and corn flour products, to chewing gums and peanut butter.

Corn ethanol is produced from the fermentation of corn stover.[10] Figure 20 shows the ethanol production plants in District 7. As the figure shows, there are 10 ethanol production plants in District 7: Agri-Energy LLC (Luverne), Corn Plus LLP (Winnebago, re-opening as Greenfield Global in 2021)[11], Gevo (Luverne), Green Plains Inc. (Fairmont), Guardian Energy LLC (Janesville), Heartland Corn Products (Winthrop), Heron Lake BioEnergy LLC (Heron Lake), POET Bingham Lake (Bingham Lake), POET Lake Crystal (Lake Crystal), and Valero Renewable Fuels (Welcome). All of these plants use corn as feedstock and have an aggregate capacity of 701 million gallons per year.[12] The byproduct of corn processed for food or biofuel production is animal feed. Silage is another corn byproduct that is used for animal feed. In 2020, more than 550,000 tons of corn silage were produced in the District.

Soybeans

Soybeans are important for Minnesota's economy as they are a top agricultural export commodity. The majority of Minnesota's soybean fields are located in central, southern, and western Minnesota. Over 50 percent of the soybean bushels harvested in the state are exported, mainly to China, Mexico, Indonesia, Japan, and Taiwan. The rest is processed to produce livestock feed or used for food and biofuel production.[13] District 7's soybean production fields represent about 23 percent of the state's harvested area producing more than 97 million bushels of soybeans on an annual basis.[14]

Acres Planted in District 7	Acres Harvested in District 7	Production, Measured in Bushels in District 7
1,678,900	1,664,600	97,156,000

Source: USDA National Agricultural Statistics Service. 2020.

Processing soybean results in biodiesel and glycerin. As shown in Figure 20 Nobles County has the Minnesota Soybean Processors biodiesel plant. This facility has a production capacity of over 100,000 bushels/day and ships soybean meal to farmers and suppliers domestically and internationally.

Other Agriculture

In addition to the major cultivation of corn and soybeans, District 7 has more-limited acreage devoted to other food crops such as sweet corn, and green beans, which support some canning operations. Agriculture also supports a large animal production and processing industry. In particular, hog farming is prevalent in Cottonwood, Jackson, and Nobles counties, and some cities like Worthington have animal processing plants.

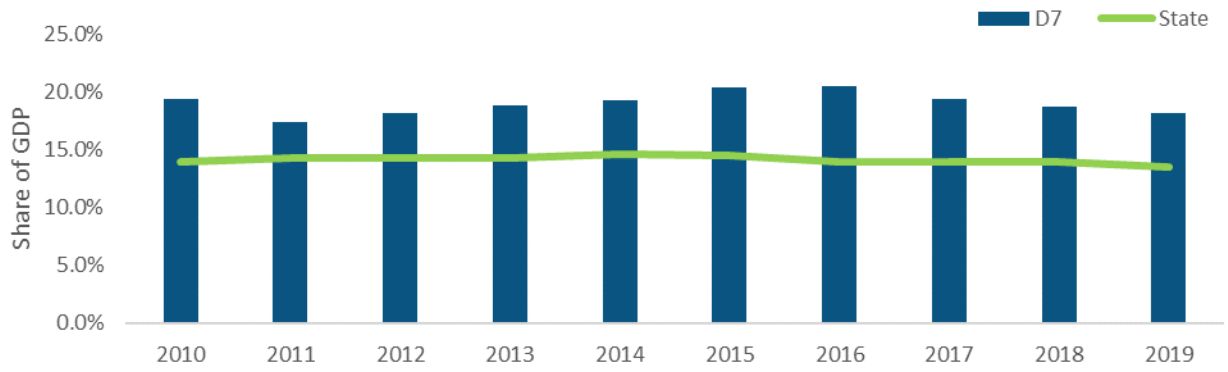
Manufacturing

Manufacturing is the most competitive freight-related industry in District 7. Manufacturing business activities are generally divided into two categories: 1) Local Clusters: firms that trade internally with other businesses in the region, and (2) Traded Clusters: firms that trade with businesses outside the region. In District 7, most

[10] USDA, National Corn Growers Association, 2010.
[11] Krohn, Tim. "Winnebago ethanol plant to restart in fall, teaming up with CFS." Mankato Free Press. Jun 4, 2021.
[12] NREL, Biofuel Atlas, accessed May 2021.
[13] Minnesota Soybean Research and Promotion Council, accessed 2019. https://mnsoybean.org/msrpc/about-soy/
[14] USDA National Agricultural Statistics Service, 2017.

manufacturing firms tend to be engaged in traded clusters, bringing trade into the region from other states and other countries. Figure 21 shows the trends in the share of manufacturing in the total GDP for Minnesota and District 7. While shift-share analysis proved that Minnesota's GDP is more reliant on the manufacturing industry compared to the national average, analysis of county-level industry GDP trends shows that manufacturing has maintained its share of total GDP over the past decade. Minnesota's manufacturing share of GDP has remained relatively steady, around 14 percent between 2010 and 2019. Comparatively, District 7's share of manufacturing-driven GDP of its total GDP is higher than statewide levels.

Figure 21: Manufacturing Share of GDP in Minnesota and District 7 (2010-2019)



Source: CPCS analysis of BEA GDP data. 2021.

Over the past ten years, manufacturing has consistently made a significant share of District 7's economy and made up a greater share of the District's economy than for Minnesota's economy as a whole

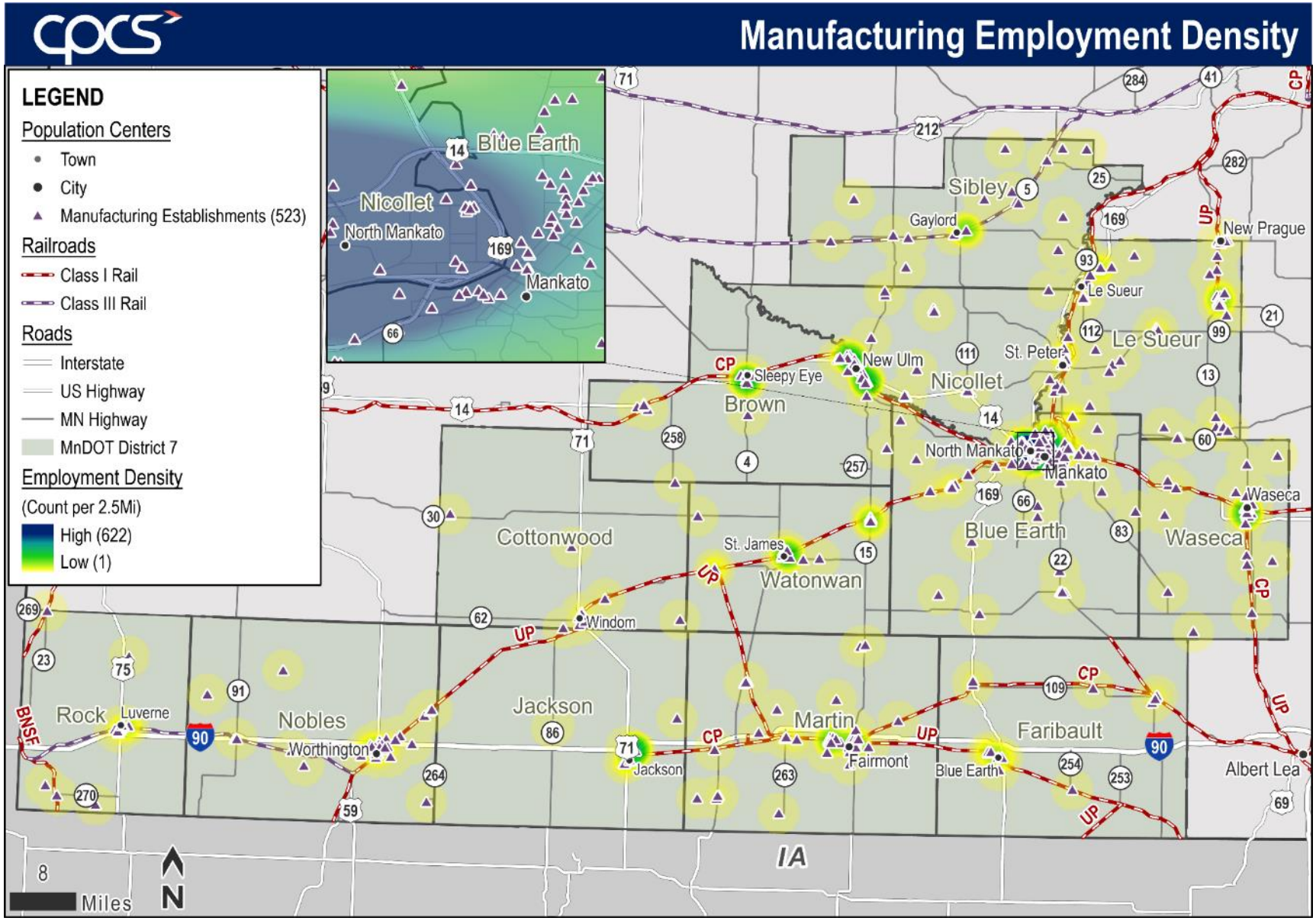
As Figure 22 shows, Blue Earth, Brown, Nicollet, Waseca, and Watonwan Counties stand out as particularly important centers for manufacturing employment, with cities such as Mankato, New Ulm, Sleepy Eye, and Waseca hosting the greatest concentrations of manufacturing jobs. District 7's manufacturing businesses are clustered close to major highways such as Highway 169, Highway 14, and the major Class I rail lines served by Union Pacific and Canadian Pacific.

Other Industries

In recent years, District 7 has become a target for warehousing and distribution center facilities, particularly in and around Mankato. In 2015, Walmart built a $75 million, 450,000 square-foot distribution center in Mankato that stores and distributes cold and frozen products to Walmart's and Sam's Clubs in Minnesota, Iowa, South Dakota, and Wisconsin.[15] Additionally, printing & related support services are prevalent in Nicollet, Blue Earth, and Nobles Counties.

[15] https://www.mankatofreepress.com/news/wal-mart-distribution-center-holds-a-rousing-grand-opening/article_b6929fa2-4b56-11e5-b01d-bf74287cdebd.html

Figure 22: Manufacturing Industry Business Concentration in District 7 (2021)



Source: CPCS Analysis of ReferenceUSA Data, 2021.

2 District 7's Multimodal Freight System

Key Findings:

District 7's freight system covers multiple modes of transportation, including roads, railroads, and pipelines. Trucking is particularly important as it serves almost all freight-reliant businesses in the District and is therefore the main freight carrier for many of the District's manufacturing, agricultural, and retail businesses. Highways such as I-90, US-14, and US-169, MN-60 serve as key trucking routes connecting the District's communities with the Twin Cities, and other destinations outside of the District.

The District's rail network includes three Class I railroads, the Union Pacific, Canadian Pacific, and BNSF Railway. District 7 also has two Class II (also referred to as short line) railroads, the Ellis & Eastern Railroad (trackage owned by the Buffalo Ridge Regional Rail Authority) and Minnesota Prairie Line (trackage owned by the Minnesota Valley Regional Rail Authority). Generally, these short line railroads provide connection points to the Class I railroads in and outside of the District. All these railroads are important because they support the affordable movement of large volumes of cargo, such as agricultural products.

In addition to railroads and highways, there are 869 miles of pipeline in District 7 that move natural gas, crude oil, refined petroleum products, and finished gasoline products. The District's shippers are also reliant on other modes of freight transportation elsewhere in the state, including air cargo, intermodal container, and barge service in the Twin Cities.

2.1 District 7 Freight System Overview

District 7 Freight System Overview

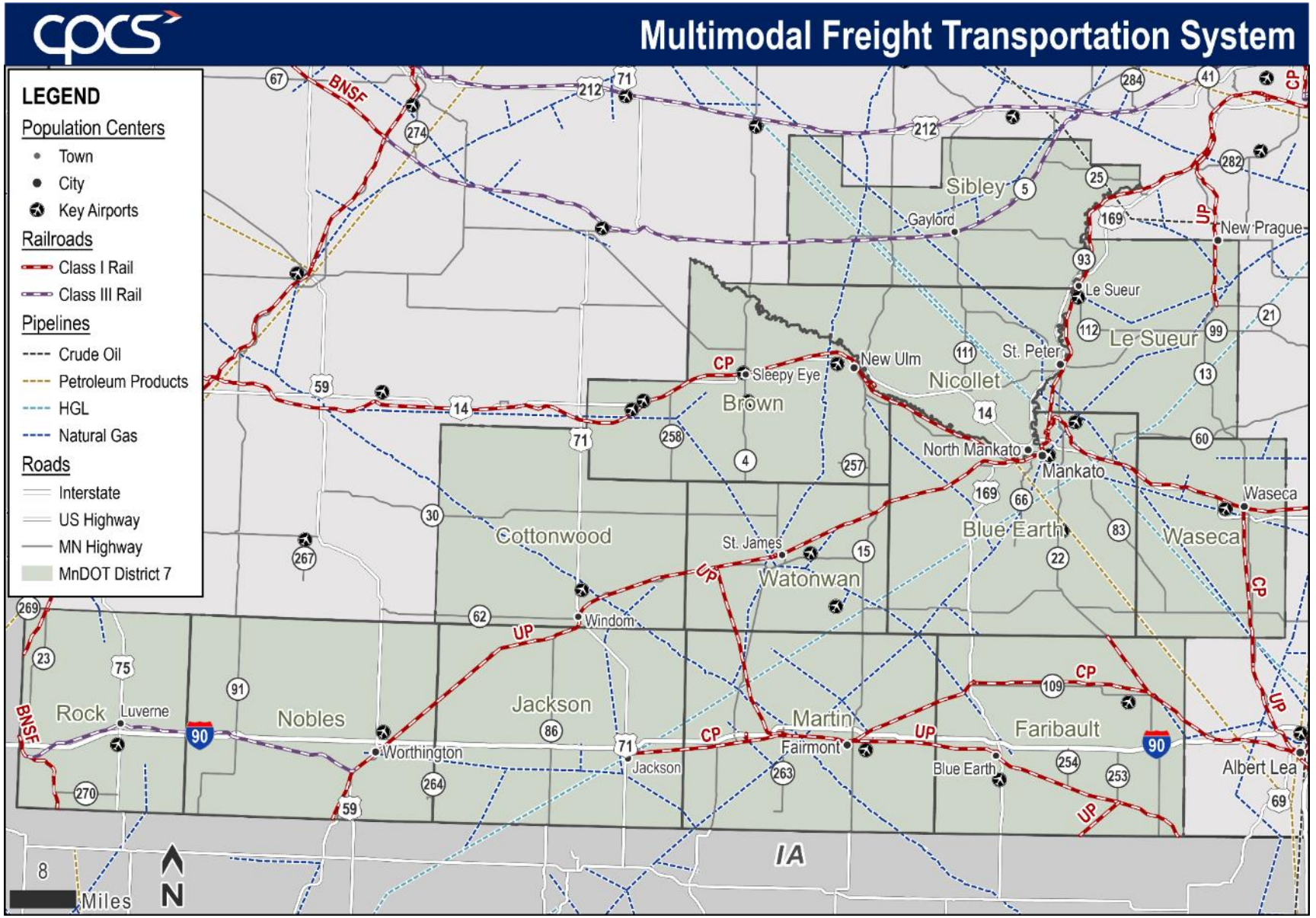
District 7's thirteen counties make up almost 15 percent of Minnesota's land area, and these counties are notably strong in agriculture as well as manufacturing. A safe, efficient, and accessible transportation system is key to supporting the businesses and communities spread out across the District.

Many of District 7's key highway and railroad transportation corridors are important for two reasons (1) they connect major communities within the District, and (2) they connect to markets outside of the region, particularly the Twin Cities. The importance of these two factors is reflected in the highest-volume interstate, national, and state highways in the region, which include I-90, US-169, and US-14, MN-60. I-90 provides connections to Wisconsin and South Dakota, US-169 provides North-South connections for much of the District to I-90 and the Twin Cities, US-14 provides an east-west route and connection to I-35 for many communities, and MN-60 provides an additional north-south link between the Twin Cities and I-90.

A similar role can be seen for the District's railroads; Class I railroads such as Canadian Pacific and Union Pacific provide connections to national and international markets, while short line railroads provide additional communities and businesses with access to the Class I railroads. Both types of railroads are particularly important for the movement of agricultural products, a key part of the District's economic production.

Figure 23 provides an overview of District 7's major freight transportation infrastructure. For District 7 to support its existing businesses and provide opportunities for economic growth, its freight transportation network elements must be well-aligned and complement each other. This chapter provides a review of the key freight-related transportation infrastructure. In turn, this infrastructure information provides context for the initial performance assessment described in Chapter 3.

Figure 23: District 7 Multimodal Freight Transportation System



Source: CPCS analysis of National Transportation Atlas Database. 2021.

146	1,126	514	2,928	14	879
Miles of Interstate	Miles of Trunk Highways	Miles of Rail	Bridges over 10 feet (469 on state system)	Public Airports	Miles of Pipelines

Statewide Freight System Trends

A review of statewide freight transportation patterns and trends provides context for understanding how District 7's freight transportation system is used. In 2017, Minnesota's freight system moved 1.16 billion tons of freight with an estimated value of $694.4 billion, a tonnage increase of 7.9 percent from 2012. In terms of both freight tonnage, and the value of goods moved, trucking is the most-used mode of transportation in Minnesota. Trucks handle approximately 66.6 percent of the total share of freight tonnage and 72.5 percent of the total share of freight value carried in Minnesota. Figure 24 provides further analysis of statewide changing modal freight movements by tonnage and value from 2012 to 2017, with two major changes that are potentially relevant to District 7:

- **Declining rail tonnage**. Rail is the second most-utilized mode of transportation in Minnesota by tonnage, but rail tonnage decreased by over 13 percent and the value of this tonnage decreased by 16 percent between 2012 and 2017.
- **Increasing pipeline tonnage**. Between 2012 and 2017, pipeline tonnage movements in Minnesota increased by 10 percent and the value of commodities moved by pipeline grew over 2 percent. This increase in pipeline movement and the decrease in railroad shipping may reflect the shift of North Dakota's oil exports from railroad shipping to pipeline shipping.

A Note About the Freight Analysis Framework

The statewide analysis provided in this section utilizes the fifth generation of the Freight Analysis Framework (FAF5), which was created by the Bureau of Transportation Statistics (BTS). FAF combines several data sources to show a near-complete overview of multimodal freight movements among states and Metropolitan Statistical Areas (MSA). These sources include the Census Bureau's international trade statistics and the Commodity Flow Survey (CFS). The existing version of FAF5 was released in early 2021 and is benchmarked to the most recent version of CFS data. This version provides base year (2017) regional and state-level commodity and transportation flows. Future releases of FAF5 are expected and will also include forecasted tonnages, values, commodity types, and modal shares.

Figure 24: Freight Modal Split in Minnesota, 2012 and 2017

Freight Mode	2012 Tonnage	2017 Tonnage	2012 Value	2017 Value
Truck	63%	66.6%	67%	72.5%
Rail	25%	11.9%	21%	4.3%
Water	3%	2.1%	<1%	0.2%
Pipeline	5%	15.1%	3%	5.3%
Multiple Modes and Mail	4%	4.4%	7%	14.5%
Air	-	0.02%	2%	3.2%

Source: Freight Analysis Framework 4.5 and Freight Analysis Framework 5. 2021.

The Federal Highway Administration (FHWA) projects that between 2012 and 2040, total freight volumes in Minnesota will have risen by 80 percent to 1.8 billion tons. The value of this tonnage is expected to increase by 161 percent ($2.3 trillion) over the next two decades. Despite these tonnage and value changes, the modal split of freight moved in Minnesota is expected to remain relatively constant during this timeframe.

Minnesota's freight tonnage is expected to increase by 80 percent between 2012 and 2040. Freight value is expected to increase by 161 percent.

Figure 25 shows the top five commodities carried in Minnesota in 2012 and 2017. As of 2017, grain was the top freight commodity by volume, accounting for 18.5 percent of the total freight tonnage. Additionally, coal and petroleum products and gravel grew by 3.7 percent and 1.8 percent, respectively. The uptick in petroleum products movement may be due to the increase of oil production in North Dakota and the increasing usage of pipeline infrastructure. Other agricultural products contributed over 8 percent of freight movement tonnages in 2017. Metallic ores remained in the top five commodities by volume, yet the tonnage moved decreased by 3.6 percent, reflecting global changes in the iron ore and steel markets.

Figure 25: Top Five Current Commodity Shares by Tonnage (2012 vs. 2017)

2012 Top Commodities by Tonnage	Share %	2017 Top Commodities by Tonnage	Share %
Cereal Grains	18.7%	Cereal Grains	18.5%
Coal-n.e.c.	10.4%	Coal-n.e.c.	14.1%
Gravel	8.3%	Gravel	10.1%
Other Agriculture Products	8.0%	Other Agriculture Products	8.1%
Metallic Ores	7.6%	Metallic Ores	5.0%

Source: Freight Analysis Framework 4.5 and Freight Analysis Framework 5
Note: Coal-n.e.c. refers to coal and petroleum products not elsewhere classified, including natural gas.

Regarding the value of freight, mixed freight experienced nearly a 2 percent increase in commodity shares by value and is now the top commodity moved by value in Minnesota. Motorized vehicles and precision instruments moved into the top 5 of commodity shares by value, replacing cereal grains and other prepared foodstuffs. This shift is due to an increasingly larger presence of the manufacturing and technology supply chains in Minnesota.

Figure 26: Top Five Current Commodity Shares by Value (2012 vs. 2017)

2012 Top Commodities by Value	Share %	2017 Top Commodities by Value	Share %
Electronics	7.4%	Mixed Freight	8.7%
Mixed Freight	6.8%	Electronics	7.2%
Machinery	5.8%	Machinery	6.3%
Cereal Grains	5.4%	Motorized Vehicles	5.1%
Other Prepared Foodstuffs	5.3%	Precision Instruments	5.0%

Source: Freight Analysis Framework 4.5 and Freight Analysis Framework 5

2.2 Road Network

District 7's network consists of one interstate highway (I-90), five US highways (US-169, US-14, US-71, US-75, and US-59), and many state, county, and local highways and roads. The District's road network is a critical component of freight movements as it provides last-mile access for businesses, as well as access to other key markets (such as the Twin Cities) and other modes of transportation. Figure 27 displays the road mileage, by major highway type, in District 7 compared to Minnesota's statewide total.

Figure 27: District 7 Road System Mileages

	District 7	Minnesota
Interstate	143	913
Trunk Highways	1,126	10,805

Source: District 7 Fact Sheet. 2020

Commodity tonnage information specific to District 7 is not available beyond 2012. However, recent statewide truck tonnage information provides insight into broad trends for truck freight moving on the District's roads. As previously mentioned in section 2.1, trucks carry 66 percent of the total tonnage and 72.5 percent of the total value carried in Minnesota. As seen in Figure 28, cereal grains were the top commodity carried by trucks in Minnesota in 2017, comprising over 22 percent of all commodities carried by trucks. Gravel and other agricultural products were also top commodities moved by truck in Minnesota in 2017.

Figure 28: Major Commodities Carried by Trucks (2017)

Top Commodities	Tonnage Carried by Trucks in 2017	Percent of Total
Cereal Grains	172,681,700	22.46%
Gravel	110,912,500	14.43%
Other Agriculture Products	86,033,180	11.19%
Nonmetal Mineral Products	54,815,570	7.13%
Gasoline	50,116,900	6.52%
Animal Feed	34,977,770	4.55%
Other Foodstuff	32,385,590	4.21%
Coal	24,604,210	3.20%
Waste/Scrap	19,572,380	2.55%
Nonmetallic Minerals	19,544,310	2.54%
Mixed Freight	18,268,740	2.38%
Fuel Oils	17,737,510	2.31%
Logs	17,178,830	2.23%
Natural Sands	13,146,370	1.71%
All Other	96,889,483	12.60%
Total	768,865,043	100%

Source: Freight Analysis Framework 5, 2017.

It is important to distinguish the unique commodities carried by trucks in District 7 and statewide. While statewide and District-level commodity tonnage data reflect different periods, comparing the data provides some insight into the differences between the District 7 and statewide transportation system. These differences include:

- **Cereal Grains** are the top commodities transported by truck in both District 7 and Minnesota. However, the cereal grain made up 51 percent of District 7's truck tonnage in 2012, which is more than two times the statewide share in 2017. The high percentage of cereal grains movements in District 7 is likely due to agriculture being the dominant industry.
- **Animal Feed** is the second-highest commodity volume transported by truck, contributing 10 percent of the total truck tonnage in District 7 in 2012. Unlike the District, the share of animal feed 2017 truck tonnage statewide is only 4.5 percent. This further reflects the concentrated agriculture industry in the District.
- **Gravel** made up 3 percent of District 7's truck tonnage in 2012, which is significantly lower than 14.43 percent of the statewide truck tonnage. The minimal aggregate activity occurring by truck within the District is likely due to relatively low new construction activity associated with minimal population growth in the District.
- **Live Animals/Fish** made up 1 percent of District 7's truck tonnage in 2012, whereas it contributed less than 1 percent to Minnesota's truck tonnage in 2017.

Trucking is an important first/last-mile transportation service for District 7's agricultural businesses.

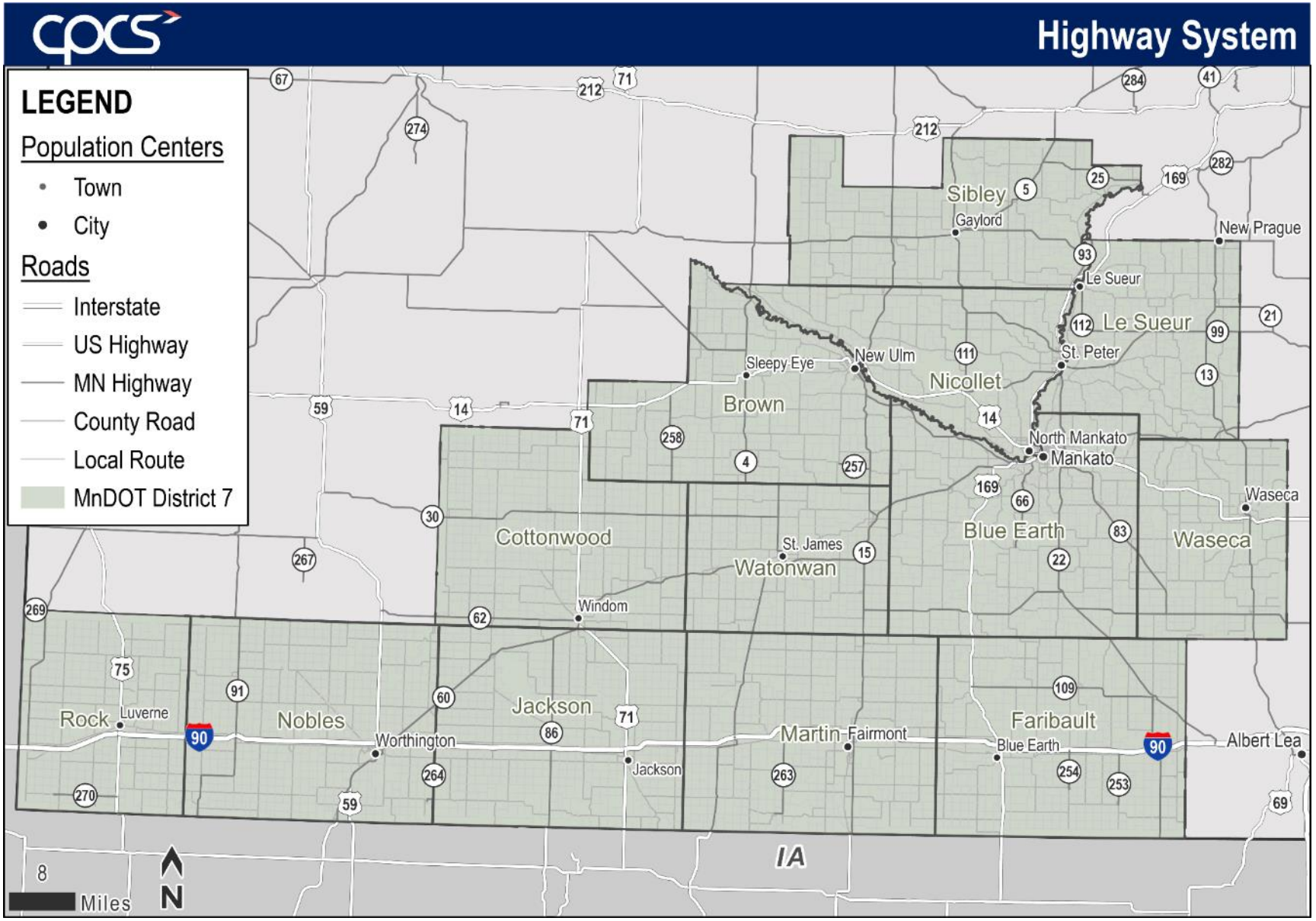
Key Corridors for Trucking

Trucking activity is concentrated on select corridors within District 7, and these corridors often correspond to routes either connecting the District's communities, or routes connecting the District with other regions. Figure 29 shows an overview of District 7's highway system, while Figure 30 and Figure 31 display the Annual Average Daily Traffic (AADT) for all vehicles and trucks, respectively. AADT is the bi-directional estimate of total vehicles on a road segment in any given year. This represents the total number of vehicles per year divided by 365 and is developed using factors to adjust for the season, day of the week, and vehicle type. In particular, Figure 31 illustrates how select corridors such as US-169, US-14, I-90, and MN-60 are particularly important for truck traffic based on vehicle volume. Brief profiles of the District's major truck corridors are provided below, listed by general truck volumes.

US-169

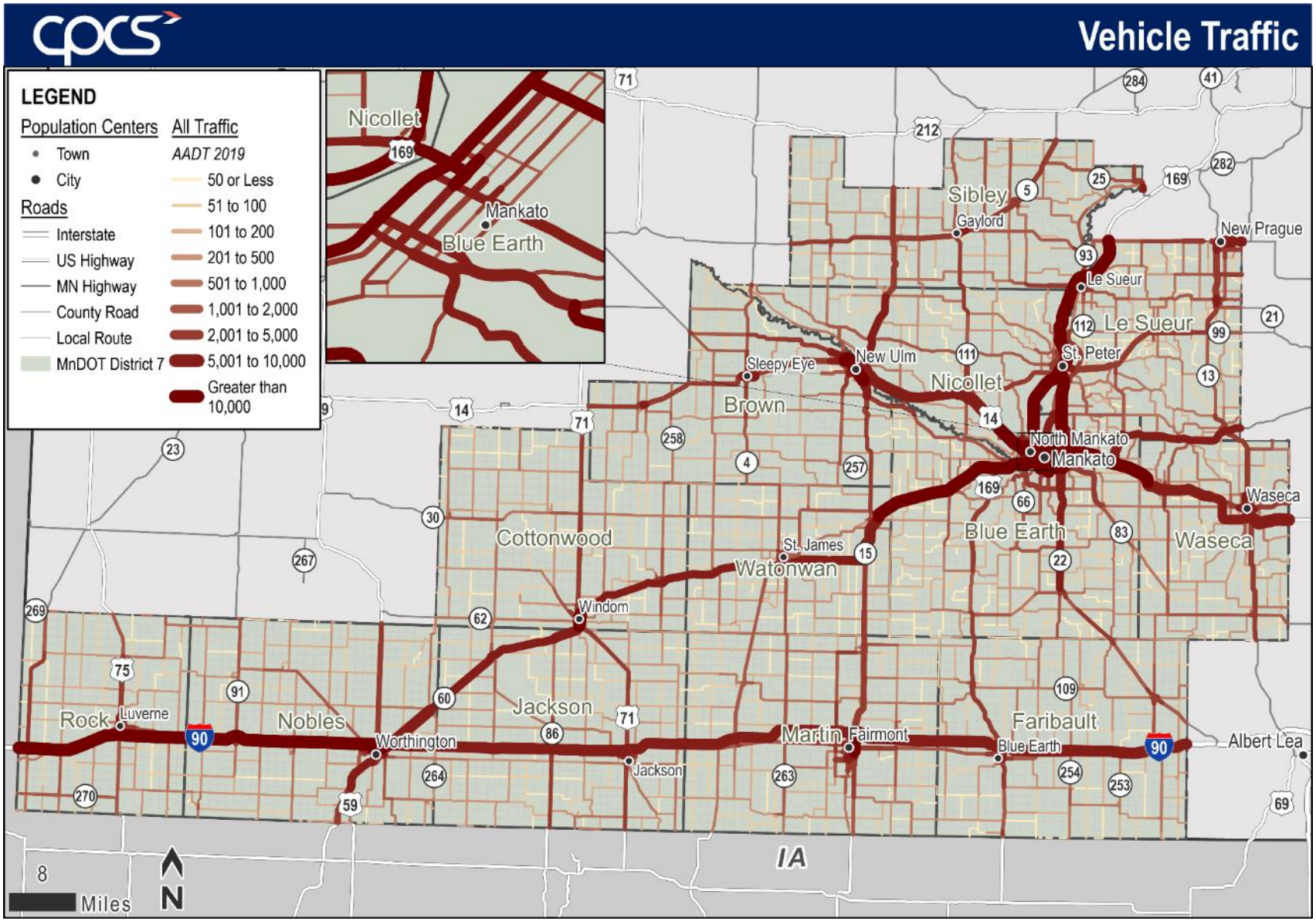
US Route 169 is a north-south US highway that originates in the city of Virginia, MN, and ends in Tulsa, OK. Along its 966-mile route, US-169 travels through Minnesota, Missouri, Kansas, and Oklahoma. The highway enters District 7 in Elmore in Faribault County and intersects with I-90 in Blue Earth. Moving north and passing through Mankato, the highway crosses the Minnesota River twice before exiting District 7 in Le Sueur County.

Figure 29: MnDOT District 7 Highway System



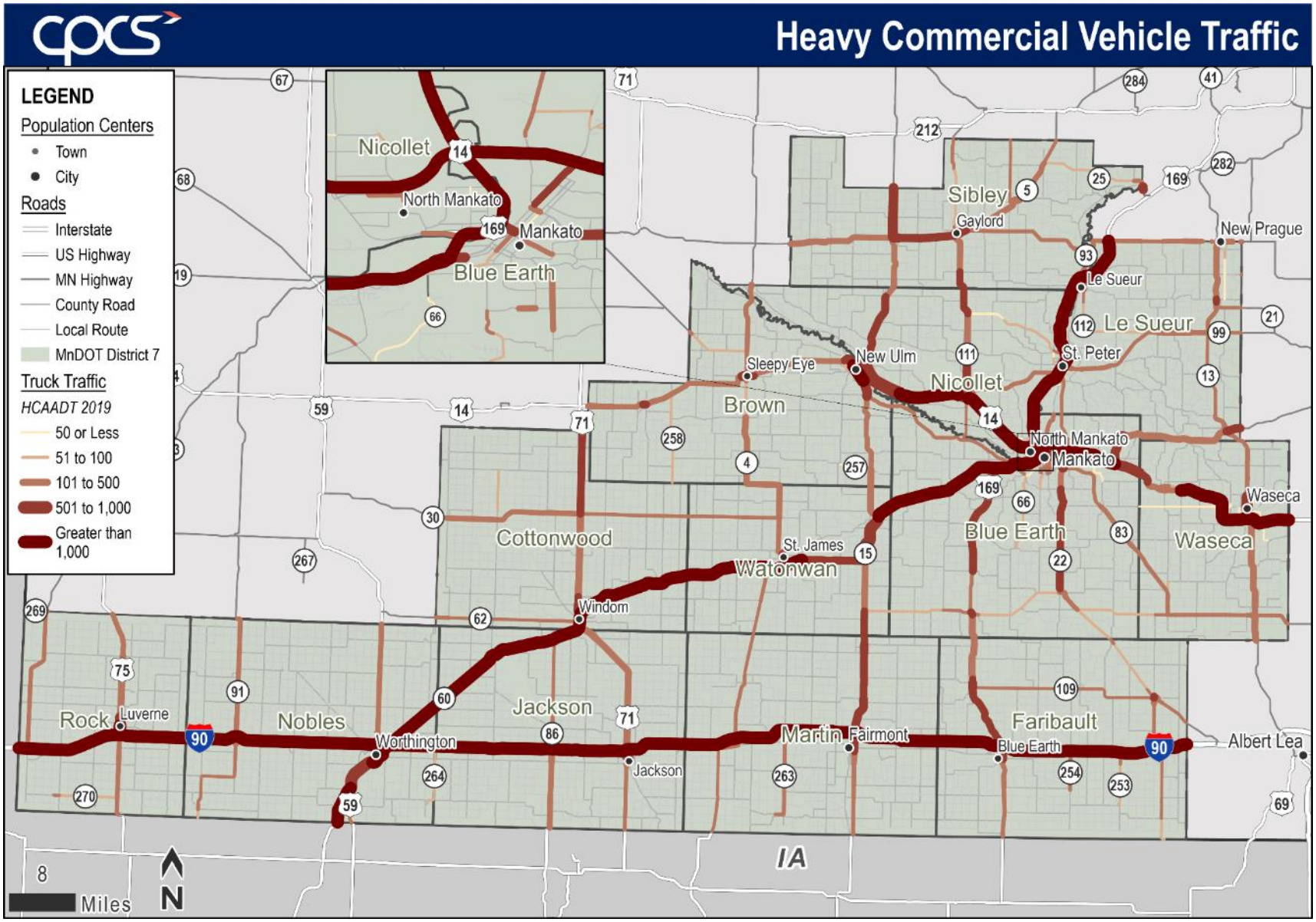
Source: CPCS analysis of FHWA Data, 2021.

Figure 30: District 7 Annual Average Daily Traffic Volumes (All Vehicles, 2019)



Source: CPCS analysis of MnDOT and NTAD data, 2021.

Figure 31: District 7 Annual Average Daily Truck Traffic Volume (2019)



Source: CPCS analysis of MnDOT and NTAD data, 2021.

US-14

US Route 14 runs east-west and is one of the US' original highways developed during the 1920s. It begins in Chicago and ends in Wyoming after passing through Illinois, Wisconsin, Minnesota, South Dakota, and Wyoming. In Minnesota, the highway intersects with I-35 in Owatonna and I-90 in La Crescent. US-14 enters District 7 in Brown County, passing through Sleepy Eye and New Ulm. This segment of the highway is a two-lane road until it reaches New Ulm and becomes a divided highway. The section from New Ulm eastward to Nicollet will be expanded during the 2022 and 2023 construction seasons to become a four-lane divided expressway with grade-separated interchanges at previously identified high-risk intersections. After the project on US 14 in District 7 is complete, the highway will be a four-lane divided expressway from New Ulm to the west limit of North Mankato, freeway through North Mankato and Mankato to CSAH-12, and four-lane divided expressway east of CSAH-12. The highway widens again and becomes an expressway east of Mankato and exits District 7 in Waseca County.

I-90

I-90 is the longest interstate highway in the US – beginning in Seattle and ending in Boston. It runs through the Southern part of Minnesota and enters District 7 in Rock County and exits in Faribault County. The I-90 corridor serves key agricultural businesses in District 7. Some of the District 7 communities on I-90 include Worthington, Fairmont, Jackson, Blue Earth, and Luverne.

MN-60

Minnesota State Highway 60 is a trunk highway that begins in Iowa (as IA-60), runs diagonally through Southern Minnesota, and ends in Wabasha. In District 7, MN-60 is a key connection point for the Western Counties in the District to Mankato and the Twin Cities. Trucks traveling along MN-60 in District 7 serve manufacturing and agricultural businesses along its route.

Secondary Corridors for Trucking

In addition to the major highway routes profiled above, there are several other important state and national highways that support truck traffic in the District, listed based on vehicle volume and length in the District.

MN-15

Minnesota State Highway 15 is a 154-mile-long state highway that runs from Iowa Highway 15 at the Iowa-Minnesota state line to US-10 near Sartell and Sauk Rapids, north of St. Cloud. The highway runs through Watonwan, Brown, Nicollet, and Sibley in District 7. Within the District, major junctions include MN-30, MN-60, MN-68, and US-14.

US-59

US Route 59 runs from the Texas-Mexico border to the US-Canadian border ending in northeast North Dakota. It enters Minnesota in Nobles County (District 7) from Iowa and travels along the western border of the state. US-59 intersects with I-90 in Worthington, Minnesota, which is a major intersection for the highway.

MN-13

Minnesota State Highway 13 runs 111 miles from US-65 in Albert Lea to MN-149 in St. Paul. In District 7, the highway passes through Le Sueur and Waseca Counties, where it interchanges with US-14.

MN-22

Minnesota State Highway 22 runs from south-central to central Minnesota. It originates from Winnebago County Road 50 in Iowa near Kiester at the Iowa-Minnesota state line and ends at MN-23 in Richmond. The route passes through Faribault, Blue Earth, Nicollet, and Sibley counties in District 7.

US-75

US Route 75 begins in Dallas, Texas and ends in an unincorporated community (Noyes) in northern Minnesota at the U.S.-Canadian Border. US-75 enters Minnesota in Rock County (District 7) and travels along the western border of the state and ends near the US-Canadian border. Rock County is the only District 7 County that US-75 travels through. US-75 intersects with I-90 in District 7, which provides a major East-West route for trucks.

US-71

US Route 71 is a major north-south corridor that stretches for more than 1,500 miles. The north terminus is in International Falls, MN at the US-Canadian border. It connects with the Fort Frances-International Falls International Bridge, which carries road and rail traffic between the US and Fort Frances, Ontario. The southern terminus of US-71 is in Louisiana. The major junctions along US-71 in Minnesota include US-2 in Bemidji, I-94/US-52 in Sauk Centre, and I-90 in Jackson, MN. The highway enters District 7 in Jackson County and continuously travels north, traversing through Windom in Cottonwood County.

Key Origins and Destinations

In addition to information about traffic flow, information on the origin and destination of truck trips is available as well. Examining the origins and destinations of truck trips provides insight into the location and relative importance of major freight "generators" in the District. These truck trip "generators" often include major manufacturing facilities, agricultural processing facilities, warehouses, and truck stops.

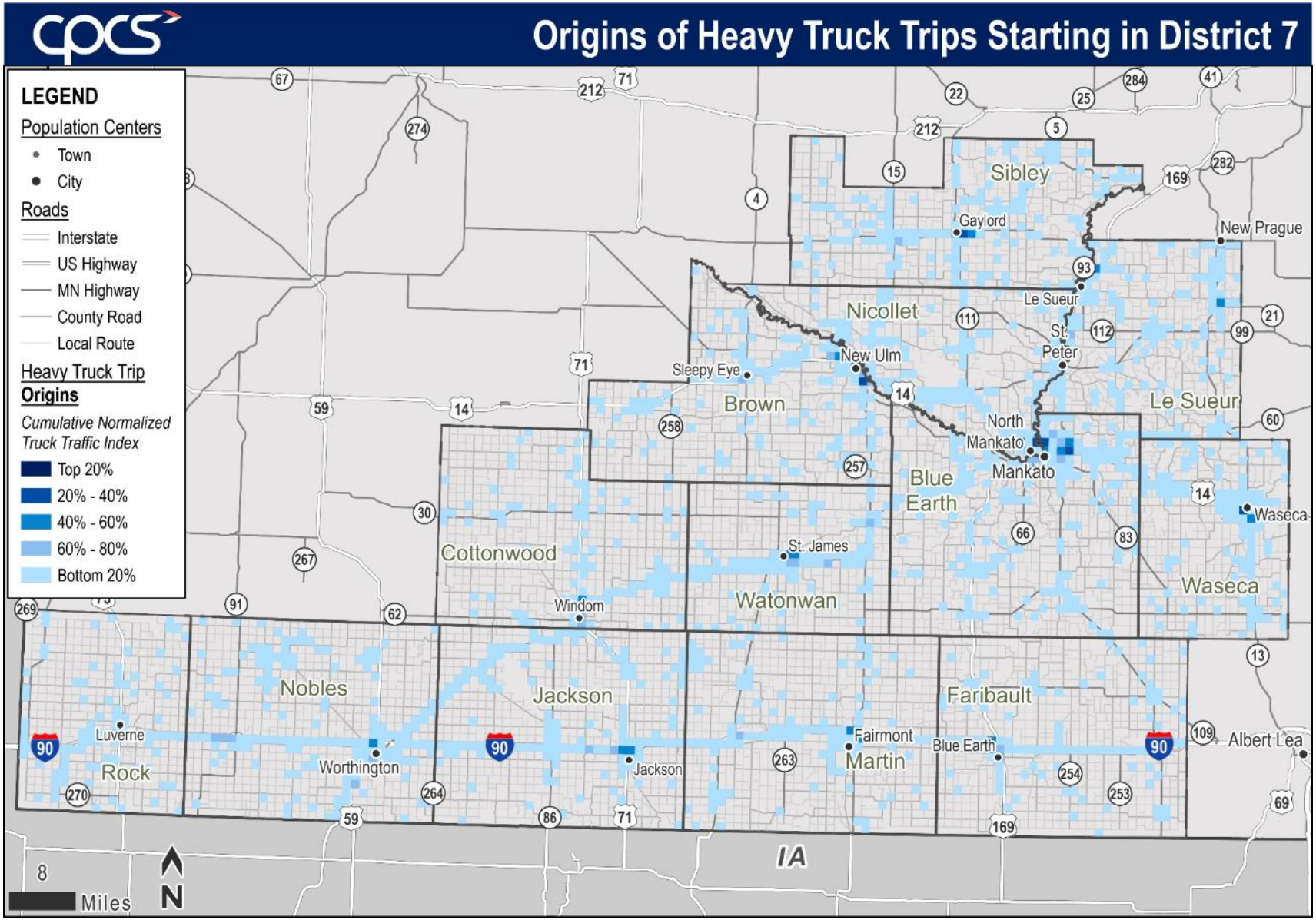
This origin and destination information was derived from vehicle tracking data provided by MnDOT's Streetlight platform, which allows users to analyze and visualize data related to road traffic conditions and performance. These vehicle location and speed data are collected through various sources, including INRIX's truck GPS data which is generated mostly from Waze, Google Maps, navigation systems, and some Electronic Logging Devices (ELDs). Streetlight preserves the confidentiality and anonymity of individuals and businesses through aggregation. Consequently, origin and destination data is aggregated into Transportation Analysis Zones (TAZs) and Township Sections to provide generalized insight into local transportation patterns.

Figure 32 displays the origins of truck trips beginning in District 7, while Figure 33 displays the destinations of trips starting in District 7. Alternately, Figure 34 shows the origin of trips ending in District 7, while Figure 35 indicates where those trips ended.

There are a few important key takeaways from the analysis of this origin and destination data:

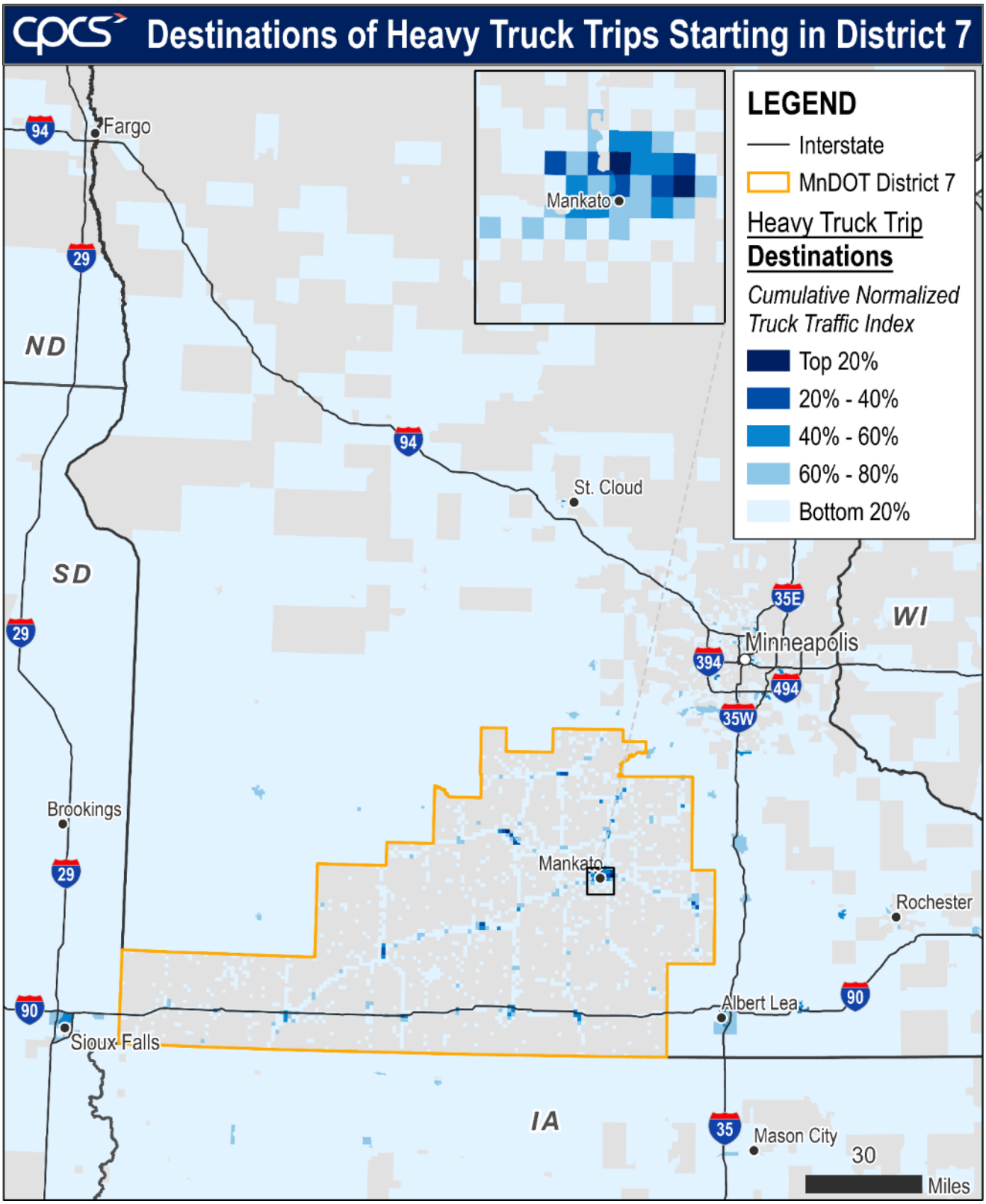
- As the largest urban area in District 7, Mankato is a hot spot for truck trips originating and ending in the District largely due to a large warehouse and distribution center presence. US-169 and US-14 are the key road facilitators for trucks moving into and through Mankato.
- New Ulm and Worthington are also frequent origin and destination points for trucks in District 7.
- Origins of heavy truck trips beginning in District 7 tend to be along major highway segments (i.e. I-90, US-169, and US-14) where agricultural, manufacturing, retail, and other businesses are strategically located. Some examples of major truck origins include:
    - Northern and eastern Mankato, due to the area's large number of industrial facilities.
    - Industrial complexes on the north side of Jackson,
    - The north side of Fairmont, which has a truck stop
    - The west side of Waseca, which is home to a large food manufacturing plant.
    - The east side of Gaylord, which is the location of a food production facility and truck stop.
- Many areas identified as heavy origins of truck trips also appeared to be significant destinations for truck trips, particularly the north and west sides of Mankato.
- Out-of-state origins for truck trips ending in District 7 and out-of-state destinations for truck trips beginning in District 7 tend to be West and South of the District in North Dakota, South Dakota, and Iowa, rather than Wisconsin. Some notable origins and destinations include:
    - Northeast Sioux Falls, which is the site of a large industrial park and truck stop.
    - Southeast Albert Lea, which has multiple food production facilities and truck stops.

Figure 32: Origins of Heavy-Duty Truck Trips Starting in District 7 (2019)



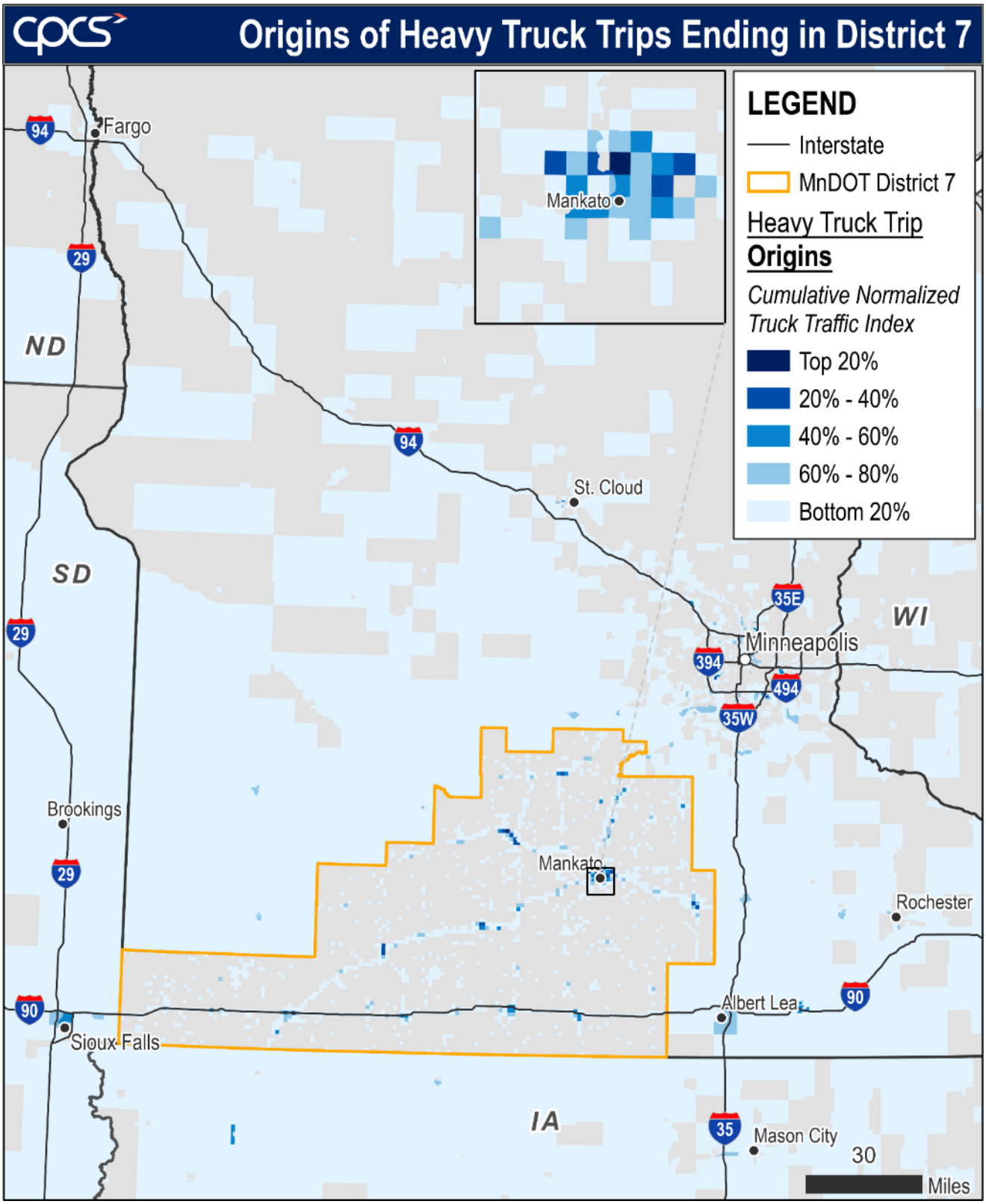
Source: CPCS Analysis of StreetLight Data. 2021.

Figure 33: Destinations of Heavy-Duty Truck Trips Starting in District 7 (2019)



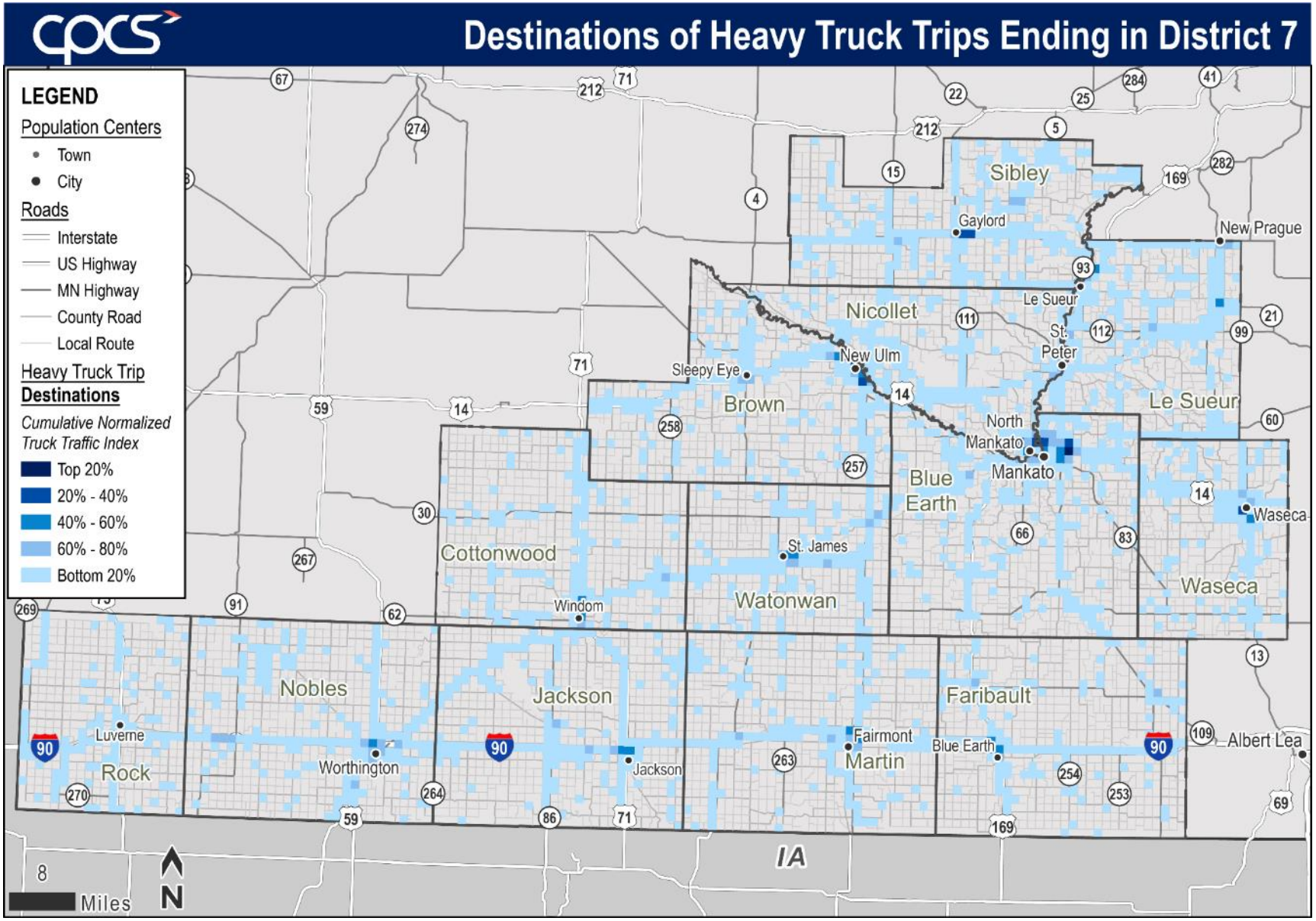
Source: CPCS Analysis of StreetLight Data. 2021.

Figure 34: Origins of Heavy-Duty Truck Trips Ending in District 7 (2019)



Source: CPCS Analysis of StreetLight Data. 2021.

Figure 35: Destinations of Heavy-Duty Truck Trips Ending in District 7 (2019)



Source: CPCS Analysis of StreetLight Data. 2021.

Key Structures and Facilities

Bridges

District 7 contains 2,928 bridges that are ten feet or longer, or about 14 percent of bridges statewide.[16] Of these, 469 are on the state highway system, while the remaining bridges are on county, city, and township roads. There are 37 rail bridges in District 7, and while rail bridges minimize safety concerns by separating modes of traffic, there are low vertical clearances on rail bridges that create route restrictions for some trucks, including trucks with Oversize-Overweight loads. Further information on bridge conditions and clearances is provided in Chapter 3.

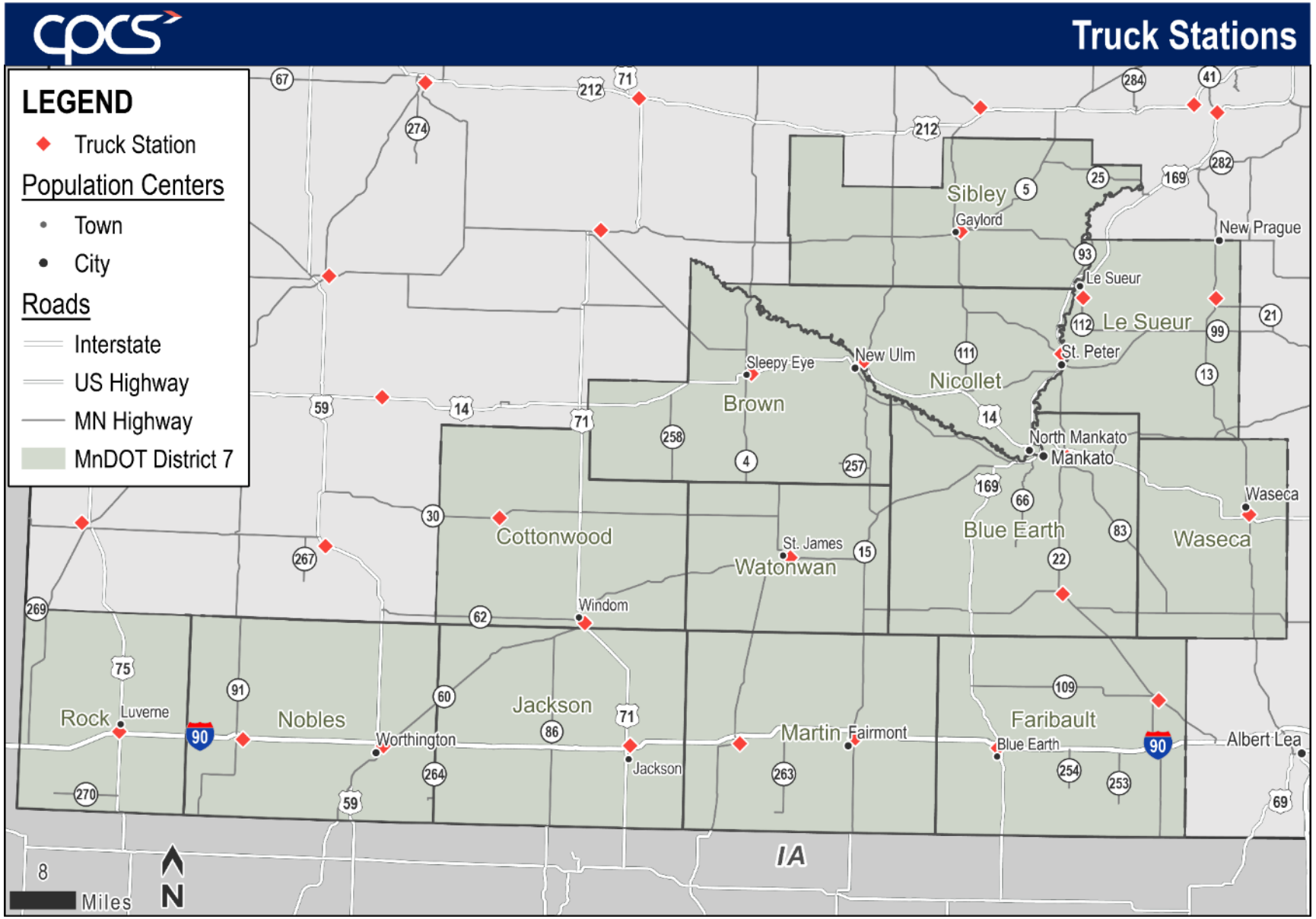
Truck Stations and DOT Headquarters

MnDOT's District 7 headquarters are in Mankato, with a second office in Windom. It operates and maintains 20 truck stations, which provide a multitude of services for trucks traveling on the District's roadways. The truck stations are largely located along rural highways across the District near the entry points onto major highways or along high volume/traffic highways. Figure 36 shows the truck stations in and around District 7.

In Minnesota, the size of truck stations varies based on the number of snowplows assigned to them. As of 2020, District 7 had 75 snowplows. The District has 27 miles of permanent and temporary snow fences that mitigate snow blown from outside of the District that create large snowdrifts.[17]

[16] MnDOT, Minnesota Bridges, 2019: https://www.dot.state.mn.us/bridge/pdf/minnesotabridges-2019-report.pdf
[17] MnDOT District 7 Fact Sheet, 2020.

Figure 36: District 7 Truck Stations



Source: CPCS analysis on MnDOT Data, 2021.

2.3 Railroad Network

Minnesota has 4,613 miles of rail lines and ranks 8th in the US for rail mileage. Of all the freight moved in Minnesota, 25 percent is transported via rail. District 7 has 503 miles of rail line, which accounts for over 11 percent of statewide totals. These miles are owned and operated by three Class I and two Class III (also referred to as short line) railroads. Class I railroads are major railroads serving large portions of the US, with thousands of miles of track. Short line railroads are rail networks that generally run short distances, carry correspondingly smaller tonnages, and provide shippers with access to larger freight railroads. Generally, businesses in District 7 rely on access to rail as a low-cost option to move bulk goods easily. Additionally, District 7 has 549 rail crossings, 153 of which are actively protected with signals.[18]

514	11.1%	148	390	3	2
Miles of Track	of the State's Total Track Miles	Actively-Protected Public Crossings	Passively-Protected Public Crossings	Class I Freight Rail Operators	Short Line Railroads

The Class I rail operators in District 7 are Burlington Northern Santa Fe Railway (BNSF), Canadian Pacific, and Union Pacific Railway (UP). The two short line railroads are the Minnesota Prairie Line railroad (MPL), which operates a track that runs through Sibley County, and the Ellis & Eastern short line railroad, which operates track in Nobles and Rock County. Both short line railroads connect manufacturing, agricultural, and other bulk commodity businesses to Class I rail line. Figure 37 displays the number of miles and railroad crossings owned by each railroad company, while Figure 38 and Figure 39 show the rail network and its general speed and use.

Figure 37: District 7's Freight Railroad System

Railroad	System Miles in District 7	Public Road Crossings
UP	221	226
CP	186	209
BNSF	18	12
Ellis & Eastern	41	54
Minnesota Prairie Line	37	45

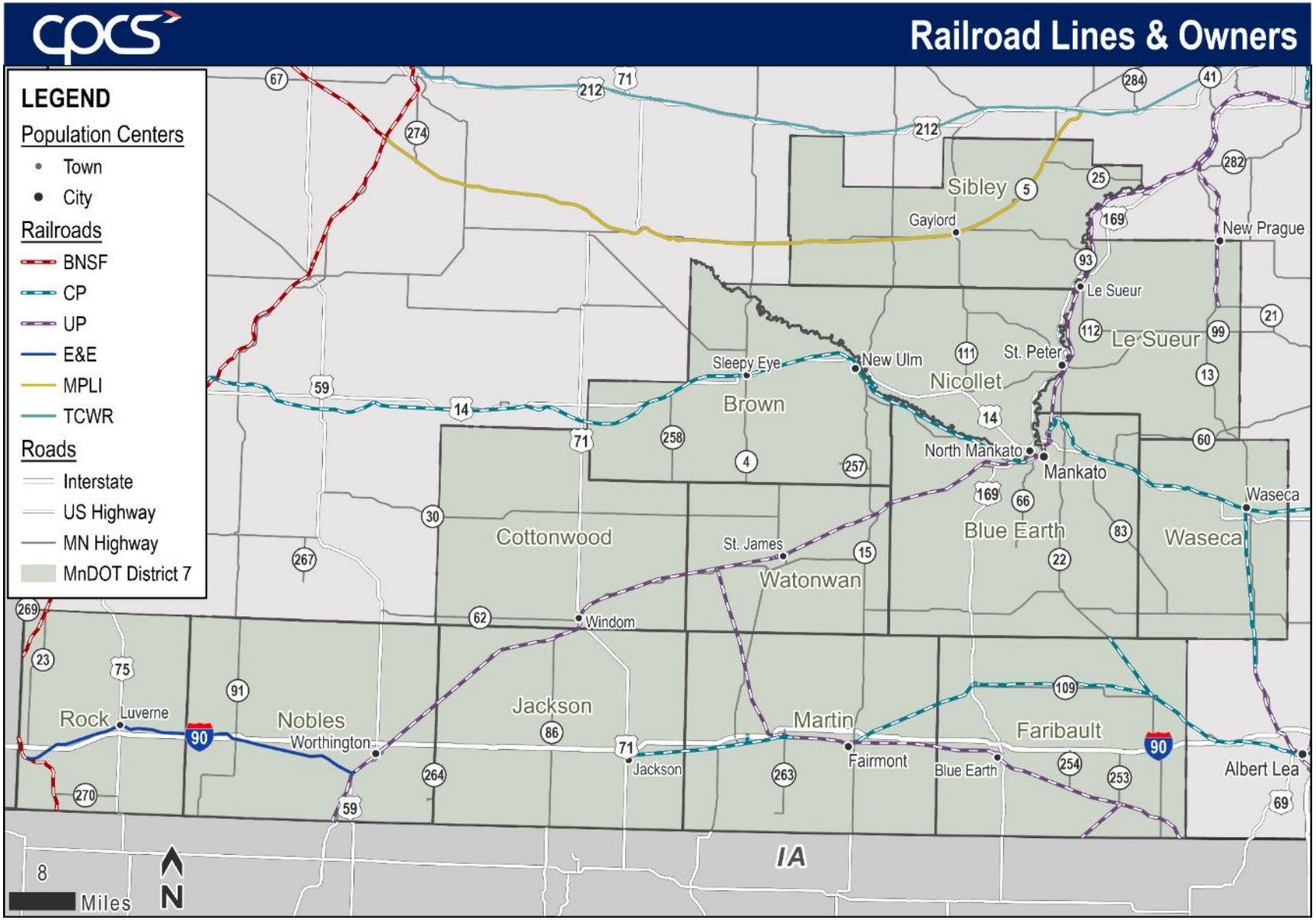
Source: Minnesota State Rail Plan, 2015. FRA Grade Crossing Safety Data, 2021. National Transportation Atlas Database, 2021.

According to commodity data provided by the Federal Highway Administration's Freight Analysis Framework tool, over 137 million tons of cargo were moved by rail in Minnesota in 2017. Additionally, statewide rail tonnage is expected to grow by 83 percent to more than 460 million tons by 2040, with 90 percent of the tonnage carried in individual carloads and 10 percent within intermodal containers.[19]

As seen in Figure 40, cereal grains, metallic ores, coal, and natural sands comprised approximately 65 percent of the total rail tonnage in the state in 2017. In comparison to 2012, the top commodities by tonnage remained the same; however, natural sands became an increasingly carried commodity from 2012 to 2017.

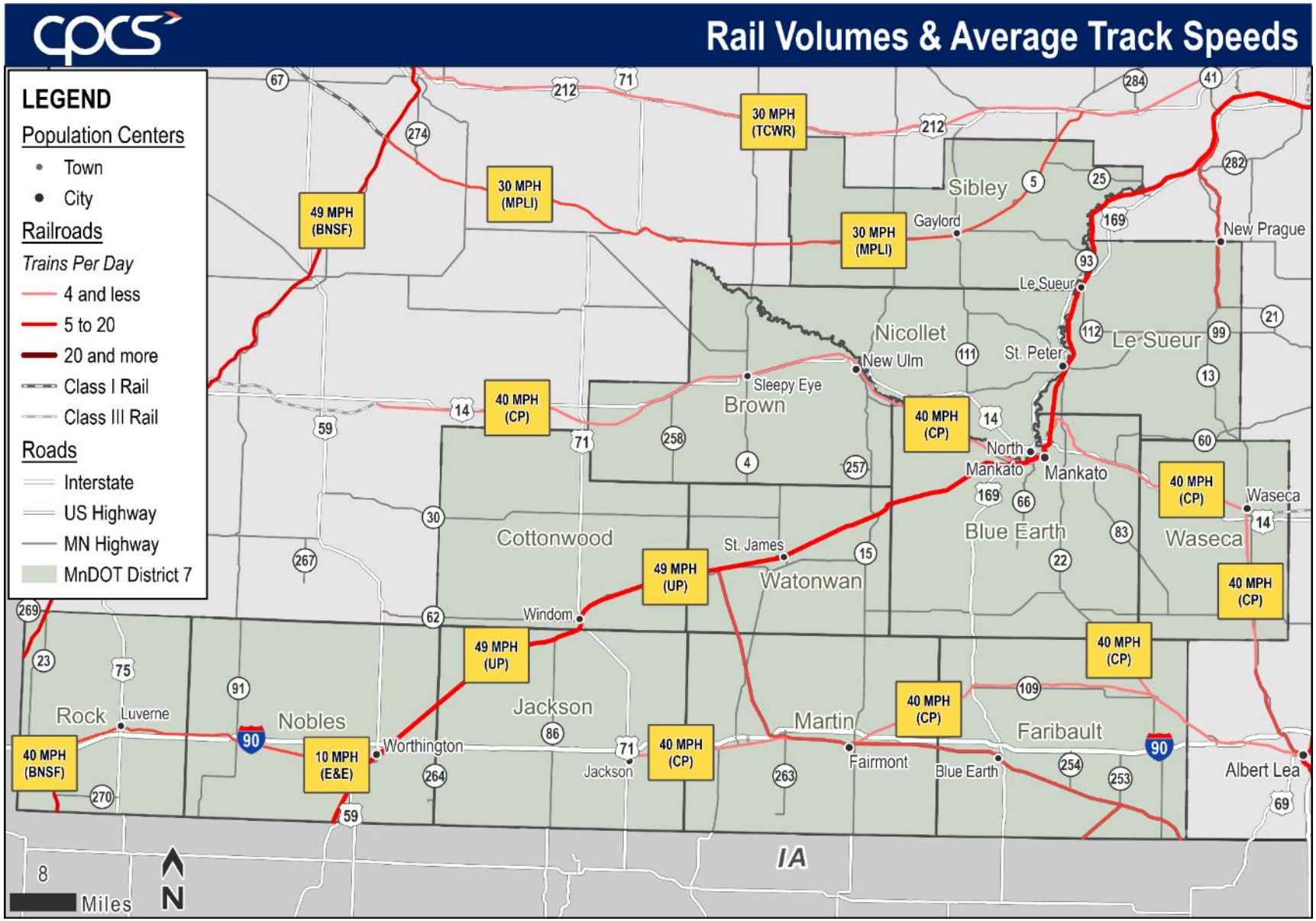
[18] MnDOT District 7 Fact Sheet, 2020.
[19] MnDOT "Minnesota State Rail Plan" (2015). http://www.dot.state.mn.us/planning/railplan/resources.html

Figure 38: District 7 Railroad Lines & Owners



Source: CPCS analysis of National Transportation Atlas Database, 2021.

Figure 39: District 7 Rail Volumes and Average Track Speeds



Source: CPCS analysis of National Transportation Atlas Database and MnDOT Freight Railroad Map, 2021.

Figure 40: Major Commodities Carried by Rail in Minnesota

Top Commodities	Tonnage	Percent
Cereal Grains	34,267,550	25.01%
Metallic Ores	27,657,970	20.18%
Coal	13,116,550	9.57%
Natural Sands	12,683,130	9.26%
Other Agriculture Products	5,981,669	4.37%
Fertilizers	5,816,964	4.25%
Fuel Oils	5,544,231	4.05%
Wood Products	5,511,333	4.02%
Animal Feed	4,048,598	2.95%
Crude Petroleum	3,851,534	2.81%
Other Foodstuffs	3,163,464	2.31%
Nonmetallic Minerals	3,106,955	2.27%
Newsprint/paper	2,303,553	1.68%
Basic Chemicals	2,041,154	1.49%
All Other	7,933,299	5.79%

Source: Freight Analysis Framework 5, 2021.

Key Corridors

Union Pacific

UP operates 665 miles of rail in Minnesota, about 11 percent of its entire US trackage. 221 of these miles are in District 7 where they connect the District to the Twin Cities. The UP route running through the District is referred to as UP's Mankato Subdivision. The top commodities that Union Pacific ships in Minnesota are biofuels and sweeteners, grains, meals and oils, petroleum coke, and petroleum products.[20] Figure 41 breaks down UP's operations in District 7 by segment, trains per day, and maximum speed.

Figure 41: UP Railway Operations in District 7

Railway Segment	Trains Per Day	Maximum Speed (MPH)
Worthington to Mankato	5 to 20	49 MPH
Mankato to eastern Sibley County	5 to 20	49 MPH
Eastern portion of Le Sueur County	5 to 20	49 MPH

Source: CPCS analysis of Minnesota Freight Railroad Map developed by Office of Freight and Commercial Vehicle Operations, 2021.

[20] Union Pacific in Minnesota, 2020.
https://www.up.com/cs/groups/public/@uprr/@corprel/documents/up_pdf_nativedocs/pdf_minnesota_usguide.pdf

Canadian Pacific

CP operates 1,804 miles of track in Minnesota, comprising over 30 percent of its entire operations. In 2007, CP acquired the Dakota, Minnesota, and Eastern Railroad (DME), which owned 186 miles of track in District 7 running through Jackson, Mankato, Waseca, Janesville, and up to St. Paul. This CP route is known as the Waseca Subdivision. A majority of CP's carload movements in Minnesota contain intermodal, grain, energy, chemicals, plastics, and metals. Figure 42 breaks down CP's operations in District 7 by segment, trains per day, and maximum speed.

Figure 42: CP Railway Operations in District 7

Railway Segment	Trains Per Day	Maximum Speed (MPH)
Brown County to Mankato	4 or less	40 MPH
Mankato to Waseca	4 or less	40 MPH
Waseca to Albert Lea	4 or less	40 MPH
Jackson to southeast Faribault County	1 to 20	40 MPH
Faribault to Albert Lea	4 or less	40 MPH

Source: CPCS analysis of Minnesota Freight Railroad Map developed by Office of Freight and Commercial Vehicle Operations, 2021.

BNSF

BNSF operates 1,686 miles of rail track in Minnesota, which comprises 28 percent of their total system. 18 miles of their Marshall Subdivision are in District 7. BNSF primarily carries agricultural, coal, and other bulk commodities. Figure 43 breaks down BNSF's operations in District 7 by segment, trains per day, and maximum speed.

Figure 43: BNSF Railway Operations in District 7

Railway Segment	Trains Per Day	Maximum Speed (MPH)
Rock County	5 to 20	40 - 49 MPH

Source: CPCS analysis of Minnesota Freight Railroad Map developed by Office of Freight and Commercial Vehicle Operations, 2021.

Short Line Railroads

District 7's two short line railroads operate 78 miles of track that makes up 10 percent of Minnesota's short line mileage. These railroads are important because they provide additional communities and companies with the opportunity to access larger national and international railroad networks. Figure 44 provides an overview of short line railroad operations in District 7.

Figure 44: Short Line Railroads Operating in District 7

Short Line Railroads	Mileage	Area Served	Class I Connection	Commodities
Ellis & Eastern (EE), trackage owned by the Buffalo Ridge Regional Rail Authority	41	Rock and Nobles Counties	BNSF	Agricultural, manufacturing, retail and wholesale trade, chemicals
Minnesota Prairie Line (MPL), trackage owned by the Minnesota Valley Regional Rail Authority	37	Sibley County	UP	Manufacturing, agricultural, technology products, coal, chemicals

Source: CPCS analysis of information provided on short line websites, accessed May 2021.

Ellis & Eastern operates 41 miles of track in the southwest portion of District 7 connecting the Union Pacific's junction site in Agate, Minnesota to the BNSF rail line west of the District. This line mainly travels along I-90 serving manufacturing and agricultural businesses. E&E's presence in District 7 stems from its acquisition of the Minnesota Southern Railroad line in 2017. Their track in the District is owned by the Buffalo Ridge Regional Rail Authority (BRRRA), while the operating rights are assigned to E&E.

Minnesota Prairie Line is a wholly-owned subsidiary of the Twin Cities & Western Railroad (TCWR) that operates 37 miles of track in District 7 serving mostly agricultural businesses in Sibley County. MPLI connects the area to the Twin Cities via TCWR's main rail line and UP's rail line. MPLI's track is owned by the Minnesota Valley Regional Rail Authority (MVRRA), which is a public agency.

Short Line Railroads and Public Rail Authorities

District 7's MPL and EE railroads operate under a form of public-private partnership. These two railroads are operated by privately-owned companies on tracks owned by public rail authorities. Since these rail authorities are public entities, they are eligible for funding that is not available to privately-owned and operated railroads.

A review of the previous rail-related studies shows that Minnesota and District 7 short lines are struggling to maintain and improve their infrastructure conditions. Generally, short line railroads are less preserved, limiting their operations to lighter-weight trains.[21] A lack of sufficient infrastructure does not allow short lines to accommodate modern-day rolling stock and heavier rail cars, which in turn disallows them to transport certain commodities.

At-Grade Rail Crossings

Highway-rail grade crossings are potential points of conflict between rail and road users. Safety at highway-rail grade crossings is an ongoing topic of concern for the public as grade crossings can create risks for crashes and passenger and freight transportation delays. District 7 has 826 at-grade crossings – 65 percent of which are crossings on public roads.

MnDOT categorizes its at-grade crossings as either actively-protected or passively-protected. Actively-protected crossings are equipped with active safety devices such as gates, flashing lights, or bells, while passively-protected crossings are only protected by passive safety devices such as stop signs, pavement markings, or crossbucks. Only about 28 percent of public crossings in District 7 are actively-protected. Figure 45 provides a breakdown of the number of public and private at-grade crossings by county in the District, and Figure 47 shows all of the rail grade crossings and rail bridges in District 7.

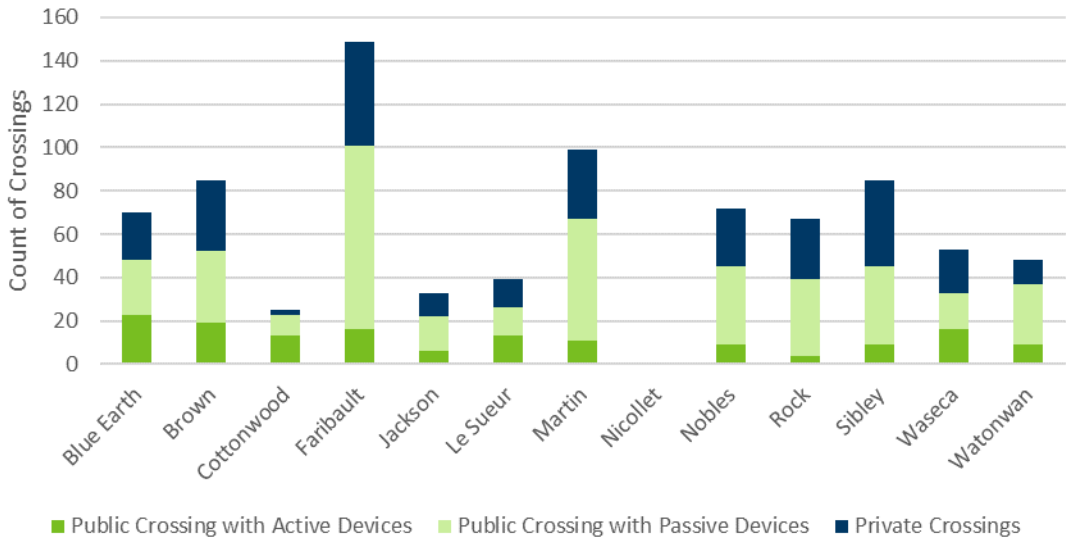
[21] MnDOT, Minnesota State Rail Plan, 2015.

Figure 45: Public At-Grade Crossings in District 7 (by County)

County	Public Crossing with Active Devices	Public Crossing with Passive Devices	Total Public Crossings	Private Crossings
Blue Earth	23	25	48	22
Brown	19	33	52	33
Cottonwood	13	10	23	2
Faribault	16	85	101	48
Jackson	6	16	22	11
Le Sueur	13	13	26	13
Martin	11	56	67	32
Nicollet	0	0	0	1
Nobles	9	36	45	27
Rock	4	35	39	28
Sibley	9	36	45	40
Waseca	16	17	33	20
Watonwan	9	28	37	11
Total	**148**	**390**	**538**	**288**

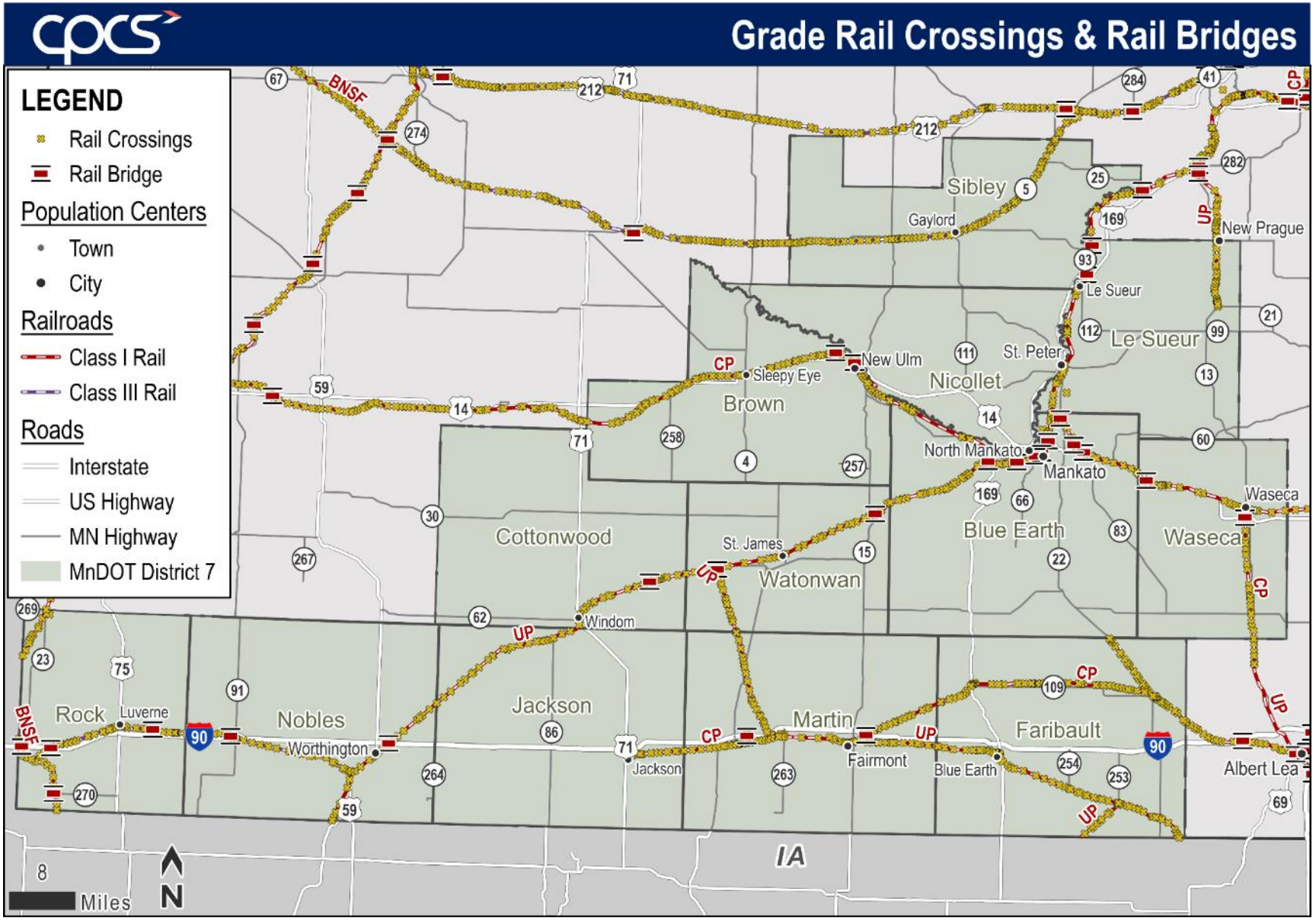
Source: Federal Railroad Administration Crossing Inventory, 2021.

Figure 46: County Comparison of Grade Crossing Counts



Source: Federal Railroad Administration Crossing Inventory, 2021.

Figure 47: District 7 Grade Rail Crossings and Bridges



Source: CPCS analysis of Federal Railroad Administration Data, 2021.

Rail Transload Facilities

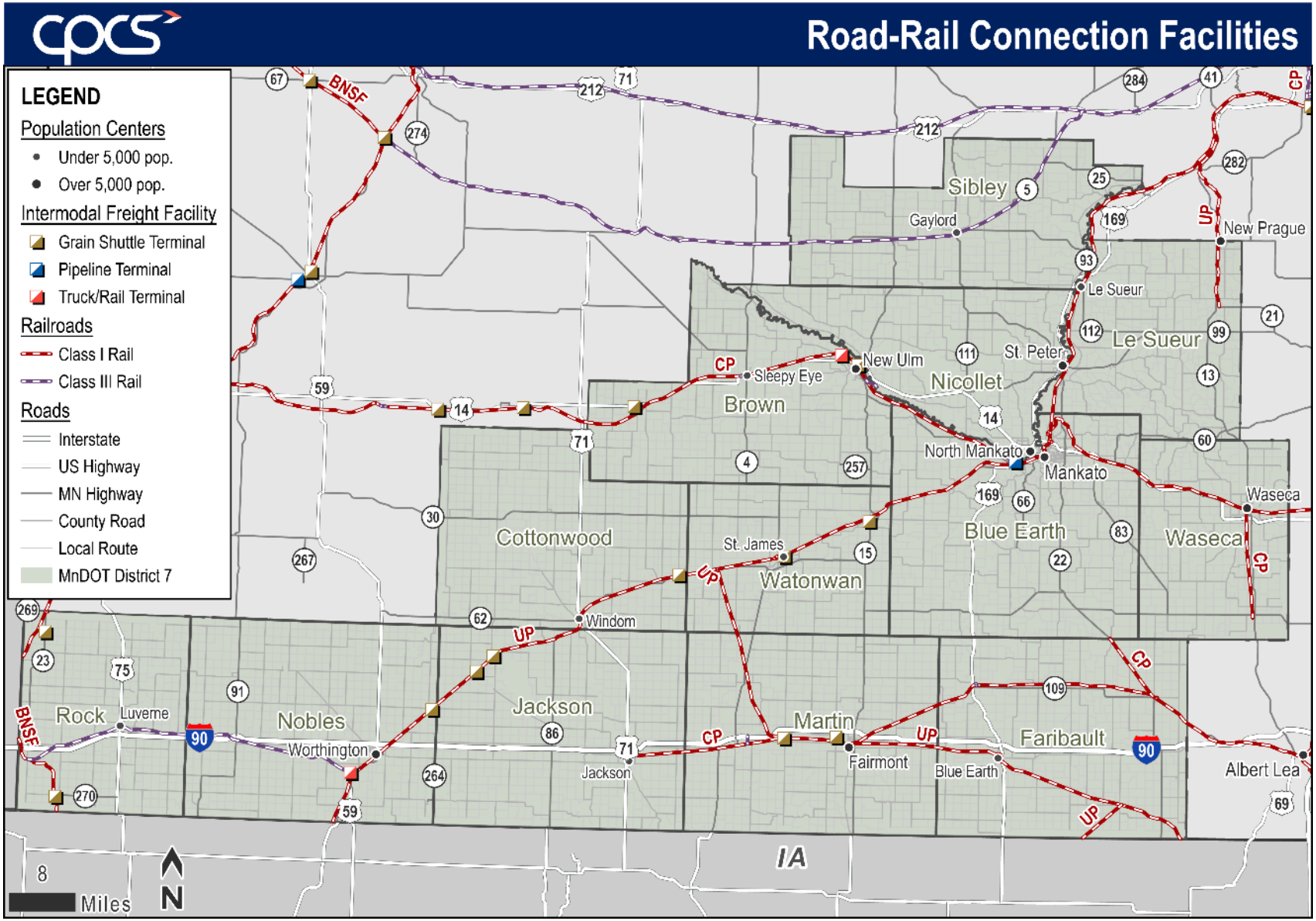
Intermodal container terminals in Minnesota that are served by rail are generally located in and around the Twin Cities. However, District 7 has numerous rail terminals and grain shuttle terminals that provide transloading and offloading services and serve as key connection points between truck and rail. Figure 48 shows the various rail terminals and yards in District 7, while Figure 49 displays District 7's road-rail facilities.

Figure 48: District 7's Rail Terminals and Yards

Facility Name	City	Facility Type	Commodity	Railway
Agate Terminal	Worthington	Truck/Rail Terminal	Dry bulk	EE
Atlas Cold Storage	New Ulm	Truck/Rail Terminal	General Commodities; Temperature Control Food Grade	CP
Cargill Aghorizons	Miloma	Grain Shuttle Terminal	Corn, soybeans	UP
Cargill, Inc.	Fairmont	Grain Shuttle Terminal	Corn, soybeans	UP
Central Farm Service	Blue Earth	Grain elevator	Corn, soybeans	CP
Central Farm Service	Delavan	Grain elevator	Corn, soybeans	CP
Central Farm Service	St. James	Grain elevator	Corn, soybeans	UP
Central Region Coop	Sleepy Eye	Grain elevator	Corn, soybeans	CP
Crystal Valley	Madelia	Grain elevator	Corn, soybeans	UP
Eastern Farmers Cooperative	Jasper	Grain Shuttle Terminal	Corn, oats, soybeans	BNSF
Hanska Farmers Co-op	New Ulm	Grain Shuttle Terminal	Corn, soybeans	CP
Harvest Land Cooperative	Springfield	Grain Shuttle Terminal	Corn, soybeans, wheat	CP
La Salle Farmers Grain Company	Madelia	Grain Shuttle Terminal	Corn, soybeans	UP
Magellan Pipeline	Mankato	Pipeline Terminal	Oil Products	None
New Vision Co-op	Brewster	Grain Shuttle Terminal	Corn, soybeans	UP
New Vision Co-op	Worthington	Grain Shuttle Terminal	Corn, soybeans	UP
New Vision Co-op	Heron Lake	Grain Shuttle Terminal	Corn, soybeans, wheat	UP
New Vision Co-Op	Magnolia	Grain elevator	Corn, soybeans	EE
New Vision Co-op	Mountain Lake	Grain Shuttle Terminal	Corn, soybeans, wheat	UP
New Vision Co-op	Hills	Grain Shuttle Terminal	Corn, soybeans	BNSF
Watonwan Farm Service	Saint James	Grain Shuttle Terminal	Corn, soybeans	UP
Watonwan Farm Service	Welcome	Grain Shuttle Terminal	Corn, soybeans	CP/UP
Mankato	Mankato	Rail Yard	N/A	UP
Saint James	Saint James	Rail Yard	N/A	UP
Waseca	Waseca	Rail Yard	N/A	CP
Worthington	Worthington	Rail Yard	N/A	UP

Source: Minnesota Intermodal Freight Facility Dataset, Minnesota State Rail Plan, 2015.
*Note: Facilities classified as "Grain Elevators" instead of "Grain Shuttle Terminals" were identified by scans of Google Earth and Google Maps imagery, and information about their classification as shuttle facilities was unavailable.

Figure 49: District 7 Rail-Served Facilities



Source: CPCS analysis of National Transportation Atlas Database, 2021.

2.4 Air Cargo Network

Compared to other modes of freight transportation in Minnesota, air accounts for a small portion of freight movements. However, air freight is critical to the economy as it handles high-value goods and commodities, and provides rapid service. As shown in Figure 50, air freight movements in Minnesota handle a wide variety of products, including precision instruments, plastics/rubber, electronics, and machinery, among many others.

Freight shipped by air accounts for a small portion of the freight carried by other modes. As the below figure shows, precision instruments, plastics/rubber, electronics, and valuable machinery are the top air-carried commodities in Minnesota.

Figure 50: Top Air Commodities in Minnesota

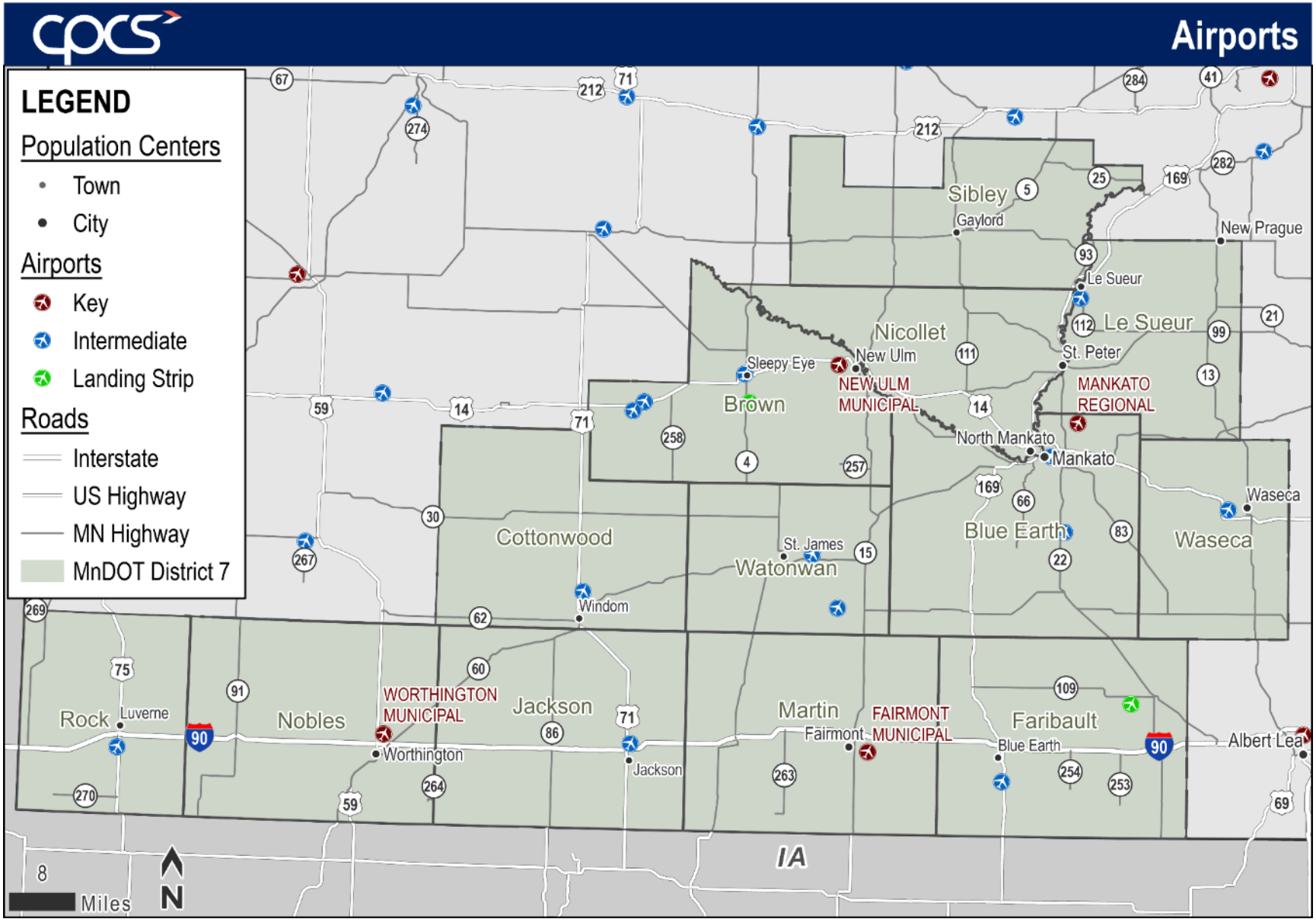
Top Commodities	Tonnage Carried by Air in 2017	Percent
Precision Instruments	85,781.9	32.6%
Plastics/rubber	29,165.7	11.1%
Electronics	26,328.8	10.0%
Machinery	19,119.4	7.3%
Nonmetal Mineral Products	17,674.3	6.7%
Textiles/leather	16,111.9	6.1%
Chemical Products	11,309.8	4.3%
Mixed Freight	6,543.4	2.5%
Articles-base Metal	5,833.2	2.2%
Basic Chemicals	5,628.6	2.1%
All Other	39,975.9	15.2%

Source: Freight Analysis Framework 5, 2021

District 7 has four key commercial airports (Mankato Regional, New Ulm Municipal, Fairmont Municipal, and Worthington Municipal). Additionally, the District has 13 intermediate airports and two landing strips. Intermediate airports serve as landing facilities for flight training, aircraft maintenance, and general aviation/business jets. There are a few airports in District 7 that handle cargo. The Worthington Municipal Airport facilitates just-in-time shipments for local businesses, such as Ralco Nutrition, Mainstream Holdings, and Hitchdoc.[22] Also, the New Ulm Municipal Airport supports just-in-time shipments for August Schell Brewing Company, Christensen Farms, SpecSys Inc, Anderson Custom Processing, and Heartland Corn Products. Lastly, the Fairmont Municipal Airport provides just-in-time shipments for Kahler Automation, Bevcomm, 3M, Hy-Vee, and Mayo Health. The closest major international airport to District 7 is the Minneapolis-St. Paul Airport, which has a high volume of air cargo and serves as a connection and access point to businesses and consumers in the District. Figure 51 highlights the airports located in District 7.

[22] Minnesota Statewide Airport Economic Impact Study, 2019.

Figure 51: District 7 Airports



Source: National Transportation Atlas Database, 2021.

2.5 Pipeline Network

Pipelines are an important mode of freight transportation in Minnesota as they are a high-volume, low-cost option for critical oil and gas movements. As seen in Figure 52, nearly 99 percent of the commodities moved by pipeline in Minnesota are natural gas and crude petroleum.

Figure 52: Major Commodities Carried through Minnesota's Pipelines (2017)

Commodity	2017 Tonnage	Percent of Total	Projected 2040 Change	Annual Change between 2012 – 2040
Coal-n.e.c.	138,074,600	79.33%	117%	3%
Crude Petroleum	33,462,770	19.23%	109%	3%
Gasoline	1,662,230	0.96%	-20%	-1%
Fuel Oils	372,610	0.39%	-17%	-1%

Note: The coal-n.e.c. category represents natural gas, propane, selected coal products, and products of petroleum refining, excluding gasoline, aviation fuel, and fuel oil.

Source: FAF 5, 2021.

Considering that Minnesota has no petroleum or natural gas resources, it primarily imports crude oil, natural gas, and other petroleum products from domestic and international sources. The state has two oil refineries near the Twin Cities that mostly process crude oil transported from North Dakota and Canada and is dispersed throughout the state and nearby markets.

In District 7, there are 879 miles of active pipeline, most of which is dedicated to natural gas distribution and transmission lines, and hydrocarbon gas liquids transmission pipelines. Figure 53 summarizes the pipeline coverage, by type, within the District and Figure 54 illustrates the pipeline network in District 7.

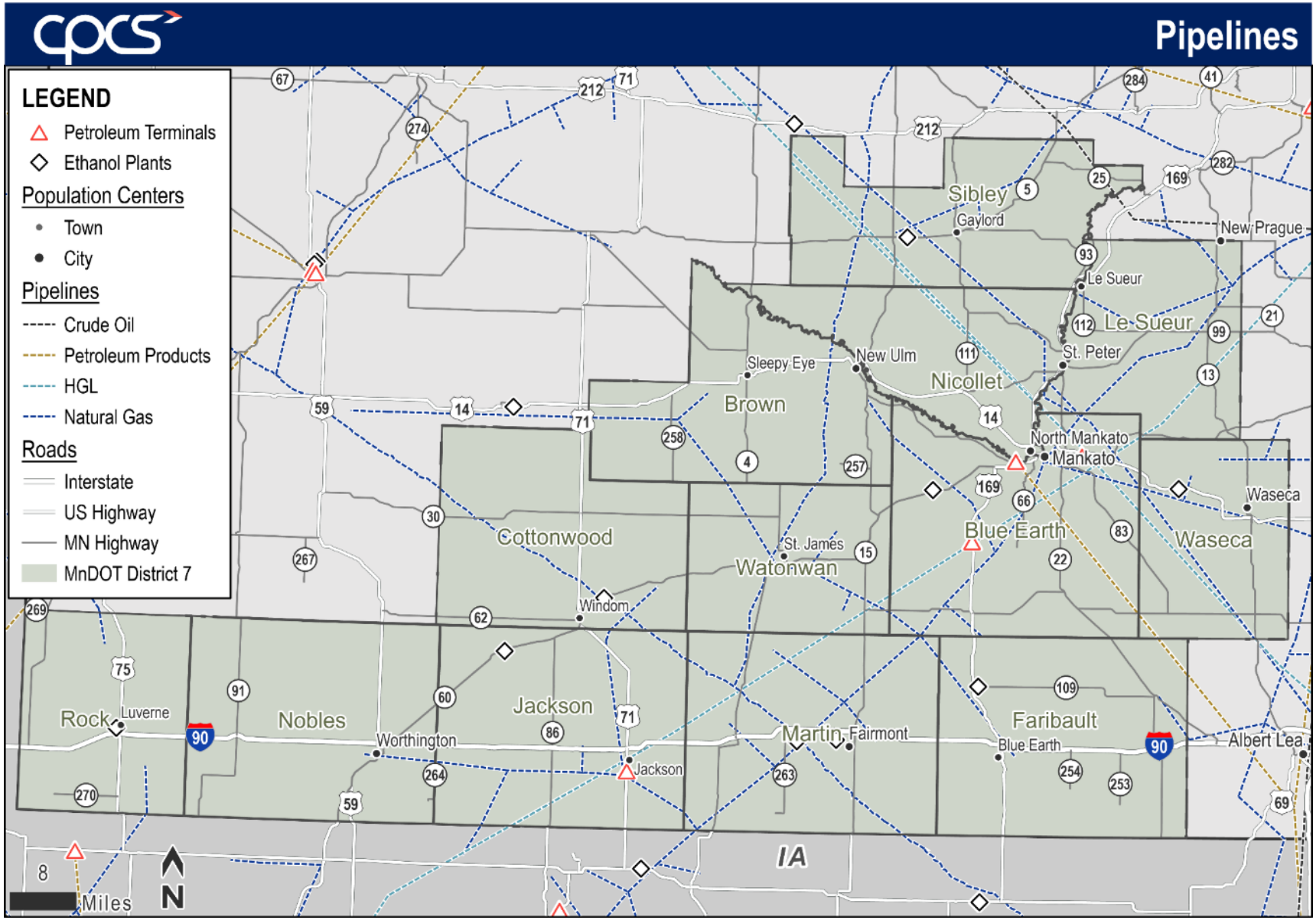
Figure 53: District 7 Pipeline Coverage

Commodity	Length (Miles)	Percent of State Total
Crude Oil	8.4	0.6%
Hydrocarbon Gas Liquids (HGL)	186.6	27.3%
Natural Gas	650.8	16.7%
Petroleum Products	33.2	2.3%

Source: US EIA, 2020.

It is also important to note that pipeline operations for the transmission and distribution of natural gas and refined petroleum products are supplemented with truck and rail transportation. In particular, the road network serves as an important final-mile link in gasoline, diesel, and propane supply chains from pipeline terminals to retail establishments such as gas stations and propane dealers.

Figure 54: MnDOT District 7 Pipelines



Source: CPCS analysis of EIA data. 2021.

3 District 7 Freight System Condition and Performance

Key Findings:

In this plan, freight system performance is examined through the lenses of safety, condition, and mobility. In regard to safety, between 2010 and 2019 over 3,700 truck-involved crashes happened in District 7: about 23 percent of these crashes resulted in injuries, and 2 percent resulted in fatalities. Additionally, rail grade crossing safety is a relevant issue in the District, as District 7 had the highest count of passively-protected crossing crashes among all of MnDOT's districts.

Most of the roadway pavement in District 7 is in good or fair condition, and 4.3% of the District's bridges are structurally deficient and need infrastructure improvements.

Generally, roadway congestion and truck travel speeds are not an issue in District 7 during peak periods. Occasionally, Mankato and other more urban areas experience congestion and low average truck travel speeds, particularly along US-169 and US-14.

3.1 Linking System Evaluation to Statewide Goals

The Minnesota Statewide Freight System and Investment Plan established goals for investments in the multimodal freight system. To support these goals, the plan identified three main topic areas for evaluating the performance of the transportation system:

- **Safety.** To assess and ensure the safety, security, and resiliency of the freight system.
- **Infrastructure Condition.** To assess and ensure the suitability of the transportation system for handling freight.
- **Mobility.** To assess and minimize transportation system delay, congestion, and improve reliability for freight users.

These areas served as the starting point for the data analysis presented in this chapter. This chapter uses data that is readily available at the state and federal levels and, where available, builds on other relevant studies that have been conducted by MnDOT. The condition and performance of the District 7 freight system will be further quantified to identify the issues and prioritize the needs in Working Paper 4: Investment Priorities.

Minnesota Statewide Freight Goals

The Minnesota Statewide Freight System and Investment Plan identified five goals to reflect those aspects of the multimodal freight system viewed as most important to the public and private sector freight stakeholders in the state:

- Support Minnesota's Economy;
- Improve Minnesota's Mobility;
- Preserve Minnesota's Infrastructure;
- Safeguard Minnesotans; and
- Protect Minnesota's Environment and Communities.

3.2 Safety

Ensuring the safety of the transportation system is one of MnDOT's most critical missions. This District Freight Plan intends to build upon the work completed in the 2020-2024 Strategic Highway Safety Plan, which sets road safety improvement targets to guide statewide, county, and local government-level system planning and investments. Ultimately, Minnesota's long-term traffic safety goal is to eliminate road crash-related deaths and

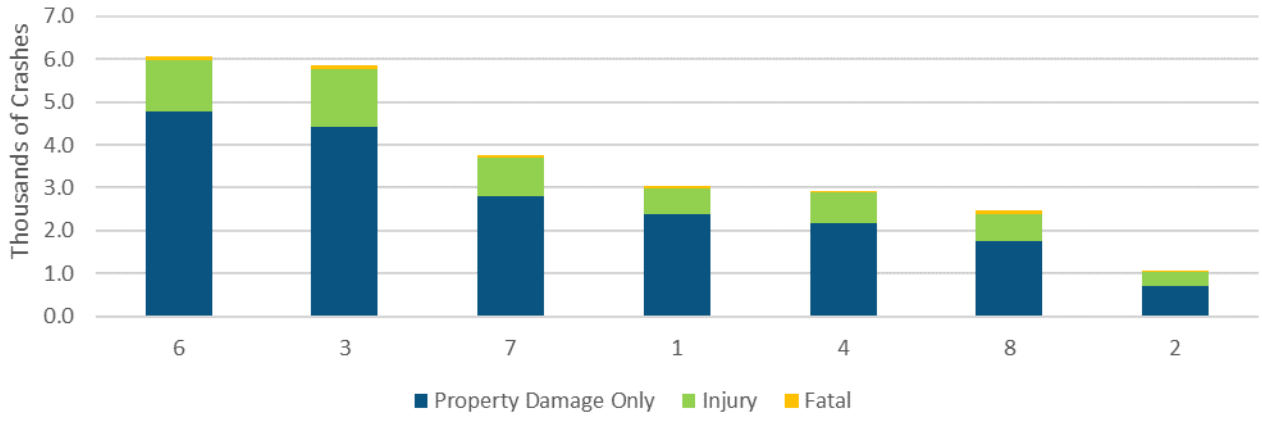
injuries. However, the state's 2025 target is less than 225 traffic-related deaths and 980 injuries.[23] Not only can crashes result in physical harm, but they can also result in damaged vehicles and cargo, and negatively impact the performance of the transportation system. To assess the safety of District 7's freight network, this plan examines four topics:

- **Previous roadway crashes:** an examination into the location and severity of previous truck-related crashes in District 7, which provides important context for discussion of crash risk factors.
- **Roadway and intersection crash risk factors:** analysis of District-level road crash risk factors based on MnDOT's "sustained crash location" metric and other factors. This risk information is taken from the District 7 Safety Plan.
- **Previous road-rail grade crossing incidents:** an examination of the location and severity of grade crossing crashes in the District. As with road crash data, this grade crossing crash information provides context for further discussions of grade crossing risk factors.
- **Road-rail grade crossing risk factors:** analysis of grade crossing safety risks based on MnDOT's assessment of the relative safety of public grade crossings in the state.

Roadway Safety

To understand District 7's relative roadway safety, this section compares the District's crash rates with other areas in Minnesota, which will determine whether safety-related performance is relatively better or worse than other MnDOT Districts. Figure 55 displays the count of commercial vehicle-involved crashes in each district between 2010 and 2019. In this period, District 7 ranked third highest among Greater Minnesota's districts in terms of total crash counts. While this rank is relatively high, it is important to note that District 7's truck-involved crash count was more than one-third less than the second-highest district (District 3).

Figure 55: Crashes Involving Commercial Vehicles by District (2010-2019)



Source: District Safety Plans Update, 2016.
Note: Metro District is not included due to its significantly higher traffic volumes, and disproportionately higher number of crashes.

For freight-specific safety analysis, crashes involving trucks have been isolated to determine if there are specific high-density "hot spots" of truck crashes. Figure 56 summarizes the total number of crashes that involved trucks greater than 10,000 lbs. in District 7. Between 2010 and 2019, 3,777 truck-involved crashes happened in District

[23] MnDOT, 2020-2024 Strategic Highway Safety Plan, 2020. https://www.dot.state.mn.us/trafficeng/safety/shsp/mn-shsp-2020-24.pdf

7. Almost 3/4ths of these crashes only resulted in property damage. A relatively smaller share resulted in injuries (23 percent), and only about 2 percent of crashes were fatal.

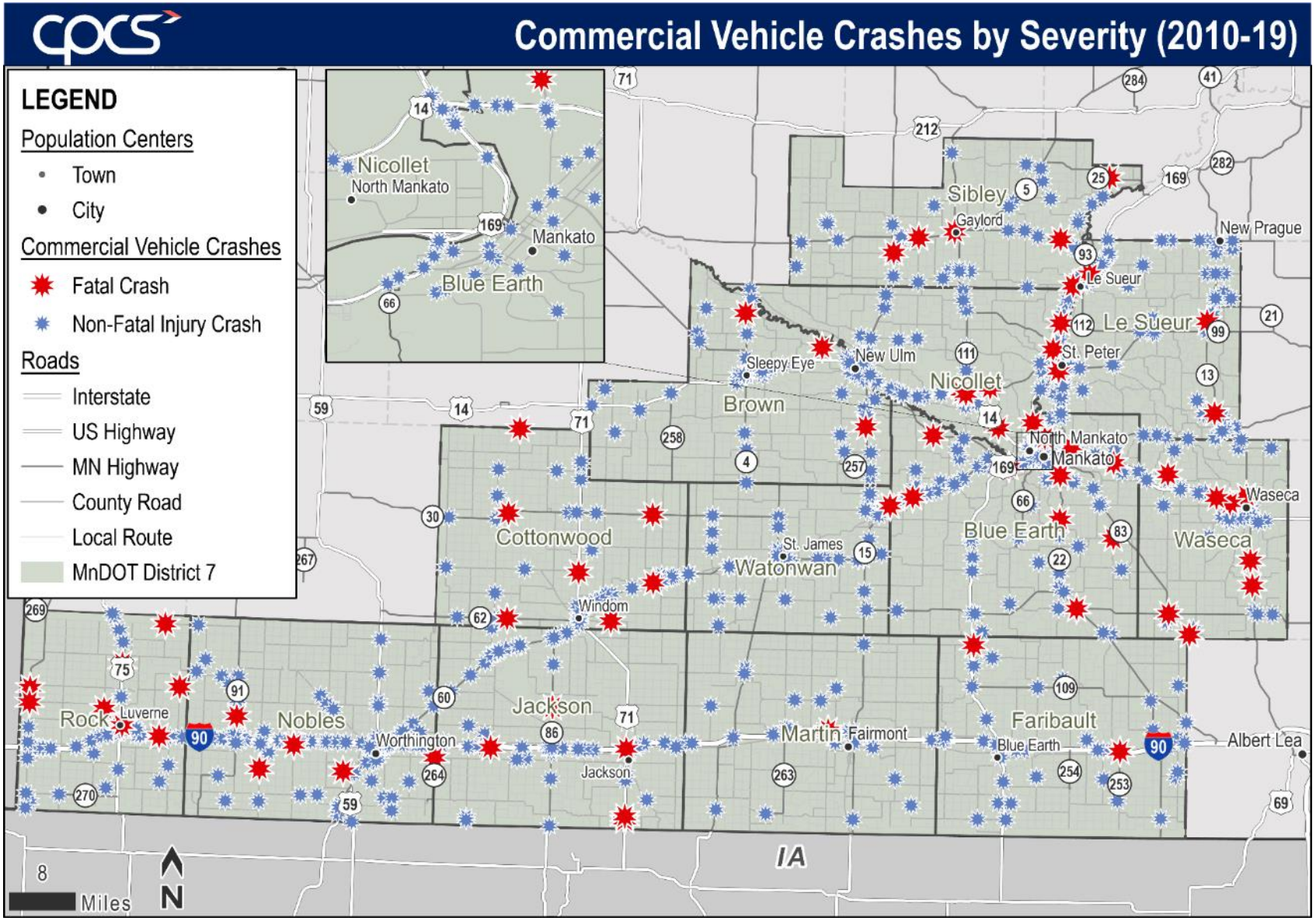
Figure 56: Number of Truck-Involved Crashes by Crash Severity, 2010-2019

Crash Severity	Crash Count
Fatal	70
Injury	890
Property Damage Only	2,811
Unknown	6

Source: CPCS analysis of MnDOT crash data, 2021.

Figure 57 displays a map of the locations of truck-related crashes in District 7, by severity. As shown, a large portion of truck-related crashes occur along I-90, US-169, and US-14, which are critical and dense freight corridors in the District with high traffic volumes. It is important to note that Figure 57 does not show the location of all crashes counted in Figure 56, as some crash records do not have latitude and longitude attributes provided. The 2020 and 2021 data is not shown either, as this data is still considered to be preliminary, and is under review.

Figure 57: Truck Crashes by Severity in District 7 (2010-2019)



Source: CPCS analysis of MnDOT Truck Crash Data. 2021.

District 7 truck crashes primarily occurred along higher-traffic routes such as I-90, MN-60, US-169, and US-14.

According to the MnDOT District 7 Safety Plan Update, approximately 10 percent of severe crash locations are high-crash locations, while the remaining 90 percent of severe crashes occur in apparently "random" locations, which is mostly true in District 7. While many crashes that resulted in serious injury or death occurred along I-90 and US-169 in District 7, many happened along relatively lower-volume corridors, such as US-59, MN-19, and MN-13.

Crashes can be caused by a wide range of factors including driver behavior, weather and pavement conditions, vehicle maintenance complications, time of day, and roadway geometric design. Many of these factors lie well outside of MnDOT's control, but MnDOT can help improve safety through its choices about roadway design or operations. MnDOT analyzes crash histories to inform their infrastructure design and investment decisions. However, studying crash histories alone is not sufficient, as severe crashes show some degree of "randomness" in their location, and guiding safety investments on crash histories alone may result in planners "chasing" severe crashes around the network. Consequently, MnDOT adopted a risk factor-based approach to examining safety at certain locations and prioritizing subsequent safety improvement projects. A variety of risk factors inform the evaluation of crash risk for different types of roads and intersections, including 2-lane, 4-lane, and freeway segments and intersections for both rural and urban areas. Examples of the type of risk factors evaluated for road segments include: shoulder width, median width, curve density, access point density, and vehicle volume on mainline and intersecting roads. Meanwhile, factors such as speed limit, traffic control, skew and curvatures, and land use are used to evaluate intersection crash risk. Additionally, this risk factor tabulation indicates the expected costs associated with crashes at specific locations, and this combined risk and expected cost data can help inform investment decision-making. Specific risk thresholds for each safety factor are created, and if a segment exceeded a threshold in a specific factor, it is awarded a star. An example of this approach is shown in Figure 58 for high-risk crash locations in District 7.

Figure 58: District 7 Example Risk Factor Tabulation

#	Intersection ID	Route System	Route No.	Description	Speed Limit	Cross Product	Traffic Control	Major Corridor Speed	Skew	On/Near Curve	Primary Land Use	Severe RA Crash Density	Total Stars	Crash Cost
1	7.013.020	MN	13	STATE ST/22ND AVE WASECA	55	★	★	★	★		★	★	★★★★★★	$10,395,800
2	7.015.018	MN	15	TORGERSONDR M295/FAIRMONT	45	★	★	★	★	★	★		★★★★★★	$732,800
3	7.060.013	MN	60	CSAH 33 RT	50	★		★		★	★	★	★★★★★	$1,713,400
4	7.071.018	US	71	S JCT TH 60/WINDOM	60	★		★	★	★	★		★★★★★	$1,251,400
5	7.060.030	MN	60	TH 62 LT CSAH17 RT/WINDOM	30	★	★		★	★	★		★★★★★	$351,600
6	7.015.009	MN	15	ADAMS AVEM 298/FAIRMONT	30	★	★		★	★	★		★★★★★	$309,600
7	7.013.018	MN	13	13TH AV NWM 102 LT/WASECA	30	★	★		★	★	★		★★★★★	$241,000
8	7.071.019	US	71	N JCT TH 60/WINDOM	45	★		★	★	★	★		★★★★★	$140,200
9	7.013.005	MN	13	STATE ST/8TH ST WASECA	45	★		★	★	★	★		★★★★★	$0
10	7.059.005	US	59	GRAND AVEM 64/WORTHINGTN	35	★	★		★		★		★★★★	$11,692,400

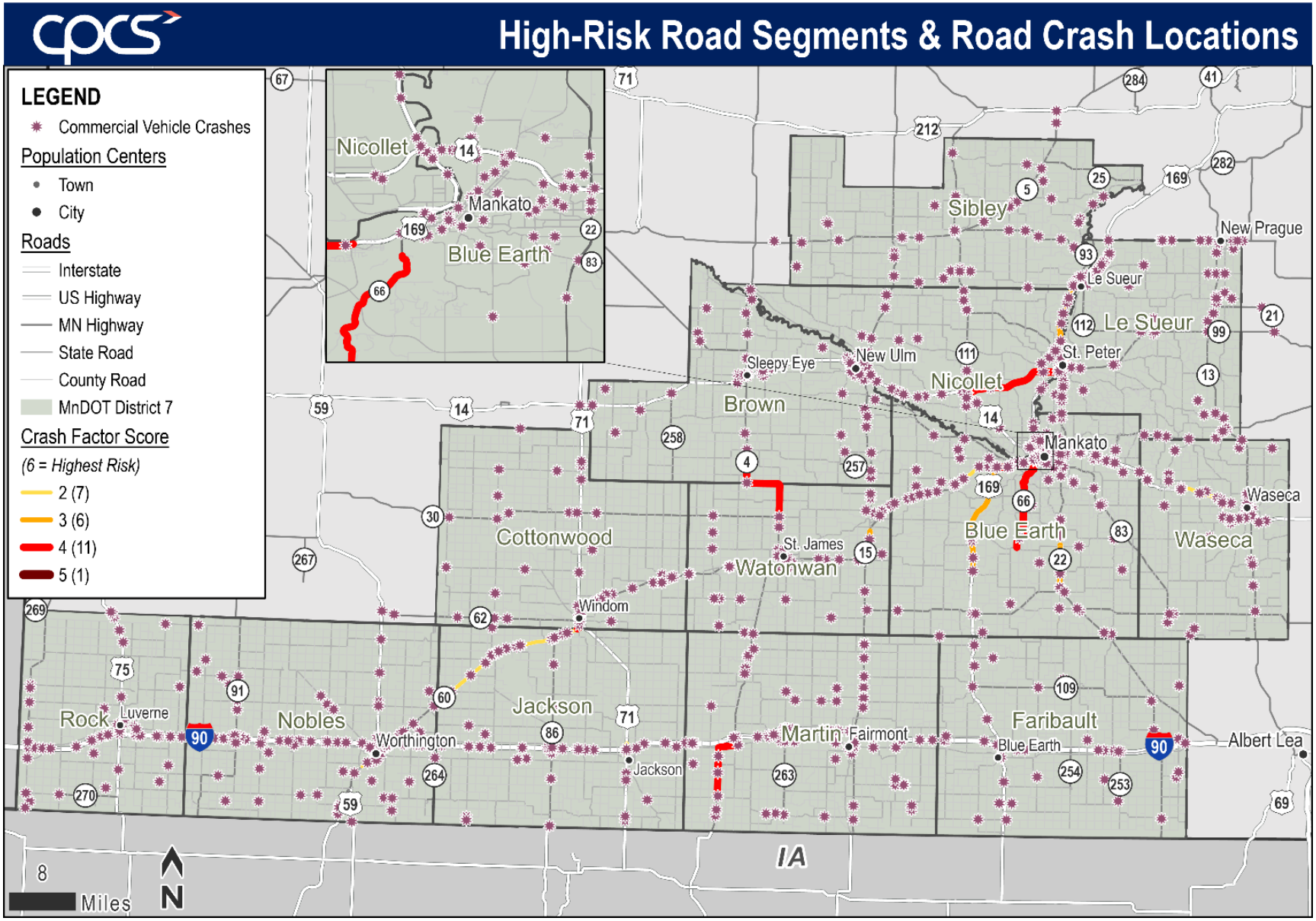
Source: MnDOT District Safety Plans, 2016.

- MN-4 south of I-90 in Martin County

Figure 59 shows the District 7 highways that are considered "high-risk" in addition to the locations of truck crashes. The areas with a higher risk in District 7 are:

- CSAH 1 south of its interchange with US-169
- MN-99 east of its interchange with US-14
- MN-4 in the southern portion of Brown County and the northern portion of Watonwan County
- MN-4 south of I-90 in Martin County

Figure 59: High-Risk Road Segments



Source: CPCS analysis of MnDOT crash data from 2013- 2020, District Safety Plan Updated, 2016.

Figure 60 displays a summary of the count of higher-risk network elements in District 7 and Minnesota (not including the Metro District). As shown, the number of qualified safety projects corresponds with the percentage of severe crashes at qualified locations. To better inform future freight-related safety improvements, District 7 could consider conducting a freight-specific risk analysis targeted to truck-related issues (i.e. the potential need for acceleration/deceleration, roadway shoulders, and turning lanes).

Figure 60: Systemic High-Risk Locations in District 7 and Minnesota (not including the Metro District)

	Intersections		Road Segments		Curves	
	Qualified Projects	% Severe Crashes at Qualified Locations	Qualified Projects	% Severe Crashes at Qualified Locations	Qualified Projects	% Severe Crashes at Qualified Locations
District 7	128	44%	45	25%	150	54%
Remainder of MN Total	1,206	59%	584	55%	1,434	64%
District 7 Share of MN Total	9.6%	-	7.2%	-	9.5%	-

Source: CPCS analysis of MnDOT 2016 District Safety Plan Update. 2021.

Grade Crossing Safety

One of the major concerns related to freight rail is the safety of railroad grade crossings. By analyzing grade crossing safety in Minnesota, MnDOT can make informed decisions on how to improve safety at grade crossings through infrastructure investment. Traditionally, grade crossing safety analysis uses multiple factors to assess crash risk at rail grade crossings, including: speed of rail traffic, speed of road traffic, number of tracks, level of protection (gates, lights bells, etc.), sightlines, and other geometric factors.

Between 2010 and 2019, District 7 experienced 51 incidents at its rail grade crossings, 2 of which were fatal and 17 of which resulted in injuries. A breakdown of this is shown in Figure 61, which further breaks down the information by passively and actively-protected rail grade crossing sites.

Figure 61: District 7 Public Grade Crossing Crashes (2010-2019)

Crossing Type	Property Damage Only	Injury	Fatality	Total
Passively-protected	6	6	1	13
Actively-protected	26	11	1	38
Total	32	17	2	51

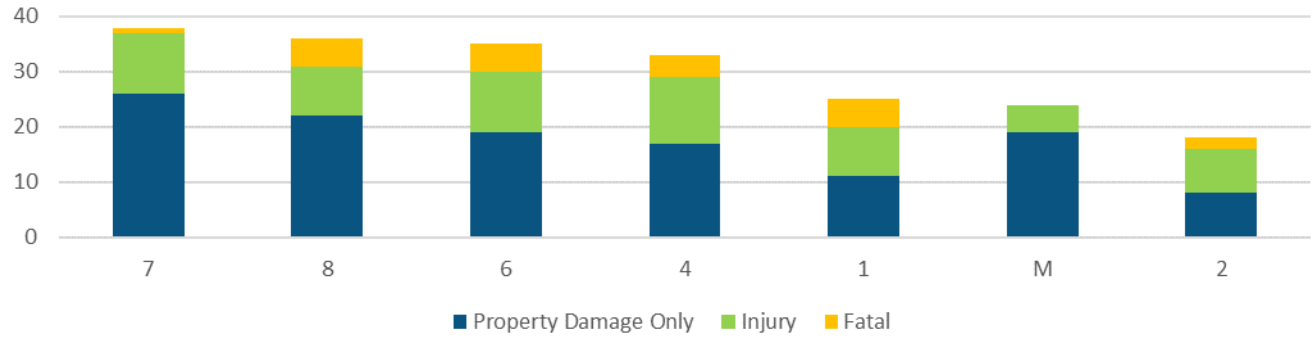
Source: CPCS analysis of MnDOT Rail Grade Crossing Safety Data. 2021.

Between 2010 and 2019, District 7 had the greatest number of passively-protected public grade crossing crashes among all MnDOT Districts, but it had the third-lowest count of crashes at actively-controlled public grade crossings.

Figure 62 and Figure 63 show the number of crashes at passively and actively-protected public grade crossings by MnDOT District between 2004 and 2013. District 7 had the most crashes at passively-protected public grade

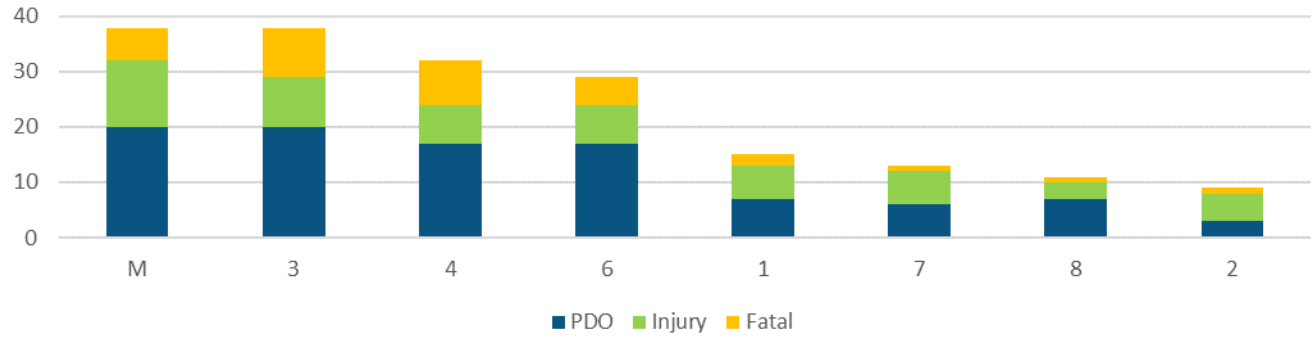
crossings; however, the District had a below-average amount of crashes at actively-protected public grade crossings. Figure 64 displays the location of public grade crossings incidents that occurred in the District between 2010 and 2019.

Figure 62: Crashes at Passively-Protected Public Grade Crossings by District (2010-2019)



Source: CPCS analysis of MnDOT Rail Grade Crossing Safety Data, 2021.

Figure 63: Crashes at Actively-Protected Public Grade Crossings by District (2010-2019)

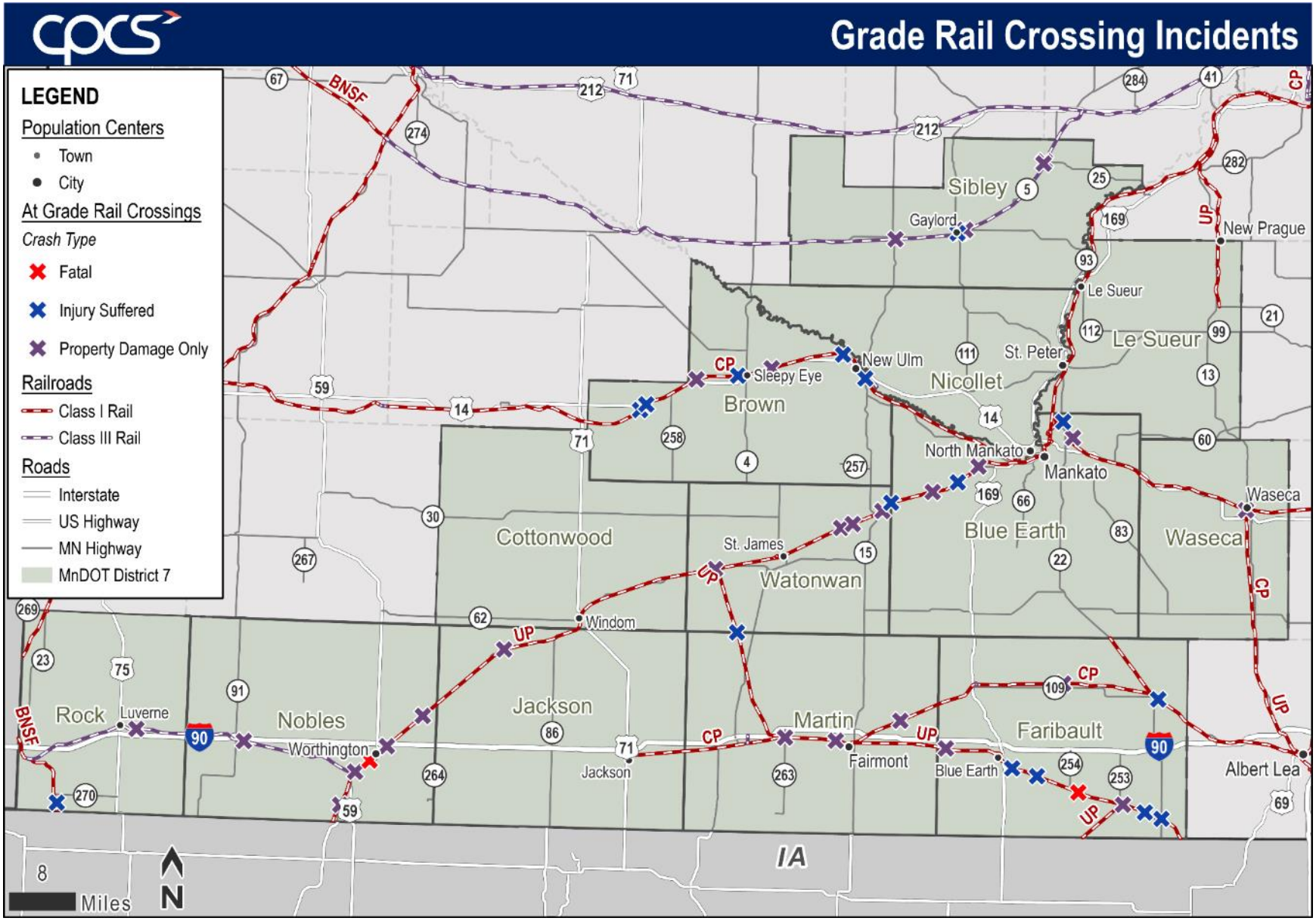


Source: CPCS analysis of MnDOT Rail Grade Crossing Safety Data, 2021.

MnDOT uses several factors to calculate rail crossing risk, including road and rail traffic at the crossing, speed limits, number of tracks, angle of crossing (or skew), sight distances, and distance to other rail crossings or road intersections. Based on each of these factors, a numbered risk rating between 0 and 9 is assigned to each crossing, with a risk rate of 8 or 9 indicating the highest level of safety hazard. According to MnDOT, safety issues at the rail crossings with ratings of 8 and 9 identified in the 2016 Safety Report have already been studied further and addressed if needed. MnDOT has also studied crossings with a rating of 7 and has partially examined crossings rated 6. [24] The risk factors at passively-protected and actively-protected grade crossings are shown in Figure 65 and Figure 66. As the figures show, fatal and injury rail crossing incidents occurred at random locations in District 7. However, there was somewhat of a high volume of crashes in and around Mankato and in the southeastern portion of the District.

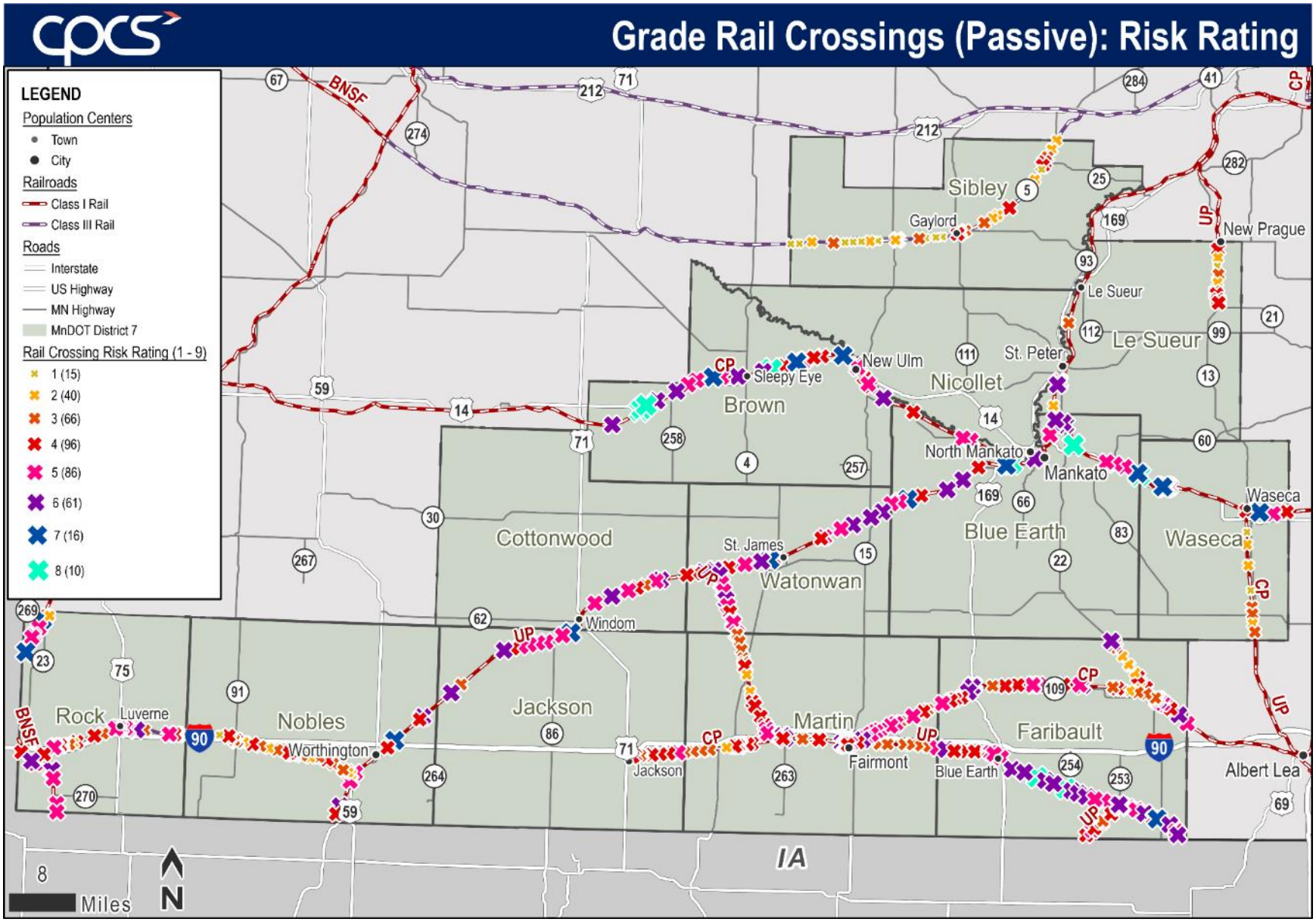
[24] MnDOT, Rail Safety and Education, accessed 2021. https://www.dot.state.mn.us/ofrw/railroad/safety.html

Figure 64: Rail Grade Crossing Incidents in District 7 (2010-2019)



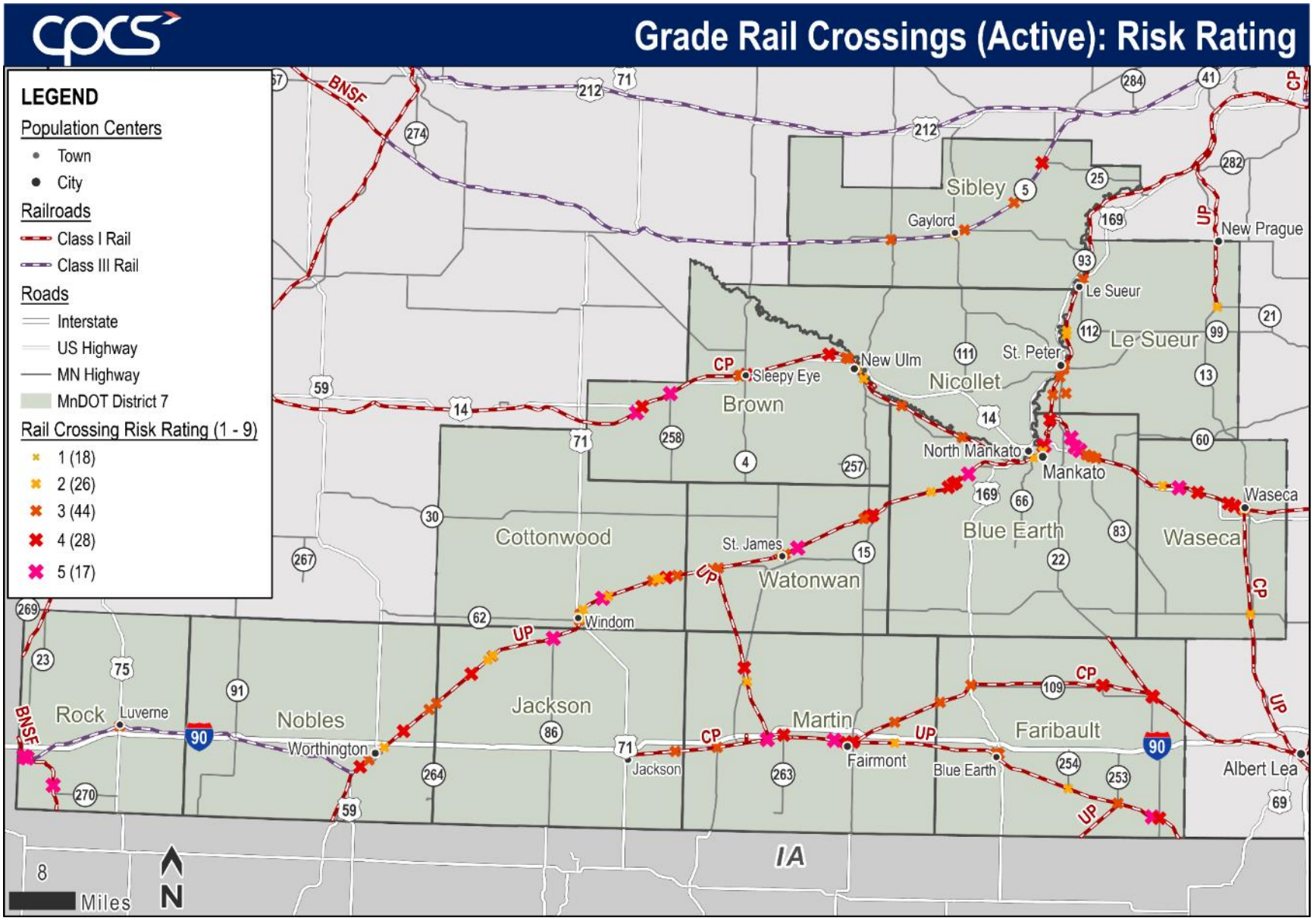
Source: CPCS analysis of MnDOT Rail Grade Crossing Safety Data. 2021.

Figure 65: Passively-Protected Crossing Risk Ratings in District 7



Source: CPCS analysis of MnDOT 2016 Rail Grade Crossing Safety Data. 2021

Figure 66: Actively-Protected Crossing Risk Ratings in District 7



Source: CPCS analysis of MnDOT 2016 Rail Grade Crossing Safety Data. 2021.

The District's passively-protected public grade crossings have risk factors between 2 and 6. There are a few locations where the risk factors are higher, particularly on UP and CP track near Mankato and CP track in Brown County. Actively-protected public grade crossings in District 7 primarily have risk ratings between 3 and 5. Similar to passively-protected crossings in the District, actively-protected crossings with a higher risk rating occur around Mankato and in Brown County. There are also a few high-risk locations in Martin and Faribault Counties.

3.3 Mobility

Efficiency is a critical component of performance for freight transportation because efficient movement is cost-effective movement. Since freight transportation significantly supports District 7's economic vitality and well-being, a transportation system that is relatively expensive and unreliable can represent a threat to the economic well-being of District 7's communities. Four measures were evaluated to understand District 7's freight mobility:

- Truck travel speed, a measure of overall mobility;
- Travel Time Index (TTI), a comparison of travel speeds between free-flow and peak travel times;
- Travel Time Reliability (TTR), a measure of the variability of travel speeds; and
- Bridge vertical clearances and oversize-overweight (OSOW) load restrictions, measures of the system's ability to accommodate oversize-overweight loads.

Many of these measures were evaluated using one year's worth of truck GPS probe data from 2019, which was aggregated and analyzed through StreetLight – a data platform that provides big data analysis tools for the evaluation of traffic mobility. This GPS probe data was primarily generated by GPS tracking devices installed by private trucking companies and used to monitor fleet performance and driver behavior. The GPS units transmit data back to centralized computer systems regularly. Aggregated data from hundreds of companies and thousands of trucks can be used to measure traffic speed and system performance.

Using and Interpreting StreetLight Data

Data and performance measures extracted from StreetLight can provide an understanding of traffic phenomena. However, the tool has some limitations, detailed below:

- StreetLight's input data favors larger commercial fleets due to the use of standardized GPS tracking systems across all their vehicles. By comparison smaller fleets and owner-operators are less likely to have large standardized systems passing data to Streetlight's vendors, and therefore smaller fleets, and owner-operators are likely to be less-represented in the data;
- Given the consideration above, industries primarily served by smaller truck fleets or individual owner-operator truck drivers, such as logging, agriculture, and some manufacturing will be less-represented in the data;
- StreetLight's underlying data sources often rely on cell phone coverage to collect GPS data, and therefore insight into traffic in areas without cell phone service may be unavailable or less-reliable.

Therefore, the relatively small sample of trucks and vehicles used to compute results may not be representative of all road users. Consultations with companies and individuals in these industries will be used to address these data gaps and ensure the plan has a holistic view of freight needs and issues.

Truck Speed

Figure 67 displays the average speed along highways and other local roadways in District 7 during peak periods. As shown, slower average truck speeds congregate along major highways, such as I-90, US-169, and US-14 in

addition to larger urban areas, such as Mankato, St. Peter, Fairmont, and Waseca. As the roadway network moves further away from Mankato into rural areas, average speeds begin to increase to between 41 and 55 miles per hour and in many cases, above 55 miles per hour.

Travel Time Index

Travel Time Index (TTI) ratio is used to better understand a roadway's congestion levels. TTI is the ratio of travel time along a particular segment of a roadway to the same segment when vehicles are traveling at free-flow speeds.

For District 7, Streetlight data was used to calculate TTI. The Streetlight tool provides the ratio of average and free-flow trip speeds along each segment on the road network, using the following formula:

Truck Travel Time Index = Average Truck Trip Speed/Free Flow Truck Speed

where Free Flow Trip Speed is the maximum average trip speed observed in any 1 hour of a single day, averaged over all days in the data period. Free Flow Trip Speed is calculated through the following procedure:

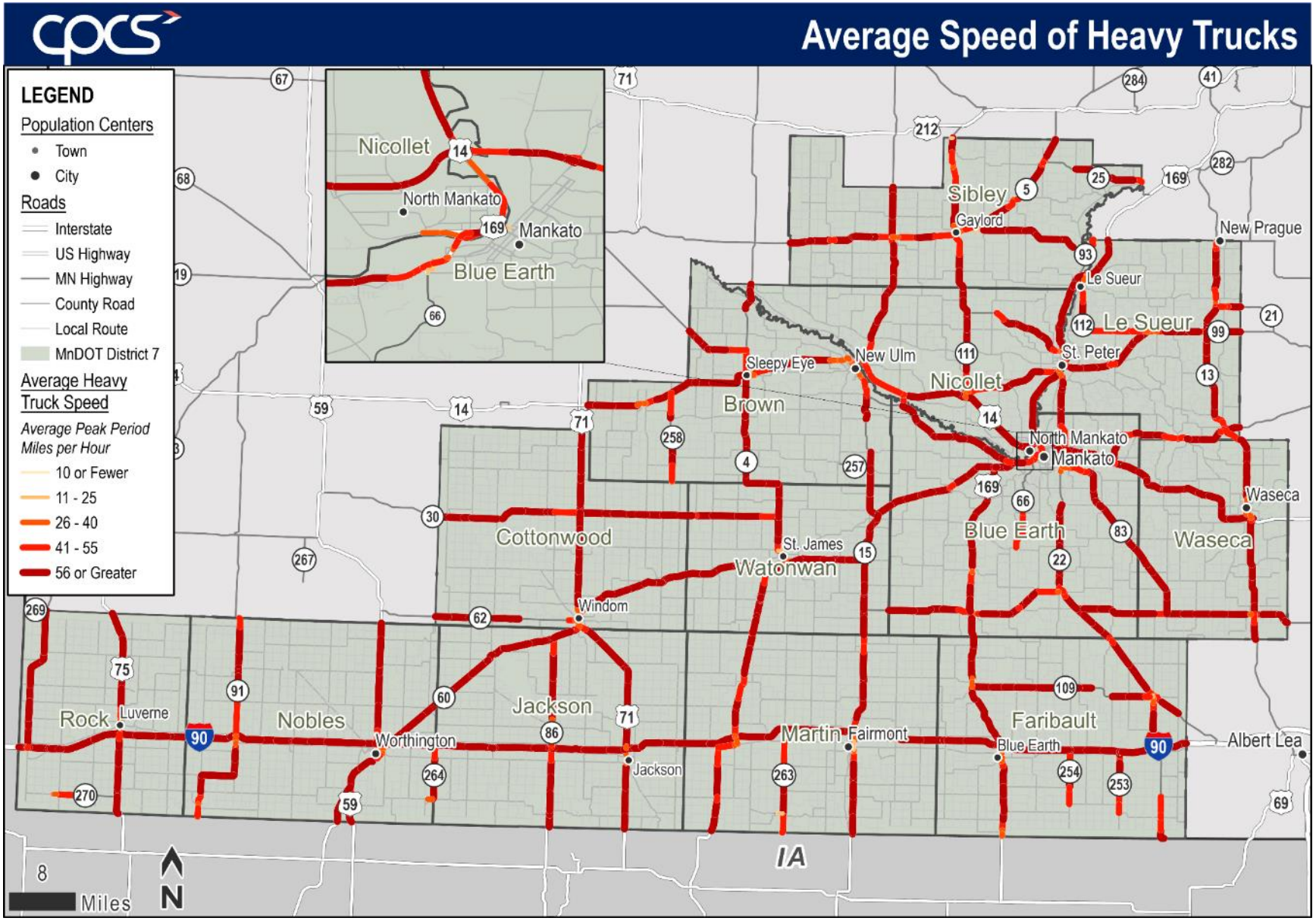
1. Calculating the average speed of all trips for every 1-hour time window on a specific day (24 windows);
2. Taking the maximum of 24 average speeds;
3. Repeating steps 1 and 2 for all days in the data period;
4. Taking the average of all maximum average trip speeds, which will be the Free Flow Trip Speed for a given segment for the data period.

TTI calculation using StreetLight data nearly always produces values equal to or less than one since the Free Flow Trip Speed (the denominator in the TTI formula) is calculated dynamically from the data and not based on static parameters like the posted speed limit. Therefore, to better understand congestion at peak times, the TTI measures calculated based on StreetLight data for the AM and PM peak periods (6-10 am & 3-7 pm, respectively) are averaged, and the result is displayed in percentage of peak period free-flow speeds for each road segment (Free Flow Factor). Figure 68 shows the Free Flow Factors (FFF) for heavy-duty truck trips, while Figure 69 shows the FFFs for passenger vehicles.

FFFs shown in these maps indicate the relative "slowness" of traffic; for instance, FFF values of 80 percent or greater mean that traffic is moving at 80 percent of free-flow speeds, while FFF values of 20 percent indicate that the traffic is moving at speeds equal to 20 percent of free-flow speeds. Therefore, FFF measure reveals areas where traffic congestion may be more likely, particularly at peak times.

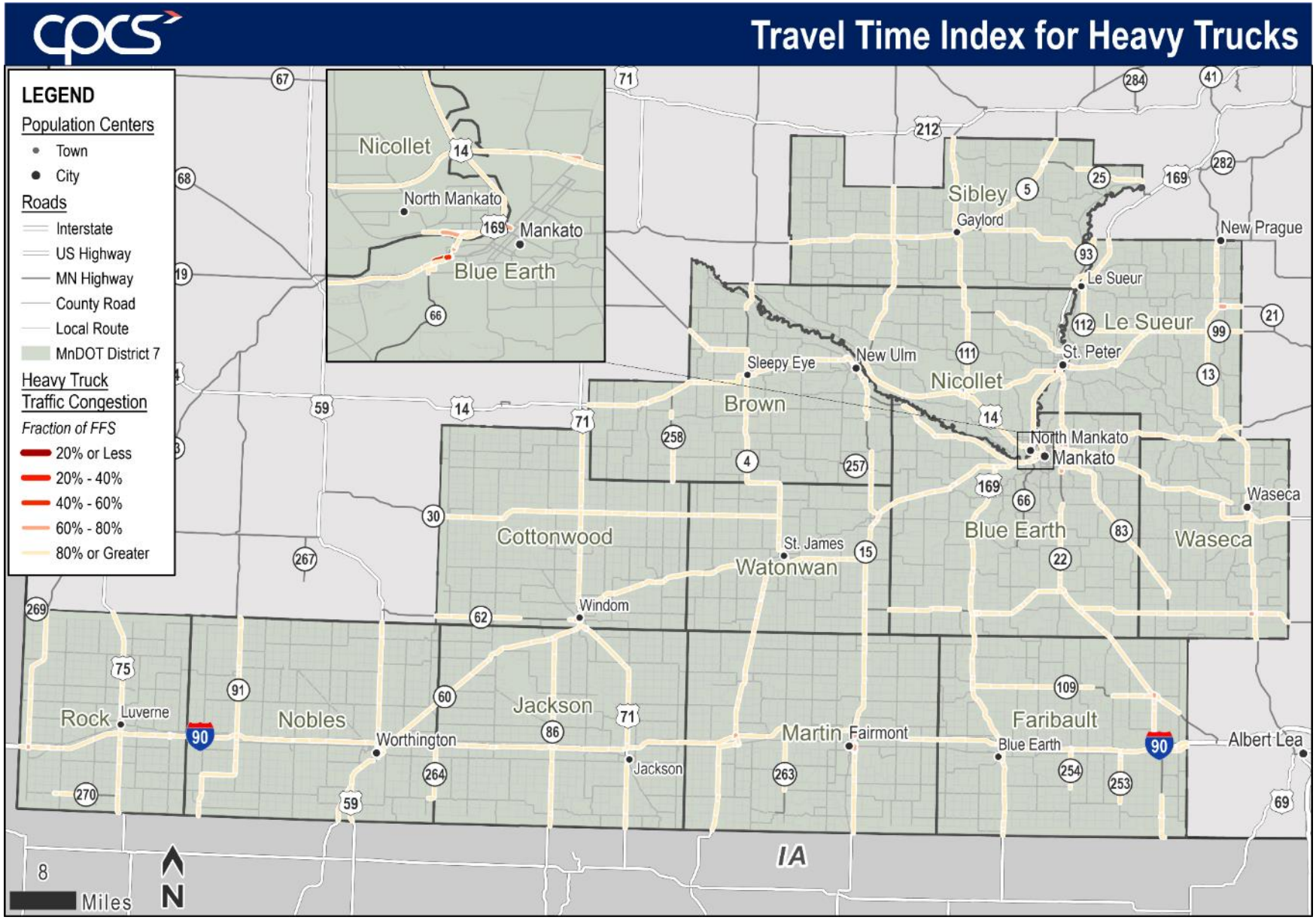
As seen in Figure 68 and Figure 69, the District's highways and corridors do not experience significant peak-time congestion due to trucking activities, besides in and around Mankato where US-169 and US-14 intersect. Similarly, the peak-time congestion for personal vehicles is sporadically high at random segments in District 7, particularly in Mankato/North Mankato, Eagle Lake, Lake Crystal, and New Ulm. For both heavy trucks and personal vehicles, the lowest FFF values (corresponding to high congestion) occur most commonly at intersections, interchanges, and the partial road segments in their vicinity. This pattern is likely a statistical effect deriving from the low sample counts on the freight network.

Figure 67: Average Speed of Heavy Trucks in District 7 (2019)



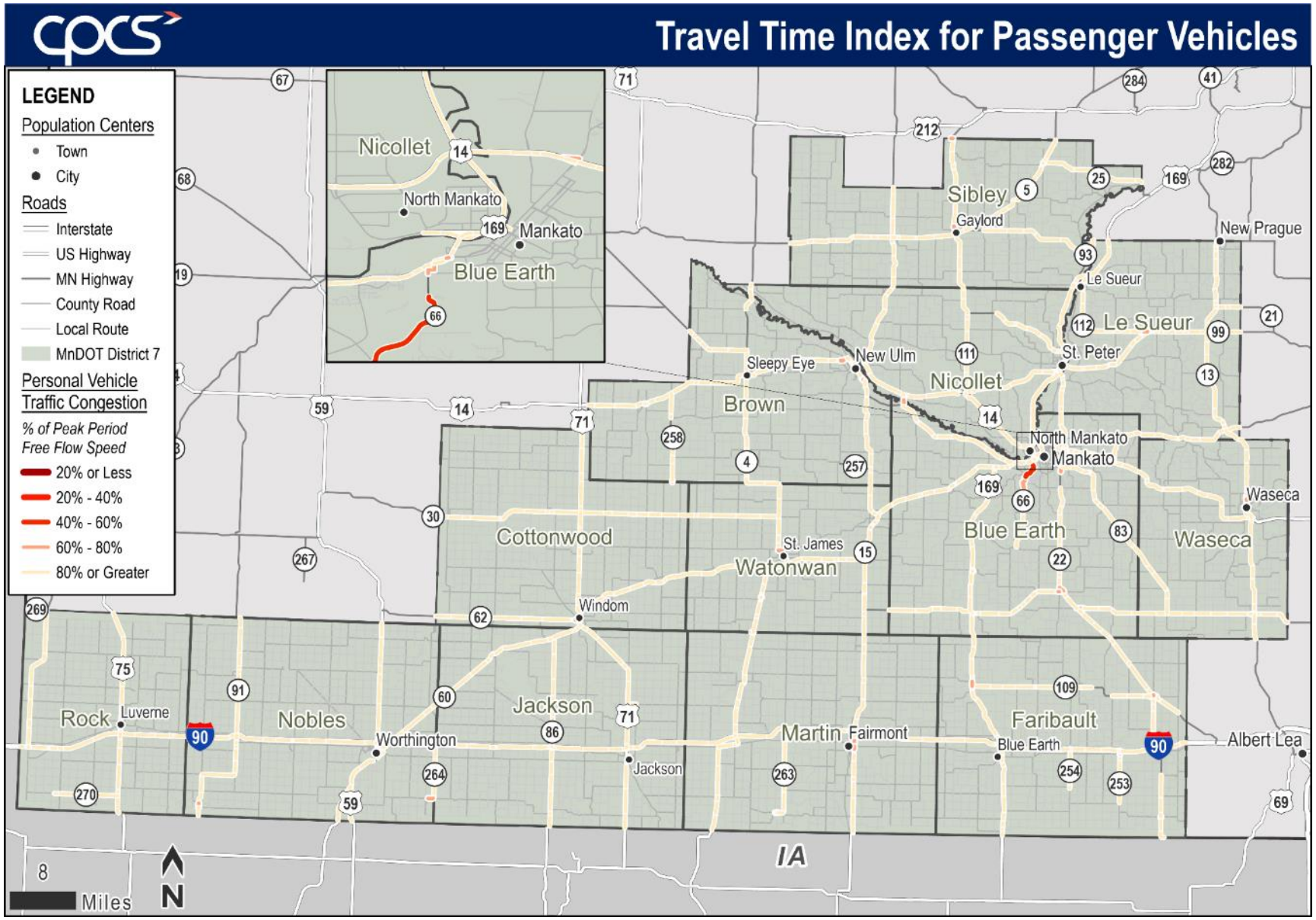
Source: CPCS analysis of StreetLight Data. 2021.

Figure 68: Travel Time Index for Heavy Trucks in District 7 (2019)



Source: CPCS analysis of StreetLight Data. 2021.

Figure 69: Travel Time Index for Passenger Vehicles in District 7 (2019)



Source: CPCS analysis of StreetLight Data, 2021.

Travel Time Reliability

Travel Time Reliability (TTR) is a measure of the consistency of travel times or the degree to which delays are unexpected. TTR is important because businesses and commuters may be able to plan trips to accommodate peak congestion, but unexpected delays cannot be planned for and can disrupt operations. TTR is not directly provided by the outputs of StreetLight's analytics tools. Consequently, for this plan, TTR was calculated for both personal vehicles and trucks through interpolation of the results and data that were available. Travel Time Reliability is calculated using the following formula:

Truck Travel Time Reliability = 50^{th} % Truck Travel Speed/95^{th} % Truck Travel Speed[25]

As Figure 70 and Figure 71 show, travel times in the region are more variable along major highway corridors, including US-169, US-14, I-90, and MN-60. On these maps, darker colors correspond to routes with higher TTR values. These higher TTR values mean that these routes have a relatively high amount of travel time variability and it may be more difficult to plan for reliable travel times along them. A few routes and corridors with higher variability in travel times include:

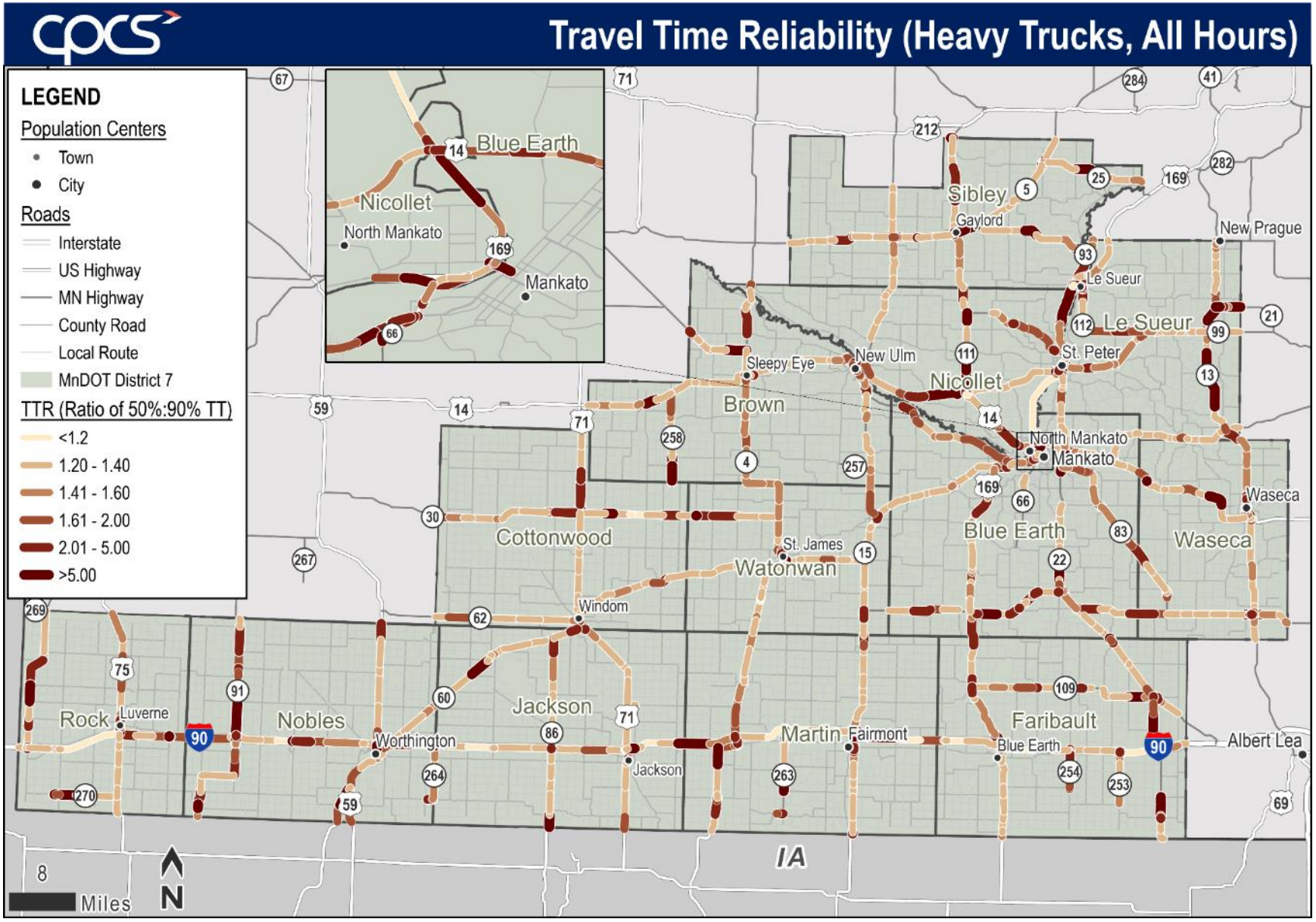
- US-169 intersecting with US-14 in Mankato
- MN-91 intersecting with I-90 in the western portion of Nobles County
- US-169 southwest of Le Sueur to St. Peter.

Concurrent analysis of TTI and TTR measures for District 7 show that mobility challenges are more closely related to the general performance characteristics of trucks, such as their slow speed and heavy mass, and the need for infrastructure such as turning lanes and passing lanes to support safe truck movements.

Truck congestion and travel speeds are not a concern in District 7; however, infrastructure investments can further enhance reliable and efficient freight mobility.

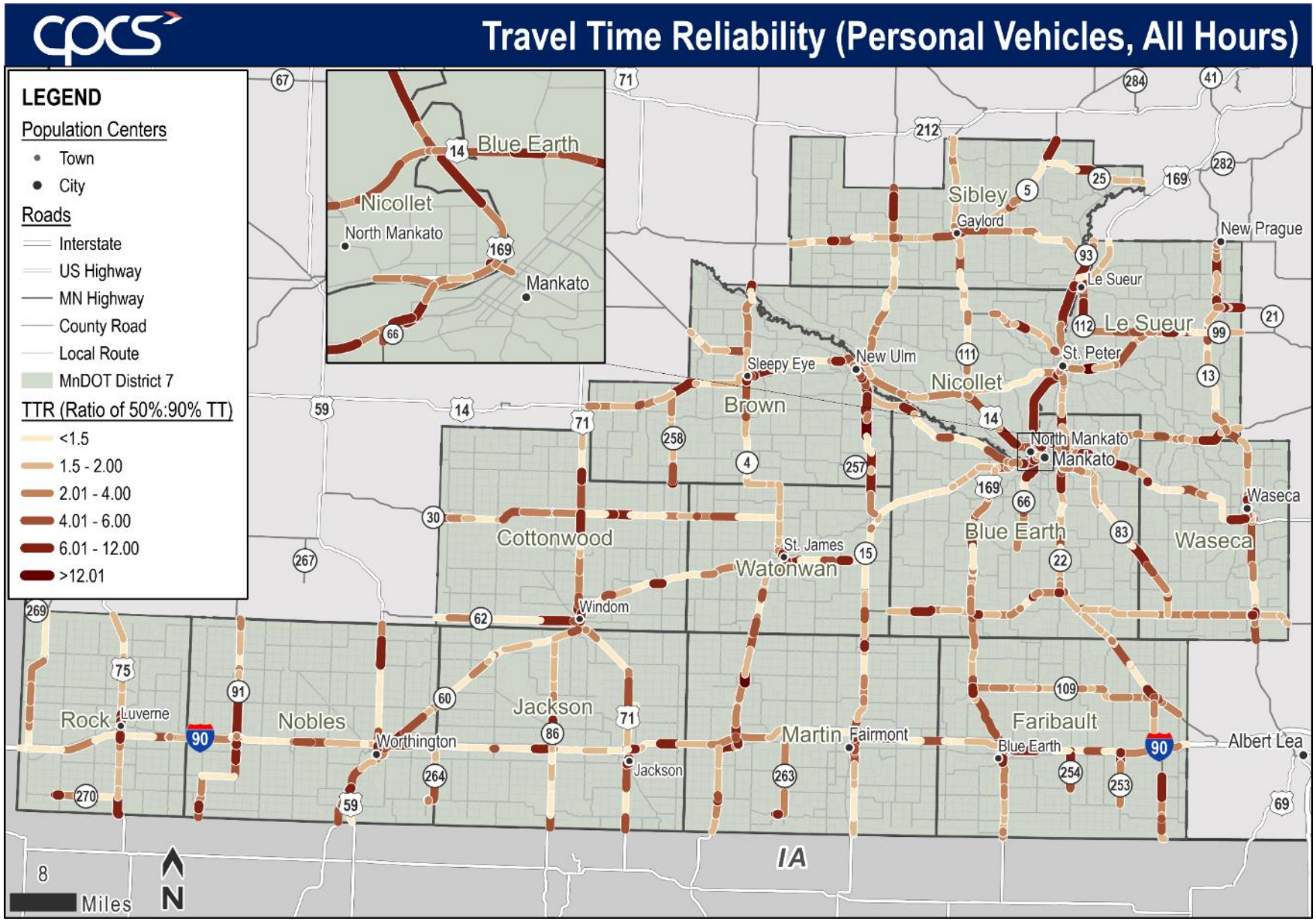
[25] StreetLight's results provide information on the percentage of trips that fall into specified bins of speed and duration. For example, it is known that, for a given segment, 3 percent of trips had an average speed between 10 and 20 miles per hour. StreetLight's results provide up to 50 speed and duration bins with a range of no less than 1 mph or 1 minute each. These percentages were used to locate the bin in which the 50th and 95th percentile travel speeds occurred, and interpolation was used to estimate the final values used to calculate TTR.

Figure 70: Travel Time Reliability for Heavy Trucks (2019)



Source: CPCS analysis of StreetLight Data. 2021.

Figure 71: Travel Time Reliability for Passenger Vehicles (2019)



Source: CPCS analysis of StreetLight Data. 2019.

OSOW Operations

In 2016, 1,801 permits were issued to OSOW trips either starting or ending in District 7. This represented about 16 percent of the total permits issued in Minnesota for the year. Figure 72 provides a list of MnDOT's permit categories.

- **Transactional permits** are considered to have dimensions that present minimal problems for routing.
- **Collaborative permits** require more coordination, and MnDOT OSOW analysis documents note that "improvements to existing infrastructure that accommodate the collaborative range of dimensions could have the biggest impact in the overall movement of OSOW."[26]
- **Consultative permits** are related to "megaloads" or "superloads," where unique planning processes are required for each move.

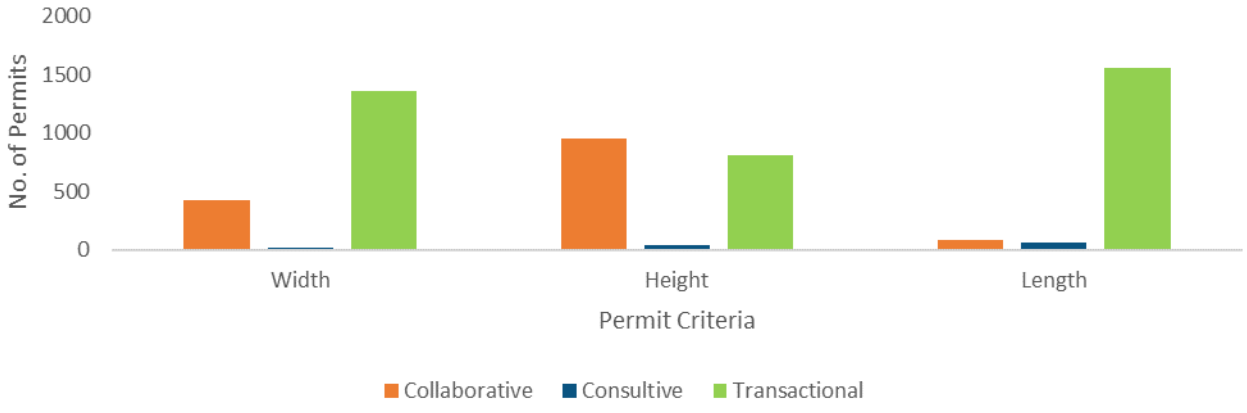
Figure 72: MnDOT OSOW Permit Types and Criteria

Permit Type	Height	Width	Length	Gross Vehicle Weight (1000s of lbs)
No Permit	Up to 13.5 feet	Up to 8.5 feet	Up to 75 feet	Up to 80
Transactional	13.5 to 15 feet	8.5 to 15 feet	75 to 140 feet	80 to 187
Collaborative	15 to 16.5 feet	15 to 17 feet	140 to 180 feet	187 to 255
Consultative	Over 16.5 feet	Over 17 feet	Over 180 feet	Over 255

Source: MnDOT Oversized/Overweight Permit Data, 2016.

Figure 73 shows the breakdown of the dimensions listed in 2016 permits for District 7 in addition to the load dimensions into each permit type. Most of the permits issued for movements in District 7 fall under the "transactional" classification for width and length, while collaborative and transactional permits were common for height.

Figure 73: Height, Width, and Length on OSOW Permits with Origin or Destination in District 7 (2016)



Source: CPCS analysis of MnDOT OSOW data. 2021

[26] MnDOT OFCVO.

A portion of MnDOT's 2016 OSOW data did not include weight information, and approximately 64 percent of the loads with origins or destinations in District 7 had weight information – most of which were transactional or collaborative. There were 17 permits issued in District 7 in 2016 that were consultive for weight.

Based on analysis for OSOW permitting and bridge clearance data, some corridors in District 7 pose restrictions to certain OSOW movements, which are listed below:

- I-90 is a superload corridor but has vertical restrictions in District 7, particularly in Rock, Nobles, Jackson, and Martin County.
- MN-30 on the eastern portion of Watonwan County through Waseca County has some OSOW restrictions.
- US-169 is a superload corridor with some bridge and OSOW restrictions along its route in District 7.
- US-71 in the northern portion of Cottonwood County has a few bridge restrictions.
- MN-15 from northern Watonwan County to its intersection with MN-60 has a few bridge and OSOW restrictions.

The consequences of OSOW restrictions are that oversized trucks may be required to avoid these routes, which leads to longer travel times, more fuel emissions, higher costs, and reduced availability of shipments. Additionally, it increases the amount of time carrying heavy loads on District 7's roads, which may worsen pavement condition.

3.4 Condition

Maintaining the physical condition of infrastructure is crucial to ensuring the long-term reliability, efficiency, and safety of freight movements. Poor infrastructure can lead to delayed transportation, damaged commodities, and unsafe conditions for freight operators and the public. Condition analysis and understanding can drive decisions made relating to inspection, maintenance, and construction investments. District 7's condition analysis focuses on pavement and bridges and utilizes information compiled by MnDOT's Central Office and District 7.

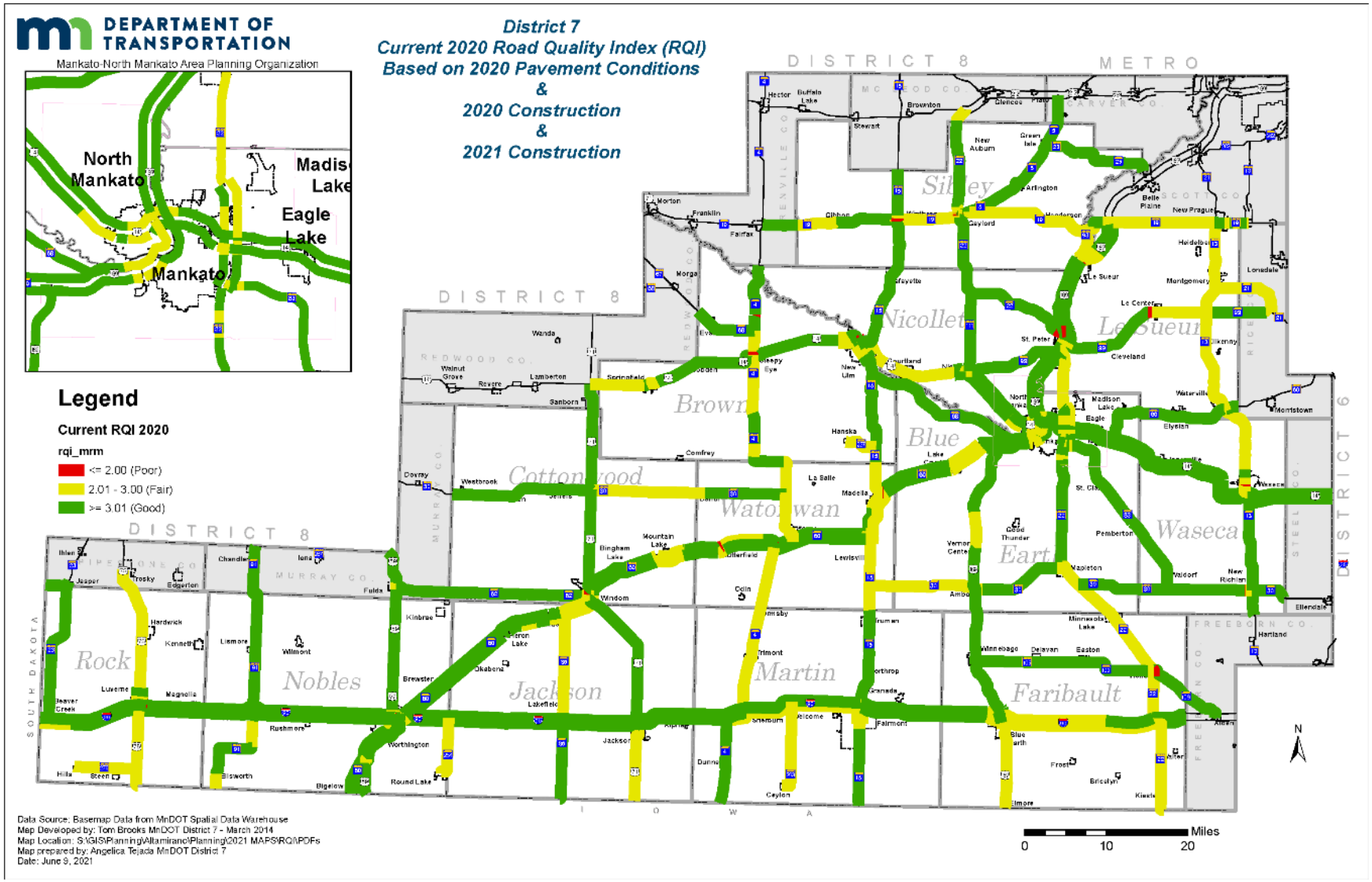
Pavement Condition

Pavement condition data is collected using MnDOT's Digital Inspection Vehicles (DIV) that utilize laser measurement devices. DIVs take measurements of the pavement's longitudinal profile every 1/8" while traveling at a full highway speed.

These real-world measurements are input into a model that calculates pavement condition indices, including Ride Quality Index (RQI), which is highlighted for District 7 in Figure 74. RQI uses a zero to five scale that measures ride smoothness: the higher the number, the "smoother" the ride. Road segments with RQI ranging between 3 and 5 are considered in good condition. Meanwhile, segments with RQI of 2 to 3 are in fair condition, and segments with RQI of lower than 2 are in poor condition.

As shown, most of the pavement in District 7 is in good or fair condition, or is expected to be in good condition after the 2021 construction season. However, there are a few small segments where the pavement condition is poor, particularly in Nicollet, Le Sueur, and Faribault counties.

Figure 74: District 7 Expected Pavement Conditions



Source: MnDOT District 7. 2021.

Bridge Condition

Figure 75 shows the road bridge inventory of District 7 by county. Interstate bridges are in Faribault, Jackson, Martin, Nobles, and Rock counties. Among all the counties in District 7, Martin County has the highest number of bridges. In terms of bridge Sufficiency Rating (SR), District's bridges are on average serviceable. SR of a bridge is calculated based on a percentage scale of 0 through 100, and is used to establish federal funding eligibility and priority for bridge replacement and rehabilitation. SR is a measure of the sufficiency of a bridge for remaining in service and is calculated based on factors such as structural adequacy and safety, functional obsolescence (deck geometry, waterway adequacy, etc.), and importance for public use. An average SR higher than 80 indicates serviceability, while SRs equal to or lower than 80 indicate eligibility for receiving federal funding for improvement projects under Highway Bridge Program funds. The average bridge sufficiency ratings in counties in the District is above 90, except for Waseca County.

Figure 75: Count, Average Age and Condition of Bridges 10 Feet and Over (2019)

County	Interstate	Trunk Highway	County Road	Other Local Road	Total	Average Age	Average Sufficiency Rating
Blue Earth	0	59	131	67	257	36	93
Brown	0	18	67	79	164	39	93
Cottonwood	0	25	93	118	236	41	94
Faribault	24	22	105	146	29	36	90
Jackson	17	16	101	115	249	35	91
Le Sueur	0	27	62	22	111	40	94
Martin	35	12	74	107	228	44	90
Nicollet	0	28	47	26	101	30	95
Nobles	27	28	139	218	412	38	93
Rock	21	20	145	190	376	30	95
Sibley	0	25	67	65	157	24	96
Waseca	0	27	64	31	122	34	89
Watonwan	0	31	97	90	218	38	95
Total	**124**	**338**	**1,192**	**1,274**	**2,928**	**36**	**93**
% of MN	**9.76%**	**10.15%**	**15.31%**	**17.22%**	**14.80%**	**-**	**-**

Source: MnDOT, Minnesota Bridges, 2021.

Deficient structures are either Structurally Deficient (SD) or Functionally Obsolete (FO) structures. SD condition is assessed based on the bridge deck, superstructure, substructure, and culverts' water adequacy conditions. FO appraisals are based on deck geometry, under clearance, and the condition of approaching roadway. A bridge that is considered "deficient" also has a sufficiency rating of 80 or less.[27] Figure 76 shows that over a quarter of the deficient bridges are on the county system, which could limit the last and first-mile truck transportation. On the other hand, the low deficient rates on the trunk highway system demonstrate that the District has relatively well-preserved infrastructure for freight movements.

[27] MnDOT, Bridge and Structure Inspection Program Manual, 2019.

In District 7 there are 126 deficient bridges, accounting for 4.3 percent of all bridges in the District. Faribault County has the highest number of deficient bridges, followed by Martin County, Blue Earth County, and Rock County.

Figure 76: Counts of Deficient Bridges, by System and County (2018)

County	Trunk	County	Township	City	Total
Blue Earth	2	12	0	0	14
Brown	0	2	3	0	5
Cottonwood	0	2	5	0	7
Faribault	0	12	15	0	27
Jackson	0	7	6	0	13
Le Sueur	1	2	0	0	3
Martin	0	4	12	1	17
Nicollet	1	1	1	0	3
Nobles	1	2	3	2	8
Rock	0	8	3	3	14
Sibley	1	3	1	0	5
Waseca	0	5	1	0	6
Watonwan	0	2	2	0	4
Total	**6**	**62**	**52**	**6**	**126**
% of District 7's Total Bridges	**5.36%**	**26.50%**	**5.95%**	**16.67%**	**4.30%**

Source: MnDOT, Minnesota Bridges, December 2018.

4 Conclusions and Next Steps

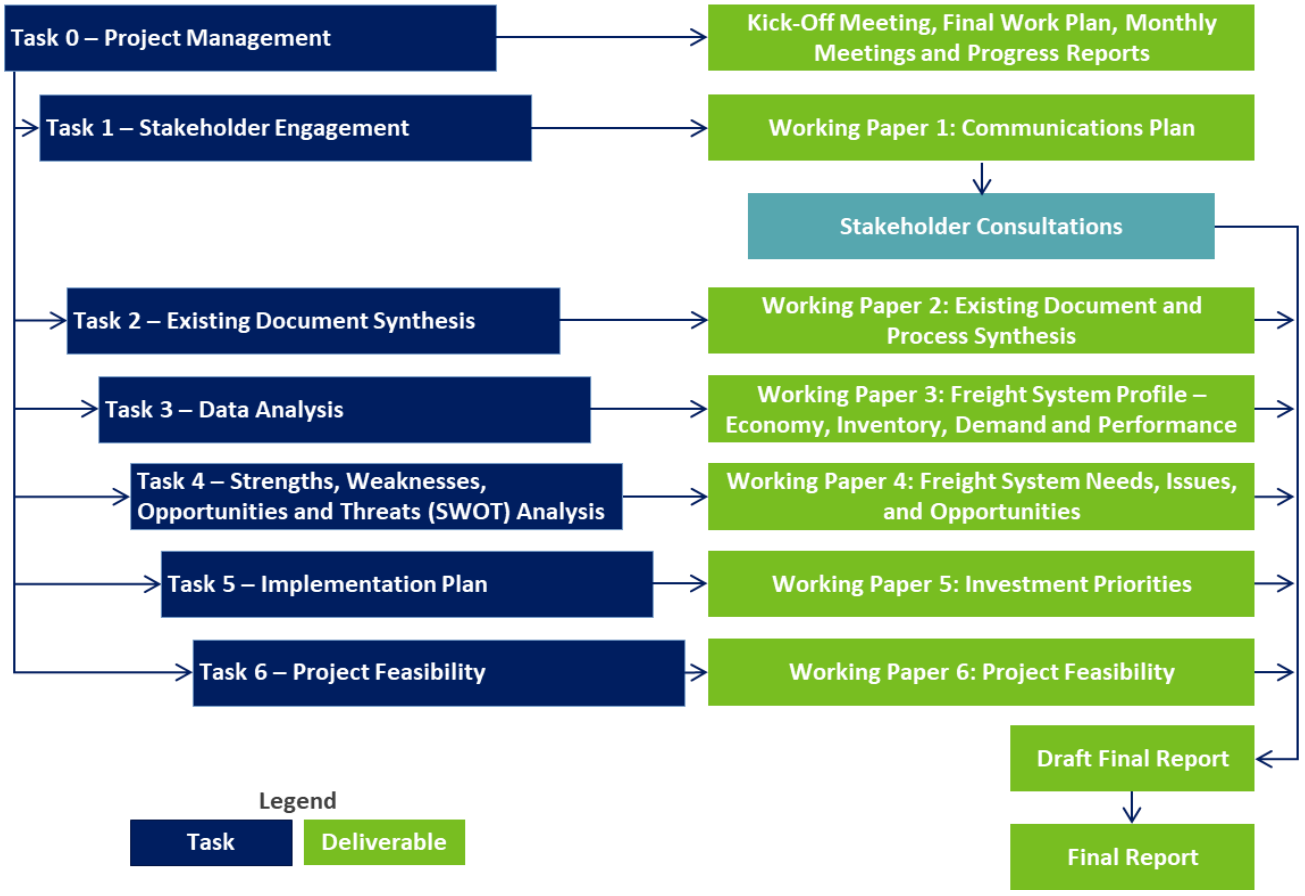
4.1 Conclusions

District 7's freight network is a critical component and driver of the economic vitality of the region. Also, while traffic congestion is not a significant issue in District 7, truck safety is a potential area for further investment due to ongoing truck-involved crashes happening District. It will be important to consider the above factors (in addition to grade crossing safety) when prioritizing infrastructure improvements as poor infrastructure and safety conditions can lead to problems moving goods.

4.2 Next Steps

Figure 77 shows the overall District 7 Freight Plan project approach and flow. This Working Paper addresses Task 3 (Data Analysis) and will be further added to once stakeholder consultations are held. The data analysis from this Working Paper and information from the stakeholder consultations will inform Task 4 – Strengths, Weaknesses, Opportunities, and Threats (SWOT) of District 7's freight system and Working Paper 4.

Figure 77: District 7 Freight Plan Project Approach



Source: CPCS

Appendix A Freight-Related Industry Detailed Location Quotient and Shift Share Analysis Methodology

Location Quotient Analysis

Location Quotients use employment as a proxy for regional strength due to the availability of data. As with all economic models, certain assumptions are made to analyze across different variables. Using both Location Quotients and the Shift Share Analysis more accurately depicts regional strength. The Location Quotient methodology makes the following assumptions about the US economy:

- **Uniform labor productivity:** labor productivity is the measure of economic output per labor hour, meaning the region's real Gross Domestic Product is divided by aggregate labor hours in the region. Changes in labor productivity depend on investments and savings, new technologies, and human capital. Industries located in different regions in the US may not have the same labor productivity as there are differences in infrastructure investments, tax and other regulatory policies, educational opportunities, technology investments by businesses, and so on.
- **Identical consumption between local regions:** this factor is also not expected in the real economy. Different regions also consume different baskets of goods based on geographic availability, cultural preferences, and socioeconomic levels. However, freight-dependent commodities in mining, agriculture, and forestry/fishing tend to be less substitutable goods (many agricultural goods and paper products) or those with a higher replacement cost (e.g., renewable energy instead of mining goods).
- **Homogeneous goods being produced:** this assumption in District 7 is less of a concern for the agricultural industry. However, manufacturing is one of the dominant industries in the District, which is typically less homogeneous in terms of commodities, and therefore, there can be premium goods and services that are not captured by Location Quotients.
- **Closed economy:** meaning that the region does not compete with international markets. This assumption can be problematic for imported goods and services the US is dependent upon, such as in manufacturing. A high Location Quotient does not necessarily mean that the industry can successfully export its goods and services to other regions of the country if similar or substitute goods and services can be imported from international markets. The District's construction Location Quotient of 1.72 shows relative specialization in this sector compared to the rest of the country.

Shift-Share Analysis

The shift-share formula used is as follows:

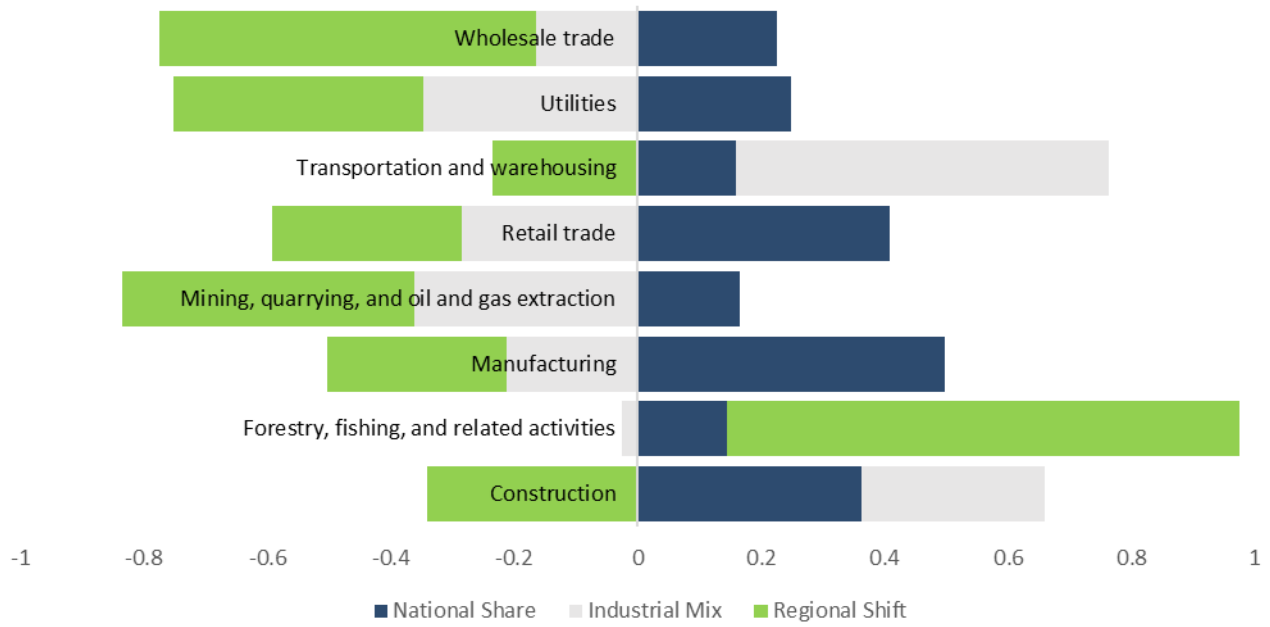
Actual Employment Change = National Share + Industrial Mix + Regional Shift

- **National Share** refers to the amount of employment change due to overall national trends.
- **Industrial Mix** provides the amount of employment change based on national trends for a specific industry.

- **Regional Shift** indicates the amount of employment change due to changes in regional competitiveness for a specific industry.

The following graph provides additional detail for all three factors of shift-share analysis affecting the District's freight-related industries: national share, industrial mix, and regional shift. Employment growth is portrayed as an index between -1 and 1, with negative numbers indicating a negative growth and positive numbers indicating positive growth based on employment.

Figure A-1: Factors for Regional Employment Change by Freight-Related Industry (2010 to 2019)



Source: CPCS analysis of US Census 2010 and 2019 County Business Pattern Data.

As shown above, the regional shift in certain sectors is significantly impacting employment in District 7. It is especially prominent in the forestry, fishing, and related activities area where the regional shift is driving major job growth. Conversely, wholesale trade and mining, quarrying, and oil and gas extraction sectors are experiencing regional declines. In regard to national trends, manufacturing is driving employment growth in District 7 due to a large National Share increase. As previously shown in Figure 15, wholesale trade and retail trade are experiencing a sharp decline in District 7. The above analysis further validates this as the regional decline in wholesale trade and retail trade sectors fail to offset growth at a national level.