

Grayson County Freight Mobility Plan

Final Report

prepared for

Sherman Denison MPO

prepared by

Cambridge Systematics, Inc.

with

University of North Texas

final report

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date

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Table of Contents

1.0	Overview	1-1
1.1	Infrastructure	1-1
1.2	Economy and Supply Chains	1-4
1.3	SWOT Analysis and Needs Identification	1-5
1.4	Plan Findings and Recommendations	1-6
2.0	Grayson County Freight Assets Inventory and Performance	2-1
2.1	Highway Assets	2-1
2.2	U.S. 75 Corridor Analysis	2-12
2.3	Railroad Assets	2-22
2.4	Airport Assets	2-24
2.5	Freight-Intensive Land Use	2-25
3.0	Grayson County Economic Analysis	3-1
3.1	Background and Regional Economic Trends	3-1
3.2	Benchmarking the Grayson County Economy	3-9
3.3	Economic Analysis of Freight Generating and Transportation Activities	3-17
3.4	Regional Supply Chains	3-24
4.0	Recommendations	4-1
4.1	Grayson County Multimodal Freight Network	4-1
4.2	Highway Needs and Recommendations	4-2
4.3	Multimodal Freight Needs and Recommendations	4-6
4.4	Policy and Program Recommendations	4-6
5.0	Funding Opportunities	5-1
5.1	TxDOT Funding Categories	5-1
5.2	Federal Transportation Grant Opportunities	5-3
5.3	Other Financing Mechanisms	5-6
Appendix A.	SWOT Analysis Input	A-1
Appendix B.	Freight Project List	B-1
Appendix C.	Industry Linkages by Industry Sector	C-1

List of Tables

Table 1.1	Grayson County SWOT Analysis Summary Findings	1-5
Table 2.1	Grayson County Roadways by Functional Classification	2-2
Table 2.2	Major Roadways by Ownership	2-3
Table 2.3	Pavement Quality on Major Roadways	2-5
Table 2.4	Vertical Clearance by Facility Type Crossed.....	2-8
Table 2.5	Commercial Motor Vehicle Crashes and Rates 2015	2-9
Table 2.6	U.S. 75 Corridor Benchmarking.....	2-21
Table 2.7	Railroad Miles by Ownership and Trackage Rights	2-22
Table 2.8	Railroads in Grayson County and Texas.....	2-23
Table 3.1	Historic Population Growth in Grayson County and Texas 1960-2010.....	3-1
Table 3.2	Recent Population Change Grayson County 2010-2017	3-2
Table 3.3	Nominal Median Household Income in Texas and Grayson County 2010 and 2016	3-9
Table 3.4	Major Employers and Freight Generators in Grayson County	3-24
Table 3.5	Freight Sensitive Major Employers in Grayson County.....	3-25
Table 3.6	Total Commodity Flows in Grayson County, 2015	3-26
Table 3.7	Top Commodities by Tonnage 2015	3-27
Table 3.8	Movements of Major Freight Commodities in Grayson County 2015.....	3-27
Table 3.9	Commodity Movements in Grayson County by Transportation Mode.....	3-29
Table 3.10	Primary Trading Partners with Grayson County by Select Industry Sector.....	3-31
Table 3.11	Industry Linkages for the Semiconductors Sector <i>Employment change per 100 added workers</i>	3-33
Table 5.1	Statutory Requirements of BUILD Grants	5-4
Table 5.2	Statutory Requirements of INFRA Grants	5-5
Table A.1	Freight Advisory Committee SWOT Responses	A-2
Table B.1	Funded Freight Projects in Grayson County 2018	B-2
Table B.2	Unfunded Freight Projects in Grayson County 2018.....	B-3
Table C.1	Industry Linkages for the Oil & Gas Machinery & Equipment Manufacturing Sector <i>Employment change per 100 added workers</i>	C-1
Table C.2	Industry Linkages for the Non Residential Construction Sector <i>Employment change per 100 added workers</i>	C-1
Table C.3	Industry Linkages for the Other Aluminum Rolling Sector <i>Employment change per 100 added workers</i>	C-2
Table C.4	Industry Linkages for the Truck Transportation Sector <i>Employment change per 100 added workers</i>	C-2
Table C.5	Industry Linkages for Plumbing Fixture Manufacturing Sector <i>Employment change per 100 added workers</i>	C-3
Table C.6	Industry Linkages for Valves and Fittings Manufacturing Sector <i>Employment change per 100 added workers</i>	C-3

Table C.7	Industry Linkages for Plastics Packaging Material Sector <i>Employment change per 100 added workers</i>	C-4
Table C.8	Industry Linkages for the Other Electronic Component Manufacturing Sector <i>Employment change per 100 added workers</i>	C-4
Table C.9	Industry Linkages for the Hospitals Sector <i>Employment change per 100 added workers</i>	C-5
Table C.10	Industry Linkages for the Frozen Specialty Manufacturing Sector <i>Employment change per 100 added workers</i>	C-5
Table C.11	Industry Linkages for the New Multifamily Construction Sector <i>Employment change per 100 added workers</i>	C-6
Table C.12	Industry Linkages for the Oil & Gas Drilling Sector <i>Employment change per 100 added workers</i>	C-6
Table C.13	Industry Linkages for the Nonferrous Metal Foundries Sector <i>Employment change per 100 added workers</i>	C-7
Table C.14	Industry Linkages for the New Nonresidential Construction Sector <i>Employment change per 100 added workers</i>	C-7
Table C.15	Industry Linkages for the Oil & Gas Extraction Sector <i>Employment change per 100 added workers</i>	C-8
Table C.16	Industry Linkages for the General Merchandise School Sector <i>Employment change per 100 added workers</i>	C-8
Table C.17	Industry Linkages for the Cattle Ranching Sector <i>Employment change per 100 added workers</i>	C-9
Table C.18	Industry Linkages for the Other Crop Farming Sector <i>Employment change per 100 added workers</i>	C-9

List of Figures

Figure 1.1	Grayson County Overview.....	1-1
Figure 1.2	Sherman-Denison Urbanized Area.....	1-2
Figure 1.3	Pavement Roughness in Grayson County and Texas (IRI ¹)	1-3
Figure 1.4	Oversized Load in Tom Bean.....	1-4
Figure 2.1	Grayson County Roadway Network	2-2
Figure 2.2	Average Annual Daily Truck Traffic.....	2-4
Figure 2.3	Pavement Quality on Major Roadways	2-6
Figure 2.4	Poor Condition or Load Restricted Bridges	2-7
Figure 2.5	Bridge Vertical Clearance.....	2-8
Figure 2.6	CMV-Involved Crashes per Mile 2012-2016	2-10
Figure 2.7	Level-of-Service 2016.....	2-11
Figure 2.8	Reliability: Buffer Time Index.....	2-12
Figure 2.9	U.S. 75 Overview (1 of 3)	2-14
Figure 2.10	U.S. 75 Overview (2 of 3)	2-15
Figure 2.11	U.S. 75 Overview (3 of 3)	2-16
Figure 2.12	U.S. 75 Bottlenecks (1 of 2).....	2-18
Figure 2.13	U.S. 75 Bottlenecks (2 of 2).....	2-19
Figure 2.14	Railroads by Owner	2-23
Figure 2.15	Airport Locations.....	2-25
Figure 2.16	Freight Business Locations	2-26
Figure 3.1	Population Projections for Grayson County 2018 to 2050	3-2
Figure 3.2	Sherman-Denison MSA Real Gross Domestic Product (GDP) 2001-2016.....	3-3
Figure 3.3	Sherman-Denison GDP by Industry Sector (Chained 2009 dollars) 2001-2016.....	3-4
Figure 3.4	Total Employment in Grayson County 2001-2017	3-5
Figure 3.5	Grayson County Employment by Industry Sector 2017	3-6
Figure 3.6	Grayson County Employment Change by Sector 2007-2017	3-7
Figure 3.7	Month-on-Month Employment Change in Grayson County 2001-2017	3-7
Figure 3.8	Monthly Unemployment Rate in the United States, Texas, and Grayson County 2007-2017 (Not adjusted)	3-8
Figure 3.9	Average Weekly Wage by Industry in Grayson County 2017	3-9
Figure 3.10	Rate of Population Growth versus Employment Growth in Texas 2010-2017.....	3-11
Figure 3.11	Unemployment Rate versus Change in Unemployment Rate in Texas MSAs 2010-2017.....	3-12
Figure 3.12	2016 Median Household Income versus Change in Median Household Income in Texas MSAs 2010-2016	3-13
Figure 3.13	Change in Median Household Income versus Change in Unemployment Rate in Texas MSAs 2009-2016	3-14

Figure 3.14	Change in Manufacturing Employment versus Average Weekly Wage (Nominal) in Texas MSAs 2010-2017	3-15
Figure 3.15	Change in Manufacturing Sector Employment versus Average Weekly Wage (Real) 2010-2017.....	3-16
Figure 3.16	Total Employment Impact on Grayson County from Adding 100 Workers by Industry Sector	3-19
Figure 3.17	Total Indirect Employment Impact on Grayson County from Adding 100 Workers by Industry Sector.....	3-20
Figure 3.18	Total Induced Employment Impact on Grayson County from Adding 100 Workers by Industry Sector.....	3-21
Figure 3.19	Direct, Indirect, and Induced Income Impacts on the Grayson County Economy from Adding 100 Workers by Industry Sector	3-22
Figure 3.20	Total Jobs Created versus Average Annual Wage (Assuming 100 Direct Jobs Added) in Grayson County	3-23
Figure 4.1	Grayson County Multimodal Freight Network.....	4-2
Figure 4.2	Highway Needs in Grayson County.....	4-4
Figure 5.1	TxDOT Funding Categories.....	5-1

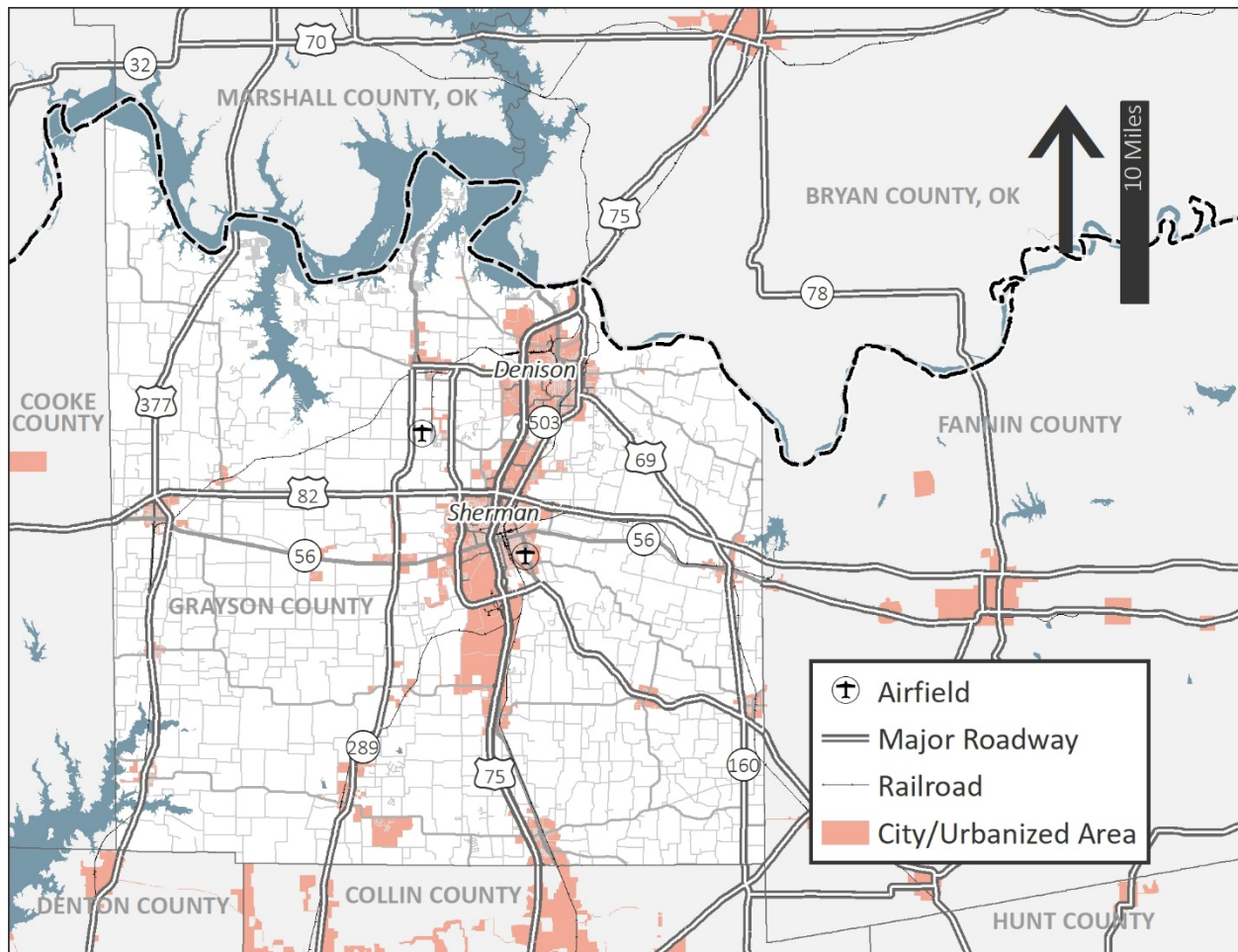
1.0 Overview

The Grayson County Freight Mobility Plan was developed by the Sherman-Denison Metropolitan Planning Organization (SDMPO) in 2018. This plan included an infrastructure and economic technical analysis, and convened two meetings of a Countywide Freight Advisory Committee (FAC). The Plan culminates in a countywide freight network and a set of infrastructure and policy recommendations for Grayson County and the Sherman-Denison MPO. The remainder of this overview section highlights the major activities, analysis, findings, and recommendations of this plan, and is followed by sections which detail each of these activities.

1.1 Infrastructure

Grayson County is located on the Texas-Oklahoma border, north of the Dallas-Fort Worth Metroplex. Figure 1.1 overviews Grayson County's freight infrastructure of Grayson County and urbanized areas, primarily in Sherman and Denison. Figure 1.2 provides a closer view of the infrastructure in this urbanized area.

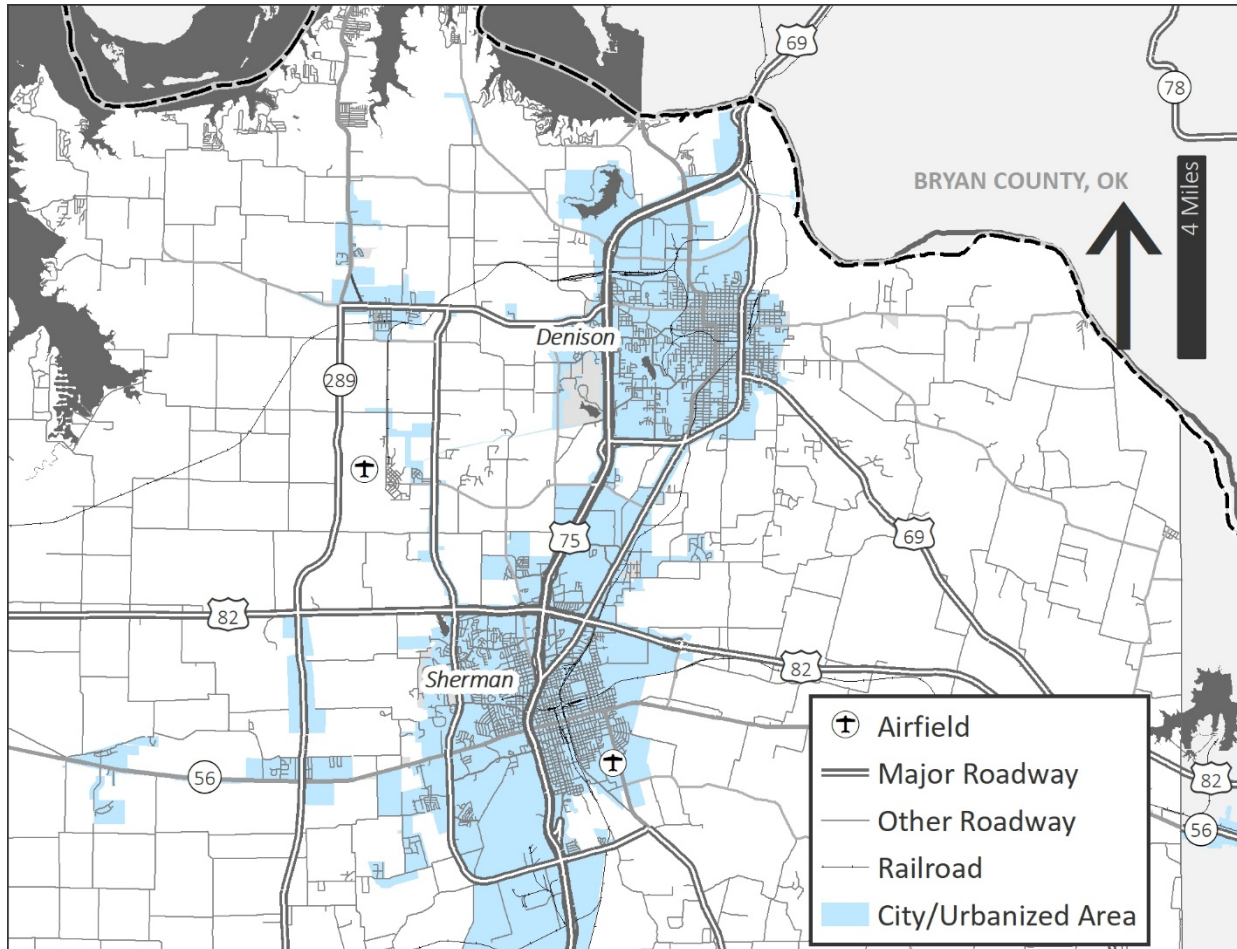
Figure 1.1 Grayson County Overview



Source: TxDOT Transportation Planning and Programming and Federal Highway Administration, 2016.

Transportation in Grayson County benefits from having several U.S. Highways, state and local roads, two Class I railroads, two short line railroads, and two airports. Additionally, clusters of freight-dependent businesses are located throughout the County and particularly along U.S. 75.

Figure 1.2 Sherman-Denison Urbanized Area



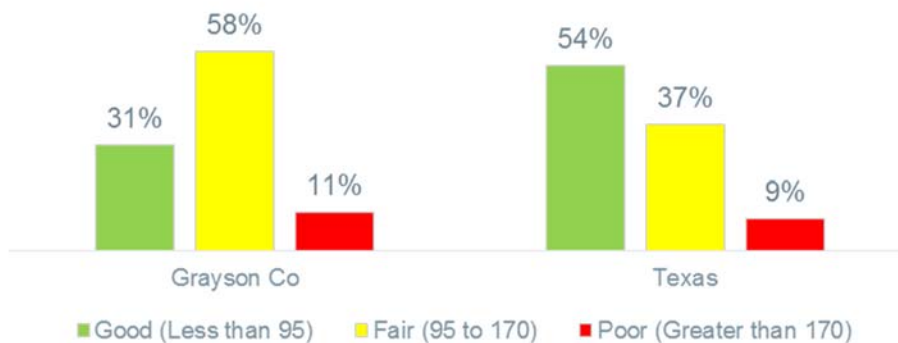
Source: TxDOT Transportation Planning and Programming and Federal Highway Administration, 2016.

The performance of the Grayson County highway network was assessed in terms of safety, asset condition, congestion, reliability, and connectivity. In summary:

- The pavement condition in the County is generally poorer than Texas as a whole, as shown in Figure 1.3. The County has fewer commercial motor vehicle (CMV) crashes per truck-mile traveled than the state, and it has a similar rate of CMV-involved fatalities per mile of travel.
- Most Grayson County roadways are uncongested for freight, though U.S. 75 and SH 289 become congested during peak hours. For comparison, approximately 15 percent of lane-miles on U.S. 75 in Grayson County are congested during the PM peak, while 64 percent of lane-miles on I-35 in Cooke County are congested at this time. Similarly, most of the County has reliable travel times as measured by truck buffer time index, a measure of how much extra time must be allocated in order to arrive on time 95 percent of the time. The lack of congestion in Grayson County makes it an attractive location for freight businesses requiring efficient and reliable transportation.

- Generally, freight can move easily through the County, with most of the freight-related challenges relating to movements of oversized loads. The County has few bridges with sub-standard vertical clearance, and these bridges do not cross roadways which carry the bulk of freight in the County. Similarly, load restricted and poor condition bridges do not restrict most freight movement on U.S. and State Highways carrying the most truck traffic. However, bridges on smaller roadways may still interfere with freight movement if a business generating freight activity is located nearby. Additionally, oversize or overweight cargo may be impeded by infrastructure that only supports standard load. Figure 1.4 shows an example of an oversized load on FM 902 in Tom Bean.
- U.S. 75 carries more truck traffic than any corridor in the County, and carries a similar amount of trucks as I-35 in neighboring Cooke County. There are a number of potential bottlenecks on this corridor, generally related to roadway merging or splitting, or crashes. The corridor has more CMV-involved crashes per mile than other corridors in the County, but similar rates to interstates in the region which have similar traffic flows and speeds. It is relatively uncongested and reliable compared to neighboring corridors.
- Grayson County benefits from two Class I railroads and two rail short lines. These facilities serve a mix of through and local traffic. Union Pacific and BNSF Railway each have a rail yard in the County, and both are located in the U.S. 75 corridor. Genesee & Wyoming's two short lines interchange with the Class Is at these locations and connect customers within the County as well as to the east and south.
- Of the County's two airports, North Texas Regional Airport is the largest. Its 9,000 ft. runway can accommodate large commercial aircraft, and industrial sites are available for lease or development. In addition to highway access, an unused rail spur exists to the east of the airport.

Figure 1.3 Pavement Roughness in Grayson County and Texas (IRI¹)



Source: Federal Highway Administration, Highway Performance Monitoring System, 2015. Excludes local and minor collector roadways.

¹ IRI: International Roughness Index.

Figure 1.4 Oversized Load in Tom Bean



Source: City of Tom Bean.

1.2 Economy and Supply Chains

Overall, Grayson County has a strong and diversified economy, which requires a robust freight transportation network to serve existing employers and to attract similar industries. Since the 2008-2009 Recession, the Grayson County economy has rebounded strongly and has low unemployment coupled with a relatively strong rate of employment growth. However, because Grayson County's unemployment rate and wages are low, its total employment has been growing, and its population growth has lagged the state of Texas overall, skilled labor shortages are being reported by local employers. The County's population is expected to grow—perhaps more than double—over coming decades, which will create challenges for planners, local governments and service providers. At the same time, this growth can feed the region's growing economy, and is an opportunity for reinvestment in infrastructure and manufacturing industries.

The prominent role of the manufacturing sector in the Grayson County economy means that local freight producing/dependent industries are highly reliant on the movement of goods to and from the region. Local stakeholders have reported that relatively few commodities are sourced locally by manufacturers, which has amplified the need to maintain a strong local freight transportation network. Similarly, an analysis of the backward linkages for key freight-producing sectors in the Grayson County input-output model appeared to confirm these anecdotal observations.

Available data from TRANSEARCH and the Federal Highway Administration on freight commodity flows into, out of, and within Grayson County estimate that approximately 7.2 million tons valued at \$7 billion were moved in the county in 2015. Ten commodity groups were selected by prevalence of local freight business and employment for more detailed analysis. These industries were found to have a mix of regional trading partners such as nearby counties or states as well as linkages to supply chains throughout the county and with Mexico.

Based upon this information, the following economic-based recommendations are offered to local freight transportation planners and economic development officials:

- Ensure that local freight transportation planning efforts address the needs of industry sectors with larger local multipliers and linkages to local freight-generating industries.
- Target economic development strategies to sectors that create the largest regional economic impact. These strategies may include attracting entirely new industry sectors, expanding existing sectors, or attracting industries that support local employers and make the Grayson County economy more vertically integrated.
- Coordinate local economic development strategies and partners across disciplines, such as freight planning and workforce development. While the disciplines may appear disparate, they are part of a “basket” of attributes that site selection specialists consider when choosing new locations.
- Develop greater resiliency in the local transportation network. While U.S. 75 is considered the region’s most important corridor for moving freight, other highways like SH 289, U.S. 69, U.S. 82, and U.S. 377 that can and do support local industries. Likewise, creating opportunities for local shippers to make greater use of local rail services would make the local economy more resilient and reduce traffic volumes on the region’s primary roadways.

1.3 SWOT Analysis and Needs Identification

A freight-based Strengths, Weakness, Opportunities, and Threats (SWOT) analysis was conducted with the Grayson County Freight Advisory Committee (FAC) on May 16, 2018. U.S. 75 was seen as both a strength and a weakness/threat, as it needs significant engineering and infrastructure investments to continue to support regional mobility and connectivity. Growing population was seen as an opportunity to develop a more robust workforce and economy; however without proper support a growing population can be seen as a threat. Rail infrastructure and the regional airport were also seen as opportunities to cultivate economic growth. Finally, policy issues such as better routing for oversize or overweight (OSOW) truck traffic was seen as a concern. Key findings from the SWOT analysis are summarized in Table 1.1. Full responses from stakeholders are presented in Appendix A.

Table 1.1 Grayson County SWOT Analysis Summary Findings

Strengths	Weaknesses	Opportunities	Threats
U.S. 75 connections to major markets	Outdated U.S. 75 infrastructure	Booming population growth	Increasing U.S. 75 traffic
Robust economic environment	OSOW vehicle challenges	Technological change	Changing workforce needs / technology
Available industrial sites	Underutilized Rail and Air facilities	Developing rail sites/yards	Supporting growing population
Workforce availability	Need for East-West highway connections	Airport-related economic development	Infrastructure obsolescence
		Relationships with other agencies (TxDOT, local ED)	

1.4 Plan Findings and Recommendations

The Grayson County Multimodal Freight Network builds off of the Texas Multimodal Freight Network by adding facilities of local and regional significance to the existing set of highways and railroads on the statewide network. The resulting network includes all railroad facilities, the North Texas Regional Airport, the Sherman Municipal airport, and major highway facilities within the region, including: U.S. 75, U.S. 82, U.S. 69, U.S. 377, SH 289, SH 91, SH 160, Spur 503, FM 1417, and FM 120.

The needs on this network were identified and vetted through analysis of highway performance data, stakeholder interviews, and meetings of the Grayson County Freight Advisory Committee. The major highway priorities identified were: Increasing mobility and reliability, particularly on U.S. 75, bridges with low vertical clearance, east/west connectivity, and safety improvements. Planned and potential freight projects were identified to meet these needs on the highway freight network. Rail priorities include investigating options to improve rail efficiency on the regional short line rail network, and increasing utilization of rail yards in the County. No current air cargo infrastructure needs were identified, though stakeholders commented that the county should continue to invest in the North Texas Regional Airport as it expands. The airport would benefit from a customs broker to facilitate international trade and leverage FTZ exemptions by assisting importers and exporters.

Policy and program recommendations for Grayson County fall into two categories: transportation-related solutions and economic development-related solutions. Transportation solutions recommended are to continue to engage freight stakeholders, reduce the impacts of oversize/overweight vehicles, pursue strategic land use and “smart growth,” and support infrastructure connections to other markets. Economic development solutions include increasing rail access and traffic, leveraging the airport for growth, study manufacturing and logistics-based development opportunities, and prioritizing workforce development.

Finally, Federal, state, and other funding opportunities to meet these needs were identified. In some cases, only certain roadways are eligible for a funding source. Segments of U.S. 75 and U.S. 82 are located on numerous networks, including the National Highway System, the Texas Trunk System, and the National Highway Freight Network (U.S. 75 only). Projects on these roadways may be most flexible in terms of funding eligibility. In addition to grants and distributions of Federal and state money, the Federal Government offers financing options to reduce the cost of advancing projects.

2.0 Grayson County Freight Assets Inventory and Performance

Grayson County has highway, railroad, and airport freight assets that enable the movement of freight in, out, and through the County. This chapter inventories these assets and summarizes their performance. U.S. 75 is of particular importance to Grayson County, and is profiled in a separate section, in addition to being included in the Highway Assets subsection. The final section in this chapter overviews freight-intensive land use and businesses in the County.

2.1 Highway Assets

2.1.1 Inventory

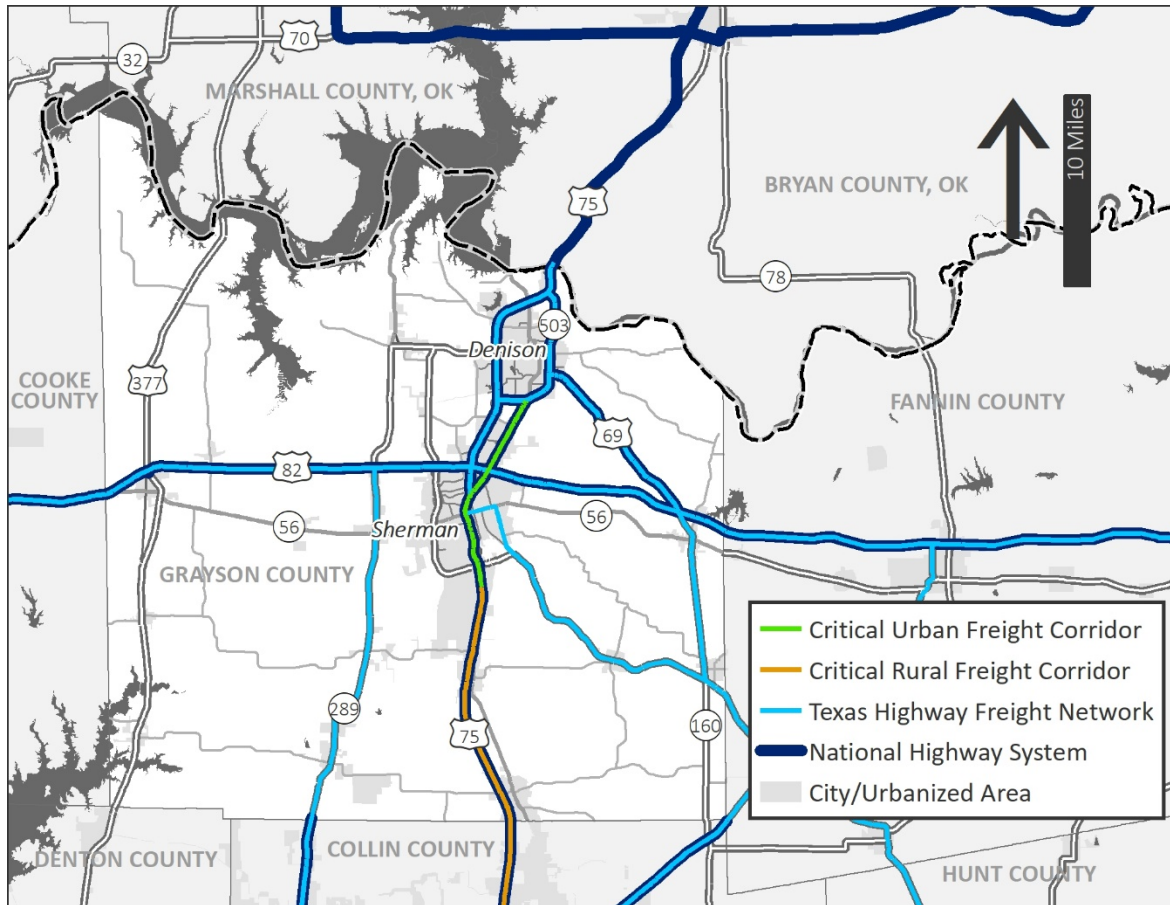
Grayson County has nearly 2,500 miles of public roadways ranging from U.S. Highways to local roads. These highway assets include segments of the National Highway System (NHS), the Texas Highway Freight Network (THFN), Critical Urban Freight Corridors (CUFC), and Critical Rural Freight Corridors (CRFC). These designations recognize the significance of roadways in Grayson County for the movement of people and goods. Roadways designated as Critical Urban or Rural Freight Corridors are submitted by the Texas Department of Transportation (TxDOT) to the Federal Highway Administration (FHWA) in order to be eligible for National Highway Freight Program funding. These designations are shown in Figure 2.1.

Grayson County Highway Assets

- 90 miles on **National Highway System.**
 - US 75, US 82, US 69, SH 289, SH 91, Spur 503.
- 137 miles on **Texas Highway Freight Network.**
- 10.7 miles of **Critical Urban Freight Corridors.**
- 12.8 miles of **Critical Rural Freight Corridors.**

The FHWA defines the functional classification of a roadway by the range of mobility and access functions that it serves.¹ Characteristics such as physical barriers, managed access, and regional connectivity determine the functional classification for all roadways except interstates, which are designated by the Secretary of Transportation. Functional classifications for the County and the State are shown in Table 2.1. Similar to the rest of Texas, most of Grayson County's roadways are local roads, followed by major collectors. Interstate highways, other freeways, and principal arterials have the highest capacity for freight movement but comprise a small portion of the total roadway network.

¹ Federal Highway Administration, Functional Classifications, 2017. https://www.fhwa.dot.gov/planning/processes/statewide/related/highway_functional_classifications/section03.cfm.

Figure 2.1 Grayson County Roadway Network

Source: TxDOT Transportation Planning and Programming, Roadway Inventory, 2016.

Table 2.1 Grayson County Roadways by Functional Classification

Functional Classification	Mileage in Grayson County	Percent of Grayson County Mileage	Mileage in Texas	Percent of Texas Mileage
Interstate	0	0%	3,935	1%
Other Freeways and Expressways	27	1%	1,701	<1%
Other Principal Arterial	87	4%	14,647	5%
Minor Arterial	183	8%	18,460	6%
Major Collector	279	11%	50,913	16%
Minor Collector	33	1%	16,002	5%
Local	1,841	75%	208,881	66%
Grand Total	2,451	100%	314,539	100%

Source: TxDOT Transportation Planning and Programming, Roadway Inventory, 2016. Numbers may not add to total due to rounding.

Data on roads with a functional classification of major collector and higher are reported to the FHWA and included in the Highway Performance Monitoring System (HPMS) dataset. HPMS includes data on roadway ownership, daily traffic, daily truck traffic, and pavement conditions. Table 2.2 lists the reported ownership by mileage for major roadways² in Grayson County. A majority of these roadways are owned by TxDOT (90 percent), followed by cities and municipalities (8 percent). The Sherman-Denison MPO partners with these organizations to maintain and improve the highway assets in Grayson County.

Table 2.2 Major Roadways by Ownership

Ownership	Mileage in Grayson County	Percent of Mileage
TxDOT	539	90%
Grayson County	7	1%
City or Municipality	46	8%
Not indicated	5	1%
Grand Total	596	100%

Source: Federal Highway Administration, Highway Performance Monitoring System, 2015. Excludes local and minor collector roadways. Numbers may not add to total due to rounding.

2.1.2 Truck Traffic Volumes

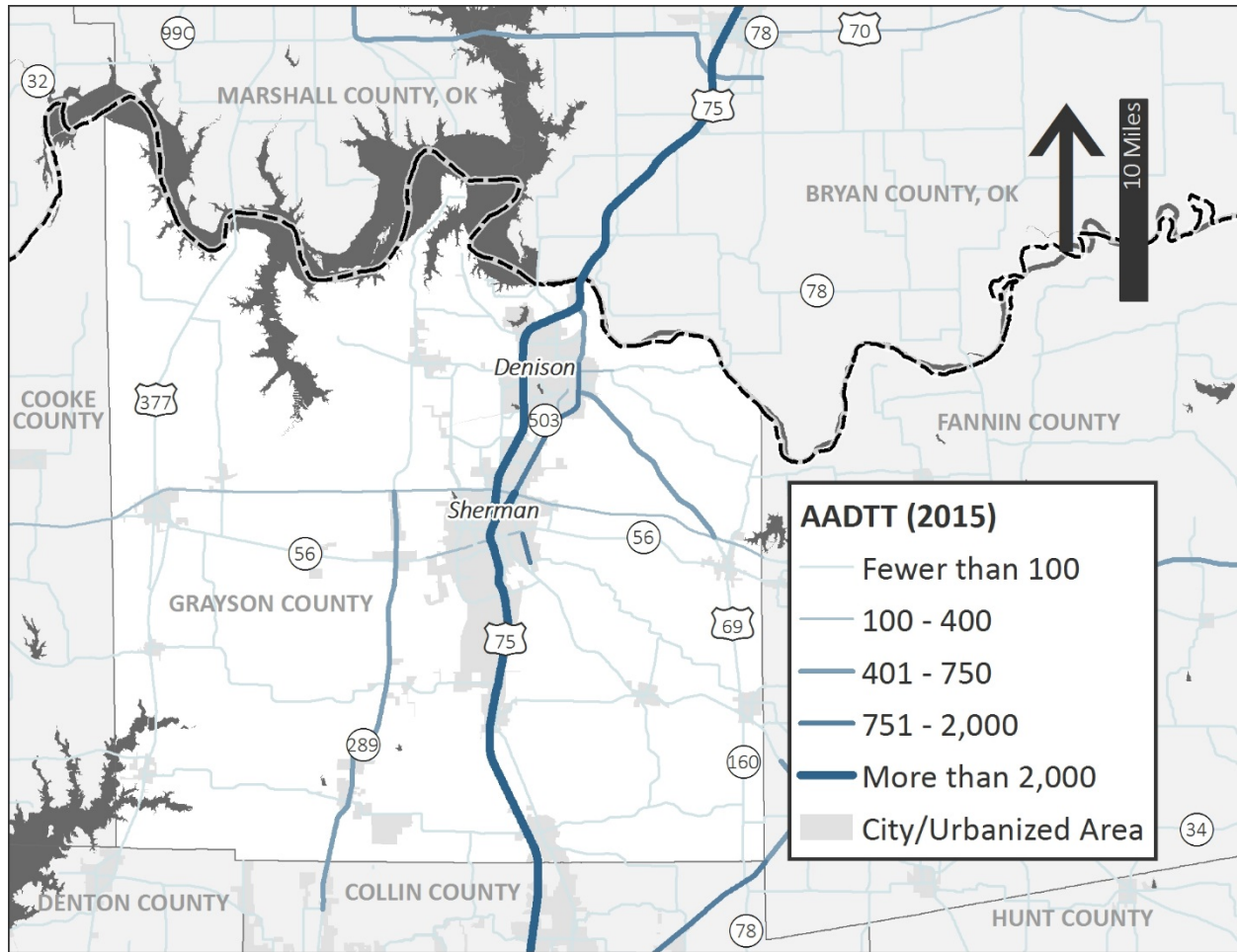
Of the roadways included in the HPMS dataset, U.S. 75 has the largest Average Annual Daily Truck Traffic (AADTT) with more than 6,500 combination trucks recorded daily.³ By comparison, I-35 near the Oklahoma border carries between 8,000-9,000 combination trucks per day. Other roadways with high levels of truck traffic include:

- SH 91/Texoma Parkway in Sherman (2,200 AADTT).
- Spur 503/U.S. 69/Eisenhower Parkway in Denison (1,800 AADTT).
- SH 11 near Sherman Municipal Airport (800 AADTT).
- SH 289 between U.S. 82 and Collin County line (600 AADTT).
- U.S. 69 between U.S. 82 and Spur 503 (600 AADTT).

The roadways with the highest daily truck traffic are predominantly north/south routes and include those serving through traffic as well as local traffic. The AADTT for Major Collectors and higher are shown in Figure 2.2.

² Functional classification Major Collector or higher.

³ The FHWA defines combination trucks as vehicle classes 8 through 13 (four-or-less axle, single-trailer trucks through seven-or-more axle, multi-trailer trucks).

Figure 2.2 Average Annual Daily Truck Traffic

Source: Federal Highway Administration, Highway Performance Monitoring System, 2015. Excludes local and minor collector roadways.

2.1.3 Connectivity to Other Markets

Grayson County has one primary north-south route and one primary east-west route connecting to markets outside of the County. U.S. 75 is the only north-south route which connects to both Dallas and Oklahoma. In Dallas, U.S. 75 becomes I-45 which provides a connection to ports and markets in Houston and Galveston, Texas. To the north, U.S. 75 is the primary connection to Oklahoma in the County and is the nearest route to Tulsa, the second largest city in Oklahoma. Additionally, this route provides a connection from Texas to the oil-producing regions in Osage County, Oklahoma, and natural gas-producing regions in Pittsburg County, Oklahoma.⁴ SH 289 is an alternate route to the south, extending into Collin County near the Dallas North Tollway. U.S. 377 is an alternate route to the north, crossing the Red River into Oklahoma approximately 20 miles to the west of U.S. 75. However, neither highway provides an alternate route to both Dallas and Oklahoma. U.S. 82 is the primary east-west route in Grayson County, providing access to producers and markets in Wichita Falls to the west and to Paris and Texarkana to the east. U.S. 82 is also a connection to several interstates, including I-44 in Wichita Falls, I-35 in Gainesville, and I-30 and I-49 near Texarkana.

⁴ Oklahoma Corporation Commission data analyzed by NPR StateImpact, 2012.

Additional facilities serve local freight traffic moving within the County. Near the U.S. 75 corridor, FM 1417/Heritage Parkway, Travis Street, and Texoma Parkway all provide alternatives to the primary highway and provide local connectivity to homes and businesses. Multiple east-west State Highways and Farm-to-Market roads traverse the County and create routes between urbanized areas, freight generators, and freight destinations.

2.1.4 Highway Condition and Performance

Highway condition and performance is evaluated based on the ability of assets to provide safe, efficient, and reliable movement of goods. Crash rates, pavement quality, bridge conditions, congestion, and variation in travel times are measures for highway condition and performance important to freight. These are examined in each of the following subsections.

Pavement Condition

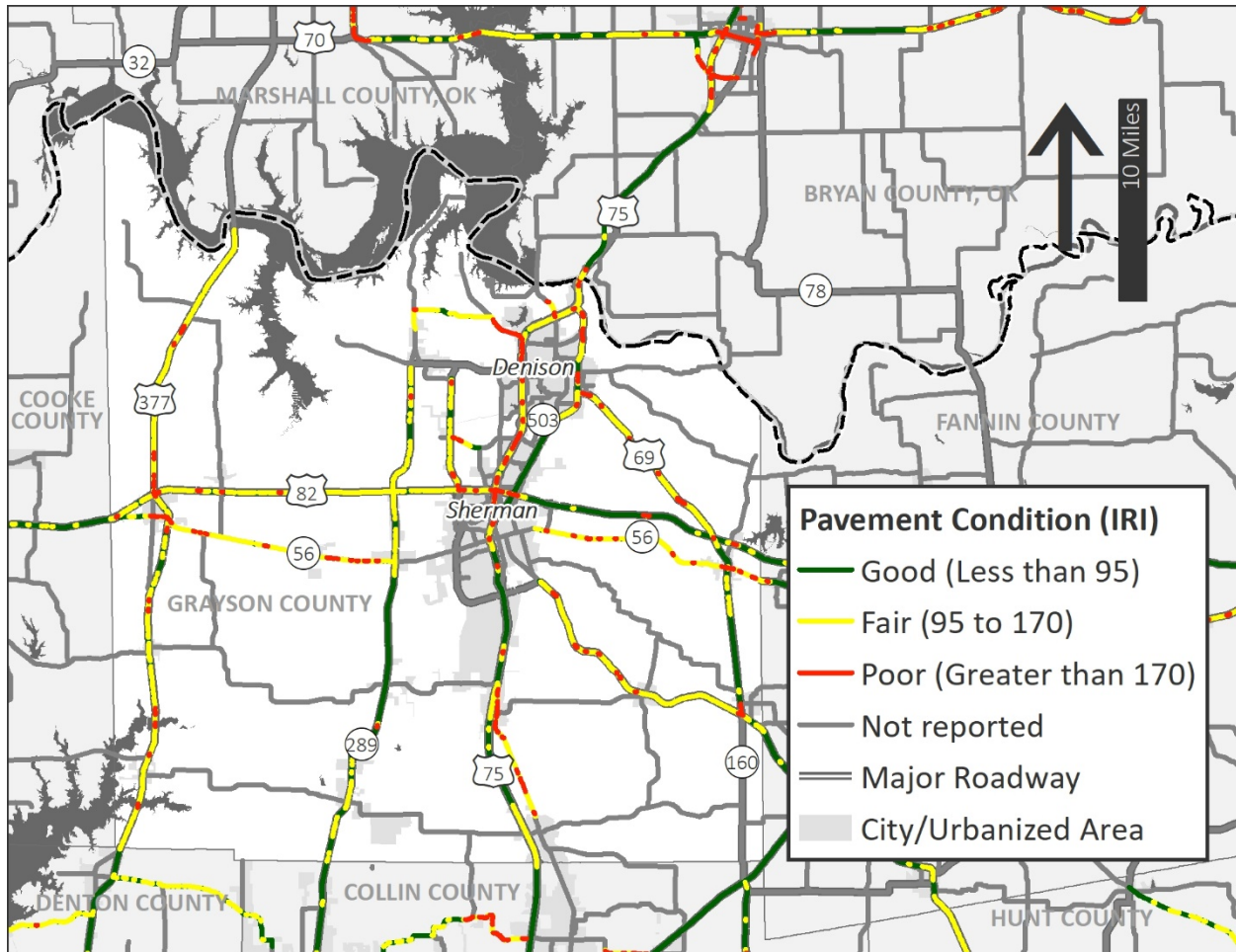
Two measures of highway asset condition are pavement roughness and bridge condition. Nearly 90 percent of roadway mileage in Grayson County is in Fair or Good condition. This is a similar proportion as observed for the state. However, roadways in Fair condition comprise more than half of mileage in Grayson County, while Good condition roadways comprise more than half of mileage in Texas. Pavement condition in the State and County is summarized in Table 2.3. The roadways with the roughest pavement in Grayson County as of 2015 include U.S. 75, U.S. 69, Spur 503, SH 56, and U.S. 377. Many of these roadways are also those which carry the most truck traffic in the County.

Table 2.3 Pavement Quality on Major Roadways

Pavement Quality (IRI ¹)	Mileage in Grayson County	Percent of Reported Mileage in Grayson County	Mileage in Texas	Percent of Reported Mileage in Texas
Good (Less than 95)	68	31%	16,354	54%
Fair (95 to 170)	128	58%	11,134	37%
Poor (Greater than 170)	24	11%	2,753	9%
Total of Reported	220	100%	30,240	100%
Not reported	377	N/A	71,450	N/A
Grand Total	596	N/A	101,690	N/A

Source: Federal Highway Administration, Highway Performance Monitoring System, 2015. Excludes local and minor collector roadways. Numbers may not add to total due to rounding.

¹ IRI: International Roughness Index.

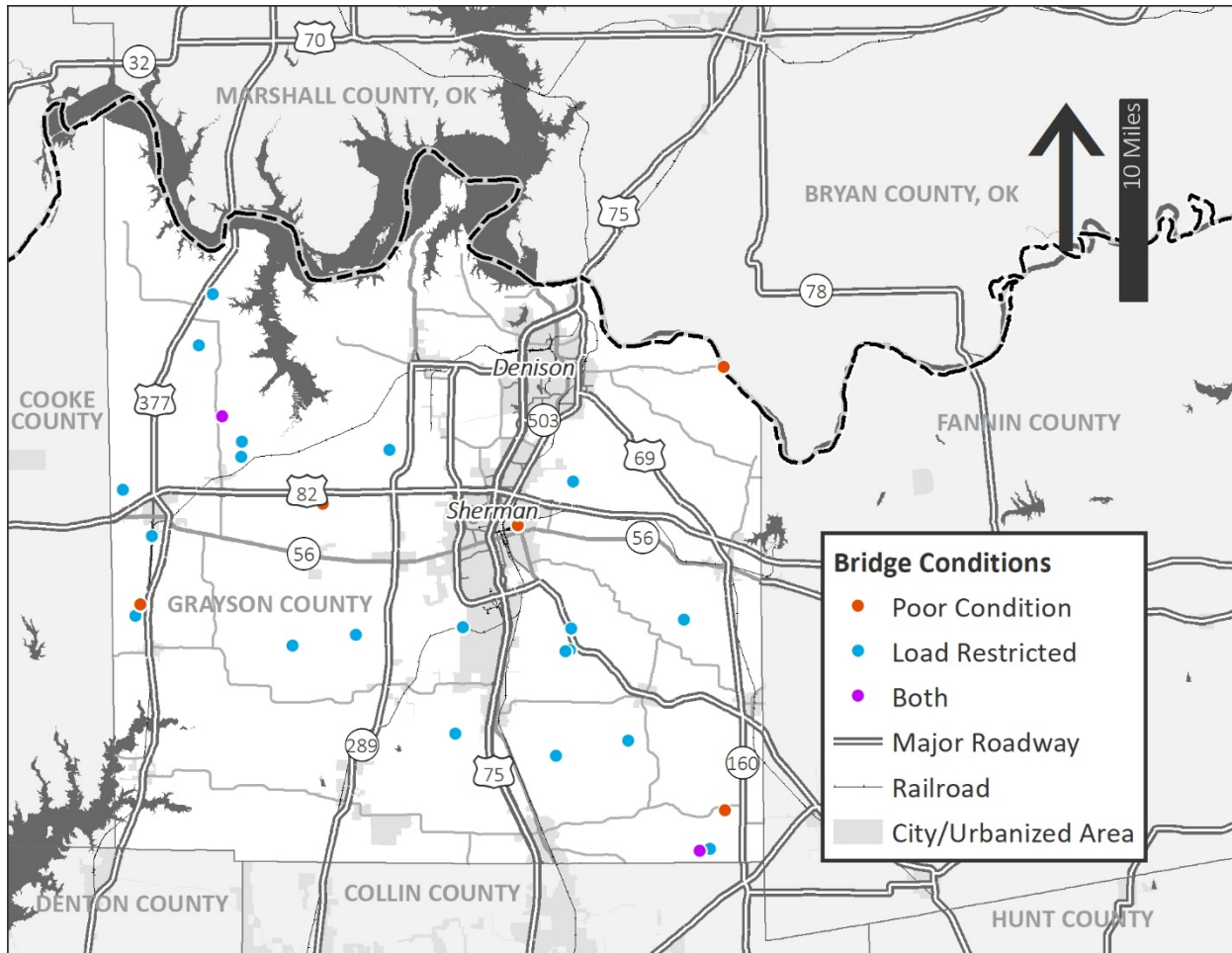
Figure 2.3 Pavement Quality on Major Roadways

Source: Federal Highway Administration, Highway Performance Monitoring System, 2015. Excludes local and minor collector roadways.

Bridge Conditions

Bridge conditions can also impact the movement of highway freight due to poor condition,⁵ load restrictions, or height restrictions. Of 535 bridges in Grayson County, five are in poor condition, twenty-one are load restricted, and two are both. All of the poor condition and load restricted bridges cross and carry local roadways, and as a result may not impact freight movement in the County. Bridges in poor condition or with load restrictions are shown in Figure 2.4.

⁵ Those bridges that have a score of 4 or less for items 58—62 or 65 (respectively deck, superstructure, substructure, channel and channel protection, culverts, and approach) of the TxDOT and U.S. DOT National Bridge Inventory (NBI) Coding Guides.

Figure 2.4 Poor Condition or Load Restricted Bridges

Source: Texas Department of Transportation Bridge Division, 2017.

Vertical clearance beneath a bridge can be a challenge to freight movement by limiting the maximum vehicle size that can use the facility. Bridges with vertical clearance under the Federal minimum of 13 feet 6 inches can severely limit freight movement, as can clearances less than 16 feet and 6 inches (the current standard for TxDOT bridges). TxDOT is in the process of updating design standards for major roadways to increase the standard clearance to 18 feet and 6 inches to facilitate movement of large freight vehicles beginning in September 2020.

Low clearance bridges over U.S. and State Highways likely have the greatest impact on freight movement due to the volumes carried on these facilities. Nearly 80 percent of bridges in Grayson County cross a non-roadway feature such as a water body. Table 2.4 lists the types of facilities crossed by the remaining 114 bridges. Bridges crossing a roadway are also shown in Figure 2.5. Seven bridges in the County are below the Federal minimum of 13 feet 6 inches vertical clearance, though none are crossing a U.S. or State Highway. Six of the seven bridges in Grayson County with vertical clearance less than the Federal minimum are railroad bridges and require coordination with the private sector to improve. Forty-seven bridges in the county have lower clearance than TxDOT's current standards, and 28 of these cross a U.S. or State Highway. The impact of these bridge heights on freight movement should be evaluated on a corridor basis to determine whether bridge projects need to be developed.

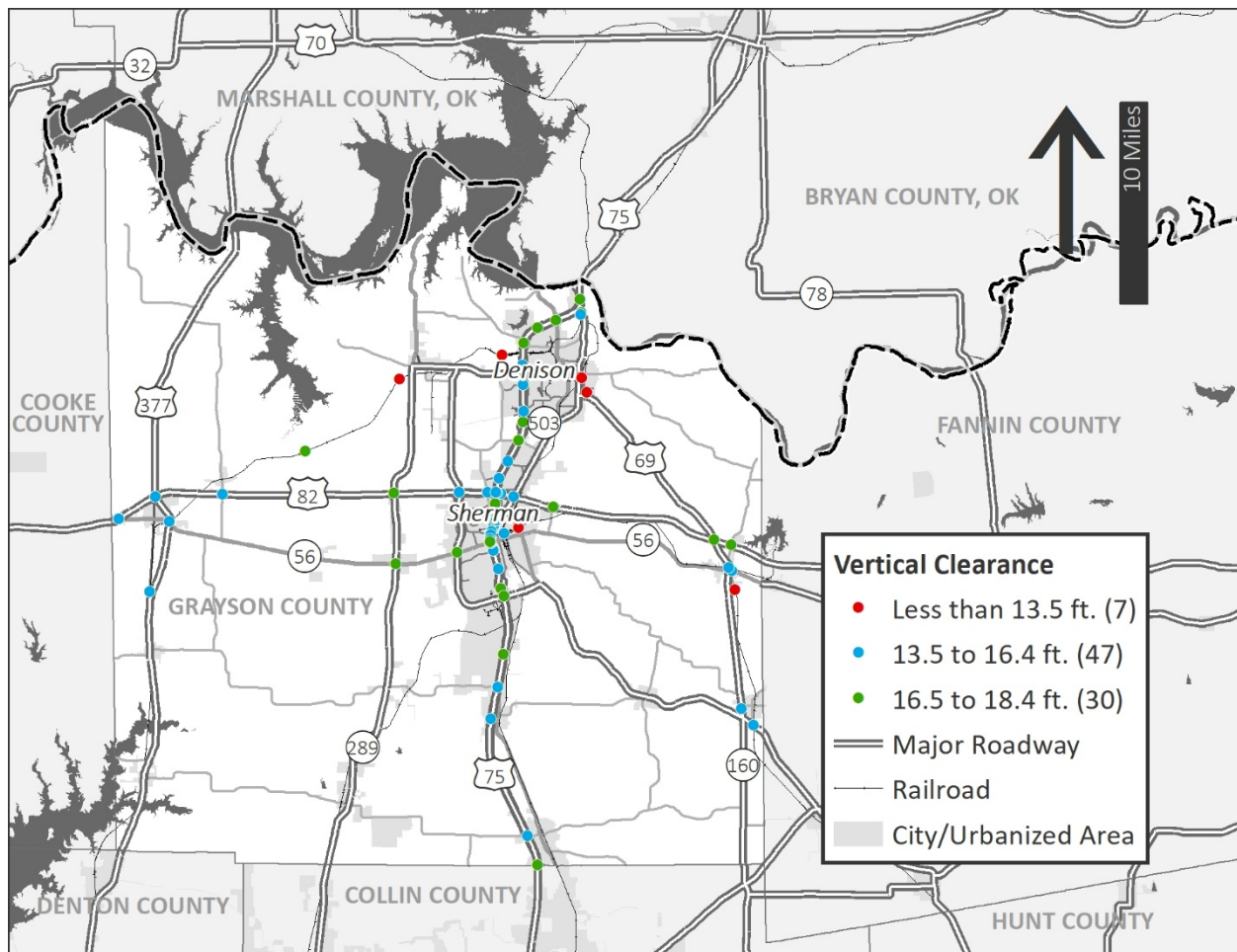
Low bridges over other facility types may have a smaller impact on freight movement and should be evaluated based on adjacent freight origins and destinations. Vertical clearance restrictions are most problematic on routes that carry oversized loads. For example, two bridges below TxDOT standards on U.S. 69 require oversized loads to divert through residential areas of Whitewright via Grand Avenue.

Table 2.4 Vertical Clearance by Facility Type Crossed

Facility Type	Less than 13'6"	13'6" to 16'5"	16'6" to 18'5"	18'6" or Greater	Total
U.S. Highway	0	19	16	2	37
State Highway	0	9	6	1	16
Other	7	19	8	27	61
Total	7	47	30	30	114

Source: Texas Department of Transportation Bridge Division, 2017.

Figure 2.5 Bridge Vertical Clearance



Source: Texas Department of Transportation Bridge Division, 2017.

Safety

Highway freight safety can be measured by the frequency and severity of crashes involving commercial motor vehicles (CMV). However, many factors contribute to highway safety, and crash location alone cannot be used to determine causality of crashes. Over the five-year period from 2012-2016, there were 449 crashes involving CMVs in Grayson County⁶. Of these, eleven were fatal crashes (six located on U.S. 75). Roadways with the highest rates of CMV-involved crashes per mile include:

- U.S. 75 throughout Grayson County—U.S. 75 is the corridor with the highest AADTT in the County, and it also has the highest rate of CMV-involved crashes per mile. Six of the eleven fatal CMV-involved crashes during the study period occurred on U.S. 75. The segment from south of FM 1417 to north of Spur 503, spanning most of the Sherman urbanized area, had the highest CMV-involved crash rate of both the corridor and the County. This segment had approximately 25 crashes per year from 2014-2016.
- U.S. 82 between U.S. 377 and U.S. 75—this primary east/west corridor had approximately 10 CMV-involved crashes per year from 2014-2016 and was the location of one CMV-involved fatality.
- Spur 503 between U.S. 69 and U.S. 75—this segment connects two U.S. highways through the eastern edge of the Denison urbanized area. There were between one and three CMV-involved crashes per year on this segment between 2012-2016.

Table 2.5 compares the number and rate of crashes and fatal crashes involving commercial motor vehicles for Grayson County and Texas for the year 2015. Crashes were identified from TxDOT's Crash Records Information System (CRIS). Truck miles traveled were obtained from the Texas Planning and Programming Division 2015 annual inventory. Based on this comparison, Grayson County has a lower rate of CMV-involved crashes than Texas as a whole and the same rate of CMV-involved fatal crashes.

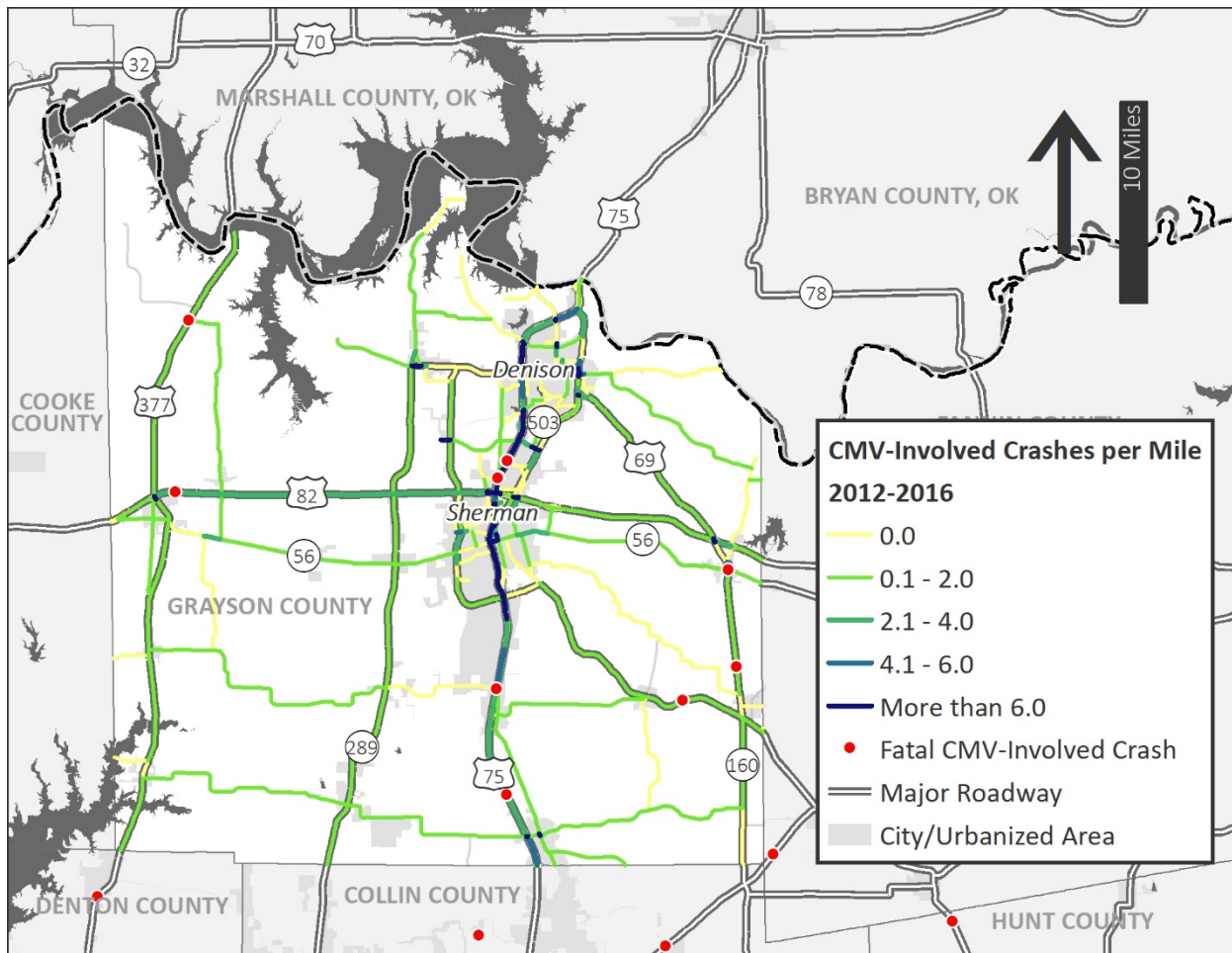
Table 2.5 Commercial Motor Vehicle Crashes and Rates
2015

Location	CMV-Involved Crashes	CMV-Involved Crashes per Million Truck Miles Traveled	CMV-Involved Fatal Crashes	CMV-Involved Fatal Crashes per Million Truck Miles Traveled
Grayson County	123	0.79	3	0.019
Texas	39,108	1.42	521	0.019

Source: Texas Department of Transportation, Crash Records Information System, 2017.
<https://www.txdot.gov/inside-txdot/division/transportation-planning/roadway-inventory.html>.

⁶ CMV-involved crashes means that a commercial motor vehicle such as a truck or bus was involved in the crash. CMV-involved does not indicate causality or assign fault for the crash.

Figure 2.6 CMV-Involved Crashes per Mile
2012-2016



Source: Texas Department of Transportation, Crash Record Information System, 2012-2016. Classification of CMVs may include buses or other non-truck commercial vehicles.

Congestion and Reliability

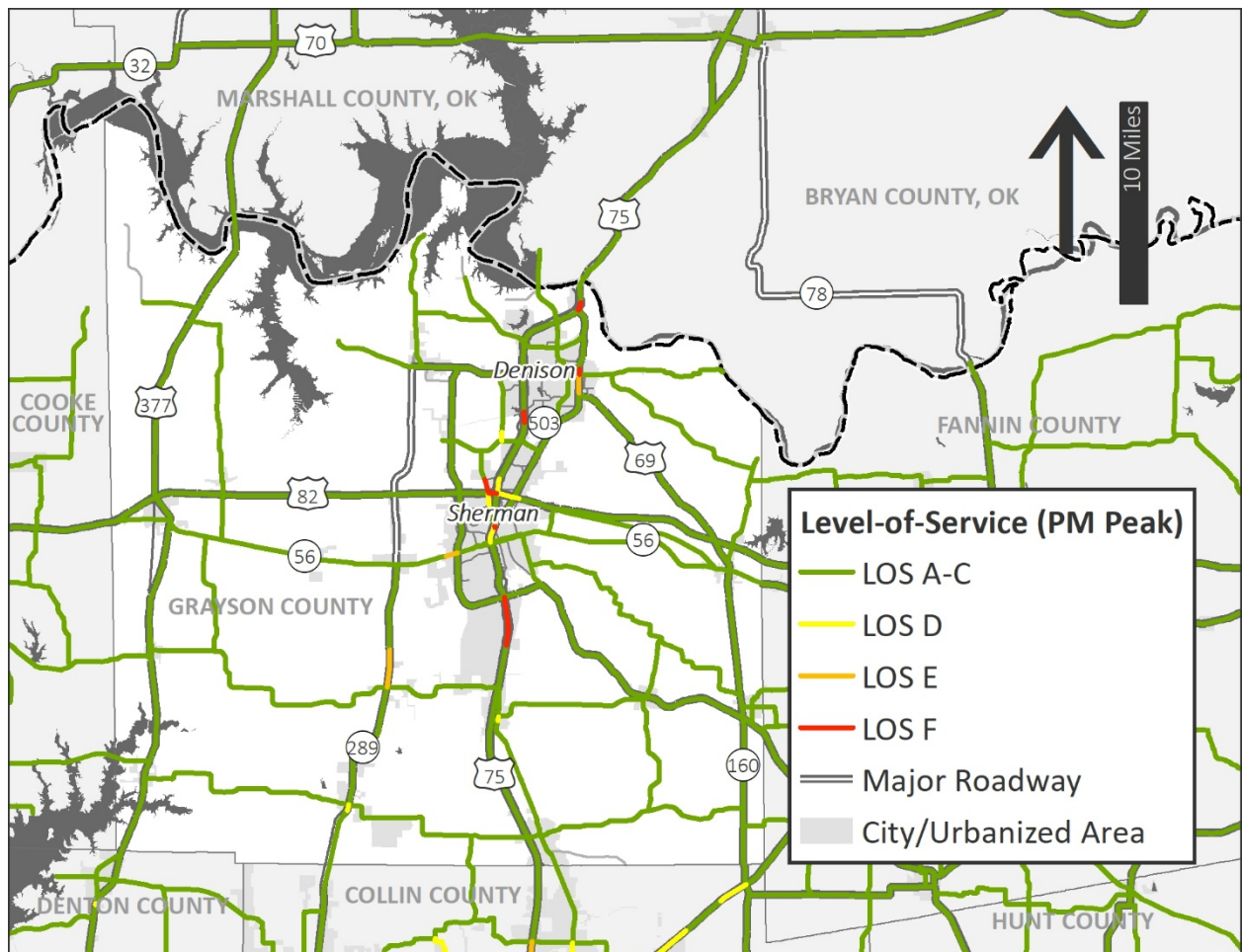
Level-of-service (LOS) is one measure of the congestion level on a roadway based on the amount of traffic carried on a facility relative to its design capacity, with an LOS of A indicating free-flowing conditions down to an LOS of F indicating severe congestion.⁷ Peak level-of-service in Grayson County as modeled by the TxDOT Statewide Analysis Model (SAM) is shown on Figure 2.7. In Grayson County, U.S. 75 is the most congested roadway with segments near the urbanized areas of Sherman and Denison operating at LOS F during peak traffic. FM 131 (Travis Street/Preston Road) and U.S. 69 in Denison also have segments operating at LOS F. SH 289 north of Dorchester and U.S. 82 near U.S. 75 show lower levels of congestion with segments operating at LOS D or E. Data collection for observed traffic conditions and causes of congestion on specific segments is necessary to determine whether geometric or operational improvements are appropriate to address the causes of congestion.

⁷ LOS analysis should be used to understand relative congestion and ultimately be combined with other measures to determine the need for roadway investment. It is not feasible or desirable for all roadways to operate at LOS A; some roadways in urban areas, for example, are designed to operate at LOS C or D.

In addition to congestion, reliability is an important measure for freight transportation as businesses must plan for non-recurring congestion due to lane closures, crashes, or other periodic interruptions in addition to recurring daily congestion. The truck buffer time index represents the extra time (buffer) commercial vehicles need to add to their average travel time to ensure 95 percent on-time arrival. For instance, a buffer time index of 20 percent (0.2) means that a truck should budget an additional 20-minutes for a trip that typically takes 100-minutes to ensure that they arrive on time 95 percent of the time. The higher the buffer index, the more extra time must be planned for in order for trucks to reliably make it to their destination on time.

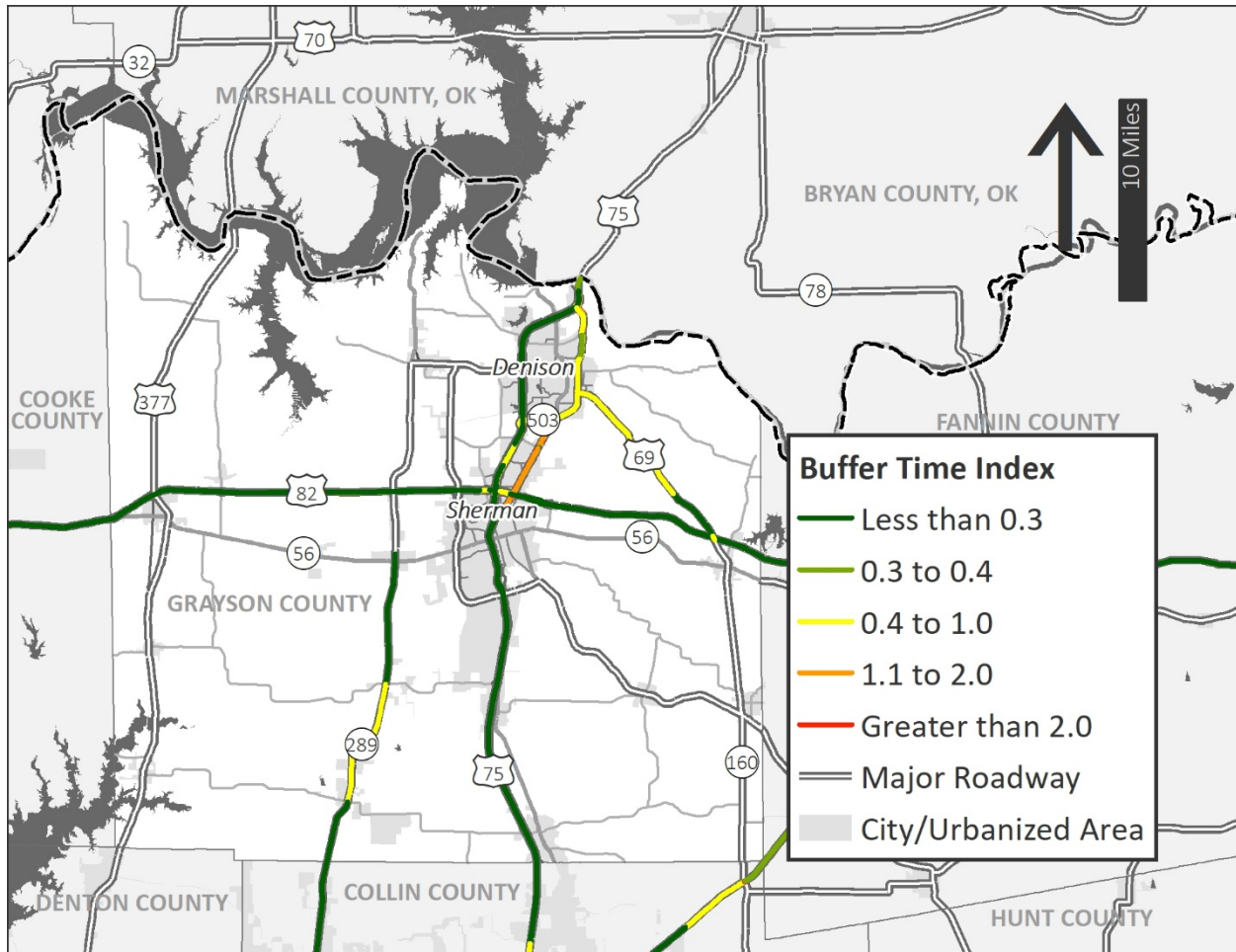
In Grayson County, the major thoroughfares such as U.S. 75, U.S. 82, and SH 289 generally operate reliably with low buffer time indices.⁸ This is advantageous for businesses as they can reliably predict the amount of time it will take to traverse Grayson County. In Grayson County, about 20 percent of roadways are considered unreliable for trucks when using this measure. As with observed congestion, investigation into the causes of unreliability on a particular segment is necessary to determine the potential benefit of either geometric or operational improvements. The buffer time indices on Grayson County roadways are shown on Figure 2.8.

Figure 2.7 Level-of-Service
2016



Source: Texas Department of Transportation, Statewide Analysis Model, 2016.

⁸ A buffer time index of 0.5 or higher as observed across five time periods is considered unreliable.

Figure 2.8 Reliability: Buffer Time Index

Source: National Performance Management Research Dataset processed for Texas Freight Mobility Plan, 2018.

2.2 U.S. 75 Corridor Analysis

2.2.1 Overview

The U.S. 75 corridor is the center of freight activity in Grayson County. This highway carries more truck traffic than any other roadway in the County and connects the County to markets in Dallas and Houston to the south and in Oklahoma to the north. The corridor is also a center for freight-dependent businesses, with 53 percent of freight businesses in the County located within two miles of the corridor and 32 percent within one mile.

While most of U.S. 75 is designed to interstate standards, a 4-mile gap exists between FM 1417 and SH 91. South of Grayson County, U.S. 75 is as many as 10 lanes wide. The roadway narrows to four lanes in Collin County and is four lanes wide throughout Grayson County. Frontage roads exist on both sides of the highway; however they are not continuous throughout the County, with gaps in the following locations:

- Northbound at Ponderosa.
- Northbound at Travis.

- Northbound at Spur 503.
- In both directions at the UP tracks in Denison.
- North of U.S. 69.

Breaks in frontage roads limit their ability to serve as an alternate route in the event of a traffic incident on the highway main lanes, and may make local businesses and roads more difficult to access. Frontage roads and freight businesses are shown in Figure 2.9, Figure 2.10, and Figure 2.11.

Figure 2.9 U.S. 75 Overview (1 of 3)

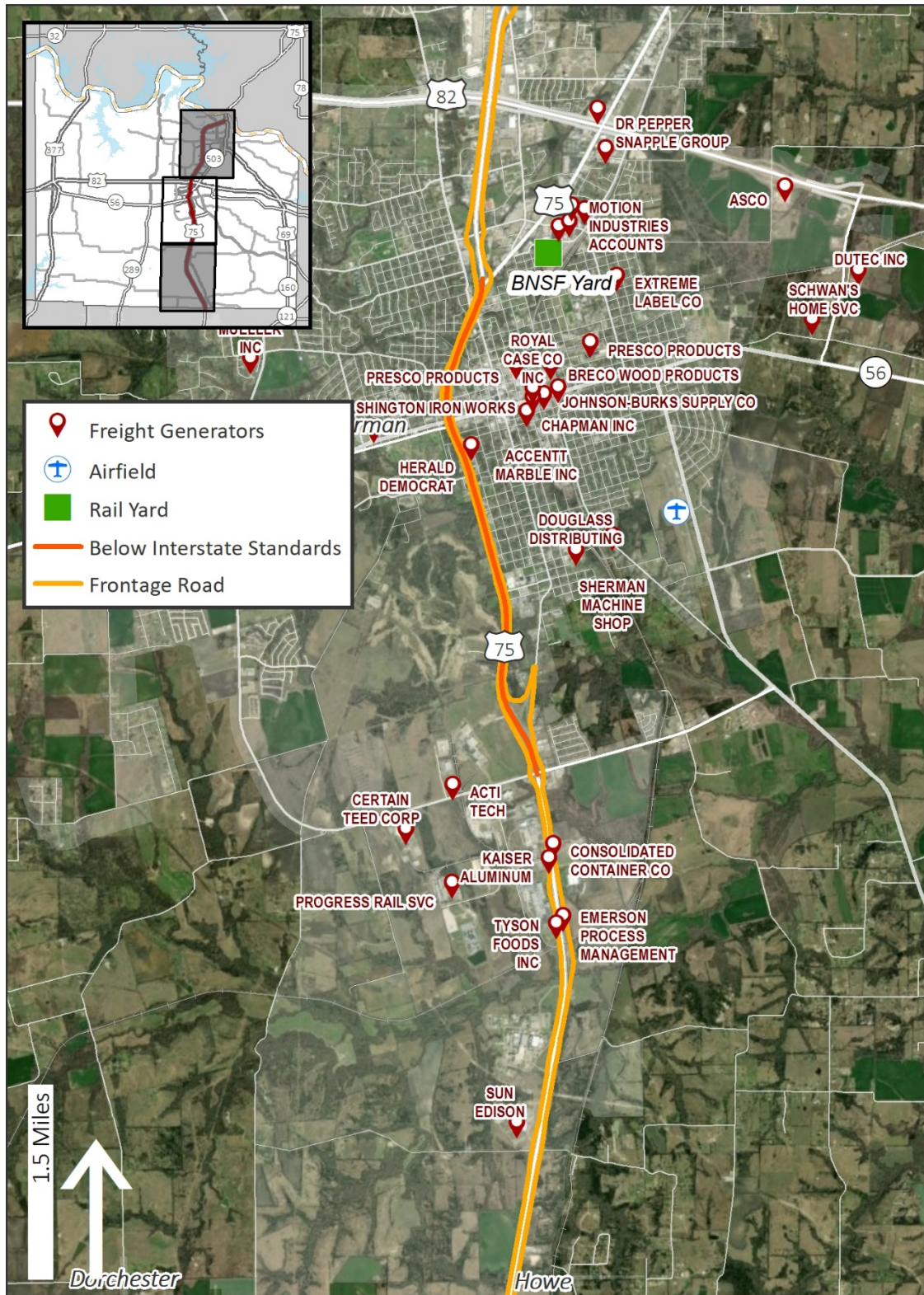


Source: TxDOT Transportation Planning and Programming, 2016.

IHS Global Insight, Freight Finder, 2018.

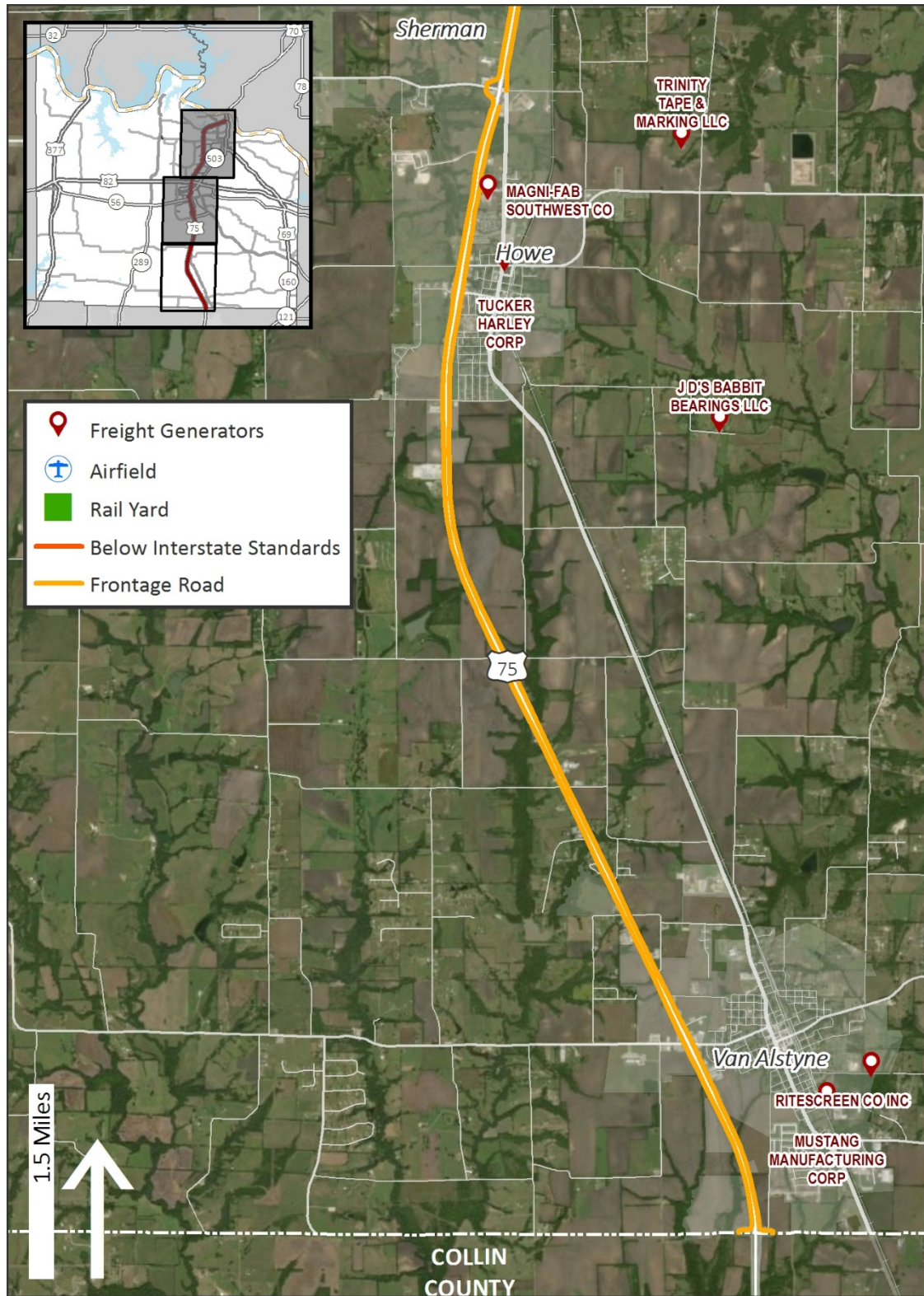
Note: Oklahoma businesses are not included in this dataset.

Figure 2.10 U.S. 75 Overview (2 of 3)



Source: TxDOT Transportation Planning and Programming, 2016.
 IHS Global Insight, Freight Finder, 2018.
 Note: Oklahoma businesses are not included in this dataset.

Figure 2.11 U.S. 75 Overview (3 of 3)



Source: TxDOT Transportation Planning and Programming, 2016.
 IHS Global Insight, Freight Finder, 2018.
 Note: Oklahoma businesses are not included in this dataset.

2.2.2 Performance

The performance of a roadway can be measured in terms of asset condition, safety, congestion, and reliability. This corridor analysis considered bottlenecks on U.S. 75 based on congestion and safety factors, and compares U.S. 75 and similar corridors in the region.

Bottleneck Analysis

Bottleneck locations with recurring congestion and poor reliability were examined to identify potential causes for poor performance relative to the rest of the corridor, such as interchanges, lane merges, or recurring crashes. More detailed study of causes of recurring and intermittent congestion is required to develop targeted solutions for each location.

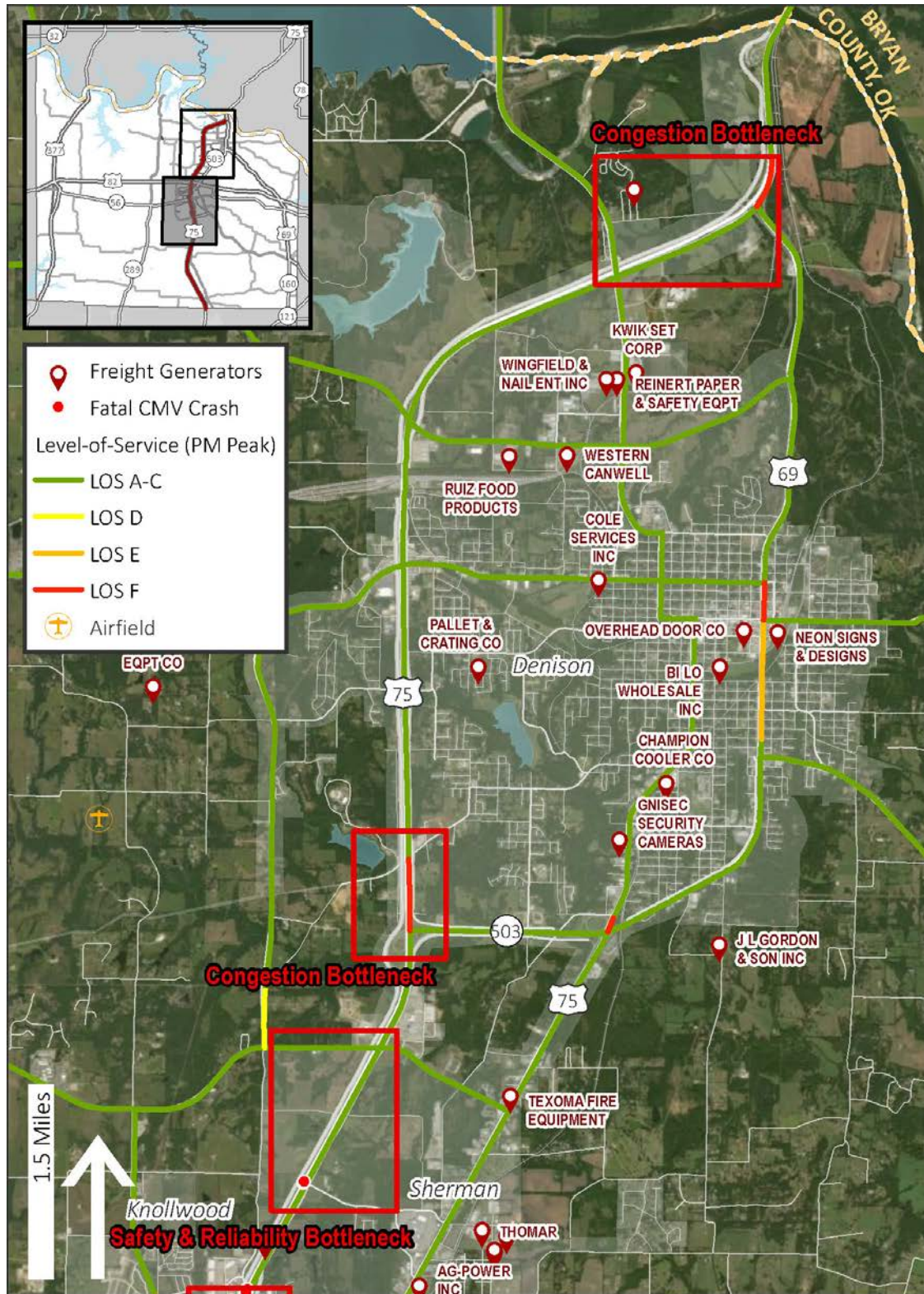
Bottlenecks were identified by locating segments with LOS D or worse or unreliable travel times. Then, potential causes of the bottleneck were identified using crash data and aerial imagery as bottlenecks often occur where lanes drop or at an interchange. Non-safety congestion bottlenecks along U.S. 75 include:

- U.S. 75/U.S. 69 interchange in Denison, predominantly on the north side. Both northbound and southbound directions on U.S. 75 interchange with U.S. 69 north of the intersection, while the roadway south of the intersection is typical of the rest of the corridor.
- U.S. 75/Spur 503 interchange in Denison, predominantly on the north side in the northbound direction.
- U.S. 75/U.S. 82 interchange in Sherman, predominantly on the north side in the southbound direction. Additionally, approaches on U.S. 82 become congested.
- U.S. 75/SH 91 split in Sherman, predominantly on the south side in the northbound direction.

Congestion bottleneck improvements can increase performance on the entire corridor. Bottleneck projects may include operational improvements to enhance vehicle movement and merging, the addition of auxiliary lanes, ramp reversals, or similar, strategic actions which address a localized design deficiency. These geometric and traffic management solutions can reduce the impact of bottlenecks and facilitate smoother traffic flow throughout the corridor. For example, northbound between U.S. 82 and Grayson Drive (near Fallon Drive), there are 2.5 miles between exit ramps. The addition of a ramp to the frontage road could improve reliability and travel times in the event of a crash or other disruption to the highway at a much lower cost than a widening project.

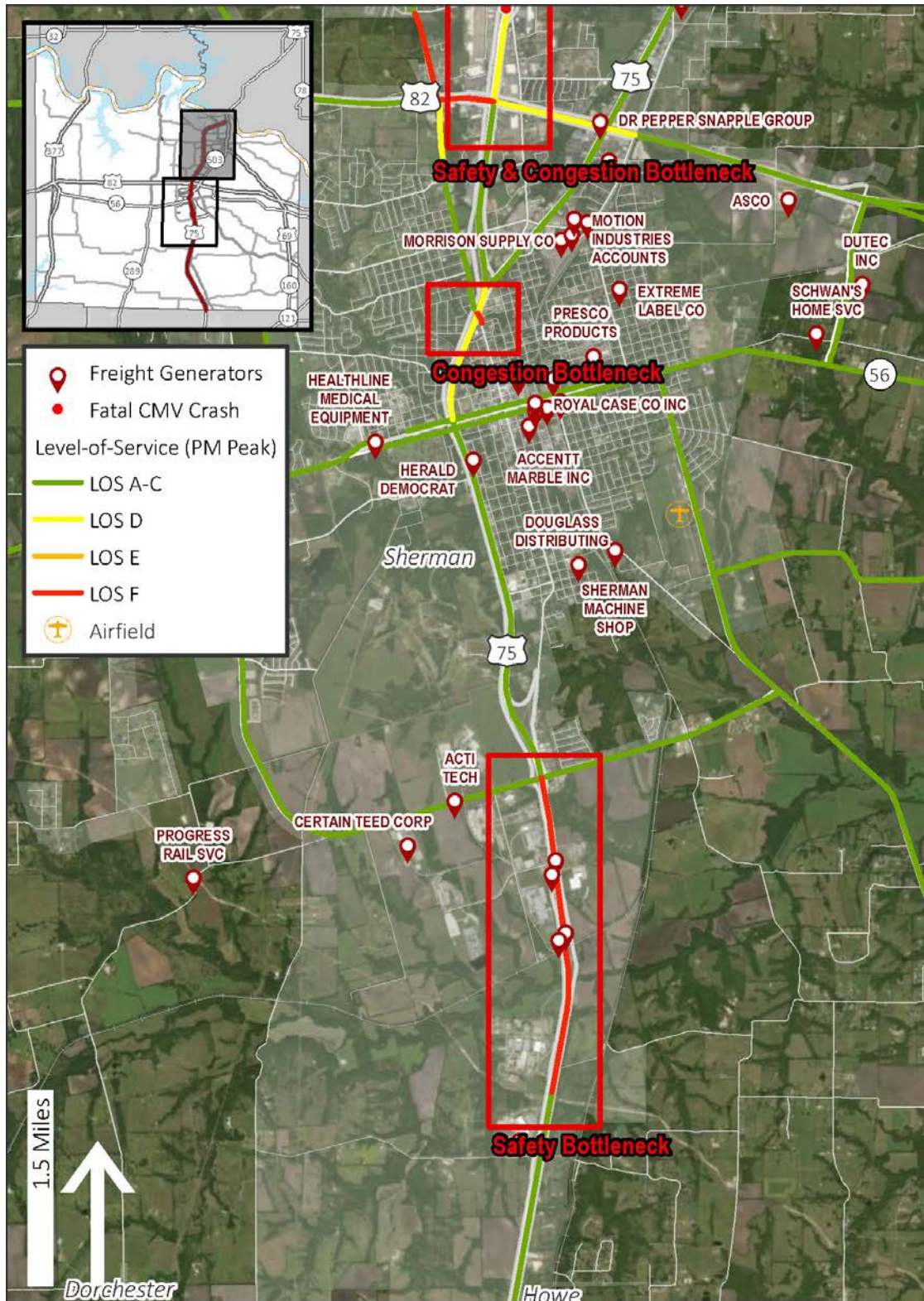
Crashes cause non-recurring congestion when lanes must be closed to clear an incident, and fatal crashes result in longer closures. Locations with poorer safety performance may result in recurring congestion issues if crashes occur frequently. Two safety-related bottlenecks on U.S. 75 are located between U.S. 82 and FM 691, shown on Figure 2.12 and Figure 2.13. A third safety-related bottleneck is located south of FM 1417.

Figure 2.12 U.S. 75 Bottlenecks (1 of 2)



Source: TxDOT Transportation Planning and Programming, 2016.
 IHS Global Insight, Freight Finder, 2018.
 Note: Oklahoma businesses are not included in this dataset.

Figure 2.13 U.S. 75 Bottlenecks (2 of 2)



Source: TxDOT Transportation Planning and Programming, 2016.
 IHS Global Insight, Freight Finder, 2018.
 Note: Oklahoma businesses are not included in this dataset.

U.S. 75 Corridor Benchmarking

U.S. 75 was compared to other freight corridors to better understand its relative performance within the County and within the region. The following corridors were chosen based on proximity to U.S. 75 and their potential to serve as alternate or complementary routes:

- U.S. 75 in Collin County.
- U.S. 75 in Bryan County, Oklahoma.
- I-35 in Cooke County.
- I-30 in Hopkins County.
- I-30 in Hunt County.
- U.S. 82 in Grayson County.
- SH 289 in Grayson County.
- U.S. 377 in Grayson County.

Table 2.6 summarizes the results of this comparison, and notable findings follow:

- Truck traffic on U.S. 75 decreases between Collin County and Bryan County, Oklahoma, as development becomes less dense. U.S. 75 has more truck traffic than other corridors in Grayson County, and less than nearby interstates.
- In terms of congestion, U.S. 75 in Grayson County fell in the middle of the comparison corridors. It is less congested than I-35 and U.S. 75 in Collin County during peak periods but more congested than I-30 or other Grayson County roads.
- U.S. 75 is more reliable in Grayson County than it is in Collin County with only four percent of lane-miles operating unreliably (defined as a buffer or planning time of 50 percent or greater to arrive on time 95 percent of the time). Its reliability is similar to interstates which, like much of U.S. 75, benefit from frontage roads as an alternate route.
- U.S. 75 has among the worst pavement condition of the selected corridors due to traffic and operations that exceed the initial design parameters.
- Finally, U.S. 75 fell in the middle with regard to total crashes and fatal crashes. While it performed more poorly than other Grayson County corridors in terms of crashes per mile, U.S. 82 was the corridor with the highest frequency of crashes per truck mile traveled. U.S. 75 in Collin County also exhibited a higher rate of CMV-involved crashes per truck mile traveled.

Table 2.6 U.S. 75 Corridor Benchmarking

Corridor	Mobility: AADTT	Congestion: Percent of lane-miles at LOS D or worse	Reliability: Percent of lane-miles unreliable (Buffer Index ≥ 0.5)	Asset Condition: Percent of lane-miles in Good/Poor pavement condition	Safety: CMV- Involved Crashes per Mile (2012- 2016)	Safety: CMV- Involved Fatalities per Mile (2012- 2016)	Safety: CMV- Involved Crashes per million TVMT (2012-2016)	Safety: CMV- Involved Fatalities per million TVMT (2012-2016)
U.S. 75 in Grayson Co	5,688	15%	4%	36% Good / 16% Poor	7.16	0.20	0.69	0.019
U.S. 75 in Bryan Co, OK	5,186	0%	No Data	75% / 6%	No Data	No Data	No Data	No Data
U.S. 75 in Collin Co	6,305	70%	44%	48% / 9%	23.66	0.07	2.06	0.006
I-35 in Cooke Co	8,110	64%	0%	55% / 4%	9.27	0.37	0.63	0.025
I-30 in Hopkins Co	10,711	0%	8%	84% / 1%	5.31	0.09	0.27	0.005
I-30 in Hunt Co	8,987	0%	0%	99% / 0%	10.61	0.30	0.65	0.018
U.S. 82 in Grayson Co	203	4%	1%	41% / 6%	1.77	0.03	4.77	0.081
SH 289 in Grayson Co	No Data	14%	35%	62% / 1%	0.45	0.00	No Data	No Data
U.S. 377 in Grayson Co	No Data	0%	No Data	17% / 8%	0.86	0.03	No Data	No Data

Source: TxDOT Transportation Planning and Programming, 2016.
National Performance Management Research Dataset processed for Texas Freight Mobility Plan, 2016.

Note: Not all data sources are available for every segment.

2.3 Railroad Assets

Grayson County Railroad Assets

Grayson County has two Class I railroads and two short line railroads.

The two Class I railroads—Union Pacific (UP) and BNSF Railway

(BNSF)—have extensive networks and

provide access to markets throughout North America. Both short line railroads—the Dallas, Garland & Northeastern (DGNO) and Texas Northeastern (TNER)—are owned by Genesee & Wyoming (G&W).

- 158 miles of track
- Two Class I railroads: Union Pacific and BNSF Railway
- Two Genesee & Wyoming short lines: DGNO and TNER

The UP line runs along the western part of the County and crosses through Denison before entering Oklahoma. This line primarily serves traffic between Mexico and the United States, and Ray Yard in Denison is a fueling station for through traffic. Portions of Ray Yard are also used by G&W. BNSF Railway's line runs along SH 289 in the southern half of the County and near U.S. 75 in the northern half, connecting to more businesses in the county than the UP line. A BNSF rail yard is located in Sherman east of U.S. 75 and Texoma Parkway.

Short line railroads typically serve regional customers or industries. The DGNO railroad in Grayson County provides a connection between Sherman and McKinney. South of McKinney, the tracks are owned by Dallas Area Rapid Transit (DART) and serve passenger rail in Collin and Dallas Counties. The TNER runs east-west through Sherman, and service currently runs east to Bells, Texas. Additional track on the TNER exists from Bells to Bonham, Texas, but requires rehabilitation. Both lines interchange with BNSF in Sherman and with UP in Denison. However, capacity on the Denison Industrial Lead connecting Class I and short line railroads is limited to 75-car unit trains due to insufficient siding length at the G&W/BNSF interchange.

UP, BNSF, and G&W each own between 29 and 36 percent of rail mileage in the County, with UP owning the largest share of track in the County. In addition to the segments owned by a company, trackage rights allow railroads to operate on track owned by another railroad. The two G&W short lines have trackage rights on more than 30 miles in Grayson County, resulting in an operating network in the County that is larger than that of either of the two Class I railroads. Class I railroads comprise a smaller share of the Grayson County rail network than the state as a whole, at 65 percent of mileage in Grayson County and 78 percent of mileage in Texas (Table 2.8).

Table 2.7 Railroad Miles by Ownership and Trackage Rights

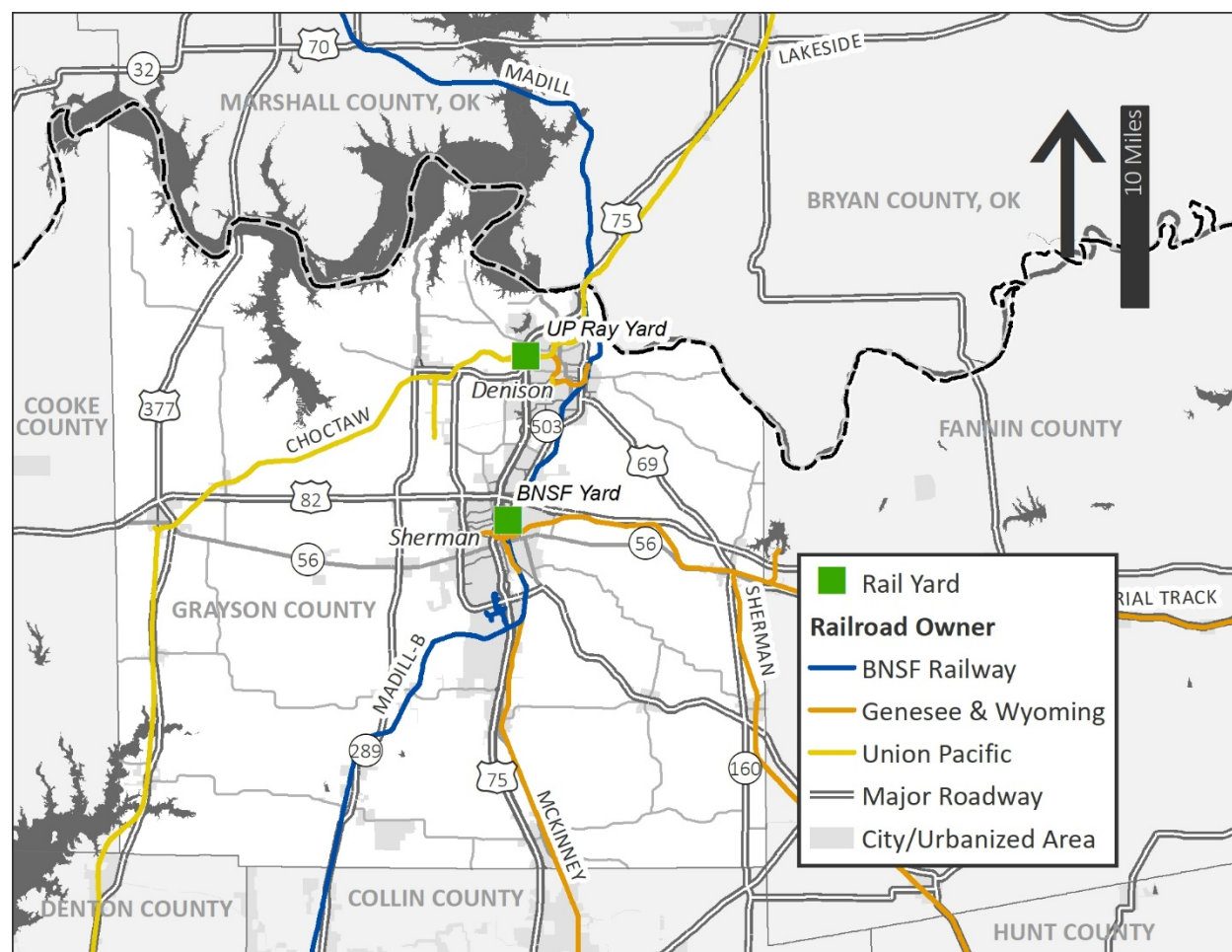
Railroad	Miles Owned in Grayson County	Split of Miles Owned	Additional Miles of Trackage Rights	Total Operating Miles in Grayson County
BNSF	46.1	29.2%	9.4	55.5
UP	56.8	36.0%	5.1	62.0
G & W (DGNO and TNER)	54.8	34.7%	32.0	86.8
Total	157.7	100.0%	N/A	N/A

Source: Bureau of Transportation Statistics, North American Rail Lines, October 2017.

Table 2.8 Railroads in Grayson County and Texas

Railroad	Miles Owned in Texas	Split of Miles Owned in Texas	Miles Owned in Grayson County	Split of Miles Owned in Grayson County
Class I	11,138	78%	103	65%
Other	3,154	22%	55	35%
Total	14,292	100%	158	100%

Source: Bureau of Transportation Statistics, North American Rail Lines, October 2017.

Figure 2.14 Railroads by Owner

Source: Bureau of Transportation Statistics, North American Rail Lines, October 2017.

2.3.1 Rail System Performance

All railroads in Grayson County are privately owned, and detailed information about the performance of these systems is not publicly available. However, two capacity constraints that can influence performance are 286,000-lb. compatibility and chokepoints caused by single-tracked segments or interchanges. TxDOT's 2016 Rail Plan cited accommodating 286,000-lb. maximum gross weight as one of the largest

constraints on short line railroads in the U.S. These heavier cars are now the industry standard, though some short lines having antiquated infrastructure unable to accommodate them. The two short line railroads in Grayson County, DGNO and TNER, both have capacity for 286,000-lb. cars.

Capacity is limited on the Denison Industrial Lead for unit trains interchanging with BNSF's track in Denison. Currently, a maximum unit train length of 75 cars can be turned around to travel south, and the turnaround requires approximately two hours. The G&W Railroad has proposed the addition of a wye at this location to increase capacity to 110 cars and eliminate the turnaround time. The railroad anticipates that this improvement would lower costs for customers and allow additional trains to run each week.

2.3.2 Other Rail Facilities

Two truck/rail intermodal facilities exist in the County. However, stakeholder interviews indicate that neither are currently active. The ConAgra intermodal facility is located near the center of Sherman, east of U.S. 75. The track is owned by G&W and is near an interchange with BNSF. Three spurs exist at the ConAgra site. Additional sidings and spurs facilitate rail movement to the north and east of this intermodal facility on both G&W and BNSF lines. The Farm and Ranch Supply facility in Denison is also located near an interchange between the G&W-owned Denison Industrial Track adjacent to the facility and BNSF-owned track. Instead of functioning as an intermodal facility, this spur is used to turn around trains to access the southbound BNSF track. Additionally, the Denison Industrial Track interchanges with the UP Choctaw subdivision approximately 2 miles northwest of the facility.

Progress Park is an industrial development area southwest of U.S. 75 and FM 1417. This site has several rail spurs connected to the BNSF Railway track that runs through the Sherman-Denison urbanized area. Nearly 20 businesses are located in this development, though not all have rail access. Progress Rail is located here, and uses the rail spur to ship rail equipment and materials. There are five available sites with rail access, and additional site and building space without rail access.

2.4 Airport Assets

Grayson County Airport Assets

The primary airport in Grayson County is the North Texas Regional Airport (NTRA). NTRA is located off of SH 289 near the largest urbanized areas in the County, Sherman and Denison.

- North Texas Regional Airport with 9,000 ft. and 4,000 ft. runways.
- Sherman Municipal Airport.
- Two additional major freight airports within 90 miles.

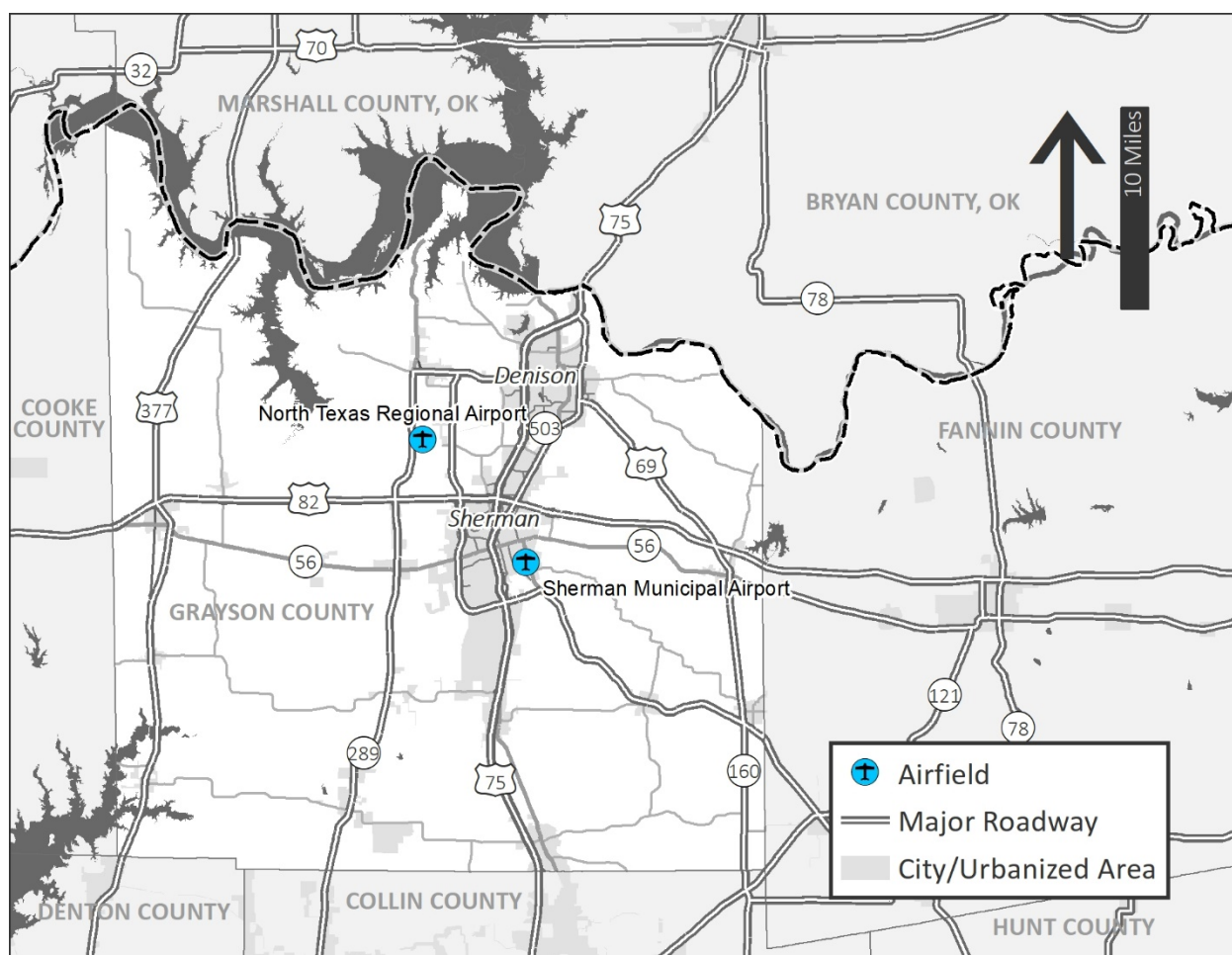
This airport has a 9,000-foot runway and can accommodate large commercial aircraft. Foreign-trade zone (FTZ) exemptions are available at the airport, which provide advantages to industrial uses with international supply chains. For example, it may be cost-advantageous for a company to receive materials in a FTZ, add value through manufacturing or assembling, and import the final product rather than importing each of the intermediate materials. The airport would benefit from a customs broker to facilitate international trade and leverage FTZ exemptions. Customs brokers assist importers and exporters by submitting necessary paperwork and payments to U.S. Customs and Border Patrol (CBP) on their behalf.

The airport has hangars, a full service fixed-base operator, and sites available for lease and development. Smaller airports in the region, shown in Figure 2.15, provide additional connectivity throughout the County. While small airports may not move a large amount of freight, they create connections which

enable just-in-time deliveries for distribution and logistics companies as well as manufacturers of high value products such as electrical components.

Air cargo originating in or destined for Grayson County may also pass through a large hub such as Dallas-Fort Worth International Airport (DFW). DFW is located approximately 70 miles south of the heart of the County with drive times between 1-1.5 hours. Fort Worth Alliance Airport is another freight hub approximately 85 miles away. These two major air cargo facilities with domestic and international connections within a reliable two-hour drive of the County's industrial hubs are an advantage for companies who rely on air cargo.

Figure 2.15 Airport Locations



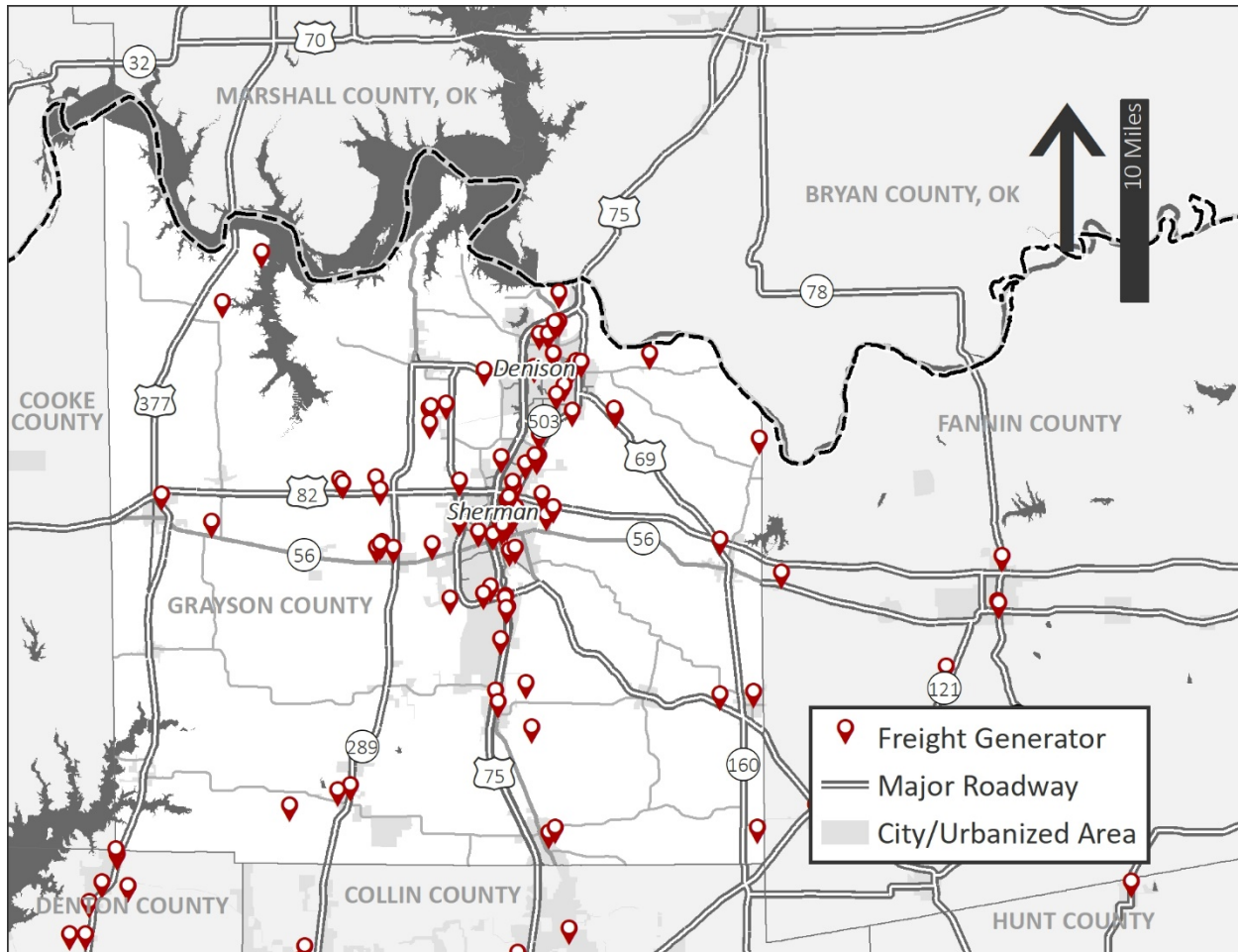
Source: TxDOT Transportation Planning and Programming, Airport Inventory, 2016.

2.5 Freight-Intensive Land Use

In general, freight-dependent businesses in Grayson County are located near a major roadway, a rail line, or an airport where materials and goods can be shipped in and out effectively. Freight-dependent businesses are also concentrated along the U.S. 75 corridor in Sherman and Denison, including clusters on nearby corridors such as SH 91. Outside of the central corridor, freight-intensive land use is located

west of U.S. 75 on U.S. 82 and SH 56, near the North Texas Regional Airport, and in smaller urbanized areas throughout the County. These locations are often selected due to the presence of freight infrastructure, and they also generate additional demand for investment in these assets to preserve the competitiveness of the location. Freight businesses in Grayson County are shown in Figure 2.16.

Figure 2.16 Freight Business Locations



Source: TxDOT Transportation Planning and Programming and Federal Highway Administration, 2016.
IHS Global Insight, Freight Finder, 2018.
Note: Oklahoma businesses are not included in this dataset.

3.0 Grayson County Economic Analysis

The chapter will begin with a review of population, employment, income, and economic output statistics, identifying their historic trends and disaggregating the data (when available) to discuss smaller units of the local economy. The next portion of the chapter will use this information to help benchmark Grayson County's recent performance against other metropolitan areas in Texas. This discussion will be followed by an analysis of Grayson County's key freight industry sectors, estimating their impact on regional employment and income. The section that follows will discuss the actual movement of freight within Grayson County and how freight volumes might be impacted by the region's key freight industries. The final section will summarize the findings and provide some recommendations for local freight transportation planners and economic development specialists.

3.1 Background and Regional Economic Trends

3.1.1 Population

During the 2010 U.S. Census, Grayson County had a population of 120,877 residents, which was an increase of 65 percent since 1960. Between 1960 and 2010, Grayson County's population growth varied from decade to decade, but its rate of growth has consistently lagged the state overall. Between 2000 and 2010, Grayson County's population grew by a Compound Annual Growth Rate (CAGR) of 0.9 percent, compared to the state of Texas's population, which grew by 1.89 percent during the same period (See Table 3.1). In terms of total population, the Sherman-Denison metropolitan statistical area (MSA) ranks #23 out of 25 MSAs in Texas and #313 out of 383 MSAs in the United States.

Table 3.1 **Historic Population Growth in Grayson County and Texas**
1960-2010

Year	Grayson County	CAGR	State of Texas	CAGR
1960	73,043		9,579,677	–
1970	83,225	1.3%	11,196,730	1.57%
1980	89,796	0.8%	14,229,191	2.43%
1990	95,021	0.6%	16,986,510	1.79%
2000	110,595	1.5%	20,851,820	2.07%
2010	120,877	0.9%	25,145,561	1.89%

Source: U.S. Census Bureau, 2018.

Between 2010 and 2017, the population of Grayson County grew by more than 10,000 persons to 131,140 residents. Despite this increase, Grayson's County's population growth rate continued to lag the state's rate during most years, with the exceptions of 2016 and 2017 (Table 3.2).

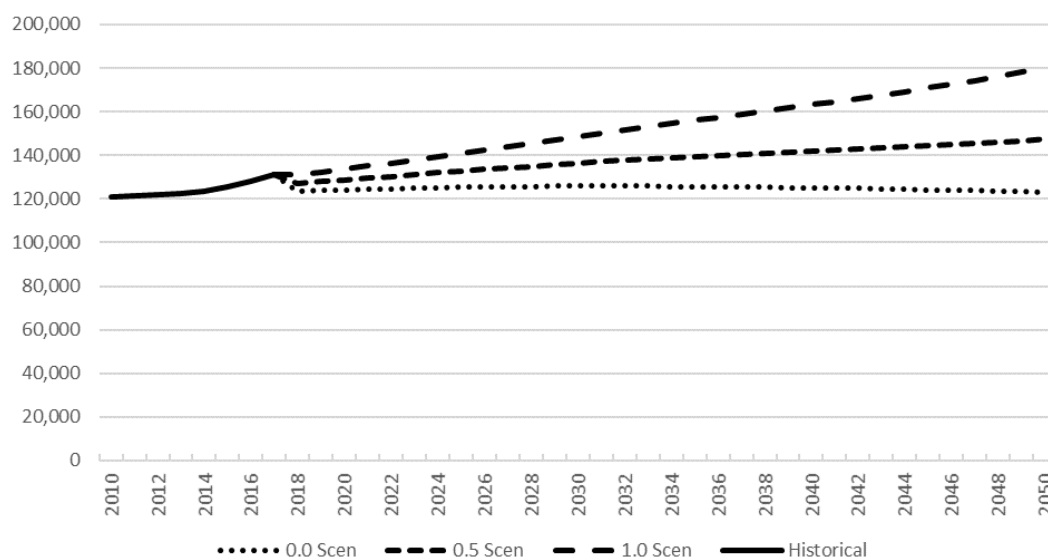
Table 3.2 Recent Population Change Grayson County
2010-2017

Year	Grayson County	Annual Growth	Percent Growth	State of Texas	Percent Growth
2010	120,877	–	–	25,145,561	–
2011	121,372	495	0.4%	25,644,424	2.0%
2012	121,750	378	0.3%	26,078,327	1.7%
2013	122,295	545	0.4%	26,479,279	1.5%
2014	123,540	1,245	1.0%	26,954,436	1.8%
2015	125,549	2,009	1.6%	27,454,880	1.9%
2016	128,206	2,657	2.1%	27,904,862	1.6%
2017	131,140	2,934	2.3%	28,304,596	1.4%

Source: U.S. Census Bureau, 2018.

Every few years the Texas State Data Center prepares population projections for the state and each county in Texas. Three sets of projections are prepared, based upon three growth scenarios. The first scenario, called the zero-migration scenario assumes a region has no net migration. The region's future population growth is determined entirely by recent birth and death rates. The 0.5 migration scenario assumes that the future county migration rate will be one-half the historic 2000 to 2010 migration rate, as estimated by the U.S. Census Bureau. The 1.0 migration scenario assumes that future migration rate will equal to the region's 2000-2010 migration rate. Figure 3.1 suggests that the 1.0 migration scenario for Grayson County will most closely align recent population growth trends. However, population growth is expected to continue to accelerate due to development patterns in the county and growth pressure from the south. The Sherman-Denison MPO has forecasted a population as high as 335,000 in 2050.

Figure 3.1 Population Projections for Grayson County
2018 to 2050

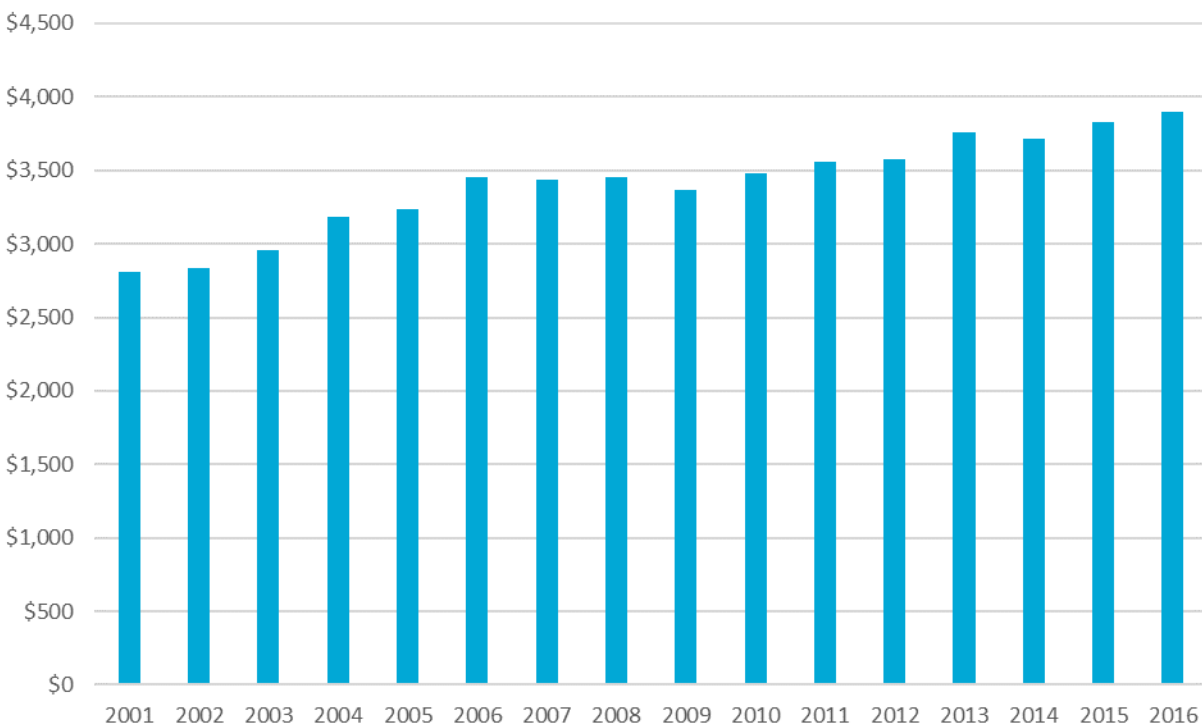


Source: Texas State Data Center and U.S. Census Bureau, 2018.

3.1.2 Regional Gross Domestic Product (GDP)

Regional gross domestic product (GDP) is a measure of the total goods and services produced within the region. The U.S. Bureau of Economic Analysis (BEA) prepares estimates of GDP for each MSA in the United States on a quarterly basis. Figure 3.2 shows the Sherman-Denison MSA's GDP for the period between 2001 and 2016. During this period, the real GDP (i.e., adjusted for inflation) in the region has grown from \$2.8 billion to almost \$3.9 billion or an increase of 38.4 percent. The strongest growth period occurred between 2001 and 2006, followed by another, more modest growth period following the 2008-2009 Recession, between 2009 and 2016.

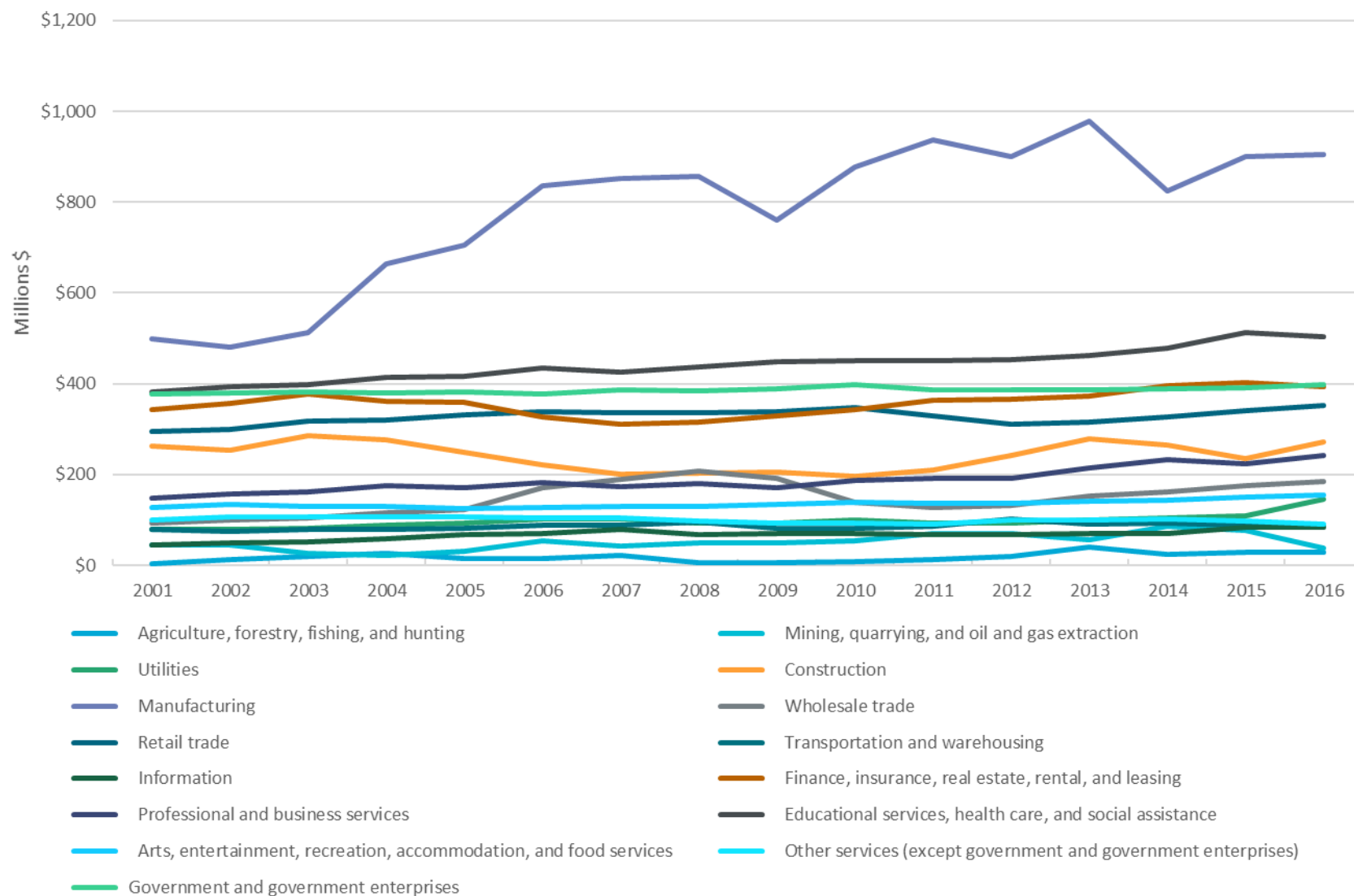
Figure 3.2 Sherman-Denison MSA Real Gross Domestic Product (GDP)
2001-2016



Source: U.S. Bureau of Economic Analysis; Note: Chained to 2008 dollars.

In addition to the aggregate, regional measure of GDP, the BEA also produces estimates of GDP by industry sector. Figure 3.3 shows the annual GDP produced by each sector in the Grayson County economy. The key takeaway from the data is that the manufacturing sector was the dominant contributor of the economic output of Grayson County. Its role grew significantly between 2003 and 2006 and has fluctuated since then. Other freight-oriented industry sectors, such as construction, wholesale trade, and transportation and warehousing did not substantially increase their contribution to the GDP of the Sherman-Denison MSA.

Figure 3.3 Sherman-Denison GDP by Industry Sector (Chained 2009 dollars)
2001-2016

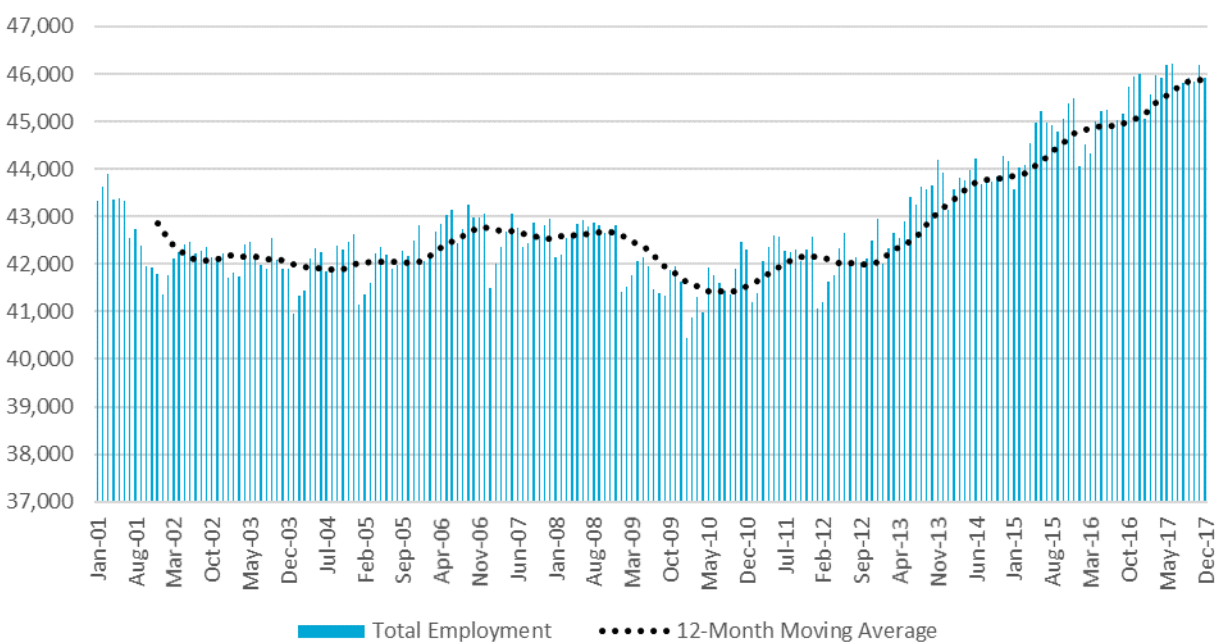


Source: U.S. Bureau of Economic Analysis, 2018.

3.1.3 Employment

At the end of 2017, the Grayson County economy had roughly 46,000 jobs. Figure 3.4 shows the total employment in Grayson County between 2001 and 2017. These data show that employment growth in the region was essentially stagnant from 2001 to 2012. During the economic expansion that followed the 2001 Recession, job growth was modest, as were the job losses during the 2008-2009 Recession. However, starting in 2012, the region began to experience substantial job growth that continued through 2017. The 12-month moving average line shows the smoothed growth trend over this period.

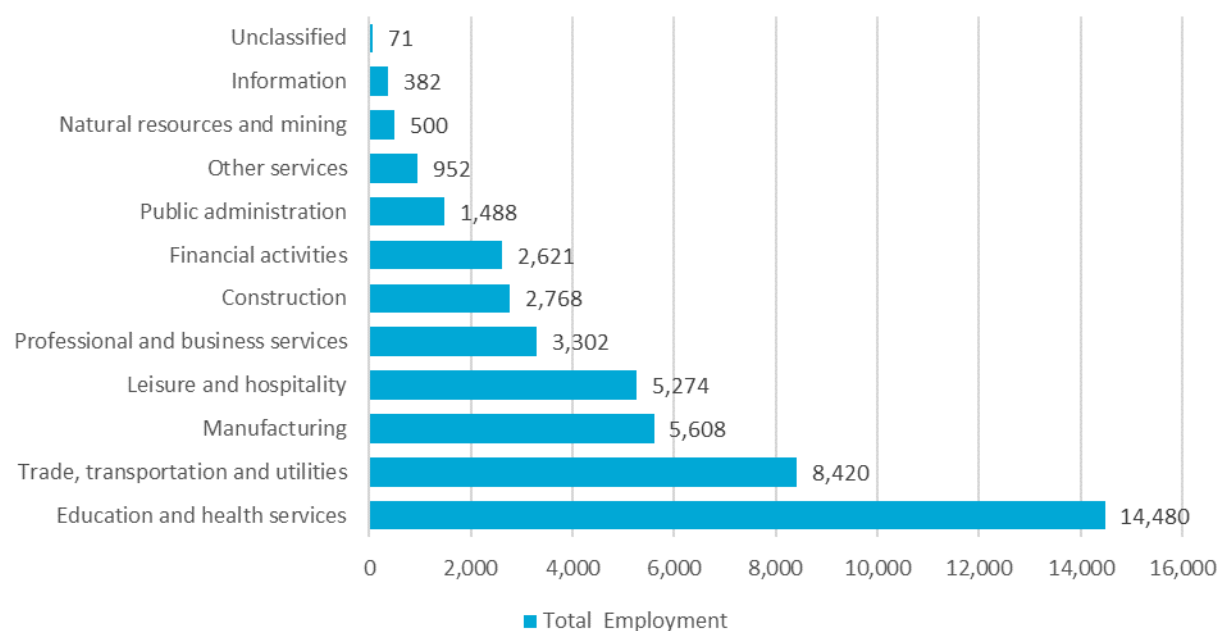
Figure 3.4 Total Employment in Grayson County
2001-2017



Source: U.S. Bureau of Labor Statistics, 2018.

Total employment by industry sector is shown in Figure 3.5. The region's largest employment sector is education and health care services, which is generally a function of population. The next largest share of total employment is in the trade, transportation, and utilities sector. This sector includes retail establishments. Notably, Grayson County's third largest employment sector, with more 5,600 workers, is manufacturing. Other freight intensive sectors are construction (2,768 jobs) and natural resources and mining (500 jobs).

**Figure 3.5 Grayson County Employment by Industry Sector
2017**

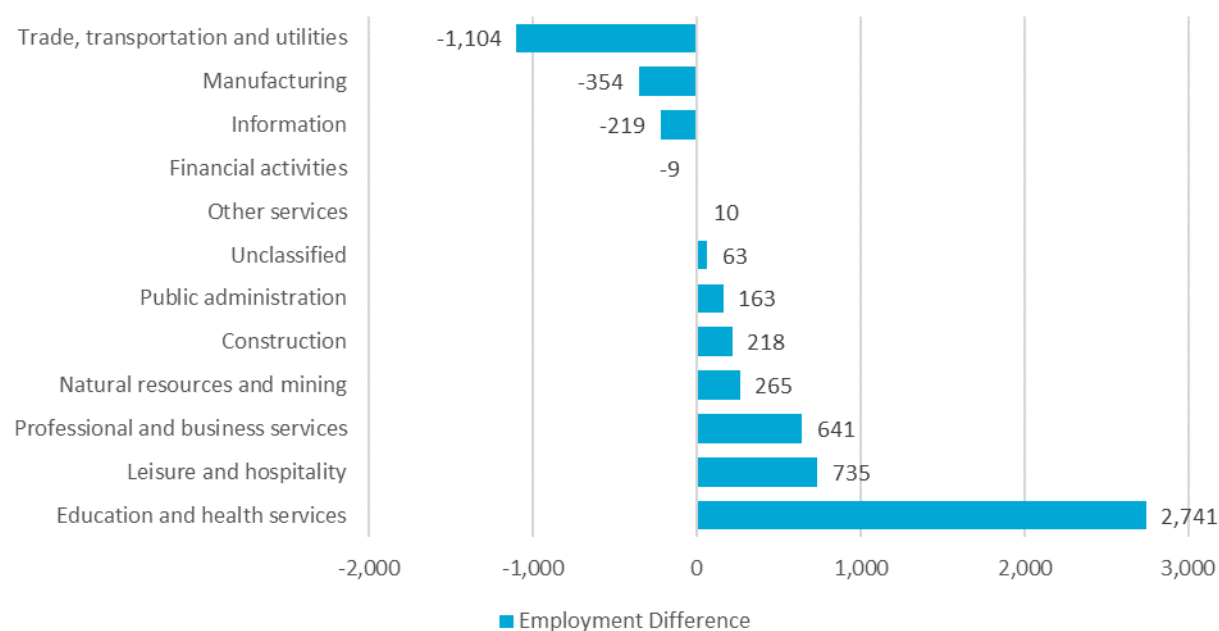


Source: Texas Workforce Commission, 2018.

Between 2007 and 2017, two sectors that heavily influence freight movements in Grayson County lost employment. The trade, transportation, and utilities sector, which would include retailers and trucking, lost slightly over 1,100 jobs, while the manufacturing sector lost approximately 350 jobs (See Figure 3.6). Other freight intensive sectors experienced employment growth during this ten-year period, although the growth was modest. The construction sector added 218 jobs and the natural resources and mining sector added 265 jobs. Most of the employment growth in the region has been in the service sector, with education and health services accounting for more than half of the county's employment growth with 2,714 new jobs. The leisure and hospitality sector was the second fastest growing sector with 735 new jobs and the professional and business services sector was the third fastest growing sector with 641 additional jobs.

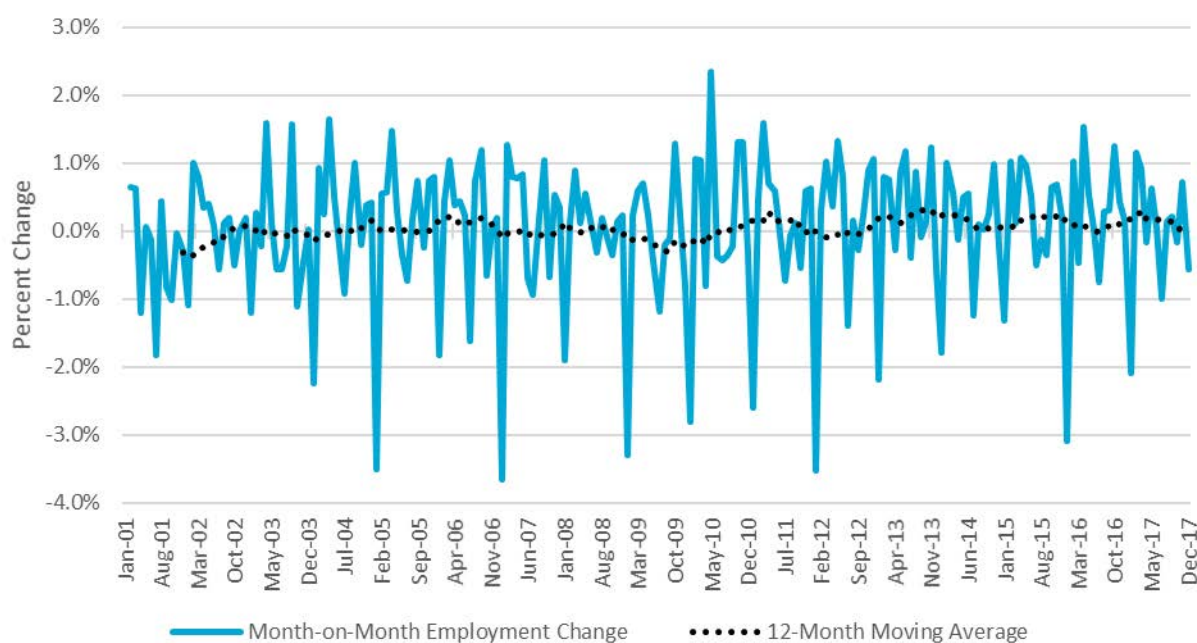
Figure 3.7 shows unadjusted month-on-month employment change in Grayson County between 2001 and 2017. As is obvious from the graph, the percent employment change can fluctuate significantly from month to month. Many of the largest swings are the result of seasonal hiring, but other abrupt changes can reflect academic calendars, new employers, layoff, or shutdowns. The 12-month moving average smooths this "noise" to show the overall employment trend. The figure shows that employment change has been positive since 2012, as noted earlier, with relatively modest average monthly growth.

Figure 3.6 Grayson County Employment Change by Sector
2007-2017



Source: Texas Workforce Commission, 2018.

Figure 3.7 Month-on-Month Employment Change in Grayson County
2001-2017

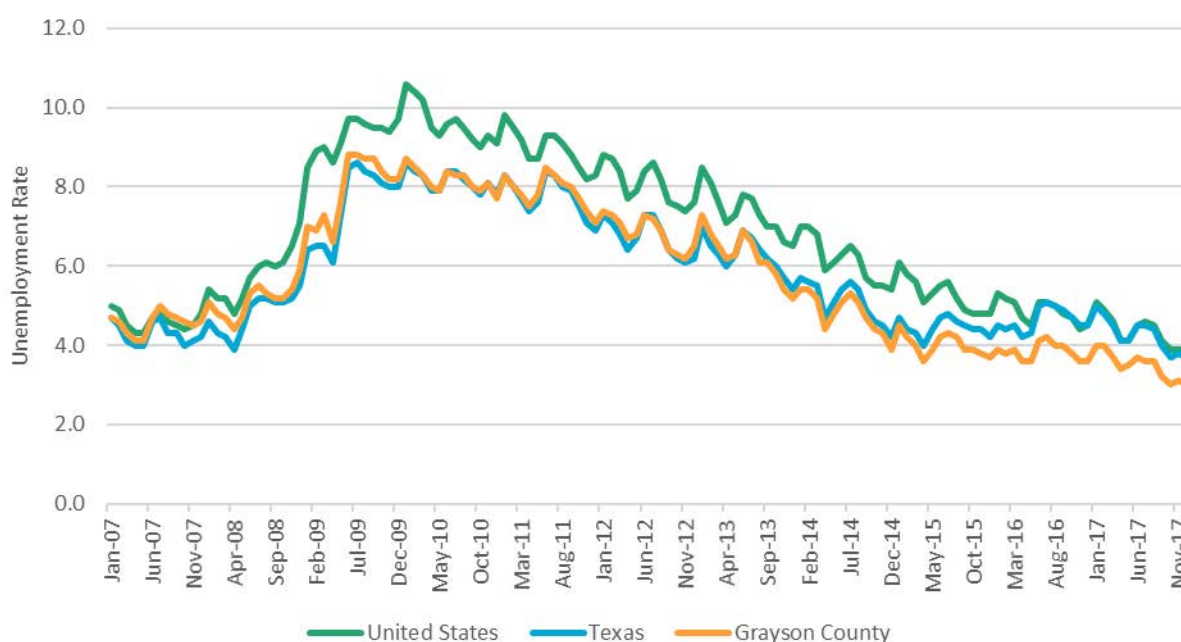


Source: U.S. Bureau of Labor Statistics, 2018; Note: Unadjusted unemployment data.

3.1.4 Unemployment

Grayson County's unemployment rate has typically been at or below the national unemployment rate between 2001 and 2017. During the 2008-2009 Recession, Grayson County's unemployment rate peaked at 8.8 percent in July 2009 (See Figure 3.8). Since 2011, the county's unemployment rate fell gradually, where it stood at 3.0 percent in December 2017. Grayson County's unemployment rate has also generally followed the statewide rate before diverging in early 2015, as the state began to lose jobs in the oil and gas sector.

Figure 3.8 Monthly Unemployment Rate in the United States, Texas, and Grayson County
2007-2017 (Not adjusted)



Source: Texas Workforce Commission, 2018.

3.1.5 Income and Wages

In 2016, the median household income in Grayson County was \$50,212, which had increased 7.1 percent from the 2010 median household income of \$46,875 (See Table 3.3). Household incomes in Grayson County lag behind the state overall, which had a median household income of \$54,727 in 2016. Household income also grew faster at the state level at 10.2 percent between 2010 and 2016.

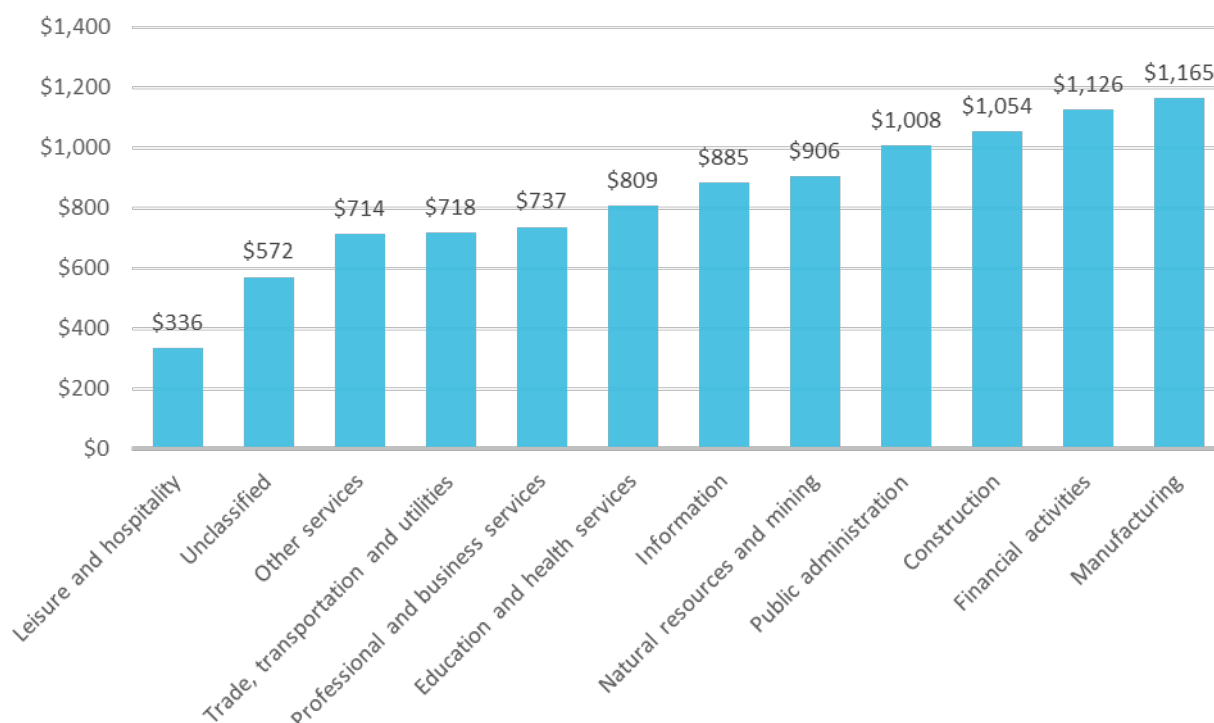
Table 3.3 **Nominal Median Household Income in Texas and Grayson County**
2010 and 2016

Geography	2010	2016	Change
State of Texas	\$49,646	\$54,727	10.2%
Grayson County	\$46,875	\$50,212	7.1%

Source: U.S. Census Bureau, 2018.

Figure 3.9 shows the average weekly wage by industry in Grayson County during 2017. The region's manufacturing sector provided the highest average wages at \$1,165 per week. Other freight-oriented sectors with higher weekly wages were construction (\$1,054) and natural resources mining (\$906).

Figure 3.9 **Average Weekly Wage by Industry in Grayson County**
2017



Source: Texas Workforce Commission, 2018.

3.2 Benchmarking the Grayson County Economy

While descriptive statistics are helpful for conveying the basic characteristics of the Grayson County economy, they do not necessarily provide a more nuanced understanding of the region's competitiveness within the overall state economy. What follows is a series of scatterplots that compare conditions in the Sherman-Denison MSA to the other Texas MSAs. The benchmarking graphs show that the region generally performs well, but there remain areas for improvement. It is also worth noting that the

comparison period for this analysis covers a unique span of time, when the state economy experienced a recovery from the 2008-2009 Recession, the rapid expansion of the state's petroleum industry from hydraulic fracturing, and the subsequent decline of the petroleum industry as prices collapsed. All of these recent events should be taken into consideration when assessing the scatterplots.

Figure 3.10 shows each MSA's population growth rate between 2010 and 2017 plotted against its employment growth rate over the same period. As would be expected, the plots generally align from the axis to the upper right quadrant. In other words, as population grows, it would be expected that employment grows at a similar rate or vice-versa. Population in the Sherman-Denison MSA has grown by 10.2 percent during this seven-year period and its employment grew by 8.5 percent. These growth rates place it near the average among all MSAs in Texas. However, Texas's largest MSAs are growing at some of the fastest rates, even though it might be expected that (given their size) their rates of growth might be slower.

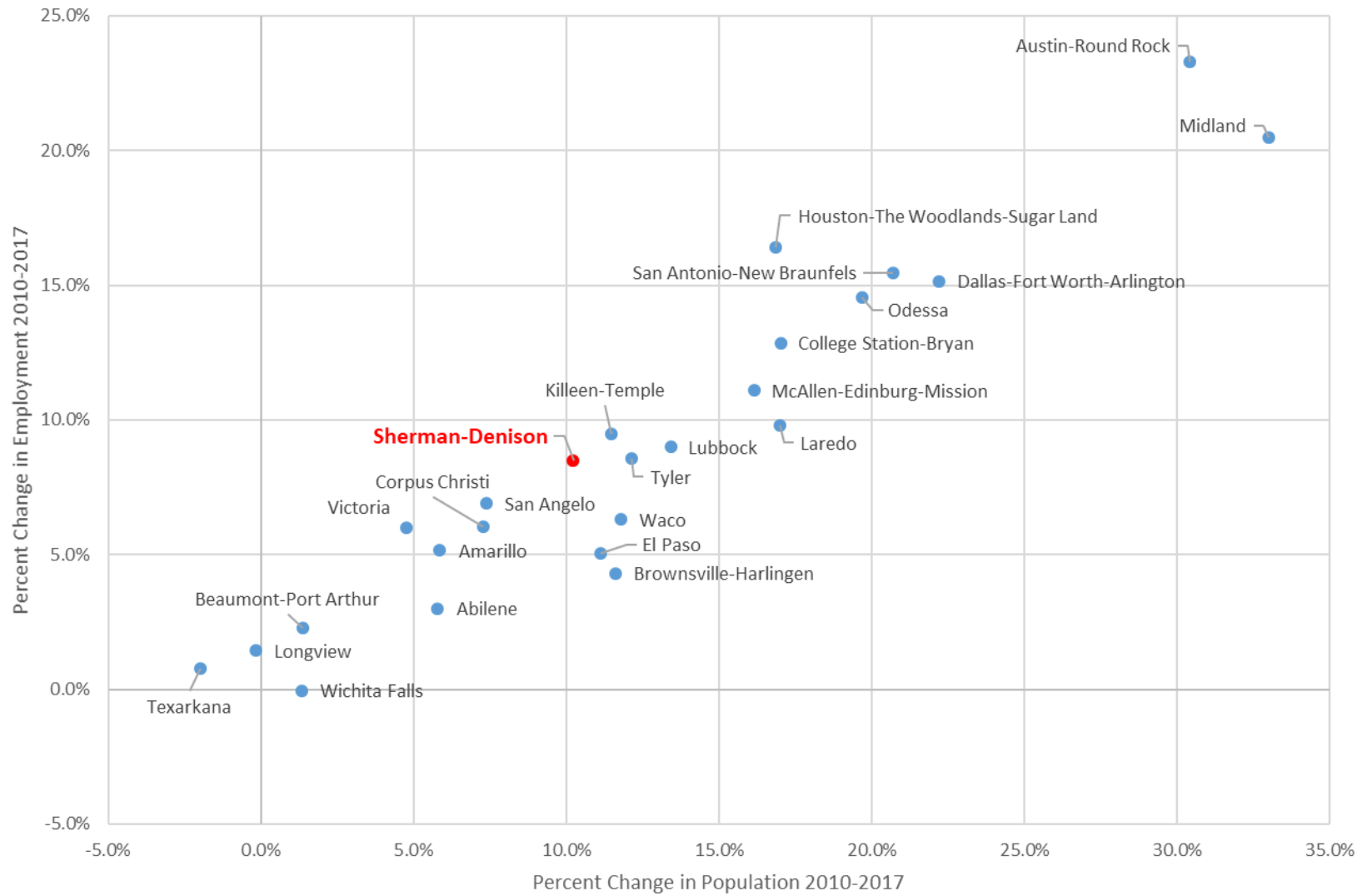
The next figure shows the overall unemployment rate in each MSA against the change in the region's unemployment rate between 2010 and 2017 (See Figure 3.11). The Sherman-Denison MSA occupies an enviable position on this chart. Notably, among all the MSAs in Texas, Sherman-Denison not only had a very low unemployment rate, at 3.5 percent, and it also had the largest reduction in unemployment among all Texas MSAs, falling from 8.2 percent to 3.5 percent between 2010 and 2017.

The next scatterplot, Figure 3.12, shows each MSA's median household income against the percent change in median household income between 2010 and 2016. These data show that the Sherman-Denison MSA's median household income is within a reasonable norm, compared to other MSAs in the state. However, income growth has lagged behind many other MSAs in Texas.

Figure 3.13 provides a comparison of the change in the unemployment rate and the median household income for Texas MSAs. Given the historical context of this figure (i.e., spanning from the depths of the 2008-2009 Recession to present), the least desirable location in the chart would be the upper left quadrant, where regions have not substantially reduced unemployment rates and incomes are not growing, while the lower right quadrant would be the most desirable. Interestingly, no Texas MSAs are located in the lower right quadrant and only two MSAs (Midland and Odessa) are located in the upper right quadrant, where households have experienced rapidly rising household incomes due to the expansion in the oil and gas sector. As previously mentioned, Grayson County was able to lower its unemployment rate more than any other MSA in the state of Texas. However, the region has somewhat lagged in wage growth compared to the rest of the state, which could discourage workers from migrating to the region and contributing to a skilled labor shortage that was discussed during the first Freight Advisory Committee meeting.

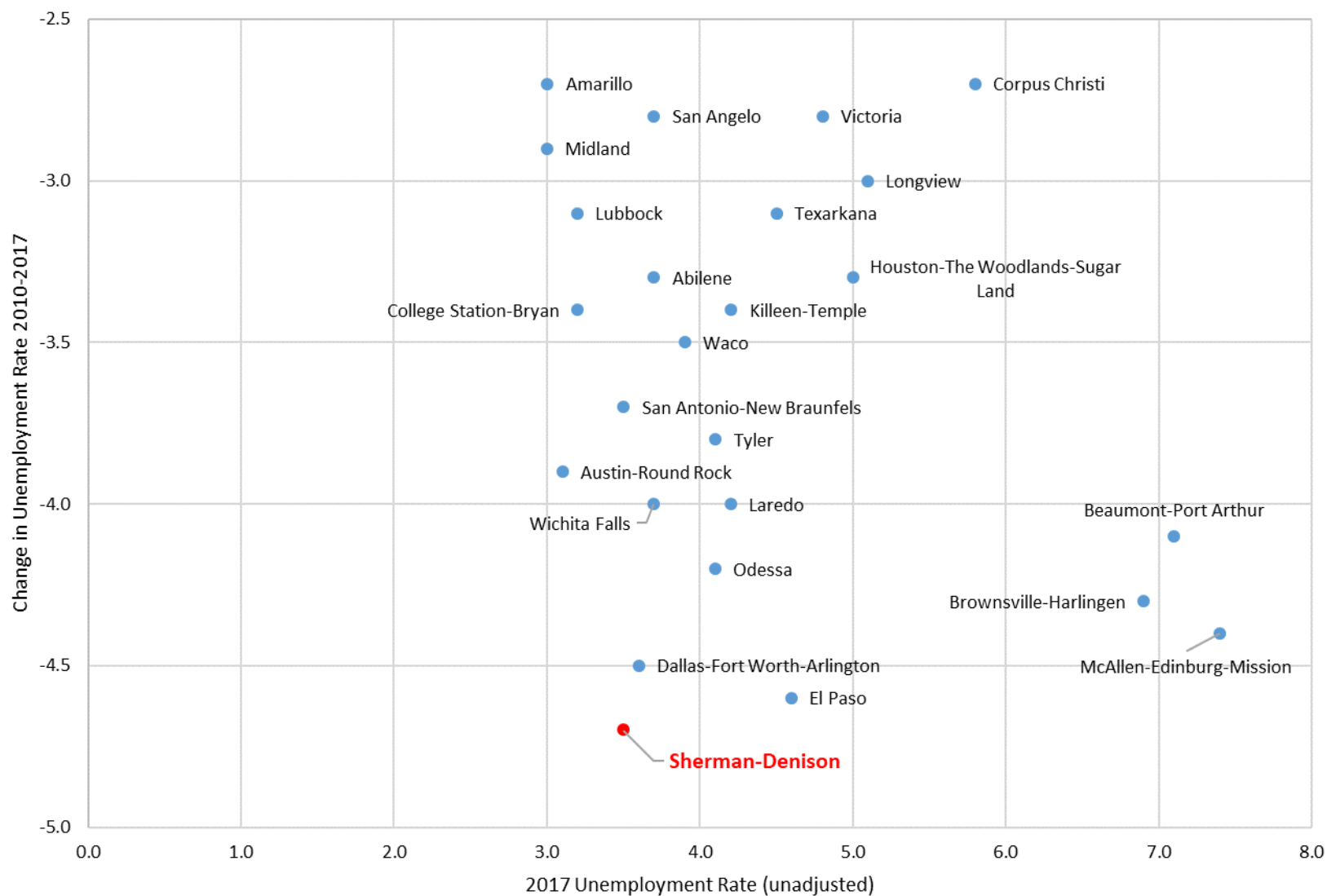
Figure 3.14 and Figure 3.15 compare employment change in the manufacturing sector between 2010 and 2017 with the change in wages over the same period. The data show that the Sherman-Denison MSA is among the higher performers in employment growth in the manufacturing sector, growing by almost 10 percent during this period. However, where the Sherman-Denison MPO does perform poorly is in wage growth. Nominal wages have declined by more than 8 percent, compared to many other areas of the state where they have grown significantly, even while the manufacturing sector overall was shrinking. When the change in wages is adjusted by the change in the consumer price index (CPI), the average real wage for Grayson County workers in the manufacturing sector declined by more than 18 percent in seven years. This change has made the Sherman-Denison region an outlier in the state and may explain some of the difficulty finding skilled workers.

Figure 3.10 Rate of Population Growth versus Employment Growth in Texas
2010-2017



Sources: U.S. Census Bureau and the Texas Workforce Commission, 2018.

Figure 3.11 Unemployment Rate versus Change in Unemployment Rate in Texas MSAs
2010-2017



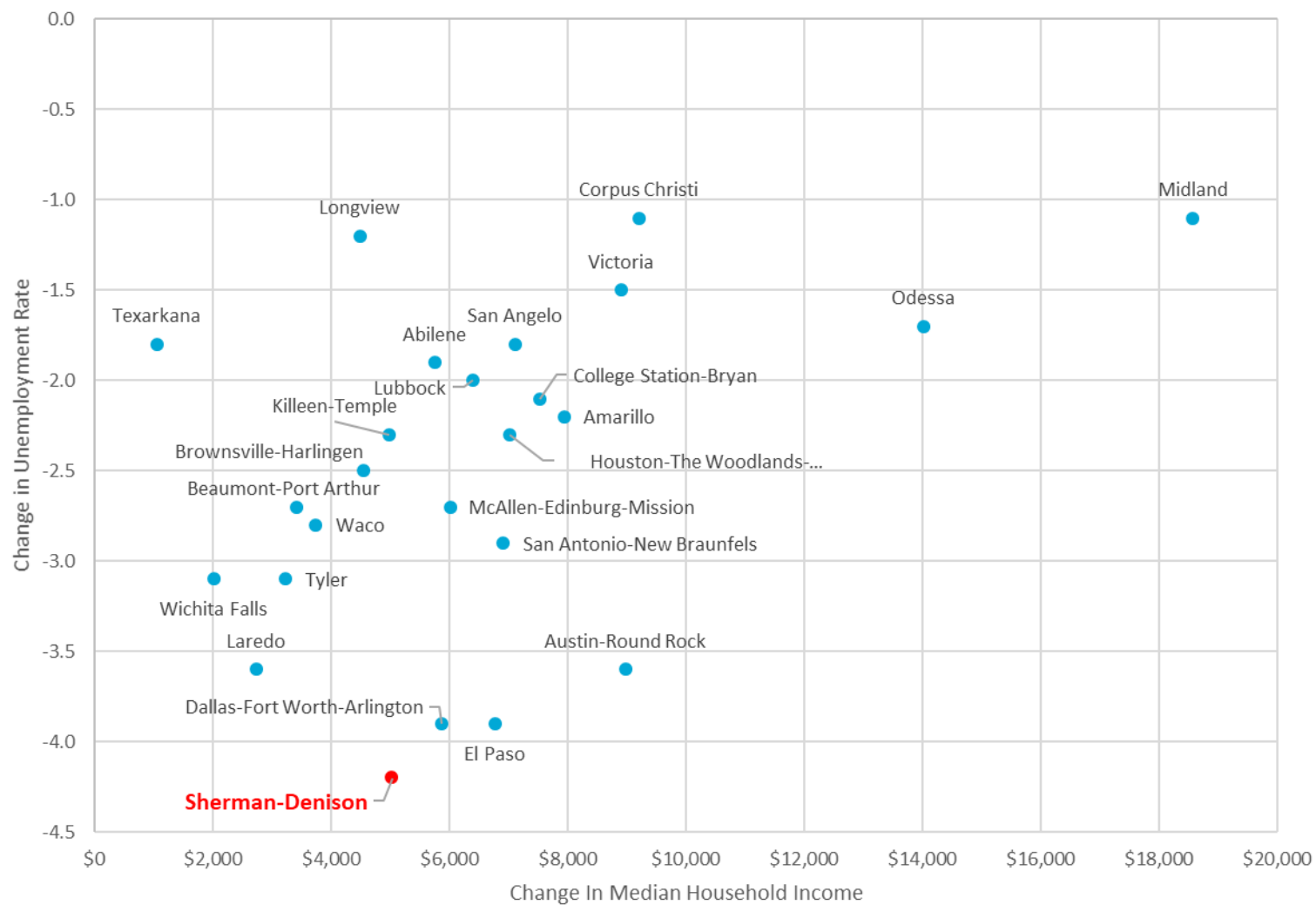
Source: Texas Workforce Commission, 2018.

**Figure 3.12 2016 Median Household Income versus Change in Median Household Income in Texas MSAs
2010-2016**



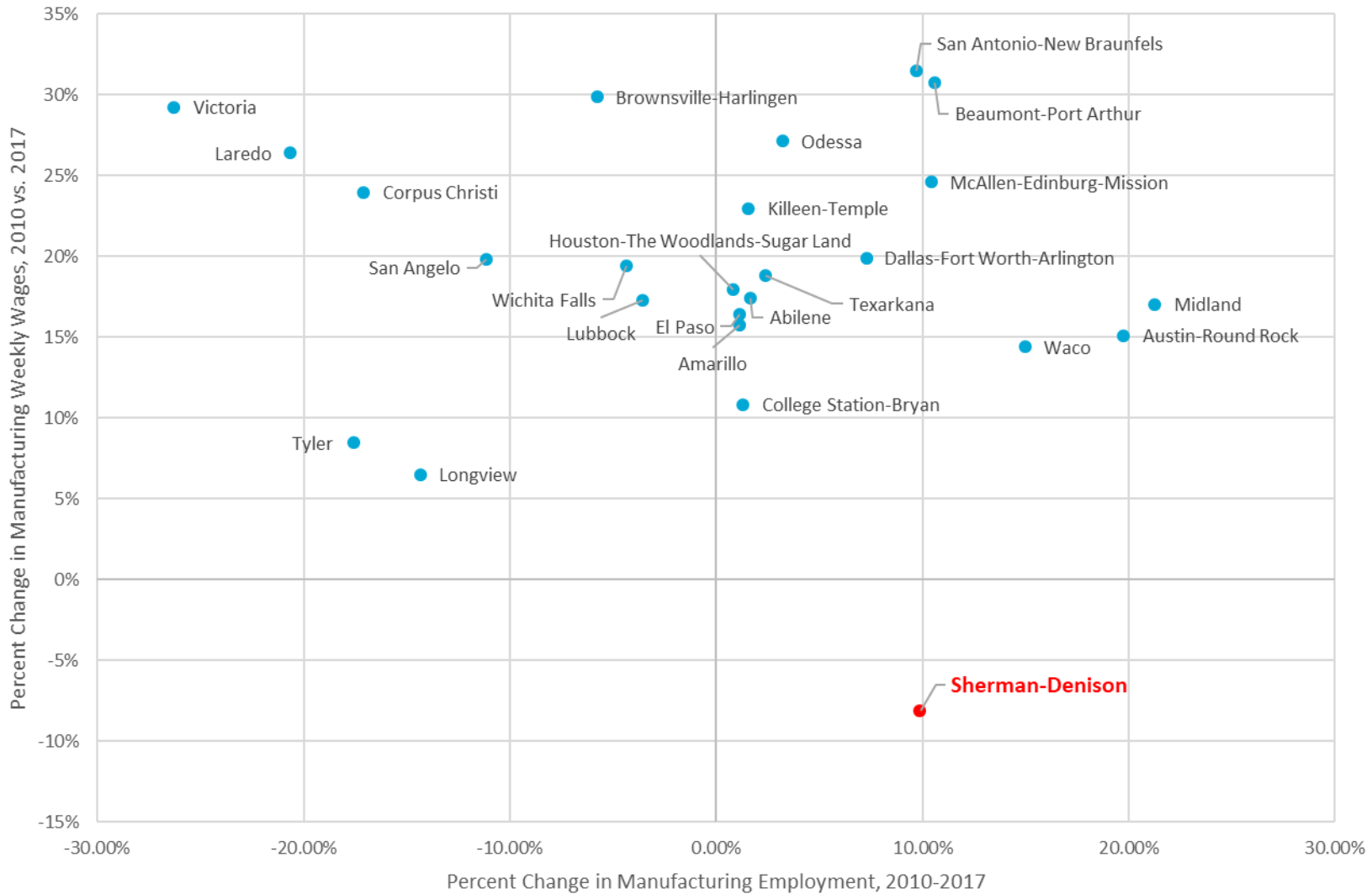
Source: U.S. Census Bureau, 2018.

Figure 3.13 Change in Median Household Income versus Change in Unemployment Rate in Texas MSAs
2009-2016



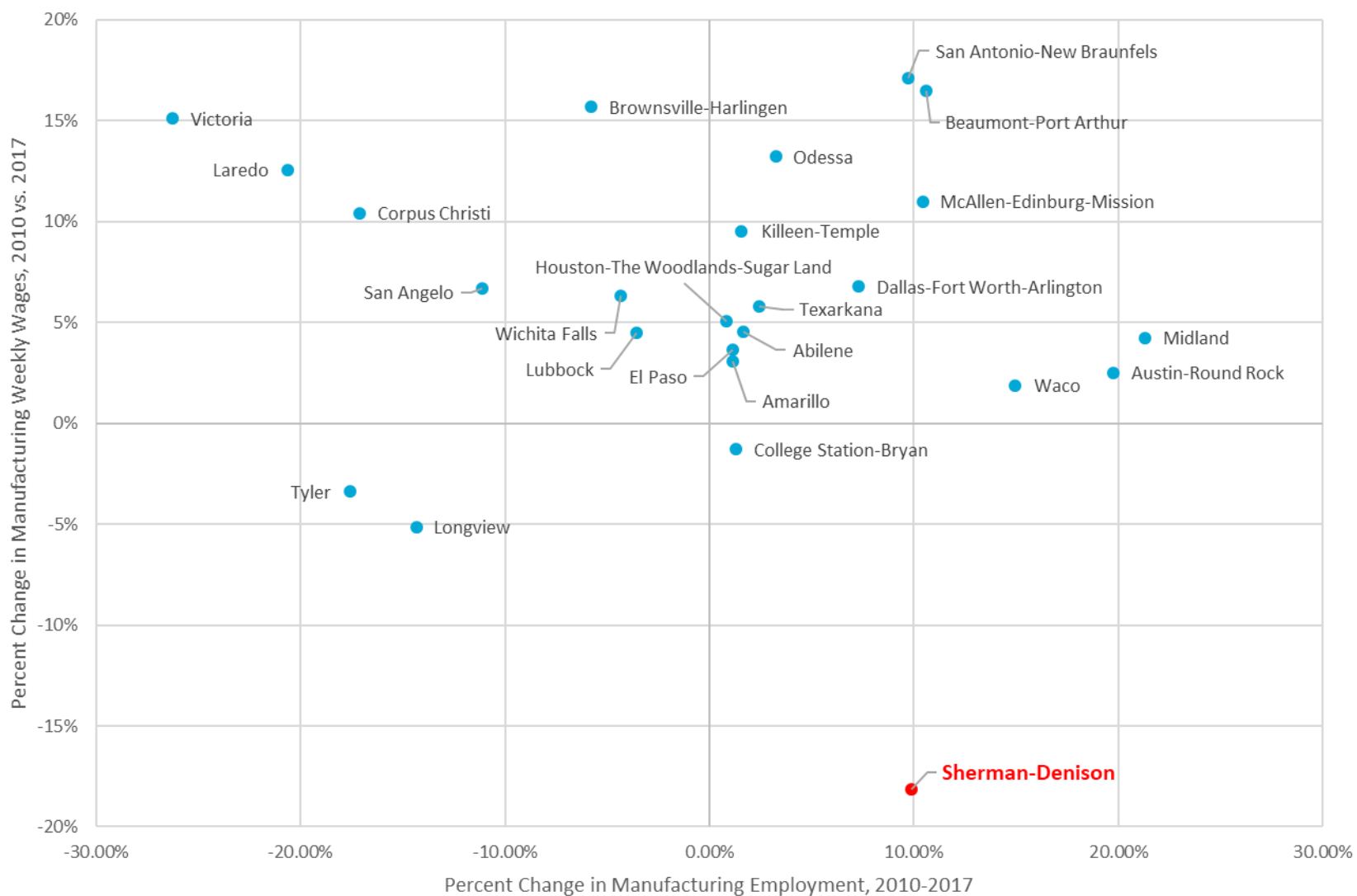
Source: U.S. Census Bureau and Texas Workforce Commission

Figure 3.14 Change in Manufacturing Employment versus Average Weekly Wage (Nominal) in Texas MSAs 2010-2017



Source: Texas Workforce Commission, 2018.

**Figure 3.15 Change in Manufacturing Sector Employment versus Average Weekly Wage (Real)
2010-2017**



Source: Texas Workforce Commission, 2018.

3.3 Economic Analysis of Freight Generating and Transportation Activities

Generally, the most desired outcome of building freight transportation infrastructure in a region is to induce economic development that will lead to increased employment and higher wages. However, in most cases, the causality between building transportation infrastructure and new jobs is not so clear cut. Employers typically choose locations for a combination of reasons, with transportation infrastructure being just one of many decision-making factors. Nonetheless, it would be a mistake to downplay its importance. For more than 30 years, *Area Development* magazine has been surveying corporate executives to find out which factors have the most important role in site selection decisions. In their 2018 survey, “Highway accessibility” was rated as “important” or “very important” by 91.3 percent of the respondents, which made it the most important selection factor and surpassing the ranking for “Labor costs” at 91.1 percent or “Availability of skilled labor,” which was ranked third at 88.8 percent. Interestingly, only 71.8 percent of respondents said “Inbound/outbound shipping costs” were “important” or “very important.”

Assuming that highway accessibility and other transportation factors play a similar role in Grayson County, it is likely that a high-quality freight transportation network in the region would be a strong contributor to its economic growth. In an attempt to better understand the potential consequences of induced economic development, the consultant team calculated the employment and income impacts of job growth in Grayson County using the Minnesota IMPLAN Group’s (MIG) IMPLAN software. IMPLAN is a commonly employed tool for input-output analysis, which is used by governments, consultants, and academics. It estimates the economic impacts of activities, according to their type and scale. Through MIG, the consultant team obtained the 2016 dataset for the Grayson County economy and set up a countywide input-output model.

To perform the analysis, the consultant team selected key freight-generating or freight transportation industries in Grayson County, based on lists of major employers and other employment characteristics. It is important to note that the employment categories in the IMPLAN model do not always align well with Federal labor statistics. Additionally, not every industry that is known to exist in Grayson County shows up in the IMPLAN model, which uses U.S. Bureau of Labor Statistics data. There reasons why this would be so and two of the reasons include:

- *Parent/child problem*—County employment statistics are based upon unemployment insurance records. When companies have more than one location, the unemployment insurance may be filed at the “parent” facility where the employment for the entire firm shows up, leaving the “children” facilities unaccounted for in the county where they are physically located.
- *Confidentiality*—The BLS cannot directly report the number of employees at an individual firm or statistics that might make a firm’s employment imputable. When there is the potential for employment information to be divulged, the BLS suppresses the detailed data and only reports it at a more aggregated level.

One mechanism for addressing these issues is to add employers to the IMPLAN model. However, since some of the missing employers were very large, there was a concern that introducing them might skew the model’s results. The upshot is that there were limitations to the data analysis because these issues are not easily resolvable.

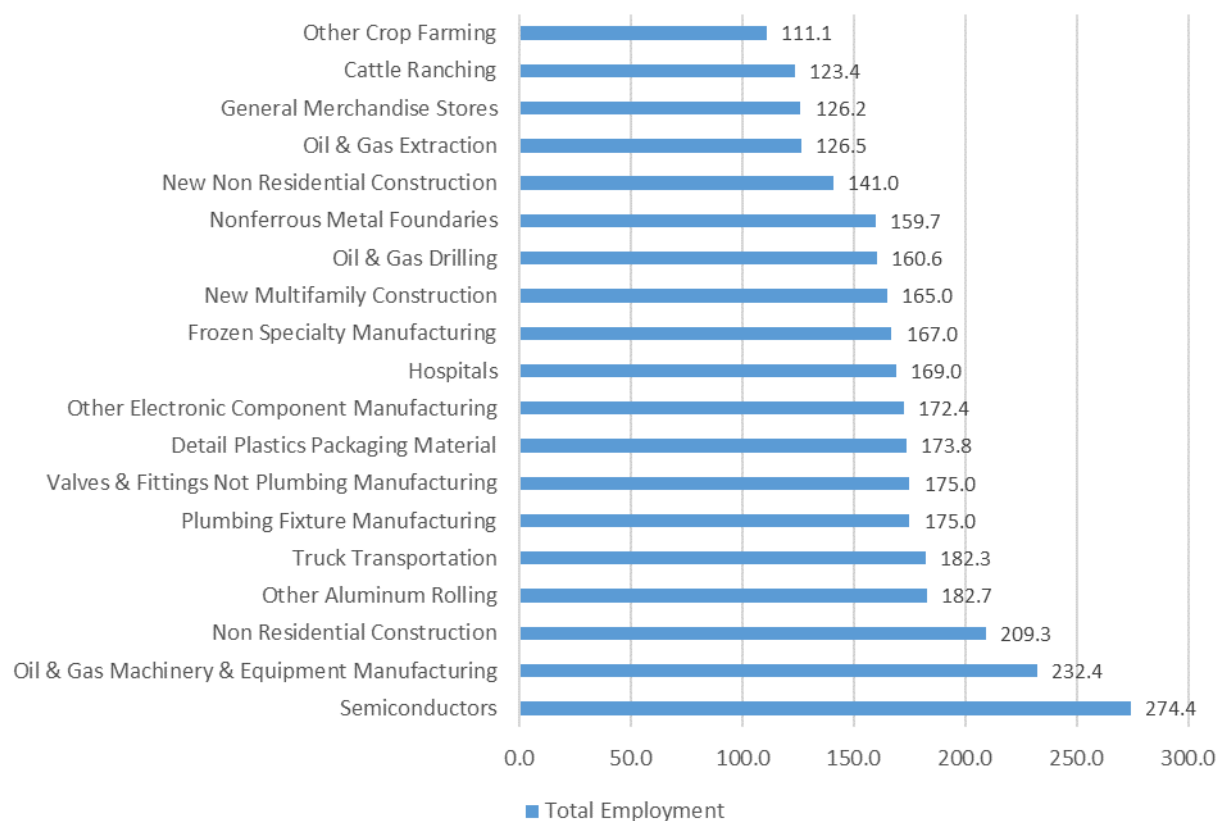
3.3.1 *Employment Impacts of Expanding Freight Intensive Industries*

Figure 3.16 shows the total employment impact of adding 100 jobs to select industry sectors representing many of the most important freight generators in the Grayson County economy. The total employment generated includes the direct jobs added (i.e., 100), as well as the indirect and induced employment that results from those additional 100 jobs. Indirect employment represents the jobs created by the purchase of inputs from within the region to support the new activity. The indirect employment reflects the backwards linkages to the local economy (i.e., the local supply chain). Induced jobs are the result of expenditures in the region by the workers of the direct and indirect employment, who consume goods and services with the wages they earn.

A number of the sectors analyzed in the IMPLAN model represent Grayson County's manufacturing sector, which produce strong multipliers.⁹ The multiplier of an industry is its total employment impact in the model divided by 100. Expansion of the semiconductor manufacturing sector has the greatest potential impact on the Grayson County economy, adding approximately 175 indirect and induced jobs, in addition to the 100 direct jobs. The semiconductor manufacturing sector's multiplier is 2.74, meaning each job added creates a total of 2.74 jobs (a shorthand for direct, indirect, and induced employment). The oil and gas machinery manufacturing sector also create strong economic impacts, with a multiplier of 2.35. Most manufacturing sectors have multipliers between 1.67 and 1.82. The construction sector also contributes strongly to the local economy with multipliers between 1.67 and 2.09. Other freight generating industries like general merchandise stores have very small impacts on the Grayson County economy, with a multiplier of 1.26, while the agricultural sector creates multipliers of 1.11 to 1.23.

⁹ Surprisingly, the analyzed industry sector with the greatest impact on the Grayson County economy is flour milling, which is estimated to create almost 400 additional jobs for each 100 jobs added. One possible explanation for this large impact is that Grayson County produces a large amount of wheat, which is likely assumed in the model to be consumed locally. Additionally, many of the services required for a flour mill, such as trucking, are also likely to be provided by local firms. However, unlike many manufacturing sectors, it could be difficult to scale up this sector as an economic development strategy, so it is not included in the figures that follow.

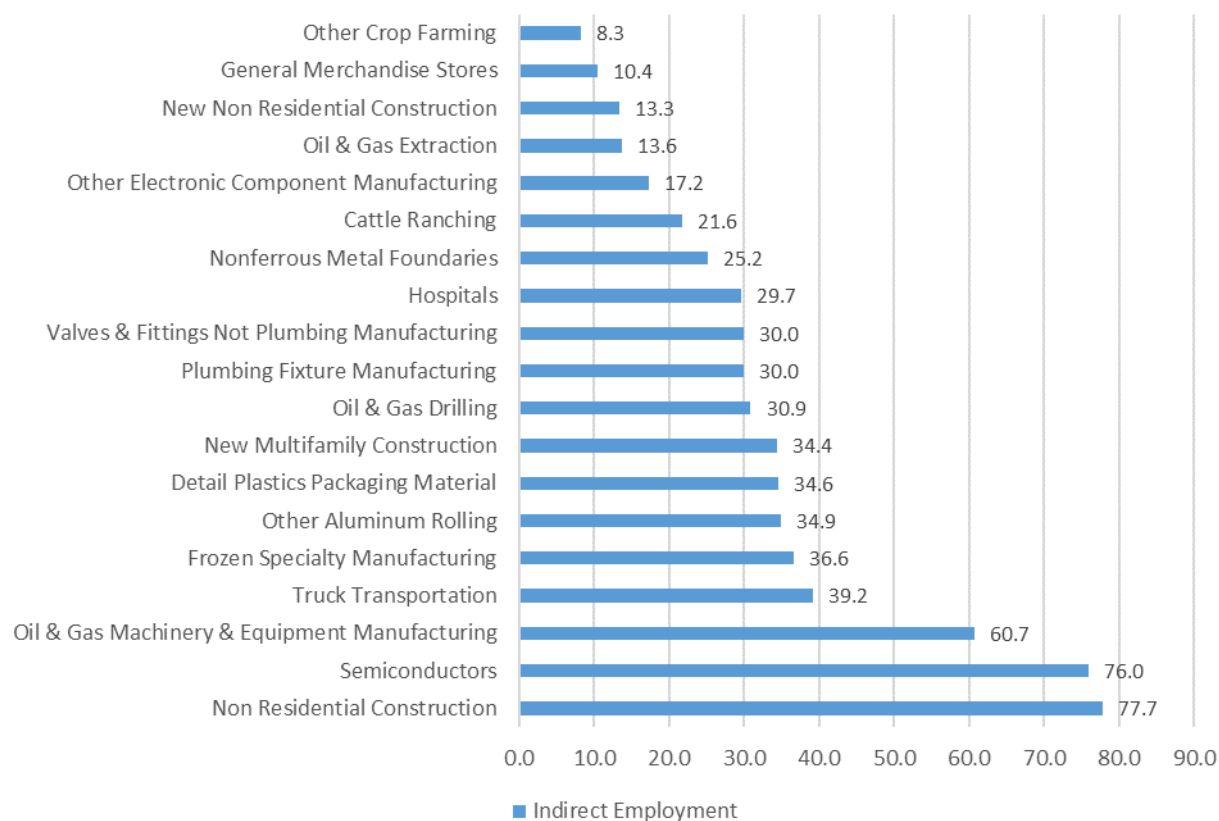
Figure 3.16 Total Employment Impact on Grayson County from Adding 100 Workers by Industry Sector



Source: Derived from IMPLAN model, 2018.

Figure 3.17 shows the indirect employment impact of adding 100 jobs to each of the analyzed sectors. High impact sectors are nonresidential construction, semiconductor manufacturing, and oil & gas machinery & equipment manufacturing. Most of the analyzed sectors in the Grayson County create between 20 and 40 indirect jobs for every 100 direct jobs added.

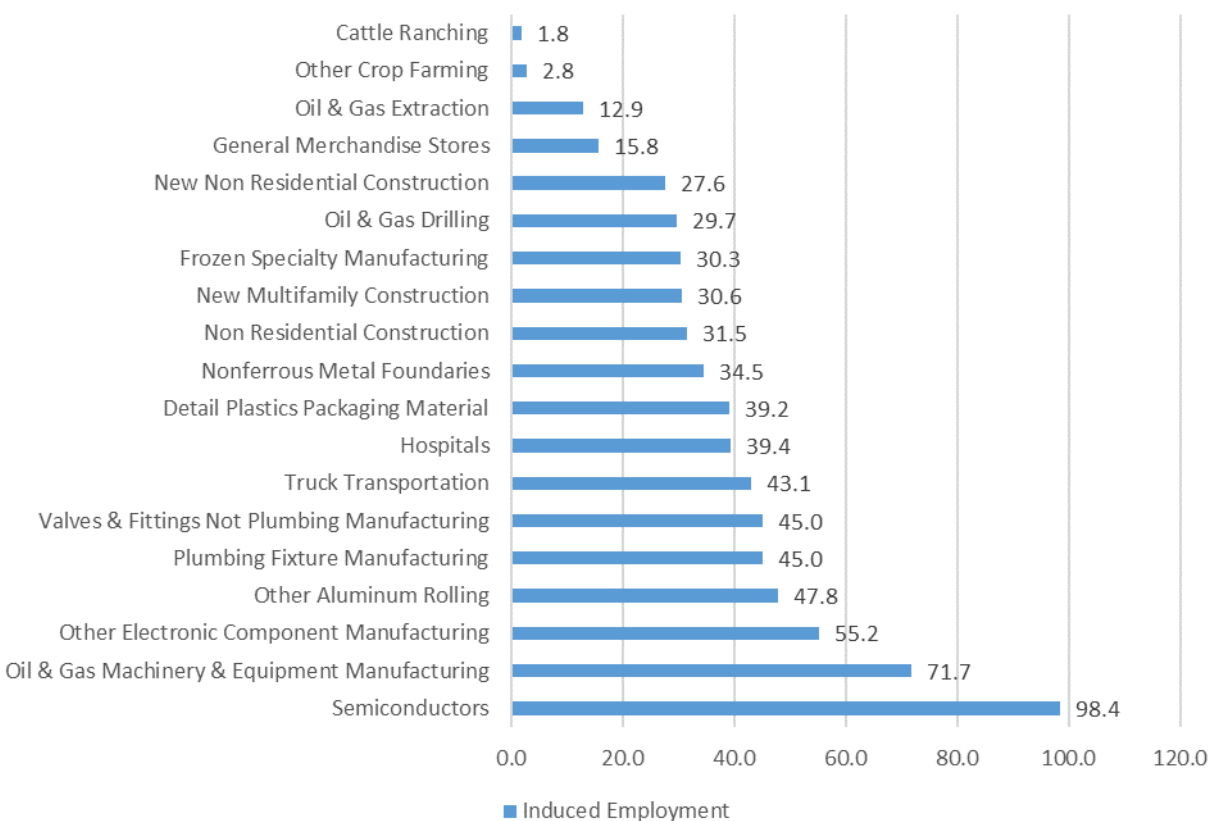
Figure 3.17 Total Indirect Employment Impact on Grayson County from Adding 100 Workers by Industry Sector



Source: Derived from IMPLAN model, 2018.

The induced employment impacts show a similar pattern to the indirect impacts. The semiconductor manufacturing sector has the highest induced employment impact on the Grayson County economy, adding nearly 100 induced jobs for every 100 direct jobs (See Figure 3.18). Oil & gas machinery & equipment manufacturing and electronic component manufacturing are other sectors with high induced impacts. Most freight-oriented sectors produce between 25 and 50 induced jobs for every 100 direct jobs added. The two agricultural sectors included in the analysis produced very little induced employment. The total direct, indirect, and induced employment for each sector is shown in Figure 3.19.

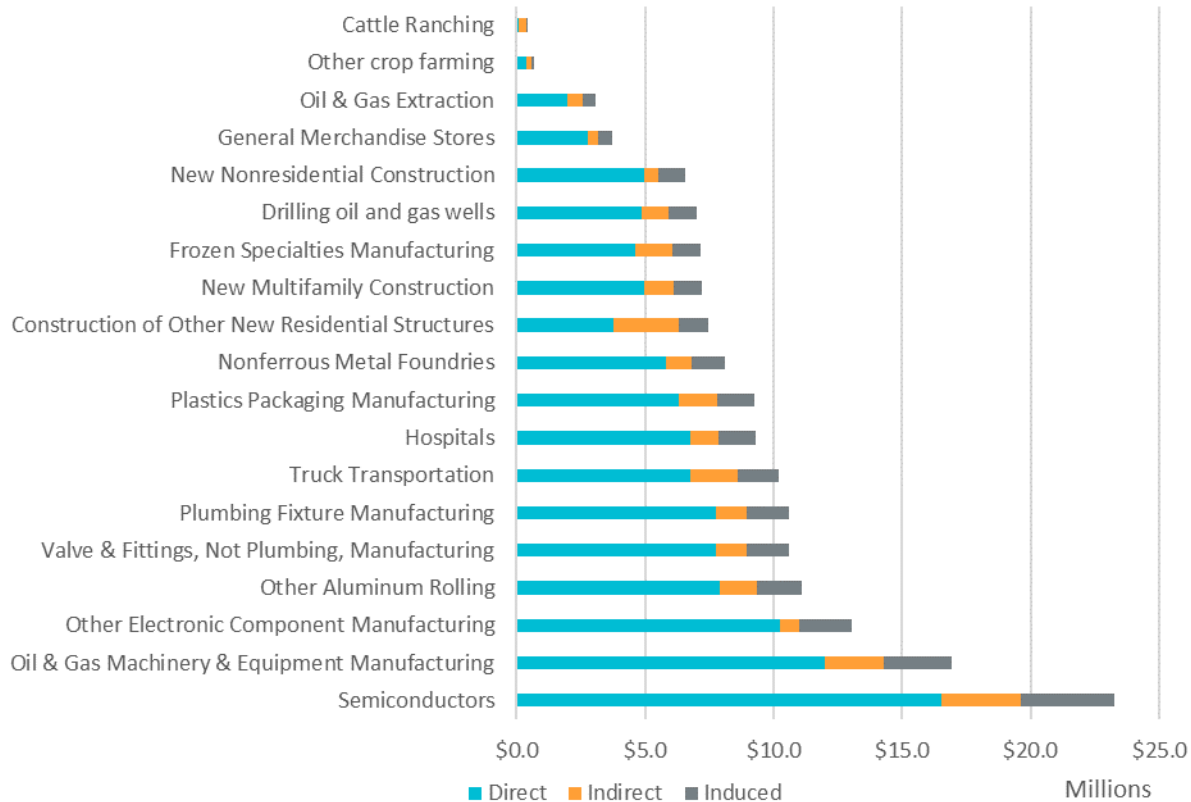
Figure 3.18 Total Induced Employment Impact on Grayson County from Adding 100 Workers by Industry Sector



Source: Derived from IMPLAN model, 2018.

Adding employment to the semiconductor industry generates the greatest overall increase to income in the Grayson County economy, primarily due to the high wages for workers in that sector. Other skilled manufacturing sectors, such as oil & gas machinery manufacturing, electronic component manufacturing, aluminum rolling, and plumbing-related manufacturing are also strong contributors. On the other hand, although general merchandise stores are large freight generators, they contribute little to local income outside of direct income, which itself is lower than most other sectors in the analysis. Agriculture, which is frequently a part-time endeavor, generates the most modest incomes.

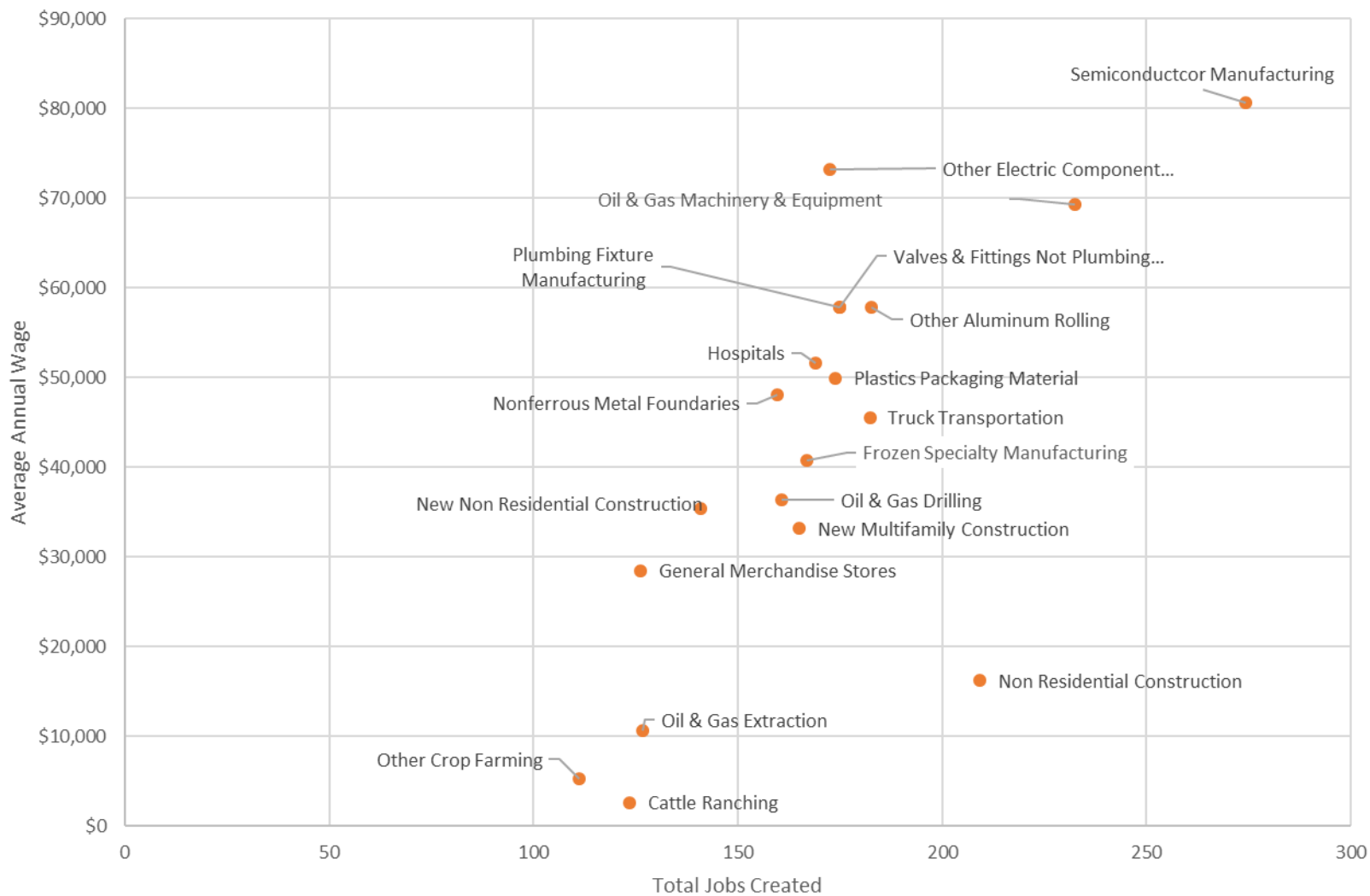
Figure 3.19 Direct, Indirect, and Induced Income Impacts on the Grayson County Economy from Adding 100 Workers by Industry Sector



Source: Derived from IMPLAN model, 2018.

Lastly, Figure 3.20 is a scatterplot showing the average wage for each industry sector from the IMPLAN model against the total employment impact per 100 direct jobs added. The upper right quadrant would be considered the most desirable location, which would be an industry sector that creates many high wage jobs. Semiconductor manufacturing, electronic components manufacturing, and oil and gas machinery and equipment manufacturing are examples of industries that fit into this quadrant. The least desirable location would be the lower left quadrant, where wages are lower and there are fewer indirect and induced jobs created. The expected industry sectors are found there, namely agriculture and retail. Given Grayson County's very low unemployment and below average wage conditions, industry sectors that fit in the upper left corner are possibly the most desirable, since they pay good wages and create less pressure on the local labor market.

Figure 3.20 Total Jobs Created versus Average Annual Wage (Assuming 100 Direct Jobs Added) in Grayson County



Source: Derived from IMPLAN Model, 2018.

3.4 Regional Supply Chains

With the Grayson County heavily concentrated in the manufacturing sector, efficient regional supply chains are essential for the local economy to retain its employment base and maintain its regional competitiveness. They are also necessary to support the region's retail industry and its hospitals, which rely on the rapid and reliable delivery of goods. This section will discuss, in greater detail, the contributors to Grayson County's freight intensive industry sectors. Namely, Grayson County's major freight-related employers and the larger firms in its freight logistics industry. It will also discuss commodity movements within Grayson County, based upon TRANSEARCH data and the intraregional supply chains for its key freight industries.

3.4.1 Major Employers

Despite being a medium-sized community, Grayson County is well represented by the manufacturing sector and other sectors of the economy that are freight generators or receivers. The county's largest two employers are in the food manufacturing industry, Tyson Fresh Meats (1,745 jobs) and Ruiz Foods (1,198 jobs). Walmart is a major freight receiver and Grayson County's third largest employer with 450 workers among its multiple stores. Moving down the list in Table 3.4, the region has a number of traditional manufacturers that produce goods ranging from earth-moving equipment to door locks to plastic wrap and aluminum cans. Progress Rail Services not only receives and generates freight, it also supports it by maintaining track.

Table 3.4 Major Employers and Freight Generators in Grayson County

Company	Industry	Employees
Tyson Fresh Meats	Beef & Pork Products	1,745
Ruiz Foods	Frozen Foods	1,191
Wal-Mart/Sam's	Retail	450
Caterpillar, Inc.	Machinery	400
Emerson Process/Fisher Controls	Industrial Equipment	360
ACS Manufacturing	Acoustical Equipment Enclosures	340
Eaton B-Line	Metal Fabricated Products	335
Douglass Distributing	Fuel and convenience stores	300
Royal Case	Carrying Cases	280
Spectrum Brands-Kwikset	Door Locks	250
Champion Cooler Corporation	Evaporative Coolers	220
GlobiTech	Silicon-epitax Coating Services	213
Presco Products	Flexible PVC Film	190
Progress Rail Services	Rail Equipment	190
Kaiser Aluminum	Aluminum Extrusions	170

Source: Sherman Economic Development Corporation and Denison Development Alliance, 2018.

Table 3.5 shows major employers in Grayson County that generate or receive freight that is often high-value and/or time-sensitive, nonetheless, the volumes may not necessarily be significant when compared to other

freight industries. Employers within these sectors are dependent upon a reliable freight transportation and often rely upon air freight to send or receive time-sensitive goods. Two important sectors in the Grayson County economy with these characteristics are hospitals and electronics and computer manufacturing. Grayson County has four hospitals among its major employers, which collectively employ approximately 4,200 workers. The Texoma Regional Medical Center is the largest hospital with approximately 3,000 workers. The largest technology employer in Grayson County is Texas Instruments, which has 900 workers. Finisar is opening a new facility in Grayson County and is expected to employ 500 workers when fully staffed.

Table 3.5 Freight Sensitive Major Employers in Grayson County

Company	Industry	Employees
Texoma Regional Medical Center	Hospital	3,000
Texas Instruments	Semiconductors	900
Wilson N. Jones Regional Medical Center	Hospital	792
Finisar	Electronics	500 ¹
Carrus Hospital	Hospital	205
Baylor Scott & White Surgical Hospital	Hospital	200

Source: Sherman Economic Development Corporation and Denison Development Alliance, 2018.

¹ Anticipated employment.

3.4.2 Freight Carriers and Logistics

Grayson County's freight customers are served by a number of locally-based freight carriers. Some carriers represent regional or national trucking firms, while others are smaller local firms that may have only a few or even one driver. Freight carriers with a larger presence in Grayson County, which includes a cross-docking facility are:

- ABF Freight Systems (Sherman).
- Central Freight Lines (Sherman).
- Con-Way Southern Express (Sherman).
- Fed-Ex Freight.
- Stanford Trucking.
- SAIA Motor Freight Lines (Sherman).
- Southeastern Freight Lines (Sherman).
- YRC Freight (Sherman).

Grayson County is also served by the Union Pacific and BNSF railroads. There is also service by two short lines: the Dallas, Garland & Northeastern Railroad (DGNO) and the Texas Northeastern Division (TNER). Both short line railroads are owned and operated by Genesee & Wyoming, Inc.

3.4.3 Warehousing and Distribution

Despite Grayson County's proximity to the Dallas-Fort Worth region and that region's importance for warehousing and distribution—locally, regionally, and nationally—Grayson County has not yet developed into a major warehousing and distribution center, even though it has abundant land and low wages. The only major distributor is Douglass Distributing (300 workers), which delivers fuel and goods for convenience stores. One challenge may be that Grayson County is still too far from the Metroplex to serve efficiently. However, as Collin County continues to grow northward, it is anticipated that Grayson County will be considered a more attractive location for distribution activities.

3.4.4 Commodity Movements

The movement of commodities to and from Grayson County is generated through consumption by local residents and economic activity. This activity was quantified using two sources: TRANSEARCH and the FHWA's Freight Analysis Framework (FAF). TRANSEARCH is reported at the county level for truck and "other" modes; however it is aggregated to larger regions for rail flows. To account for this shortcoming, FAF supplied rail estimates. The FAF is reported in multi-county regions, and was disaggregated to isolate the rail flows for Grayson County. TRANSEARCH and FAF flows are developed using different methods and cannot be directly compared; however, both data sources were used in this analysis to better understand the level of freight activity, top commodities and supply chains, and trading partners for Grayson County.

In total, an estimated 7.2 million tons valued at \$7 billion moved into, out of, or within Grayson County in 2015. Outbound tonnage accounted more than half of tonnage and value, reflecting the strong manufacturing sector in Grayson County. Inbound freight comprises 47 percent of tonnage and 41 percent of value, and only 3 percent of freight is estimated to move within the county. Freight flows by direction are shown in Table 3.6.

Table 3.6 Total Commodity Flows in Grayson County, 2015

Direction	Tonnage	Percent of Tonnage	Value	Percent of Value
Inbound	3,341,925	46.6%	\$2,878,719,336	41.1%
Outbound	3,614,719	50.4%	\$3,952,392,722	56.4%
Within	215,597	3.0%	\$176,322,980	2.5%
Total	7,172,241	100.0%	\$7,007,435,039	100.0%

Source: IHS Global Insight, TRANSEARCH, 2015. Federal Highway Administration, Freight Analysis Framework, 2016.

The top commodities by weight in the county are shown Table 3.7. These commodities are typically heavy, relatively low value commodities such as minerals, waste, or stone. Grayson County also has a large percentage of tonnage in the food and farm products commodity groups reflecting local industries and facilities. By comparison, the statewide top commodities include similar low value commodities with the addition of petroleum, chemicals, and secondary traffic.¹⁰

¹⁰ Secondary traffic is mainly last mile or warehousing and distribution delivery shipments.

Table 3.7 Top Commodities by Tonnage
2015

Grayson County		Texas	
Commodity	Percent of Tonnage	Commodity	Percent of Tonnage
Nonmetallic Minerals	37%	Petroleum or Coal Products	21%
Waste or Scrap Materials	14%	Nonmetallic Minerals	14%
Food or Kindred Products	10%	Chemicals or Allied Products	13%
Farm Products	8%	Secondary Traffic	8%
Clay, Concrete, Glass or Stone	7%	Clay, Concrete, Glass or Stone	7%
All Others	24%	All Others	37%
Total	100%	Total	100%

Source: IHS Global Insight, TRANSEARCH, 2015. Federal Highway Administration, Freight Analysis Framework, 2016.

The commodities shown in Table 3.7 affect the transportation network due to truck volume and accelerated roadway deterioration. However, these commodities do not necessarily result in the largest economic impact in the county. Grayson County's large manufacturing sector means there is a variety of sectors that are contributing to regional freight flows. Table 3.8 shows TRANSEARCH estimates of the inbound, outbound, and intra-county movement of select commodities in Grayson County during 2015. These commodity groupings were chosen to align with many of the major freight generating employers in Grayson County.

Food and farm products collectively accounted for more than 40 percent of freight by value in Grayson County in 2015 (18 percent of weight) at \$2.8 billion. The high value of this industry aligns with the almost 3,000 workers in Grayson County employed by food manufacturers. Inbound flows of farm products comprised nearly 10 percent of value (6 percent of tonnage), and outbound flows of food products comprised more than 20 percent of value (6 percent of tonnage). The second largest sector was rubber and miscellaneous products, which accounted for 20 percent of the value and 4 percent of the tonnage of commodities moved in the region. Rubber and plastics are incorporated into the manufacturing process of many products, as well as by firms like Presco Products, which produce plastics-based goods. The remainder of the table shows the other selected commodities.

Table 3.8 Movements of Major Freight Commodities in Grayson County
2015

Commodity Group	Tonnage	Share of County Tonnage	Value	Share of County Value
Food or Kindred Products				
Inbound	260,493	3.6%	\$589,228,042	8.4%
Outbound	404,983	5.6%	\$1,423,047,560	20.3%
Within	34,207	0.5%	\$117,556,201	1.7%
Total	699,683	9.8%	\$2,129,831,804	30.4%

Commodity Group	Tonnage	Share of County Tonnage	Value	Share of County Value
Rubber or Miscellaneous Plastics				
Inbound	48,011	0.7%	\$217,860,019	3.1%
Outbound	254,357	3.5%	\$1,205,366,231	17.2%
Within	596	0.0%	\$2,619,882	0.0%
Total	302,965	4.2%	\$1,425,846,132	20.3%
Farm Products				
Inbound	436,187	6.1%	\$678,604,782	9.7%
Outbound	146,115	2.0%	\$47,382,723	0.7%
Within	3,927	0.1%	\$4,351,213	0.1%
Total	586,228	8.2%	\$730,338,718	10.4%
Machinery				
Inbound	8,982	0.1%	\$98,854,783	1.4%
Outbound	23,785	0.3%	\$271,179,676	3.9%
Within	995	0.0%	\$11,095,849	0.2%
Total	33,761	0.5%	\$381,130,308	5.4%
Fabricated Metal Products				
Inbound	24,605	0.3%	\$94,775,602	1.4%
Outbound	64,248	0.9%	\$268,593,439	3.8%
Within	3,351	0.0%	\$11,821,857	0.2%
Total	92,203	1.3%	\$375,190,898	5.4%
Primary Metal Products				
Inbound	82,237	1.1%	\$137,579,237	2.0%
Outbound	48,378	0.7%	\$98,330,394	1.4%
Within	1,270	0.0%	\$3,267,700	0.0%
Total	131,885	1.8%	\$239,177,331	3.4%
Transportation Equipment				
Inbound	25,089	0.3%	\$162,072,632	2.3%
Outbound	9,265	0.1%	\$15,105,620	0.2%
Within	836	0.0%	\$1,254,198	0.0%
Total	35,191	0.5%	\$178,432,450	2.5%
Chemicals or Allied Products				
Inbound	38,670	0.5%	\$108,161,438	1.5%
Outbound	22,909	0.3%	\$31,200,592	0.4%
Within	2,006	0.0%	\$2,621,283	0.0%
Total	63,585	3.1%	\$141,983,313	2.0%

Commodity Group	Tonnage	Share of County Tonnage	Value	Share of County Value
Lumber or Wood Products				
Inbound	64,311	0.9%	\$27,607,179	0.4%
Outbound	37,964	0.5%	\$50,876,913	0.7%
Within	931	0.0%	\$1,846,080	0.0%
Total	103,206	1.4%	\$80,330,172	1.1%
Leather or Leather Products				
Inbound	1,771	0.0%	\$34,984,681	0.5%
Outbound	4,809	0.1%	\$41,853,531	0.6%
Within	196	0.0%	\$1,611,856	0.0%
Total	6,777	0.1%	\$78,450,068	1.1%

Source: IHS Global Insight, TRANSEARCH, 2015. Federal Highway Administration, Freight Analysis Framework, 2016.

The TRANSEARCH and FAF data also provide estimates of how much tonnage of each selected commodity is moved by transportation mode. A summary of these data is provided in Table 3.9. It is estimated that the vast majority of freight movements in Grayson County occur by truck, with a relatively small percentage moving by rail. Commodity groupings with largest share of movements by rail are chemical and allied products (90 percent), fabricated metal products (38 percent), and primary metal products (20 percent). Notably, relatively small portions of food and farm products move by rail. The truck and rail estimates presented below are not directly comparable due to the use of two different data sources for these estimates. However, they are presented together here to illustrate which industries and movements are most truck-dependent, and which use rail more heavily than others.

Finally, Table 3.10 shows the top trading partner for each commodity. Within Texas, origins and destinations are disaggregated to the county, but outside of Texas they are reported at the state or country level. Most top trading partners are urban counties within Texas (Dallas, Harris, and Tarrant counties) or nearby states (Oklahoma, Louisiana, and Arkansas). Mexico was the largest trading partner for primary metal products, inbound machinery, and inbound transportation equipment. This trade flow reflects the closely linked advanced manufacturing supply chain between Texas and Mexico.

Table 3.9 Commodity Movements in Grayson County by Transportation Mode

Commodity Group	Percent Tonnage Truck	Percent Tonnage Rail ¹	Percent Tonnage Other
Food or Kindred Products			
Inbound	88%	12%	0%
Outbound	100%	0%	0%
Within	100%	0%	0%
Total	95%	5%	0%
Rubber or Miscellaneous Plastics			
Inbound	96%	4%	0%
Outbound	95%	5%	0%

Commodity Group	Percent Tonnage Truck	Percent Tonnage Rail ¹	Percent Tonnage Other
Within	97%	3%	0%
Total	96%	4%	0%
Farm Products			
Inbound	88%	12%	0%
Outbound	94%	6%	1%
Within	100%	0%	0%
Total	92%	7%	1%
Machinery			
Inbound	82%	18%	0%
Outbound	96%	4%	0%
Within	100%	0%	0%
Total	93%	7%	0%
Fabricated Metal Products			
Inbound	55%	45%	0%
Outbound	68%	26%	5%
Within	100%	0%	0%
Total	60%	38%	2%
Primary Metal Products			
Inbound	75%	25%	0%
Outbound	92%	8%	0%
Within	100%	0%	0%
Total	80%	20%	0%
Transportation Equipment			
Inbound	80%	20%	0%
Outbound	85%	15%	0%
Within	100%	0%	0%
Total	82%	18%	0%
Chemicals or Allied Products			
Inbound	32%	68%	0%
Outbound	6%	94%	0%
Within	41%	59%	0%
Total	10%	90%	0%
Lumber or Wood Products			
Inbound	82%	18%	0%
Outbound	99%	1%	0%
Within	100%	0%	0%
Total	88%	12%	0%

Commodity Group	Percent Tonnage Truck	Percent Tonnage Rail ¹	Percent Tonnage Other
Leather or Leather Products			
Inbound	100%	0%	0%
Outbound	98%	0%	2%
Within	100%	0%	0%
Total	99%	0%	1%

Source: IHS Global Insight, TRANSEARCH, 2015. Federal Highway Administration, Freight Analysis Framework, 2016.

¹ Rail forecasts may not be directly comparable to highway forecasts and are presented for comparison only.

Table 3.10 Primary Trading Partners with Grayson County by Select Industry Sector

Commodity Group	Top Trading Partner by Tonnage	Top Trading Partner by Value
Food or Kindred Products		
Inbound	Dallas County	Kansas
Outbound	Dallas County	Kansas
Rubber or Miscellaneous Plastics		
Inbound	Louisiana	Louisiana
Outbound	Harris County	Harris County
Farm Products		
Inbound	Oklahoma	Oklahoma
Outbound	Dallas County	Tarrant County
Machinery		
Inbound	Mexico	Mexico
Outbound	West Virginia	West Virginia
Fabricated Metal Products		
Inbound	Harris County	Canada
Outbound	Dallas County	Canada
Primary Metal Products		
Inbound	Mexico	Mexico
Outbound	Mexico	Mexico
Transportation Equipment		
Inbound	Mexico	Mexico
Outbound	Tarrant County	Mexico
Chemicals or Allied Products		
Inbound	Harris County	Tarrant County
Outbound	Dallas County	Dallas County

Commodity Group	Top Trading Partner by Tonnage	Top Trading Partner by Value
Lumber or Wood Products		
Inbound	Arkansas	Arkansas
Outbound	Dallas County	Dallas County
Leather or Leather Products		
Inbound	California	California
Outbound	Cooke County	Cooke County

Source: IHS Global Insight, TRANSEARCH, 2015. Federal Highway Administration, Freight Analysis Framework, 2016.

3.4.5 Intraregional Supply Chains

Freight-oriented production activities (such as manufacturing, mining, or agriculture) require the use of multiple inputs and, typically, some or many of them must be imported into the regional economy.¹¹ Understanding where these inputs come from is useful for economic development purposes, since sourcing locally produced inputs can generate more local economic activity. It is also relevant and important for understanding regional freight flows. However, most firms consider their sourcing data to be proprietary information and they are unwilling to share it. As a result, there is typically little data about intraregional supply chains for freight planners to incorporate into their analysis. To address this deficiency, the project team explored two data sources. The first source was simply to ask firms and other knowledgeable parties if they would report it. These questions were relayed during the stakeholder interviews and during the first Freight Advisory Committee Meeting. A few of the participants described instances of intraregional supply chains, although some of the examples they reported are no longer active. The second source of information came from the industry linkages information incorporated into IMPLAN's regional model for Grayson County.

To calculate the output of economic activity, Input-output models contain tables showing the inputs necessary for production. Based on information incorporated into the model from Federal and state sources, assumptions are made about the amount of each input that is sourced from the local economy and the amount that must be sourced from outside of the region. To understand a local industries' linkages to other local sectors, employment growth (i.e., Adding 100 new employees) was assumed for key freight-related sectors and the IMPLAN model estimated the impacts of this stimulus on the other sectors of the Grayson County economy.

The results of the analysis for the semiconductor manufacturing industry are shown below in Table 3.11 and for the remaining sectors in Appendix C. The indirect employment impacts, which show the backward linkages from production in the semiconductor manufacturing sector to the other sectors of the Grayson County economy, are ranked to show the top ten affected sectors. Most the local labor inputs come from service sectors and are not necessarily freight-related, with the exceptions of wholesale trade and truck transportation. This pattern was a common finding in the analysis of the manufacturing sectors. This finding also appears to confirm the information provided during the stakeholder interviews and during the first Freight Advisory Committee meeting that most local industries received their inputs from outside of Grayson County and sold most of their output outside of it, as well. The construction sectors had more impacts on the

¹¹ In the context of this discussion, "imported" could mean an input is brought into the region from another domestic regional economy or it can be brought from an international economy.

retail sectors, which would generate freight, and the agricultural and food manufacturing sectors and the oil and gas sectors had a greater influence on other freight related sectors in the local economy.

Table 3.11 Industry Linkages for the Semiconductors Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Business support services	0.00	8.20	0.52	8.73
2	Services to buildings	0.00	7.45	2.09	9.53
3	Wholesale trade	0.00	6.65	1.34	8.00
4	Employment services	0.00	5.27	1.22	6.49
5	Maintenance and repair construction of nonresidential structures	0.00	4.83	0.55	5.38
6	Management of companies and enterprises	0.00	4.54	0.29	4.84
7	Investigation and security services	0.00	3.68	0.38	4.06
8	Other support services	0.00	3.21	0.16	3.37
9	Landscape and horticultural services	0.00	2.11	0.72	2.83
10	Truck transportation	0.00	1.81	0.61	2.42
TOTAL EMPLOYMENT IMPACTS ALL SECTORS		100.0	76.0	98.4	274.4

Source: Derived from IMPLAN, 2018.

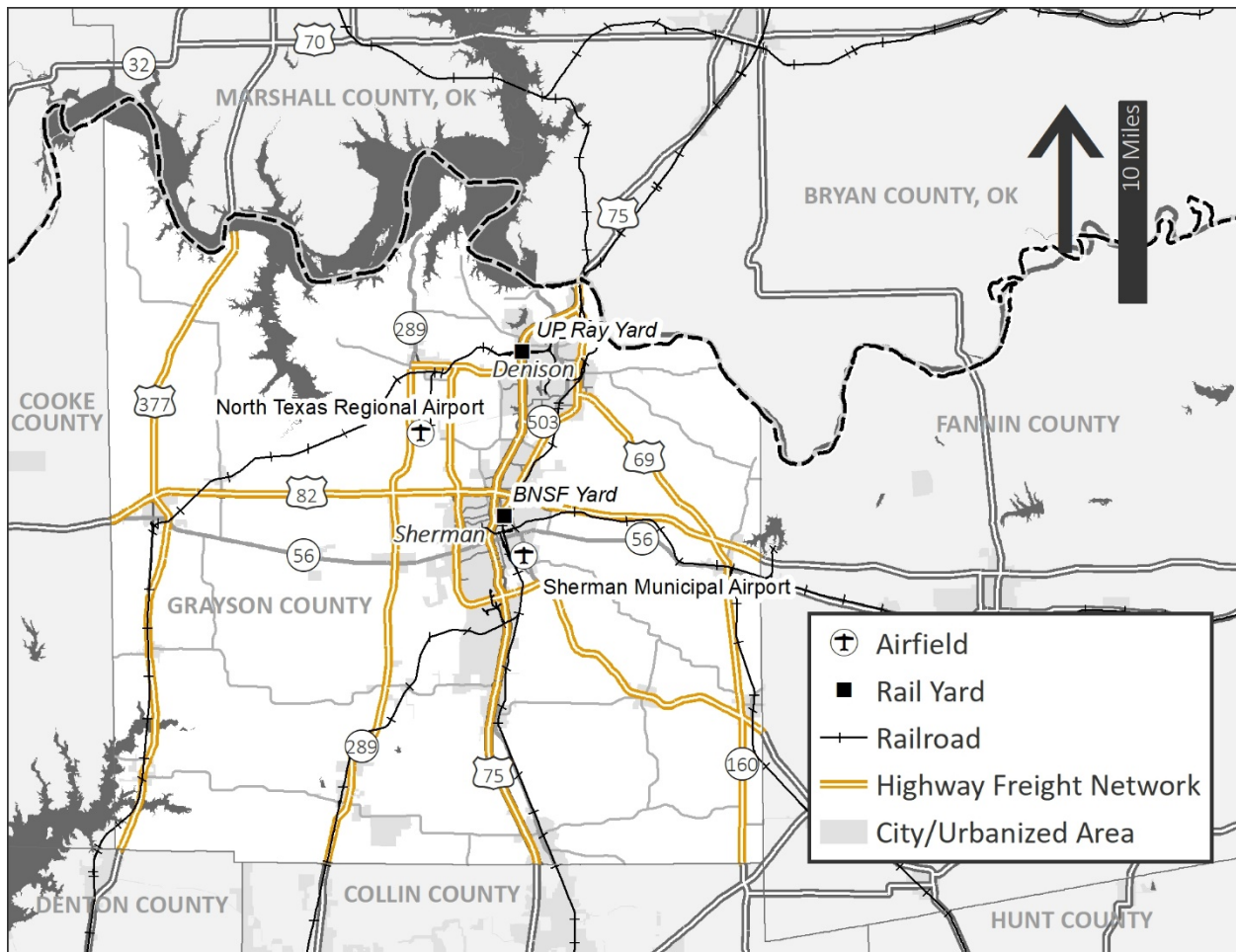
4.0 Recommendations

The 2018 Grayson County Freight Mobility Plan culminates in a countywide freight network and a set of infrastructure recommendations for that network, as well as policy and programming recommendations for Grayson County and the Sherman-Denison MPO. This chapter details these findings and recommendations.

4.1 Grayson County Multimodal Freight Network

The Grayson County Multimodal Freight Network builds off of the Texas Multimodal Freight Network by adding facilities of local and regional significance to the existing set of highways and railroads on the statewide network. The resulting network includes all railroad facilities, the North Texas Regional Airport, the Sherman Municipal airport, and major highway facilities within the region, including: U.S. 75, U.S. 82, U.S. 69, U.S. 377, SH 289, SH 91, SH 160, Spur 503, FM 1417, and FM 120.

These facilities were selected from the infrastructure evaluated this plan based on their role in freight transportation and stakeholder input. The network builds upon the Texas Multimodal Freight Network developed by the Texas Department of Transportation (TxDOT) to include additional roadways serving local and regional freight generators and traffic as well as two additional airports. Each of the transportation assets shown in Figure 4.1 serves freight transportation in Grayson County by moving a significant amount of freight, providing a connection to businesses or intermodal opportunities, or providing an alternate route for freight.

Figure 4.1 Grayson County Multimodal Freight Network

Source: TxDOT Open Data Portal; Bureau of Transportation Statistics.

4.2 Highway Needs and Recommendations

The majority of freight needs, recommendations, and projects in the County are found on the highway system. The following subsections identify specific types of needs (mobility and reliability, bridge vertical clearance and condition, east-west connectivity, and safety), as well as planned and potential projects on the highway system.

4.2.1 Mobility and Reliability

The resulting highway needs are shown in Figure 4.2. The most congested segments of U.S. 75 are located near interchanges at Spur 503 and SH 91; however, the entire corridor is at least moderately congested. Segments of U.S. 75, SH 289, SH 91, and Spur 503 have a buffer time index greater than 0.5, indicating that during at least one time of day, shippers must plan 1.5 times the normal drive time to ensure on-time delivery. Additionally, the turning radii at U.S. 75 and U.S. 82 was identified as a challenge for trucks, causing traffic to back up behind them.

Several planned projects in Grayson County address freight mobility and reliability, including completion of the “gap” project. This project addresses a 4.5-mile stretch of U.S. 75, the only section in Texas that does not meet interstate standards, and is expected to start construction in September 2019. Construction of ramp reconfigurations on U.S. 75 at Spur 503 is planned to begin in August 2019, and another ramp project funded by the City of Sherman is planned at FM 1417. Interchange improvements at U.S. 75 and U.S. 82 to address congestion and turning radii are planned for September 2019.

In addition to projects on U.S. 75, FM 1417 (Heritage Parkway) is planned to be widened to four lanes between U.S. 82 and SH 56 beginning in August 2019, and a new spur is planned in the southwest corner of the County. The spur is aligned with existing and planned segments of the Dallas North Tollway and is designed to integrate into a future extension of the tollway into Grayson County.

4.2.2 Bridge Vertical Clearance and Conditions

Bridges over U.S. 75 and U.S. 69 were identified by stakeholders as an obstacle to moving oversized trucks in Grayson County. Three bridges over U.S. 69 cause truck traffic to divert off of the highway and through cities on local streets in Bells and Whitewright. Two of these bridges are owned by the G & W Railroad and will require coordination to improve. Additionally, there are eight bridges on U.S. 75 that are below 16'6" in at least one direction with a cluster between U.S. 82 and SH 56. Seven vertical clearance issues on U.S. 75 between FM 1417 and SH 91 will be addressed during the gap project (beginning September 2019). Two bridges on U.S. 377 are also below this threshold. However, upgrading these bridges is a lower priority due to lack of stakeholder input and less truck traffic in the western portion of the County. Additionally, the U.S. 377 bridge over Lake Texoma provides limited connectivity between Texas and Oklahoma in the western part of the County due to its narrow and outdated design. The Oklahoma Department of Transportation is funding bridge and approach replacements on U.S. 377 over Lake Texoma. However, the timeline of this project is unknown due to water resource issues and coordination efforts with the U.S. Army Corps of Engineers.

4.2.3 East/West Connectivity

While there are multiple north/south routes in the County, only one major east/west route exists: U.S. 82. Additional east/west connections between major roadways and in the southern portion of the County will improve freight mobility by providing reasonable route alternatives and connecting markets within the County. FM 902 and FM 121, particularly between the Grayson Parkway spur (under development) and U.S. 75, are both east/west priorities identified as principal arterials in the Grayson County Thoroughfare Plan. In some cases, discontinuous roadways through a city or town complicate freight movement and are a barrier to east/west connectivity. For example, FM 902 intersects with U.S. 377 in Collinsville. The segment of FM 902 to the west of U.S. 377 is a quarter-mile south of the segment to the east, requiring traffic to zig-zag through town.

A segment of a bypass around Gunter is planned for fiscal year 2022 to address east/west mobility on FM 121 east of SH 289, and once complete will eliminate two sharp turns in the through route. The continuation of the project west of SH 289 is unfunded. This project will remove through-traffic from the town's Main Street. Similar projects are planned for FM 902 in Howe and Tom Bean and for FM 121 in Van Alstyne beginning in fiscal year 2022.

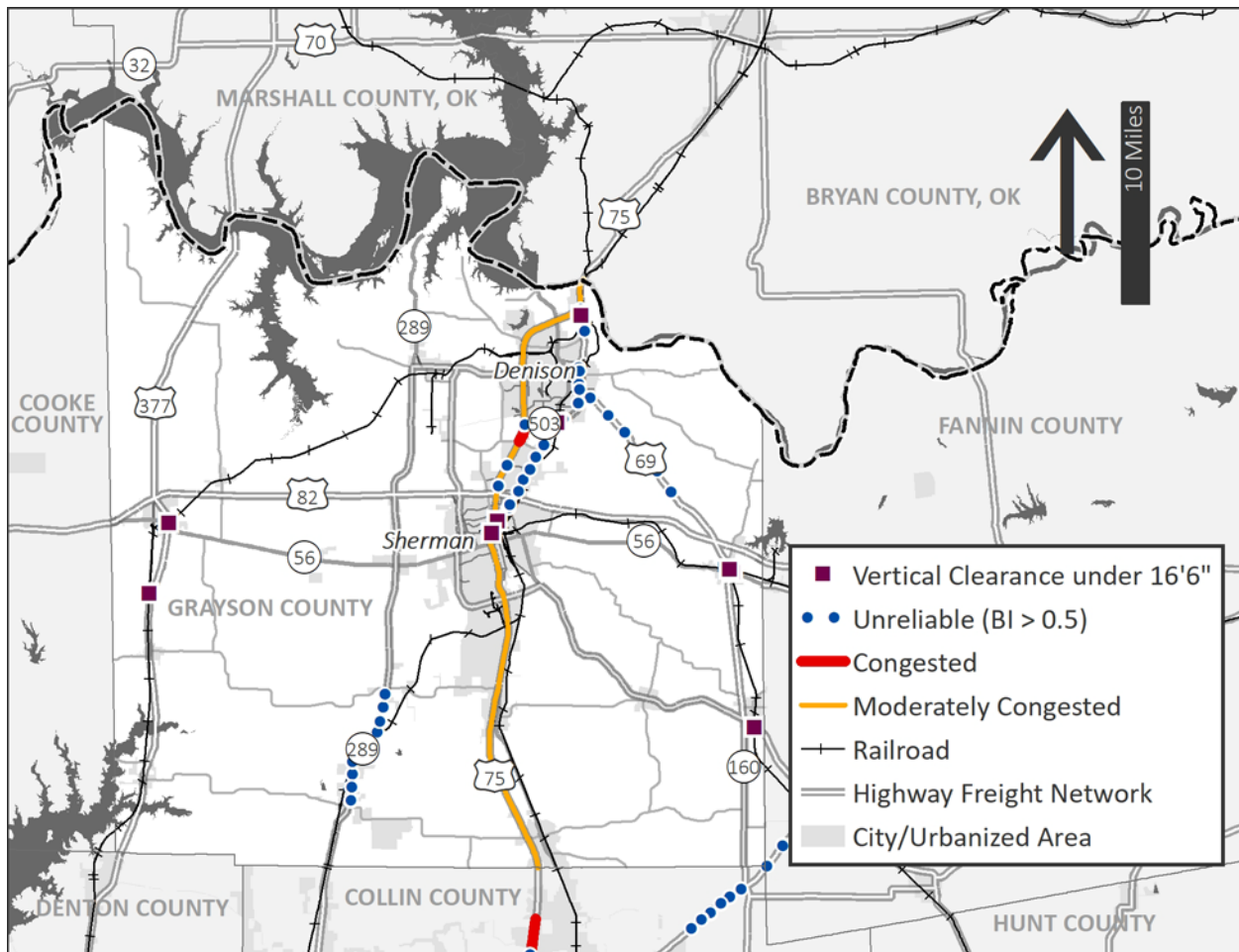
4.2.4 Safety

Safety issues are often caused on roadways where infrastructure is not designed for current traffic volumes or mixes. Most traffic, as well as crashes involving commercial vehicles (CMV) in Grayson County are

located on or near U.S. 75. U.S. 75 was initially designed as a 45-mph roadway and its design does not reflect the level and speed of traffic today. The gap project FM 1417 to SH 91 and ramp relocations at Spur 503 and FM 1417 will address these issues beginning in fall 2019. U.S. 82 west of U.S. 75 is also a top location for CMV crashes. This is a four-lane divided highway with a grass median with a speed limit of 70 mph. Driveways for businesses and residences are directly connected to the highway, requiring passenger vehicles and trucks to accelerate and decelerate in the main lanes of the highway.

Additionally, stakeholders identified grade changes and hills as challenges for trucks entering and exiting facilities due to visibility, increasing or decreasing speed of traffic on inclines, and low truck clearance preventing vehicles from overcoming sudden grade changes. Ramp spacing can also present a challenge to trucks if sightlines are poor or ramps are close to the facility they are accessing. Abrupt movements from lane changes, roadway curves, or traffic interactions are more dangerous for trucks carrying liquid loads as the shifting weight of the load can cause rollovers. Two of the problem areas identified were the U.S. 75/FM 84 interchange and SH 56 at Friendship Road.

Figure 4.2 Highway Needs in Grayson County



Source: TxDOT Open Data Portal; National Performance Management Research Data Set; Bureau of Transportation Statistics.

4.2.5 Highway Freight Priority Projects

The following sections summarize highway freight project priorities in Grayson County. There are thirteen projects that are planned and funded, and 38 projects that are unfunded. Appendix B contains a full list of freight projects identified by the MPO and stakeholders.

Complete Improvements on U.S. 75

The gap project is widening U.S. 75 from four to six lanes in Sherman (FM 1417 to SH 91); however, the remainder of the four-lane corridor does not have a funded widening project. The TxDOT Paris District has included the segment from SH 91 to FM 120 in its stakeholder outreach conducted as part of Federal environmental regulations in anticipation of a phased implementation. Additionally, two other segments are under development: from U.S. 69 to the state line to the north, and from the County line to FM 902 to the south. In the long-term, increased traffic may warrant development of projects to widen the remaining segments beyond those currently under development, including from the county line to FM 1417 and FM 120 to U.S. 69. The top priority segments are:

- SH 91 to FM 120: Complete current study area.
- FM 120 to US 69: Align roadway with improvements to the south.
- Grayson/Collin County line to FM 1417: Align roadway with improvements to the south.
- US 69 to Oklahoma state line: Align roadway with improvements to the north.

Continuous frontage roads and ramp improvements will enhance performance of the roadway in locations where widening is not yet warranted by improving reliability and increasing access to local businesses. These features will be addressed during planned widening projects. However, they may be advanced as individual projects in locations without a funded project as a near-term mobility solution.

Improve Mobility on Other Highways

Freight mobility projects have been identified for several other corridors in the County for both east/west and north/south corridors. In general, north/south thoroughfare projects are aimed at increasing capacity, and east/west thoroughfare projects are bypasses to create a continuous corridor. Mobility projects are located on the following freight corridors:

- U.S. 82.
- Spur 503.
- SH 289.
- FM 1417.
- FM 121.
- FM 902.
- Grayson Parkway Spur (future tollway alignment).

Additionally, three bridges over U.S. 69 identified by stakeholders are the top priority vertical clearance issues in the County. While additional bridges in the County may create a barrier to movement of large freight in the future, funding replacement of these bridges is a lower priority than meeting existing needs.

4.3 Multimodal Freight Needs and Recommendations

Although the highway system carries the most freight in Grayson County, the County's rail connections and airport are also important to freight movement. These multimodal facilities also have the potential to play a greater role in the County's future economic picture. This section highlights needs and infrastructure recommendations on the rail system and airport.

4.3.1 Rail Infrastructure Recommendations

Grayson County is currently served by UP, BNSF, and regional railroads through the short-line conglomerate G&W. As both UP and BNSF have major facilities in the Dallas region, the infrastructure for Grayson County is typically considered "through" traffic. Most customers or future customers in the County receive rail service via the short-line, which transfers railcars from smaller operators either directly to the destination, or to the cross-county Class I railroads. In Grayson County, the primary constraint for G & W Railroad, which operates two short line railroads, is a complex interchange with the BNSF line for their southbound traffic. Trains currently are limited to 75 cars due to available track length, though 110-car train capacity is desired. In addition to limiting the capacity of a single train, turning the train around requires approximately two additional hours of travel time in the County, limiting the weekly capacity of the line.

The railroad also expressed interest in rehabilitating the railroad from Bells to Bonham. While this section is predominantly outside of Grayson County, it could benefit freight businesses in the County by increasing connectivity to regional markets. Finally, the railroad expressed interest in operations out of Ray Yard, currently owned by UP. Currently, Ray Yard is operating under capacity and there is the opportunity to expand operations by UP or another operator. There is no current project or funding sources identified for these needs.

4.3.2 Air Infrastructure Recommendations

The North Texas Regional Airport (NTRA) recently completed a series of projects to increase capacity through a second runway and to become eligible for the Federal Aviation Administration's (FAA) Tower Program. Participation in this program introduces new funding mechanisms and elevates the status of the airport on the national level. No additional air cargo-related infrastructure investment needs were identified as part of this study; however, economic development investment in the area surrounding the airport was identified as an opportunity and discussed in the next section. The ability to bring in international goods to the airport was also identified as a need; coordination with U.S. Customs and Border Protection and the addition of a Customs Agent at the airport will be needed.

4.4 Policy and Program Recommendations

In addition to the infrastructure projects identified above, there are a number of opportunities for the County to positively impact freight within the region through strategic policies and partnerships. Eight recommendations are presented below. These recommendations are designed to strengthen the link between regional transportation and economic development activities, engage regional stakeholders, and position the County and the region for continued growth and investment.

4.4.1 Transportation Policy and Partnerships

Continue to Engage Stakeholders

The Sherman-Denison MPO has an opportunity to increase its role to serve as a regional, strategic leader and focal point on issues related to transportation and economic growth. Implementation of these recommendations will need strengthening—and in some cases formalizing—partnerships between regional players—both in the public and private sector. Involving local stakeholders and business leaders in the investment process is critical, as it both creates “buy-in” at the local level, but also gives the public sector agencies a channel to gather critical information from the users of the system.

As part of this freight plan, the MPO formed a Freight Advisory Committee (FAC) that met at the beginning and near the end of the project to identify issues and needs, discuss opportunities, and vet recommendations and projects. The MPO should continue to engage the FAC when undertaking additional freight related activities or at other key points when local input or support is desired. While regular meetings may not be necessary when activities are lighter, other communications tools like mailing lists, newsletters or briefings can help keep stakeholders engaged in the process.

Reduce impacts of OSOW Vehicles

Oversize and overweight (OSOW) vehicles create an oversized impact on local communities. Policies and regulations surrounding these vehicles can promote or hinder economic growth. During the 85th Texas Legislature, OSOW regulations were generally broadened to permit greater movement of OSOW vehicles, including increasing certain weight limits near the Arkansas state line (HB 2319), increasing the authorized areas for OSOW permits near ports (HB 4156, SB 1291), and preventing municipalities from restricting certain OSOW movements near ports (SB 1524).¹² While these changes do not affect Grayson County directly, the trend toward expansion of OSOW permits is expected to continue in future legislative sessions, particularly near intermodal port and rail facilities. To prepare for these potential changes, Grayson County may consider evaluating bridge conditions near rail facilities.

In Grayson County, there have been numerous hindrances or close calls due to undesirable OSOW routing through communities like Tom Bean, where a 150-foot methane extractor was routed on FM 902. OSOW vehicles or loads require a permit from the Texas Department of Motor Vehicles (TxDMV), and certain loads require route inspections from TxDMV as well. Grayson County should collaborate with TxDMV to ensure that the department’s preferred OSOW routes align with available infrastructure. Additionally, as Grayson County is at and near the border of other states, the MPO should support efforts for OSOW harmonization with neighboring states such as Oklahoma and Arkansas.

Pursue Strategic Land Use and “Smart Growth”

Grayson County is expected to experience continued to increasing population growth over the next decades. State demographers estimate the County’s population will grow from over 130,000 in 2017 to more than 180,000 in 2050.¹³ Estimates by the MPO forecast the population to grow as high as 335,000 by 2050¹⁴. This

¹² TxDOT, 85th Legislature 2017, Summary of Enacted Legislation. <https://ftp.dot.state.tx.us/pub/txdot-info/sla/85th-legislative-summary.pdf>.

¹³ Source: Texas State Data Center and U.S. Census Bureau, 2018.

¹⁴ <https://www.heralddemocrat.com/news/20180210/grayson-population-to-surpass-330k-by-2050>.

population growth is projected in part due to growth in and around the Metroplex and North Texas. Already, this growth has led to increased competition for land, particularly in prime locations near transportation and commercial infrastructure. Typically, these growth patterns can lead to residential and commercial developments supplanting previously industrial land. However, many times this competition leads to industrial and freight generating facilities, which are critical job-creators and economic drivers, being pushed onto less desirable parcels at the fringes of a community—or beyond. This creates challenges for businesses such as reduced access to multimodal facilities or services, as well as for the public sector and residents as this shift can lead to increased congestion and reduced access to jobs.

Preserving industrial zoned land and/or promoting mixed use development can help alleviate some growth challenges that may soon face Grayson County. While not directly in charge of zoning regulations, the MPO can be a local leader in zoning decisions such as:

- Ensuring that appropriate land with access to rail lines is reserved for industrial businesses.
- Reducing conflicts between residential and industrial land use and users through enacting barriers, access roads, or other strategic zoning decisions.
- Supporting mixed-use or multi-purpose developments that preserve workforce access to jobs.

Support Infrastructure Connections to Major Markets

An effective freight network enables the movement of goods through mobility, reliability, and connectivity. There are a number of projects being undertaken by TxDOT, nearby regions, and by neighboring states that have significant impacts to Grayson County businesses and customers. It will be important for the County to monitor (and participate, as needed) in these efforts to ensure that connections to these markets are maintained and enhanced.

The most proximate of these are major improvements to U.S. 75, as detailed in the TxDOT workplan. In addition, TxDOT, the North Texas Tollway Authority, and the Grayson County Regional Mobility Authority are conducting studies on extending the Dallas North Tollway through the county.¹⁵ The Grayson County Thoroughfare Plan identifies additional corridors which will serve as the future transportation network.

In addition, it will be important to monitor and/or coordinate with Oklahoma DOT activities. Grayson County is connected to the major markets of Tulsa (and the Port of Catoosa) and Oklahoma City. U.S. 69/U.S. 75 is highlighted as key freight corridors in ODOT's Freight Plan. These roadways are also a major safety concern, as they are (1) used extensively by the U.S. Military for transport of hazardous materials, including munitions and (2) has an unusually high rate of crashes per mile traveled.¹⁶ ODOT has about \$121 million in work planned for U.S. 69/U.S. 75 between Calera and the U.S. 70 interchange as part of its 2018-2025 CWP. This section has many at-grade intersections, and is considered a bottleneck (and is one of the few non-urban bottlenecks in the Freight Plan).¹⁷

¹⁵ While tolling agreements can potentially be effective public-private partnerships and project finance mechanisms, the Texas Transportation Commission is not currently permitting inclusion of any tolled projects in the state's Unified Transportation Program, the 10-year funding document for major transportation projects in the state.

¹⁶ https://ok.gov/odot/documents/OKFreightPlan2018_2022.pdf.

¹⁷ http://www.odot.org/cwp-8-year-plan/cwp_ffy2018-ffy2025/8_year_cwp_division2_map.pdf.

4.4.2 Economic Development Related Recommendations

Increase Rail Access and Traffic

Grayson County is currently served by UP, BNSF, and regional railroads through the short-line conglomerate G&W. With under-utilized rail facilities and available land that is or could be rail-served, there is the opportunity to increase rail-served industries in the region. In particular, the UP-owned Ray Yard is operating well under capacity, and opportunities may exist to lease part of that yard to increase rail service. There are also industrial areas in at least three areas of the County: near the airport, downtown Sherman, and downtown Denison that are no longer active users of the rail lines; however the infrastructure still exists and could potentially be revitalized in partnership with a rail-focused economic development program.

G&W also noted that the North Texas market in general, including Greenville, Sherman, McKinney in particular are areas where they see continued growth. As described above, the connection from Bells to Bonham (currently not in use) is also a potential growth area, and investment in a Denison Wye to reduce the constraining maneuvering faced by the G&W operations can increase rail mobility in the region. These, along with exploration of investing or re-investing in rail served facilities can help increase the attractiveness of the region to rail-served industries.

Leverage the Airport for Economic Development

The Grayson County-owned North Texas Regional Airport (formerly Perrin Air Force Base, then Grayson County Airport; ICAO identifier KGYI) has several potential economic development opportunities. The airport has multiple runways, a control tower, relatively unobstructed airspace, available land and facilities previously used by the military, and is located close to U.S. 75 and both Sherman and Denison. These factors position the airport well for a variety of “on-airport” opportunities, including military and/or civilian training aviation training or maintenance programs. To support these efforts and reduce the overall burden of the airport on the community, the airport is working to improve its Air Traffic Control facilities and join the Federal Aviation Administration’s Contract Tower Program. Support from the FAA would reduce county operating obligations to the airport.¹⁸

At the same time, the MPO should explore opportunities to support logistics and freight-related business development around the airport. The region’s proximity to the Metroplex, strengths in existing industry, and latent airport capacity could provide a welcome base to a number of industries, including those whose supply chains include air cargo. The MPO should further study the opportunity to develop an air-served multimodal industrial hub and/or industrial district near the airport. Future studies could examine the market proposition and requirements of potential industries, role of the MPO and County in economic development efforts, and coordination opportunities with local and state economic development agencies to develop a realistic development plan for both on- and off-airport sites.

Study Manufacturing and Logistics-based Economic Opportunities

With the continued growth of its population, location in relative proximity to the Metroplex, and strong industrial base, Grayson County has the opportunity to grow and diversify its economy by leveraging its transportation infrastructure, strengths in existing industries and workforce to support existing employers and attract new businesses. While it has strengths in a diverse existing industrial base, the region is currently

¹⁸ <http://www.heralddemocrat.com/news/20180628/grayson-approves-new-contract-with-texas-aviation-partners-for-ntra>.

struggling with low wages combined with low unemployment. These dual-indicators mean that it will be vitally important for the County to attract higher-wage jobs in order to compete in a strong suburban and ex-urban market surrounding the Metroplex.

A focused study on the opportunity to attract business through targeted, regionally-focused investments or policies that leverage the trade gateways—U.S. 75, Class I and short line rail service, and the regional airport, can help the County and MPO identify the best use of its resources and partnerships to support a robust manufacturing, industrial, and agricultural economy and bring in high-wage, quality jobs.

Prioritize Workforce Development

As noted in the previous recommendation, the region is in need of high-wage jobs to support a growing economy. This can be achieved through a number of strategies that work together to reach a scale of economic activity and supply chain efficiency that fully utilizes the region's freight assets. At the same time that economic development efforts are focused on supporting, retaining, and attracting industries, complementary efforts should ensure the availability of a highly-trained workforce and access to jobs, including first- and last-mile connections for workers who do not have access to a personal automobile.

There are a number of existing programs related to workforce development in the County. Grayson College provides workforce development and occupational training based on employment growth areas identified by Workforce Texoma and through collaboration with local businesses. Currently, manufacturing technicians are among the highest growth and wage occupations in the region due to the presence of existing technology manufacturers and attraction of new firms such as Finisar. Coordination among these programs, the MPO, County, and local businesses is critical to provide a strong workforce to support local employment and economic development efforts in the region.

5.0 Funding Opportunities

This section provides an overview of potential funding opportunities available to Grayson County for capital infrastructure and transportation planning projects. While not an exhaustive list, the sources detailed here include major programs at the state and Federal level typically available to infrastructure investments and projects such as those identified as part of this plan.

5.1 TxDOT Funding Categories

TxDOT funnels its available funding through 12 categories, shown in Figure 5.1. These categories direct Federal, state, and local funds into buckets organized by the types of projects funded by each category. Each category is described below with information on potential corridors and projects that could be funded in Grayson County.

Figure 5.1 TxDOT Funding Categories

FUND DEFINITIONS	12 FUNDING CATEGORIES	FEDERAL FUNDS	STATE FUNDS	OTHER STATE & LOCAL FUNDS
FEDERAL FUNDS APPROPRIATED BY CONGRESS THROUGH THE FEDERAL HIGHWAY TRUST FUND	1 PREVENTIVE MAINTENANCE AND REHAB	●	●	○
	2 METRO AND URBAN AREA CORRIDORS	●	●	○
	3 NON-TRADITIONALLY FUNDED PROJECTS	○	○	●
STATE FUNDS APPROPRIATED BY THE TEXAS LEGISLATURE THROUGH THE STATE HIGHWAY FUND	4 STATEWIDE CONNECTIVITY CORRIDORS	●	●	○
	5 CONGESTION MITIGATION AND AIR QUALITY*	●	○	○
	6 STRUCTURES REPLACEMENT (BRIDGES)	●	●	○
OTHER STATE & LOCAL FUNDS INCLUDES THE TEXAS MOBILITY FUND, BOND REVENUE, CONCESSIONS AND REGIONAL TOLL REVENUE, AND LOCAL FUNDS	7 METROPOLITAN MOBILITY & REHAB*	●	○	○
	8 SAFETY	●	●	○
	9 TRANSPORTATION ALTERNATIVES*	●	○	○
	10 SUPPLEMENTAL TRANSPORTATION PROJECTS	●	○	○
	11 DISTRICT DISCRETIONARY	●	●	○
	12 STRATEGIC PRIORITY	●	●	○

*CAN INCLUDE STATE/LOCAL FUNDS TO COVER MATCH REQUIREMENTS

Source: TxDOT, 2019 Unified Transportation Program.

- Category 1: Preventative Maintenance and Rehabilitation**—Preventive maintenance and rehabilitation on the existing state highway system, including minor roadway modifications to improve operations and safety; and the installation, rehabilitation, replacement, and maintenance of pavement, bridges, traffic control devices, traffic management systems, and ancillary traffic devices. Projects are selected by districts. The Texas Transportation Commission allocates funds through a formula allocation program. Projects selected for energy-sector distribution/initiatives are managed by the Maintenance Division (MNT). This funding category applies to all state roadways in Grayson County.
- Category 2: Metropolitan and Urban Area Corridor Projects**—Mobility and added capacity projects along a corridor that improve transportation facilities in order to decrease travel time and the level or

duration of traffic congestion, and safety, maintenance, or rehabilitation projects that increase the safe and efficient movement of people and freight in metropolitan and urbanized areas. Projects are selected by MPOs in consultation with TxDOT. The Texas Transportation Commission allocates funds through a formula allocation program. This funding category applies to all state roadways in Grayson County.

- **Category 3: Non-traditionally Funded Transportation Projects**—Transportation-related projects that qualify for funding from sources not traditionally part of the state highway fund including state bond financing under programs such as Proposition 12 (General Obligation Bonds), Texas Mobility Fund, pass-through toll financing, unique Federal funding, regional toll revenue, and local participation funding. Projects are determined by legislation, Texas Transportation Commission approved Minute Order, and local Government commitments.

The Texas Mobility Fund (TMF) could present a funding opportunity for roadways in Grayson County if bonding capacity becomes available. Local governments can coordinate directly with TxDOT districts to request TMF funding. TxDOT evaluates TMF requests on a case-by case basis and funds projects that provide the highest public transportation benefits. Once funding is approved, the local Government will then coordinate with the MPO to ensure the project is listed in regional planning documents.

- **Category 4: Statewide Connectivity Corridor Projects**—Mobility and added capacity projects on major state highway system corridors which provide statewide connectivity between urban areas and corridors, to create a highway connectivity network composed of the Texas Highway Trunk System, National Highway System, and connections from those two systems to major ports of entry. In Grayson County, the following highways are on these networks:
 - Texas Highway Trunk System: U.S. 75 and U.S. 82.
 - National Highway System: U.S. 75 and U.S. 82.
- **Category 6: Structures Replacement and Rehabilitation**—Replacement and rehabilitation of deficient existing bridges located on public highways, roads, and streets in the state; construction of grade separations at existing highway and railroad grade crossings; and rehabilitation of deficient railroad underpasses on the state highway system. Projects are selected by the Bridge Division (BRG) based on a listing of eligible bridges prioritized first by deficiency categorization (structurally deficient followed by functionally obsolete) and then by sufficiency ratings. Railroad grade separation projects are selected based on a cost-benefit index rating. Projects in the Bridge Maintenance and Improvement Program are selected statewide based on identified bridge maintenance/improvement needs to aid in ensuring the management and safety of the state's bridge assets. The Texas Transportation Commission allocates funds through the Statewide Allocation Program.
- **Category 8: Safety**—Safety-related projects both on and off the state highway system including the Federal Highway Safety Improvement Program, Railway-Highway Crossing Program, Safety Bond Program and High Risk Rural Roads Program. Projects are selected statewide by federally mandated safety indices and prioritized listing. Projects selected in the Systemic Widening Program are evaluated by roadway safety features for preventable severe crash types using total risk factor weights. The Texas Transportation Commission allocates funds through the Statewide Allocation Program.
- **Category 11: District Discretionary**—Projects eligible for Federal or state funding selected at the district engineer's discretion. The Texas Transportation Commission allocates funds through a formula

allocation program. A minimum \$2.5 million allocation goes to each district per legislative mandate. The commission may supplement the funds allocated to individual districts on a case-by-case basis to cover project cost overruns.

- **Category 12: Strategic Priority**—Projects with specific importance to the state including those that generally promote economic opportunity, increase efficiency on military deployment routes or retain military assets in response to the Federal military base realignment and closure reports, and maintain the ability to respond to both manmade and natural emergencies. The Texas Transportation Commission selects these projects.

5.2 Federal Transportation Grant Opportunities

Since the implementation of the Transportation Investment Generating Economic Recovery (TIGER) discretionary grant program as part of the American Recovery and Reinvestment Act (ARRA) of 2009, discretionary funding has played a larger role in large scale transportation infrastructure projects. This trend has increased with programs under the Moving Ahead for Progress in the 21st Century (MAP-21) and the Fixing America's Surface Transportation (FAST) Act, which provided the first Federal funding specifically targeted towards freight investments. Currently, the two major Federal transportation grant programs are Better Utilizing Investments to Leverage Development (BUILD) and the Infrastructure for Rebuilding America (INFRA) discretionary grant programs. Each of these is summarized below.

5.2.1 Better Utilizing Investments to Leverage Development (BUILD) Grant Program

The Better Utilizing Investments to Leverage Development (BUILD) grant program is a U.S. Department of Transportation (U.S. DOT) discretionary grant program previously known as TIGER¹⁹. BUILD grants can be used for surface transportation projects, including multimodal or intermodal projects. The U.S. DOT plans to award a greater share of funding to rural transportation projects than urban projects, which may benefit some parts of Grayson County. The fiscal year 2018 appropriation for the BUILD program was \$1.5 billion. Up to \$15 million can be awarded to planning or design of projects, and up to \$300 million can be combined with the Transportation Infrastructure Finance and Innovation Act (TIFIA) program for loan assistance. Statutory requirements related to minimum project size and grant amounts are depicted in Table 5.1.

Eligible projects under the BUILD grant program include:

- Highway, bridge or other road projects.
- Freight rail transportation projects.
- Intermodal freight projects.

¹⁹ <https://www.transportation.gov/BUILDgrants>.

Table 5.1 Statutory Requirements of BUILD Grants

	Minimum Grant Amount ¹	Cost Share
Urban Projects	• Minimum: \$5 million • Maximum: \$25 million	Up to 80% BUILD Up to 80% total Federal
Rural Projects	• Minimum: \$1 million • Maximum: \$25 million	Up to 80%, Secretary may increase

Source: U.S. Department of Transportation.

¹ There is no minimum award for planning projects.

The selection criteria for BUILD grants include:

- Safety.
- State of Good Repair.
- Economic Competitiveness.
- Environmental Protection.
- Quality of Life.
- Innovation.
- Partnership.
- Non-Federal Revenue for Transportation Infrastructure Investment.

5.2.2 Infrastructure for Rebuilding America (INFRA) Grant Program

Revisions to the FAST Act created the Infrastructure for Rebuilding America (INFRA) grants program (previously known as Fostering Advancements In Shipping And Transportation For The Long-Term Achievement Of National Efficiencies, or FASTLANE)²⁰. INFRA allows eligible applicants to apply for funding to complete projects that improve safety and hold the greatest promise to eliminate freight bottlenecks and improve critical freight movements. Approximately \$1.5 billion were available for infrastructure grants for fiscal years 2017 and 2018. States can leverage their own dedicated transportation funding with these Federal sources, as well as with other local, regional, and private-sector funding.

Eligible projects under the INFRA grant program include:

- Highway freight projects on the NHFN, which includes the segments of U.S. 75 designated as Critical Urban and Rural Freight Corridors.
- Highway or bridge projects on the National Highway System (NHS), which includes U.S. 75 and U.S. 82.

²⁰ <https://www.transportation.gov/buildamerica/infragrants>

- Grade crossing or grade separation projects.
- Other freight projects that are:
 - An intermodal/rail freight project, or
 - Within the boundaries of a public or private freight rail, maritime (including ports) or intermodal facility.

Eligible project costs include development phase activities and construction activities. Development phase activities involve planning, feasibility analysis, revenue forecasting, environmental review, preliminary engineering, design work, and other pre-construction activities. Construction activities involve new construction, reconstruction, rehabilitation, property or equipment acquisition, environmental mitigation, construction contingencies, and operational improvements. Additional statutory requirements related to minimum project size and grant amounts are depicted in Table 5.2.

The selection criteria for the INFRA grants include:

- Support for national or regional economic vitality.
- Leveraging of Federal funding.
- Potential for innovation.
- Performance and accountability.

Table 5.2 Statutory Requirements of INFRA Grants

	Minimum Project Size ¹	Minimum Grant Amount	Cost Share ²
Large Projects	The lesser of: • \$100 million. • 30 percent of State's FY2015 apportionment, if project is located in one State. • 50 percent of larger participating State's FY2015 apportionment, if project located in more than one State.	\$25 million	Up to 60% INFRA grants Up to 80% total Federal
Small Projects	Does not meet large project minimum project size.	\$5 million	Up to 60% INFRA grants Up to 80% total Federal

Source: U.S. Department of Transportation

¹ Previously incurred expenses may count toward meeting minimum project size requirement if they are eligible project costs and were expended as part of the project for which the applicant seeks funding.

² Previously incurred expenses cannot count toward cost share.

5.3 Other Financing Mechanisms²¹

5.3.1 *Transportation Infrastructure Finance and Innovation Act (TIFIA) Program*²²

The Transportation Infrastructure Finance and Innovation Act (TIFIA) program provides Federal credit assistance in the form of direct loans, loan guarantees, and standby lines of credit to finance surface transportation projects of national and regional significance. TIFIA credit assistance provides improved access to capital markets, flexible repayment terms, and potentially more favorable interest rates than can be found in private capital markets for similar instruments. TIFIA can help advance qualified large-scale projects that otherwise might be delayed or deferred because of size, complexity or uncertainty over the timing of revenues, and could be considered as a source of funding for infrastructure projects in Grayson County. TxDOT and local governments are both eligible applicants for the TIFIA program, though local governments may wish to apply in collaboration with TxDOT if creditworthiness is a concern.

Projects eligible for Federal assistance through existing transportation programs are eligible for the TIFIA credit program. These projects include:

- Highway projects; including intelligent transportation systems (ITS).
- International bridges and tunnels.
- Publicly-owned freight rail facilities.
- Private facilities providing public benefit for highway users.
- Intermodal freight transfer facilities, projects that provide access to such facilities.
- Service improvements on the National Highway System.

Projects located within the boundary of an intermodal terminal are also eligible to receive TIFIA credit assistance under certain conditions. The project must address surface transportation to facilitate direct intermodal interchange, transfer, and access into and out of the facility. Construction and non-construction costs are eligible to be financed, including but not limited to planning, feasibility analysis, environmental review, permitting, and preliminary engineering and design work. Eligible projects must be included in the State Transportation Improvement Program (STIP) with a capital cost of at least \$50 million. ITS projects have a \$15 million eligibility requirement. TIFIA financing should attract public and private investment, result in a project proceeding earlier and/or more efficiently, and reduce use of Federal grant assistance to the project.

5.3.2 *Railroad Rehabilitation and Improvement Financing (RRIF) Program*²³

The Railroad Rehabilitation and Improvement Financing (RRIF) Program is a potential source of funding for rail-related projects in Grayson County. The program was established in the 1998 Transportation Equity Act

²¹ U.S. Department of Transportation. https://www.transportation.gov/bts/sites/dot.gov/files/docs/policy-initiatives/programs-and-services/tifia/Bureau%20Credit%20Programs%20Guide_March_2017.pdf.

²² U.S. Department of Transportation. <https://www.transportation.gov/buildamerica/programs-services/tifia>.

²³ U.S. Department of Transportation. <https://www.transportation.gov/buildamerica/programs-services/rrif>.

for the 21st Century and amended most recently by the FAST Act in 2016. The RRIF program authorizes the Federal Railroad Administration (FRA) Administrator to provide direct loans and loan guarantees for projects which:

- Acquire, improve, or rehabilitate intermodal or rail equipment or facilities, including track, components of track, bridges, yards, buildings and shops.
- Refinance outstanding debt incurred for the purposes listed above.
- Develop or establish new intermodal or railroad facilities.

The FAST Act amended the program to clarify that pre-construction activities such as planning or design can be financed.

Up to \$35 billion of financing is available, with at least \$7 billion reserved for projects not on Class I railroads. Since 2002, 35 loan agreements totaling \$5 billion have been executed (an average of \$147 million per agreement). Financing can be provided for up to 100% of project costs with repayment periods of up to 35 years. Recipients benefit from interest rates that equal to the cost of borrowing to the Government. The FAST Act also authorized the U.S. DOT to enter into Master Credit Agreements. These agreements include one or more loans to be made in the future on a program of related projects.

Railroads, state and local governments, Government-sponsored authorities and corporations, joint ventures that include at least one railroad, and limited option freight shippers who intend to construct a new rail connection are all eligible to borrow under RRIF. The FAST Act increased access to this program by extending eligibility to allow joint ventures with any type of eligible applicant.

Applications will be selected based on the following criteria:

- The statutory eligibility of the applicant and the project.
- The creditworthiness of the project, including the present and probable demand for rail services and a reasonable likelihood that the loan will be repaid on a timely basis.
- The extent to which the project will enhance safety.
- The significance of the project on a local, regional, or national level in terms of generating economic benefits and improving the railroad transportation system.
- The improvement to the environment that is expected to result directly or indirectly by the implementation of the project.
- The improvement in service or capacity in the railroad transportation system or the reduction in service- or capacity-related problems that is expected to result directly or indirectly from the implementation of the project.

Priority will be given to projects that:

- Enhance public safety, including positive train control;

- Enhance the environment through energy efficiency and environmental quality improvements;
- Promote economic development and increase U.S. competitiveness in international markets;
- Are endorsed by applicable statewide planning documents;
- Preserve or enhance rail or intermodal service to small communities or rural areas;
- Enhance service and capacity in the national rail system; or,
- Materially alleviate rail capacity problems.

5.3.3 *Public-Private Partnerships in Texas*

A Public-Private Partnership (P3) is a contractual agreement between a public agency (Federal, state or local) and a private entity for a long-term performance based approach to procure public infrastructure. The private entity assumes the major share of the risk in terms of financing, constructing and the performance of the project in return for the right to collect revenue from the project over a set period of time. In Texas, this model was used effectively to expand transportation infrastructure such as the Dallas LBJ Expressway and the North Tarrant Express, both sponsored by TxDOT in cooperation with local entities. The Texas Transportation Commission has elected to remove toll projects from the TxDOT UTP for the time being. However, plans for the Dallas North Tollway's extension to the Grayson/Collin County line continue to be developed, and Grayson County is preparing for a future extension of that alignment into the County by developing the Grayson Parkway Spur. Additionally, rail and intermodal projects are an opportunity for public-private partnerships with private railroad companies when these projects can provide enough public benefit to justify spending County funding.

Appendix A. SWOT Analysis Input

This appendix details the responses of the Grayson County Freight Advisory Committee members for the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis conducted in May, 2018. Participants were given prompts from the consultant team and the opportunity to provide free responses in each of the SWOT categories. The responses were summarized and organized by the consultant team into the categories shown below.

Table A.1 Freight Advisory Committee SWOT Responses

Category	Response	Strength	Weakness	Opportunity	Threat
Air Cargo	691-289 connection would help NTRA			O	
Air Cargo	NTRA has long runway, outside of DFW airspace			O	
Air Quality	Air quality in attainment	S			
Air Quality	Air quality is near non-attainment; proactive planning needed with DFW				T
Bridges	FY21 bridge heights going up to 18.5 ft for TxDOT standards			O	
Collaboration	MPO and RMA able to move forward on ideas	S			
Collaboration	MPO/FAC policy group			O	
Collaboration	Siloed discussions occurring				T
Collaboration	Engaged community/good planning	S			
Collaboration	Active EDCs, TxDOT, communities	S			
Economic Environment	Diversified markets can weather economic shifts	S			
Economic Environment	Niche markets are specialized (semiconductor, food)	S			
Economic Environment	Business friendly	S			
Economic Environment	Low cost of living	S			
Economic Environment	Low cost of permitting, doing business	S			
Economic Environment	Proximity to Metroplex	S			
Economic Environment	DFW labor and land cost going up—Grayson more attractive			O	
Funding	Roadway funding—funding diversions and declining revenue				T
Funding	Using innovative funding mechanisms	S			
Funding	Vehicle registration fee/highway funding			O	

Category	Response	Strength	Weakness	Opportunity	Threat
Intermodal	Intermodal facilities (ex: ACS)			O	
Maintenance	If max weight goes up, maintenance cost goes up				T
Maintenance	Poor maintenance could lead to lower weight limits				T
Maintenance	69/75—road conditions		W		
Mobility/Access	Access to western markets (have to go to Dallas or 82)		W		
Mobility/Access	U.S. 82—if not invested in before development comes (don't want to be like 380)				T
Mobility/Access	Alternate routes available (120, 289)	S			
Mobility/Access	U.S. 82 could be major E/W route with investment			O	
Mobility/Access	Truck weight increase to 100k would reduce number of trucks			O	
OS/OW	OS probably not affected by CAV in the near future			O	
OS/OW	U.S. 75/U.S. 82 (SB 75 -EB 82)—OS trucks (12-14 ft wide)		W		
OS/OW	Dallas has OW truck curfew, OW routes down 69 to avoid		W		
OS/OW	Policy- if U.S. 75 becomes IH, could change OS/OW permitting				T
Rail	UP not serving local businesses; generally, some customers don't have access		W		
Rail	At-grade crossings need separation, especially if growth continues		W		
Rail	2 Class I railroads (UP and BNSF)	S			
Rail	Rail access and development			O	
Rail	Customers could use rail if available			O	
Site Development	Gas distribution infrastructure not developed at some sites		W		
Site Development	Rail-served industrial park	S			
Site Development	Water supply, air quality, power plant, land availability	S			
Site Development	Many sites with good road access	S			
Site Development	Air quality, water/land availability			O	
Technology	CAV could open funding for SDMPO			O	
Technology	Increased demand for parking due to HOS, ELD			O	

Category	Response	Strength	Weakness	Opportunity	Threat
Technology	U.S. 75 as technology-ready corridor			O	
Technology	Smarter traffic mgmt—including partnering with neighbors			O	
Trade	Lack of customs broker (at the airport)		W		
U.S. 75 Mobility	U.S. 75 has 4.5 mile gap not up to IH standard (safety and mobility issue)		W		
U.S. 75 Mobility	U.S. 75 outdated geometry		W		
U.S. 75 Mobility	On/off ramps need to be updated (some in design now)		W		
U.S. 75 Mobility	U.S. 75 constraints with growth (10 lanes in Collin County down to 4 in Grayson)				T
U.S. 75 Mobility	Major employers look for interstates, none in Grayson Co				T
U.S. 75 Mobility	Investment in on/off ramps in some areas	S			
U.S. 75 Mobility	U.S. 75 serves major N/E corridor	S			
U.S. 75 Mobility	Oklahoma investing in bringing U.S. 75 to IH standards			O	
U.S. 75 Mobility	Bond for U.S. 75 gap, could make I-45 designation possible			O	
Workforce	Partner with teachers to shift perception of mfg. careers			O	
Workforce	Low wages		W		
Workforce	Labor shortage (relatively recent issue)		W		
Workforce	If workforce comes from outside county, traffic and cost are worse				T
Workforce	Labor shortage for some industries (pulling from DFW)				T
Workforce	Perceptions of mfg. careers for potential employees (pressure to go to 4-year college)				T
Workforce	Increased employment	S			
Workforce	Partnership with Grayson College and Companies	S			
Workforce	Workforce development with Grayson College	S			
Workforce	Grants with Grayson College for training			O	
Workforce	High school advanced manufacturing program			O	

Appendix B. Freight Project List

The following lists of funded and unfunded projects were identified by the Sherman-Denison MPO through transportation planning documents, stakeholder input, and needs analysis. These projects were selected for their impact on the safety and mobility of freight transportation in Grayson County.

Table B.1 Funded Freight Projects in Grayson County 2018

Location	Highway	From	To	Description	Estimated Construction Cost	Estimated Construction Start Date
Sherman	U.S. 75	FM 1417	SH 91	Reconstruct and widen from 4 lane to 6 lane	\$140,000,000	September 2019
Sherman	U.S. 75	At U.S. 82		Interchange and frontage road improvements	\$21,700,000	September 2019
Sherman	U.S. 75	At FM 1417		Ramp reversal	\$2,100,000	2018
Denison	U.S. 75	At Spur 503		Ramp relocation	\$7,000,000	August 2019
Gunter	FM 121 Bypass	Block Road	SH 289	Construct 2 lane segment of FM 121 Bypass	\$3,600,000	FY2022
Van Alstyne	FM 121 Bypass	Lincoln Park Road	U.S. 75	Construct 2 lane segment of FM 121 Bypass along Spence Road	\$4,400,000	FY2022
Sherman	FM 1417	U.S. 82	SH 56	Widen from 2 lane to 4 lane, reconstruct interchange at SH 56, replace bridge at Sand Creek	\$24,843,000	August 2019
Sherman/Denison	FM 691	SH 91	Theresa Road	Reconstruct and add 2 lanes	\$4,550,000	FY2022
Howe	FM 902 Bypass	U.S. 75	FM 902	Construct 2 lane segment of FM 902 Bypass	\$4,440,000	FY2022
Tom Bean	FM 902 Bypass	Joe Bob Ln	SH 11	Construct 2 lane segment of FM 902 Bypass	\$1,800,000	FY2022
Grayson County	Grayson Parkway	FM 121	County Line Road	Construct new 2 lane Spur (future Tollway alignment)	\$8,000,000	2020
Whitesboro	U.S. 82	Shawnee Trail	U.S. 377	Construct Frontage Road from Shawnee Trail to U.S. 377 and reverse ramps	\$2,200,000	FY2022
Gordonville	U.S. 377	At Lake Texoma		Bridge and Approach Replacement	\$30,067,000	TBD

Table B.2 Unfunded Freight Projects in Grayson County 2018

Location	Highway	From	To	Description	Estimated Construction Cost	Type	Priority Project?
Sherman/Denison	US 75	FM 120	SH 91	Widen From 4 Lane to 6 Lane	TBD	North/South Mobility	Y
Denison	US 75	US 69	FM 120	Widen From 4 Lane To 6 Lane	TBD	North/South Mobility	Y
Denison	US 75	State Line	US 69	Widen From 4 Lane To 6 Lane	TBD	North/South Mobility	Y
Grayson County	US 75	FM 902	Collin County Line	Widen From 4 Lane To 6 Lane	\$86,120,000	North/South Mobility	Y
Grayson County	US 75	FM 1417	FM 902	Widen From 4 Lane To 6 Lane	\$42,400,000	North/South Mobility	Y
Sherman	FM 1417	SH 11	SH 56	Complete FM 1417 Loop	\$25,000,000	North/South Mobility	
Sherman	FM 1417	SH 56	Ob Groner Road	Widen From 2 lane to 4 lane	\$10,000,000	North/South Mobility	
Tom Bean	FM 2729 Bypass	SH 11	Meadows Estate St	Construct 2 lane segment of FM 2729 Bypass around Tom Bean	\$2,200,000	North/South Mobility	Y
Gunter	SH 289	CR 60 / CR 107 (County Line)	North CR 60 / CR 107	Reconstruct And Widen 2 Lane Rural Highway To 4 Lane Divided Urban (transition)	\$665,000	North/South Mobility	
Pottsboro	SH 289	FM 996	Elks Blvd.	Construct Four Lanes With Raised Median	\$28,500,000	North/South Mobility	
Van Alstyne	SH 5 Bypass	County Line Road	Judd Road	Construct 2 lane segment of SH 5 Bypass along Lincoln Park Road	\$12,200,000	North/South Mobility	Y
Denison	Spur 503	US 75	SH 91	Reconstruct and widen from 4 lane to 6 lane; remove service roads	\$13,600,000	North/South Mobility	
Denison	Spur 503	SH 91	Acheson St	Reconstruct and widen from 4 lane to 6 lane; remove service roads	\$18,100,000	North/South Mobility	

Location	Highway	From	To	Description	Estimated Construction Cost	Type	Priority Project?
Sherman	US 82	At Skaggs Road		Construct Overpass	\$6,000,000	East/West Mobility	
Grayson County	US 82	Throughout		Continuous Frontage Roads	TBD	East/West Mobility	Y
Gunter	FM 121 Bypass	SH 289	FM 121	Construct 2 lane segment of FM 121 Bypass	\$6,200,000	East/West Mobility	Y
Van Alstyne	FM 121 Bypass	US 75	Hinton Ln	Construct 2 lane segment of FM 121 Bypass	\$4,400,000	East/West Mobility	Y
Tioga	FM 121 Bypass	Kardum Lane	FM 922	Construct 2 lane segment of FM 121 Bypass Along Airport Road around Tioga	\$8,780,000	East/West Mobility	Y
Van Alstyne	FM 3133 Bypass	Chapman Road	US 75	Construct 2 lane segment of FM 3133 Bypass along County Line Road	\$8,100,000	East/West Mobility	Y
Collinsville	FM 902 Bypass	Batey Road	Jordan Creek	Construct 2 lane segment of FM 902 Bypass around Collinsville	\$7,320,000	East/West Mobility	Y
Sherman	SH 56	Friendship Rd	Case Rd.	Reconstruct and widen from 2 lane to 4 lane	\$1,550,000	Safety	
Grayson County	Grayson Parkway	Collin County Line	US 75	Feasibility Study Of Extension Of Dallas North Tollway Into Grayson County	\$6,500,000	Tollway Extension	Y
Grayson County	Grayson Parkway	FM 121	FM 902	Construct 2 lane segment of service road for Grayson Parkway (Extension of DNT)	\$14,000,000	Tollway Extension	
Grayson County	Grayson Parkway	FM 902	US 82	Construct 2 lane segment of service road for Grayson Parkway (Extension of DNT)	\$33,500,000	Tollway Extension	
Grayson County	Grayson Parkway	US 82	SH 289	Construct 2 lane segment of service road for Grayson Parkway (Extension of DNT)	\$24,100,000	Tollway Extension	
Grayson County	Grayson Parkway	SH 289	Preston Road	Construct 2 lane segment of service road for Grayson Parkway (Extension of DNT)	\$8,800,000	Tollway Extension	

Location	Highway	From	To	Description	Estimated Construction Cost	Type	Priority Project?
Grayson County	Grayson Parkway	Preston Road	US 75	Construct 2 lane segment of service road for Grayson Parkway (Extension of DNT)	\$11,550,000	Tollway Extension	
Whitewright	US 69	G&W Railroad		Increase Bridge Clearance (current minimum is 14'4")	TBD	Bridge	
Whitewright	US 69	Spruce Street		Increase Bridge Clearance (current minimum is 14'10")	TBD	Bridge	
Bells	US 69	G&W Railroad		Increase Bridge Clearance (current minimum is 13'11")	TBD	Bridge	
Denison	US 69	UP RR		Increase Bridge Clearance (current minimum is 15'4")	TBD	Bridge	
Sherman	FM 1417	US 82		Increase Bridge Clearance (current minimum is 14'9")	TBD	Bridge	
Sherman	SH 91	US 82		Increase Bridge Clearance (current minimum is 15'1")	TBD	Bridge	
Denison	Spur 503	BNSF Railroad		Increase Bridge Clearance (current minimum is 14'1")	TBD	Bridge	
Whitesboro	US 377	US 82		Increase Bridge Clearance (current minimum is 14'11")	TBD	Bridge	
Denison	US 75	FM 120		Increase Bridge Clearance (current minimum is 15'10")	TBD	Bridge	
Sherman	US 75	Loy Lake Road		Increase Bridge Clearance (current minimum is 16'4")	TBD	Bridge	
Sherman	US 75	Fallon Drive		Increase Bridge Clearance (current minimum is 16'2")	TBD	Bridge	
Howe	US 75	SH 5 / FM 902		Increase Bridge Clearance (current minimum is 15'9")	TBD	Bridge	
Sherman	US 82	FM 131		Increase Bridge Clearance (current minimum is 16'1")	TBD	Bridge	
Sherman	US 82	Loy Lake Road		Increase Bridge Clearance (current minimum is 16'0")	TBD	Bridge	

Location	Highway	From	To	Description	Estimated Construction Cost	Type	Priority Project?
Denison	G & W Railroad	BNSF Interchange		Support construction of wye to facilitate short line movements	TBD	Railroad	Y

Appendix C. Industry Linkages by Industry Sector

Table C.1 Industry Linkages for the Oil & Gas Machinery & Equipment Manufacturing Sector

Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Wholesale trade	0.00	6.05	0.98	7.03
2	Business support services	0.00	5.50	0.38	5.88
3	Limited-service restaurants	0.00	4.86	4.78	9.64
4	Employment services	0.00	3.72	0.89	4.60
5	Full-service restaurants	0.00	3.40	3.87	7.27
6	Services to buildings	0.00	3.27	1.52	4.79
7	Truck transportation	0.00	2.87	0.44	3.32
8	Investigation and security services	0.00	2.55	0.28	2.83
9	Other support services	0.00	2.03	0.12	2.15
10	Maintenance and repair construction of nonresidential structures	0.00	2.03	0.40	2.43
TOTAL EMPLOYMENT IMPACTS ALL SECTORS		100.0	60.7	71.7	232.4

Source: Derived from IMPLAN, 2018.

Table C.2 Industry Linkages for the Non Residential Construction Sector

Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Wholesale trade	0.00	3.52	0.53	4.05
2	Marketing research and all other miscellaneous professional, scientific, and technical services	0.00	3.12	0.08	3.20
3	Services to buildings	0.00	2.53	0.83	3.36
4	Truck transportation	0.00	1.86	0.24	2.10
5	Limited-service restaurants	0.00	1.71	2.61	4.32
6	Management of companies and enterprises	0.00	1.50	0.12	1.62
7	Accounting, tax preparation, bookkeeping, and payroll services	0.00	1.46	0.35	1.82
8	Business support services	0.00	1.45	0.21	1.66
9	Maintenance and repair construction of nonresidential structures	0.00	1.36	0.22	1.58
10	Full-service restaurants	0.00	1.23	2.11	3.34
TOTAL EMPLOYMENT IMPACTS ALL SECTORS		100.0	77.7	31.5	209.3

Source: Derived from IMPLAN, 2018.

Table C.3 Industry Linkages for the Other Aluminum Rolling Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Wholesale trade	0.00	5.41	0.65	6.06
2	Marketing research and all other miscellaneous professional, scientific, and technical services	0.00	2.91	0.10	3.01
3	Services to buildings	0.00	2.46	1.01	3.47
4	Securities and commodity contracts intermediation and brokerage	0.00	1.89	0.19	2.08
5	Maintenance and repair construction of nonresidential structures	0.00	1.47	0.27	1.73
6	Limited-service restaurants	0.00	1.31	3.19	4.49
7	Truck transportation	0.00	1.28	0.30	1.57
8	Business support services	0.00	1.23	0.25	1.48
9	Accounting, tax preparation, bookkeeping, and payroll services	0.00	1.21	0.43	1.64
10	Management of companies and enterprises	0.00	1.18	0.14	1.32
TOTAL EMPLOYMENT IMPACTS ALL SECTORS		100.0	34.9	47.8	182.7

Source: Derived from IMPLAN, 2018.

Table C.4 Industry Linkages for the Truck Transportation Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Couriers and messengers	0.00	8.57	0.13	8.69
2	Postal service	0.00	4.67	0.12	4.79
3	Employment services	0.00	2.15	0.53	2.68
4	Scenic and sightseeing transportation and support activities for transportation	0.00	2.03	0.05	2.08
5	Extraction of natural gas and crude petroleum	0.00	1.60	0.08	1.68
6	Real estate	0.00	1.58	1.97	3.55
7	Insurance carriers	0.00	1.28	0.62	1.90
8	Warehousing and storage	0.00	1.17	0.09	1.26
9	Wholesale trade	0.00	1.11	0.59	1.70
10	Truck transportation	100.00	0.95	0.27	101.22
TOTAL EMPLOYMENT IMPACTS ALL SECTORS		100.0	39.2	43.1	182.3

Source: Derived from IMPLAN, 2018.

Table C.5 Industry Linkages for Plumbing Fixture Manufacturing Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Wholesale trade	0.00	3.83	0.61	4.44
2	Business support services	0.00	2.18	0.24	2.42
3	Services to buildings	0.00	1.70	0.95	2.65
4	Employment services	0.00	1.51	0.56	2.06
5	Marketing research and all other miscellaneous professional, scientific, and technical services	0.00	1.43	0.10	1.53
6	Management of companies and enterprises	0.00	1.29	0.13	1.42
7	Truck transportation	0.00	1.27	0.28	1.55
8	Accounting, tax preparation, bookkeeping, and payroll services	0.00	1.14	0.41	1.55
9	Maintenance and repair construction of nonresidential structures	0.00	0.97	0.25	1.22
10	Investigation and security services	0.00	0.94	0.17	1.11
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	30.0	45.0	175.0

Source: Derived from IMPLAN, 2018.

Table C.6 Industry Linkages for Valves and Fittings Manufacturing Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Wholesale trade	0.00	3.83	0.61	4.44
2	Business support services	0.00	2.18	0.24	2.42
3	Services to buildings	0.00	1.70	0.95	2.65
4	Employment services	0.00	1.51	0.56	2.06
5	Marketing research and all other miscellaneous professional, scientific, and technical services	0.00	1.43	0.10	1.53
6	Management of companies and enterprises	0.00	1.29	0.13	1.42
7	Truck transportation	0.00	1.27	0.28	1.55
8	Accounting, tax preparation, bookkeeping, and payroll services	0.00	1.14	0.41	1.55
9	Maintenance and repair construction of nonresidential structures	0.00	0.97	0.25	1.22
10	Investigation and security services	0.00	0.94	0.17	1.11
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	30.0	45.0	175.0

Source: Derived from IMPLAN, 2018.

Table C.7 Industry Linkages for Plastics Packaging Material Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Wholesale trade	0.00	3.52	0.53	4.05
2	Marketing research and all other miscellaneous professional, scientific, and technical services	0.00	3.12	0.08	3.20
3	Services to buildings	0.00	2.53	0.83	3.36
4	Truck transportation	0.00	1.86	0.24	2.10
5	Limited-service restaurants	0.00	1.71	2.61	4.32
6	Management of companies and enterprises	0.00	1.50	0.12	1.62
7	Accounting, tax preparation, bookkeeping, and payroll services	0.00	1.46	0.35	1.82
8	Business support services	0.00	1.45	0.21	1.66
9	Maintenance and repair construction of nonresidential structures	0.00	1.36	0.22	1.58
10	Full-service restaurants	0.00	1.23	2.11	3.34
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	34.6	39.2	173.8

Source: Derived from IMPLAN, 2018.

Table C.8 Industry Linkages for the Other Electronic Component Manufacturing Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Wholesale trade	0.00	3.58	0.75	4.33
2	Services to buildings	0.00	1.33	1.17	2.50
3	Management of companies and enterprises	0.00	0.98	0.16	1.15
4	Business support services	0.00	0.92	0.29	1.21
5	Maintenance and repair construction of nonresidential structures	0.00	0.85	0.31	1.16
6	Truck transportation	0.00	0.83	0.34	1.18
7	Employment services	0.00	0.67	0.68	1.35
8	Accounting, tax preparation, bookkeeping, and payroll services	0.00	0.54	0.50	1.04
9	Landscape and horticultural services	0.00	0.38	0.40	0.78
10	Real estate	0.00	0.35	2.55	2.91
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	17.2	55.2	172.4

Source: Derived from IMPLAN, 2018.

Table C.9 Industry Linkages for the Hospitals Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Employment services	0.00	3.52	0.49	4.00
2	Real estate	0.00	2.21	1.82	4.03
3	Other ambulatory health care services	0.00	2.12	0.23	2.35
4	Full-service restaurants	0.00	1.80	2.13	3.93
5	Insurance carriers	0.00	1.76	0.57	2.33
6	Services to buildings	0.00	1.47	0.83	2.30
7	Office administrative services	0.00	1.28	0.12	1.40
8	Accounting, tax preparation, bookkeeping, and payroll services	0.00	1.27	0.36	1.63
9	Other financial investment activities	0.00	1.25	0.53	1.78
10	Legal services	0.00	0.89	0.37	1.26
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	29.7	39.4	169.0

Source: Derived from IMPLAN, 2018.

Table C.10 Industry Linkages for the Frozen Specialty Manufacturing Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Wholesale trade	0.00	7.50	0.41	7.92
2	Grain farming	0.00	6.45	0.00	6.45
3	Support activities for agriculture and forestry	0.00	2.30	0.01	2.31
4	Truck transportation	0.00	2.19	0.19	2.38
5	Management of companies and enterprises	0.00	2.11	0.09	2.20
6	Services to buildings	0.00	1.35	0.64	1.99
7	Maintenance and repair construction of nonresidential structures	0.00	0.99	0.17	1.16
8	Rail transportation	0.00	0.91	0.01	0.92
9	Real estate	0.00	0.73	1.40	2.14
10	Accounting, tax preparation, bookkeeping, and payroll services	0.00	0.73	0.27	1.00
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS		100.0	36.6	30.3

Source: Derived from IMPLAN, 2018.

Table C.11 Industry Linkages for the New Multifamily Construction Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Retail—Miscellaneous store retailers	0.00	4.11	0.51	4.62
2	Retail—Building material and garden equipment and supplies stores	0.00	3.28	0.43	3.71
3	Retail—Health and personal care stores	0.00	3.14	0.37	3.51
4	Retail—Clothing and clothing accessories stores	0.00	2.39	0.39	2.78
5	Retail—Sporting goods, hobby, musical instrument and book stores	0.00	2.18	0.28	2.46
6	Retail—Gasoline stores	0.00	1.94	0.28	2.22
7	Retail—Nonstore retailers	0.00	1.66	0.62	2.28
8	Wholesale trade	0.00	1.33	0.42	1.75
9	Retail—Electronics and appliance stores	0.00	1.31	0.08	1.38
10	Real estate	0.00	1.21	1.40	2.61
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	34.4	30.6	165.0

Source: Derived from IMPLAN, 2018.

Table C.12 Industry Linkages for the Oil & Gas Drilling Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Support activities for oil and gas operations	0.00	8.54	0.00	8.54
2	Legal services	0.00	6.20	0.28	6.49
3	Services to buildings	0.00	3.52	0.63	4.15
4	Maintenance and repair construction of nonresidential structures	0.00	1.11	0.16	1.27
5	Other financial investment activities	0.00	0.75	0.40	1.15
6	Wholesale trade	0.00	0.71	0.40	1.11
7	Accounting, tax preparation, bookkeeping, and payroll services	0.00	0.65	0.27	0.92
8	Monetary authorities and depository credit intermediation	0.00	0.54	0.52	1.06
9	Real estate	0.00	0.53	1.36	1.89
10	Management of companies and enterprises	0.00	0.51	0.09	0.59
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	30.9	29.7	160.6

Source: Derived from IMPLAN, 2018.

Table C.13 Industry Linkages for the Nonferrous Metal Foundries Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Business support services	0.00	2.29	0.18	2.47
2	Wholesale trade	0.00	2.14	0.47	2.61
3	Services to buildings	0.00	1.90	0.73	2.63
4	Employment services	0.00	1.51	0.43	1.93
5	Management of companies and enterprises	0.00	1.46	0.10	1.57
6	Marketing research and all other miscellaneous professional, scientific, and technical services	0.00	1.15	0.07	1.22
7	Maintenance and repair construction of nonresidential structures	0.00	1.14	0.19	1.34
8	Investigation and security services	0.00	1.03	0.13	1.16
9	Truck transportation	0.00	0.99	0.21	1.20
10	Other support services	0.00	0.93	0.06	0.99
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	25.2	34.5	159.7

Source: Derived from IMPLAN, 2018.

Table C.14 Industry Linkages for the New Nonresidential Construction Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Retail—Miscellaneous store retailers	0.00	8.44	0.52	8.96
2	Retail—Building material and garden equipment and supplies stores	0.00	6.73	0.45	7.18
3	Retail—Health and personal care stores	0.00	6.45	0.38	6.83
4	Retail—Clothing and clothing accessories stores	0.00	4.91	0.40	5.32
5	Retail—Sporting goods, hobby, musical instrument and book stores	0.00	4.47	0.29	4.76
6	Retail—Gasoline stores	0.00	3.99	0.29	4.28
7	Retail—Nonstore retailers	0.00	3.42	0.64	4.06
8	Wholesale trade	0.00	3.35	0.43	3.78
9	Real estate	0.00	2.75	1.41	4.16
10	Retail—Electronics and appliance stores	0.00	2.68	0.08	2.76
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	13.3	27.6	141.0

Source: Derived from IMPLAN, 2018.

Table C.15 Industry Linkages for the Oil & Gas Extraction Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Extraction of natural gas and crude petroleum	100.00	3.58	0.02	103.61
2	Support activities for oil and gas operations	0.00	3.40	0.00	3.40
3	Maintenance and repair construction of nonresidential structures	0.00	2.46	0.07	2.54
4	Management of companies and enterprises	0.00	0.77	0.04	0.81
5	Commercial and industrial machinery and equipment rental and leasing	0.00	0.27	0.00	0.28
6	Accounting, tax preparation, bookkeeping, and payroll services	0.00	0.27	0.12	0.39
7	Wholesale trade	0.00	0.21	0.17	0.38
8	Architectural, engineering, and related services	0.00	0.19	0.02	0.20
9	Legal services	0.00	0.14	0.13	0.27
10	Real estate	0.00	0.13	0.58	0.71
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	13.6	12.9	126.5

Source: Derived from IMPLAN, 2018.

Table C.16 Industry Linkages for the General Merchandise School Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Real estate	0.00	2.09	0.73	2.81
2	Warehousing and storage	0.00	1.49	0.03	1.52
3	Management of companies and enterprises	0.00	0.97	0.05	1.02
4	Truck transportation	0.00	0.49	0.10	0.58
5	Couriers and messengers	0.00	0.47	0.05	0.51
6	Advertising, public relations, and related services	0.00	0.38	0.05	0.43
7	Employment services	0.00	0.38	0.19	0.57
8	Services to buildings	0.00	0.38	0.33	0.71
9	Postal service	0.00	0.28	0.05	0.32
10	Radio and television broadcasting	0.00	0.23	0.03	0.26
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	10.4	15.8	126.2

Source: Derived from IMPLAN, 2018.

Table C.17 Industry Linkages for the Cattle Ranching Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Beef cattle ranching and farming, including feedlots and dual-purpose ranching and farming	100.00	11.06	0.00	111.06
2	Support activities for agriculture and forestry	0.00	5.26	0.00	5.26
3	All other crop farming	0.00	2.10	0.00	2.10
4	Truck transportation	0.00	0.53	0.01	0.54
5	Wholesale trade	0.00	0.52	0.02	0.54
6	Real estate	0.00	0.35	0.08	0.43
7	Grain farming	0.00	0.31	0.00	0.31
8	Extraction of natural gas and crude petroleum	0.00	0.16	0.00	0.17
9	Monetary authorities and depository credit intermediation	0.00	0.16	0.03	0.19
10	Services to buildings	0.00	0.08	0.04	0.12
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	21.6	1.8	123.4

Source: Derived from IMPLAN, 2018.

Table C.18 Industry Linkages for the Other Crop Farming Sector
Employment change per 100 added workers

Rank	Industry Sector	Direct	Indirect	Induced	Total
1	Support activities for agriculture and forestry	0.00	6.38	0.00	6.38
2	All other crop farming	100.00	0.23	0.00	100.24
3	Real estate	0.00	0.21	0.13	0.33
4	Insurance carriers	0.00	0.14	0.04	0.18
5	Beef cattle ranching and farming, including feedlots and dual-purpose ranching and farming	0.00	0.14	0.00	0.14
6	Wholesale trade	0.00	0.11	0.04	0.15
7	Monetary authorities and depository credit intermediation	0.00	0.08	0.05	0.13
8	Insurance agencies, brokerages, and related activities	0.00	0.08	0.02	0.10
9	Accounting, tax preparation, bookkeeping, and payroll services	0.00	0.07	0.03	0.09
10	Grain farming	0.00	0.06	0.00	0.06
	TOTAL EMPLOYMENT IMPACTS ALL SECTORS	100.0	8.3	2.8	111.1

Source: Derived from IMPLAN, 2018.