District 8 Freight Plan

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

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Acronyms and Abbreviations

Abbreviation	Definition
AADT	Average Annual Daily Traffic
ADM	Archer Daniels Midland
BEA	Bureau of Economic Analysis
BNSF	Burlington Northern Santa Fe Railway
CP	Canadian Pacific Railway
CRFC	Critical Rural Freight Corridor
CUFC	Critical Urban Freight Corridor
DME	Dakota, Minnesota, and Eastern Railroad
DOT	Department of Transportation
EIA	US Energy Information Administration
ELD	Electronic Logging Device
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
GDP	Gross Domestic Product
HCAADT	High Capacity Average Annual Daily Traffic
HGL	Hydrocarbon Gas Liquid
kWh	Kilowatt-hour
LQ	Location Quotient
MN	Minnesota
MnDOT	Minnesota Department of Transportation
MPL	Minnesota Pipeline System
MPLR	Minnesota Prairie Line Railroad

Abbreviation	Definition
MPO	Metropolitan Planning Organization
NAICS	North American Industry Classification System
NHS	National Highway System
OSOW	Oversize-Overweight
PHFS	Primary Highway Freight System
PPP	Public-Private Partnership
QCEW	Quarterly Census of Employment and Wages
SD	South Dakota
SMBSC	Southern Minnesota Beet Sugar Cooperative
TAZ	Transportation Analysis Zone
TCWR	Twin Cities & Western Railroad
TTI	Travel Time Index
TTR	Travel Time Reliability
UPS	United Parcel Service
USDA	US Department of Agriculture
USDOT	US Department of Transportation

Executive Summary

The Minnesota Department of Transportation's (MnDOT) District 8 is made up of 12 counties: Chippewa, Kandiyohi, Lac qui Parle, Lincoln, Lyon, McLeod, Meeker, Murray, Pipestone, Redwood, Renville, and Yellow Medicine. Together, these 12 counties make up about 10.4 percent of Minnesota's land area, and hold about 3.2 percent of its population. The District 8 Freight Plan is being created to provide MnDOT with a clear understanding of District 8's multimodal freight system, how this system is connected to the District's economy, and what the transportation needs and issues of the District's industries are. This understanding will assist MnDOT in making well-informed policy and programming decisions in District 8.

The District 8 Freight Plan will provide MnDOT with information and guidance so MnDOT's policy and programming decisions can be better informed.

The District 8 Freight Plan is important for two main reasons. First, it will provide an up-to-date assessment of freight needs and issues specific to District 8, and second, it will produce a list of strategies and projects to improve freight mobility in the District. The Minnesota Statewide Freight System and Investment Plan (State Freight Plan) provides a framework for District 8 freight planning activities; the findings and recommendations of the District 8 Freight Plan will be linked to this overarching state-level guidance.

District 8's Economic Context

District 8's economy is heavily supported by industries that rely on the transportation of physical goods to support their operations. These "freight related" businesses employ nearly 40 percent of the District's workforce. In particular, agriculture and manufacturing stand out as important freight-related industries in District 8. An aging and shrinking population and workforce are trends that could potentially affect the District's economy and transportation system in the future, as employees may be increasingly difficult to find.

Figure 1: District 8's Freight-Related Industry Employment

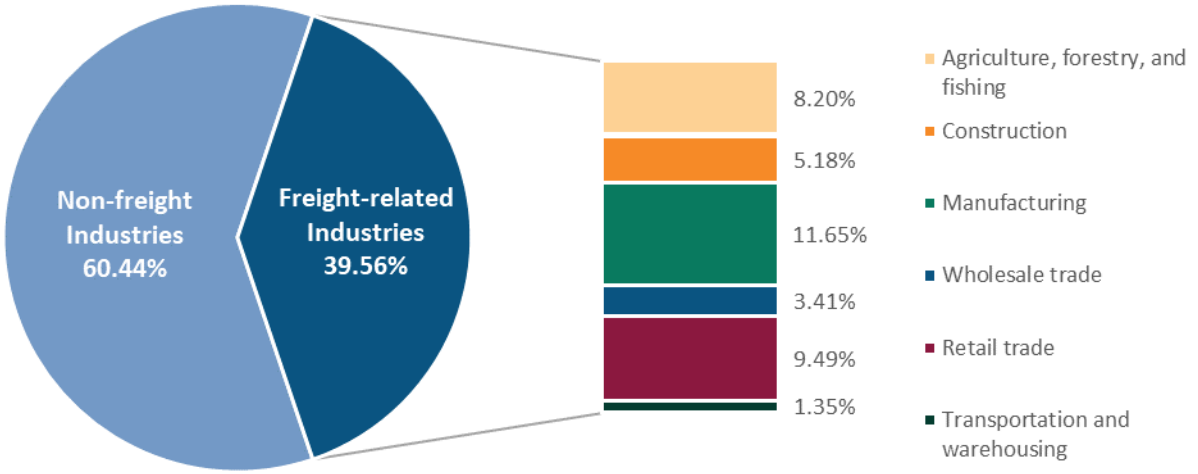
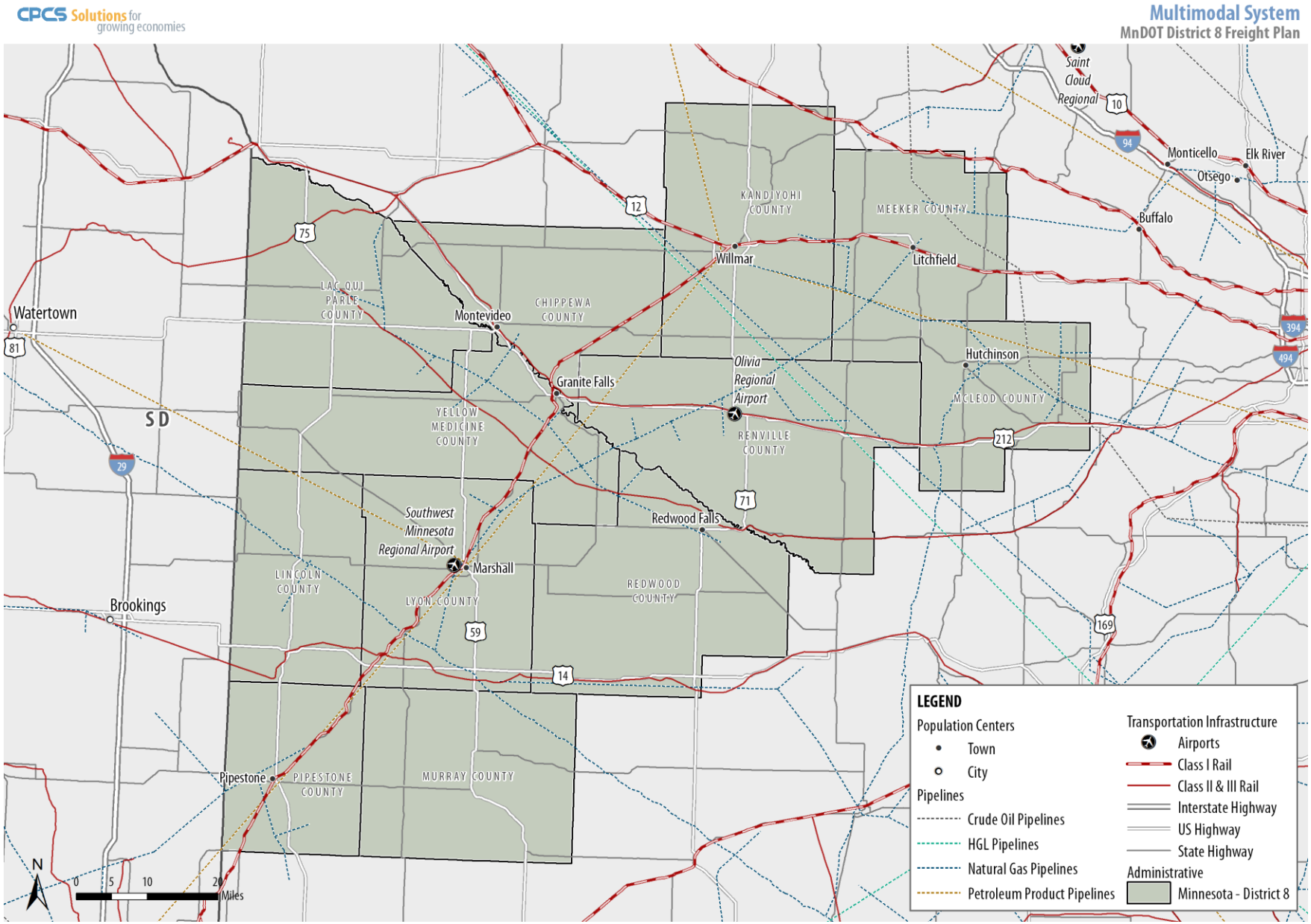


Figure 2: District 8's Multimodal Freight System



Source: CPCS Transcom Inc.

District 8's Freight Transportation System

District 8's transportation system is focused on a select set of trunk highways and railroad corridors. **Error! R eference source not found.** illustrates the District's major freight system assets. Since the District does not have any interstate highways, trunk highways such as MN-23, US-12, US-212, and US-71 provide key road connections to other areas such as the Twin Cities and St. Cloud. Additionally, the District is served by two Class I railroads and two regional railroads with a total of 468 miles of track. The District does not have regular commercial air service, or direct access to the inland waterway system, but District industries utilize airport and barge terminals closer to the Twin Cities. The District also has an extensive pipeline system, with a petroleum products terminal near Marshall.

District 8's Freight System Safety, Condition, and Performance

District 8's freight system performance does not suffer from traffic congestion problems like larger metropolitan areas. However, road safety and truck collisions are a concern. In particular, 21 percent of Minnesota's severe high-crash locations were located in District 8 between 2009 and 2013. During the same period, District 8 was ranked as the fourth highest region in terms of the highest number of severe crashes and third in terms of the highest number of severe crashes at intersections. Truck-involved crashes in the District are primarily concentrated in areas with high traffic volumes.

Congestion is not a concern for District 8, but road safety concerns require additional attention.

On a more positive note, District 8's active grade crossing crash rate compares favorably to other Districts, but it has a relatively high number of crashes at passively-protected crossings. Condition of the network is also mixed: District 8 bridges have an average sufficiency rate lower than the state's average. However, the majority of deficient bridges in the District are on county and township routes while the freight-critical trunk highways have relatively well-maintained bridge structures. The deficiency of the bridge structures on local roads directly affects last-mile connections to specific locations around District 8.

Next Steps for the District 8 Freight Plan

Working Paper 3 provides context for all future work on the District 8 Freight Plan. The data and analysis presented in this Working Paper will be completed with feedback and insight from stakeholder consultations and committee meetings. Together, this data and feedback will be used to create a comprehensive assessment of District 8's freight-related needs, issues, and potential improvements in Working Paper 4.

1 District 8 Economic Context

Key Findings

District 8's economy has rebounded from the 2008 recession and is trending upwards in employment and income levels. However, one of the significant economic issues in District 8 is the slow but steady decline in the population. On the other hand, the District's labor market is suitable for middle-income jobs, many of which are concentrated in freight-relevant industries such as agriculture and manufacturing. Therefore, the main threat to the District's workforce is a shrinking size due to out-migration, retiring, and aging of the population.

District 8's economic growth is closely tied to a freight transportation network that supports its agriculture and manufacturing of goods such as fabricated metal and machinery products. While some freight-related industries have declined in regional competitiveness in recent years such as construction and retail trade, agriculture, wholesale trade, manufacturing, and transportation/warehousing have increased in competitiveness relative to the rest of the country.

1.1 District 8's Economy

This chapter provides an overview of the economic characteristics of District 8, focusing on social aspects such as education and income. Additionally, a review of employment and income in "freight-related" industries provides context for understanding the general transportation needs of businesses in the District. This information provides a foundation for further discussions of freight transportation needs and issues in the District.

Population

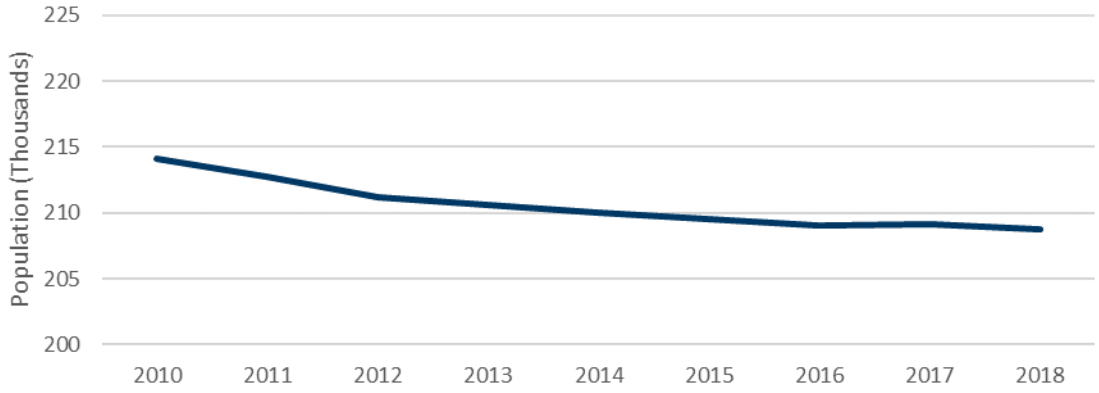
Economic development, labor force availability, and the current demand and future needs for transportation infrastructure are all influenced by population trends. Since 2010, District 8's population decreased by 2.5 percent, and all but one of the 12 counties in the District have experienced a decline in population indicating out-migration.[1] The highest decline rates were observed for Lac Qui Parle (8.11 percent) and Renville counties (6.84 percent). Only Kandiyohi County has grown, with a nearly 1.5 percent increase in population between 2010 and 2018. By comparison, Minnesota's total population increased by more than 5.6 percent over the past eight years.

In 2018, District 8 had a total population of 208,732 people, with Lincoln County being the least populous (5,673 residents), and Kandiyohi County as most populous (42,855 residents). District 8's population saw a slight growth of 0.06 percent in 2017 compared to 2016, but the population started to decline again (by a rate of 0.02 percent) to 208,732 in 2018. This slow but (almost) steady decline in the District's population is primarily due to a mixture of out-migration and aging population, which are common in rural counties.

Figure 3 shows the District's population levels between 2010 and 2018, and Figure 4 illustrates the county-specific population changes during the same period.

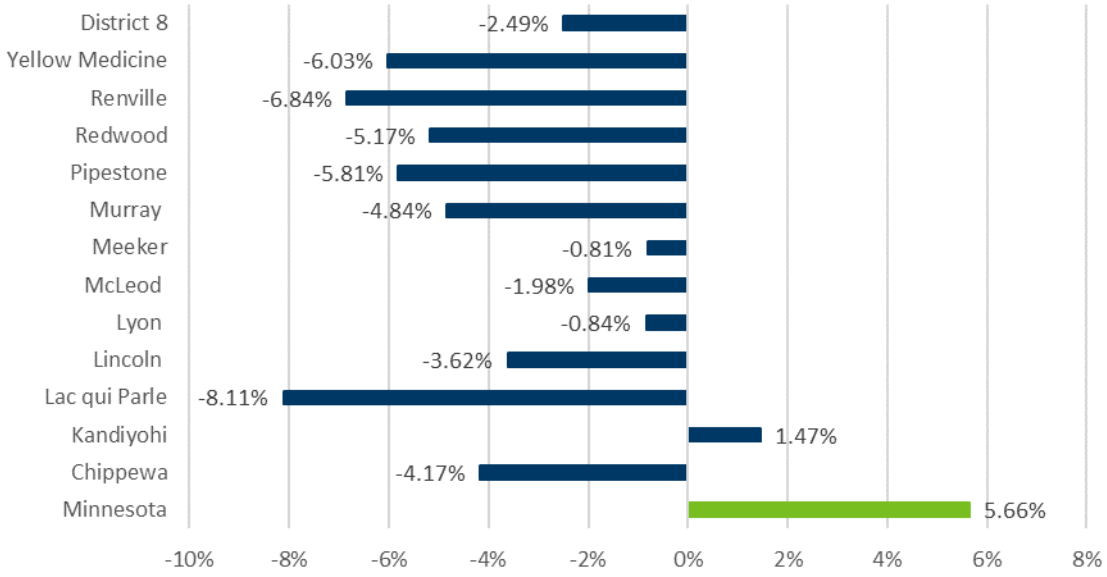
[1] CPCS analysis of US Census Bureau Historical Population by County 2010-2018.

Figure 3: District 8 Population Trend (2010-2018)



Source: CPCS analysis of US Census Bureau Historical Population by County 2010-2018.

Figure 4: Population Trends (2010 to 2018)



Source: CPCS analysis of US Census Bureau Population Estimates for July 1, 2010-2018.

In 2010, an average of 21 percent of District 8's population (by county) was age 65 and over, compared to 12 percent for all for Minnesota. In addition, the District had minimal in-migration from out-of-state or foreign countries. According to the US Census's migration flow data, between 2012 and 2016, in-migration from other states and foreign countries to the District contributed to nearly 12 percent of the total District 8's population growth. This is while only in 2016, about 14.4 percent of the State's population growth was due to in-migration from other states or countries.[2]

The minimal in-migration and aging of the labor force could have a significant impact on the future economy of the District. The decline in working-age population in District 8 can create labor shortages which affect labor-intensive industries such as agriculture and manufacturing. Additional, aging of the population can reduce labor

[2] US Census County-to-County Migration Flows (2012-2016).
https://www.census.gov/data/tables/2016/demo/geographic-mobility/county-to-county-migration-2012-2016.html

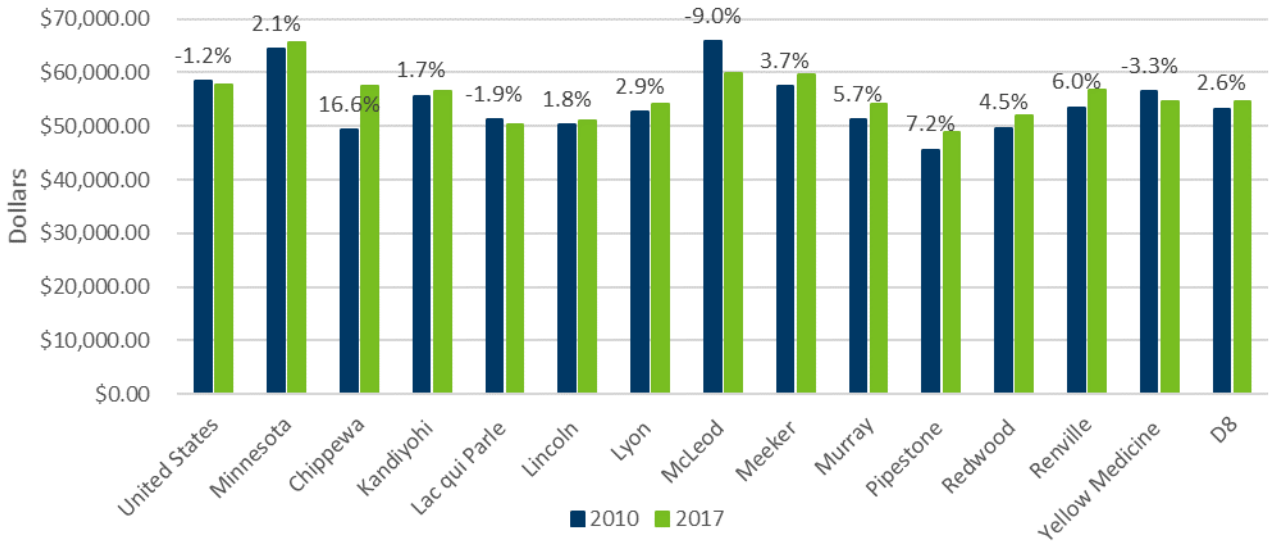
productivity growth and increase social costs due to delayed retirement. Studies show that a 10 percent increase in the fraction of population aged 65 and more, can cause an approximately 5.5 percent decrease in the GDP growth rate per capita.[3]

Income and Education

An individual's level of education influences their career opportunities and earning potential. Therefore, education and income levels are often closely connected, as educational attainment level can be a determining factor in workforce development to support different industries. Analysis of the income and education levels of the District provides a better understanding of the economic well-being of the District, as well as the ability of the District's workforce 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.

District 8's household incomes are below the United States' and Minnesota's median and average incomes. Household income in the District increased by 2.6 percent between 2010 and 2017. The greatest income increases occurred in Chippewa and Pipestone Counties. Chippewa saw the largest increase at 16.6 percent, roughly $8,200 between 2010 and 2017, although the county has a very small population of 11,980 based on Census estimates for 2017. Median household income for the District in 2017 was $54,626, which is lower than the average household income for the US ($57,652) and Minnesota ($65,699). Figure 5 shows the estimated median household income trends for each county.

Figure 5: Median Household Income (2010 and 2017 Census Estimates - Presented in 2017 Dollars)



Source: CPCS analysis of 2006-2010 American Community Survey Data and 5-year estimates, US Census Bureau.

The District's educational attainment increased between 2010 and 2017. In District 8, the share of the population over 25 years old with the educational attainment of a high school degree or and an associate's degree is higher than the state and the country. However, less of a share of the District's population has a bachelor's degree, compared to Minnesota or the United States. Between 2010 and 2017, the percentage of residents 25 and older without a high school degree dropped from 11.9 percent percent to 9.46 percent

[3] Maestas et al., (2016) "The Effect of Population Aging on Economic Growth, the Labor Force and Productivity" Rand Corporation.

percent. In that same period, the percentage of residents 25 and older with a bachelors' degree had a slight increase from 18.53 percent percent to 19.88 percent percent.

The majority of District 8's residents have an education of at least high school or some college degree.

Figure 6 lists the highest level of education attained by the District's residents in 2010 and 2017 and shows how educational attainment is improving.

Figure 6: Educational Attainment

Highest Level of Education Attained	D8 2010	D8 2017	Minnesota 2017	US 2017
No high school diploma	11.9%	9.46%	7.2%	12.6%
High school graduate (includes equivalency)	35.99%	34.30%	25.4%	27.3%
Some college, or an Associate's degree	33.58%	36.36%	32.6%	29.1%
Bachelor's degree or higher	18.53%	19.88%	34.8%	30.9%

Source: CPCS analysis of 2010 and 2017 FactFinder Data, US Census Bureau.

These relatively high levels of mid-range educational attainment suggest the labor market in District 8 may be suitable for middle-income jobs that require some prior training or experience, many of which are concentrated in freight-related industries such as agriculture and manufacturing.

1.2 Employment and Industries

Employment is an important measure of economic well-being as it informs the assessment of industries that are critical to providing jobs. It can also help illustrate the relative importance of freight-related industries, or industries that rely on the physical movement of goods to support their operations. In 2010, the District's unemployment rate was 7 percent. By 2018, this number had decreased to and 4 percent,[4] which, according to the Federal Reserve, is considered a normal unemployment rate in the absence of economic shocks.[5] However, increased employment rates may not be fully driven by increased hiring, but also by individuals leaving the workforce.

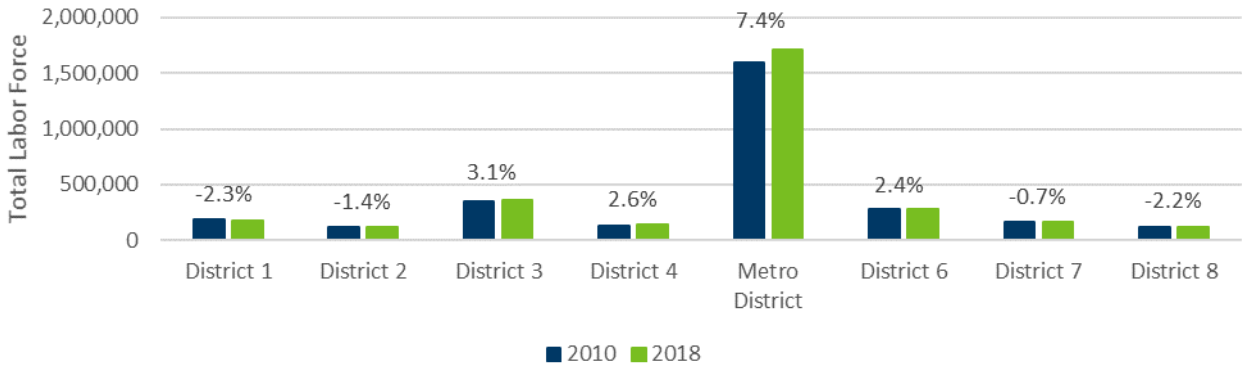
Labor Force

Between 2010 and 2018, the labor force in the District decreased by 2,590 people. Meanwhile, the number of employed residents increased by 2,350 people, and the number of the unemployed population decreased by 4,940. Therefore, we can conclude that at least half of the decline in the District's unemployment rate is due to individual leaving the labor force, a trend that further emphasizes the fact that most counties in the District are experiencing a decline in the population.

Figure 7 shows the changes in the labor force in MnDOT' Districts between 2010 and 2018. The figure illustrates that District 8 is not alone in a shrinking labor force, as labor forces in Districts 1, 2, and 7 declined as well.

[4] Local Area Statistics, Bureau of Labor Statistics, Labor Force Data by County Annual Averages https://www.bls.gov/lau/
[5] Federal Reserve, June 2018 Projections https://www.federalreserve.gov/faqs/economy_14424.htm

Figure 7: Labor Force Changes Between 2010 and 2018 in Minnesota Districts



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

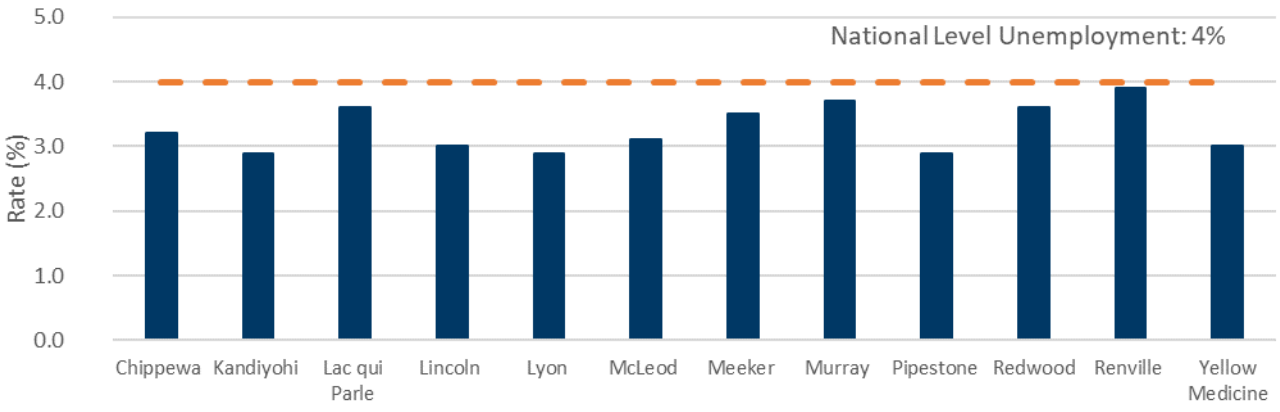
This decline in the labor force is expected to continue as District 8's population continues to age and in-migration is minimal. Although the decrease in the workforce may result in declined demand for the transportation system by people living in District 8, the District's freight-related industries will continue to rely on the transportation system to remain competitive. Workforce shortages related to a declining labor force may also aggravate the prevalent truck driver shortage that currently exists across the country, and which is present in District 8.

The main threat to the District's workforce is a shrinking size due to out-migration, retirement, and aging of the population.

Unemployment

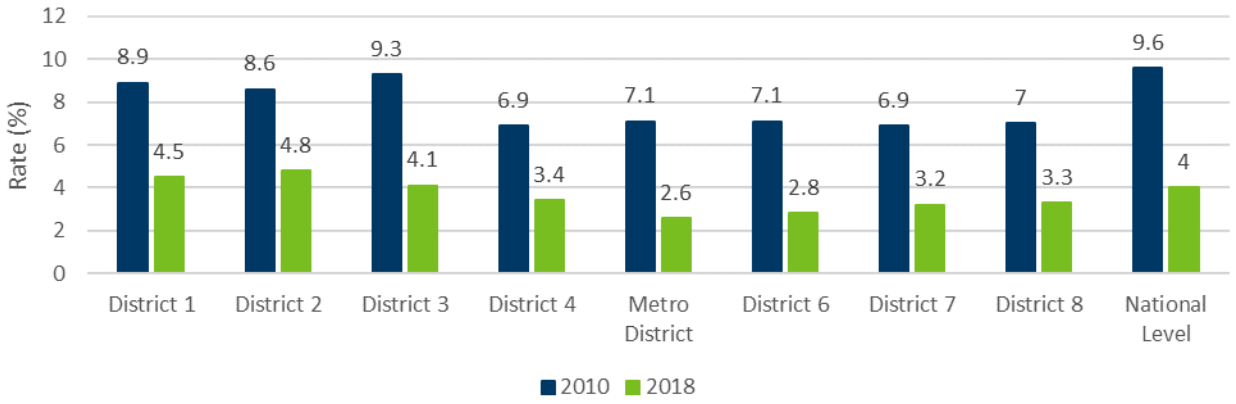
In 2018, District 8 had an unemployment rate of 3.3 percent, which was less than the national unemployment rate (4 percent), meaning that overall, the District was not economically distressed. Figure 8 shows the distribution of unemployment rates across the 12 counties in the District, and Figure 9 displays the District's unemployment rate compared to other Districts in Minnesota as well as the national level unemployment.

Figure 8: District 8 County-Level Unemployment Rates 2018



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

Figure 9: Minnesota District Unemployment Rates for 2010 and 2018



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

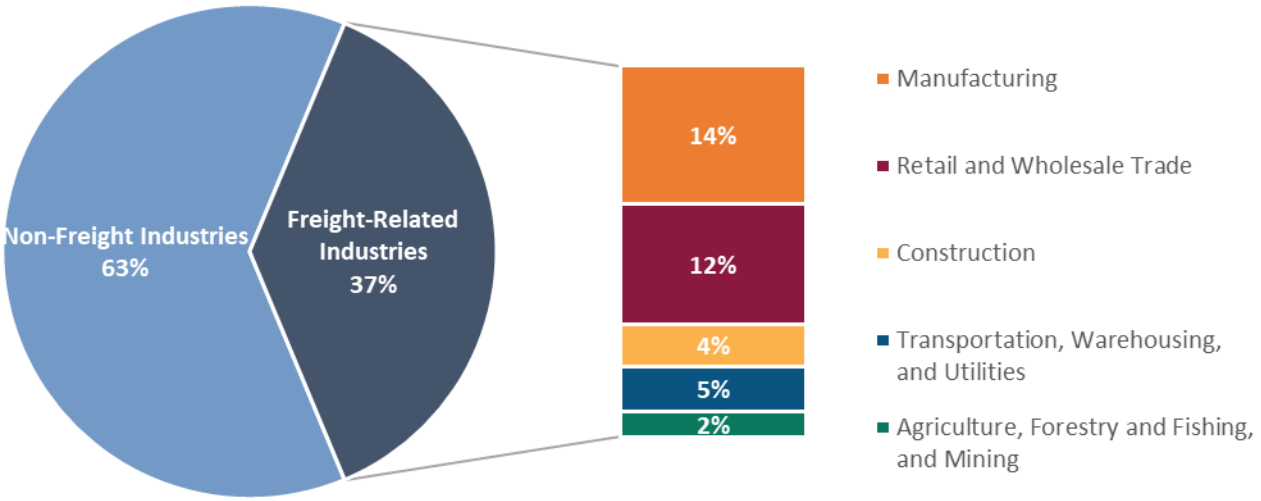
1.3 Gross Domestic Product

Gross Domestic Product (GDP) is a measurement of the monetary values of the services produced in a country, state, or county. Investigating periodic GDP trends provides insight into the health and growth of an economy, and can reveal which industries are most important or productive. Industry-based GDPs are typically provided at the state and metropolitan area levels.

Minnesota's Gross Domestic Product

Figure 10 provides a breakdown of Minnesota's GDP by industry. As a state, non-freight industries represent 63 percent of Minnesota's GDP, and freight-related industries represent 37 percent of GDP.

Figure 10: Minnesota GDP Share by Industry



Source: CPCS analysis of GDP by State in Current Dollars by NAICS Industry 2016, Bureau of Economic Analysis.

District 8 Gross Domestic Product

To protect the confidentiality of specific companies, GDP is typically not disaggregated industry-by-industry at the county level. However, the Bureau of Economic Analysis does provide a higher-level breakdown of GDP by

county. The BEA data includes government enterprises and non-government industries that either produce goods or provide services. Figure 11 shows the GDP share of the industries located in the District. Based on these figures, goods-producing industries (which would rely on freight transportation) account for about 32 percent of District 8's GDP.

Figure 11: District 8's GDP by Industry

Industry Name	GDP (Thousands of Dollars)	% of Total*
Private goods-producing industries	3,034,589	32.37%
Private services-providing industries	3,629,503	38.71%
Government and government enterprises	1,251,162	13.34%
All Industries	9,375,760	-

(*) about 16% of the data for government and private entities is masked for McLeod County. Those masked GDPs are presented in the total for all industries.

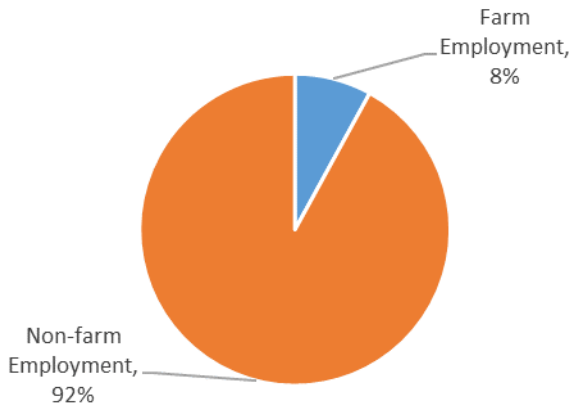
Source: CPCS analysis of Bureau of Economic Analysis GDP Data, 2015.

Freight-Related Employment

The employment by industry data provided by the Quarterly Census of Employment and Wages (QCEW) program provides a comprehensive view of jobs associated with specific industries at the county and state level. While the QCEW database provides employment data by 2-digit North American Industry Classification System (NAICS) sectors as well as proprietors of both farm and non-farm businesses, Agricultural Census data is used to supplement farm employment information where employment data coverage is insufficient.

As Figure 12 shows, about 8 percent of the jobs in District 8 belong to the agriculture industry. More than 17 percent of the non-farm jobs belong to the government and government enterprises industry, followed by manufacturing covering nearly 16 percent, and retail trade providing 13 percent of jobs.

Figure 12: District 8's Farm and Non-Farm Employment



Source: CPCS analysis of Full-Time and Part-Time Employment by NAICS Industry 2017, Bureau of Economic Analysis for non-farm employment and 2017 Census of Agriculture for farm employment.

The highlighted rows in Figure 13 show employment in freight-related industries. Freight-related industries are defined as industries that rely heavily on the transportation network for shipping and receiving goods that support their operations. These industries include forestry, fishing, and related activities, mining, quarrying, and fossil fuel extraction, manufacturing, retail and wholesale trade, construction, transportation, and warehousing, and utilities.

Figure 13: District 8's Non-Farm Employment

Industry		Employment	% of Total
Private Non-Farm	Forestry, fishing, and related activities	534	0.49%
	Mining, quarrying, and oil and gas extraction	137	0.12%
	Utilities	296	0.27%
	Construction	7,778	7.08%
	Manufacturing	17,476	15.92%
	Wholesale trade	5,114	4.66%
	Retail trade	14,232	12.96%
	Transportation and warehousing	2,020	1.84%
	Information	1,042	0.95%
	Finance and insurance	6,144	5.60%
	Real estate and rental and leasing	4,406	4.01%
	Professional, scientific, and technical services	3,201	2.92%
	Management of companies and enterprises	1,002	0.91%
	Administrative & support & waste management & remediation services	3,419	3.11%
	Educational services	645	0.59%
	Health care and social assistance	7,573	6.90%
	Arts, entertainment, and recreation	1,600	1.46%
	Accommodation and food services	6,343	5.78%
	Other services (except government and government enterprises)	7,261	6.61%
Government and government enterprises		19,579	17.83%
Total Non-Farm Employment		109,802	100%

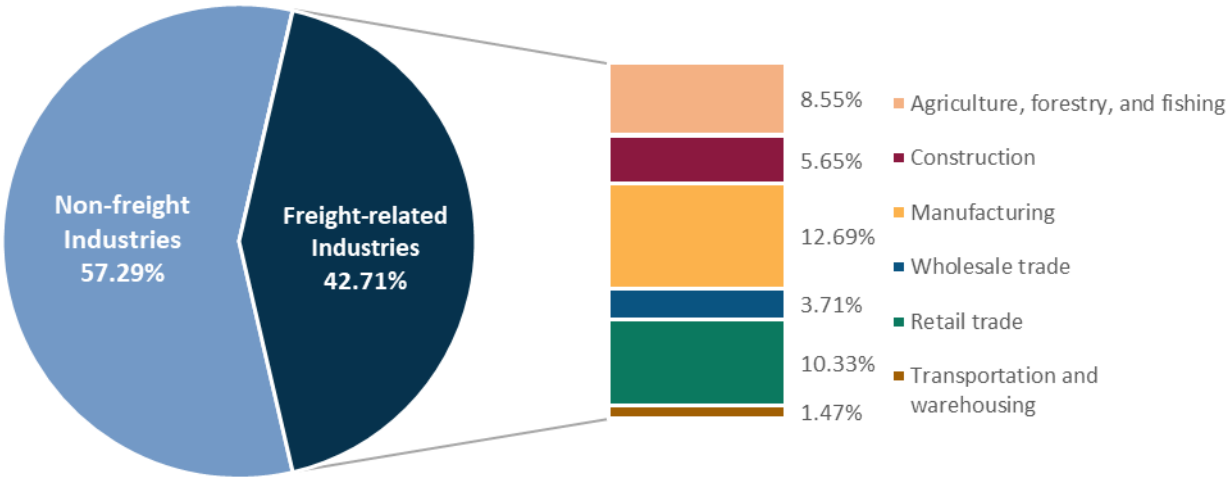
Source: CPCS analysis of Full-Time and Part-Time Employment by NAICS Industry 2017, Bureau of Economic Analysis. Note that 5.6% of regional employment (11,096 people) is unavailable to avoid disclosure of confidential information.

Many of the freight-related industries, particularly, mining, quarrying, and transportation are location-dependent (farms, mines, railroads, and rivers cannot be moved like factories), and thus are dependent on the performance of the freight system to remain competitive.

Nearly 40 percent of the District's workers are employed at freight-related industries.

Figure 14 shows the relative employment by industry for the Region based on freight-related and non-freight jobs.

Figure 14: District 8's Freight Related Industries



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 2017, Bureau of Economic Analysis; 2017 Census of Agriculture.

Freight-Related Industry Specialization

This section provides an overview of the District's specialization in freight-related industries using Location Quotient (LQ) analysis. A location quotient of an industry indicates the proportion of the workforce employed in that industry relative to other geographic areas or industries. Therefore, analyzing LQs is a quick way to understand a local region's economic base specialization relative to the national norm.

Industries that have higher LQ values are typically more export-oriented[6] and therefore greater contribution to the regional economy. Although an LQ value of greater than 1 shows relatively high regional employment compared to national-level employment in a certain industry, studies show that an LQ of 1.3 is a better threshold for analyzing industry competitiveness.[7]

The QCEW database in Figure 15 summarizes the District's annual country-level analysis of average employment LQs. For more information on LQ method, assumptions, and more detailed LQ tables, refer to Appendix B.

Figure 15: Aggregated Location Quotients for Freight-Related Industries in District 8

Freight-Related Industry Group (2-Digit NAICS Code)	D8 Location Quotient
Agriculture, forestry, fishing and hunting (11)	7.07
Crop production	10.25
Corn Farming	4.55
Sugar Beet Farming	28.3

[6] EMSI Resource Library "Understanding Location Quotient", 2007. https://www.economicmodeling.com/wp-content/uploads/2007/10/emsi_understandinglq.pdf
[7] 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

Freight-Related Industry Group (2-Digit NAICS Code)	D8 Location Quotient
Soybean Farming	5.3
Oilseed and grain farming	5.6
Other grain farming	2.4
Mining, quarrying, and oil and gas extraction (21)	NC*
Sand, gravel, clay, and refractory mining	3.15
Support activities for mining	3.15
Utilities (22)	0.5
Water supply and irrigation systems	5.4
Construction (23)	1.12
Utility system construction	3.8
Other heavy construction	18.4
Manufacturing (31-33)	0.39
Chemical manufacturing	2.48
Breweries	5.04
Textile product mills	5.95
Wholesale trade (42)	0.3
Industrial machinery merchant wholesalers	2.25
Farm supplies merchant wholesalers	4.44
Retail trade (44-45)	0.4
Used car dealers	4.7
Gasoline stations	2.7
Transportation and warehousing (48-49)	0.44
General freight trucking, long-distance	1.02

(NC) Not Calculable, the data does not exist, or it is zero.
Note: Employment information relies on approximations due to company confidential information. Employment data is estimated based on the median of each employment range. Employment figures do not include government employees, railroad employees, and self-employed persons.
Source: CPCS analysis of Full-Time and Part-Time Employment, US Census Data 2018, and County Business Patterns.

Among the freight-related industries in the District, agriculture has the highest degree of specialization compared to the nation. The District is highly specialized in corn, sugar beet, soybean, and oilseed farming.

Figure 16 lists some of the most competitive industries for the 12 counties in the District. Cells with "NC" indicate areas where data was not available due to confidentiality restrictions.

Figure 16: Location Quotients of Freight-Related Businesses in the 12 Counties of District 8

Industry	Chippewa	Kandiyohi	Lac Qui Parle	Lincoln	Lyon	McLeod	Meeker	Murray	Pipestone	Redwood	Renville	Yellow Medicine
Agriculture, forestry, fishing and hunting (11)	NC*	NC	3.27	7.08	1.49	NC	NC	2.82	NC	NC	NC	NC
Utilities (22)	1.93	NC	ND*	NC	NC	NC	NC	NC	2.17	1.11	NC	NC
Manufacturing (31-33)	2.44	2.04	0.74	0.13	1.58	3.50	2.38	1.94	1.36	2.11	1.78	0.66
Wholesale trade (42)	1.61	0.78	2.41	1.23	1.04	0.77	1.43	1.69	1.34	1.75	NC	1.29
Retail trade (44-45)	0.88	1.10	NC	0.98	1.12	NC	NC	NC	1.03	1.02	0.66	NC
Transportation and warehousing (48-49)	1.18	0.86	2.68	2.94	1.08	0.89	1.61	2.51	1.35	1.49	1.92	1.74

(NC) Not Calculable, the data does not exist, or it is zero. (ND) Not Disclosable.
Source: CPCS analysis of Bureau of Labor Statistics, 2018. Location Quotients reflect annual averages based on employment level.

As shown in the table, the highest concentration of competitive agricultural activities is in Chippewa and Renville Counties. Also, Lac Qui Parle and Yellow Medicine Counties are highly competitive in terms of oilseed production. Manufacturing businesses are almost equally competitive across all counties except Lac Qui Parle, Lincoln, and Yellow Medicine.

Freight-Related Industry Competitiveness

Although Location Quotients at the county and district levels reflect the competitiveness of different regional industries compared to the national averages, Shift Share Analysis is a more dynamic economic indicator used to understand changes in a region's industrial competitiveness over time, compared to the national norm.

Shift share analysis estimates regional job growth based on three factors:

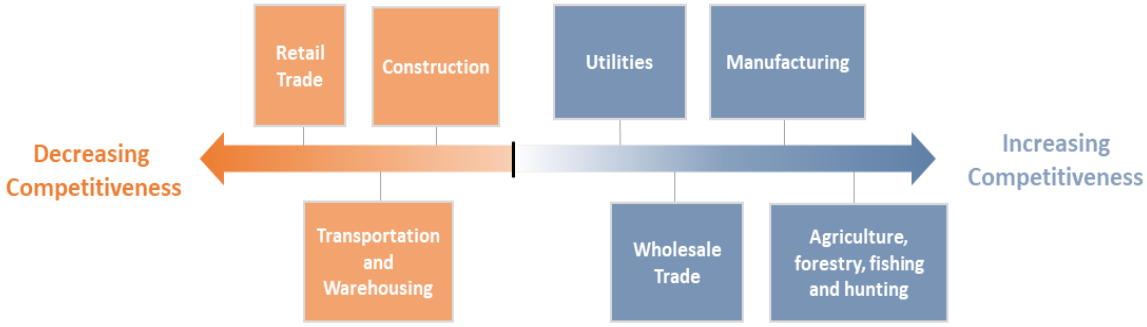
- Industrial mix effect: the growth of a specific industry at the national level. This effect is calculated through analysis of industry-level employment data for the desired time frame.
- National growth effect: the regional industry growth impacted by the national level growth rates for the desired 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

Figure 17 illustrates the change in employment due to the above-mentioned factors for District 8's freight-related industries.

Figure 17: District 8's Freight-related Industry Regional Shift (2010-2016)

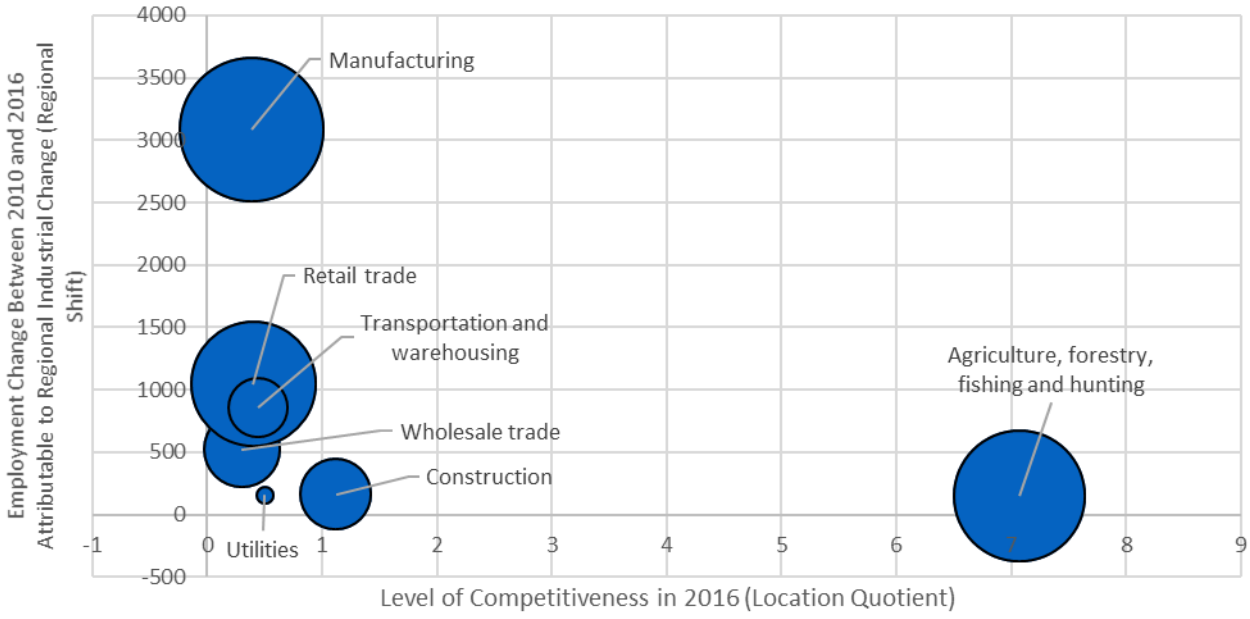


Source: CPCS analysis of US Census 2010 and 2016 County Business Pattern Data.
Note: Mining, quarrying, and oil and gas extraction employment data are not provided for the 12 counties in District 8.

While the LQ analysis in the previous section proved that agriculture and manufacturing are important to the District's economy, the shift-share analysis adds another layer to this by highlighting the significant advantages for the manufacturing industry in District 8. The results of the shift-share analysis also show that there has been a growth in agriculture, forestry, fishing, and hunting employment, in line with the national growth in this industry.

Figure 18 provides a visual comparison of the District's freight-related industries by how competitive they were in 2016 (X-axis) and how much employment has increased or declined independently of national trends (Y-axis). Industries with a Location Quotient greater than 1.0 on the X-axis indicates that they were more competitive than the US average in 2010, while industries lower than 1.0 on the X-axis indicates that they were less competitive. On the Y-axis, positive values indicate that the industry has improved in competitiveness between 2010 and 2016, while the employment size of each industry in the District is indicated by the size of the circle for each industry. **Appendix C** provides additional detailed results of District 8's shift-share analysis.

Figure 18: Regional Competitiveness in Freight-Related Industries



Source: CPCS analysis of Bureau of Labor Statistics Location Quotient data of 2016 and 2010-2016 County Business Pattern Data.

Despite the national decline in manufacturing employment between 2010 and 2016, there has been significant growth in manufacturing jobs in the District.

1.4 District 8 Industrial Profiles

District 8 Freight-Related Industry Locations

Figure 1-18 shows the locations of freight-related businesses with more than 20 employees in District 8. Most of these businesses are congregated close to railroads (especially in Willmar and Marshall), as well as major highways such as US-212 and MN-23. The majority of shuttle loaders, ethanol manufacturing plants, and feed product origins are located next to BNSF's Marshall Subdivision which runs across the District.

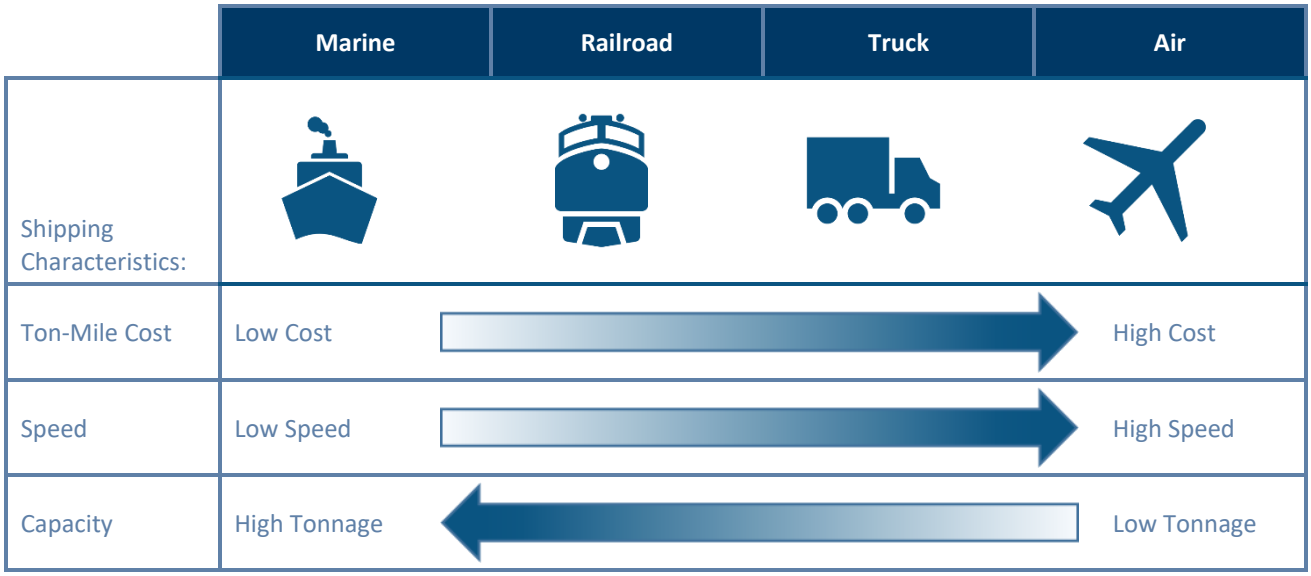
Construction businesses are primarily clustered in McLeod, Redwood, and Kandiyohi Counties while some industry concentration also exists in Montevideo (Chippewa County) and Litchfield (Meeker County).

Freight-Related Industry Transportation Requirements

Shippers have a range of modal options to consider when moving freight, including trucks, railroads, air freight, and barge or ship service. However, the true range of choices is limited by the availability of access to each of these modes, as well as the characteristics of the cargo being moved. In particular, the value per ton of the cargo plays an important role: shipping costs can make up a larger share of the overall cost of low-value cargoes, while higher-value cargos can "absorb" a greater transportation cost. Therefore, shippers of low-value, bulk cargoes may place a higher emphasis on transportation cost. In addition to shipping cost, additional shipping considerations that influence modal choices include shipping speed, and reliability of shipping service.

Each mode of transportation has its own set of characteristics, and together, modes make up a "spectrum" of service, which is illustrated in Figure 19.

Figure 19: The Modal "Spectrum" of Services



Maritime transportation (such as barge service) is best suited for the long-distance movement of bulky low-volume goods. These can include raw materials such as grain, oil, chemicals, and aggregates. Maritime can also be suitable for long-distance movement of higher-value manufactured goods when fast service is not required

Railroad shipping has a similar service profile to maritime shipping: it is capable of moving large volumes of lower-value goods effectively, and common loads include grain, aggregates, forest products, and oil. Additionally, higher-speed rail service (such as intermodal container service) for higher-value goods is available in select areas.

Trucking is important because road connections may be the only immediate modal connections that many establishments have. Therefore trucking is often a key element in the first- and last-mile movement of goods. However, trucking costs are higher and capacity is lower relative to rail. Therefore, trucking can only move lower-value goods short distances for transloading to other modes. However, truck service is a viable and common option for moving moderate- and higher-value goods longer distances in shorter periods of time.

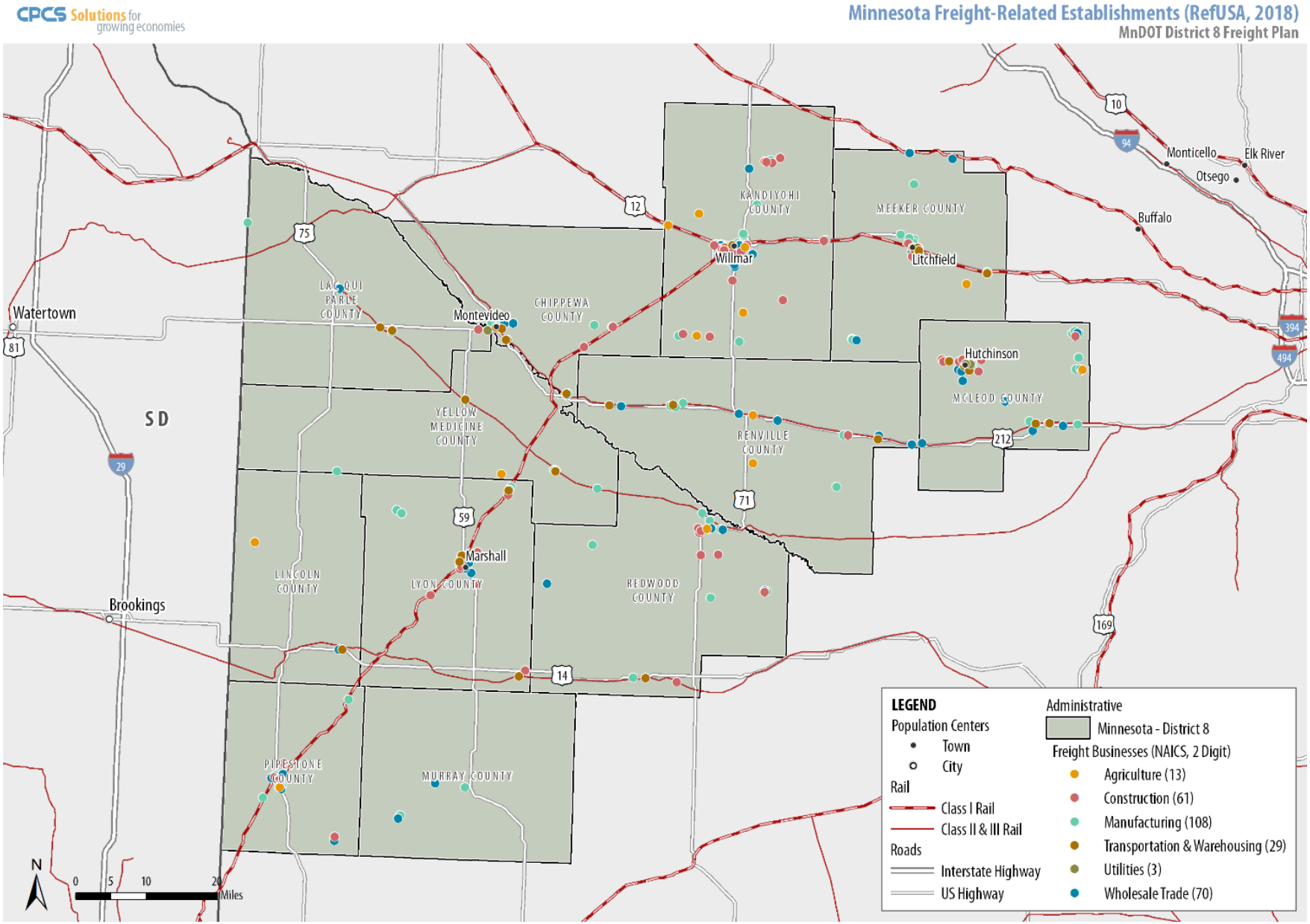
Air freight is the most expensive modal choice, on a ton-per-mile basis, and is generally only used for high-value, low-volume, time-sensitive goods, such as pharmaceuticals, electronic components, and parcel service

In addition to these modes, select liquid or gas commodities may be moved by pipelines.

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

An example of modal considerations can be seen in District 8's agricultural and food industries. Grain produced in the district has a relatively low value per ton, so it is trucked from fields to grain elevators, where it can be loaded onto rail for more cost-effective long-distance shipping.

Figure 20: District 8 Freight-Related Business Clusters



Source: CPCS analysis of Reference USA Data 2018

Agriculture

Minnesota is ranked as fifth among all US states in terms of total agricultural production. 26 percent of the cash receipts in the state's agricultural market are associated with corn, and 21 percent with soybeans production.[8] Although county-level GDP-by-industry data is not available, the majority of the corn and soybeans farms in the state are congregated in central, southern, and western counties. Corn and soybean production and processing businesses are distributed among all counties in District 8.

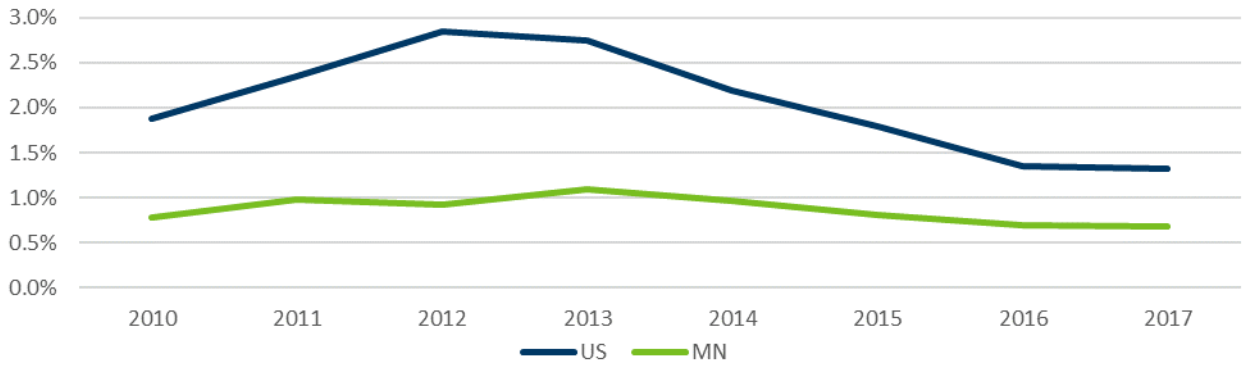
As Figure 21 shows, the agricultural industry became increasingly important for the state's economy between 2011 and 2013. However, the industry has seen a steady decline in contribution to GDP and is expected to continue this trend.[9] Majority of this decline can be linked to the decline in the average corn yields both in Minnesota and across the country. Minnesota's cornfields in the south and the west (including District 8 Counties) have seen a significant drop in yields primarily due to severe rain.

Climate Change and Agriculture

Excessive rain and snow decreases the optimum period for planting crops such as corn and soybeans. Less opportunities for planting in optimum periods means that in each planting cycle, a bigger portion of the area planted yields a lower amount of crops. Climate change increases the risk of crop failures as it reduces the accuracy of weather forecasts and affects farmers' ability to sow for optimum yield. Additionally, both corn and soybeans crops suffer from high temperatures. A four degrees Celsius increase in the global temperature, which is projected to happen with the current Green House Gas (GHG) emissions, will cut the US's corn production by half and significantly impact soybeans production.

Fourth National Climate Assessment (NCA), Volume II: Impacts, Risks, and Adaptation in the United States.

Figure 21: Agriculture Industry Share of GDP (2010-2017)



Source: BEA GDP Data 2010-2017.

Minnesota is ranked first in sugarbeet, second in corn, and third in soybeans production across the nation.[10] Agriculture is a major industry in District 8 with corn, soybeans, and sugarbeets as the top three crops. The following map shows the concentration of farmlands across District 8. As Figure 22 shows, while corn and soybeans farms are almost uniformly distributed across the District, sugarbeet production is concentrated in

[8] "Minnesota Agricultural Profile", Minnesota Department of Agriculture (2017). https://minnesota.agclassroom.org/educator/materials/profile.pdf

[9] USDA Crop Production Report 2018-19. https://www.usda.gov/topics/farming/crop-production

[10] USDA Crop Production Report 2018-19. https://www.usda.gov/topics/farming/crop-production

Chippewa, Kandiyohi, Redwood, and Renville counties. More details on the agricultural operations related to each of the top three crops are provided in the following sections.

Corn

Production of corn in Minnesota dates back to the farming practices established by the indigenous people. Over the centuries, corn production density has kept increasing across the state, clustering mostly in central, southern, and western Minnesota. As of 2017, more than 21 percent of the corn production in Minnesota is located in District 8, with nearly a quarter of the state's harvested area producing more than 370 million tons of corn on an annual basis.[11]

Number of Operations in District 8	Acres Harvested in District 8	Production, Measured in Tons in District 8
5,903	1,908,123	370,422,708

Source: USDA National Agricultural Statistics Service, 2017.

On average, around 85 percent of corn crops are processed for food, animal feed, and industrial product manufacturing. The wide variety of food products that use corn as base ingredient range from cereals, corn oil, and cornflour products to chewing gums and peanut butter. Corn ethanol is produced from the fermentation of corn stover.[12] Figure 22 displays the ethanol production plants in Minnesota. As the figure shows, seven ethanol production plants are located in District 8.

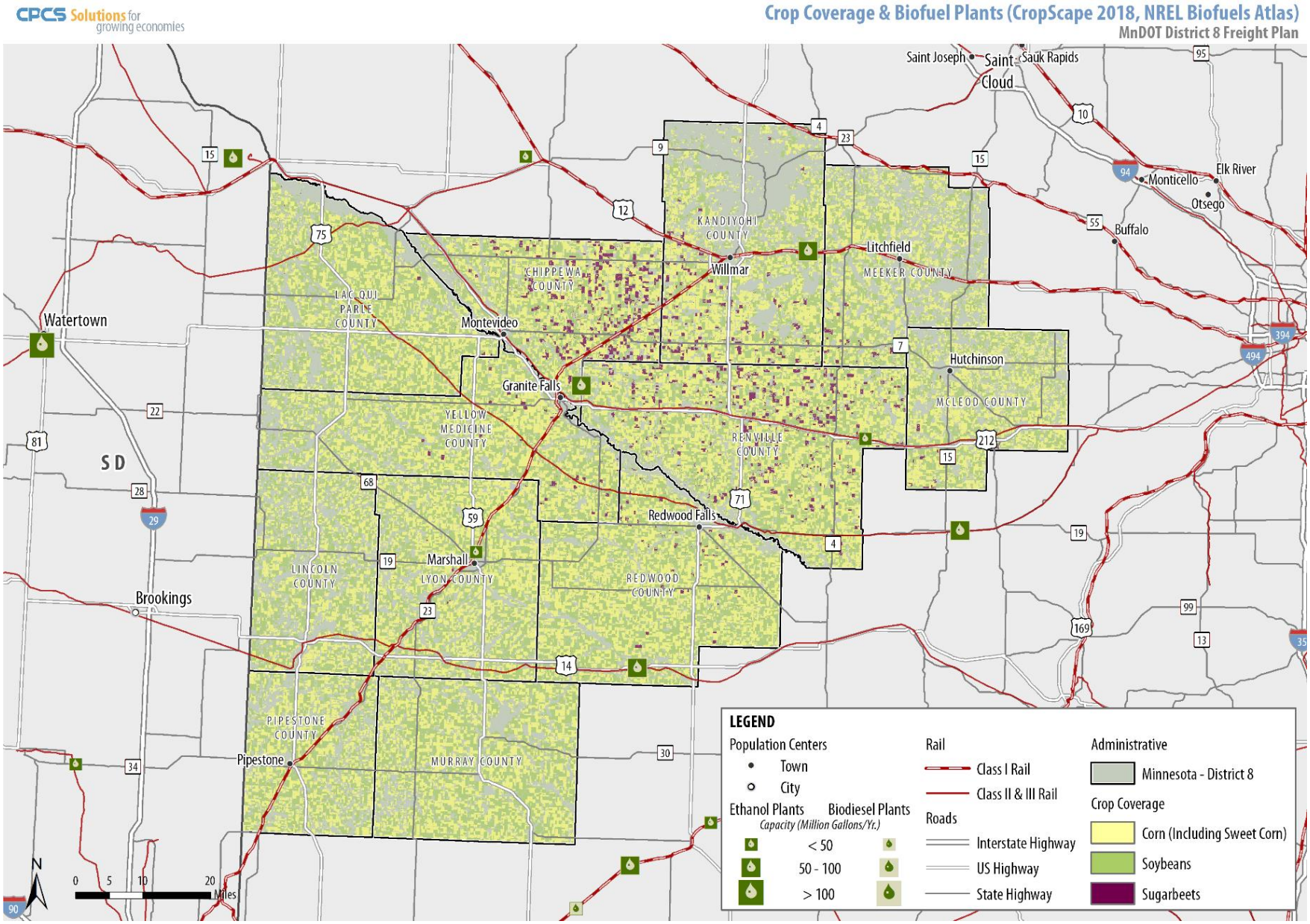
The bi-product of corn processed for food or biofuel production is animal feed. Silage is another corn bi-product which is used for animal feed. In 2017, more than 1 million tons of corn silage was produced in the District.

Soybeans

Soybeans are the top agricultural export in Minnesota. Like corn, the majority of the state's soybean production is located in central, southern, and western Minnesota. More than half of the soybeans harvested in Minnesota are processed to produce livestock feed while the rest is used for food and biofuel production.[13] Nearly 22 percent of the soybean production operations in Minnesota are located in District 8, with about 21 percent of the state's harvested area producing more than 85 million tons of soybeans on an annual basis.[14]

[11] Source: USDA National Agricultural Statistics Service, 2017.
[12] USDA, National Corn Growers Association, 2010.
[13] Minnesota Soybean Research and Promotion Council, accessed 2019. https://mnsoybean.org/msrpc/about-soy/
[14] USDA National Agricultural Statistics Service, 2017.

Figure 22: District 8 Crop Production Locations and Biofuel Production Plants



Source: National Agricultural Statistics Service data of 2018 and the Biofuel Atlas, accessed 2019.

Number of Operations in District 8	Acres Harvested in District 8	Production, Measured in Tons in District 8
5,878	1,716,487	85,276,170

Source: USDA National Agricultural Statistics Service, 2017

The biofuel produced from soybean is biodiesel, with glycerin as the main by-product. The closest biodiesel plant to the District is the Minnesota Soybean Processors plant in Nobles County which is connected to farms in District 8 through Union Pacific's Worthington route, and Highway 60.

Sugarbeets

Minnesota has the record for highest production of sugarbeets in the country. In 2017, nearly 35.5 million tons of sugarbeets were produced in the US, 35 percent of which was harvested in Minnesota. Within the District, sugarbeet farms are mostly clustered Chippewa, Kandiyohi, Renville, and Redwood Counties. District 8 produces more than a quarter of the sugarbeets harvested across the state (more than 3 million tons in 2017).

Number of Operations in District 8	Acres Harvested in District 8	Production, Measured in Tons in District 8
304	108,388	3,193,955

Source: USDA National Agricultural Statistics Service, 2017.

Sugarbeets are primarily used to produce sucrose or common sugar. Sugarbeet pulp is the main by-product of sugar production and is used for animal feed. Molasses is another by-product and is used for alcohol and pharmaceutical manufacturing. The sugarbeet leaves are also used for silage. The majority of the sugarbeet processing factories are located proximate to the beet fields for optimum productivity.

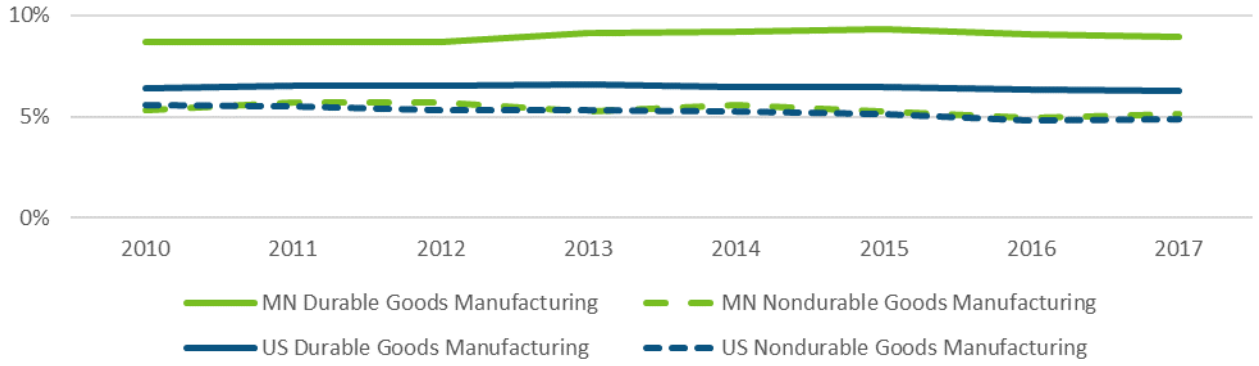
Manufacturing

Manufacturing is the most competitive freight-related industry in District 8. Activities within the manufacturing industry can be broken into two categories:

- **Local Clusters:** firms that trade internally with other businesses in the region.
- **Traded Clusters:** firms that trade with businesses outside the region.

District 8's manufacturing firms tend to be engaged in traded clusters, bringing trade into the region from other states and other countries. Figure 23 shows the trends in the share of manufacturing in the total GDP for Minnesota and the US. Shift share analysis proved that Minnesota's GDP is more reliant on the manufacturing industry than the US as a whole, and the following figures show that Minnesota's manufacturing industry is slightly more represented by durable goods compared to the rest of the country.

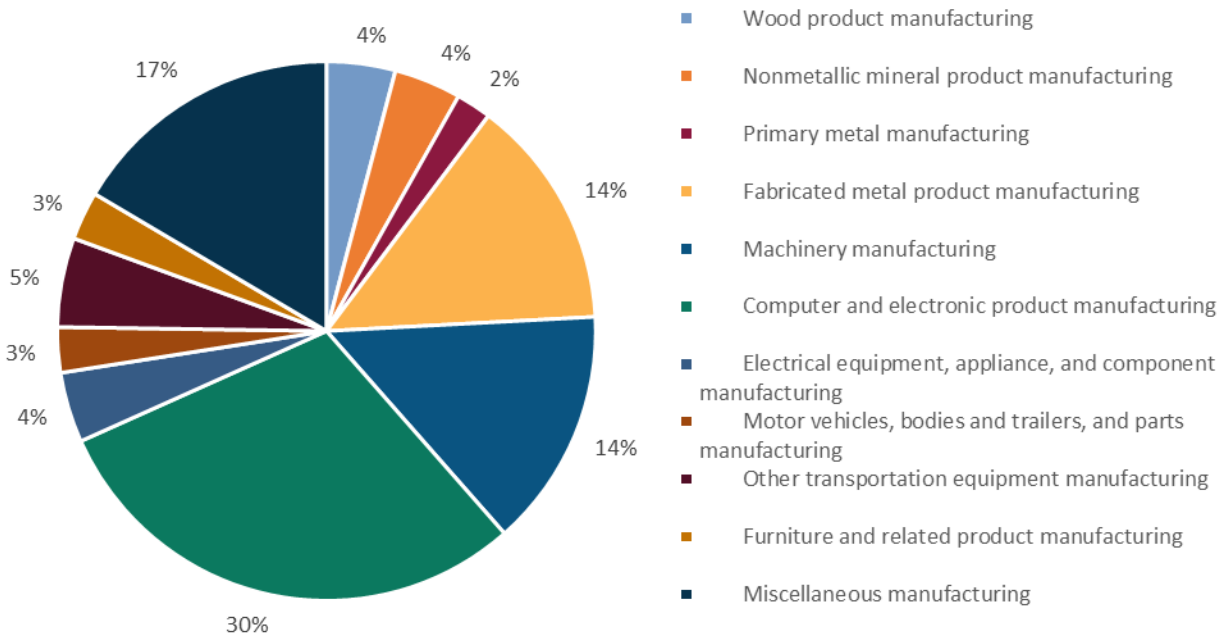
Figure 23: Manufacturing Share of GDP



Source: BEA GDP Data, chained to 2009 dollars, 2010-2017.

Minnesota's manufacturing share of GDP has remained relatively steady between 14.0 and 15.0 percent between 2010 and 2017, while the US' manufacturing share of GDP represents between 11.15 and 12.0 percent of GDP (Figure 24).

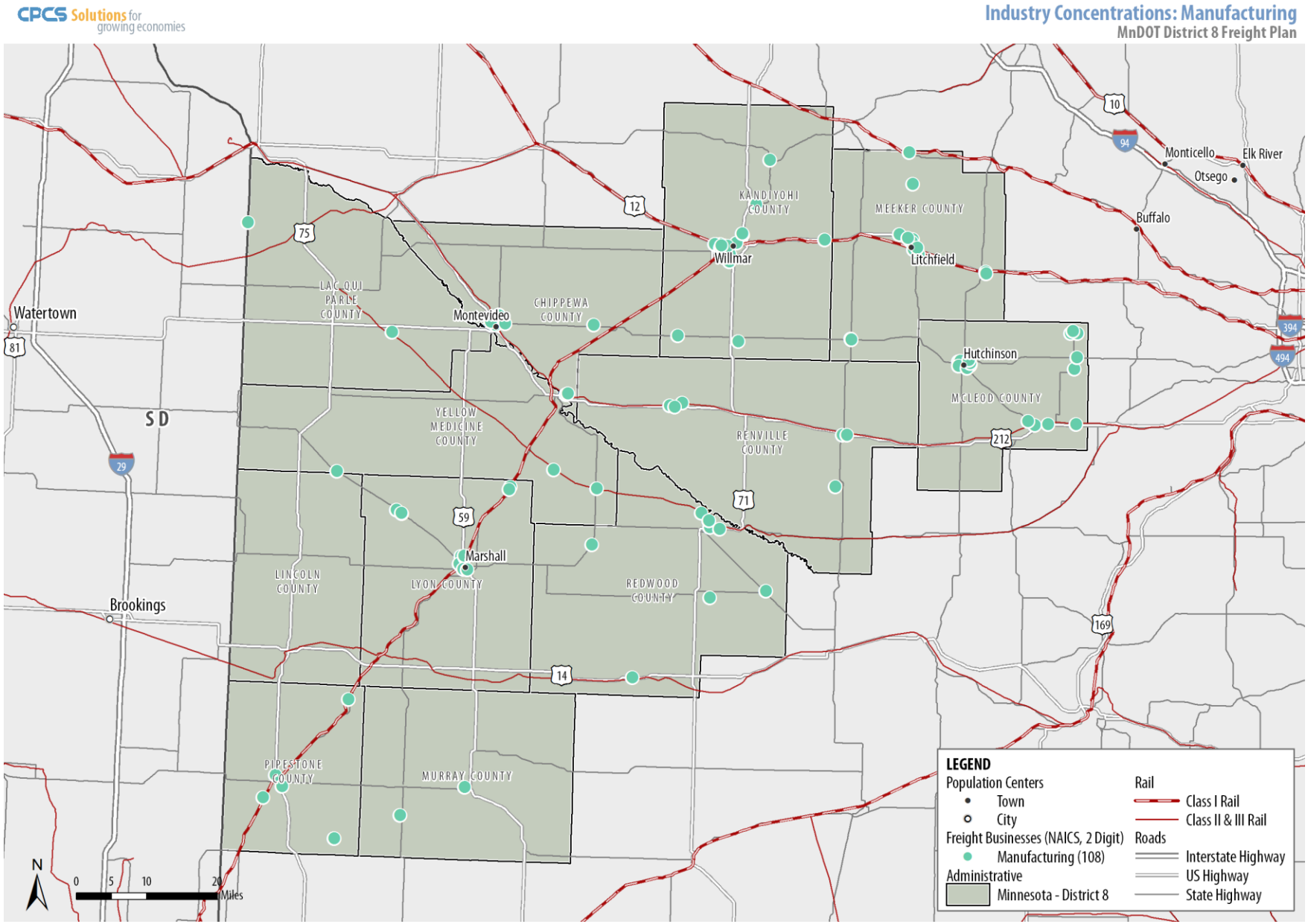
Figure 24: Breakdown of Nondurable Goods Manufacturing Industries in Minnesota – 2017



Source: BEA GDP Data, chained to 2009 dollars, 2010-2017.

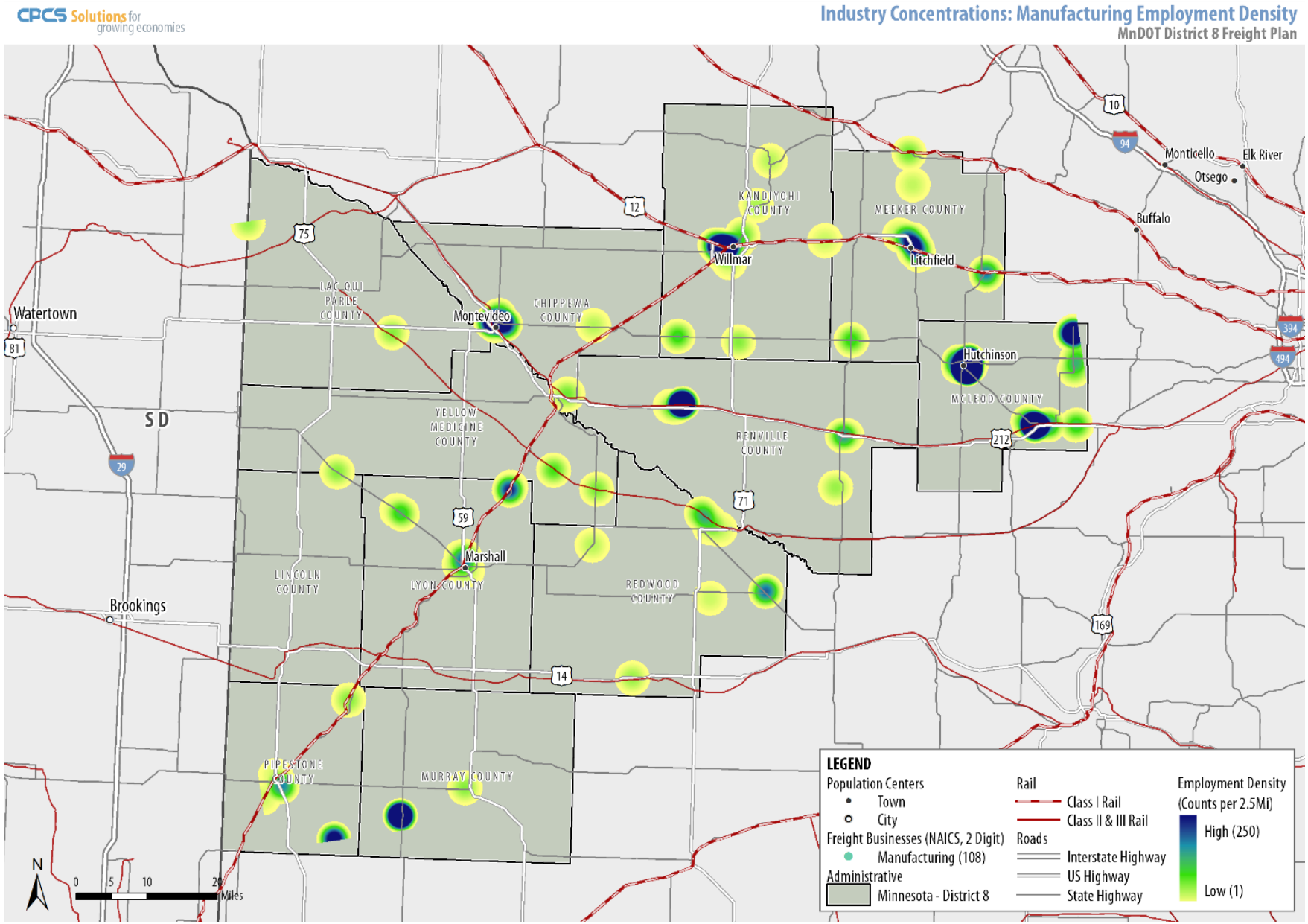
Figure 25 provides a map of the distribution of manufacturers across the District, and Figure 26 shows where employment in manufacturing is concentrated.

Figure 25: District 8 Manufacturing Establishments



Source: CPCS analysis of Reference USA Data.

Figure 26: Employment Density of Manufacturing Industries



Source: CPCS analysis of BEA employment Data.

Chippewa, Kandiyohi, Meeker, McLeod, and Renville counties stand out as particularly important centers for manufacturing employment, with towns such as Montevideo, Willmar, Litchfield, and Hutchinson hosting the most concentrations of manufacturing jobs.

The manufacturing industry's freight needs are varied due to the wide variety of products. In general, manufacturing businesses are clustered in close proximity to major highways such as Highway 212 and Highway 12, as well as BNSF's Marshall Subdivision stations.

Wind Component Manufacturing

Wind energy production plays a crucial role in providing clean energy: a 1.5 MW wind turbine can produce the energy required to support 332 average US households. Capacity in Minnesota is even higher: wind turbines in District 8 are being refitted to generate 2-3 MW, and new installations are capable of generating 3.6 – 4.2 MW.[15] New wind developments in District 8 have even higher capacity: A wind farm is comprised of multiple wind turbines to produce more energy.[16]

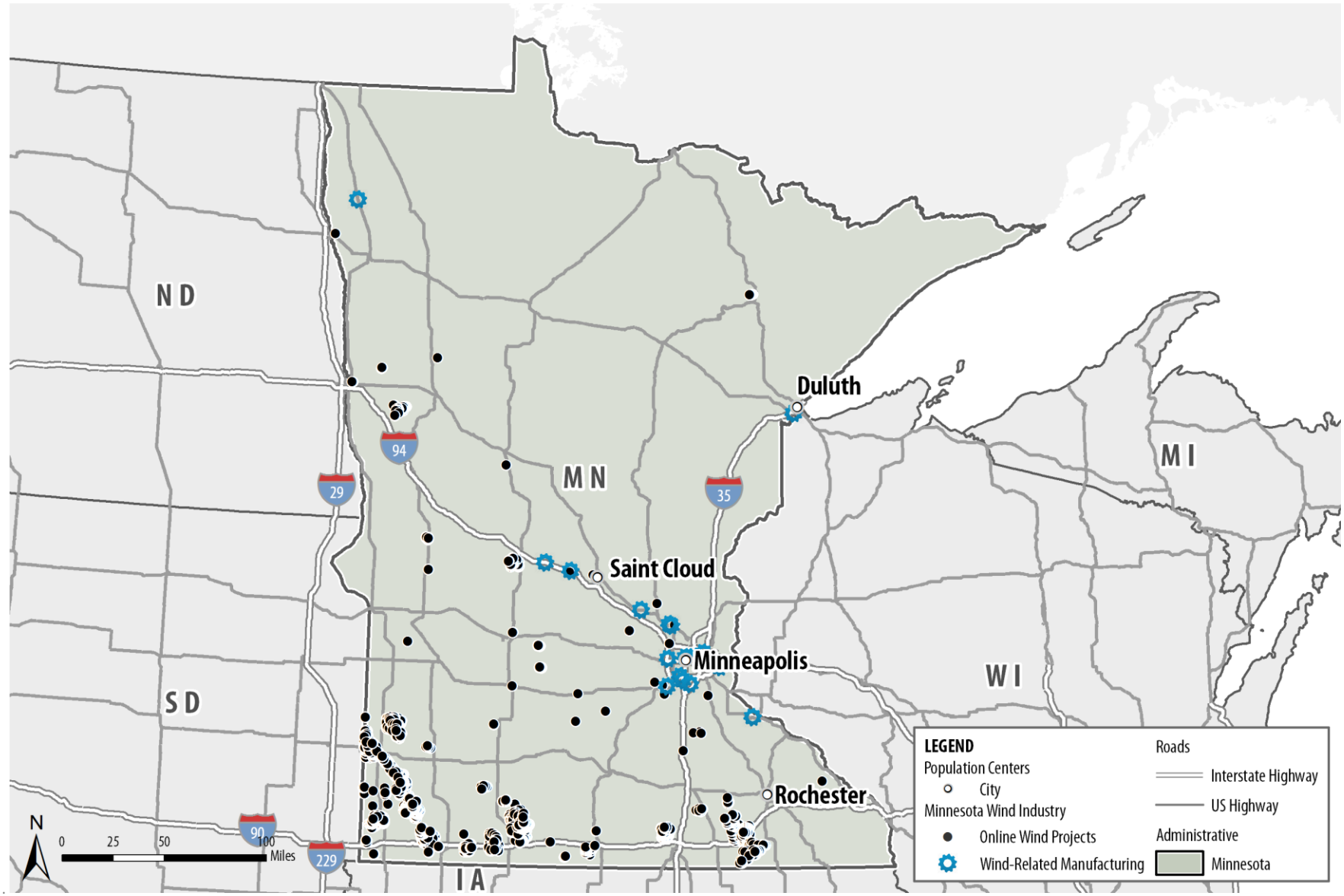
Wind power generation in Minnesota started in 2000, offering around 897,000 Mwh capacity, which has increased by more than 12 times to 11,346,000 Mwh by the end of 2018. In 2018, nearly 18 percent of the total electricity generation in the state was from wind turbines. Wind production is one of the growing manufacturing sectors in Minnesota and the District.[17]

In addition to the environmental benefit inherent in clean energy production, wind farm construction and operations provide jobs and other economic opportunities for the state. Minnesota exacts a wind production tax of 0.0012 to 0.012 cent per Kwh depending on the farm sizes. The wind production tax is collected annually by county treasurer offices. In 2018, wind farms across 27 counties of Minnesota paid a combined wind production tax of $12.7 million. This tax revenue may be used for a range of purposes, including financing road and infrastructure maintenance projects.

Wind turbines are typically installed in plains and hills that offer a desirable annual average speed of the wind to turn the blades. As Figure 27 shows, the majority of counties in the south and west of Minnesota provide ideal conditions for wind farms. This is while the state's wind turbine manufacturing facilities are currently located in St. Cloud and Minneapolis. Also, Port of Duluth and Wisconsin are important points of entry for wind turbine parts imported from other states or countries.[18]

[15] Consultations with District 8 Regional Development Commission staff.
[16] National Wind Watch (accessed July 2019). https://www.wind-watch.org/faq-output.php
[17] WINDExchange "Wind Energy in Minnesota" (accessed July 2019). https://windexchange.energy.gov/states/mn
[18] John Myers "Parts for Minnesota Power wind turbines blow through Twin Ports", 2012.

Figure 27: Wind Turbine Capacity and Part Production Factories in Minnesota



Source: CPCS analysis of US Wind Turbine Database, 2019.

Recent technological innovations have enabled the optimization of wind energy production through the development of very large wind turbines. However, transportation and logistics requirements for moving wind turbines have created challenges for transportation decision-makers. Currently, an average-sized wind turbine has about 8,000 parts, including up to 250-foot blades and over 260-foot towers (Figure 28).

Some elements of District 8's, Minnesota's, and national infrastructure as a whole significantly limits the size and height of wind turbines. Examples of such limitations and infrastructure-related challenges are low-height highway underpasses, crane availability to handle and install the turbine pieces, and the trucking fleet's difficulty in transporting longer wind blades due to geometric road design and OSOW route constraints. Section 0 provides a detailed assessment of the OSOW needs and issues in the District.

Figure 28: Wind Turbine Transportation

Source: 2010 Transportation Engineering and Road Research Alliance Pavement Conference, Presentation by Tim Stahl, Jackson County.

2 District 8 Multimodal Freight System

Key Findings

The transportation systems in District 8 work together to facilitate the movement of agricultural goods and heavy machinery, originating, entering, and exiting the District at every corner. Interstate highways do not serve the District, and therefore trucks traveling in the region are highly reliant on the system of US highways and Minnesota state and county routes to move goods. In terms of rail, the District is served by two Class I railroads (BNSF and CP) and operates on more than 460 miles of tracks that provide inter-district, inter-state, and cross-border connections. In addition, there are two regional airports in the District that have the ability to provide air cargo service, with additional dedicated hangars that facilitate crop dusting planes. The pipeline network in District 8 is extensive, totalling approximately 690 miles of active pipeline. Though natural gas is primarily moved throughout the District, the pipeline network also carries crude oil, hydrocarbon gas liquid, and a variety of petroleum products.

2.1 District 8 Freight System Overview

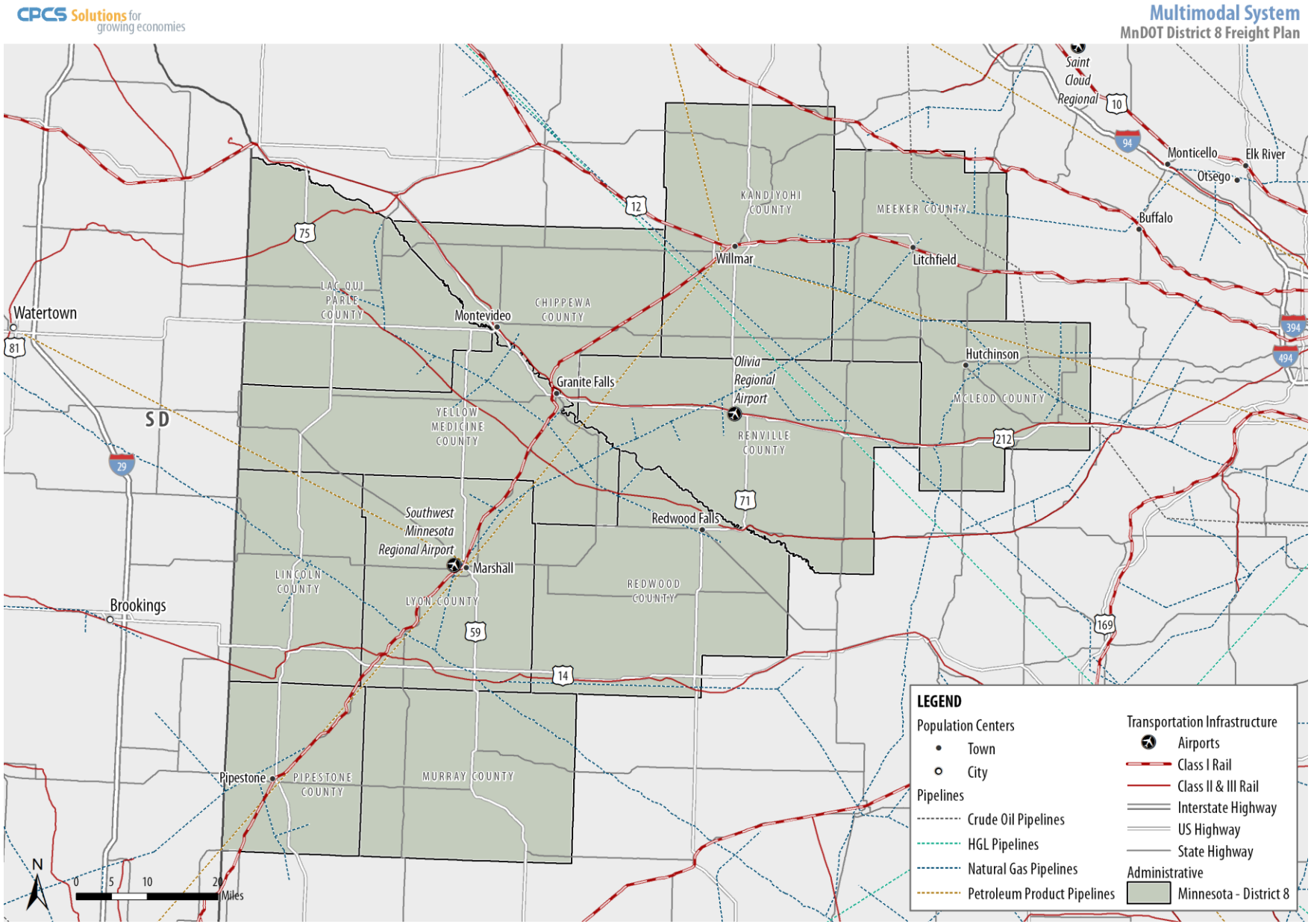
In District 8, the *Weight Enforcement Investment Plan* identified two needs: additional weight enforcement on US-71 and MN-23 near Willmar, and updated Weigh-In-Motion equipment on US-212 near Olivia.

District 8 covers 12 counties in West Central and Southwestern Minnesota, and together these counties hold nearly 10 percent of Minnesota's total land area and approximately 5 percent of the population. Some of the major cities and towns in the District include Hutchinson, Marshall, and Willmar, all of which are involved in the manufacturing and shipping of agricultural goods and heavy machinery. District 8 is unique as it does not have any interstate highways within the District. Therefore, access to I-90, I-94 and other corridors around the Twin Cities is vital for many of the District's businesses.

Today, some of the key regional corridors include MN-23, US-212, and US-12, which provide access to larger metropolitan areas such as the Twin Cities and St. Cloud, key interstates (i.e. I-35, I-494), and other modes of transport not present in the District itself (i.e. marine transport via the Great Lakes or inland river system). The Burlington Northern Santa Fe Railway (BNSF) is the most extensive Class I rail operator within the District, though there are a number of short line railroads, as well as the Canadian Pacific Railway that are vital in serving District 8. Another key component of the District's freight system is a system of shuttle terminals, which facilitate in the movement of grain across modes. These shuttle terminals are important because grain is the largest commodity produced in the District, and is a key part of the region's economy. In District 8 alone, there are thirteen grain shuttle terminals, with the remainder of the state's shuttle terminals heavily located in the West Central and Southwestern regions of Minnesota.

Figure 29 provides a high-level snapshot of the District's key transportation assets. In order for District 8 to remain economically prosperous, it is important for transportation systems to be well-aligned and work in conjunction with one another in order to continue to provide key freight services to the District. This section reviews each modal element of the District's freight system, which will provide a baseline for the evaluation of its condition and performance.

Figure 29: The District 8 Multimodal System



Source: CPCS analysis of National Transportation Atlas Database

0	1,390	468	365	18	858
Miles of Interstate	Miles of US and State Highways	Miles of Rail	Bridges	Public Airports	Miles of Pipelines

Statewide Freight System Trends

A high-level overview of Minnesota's freight system is outlined here to provide additional context for the following District 8-specific discussion. In 2012, Minnesota's freight system moved one billion tons of freight with an estimated value of $912 billion. Trucking is Minnesota's dominant mode by tonnage, handling about 63 percent of the total share of freight tonnage carried in Minnesota. Rail had the second-highest share of tonnage (25 percent), with smaller volumes of freight moved by water, pipeline, and air. Trucking also accounted for 67 percent of the state's total freight value, while rail held a 21 percent share of value.[19] The following table summarizes the 2012 and projected 2040 freight modal split for Minnesota.

Figure 30: Freight Modal Split in Minnesota

Freight Mode	2012 Tonnage	Projected 2040 Tonnage	2012 Value	Projected 2040 Value
Truck	63%	63%	67%	63%
Rail	25%	26%	21%	20%
Water	3%	2%	<1%	<1%
Pipeline	5%	6%	3%	2%
Multiple Modes and Mail	4%	3%	7%	11%
Air	-	-	2%	4%

Source: MnDOT "Statewide Freight System Plan" (2016).

The Federal Highway Administration (FHWA) projects that by 2040, total freight volumes in Minnesota will have risen by 80 percent to 1.8 billion tons. The value of this tonnage will increase more quickly, increasing 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.

In 2012, grain accounted for 23 percent of the total freight tonnage carried in Minnesota, followed by metallic ores (9 percent), coal (7 percent), gravel (7 percent) and animal feed (5 percent). As Figure 31 shows, based on 2040 projections, the share of freight tonnage associated with cereal grains, other agricultural products, and animal feed is expected to increase to a combined 38 percent. This increase in freight tonnage associated with agricultural products quite relevant to the District due to its heavy-engagements in agricultural production. The forecasted increase in agricultural tonnage is therefore indicative of a future increase in freight tonnage within the District.

[19] MnDOT Statewide Freight System Plan (2016). https://www.dot.state.mn.us/planning/freightplan/pdf/mn-statewide-freight-system-plan.pdf

In 2012, top commodities by value were electronics, machinery, motorized vehicles, mixed freight, and precision instruments. By 2040, precision instruments are expected to hold a 23 percent share of the state's commodity value followed by machinery and commodities with 9 percent and 8 percent shares respectively.

Figure 31: Top Five Current and Forecasted Commodity Shares

2012 Top Commodities by Tonnage	Share %	2040 Top Commodities by Tonnage	Share %	2012 Top Commodities by Value	Share %	2040 Top Commodities by Value	Share %
Cereal Grains	23	Cereal Grains	24	Electronics	8	Precision Instruments	23
Metallic Ores	9	Coal	8	Machinery	8	Machinery	9
Coal	7	Other Agriculture	8	Motorized Vehicles	6	Electronics	8
Gravel	7	Animal Feed	6	Mixed Freight	6	Mixed Freight	5
Animal Feed	5	Gravel	6	Precision Instrument	5	Misc. Manufacturing Products	5

Source: MnDOT Statewide Freight System Plan (2016).

The implications of these expected shifts for District 8's freight system are uncertain, though the anticipated increase in grain tonnage alone is likely to add pressure on the system. Animal feed, gravel, and other agriculture (which are all dominant commodities in the District) are also estimated to account for large portions of the tonnage handled within the region.

The following sections provide an introduction to the District's multimodal freight system and describe infrastructure, key facilities, and the corridors that integrate the District's freight operations with the State's freight network.

2.2 Road Network

The District's road network consists of a variety of road types, including US highways, state highways, and county roads. However, unlike most other Districts, District 8 lacks interstate highway mileage. The road network plays an important role because it provides direct connections not only rail within the District and to all of the District's businesses, but also to other modal systems located beyond District boundaries. Figure 32 lists the mileages of some elements of the District's roads, and Figure 34 provides a visual overview of the routes within the system. Due to the absence of interstate highway in the District, there is a strong reliance on US and state highways to provide connections to much of the District. County roads also play an important role in the region.

Figure 32: District 8 Road System Mileages

	District 8	Minnesota
Interstate	0	912
US Highway	544	3,294
State Highway	846	7,080

Source: CPCS analysis of FHWA Data

Interstate highways in District 8 are absent, therefore making US, State, and County highways critical road connections for much of the region.

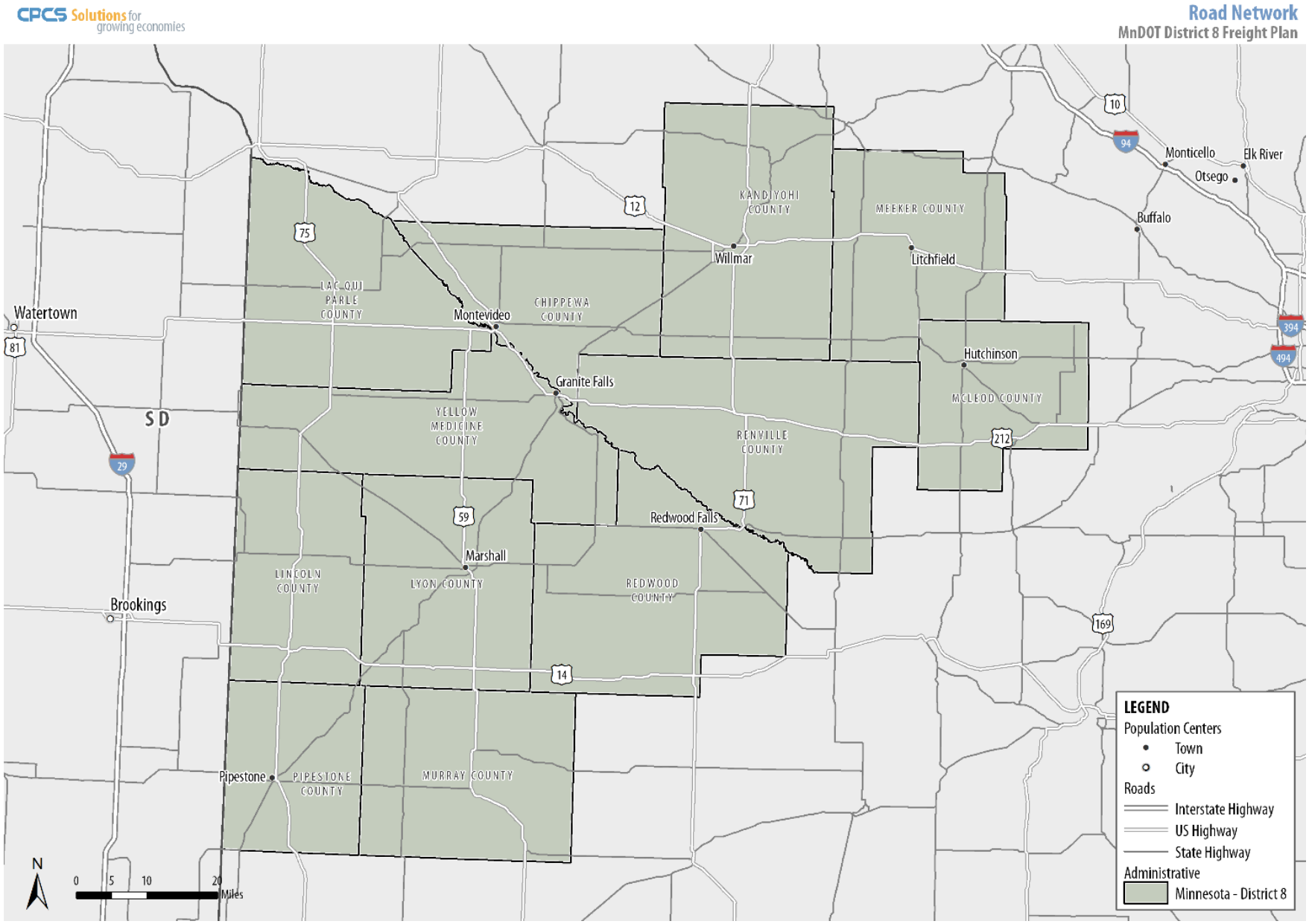
Tonnage information by commodity specific to District 8 is not available, but statewide tonnage figures can provide insight into potential trends for freight moving on District 8's road network. Trucks carry 63 percent of the total freight tonnage and account for 67 percent of the commodity value carried in Minnesota. Due to the flexibility of trucking operations, trucks carry a wide range of commodities in short and long haul operations and are the sole provider of "last mile" services for most businesses. In 2012, cereal grains, animal feed, agricultural products, and gravel were the top commodities carried via trucks in terms of tonnage. Figure 33 summarizes Minnesota's top commodities carried by truck in 2012 and 2040, and Figure 35 lists District 8's top truck-borne commodities as of 2012.

Figure 33: Major Commodities Carried by Trucks, 2012

Top Commodities	Tonnage Carried by Trucks in 2012	Percent	Projected Increase by 2040
Cereal Grains	102,444,952	27%	56%
Gravel	36,411,736	9%	21%
Animal Feed	27,660,293	7%	104%
Nonmetal Mineral Products	26,059,761	7%	68%
Waste/Scrap	21,527,179	6%	32%
Other Agricultural Products	21,194,640	5%	153%
Other Foodstuffs	14,968,912	4%	79%
Coal	14,024,837	4%	2%
Gasoline	12,075,671	3%	9%
Wood Products	8,706,138	2%	21%
Base Metals	7,974,647	2%	N/A
Fuel Oils	7,470,600	2%	N/A
Fertilizers	7,127,865	2%	N/A
Milled Grain	6,512,195	2%	188%
Logs	6,413,718	2%	N/A
All Others	65,388,376	17%	N/A

Source: MnDOT "Statewide Freight System Plan" (2016).

Figure 34: District 8 Highway System Map



Source: MnDOT, "Southwest Minnesota Regional Information" (July 2019). http://www.dot.state.mn.us/d8

Figure 35: District 8's Major Commodities by Total Truck Tonnage, 2012

Commodity	Tonnage	Percent	Percent Originating in D8
Cereal Grains	25,181,939	41%	51%
Animal Feed	7,916,521	13%	43%
Other Agricultural Products	4,027,701	6%	51%
Gravel	2,210,740	4%	26%
Gasoline	2,156,431	3%	50%
Waste/Scrap	2,146,823	3%	66%
Other Foodstuffs	2,090,693	3%	63%
Motorized Vehicles	1,845,853	3%	84%
Coal-n.e.c.	1,838,020	3%	58%
Base Metals	1,646,764	3%	73%
All Others	11,010,578	18%	52%

Source: MnDOT Statewide Freight System Plan Technical Memo 3.

Comparing statewide commodities and District 8-specific commodities provides insight into the unique qualities of the District's transportation system. Specific differences between District 8 and Statewide commodities include:

- **Cereal Grains** made up a larger portion of District 8's truck tonnage (41 percent) than the share within all of Minnesota (27 percent). This is likely due to the high levels of agricultural activity within the District relative to the entirety of the State.
- **Animal Feed** made up 13 percent of District 8's truck tonnage, but only 7 percent of Minnesota's truck tonnage. Again, this difference likely reflects the fact that District 8 is heavily involved in agricultural activity and various crop production.
- **Gravel** makes up 9 percent of Minnesota's truck tonnage, but only 4 percent of District 8's. The minimal aggregate activity occurring by truck within the District is likely due to the expense attached to trucking gravel great distances in combination with the remoteness and minimal population growth of the District.
- **Non-metal Mineral Products** made up 7 percent of Minnesota's truck tonnage, but 0 percent was identified in District 8.

The FHWA's projections anticipate a 56 percent increase in the cereal grain tonnage, 104 percent increase in animal feed tonnage, 153 percent increase in agricultural products tonnage, and 21 percent increase in gravel tonnage carried via trucks by 2040.[20] Excluding the "All Others" commodity category, these commodities are the top four types of goods moving on District 8's road network. It is likely that truck tonnages in this District will increase in the future, although they may do so at a rate slower than Minnesota as a whole, given District 8's historically flat population growth.

[20] MnDOT "Statewide Freight System Plan" (2016). https://www.dot.state.mn.us/planning/freightplan/pdf/mn-statewide-freight-system-plan.pdf

It is likely that truck tonnages in District 8's will increase in the future, although their growth may be slower than Minnesota's overall truck tonnages due to slow population growth.

Key Corridors

Because interstates are non-existent within the District, trucking activity is reliant on US Highways and State Routes, primarily US-12, US-212, and MN-23. These corridors are important because they support freight movement between densely populated areas both inside and outside the District.

Figure 36 provides an overview of all vehicle and truck-specific traffic volumes in District 8, and illustrate which routes are most important based on vehicle volume.

Figure 37 shows how the road network and truck traffic is anchored to the Northeast portion of the District, though MN-23 acts as a key artery in connecting the District to the surrounding Interstates, and US-212 provides a link to the Twin Cities. US-14, US-12, US-71, and US-75 also provide links to other sections of the District, though volumes carried along these corridors are relatively lower.

US-12

US Highway 12 runs East-West across the northern portion of the District. The route passes through ten states, starting in Aberdeen, Washington and terminating in Detroit, Michigan. US-12 enters Minnesota in Ortonville, carrying through to Wayzata just west of Minneapolis. For the majority of its traverse through Minnesota it remains a two-lane highway, though it widens to a four-lane arterial throughout the city of Willmar. Beyond Wayzata to I-394, US-12 becomes a six-lane freeway and runs simultaneously with I-394 and I-94, passing through the Twin Cities and on to the Wisconsin state line at Hudson. Within the District, US-12 has an average AADT of 6,932 and an HCAADT of 1,114, which means that over 15 percent of the traffic carried along this corridor is heavy commercial vehicles. Not only is this corridor important for the volume of freight that it handles, but US-12 is also important to the District because of its links with the interstates that enter into Wisconsin, which is a key route for truck freight bound to or from the large port cities of Chicago or Milwaukee. Also notable is the connection between US-12 and US-71 in Willmar, a major North-South route that connects Canada to the Gulf Coast in Louisiana.

US-212

US Highway 212 runs for nearly 950 miles from MN-62 through to Yellowstone National Park. Within the District, US-212 connects to a number of cities and corridors throughout. Noteworthy intersections are US-75 (south of Madison), US-59 (southwest of Montevideo), MN-23 in Granite Falls, US-71 in Olivia, MN-4 in Hector, MN-15 (southwest of Brownton), and finally MN-22 in Glencoe before continuing on towards Norwood Young America. The majority of the corridor within the District is a two-lane rural highway, though it is technically classified as an urban freeway within the Twin Cities area. As it does traverse areas that are mainly rural, the portions of US-12 that pass through farming areas are vital in the transportation of commodities involved within the farming supply chain.

As Figure 36 and Figure 37 show, in the District, US-212 is most heavily traveled between Olivia and Glencoe. The average AADT for US-212 in the entire District is 5,047, with 15 percent of traffic volume (757) being made up of heavy commercial trucks.

MN-23

Minnesota 23 runs northeast to southwest across Minnesota, connecting Duluth to Sioux Falls, SD. Within District 8, MN-23 passes through the counties of Kandiyohi, Chippewa, Yellow Medicine, Lyon, and Pipestone. Specifically, MN-23 enters/exits the District just southwest of Paynesville and intersects with US-71/US-12 at Willmar before continuing towards Granite Falls (US-212), Marshall (US-59), and Pipestone (US-75). This route serves as a major connector to key interstates beyond District boundaries at either end, particularly I-94 at St. Cloud and I-90 just outside of Beaver Creek. MN-23 also intersects with I-35 in both Hinckley and Duluth. In the District, the Annual Average Daily Traffic count (AADT) on MN-23 is about 5,075, about 12 percent of which (612 vehicles) is Heavy Commercial Annual Average Daily Traffic (HCAADT).[21] MN-23 has a relatively high portion of HCAADT volume compared to other highways in the District, as shown in Figure 37, suggesting that it is an essential corridor within the District's integrated freight network. Unlike many other roadways in the District, MN-23 has some four-lane sections, including the Marshall area, the Granite Falls area, Willmar to New London. Additional 4-lane sections are being added from Paynesville to Richmond, in Stearns County (District 3). This additional improvement is expected to improve truck operations in District 8 by providing more reliable access to I-94 and St. Cloud.

Secondary Corridors

In addition to the key corridors previously described, there are other important routes that support freight movements within the District:

US-71 is a North-South route that enters Minnesota through the Canada-US border at the Fort Frances-International Falls International Bridge, and connects to Iowa near Jackson, MN. It is a largely rural highway, though it remains a major route for Northern Minnesota. As it passes through Willmar, US-71 is built to freeway standards, likely due to the high volume of both AADT and HCAADT in the city. Beyond Willmar, US-71's truck traffic volume is relatively high as it is affected by high-volume trucking activities south of Redwood Falls, which could be attributed to Manufacturing and Construction activity within the area.

US-59 is a North-South route that enters Minnesota through Lancaster at the Canada-US Border, and the southern end of the highway is the Mexico-US border in Laredo, Texas. Statewide, the majority of US-59 connects rural communities along the western portion of the state, running for approximately 425 miles. Within the District, key intersections include US-212 (west of Montevideo), MN-67 in Clarkfield, MN-23 in Marshall, and MN-30 in Slayton. Both AADT and HCAADT are higher around Marshall and Slayton.

MN-15 is a 154-mile highway that runs between St. Cloud and Fairmont at the Southern Minnesota border. The route serves as an important truck connection between Hutchinson and St. Cloud, and provides some northern portions of District 8 with access to I-94 through intersections with US-12, US-212, and MN-7.

[21] MnDOT Traffic Data (September 2018), [Online]. http://mndotgis.dot.state.mn.us/tfa/Map

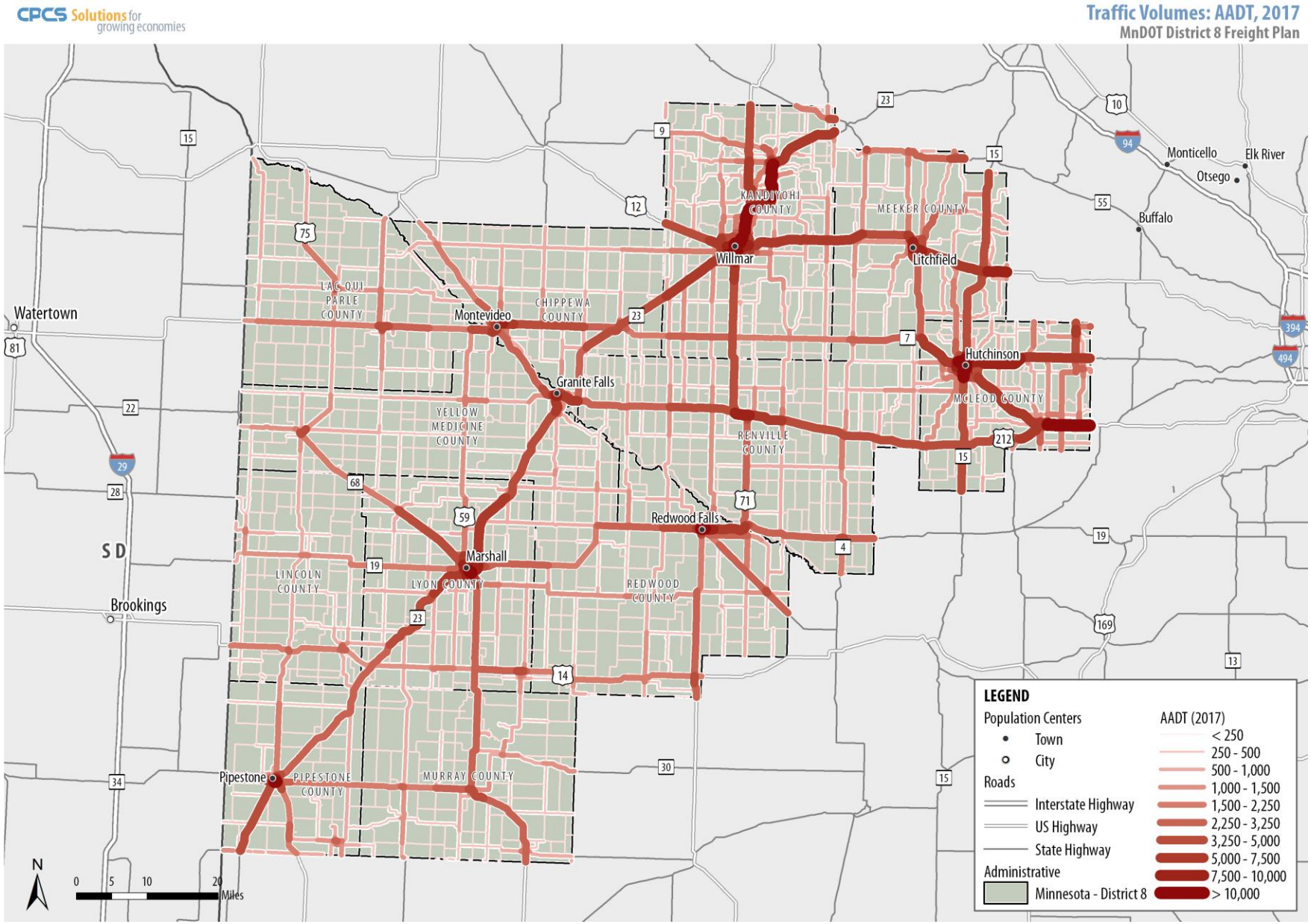
MN-22 is a North-South route, starting at an interchange with MN-23 in the city of Richmond and continues south towards Wells, where it then intersects with I-90 just north of the Minnesota-Iowa border. In the District, MN-22 is most heavily traveled between Hutchinson and Glencoe, before connecting with US-212. This section in particular has an average AADT of 4,940 and HCAADT of 429.

MN-7 is a 195-mile trunk highway running from Beardsley and continues east towards Minneapolis where it ends an intersection with MN-100. MN-7 has a low to moderate truck traffic (average AADT of 4,940, HCAADT 445) but has been identified on the National Highway System as it serves an important connector for the state's – and the nations – transportation of goods. Locally, key connections include US-212 in Montevideo, MN-23, US-71, and MN-15 in Hutchinson

MN-19 is a primarily East-West route running through Southwest and Southeast Minnesota, starting at the South Dakota border near Ivanhoe to end at an intersection with US-61 in Red Wing, just west of the Wisconsin border. In the District, MN-19 passes through Lincoln, Lyon, Redwood, and Renville Counties, though it is most heavily traveled near Marshall and Redwood Falls. The AADT of MN-19 in District 8 is 4,217, with an HCAADT of 335.

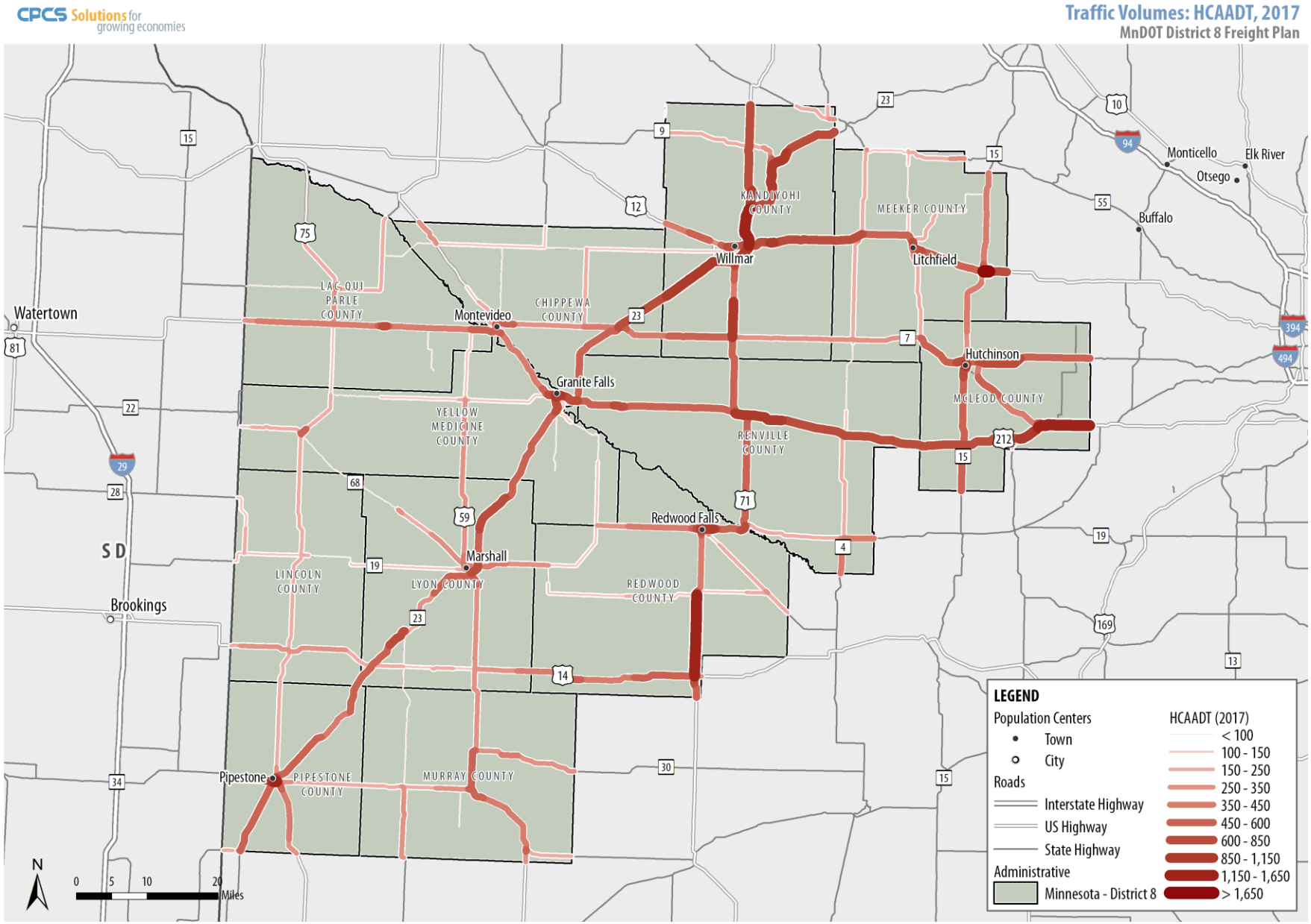
MN-30 is a 266-mile highway that runs from the South Dakota State border to the west of Pipestone, through to its ultimate intersection with MN-43 in Rushford. North of Slayton, MN-30 runs parallel with US-59 for approximately 5.5 miles before continuing east-west through Murray County. MN-30 is most heavily traveled in Pipestone and throughout the District has an AADT of 3,050 and an HCAADT of 430, making it one of the highest-ranking for heavy commercial traffic share within the District.

Figure 36: District 8 Average Annual Daily Traffic Volumes (all vehicles)



Source: CPCS analysis of MnDOT and NTAD data. 2017.

Figure 37: District 8 Annual Average Daily Truck Traffic Volume



Source: CPCS analysis of MnDOT and NTAD data. 2017.

Key Origins and Destinations

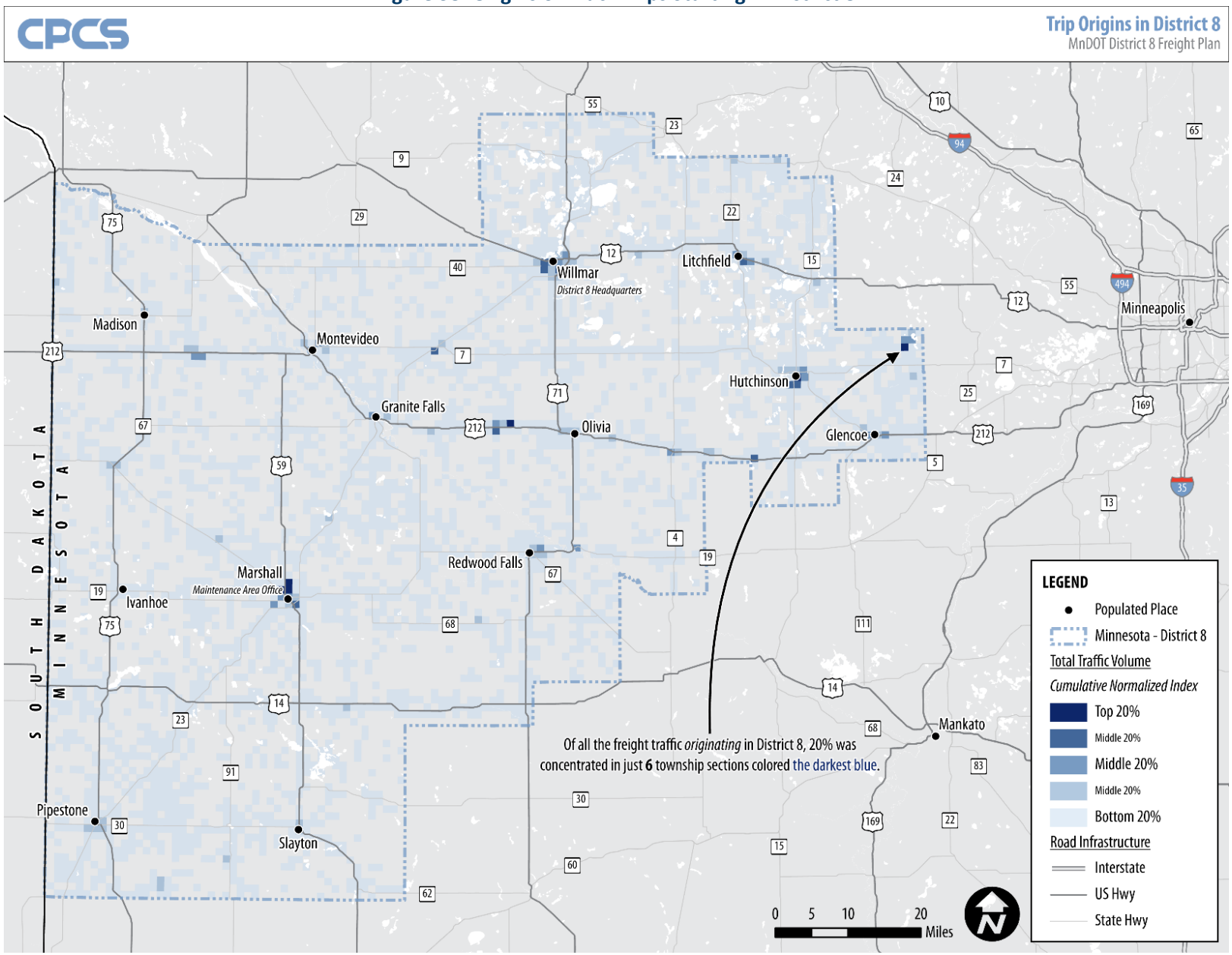
Information on common origins and destinations of truck trips in District 8 was derived from vehicle tracking data provided by StreetLight Data. MnDOT maintains a subscription to StreetLight, which enables users to easily analyze and visualize information related to traffic phenomena and performance. This data is collected from a variety of sources including INRIX's database derived from mobile phone applications such as Google Maps and Waze, onboard navigation systems, and truck Electronic Logging Devices (ELDs). The data utilized by StreetLight is aggregated and generalized to preserve confidentiality and anonymity.

StreetLight's analytical tools allow users to query the origin and destination of truck trips in specific areas. In order to preserve confidentiality, origins and destinations have been aggregated into Transportation Analysis Zones (TAZs) and Township Sections, which provide more generalized information on areas of origin and destination. Figure 38 shows the origin of truck trips starting in District 8, and Figure 39 shows the destination of truck trips that started in District 8. Figure 41 shows the opposite, with destinations of trips ending in the District, and the general areas where those inbound trips originated.

Based on analysis of the figures, some key points emerge:

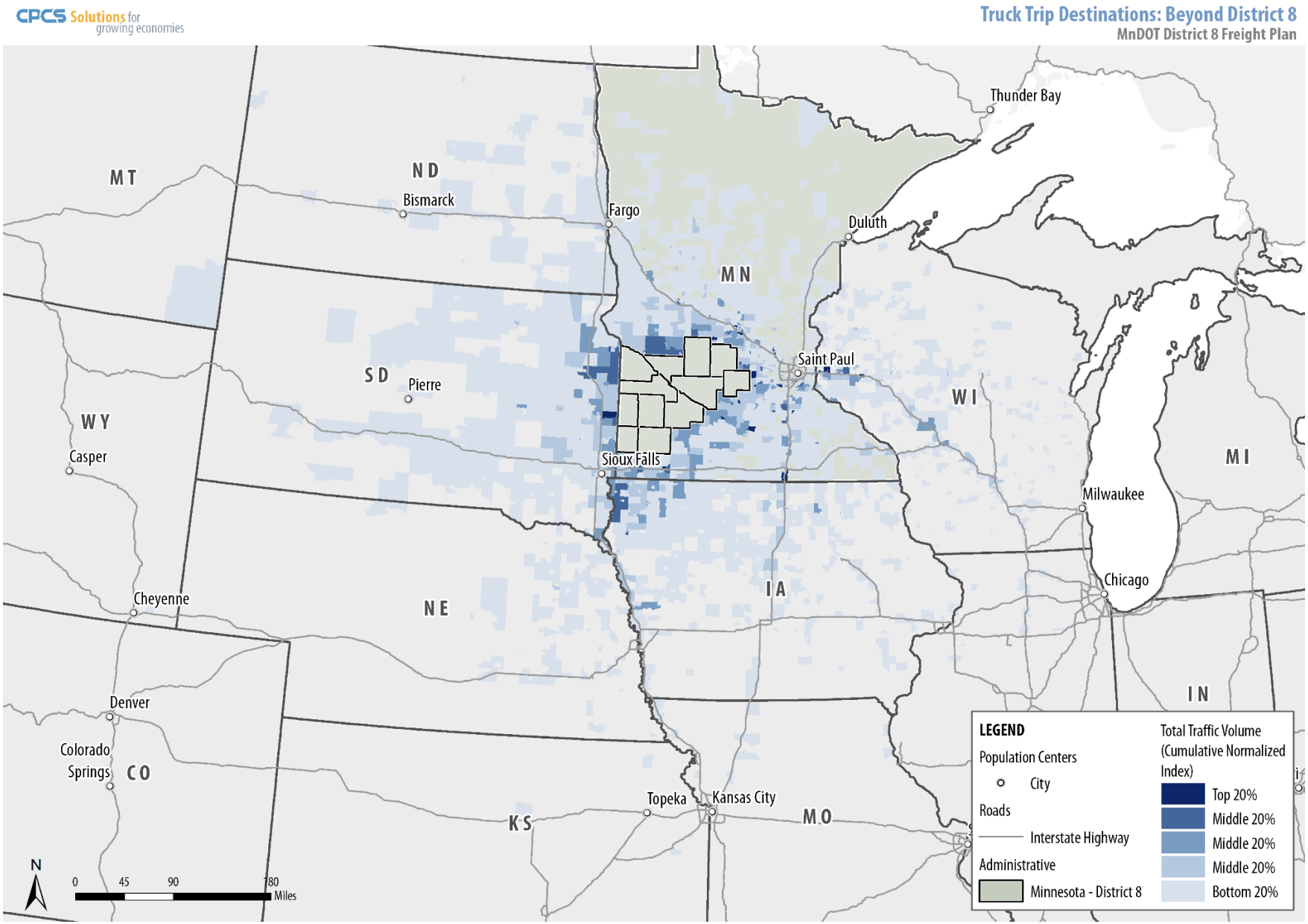
- **The majority of tracked truck trips start and end entirely within District 8**. This finding aligns with our understanding of the District as a key agricultural area, where short truck trips are used to carry agricultural products from farms to local storage and processing areas. This also aligns with findings from stakeholder consultations, as agricultural stakeholders noted that processing plants usually drew from nearby farms.
- Trip origins are strongly concentrated on manufacturing centers. In particular, major origin areas included:
    - **The west side of Willmar**, which is home to a Jennie-O processing plant, UPS and FedEx terminals, and other manufacturers and wholesalers.
    - **The north side of Marshall**, which is a Schwan's Food plant, as well as an ADM corn processing plant and equipment wholesalers.
    - **Southwest Hutchinson**, which is home to a 3M adhesives plant.
    - **Renville**, which is home to the Southwest Minnesota Beet Sugar Cooperative (SMBSC) sugar plant.
    - **The southeast side of Litchfield,** which has a Bobcat manufacturing facility.
    - **Winsted** which has a number of manufacturing and warehousing facilities, including a Tetra Pak food packaging manufacturing plant.
- **Trip Destinations** are also focused on major manufacturing centers, but also included major grain elevators and agricultural facilities, including:
    - Grain elevators in **Dawson**
    - United Farmers' Coop in **Brownton** and **Winthrop**
    - Farmward Coop in Morton, Renville, Danube, Sacred Heart, and Bird Island
    - SMBSC in **Renville**.

Figure 38: Origins of Truck Trips Starting in District 8



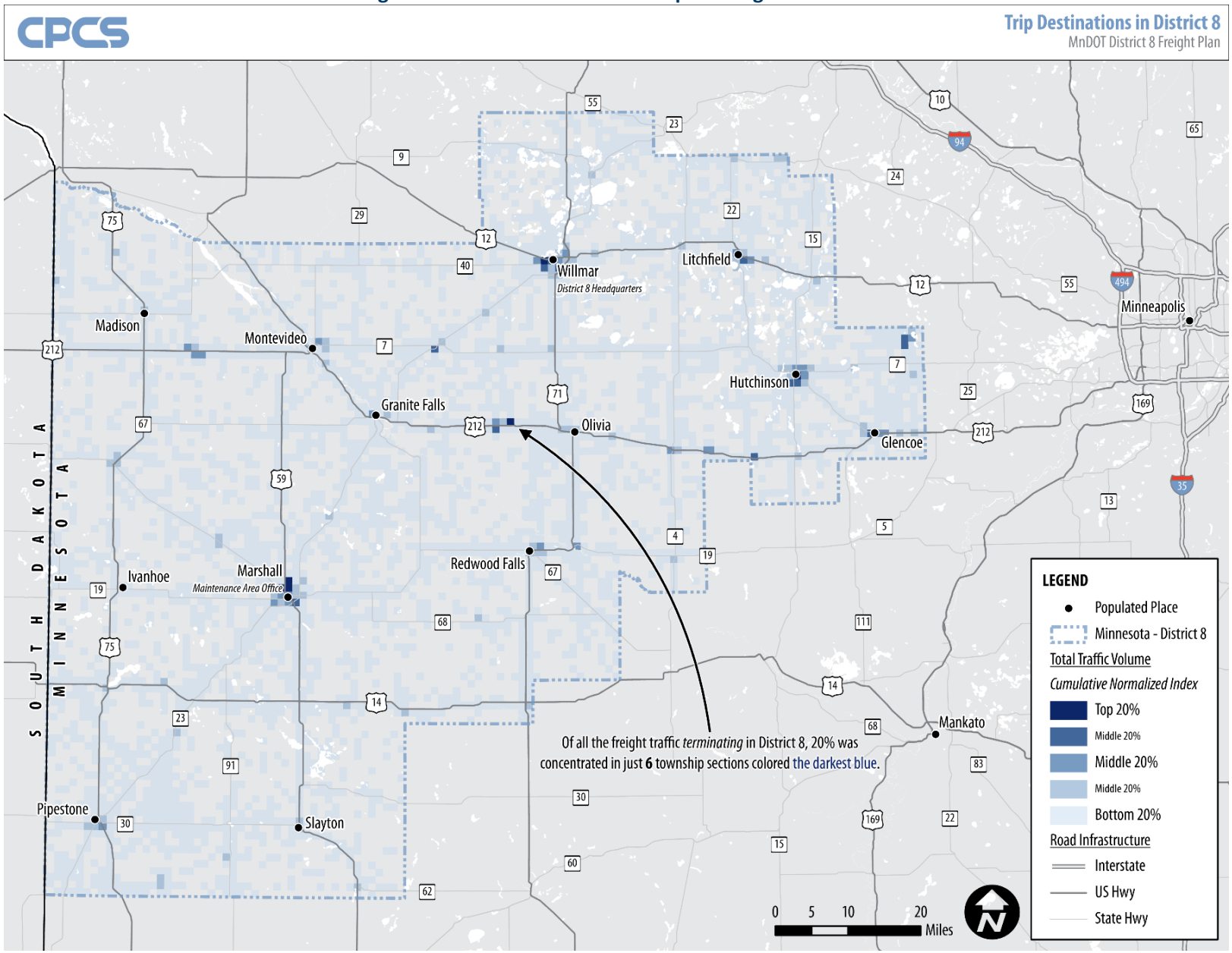
Source: CPCS analysis of MnDOT StreetLight Data

Figure 39: Destination of Truck Trips Starting in District 8



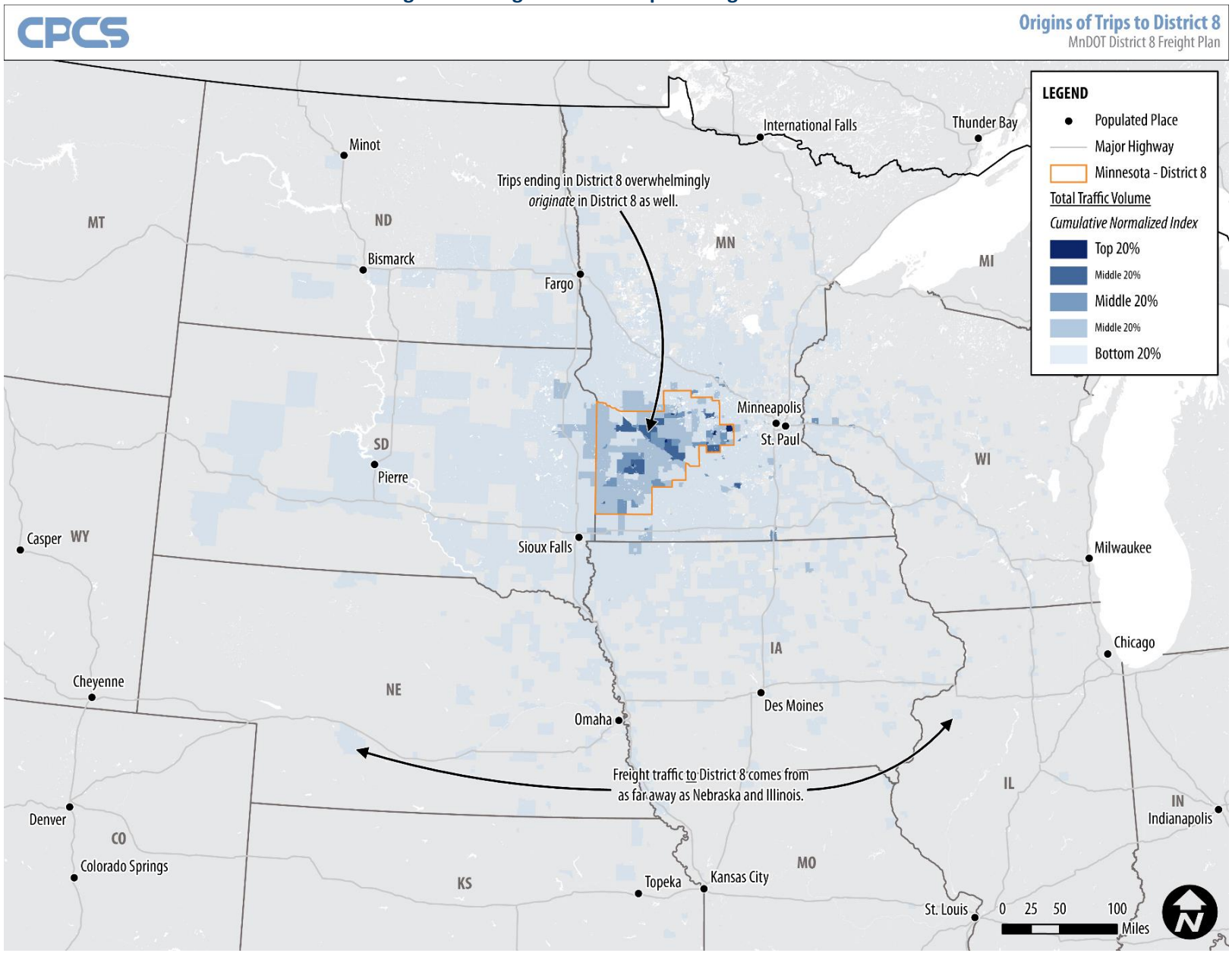
Source: CPCS analysis of MnDOT StreetLight Data

Figure 40: Destination of Truck Trips Ending in District 8



Source: CPCS analysis of MnDOT StreetLight Data

Figure 41: Origin of Truck Trips Ending in District 8



Source: CPCS analysis of MnDOT StreetLight Data

Interestingly, another moderately- common destination was the southeast corner of the intersection of MN-7 and MN-23, which is a truck stop and restaurant. This example illustrates the importance of combining truck trip information with additional data sources, as a concentration of origins or destinations does not necessarily correlate with industrial activity.

Connectors and Critical Freight Corridors

NHS intermodal connectors serve as critical components of the national transportation system by tying modes together and facilitating the distribution of people and goods regionally, nationally, and internationally. NHS freight intermodal connectors provide first and last mile connections between key intermodal freight facilities and the NHS. The USDOT, state DOTs and MPOs work together to select connectors based on criteria such as traffic volume thresholds and the importance of the role each connector serves. In order to comprehend the significance of these connectors and corridors within Minnesota, it is vital to understand the use, condition, and performance of these segments.

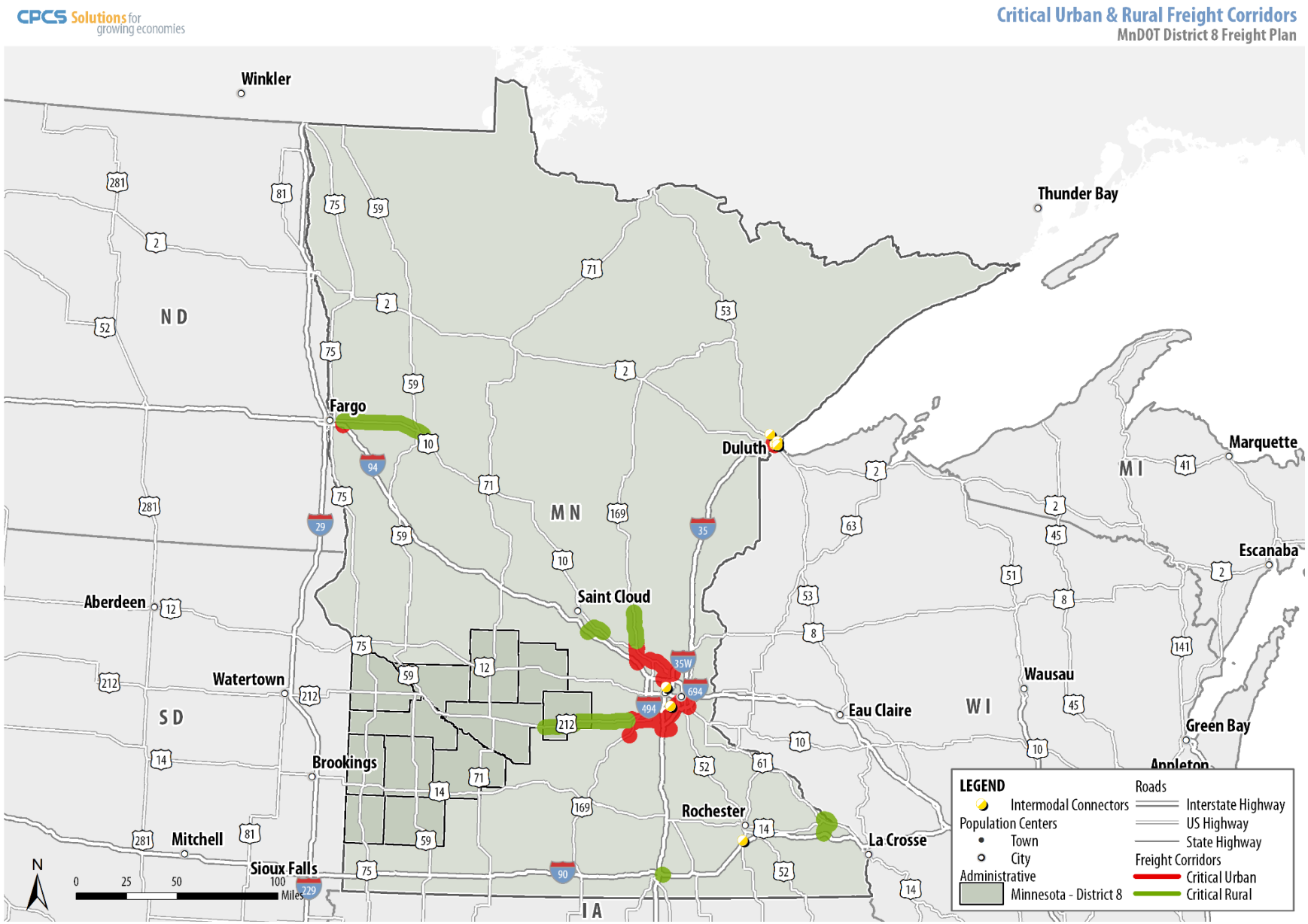
Nationwide, USDOT has designated more than 1,000 miles of urban connectors and nearly 220 miles of rural connectors that connect 616 freight intermodal terminals to the NHS. In total, these segments account for less than one percent of total NHS mileage; nonetheless these routes are vital to efficient goods movement and delivery. In Minnesota, seven connectors have been designated, though none of which are located within District 8.

Critical Urban and Critical Rural Freight Corridors (CUFCs/CRFCs) are another type of classification used to identify key connectors within the state of Minnesota. A Critical Urban Freight Corridor (CUFC) is defined as an urban arterial that fosters connections between intermodal freight facilities to the interstate system, while a Critical Rural Freight Corridor (CRFC) is a rural arterial whereby more than 25 percent of the AADT is truck traffic. Designating a corridor as a CRFC or CUFC allows for guidance in directing Federal resources towards prioritized freight performance improvements, as these corridors are considered priority. FHWA has designated a maximum of 150 miles or 20 percent of Primary Highway Freight System (PHFS) for CRFC and a maximum mileage of 75 or 10 percent of PHFS for CUFC in Minnesota (centerline mileages).[22] MnDOT has designated one Critical Rural Freight Corridor in District 8: US-212 from McLeod County Line to MN-7 in Stewart. This corridor is vital for the District in that it provides oversize-overweight truck service to Critical Urban Freight Corridors and Interstates outside of the District. No Critical Urban Freight Corridors have been designated in District 8.

District 8 has a one listed CRFC that is vital to the region; it provides a critical connection for oversize-overweight truck movements to points outside the District.

[22] PHFS is designated by FASC Act as the network of the most critical freight highways in the U.S. transportation system. FHWA designates the PHFS highways and updates the list every five years. For more information see: https://ops.fhwa.dot.gov/freight/infrastructure/ismt/nhfn_states_list.htm

Figure 42: Critical Urban and Rural Corridors, and NHS Intermodal Connectors



Source: CPCS analysis of MnDOT data

Key Structures and Facilities

Bridges

District 8 has 354 state-owned bridges that account for 7.3 percent of Minnesota's total number of bridges (10 ft. and greater). Including County Highway, Municipal, and Township agencies, the District has a total of 2,808 bridges, all of which are shown in Figure 43. Sixteen of these bridges are considered rail bridges, carrying freight overtop a roadway of some sort. These types in particular have important implications for freight movement within the District. Although rail can move relatively freely throughout the District, the vertical clearance can play a role in terms of route restrictions when transporting freight, particularly hindering OSOW movements. Further information on bridge condition and clearance is provided in Chapter 3.

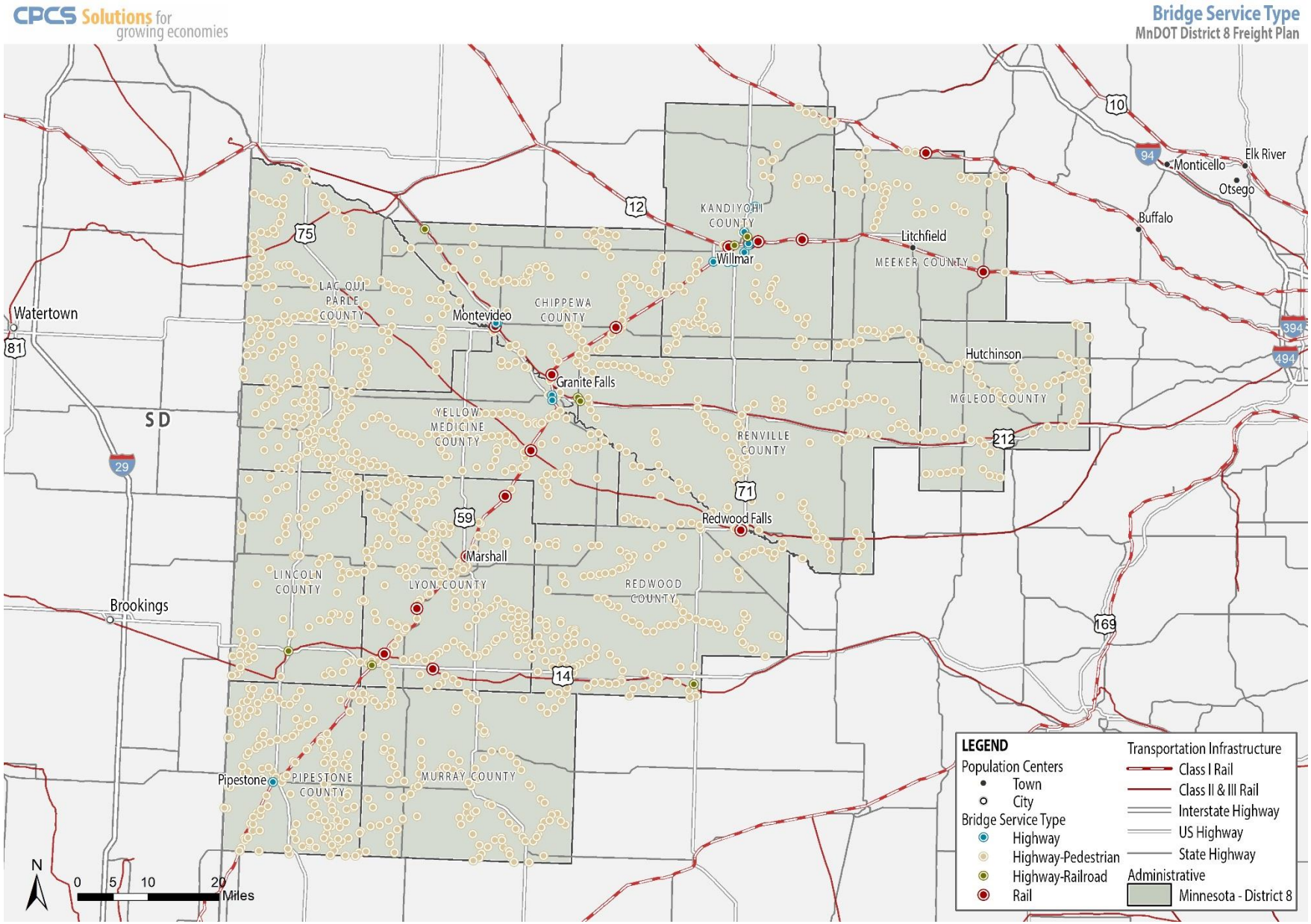
Truck Stations and DOT Headquarters

MnDOT's District Area Headquarters is located in Willmar and there are secondary regional offices in Hutchinson and Marshall. MnDOT also operates 12 truck stations throughout the District to aid in highway maintenance, all of which are primarily located along major state highway corridors including US-212, US-71, US-14, US-59, and US-75.

Minnesota is equipped with more than 840 snowplows and reserve trucks[23] as an effort to manage the burden of extreme weather events, such as snow and ice storms, along major corridors. MnDOT has allocated 51 snow removal trucks to the District, and between 2017 and 2018, MnDOT's plow operations in the District plowed approximately 3,750 lane miles of snow.[24] In addition to MnDOT's work, local counties, municipalities, and private companies operate their own maintenance and plowing programs for their respective transportation assets.

[23] MnDOT "Work Zone Safety" (September 2018). https://www.dot.state.mn.us/workzone/snowplow-facts.html
[24] MnDOT "District 8 Fact Sheet" (2019). https://www.dot.state.mn.us/information/factsheets/d8-fact-sheet.pdf

Figure 43: District 8 Bridge Inventory



Source: CPCS analysis of MnDOT Bridge Inventory Data.

2.3 Railroad Network

Rail has historically played a large role in District 8's freight system, as it has for all of Minnesota. It has the eighth highest number of rail miles in the nation and rail accounts for nearly 25 percent of all freight tonnage moved within the state.[25] Especially important for District 8 is the role that rail plays in moving bulk commodities, namely agricultural products, which drive the District's economy. Today, rail still serves as a key mode in the District and provides connections to markets such as Chicago and the Pacific, Atlantic, and Gulf coasts. District 8 is served by two Class I and three Class III railroads that, combined, operate over 470 miles of track. 480 railway and roadway crossings exist in the District of which only 30 percent are signalized.

468	10.5%	143	337	2
Miles of Track	of the State's Total Track Miles	Actively-Protected Public Crossings	Passively-Protected Public Crossings	Class I Freight Rail Operators

Burlington Northern Santa Fe (BNSF) and Canadian Pacific (CP) are the two Class I railroads that own trackage in the District. Figure 44 lists the trackage and crossings held by the BNSF and CP, and Figure 46 shows the train volumes and speed limits on each Class I lines (and short lines, where available).

Figure 44: Freight Railroad System of the District

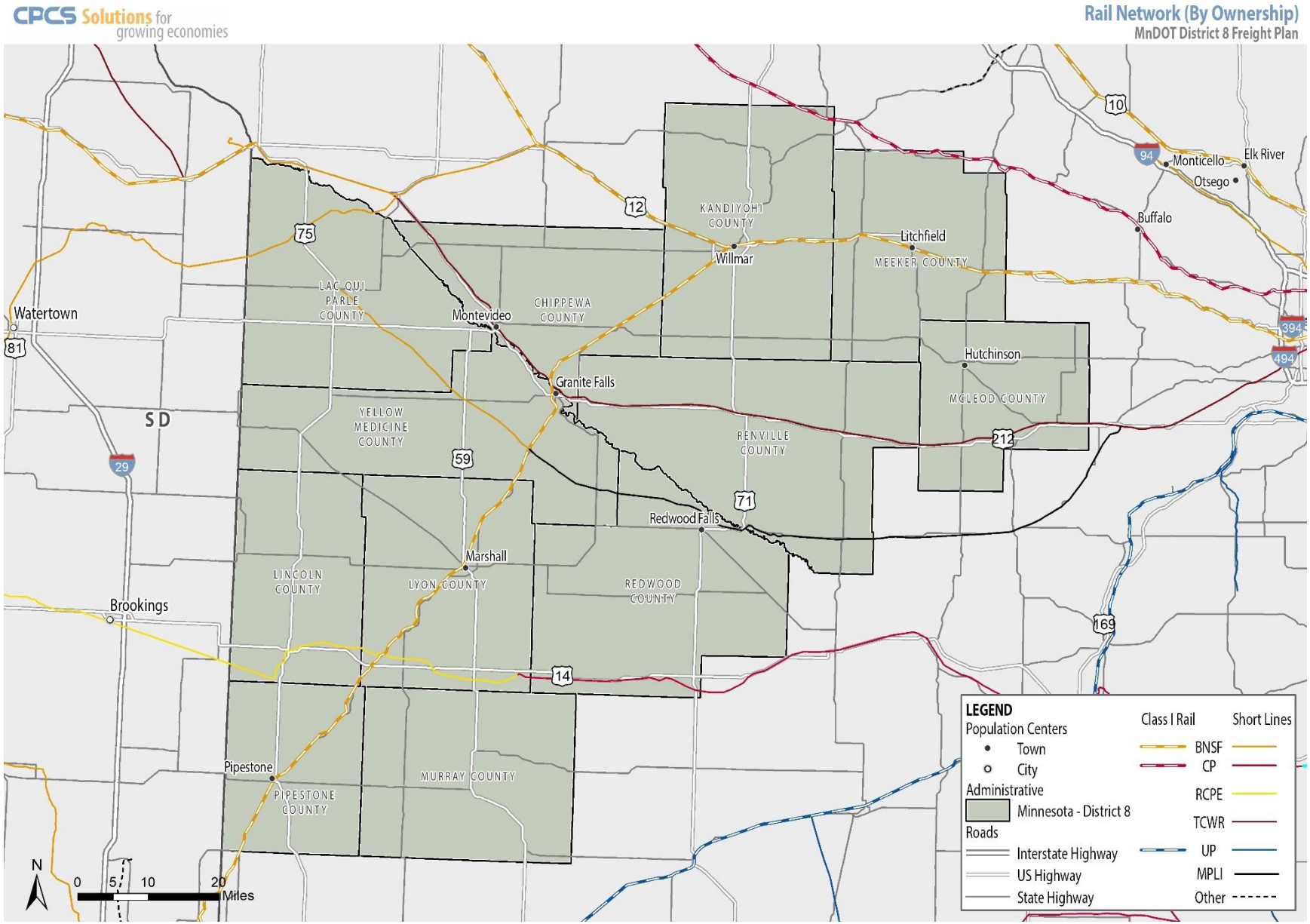
Railroad	System Miles in the District	Number of Mainline Tracks	Public Road Crossings
BNSF	225	1	241
CP	41	1	0
Rapid City, Pierre & Eastern Railroad (RCPE)	46	1	24
Minnesota Prairie Line (MPLI), trackage owned by Minnesota Valley Regional Rail Authority (MVRRA)	52	1	12
Twin Cities & Western Railroad (TCWR)	112	1	34

Source: Minnesota State Rail Plan, 2015. MnDOT Grade Crossing Safety Data, 2015. National Transportation Atlas Database, 2017.

Rail lines in Minnesota carried more than 250 million tons of cargo in 2012, 93 percent of which was carried in rail cars while the remainder was carried in intermodal containers. The state's rail freight tonnage is anticipated to grow by 83 percent to more than 460 million tons by 2040, 90 percent of which is expected to be carried in carloads and the remaining 10 percent is expected to be carried in intermodal containers.[26]

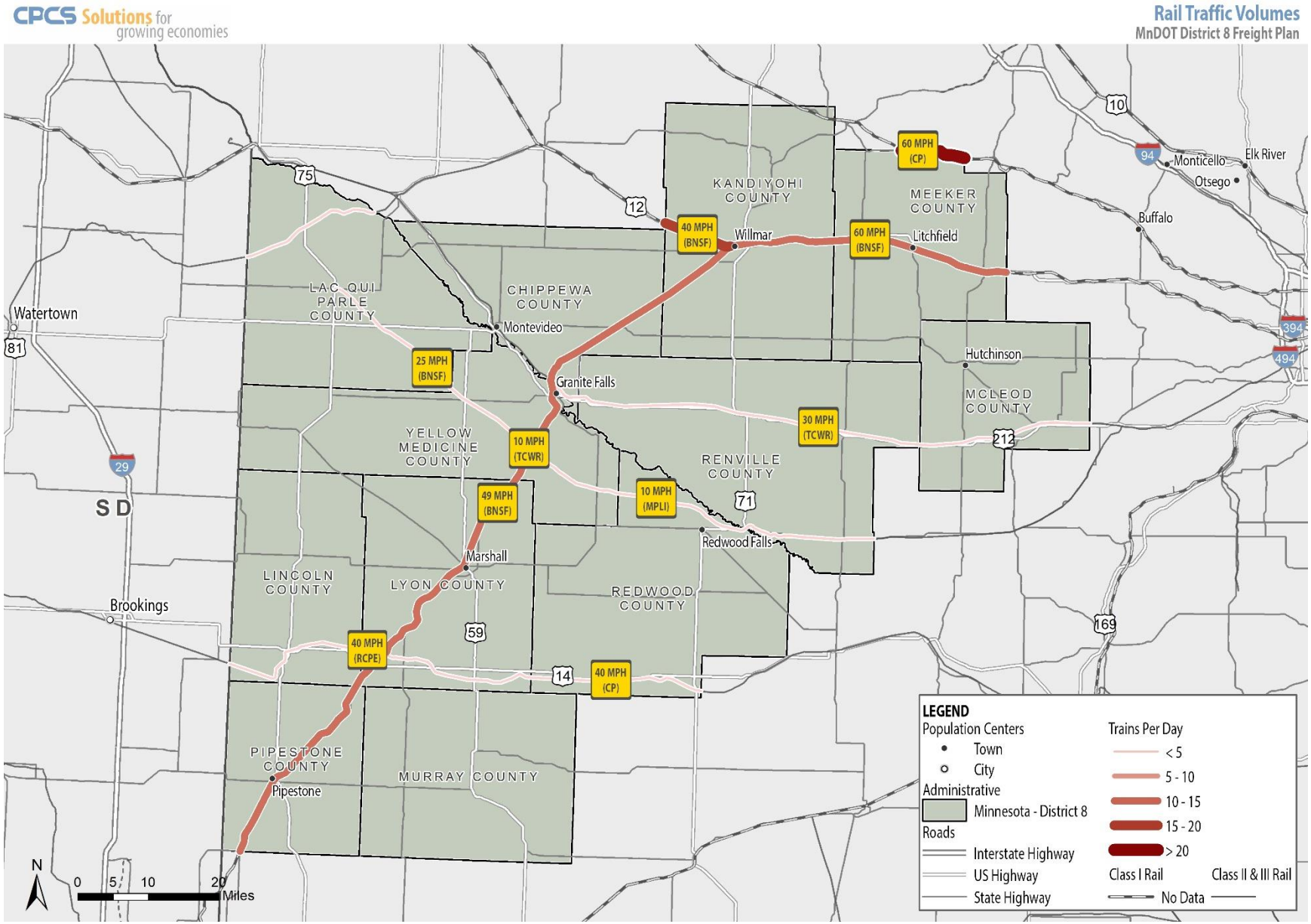
[25] MnDOT "Minnesota State Rail Plan" (2015). http://www.dot.state.mn.us/planning/railplan/resources.html
[26] MnDOT "Minnesota State Rail Plan" (2015). http://www.dot.state.mn.us/planning/railplan/resources.html

Figure 45: District 8 Railroad Lines and Owners



Source: CPCS analysis of National Transportation Atlas Database. 2017.

Figure 46: District 8 Rail Volumes and Average Track Speeds



Source: CPCS analysis of National Transportation Atlas Database. (2017) and MnDOT Freight Railroad Map.

The use of Minnesota's freight rail system has changed over time, and is expected to continue changing in the future. Figure 47 lists the major commodities carried by rail in Minnesota. In 2012, cereal grains, metallic ores, and coal held the highest shares of the total tonnage carried by rail in the state. The FHWA's provisional estimates project a 232 percent increase in the total cereal grain tonnage carried in Minnesota by 2040, while shares of metallic ores and coal commodities from the total tonnage are anticipated to decrease by 4 percent and 6 percent respectively. The large volume of grain moving in District 8, combined with a forecasted 232 percent growth in cereal grain tonnage, will mean that the overall freight moved on the District's rail system will increase significantly, which will have likely implications on the remaining cargo makeup in the District. A study cited in the Minnesota State Rail Plan (2015) indicated that delays in railroads shipping for Minnesota corn, soybean, and wheat farmers cost nearly $100 million due to poor delivery caused by bottlenecks and loss of market responsiveness. Unfortunately, more-detailed disaggregated rail tonnage data specific to District 8 is unavailable.

Figure 47: Major Commodities Carried by Rail in Minnesota

Top Commodities	Tonnage Carried by Rail in 2012	Projected Change by 2040
Cereal Grains	89,294,595	232%
Metallic Ores	30,782,670	-4%
Coal	17,805,883	-6%
Basic Chemicals	15,411,006	355%
Fertilizers	10,167,477	84%
Other Agricultural Products	8,303,144	159%
Coal	7,698,022	159%
Non-metallic Minerals	6,578,648	255%
Animal Feed	5,963,228	87%
Wood Products	5,918,011	4%

Source: Minnesota State Rail Plan (2015).

The large volume of grain moving in District 8, combined with a forecasted 232 percent growth in cereal grain tonnage, will mean that the overall freight moved on the District's rail system will increase significantly.

As noted above, major shifts in commodity markets can have a major impact on rail volumes and rail service in District 8. The oil production boom in North Dakota, and record grain harvests in the upper Midwest have translated directly into increased demand for rail service. Railway system congestion on Minnesota's main rail corridors in previous years has led to slower travel times and longer wait times, reducing rail service reliability across the state. Plans are currently underway in District 8 to improve freight movements (Willmar Wye, briefly discussed below), in hopes of relieving the continued challenges faced by farmers both within in the District and statewide.

Key Corridors

BNSF Railway

The BNSF railway operates 1,584 miles of track in Minnesota and 225 miles of track within the District. BNSF is the dominant freight rail service provider in the state, by trackage owned, primarily carrying agricultural commodities, coal, and ore as well as intermodal freight traffic.

Figure 48 shows the number of trains per day and average speed of trains on BNSF tracks in the District. There is a rail connector in Willmar, which translates into heavy train volumes from Willmar heading east to the Twin Cities and Chicago, west to the Pacific Northwest, and south to the Sioux Falls and Kansas City as a primary gateway.

Figure 48: BNSF Railway Operations in the District

Railway Segment	Trains Per Day	Maximum Speed (MPH)
Between Madison and Hanley Falls	<1	25
Between Willmar and Pipestone	13	49
Between Willmar and Dassel	12	60
Between Willmar and Benson	16	40
Between Benson and Breckenridge/Wahpeton, ND	7	40

Source: CPCS analysis of Minnesota Freight Railroad Map, June 2015, Office of Freight and Commercial Vehicle Operations.

The Willmar Wye project is an ongoing Public Private Partnership (PPP) between BNSF and MnDOT in addition to Kandiyohi County, the City of Willmar, and the Kandiyohi/Willmar Economic Development Commission in order to make rail improvements to BNSF rail lines and highway improvements near the junction.[27] The end result of this project will be a direct connection between BNSF's Marshall and Morris subdivisions, reducing the number of trains moving through the downtown core of Willmar, but also reducing congestion and allow freight to better move through the city.

CP Railway

CP Railway operates a small portion of track within District 8, namely 26 miles running from Tracy to Springfield. Continuing east, the CP tracks continue to connect Minneapolis to different destinations in Wisconsin.

Figure 49: CP Railway Operations in the District

Railway Segment	Trains Per Day	Maximum Speed (MPH)
Between Paynesville and Annandale (Passes through NE Meeker County)	24	60
Between Tracy and Springfield	4	40

Source: CPCS analysis of Minnesota Freight Railroad Map, June 2015, Office of Freight and Commercial Vehicle Operations.

[27] MnDOT "Willmar Rail Connector & Industrial Access Project" (2018). http://151.111.142.5/d8/projects/willmarwye/index.html

CP serves a variety of commodity groups with grain (22 percent), intermodal freight (22 percent), energy, chemicals and plastics (17 percent) and metals, minerals and consumer products (11 percent) accounting for the highest shares of the company's total revenue in 2018.[28]

Figure 46 and Figure 49 display the number of trains per day and average speed of trains on CP tracks. The CP tracks between Paynesville and Annandale only passes through the District in Meeker County, though it does have the highest train volume and speed as this line is a critical link between Canada, the Midwest and the Great Lake.

Short Lines

Short lines are freight carriers that serve the local or regional freight demands. In addition to the two Class I railroads serving the freight activities in the District, three short lines operate on over 205 miles of track (~25% of the State's total Short Line mileage). The following table provides an overview of the short lines that are active in the District.

Figure 50: Short Lines Operating in the District

Short Line Railroads	Mileage	Area Served	Class I Rail Connection	Commodities
Rapid City, Pierre & Eastern Railroad (RCPE)	46	From South Dakota into Tracy (Lyon County)	CP	Bentonite Clay, Cement, Ethanol, Fertilizer, Grain
Twin Cities & Western Railroad (TCWR)	112	From South Dakota into Twin Cities	BNSF	Ethanol, Fertilizer, Grain, Machinery, Lumber, Aggregates
Minnesota Prairie Line (MPLI), trackage owned by Minnesota Valley Regional Rail Authority (MVRRA)	52	Rewood and Yellow Medicine Counties (Norwood to Hanley Falls), with connections to TC&W in east.	BNSF	Ethanol, Fertilizer, Grain, Machinery, Lumber, Aggregates

Source: CPCS analysis of Minnesota Freight Railroad Map, June 2015, Office of Freight and Commercial Vehicle; Minnesota State Rail Plan of 2015.

Short lines in Minnesota, and District 8 particularly, continue to face challenges related to infrastructure conditions. Compared to Class I lines, short line tracks are generally less preserved and use could be characterized by lighter weight rail, lower-grade tie and ballast conditions.[29] As is the case, many carriers are unable to accommodate for some modern rolling stock and without accommodation of these heavier cars, the option of using short lines for certain freight requiring transportation in specific rail cars becomes less economically viable. The competitive position of some carriers therefore becomes significantly undermined. Trackage right agreements within the District do exist, and the problem of rail car-rail line suitability as mentioned above has been associated to these types of contracts. Smaller railroads, such as RCPE and TCWR, sometimes have to rely on connecting carriers to serve the market needs of their own customers which could sometimes end problematically.

The District's Minnesota Prairie Line (MPL) occupies a unique position relative to purely privately-held railroads. The MPL track and right-of-way is owned by the Minnesota Valley Regional Rail Authority (MVRRA), which is a public agency. The MPL is a wholly-owned subsidiary of the TCW, and is a contract rail service operator on behalf of the MVRRA. Since the MVRRA is a public entity, it is eligible for government funding for improvements.

[28] CP "Built to Drive Growth: 2018 Annual Report" (2018). https://s21.q4cdn.com/736796105/files/doc_financials/Annual-Report/2018/CP_2018_AnnualReport_FINAL.pdf

[29] MnDOT "Minnesota State Rail Plan" (2015). http://www.dot.state.mn.us/planning/railplan/resources.html

It is important to note that some of the funding tools or programs available to MVRRA are not available to privately-owned railroads.

At-Grade Rail Crossings

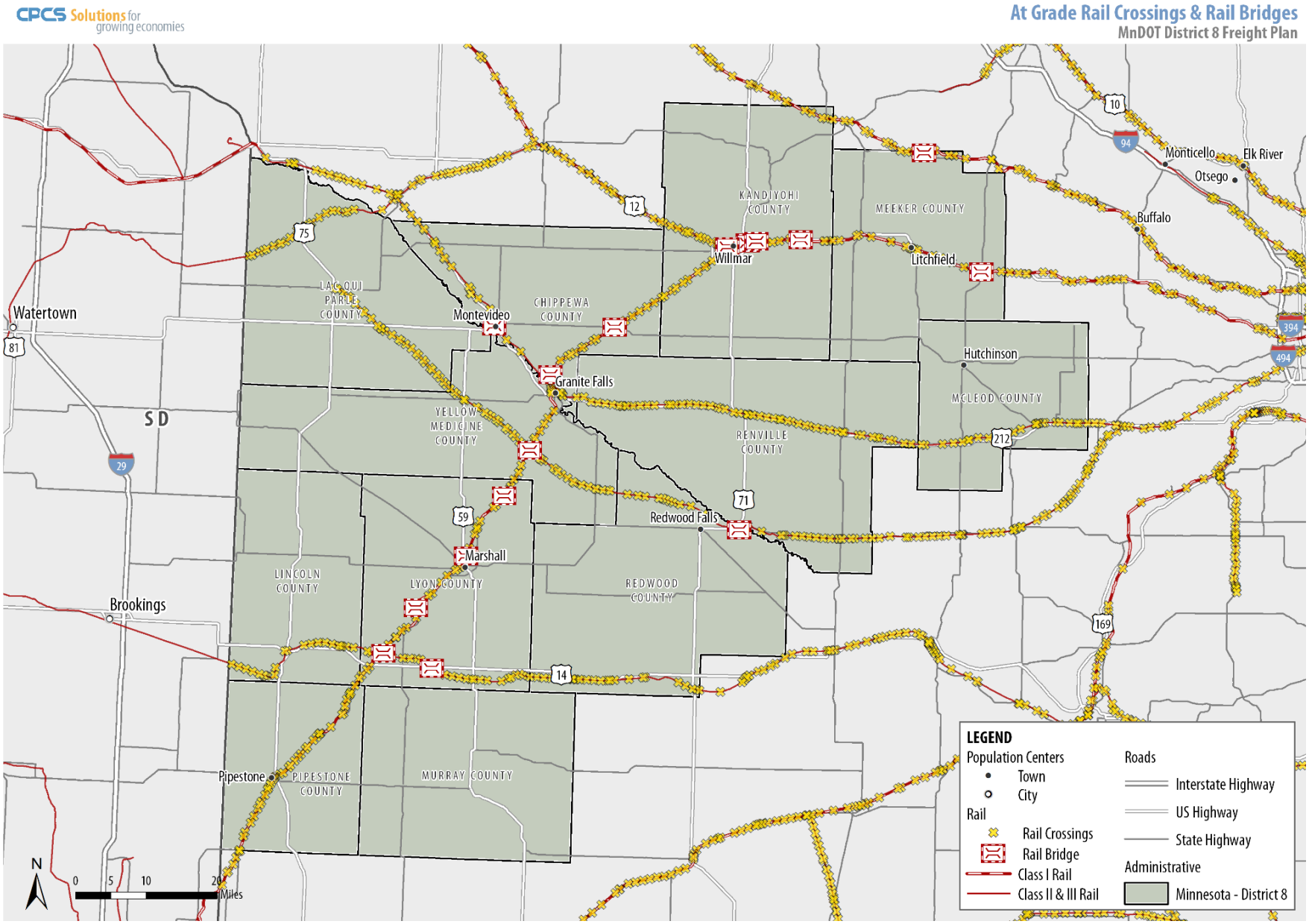
Railroad-road grade crossings are potential safety conflict points that can create delays for the whole freight system (both truck and rail modes). Figure 51 provides a breakdown of the types and number of crossings by county. Controlled crossings are equipped with active warning devices like gates, flashing lights, or bells, while uncontrolled crossings are only protected by passive warning devices such as stop signs or crossbucks.

Figure 51: Public Grade Crossings in the District

County	Active	Passive	Total Public	Private*
Chippewa	13	31	44	35
Kandiyohi	22	23	45	31
Lac Qui Parle	3	50	53	14
Lincoln	6	17	23	1
Lyon	27	32	59	11
McLeod	13	13	26	19
Meeker	19	6	25	24
Murray	0	0	0	0
Pipestone	15	26	41	12
Redwood	8	29	37	27
Renville	12	62	74	55
Yellow Medicine	6	49	55	18
Total	144	338	482	247

Source: MnDOT, *Information on private crossings was not available from MnDOT, and this private crossing data was retrieved from the Federal Railroad Administration Crossing Inventory.

Figure 52: District 8 Rail Crossings and Bridges



Source: CPCS analysis of Federal Railroad Administration Data.

Key Structures and Facilities

Rail and Grain Shuttle Terminals

While the majority of intermodal terminals in Minnesota are clustered along the BNSF Corridor from Willmar to Pipestone, there are a handful of rail intermodal facilities dispersed along Class I and II lines that aid in serving the Districts freight activities. Figure 53 lists the rail terminal and yard facilities in the District, and Figure 54 visually displays these locations throughout the District.

Figure 53: District 8's Rail Terminals and Yards

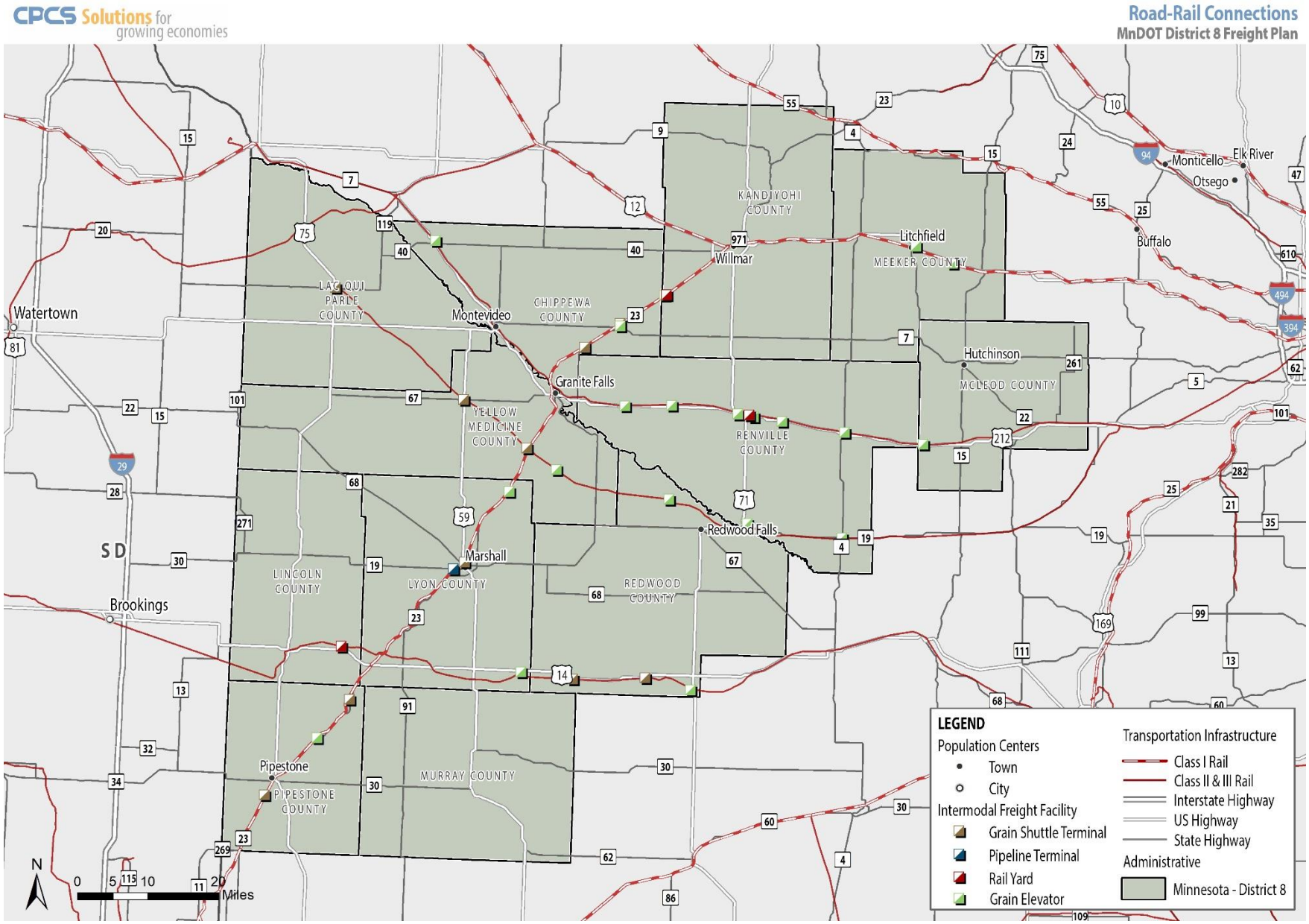
Facility Name	City	Facility Type*	Commodity	Railway
ADM Corn Processing	Marshall	Grain Shuttle Terminal	Corn, Soybeans, Wheat	BNSF
ADM Corn Processing	Holland	Grain Elevator	Corn	BNSF
ADM	Sanborn	Grain Elevator	Grain	CP
ADM Edible Bean Specialties	Olivia	Grain Elevator	Soybeans	TC&W
Cargill, Inc.	Maynard	Grain Shuttle Terminal	Corn, Soybeans, Wheat	BNSF
Cargill, Inc.	Pipestone	Grain Shuttle Terminal	Corn, Soybeans	BNSF
Cenex Harvest States	Tyler	Grain Shuttle Terminal	Corn, Soybeans	DME
Central Regional Cooperative	Buffalo Lake	Grain Shuttle Terminal	Corn, Soybeans, Wheat	TC&W
Central Regional Cooperative	Fairfax	Grain Elevator	Corn, Soybeans, Wheat	MPL
Central Region Cooperative	Hector	Grain Elevator	Corn, Soybeans	TC&W
CHS, Inc.	Ruthton	Grain Shuttle Terminal	Corn, Soybeans	BNSF
CHS Inc	Tracy	Grain Elevator	Grain	CP
Cooperative Country Farmers	Olivia	Grain Shuttle Terminal	Corn, Soybeans	TCW
Farmers' Cooperative Elevator	Hanley Falls	Grain Shuttle Terminal	Corn, Soybeans	BNSF
Farmers' Cooperative Elevator	Montevideo	Grain Shuttle Terminal	Corn, Soybeans	TC&W
Farmers' Cooperative Elevator	Cottonwood	Grain Elevator	Corn, Soybeans, Wheat	BNSF
Farmers Elevator	Raymond	Grain Elevator	Corn, Soybeans, Wheat	BNSF
Farmers Elevator	Clara City	Grain Elevator	Corn, Soybeans, Wheat	BNSF
Farmward Cooperative	Danube	Grain Shuttle Terminal	Corn, Soybeans, Wheat	TC&W
Farmward Cooperative	Morton	Grain Elevator	Corn, Soybeans, Wheat	MPL
Farmward Cooperative	Wood Lake	Grain Elevator	Corn, Soybeans, Wheat	MPL
Farmward Cooperative	Olivia	Grain Elevator	Corn, Soybeans, Wheat	TC&W
Farmward Cooperative	Renville	Grain Elevator	Corn, Soybeans, Wheat	TC&W
Farmward Cooperative	Sacred Heart	Grain Elevator	Corn, Soybeans, Wheat	TC&W
Forsman Farms	Darwin	Grain Elevator	Corn	BNSF
FW Cobs Company	Stewart	Grain Elevator	Grain	TC&W
Glacial Plains Coop	Milan	Grain Elevator	Grain	TC&W
Madison Energy	Madison	Grain Shuttle Terminal	Corn, Soybeans, Wheat	BNSF
Magellan Pipeline	Marshall	Pipeline Terminal	Oil Products	--
Meadlowland Farmers' Cooperative	Delhi	Grain Elevator	Grain	MPL

Facility Name	City	Facility Type*	Commodity	Railway
Meadowland Farmers' Cooperative	Lamberton	Grain Shuttle Terminal	Corn, Soybeans, Oats	RCPE, CP
Meadowland Farmers' Cooperative	Walnut Grove	Grain Shuttle Terminal	Corn, Soybeans, Wheat	RCPE, CP
Prairie Grain Partners	Clarkfield	Grain Shuttle Terminal	Corn, Soybeans, Wheat	BNSF
Prinsburg Farmers' Cooperative	Clara City	Grain Shuttle Terminal	Corn, Soybeans, Wheat, Oats	BNSF
Prinsburg Farmers' Cooperative	Raymond	Grain Shuttle Terminal	Corn, Soybeans, Wheat	BNSF
United Farmers Cooperative	Brownton	Grain Shuttle Terminal	Corn, Soybeans	TC&W
United Farmers Cooperative	Bird Island	Grain Elevator	Corn, Soybeans	TC&W
United Farmers Cooperative	Litchfield	Grain Elevator	Grain	BNSF
Western Consolidated Coop	Appleton	Grain Shuttle Terminal	Corn, Soybeans	TC&W
Willmar Yard	Willmar	Rail Yard	--	BNSF

Source: Minnesota Intermodal Freight Facility Dataset, Minnesota State Rail Plan (2015), Google Earth.
*Note: Facilties 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.

Grain shuttle loading terminals (high capacity, high-speed grain loading facilities) are a recent example of the agricultural industry using technology in order to improve efficiency. Besides the fact that grain shuttle terminals have the capacity to load/unload a 110-car shuttle in less than eight hours, these types of terminals also offer reduced rail rates and assured car availability. These two factors combined provides potential for attracting grain from further distances. Given the District's prominence in the agricultural industry then, it comes as no surprise that the majority of the District's intermodal rail terminals are grain shuttle terminals – all of which are classified as loading facilities. There is an additional pipeline terminal located in Marshall. Owned by Magellan, this facility handles refined petroleum assets mainly from the Midwest.

Figure 54: District 8 Road-Rail Connection Facilities



Source: CPCS analysis of National Transportation Atlas Database (February 2018).

Willmar Wye Project

Kandiyohi County has been known as a rail hub for many years, as BNSF has trains moving into and out of the county in all directions. Notably, the Willmar Rail Switching Yard is the only one of its type within the District. The rail yard is operated and owned by BNSF, largely handling commodities such as coal, petroleum, and grain. The Willmar Wye project, a joint initiative between the State of Minnesota, Kandiyohi County, City of Willmar, Willmar/Kandiyohi County EDCs, and BNSF, is currently underway as of July 2019. It was originally proposed in an effort to move freight more efficiently through the city of Willmar by decreasing the number of trains required to pull into the rail yard in the downtown area. Increased multimodal opportunities for shippers, economic growth, and delay savings have been identified in the FRA's Environmental Review as additional project benefits, all of which have important implications on freight movements occurring within the District.[30]

The project will consist of constructing a new railway connection between the Marshall and Morris Subdivisions of the existing BNSF railway network, as well by providing direct freight rail access to the City of Willmar's industrial park. Surrounding roadways will also be modified in order to accommodate for the new rail connections, namely US-212, US-12, CR-5, CR-55.

Increased multimodal opportunities for shippers, economic growth, and delay savings have been identified as additional Willmar Wye project benefits, all of which have important implications on freight movements occurring within the District.

Due to the increase in rail shipments from surrounding regions, for example the Bakken fields of North Dakota, the current network capacity is unable to "keep up" with demand. With a lack of pipeline as an alternative transportation option, investments into the rail network within the District are necessary. Trains pass through District 8 that are destined to local refineries as well as those in the Gulf, while coal is being directed largely the ports of the Great Lakes.[31] Additionally, grain trains within the area are being delayed, increasing the aches experienced by the many farmers in Central Southwest Minnesota. Once complete, the Willmar Wye Rail Connector will be able to ease many of the issues currently experience at this chokepoint within the District.

MVRRA/MPL Rehabilitation

Since 2002, over $35 million in state and federal funds have been invested to replace and upgrade MPL trackage (owned by MVRRA.) In particular, the line has been undergoing major rail rehabilitation, including rail replacement, ballast replacement, and tie replacement. This work has enabled the line to support heavier and faster trains. As of fall 2019, there are 50 miles of track remaining to be rehabilitated west of Morton. A key future project will include improvements to the bridge structures crossing the Minnesota River and surrounding river bottoms.

[30] USDOT FRA "Willmar Rail Connector and Industrial Access Project, Minnesota" (2018). https://www.fra.dot.gov/Page/P1024

[31] USDOT FRA "Willmar Rail Connector and Industrial Access Project, Minnesota" (2018). https://www.fra.dot.gov/Page/P1024

2.4 Aviation Network

Freight shipped by air accounts for a small portion of the freight carried by other modes. However, air freight is still important to the economy as the cargo carried by air is typically of high value. Also, air cargo usually has relatively lower weight, and is highly time-sensitive. As Figure 55 shows, precision instruments, electronics, and valuable machinery are the top air-carried commodities in Minnesota. As the table shows, the FHWA's projected 2040 growth for air cargo activities in Minnesota estimates a significant increase in the chemical product tonnage.

Figure 55: Top Air Commodities in Minnesota

Commodity	2012 Tonnage	Percent of Total	Projected 2040 Increase
Precision Instruments	202,395	31	697%
Electronics	134,068	21	125%
Machinery	65,260	10	268%
Chemical Products	37,974	6	327%
Manufacturing Products	35,808	5	224%
Basic Chemicals	31,135	5	1623%
Article-Based Metal	19,081	3	193%
Plastics	18,661	3	190%
Motorized Vehicles	14,749	2	74%
All Other Freight	79,142	14	79%

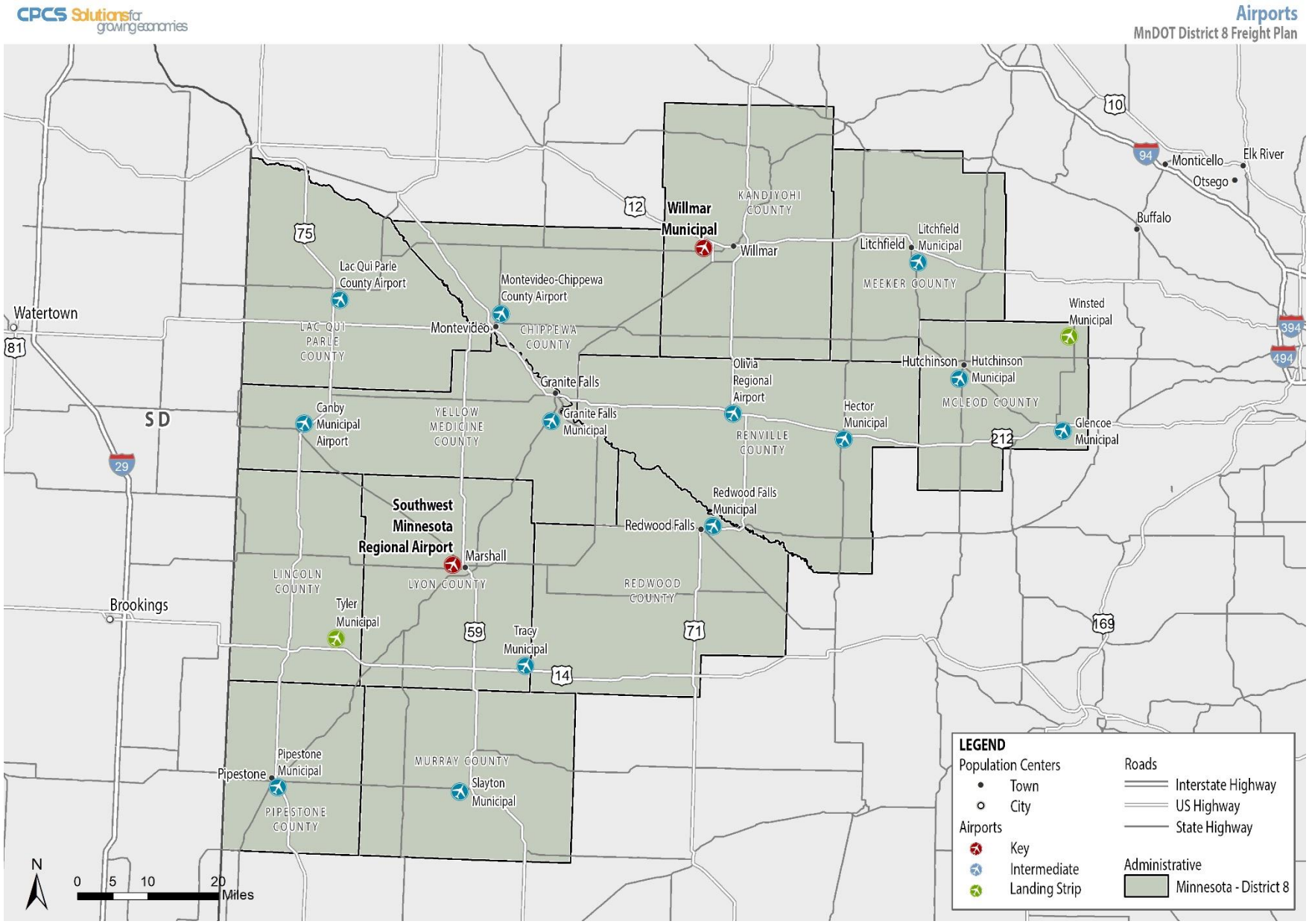
Source: Minnesota State Freight Plan, 2016.

There are a total of 18 publically owned airports in District 8 that received state funding.[32] None of District 8's airports have commercial service, but two(Willmar and Marshall) are identified by MnDOT as key airports. These airports are shown in Figure 56. Southwest Minnesota Regional Airport in Marshall is noted as occasionally used for specialty cargo shipments.

Other than these two regional airports located in the District, the area is close to St. Cloud Regional Airport (STC) and the Mankato Lakes Regional Airport (MKT). Outside of the state, Brookings Regional Airport (BKX) is also nearby. Minneapolis-St. Paul International Airport (MSP) is the closest international airport to the District, and is among the busiest commercial airports in the US.

[32] MnDOT "MnDOT District 8 2019 Fact Sheet" (2019). http://www.dot.state.mn.us/information/factsheets/d8-fact-sheet.pdf

Figure 56: Airports in the District



Source: MnDOT State Aviation System Plan (July 2013).

2.5 Pipeline Network

Pipelines offer a high-volume, low-cost option for transporting large amounts of liquids and gases, and this quality means they are key elements of transportation network for liquid fuels. Figure 57 summarizes major commodities that are transported via pipelines in Minnesota.

Figure 57: Major Commodities Carried through Minnesota's Pipeline

Commodity	2012 Tonnage	Percent of Total	Projected 2040 Change
Coal	64,674,269	63%	117%
Crude Petroleum	26,447,999	26%	109%
Gasoline	8,386,049	8%	-20%
Fuel Oils	3,552,178	3%	-17%

Source: MnDOT Statewide Freight System Plan (2016).

Minnesota has no petroleum or natural gas resources and primarily imports crude oil, natural gas, and other petroleum products. Minnesota has two oil refineries that process crude coming from Canada and North Dakota. Both of these refineries are located near the Twin Cities metro area.

In District 8 alone there are 690 miles of active pipeline, most of which is dedicated to natural gas. Figure 58 summarizes the pipeline coverage, by type, within the District.

Figure 58: District 8 Pipeline Coverage

Commodity	Length (Miles)	Percent of Total
Crude Oil	40.37	6%
Hydrocarbon Gas Liquid (HGL)	47.99	7%
Natural Gas	546.77	79%
Petroleum Products	55.69	8%

Source: US EIA (2018).

In the last decade, increased oil production in Canada and North Dakota due to technological advances in hydraulic fracturing have required capacity increases at Minnesota's refineries and expansion of pipelines across the state to carry crude oil to other refineries in US and Canada. The Minnesota Pipeline System (MPL) is a crude oil pipeline system that passes through McLeod and Meeker County, the north-eastern portion of District 8. The pipeline runs south from the Clearbrook terminal towards the Twin Cities, and is principally supplied by crude from the Midwest and Alberta, Canada through Enbridge Energy's pipeline system. More relevant to District 8 is MPL Line 4, the portion of the pipeline found after the split in Cottage Grove, Minnesota. This branch in particular serves the Pine Bend Refinery located in Rosemount, Minnesota. Since the addition of six pump stations along Line 4 in 2014, the estimated capacity of this pipeline is now approximately 350,000 barrels/day.[33]

While there are no refineries found within District 8, the Magellan Pipeline Company does make use of a refined petroleum product terminal that is located in Marshall. Trucks – and sometimes rail cars – will use this terminal

[33] Star Tribune "Crude Oil to Pipeline to get $125M Upgrade" (2014). http://www.startribune.com/april-17-oil-pipeline-to-twin-cities-to-get-125m-upgrade/255641921/

for product loading and distribution to smaller storage facilities and retailers.[34] As the map in Figure 59 shows, the Marshall terminal receives petroleum mainly from the Midwest states (North Dakota, South Dakota, Montana) via the Cenex and Magellan pipelines that stretch across the majority of the District.

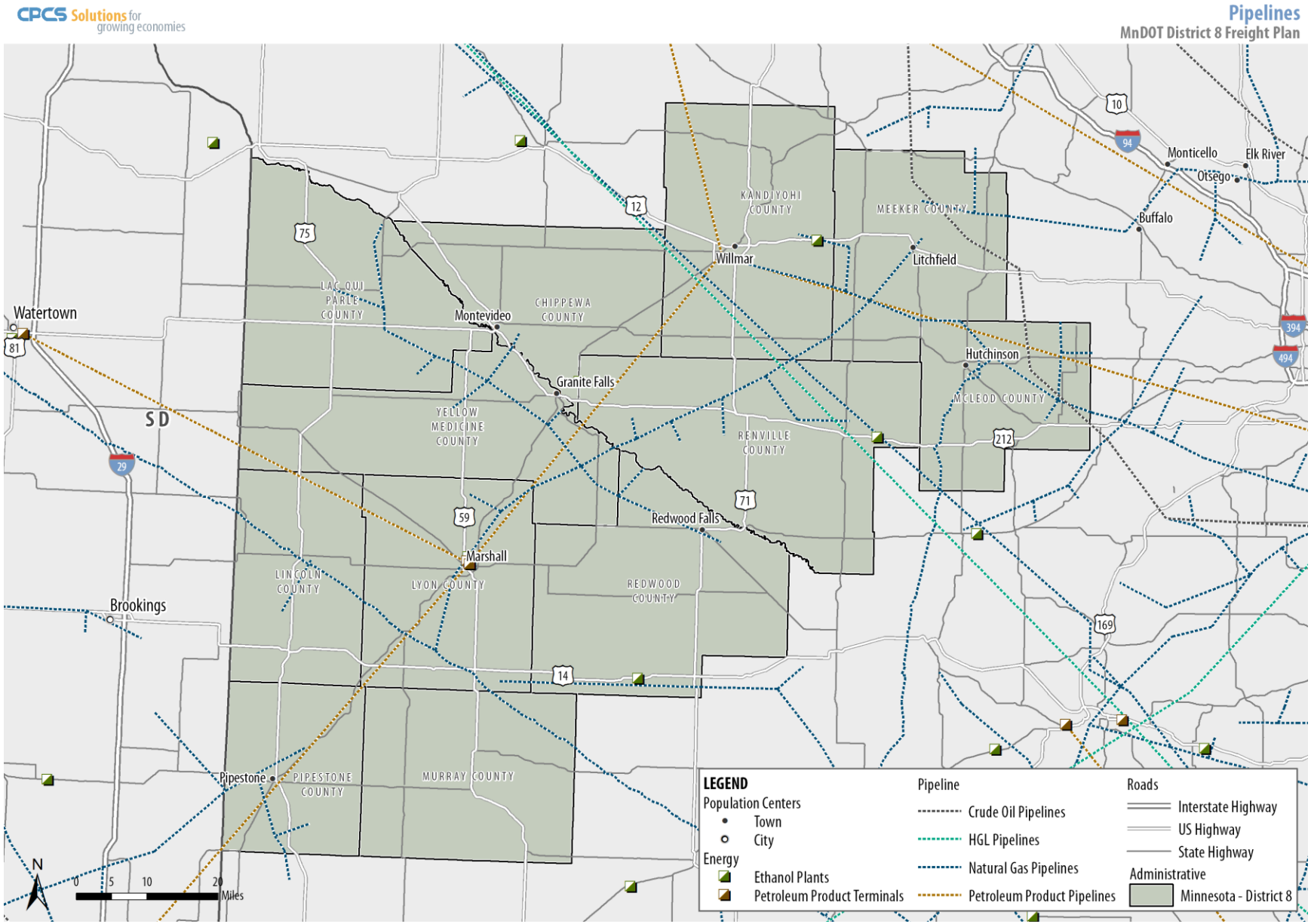
The majority of pipelines found within District 8 are moving natural gas, totally nearly 550 miles of network. The Northern Border Pipeline connects to the existing TransCanada Pipeline, moving liquids interstate across the Midwest eventually into Illinois. The Alliance Pipeline also moves natural gas from Canada (British Columbia, Alberta) and North Dakota into the Chicago market hub. This pipeline carries nearly 1.6 billion standard cubic feet per day of natural gas into Illinois.[35] A Minnesota local natural gas pipeline, owned by Hutchinson Utilities, finds itself entering McLeod County from the south in order to supply both power plants and distribute natural gas to customers. Northern Natural Gas Co. shares the majority (75 percent) of pipelines moving natural gas through District 8, with gas coming from the Permian Basin in Texas.

The Hydrocarbon Gas Liquid (HGL) pipeline crossing District 8 is the Kinder Morgan Cochin Pipeline. Condensates move westbound from north-eastern Illinois to the Kinder Morgan terminal facility located in Fort Saskatchewan, Alberta. The estimated capacity of this pipeline is approximately 95,000 barrels/day.[36]

In addition to the pipelines and petroleum refinery located within the District, there are also five ethanol plants (representing over 25 percent of ethanol plants within the entire State). Policy and financial backing have allowed for production capacity of ethanol to grow substantially over the last three decades. Combined, the plants in District 8 alone maintain a yearly capacity of 233 million gallons produced, accounting for nearly 20 percent of all ethanol produced in Minnesota.[37] Statewide, it was reported by the EIA that Minnesota produced more than 1.3 billion gallons of ethanol in 2017.

[34] House of Research, MN House of Representatives "Minnesota's Petroleum Infrastructure: Pipelines, Refineries, Terminals" (2018). https://www.house.leg.state.mn.us/hrd/pubs/petinfra.pdf
[35] Alliance Pipeline "Our System". https://www.alliancepipeline.com/AboutUs/OurSystem/Pages/default.aspx
[36] Kinder Morgan "Cochin Pipeline System" (2015). https://www.kindermorgan.com/pages/business/products_pipelines/cochin.aspx
[37] EIA "Layer Information for Interactive State Maps" (2018). https://www.eia.gov/maps/layer_info-m.php

Figure 59: District 8 Pipelines



Source: CPCS analysis of Environmental Protection Agency Data

3 District 8 Freight System Condition and Performance

Key Findings

District 8's freight system performance does not suffer from traffic congestion problems like larger metropolitan areas. However, road safety and truck collisions are a concern. In particular, 21 percent of severe high-crash location crashes of the State have occurred in District 8 between 2009 and 2013. During the same period, District 8 was ranked as the fourth highest region in terms of the highest number of severe crashes and third in terms of the highest number of severe crashes at intersections. Truck-involved crashes in the District are primarily concentrated in areas with high traffic volumes.

On a more positive note, District 8's active grade crossing crash rate compares favorably to other Districts, but it has a relatively high number of crashes at passively-protected crossings. Condition of the network is also mixed: District 8 bridges have an average sufficiency rate lower than the state's average. However, the majority of deficient bridges in the District are on county and township routes while the freight-critical trunk highways have relatively well-maintained bridge structures. The deficiency of the bridge structures on local roads directly affects last-mile connections to specific locations around District 8.

3.1 Linking System Evaluation to Statewide 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.

To support these goals, the statewide plan identified three key areas for monitoring the condition and performance of the freight system.

- **Safety.** To assess and ensure the safety, security, and resilience 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 are the starting points for data analysis in this chapter. This analysis uses data that is readily available at the state and Federal levels and, where available, builds on other relavent studies that have been conducted by MnDOT. The condition and performance of the District 8 freight system will be further quantified, and needs prioritized, in Working Paper 5: investment Priorities.

3.2 Safety

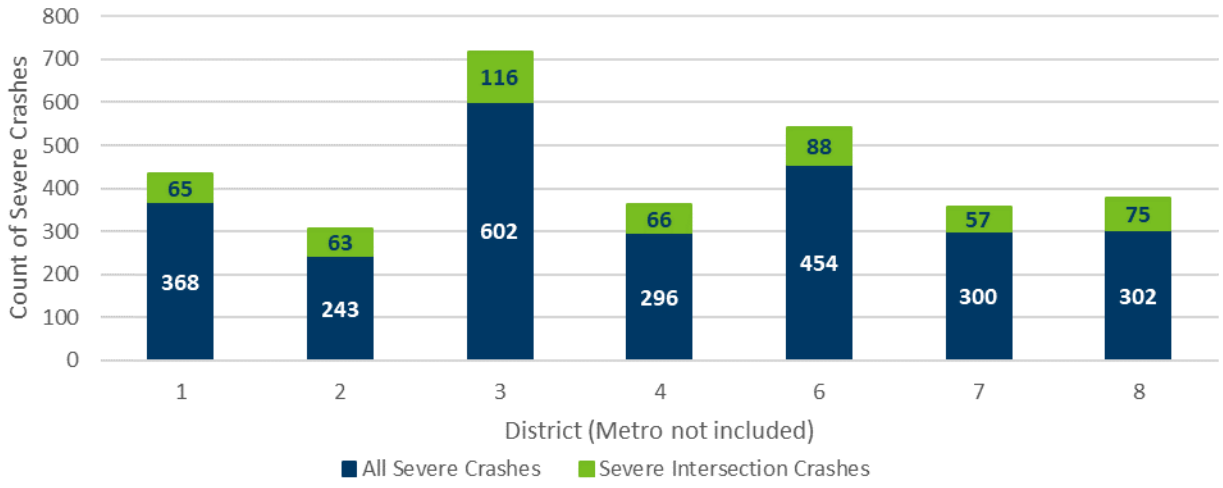
Ensuring the safety of the transportation system is one of MnDOT's most critical missions. Not only can accidents result in physical harm, but they can also result in damaged vehicles and cargo, and negatively impact the performance of the transportation system. To assess safety of District 8's freight network, this plan examines four topics:

- **Previous roadway crashes:** This assessment reflects MnDOT's Investment Plan measure of "sustained crash location" and provides a background to inform discussion of risk factors.
- **Roadway crash risk factors:** MnDOT has developed District Safety Plans for the state, and part of this safety planning work involves an assessment crash risk factors. The risk analyses conducted in the District 8 Safety Plan were used to aid in safety analysis for this Freight Plan.
- **Previous road-rail grade crossing incidents:** Like roadway crashes, this assessment reflects MnDOT's Investment Plan measure of "sustained crash location" and provides additional context to the discussion of risk factors.
- **Road-rail grade crossing risk factors:** MnDOT recently completed an assessment of the relative safety of public grade crossings in the state, and the results of that assessment are incorporated into this analysis.

Roadway Safety

This section uses a comparison of the District's crash rates with other areas in Minnesota to understand road safety in District 8. This comparison can help determine whether or not District 8's safety-related performance is relatively better or worse than other Districts. Figure 60 provides a snapshot comparing severe (injury and fatality) crashes in District 8 against the remainder of Minnesota for five years from 2009 to 2013. The Metro District is not included because of its significantly higher traffic volumes, and correspondingly higher number of crashes.

Figure 60: Severe Crashes in Minnesota, 2009-2013

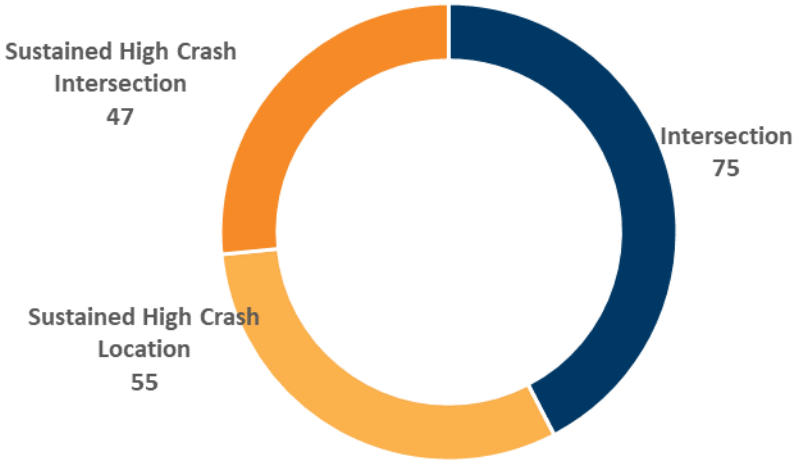


Source: District Safety Plans Update, 2016.

Between 2009 and 2013 District 8 was ranked as the fourth region in terms of the highest number of severe crashes and third in terms of the highest number of severe crashes at intersections. Figure 61 shows the distribution of severe crashes in the District. Sustained high-crash locations or intersections are where a significantly higher number of crashes leading to serious injuries or fatalities have happened between 2009 and 2013. As the figure shows, 47 intersections across the district were identified as sustained high crash locations. The most common severe intersection crashes were right-angle and left-turn collisions.[38]

[38] MnDOT "District Safety Plans Update" (2016).

Figure 61: District 8's Severe Crashes



Source: District Safety Plans Update, 2016.

14 percent of severe intersection crashes, 21 percent of severe high-crash location crashes, and 22 percent of severe high-crash intersection crashes of the State have occurred in District 8.

The Minnesota Strategic Highway Safety Plan provides additional background on truck-specific safety trends. Overall, truck-involved crashes made up about 10 percent of all of Minnesota's severe crashes between 2008 and 2012, and 88 percent of these truck-involved severe crashes were concentrated on state trunk highways and county roads. Furthermore, 50 percent of the state's severe truck-involved crashes were intersection-related, 61 percent of severe crashes occurred during the day, and 78 percent occurred on dry pavement. These findings suggest that, for Minnesota as a whole, inclement weather or low light conditions may not be major risk factors for truck-involved severe crashes, but intersections on trunk and county highways may be particularly "risky."

Not all of District 8's crashes involve commercial vehicles, but for this freight-specific plan, crashes involving commercial vehicles have been isolated to determine if there are specific locations that are "hot spots" for truck crashes. Figure 62 shows the number of crashes that involved trucks greater than 10,000 lbs. in District 8. Further detail on crash rate breakdowns between medium and heavy trucks is not available.

Figure 62: Truck-Involved Crashes in District 8, 2009-2018

Crash Severity	Crash Count
Fatality	61
Injury	579
Property Damage Only	1,460
Unknown	3

Source: CPCS analysis of MnDOT crash data, 2018.

Figure 63 shows the distribution and severity of truck crashes in District 8 from 2009 to 2018. Generally, commercial vehicle crashes are concentrated around high-volume traffic corridors and urban areas, such as US-12, MN-23, US-212, US-71, and MN-7.

A common theme between these population centers and major highways is that they both have high overall traffic volumes and truck traffic volumes relative to the region as a whole. The concentration in crashes in these areas is unsurprising, as traffic numbers rise, so does the potential for traffic incidents. Another common theme is the occurrence of crashes near roadway intersections, where the potential for incidents is increased by the presence of stopping, turning, cross-cutting and accelerating traffic.

Statewide, only 10 percent of severe crashes occur at high-crash locations.

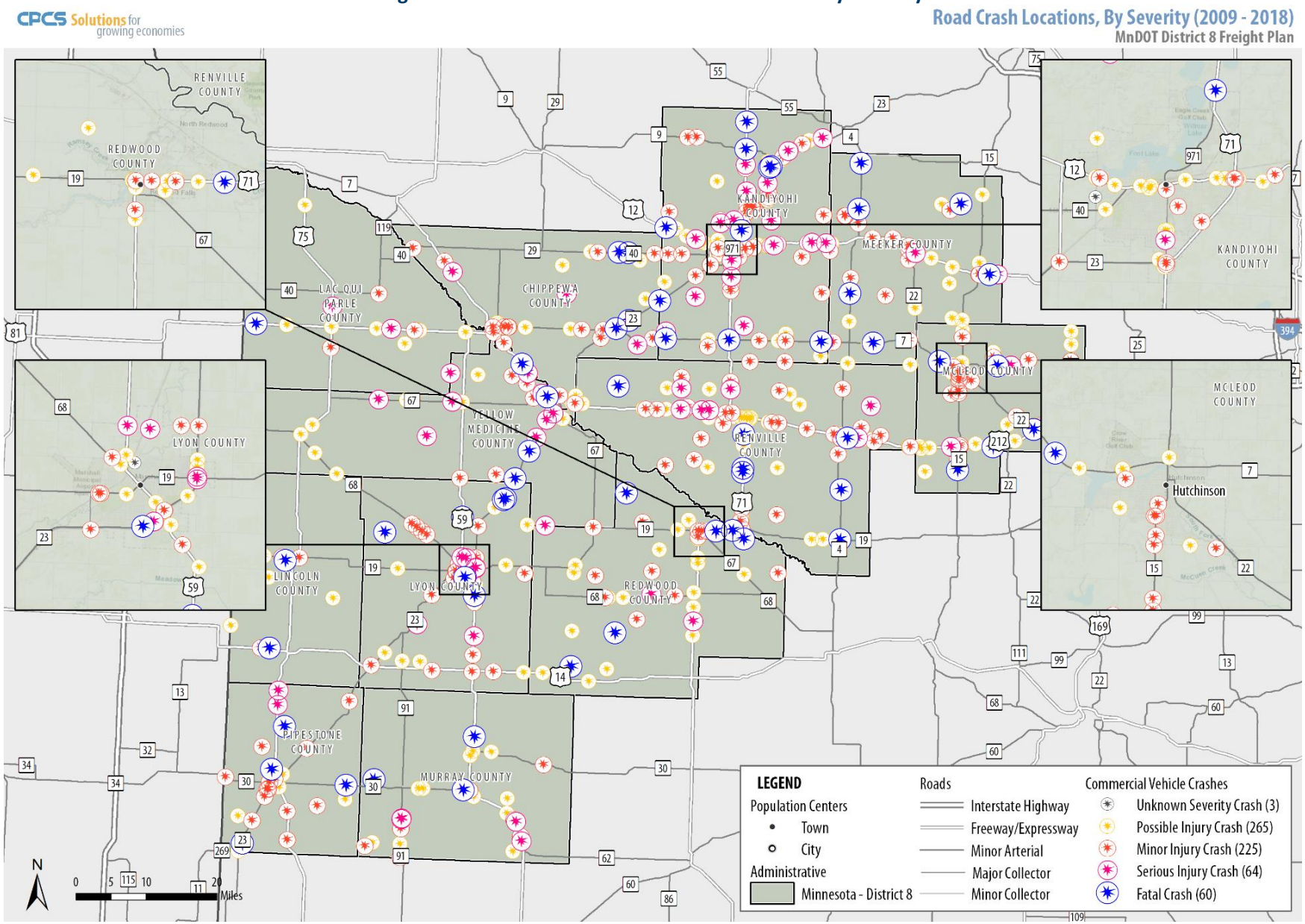
Additionally, the District's most severe crashes appear to be concentrated mostly on high-volume corridors such as the highways listed above. In particular, fatal and serious industry crashes exhibit some overlap on MN-23 in northeastern Lyon County, MN-23 northwest of Willmar, and US-71 in Renville County. The remainder are distributed more "randomly" across the District's major highways. This phenomenon is noted in MnDOT's District Safety Plans, as a statewide analysis found that approximately only 10 percent of severe crashes occur at high-crash locations.

Commercial vehicle-involved crashes in the District are primarily concentrated in areas with higher traffic volumes.

Crashes can be caused by a wide range of factors, many of which (such as weather, time of day, driver behavior, vehicle maintenance) are largely outside of the DOT's control. However, the DOT can strongly influence a particular factor: the design of infrastructure. In response to the apparent "randomness" of crashes and the fact that it can control infrastructure design, MnDOT has adopted a risk factor-based approach to examining and investing in safety improvements. This risk-based approach is intended to be a supplement to more traditional historic high-crash analysis. Figure 65 provides an illustration of the District highways identified as higher-risk, as well as the locations of crashes.

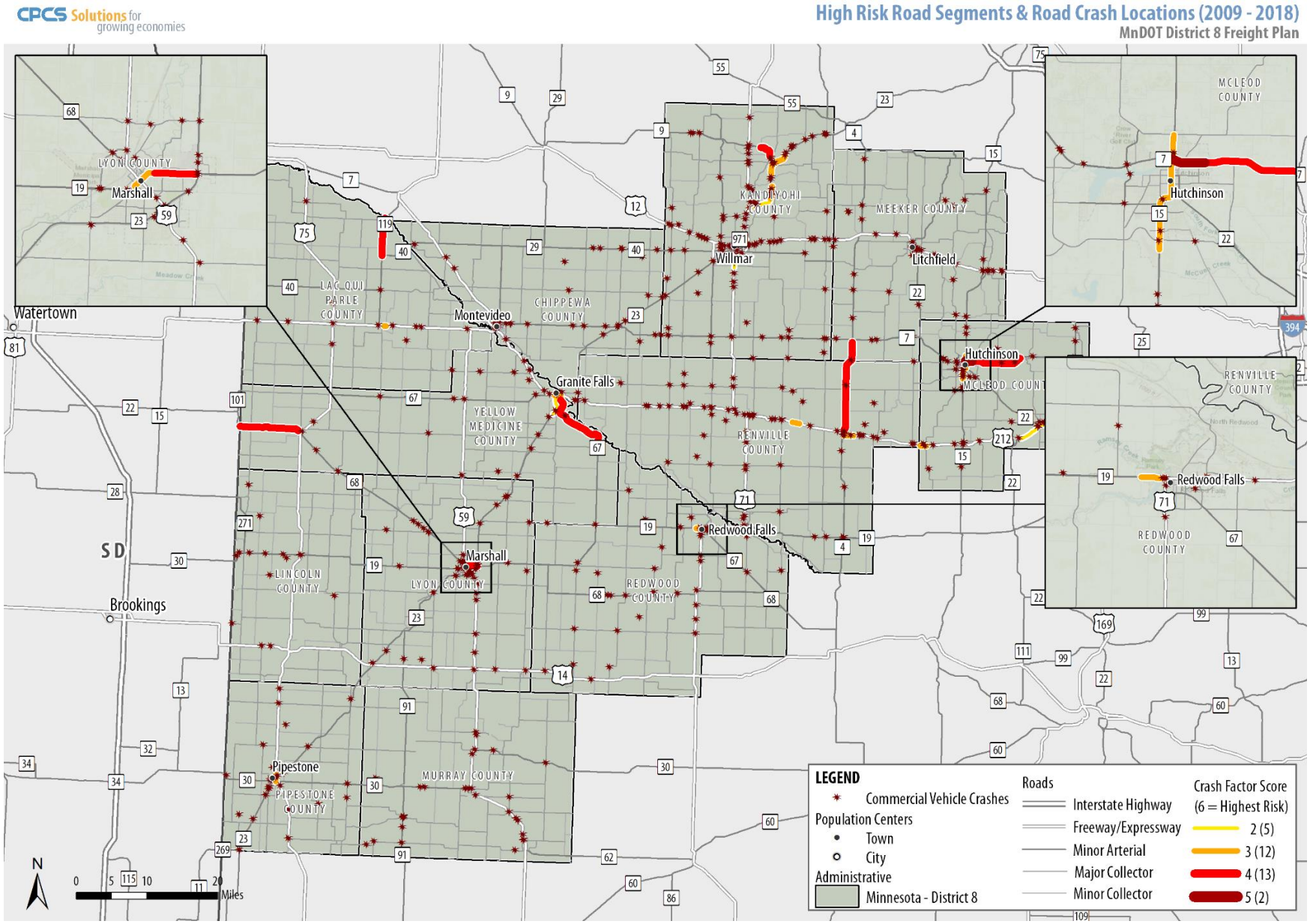
MnDOT's District Safety Plans use a variety of risk factors to evaluate the risk of accident for different types of roads and intersections, including 2-lane, 4-lane, and freeway segments and intersections for both rural and urban areas. Examples of the risk factors evaluated include shoulder width, median width, curve density, access point density, vehicle volume on mainline and intersecting roads, the angle of intersections, previous crash history, and speed limit. Specific risk thresholds for each safety factors were created, and if a segment exceeded a threshold in a specific factor, it was awarded a star. For example, if a segment exceeded a particular traffic volume range considered safe for that road type, it may receive a star. Segments could receive a total of 0 to 6 stars, with 0 as least risky, and 6 as most risky. Figure 63 provides an example of stars assigned to some segments of 4-lane rural roads.

Figure 63: District 8 Commercial Vehicle Crashes by Severity



Source: CPCS analysis of MnDOT crash data from 2009- 2018.

Figure 64: District 8 High-Risk Road Segments



Source: CPCS analysis of MnDOT crash data from 2009- 2018, District 8 Safety Plan Updated (2016).

Figure 65: Risk Factor Tabulation

End	Length	ADT	ADT Range	Severe Lane Departure Density	Access Density	Critical Curve Radius Density	Edge Risk	Shoulder Width	Total	Tiebreakers: Edge Risk	Tiebreakers: ADT
.2 MI N CSAH 33	2.0	2,450			★	★	★	★	★★★★	2	2,450
.2 MI S CSAH 18	10.6	766			★	★	★	★	★★★★	2	766
W OF SILVER LAKE	7.0	7,045	★	★	★	★			★★★★	1	7,045
DISTRICT BOUNEND D8DARY	5.4	1,250		★	★	★		★	★★★★	1	1,250
NW OF CANBY (SL 40)	8.2	1,125		★	★	★		★	★★★★	1	1,125
.45 MI S MN 7 COSMOS (SL 30)	12.7	952		★	★	★		★	★★★★	1	952
.65 MI W JCT US 71	1.0	7,100	★		★		★		★★★	2	7,100
CSAH 39 DAWSON	0.2	4,350	★		★		★		★★★	2	4,350
E SIDE HECTOR	1.3	4,075	★		★		★		★★★	2	4,075

Source: MnDOT District Safety Plans, 2016.

Figure 64 highlights key areas with a higher risk in the District, including:

- Route 15 in Hutchinson and Route 7 between Hutchinson and Silver Lake;
- Route 4 between Hector in Renville County (Highway 212) and Cosmos in Meeker County (Route 7);
- Highway 67 in Granite Falls;
- Route 22 in Yellow Medicine County;
- Route 68 in Marshall, Lyon County;
- Route 19 in Redwood Falls;
- Route 9 near New London and Route 23 between Willmar and New London in Kandiyohi County.

With the exception of Route 23 between Willmar and New London and Route 7 between Hutchinson and Silver Lake, these identified segments, had little to no truck accident activity. This reflects the fact that risk factors are not truck-specific, and reflect risk for all road users as a whole. However, examining high-risk corridors is still a useful exercise because safety funds and plans could still benefit freight projects identified in these areas.

A brief summary of the count of higher-risk network elements in District 8 and Minnesota as a whole is provided in Figure 66. The figure shows that the majority of District 8's severe crashes at intersections and curves occurred at locations where potential projects were identified. However, only 26 percent of severe crashes in the District occurred on road segments that were identified as high-risk.

Figure 66: Systemic High-Risk Locations in District 8 and Minnesota as a Whole (Metro District excluded)

	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 8	160	56%	56	26%	143	68%
Remainder of MN Total	1,334	57%	629	51%	1,584	63%
District 8 Share of MN Total	12%	6.7%	8.9%	2.3%	9%	6.1%

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

Road segments and intersections identified as "risky" in the District Safety Plan had little overlap with 2016-2017 truck crashes.

In order to better inform freight-related safety improvements, the District may wish to do a freight-specific risk factor analysis tailored to target truck-specific concerns, such as the need for shoulders, acceleration, deceleration, and turning lanes.

Grade Crossing Safety

Review of incidents at at-grade crossings crashes provides insight into safety issues through both road (truck) and rail lenses. Between 2004 and 2013, District 8 had a total of 46 incidents at public grade crossings, and Figure 67 provides a breakdown between types of crossings and severity of incidents. Passive crossings are crossings with signage such as stops signs, whereas active crossing protection includes equipment such as gates, lights, and bells.

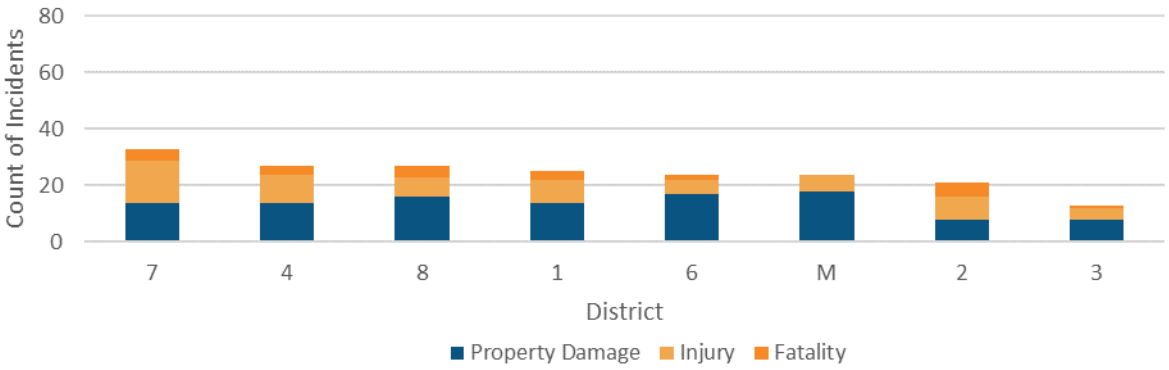
Figure 67: District 8 Public Grade Crossing Crashes, 2004-2013

Crossing Type	Property Damage Only	Injury	Fatality	Total
Passive	16	7	4	27
Active	12	5	2	19
Total	28	12	6	46

Source: CPCS analysis of MnDOT Rail Grade Crossing Safety Data. 2018

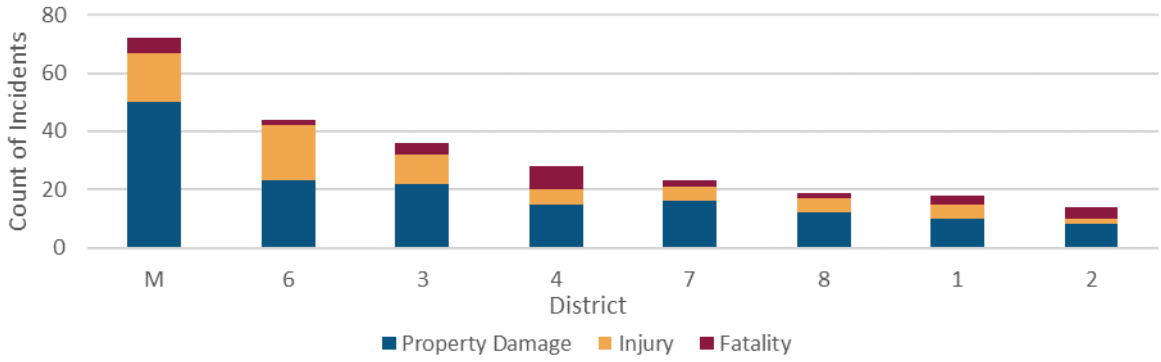
District 8's grade crossing safety performance is generally better than road safety performance: the District had moderate numbers of grade crossing incidents relative to the rest of the state. Figure 68 illustrates how District 8 had a roughly average crash rate at public crossings with passive protection and Figure 69 shows how the District had the third lowest rate of incidents at actively-protected crossings.

Figure 68: Crashes at Passively-Protected Public Grade Crossings, 2004-2013



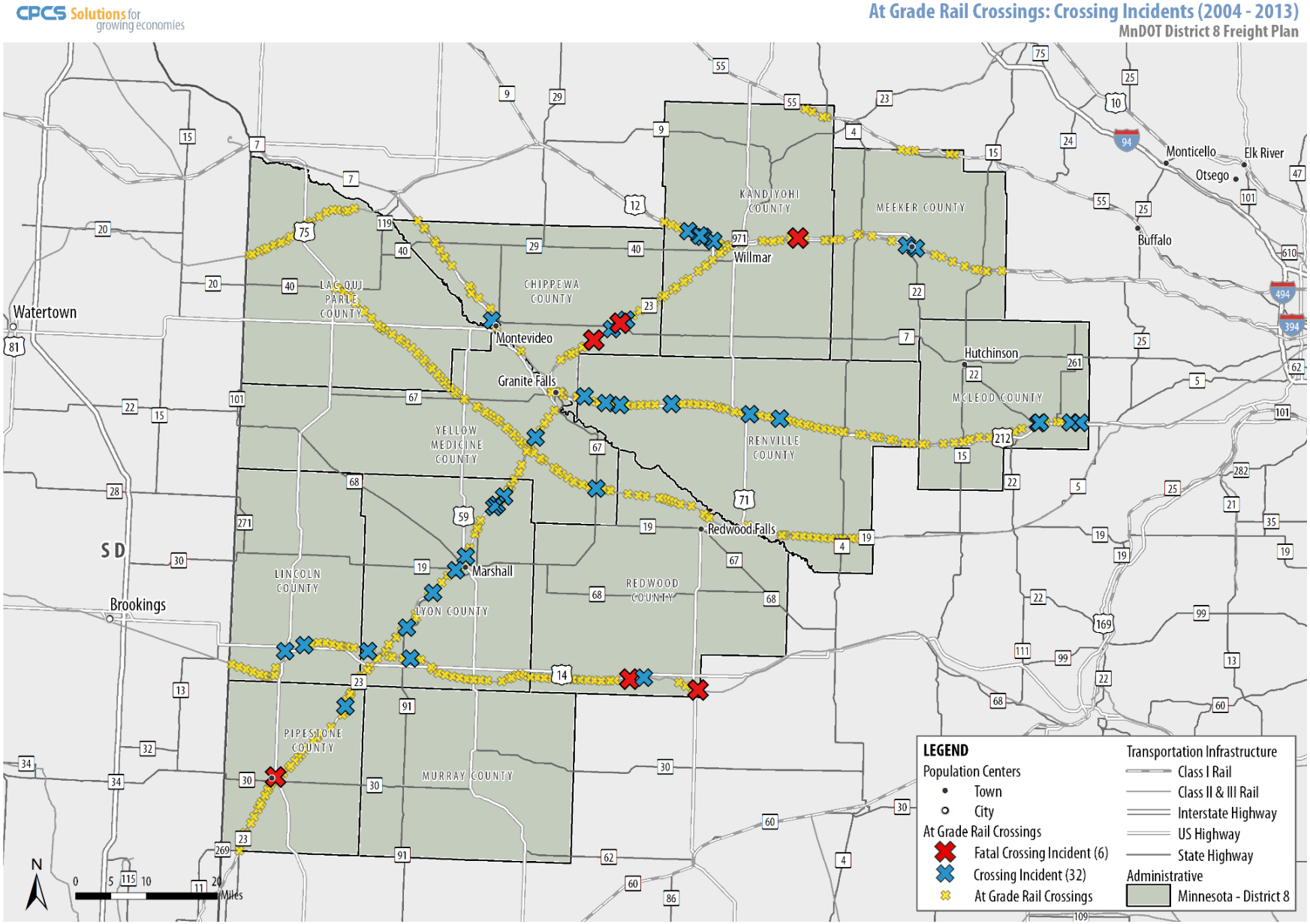
Source: CPCS analysis of MnDOT Rail Grade Crossing Safety Data. 2018

Figure 69: Crashes at Actively-Protected Public Grade Crossings, 2004-2013



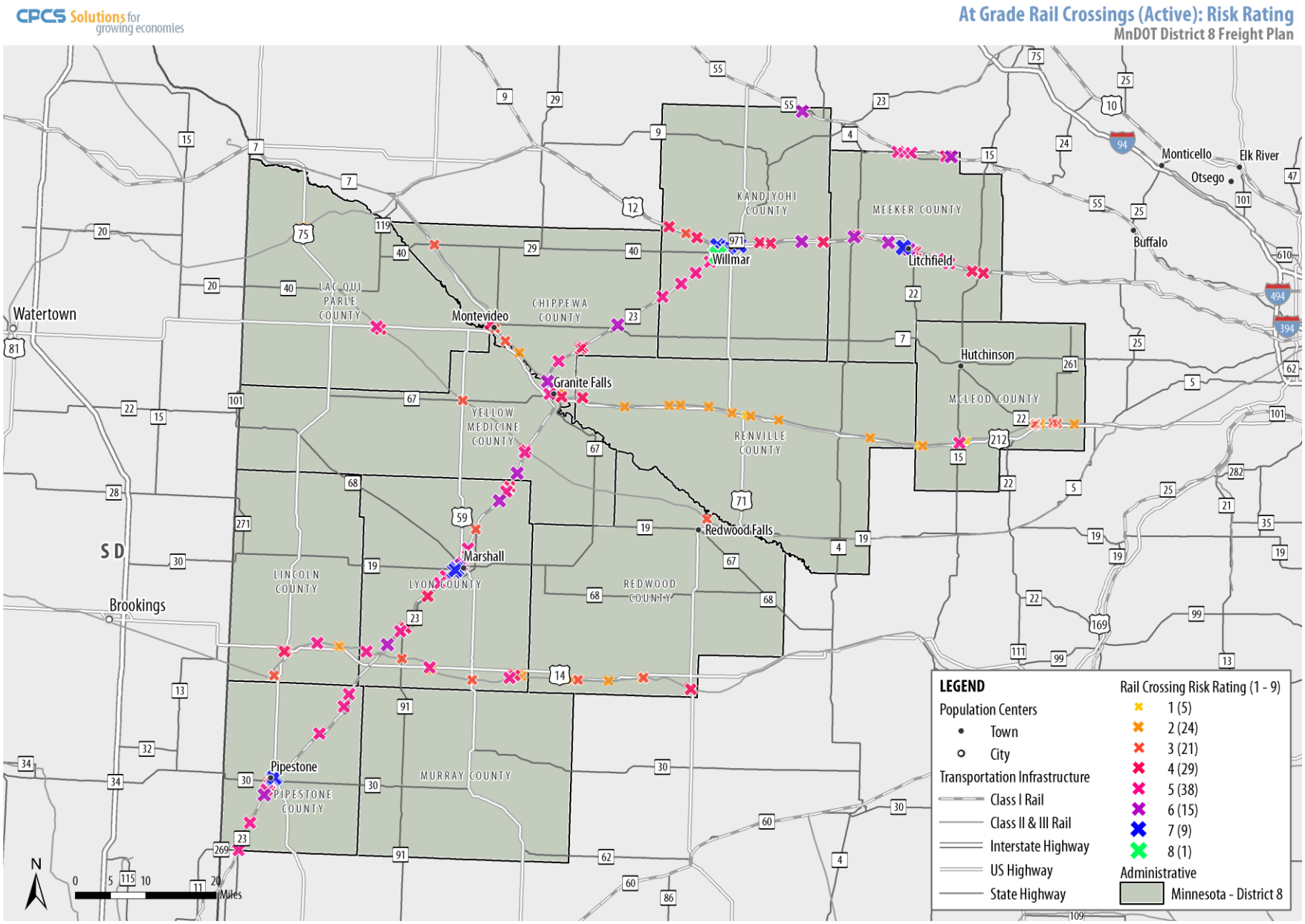
Source: CPCS analysis of MnDOT Rail Grade Crossing Safety Data. 2018

Figure 70: Rail Crossing Crashes, 2004-2013



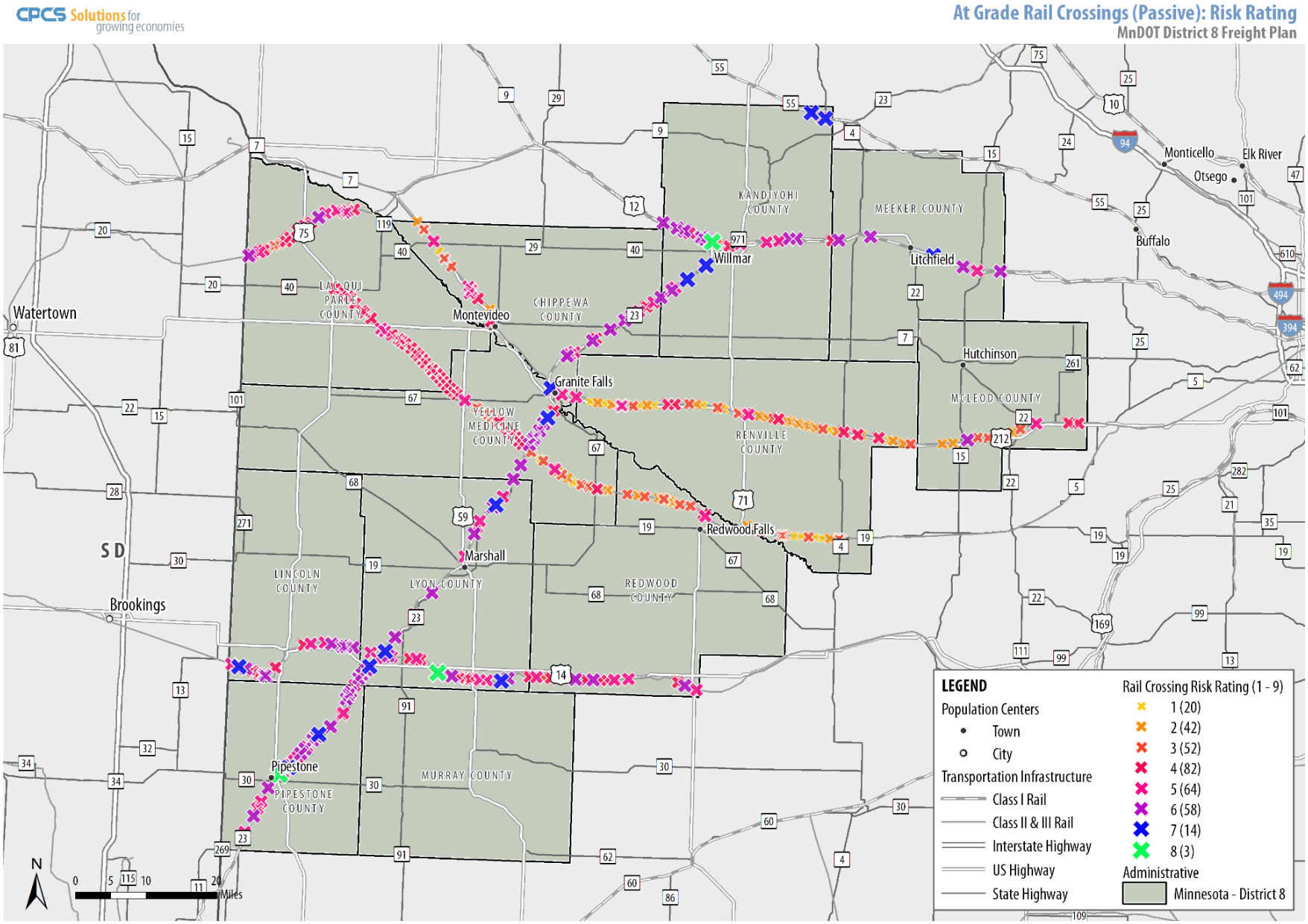
Source: CPCS analysis of MnDOT Rail Grade Crossing Safety Report. 2016.

Figure 71: Actively-Protected Crossing Risk Ratings



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

Figure 72: Passively-Protected Crossing Risk Ratings



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

District 8's active grade crossing crash rate compares favorably to other Districts, but it has a relatively high number of crashes at passively-protected crossings.

Figure 70 provides a map of public grade crossing incidents in the District between 2004 and 2013. The data was provided by MnDOT and used for their Rail Grade Crossing Safety Project Selection report (2016), which included a risk factor analysis.

Like fatal truck accidents, fatal rail accidents were relatively rare, with only six fatal incidents in ten years. Furthermore, like many road accidents, these fatal rail accidents also exhibited "randomness" in their distribution across the region. General crossing incidents appeared to be concentrated on higher-volume rail lines, particularly BNSF's Marshall subdivision.

District 8's grade crossing incidents were concentrated on the BNSF's Marshall subdivision, as well as the TC&W's line to Redwood Falls.

A risk factor analysis was conducted for active and passive crossings in Minnesota, and results of that work are presented in Figure 71 and Figure 72. Figure 71 shows the risk ratings for crossings with active control devices such as lights, bells, and gates. Figure 72 shows the risk ratings for crossings with passive protection, such as stop or yield signs or crossbucks.

The risk factors used to evaluate crossing risk included road traffic, rail traffic, speed limits, number of tracks, angle of crossing (or skew), and number of tracks, sight distances, and distance to other crossings or intersections. Based on each of these factors, active and passive crossings were assigned a numbered risk rating between 0 and 9. MnDOT staff have indicated that crossings with ratings of 8 and 9 had already been assessed and/or improved since the 2016 Safety Report was completed.

The risk rating figures above illustrate that most of District 8's actively-protected crossings have moderate (4-6) levels of risk. By comparison, most of the District's passively-protected crossings show higher levels of risk. This difference in risk is not surprising, as passively-protected crossings, by definition, lack some of the protective measures that can lower risk. In terms of distribution of risk, the District's Class 1 BNSF and CP rail lines showed relatively higher levels of risk for both active and passive crossings, relative to TC&W and MPL lines. This difference in risk is likely due to higher operational speeds and higher traffic volumes on the Class 1 trackage.

3.3 Mobility

The ease and cost-effectiveness of moving goods, along with the confidence to know that goods will arrive on time, are critical transportation considerations for many firms. Conversely, a transportation system that is unreliable, expensive, or otherwise cannot support efficient freight movement can represent a threat to a region's economic well-being. In order to understand freight mobility in District 8, four measures were evaluated:

- Overall truck travel speed.
- Travel Time Index, a measure of roadway congestion.

- Travel Time Reliability, a measure of the variability of travel speeds
- Roadway clearances and oversize-overweight load restrictions.

These measures were evaluated using one year's worth of truck GPS probe data from 2018 which was aggregated and analyzed through StreetLight. This 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 information back to centralized computer systems on a regular basis. Aggregated data from hundreds of companies and thousands of trucks can be used to measure traffic speed and system performance.

Notes on Using and Interpreting StreetLight Analytics

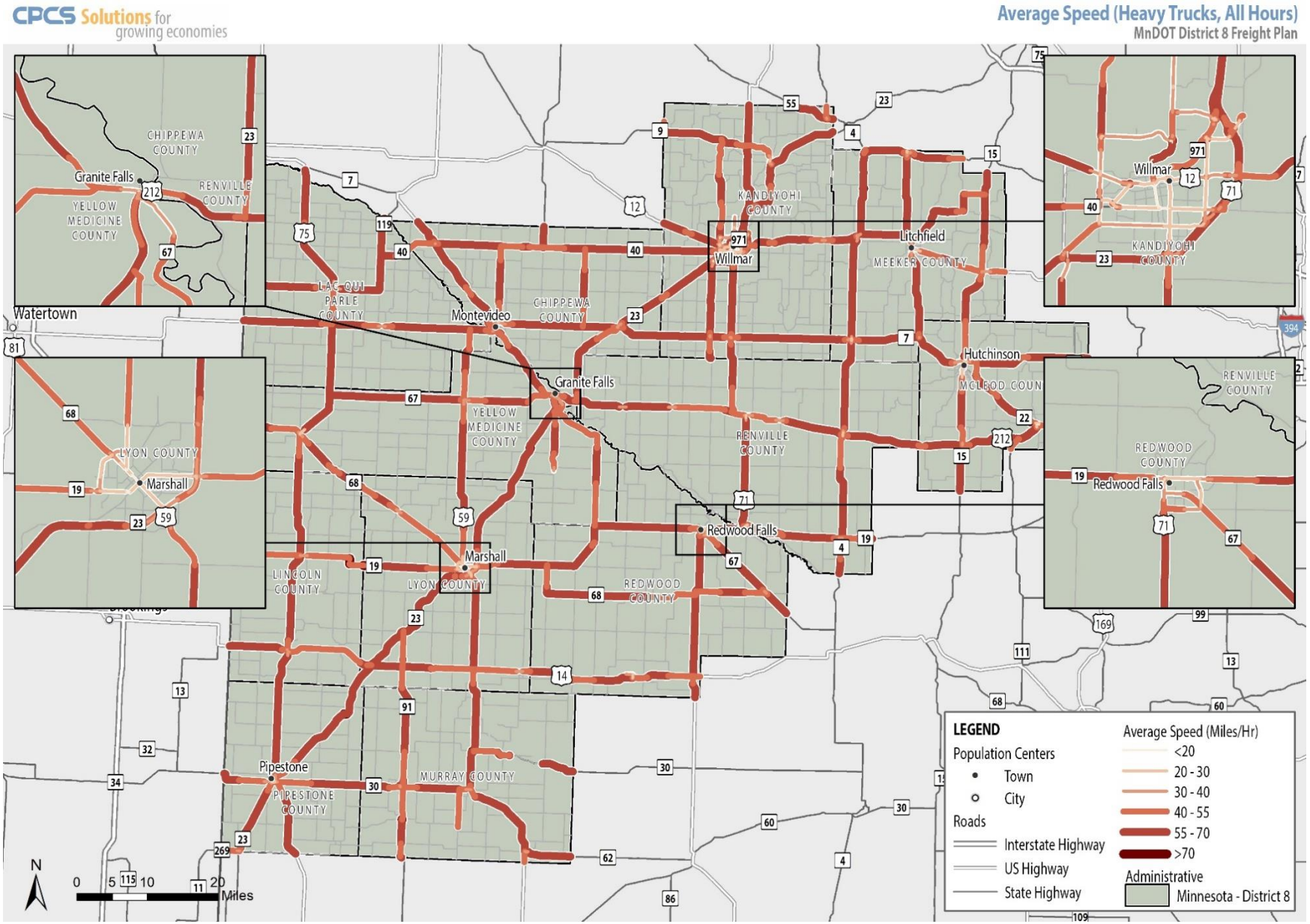
StreetLight analytics can be a powerful tool for understanding traffic phenomena, but the platform does have some limitations. For example, the sample of trucks and vehicles used to compute results may not be representative. StreetLight (along with other analytics platforms) generally favors larger commercial fleets, which can afford and leverage the implementation of standardized GPS tracking systems across all their vehicles. Smaller fleets and owner-operators are less likely to be represented in the data because they are less likely to have installed such devices. Therefore, industries primarily served by these smaller fleets – including logging, agriculture, and some manufacturing – are also likely to be under-represented in the results.
Furthermore, cell phone coverage limits in some sparsely-populated areas may mean that data will be unavailable, as GPS tracking systems rely on cell phone signals to report speed and location information to central servers.

Consultations with companies and individuals in these industries can help fill these data gaps and will continue to be important for holistic freight planning.

Truck Speed

Examining overall truck speed will help inform more in-depth measures of truck mobility and system performance. Figure 73 displays the average speed of trucks in the District. The average speed on the District's major road corridors is high, suggesting that there are no major problems with truck congestion at a system-wide level.

Figure 73: Average Speed of Heavy Trucks in District 8



Source: CPCS analysis of MnDOT StreetLight Data.

Travel Time Index

Travel Time Index (TTI) is a metric which describes roadway congestion. For this analysis, TTI was calculated by StreetLight as the ratio of average and free flow trip speeds along each segment on the road network. StreetLight uses the following formula to calculate this metric:

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

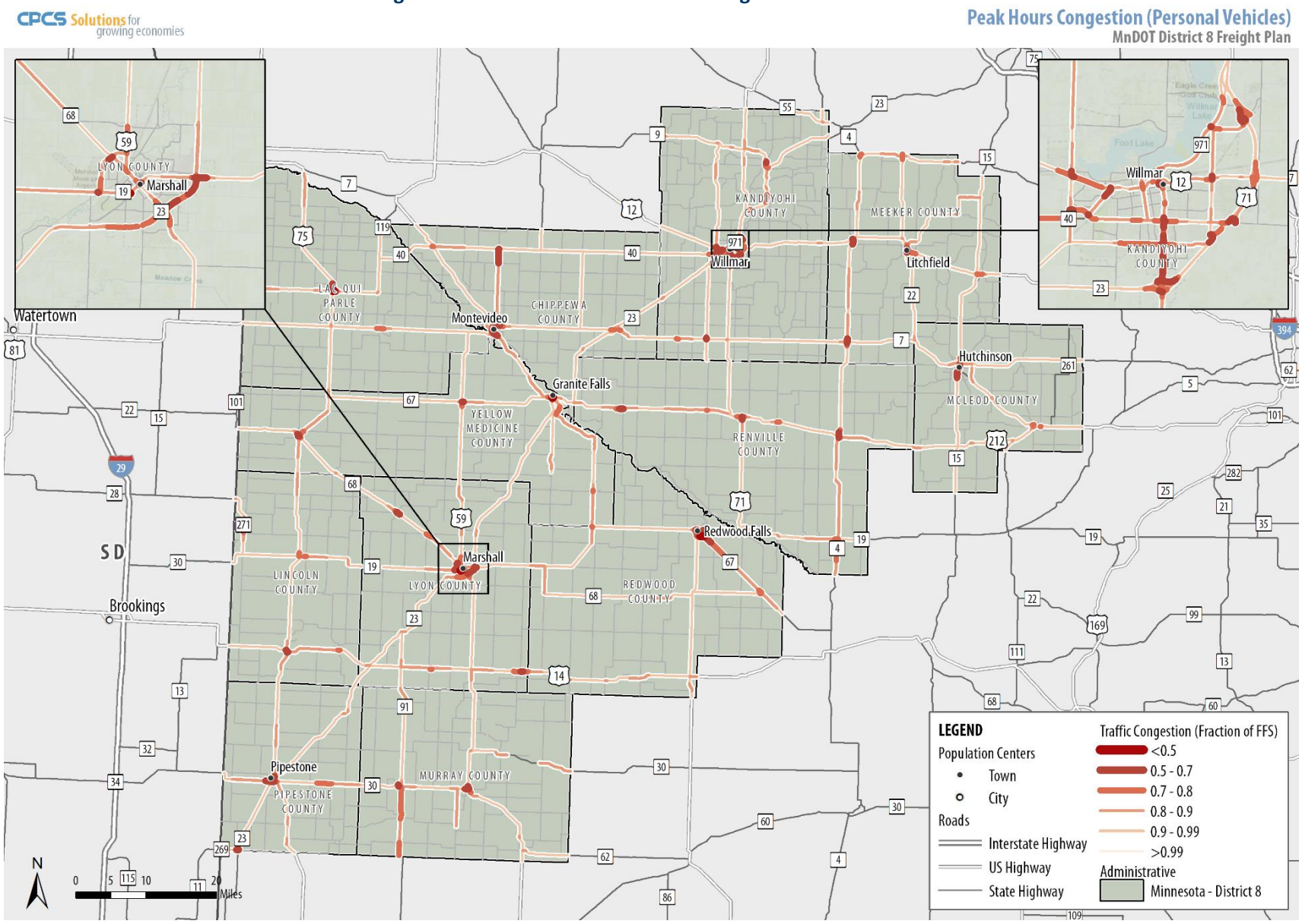
The denominator in this formula, *Free Flow Trip Speed*, is the average, over all days in the data period, of the maximum average trip speed observed in any 1-hour time period of a single day. Free Flow Trip Speed is calculated through the following procedure:

1. Calculate the average speed of all trips for a 1-hour time window on a specific day. Repeat this for the other 23 one-hour time periods on that day.
2. Take the maximum of those 24 average speeds. This is the maximum average trip speed for that day.
3. Repeat steps 1 and 2 for all days in the data period
4. Take the average of all maximum average trip speeds. This is the Free Flow Trip Speed for a given segment for the data period.

The Travel Time Index calculation methodology used by StreetLight nearly always produces values equal to or less than 1 because the "ceiling" it is measured against (the Free Flow Trip Speed) is calculated dynamically from the data, and not based on static parameters like the posted speed limit.

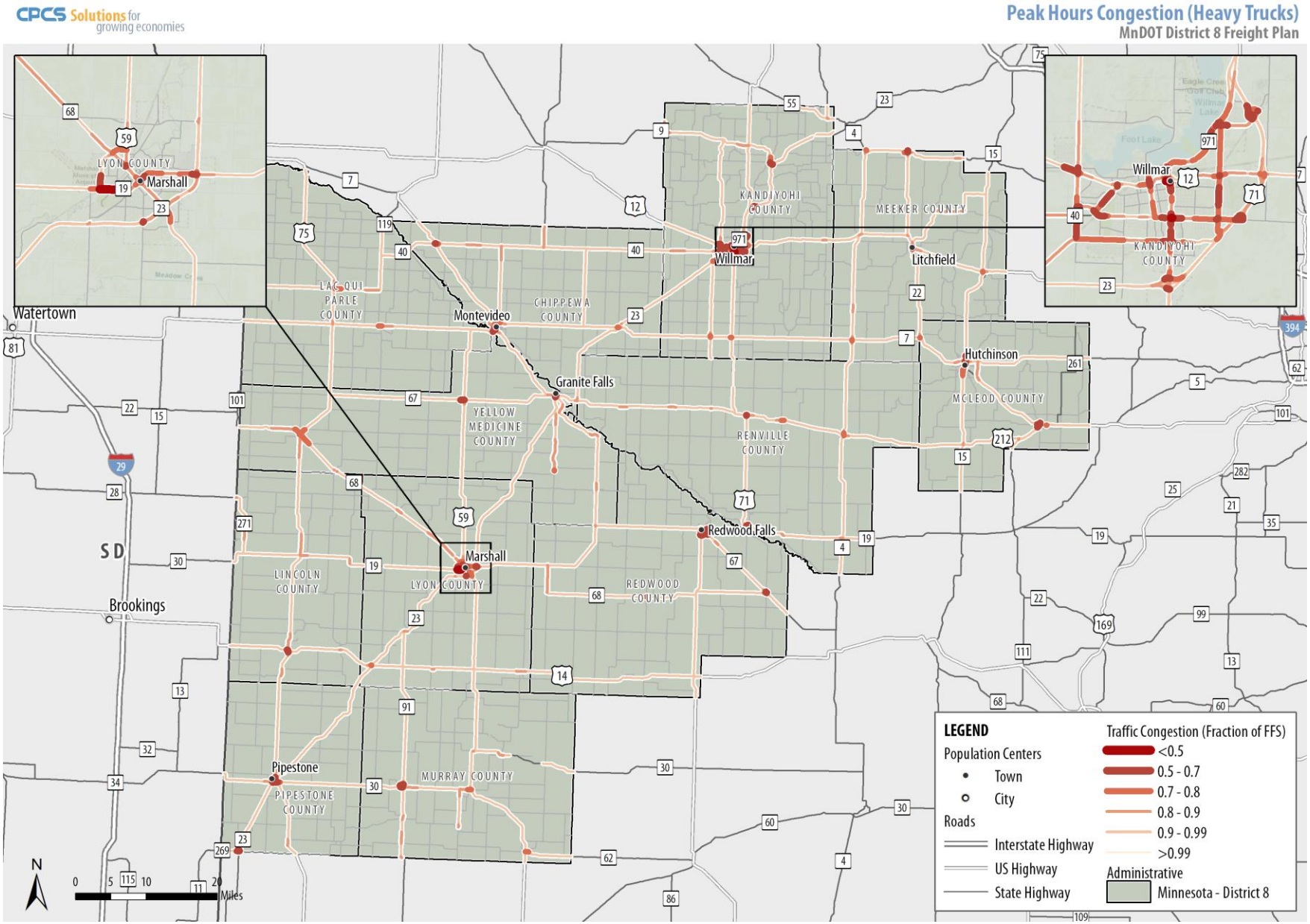
To understand congestion at peak times, the StreetLight-calculated Travel Time Indices for the AM and PM peak periods (6-10am & 3-7pm, respectively) were averaged together. The result is displayed in Figure 74 for personal vehicles and Figure 75 for heavy trucks.

Figure 74: Travel Time Index for Passenger Cars in District 8



Source: CPCS analysis of MnDOT StreetLight Data.

Figure 75: Travel Time Index for Heavy Trucks in District 8



Source: CPCS analysis of MnDOT StreetLight Data.

TTI can be thought of as representing the relative "slowness" of traffic. For example: a TTI value of 0.9 would indicate that traffic is moving at 90 percent of free flow speeds, and a TTI value of 0.5 would indicate that traffic is moving at 50 percent of free-flow speeds. Evaluating TTI for the road network is useful because it can reveal areas where traffic congestion may be more likely, particularly at peak times. In turn, this understanding of congestion locations and patterns can help inform policy and operations decisions.

An examination of traffic in Figure 74 and Figure 75 shows that the District's highways and corridors do not experience significant peak-time congestion. US Highway 212 into the Twin Cities, for example, largely has values close to 1, except at intersections. These exceptions, however, form an important pattern. For both heavy trucks and personal vehicles, low TTI values (corresponding to high congestion) occur most commonly at intersections and the partial road segments in their vicinity. It is likely that this pattern is a statistical artefact deriving from the low sample counts on the freight network. On a rural, low-traffic network like District 8's, a small handful of vehicles queuing at an intersection could introduce enough change to suggest significant congestion, even though such an event does not necessarily imply an operational issue with the roadway.

Peak-hour congestion for trucks and personal vehicles is generally not a problem in District 8.

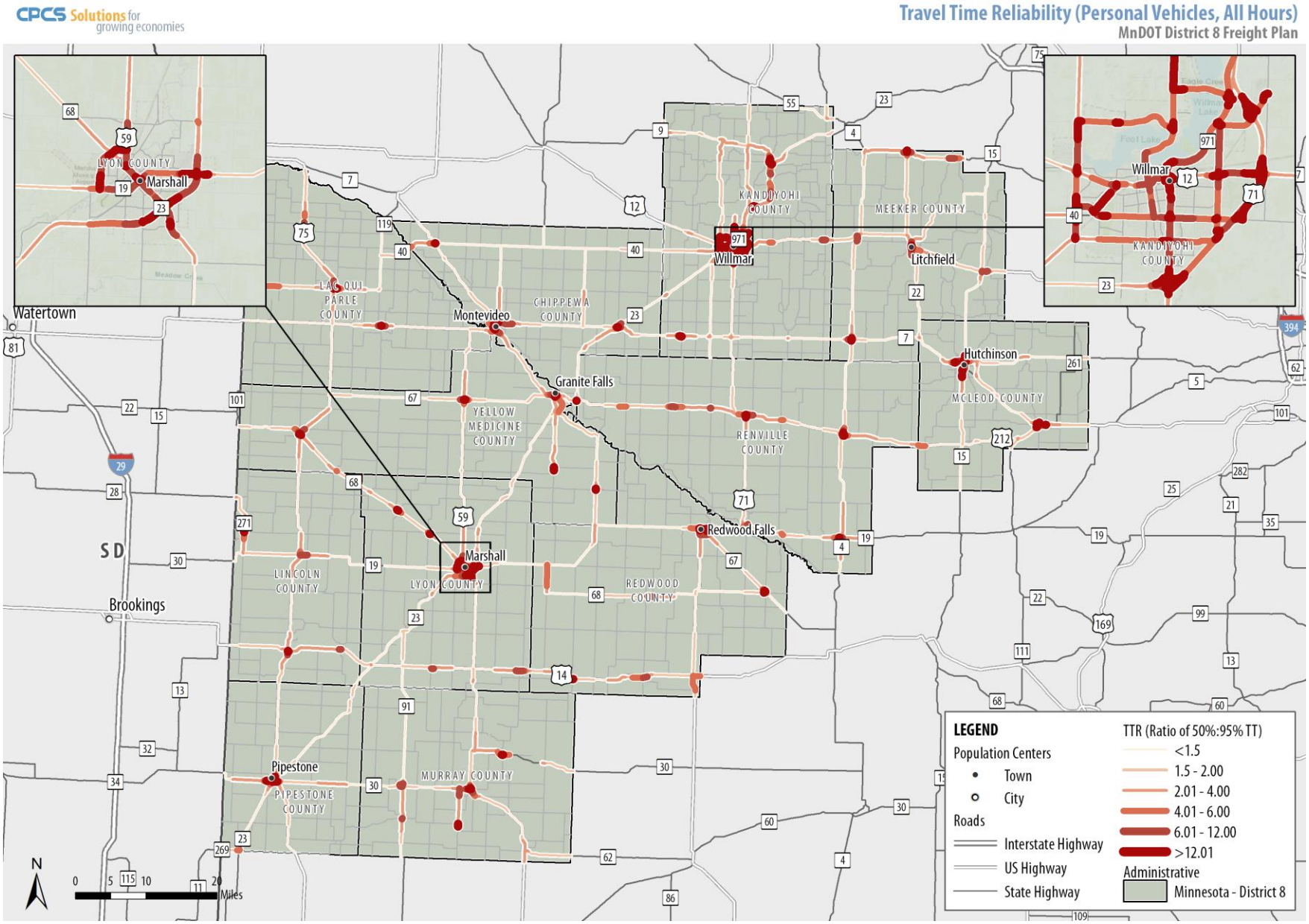
Travel Time Reliability

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 results programmed into StreetLight's analytics platform. 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:

$$\text{Travel Time Reliability} = 50^{th}\ \%\ \text{Travel Speed} / 95^{th}\ \%\ \text{Travel Speed}$$

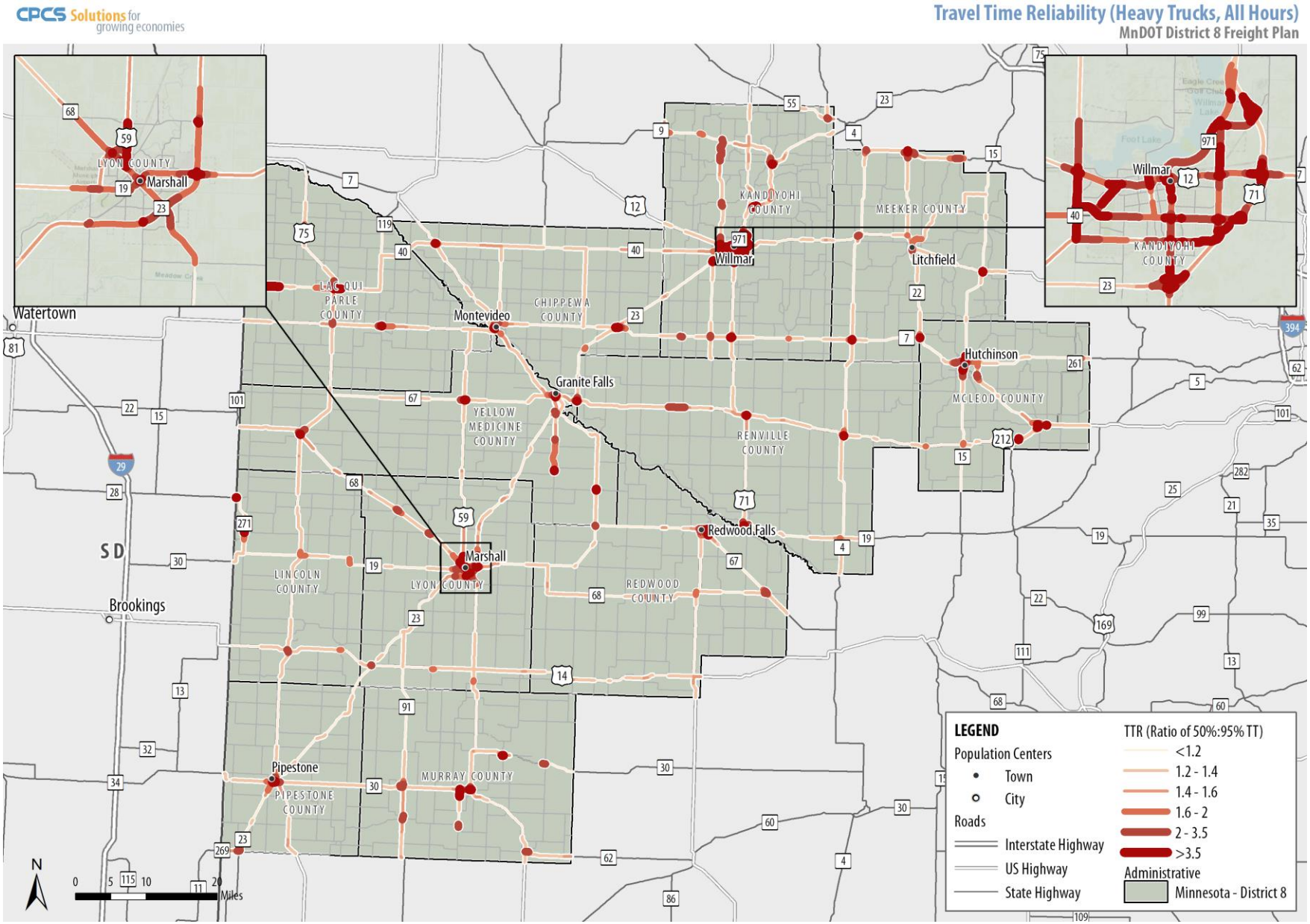
StreetLight's results provide information on the percentage of trips which fall into specified bins of speed and duration. For example, it is known that, for a given segment, 3 percent of trips had an average speed between 10 and 20 miles per hour. StreetLight's results provide up to 50 speed and duration 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 estimate the final values used to calculate TTR.

Figure 76: Travel Time Reliability for Passenger Cars in District 8



Source: CPCS analysis of MnDOT StreetLight Data.

Figure 77: Travel Time Reliability for Heavy Trucks in District 8



Source: CPCS analysis of MnDOT StreetLight Data.

With this formula, lower values represent a more reliable travel speed, while higher values represent more variable travel speeds. Therefore, a high TTR value means low reliability. TTR for passenger vehicles and trucks are illustrated in Figure 76 and Figure 77, respectively. The maps show that travel times in the region are relatively consistent; no corridor-level patterns rise to figure. There are, however, some of the same exceptions observed in the TTI maps. Intersections and the adjacent segments are frequently the site of the highest TTR values, again likely due to the low sample counts on the District 8 freight network that make it easy for one outlying data point to dramatically change result.

Rather than specific problematic corridors or traffic issues, an analysis of TTI and TTR suggests that mobility challenges in District 8 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 speed is not an issue for District 8, but appropriate infrastructure can continue to support safe mobility.

Bridge Clearances

The movement patterns of trucks can also be influenced by the design and dimensions of roadways and bridges, and specifically low bridges. Low bridge clearances are a localized barrier to truck operations and in particular limit the movement of oversize-overweight (OSOW) loads, which may exceed the dimensions of a normal truck. This section provides a discussion of bridge clearances in the District.

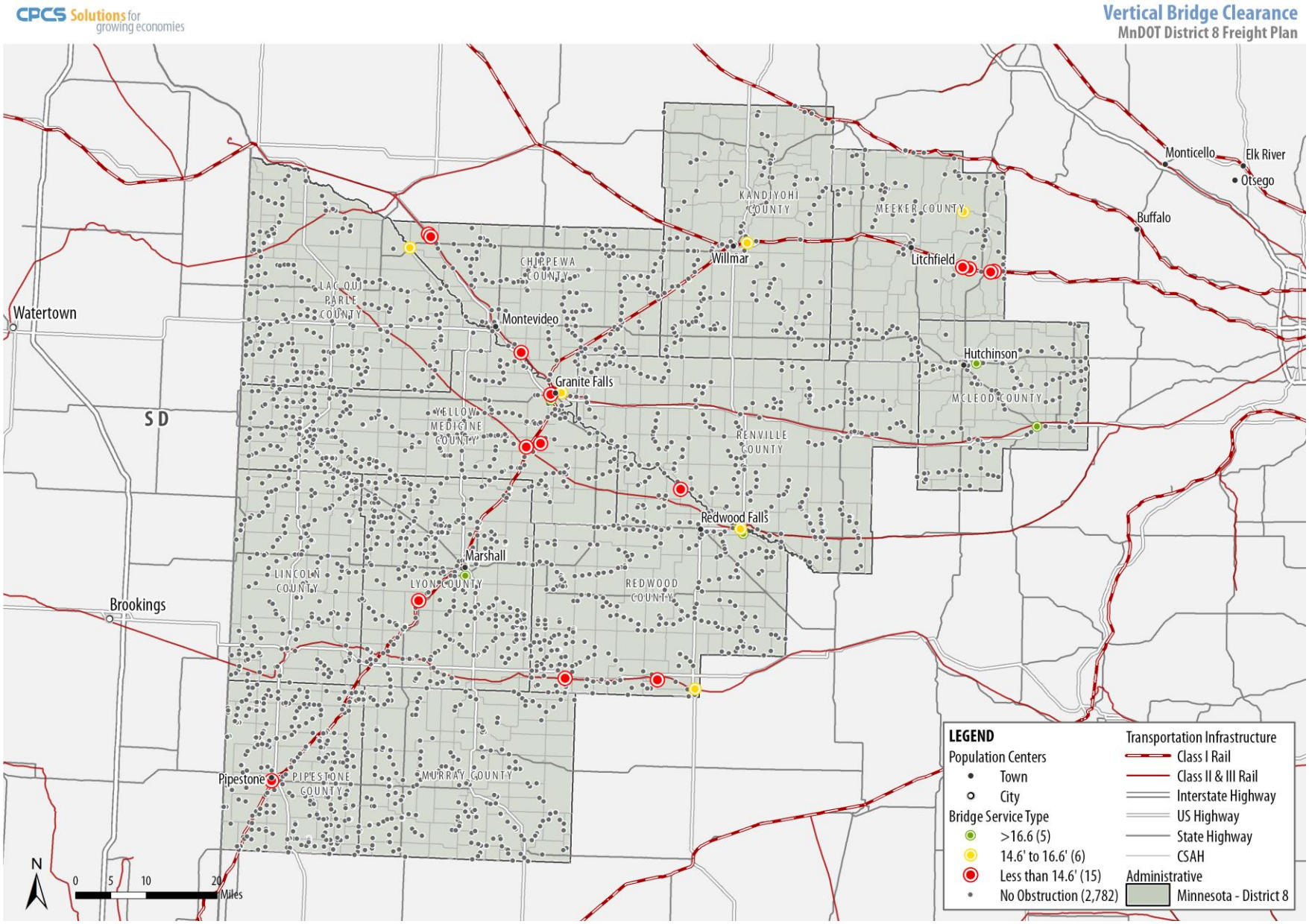
Previous plans and studies conducted on the transportation infrastructure in the District consistently identify the poor condition of pavement surfaces and bridge structures as a significant threat to safe and efficient goods movement in District 8. Four railroad bridges (MN-30 through Pipestone, US-212 in Granite Falls, US-59 north of Milan, and US-71 near Sanborn) have been noted as major barriers to truck routing.

Figure 78 shows the location of road bridges in the District and highlights potential areas for conflict. In general, bridges are broken down into four categories:

- Red icons indicate bridges over roads with a vertical clearance of less than 14’ 6”, which may present major barriers to truck movement. The maximum truck height allowed per Minnesota Commercial Truck and Passenger Regulations is 13’6”, and the FHWA recommends that bridges be constructed with at least one foot of additional clearance above maximum truck height.
- Yellow icons indicate bridges over roads that have enough clearance to accommodate regular truck traffic but are below the 16’6” minimum height requirement for MnDOT Super Load OSOW Corridors.
- Green icons indicate bridges that have enough vertical clearance to qualify for OSOW Super Load Corridor status, which requires a minimum vertical clearance of 16’6”.
- Gray dots indicate other bridges in the region, with no vertical obstruction over a road.

Overall, District 8 has few bridge clearances that would create barriers to general truck traffic, as bridges lower than 14’6” on trunk highways are relatively rare outside of a couple of locations, such as Granite Falls, and Pipestone. However, the rail-over-road bridges at these two points are located on major truck routes, and create barriers to efficient freight movement.

Figure 78: District 8 Bridge Clearances



Source: CPCS analysis of MnDOT Bridge Office Data

OSOW Operations

Oversize and overweight loads are fairly common in District 8 and take a variety of forms based on the industries they serve. In order to ensure the safe movement of OSOW load and to mitigate damage to pavement and bridges, or prevent collisions with infrastructure, carriers are required to obtain OSOW permits prior to moving loads. MnDOT issues permits for interstate, US, and state highways, while some counties and municipalities may require permits for local roads. A variety of permit types may be available based on a carrier's goods and operations. For example, annual MnDOT OSOW permits are available for specific routes and specific commodities such as construction materials, and monthly permits are available for "jobs" of like-loads carried on specific corridors. Seasonal permit exemptions are also available for the agricultural and forestry industries.

MnDOT classifies oversize loads as loads with a height greater than 13'6", and width greater than 8'6". Loads greater than 14'6" wide, 16'0" tall, and 110'0" are not eligible for annual permits, and are often restricted from movement on high-volume days such as holidays and summer weekends. Definitions of "overweight" loads are more complicated, as they are based upon axle counts, axle groups, and weight per axle of specific loads.

In 2016, 2,389 permits were issued to OSOW trips either starting or ending in District 8. This represented about 22 percent of the total permits issued in Minnesota for the year. Figure 79 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."[39]
- **Consultative permits** are related to "megaloads" or "superloads," where unique planning processes are required for each move.

Figure 79: 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

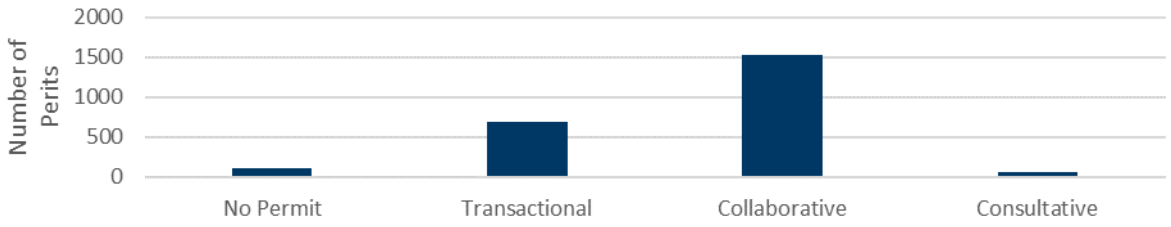
Source: MnDOT. "District 1 2016 Oversized/Overweight Permit Data."

The figures below provide a summary of the dimensions listed on permits for District 8 in 2016 and breaks each dimension of a load into its respective permit type. These figures show that most of the OSOW permits in District 8 fall into the transactional categories for width and length, but the majority of permits fell into the "collaborative" category for height. Based on height alone, 64 percent of District 8's OSOW permits would be considered "collaborative."

[39] MnDOT. "District 1 2016 Oversized/Overweight Permit Data."

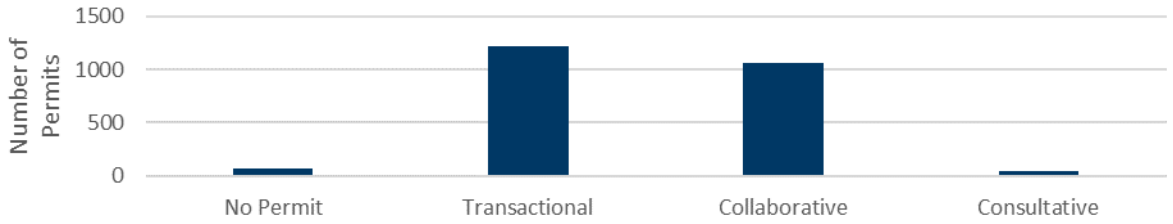
Height is the most limiting factor for OSOW loads in District 8.

Figure 80: Height on OSOW Permits with Origin or Destination in District 8, 2016



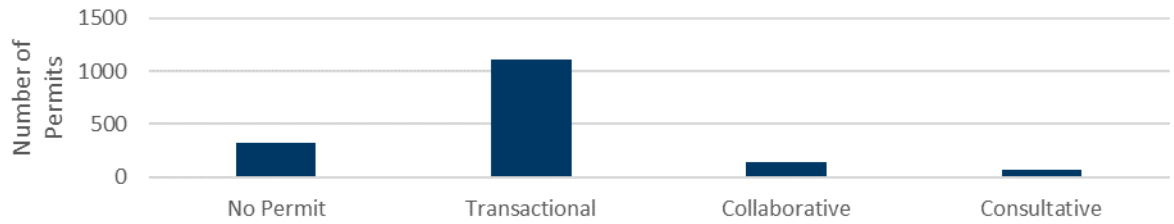
Source: MnDOT OSOW permit data. 2016.

Figure 81: Width on OSOW Permits with Origin or Destination in District 8, 2016



Source: MnDOT OSOW permit data. 2016.

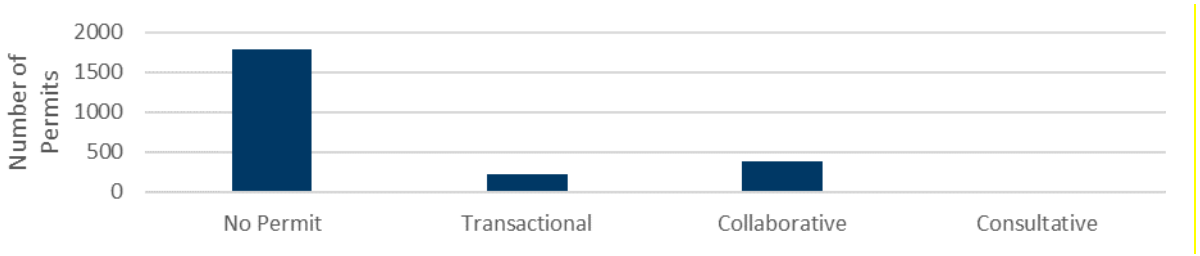
Figure 82: Length on OSOW Permits with Origin or Destination in District 8, 2016



Source: MnDOT OSOW permit data. 2016.

Relatively limited data was available on OSOW load weights, with most permits (1,509) listed with "0" weight. Only 9 percent of loads had a weight considered "transactional" while 15 percent fell into the "collaborative" weight category. Only 15 permits had a gross vehicle weight greater than 255,000 lbs, putting them in the "consultative" category.

Figure 83: Gross Vehicle Weight on OSOW Permits with Origin or Destination in District 1, 2016*



Source: MnDOT OSOW permit data. 2016. 1,509 permits had a weight of "0" listed, and were excluded from this figure.

OSOW Flows To and From District 8

In District 8, the majority of OSOW permits are issued for loads originating in the District and outbound to other areas. Figure 84 shows the number of permits that are issued for different combinations of origins and destination, with top combinations highlighted. It is important to keep in mind that the numbers below reflect **permits**, and not total OSOW **loads** carried. Multiple trips or loads may be allowed under monthly and annual permits.

Figure 84: District 1 OSOW Load Permit Origins and Destinations, 2016

		Origin				
Destination		Interior District 8	Other MN District	South Dakota (through District 8)	Other State (IA, ND, WI, and SD) through other Districts	Total
	Interior District 8	182	197	59	66	504
	Other MN District	736	N/A	56	N/A	792
	South Dakota (through District 8)	751	81	0	25	857
	Other State (IA, ND, WI, and SD) through other Districts	226	N/A	10	N/A	236
	Total	1,895	278	125	91	2,389

Source: CPCS analysis of MnDOT OSOW permit data. 2016.

- Only 7.6 percent of permits (182) were issued for moves **entirely within District 8**. 46 percent of these intra-district permits were for construction equipment, and 42 percent were for mobile homes. The remainder of permits were primarily associated with farm equipment such as grain dryers and mobile implements.
- About 31 percent of permits (751) were issued for **loads originating in District 8 and bound for South Dakota.** 93 percent of these permits for mobile homes.
- Another 31 percent of permits (736) were issued for **loads originating in District 8 and bound for other Districts in Minnesota.** Like other origin-destination pairs, most of these loads were associated with mobile homes.

Key OSOW Routes in District 8

OSOW permit data provided by MnDOT also provides limited insight into key corridors for OSOW freight in the District. Unfortunately, this OSOW data is not an easily-mapped format, so the number of OSOW permits issued for specific road segments cannot be isolated. Instead, counts of specific routes mentioned in OSOW permits are listed in Figure 85.

Figure 85: Top 10 Highways Listed in District 1 OSOW Permits

Route	Count
US212 W	733
US71 N	628
MN19 W	371
MN29 S	355
MN7 E	305
US212 E	300
US71 S	298
MN23 N	295
MN23 S	280
US59 N	211

Source: CPCS analysis of MnDOT OSOW permit data. 2016.

In addition to this identification of routes, the top 5 OSOW origins and destinations in District 8 were identified, as listed in Figure 86.

Figure 86: Top OSOW Permit Origins and Destinations in District 8, 2016

Top Origins	Trips	Top Destinations	Trips
Redwood Falls	544	US-212 at SD	581
Montevideo	543	US-14 at SD	127
Olivia	132	MN-19 at SD	105
Blomkest	109	Fergus Falls	48
Danube	107	Lakeville	46

Source: CPCS analysis of MnDOT OSOW permit data. 2016.

3.4 Condition

The condition of the freight system infrastructure is critical to goods movement activities as deficient structures may create barriers for truck movement, and rough road surfaces can create bumps and shocks that damage or dislodge cargo. Infrastructure condition measures define the physical suitability of the network to serve transportation activities and can inform inspection and maintenance investment decisions. The condition analysis conducted for the District 8 Freight Plan focuses on bridges. Pavement condition is not included in this condition analysis, because as shown in the District 1 Freight Plan MnDOT and county staff indicated that impaired or deficient road segments would be identified and programmed for improvement as part of routine highway maintenance and improvement plans. This will be further confirmed for District 8 during the needs assessmen phase of plan development.

Bridge Condition

Figure 87 describes the current distribution of bridges across the District. While less than 6 percent of Minnesota's trunk highway bridges are located in District 8, the number of bridges located along county and township routes in the District is relatively high.

Figure 87: Count of Bridges in District 8

	Count	Percent of MN	Rank
Trunk Highway	356	4.6%	5
County	1,104	14.2%	3
Township	1,267	20.3%	2
City	52	4.5%	6
Total	2,779	14.0%	3

Source: MnDOT, Minnesota Bridges, December 2018.

Figure 88 lists the bridges over 10 feet in each District, their average age, and average sufficiency rating. A bridge is considered "deficient" if it has a rating of 80 or less.

Figure 88: Count, Average Age and Condition of Bridges 10 Feet and Over, 2018

District	Interstate	Trunk Highway	County	Township	City	Total	Average Age	Average Sufficiency Rating
1	153	401	993	207	142	1,896	34	90
2	0	312	948	935	32	2,227	30	95
3	70	388	869	505	52	1,884	33	93
4	78	246	706	614	58	1,702	32	94
Metro	643	639	561	132	580	2,555	29	89
6	203	640	1,435	1,352	195	3,825	37	91
7	124	342	1,186	1,224	56	2,932	36	93
8	0	356	1,104	1,267	52	2,779	35	91
TOTAL	1,271	3,324	7,802	6,236	1,167	19,800	34	92

Source: MnDOT, Minnesota Bridges, December 2018.

District 8 has the third-highest number of bridges 10 feet and over in Minnesota with an average sufficiency rating of 91, which is lower than the state's average.

As Figure 89 shows, District 8 has a total of 268 deficient bridge structures 10 feet and over which account for about 10 percent of Minnesota's total number of deficient bridges. More than 40 percent of the District's deficient bridge structures are located in Redwood and Renville counties.

Figure 89: Counts of Deficient Bridges, by System and County.

County	Trunk	County	Township	City	Total
Chippewa	1	7	13	2	23
Kandiyohi	0	4	4	0	8
Lac Qui Parle	0	5	9	0	14
Lincoln	0	16	22	0	38
Lyon	1	5	4	1	11
McLeod	0	1	1	1	3
Meeker	0	1	1	1	3
Murray	0	6	7	0	13
Pipestone	1	14	20	0	35
Redwood	1	23	34	4	62
Renville	0	34	15	0	49
Yellow Medicine	2	1	6	0	9
Total	6	117	136	9	268
% of District 8's Total Bridges	1.7%	10.6%	10.7%	17.3%	9.6%

Source: MnDOT, Minnesota Bridges, December 2018.

The results above also show that the majority of deficient bridges in the District are on county and township routes while the freight-critical trunk highways have relatively well-maintained bridge structures. However, the deficiency of the bridge structures on local roads directly affects last-mile connections to specific locations around District 8.

4 Conclusions and Next Steps

4.1 Conclusions

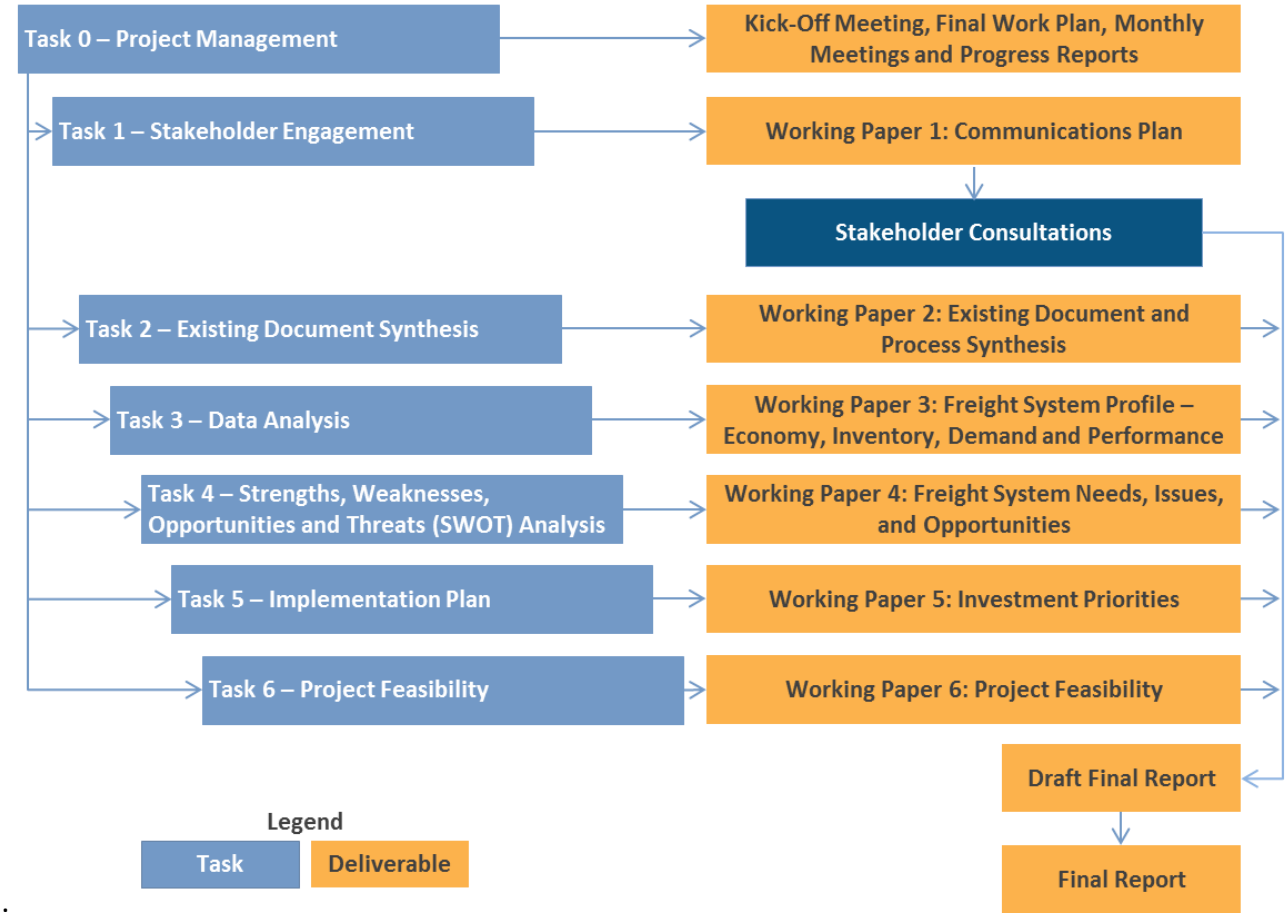
District 8's freight system consists primarily of road and rail assets, which provide an extensive range of freight service and support the continued economic well-being of the district, particularly in agriculture and manufacturing.

District 8's freight system performance is mixed. The District does not experience traffic congestion, but can be affected by congestion in the Twin Cities. At the same time, road safety and truck-related accidents are a concern, while grade crossing safety is comparatively better. Overall, condition of the system

4.2 Next Steps

As shown in the following figure, this Working Paper represents the results of Task 3, and provides a baseline understanding for all future tasks. The data analysis created for this Working Paper will be complemented by stakeholder insights from ongoing engagement, and together these two sources of information will inform a complete assessment of District 8's freight system strengths, weaknesses, threats, and opportunities (SWOT) in the next Working Paper.

Figure 90: Project Approach



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Appendix A: Stakeholders Consulted

This list reflects stakeholders consulted as of August 30. Consultations are ongoing, and will be used to inform analysis in Working Paper 4: Freight System Needs, Issues, and Opportunities.

- Highway 23 Corridor Coalition
- Anderson Trucking
- Archer Daniels Midland
- BNSF
- Central Minnesota Fabricating
- FedEx
- Friendship Homes
- Haug Implement
- Jennie-O
- Schwan Food Company
- South Dakota DOT
- Southern Minnesota Sugar Beet Coop
- Suzlon Wind Power
- TC&W / MPL
- Truck Transport
- Viessman Trucking
- West Central Steel
- Woody's Trucking

Appendix B: Freight-Related Industry Detailed 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 in order 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 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 in lieu of mining goods).
- **Homogeneous goods being produced:** this assumption in District 8 is less of a concern for 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 is able to 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 Region's manufacturing Location Quotient of 2.08 shows relative specialization in this sector compared to the rest of the country. According to the Location Quotient analysis, District's manufacturing is highly concentrated around fabricated metal product manufacturing.

The following table provides a more detailed analysis of the Location Quotient for freight-related industries in District 8. A summary of the Location Quotient analysis findings for the District are presented in Figure 15 of Chapter **Error! Reference source not found.**.

Figure B-1: County-Level Location Quotient Analysis

Industry	Chippewa	Kandiyohi	Lac Qui Parle	Lincoln	Lyon	McLeod	Meeker	Murray	Pipestone	Redwood	Renville	Yellow Medicine
NAICS 11 Agriculture, forestry, fishing and hunting	0.00	0.00	3.27	7.08	1.49	0.00	0.00	2.82	0.00	0.00	0.00	0.00
NAICS 111 Crop production	5.40	1.50	3.27	0.00	0.00	0.70	1.02	0.00	0.00	3.51	10.06	2.10
NAICS 1111 Oilseed and grain farming	30.94	10.92	32.74	0.00	0.00	1.62	9.11	0.00	0.00	0.00	65.03	20.97
NAICS 11119 Other grain farming	35.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.98	0.00
NAICS 111191 Oilseed and grain combination farming	44.28	6.63	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	75.04	0.00
NAICS 112 Animal production and aquaculture	0.00	17.29	0.00	21.03	4.55	3.11	14.92	7.75	30.68	3.78	21.67	10.89
NAICS 115 Agriculture and forestry support activities	0.46	1.61	0.00	0.00	1.00	0.32	0.00	0.00	2.75	0.57	0.00	0.00
NAICS 1151 Support activities for crop production	0.52	1.10	0.00	0.00	0.00	0.00	0.00	0.00	2.48	0.00	2.12	ND
NAICS 11511 Support activities for crop production	0.52	1.10	0.00	0.00	0.00	0.00	0.00	0.00	2.48	0.00	2.12	ND
NAICS 115112 Soil preparation, planting, and cultivating	4.28	1.42	0.00	0.00	9.96	0.00	0.00	0.00	0.00	0.00	9.20	ND
NAICS 22 Utilities	1.93	0.00	ND	0.00	0.00	0.00	0.00	0.00	2.17	1.11	0.00	0.00
NAICS 221 Utilities	1.93	0.00	ND	0.00	0.00	0.00	0.00	0.00	2.17	1.11	0.00	0.00
NAICS 236 Construction of buildings	2.13	1.06	0.37	1.19	0.70	0.62	1.28	1.27	0.78	1.39	0.57	3.86
NAICS 2361 Residential building construction	0.61	0.97	0.00	2.41	0.74	0.39	1.46	1.60	0.00	1.88	0.44	0.00
NAICS 23611 Residential building construction	0.61	0.97	0.00	2.41	0.74	0.39	1.46	1.60	0.00	1.88	0.44	0.00

Industry	Chippewa	Kandiyohi	Lac Qui Parle	Lincoln	Lyon	McLeod	Meeker	Murray	Pipestone	Redwood	Renville	Yellow Medicine
NAICS 236115 New single-family general contractors	0.56	1.33	0.00	2.90	0.93	0.45	1.11	2.17	0.00	0.00	0.00	1.90
NAICS 2362 Nonresidential building construction	3.60	1.14	0.00	ND	0.66	0.84	1.10	0.95	0.00	0.90	0.70	0.00
NAICS 23622 Commercial building construction	0.00	0.00	0.00	ND	0.00	1.06	1.39	0.00	0.00	1.13	0.00	0.50
NAICS 236220 Commercial building construction	0.00	0.00	0.00	ND	0.00	1.06	1.39	0.00	0.00	1.13	0.00	0.50
NAICS 2371 Utility system construction	0.00	1.29	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00
NAICS 23711 Water and sewer system construction	0.00	0.00	ND	ND	0.00	2.39	0.00	0.00	0.00	0.00	0.00	ND
NAICS 237110 Water and sewer system construction	0.00	0.00	ND	ND	0.00	2.39	0.00	0.00	0.00	0.00	0.00	ND
NAICS 2379 Other heavy construction	0.00	0.00	0.00	0.00	1.14	0.46	ND	0.00	0.00	4.00	3.64	2.48
NAICS 23799 Other heavy construction	0.00	0.00	0.00	0.00	1.14	0.46	ND	0.00	0.00	4.00	3.64	2.48
NAICS 237990 Other heavy construction	0.00	0.00	0.00	0.00	1.14	0.46	ND	0.00	0.00	4.00	3.64	2.48
NAICS 238 Specialty trade contractors	0.00	0.59	0.63	1.01	0.54	0.73	1.32	1.11	1.51	0.84	0.60	0.30
NAICS 2382 Building equipment contractors	0.47	0.63	0.61	0.72	0.67	0.55	0.74	1.06	0.00	0.84	0.97	0.38
NAICS 23821 Electrical and wiring contractors	0.74	0.68	0.00	0.00	0.65	0.00	0.00	1.90	0.00	0.00	1.21	0.31
NAICS 31-33 Manufacturing	2.44	2.04	0.74	0.13	1.58	3.50	2.38	1.94	1.36	2.11	1.78	0.66
NAICS 311 Food manufacturing	0.00	0.00	0.00	ND	8.32	0.00	2.44	0.00	0.00	0.00	0.00	0.00
NAICS 323111 Commercial printing, except screen & books	0.00	0.00	ND	ND	1.37	0.00	0.00	0.00	0.00	ND	0.00	0.00

Industry	Chippewa	Kandiyohi	Lac Qui Parle	Lincoln	Lyon	McLeod	Meeker	Murray	Pipestone	Redwood	Renville	Yellow Medicine
NAICS 332 Fabricated metal product manufacturing	0.00	1.45	0.00	0.00	0.00	3.41	4.67	0.00	0.00	0.52	2.15	1.50
NAICS 337 Furniture and related product manufacturing	0.00	0.44	ND	ND	0.00	5.84	0.00	ND	ND	0.00	ND	0.00
NAICS 44-45 Retail trade	0.88	1.10	0.00	0.98	1.12	0.00	0.00	0.00	1.03	1.02	0.66	0.00
NAICS 445 Food and beverage stores	0.78	0.79	0.00	1.39	1.18	0.00	0.00	0.00	1.70	0.75	0.71	1.61
NAICS 446 Health and personal care stores	0.00	0.90	1.20	1.40	0.43	0.70	0.15	0.00	0.00	0.85	0.00	1.47
NAICS 4461 Health and personal care stores	0.00	0.90	1.20	1.40	0.43	0.70	0.15	0.00	0.00	0.85	0.00	1.47
NAICS 44611 Pharmacies and drug stores	0.00	0.69	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	2.19
NAICS 446110 Pharmacies and drug stores	0.00	0.69	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	2.19
NAICS 447 Gasoline stations	2.01	2.33	0.00	6.80	1.64	2.40	4.27	3.93	3.05	2.54	3.54	0.00
NAICS 4471 Gasoline stations	2.01	2.33	0.00	6.80	1.64	2.40	4.27	3.93	3.05	2.54	3.54	0.00
NAICS 44719 Other gasoline stations	0.00	0.00	0.00	0.00	ND	ND	ND	9.98	0.00	ND	0.00	0.00
NAICS 447190 Other gasoline stations	0.00	0.00	0.00	0.00	ND	ND	ND	9.98	0.00	ND	0.00	0.00
NAICS 453 Miscellaneous store retailers	0.00	0.74	0.00	ND	0.82	0.53	0.31	1.52	0.50	0.00	0.39	0.00
NAICS 48-49 Transportation and warehousing	1.18	0.86	2.68	2.94	1.08	0.89	1.61	2.51	1.35	1.49	1.92	1.74
NAICS 485 Transit and ground passenger transportation	3.02	0.00	ND	0.00	0.00	2.35	0.00	0.00	2.03	0.00	4.73	0.00

Source: CPCS analysis of Bureau of Labor Statistics, 2018. Location Quotients reflect annual averages based on employment level and "ND" indicates that data for specific industry is not available.

Appendix C: Shift Share Analysis

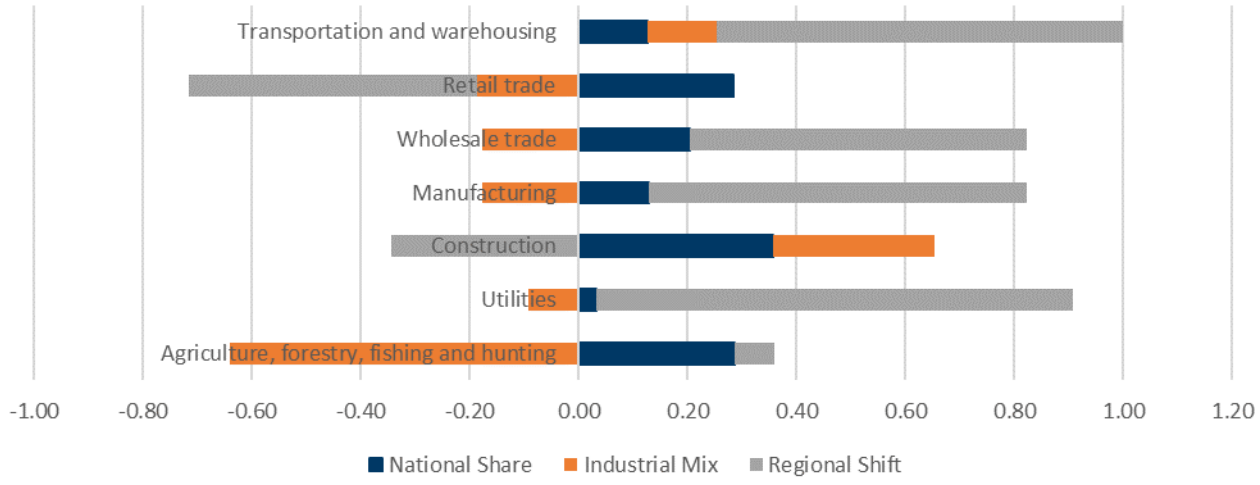
While Location Quotients report economic competitiveness at a particular point in time, Shift Share Analysis is a more dynamic economic indicator used to understand changes in a region's industry competitiveness over time compared to the national norm. The shift share formula is as follows:

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 C-1: Factors for Regional Employment Change by Freight-Related Industry (2010 to 2016)



Source: CPCS analysis of US Census 2010 and 2016 County Business Pattern Data.
Note: Mining, quarrying, and oil and gas extraction employment data is not provided for the 12 counties in District 8.

Overall, the national trends (National Share) positively affect employment growth in District 8 across all freight-related industries except for retail trade and construction. The national impact is especially prominent in utilities and transportation and warehousing businesses. This is while industry trends (Industrial Mix) only positively impact employment growth in transportation and warehousing as well as construction industries. Employment declines in District 8 were affected by national industry trends (Industrial Mix) most significantly in agriculture, forestry, fishing, and hunting, as well as retail and wholesale trade businesses.