4.0 The Freight Future

This chapter describes trends that affect the demand for and provision of freight transportation services in the state. The text outlines the implications that these trends pose for the current freight system in Oklahoma. It closes with a discussion of long-term forecasted freight flows and needs.

4.1 TRENDS

Freight transportation has always responded to changes in the economy and goods movement patterns. In recent years, the freight transportation process has undergone significant transformation. This section describes the trends that will affect freight transportation in the future.

4.1.1 Energy Trends

Energy in Oklahoma is seen both as a major industry, and as an important national and international commodity. Because the state is heavily involved in oil and gas production, the international picture is highly valued in Oklahoma. Oklahoma produces crude oil, refined petroleum products, and natural gas, a more environmentally viable option over other fossil fuels. Wind energy is growing in importance as a resource to the state.

Vehicle-related emissions are a concern associated with increased rail and truck traffic. Oklahoma is in compliance with U.S. Environmental Protection Agency air quality standards, in part because of efficient travel patterns, relatively low-emission rail service, and promotion and use of alternative fuels.

THE BAKKEN REGION-IMPACT ON OKLAHOMA

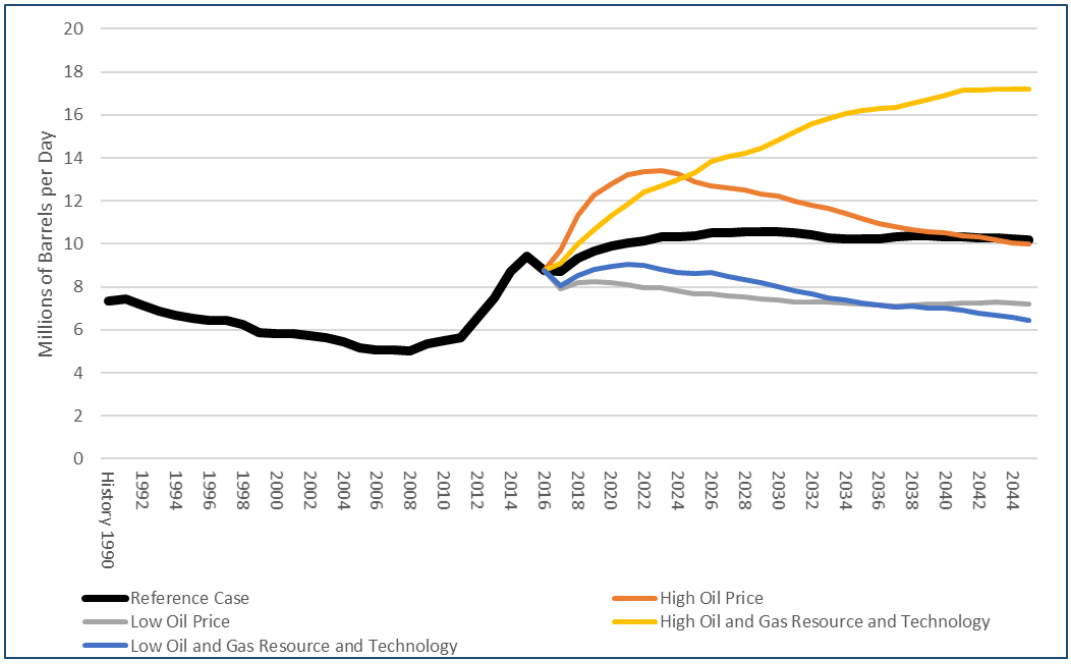
The U.S. Energy Information Administration has produced several forecasts for U.S. crude oil production reflecting varying assumptions on price and technology (**Figure 18).** Unless there is an increase in oil prices, the U.S. Energy Information Administration expects nationwide production to fall in 2017, and then rise slightly and stabilize in the 2020s. Should oil prices trend downward, production is expected to also decrease.

Oil transported in Oklahoma is influenced by production at two sources. One source is oil extracted locally in Oklahoma. Most of the locally produced oil moves by truck to bulk storage facilities or pipeline hubs. The second source of oil—one that materialized within the last five years—is the Bakken Formation (the Bakken) in North Dakota. The Bakken became a major oil production area due to new extraction technologies that became cost effective as oil prices increased, reaching a peak production of 1.2 million barrels per day in December 2015.

In 2013, the production in the Bakken outstripped the existing pipeline capacity. The high price of oil made railroads a cost-effective means of transportation. Oil moving to the Gulf of Mexico was either shipped entirely by rail or moved by rail to Oklahoma for subsequent transport by pipeline. Crude oil coming into Oklahoma by rail was moved by the Stillwater Central (SLWC) short line to Stroud where it was transferred by pipeline to Cushing, where it was in turn shipped by larger pipelines to the Gulf.

Since 2013, pipeline capacity serving the Bakken has increased. Pipeline and refinery projects are planned that would more than double refining and pipeline takeaway capacity in the region. The use of rail transportation will, for the most part, be limited to shipping to markets not accessible by pipeline, particularly the East and West Coasts' refineries and ports. Consequently, crude oil moving by rail into Oklahoma from the Bakken is not expected to reach levels of the past.

Figure 18. U.S. Crude Oil Production under Five Scenarios (million barrels per day)



Source: U.S. Energy Information Administration, Annual Energy Outlook, 2016

Canadian Crude Oil

Although the shipping of North Dakota crude oil into Oklahoma has diminished significantly, it is being replaced by shipments from Canada. Pipelines from Alberta are currently operating at capacity, resulting in significant congestion. Required new capacity is not expected until 2019.

USD Group, a company involved in oil logistics management and infrastructure acquired, acquired the crude oil destination terminal in Stroud in June 2017.[13] Canadian crude oil is being shipped by rail from USD Group's Hardisty oil origination terminal in Alberta to Stroud. The route, over BNSF and SLWC railroads, is similar to the rail corridor previously used for transporting North Dakota oil. From Stroud, the oil is moved by pipeline to Cushing. Producers are again turning to rail transportation—at least until additional pipeline capacity is in place.[14]

Anadarko Basin: Oil and Gas

The Anadarko Basin located in the western part of the state is a major source of natural gas, and to a lesser extent, crude oil. While oil production is significantly diminished, natural gas production has increased and is expected to continue to grow. Although natural gas is shipped by pipeline, the sand, water, gravel and heavy equipment that is required in the extraction process is moved primarily by rail and truck.

Environmental Issues and Clean Fuels

While Oklahoma maintains a favorable federal air quality standard, there remains a sharp focus on upholding this status. The increasing number of vehicles on the transportation system presents opportunities to find innovative ways of sustaining environmental integrity in Oklahoma.

Oklahoma is poised to support industries producing clean energy and using clean energy technology as a means of meeting federally mandated air quality standards. Oklahoma continues to improve alternative fuel corridors, providing clean energy options to motorists—including charging stations and compressed natural gas stations on federally designated alternate fuel corridors.[15] Other beneficial environmental opportunities lie with increasing

utilization of low-emission rail and waterway services to transport goods due to their large carrying capacity and lower shipping costs.

Wind Turbines and Trucks

WIND ENERGY

According to the U.S, Energy Information Administration, in 2015 Oklahoma ranked third in the nation in net electricity generation from wind, which provided about one-fourth of the state's total. The state's share of power generation fueled by coal has decreased in recent years as wind-powered generation and natural gas have increased.

IMPLICATIONS OF ENERGY AND ENVIRONMENTAL TRENDS

Oklahoma has long been a leader in the energy sector, and will continue to maintain that status. In addition to raw materials extraction, core components of Oklahoma's energy system include machinery and manufacturing natural gas products and distribution systems. The state is also proud of its ability to meet air quality standards, leveraged in part by proactive efforts in promoting and using natural gas.

Energy freight movements are sensitive to national and global market forces and thus Oklahoma's freight transportation will need to position itself to be responsive to changes in the international scene. Oklahoma's use of rail, truck, and waterway systems provide a variety of ways to respond to the changing demand for this commodity. The volatile energy market poses a unique challenge to the transportation system due to the high volume of heavy loaded vehicles traveling through rural communities that are not equipped to handle the size and scale of these shipments.

4.1.2 Demographic Trends

POPULATION

Oklahoma is the 28th most populated state. Since the last census in 2010, population in Oklahoma is estimated to have grown to 3.9 million people in 2016. This represents a 4.6 percent increase in population over the period. Population growth in Oklahoma tracked closely with national growth of 4.7 percent.

While the state's population is anticipated to exceed 4.2 million people in 2025, a 15 percent increase over 2010, this reflects a tapering of growth.[16] Growth is expected to be centered in the existing metropolitan areas.

EMPLOYMENT

Oklahoma employment growth began to lag that of the nation in 2013 as Oklahoma's mining employment flattened out, before the decline in energy prices. Looking ahead, unemployment rates in the state are expected to be around 4 percent in 2017 and 2018, comparable to U.S. forecasted rates of 4.5 percent.[17]

Industry employment projections are developed by the Oklahoma Employment Security Commission. **Table 6** illustrates the importance of freight-related industry employment to Oklahoma. Thirty-six percent of the state's employment depends on freight transportation.

Table 6. Oklahoma Economic Sector Employment (Third Quarter, 2016)

Sector	Average Employment
Goods Producing	282,846
Agriculture, Forestry, Fishing, and Hunting	10,688
Mining	42,860
Utilities	16,335
Construction	83,518
Manufacture	129,444
Trade and Transportation	302,731
Wholesale Trade	58,534
Retail Trade	186,095
Transportation and Warehousing	58,102
Other Services	734,639
Government	235,611
Total	**1,555,827**

Source: Oklahoma Employment Security Commission and the U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW), 2016.
https://www.ok.gov/oesc_web/Services/Find_Labor_Market_Statistics/QCEW/qcewdata2.html

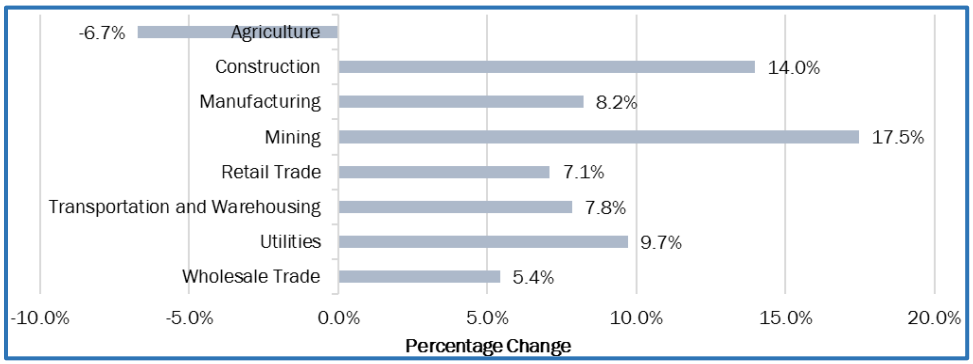
Implications of Demographic Trends

Oklahoma, like many other Midwestern and South Central states, is expecting modest growth in population and employment over the next decade. With growth concentrated in urban areas, freight flows, congestion, and conflicts are likely to increase. The expected future increase in population concentration in Oklahoma City and Tulsa will have a twofold impact on freight transportation in the state. First, the two major population centers will experience an increase in demand for goods, intensifying truck movements in the metropolitan areas. Second, increased inbound truck activity combined with a growth in personal auto travel associated with the increase in population will contribute to additional congestion on the Oklahoma City and Tulsa road networks. Adding further to the congestion will be increased traffic passing through the two metropolitan areas.

As rural populations are more dispersed, other issues related to efficient freight transport will need to be addressed. In rural areas, increased home delivery and consolidation of commercial rail and intermodal services present challenges as further described later in this chapter.

Figure 19 shows the projected change in employment for Oklahoma freight-related industries between 2014 and 2024.

Figure 19. Projected Employment Growth (2014 through 2024)



Source: Oklahoma Employment Security Commission, 2017
https://www.ok.gov/oesc_web/Services/Find_Labor_Market_Statistics/Projections/

- During this time period, mining, which includes oil and gas extraction, and construction are expected to demonstrate the greatest employment growth.
- Agriculture is the one industry sector expected to have a decrease in employment. The decrease, however, will likely not affect agriculture transportation demand as productivity will continue to improve. Additionally, agriculture is a land intensive sector of the economy, so shipment distances and freight transportation demand could increase, despite employment decline.
- Employment in the transportation and warehousing sector is expected to increase by 7.8 percent. Within that sector, however, warehousing and distribution center employment is projected to grow by 41.8 percent.

4.1.3 Economy and Trade

Economic Growth

Measured by annual real GDP, U.S. economic growth slowed in 2016. In 2016, annual GDP grew 1.6 percent compared with annual growth of 2.6 percent in 2015. Although the economy grew over the two-year period, freight traffic did not always parallel that growth. Using rail carloads as a measure, non-containerized rail traffic decreased 13.8 percent over the period. If coal is excluded, the two-year decrease was 3.8 percent. Intermodal loads were flat over the two years. Truck vehicle-miles traveled (VMT) over the two years—measured in combination truck mileage in Oklahoma—increased 0.8 percent.

By comparison, the Oklahoma economy enjoyed a period of prolonged growth from the middle of 2010 through 2014 before oil prices peaked and the recent 2015 through 2016 downturn ensued. As measured by gross state product, the state suffered a recession similar to the experience of 2008. In 2016, oil and gas production was down after climbing for the previous six years. Growth occurred in the areas of education, health, construction, hospitality, and agriculture; and annual GDP grew 1.3 percent in 2016. In 2017, oil and gas employment is steady, but has yet to show signs of significant gains. Industry professionals expect the growth to continue with growth to average 2.0 percent in 2017 and 2018.[18] Looking to the national future, GDP is expected to average 2 percent annual growth over the next 10 years.[19]

Agriculture Products – Transmodal Transport

Agriculture produces about 1 percent of Oklahoma's GDP and has been identified as a critical user of the transportation system. Intermodal transportation can benefit a wide range of shippers including agriculture producers. According to the U.S. Department of Agriculture, about 28 percent of U.S. agricultural shipments are shipped in containers, and about 10 percent of U.S. grains are shipped in containers.[20]

Flatbed Truck on I-40

Containerized (intermodal) transport allows shippers to maintain the identity of bulk agricultural products and allows customers to buy in small lot sizes. Providing intermodal service to rural areas is difficult. At present, Oklahoma markets do not generate sufficient quantities to meet the required threshold for financially viable intermodal services.

Similar to the intermodal transportation, there is a growing demand for transload facilities so that non-containerized freight can be transferred from one mode to another. In particular, there is an increasing demand for shipments that travel on Oklahoma rail or water systems and use truck for "last mile" transport. In Oklahoma, wheat production is a primary agriculture product using transload facilities. Grown largely in low-density western areas of the state, farmers rely on trucks and short-line railroads to get their products to barges and/or Class I rail terminals.

Retail Home Delivery

A major reason for the emphasis on time to market is the growth in consumer home delivery. All of Tompkins International Supply Chain Consortium[21] members—retailers and manufacturers alike—expect direct to consumer sales to increase in the next three years.

E-Commerce

From 2004 to 2014 (the latest data fully available) the U.S. Census Bureau's Retail Trade Survey reports that electronic commerce rose from 2.1 percent of total retail trade to 6.4 percent, climbing at a compound annual growth rate of 17 percent compared to 2.7 percent for traditional retail. This trend underlies fierce competition between electronic and storefront retailers, and has given rise to so-called omni-channel retail, which denotes the attempt to merge in-store with online shopping. A department store customer can view merchandise from their smartphone, know which stores have it in stock, examine it in the store, buy it, bring it home or have it delivered, order a different style from another store or Distribution Center (DC), pick it up or send it home—or handle the entire transaction from home on their smartphone.

> We appreciate being involved in the freight discussion and building relationships with others to improve freight transportation. Relationships are important to share information in order to improve infrastructure, increase efficiency for our fleet, and reduce costs for our customers
> *—Large-retail corporation executive*

Underlying these marketing strategies are logistics strategies. The more volume an online retailer like Amazon commands in the light-density lanes into residential areas, the lower its cost and the less room there is for competitors. The same logic applies to rapid delivery: only a few competitors can attract the volume to afford it, and the speed is designed to approximate the convenience and immediacy of in-store purchases. Moreover, consumer research demonstrates that the demand for next-day and same-day delivery service rises along with the frequency of online purchases, suggesting that growth in one facilitates growth in the other.[22] Storefront retailers in turn are obliged to match the fast delivery service for customers who prefer it.

For both electronic and storefront merchants, the goods have to be positioned to fulfill the time commitment, requiring facilities—distribution centers, stores and other staging points—close enough to accomplish this. While consolidation of next-day and same-day deliveries can be achieved through the networks of such major package carriers as UPS, FedEx, and U.S. Postal Service, smaller time windows reduce the opportunity for it. In addition, traffic, access, and parking conditions affect the ability to meet time commitments.

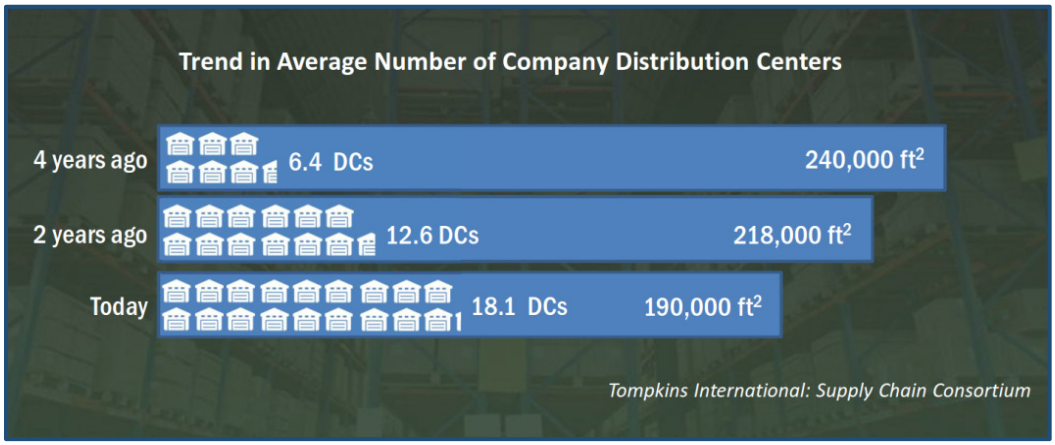
Warehouse Location and Automation

The number of DCs used by U.S. supply chains has tripled in the past four years, from an average of 6 to an average of 18 per supply-chain, according to data collected by Tompkins.[23] Tompkins reports pronounced growth in DCs in both sectors, although it is strongest among retailers. The reason for this dramatic increase in facilities is the rising importance of faster time to market, which requires that the staging points for goods be placed closer to the points of consumption.

Distribution Centers

The average size of DCs (**Figure 20**) has decreased in parallel, partly because inventory is divided up and some of the added facilities are simple cross-docks or branch DCs, but also because warehouse automation has made it possible to reduce the physical footprint of DCs by two-thirds with no sacrifice in throughput.[24]

Figure 20. Proliferation of Distribution Centers



Source: Tompkins International, 2015.

DCs in Oklahoma are likely to increase in number. Oklahoma traditionally has not attracted large regional retail DCs because much of its population is within overnight or same-day trucking range of Dallas and Kansas City, both of which have larger urban markets for anchors and serve as regional distribution hubs. The proliferation of warehousing does not change this, but it can mean that the need for, and the viability of, satellite facilities in Oklahoma will grow, especially near its cities. Smaller facilities could have a competitive edge since facilities designed for more labor-intensive warehouse operations could gradually become obsolete.

Implications of Economic and Trade Trends

Innovations in transportation and e-commerce will affect the future for agriculture, retail, and warehouse operations.

As agriculture productivity and global demand for Oklahoma products such as wheat and soybeans increase, transportation efficiency will be of heightened importance. Oklahoma exports are likely to be transported by truck to rail or barge terminals. These transmodal (non-containerized) operations present an opportunity to leverage the strengths of each mode to reduce agriculture transportation costs.

Multiple factors related to retail trade have implications for Oklahoma:

- Delivery vehicles in urban residential and rural areas are likely to increase. As volumes grow across the variety of product types noted above, the carrying capacity as well as the number of delivery vehicles required becomes an issue. A case in point is that of drones, whose capacity generally is a shipment of about five pounds.[25] Drones can be productive for rural and suburban deliveries with infrequent and dispersed demand but, as traffic builds up and shipment types proliferate, they become less well suited.
- Competition between storefront retail and online sales will be stiff. Oklahoma has recently broadened sales tax requirements, and this will provide a balance point for retail sales.
- Delivery delays and their causes will be more visible to Oklahoma residents. This could lead to a higher incidence of complaints, but could also make the challenges of freight delivery more tangible and meaningful

to citizens. The belief that "freight doesn't vote" could begin to recede as residents experience their household supplies failing to arrive when needed and learn the reasons firsthand.

- Concern for the safety and environmental qualities of delivery trucks is likely to continue. Adoption of different and new technology is apt to accelerate, including use of natural gas and hybrid electric trucks, and safety advances associated with connected and automated/autonomous vehicles (C/AV). The ability for drivers to see—and vehicles to sense—activity and obstacles all around them, promises substantial reductions in incidents and accidents, and makes trucks far more neighborhood-friendly.

Trucks on I-40

Warehouse and DCs in Oklahoma are likely to increase in number. Oklahomans can expect distribution from smaller local facilities; higher shipping volume per acre because of greater storage density; and continued emphasis on speed and reliability of the freight network.

4.1.4 Transportation Technology and Innovation

Connected and Automated/Autonomous Vehicles

In October 2016 in Colorado Springs, CO, the first automated freight delivery was completed by the self-driving truck company, OTTO, carrying a 120-mile shipment of Budweiser beer for Anheuser-Busch InBev.[26] This is remarkable not only as a transportation milestone, but for the degree of automation: the beverages rolled off the production line onto the truck and continued from the plant to the delivery point with little or no direct involvement of labor. Effectively, this made the delivery process an extension of the manufacturing—and OTTO in fact is marketing itself as a "self-driving solution for lean factories."[27]

OTTO Budweiser Driverless Delivery

Truck Platoons

Truck platoons are an aspect of connected and automated/autonomous truck technology that is apt to be especially meaningful in Oklahoma because of its high proportion of through freight and its long travel distances over relatively open and flat territory. Platoons consist of two or more trucks traveling closely behind one another,

using automated sensors and controls to maintain short headway distances between vehicles, which in turn allow the vehicles behind the lead truck to reduce fuel consumption by air drafting. Fuel savings vary by position in the line. The Texas A&M Transportation Institute quotes estimates of 5 to 20 percent fuel savings,[28] and a European manufacturer claims an average savings of 10 percent.[29]

Coupled with the potential for drivers to switch to autonomous "autopilot" mode (especially in the trailing vehicles, although the lead vehicle could do the same), significant cost savings become available in fuel and labor, which are the two largest cost components in trucking. Live demonstrations of truck platoons have been conducted in the United States and Europe,[30] including a successful 2016 European Union "challenge" that saw half a dozen truck manufacturers run platoons over separate public roadways through five countries—thus testing the regulatory as well as the operational concept.[31]

Commercial Vehicles Equipment and Other Technology

For some time, truckers have been employing technology in their operations and supporting public initiatives to add technologies on the highways. The products that have developed are important to safety, cost monitoring, and efficient operations.

Truck and Trailer Information Systems

Trucking equipment is continually evolving to include technologies to monitor the performance and operation of the vehicle, to improve communication with company personnel and for the safety and convenience of the operator. These technologies cover a wide range of capabilities from speed control, engine monitoring, communication and driver comfort and convenience.

Highway Technology

Highway technologies are also evolving and being deployed with greater frequency. Current applications of electronic signage help drivers avoid problem areas and improve their trips by having access to current travel time and alternate route notification. Commercial-vehicle monitoring allows enforcement officials to monitor regulatory compliance of passing vehicles.

Load Access

Online load boards have been around for a considerable length of time. New technological capabilities have allowed the concept of real-time load access to balloon. Brokers, logistics services, and trucking companies with excess freight are all developing some form of a cellphone application that gives drivers access to potential loads, to capture detailed load information and report status.

Railroad Technology

As an example of next generation technology, drones are being used to inspect difficult locations like tunnels and bridges. The Positive Train Control systems that railroads are implementing nationwide promise improvement in safety performance. Additionally, regulators at the Federal Railroad Administration and the Pipeline and Hazardous Materials Safety Administration called for a new electronically controlled pneumatic braking system that would prevent—or lessen the severity of—hazardous materials crashes.

Waterways Innovation and Technology

The USACE Tulsa District has used real-time technology to monitor loads applied to a center-post. A center-post is used to set a temporary de-water closure on one end of a lock chamber, which allows the gates to be operated for repair and inspection purposes while the chamber is empty. A real-time system detects loads and provides information to the USACE personnel to better understand the forces that are applied to this structure during the temporary lock closure.

The USACE is working with its Engineering Research and Development Center[32] to evaluate ways to address corrosion for gates at Webbers Falls lock and dam. Corrosion protection is a major maintenance need for miter gates, and an innovative primer is being tested to determine its effectiveness.

IMPLICATIONS OF TRANSPORTATION TECHNOLOGY TRENDS

The implications of automated vehicle technology for Oklahoma are many and uncertain. The safety benefits when a driver is present in an automated vehicle could be substantial, and would accrue from the interaction with technology-enabled automobiles as well as from enabled trucks. Advancements in safety could reduce community concerns about truck traffic, and would be especially helpful in the context of home deliveries. However, without a driver actively behind the wheel, the public perception is apt to be different and risk-averse, even if the safety profile is equally strong. There are other legal, technological, and market issues that could slow or speed implementation. As a result, truck and automobile technologies are likely to evolve by degrees, and automated operations are likely to coexist with traditional ones for years.

ODOT will have a role in implementing new vehicle technology as it interacts with the transportation network. Information technology and ITS applications will need to continue to evolve and expand to address various levels of communication and automation.

The rail and waterways industries are using new and sustainable methods for their systems as well. Drone technology, new braking systems, and improved replacement or repair components for locks and dams will improve efficiency and safety for rail and waterways, respectively.

4.1.5 Transportation Industry Trends

SUPPLY CHAINS

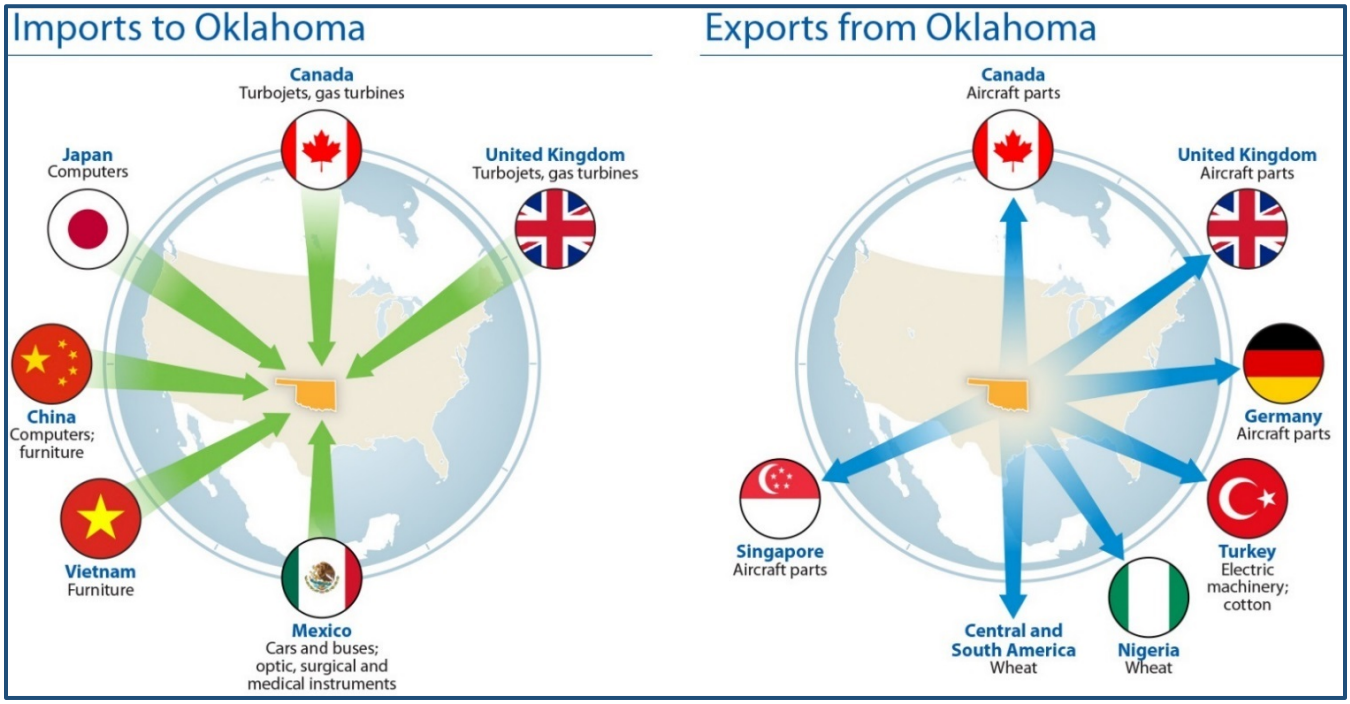
Supply-chain sourcing relates to where retailers obtain products for sale, where manufacturers obtain materials and components, and relatedly, where manufacturers locate the production that supplies retailers. The concept of supply-chain management or logistics is about efficient management of business operations from initial input (sourcing) to final product delivery. Clearly, an optimized transportation system plays an essential role. Oklahoma is involved in complex supply chains that require goods movement across the globe, as shown in **Figure 21**.

The long advancing off-shoring trend shuttered 40 percent of large U.S. factories in the 2000s,[33] even though U.S. manufacturing output was almost 40 percent higher in 2011 than in 2001, and has grown since.[34] The growth in manufacturing output could be explained by higher productivity enabled by automation and information technology, as well as lower labor components for some of the production that stayed in the United States.

As wages overseas began to rise along with fuel prices, the expectation that production could return to the United States arose in the mid-2000s. This is known as the near-shoring or re-shoring phenomenon. Supporting it was the increasing importance of time to market. Nevertheless, more recent research from A.T. Kearney indicates that re-shoring mainly has not materialized, apart from a blip in 2011.[35] While the report cites scores of instances where re-shoring occurred in the same industries cited above, there has not been a sea change. Even so, other survey research found 31 percent of North American manufacturers considered near-shoring a possible opportunity for their company, with the United States and Mexico about equally attractive.[36]

In light of the findings, the key question is not whether near-shoring was a possibility, but to what degree. U.S. production clearly does have advantages in time to market and benefits from automation (e.g., robotics, optics, artificial intelligence, 3D printing). Availability of lower cost domestic raw materials, regionalization, and investment in local jobs are also factors in the equation.

Figure 21. Examples of International Imports and Exports To and From Oklahoma



Three-Dimensional (3D) Printing

Three-dimensional (3D) printing (or additive manufacturing) is not new, but its appearance in new applications with advanced materials is bringing it more deeply into manufacturing processes and supply chains. The technology replaces traditional fabrication in factories with production from specialized printing devices operating in three dimensions, using a variety of materials, and able to be located almost anywhere. Its principal transportation effect is to substitute local production for longer distance transportation from plants and DCs. Thus, local traffic related to such locations could increase as well.

CHANGING INTERNATIONAL SHIPPING LOGISTICS

East Coast ports have gained market share at the expense of West Coast ports in recent years, with the West Coast ports' import market share decreasing from 56.8 percent in 2000 to 49.5 percent in 2015. The modernization of the Panama Canal, which was completed in June 2016, could cause this trend to continue. The project increased the capacity of the canal since it now allows the passage of much larger ships. Economies of scale from the increase in vessel size reduce the cost of all-water service via the canal between Asia and the East Coast. With lowered costs, some cargoes could shift from entering the United States through West Coast ports to East Coast ports, eliminating the rail trip to the east.

However, several factors will moderate the transfer. The all-water transpacific service via the Panama Canal is much slower than shipments using West Coast ports and intermodal rail service to the East Coast or Gulf Coast states. Products that are cost-sensitive could shift to the all-water service, but products that are more time sensitive will continue to be transported by existing West Coast/inland rail routes. Finally, a study for the Texas Department of Transportation (Panama Canal Study)[37] demonstrates that rising charges and high volumes at the Southern California ports have stimulated interest in other trade corridors. Growth of freight in and out of Texas ports means growth in transport of products to and from Texas and neighboring states like Oklahoma.

IMPLICATIONS OF TRANSPORTATION INDUSTRY TRENDS

Changes surrounding supply-chain management, international shipping logistics, trucking and rail infrastructure affect where goods will be shipped, in what quantities, and how they will be transported.

Truck Parking

The opening of the expanded Panama Canal is expected to result in an increase in cargo handled at Gulf Coast ports, although the magnitude is unclear and will depend on a number of factors, including the tolls levied by the Panama Canal Authority and how railroad and port pricing structures change.[38] If cargo handled at Gulf Coast ports does increase, there will be a ripple effect of freight transportation growth in Oklahoma.

Supply-chain matters for freight planning, first, because it affects Oklahoma's locations of goods movement. Secondly, freight-based investments could be motivated by economic development and could be influenced by the market prospects for the businesses involved. Some of the investments, like 3D printing, could substitute local traffic for regional traffic; others could result in modal shifts. Understanding Oklahoma's industrial profile is important, so that opportunities and threats can be recognized, new developments can be observed closely, and forecasts are viewed as guides to (not proclamations of) the future.

The trucking industry in Oklahoma is strong and plays a significant role in the economy. Trucking in Oklahoma includes every type of carrier from individual haulers and small companies with a few trucks to the largest national carriers. The types of vehicles in operation and the commodities that they carry are equally diverse. Oklahoma's mean wage for heavy truck driving jobs ($42,000) is among the highest in the nation. This is reflective of both the demand and the skill level of certain driving jobs in the state, including the transport of hazardous materials in the energy market. Conditions such as driver shortages and hours of service—combined with an economy that continues to prefer faster and more customized service—reinforce the need for the continued growth and development of this industry.

Demand for freight rail service is expected to continue in Oklahoma, enhanced by the state's geographic location. Twenty-one freight railroads, including three Class I carriers, operate in the state. Attracting and training talented workers, and implementing new technology for safety and efficiency will continue to be important to the rail industry.

The lack of investment in infrastructure has resulted in highways, bridges and waterways that are obsolete and in disrepair. The U.S. freight railroads are private organizations that are responsible for their own maintenance and improvement projects. It is anticipated that railroad companies will need to continue adding to their systems to address the growth in rail traffic over the next decades. Once a source of pride and a great asset for U.S. businesses, many parts of the nation's transportation infrastructure network urgently require investment in renovation and restoration.

4.2 FUTURE GROWTH

Table 7 shows the growth in freight by tonnage between 2015 and 2045. Freight in Oklahoma is expected to grow by nearly 50 percent over the next 30 years. Most of this growth is projected to be in longer trips that have either an

origin or destination point, or both, outside of the state. Through traffic is expected to see the greatest growth, at 63 percent.

Table 7. Long-Term Oklahoma Freight Growth (2015 through 2045)

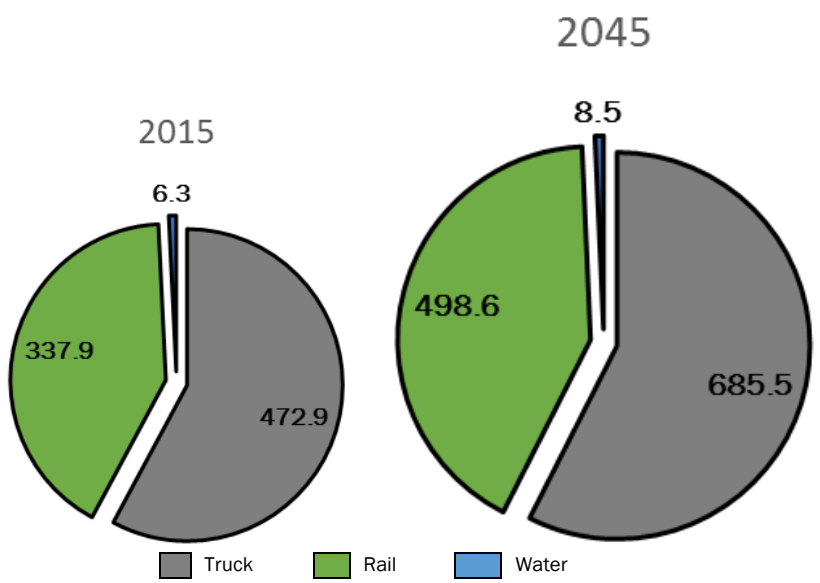
Flow	Mode	Tons (Millions)		Percentage Growth
		2015	2045	2015 through 2045
Inbound	Truck	46.5	65.1	40.04%
	Rail	29.5	29.7	0.60%
	Water	3.1	3.9	25.38%
	Total	*79.1*	*98.7*	*24.76%*
Outbound	Truck	78.5	103.6	32.02%
	Rail	18.0	24.0	32.83%
	Water	3.2	4.6	45.01%
	Total	*99.7*	*132.2*	*32.57%*
Within	Truck	123.6	123.8	0.17%
	Rail	2.5	3.2	30.99%
	Total	*126.1*	*127.0*	*0.78%*
Through	Truck	224.3	393.0	75.19%
	Rail	287.9	441.7	53.42%
	Total	*512.2*	*834.7*	*62.95%*
Total	**Truck**	**472.9**	**685.5**	**44.97%**
	Rail	**337.9**	**498.6**	**47.54%**
	Water	**6.3**	**8.5**	**35.14%**
	Total	**817.1**	**1,192.6**	**45.96%**

Source: IHS Markit Transearch, Freight Analysis Framework 4.3, WSP analysis

In terms of modes, trucking will represent the largest mode share in 2045; however, rail freight is expected to grow at a slightly faster rate (nearly 48 percent compared to 45 percent) over the 30-year period. Water is expected to grow more slowly (35 percent).

Figure 22 shows the tonnage by truck, rail, and water in 2015 and 2045. As shown, all modes are expected to grow substantially over the 30-year period.

Figure 22. Oklahoma Freight by Mode, 2015 and 2045 (millions of tons)



Source: IHS Markit Transearch, Freight Analysis Framework 4.3, WSP analysis

4.3 CONCLUSION

Several important trends are likely to affect the demand for and availability of future freight transportation in Oklahoma:

- Energy independence will require increased production of crude oil. While this will be shipped principally by pipeline, sand required in the extraction process will be moved by rail.
- Agriculture will continue to be a growth industry consuming significant amounts of highway, rail, and waterway capacity.
- The changing retail trade environment will increase both urban and deliveries by truck; expanded number of branch distribution centers will also increase truck volumes; both will compete with through traffic for highway capacity.
- Technology advances supporting truck platoons could divert traffic from rail; safety concerns may require the construction of dedicated truck lanes, but also add to future congestion.

Chapter 5 identifies specific bottlenecks and mobility issues that will prevent the smooth flow of freight. Chapter 6 identifies and prioritizes potential projects to eliminate or mitigate them.