

TEXAS FREIGHT MOBILITY PLAN 2017



FINAL – MARCH 7, 2018

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List of Acronyms

AADT	Average Annual Daily Traffic
AADTT	Average Annual Daily Truck Traffic
AAR	Association of American Railroads
AC AIS	Air Carrier Activity Information System
ACV	Autonomous and Connected Vehicles
AFW	Fort Worth Alliance Airport
AIP	Airport Improvement Program
ALEC	American Legislative Exchange Council
ATA	American Trucking Associations
ATRI	American Transportation Research Institute
AUS	Austin–Bergstrom International Airport
BEA	Bureau of Economic Analysis
BLS	Bureau of Labor Statistics
BNSF	BNSF Railway
BRO	Brownsville/South Padre Island International Airport
BTAC	Border Trade Advisory Committee
BTS	Bureau of Transportation Statistics
CAD	Computer-aided Design
CBP	Customs and Border Protection
CES	Current Employment Statistics
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CRFC	Critical Rural Freight Corridors
CRIS	Crash Records Information System
CTR	University of Texas Center for Transportation Research
CUFC	Critical Urban Freight Corridors
DAL	Dallas Love Field Airport
DFW	Dallas/Fort Worth International Airport
DOT	Department of Transportation
DPS	Department of Public Safety
EFM	Electronic Flow Measurement
EIA	U.S. Energy Information Administration
ELP	El Paso International Airport
FAA	Federal Aviation Administration
FAF	Freight Analysis Framework
FAST	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
FIP	Freight Investment Plan
FIT	Freight and International Trade
FM	Farm-to-Market
FO	Functionally Obsolete Structure
FRA	Federal Railroad Administration
FRATIS	Freight Advanced Traveler Information System

FSD	Freight System Designation
FSI	Freight Shuttle International
FSS	Freight Shuttle System
FTA	Free Trade Agreements
FWWR	Fort Worth and Western Railroad
FY	Fiscal Year
GB	Good or Better Structure
GDP	Gross Domestic Product
GIS	Geographic Information System
GIWW	Gulf Intracoastal Waterway
GM	General Motors
GPS	Global Positioning Systems
GSP	Gross State Product
HRL	Valley International Airport
HSIP	Highway Safety Improvement Program
HVL	Highly Volatile Liquids
IAH	George Bush Intercontinental Airport
IHS	Interstate Highway System
INFRA	Infrastructure for Rebuilding America
ITA	International Trade Administration
ITS	Intelligent Transportation Systems
JIT	Just-in-Time
JPO	Joint Program Office
KCS	Kansas City Southern Railway
LBB	Lubbock Preston Smith International Airport
LEO	Low earth-orbiting satellite
LNG	Liquefied Natural Gas
LOS	Level-of-Service
LRD	Laredo International Airport
MAP-21	Moving Ahead for Progress in the 21st Century Act
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
NAFTA	North American Free Trade Agreement
NES	Non-employer Statistics
NHFN	National Highway Freight Network
NHFP	National Highway Freight Program
NHS	National Highway System
NMFN	National Multimodal Freight Network
NPMRDS	National Performance Management Research Data Set
NTSB	National Traffic Safety Board
OES	Occupational Employment Statistics
OS/OW	Oversize/Overweight
PDO	Property Damage Only
PHFS	Primary Highway Freight System
PHMSA	Pipeline and Hazardous Materials Safety Administration

PEMEX	Mexican Petroleum
PMIS	Pavement Management Information System
QCEW	Quarterly Census of Employment and Wages
RFID	Radio Frequency Identification
RM	Ranch-to-Market
RMA	Regional Mobility Authorities
SAM	Statewide Analysis Model
SAT	San Antonio International Airport
SCADA	Supervisory Control and Data Acquisition
SCF	Standard Cubic Foot
SD	Structurally Deficient Structure
SH	State Highway
SL	State Highway Loop
SME	Small and medium-sized businesses.
SORR	South Orient Railroad
SP&R	State Planning and Research
SSLO	Sub-standard for load only structure
STB	Surface Transportation Board
STIP	State Transportation Improvement Program
STP	Surface Transportation Program
TASP	Texas Airport System Plan
TCEQ	Texas Commission on Environmental Quality
TDA	Texas Department of Agriculture
TFMP	Texas Freight Mobility Plan
THFN	Texas Highway Freight Network
TIGER	Transportation Investment Generating Economic Recovery
TMFN	Texas Multimodal Freight Network
TMT	Truck-miles Traveled
TPP	Trans-Pacific Partnership
TRRIF	Texas Rail Relocation and Improvement Fund
TSDC	Texas State Data Center
TTI	Texas A&M Transportation Institute
TPP	Texas Transportation Plan
TTTR	Truck Travel Time Reliability
TWC	Texas Workforce Commission
TxDOT	Texas Department of Transportation
TxDOT TPP	TxDOT Transportation Planning and Programming Division
UNT	University of North Texas
UP	Union Pacific Railroad
UPS	United Parcel Service
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
USEIA	U.S. Energy Information Administration
USPS	United States Postal Service

UTEP	University of Texas at El Paso
UTP	Unified Transportation Program
VMT	Vehicle Miles Traveled
WIM	Weigh in Motion
WRRDA	Water Resources Reform and Development Act
WTO	World Trade Organization



Texas Freight Mobility Plan

Chapter 1: Introduction



The Texas Freight Mobility Plan (Freight Plan) provides a blueprint for facilitating economic growth potential in Texas through a solid but flexible strategy for addressing freight transportation needs throughout the state.

With one in sixteen jobs in Texas directly supported by freight transportation, the importance of setting the right course for and investing in our state's safety and mobility improvements can't be overstated.

1.1 Purpose of the 2017 Texas Freight Mobility Plan

The 2016 Freight Plan was the first comprehensive multimodal transportation plan that focused on the needs of the state's freight industry and businesses. That Plan identified challenges, investment strategies, policies and data needed to enhance freight safety and mobility across all modes; to provide efficient, reliable and safe freight transportation; and to improve the state's economic competitiveness.

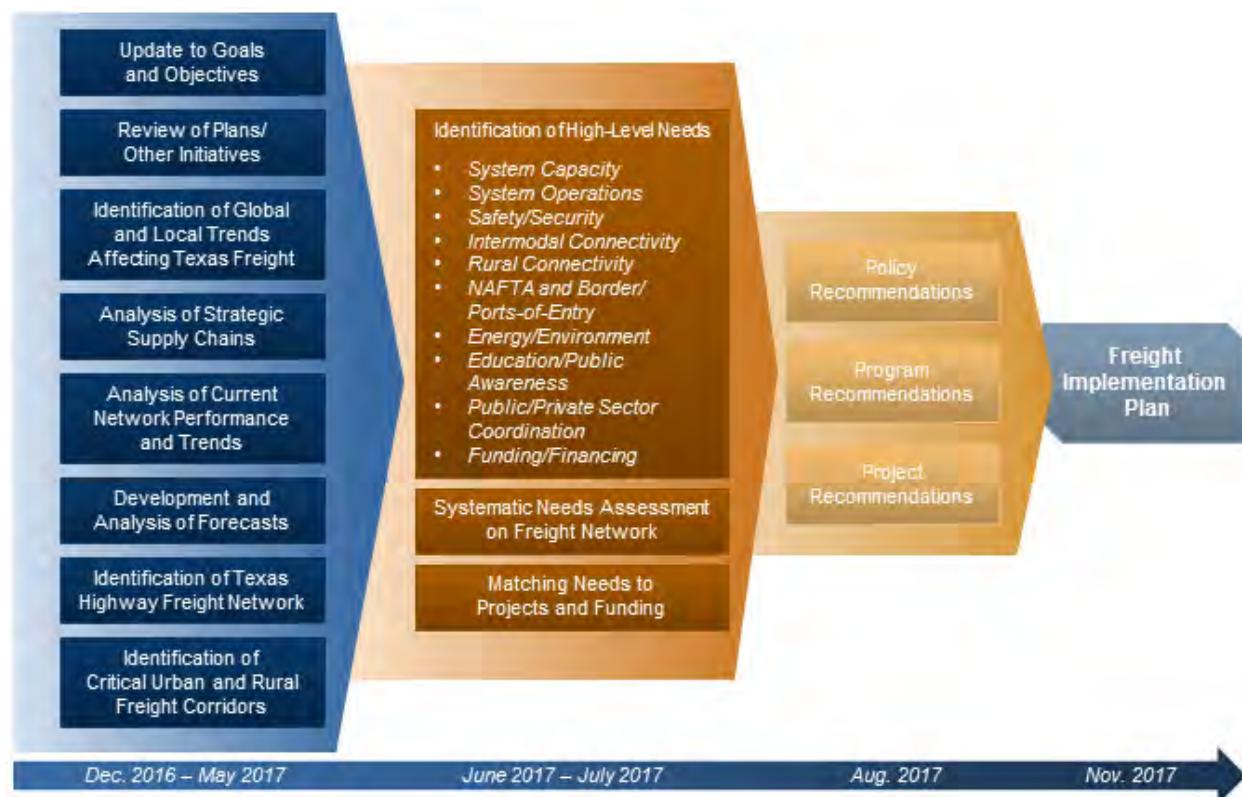
The 2017 Texas Freight Mobility Plan allows the Texas Department of Transportation (TxDOT) to enhance and expand on the 2016 Freight Plan, ensuring a comprehensive approach for facilitating the efficient and safe movement of people and freight while meeting new federal requirements, discussed later in this chapter. The 2017 Freight Plan reaffirms and enhances the framework for Texas' comprehensive freight planning program and decision-making by:

- Outlining high-, medium-, and low-priority plans for freight investments and planning activities. **(Chapters 11-14)**
- Identifying freight transportation facilities that are critical to economic growth and goods movement and updating the Texas Multimodal Freight Network through a comprehensive, data-driven, stakeholder-informed process. **(Chapter 6)**
- Providing strategies to enhance economic growth and competitiveness by focusing on key freight intensive industries throughout the state and improvements on the Freight Network. **(Chapters 3, 4 and 6)**
- Updating the economic impact of all freight modes on Texas and its economy. **(Chapter 3)**
- Validating and expanding policies and investment strategies to enhance Texas' freight transportation system. **(Chapters 11-13)**
- Ensuring consistency with neighboring states and federal goals and objectives. **(Chapters 2 and 11)**
- Providing a realistic implementation plan focused on immediate and robust strategies to ensure prioritized needs will be addressed within a reasonable timeframe. **(Chapter 14)**

This plan builds upon the 2016 Freight Plan which incorporated a decade of multimodal strategic planning at the statewide, regional and local levels. Developing the 2017 Texas Freight Mobility Plan involved a number of steps, including analyzing the current and future freight transportation system, updating the Texas Multimodal Freight Network and Texas Highway Freight Network, identifying needs and gaps and developing recommendations. Stakeholder engagement was incorporated throughout the entire update process. Outreach was conducted through the Texas Freight Advisory Committee (TxFAC); 23 stakeholder

workshops; and multiple webinars with Metropolitan Planning Organizations (MPOs), TxDOT Districts and Divisions and neighboring states' departments of transportation. A key outcome of the Freight Plan is an implementation plan that will meet the needs and challenges faced by TxDOT. This includes a prioritized list of projects, funding considerations and performance measures. **Exhibit 1-1** displays the Freight Plan's development process.

Exhibit 1-1: *Freight Plan Development Process*



1.2 Texas Freight Transportation Overview

Goods movement is the foundation of the Texas economy. Texas' ability to maintain its position as a leader in the global economy depends on the strength of its freight network. An efficient and cost-effective multimodal freight transportation system in Texas connecting rural and urban areas, economic activity and production and consumption centers is critical for continued economic stability and growth. A multimodal freight network provides access to markets and jobs, as well as the delivery of raw materials and the shipment of finished goods.

Commerce and quality of life in Texas depend on the daily delivery of millions of tons of goods shipped through the state's multimodal network of highways, railways, waterways and ports, inland ports, airports and pipelines. The state's multimodal freight network must keep pace with increasing demands from businesses, manufacturers and residents. The movement of freight through, from, within and into Texas will continue to increase, thanks to a robust economy, population growth, increased trade and continued energy production. In 2016, more than 2.2 billion tons of freight – 19.7 tons per household and 12,743 tons per business – moved within Texas, and this volume is anticipated to increase to over 4.0 billion tons by 2045.¹ To meet this demand and to support current and future economic opportunities, Texas must continue to make strategic investments in its transportation system.



1.2.1 Economy

The efficient and cost-effective movement of freight plays a critical role in the state's economy. Texas has the second largest economy in the U.S. and relies on its multimodal transportation system to ensure continued economic prosperity. If Texas were a nation, it would rank as the 10th largest economy in the world.² Texas has a gross state product of \$1.6 trillion (2016) and is home to five of the top 50 companies on the Fortune 500 list and home to 50 companies on that list overall.³

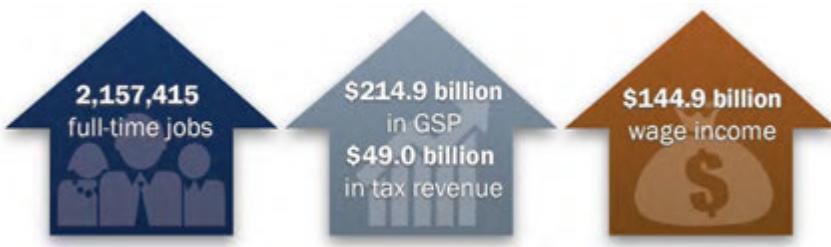
¹ The estimated tonnage in 2045 does not account for pipeline. Cambridge Systematics analysis based on IHS/Global Insight TRANSEARCH, 2010.

² Office of the Governor, Economic Development and Tourism, retrieved September 23, 2017 from https://businessintexas.com/sites/default/files/02/06/17/edt-2016review_0.pdf.

³ Fortune 500. 2017. Retrieved September 25, 2017. <http://fortune.com/fortune500/list/filtered?statename=Texas>.

In total, the freight transportation sector supports nearly 2.2 million jobs in Texas, which adds close to \$145 billion in labor income, and leads to \$215 billion in Gross State Product (GSP). This yields \$49 billion in tax revenues, which include \$33 billion in federal taxes and \$16 billion in state/local taxes.⁴ More detail on the economic impacts of freight transportation is provided in Chapter 3.

Total Economic Impact of Freight Transportation in Texas



1.2.2 Population

Population growth is a significant factor that affects freight growth in Texas because residents consume commodities that must be transported throughout the state and beyond. Texas is the second most populated state in the nation, with about 28 million people in 2016.

If current trends continue through 2045, the population is expected to grow by 40 percent to nearly 39 million. Population is expected to further concentrate in urbanized areas and existing population centers.⁵ As population concentrates in the state's urban areas, freight movement to consumers will be focused in these areas, increasing pressure on already congested roadways. In addition, as population increases in urban areas, so do land prices. This has the effect of pushing more freight industry and freight-intensive activities to the rural regions where land is more cost-effective.

**2016 Population:
28 million**
**2045 Projection:
39 million**

<http://txsdc.utsa.edu/Data/>

⁴ The employment and wage data utilized in this analysis come from the Quarterly Census of Employment and Wages (QCEW) database and the Employment and Wages from Occupational Employment Statistics (OES) survey provided by the Bureau of Labor Statistics (BLS), the Non-employer Statistics (NES) provided by the U.S. Census Bureau, and the rail statistics provided by the Association of American Railroads (AAR) in its States Statistics in 2010 and its Freight Railroad in Texas, Rail Fast Facts for 2015 (February 2017).

⁵ Texas Demographic Center. Accessed August 20, 2017. <http://txsdc.utsa.edu/Data/TPEPP/Projections/>.

1.2.3 Trade

In 2016, Texas was ranked number one in the nation in exports by the U.S. Census Bureau, a position it has maintained for 15 consecutive years. With \$232.6 billion in total exports in 2016, the value of exports of Texas goods has increased by an average of 4.4 percent annually since 2006. Texas trades with countries throughout the world. Mexico, Canada, China, Brazil and South Korea are the countries receiving most of the state's exports.



**2016 Exports:
\$232.6
billion**

Texas serves as a critical gateway for the nation's strategic trade relationships with Mexico, Central America and South America. The state is ideally positioned to benefit from the continued increase in trade between the North American Free Trade Agreement (NAFTA) countries. I-35, I-10 and multiple rail corridors connect these countries. Trade with Mexico relies on efficient highway and rail transportation in Texas, including both freight destined for the state and freight moving through to another market.

1.2.4 Energy Production and Refining

Texas leads the nation in crude oil and natural gas production, as well as wind energy production. Final fossil fuel production for 2016 was more than 974 million barrels of crude oil from about 179,000 producing wells and over 8.1 trillion cubic feet of natural gas.⁶ Texas oil and gas production occurs throughout the state with significant production in the Permian Basin and Eagle Ford Shale plays in West and South Texas. Oil and gas extraction is also prevalent in some urbanized areas of the state such as the Barnett Shale play under Denton, Texas. As of January 2016, the 29 petroleum refineries in Texas, which are primarily located along the Gulf Coast, had a capacity of over 5.4 million barrels of crude oil per day and accounted for 30 percent of total U.S.



2016:
974 million barrels oil
179,000 wells
8.1 trillion c. ft.
of natural gas

⁶ Railroad Commission of Texas. Texas Monthly Oil & Gas Production. Retrieved September 3, 2017 from <http://www.rrc.state.tx.us/oil-gas/research-and-statistics/production-data/historical-production-data/>

refining capacity.⁷ Wind energy production is most common in West Texas where wind currents cover wide, open spaces.

Rural and urban areas experience different challenges to support fuel production and distribution. Energy production in rural areas can experience damaged roadways that were not designed to support heavy trucks carrying water, sand and gas. Urbanized areas are more likely to have access to other modes and to a robust network of roadways but they must also compete with residents on congested sections of the highway system. Freight challenges for wind energy development are primarily in handling oversized loads on roadways not designed to carry large cargo.

1.2.5 Rural Freight Transportation

Approximately 70 percent of the land area and 172 counties in Texas are classified as rural, according to the U.S. Office of Management and Budget. These regions are home to Texas' large agricultural economy and support transportation of freight in all industries by connecting Texas businesses to markets throughout the country. These rural communities are also increasingly important to the state's energy industry. Texas' rural transportation system provides the first and last link in the agricultural supply chain from farm to market while supporting the energy and tourism industries.⁸

1.2.6 Urban Freight Transportation

Growing population and employment in Texas' urban areas means increased demand for the delivery of goods. The growth of freight movement within Texas urban areas intensifies congestion, since the movement of goods, like the movement of passengers, contributes to traffic. Congestion in urban areas greatly impacts the efficient movement of goods and affects the reliability, timing and distribution of freight.

⁷ U.S. Energy Information Administration. Texas State Energy Profile. Retrieved September 23, 2107 from <https://www.eia.gov/state/?sid=TX>

⁸ TRIP. 2017. "Rural Connections: Challenges and Opportunities in America's Heartland."

Most highway freight bottlenecks are located in Texas' urban areas. Bottlenecks do not just impact local deliveries; they affect statewide, national and even international goods movement. In the latest 2017 report of the top 100 freight bottlenecks in the U.S., Texas has six of the top 25 freight bottlenecks in the nation, located in Austin, Dallas, Fort Worth and Houston.⁹ The estimated cost of congestion in Texas to the trucking industry tops \$5.1 billion. For example, in 2013, Dallas-Fort Worth had an annual cost of congestion of \$406 million. By 2015, the congestion had increased to \$1.3 billion annually, an increase of over 220 percent. Similarly, for the Houston area, the 2013 cost of congestion to trucking was \$373 million, which tripled to more than \$1.1 billion by 2015. These urban areas are not only significant employment and population centers, where last mile deliveries are critical, they are home to major freight generators and gateways, including ports, airports, manufacturers and distribution centers.

1.2.7 Multimodal Transportation System

To meet the future challenges of moving freight and people, additional strategic investment in the multimodal freight transportation system is needed. The multimodal system necessary to support the state's economy includes highways, railways, waterways, airports and pipelines. The components of the multimodal system, briefly described in the following section and detailed in **Chapters 6 and 7**, connect the gateways with origins and destinations. Gateways include facilities through which exports/imports flow, such as border



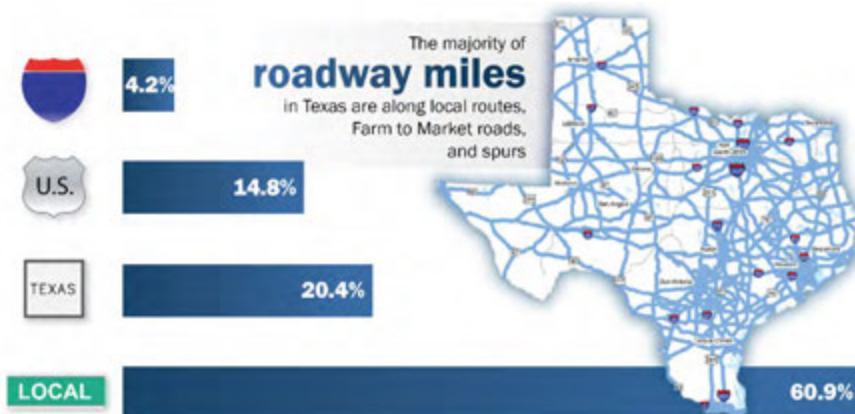
⁹ American Transportation Research Institute. 2017 Top 100 Freight Bottlenecks in the U.S. Retrieved September 4, 2017 from <http://atri-online.org/2017/01/17/2017-top-100-truck-bottleneck-list/>.

crossings with Mexico, water ports, inland ports, intermodal transfer facilities, warehouse and distribution facilities, and commercial airports.

One of the key outcomes of the 2017 Freight Plan is the redesignation of the Texas Multimodal Freight Network using a data-driven, stakeholder-informed process. The Texas Multimodal Freight Network represents the set of the state's freight assets that are most important for moving the largest volumes of freight and that serve the state's key freight intensive industries.

Highways

Currently, highways are the predominant mode for freight movement within the state. They provide the first and last mile connection to rail facilities, ports and airports as well as serve long haul trips destined throughout the state and



beyond. Texas has the most extensive highway network of any state with over 313,000 centerline miles of public roadways, more than 3,200 miles of interstate and over 12,000 miles of U.S. highways. This Freight Plan includes a redesignation of the Texas Highway Freight Network to include the designation of Critical Urban and Rural Freight Corridors. This redesignation adds about 3,000 miles over the 2016 network and includes Texas' portion of the National Highway Freight Network, the Texas Trunk System and other state highways critical to moving freight.

Trucks accounted for 54 percent of total tonnage movement in Texas in 2016 and that tonnage is projected to grow significantly by 2045 assuming that there is capacity to handle the traffic and that commodities travel the same way in 2045 as they do currently.^{10,11} Most of the projected growth is driven by an increase in intrastate trucking as more residents, businesses and freight are located within the state.

¹⁰ Cambridge Systematics updating of IHS/Global Insight TRANSEARCH, 2010.

¹¹ Note that for the 2017 Texas Freight Mobility Plan, trucks are defined based on assignment classes from the Texas Statewide Analysis Model Version 3. Assignment classes included both Light Trucks (Class 3-7) and Heavy Trucks (Class 8-13).

Railroads

Railroads support many industries, shipping materials for energy production, agricultural products, automobiles and many other important commodities. Texas has more miles of rail and more railroad employees than any other state, with over 10,000 track miles. In fact, Texas has 30 percent more freight rail miles than the next highest state (Illinois), making it a rail hub for North America. Railroads are also critical connections for trade between the U.S. and Mexico. Texas has five of the seven rail crossings between the two countries.



Texas is served by three major (Class I) railroad companies: BNSF Railway, Kansas City Southern and Union Pacific. These are the largest railroads in the state and support significant freight movement through and throughout Texas. Additionally, Texas has 49 shortline railroads (local line haul and switching railroads) that are of strategic importance to the state, and serve as first or last mile railroads for Class I railroads, Texas' ports and many of the state's rail-served industries.¹² In rural communities, a connection to a shortline railroad may be the lifeblood of the community.

Ports and Waterways

Ports connect Texas and the U.S. to foreign markets and connect the state to other partners on U.S. coasts. Texas handles the second most total maritime tonnage of any state in the nation, and it is the leading state for international maritime tonnage. Its waterways and ports are important economic engines for the state and the nation and play critical roles in the movement of freight. Port and waterway access is necessary to attract and support many businesses, including the petrochemical sector, one of the state's most important industries. Ports are expected to continue to drive economic growth in the state as industry expands to export plastic, gas and other products. Texas has 12 deep-draft ports and nine shallow-draft ports.¹³ Seven Texas



¹² Association of American Railroads, Freight Railroads in Texas, February 2017. Accessed September 15, 2017.

<https://www.aar.org/data-center/railroads-states#state/TX>

¹³ Deep-draft ports are defined as having a depth of 30 feet or more.

ports rank in the top 50 of all U.S. ports in terms of annual tonnage, including Houston (second), Beaumont (fifth) and Corpus Christi (sixth). Galveston is ranked 51st.¹⁴

Integral to the movement of freight within Texas and the Gulf region of the U.S. is the Gulf Intracoastal Waterway (GIWW). This waterway stretches 1,100 miles along the Gulf of Mexico from Brownsville, Texas to St. Marks, Florida. It is the nation's third-busiest inland waterway. Texas' 379-mile portion of the waterway, designated as Marine Highway 69, is the longest segment of any of the Gulf States, handling two-thirds of the waterway's traffic and moving approximately 86 million short tons of cargo a year.¹⁵

Airports

Air cargo is a key component of Texas' multimodal freight transportation system, particularly for shipping goods with high value or which are very time-sensitive. In 2016, Texas was home to six of the top 50 cargo airports in the U.S. in terms of landed weight.¹⁶ Those airports include Dallas/Fort Worth International, George Bush Intercontinental/Houston, San Antonio International, Fort Worth Alliance, El Paso International and Austin-Bergstrom International. Laredo International was ranked 52nd. Air cargo tonnage is expected to grow at a higher rate than any other mode due to the proliferation of e-commerce paired with expectations of one- or two-day shipping among other market changes.

GULF INTRACOASTAL WATERWAY (GIWW)

Runs **379** main channel miles along the full length of the Texas Gulf Coast

Authorized to be **12** feet deep and **125** feet wide

Provides essential service to the petroleum industry

The Texas portion of the GIWW carried **86** million tons in 2016. This is **63%** of GIWW's total tons

AIRPORTS

24 commercial airports

7 included on TMFN

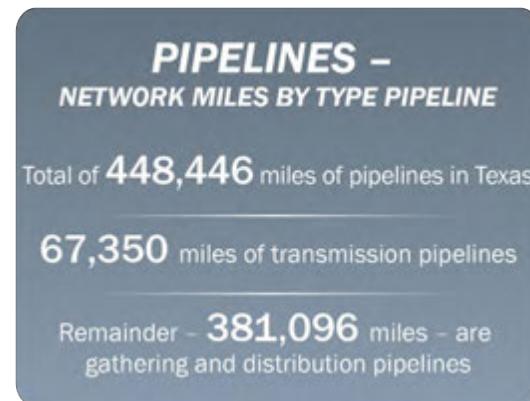
¹⁴ Tonnages are reported by the U.S. Army Corps of Engineers and are compiled in the TxDOT report "Texas Port Profiles, 2017."

¹⁵ <http://ftp.dot.state.tx.us/pub/txdot-info/tpp/giww/legislative-report-85.pdf>

¹⁶ Federal Aviation Administration, 2017.

Pipelines

Pipelines play a critical role in moving oil, natural gas, petroleum products, carbon dioxide, water and a variety of other fluid commodities. Texas has the most extensive pipeline network in the nation—over 448,000 total miles—of which 89 percent are intrastate and 11 percent are interstate¹⁷ – carrying 826.6 million tons of cargo in 2016.¹⁸



1.2.8 Resiliency

A key aspect of an efficient and cost effective freight system is the resiliency of the freight network. Population and employment growth, changes in industry and economic trends, natural disasters, and other hazards or unexpected changes can unexpectedly impact demand and freight operations. A flexible and resilient freight network allows for multimodal connectivity and opportunities to sustain freight mobility, even as unexpected disruptions impact service demand and product delivery. Resiliency planning is inherent in the development of the multimodal freight network and specific recommendations will be addressed in later chapters of the report.

1.3 Organization of the Freight Plan

This Freight Plan has been developed to meet the requirements of the current federal transportation act, the Fixing America's Surface Transportation (FAST) Act. Enacted in 2015, the FAST Act requires each state to develop a comprehensive statewide freight plan for guiding state freight transportation investments. **Exhibit 1-2** provides the location of the FAST Act requirements in the 2017 Texas Freight Mobility Plan.

The remainder of the Freight Plan is organized as presented in **Exhibit 1-3**.

¹⁷ Railroad Commission of Texas. *Texas Pipeline System Mileage*. Retrieved September 2017 from <http://www.rrc.state.tx.us/pipeline-safety/reports/texas-pipeline-system-mileage/>.

¹⁸ Cambridge Systematics analysis of FHWA Freight Analysis Framework, V3.4.

Exhibit 1-2: *Location of the FAST Act Required State Plan Elements in the Texas Freight Mobility Plan*

FAST Act State Freight Plan Element	Chapter(s)
An identification of the State's significant freight system needs and issues	Chapters 4, 7, 8 and 9
A description of the freight policies, strategies, and performance measures that will guide the State's freight-related transportation investment decisions	Chapters 2, 10, 11 and 14
Listing of multimodal critical rural freight facilities and corridors (Includes the National Highway Freight Network, Class 1 railroad systems, U.S. ports with at least two million tons in annual traffic, inland & intracoastal waterways, Great Lakes, St. Lawrence Seaway, and coastal/ocean routes where freight is transported, top 50 U.S. airports, and other strategic freight assets)	Chapters 6 and 7
Identification of Critical Rural Freight Corridors and Critical Urban Freight Corridors	Chapter 6
A description of how the plan will improve the ability of the State to meet the national multimodal freight policy goals and the national highway freight program goals	Chapter 2
<ul style="list-style-type: none"> • National multimodal freight policy goals: defined in FAST Act section 70101. Includes a list of ten goals that ultimately maintain and improve the condition and performance of the National Multimodal Freight Network. • National highway freight program goals: defined in MAP-21 section 167 of title 23. Includes a list of seven goals that ultimately improve the condition and performance of the national freight network. 	
A description of how innovative technology and operational strategies, including freight intelligent transportation systems (ITS), that improve the safety and efficiency of freight movement, were considered	Chapters 7, 11, 12 and 13
In the case of roadways on which travel by heavy vehicles (including mining, agricultural, energy cargo or equipment, and timber vehicles) is projected to substantially deteriorate the condition of the roadways, a description of improvements that may be required to reduce or impede the deterioration	Chapters 7, 12 and 13

FAST Act State Freight Plan Element	Chapter(s)
An inventory of facilities with freight mobility issues, such as bottlenecks, within the State, and for those facilities that are State owned or operated, a description of the strategies the State is employing to address the freight mobility issues	Inventory: Chapters 7, 8, and 9 Strategies: Chapters 12 and 13
Consideration of any significant congestion or delay caused by freight movements and any strategies to mitigate that congestion or delay	Identification: Chapters 7, 8, and 9 Strategies: Chapters 12 and 13
A freight investment plan that includes a list of fiscally-constrained priority projects and describes how funds made available would be invested and matched	Chapter 13 and Appendix C
Consultation with the State Freight Advisory Committee, if applicable	Ongoing throughout plan. 7 specific meetings

Exhibit 1-3: Organization of the Freight Plan

The Freight Plan Chapters

The Freight Plan chapters are organized as follows:

Chapter 1: Introduction - Provides an overview and describes the purpose and organization of the Freight Plan.

Chapter 2: Strategic Goals - Explains Texas' strategic freight goals to guide investment decisions.

Chapter 3: The Importance of Freight Transportation to the Texas Economy - Discusses the importance of freight to the Texas economy and key exporting supply chains.

Chapter 4: Overview of Trends, Issues and Needs – Provides an overview of current trends impacting freight transportation and the implications for Texas in terms of the needs and issues.

Chapter 5: Freight Policies, Programs and Institutions - Develops and discusses Texas freight policies and strategies and includes funding programs, freight-related institutions, governance structure, private infrastructure owners, statutory/ constitutional constraints, regional freight planning activities and Texas' priorities.

Chapter 6: Designating the Texas Multimodal Freight Network - Provides a statewide inventory of critical multimodal freight transportation infrastructure assets and discusses the designation of critical urban and rural freight corridors.

Chapter 7: Freight Assets, Conditions and Performance - Analyzes the conditions and performance of the Texas freight network, including bottlenecks, level-of-service, safety, crashes and pavement and bridge conditions.

Chapter 8: Freight Demand and Forecasts - Analyzes existing and forecasted amount of freight by mode in the future to determine the impacts on the freight system across the state.

Chapter 9: Strengths and Weaknesses of the State's Freight Transportation System - Explains what works well and where improvements are needed.

Chapter 10: Freight Project Identification and Prioritization - Discusses the Texas' decision-making process for freight transportation improvements, including outreach to stakeholders and the general public, and how Texas has prioritized strategies, projects and policy changes.

Chapter 11: Freight Policy and Program Recommendations - Provides recommendations for programs and policies that will address identified needs.

Chapter 12: The State's Unconstrained Freight Investment Plan - Provides TxDOT's comprehensive longer-term freight investment plan.

Chapter 13: The State's 5-Year Financially Constrained Freight Investment Plan - Provides an analysis of the fiscally constrained list of projects to be implemented between 2016 and 2020.

Chapter 14: Freight Transportation Implementation Plan - Identifies a schedule, funding considerations, proposed partners and prioritization of alternative freight strategies to ensure the continued efficient movement of freight in Texas.



Texas Freight Mobility Plan

Chapter 2: Strategic Goals



Strategic goals are intended to guide current and ongoing freight-related transportation planning, programming and implementation efforts and serve as a touchstone by which to gauge the success of these efforts. In addition to articulating goals for the state's multimodal freight transportation system, which is described in detail in **Chapter 7**, several objectives are identified for each goal. Accomplishing these objectives will contribute to measurable progress toward the attainment of the freight transportation system goals and ultimate achievement of the purpose laid out in the 2016 Texas Freight Mobility Plan, stated as:

"Identifying challenges, investment strategies, policies and data needed to enhance freight mobility; to provide efficient, reliable and safe freight transportation; and to improve the state's economic competitiveness."

2.1 Establishment of Consistent Goals

Development of the Freight Plan goals was influenced by a range of both freight-specific and broader transportation considerations. With a focus on safety, mobility, economic impact, asset preservation and infrastructure improvements, the goals of the 2016 Freight Plan aligned with the state's long-range transportation plan and federal guidance in the Moving Ahead for Progress in the 21st Century Act (MAP-21). In the 2017 Freight Plan, goals were revised to reflect goals in new federal transportation legislation: the Fixing America's Surface Transportation (FAST) Act's National Multimodal Freight Policy. Additionally, the most recent Texas Department of Transportation (TxDOT) 2017-2021 Strategic Plan was incorporated. These documents provided guidance to ensure that the 2017 Freight Plan included consistent and achievable goals.

What's New Since the 2016 Freight Plan?

- ✓ FAST Act
- ✓ 2017 – 2021 TxDOT Strategic Plan
- ✓ Sunset Advisory Commission recommendation to adopt one consistent set of statewide transportation goals

2.1.1 National Freight Goals

Two federal transportation bills guide the nation's freight policy: MAP-21, passed in 2012, and the FAST Act, passed in 2015.

MAP-21 (2012)	FAST Act (2015)
<ul style="list-style-type: none"> • Established national freight policy and goals • Established National Freight Network • No designated freight funding 	<ul style="list-style-type: none"> • Builds on national freight policy and goals • Established National Multimodal Freight Network (NMFN) • Established dedicated freight funding through the National Highway Freight Program (NHFP) program • Requires state freight plan to receive designated freight funding

MAP-21 established seven national freight goal areas and required that state freight plans demonstrate consistency with these goals:

1. **Safety, Security, Resiliency.** Improve the safety, security and resilience of freight transportation.

2. **State of Good Repair.** Improve the state of good repair of the national freight network.
3. **Economic Competitiveness.** Invest in infrastructure improvements and implement operational improvements that strengthen the contribution of the national freight network to the economic competitiveness of the U.S. and that reduce congestion and increase productivity, particularly for domestic industries and businesses that create high-value jobs.
4. **Economic Efficiency.** Improve the economic efficiency of the national freight network.
5. **Advanced Technology.** Use advanced technology to improve the safety and efficiency of the national freight network.
6. **Environmental.** Reduce the environmental impacts of freight movement on the national freight network.
7. **Performance and Accountability.** Incorporate concepts of performance, innovation, competition and accountability into the operation and maintenance of the national freight network.

Subsequent to MAP-21, the FAST Act included several freight-related provisions. One provision, the establishment of a National Multimodal Freight Policy, includes national goals to guide decision-making. The goals of the National Multimodal Freight Policy include:

1. Identify infrastructure improvements, policies, and operational innovations that:
 - a. Strengthen the contribution of the NMFN to the economic competitiveness of the United States;
 - b. Reduce congestion and eliminate bottlenecks on the NMFN; and
 - c. Increase productivity, particularly for domestic industries and businesses that create high-value jobs;
2. Improve the safety, security, efficiency and resiliency of multimodal freight transportation;
3. Achieve and maintain a state of good repair on the NMFN;
4. Use innovation and advanced technology to improve the safety, efficiency and reliability of the NMFN;
5. Improve the economic efficiency and productivity of the NMFN;
6. Improve the reliability of freight transportation;
7. Improve the short- and long-distance movement of goods that:
 - a. Travel across rural areas between population centers;
 - b. Travel between rural areas and population centers; and
 - c. Travel from the nation's ports, airports, and gateways to the NMFN;

8. Improve the flexibility of states to support multi-state corridor planning and the creation of multi-state organizations to address freight connectivity;
9. Reduce the adverse environmental impacts of freight movement on the NMFN; and
10. Pursue the goals described above in a manner that is not burdensome to state and local governments.

To be eligible for National Highway Freight Program (NHFP) funding, the FAST Act requires that a state's freight plan include a description of how the plan will improve the ability of the state to meet these goals.

2.1.2 Texas Transportation Plan

In 2015, TxDOT adopted the statewide long-range transportation plan, entitled Texas Transportation Plan 2040, or TTP. The TTP addresses the movement of people and freight, while the Freight Plan focuses specifically on freight transportation needs and strategies. As part of the TTP development, TxDOT's system performance goals and associated investment priorities for the state's overall transportation system were updated in accordance with the Strategic Plan and federal requirements. The TTP identified seven goals:

1. **Safety.** Improve multimodal transportation safety.
2. **Asset Preservation.** Maintain and preserve infrastructure assets using cost-beneficial treatments.
3. **Mobility and Reliability.** Reduce congestion and improve system efficiency and performance.
4. **Multimodal Connectivity.** Provide transportation choices and improve system connectivity for all passenger and freight modes.
5. **Stewardship.** Manage resources responsibly and be accountable in decision-making.
6. **Customer Service.** Understand and incorporate customer desires in decision-making processes and be open and forthright in all agency communications.
7. **Sustainable Funding.** Identify and sustain funding sources for all modes.

2.1.3 TxDOT Strategic Plan

The 2017-2021 TxDOT Strategic Plan, adopted in May 2016, defines the agency's mission, values, vision, goals, action plan and budgetary structure for the five-year period covered by the plan. The strategic plan established seven new strategic goals that provide direction for all of the agency's activities:

1. **Deliver the Right Projects.** Implement effective planning and forecasting processes that deliver the right projects on-time and on-budget.
2. **Focus on the Customer.** People are at the center of everything we do.

3. **Foster Stewardship.** Ensure efficient use of state resources.
4. **Optimize System Performance.** Develop and operate an integrated transportation system that provides reliable and accessible mobility enabling economic growth.
5. **Preserve our Assets.** Deliver preventative maintenance for TxDOT's system and capital assets to protect our investments.
6. **Promote Safety.** Champion a culture of safety.
7. **Value our Employees.** Respect and care for the well-being and development of our employees.

2.2 Texas Freight Mobility Plan Goals

The Freight Plan outlines a set of freight-specific goals and objectives that articulate TxDOT's freight investment priorities, help define freight system investment needs, and identify the desired future performance of the Texas Multimodal Freight Network (discussed in **Chapter 6**). Many of these objectives support multiple goals; consequently, future transportation investments that address multiple objectives will help Texas efficiently meet goals at both the state and federal level. The relationship between all of the goals and objectives is shown in a matrix in **Appendix A**.

The Freight Plan's eight goals and associated objectives are:



Goal: Safety – Improve multimodal transportation safety. The safety objectives are to:

- Reduce rates of truck-involved crashes, injuries and fatalities on the Texas Highway Freight Network.
- Reduce the number of rail-related incidents, including crashes at at-grade highway/rail crossings.
- Increase the resiliency and security of the state's freight transportation system in response to multi-hazard threats, including natural disasters and man-made threats.
- Support the deployment of innovative technologies to enhance the safety and efficiency of the Texas Multimodal Freight Network.



Goal: Economic Competitiveness – Improve the contribution of the Texas freight transportation system to economic competitiveness, productivity and development. Economic competitiveness objectives are to:

- Strengthen Texas' position as a global trade and logistics hub by improving and maintaining Texas' multimodal freight network infrastructure and connectivity.
- Expand public-private and public-public partnerships to facilitate investments in freight improvements that enhance economic development and global competitiveness.

- Identify critical freight infrastructure improvements necessary to support future supply chains and logistics needs, and consumer demands.
- Conduct outreach activities and develop educational programs to increase awareness of the importance of freight to the Texas economy.
- Support strategic transportation investments to address the rapid increase in key industries, such as energy, plastics, agriculture and automotive production.



Goal: Asset Preservation and Utilization – Maintain and preserve infrastructure assets using cost-beneficial treatment. The asset preservation objectives are to:

- Achieve and maintain a state of good repair on the Texas Highway Freight Network.
- Improve the overall ratings of bridges on the Texas Highway Freight Network.
- Increase the percent of pavement lane-miles in good condition on the Texas Highway Freight Network.
- Leverage and utilize the Texas Multimodal Freight Network.
- Utilize technology to provide for the resiliency and security of the state's multimodal freight transportation system in response to multi-hazard threats, including natural disasters and man-made threats.



Goal: Mobility and Reliability – Reduce congestion and improve system efficiency and performance. The mobility and reliability objectives are to:

- Reduce the number of Texas Highway Freight Network miles at unacceptable congestion levels (level-of-service D or worse).
- Improve travel time reliability on the Texas Highway Freight Network.
- Apply the most cost-effective methods to improve system capacity and reliability (including technology and operations).
- Partner with U.S. and Mexican federal, state, regional, local and private sector stakeholders to address Texas-Mexico border crossing challenges.
- Support the development and deployment of integrated Texas-Mexico border crossing management through intelligent transportation systems (ITS).
- Leverage technology to improve management and operations of the existing transportation system.



Goal: Multimodal Connectivity – Provide transportation choices and improve system connectivity for all freight modes. Multimodal connectivity objectives are to:

- Increase Texas supply chain efficiencies by improving connectivity between modes.

- Improve first/last mile connectivity between freight modes and major freight generators and gateways.
- Improve connectivity between rural and urban freight centers.
- Improve access into and out of Texas' seaports to facilitate projected future growth.
- Improve ground access to commercial airports to enhance truck access and connectivity.
- Improve highway and rail connectivity to major freight gateways and generators through increased capacity improvements.
- Improve multimodal connectivity to Texas-Mexico border crossings.
- Leverage multi-state organizations to increase multimodal freight connectivity across state lines.



Goal: Stewardship – Manage environmental and TxDOT resources responsibly and be accountable in decision-making. Stewardship objectives are to:

- Implement a performance-based prioritization process for freight system investment.
- Reduce adverse environmental and community impacts of the Texas Multimodal Freight Network.
- Lead efforts to foster greater coordination among the agencies responsible for freight network investment.
- Reduce delays in freight project planning, programming and implementation.
- Coordinate freight project planning and implementation with all planning partners and stakeholders.



Goal: Customer Service – Understand and incorporate citizen feedback in decision-making processes and be transparent in all TxDOT communications. Customer service objectives are to:

- Develop and sustain partnerships with private sector industries, communities, agencies, metropolitan planning organizations (MPOs) and other transportation stakeholders and partners.
- Increase freight expertise in TxDOT districts, across departments and among elected officials.
- Partner with public and private sector stakeholders to enhance workforce recruitment and retention in the transportation and logistics industry.
- Facilitate statewide dissemination of real-time freight movement information by integrating existing traffic management centers.



Goal: Sustainable Funding – Identify sustainable funding sources for all freight transportation modes. Sustainable funding objectives are to:

- Identify funding sources for high priority multimodal freight projects.
- Identify and document the needed transportation investment costs to meet the state's future freight transportation needs.
- Educate the public and stakeholders on the costs of constructing and preserving the freight transportation system.
- Improve predictive capabilities for revenue forecasting and long-term needs assessments.

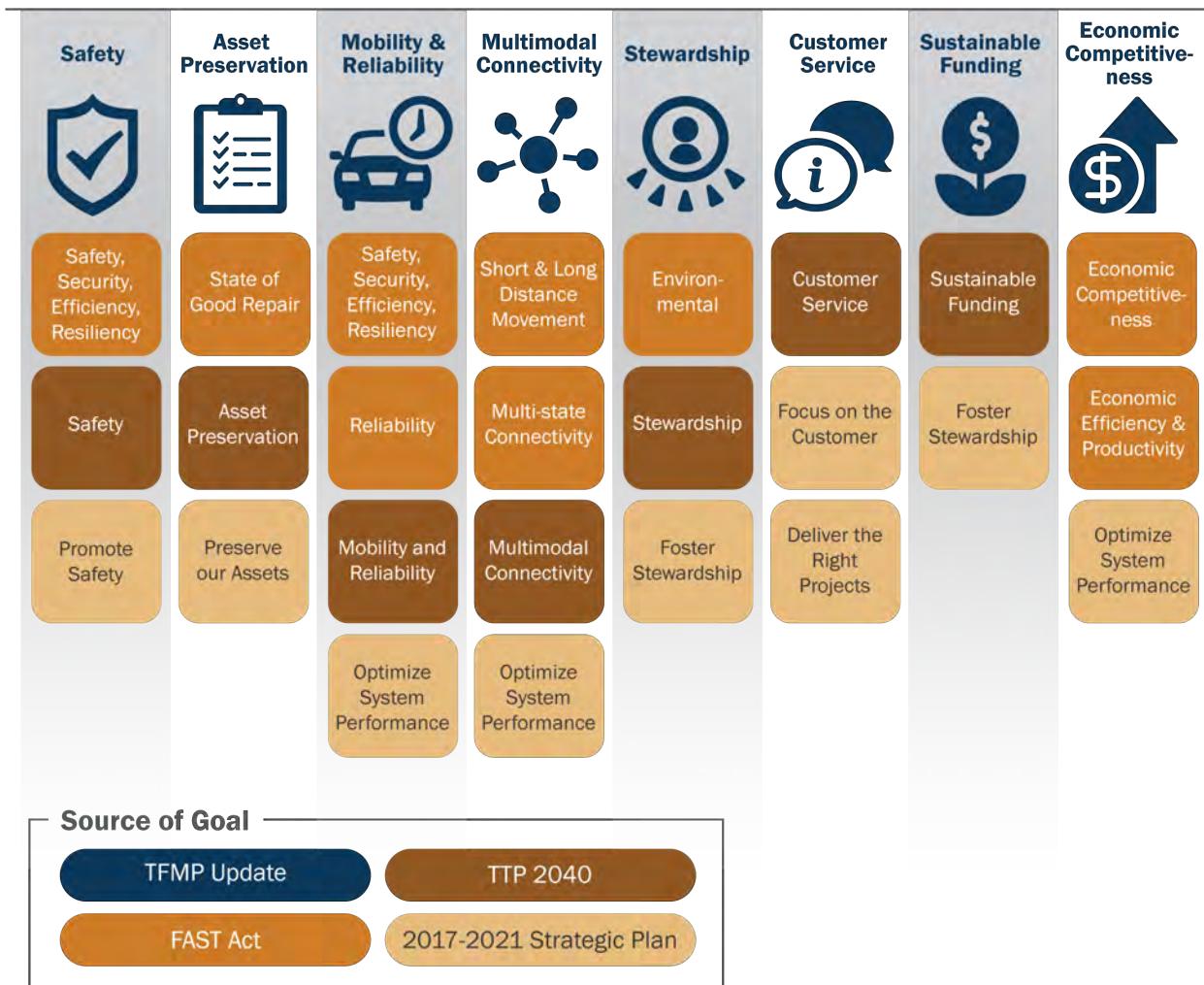
Alignment of the Freight Plan's goals with priorities established at the state and federal levels, as shown in **Exhibit 2-1**, provides several benefits:

Ensures that the Freight Plan recommendations support the TxDOT Strategic Plan and the Texas Transportation Plan goals. Adopting one consistent set of statewide transportation goals was a key recommendation of the Texas Sunset Advisory Commission's 2016 review process. The Sunset Advisory Commission is a 12-member body, with five senators and one public member appointed by the Lieutenant Governor, and five members of the House of Representatives and one public member appointed by the Speaker of the House.

Ensures that the Freight Plan recommendations support the National Multimodal Freight Policy and national freight goals. Under the FAST Act, this is a required element of the state freight plan in order to receive federal freight funding.

Establishes goals that have been shared with the public and stakeholders and thus already have substantial buy-in. The 2017 Freight Plan goals were reviewed and vetted by the Texas Freight Advisory Committee and by stakeholders attending workshops held throughout the state in 2015.

Exhibit 2-1: *Freight Plan Goal Alignment with TTP, TxDOT Strategic Plan, and FAST Act*



2.3 Summary

This chapter described the strategic goals of the Freight Plan and the relationship to federal legislative goals and state planning documents. At the federal level, MAP-21 established national freight goal areas in 2012. These goal areas were expanded upon in 2015 with the passage of the FAST Act, which established a National Multimodal Freight Policy and a framework for state freight plans. At the state level, the goals outlined in the Texas Transportation Plan, adopted in 2015, and the TxDOT Strategic Plan for 2017-2021, also formed the basis for the development of freight-specific goal areas. Building upon state and federal goals for the 2017 Freight Plan ensures that TxDOT meets the requirements of the FAST Act for federal freight funding and creates consistency across transportation plans.



Texas Freight Mobility Plan

Chapter 3: The Importance of Freight Transportation to the Texas Economy



Understanding Texas' economy and how it is supported by the freight transportation system provides the state's leaders with important information for guiding transportation investment decisions. This chapter outlines the linkage between freight transportation and the Texas economy—specifically how the Texas economy benefits from freight transportation assets and services, as well as its importance as a tool for economic development. It also provides several illustrative examples of industry supply chains that demonstrate the interrelationship between critical Texas industries and the freight transportation system.

3.1 Freight and the Texas Economy

The movement of goods is a major contributor to the Texas economy. The Texas multimodal freight transportation system is a critical component of the state's economic vitality enabling the movement of billions of tons of freight each year. Freight transportation employs Texans directly and indirectly as it supports many of the state's critical industries.

The scale and diversity of Texas' industries require a reliable multimodal freight transportation system. Key industries, such as oil and gas, depend on this system for exploration, production and export. Other key industries that rely heavily on the Texas freight transportation system include manufacturing, warehousing and distribution, agriculture and forestry, plastics, and military and defense facilities and industries.

3.1.1 Freight Transportation as an Economic Development Catalyst

The early Texas economy was built on agriculture, oil production and trade. As the state's population has grown, its economy has become more diverse. For example, the upstream and downstream opportunities arising from oil production have given rise to new manufacturing sectors such as plastics and resins. In addition, the service sector has expanded rapidly, with healthcare services leading the growth. This expansion has led to a healthcare cluster that expands into pharmaceuticals and medical device manufacturing.

Today, Texas consumers and businesses demand a wider range of goods and services. As a result, the state's economic development must be supported by a multimodal transportation infrastructure that provides efficient access to local, regional, national and global markets and a skilled labor force. Understanding and responding to the evolving needs of businesses—such as workforce skills, supply chains, multimodal transportation needs and trends—can lead to job growth and continued economic prosperity for Texas.

Texas' Economic Development Strategy

Texas' current market driven economic development strategies focus on building a competitive advantage in six diverse industry sectors with significant growth potential as identified by the Governor's Office of Economic Development. The strategy is to maximize the state's unique assets and strengths to create an optimal environment that supports the continued expansion and development of these growth sectors:

- 1. Advanced technology and manufacturing
- 2. Aerospace, aviation and defense
- 3. Biotechnology and life sciences
- 4. Information and computer technology
- 5. Energy
- 6. Petroleum refining and chemical products

Texas Trade

The Texas economy depends on world markets and free trade agreements (FTAs) which boost freight movements in the state. While there has been great progress in U.S. trade policy since NAFTA was implemented, new FTAs are needed to address digital economy, improve market access, and alterations of trade rules. New FTAs can help reinforce the U.S. commitment to upholding cutting-edge labor and environmental standards to level the playing field for American workers.¹⁹

Texas has been the leading goods export state in the U.S. for more than a decade. In 2016, exports from Texas helped contribute to the \$2.21 trillion of U.S. goods and services exports.²⁰ Texas exports contribute to a strong economy by driving wealth generation, job creation, attracting private investment and increasing public revenues. Texas is the leading state in the number of jobs supported by the export of goods. Exports also sustain thousands of Texas businesses. Over half a million Texas workers are employed in foreign-owned companies.

- Texas' top five export markets include Mexico, Canada, China, Brazil and South Korea.
- Exports from Texas to FTA markets have grown by 60 percent since 2006.
- Goods exports from Texas supported 1,046,549 U.S. jobs in 2015. 95 percent of these jobs were supported by manufactured goods exports.
- A total of 41,881 companies exported from Texas locations in 2014. 93 percent of these companies were small and medium-sized (SME) goods exporters whose exports represented 38 percent of total state goods export value.
- Foreign-owned companies employed 544,800 Texas workers in 2014.

Linking Economic Development and Freight Transportation

A key component of Texas' economic success is the state's multimodal freight transportation network, which provides businesses with efficient access to domestic and global suppliers, facilities and markets. Transportation costs, reliability, resiliency and speed to market are critical factors for competitiveness. The reliability of supply chains is closely tied to the performance and capacity of the transportation system. Supply chains depend on efficient, safe and sustainable freight transportation systems. Congestion, poor maintenance of the infrastructure and conflicting regulations erode supply chain efficiency and undermine competitiveness.

¹⁹ Office of the United States Trade Representatives.

²⁰ U.S. Department of Commerce, International Trade Administration (ITA).

The reliance of different industries on transportation modes can be measured in terms of the value of transportation services each industry must consume to produce a dollar of output.²¹ Some business sectors use freight transportation facilities and services more extensively than others. For instance, the transportation cost per dollar of product output for important Texas economic sectors typically ranges from 3.7 to 9.9 cents.²² Per the State of Logistics Report, June 2015, logistics costs as a percentage of the U.S. Gross Domestic Product (GDP) is 8.3 percent while transportation comprises approximately 90 percent of total logistics costs.²³

Freight-Intensive Industry Sectors

Globalization and technological changes boost economies around the world, redefine the way businesses operate, challenge existing supply chains and transportation networks and create new opportunities. To effectively compete within the global marketplace, businesses must optimize every asset—workforce skills, energy availability and costs, business climate and reliable transportation systems.

Manufacturing is the largest single sector contributor to Texas' freight-related economy. Manufactured goods, including those categorized as energy products, have historically accounted for over 90 percent of Texas' exports.²⁴ Manufactured goods include products like consumer goods, motor vehicle parts, aerospace products and parts, communications equipment, electrical equipment and components, machinery, fabricated metal products, plastic and rubber products and the refinement of raw materials to produce energy products and chemicals. Texas is at the center of the U.S. crude oil and petroleum products supply chain. The U.S. has become the largest producer of crude oil in the world, and Texas leads the nation in crude oil production and refining capacity. In addition to serving the domestic economy, many of these goods are exported throughout the world. Texas is also home to a large number of aerospace and defense companies with extensive manufacturing operations.

3.1.2 Economic Impacts

The economic contribution of freight transportation in Texas is estimated by assessing freight transportation jobs, labor income, gross state product (GSP), and tax revenue, which can be supported directly or indirectly and can generate a multiplier effect. Freight transportation has a multiplier effect resulting from the expenditures on goods and services

²¹ U.S. DOT, Bureau of Transportation Statistics (BTS), Transportation Satellite Accounts: A New Way of Measuring Transportation Services in America; BTS99-R-01; Washington, DC: 1999.

²² U.S. DOT, Bureau of Transportation Statistics (BTS). Industry Snapshots: Uses of Transportation 2015.

²³ Council of Supply Chain Management Professionals. *State of Logistics Report*. June 2015.

²⁴ U.S. Department of Commerce, International Trade Administration (ITA).

from suppliers and from the expenditure of disposable income of freight transportation employees. Economic impacts include:

- **Direct Impact.** Employment, income, value added and output generated by the direct operations of the freight transportation sector.
- **Indirect Impact.** Employment, income, value added and output generated as part of the intermediate consumption of the freight transportation sector, for example, spending on vehicles, fuel, supplies, maintenance parts and real estate costs.
- **Induced Impact.** Impact measured in terms of additional jobs, income, value-added and output as a result of the consumption patterns of freight transportation employees, such as spending on education and health, entertainment, groceries and real estate.

Economic impacts are measured in terms of employment (number of jobs supported by an industry), labor income (compensation of employees), gross state product (GSP) or total economic output, and tax revenue.

Freight Transportation Sectors

The economic contribution of freight transportation goes beyond businesses that provide for-hire services. To estimate the economic contribution of transportation and logistics in Texas, an expansive definition of the freight transportation sectors is adopted. In addition to activities generated by truck, rail, water, air and pipeline transportation, other activities included in the freight transportation definition are in-house truck transportation carried out by businesses in which transportation is not the main economic activity (such as grocery stores or waste collection), self-employed individuals in the trucking and couriers activities, United States Postal Service (USPS), for-hire warehousing and storage, wholesale, and other cargo handling activities. The economic impact analysis for freight transportation in Texas uses detailed employment data for each economic activity as input into the economic model. Total employment as an input helps identify accurate levels of each freight transportation activity.

Economic Contribution of the Freight Transportation Sectors

The freight transportation sectors in Texas generated nearly 895,000 direct jobs in 2015 compared to nearly 734,000 jobs in 2010 (**Exhibit 3-1**). Wages income increased by 6.8 percent annually over this five-year period, from \$32.3 billion in 2010 to \$44.8 billion in 2015 (**Exhibit 3-2**). Overall, the number of jobs and labor income generated by the freight transportation sectors in the state annually increased by 4 percent and 7 percent,

respectively, over the 2010-2015 period.²⁵ This is nearly 50 percent faster growth than the economy as a whole.

Exhibit 3-1: *Direct Jobs in the Freight Transportation Sectors in Texas, 2010 and 2015*

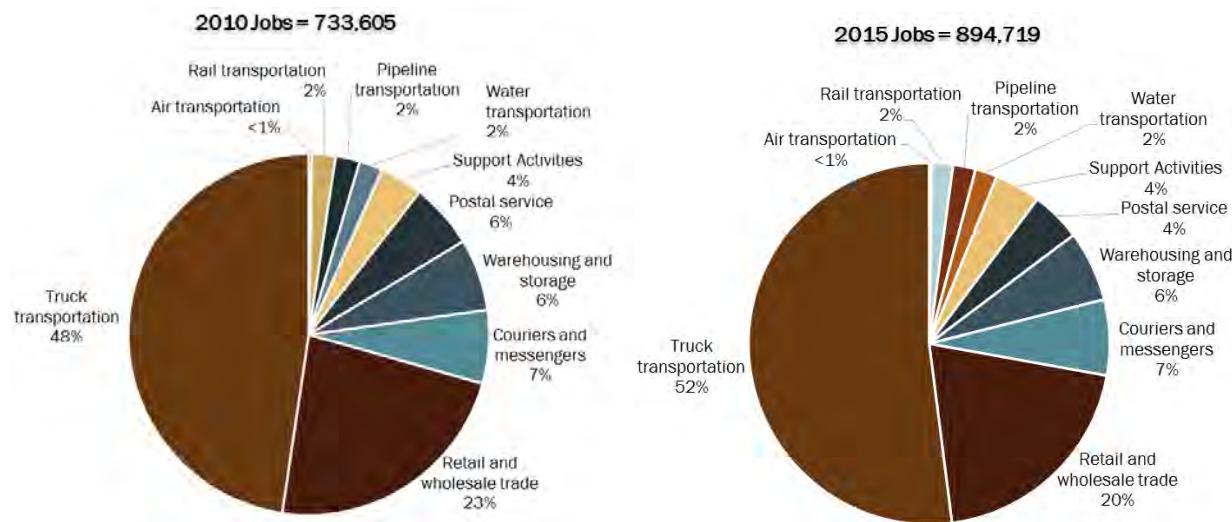
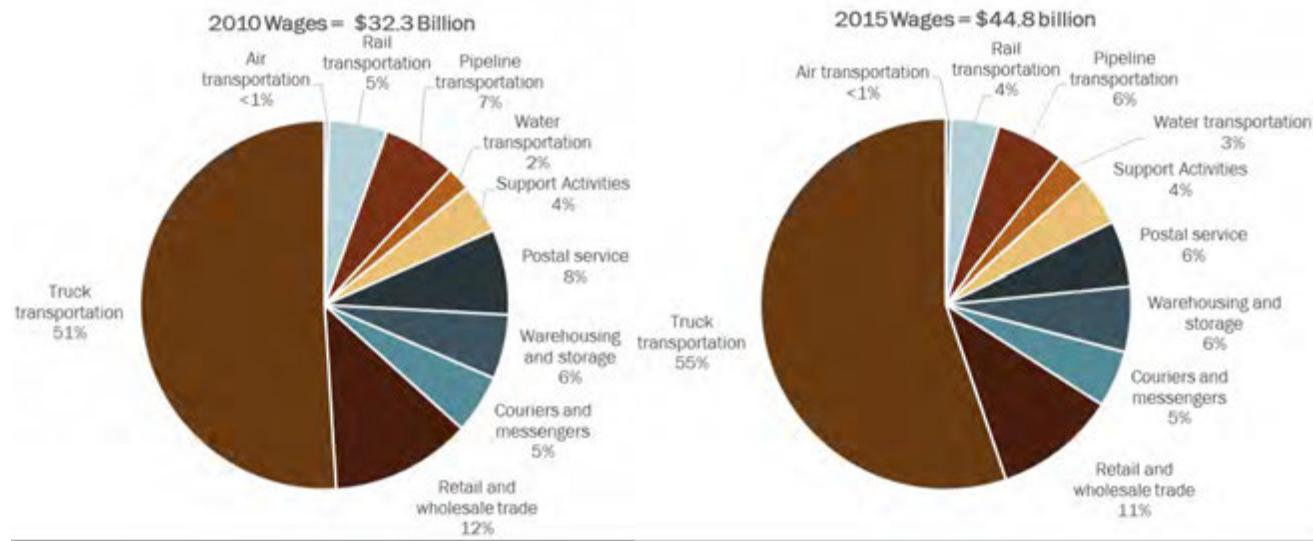


Exhibit 3-2: *Direct Wage Income in the Freight Transportation Sectors in Texas, 2010 and 2015*



²⁵ The employment and wage data utilized in this analysis come from the Quarterly Census of Employment and Wages (QCEW) database and the Employment and Wages from Occupational Employment Statistics (OES) survey provided by the Bureau of Labor Statistics (BLS), the Non-employer Statistics (NES) provided by the U.S. Census Bureau and the rail statistics provided by the Association of American Railroads (AAR) in its state statistics in 2010 and its Freight Railroad in Texas, Rail Fast Facts for 2015 (February 2017).

Trucking is the largest employer in the freight transportation sector for Texas, with a total of 465,445 jobs, which includes in-house, for-hire and owner-operator trucking services in 2015. The wholesale sector, which includes occupations typical of the distribution of goods, provides the second largest number of jobs at 180,270 in 2015. The combined rail, water, pipeline and air modes supported a total of 62,281 direct jobs in 2015.

Total Economic Impacts by Freight Transportation Sector and Mode

Exhibit 3-3 summarizes the total economic impact of the freight transportation sector in Texas. The freight transportation sector supports nearly 2.2 million jobs, which adds close to \$145 billion in labor income and leads to \$215 billion in GSP. This activity yields \$49 billion in tax revenues which include \$33 billion in federal taxes and \$16 billion in state/local taxes.

Exhibit 3-3: *Contribution of the Freight Transportation Sectors in Texas, 2015*



Source: 2015 IMPLAN model for Texas. To perform the analysis, the total number of direct jobs by sector was used as the reference for the calculation of other economic impacts (labor income, GSP, and taxes), as well as the multiplier effects.

Of the nearly 2.2 million jobs stemming from the freight transportation sector in Texas, 894,719 are direct job impacts that provide transport services, use transportation to ship and receive goods or support transportation activities and warehousing. The multiplier impacts associated with the suppliers providing intermediate goods and services to the directly impacted industries, as well as the induced impacts associated with the re-spending of earned income, created nearly 1.3 million additional jobs. This suggests that every direct job in freight transportation supports, on average, 1.4 additional jobs.

Exhibit 3-4 provides additional detail on the breakdown of the freight transportation impacts by sector followed by a summary of the modal impacts.

Exhibit 3-4: Total Annual Economic Impact by Freight Transportation Sector 2016 (Millions of Dollars)

Sector	Employment (Thousands)	Labor Income (Millions of 2016 Dollars)	GSP (Millions of 2016 Dollars)	Taxes (Millions of 2016 Dollars)
Truck transportation	1,034.9	\$60,658	\$85,707	\$18,394
Wholesale	458.2	\$32,042	\$59,913	\$15,186
Pipeline transportation	132.1	\$19,697	\$18,112	\$4,868
Water transportation	116.2	\$8,276	\$14,588	\$3,042
Couriers and messengers	100.0	\$4,132	\$6,642	\$1,321
Warehousing and storage	97.9	\$4,631	\$7,597	\$1,472
Support activities to transportation and warehousing	83.4	\$5,122	\$7,250	\$1,500
U.S. Postal Service	71.0	\$5,311	\$6,376	\$1,385
Rail transportation	56.2	\$4,483	\$7,719	\$1,576
Air transportation	7.6	\$586	\$946	\$256
Total	2,157.4	\$144,937	\$214,850	\$49,000

Source: IMPLAN model for Texas. To perform the analysis, the total number of direct jobs by sector was used as the reference for the calculation of other economic impacts (labor income, value added, and taxes).

Truck Economic Impacts



In Texas, trucks carry the most freight tonnage and value of any mode, provide the most direct accessibility and play a critical part in first and last mile deliveries. In 2015, trucking economic impacts totaled over one million jobs with labor income of \$60.7 billion. Truck-related activity generated \$85.7 billion in GSP, resulting in a tax revenue impact of approximately \$18.4 billion to various local, state and federal governments.

Pipeline Economic Impacts



Pipelines are the most efficient mode of transportation for oil, gas and certain other energy products. In 2015, total economic impacts associated with pipelines generated over 132,000 jobs, earning nearly \$20 billion in labor income and contributing \$18 billion in GSP. Pipelines generated and estimated \$4.9 billion to local, state and federal taxes.

Waterborne Economic Impacts



Many of the state's key industries are dependent on waterborne transportation, with ports providing critical import, export and storage gateways for containers, oil, natural gas, petrochemicals, and other commodities. Additionally, the Gulf Intracoastal Waterway provides a vital corridor for bulk commodities with the potential to serve as an alternative to the roadway system. The provision and use of waterborne transportation in Texas yielded total economic impacts of over 116,000 jobs, \$8.3 billion in labor income and \$14.6 billion in GSP and \$3.0 billion in tax revenue in 2015.

Rail Economic Impacts



Rail is critical to the movement of numerous commodities. In recent history, the railroads have been considered only in the movement of bulk commodities not feasible to move over the highway network in large quantities, such as coal, grains and industrial products. While that capability continues to grow, today the railroads are also a key component of consumer goods supply chains, transporting both components used in manufacturing and finished products via intermodal containers. Railroads provide an alternative to congested highway corridors for those types of goods. Rail also provides access to key gateways, such as maritime ports and international border crossings. In 2015, rail-related economic impacts totaled over 56,000 jobs, \$4.5 billion in labor income and \$7.7 billion in GSP. In total, the rail industry yielded an additional tax impact of \$1.6 billion to various local, state and federal governments. As the demand for freight transportation continues to grow, rail will assume a greater percentage of freight movements as an alternative to an increasingly congested roadway network.

Air Freight Economic Impacts



Air carries the smallest tonnage of freight but transports some of the highest value and most time-sensitive goods, such as electronics and pharmaceuticals. This mode is rapidly growing and changing due to the increase in e-commerce throughout the country. In 2015, more than 7,600 jobs were supported by air freight service providers, users and related activities. Employees earned \$586 million in labor income and generated \$946 million in GSP and \$256 million in local, state and federal taxes.

3.2 The Role of Freight Transportation in Supporting Texas Supply Chains

The freight transportation system is vital for efficient supply chains. Modal performance, cost and efficiency are all factors that determine logistics hub locations, sourcing suppliers and siting of manufacturing facilities. Four of the six growth sectors identified by the Governor's Office of Economic Development depend on complex, global multimodal supply chains.²⁶ Understanding the concept of a supply chain provides a better grasp of freight transportation's impact on the Texas economy.

A supply chain is a network between a company and its suppliers to produce and distribute a specific product and it represents the steps it takes to get the product or service to the customer. **Exhibit 3-5** shows an example supply chain that moves products from raw materials to the manufacturer to the consumer. Typical nodes in a supply chain include the following:

- **Gateways** include rail terminals, seaports, commercial border crossings and airports that receive and dispatch long-haul, large-volume freight between Texas and the world.
- **Corridors** include highways and rail lines.
- **Distribution and En-Route Facilities** include warehouses and distribution centers, transload facilities cargo can move rapidly from trains to trucks and vice versa. These facilities are often concentrated in and around large population centers and gateways
- **First and Last Mile** is an industry term for the facilities used to move cargo from distribution centers to consumers in the urban and suburban core and from manufacturers to gateways. These last mile trips can be made by truck, dry van, vans and even personal courier services.

²⁶ Texas Governor's Office of Economic Development. <https://businessintexas.com/industries/advanced-tech-manufacturing>.

Exhibit 3-5: Example Supply Chain



The reliability of the freight transportation network is critical when planning raw material sources and the distribution of finished products and consumer goods. For example, unexpected delays at the border crossing can result in slowing or halting manufacturing processes and decreasing productivity, which increases manufacturing costs and prices for the end consumer.

Key supply chains for some of the state's most important freight-intensive industries were profiled as part of the 2017 Freight Plan to provide insight into the multimodal freight needs and opportunities.

3.2.1 Texas Supply Chain: Advanced Technology and Manufacturing

Advanced technology and manufacturing, including the production of computers and the assembly of vehicles, are strengths of the Texas economy and identified as one of the state's growth sectors. In the electronics industry, Texas ranks second in the nation by total employment (196,280 jobs) and first in value of exports (\$42.4 billion).²⁷ In the automotive industry, Texas ranks seventh in the nation by total employment (39,000 jobs), with a statewide growth in automotive manufacturing of 17 percent between 2014 and 2017.²⁸

The complexity required in the assembly of vehicles puts the automobile manufacturing industry at the leading edge of supply chain management. The extraordinary number of parts necessary to assemble just one vehicle demands the input of many suppliers and reliable transportation.

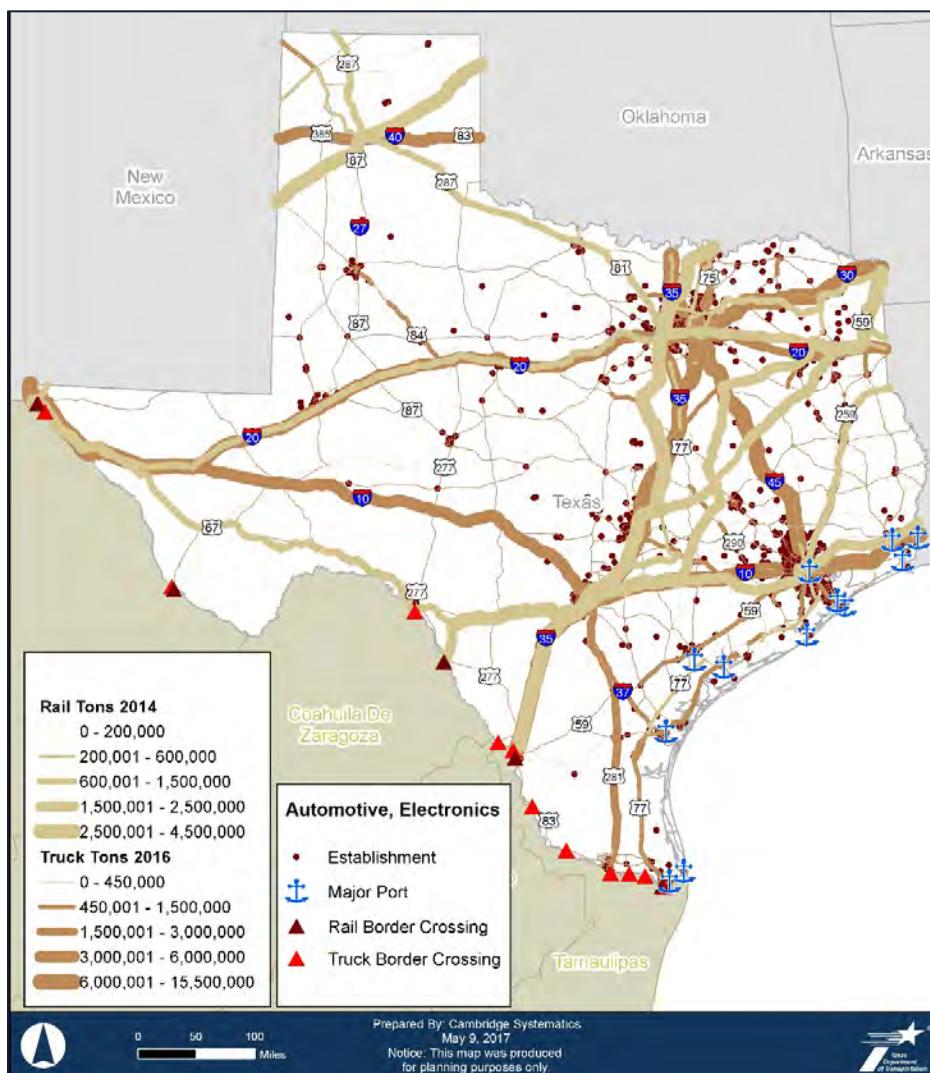
The complexity of the advanced technology and manufacturing supply chain results in significant use of the Texas freight transportation system, as illustrated by the example presented in **Exhibit 3-6**. Interstates, U.S. highways and state highways as well as railroads and waterways accommodate freight for this industry. The highest volumes for both trucks and

²⁷ Texas Wide Open for Business. The Texas Electronics Industry. 2013. Available at https://businessintexas.com/sites/default/files/07/14/17/texas_electronics_report.pdf.

²⁸ Office of the Governor of Texas, Economic Development and Tourism. Texas Automotive Industry. Available at <https://texaswideopenforbusiness.com/sites/default/files/04/03/17/autoindustry.pdf>.

railroads are focused on connecting the major cities in Texas and their assembly plants and suppliers. Additionally, the functionality of these supply chains requires access to border crossings with Mexico and the marine ports in Texas. Access to commercial vehicle border crossings at Brownsville, Pharr, Laredo and El Paso and rail crossings in Brownsville, Laredo and El Paso are critical for raw materials and finished goods. The state's port facilities also provide a cost-effective means to export advanced technology and manufacturing products globally. The advanced technology and manufacturing supply chain also relies on intermodal containers shipped from the U.S. west coast ports to Texas' intermodal hubs.

Exhibit 3-6: Texas Automotive and Electronics Manufacturing Industry: Truck and Rail Tonnage Flows and Strategic Transportation Network



Sources: 2016 Truck Tonnage OD Data estimated based on TRANSEARCH 2010 base year data and Freight Analysis Framework version 4 (FAF4) Database and assigned to the highway network using Texas Statewide Analysis Model version 3 (SAM-V3); 2014 Rail Tonnage OD Data estimated based on 2014 Carload Waybill Sample for Texas; 2014 Rail Tonnage OD Data assigned to the rail network using the Texas Statewide Analysis Model version 3 (SAM-V3); and 2013 establishment data from the Texas Workforce Commission.

3.2.2 Texas Supply Chain: Agriculture

The agriculture sector is comprised of crop production and livestock breeding. In 2014, the agriculture sector contributed \$203 billion to U.S. GDP. For Texas, agriculture contributed nearly \$11 billion to the state GDP with the output of the state's farms representing \$9.2 billion or about 84 percent.

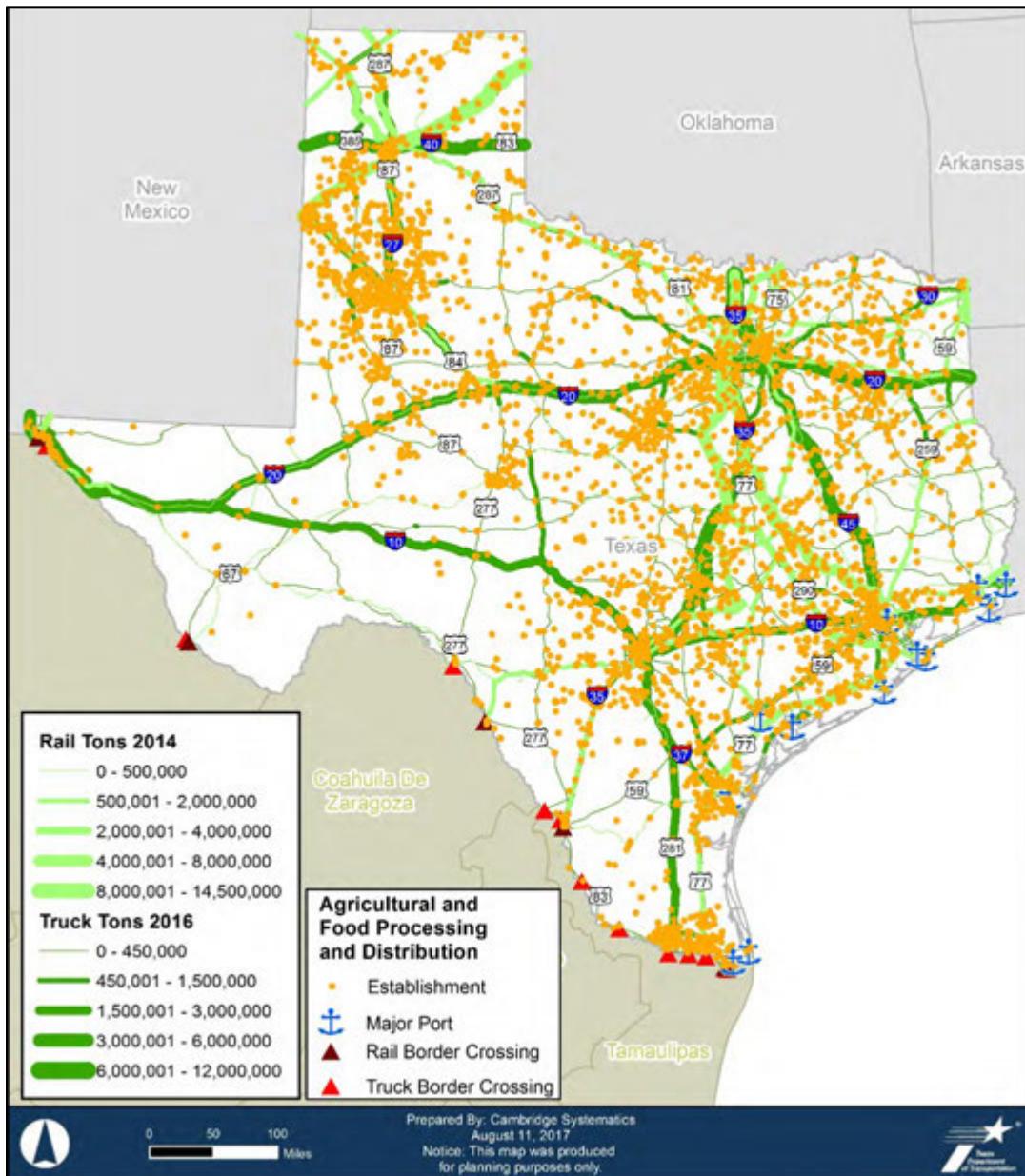
Texas' Agriculture Transportation Network

The agriculture and food processing and distribution establishments in Texas are concentrated in the Panhandle, the Texas Triangle, the Gulf Coast and the Texas-Mexico border crossings in Brownsville, Los Indios, Progreso, Pharr, Hidalgo and El Paso (**Exhibit 3-7**). Key highway corridors being used by the agriculture industry in Texas include I-10, I-20, I-27, I-35, I-37, I-40, I-45, US 60, US 84, US 281 and US 287. At the same time, Texas' Class I railroads (UP, BNSF and KCS) and shortlines serve agricultural customers across the state. Ports and rail bridges on the Texas-Mexico border are also critical trade gateways to link Texas' agriculture industries with markets and suppliers located throughout the world.

Critical Transportation Linkages in Texas' Agriculture Industry Supply Chain

Major challenges to transportation performance faced by the agriculture industry today include the following: weight restrictions on truckloads; equipment shortages; truck driver shortages; empty backhauls; deteriorating condition and funding of rural connectors; delays at border crossings; port congestion and labor issues at West Coast ports; congestion, delays or lack of reliability on major highways and rail corridors being used by the agriculture industry; and growing production needs of agricultural bulk handling sites.

Exhibit 3-7: Texas Agriculture Industry: Truck and Rail Tonnage Flows



Source: 2016 Truck Tonnage OD Data estimated based on TRANSEARCH 2010 base year data and Freight Analysis Framework version 4 (FAF4) Database FAF4 and assigned to the highway network using Texas Statewide Analysis Model version 3 (SAM-V3); 2014 Rail Tonnage OD Data estimated based on 2014 Carload Waybill Sample for Texas; 2014 Rail Tonnage OD Data assigned to the rail network using the Texas Statewide Analysis Model version 3 (SAM-V3); and 2013 establishment data from the Texas Workforce Commission.

3.2.3 Texas Supply Chain: Trade, Distribution and Logistics

Texas plays a significant role in national trade, distribution and logistics supply chain because of the capacity provided by its numerous points of entry such as ports, airports and border crossings as well as its distribution infrastructure. Over 10 percent (\$222.7 billion) of the U.S. wholesale and retail trade activity occurred in Texas in 2015.²⁹

The trade, distribution and logistics supply chain is also important to the Texas economy. Wholesale and retail trade activity comprised 14 percent of the state's \$1.6 trillion GDP in 2015.³⁰ Limiting the scope of distribution establishments to warehousing (general, farm, refrigerated, delivery services, other), there are over 2,100 establishments located in Texas. Most of these were located in urban areas led by Dallas, Harris, Tarrant, Bexar and El Paso Counties.³¹

Texas' Trade, Distribution and Logistics Transportation Network

Goods in the trade and distribution supply chain both originate in and are destined for dispersed locations. After production domestically or abroad, goods are moved to strategically located warehouses or distribution centers as shown in **Exhibit 3-8**. These locations depend on the requirements of the commodities being moved. For example:

- Farm warehousing has clusters in the Texas panhandle and along the coast (near production and ports) as well as in most metropolitan areas. These locations are strategic for agricultural products because they are nearer production and do not require locations in urban areas where land costs are higher.
- Courier and delivery services are concentrated in urban areas because the businesses and households they serve are concentrated in urban areas.
- Refrigerated warehouses are the sparsest of any type and a few hubs exist along the Texas-Mexico border and in a few metropolitan areas. These warehouses are used for fresh produce and are spaced to allow refrigerated transportation from the distribution center to the destination.
- General and other warehousing establishments are located throughout the state and are concentrated around transportation infrastructure and urban areas. These locations are strategic for moving goods efficiently as well as locating near the final markets for a variety of industries. Final consumers may be individuals or smaller retail firms. As this

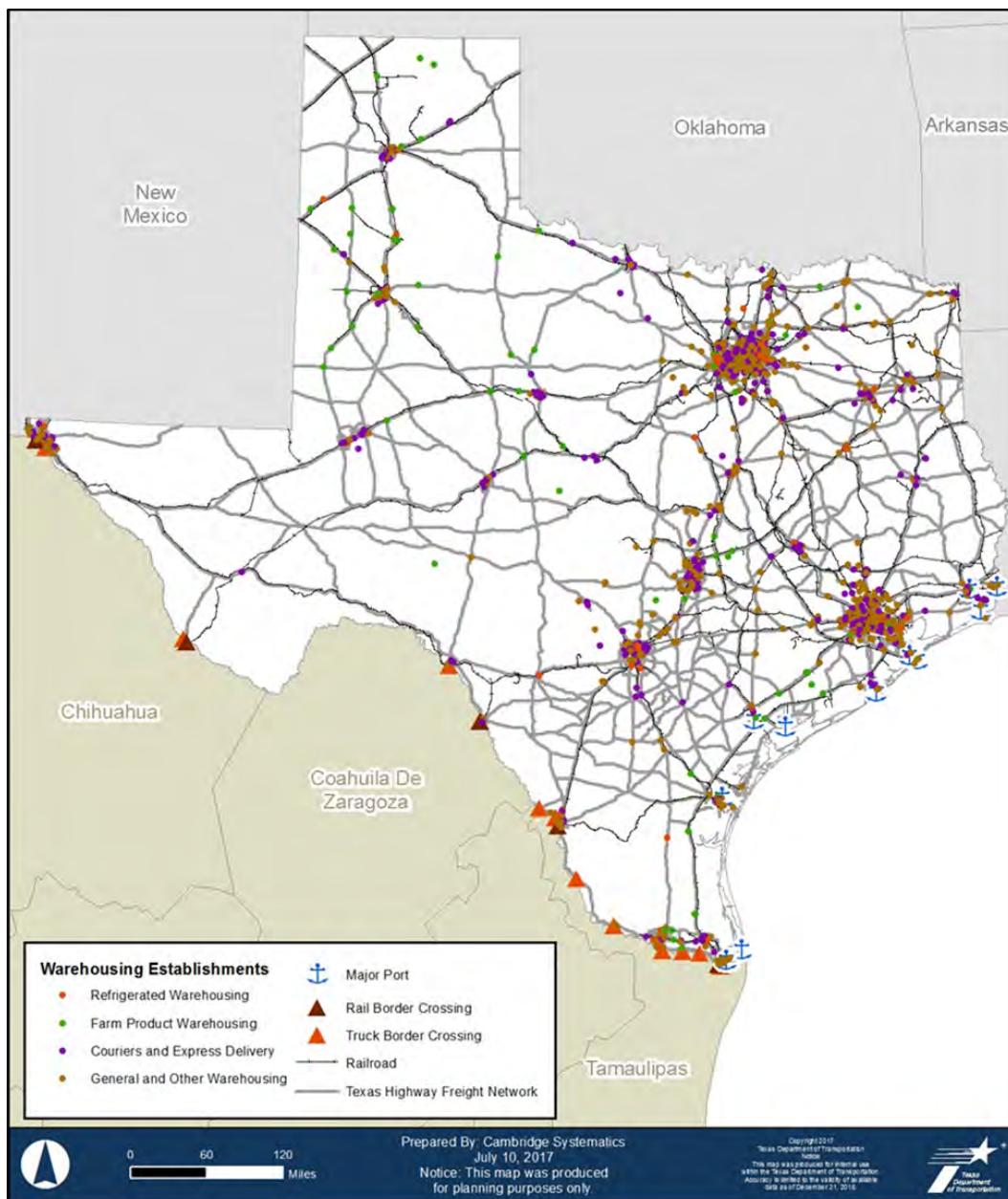
²⁹ Bureau of Transportation Statistics, Gross State Product for Selected Industries, 2015. (https://www.rita.dot.gov/bts/publications/industry_snapshots/uses_of_transportation_2015/tables_and_figures/appendix_a).

³⁰ Ibid.

³¹ Economic Census, 2012, Table A1.

supply chain is consumer-focused, destinations are predominantly concentrated near populated areas.

Exhibit 3-8: Warehousing Locations in Texas



Source: Establishment data in 2013 from the Texas Workforce Commission.

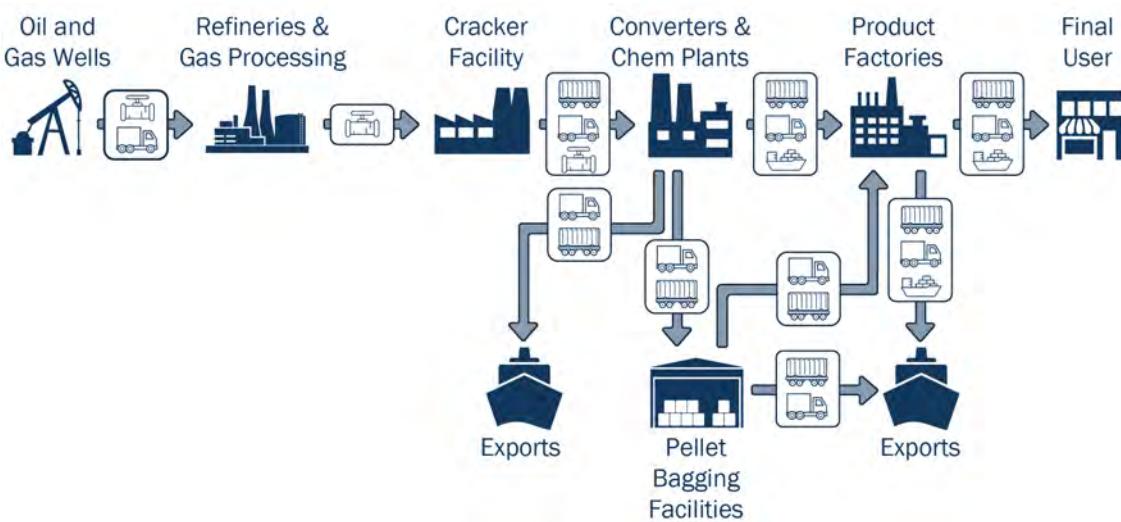
3.2.4 Texas Supply Chain: Chemicals, Plastics and Rubber

The rapid expansion in natural gas and petroleum production in Texas is spurring high growth in the state's petrochemical sector and for downstream products derived from its output, such as plastic resins, synthetic rubber and various chemicals.

Exhibit 3-9 illustrates the components of the chemicals, plastics and synthetic rubber supply chain. This simplified supply chain depicts the flow of goods in the following sequence as applied to Texas:

- Production starts in the oil and gas fields of Texas and off-shore. Natural gas is transported to cracker facilities from gas processing plants directly by pipeline. Likewise, crude petroleum is transported to oil refineries for refining. The resulting petrochemicals are then moved mainly by pipeline to nearby plastic converters and to chemical plants. Truck and rail also may be used for this later stage. Hydraulic fracturing generates significant freight in support of the wells including equipment, sand and water transported by rail or highway.
- Plastic resins and synthetic rubber for export through ports are moved in bulk by truck or rail to the waterside; alternately, plastic pellets may be moved to bagging facilities and the bags transferred into containers. Containers are then drayed to the port and transported by ocean to foreign destinations.
- Plastic resins and synthetic rubber for domestic use are transported to U.S. plastic and rubber manufacturers in bulk by truck, rail or barge, or may move first to bagging facilities and continue on to manufacturers in containers and trailers by intermodal rail, truck and barge.

Exhibit 3-9: Example of Plastic Resins and Rubber Supply Chain



Source: Graphic developed by WSP based on stakeholder interviews.

3.3 Summary

This chapter described the key role that freight plays in supporting the Texas economy. Freight transportation is a foundation of the state's economy as it creates direct jobs in logistics and transportation services, supports all elements of the manufacturing sector, provides income and tax revenue, and sustains every business located in the state. The role of the freight network in supporting supply chains was also detailed. Key supply chains in the Texas economy include advanced technology and manufacturing, which comprises everything from automobiles to semiconductors; agriculture and food processing; and petrochemical products including chemicals and plastics. These supply chains depend on an efficient and reliable freight network to succeed. As Texas plans for the future of its multimodal freight transportation network, understanding and providing for the logistical needs of freight-reliant industries will assist with economic competitiveness, and help create and sustain quality jobs.



Texas Freight Mobility Plan

Chapter 4: Overview of Trends, Issues and Needs



Understanding freight transportation's current and future trends, issues and needs is critical to maintaining and expanding Texas' freight transportation network. By identifying significant freight system trends and issues, the Texas Department of Transportation (TxDOT), along with federal, state, regional and local transportation agencies, can establish freight transportation policies and priorities, plan and execute appropriate strategies and promote opportunities for the freight industry.

This chapter: 1) identifies significant trends and their implications for the freight transportation system; 2) outlines significant freight transportation issues and needs; and 3) briefly discusses how they can be addressed.

4.1 Significant Freight System Trends

An analysis of trends and issues most likely to impact the future of freight transportation in Texas has revealed five key trends will have significant influence on the volume and pattern of freight flows in the state (**Exhibit 4-1**).

Exhibit 4-1: *Key Trends Impacting Freight Transportation in Texas*

Categories	Trends
Trade and Employment	<ul style="list-style-type: none"> ▪ Effects of key international trade markets ▪ Impacts of the Panama Canal expansion ▪ Employment and industry trends
Demographics	<ul style="list-style-type: none"> ▪ Significant population growth ▪ Importance of mega-regions
Energy	<ul style="list-style-type: none"> ▪ Expanding Texas oil and gas production ▪ Increased use of renewable energy production ▪ Increased use of alternative transportation fuels
Technology	<ul style="list-style-type: none"> ▪ Widening use of Intelligent Transportation Systems (ITS) ▪ Advent and growth of autonomous freight vehicles ▪ Availability of alternate delivery systems
Business and Consumer Practices	<ul style="list-style-type: none"> ▪ Sourcing trend ▪ Advances in manufacturing ▪ Increased growth of e-commerce

4.1.1 Trade

Texas' competitive advantages include its large geographical size, large population, central location, Gulf coastline, energy resources, extensive infrastructure and attractive business

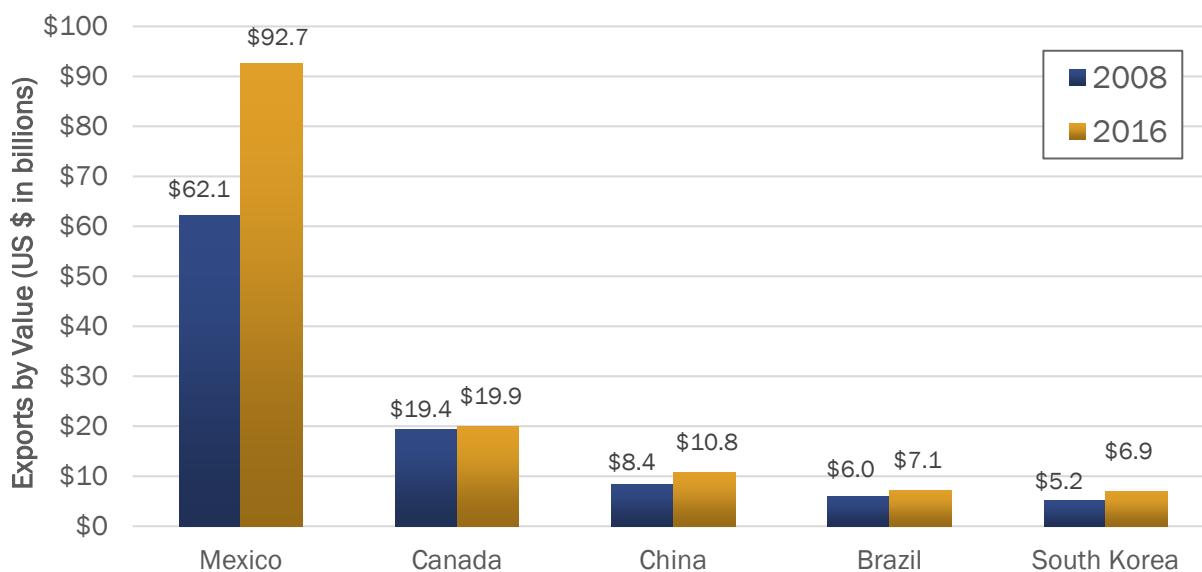
climate—all of which make it an economic leader.³² In 2016, Texas ranked second in Gross State Product in the nation, with an economy valued at nearly \$1.6 trillion.³³ According to Forbes' list of Best States for Business, Texas ranks first in 'Economic Climate, eighth in 'Growth Prospects' and fourth overall.³⁴ Fifty Fortune 500 companies and 92 of the largest 1,000 companies in the nation are headquartered in Texas.³⁵

Key International Trade Markets

With its historic ties to Mexico, strong and diversified economy and strategic location, Texas is a leader in North American Free Trade Agreement (NAFTA) trade with Mexico and Canada. Mexico accounts for nearly 40 percent of Texas' total exports, and Canada follows with 9 percent.

Exhibit 4-2 shows the historical trend of trade with NAFTA countries as well as China, Brazil, and South Korea, the next largest consumers of Texas exports. China, Brazil and South Korea each regularly account for between three and five percent of Texas exports by value.

Exhibit 4-2: *Top Five Countries Receiving Texas Exports, 2008 and 2016*



Source: International Trade Administration, U.S. Department of Commerce.

³² Chief Executive. Retrieved August 2017. <http://chiefexecutive.net/2017-best-worst-states-business/>.

³³ U.S. Department of Commerce. Bureau of Economic Analysis (BEA). Gross Domestic Product (GDP) by state. Last updated May 11, 2017.

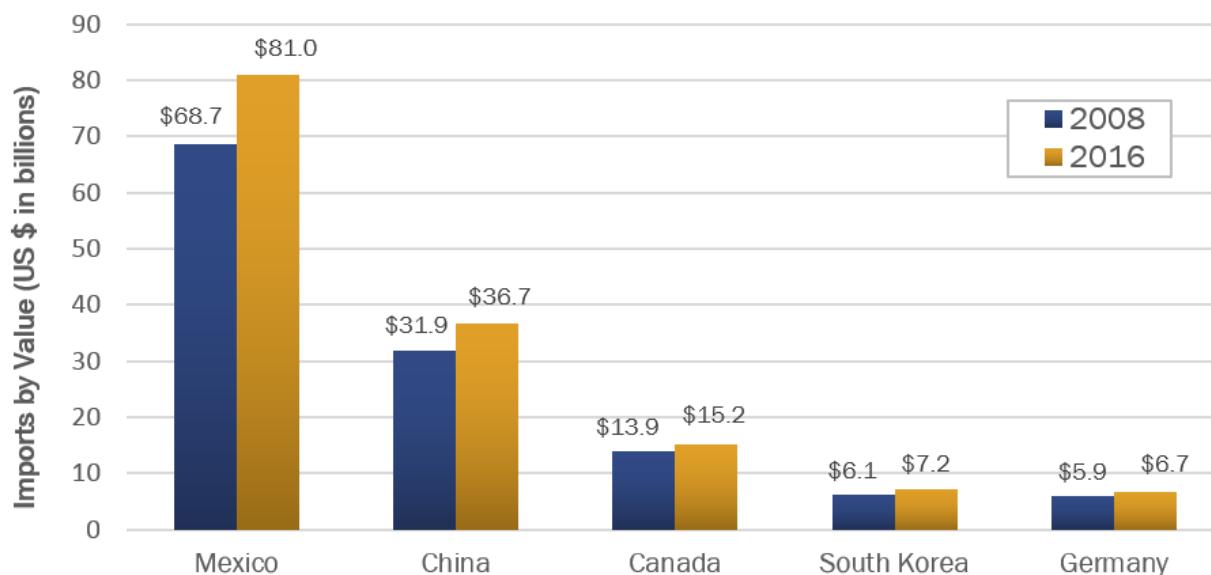
³⁴ Forbes. 2016. Retrieved 2017. <http://www.forbes.com/best-states-for-business/>.

³⁵ Fortune 500. 2017. Retrieved September 25, 2017. <http://fortune.com/fortune500/list/filtered?statename=Texas>.

NAFTA partners are important exporters to Texas, providing over half of imported goods by value. Mexico is the top country providing imports to Texas, while Canada is third, as shown in **Exhibit 4-3**. This exhibit also includes trade with China, South Korea and Germany, the remaining partners in the top five countries exporting to Texas. China is the second largest exporter to Texas with approximately half of the value of Mexican imports. In 2016, Texas reported a trade surplus:

- 42 percent of Texas imports came from the combined Mexico and Canada markets
- 48 percent of Texas exports went to the combined Mexico and Canada markets.³⁶
- Freight imports and exports through Texas' ports and at border crossings with Mexico are expected to grow.

Exhibit 4-3: *Top Five Nations Exporting to Texas, 2008 and 2016*



Source: International Trade Administration, U.S. Department of Commerce.

After sharp decreases caused by the global economic downturn in 2009, U.S. imports from Mexico increased from \$176.5 billion in 2009 to \$294 billion in 2016.³⁷ The leading U.S. import item from Mexico in 2016 was computer and electronic products, followed by transportation equipment, electrical equipment, oil and gas, and machinery. The leading U.S. export item to Mexico in 2016 was computer equipment, petroleum and coal products,

³⁶ Estimated based on trade data provided by the U.S. Department of Commerce, International Trade Administration (ITA).

³⁷ Villarreal, M. Angeles. "US-Mexico Economic Relations: Trends, Issues, and Implications," July 1, 2014.

motor vehicle parts, semiconductors and other electronic components and basic chemicals.³⁸

NAFTA has grown Texas trade, and Mexico remains the state's largest trading partner.

- Texas trade to NAFTA partners increased from \$137.3 billion in 2009 to \$208.8 billion in 2016.
- Over the 2009-2016 period, Texas exports to Mexico grew from \$56.0 billion to \$92.7 billion or 65 percent.
- Texas imports from Mexico increased from \$57.0 billion in 2009 to \$81.0 billion in 2016 or a 43 percent increase.³⁹

Railroads are a key trade link between Texas and Mexico, interchanging more than 1.5 million cars with Mexico in 2016. Automobiles and parts accounted for the largest share of rail freight, followed by intermodal containers, beer and food products, and bulk chemicals and industrial products. Northbound and southbound shipments are approximately equal.

During the development of this plan, workshop participants conveyed a wide range of feelings including optimism, pessimism and uncertainty regarding the possible influence of trade on their regions over the next 10 years. Discussion of trade dynamics and policy during the workshops revealed more uncertainty and more divergence of opinion than other trends discussed (such as overall growth, energy policy or regulatory environment).

Panama Canal Expansion

Completed in 1914, the Panama Canal created one of the most important trade routes in the world by linking the Atlantic Ocean with the Pacific Ocean. After nearly a century, a \$5.25 billion expansion increased capacity to accommodate larger ships. The expanded canal opened in June 2016 and allows for deeper, longer and wider “New Panamax” vessels as well as doubling existing throughput capacity for smaller vessels. The expansion has reduced delays within the Canal and reduced shipper costs, leading to an increasing shift of freight away from west coast ports and to ports in the gulf region and the east coast.

Influence of Trade on Freight Transportation

Global trade can be inhibited by protectionist measures such as import tariffs, encouraged by trade agreements, or influenced by other trends such as technology, infrastructure quality or availability, and changes in population and industry distribution. Changes to NAFTA and other trade agreements could alter trade between Texas and its largest trading partners

³⁸ U.S. Department of Commerce, International Trade Administration (ITA). 2016.

³⁹ Ibid.

depending on the magnitude of changes. Energy reform in Mexico may also result in more freight between the two countries. The growing shift from global (offshoring) manufacturing to regional (reshoring) could bring more freight to Texas because of its proximity to Mexico as well as its own workforce and industry clusters.

4.1.2 Employment and Industry Trends

Overall employment trends are a key driver of freight transportation demand. Between 2012 and 2015, Texas ranked number five in job growth.⁴⁰ Between 2012 and 2016, over one million nonfarm jobs were added in Texas, a 10 percent increase over the last five years.⁴¹ Texas employment forecast suggests jobs will grow 2.6 percent this year as energy and manufacturing continue to rebound in the latter half of the year.⁴² Optimism about statewide and regional economic growth was evident during stakeholder outreach as 82 percent of participants in workshops believed their region would match or exceed statewide growth.

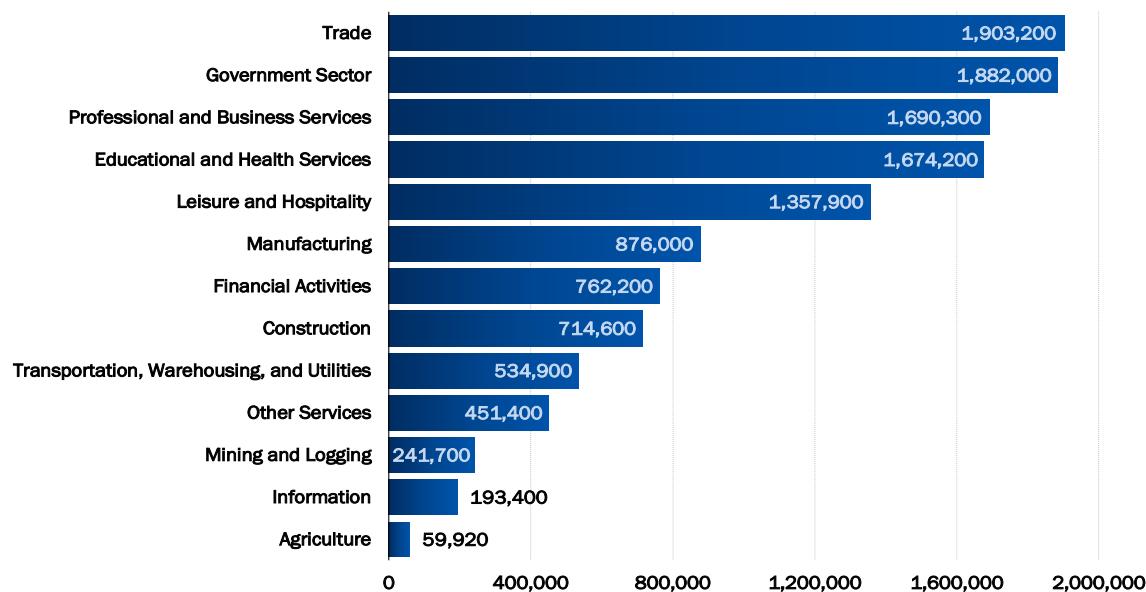
The Texas Workforce Commission (TWC) reported an average of nearly 12.3 million nonfarm employees in Texas in July 2017. As shown in **Exhibit 4-4**, the largest employment sector is retail and wholesale trade at 15 percent, while manufacturing and transportation comprise 7 and 4 percent of employment, respectively. The health and expansion of all of these sectors are dependent on an efficient multimodal freight transportation network.

⁴⁰ Ranks based on data from the Bureau of Labor Statistics (BLS). Job growth assesses the compound annual growth rate of nonfarm jobs over a three-year period between 2012 and 2015 by measuring the total nonfarm employment and the number of jobs created each year.

⁴¹ Texas Workforce Commission (TWC). Labor Market Information. Current Employment Statistics (CES). <http://www.tracer2.com/>.

⁴² Federal Reserve Bank of Dallas. Texas Employment Forecast. August 18, 2017.

Exhibit 4-4: Share of Employment by Sector in Texas, 2017



Source: Texas Workforce Commission, July 2017.

Freight Industry Employment Trends

Freight transportation is impacted directly by employment trends because a cost-effective and efficient freight transportation system depends on several factors including the availability of a qualified and skilled workforce. For example, an acute shortage has been reported over the past few years in the trucking industry. According to the American Trucking Association, the transportation industry will need to hire 890,000 additional operators nationwide by 2025.⁴³ Texas alone will need 40,000-50,000 additional operators according to the Texas Trucking Association. Increased reliance on other modes such as rail will have to be part of the solution to the driver shortage. In addition to drivers, the Texas Workforce Commission and the state's regional Workforce Development Boards are working with transportation and warehousing industries to provide customized training and other support to train new workers in this sector and provide upgraded training services to ensure existing employees in this field can meet the new requirements to maintain their licenses.

Influence of Employment on Texas Freight

Employment trends indicate that Texas is prepared to grow with increased freight demand. The state's strong economy, large share of employment in transportation and trade related jobs, and history of economic growth point to an ability to adapt with changing freight needs and seize opportunities for growth.

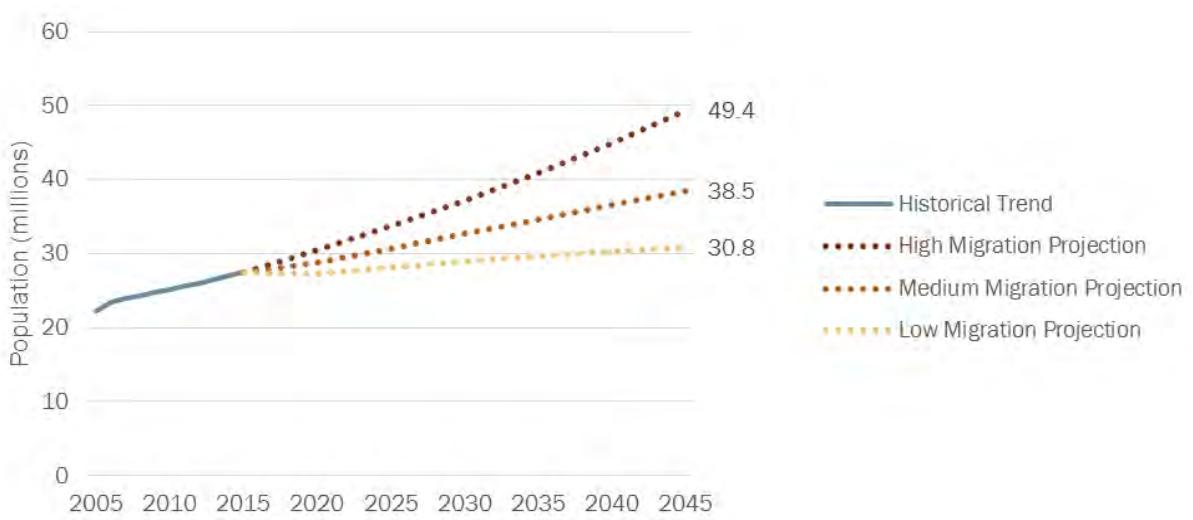
⁴³ "Truck Driver Shortage Analysis 2015," American Trucking Association

4.1.3 Demographics

Significant Population Growth

Freight is demand-driven by consumers and businesses in a region. Between 2000 and 2010, Texas added more than 4 million residents, a 20 percent increase. In 2010, Texas ranked first in numeric increase in population and continues to be the second most populous state.⁴⁴ The Texas State Data Center (TSDC) projects that if medium migration to the state occurs, the population of Texas will increase 40 percent between 2015 and 2045 from nearly 28 million to 38.5 million people.⁴⁵ The TSDC projects as much as 80 percent growth (to 49.4 million) if migration continues to contribute to population growth at the high rate it did from 2000-2010. **Exhibit 4-5** shows population trends and projections for 2005 through 2045.

Exhibit 4-5: *Population Estimates and Projections, 2005 to 2045*



Source: Texas State Data Center, 2017.

As the state population continues to grow, both freight and non-freight travel will increase the need for additional system capacity. The movement of people will put additional pressure on the transportation system, as will the projected doubling of total freight tonnage—from 2.2 billion tons in 2016 to 4.0 billion tons in 2045—moved in Texas.⁴⁶ The

⁴⁴ Texas State Data Center. <http://txsdc.utsa.edu/data/TPEPP/Projections/Index.aspx>.

⁴⁵ Texas State Data Center, 2017.

⁴⁶ FHWA, Freight Facts and Figures; Tables 2-1 and 2-1M. Weight of Shipments by Transportation Mode: 2007, 2009 and 2040. http://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/docs/10factsfigures/table2_1.htm.

increase in the demand for consumer goods will impact all freight transportation modes, particularly as increased highway congestion pushes some freight to other modes.

Mega-Regions

The TSDC projections show that the most recent population growth in Texas has occurred in major metropolitan areas, and this trend is expected to continue. A mega-region is “the name given to one or a grouping of several urban areas, linked by social, economic, demographic, environmental and cultural ties.”⁴⁷ Texas is home to two major mega-regions: the Texas Triangle and the Gulf Coast, which intersect in Houston. Within Texas, the Texas Triangle is the larger of the two, with the 66-county region spanning seven metropolitan areas including Austin, Dallas-Fort Worth, Houston and San Antonio. Three of the nation’s 10 largest cities are in the Texas Triangle, including Houston, which has a port that handles more foreign tonnage than any other U.S. port. By 2050, it is estimated that 70 percent of the population of Texas will live in the four metropolitan areas of the Texas Triangle.⁴⁸

Influence of Demographics on Texas Freight

As the focal point of future economic growth, moving people and goods in the Texas Triangle will become increasingly challenging. Effective freight planning will need to address goods movement within the Texas Triangle and how the future freight network will serve the state’s rural communities and connect them to the mega-region. This heightens the importance of addressing connectivity between rural and urban areas, in particular the need to ensure rail connectivity between rural and urban regions and between urban regions. Access to efficient rail service is instrumental in maintaining or increasing the share of the state’s freight moving on rail and for addressing expanding demand for passenger rail. Given the ever-increasing demand for both people and goods, all modes will require investment and technological advances to meet future mobility needs.

4.1.4 Energy

Oil and Gas Production

Texas currently accounts for approximately 26 percent of crude oil reserves and 29 percent of natural gas reserves in the U.S. Texas also leads in production and refining capacity with about 30 percent of the nation’s total refining capacity (5.4 million barrels of crude oil per

⁴⁷ Attributed to Shirley Franklin in “Planning for Mega-regions,” Fleming, Billy, The New Planner. Winter 2012 American Planning Association.

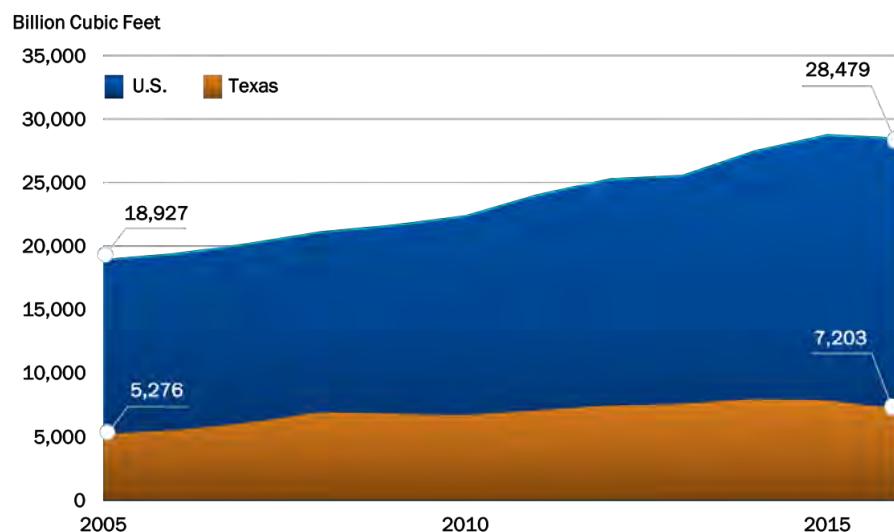
⁴⁸ Regional Plan Association, America 2050, Texas Triangle. http://www.america2050.org/texas_triangle.html.

day).⁴⁹ As of 2017, 237 of the 254 counties in Texas were actively producing oil or natural gas.⁵⁰

U.S. production of natural gas has grown dramatically over the past decade, from 20 trillion cubic feet in 2005 to 28 trillion cubic feet in 2016.⁵¹ During the same period, Texas production grew from 5 trillion cubic feet to 7 trillion cubic feet (32 percent growth).

Exhibit 4-6 summarizes Texas and national production trends. Texas' natural gas supply presents opportunities for domestic electricity generation, export of liquefied natural gas (LNG) and exports of plastic resins or pellets.

Exhibit 4-6: *Texas and U.S. Natural Gas Marketed Production, 2005 to 2016*



Source: USEIA Natural Gas Gross Withdrawals and Production.

The growth of oil and gas production also increases the demand for well equipment and sand, water and chemicals used for fracking, increasing demands on the existing highway and rail systems. The Energy Sector Task Force, created by TxDOT in 2012 to address energy sector roadway needs, noted that one oil or gas well requires:

⁴⁹ U.S. Energy Information Administration. Texas State Energy Profile. Retrieved September 23, 2107 from <https://www.eia.gov/state/?sid=TX>.

⁵⁰ Texas Railroad Commission. Oil & Gas Production Data Query. <http://webapps.rrc.state.tx.us/PDQ/generalReportAction.do>.

⁵¹ USEIA, Natural Gas Gross Withdrawals and Production, 2016.

- 1,184 loaded trucks to start production.
- 353 loaded trucks a year to maintain production.
- 997 loaded trucks once every five years to re-frack the well.
- For rail, an average of 50 rail cars are needed to start production.

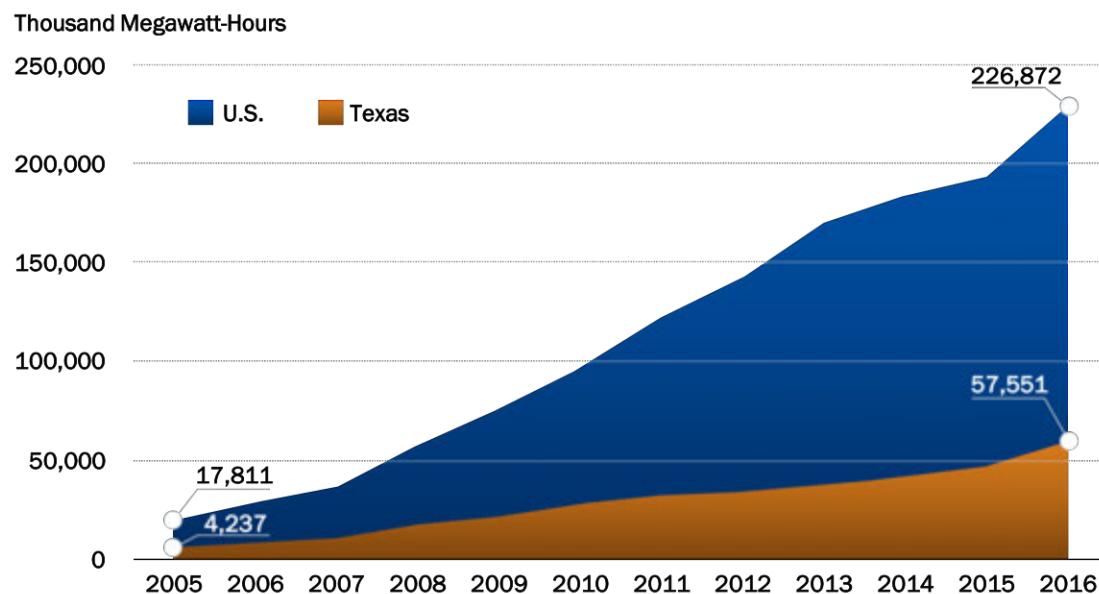
This level of heavy truck activity correlates to a cost of \$4 billion a year to repair roadway infrastructure due to damage from drilling trucks.⁵² This is especially true in rural areas where local roads were not designed to handle these heavier freight loads. The state's railroads, pipelines and ports also play indispensable roles in supporting domestic energy production.

Renewable Energy

In addition to growth in natural gas production, Texas and the U.S. have experienced growth in wind energy generation over the last 10 years. According to the U.S. Energy Information Administration (USEIA), renewable energy sources contributed one-tenth of the state's net electricity generation in 2015, which amounted to nearly one-sixth of U.S. electricity from all non-hydroelectric renewable sources. Texas produced more non-hydroelectric renewable generation than any other state in the nation that year, and is the leading wind energy producer in the U.S. **Exhibit 4-7** shows the change in wind energy generation in Texas and the U.S. between 2005 and 2016.

⁵² TxDOT Task Force on Texas' Energy Sector Roadway Needs 2012. http://ftp.dot.state.tx.us/pub/txdot-info/energy/final_report.pdf.

Exhibit 4-7: Texas and U.S. Wind Energy Generation,
2005 to 2016



Source: USEIA, 2017.

Stakeholders in West Texas observed continued development of wind farms and anticipate the need to accommodate oversize/overweight loads as more capacity comes online. Many components travel by rail, which can better accommodate these constraints. However, the first and last mile may still need to be completed by truck. The long-term impact of wind and solar energy on the Texas Multimodal Freight Network may be limited because of the expiration of tax credits in 2019 and minimal freight requirements for renewable energy sources once infrastructure is established.

Alternative Transportation Fuels

In 2011, transportation use accounted for less than one percent of the natural gas consumed in the U.S. However, natural gas consumption in the transportation sector is expected to increase 21-fold by 2040.⁵³ The main obstacle to faster conversion from diesel and gasoline is the higher cost of natural gas-powered trucks and the lack of refueling stations for long-haul trips.

Embracing natural gas for transportation use in Texas will require more filling stations, wider distribution and awareness by policy-makers. Currently, most filling stations are privately owned. If demand for compressed natural gas and/or LNG fueling stations continues to grow as expected, state and local governments will need to consider policies to increase the number of fueling stations. Export of natural gas is also expected to increase through Texas'

⁵³ U.S. Department of Energy. Available at http://www.eia.gov/forecasts/aoe/MT_naturalgas.cfm.

ports and pipelines to Mexico as the Federal Energy Regulatory Commission approves LNG export projects.

Biofuels can potentially reduce carbon emissions, reduce reliance on foreign oil and create rural economic development. Therefore, biodiesel is important for freight transportation, and increasing its use is potentially a short-term, low-cost way to reduce freight-related emissions under Environmental Protection Agency air quality standards.⁵⁴ Trucks, railroads and ports are investing in alternative fuels and technology to increase fuel efficiency and reduce costs and harmful emissions. Trucks are switching to newer models and retrofitting older fleets; railroads are using alternative fuel vehicles and equipment in railyards and testing natural gas powered locomotives; and ports are using electrification and alternative fuel equipment inside their gates.

Texas is the nation's largest producer of biodiesel, with nine producers across the state and a production capacity of more than 426 million gallons per year.⁵⁵ The effect of biodiesel on the Texas transportation network may be limited, since most existing trucks can only use a 20 percent biodiesel blend. However, continued adoption and investments in biodiesel infrastructure and distribution makes it a notable trend.

Influence of Energy on Texas Freight

During stakeholder outreach conducted for this plan, 76 percent of workshop participants thought that trends in energy dynamics and policy would cause their region to grow at the same rate or faster than it had during the last five years. Texas continues to be a leading producer of oil and gas with a large share of national reserves and refining capacity. Growth in natural gas production in the state and the country position Texas to increase use and exports of natural gas and LNG. If Texas becomes an exporter of LNG and plastics, ports will also experience increased freight tonnage. LNG export facilities are already under construction in the state, with additional facilities being considered.

4.1.5 Technology

If freight volumes continue to increase as they have across the U.S. during the past several decades, technological advances in dedicated freight infrastructure have the potential to optimize and improve the transportation network for all modes. In addition, advances in technology may increase the hauling capability of a single operator, which can help negate

⁵⁴ Sauthoff, Anjali, and Gaylord Nelson. "Assessment of Biodiesel Scenarios for Midwest Freight Transport Emission Reduction." National Center for Freight and Infrastructure Research and Education, University of Wisconsin-Madison. (2010). October 24, 2013. Available at http://www.wistrans.org/cfire/documents/CFIRE_02-10_Final_Report.pdf.

⁵⁵ U.S. Energy Information Administration. Monthly Biodiesel Production Report with data for June 2017 (August 2017).

the truck driver shortage reported by the American Trucking Associations (ATA).⁵⁶ Specifically, advances in Intelligent Transportation Systems (ITS), autonomous freight vehicles, alternate delivery systems, Positive Train Control (PTC) and on-demand shipping may change the safety and efficiency of goods movement. Furthermore, safety technology used by railroads could supplement human inspection of the railcars and tracks while improving the overall accuracy of those inspections.

Intelligent Transportation Systems

One component of ITS currently used in urban areas to monitor highway conditions and inform drivers of traffic slowdowns, delays and incidents is variable message boards/signs. This can help to relieve congestion and bottlenecks by allowing drivers to choose alternate routes and avoid heavily congested stretches of roadways. At the Federal level, Texas has been involved in ongoing demonstration projects called Freight Advanced Traveler Information System (FRATIS). FRATIS is meant to be a proof of concept deployment, with all material developed available as open source for the industry to use as it sees fit. Thus far, Texas has been the site of two deployments: Dallas-Fort Worth and the I-35 Corridor. The key features of FRATIS include: Sharing information between the terminal operator, truck dispatcher and public that relays both real-time and predicted terminal queue time; Real-time routing, navigation, construction, traffic and weather data; and Drayage optimization.

The Houston area has the Houston Transtar consortium, which combines traffic management and emergency management. Transtar uses technology to reduce congestion on major roadways. According to the Texas A&M Transportation Institute (TTI), Transtar has saved commuters nearly \$2.5 billion in reduced traveler delays and fuel costs.⁵⁷ ITS is rapidly developing and changing. As new ITS technology is developed and approved it should be considered for integration into the freight transportation system.

The rail industry's deployment of Positive Train Control (PTC) – highly advanced technology designed to automatically stop a train before certain types of incidents occur – along with other technological advancements and changes in operating practices, allow more crew flexibility by creating safety redundancies.

Additional commonly used ITS elements in freight include:

- Weigh-In Motion Systems (WIM): Devices used to capture and record axle weights and gross vehicle weights as the vehicle moves past sensors. These systems are used to ensure that trucks are within the proper weight limits and are not overloaded. WIM helps improve efficiency by decreasing truck stopping times at weigh stations.

⁵⁶ *Truck Driver Shortage Analysis 2015*. American Trucking Association.

⁵⁷ http://www.houstontranstar.org/about_transtar/.

- Route Planning Systems: Include technologies that incorporate real-time traffic data and roadway conditions which allow drivers to reroute and choose the most efficient route which can avoid congestion and roadway hazards.
- Crash Prevention Systems: Include the use of sensors to monitor speed and distance between the vehicle and objects and can alert the driver when an object is getting too close to the vehicle. Additionally, many trucks also come equipped with brakes that will automatically engage should the vehicle get too close to the one in front of it, as well as lane departure technology that can alert the driver when they are drifting out of the demarcated lane.
- Monitoring Systems: Trucking companies are also investing in video monitoring systems that record trips and can be reviewed to determine cause of accidents. These systems can also be used to improve driver behavior by recording speed and acceleration.

Autonomous and Connected Freight Vehicles

The development of autonomous and connected vehicles (ACVs) for freight continues to advance significantly. Stakeholders, including members of the Texas Freight Advisory Committee and participants in the statewide workshops, believe that ACV technology will have the greatest impact of technologies on freight movement in Texas, especially in the near to medium term. Vehicles can be categorized into levels of automation from no automation to full automation, and most automated technologies deployed today fall somewhere in the middle. For example, the Highway Pilot system enables the human driver to switch control over to the truck's embedded system after entering the flow of traffic and reaching 50 miles per hour. This technology uses a combination of vehicle-to-vehicle Wi-Fi communication, radar and cameras to operate on Highway Pilot.⁵⁸

Potential benefits of this technology include the ability to have narrower lanes of travel, closer headways between vehicles, and increased capacities on existing roadways. ACV technology also has the potential to mitigate some key trucking issues such as the driver shortage, but this technology alone will not be able to meet all of the demand. Advances and investment in the other surface modes, including rail, pipeline and yet-to-be-deployed alternative delivery systems will also be needed. Some of these solutions may also require regulatory change and/or enabling legislation.

Alternate Delivery Systems

Advancements in autonomous and connected technologies enable new delivery systems in addition to enhancing existing ones. Drones, freight shuttles, and other alternate delivery systems have been proposed as an alternative to traditional freight modes. One advantage

⁵⁸ Mercedes-Benz Debuts Self-Driving Truck on Autobahn, <http://cnsnews.com/mrctv-blog/barbara-boland/mercedes-benz-debuts-self-driving-truck-autobahn>.

of alternate delivery systems could be increased reliability and decreased cost if the systems are unaffected by congestion on the existing transportation network. Freight drones have been tested by shippers or carriers of small packages as a way to complete “last mile” distribution. While regulations from the Federal Aviation Administration (FAA) limit how drones can be used in the U.S., Amazon has been conducting a pilot in the United Kingdom and made successful deliveries in December 2016.⁵⁹ In the same time period, 7-Eleven began drone delivery in Reno, Nevada.⁶⁰

Influence of Technology on Texas Freight

Technology alone will not increase demand for freight to and from Texas; however, advances in ITS, autonomous and connected vehicles, alternative delivery systems, and on-demand shipping all have potential to reduce the time and cost of shipping freight in the state across modes. Many of these technologies also provide safety benefits, such as autonomous and connected vehicles which detect obstacles and adjust travel without human intervention. Alternative delivery systems such as drones or freight shuttles would provide another channel for freight, particularly in urbanized areas, reducing the potential for conflict.

4.1.6 Business and Consumer Practices

Sourcing

The Massachusetts Institute of Technology’s 2014 global manufacturing study found that 13.5 percent of responding companies had plans to move manufacturing back to the U.S., and another 18 percent were considering such a move. This relocation of manufacturing back in the U.S. is referred to as reshoring. Time to market was one of two key drivers of change cited by manufacturers, with 73 percent of respondents listing it as a reason for reshoring.⁶¹ In general, reshoring and particularly nearshoring, or the relocation nearer U.S. markets, is expected to increase the amount of freight in Texas and the U.S.-Mexico border region due to shipments of manufacturing inputs and intermediate goods in addition to final goods. Drivers of reshoring include existing capital investment in Mexico; Texas’ abundance of energy, proximity to Mexico (and the enactment of NAFTA in 1994), and business climate; rising wages in Asia; and increased interest in intellectual property protection and shorter, more traceable supply chains.⁶²

⁵⁹ <http://money.cnn.com/2016/12/14/technology/amazon-drone-delivery/>.

⁶⁰ <http://www.businessinsider.com/7-eleven-beats-amazon-and-alphabet-to-drone-deliveries-2016-12>.

⁶¹ MIT Forum for Supply Chain Innovation, *MIT Forum for Supply Chain releases annual report on U.S. manufacturing*. 2014. (<http://news.mit.edu/2014/mit-group-releases-annual-report-us-manufacturing-1211>).

⁶² Center for Transportation Research, LBJ School of Public Policy, *Potential Implications of the Trans-Pacific Partnership for Transportation Planning in Texas*. 2015 (<http://library.ctr.utexas.edu/ctr-publications/policy/2015brief-3.pdf>).

Advances in Manufacturing

Improvements to existing manufacturing methods, as well as emerging trends in manufacturing, are expected to have a limited impact on the amount of freight moved, though they could decentralize the origins of freight. Increased automation and technology can reduce waste and lower costs. Direct digital manufacturing, such as sending a computer-aided design (CAD) file to a machine to produce a customized part, and additive manufacturing, such as 3D printing, may shift shipping patterns by enabling near or on-site production of components. Texas' growing plastic resin and pellets industry also stands to benefit from proliferation of 3D printing technologies. Rail is a dominant mode in the transportation of resin in the state. Therefore, growth in this sector will have a ripple effect on the demand for rail service and capacity.

E-Commerce

Electronic commerce, or e-commerce, is the use of electronic devices and technologies to conduct commerce and trade, including buying products on the Internet and electronic banking. E-commerce increased from 0.6 percent of total retail activity in 1999 to 8.1 percent in 2016.⁶³ Traditional retailers have implemented new omni-channel marketing and distribution strategies to integrate online and in-person retail, such as in-store pickup, at-home delivery and local distribution centers to expedite supply chains. E-retailers have also implemented a series of centralized distribution centers, customer pick-up lockers and private fleets of delivery vehicles to supplement other postal services. Rapid e-commerce requires fast, on-time delivery which is sensitive to both distance and congestion. One result of this trend is a higher number of delivery vehicles entering residential neighborhoods and more frequent deliveries to businesses, causing increased congestion and wear and tear to the local road network. Additionally, online commerce introduces the need for reverse logistics to handle returns or recycling of goods that were formerly brought to a retail location, further increasing the strain on the freight network.

Influence of Business and Consumer Practices on Freight

Business and consumer practices influence where freight supply and demand are located as well as the total amount of freight demanded. During outreach conducted during the development of this plan, stakeholders expressed optimism that changing business practices would cause freight to grow faster than it had in the previous five years. Sourcing trends towards reshoring are expected to increase the amount of freight moving in Texas. Truck and rail transport between Texas and Mexico as well as port traffic from other regional trading partners would all contribute to this growth. E-commerce has changed shipping patterns as residences replace retail locations as freight destinations. Consumers may also

⁶³ U.S. Census Bureau News. Quarterly Retail E-Commerce Sales.

http://www.census.gov/retail/mrts/www/data/pdf/ec_current.pdf.

demand rapid shipping options for e-commerce, resulting in changing distribution center patterns or a shift between modes.

4.2 Significant Freight System Needs and Issues

Freight transportation system needs cover a wide range of issues, from increasing capacity to exploring alternative funding mechanisms. They provide the rationale for necessary solutions and are an integral part of the development of the state's freight improvement strategy. Ten freight transportation needs were identified and are categorized as follows:

1. **System Capacity.** Issues related to system capacity include rail capacity constraints, congestion and bottlenecks on key freight corridors, exploring alternative parallel corridors/redundancy and improving merging lanes at interstate interchanges.
2. **System Operations.** Efficient system operations require investing in transportation infrastructure, developing comprehensive incident management systems, addressing oversize/overweight/over-dimensional trucks, and updating and maintaining aging infrastructure.
3. **Safety.** Addressing safety issues consists of adequate truck parking, including overnight/rest stops; reducing the number of at-grade highway/rail crossings; improving and updating roadway geometrics; addressing vertical clearance issues; and increasing education/awareness of the public about commercial vehicle needs.
4. **Multimodal Connectivity.** Identifying regional corridors, improving port-rail connections and increasing the number of multimodal connection points will improve multimodal connectivity throughout the state.
5. **Rural Connectivity.** Improving north/south connectivity to the border, increasing rural access to the existing freight network and improving rail availability and connectivity in rural areas will enhance rural connectivity.
6. **NAFTA and Border Crossings.** Key issues that must be addressed for improved NAFTA and border crossings include congestion at the border, customs processing time, border-crossing staffing issues and implementing cross-border technologies. Needs that also must be evaluated include improving the connection of U.S. interstates to Mexico's infrastructure and determining the impact of Mexican infrastructure improvements on the U.S.
7. **Freight Asset Preservation and Operations.** Maintaining the existing Texas Highway Freight Network in good condition and modernization of the system are top priorities with TxDOT and freight stakeholders.
8. **Education/Public Awareness.** Communicating the importance of freight movement to the public, improving the public's understanding of freight operational needs, expanding communication between the public- and private-sectors and clarifying their roles and

responsibilities related to funding and maintaining infrastructure are all crucial to educating the public.

9. **Funding/Financing.** Focusing on funding for high-priority multimodal freight corridors, balancing existing transportation funding needs between highway and other modes and creating alternative measures for allocating funding are key to addressing funding/financing issues.
10. **Energy/Environmental.** Supporting and implementing policies and activities that reduce the cost of alternative fuels and understanding the impact of growing industry and freight tonnage on infrastructure are important energy/environmental issues that need to be reviewed.

Chapters 7 and 9 explore the major issues and needs in greater detail.

4.3 Summary

This chapter detailed significant trends that impact the freight transportation system in Texas. These trends include increasing international trade with Mexico and other countries, strong population growth that is forecast to continue into the foreseeable future, a growing energy sector including not only oil and gas but also wind energy generation, the role of technology in providing real-time traffic information and future developments such as autonomous and connected vehicles, and changing business practices including e-commerce and manufacturing innovations. Understanding how these trends impact the demand for and type of freight movements can help Texas prepare for and manage these evolving trends before they become issues and needs. Aligning the trends with the strategic goals outlined in **Chapter 2** will help identify strengths and areas that may need additional attention.



Texas Freight Mobility Plan

Chapter 5: Freight Policies, Programs and Institutions



Texas' freight policies, strategies and institutions guide freight transportation investment decisions, while also influencing freight movement and operations. This chapter discusses existing policies and the various programs available to fund and finance freight investments.

State agencies, private stakeholders and authorities responsible for maintaining the transportation infrastructure face limited or non-dedicated funding source constraints. Statutory and constitutional constraints also limit some infrastructure investments. These funding and financing challenges are compounded by a historic lack of freight-specific policies or strategies guiding investment decisions, although this has improved in recent years through increased freight planning efforts at the local, state and national levels. Partnerships and effective coordination among agencies and institutions are critical for targeting investments and addressing these challenges.

5.1 Freight Policies and Strategies

The Texas Department of Transportation (TxDOT) has developed policies and strategies to improve freight transportation infrastructure and to guide investment.

Chapter 2 detailed Texas' freight strategic goals and objectives for freight and discussed how the goals in the Freight Plan align with federal guidance, TxDOT's Strategic Plan and the Texas Transportation Plan. The policies, objectives and strategies detailed in these plans illustrate the importance of efficient multimodal freight movement to the Texas economy.

Freight-specific policy recommendations, which are discussed in **Chapter 11**, will guide transportation investment decisions made by TxDOT, local government, regional transportation agencies, other state agencies and the private-sector users of the freight transportation network. These policy recommendations support current statewide goals and incorporate the strategies identified in other plans.

5.2 Freight-Related Institutions and Policy-Making Roles

Texas institutions play a critical role in transportation planning, investment decisions, policies, strategies, implementation, management and operation of the state's infrastructure. These decisions impact the efficient and safe movement of people and freight. The duties of these institutions are discussed below.

5.2.1 Texas State Legislature

The Texas State Legislature sets statutory guidelines which contribute to the transportation planning process and establishes spending levels through appropriations by specified programs and categories. The Legislature delegates responsibility for transportation planning and investment priorities to the Texas Transportation Commission. The Legislature also oversees TxDOT's budget and policy issues.

5.2.2 Texas Transportation Commission

The Texas Transportation Commission provides leadership and oversight of TxDOT's activities. The Commission consists of five members, who are appointed by the Governor and with the advice and consent of the Senate.⁶⁴ The Commission is responsible for:

- Overseeing planning and policy making for the location, construction and maintenance of state-maintained highways;
- Overseeing the design, construction, maintenance and operation of the state-maintained highway system;

⁶⁴ Texas Department of Transportation. Retrieved May 2017 from <http://www.txdot.gov/inside-txdot/administration/commission.html>.

- Overseeing the development of a statewide transportation plan encompassing infrastructure and several modes of transportation, including highways and toll facilities, general aviation, public transportation, railroads, high-speed railroads, and waterways (including ferries);
- Approving contracts for the improvement of the state-maintained highway system;
- Overseeing the development of public transportation, particularly in rural areas; and
- Adopting rules for the operation of TxDOT.⁶⁵

5.2.3 Texas Department of Transportation

TxDOT is responsible for the planning, development, funding, construction and management of the state's transportation infrastructure. Often, TxDOT also works with private-sector entities, regional and local planning authorities, and other authorities conducting transportation planning efforts, such as ports or airports, to collaborate on the development of plans and funding strategies. These entities also work together to provide efficient and safe passenger and freight transportation throughout the state using highways, airports, railroads, waterways and public transportation systems.

Key TxDOT Committees Involved in Freight Activities

Various committees established by the Texas Transportation Commission and TxDOT engage in freight planning and policy making. These committees report their findings to the Commission and to TxDOT for recommended actions. Key committees and their responsibilities are highlighted in **Exhibit 5-1**.

⁶⁵ Texas Department of Transportation. Retrieved September 2017 from <https://www.txdot.gov/inside-txdot/administration/commission/faqs.html>.

Exhibit 5-1: Key TxDOT Committees

Committee	Description
Texas Freight Advisory Committee	The committee advises TxDOT on freight issues, priorities, projects and funding needs for freight improvements. The committee elevates freight transportation as a critical component of the state's economic vitality and its competitiveness. ^a
Port Authority Advisory Committee	The committee provides a broad perspective on ports and transportation-related matters for TxDOT policies concerning the Texas port system. The committee also prioritizes projects for any state funding and identifies landside connectivity needs. ^b
Border Trade Advisory Committee	The committee advises TxDOT in defining and developing a strategy and makes recommendations to the Texas Transportation Commission and the Governor for addressing the highest priority border trade transportation challenges. ^c
Aviation Advisory Committee	The committee provides input to TxDOT on aviation development programs and serves as its representative among aviation users. Committee members work with members of the Texas Legislature on various aviation issues. ^d
Corridor Committees	These committees assist TxDOT in corridor-specific planning and development initiatives. Usually composed of citizens, community leaders and business owners, they provide guidance on how to improve safety, mobility and economic development along a specific corridor. Examples include the Interstate 69 (I-69) advisory committee, Interstate 20 (I-20) East Texas Corridor Committee and Interstate 10 (I-10) Corridor Coalition.

^a Texas Department of Transportation. Retrieved May 2017 from <http://www.movetexasfreight.com/>.

^b Texas Department of Transportation. Retrieved May 2017 from <http://www.txdot.gov/government/legislative/state-affairs/port-committee.html>.

^c Texas Department of Transportation. Retrieved July 2017 from <https://www.dot.state.tx.us/move-texas-freight/committees/border/default.htm>.

^d Texas Department of Transportation. Retrieved May 2017 from <http://www.txdot.gov/inside-txdot/division/aviation/advisory.html>.

TxDOT Administration, Divisions and Districts

TxDOT's administration, divisions and districts are involved in planning, developing and implementing freight policies and strategies. Their responsibilities impact statewide freight movement by identifying challenges, establishing infrastructure funding and financing rules and guidelines, developing and enforcing operational and regulatory statutes and implementing transportation planning and policy guidance.

- **TxDOT Administration:** TxDOT's administration oversees all functions of the agency that are necessary to provide a safe and efficient transportation system. The members of its administration include: the Executive Director, the Deputy Executive Director, the Chief of Staff, the Chief Audit and Compliance Officer, the Chief Financial Officer, the Chief Engineer, the Chief Administrative Officer, the Director of Communications and Customer Service, the General Counsel, the Director of Government Affairs and the Director of Strategy and Innovation. Each position has its own specific responsibilities related to the

operation of the state's transportation system. All TxDOT districts, divisions and offices report to a member of the administration, who is headquartered in Austin,⁶⁶ regarding the agency's strategy, policy and/or funding decisions.

- **Transportation Planning and Programming Division:** TxDOT's Transportation Planning and Programming Division (TPP) is responsible for preparing the statewide Long-Range Transportation Plan, the Unified Transportation Program (UTP), the State Transportation Improvement Program (STIP), the Freight Mobility Plan, the Rural Transportation Plan and major corridor plans, as well as data management and statewide modeling.
- **The Freight and International Trade Section,** which is part of TPP, and is responsible for:
 - Freight planning activities, including the development of the Texas Freight Mobility Plan;
 - Overseeing department functions, operations and information related to its international trade and border planning activities;
 - The Texas Freight Advisory Committee;
 - The Border Trade Advisory Committee;
 - Effectively engaging public- and private-sector stakeholders;
 - Building partnerships with the public and private sectors to address freight mobility needs;
 - Integrating freight transportation and international trade considerations into TxDOT's planning, programming and implementation process; and
 - Providing technical assistance with regard to freight planning to districts, Divisions, Metropolitan Planning Organizations (MPOs) and other state and local agencies.
- **Other Divisions:** There are 32 divisions in TxDOT, including TPP. TPP coordinates with other TxDOT divisions when developing transportation plans, policies and goals related to freight movement. TxDOT's divisions impact statewide freight movement through a combination of policy and regulatory responsibilities; infrastructure funding guidance, design and construction; and maintenance and operation of the transportation system. Other TxDOT divisions important to freight transportation include the following:
 - Aviation Division
 - Bridge Division
 - Construction Division
 - Communications
 - Design Division

⁶⁶ TxDOT. June 2017. Retrieved from <http://www.txdot.gov/inside-txdot/administration.html>.

- Environmental Affairs Division
 - Financial Management Division
 - Government Affairs Division
 - Maintenance Division
 - Maritime Division
 - Rail Division
 - Right-of-Way Division
 - Research and Technology Implementation Division
 - Strategic Planning Division
 - Toll Operations Division
 - Traffic Operations Division
 - Travel Information Division
- **TxDOT Districts:** TxDOT has 25 districts implementing its mission on a geographic basis. The districts coordinate with TxDOT divisions and offices, MPOs and local officials and other TxDOT districts to develop and implement projects that improve freight mobility, infrastructure and operations. Districts also are responsible for the design, construction and maintenance of the multimodal freight transportation system's highways within their district. TxDOT's Area Offices provide construction, engineering and maintenance on an even smaller geographic scale within the districts.

5.2.4 Other Texas State/Local Agencies

TxDOT provides leadership and guidance on freight transportation investments through long-term policy and planning initiatives, funding and financing tools, regulatory and operational actions, information dissemination and multimodal organization. Other statewide agencies can influence freight transportation policies and investments based on their specific roles and responsibilities. Other agencies include:

- **Metropolitan Planning Organizations:** Federal law requires that an MPO be designated for each urban area with a population of 50,000 or more.⁶⁷ Texas' 25 MPOs receive federal funding for transportation planning; and several MPOs also receive state and local funds to carry on their mandated planning activities. MPOs undertake regional planning processes to develop multimodal plans consistent with TxDOT's plans. The plans identify transportation improvements and services within the metropolitan area boundaries for the next 20 to 25 years, which are primarily implemented by TxDOT.

⁶⁷ Association of Texas Metropolitan Planning Organizations. Retrieved May 2017 from <https://www.texasmpos.org/texas-mpos/about/>.

Regionally significant projects are required to be identified in a Metropolitan Transportation Plan. MPOs in non-attainment areas⁶⁸ are also responsible for Congestion Mitigation and Air Quality planning.

- **Texas Department of Motor Vehicles:** The Texas Department of Motor Vehicles (TxDMV) is responsible for titling and registering vehicles and licensing and regulating the motor vehicle sales industry. It also registers commercial vehicles, provides permits for oversize/overweight loads and provides auto theft prevention grants. The TxDMV authorizes the North American Free Trade Agreement (NAFTA) annual permit—a Texas registration for foreign commercial motor vehicles, trailers or semi-trailers that are not otherwise authorized to travel on Texas highways.⁶⁹
- **Railroad Commission of Texas:** The Railroad Commission regulates the oil and gas industry, natural gas utilities, pipeline safety, the natural gas and hazardous liquid pipeline industry, and surface coal and uranium mining.⁷⁰ TxDOT coordinates with the Railroad Commission to ensure operators have proper permits to access a site from a roadway on the state highway system. Oil and gas well permit applications are submitted to the respective TxDOT Area Office serving the county where the well is located.⁷¹ The pipeline safety department, which is a part of the railroad commission, works to enforce compliance with federal and state laws and regulation by pipeline operators.⁷²
- **Texas Commission on Environmental Quality:** Texas regulates the transportation of hazardous waste and certain non-hazardous waste through rules established and enforced by the Texas Commission on Environmental Quality (TCEQ) and the Texas Department of State Health Services. The TCEQ regulates the movement of hazardous and industrial waste on public roads and rights-of-way.⁷³
- **Texas Department of Agriculture:** The Texas Department of Agriculture (TDA) is a regulatory agency but also serves to market Texas agriculture and is committed to rural economic and agribusiness development.⁷⁴ The TDA inspects and monitors weighing and

⁶⁸ Non-attainment areas are those which do not meet National Ambient Air Quality Standards.

⁶⁹ Texas Department of Motor Vehicles, Strategic Plan Fiscal Years 2015-2019.

⁷⁰ Railroad Commission of Texas. Retrieved May 2017 from <http://www.rrc.state.tx.us/about-us/>.

⁷¹ Railroad Commission of Texas. Retrieved May 2017 from <http://www.rrc.state.tx.us/media/8659/rrcpermitnotice060611.pdf>.

⁷² Railroad Commission of Texas. Retrieve October 2017 from <http://www.rrc.state.tx.us/pipeline-safety/>

⁷³ TCEQ, Transporting Waste in Texas— A Guide to Regulations, July 2016.

⁷⁴ Texas Department of Agriculture. Retrieved July 2017 from <http://www.texasagriculture.gov/Home/SitePolicies/CompactwithTexans.aspx>.

measuring devices for accurate performance. Inspected devices include service station fuel pumps, commercial scales, airport bulk meters for re-fueling planes and liquefied petroleum gas meters for storage tanks at businesses or homes.⁷⁵

- **Texas Secretary of State's Office:** The Secretary of State is one of six state officials named by the Texas Constitution to form the Executive Department of the State. Appointed by the Governor, the Secretary serves as the Chief Election Officer for Texas as well as provides a repository for official, business and commercial records required to be filed with the Office. In addition, the Secretary serves as a senior advisor and liaison to the Governor for Texas Border and Mexican Affairs and serves as Chief International Protocol Officer for Texas.⁷⁶ The Secretary of State also serves as the chair of the Border Trade Advisory Committee which acts as a forum for agency transportation decisions affecting trade and the movement of freight at the Texas border.
- **Governor's Office of Economic Development:** The Economic Development and Tourism Division of the Governor's Office pursues statewide business expansion and relocation prospects. It manages the Texas Economic Development Bank, which provides financial incentives to expanding businesses operating in the state and businesses relocating to Texas. The bank administers financial incentives, including the Texas Product/Business Fund, Texas Leverage Fund, Texas Industry Development Loan Program, Texas Enterprise Zone Program and Industrial Revenue Bonds.
- **Other Texas Freight Infrastructure Owners, Partnerships and Advocacy Groups:** The state, primarily through TxDOT, has many public- and private-sector partners collaborating to pursue Texas' freight transportation goals.

5.2.5 Modal Owners and Partners

A brief description of private organizations that own key freight transportation infrastructure in Texas follows, with a detailed discussion of specific assets provided in **Chapters 6 and 7**.

Texas Port Authorities and Marine Terminal Operators

A port authority, also known as a navigation district (authorized in the Texas Constitution, Article XVI, Section 59), is a political subdivision formed to operate ports and other transportation infrastructure. There are 12 commercial deep water ports and nine shallow draft commercial ports operated by port authorities and navigation districts in Texas, although some are only used for recreational activities.⁷⁷ Most of these ports are governed

⁷⁵ Texas Department of Agriculture. Retrieved May 2017 from <http://www.texasagriculture.gov/RegulatoryPrograms/WeightsandMeasures.aspx>.

⁷⁶ Texas Secretary of State. Retrieved July 2017 from <http://www.sos.state.tx.us/>.

⁷⁷ Texas Department of Transportation, Maritime Division. Map of Texas Ports. Retrieved July 2017 from <http://www.txdot.gov/inside-txdot/division/maritime.html>.

by a five- or seven-member commission or a board with appointed or elected members. The Port of Texas City is the state's only privately owned deep water port.

Texas ports operate in one of three ways: landlord (or non-operating), operating, or mixed. Landlord ports are those in which all port facilities are leased or assigned, with the lessee or assignee responsible for facility operations. Operating ports are those which provide all port services with their own employees or with contract service providers. Mixed ports are those which lease some facilities but also continue to operate other facilities with port employees or contracted service providers. This results in a number of marine terminal operators at the various ports across the state which operate their own facilities and make separate capital investments to improve those operations.

Texas Airports

The most common airport ownership and operational arrangements involve traditional municipal or county governments. For example, the Dallas/Fort Worth International Airport is jointly owned by the cities of Dallas and Fort Worth and operated by the semi-autonomous Dallas/Fort Worth International Airport Board. Similarly, the three airports in the Houston Airport System (George Bush Intercontinental/Houston, William P. Hobby Airport and Ellington Field) are owned by the City of Houston and operated by its Department of Aviation. Fort Worth's Alliance Airport is owned by the city of Fort Worth, and it is operated by Alliance Air Services, a subsidiary of the Perot Company.

Texas Railroads

Most rail infrastructure in Texas is privately owned and operated. Three Class I railroads operate in Texas: BNSF Railway (BNSF), Kansas City Southern Railway (KCS) and Union Pacific Railroad (UP). UP and KCS are publicly traded, while BNSF is a subsidiary of Berkshire Hathaway, Inc. These three railroads are the largest transporters of freight by rail and are essential to connecting the Texas Multimodal Freight Network to both domestic and foreign trading partners.

Also within Texas, there are 49 shortline railroads operating,⁷⁸ which include the State of Texas owned South Orient Rail Line that runs from Presidio, on the Texas-Mexican border, to San Angelo Junction near Coleman, Texas. The line interchanges with UP at Alpine and with BNSF and the Fort Worth and Western Railroad (FWWR) at San Angelo Junction. Texas Pacifico Transportation Ltd. operates the South Orient Rail Line under a lease and operating agreement with TxDOT. Additionally, the Northeast Texas Rural Rail Transportation District (NETEX) is a state-owned railroad serving six counties northeast of Dallas/Fort Worth. This railroad is operated by Blacklands Railroad.

⁷⁸ .Association of American Railroads. Freight Railroads in Texas, February 2017. Accessed on Aug 18, 2017.

https://www.aar.org/Style%20Library/railroads_and_states/dist/data/pdf/Texas-2012.pdf.

Railroads are of strategic importance to the state's freight transportation system. Class I railroads carry more than 400 million tons of freight into, out of or through Texas, while shortlines provide first- or last-mile service for Texas' ports and many of the state's rail-served industries. Typically, shortline railroads engage in specialized services to serve a specific facility, company or industry or grouping of customers.⁷⁹

Texas Pipelines

Pipelines in Texas are privately owned, operated and maintained by a variety of oil and gas companies. In addition to building, maintaining and/or operating pipelines, many of these companies also provide storage, refining and treatment of liquefied natural gas (LNG), crude oil, refined petroleum products and other petrochemicals. According to the Pipeline Safety Division of the Texas Railroad Commission, there are more than 1,400 pipeline operators of gas distribution, gas master-meters, gas transmission, hazardous liquid transmission and gathering systems in Texas, operating nearly 440,000 miles of pipeline.⁸⁰ The largest intrastate pipelines in Texas are operated by the Energy Transfer Partners LP (8,800 miles) and the Enterprise Texas Pipeline Company (8,750 miles).⁸¹

Toll Road Authorities

Toll roads in Texas are operated by the TxDOT, Regional Mobility Authorities (RMAs), county toll authorities and private entities. Toll facilities operated by TxDOT or by a private contract with TxDOT include the Central Texas Turnpike System, which consists of four contiguous toll highways serving the Austin metropolitan region and the Austin-San Antonio corridor—State Highway 45 (SH 45) Loop 1, SH 45 Southeast and SH 130 (Segments 1 to 4)—as well as Segments 5 and 6 of SH 130. Regional toll authorities were established by Senate Bill 370 in 1997, which authorizes the toll authorities to issue bonds, impose taxes, use the power of eminent domain and provide penalties.⁸²

RMAs plan, finance, build, operate and maintain local toll roads or other transportation projects. RMAs formed to develop toll facilities include:

- Alamo RMA (San Antonio)
- Cameron County RMA (Brownsville)

⁷⁹ Texas Department of Transportation, Texas Rail Plan. Retrieved May 2017 from <https://ftp.dot.state.tx.us/pub/txdot-info/rail/2016-rail-plan/chapter-3.pdf>.

⁸⁰ Texas Railroad Commission. Retrieved May 2017 from <http://www.rrc.state.tx.us/pipeline-safety/>.

⁸¹ U.S. Energy information Agency. Retrieved May 2017 from http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/intrastate.html.

⁸² SB 370 Bill Text. Retrieved October 2017 from <http://www.legis.state.tx.us/tlodocs/75R/billtext/html/SB00370F.htm>

- Camino Real RMA (El Paso)
- Central Texas RMA (Austin)
- Grayson County RMA (Denison)
- Hidalgo County RMA (Pharr)
- Webb County-Laredo RMA (Laredo)
- North East Texas RMA (Tyler)
- Sulphur River RMA (Paris)

County toll road authorities, such as the Harris County Toll Road Authority, Fort Bend County Toll Road Authority and Montgomery County Toll Road Authority, are established by single counties. Regional tollway authorities, like the North Texas Tollway Authority, are political subdivisions of the state established by two or more counties. Regional mobility authorities differ from toll authorities in that they are authorized by the Texas legislature to finance, design, construct, operate, maintain and expand a wide variety of transportation facilities and services not just toll roads.

The state's 69 statewide toll facilities—under various forms of ownership, management and operation—include 33 operating road facilities, 15 road facilities under construction, 21 bridge facilities and one tunnel.⁸³

5.2.6 Partnerships, Advocacy and Other Public Institutions

TxDOT coordinates with several freight-related institutions on a project-by-project basis, often during major project planning or stakeholder engagement for planning studies and long-range planning updates. The major educational institutions, associations and regional freight planning partnerships that focus on freight interests in Texas are listed below.

- **Educational Institutions:** TxDOT coordinates with academic transportation research centers and transportation experts, including Texas A&M Transportation Institute (TTI), the University of Texas Center for Transportation Research (CTR), the University of Texas at El Paso (UTEP) and the University of North Texas (UNT). TxDOT's Research Program is managed by the Research and Technology Implementation Division which allows TxDOT to contract with Texas state-supported institutions of higher education through a competitive process.⁸⁴

⁸³ Texas Department of Transportation. Retrieved May 2017 from <http://ftp.dot.state.tx.us/pub/txdot-info/tod/toll-roads-bridges.pdf>.

⁸⁴ Texas Department of Transportation. Retrieved June 2017 from <http://ftp.dot.state.tx.us/pub/txdot-info/rti/university-handbook.pdf>.

- **Business and Industry Associations:** Examples include American Transportation Research Institute, Gulf Intracoastal Canal Association, Texas Association of Business and Chambers of Commerce, Texas Good Roads, Texas Pipeline Association, Texas Ports Association, Texas Railroad Association and Texas Trucking Association.
- **Regional, National or International Freight Planning Partnerships:** Examples include Alliance for I-69 Texas, Border Trade Alliance, North American Strategy for Competitiveness, Ports-to-Plains Alliance and Border Plex Alliance.
- **Rural Rail Transportation Districts:** In 1981, in response to concerns over the loss of rural rail service, the Texas Legislature voted to allow the formation of Rural Rail Transportation Districts (RRTDs). Counties have the authority to establish RRTDs to acquire abandoned rail lines, construct new rail lines or rehabilitate existing ones.⁸⁵ They also can develop rail to serve industrial parks, intermodal facilities and transloading facilities. The June 2013 joint TTI/TxDOT study, Rural Rail Transportation Districts (RRTDs) Update, noted there are 42 RRTDs in the state, but not all of these are active.

Changes in rail planning and activity patterns in specific regions highlight the need for improved coordination on a statewide level. Enhanced coordination strategies include identifying opportunities for interaction with other special districts (e.g., RMAs and MPOs), private railroads (especially Class I railroads) and TxDOT. The report concluded that TxDOT must determine its role for effectively coordinating the activities of RRTDs and incorporating these activities into statewide rail planning efforts.⁸⁶

5.3 Freight Infrastructure Funding and Financing

There are various sources for funding and financing options for freight transportation infrastructure, some of which are constrained by mode, type of route or improvement or specific responsibility of an agency. State and federal grant/loan opportunities for freight-related projects each have their own unique requirements. This section addresses Federal and state funding and financing programs and sources.

5.3.1 *Federal Freight Transportation Infrastructure Funding and Financing*

The Fixing America's Surface Transportation (FAST) Act established a National Highway Freight Program, which identified formula funds for investments on the National Highway

⁸⁵ Texas A&M Transportation Institute, Texas Rural Rail Transportation Districts: Informational Guidebook for Formation and Evaluation, 2001. Retrieved May 2017 from <http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/4007-P1.pdf>.

⁸⁶ Ibid.

Freight Network, with up to 10 percent available for intermodal projects.⁸⁷ The Texas share of these freight program dollars is presented in **Exhibit 5-2**. The total five-year apportionment is \$551.3 million; fiscal year apportionments are subject to adjustment by FHWA.

Additionally, the FAST Act created a new discretionary freight-focused grant program that allows states, MPOs, local governments, tribal governments, special-purpose districts and public authorities (including port authorities) and other parties to apply for funding to complete projects that improve safety and hold the greatest promise to eliminate freight bottlenecks and improve critical freight movements for the statutory life of the FAST Act.⁸⁸ The freight grant program was recently revised and now is referred to as the Infrastructure for Rebuilding America (INFRA) grants. This is in addition to the existing TIGER Discretionary Grant program which made its first awards in 2010. States can leverage their own dedicated transportation funding with these federal sources, as well as with other local, regional and private-sector funding. The Surface Transportation Block Grant (STBG) program, which was converted from the long-standing Surface Transportation Program, promotes flexibility in state and local transportation decisions and provides flexible funding to best address state and local transportation needs. Additionally, a state may designate up to 5 percent of STBG apportionment for border infrastructure projects.⁸⁹

⁸⁷ Federal Highway Administration, Freight-FAST-Act Factsheet, Retrieved June 2017 from <https://cms.dot.gov/sites/dot.gov/files/docs/Freight-FAST-Act-Factsheet.docx>.

⁸⁸ Ibid.

⁸⁹ Federal Highway Administration, Surface Transportation Block Grant Program Fact Sheet. Retrieved July 2017 from <https://www.fhwa.dot.gov/fastact/factsheets/stbgfs.pdf>.

Exhibit 5-2: *Estimated National Highway Freight Program Funding for Texas by Year (Millions of Dollars)*

	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	Total
Total NHFP Apportionment	\$100.6	\$96.3	\$105.0	\$118.1	\$131.3	\$551.3
2% State Planning & Research (SPR) Set-a-Side	\$2.0	\$1.9	\$2.1	\$2.4	\$2.6	\$11.0
10% Limiting Amount for Freight Intermodal & Freight Rail Projects	\$10.1	\$9.6	\$10.5	\$11.8	\$13.1	\$55.1

Source: TxDOT Planning Conference, 2016. Federal Legislation Regulatory Update.

<https://static.tti.tamu.edu/conferences/tpp16/presentations/plenary/meyer.pdf>.

Federal funding comprised 36 percent of TxDOT funding sources for fiscal year 2016-2017, at over \$8.3 billion.⁹⁰ The majority of federal funding for freight-related improvements is administered through the U.S. Department of Transportation Federal Highway Administration (FHWA). There are currently more than 90 programs/sources for federal funding. Core and other key funding programs include:

- Federal core FHWA highway formula programs:
 - Congestion Mitigation and Air Quality Improvement Program (CMAQ)
 - Highway Safety Improvement Program (HSIP)
 - National Highway Performance Program (NHPP)
 - State Planning and Research (SP&R)
 - Surface Transportation Block Grant Program (STBG)
- Other federal funding sources/programs:
 - Federal Airport Improvement Program (AIP)
 - Infrastructure for Rebuilding America (INFRA) Grant Program (formerly known as FASTLANE)
 - Private Activity Bonds
 - Railway-Highway Crossing (Section 130) Program
 - Railroad Rehabilitation and Improvement Financing Program (RRIF)
 - The Transportation Infrastructure Finance and Innovation Act (TIFIA)

⁹⁰ State of Texas Legislative Budget Board.

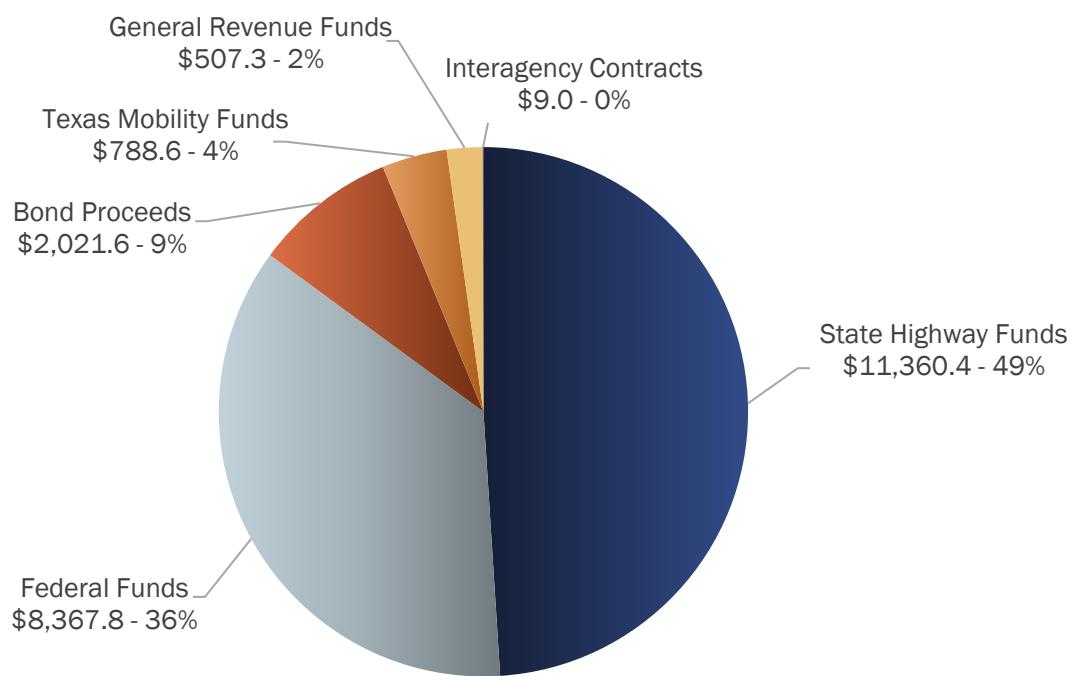
- Transportation Development Credits
- Transportation Investment Generating Economic Recovery (TIGER) Discretionary Grants
- U.S. Army Corps of Engineers Harbor Maintenance Trust Fund

5.3.2 State Freight Transportation Infrastructure Funding and Financing

State agencies are appropriated funds by the Texas State Legislature on a biennial basis. When TxDOT receives its appropriation, the bulk of the funds are allocated to previously awarded projects. The remaining funds are available to develop both projects that begin in the biennium and for future projects.

TxDOT 2016-2017 biennium funding sources totaled more than \$23 billion.⁹¹ The sources are outlined in **Exhibit 5-3**.

Exhibit 5-3: *TxDOT Funding Sources (Millions of Dollars), FY 2016 - 2017*



Source: State of Texas Legislative Budget Board.

⁹¹ State of Texas Legislative Budget Board. Overview of Transportation Funding and Revenue Sources. Retrieved June 2017 from

http://www.lbb.state.tx.us/Documents/Publications/Presentation/3287_Overview_Transportation_Funding.pdf.

The Texas Transportation Commission and TxDOT use the Unified Transportation Program (UTP) as TxDOT's 10-year plan to guide transportation project development. Despite its importance to TxDOT as a planning and programming tool, the UTP is neither a budget nor a guarantee that projects will or can be built. However, it is a critical tool in guiding transportation project development within the long-term planning context. In addition, it serves as a communication tool for stakeholders and the public in understanding the project development commitments TxDOT is making.⁹² Project information—including work descriptions, funding requirements and dates for proposed activities—is included in the UTP.

5.3.3 State Freight Transportation Infrastructure Loan and Grant Programs

Various funding and financing options and grant programs are available for transportation infrastructure; however, most are not solely dedicated to freight-specific projects.

Traffic Safety Program

Administered through its Traffic Operations Division, TxDOT provides grant funding programs to support the Texas Traffic Safety Program and to implement provisions of its Strategic Highway Safety Plan. In fiscal year 2017, the program has awarded communities more than \$44 million in state and federal grant funding for traffic safety projects.⁹³ The goal of the program is to identify traffic safety problem areas and implement programs to reduce the number and severity of vehicular crashes.⁹⁴

Routine Airport Maintenance Program

Texas is primarily involved in supporting general aviation airports through both state and federally funded programs, while financing for commercial service airports is handled directly by the Federal Aviation Administration (FAA). For the general aviation airports, TxDOT manages the Routine Airport Maintenance Program and matches local government grants for basic improvements, including parking lots, fencing and other airside and landside needs.⁹⁵

⁹² Texas Department of Transportation. Retrieved July 2017 from [http://www.txdot.gov/inside-
txdot/division/transportation-planning/utp.html](http://www.txdot.gov/inside-txdot/division/transportation-planning/utp.html).

⁹³ Texas Comptroller of Public Accounts. Retrieved May 2017 from
<https://comptroller.texas.gov/transparency/spending/txdot.php>.

⁹⁴ Texas Department of Transportation. Retrieved May 2017 from [http://txdot.gov/inside-
txdot/division/traffic/grants.html](http://txdot.gov/inside-txdot/division/traffic/grants.html).

⁹⁵ Texas Department of Transportation. Retrieved May 2017 from [http://www.txdot.gov/government/funding/airport-
grants.html](http://www.txdot.gov/government/funding/airport-grants.html).

Texas Capital Fund Infrastructure Development Program

Administered by the Texas Economic Development Division, funds from the Texas Capital Fund Infrastructure Development Program can be used for public infrastructure improvements, including water, sewer, roads, etc., and to assist with creating and/or retaining jobs.⁹⁶

Community Development Fund

The Texas Department of Agriculture oversees the Texas Community Development Block Grant Program, which uses federal funds to provide assistance to smaller communities. Eligible activities include infrastructure projects such as sewer and water system improvements, street, bridge and drainage improvements, and housing rehabilitation.⁹⁷ From 2012-2016 Texas received approximately \$356 million in Community Development Block Grants.⁹⁸

5.3.4 Local, Regional, and Targeted Freight Transportation Infrastructure Funding and Financing Programs

Local, regional and private sources—including counties and cities—also provide funding for transportation investments that benefit freight movement.

Counties and Cities

Cities have the authority to generate revenue through property and sales taxes and through the issuance of revenue and general obligation bonds. Revenue can be used for transportation improvements.⁹⁹ Many cities also impose additional sales taxes in varying amounts of up to one percent—these are known as dedicated taxes because their proceeds may be spent only for certain purposes.¹⁰⁰

⁹⁶ Texas Economic Development. Retrieved May 2017 from <https://texaswideopenforbusiness.com/services/grants>.

⁹⁷ Texas Department of Agriculture. Retrieved May 2017 from [http://www.texasagriculture.gov/GrantsServices/RuralEconomicDevelopment/RuralCommunityDevelopmentBlockGrant\(CDBG\)/CommunityDevelopment.aspx](http://www.texasagriculture.gov/GrantsServices/RuralEconomicDevelopment/RuralCommunityDevelopmentBlockGrant(CDBG)/CommunityDevelopment.aspx).

⁹⁸ Association of Rural Communities in Texas. Estimated Economic Impact of Community Development Block Grants in Rural Texas 2012-2016. Retrieved October 2017 from <https://arcit.org/wp-content/uploads/2017/10/2012-2016-CDBG-grants-economic-impact-report-full-report-9-11-17.pdf>

⁹⁹ Texas Municipal League. Retrieved May 2017 from <http://www.tml.org/HCW/HowCitiesWork.pdf>.

¹⁰⁰ Texas Municipal League. Retrieved May 2017 from <https://www.tml.org/HCW/WhereCitiesGetMoney.pdf>.

The largest portion of a county's revenue comes from property taxes.¹⁰¹ Counties also may hold an election to create county assistance districts and adopt sales taxes to fund those districts.¹⁰² A district may undertake a variety of projects, including roads or highways. Additionally, counties receive funding allocations from the Special County Road Assistance Program based on population and road mileage formulas, and they retain collection fees for state vehicle registrations.

Other Programs

Other local, regional and private funding tools available for freight transportation investments have specific improvement activities associated with their use. These programs and sources may require a substantial financial commitment or funding match. They include:

- Comprehensive Development Agreements
- Exempt Facility Bonds
- Industrial Revenue Bond Program
- Public Improvement Districts
- State Infrastructure Bank
- Tax Increment Financing

Comprehensive Development Agreements are a tool used by TxDOT to enable private development by sharing the risks and responsibilities of design and construction. The latest project to utilize this tool is the SH 288 toll lanes project in Harris County.¹⁰³

5.3.5 Funding for Non-Highway Modes

The private sector has various tools to fund and finance infrastructure projects, and it invests heavily in freight transportation infrastructure.

¹⁰¹ Texas Association of Counties. Keys to the Courthouse. Retrieved May 2017 from <https://www.county.org/texas-county-government/resources/Documents/Chap5.pdf>.

¹⁰² Texas Comptroller of Public Accounts. Retrieved May 2017 from <http://texasahead.org/lga/96-1172.pdf>.

¹⁰³ TxDOT. Current Comprehensive Development Agreement. Retrieved October 2017 from <http://www.txdot.gov/government/partnerships/current-cda.html>

Railroads

Railroads are almost entirely privately funded and invest heavily and continuously to enhance and maintain their infrastructure. For example:

- In Texas alone, UP has invested more than \$4 billion in its infrastructure since 2009 and plans to spend \$452 million in 2017.¹⁰⁴ Additionally, UP planned to spend \$3.1 billion system-wide on capital improvements in 2017.¹⁰⁵
- BNSF committed \$3.4 billion in 2017 to its capital program.¹⁰⁶ Of its 2017 capital expenditures, BNSF will invest an estimated \$255 million on maintenance and rail capacity expansion projects in Texas.¹⁰⁷
- KCS estimates to fund between \$550 and \$560 million in 2017 on capital expenditures.¹⁰⁸ While the Texas share of that investment is not known, KCS plans to invest \$25 million on its Beaumont subdivision in 2017 to replace 24 miles of rail and 70,000 cross ties as well as make improvements to 56 road crossings.¹⁰⁹

Private investment by the rail industry can be leveraged with public-sector investment to create public-private partnerships. As an example, the Tower 55 project in Fort Worth alleviates congestion at one of the busiest railroad intersections in the U.S., where 10 freight and passenger rail routes converge and carry more than 100 trains per day. In addition to a \$34 million federal TIGER II grant, the project was funded with matching contributions, including \$1 million from TxDOT, \$1 million from the City of Fort Worth and \$65 million from BNSF and UP.¹¹⁰

¹⁰⁴ Union Pacific Railroad. Retrieved May 2017 from <http://www.up.com/media/releases/170329-texas-investment.htm>.

¹⁰⁵ ibid.

¹⁰⁶ BNSF Railway. Retrieved May 2017 from <http://www.bnsf.com/news-media/news-releases/capital-investments-2017.html>.

¹⁰⁷ ibid.

¹⁰⁸ KCS Annual Report 2016. Retrieved July 2017 from <http://investors.kcsouthern.com/~/media/Files/K/KC-Southern-IR-V2/annual-report-2016.pdf>.

¹⁰⁹ Texas Rail Advocates. Retrieved July 2017 from <http://texasrailadvocates.org/2017/01/31/kcs-to-spend-25-million-in-upgrades-to-beaumont-subdivision/>.

¹¹⁰ Texas Department of Transportation. Retrieved May 2017 from http://ftp.dot.state.tx.us/pub/txdot-info/rail/grant_funded/tower_55.pdf.

Ports

Ports are funded with port revenue, local tax revenues, and general obligation and revenue bonds. Operating revenues for vessel and cargo services are collected via tariffs. Many port authorities own a diverse group of facilities designed to accommodate general cargo, containers, grain, coal, petroleum, coke, dry and liquid bulk, and project and heavy-lift cargo. In addition to owning land, setting fees and levying taxes, port authorities also can operate shipping terminals, airports and railroads.¹¹¹ Individual ports construct and maintain the landside terminal facilities, dredge their own berths, and contribute to channel improvement cost-sharing programs. Local ports also fund a share of federal navigation improvement projects.¹¹² Federal funding for maintenance dredging largely comes from the Harbor Maintenance Tax with proceeds deposited into the Harbor Maintenance Trust Fund and appropriated by the U.S. Congress.

In addition, Rider 48 of the General Appropriations Act of 2015 ensured that funding for public roadway connectors to ports was included in the state budget. This authorized the use of up to \$20 million from the Texas Mobility Fund for the 2016-2017 biennium to provide funding for public roadway connectors to ports. This funding authorization level was continued for the 2018-2019 biennium in Rider 45.

Port capital expenditures leverage private-sector and industry investment to keep up with increasing demand. This leveraging has resulted in Texas ports advancing their own capital improvement projects, more than \$1.1 billion worth since 2010.¹¹³ However, these investments are insufficient to meet customers' current and future needs. Many of the petrochemical and LNG industries located along the Texas coast are undergoing major expansion of existing facilities or building new facilities, resulting in the investment of billions of private dollars along the entire Texas coast. According to the American Chemistry Council, petrochemical companies have announced nearly 300 new major projects totaling \$179 billion since 2010, about half of which are completed or under construction, and half are in the planning phase. Many of those developments are planned along the Texas Gulf Coast.¹¹⁴

¹¹¹ American Association of Port Authorities, Seaport Governance in the United States and Canada. Retrieved May 2017 from http://aapa.files.cms-plus.com/PDFs/governance_uscan.pdf.

¹¹² American Association of Port Authorities. Retrieved October 2017 from <http://www.aapa-ports.org/Issues/content.cfm?ItemNumber=1004>.

¹¹³ "Texas Ports 2017/2018 Capital Program", issued by The (Texas) State Port Authority Advisory Committee, available at <http://ftp.dot.state.tx.us/pub/txdot-info/tpp/giww/2017-18-capital-program.pdf>.

¹¹⁴ American Chemistry Council, "ACC Cheers ExxonMobil's 'Growing the Gulf' Initiative," March 2017.

Airports

Passenger fees, jet-fuel taxes, building and facility rental fees, parking and concessions fees and passenger facility charges typically support airport facilities. Federal Airport Improvement Program (AIP) funding is available to airports that are part of the National Plan of Integrated Airports System. The grant covers 75 percent of eligible costs or 80 percent for noise program implementation for large and medium primary hub airports. The grant covers a range of 90 percent to 95 percent of eligible costs for small primary, reliever and general aviation airports.¹¹⁵ Administered by the FAA, the AIP provides funds for infrastructure improvements, including runways, taxiways, aprons, noise control, land purchases, navigational aids, safety and security.

Public-private partnerships between airport authorities and air freight integrators have allowed for the development of air cargo facilities. It is difficult to accurately determine the investment share of the air cargo system because passenger and cargo airplanes jointly share airport facilities such as runways and control towers. However, since 1994, developers have invested more than \$400 million in cargo/warehouse buildings¹¹⁶ at Dallas/Fort Worth International Airport. George Bush Intercontinental/Houston invested \$3.1 billion in airport infrastructure between 1999 and 2004 through the Houston Airport System, including a new \$180 million air cargo distribution center.¹¹⁷ Additionally, total investment in the Alliance Global Logistics Hub in Fort Worth has been \$8.4 billion, with 92.9 percent (\$7.8 billion) put forth by Hillwood Properties and its partners and \$627 million coming from public resources for roads, infrastructure and schools.¹¹⁸

5.4 Statutory and Constitutional Constraints on Freight-Related Investments and Policies

Statutory and constitutional constraints include those related to capturing already-existing transportation revenue that can be used for transportation investments, restrictions on shifting funding between categories and limitations to finance infrastructure improvements for other freight modes.

¹¹⁵ Federal Aviation Administration. Retrieved May 2017 from <http://www.faa.gov/airports/aip/overview/>.

¹¹⁶ Dallas/Fort Worth International Airport. Retrieved May 2017 from https://extapps-tst-vip.dfwairport.com/cargo/P1_008843.php.

¹¹⁷ Aero News Network. Retrieved May 2017 from <http://www.aero-news.net/index.cfm?do=main.textpost&id=da53e318-e3ce-4333-acd7-6474636e0646>.

¹¹⁸ Alliance Texas Global Logistics Hub. Retrieved May 2017 from <http://www.alliancetexas.com/News/AllianceTexasFacts.aspx#sthash.kD128Rpd.dpuf>.

5.4.1 Use of Existing Transportation Revenue

Texas collects taxes and fees associated with the use of the state's surface transportation system. Some of the revenues collected are dedicated to state government programs other than surface transportation. For example, a quarter of the motor fuel tax revenues, about \$878 million in fiscal year 2016, are allocated to the Available School Fund.¹¹⁹ Based on Proposition 7, taxes and fees that will be re-directed to the State Highway Fund amount to:¹²⁰

- \$2.5 billion of state sales tax if revenue exceeds \$28 billion in the fiscal year beginning in September 2017 (fiscal year 2018)
- 35 percent of state and motor vehicle sales and rental tax in excess of \$5 billion beginning in September 2019 (fiscal year 2020)

These revenues are not new taxes and represent funds coming from dedicating certain future revenue growth from the state's existing general sales and use tax and motor vehicle sales and rental taxes.

5.4.2 Transfer and Flexibility between Funding Sources and Categories

The Texas Administrative Code specifies 12 funding categories for highway-related projects, each with a specific project or allocation programming purpose. For project-specific categories, projects are selected and identified for funding in the UTP. While funding amounts for a specific project may change, the sum of all funding within each category is fiscally constrained by the funding levels identified in the latest UTP's funding summaries. The UTP categories are closely aligned with federal funding programs, as well as with subsequent restrictions, guidelines and requirements associated with each federal program.

UTP categories closely tied to federal programs include:

- Preventive maintenance and rehabilitation
- Metropolitan and urban corridor projects
- Statewide connectivity corridor projects
- Structures replacement and rehabilitation
- Supplemental transportation projects

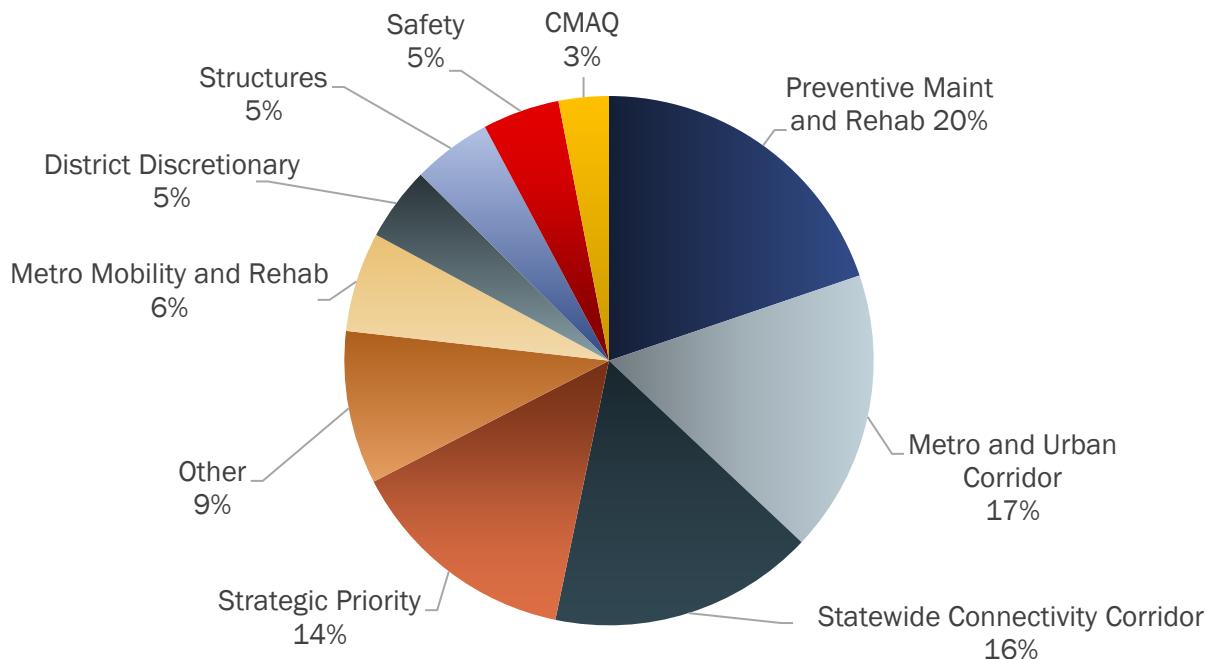
¹¹⁹ Texas Comptroller of Public Accounts, retrieved July 2017 from <https://comptroller.texas.gov/transparency/revenue/watch/all-funds/>.

¹²⁰ Proposition 7 – Constitutional Amendment for Transportation Funding, retrieved October 2017 from <http://www.txdot.gov/government/legislative/state-affairs/ballot-proposition-7.html>.

- District discretionary
- Strategic priority

A summary of the project categories by funding type are shown in **Exhibit 5-4**.

Exhibit 5-4: *TxDOT UTP Funding Categories, FY 2018 to 2027*



Source: TxDOT 2018 UTP.

TxDOT must receive approval from the Texas Legislative Budget Board and the Governor to transfer funds between items of appropriation at the General Appropriations Act category level. Legislative approval is not required to transfer funds between projects within those categories. However, TxDOT could consider removing non-mandatory funding categories to provide additional funding flexibility.

5.4.3 *Funding Other Modes*

With no dedicated funding sources for other modes, TxDOT can and has used State Highway Fund revenues not constitutionally dedicated to highway purposes for other functions, including public transportation, rail, aviation, ports and bridges. Examples of opportunities to fund other modes include the Texas Rail Relocation and Improvement Fund (TRRIF) and the Ship Channel Improvement Revolving Fund. However, both programs are currently unfunded by the Texas State Legislature. Rider 48 and Rider 45 are two recent funding authorizations for port access projects.

Texas Rail Relocation and Improvement Fund

The TRRIF is a state constitutional fund to finance the relocation and improvement of privately and publicly owned passenger and freight rail facilities to:

- Relieve congestion on public highways.
- Enhance public safety.
- Improve air quality.
- Expand economic opportunity.
- Construct railroad underpasses and overpasses if they are a part of the relocation of a rail facility.

The fund can receive proceeds from bonds, notes, dedications and appropriations made by the Texas State Legislature.¹²¹ The TRRIF is designed similarly to the Texas Mobility Fund. However, the Legislature has yet to dedicate a revenue source to the fund.

Port Related Funding Initiatives

The Ship Channel Improvement Revolving Fund, an account in the general revenue fund, provides a means for Texas ports to secure loan funding for congressionally authorized deepening or widening projects. This fund is to be administered by the Texas Transportation Commission.¹²² As with the TRRIF, the Texas State Legislature has yet to dedicate a revenue source to the fund. In the 2015 state legislative session, Rider 48 authorized up to \$20 million from the Texas Mobility Fund for fiscal years 2016 and 2017 for port access projects. In 2017, Rider 45 continued this funding level, authorizing up to \$20 million in from either available funds or the Texas Mobility Fund to be allocated each fiscal year for the 2018 – 2019 biennium to improve connectivity to Texas ports.¹²³

While the state has funded infrastructure for other modes, funds are limited to those not constitutionally dedicated to highway purposes. This greatly limits the flexibility to fund other modes, especially when the TRRIF has not been funded.

¹²¹ Texas Comptroller Manual of Accounts. Retrieved May 2017 from
<https://fmcpa.cpa.state.tx.us/fiscalmoa/fund.jsp?num=0306>.

¹²² ftp://ftp.legis.state.tx.us/bills/85R/analysis/html/senate_bills/SB00001_SB00099/SB00028S.htm.

¹²³ http://www.lbb.state.tx.us/Documents/Appropriations_Bills/85/Initial_Dockets/Article07_IssueDoc_04-23-2017_03_45_37_PM.pdf.

5.5 Summary

This chapter identified key agencies, authorities and other planning partners which are critical for making and influencing Texas' freight policies and strategies to guide freight transportation investment decisions based on freight movement and operations. These entities face continually evolving federal policies which impact the requirements of freight planning and the funding available to implement identified strategies. Partnerships and effective coordination among these agencies and institutions are critical for targeting investments and addressing these challenges. As freight volumes increase, this coordination will be a key component of Texas' continued success as a major contributor to the global freight-related economy.



Texas Freight Mobility Plan

Chapter 6: Designating the Texas Multimodal Freight Network



One of the key policy recommendations from the 2016 Freight Plan was the designation and adoption of the Texas Multimodal Freight Network. The first adopted network included Primary and Secondary Highway Freight Networks as well as designated multimodal facilities including rail, ports and waterways, air cargo facilities, and international border crossings. For this plan, TxDOT is building on the 2016 Freight Plan effort to meet additional FAST Act requirements and to take advantage of additional data and tools in the designation process. This chapter discusses the updated process and results of the designation of the Texas Multimodal Freight Network.

6.1 FAST Act Requirements – Designation of a National Multimodal Freight Network

The FAST Act strengthened existing efforts to establish the first National Freight Program which included designating the National Multimodal Freight Network. This network, discussed below, is the foundation for updating the Texas Multimodal Freight Network.

6.1.1 *The National Highway Freight Network*

The FAST Act includes an estimated average of \$1.2 billion per year for a new National Highway Freight Program, which is focused on improving the efficient movement of freight on the National Highway Freight Network (NHFN). Funds are distributed to states by formula for eligible activities, such as construction, operational improvements, freight planning and performance measurement.

The FAST Act requires the Federal Highway Administration (FHWA) to establish a National Highway Freight Network, which currently comprises the following components:

- **Primary Highway Freight System (PHFS).** The Primary Highway Freight System was designated by the FHWA based on eight factors:
 - Origins and destinations of freight movement in the United States;
 - Total freight tonnage and value of freight moved by highways;
 - Percentage of annual average daily truck traffic on principal arterials;
 - Annual average daily truck traffic on principal arterials;
 - Access to land and maritime ports of entry;
 - Access to energy exploration, development, installation or production areas;
 - Access to population centers; and
 - Network connectivity.
- Texas' portion of the Primary Highway Freight System totals 3,727.77 miles.
- **Non-PHFS Interstates.** The FAST Act included the entirety of the Interstate System—including Interstate facilities not located on the Primary Highway Freight System—in the National Highway Freight Network. The FHWA will update the maps and tables on a periodic basis, incorporating any Interstate System routes missing currently, as well as roads added to the Interstate System.

The FAST Act restricts National Highway Freight Program (NHFP) funding on non-PHFS interstates in states deemed high mileage states, defined as containing more than two percent of the National PHFS. At 8.98 percent of the total, Texas is classified as a high mileage state and thus, cannot use NHFP funding on non-PHFS interstates.

In addition, as part of the FAST Act, The U.S. Department of Transportation allocated additional miles to each state based on their Primary Highway Freight System mileage to add to the National Highway Freight Network. These miles are eligible for NHFP funds and are referred to as:

- Critical Urban Freight Corridors (CUFCs) –Key highway freight facilities in urbanized areas (defined by the U.S. Census Bureau); and
- Critical Rural Freight Corridors (CRFCs) – Key highway freight facilities located outside of urbanized areas.

Texas is allowed to designate a maximum of 372.78 miles as CUFCs and a maximum of 745.55 miles as CRFCs (10 and 20 percent of the state's Primary Highway Freight System mileage, respectively).

6.1.2 Non-Highway Modes on the National Multimodal Freight Network

In addition to the National Highway Freight Network, the USDOT designated the National Multimodal Freight Network (NMFN), which includes:

- As specified by the FAST Act, the NMFN contains the freight rail systems of the Class I railroads as designated by the Surface Transportation Board (STB),¹²⁴ totaling more than 95,000 route miles. Additionally, the statute specifically references other strategic freight assets, including other intermodal facilities and freight rail lines of Class II and Class III railroads, designated by the Under Secretary as critical to interstate commerce. A total of 9,096 miles of Class II and III railroads are included on the national network.
- Using the latest available data obtained from the United States Army Corps of Engineer's Waterborne Commerce Statistics Center (calendar year 2014), the USDOT determined that 113 U.S. ports satisfy the 2,000,000 short ton threshold criterion specified in the FAST Act. The USDOT also included (as strategic freight assets) three additional ports (Portsmouth, VA, San Diego, CA and Apra Harbor, Guam) in the Interim NMFN that did not satisfy the 2,000,000 short ton threshold but which were strategic ports as of April 1, 2016 as designated by the Department of Defense (DOD), bringing the total ports included in the Interim NMFN to 116 ports. The maritime component of the Interim NMFN also includes navigable waterways that are used to transport domestic and international freight.
- The FAST Act requires the NMFN to include the top 50 airports by landed weight as identified by the Federal Aviation Administration. The FAA identified the top 50 airports

¹²⁴ Railroads are designated Class I, II, or III based on operating revenue with Class I having the largest revenues. Class III railroads are also called shortline railroads.

by landed weight using the Air Carrier Activity Information System (AC AIS), an FAA database that reflects the certificated maximum gross landed weight of all-cargo aircraft. The USDOT included six additional airports on the NMFN because these airports receive a large amount of belly cargo activity that is not captured by the FAA's AC AIS database.

6.2 Overview of the Texas Transportation System

Texas has an extensive multimodal freight transportation system with assets including highways, rail lines, waterways and pipelines, as well as interchange points between the modes, such as airports, seaports, rail terminals, pipeline terminals and warehouse/distribution centers. Freight assets also include international border gateways and points-of-entry from surrounding states. These freight transportation assets support the world's 10th largest economy with a Gross State Product of nearly \$1.6 trillion. Over two billion tons of freight valued at over \$2.9 trillion moves on and through these transportation assets annually. The Texas Multimodal Freight Network will be designated from the complete state freight system which is summarized below. Additional detail on the inventory of Texas freight assets is provided in **Chapter 7**.

- **Texas Highway Freight Assets.** Texas has more than 313,000 centerline miles of public roads – more than any other state. More than 68 percent of these roads are in rural areas. While the interstates are a pivotal portion of the roadway network, they must be supplemented by other facilities in order to serve all freight users. To identify the additional facilities critical to freight movement, the entire state-owned system was used as the base from which the Texas Highway Freight Network was designated.
- **Texas Freight Rail Network.** Rail is a major component of freight movement in Texas. Texas has the most extensive rail system of any state with 10,539 railroad miles and is also the largest state by number of railroads with 52 freight rail operators. This includes three Class I railroads: Union Pacific Railroad (UP), BNSF Railway (BNSF) and Kansas City Southern Railway Company (KCS). The state is home to 49 Class III or shortline railroads (i.e., 27 local railroads and 22 switching and terminal railroads).
- **Texas Ports and Waterways.** Texas ports and waterways play a key role in the efficient movement of freight and are important drivers of the Texas and the U.S. economies. Texas ports have invested over \$1.1 billion in capital projects since 2010.¹²⁵ Port assets in Texas consist of twelve deep draft and nine shallow draft facilities, ranging from some of the largest ports in the country to small facilities supporting fishing and local agriculture. In addition, the Gulf Intracoastal Waterway (GIWW) connects Gulf of Mexico ports from Brownsville, Texas to Florida, linking the deep-draft and shallow-draft ports of

¹²⁵ "Texas Ports 2017/2018 Capital Program", issued by The (Texas) State Port Authority Advisory Committee, available at <http://ftp.dot.state.tx.us/pub/txdot-info/tpp/giww/2017-18-capital-program.pdf>.

Texas. The GIWW in Texas was designated by the U.S. Maritime Administration as Marine Highway 69 in 2016.

- **Texas Commercial Air Cargo Facilities.** Texas is home to 24 commercial service airports, including six of the top 50 cargo airports in the U.S. in terms of landed weight in 2015.¹²⁶ These air gateways are located near major metropolitan areas, which provide better connections to other freight infrastructure and the industries that require fast shipment of high-value/time-sensitive items.

6.3 Designating the Texas Multimodal Freight Network

The Texas Multimodal Freight Network is designated by TxDOT, and it is not constrained by mileage limits or inclusion criteria set forth at the federal level. While the process for designating the Texas Multimodal Freight Network differed by mode, there were four common elements:

- A data-driven approach that used the latest available and vetted data;
- A stakeholder-informed process that incorporated input from numerous sources including the Texas Freight Advisory Committee, stakeholder workshops held throughout the state, webinars with MPOs and TxDOT Districts, and meetings with private sector and modal stakeholders;
- Transparency of criteria being used, data sources and analytical processes; and
- Replicable process facilitated by a common framework that utilizes GIS-based tools and data.

The following section discusses the designation process and results for each of the modes and key facilities.

6.3.1 The Texas Highway Freight Network Designation

The foundation of the Texas Highway Freight Network is the Texas portion of the National Highway Freight Network discussed above. The next component of the Texas Highway Freight Network is the Texas Highway Trunk System, which is a network of rural highways that complements and includes elements of the Interstate Highway System. The Trunk System is limited to a maximum of 11,500 miles, and it is designated by the Texas Transportation Commission, as recommended by TxDOT's Executive Director. Routes in the Trunk System should meet one of the following criteria:

- Maximizing the use of existing four-lane divided roadways;
- Minimizing circuitous or indirect routing;

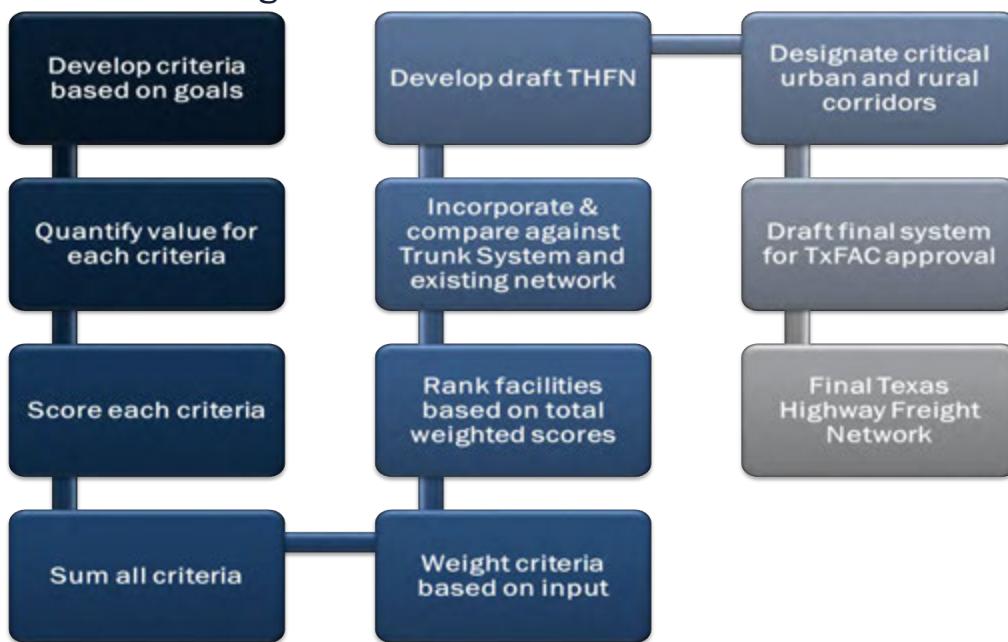
¹²⁶ Federal Aviation Administration, 2015.

- Connecting with principal roadways from adjacent states;
- Connecting with principal deep water ports with channel depths of 40 feet or more;
- Connecting with principal Mexican ports of entry;
- Serving significant military or other national security installations;
- Serving tourism or recreational areas;
- Comprising major truck routes;
- Located within 25 miles or less of cities of 10,000 population or greater;
- Closing gaps in the existing state highway system; and
- Providing system connectivity.

Evaluating the Rest of the Texas Highway System

Additional highways critical to freight movement were identified through a systematic, data-driven and stakeholder-informed process, which is summarized in **Exhibit 6-1**.

Exhibit 6-1: *Process for Designating the Texas Highway Freight Network*



The first step in the designation process was to develop criteria for measuring the role of a highway corridor in transporting freight. The evaluation process scored every highway segment based on criteria measuring the role of the highway in supporting:

- Economic competitiveness;
- Strategic supply chains; and
- Goods movement,
- Market access and connectivity.

The criteria were informed by extensive stakeholder outreach. During the first round of stakeholder workshops, participants provided input on specific criteria, as well as recommended additional criteria. The proposed criteria were presented to the TxFAC for consideration and input. Finally, the proposed criteria were presented to MPOs and District Engineers for review and comment. **Exhibit 6-2** displays the final criteria used in the designation process.

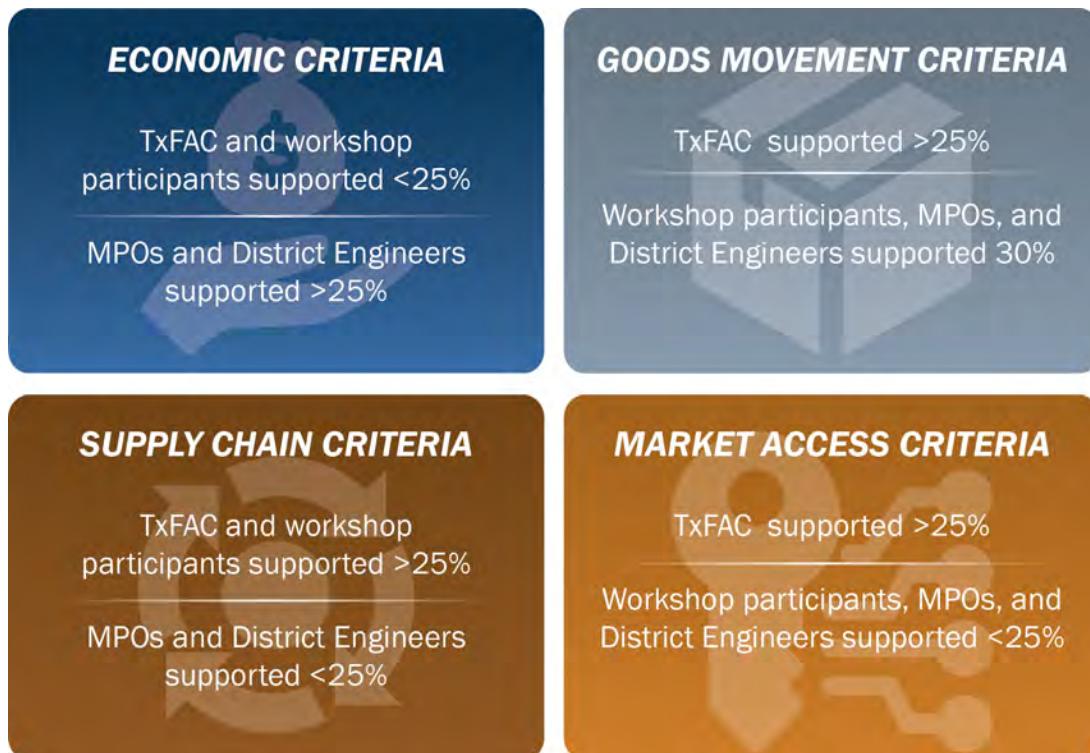
Exhibit 6-2: *Criteria Used in Designating the Texas Highway Freight Network*

Category	Criteria
Economic Competitiveness	<ul style="list-style-type: none"> ▪ Workforce size ▪ Educational attainment (high school and above) ▪ Population growth ▪ Employment in freight intensive industries
Goods Movement	<ul style="list-style-type: none"> ▪ Average annual daily truck traffic (number of trucks) ▪ Truck percentage ▪ Truck vehicle miles traveled ▪ Truck vehicle miles traveled by lane mile ▪ Total tonnage ▪ Total value of goods moved ▪ Growth in tonnage (2040) ▪ Growth in value (2040)
Strategic Supply Chains	<ul style="list-style-type: none"> ▪ Number of strategic supply chains supported ▪ Number of businesses in strategic supply chains supported ▪ Level of employment in strategic supply chains ▪ Volume of commodities associated with strategic supply chains (tonnage)
Market Access and Connectivity	<ul style="list-style-type: none"> ▪ Access to intermodal terminal ▪ Access to international gateway (port or commercial vehicle border crossing) ▪ Access to inland port

After the criteria were finalized, data were collected and evaluated for every segment on the Texas Highway System. The next step was to assign weights to the categories of criteria. Stakeholders including the TxFAC, TxDOT Districts, MPOs and participants in 11 workshops held throughout the state provided input on the relative importance of the four categories of criteria. **Exhibit 6-3** summarizes the stakeholder input on designation system criteria weighting. Based on the combined input, the criteria are weighted as follows:

- Economic competitiveness is weighted at 20 percent;
- Goods movement is weighted at 30 percent; and
- Strategic supply chains and market access and connectivity criteria are weighted at 25 percent each.

Exhibit 6-3: *Stakeholder Input on Weighting of Criteria used to Designate the Texas Highway Freight Network*



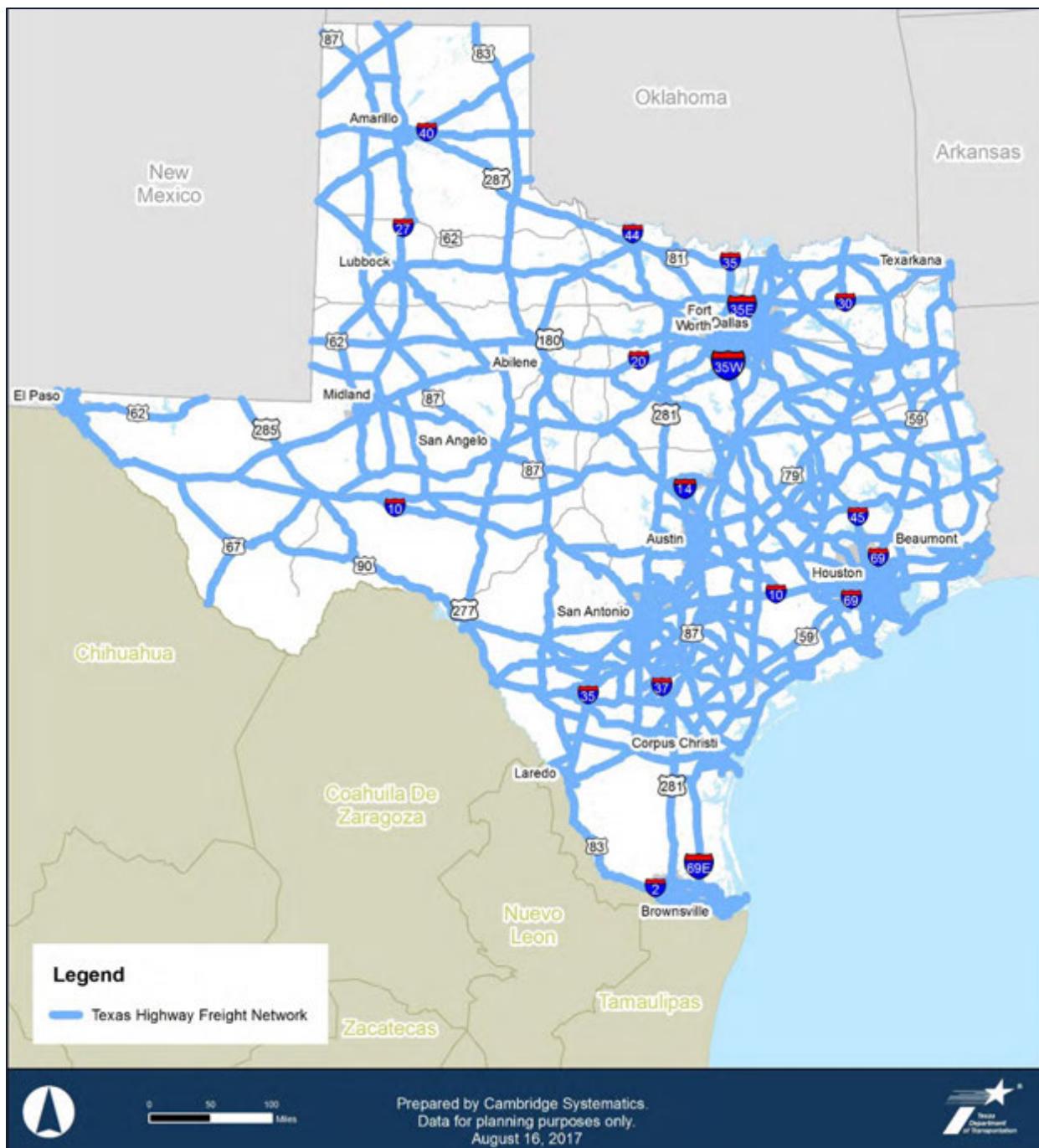
Once the segments were scored based on the final weights, the highest scoring corridors were identified and added to the NHFN and Trunk System corridors, resulting in a draft updated network.

The draft network was presented to the TxFAC for review. When comparing the draft network to the 2016 Highway Freight Network, it was noted that numerous facilities were omitted using the new process. The TxFAC recommended that any facilities from the network

designated in the 2016 Freight Plan and not identified in the designation process be grandfathered in and included in the updated network.

The final updated Texas Highway Freight Network, shown in **Exhibit 6-4**, includes 21,861 miles, an increase of 2,655 miles over the 2016 network.

Exhibit 6-4: Updated Texas Highway Freight Network



Source: TxDOT, 2017.

Designating Critical Rural Freight Corridors

The FAST Act allocated 745 miles for Texas to designate as critical rural freight corridors to become part of the national freight system and it specified that TxDOT would lead the designation process. TxDOT's approach for designating the CRFCs, summarized in **Exhibit 6-5**, was driven by FAST Act requirements. The first step was defining the pool of potential corridors, which was restricted to primary arterials that meet one or more of the following:

- Minimum of 25 percent of the Average Annual Daily Traffic (AADT) from trucks;
- Provides access to energy exploration, development, installation or production areas;
- Connects the PHFS or the Interstate System to facilities that handle more than:
 - 50,000 20-foot equivalent units per year; or
 - 500,000 tons per year of bulk commodities;
- Provides access to a/an:
 - Grain elevator;
 - Agricultural facility;
 - Mining facility;
 - Forestry facility; or
 - Intermodal facility;
- Connects to an international port of entry; or
- Provides access to significant air, rail, water or other freight facilities in the State.

Exhibit 6-5: *Process for Designating Critical Rural Freight Corridors*

IDENTIFIED THFN CORRIDORS TO BE SCORED

Primary Arterials

Outside Urbanized Areas

SCORED BY ADDING UP NUMBER OF FAST ACT CRITERIA MET

Scored Each Segment

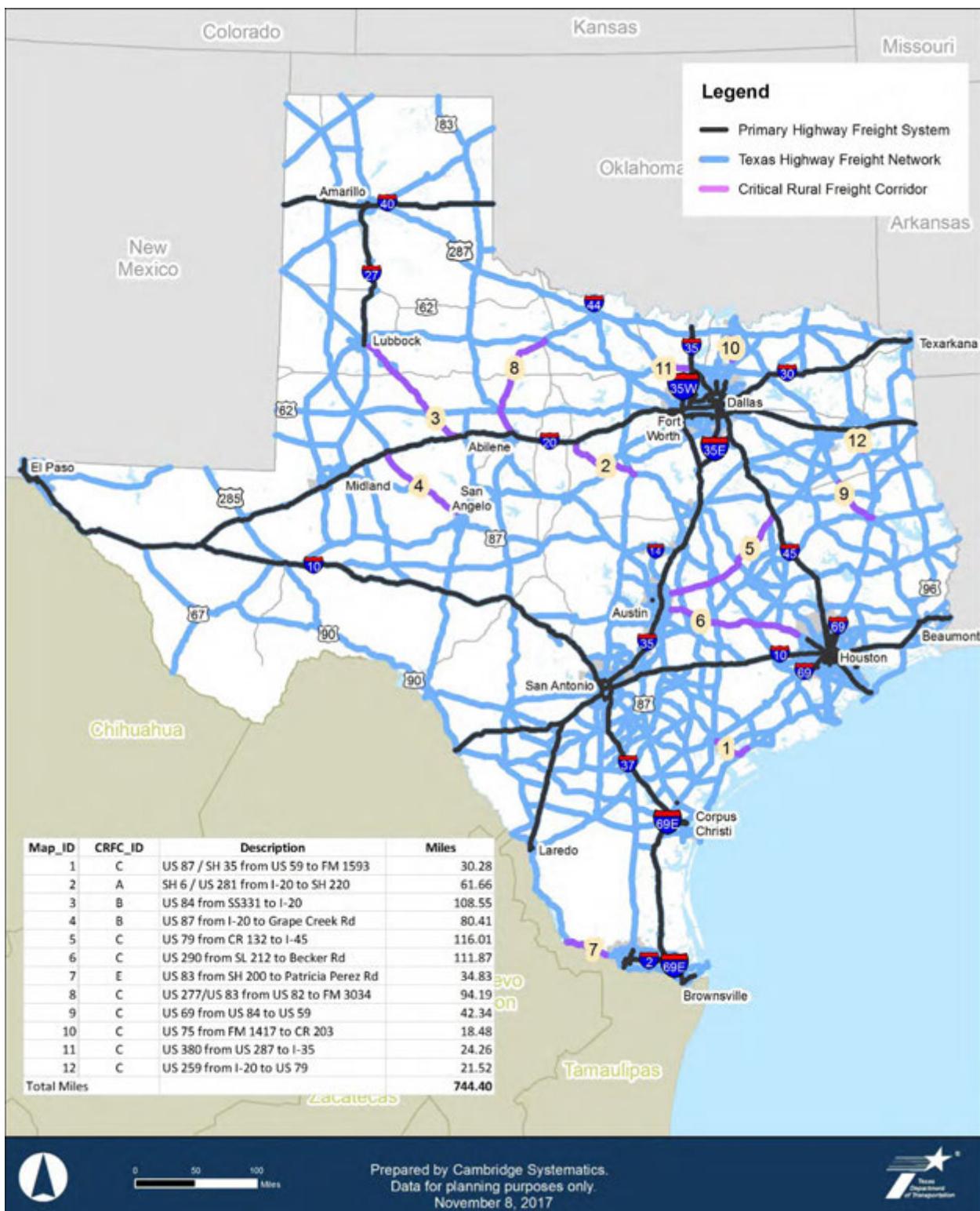
DESIGNATE 745 MILES

Corridors that Met Most Criteria

Corridors with Fully Funded UTP Project in Next 5 Years

This process identified 2,667 miles of rural corridors on the Texas Highway Freight Network that meet three or more of the FAST Act criteria. The final selection of corridors from this pool was based on the mapping of Nation Highway Freight Program qualifying projects from the Unified Transportation Program (UTP) and input from TxFAC and stakeholder workshops. **Exhibit 6-6** presents the twelve segments that have been designated CRFCs. TxDOT will reevaluate and re-designate CRFCs annually.

Exhibit 6-6: Designated Critical Rural Freight Corridors



Designating Critical Urban Freight Corridors

Texas was allocated 372 miles to designate as Critical Urban Freight Corridors (CUFC).

CUFCs are required to meet one or more of the following criteria:

- Connects an intermodal facility to:
 - the Primary Highway Freight System (PHFS)
 - the Interstate System
 - an intermodal freight facility;
- Located within a corridor of a route on the PHFS and provides an alternative highway option important to goods movement;
- Serves a major freight generator, logistic center, or manufacturing and warehouse industrial land; or
- Important to the movement of freight within the region, as determined by the MPO or the state.

The FAST Act required that MPOs with population of greater than 500,000 take the lead in designating CUFCs in their urbanized area. Six MPOs in Texas meet the criterion. TxDOT initiated the process by allocating the number of miles each MPO could designate based on their total population. In total, 299 miles, which represents just over 80 percent of the state's allowance, were allocated to the large MPOs for designation based on population.

TxDOT was responsible for designating the remaining 73 miles of CUFCs, in consultation with MPOs in urban areas of less than 500,000. The following criteria were used in the designation:

- Highest scoring corridors from designation process.
- Stakeholder input from TxFAC, MPOs and stakeholder workshops.
- Qualifying project in UTP in the next 5 years.

Exhibit 6-7 presents the final designated Critical Urban Freight Corridors for large MPOs. The remaining CUFCs are presented in **Exhibit 6-8**. The Critical Urban Freight Corridors will be evaluated and re-designated annually in cooperation with the responsible large MPOs.

Exhibit 6-7: Designated Critical Urban Freight Corridors,
Large Metropolitan Planning Organizations

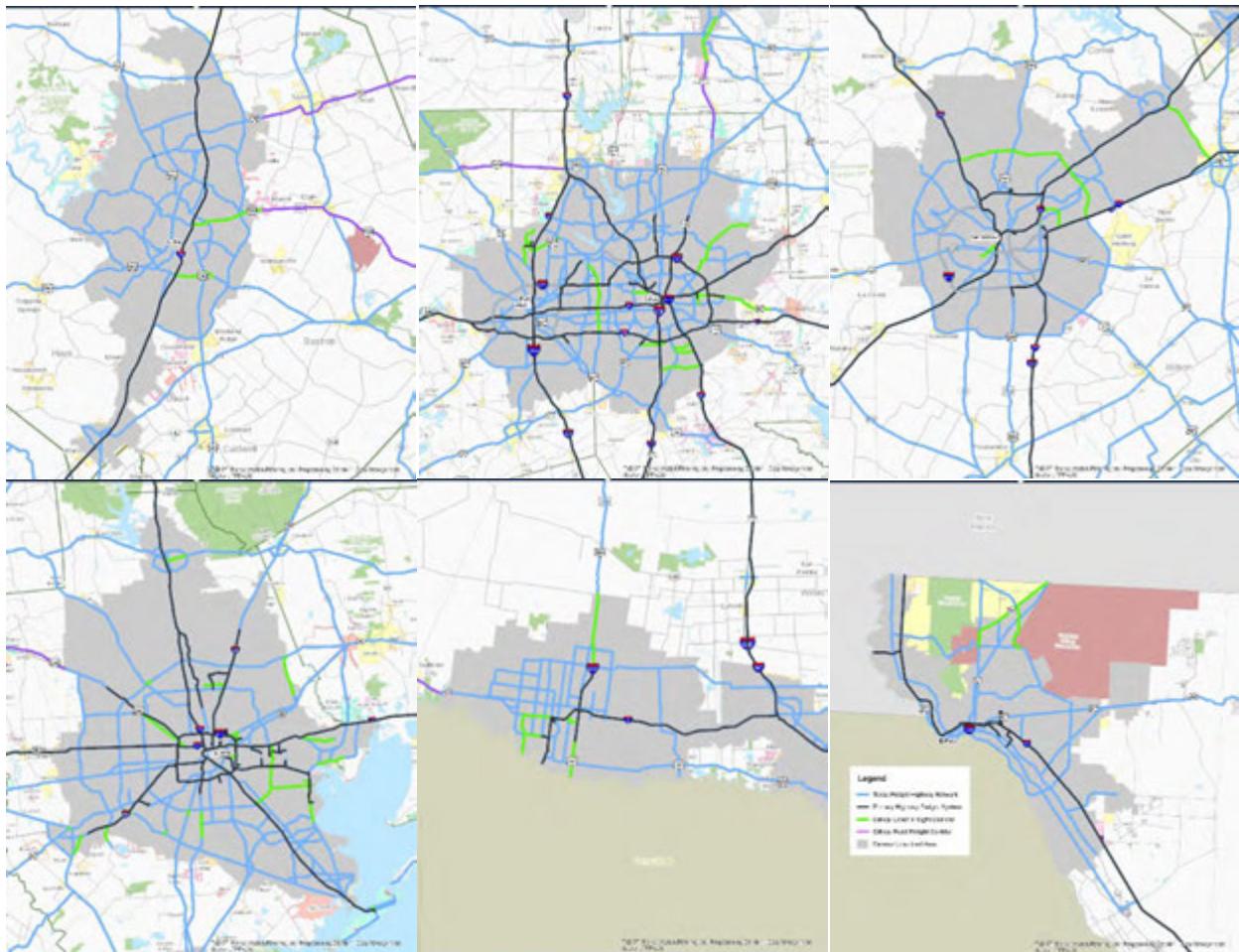


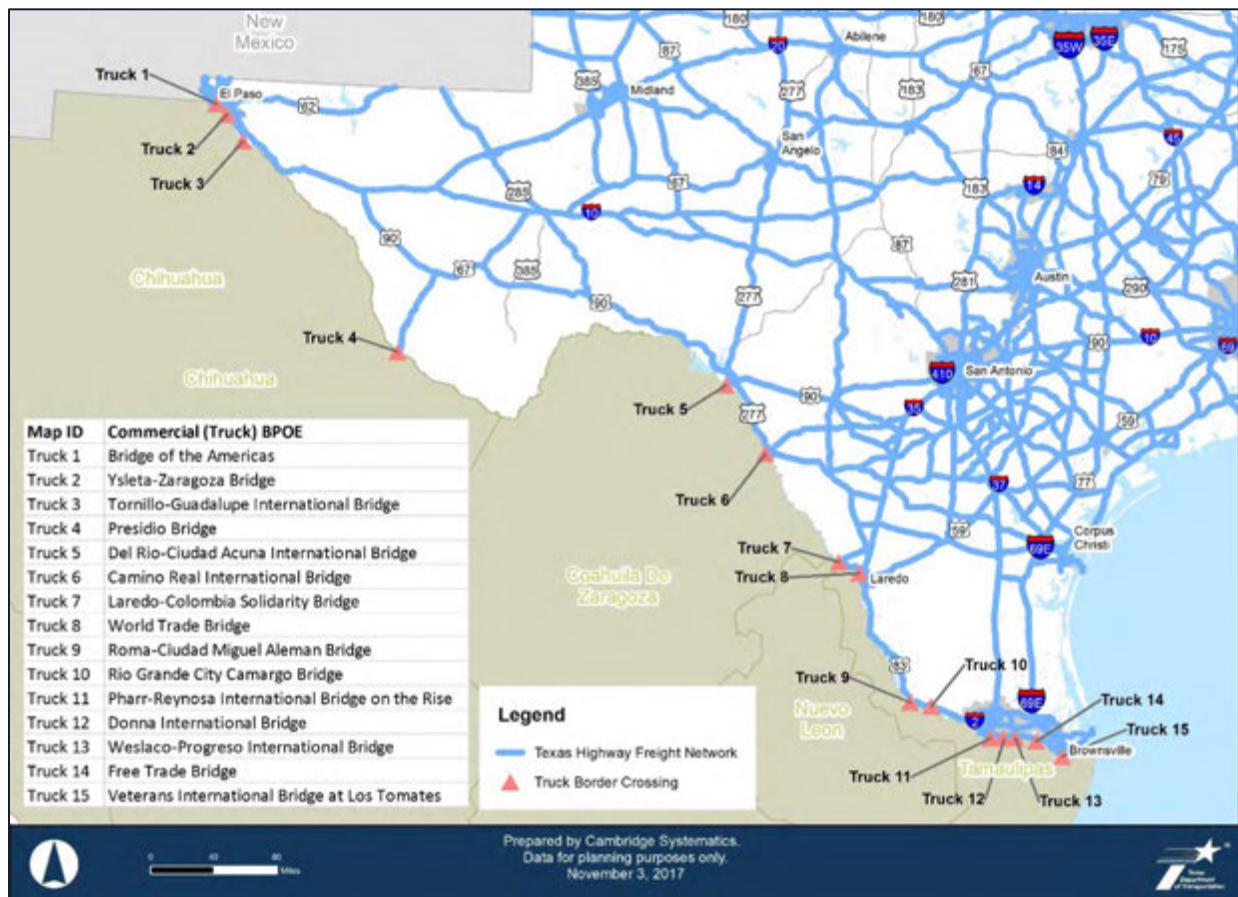
Exhibit 6-8: *Designated Critical Urban Freight Corridors for Small Metropolitan Planning Organizations*

Urban Area	Description	Miles
Sherman	US 75 / SH 91 from SS 503 to FM 1417	10.7
Wichita Falls	US 287 from Wellington Ln to I-44	3.3
Lubbock	US 84 from I-27 to SS 331	4.8
Laredo	SL 20 from I-35 to SH 359	10.9
Brownsville	FM 511 from I-69E to SH 48	9.2
Beaumont	US 69 from US 96 to I-10	9.5
Port Arthur	US 69 from I-10 to SH 73	15.3
Corpus Christi	SH 358/SH 44 from I-37 to Bockholt Rd	4.9
Tyler	US 271 from SL 323 to SH 155	4.8

International Border Crossings, Highways

Twenty-eight vehicular bridges connect Texas to Mexico along the 1,254-mile border, with 14 serving commercial traffic, and a 15th – the Donna International Bridge – serving empty containers. The 14 commercial vehicle border crossings in Texas carry 68 percent of the trucks coming from Mexico into the U.S. (**Exhibit 6-9**). The Texas Highway Freight Network connects these commercial vehicle border crossings to destinations within and outside of the state. All of the commercial vehicle border crossings are on the Texas Multimodal Freight Network.

Exhibit 6-9: Texas-Mexico Commercial Vehicle Border Crossings



Source: Texas A&M Transportation Institute, 2017.

6.3.2 Designating the Texas Rail Freight Transportation Network

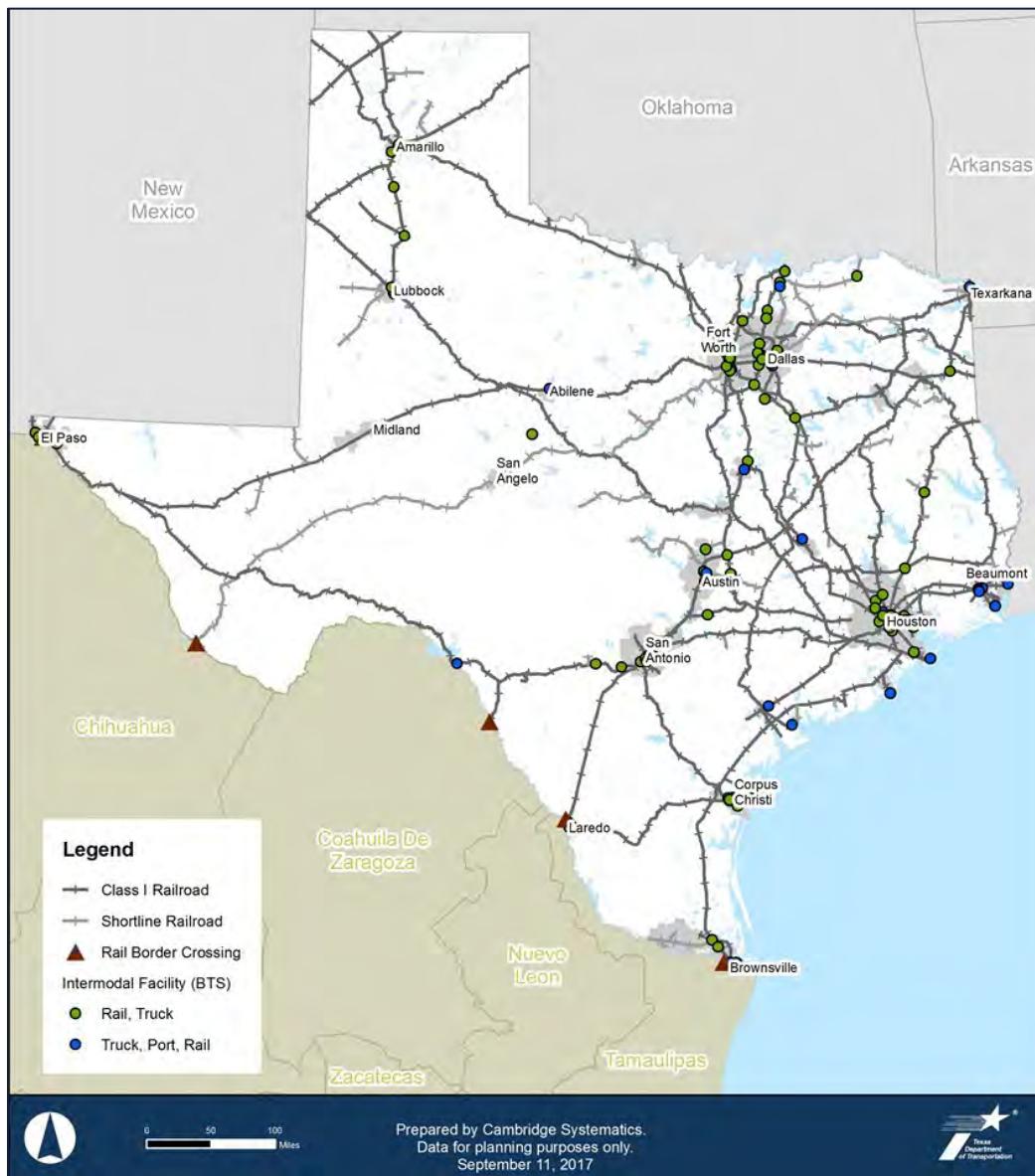
Rail is a major component of freight movement in Texas. Nationally, Texas has the most extensive rail system of any state with 10,539 railroad miles and is also the largest state by number of railroads with 52 freight rail operators, including three Class I railroads and 49 Class III or shortline railroads (i.e., 27 local railroads and 22 switching and terminal railroads).

Texas is home to five of the seven rail border crossings between the U.S. and Mexico -the West Rail Bypass International Bridge in Brownsville, Bridge of the Americas in El Paso, Texas Mexican Railway International Bridge in Laredo and the Camino Real International Bridge in Eagle Pass. In addition, the Presidio Rail Bridge is expected to reopen within the next five years using funding received from the 2017 FASTLANE Grant program.

The National Multimodal Freight Network includes all Class I railroads and shortline railroads deemed important to national freight flows. The TxFAC recommended that all rail assets be

designated as part of the Texas Multimodal Freight Network. **Exhibit 6-10** displays the state's rail network on the Texas Multimodal Freight Network.

Exhibit 6-10: *Railroads on the Texas Multimodal Freight Network*



6.3.3 Designating Ports and Waterways for the Texas Multimodal Freight Network

The National Multimodal Freight Network, designated as part of the FAST Act, included all U.S. ports handling two million or more short-tons of cargo annually. TxDOT adopted the same criterion in designating facilities for the Texas Multimodal Freight Network resulting in

the following ports being designated (**Exhibit 6-11**): Beaumont, Brownsville, Calhoun Port Authority, Corpus Christi, Freeport, Galveston, Houston, Port Arthur, Texas City and Victoria.

Exhibit 6-11: Ports on the Texas Multimodal Freight Network



The Gulf Intracoastal Waterway (GIWW) connects Gulf of Mexico ports from Brownsville, Texas to Florida, linking the deep draft and shallow draft ports of Texas. The GIWW was designated by the U.S. Maritime Administration as Marine Highway 69 (M 69) in 2016. The America's Marine Highway Program is a U.S. Department of Transportation-led program to expand the use of our nation's navigable waterways to relieve landside congestion, reduce air emissions, provide new transportation options, and generate other public benefits by increasing the efficiency of the surface transportation system. The Marine Highway System currently includes 24 all-water Marine Highway Routes that serve as extensions of the surface transportation system. These Routes are designated by the U.S. Secretary of Transportation because they provide relief to landside corridors that suffer from traffic

congestion, excessive air emissions or other environmental concerns and challenges or provide new transportation options. Marine Highway Routes may be nominated to the U.S. Department of Transportation at any time and they are designated by the Secretary after a review. Projects to improve and enhance marine highways are eligible for Marine Highway Grants.¹²⁷

M 69 in Texas is a shallow-draft waterway authorized to be 12 feet deep and 125 feet wide, consisting of a series of man-made canals and natural bays. The main channel of the Texas portion of the GIWW covers 379 miles of Texas' coastline. The U.S. Army Corps of Engineers is responsible for maintenance of the GIWW, and TxDOT is the official non-federal sponsor for the GIWW as provided by the Texas Coastal Waterway Act. Under the Act, TxDOT's primary responsibility is providing right-of-way and disposal areas for by-products of dredging operations and maintenance.

6.3.4 Designating Air Cargo Airports on the Texas Multimodal Freight Network

Texas is home to 24 commercial service airports, including six of the top 50 cargo airports in the U.S. in terms of landed weight in 2016.¹²⁸ These air gateways are located near major metropolitan areas, which provide better connections to other freight infrastructure and the industries that require fast shipment of high-value/time-sensitive items.

The six airports (Fort Worth Alliance, Austin, Dallas-Fort Worth, El Paso, George Bush Intercontinental/Houston and San Antonio) are all on the National Multimodal Freight Network. In designating the Texas Multimodal Freight Network, TxDOT added Laredo due to the fact it consistently ranks 52nd or 53rd nationally for volume of air cargo and for its strategic location and role in moving cross-border air cargo. **Exhibit 6-12** displays the air cargo airports included on the Texas Multimodal Freight Network.

¹²⁷ More information can be found at: <https://www.marad.dot.gov/ships-and-shipping/dot-maritime-administration-americas-marine-highway-program/>.

¹²⁸ Federal Aviation Administration, 2016.

Exhibit 6-12: Texas Airports on the Texas Multimodal Freight Network

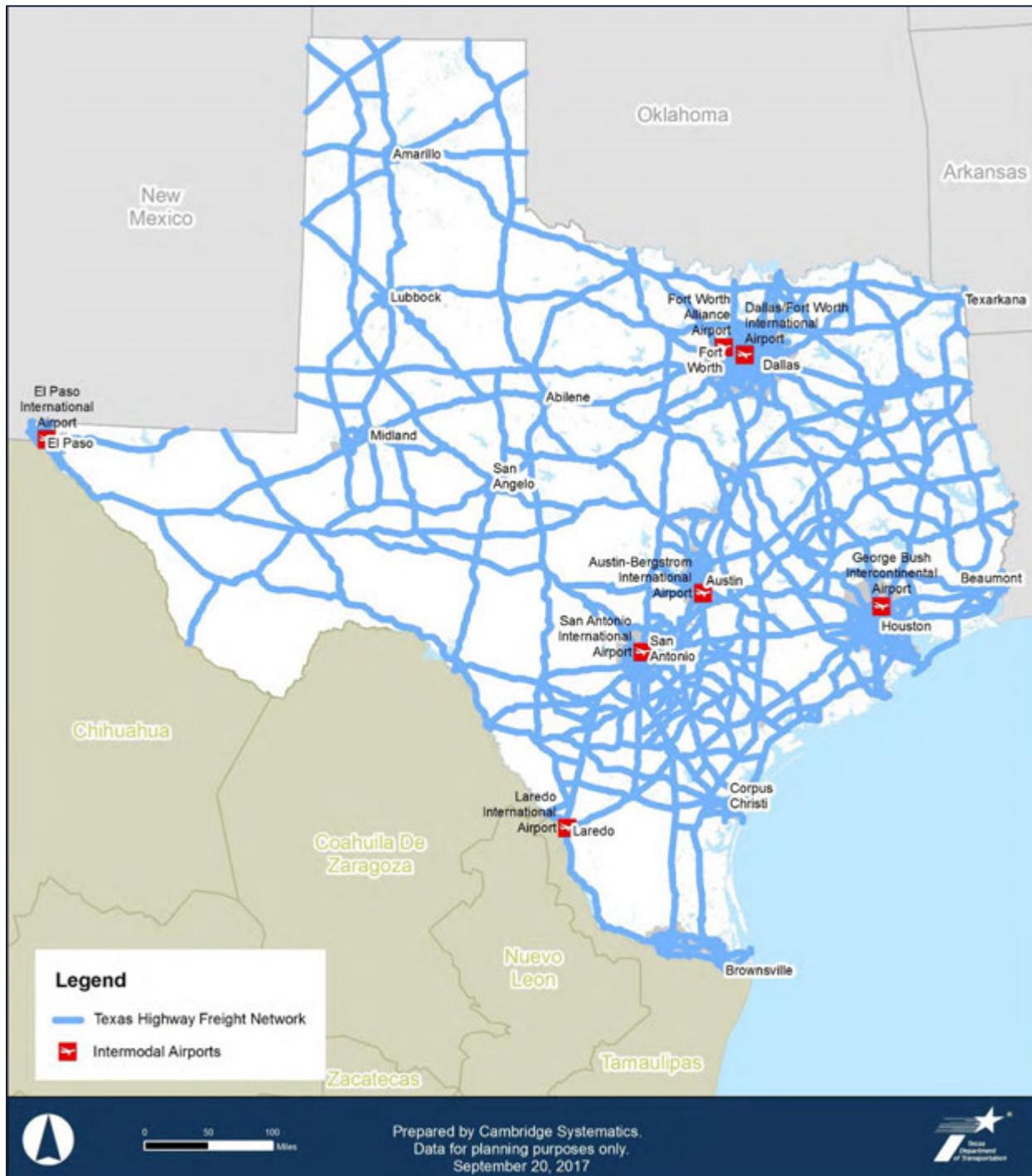
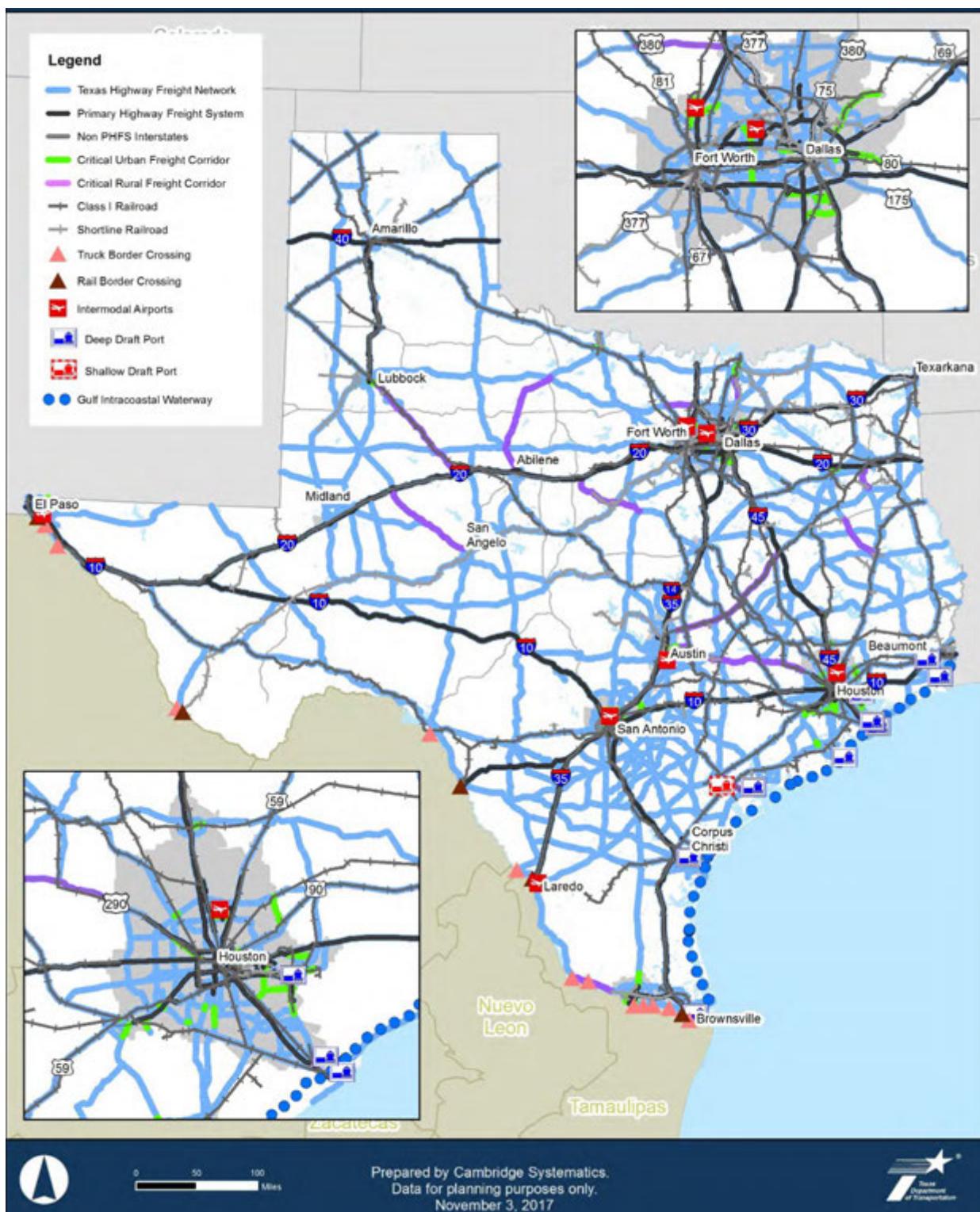


Exhibit 6-13: Texas Multimodal Freight Network



6.4 Summary

This chapter detailed a key outcome of the 2017 Freight Plan: the re-designation of the Texas Multimodal Freight Network using a data-driven, stakeholder-informed process that includes the designation of Critical Rural and Urban Freight Corridors as required by the FAST Act. TxDOT has identified these facilities and designated them as the Texas Multimodal Freight Network as shown in **Exhibit 6-13**.



Texas Freight Mobility Plan

Chapter 7: Freight Assets, Conditions and Performance



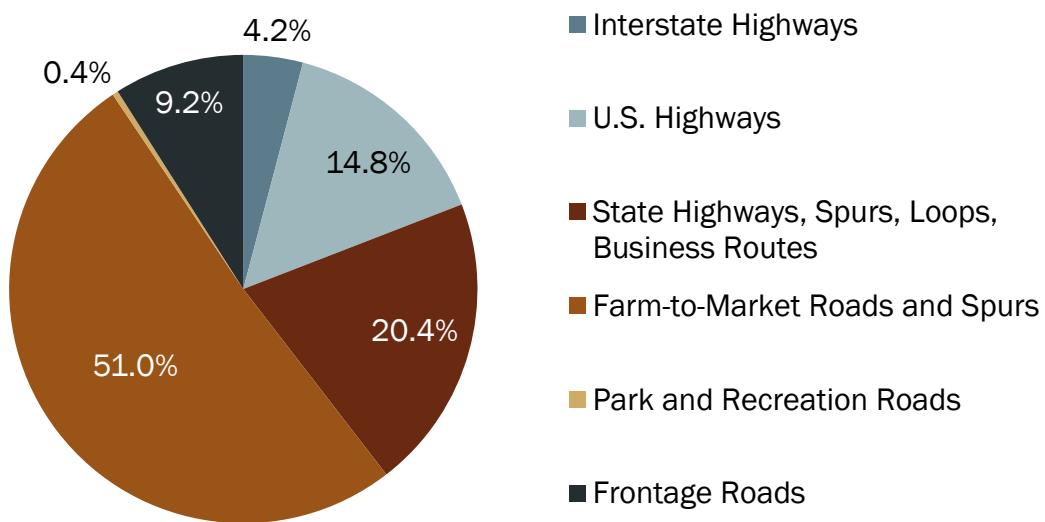
Chapter 6 included the designation process of the Texas Multimodal Freight Network. While the assets identified there have been determined to be the most significant for freight movement, other assets support the overall multimodal network. This chapter evaluates the physical condition and performance of the freight system's assets. This understanding includes describing elements of the freight system beyond the designation of the Texas Multimodal Freight Network in order to provide a full picture of Texas' assets. It also outlines the performance management framework and measures to monitor current and future freight transportation system performance. Strategies to address needs and improve the condition and performance of the Texas Freight Network to ensure that the state's infrastructure supports current and future freight demands and continues to support the state's economic goals are discussed in **Chapters 11, 12 and 13**.

7.1 Highways

7.1.1 Freight Assets

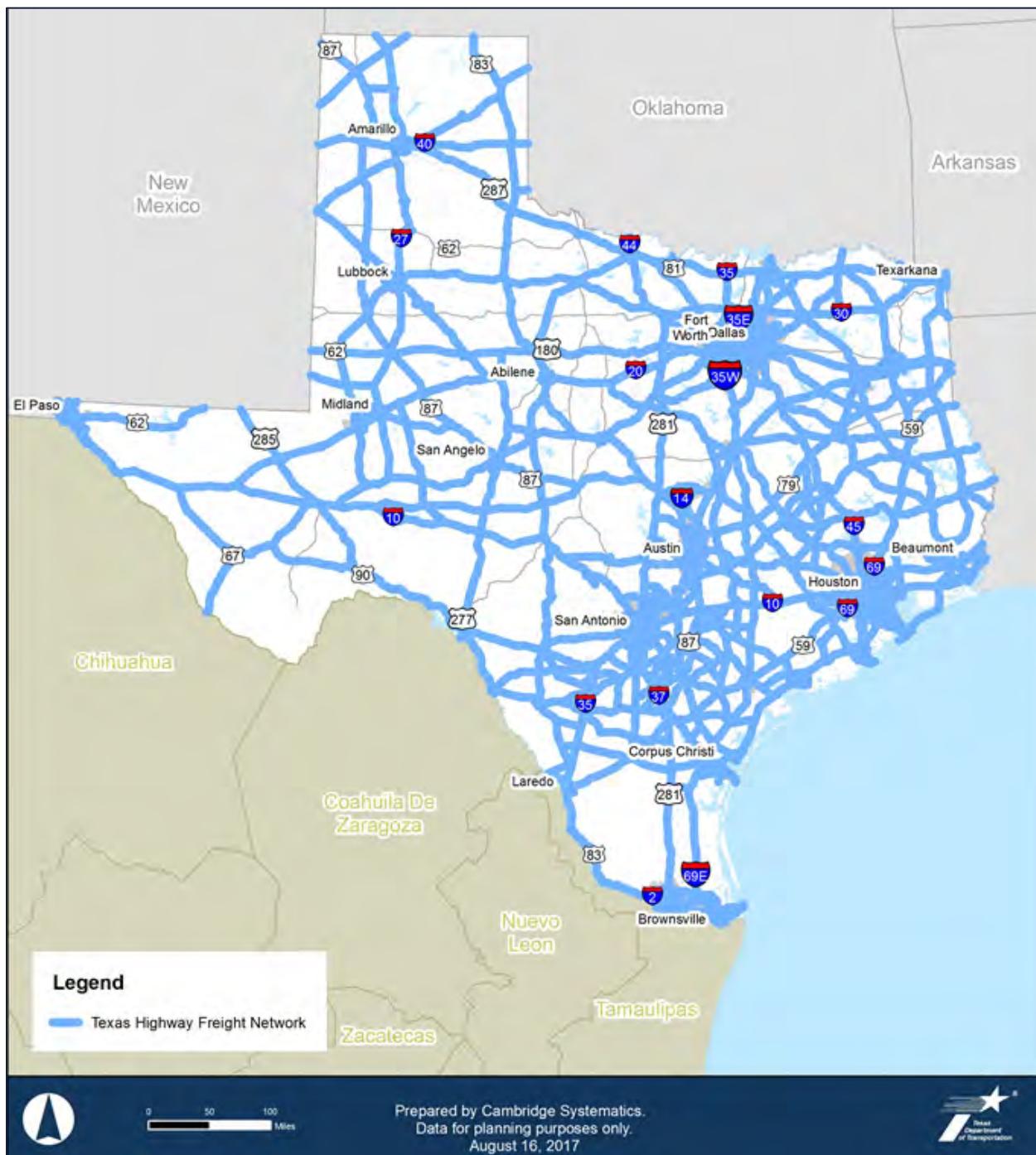
Texas has more than 313,000 centerline miles of public roads – more than any other state. More than 68 percent of these roads are in rural areas. Counties own 47 percent of the roadways and municipalities own 27 percent, with TxDOT owning just over 26 percent, or more than 80,000 centerline miles of roadway. As shown in **Exhibit 7-1**, 51 percent of these roadways are Farm-to-Market roads and spurs that are critical to the Texas agriculture industry. Twenty percent of the roadways are state highways, loops and business routes; 15 percent are U.S. highways; nine percent are frontage roads; four percent are interstate highways; and the remaining are park and recreational roads. The key freight highway assets are shown in **Exhibit 7-2**.

Exhibit 7-1: TxDOT Maintained Roadways (Type by Percentage)



Source: TxDOT Pocket Facts, 2016.

Exhibit 7-2: Texas Highway Freight Network



Source: TxDOT, 2017.

Texas' interstates handle the majority of truck traffic, due to their connectivity to major population centers, businesses, logistics centers, marine ports, military installations, international and domestic gateways and inland ports.

While the interstates are a critical portion of the roadway network, they must be supplemented by other facilities in order to provide connectivity and serve all freight users. The Texas Highway Freight Network, shown in **Exhibit 7-2**, is the system of roads that are most essential to freight movements in the state.

Intermodal Connectors

Intermodal connectors link rail yards, seaports, airports and distribution facilities where the transfer of freight is completed on-site. Access to and from these intermodal facilities is along local roadways that connect to the state's highway freight corridors and serve as the 'first' and 'last' mile for freight movement. Within Texas, a total of 191 National Highway System (NHS) intermodal connectors are provided by TxDOT to the Federal Highway Administration which includes more than 180 miles. These intermodal connectors in Texas include 23 airport/truck, 43 port/truck, 18 truck/pipeline and 20 truck/rail connectors, with the remainder serving passenger movements.¹²⁹

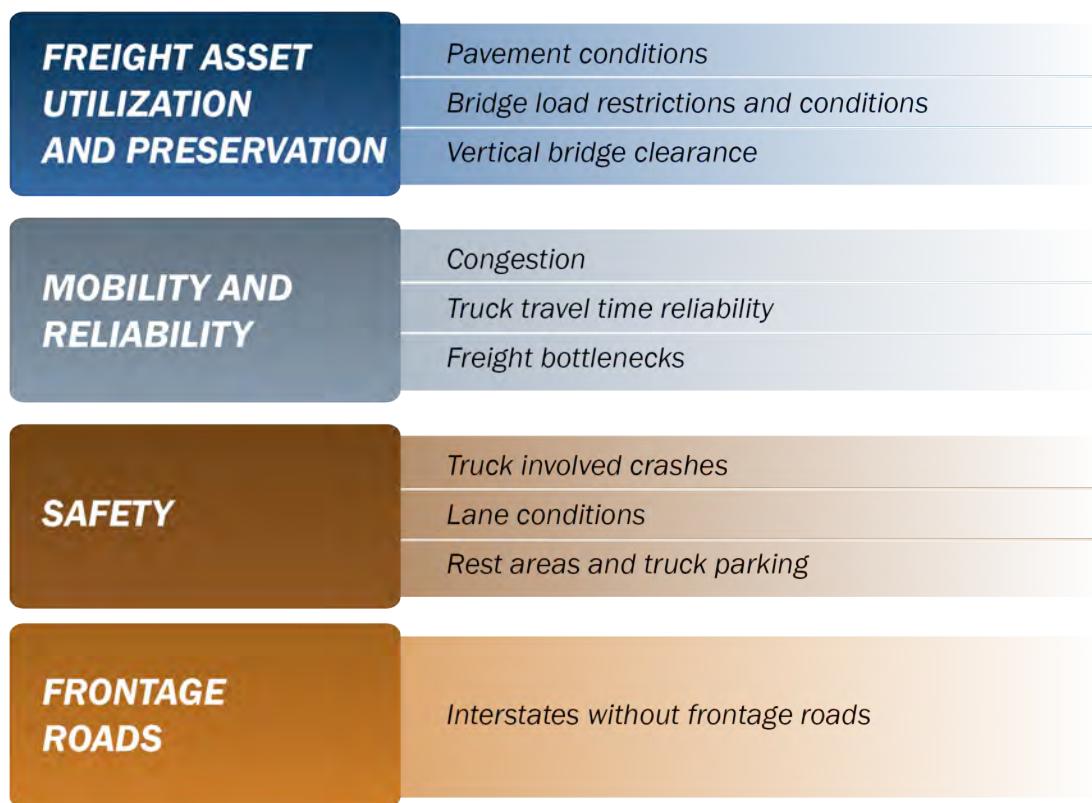
7.1.2 Current Conditions and Performance

This chapter covers current conditions and performance of the freight transportation network in Texas. Identification of highway freight conditions and performance focused only on the Texas Highway Freight Network, as these facilities have been identified as the most critical for the movement of freight throughout the state based on the designation process detailed in **Chapter 6**. Evaluation of the conditions and performance of the Texas Highway Freight Network allows for the identification of needs and gaps across the network. This evaluation is organized around the eight goals of the Freight Plan: Safety, Asset Preservation and Utilization, Mobility and Reliability, Multimodal Connectivity, Stewardship, Customer Service, Sustainable Funding and Economic Competitiveness. Specific factors related to highway infrastructure and the data evaluated to identify needs were grouped into four major categories: freight asset utilization and preservation; mobility and reliability; safety; and frontage roads. The analysis factors included in each of these categories are summarized in **Exhibit 7-3**. These same factors were used to develop project selection and prioritization discussed in **Chapter 10**, resulting in the prioritized lists of programs, policies and projects presented in **Chapters 11, 12 and 13**.

¹²⁹ Federal Highway Administration. Retrieved May 2017 from

https://www.fhwa.dot.gov/planning/national_highway_system/intermodal_connectors/texas.cfm.

Exhibit 7-3: *Factors Included in the Evaluation of Condition and Performance of the Texas Highway Freight Network*



Freight Asset Utilization and Preservation

The condition of roadways that make up the Texas Highway Freight Network play an important role in facilitating the movement of freight. Pavement and bridge conditions were the primary factors used to evaluate freight asset utilization and preservation needs. Several factors related to bridge condition were evaluated including vertical clearance and load restrictions.

Presently, asset preservation at TxDOT occurs at the district level, with only one in 25 districts having their own system and most using a variety of ad hoc methods. This approach resulted in an incomplete record of inventory, making it difficult to track work orders and prioritize repairs. To combat this issue, TxDOT has selected ServiceNow in order to manage preservation, a system already used to manage IT assets. Effectively monitoring the transportation inventory will allow for the network to be preserved in a serviceable and manageable condition. While this is one mitigation strategy to address asset preservation needs, specific policies and projects are discussed in **Chapters 11, 12 and 13**. The following sections focus on assessing current conditions and identifying needs.

Pavement Conditions

Exhibit 7-4 shows the pavement conditions within the state in 2017. Pavement condition is directly related to the movement of goods by truck. It can impact the speeds at which trucks can operate, which may influence driver fatigue, and potentially cause damage to cargo from vibration and jarring motions. Poor pavement condition imposes economic costs to the freight industry in the form of increased wear and tear on vehicles, delays associated with vehicles slowing to avoid potholes and crashes resulting from unexpected changes in surface conditions. Poorly maintained pavement can also reduce the attractiveness of sites for warehousing and distribution facilities as facility operators consider the potential impact on vehicle maintenance and repair, and product damage costs.

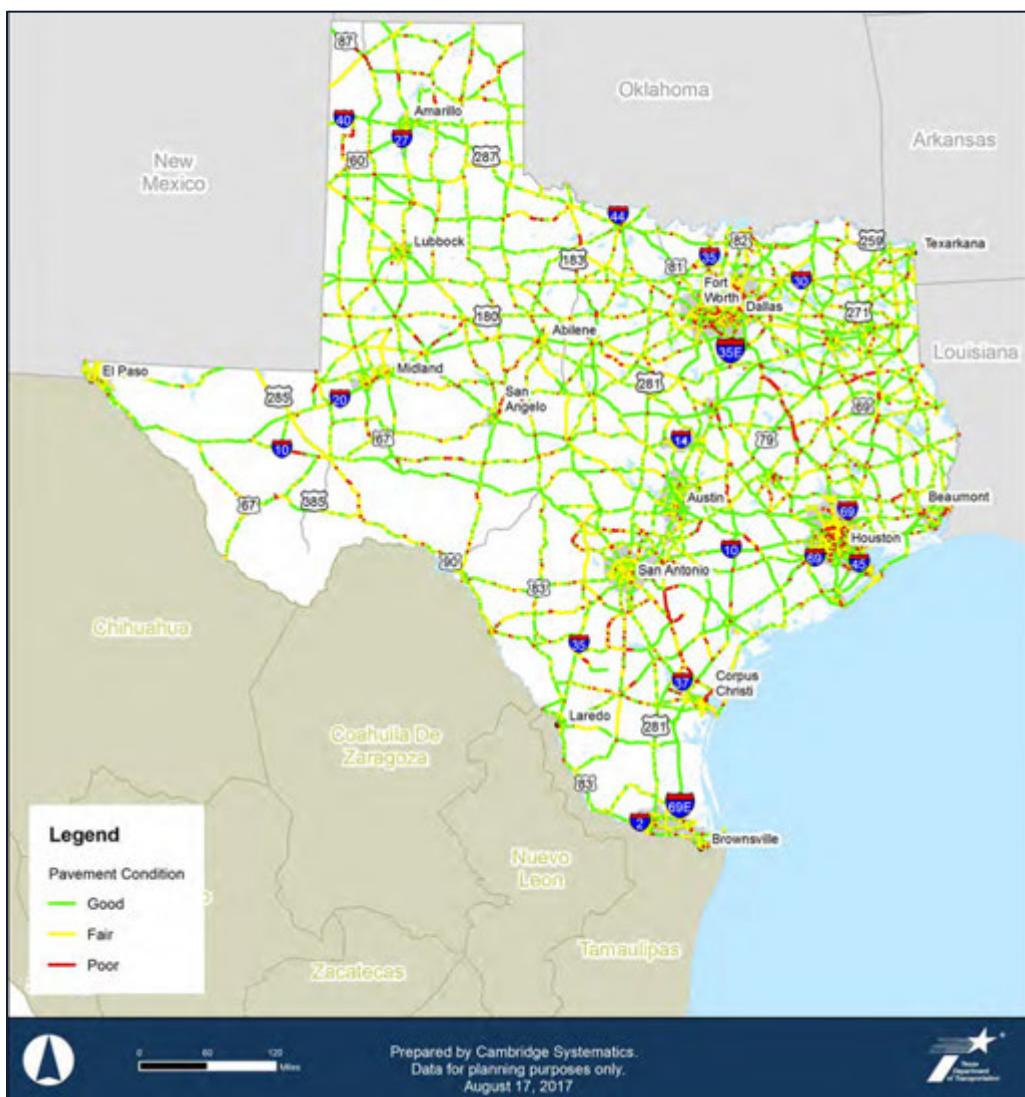
In 2016, 91 percent of total lane miles in Texas had “fair” or better pavement conditions based on roughness of the roadway.¹³⁰ Similarly, 85 percent of the Texas Highway Freight Network is also currently in “fair” or better condition¹³¹ suggesting that this network is comparable to the entire roadway system. Further analysis reveals that Texas’ interstate highways, a key component of the Texas Highway Freight Network, have a higher percentage of roadways in “fair” condition or better, at 95 percent.

Major contributors to pavement condition include heavy haul vehicles in the mining, agriculture, energy, and timber industries. This is most prevalent in Texas with regard to set up, operation, and maintenance of oil and natural gas wells, as discussed further in Section 4.1.4. Heavy vehicles in the energy sector and other industries substantially deteriorate the condition of roadways compared to original design and intended use of the routes used, many of which are rural routes off the Texas Highway Freight Network with responsibility for maintenance belonging to local jurisdictions. In these instances, both on and off the Texas Highway Freight Network, TxDOT is committed to working closely with industry and local planners to identify procedures and programs, as well as prioritize projects best suited to combat extensive roadway damage caused by heavy haul vehicles. This will include safety projects, asset management projects, and alternative routes projects, which are further discussed in **Chapters 10, 12 and 13** and listed in **Appendix B and C**.

¹³⁰ Pavement conditions are based on the International Roughness Index (IRI), a commonly used standard for measuring and reporting the condition of pavements. This is calculated based on a vehicle’s response to pavement profiles and is reported in inches per mile. IRI categories include Good (<95), Fair (95 – 170), and Poor (> 170).

¹³¹ Conditions of Texas Pavements. Pavement Management Information System. Retrieved May 2017.

Exhibit 7-4: Texas Roadway Pavement Conditions



Source: TxDOT Pavement Management Information System, Retrieved May 2017.

Bridge Conditions

Bridges which cannot handle typical truck sizes and/or weights may contribute to congestion as trucks must reduce their speed to cross or detour to avoid such bridges. Bridge conditions may affect transportation costs, as detours may result in longer routes and weight restrictions may require more trucks for the same cargo.

In 2016, Texas had 53,875 bridges,¹³² 26,000 more than any other U.S. state.¹³³ Of the total, 35,489, or 66 percent, are “on-system” bridges, which are owned and maintained by

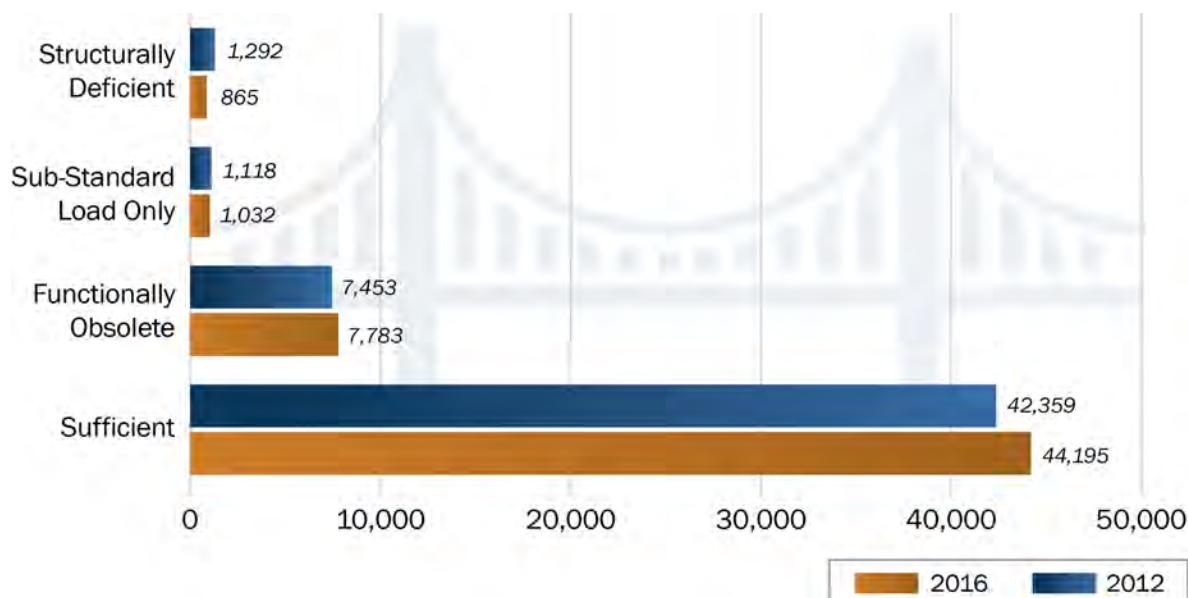
¹³² Ibid.

¹³³ TxDOT. Bridge Facts 2016.

the state. The remaining 18,386 “off-system” bridges are owned by local governments, other political subdivisions of the state, or a special district. Counties maintain 10,316 bridges, while cities or towns own 7,629 bridges.

About 82 percent (44,195) of Texas bridges were in *good or better* condition in 2016,¹³⁴ an improvement over the 81 percent in 2012. **Exhibit 7-5** shows a comparison of the state’s bridge conditions in 2012 and 2016. Overall, the number of sufficient bridges has increased, while the total number of bridges deemed structurally deficient, functionally obsolete or sub-standard for load have decreased, reflecting TxDOT’s efforts to maintain and rehabilitate its transportation assets.

Exhibit 7-5: *Texas Bridge Conditions, 2012 and 2016*



Source: TxDOT Bridge Factors FY 12, FY16.

The age of bridges also relates to their design and condition. Older bridges typically require additional maintenance and use more resources. In FY 2016, the average age of bridges on the state system was between 40 and 45 years old, while off the state system, the average age of bridges was 32 years.¹³⁵

Most bridges in Texas have sufficient load capacity and lane widths to accommodate trucks. Structurally deficient bridges are not necessarily unsafe, but they typically require significant maintenance, rehabilitation or replacement.

¹³⁴ Ibid.

¹³⁵ TxDOT. Bridge Facts 2016.

Bridges on the Texas Highway Freight Network were analyzed to identify those in *poor or very poor* condition,¹³⁶ meaning structurally deficient, or if they had a restriction for loads of 80,000 pounds or less. **Exhibit 7-6** shows these bridges statewide, and also shows the clustering in Dallas-Fort Worth and Houston. There are 76 bridges *in poor or very poor* condition and 13 bridges with load restrictions on the Texas Highway Freight Network. Projects that address bridge conditions are discussed as part of the asset preservation sections in **Chapters 10, 12 and 13**.

The height of a bridge is also an important consideration for the safe and efficient movement of people and goods. Many older structures or overpasses were constructed with vertical clearances less than current TxDOT standards of a minimum vertical clearance of 16 feet 6 inches and no less than 14 feet and 6 inches. Bridges with lower clearances are more likely to be struck and damaged by trucks of typical height (13 feet 6 inches) and may restrict oversize truck movements.

Bridges with less than the TxDOT minimum standard of 16 feet and 6 inches impose significant challenges to freight network mobility and should be addressed in project development. In response to a recommendation in the 2016 Texas Freight Mobility Plan, TxDOT is in the process of implementing a new vertical clearance standard – 18 feet 6 inches for all bridges and other overhead structures inclusive to the Texas Highway Freight Network - to respond to these challenges. The new standard, which begins with projects let September 1, 2020 or later, applies to all new construction and reconstruction projects.

Bridge clearances for the 20,778 bridges on the Texas Highway Freight Network are summarized below and are shown in **Exhibit 7-7**:

- 291 bridges have a vertical clearance of less than 15 feet. These bridges are primarily located in Dallas, Houston and San Antonio.
- 1,308 bridges currently have vertical clearances between 15 feet and 16 feet 6 inches; 634 of these are on interstates. These bridges are spread throughout the Texas Highway Freight Network, but many are located in major metropolitan areas.
- 2,118 bridges currently have vertical clearance between 16 feet 6 inches and 18 feet 6 inches, with 914 of these on interstates. These bridges are spread throughout the Texas Highway Freight Network, but tend to be on the periphery of metropolitan areas and more rural locations.

¹³⁶ Poor or Very Poor Condition – those bridges that have a score of 4 or less for items 58 - 62 and 65; respectively deck, superstructure, substructure, channel and channel protection, culverts and approach, of the TxDOT and USDOT National Bridge Inventory (NBI) Coding Guides'.

Exhibit 7-8 displays the asset preservation issues on the Texas Highway Freight Network based on the bridge and pavement conditions previously discussed. Projects to address these needs are discussed in **Chapters 12 and 13** and listed in **Appendices B and C**.

Exhibit 7-6: *Texas Highway Freight Network Load Restricted and Poor Condition Bridges*

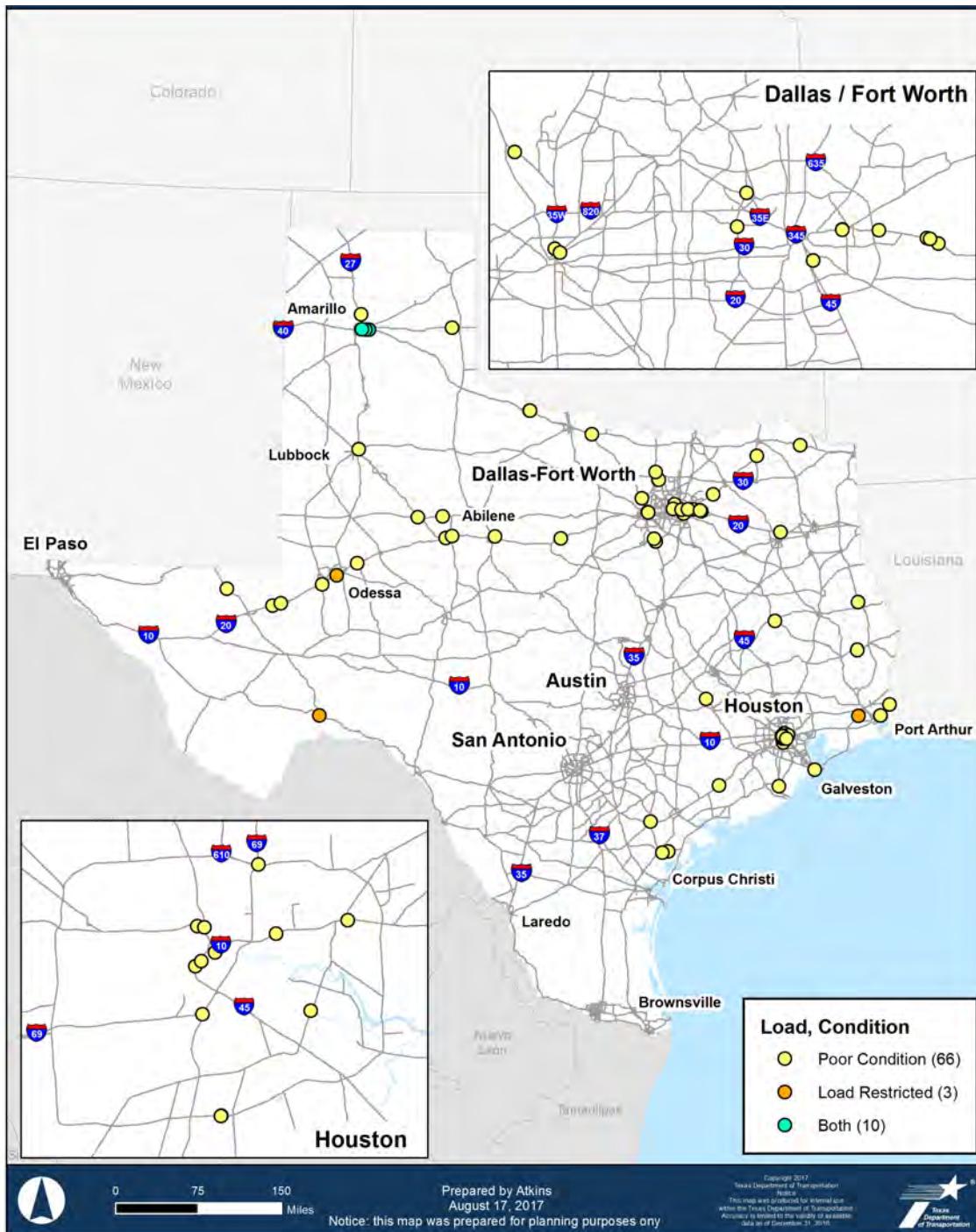


Exhibit 7-7: Texas Highway Freight Network Bridge Vertical Clearances

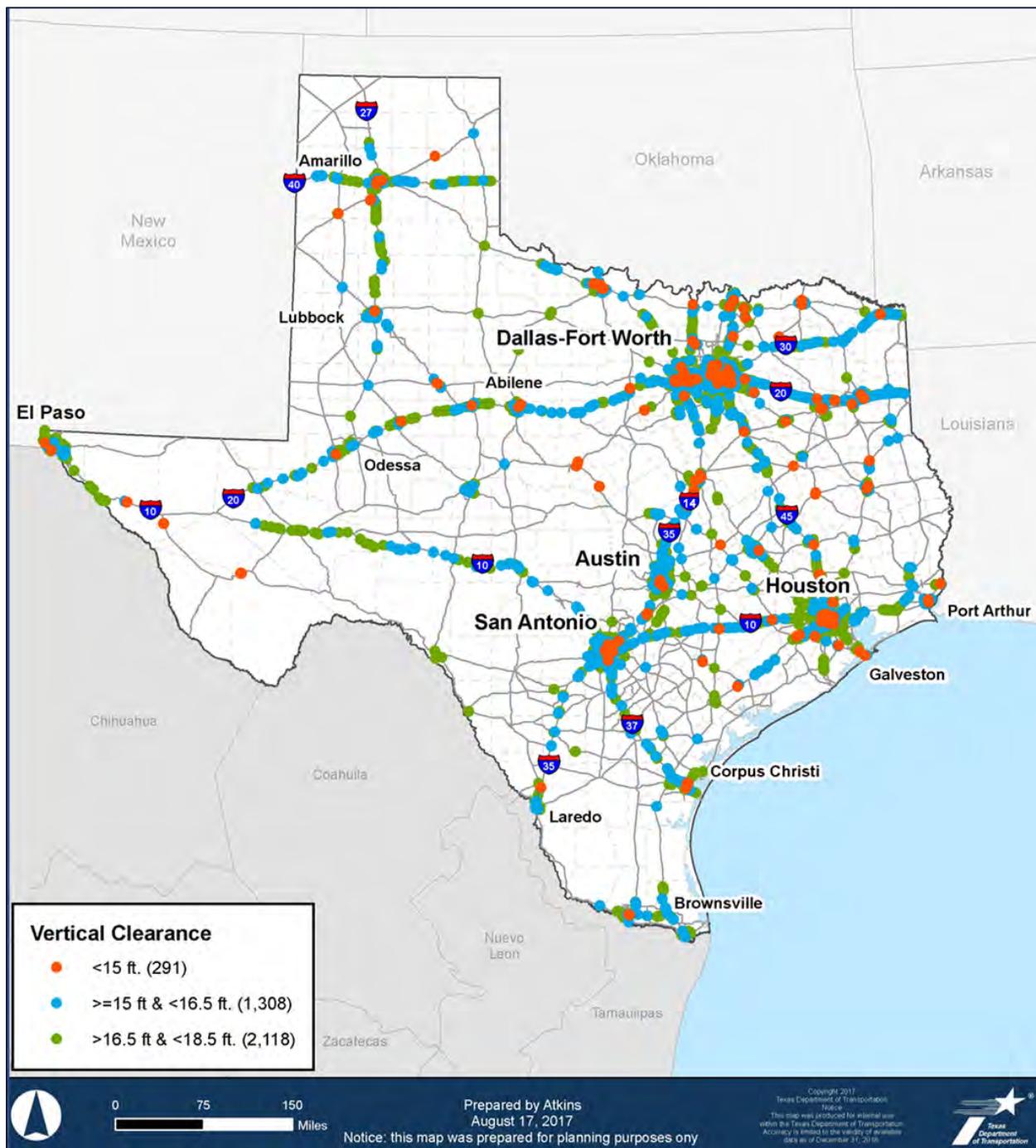
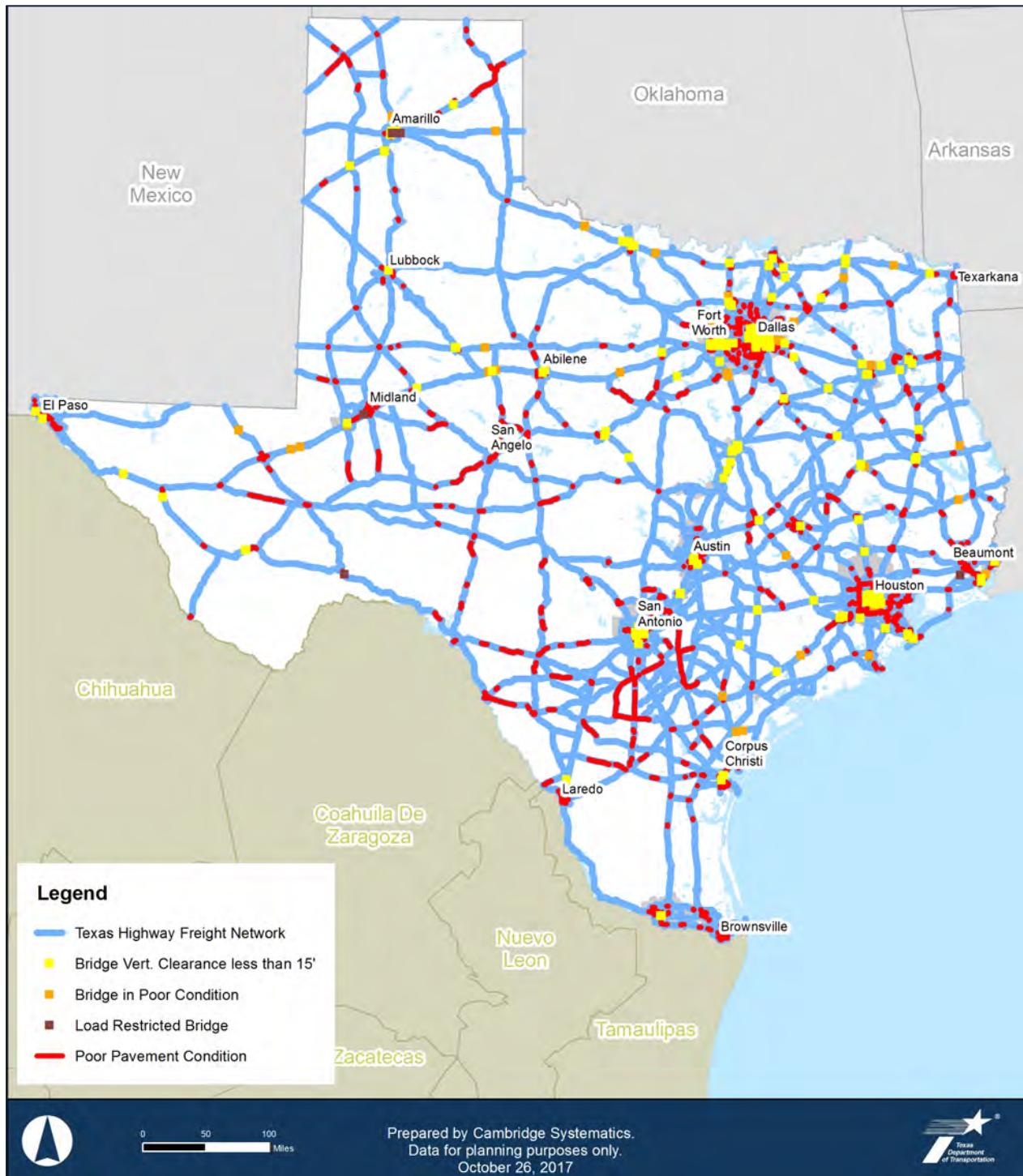


Exhibit 7-8: *Bridge Issues and Poor Pavement Conditions on the Texas Highway Freight Network*



Mobility and Reliability

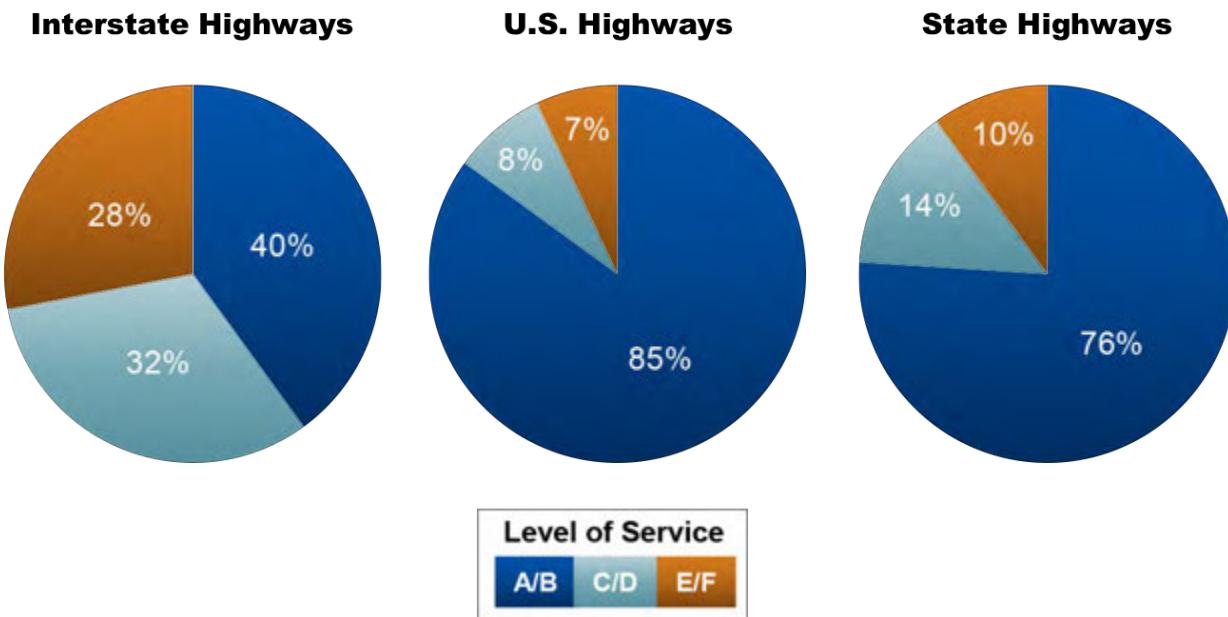
Fast, reliable truck transportation is critical to today's supply chains, which utilize more Just-in-Time (JIT) and time-definite delivery models. The ability of Texas to support these business models impacts economic development opportunities across the state. The following section examines current conditions and performance on the Texas Highway Freight Network that impact overall truck freight mobility and reliability. TxDOT recognizes the importance of congestion and bottleneck mitigation and has implemented programs, and continues seeking new strategies, to address the issues for both freight and passenger travel. Examples of these programs, discussed in greater detail in **Chapters 12 and 13**, include Texas Top 100 Congested Roadways and the Texas Clear Lanes program. In addition, mobility and reliability are key factors in freight project prioritization as discussed in **Chapter 10**. This section identifies and evaluates the needs while mitigation strategies are presented in **Chapters 11, 12 and 13**.

Level-of-Service

Congestion on the Texas Highway Freight Network adds to the travel time of freight, which affects the costs of getting goods to market. Highway congestion levels are measured by level-of-service, a qualitative measure of traffic operating conditions on a roadway. Level-of-service ratings range from A to F, where A is the best, E represents operations with traffic volumes near capacity of the roadway and F represents congested operations where traffic exceeds roadway capacity. Level-of-service C to D are generally considered acceptable for traffic operations.

During peak periods in 2016, about 72 percent of the state's interstate highway mainlines operated at a level-of-service of C or D or better. At the same time, about 85 percent of U.S. highways and 76 percent of state highways in Texas operated at level-of-service A or B. These trends are shown in **Exhibit 7-9**. Congestion leading to poor level-of-service tends to impact urban areas where freight traffic mixes with daily commuter traffic in the morning and evening rush hours. Such instances will worsen as Texas cities continue to grow in both area and population. This congestion, which can vary significantly, leads to uncertainty for freight companies, delays in shipments, time wasted in traffic and increased cost.

Exhibit 7-9: Texas Highway Freight Network Peak Period Level-of-Service, 2016



Source: Texas Statewide Analysis Model Version 3 (SAM-V3), 2016.

Exhibit 7-10 displays the 2016 level-of-service for the Texas Highway Freight Network. The large urban areas of Dallas-Fort Worth, Houston, San Antonio and Austin have the most significant congestion and the largest share of Texas Highway Freight Network facilities operating at unacceptable levels-of-service E and F.

Highway Freight Bottlenecks

Freight bottlenecks are specific locations on the highway network where frequent traffic congestion has a significant impact on truck operations. Bottlenecks are typically located in urban areas, and may occur at highway interchanges and merges/diverges, locations where the number of lanes drops, or other sites where roadway design or the volume of vehicles leads to a localized area of congestion.

In 2013, Texas had more than \$1 billion in congestion costs, a figure which increased to over \$5 billion by 2015, ranking only behind Florida.^{137,138} Urban areas in particular have seen dramatic increases in the cost of congestion to the trucking industry in recent years. For example, in 2013, Dallas-Fort Worth had an annual cost of congestion of \$406 million.

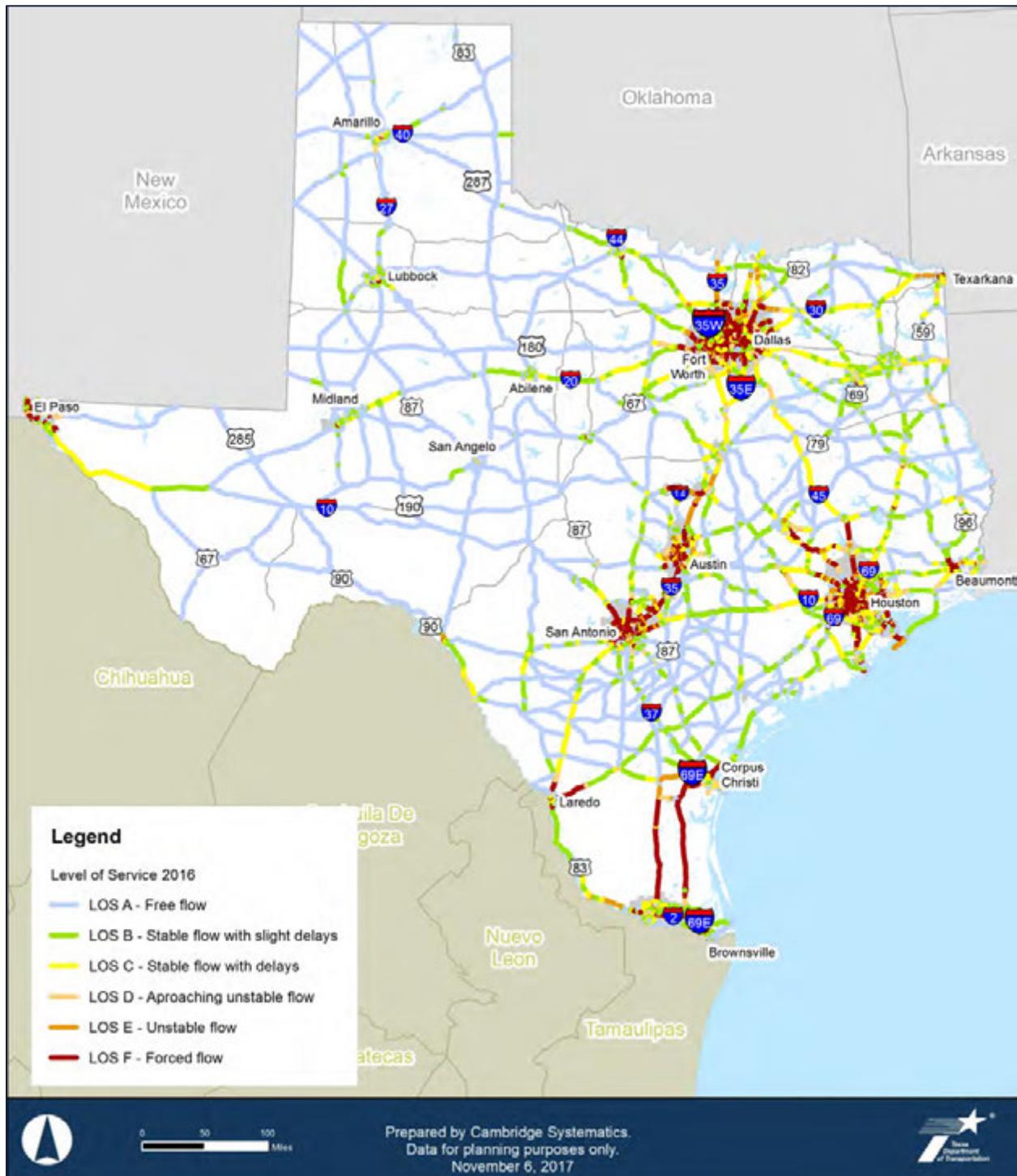
¹³⁷ American Transportation Research Institute. Cost of Congestion to the Trucking Industry: 2014. Retrieved August 2017 from <http://atri-online.org/2014/04/30/cost-of-congestion-to-the-trucking-industry/>.

¹³⁸ American Transportation Research Institute. Cost of Congestion to the Trucking Industry: 2017 Update. Retrieved June 2017 from <http://atri-online.org/wp-content/uploads/2017/05/ATRI-Cost-of-Congestion-05-2017.pdf>.

By 2015, the congestion had increased to \$1.3 billion annually, an increase of over 220 percent. Similarly, for the Houston area, the 2013 cost of congestion to trucking was \$373 million, which tripled to more than \$1.1 billion by 2015. Of the 10 metropolitan areas in the U.S., with the highest costs of congestion, Dallas-Fort Worth ranked fifth overall in 2015, having moved up from sixth place in 2013, while Houston ranked eighth in both years. These increases in the costs of congestion impact the trucking industry and freight movements, resulting in higher costs for shipments, supply chains and finished products.

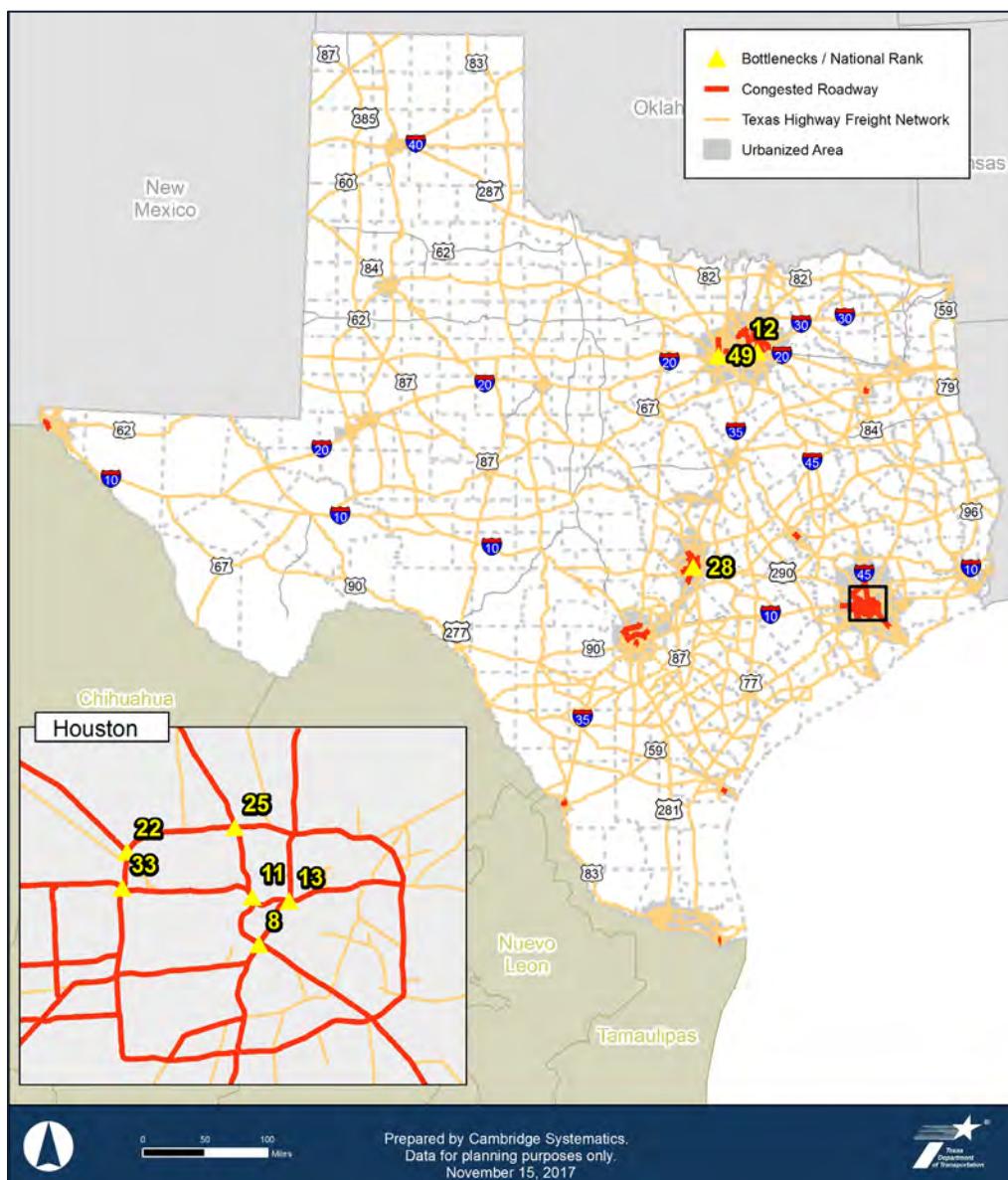
Nine of the top 50 freight bottlenecks nationwide are located in Texas, as identified in 2017 by the American Transportation Research Institute for FHWA. They are clustered in Austin, Dallas-Fort Worth and Houston, and their locations and national rankings are shown in **Exhibit 7-11**. Houston has the most bottlenecks of any urban area in Texas with six of the nine. All six are in central Houston: I-45 at US 59, I-10 at I-45, I-10 at US 59, I-610 at US 290, I-45 at I-610 (north) and I-10 at I-610 (west). These bottlenecks impact activity at Port Houston by adding delay for trucks entering and exiting the state's largest port. This congestion reduces the economic competitiveness of the port by increasing transportation costs in the supply chain. Two bottlenecks are located at highway interchanges in Dallas-Fort Worth: one on I-45 south of Dallas and one on I-35W south of Fort Worth. Finally, one bottleneck in Austin is located on I-35 through central Austin. These bottlenecks impact both the efficient and safe movement of people and goods. Specific projects to improve level of service by addressing congestion and freight bottlenecks are discussed in **Chapters 12 and 13**. This includes seven projects to improve four of the ATRI bottlenecks in the 5-Year Freight Investment Plan (see **Exhibit 13-14**).

Exhibit 7-10: Daily Level-of-Service on the Texas Highway Freight Network, 2016



Source: Texas Statewide Analysis Model version 3 (SAM-V3), 2016. V/C ratio.

Exhibit 7-11: Top 50 National Truck Bottlenecks in Texas, 2017



Source: American Transportation Research Institute. Retrieved May 2017 from: <http://atri-online.org/2017/01/17/2017-top-100-truck-bottleneck-list/>.

Each year, the Texas A&M Transportation Institute (TTI) produces a list of the 100 most congested roadways in Texas for TxDOT.¹³⁹ TTI also differentiates truck delays from total delays, and ranks the roadways by “truck delay per mile.” Truck-related congestion delays and associated costs, such as wasted time and fuel, are shown in Exhibit 7-12. All 10 segments are located in three urban areas- Austin, Dallas-Fort Worth and Houston.

¹³⁹ Texas Department of Transportation. Retrieved June 2017 from <http://www.txdot.gov/inside-txdot/projects/100-congested-roadways.html>.

Worsening congestion at these bottleneck locations threatens to slow the movement of freight in Texas, adding time and cost to shipments and limiting the potential for future economic growth.

The most congested roadway segment in Texas, based on trucking delays in 2016, is I-35 through central Austin, with about 108,000 annual hours of truck delay per mile. This section of I-35 is emblematic of growing commuter and freight traffic volumes through Texas, with overall annual hours of delay per mile increasing from 559,380 in 2011 to 1,085,000 in 2016.¹⁴⁰ Thirty-eight percent of the annual hours of truck delay occurred in the top 10 most congested locations. Houston had seven of the top 10 most congested locations for truck travel in 2016, while Dallas had two and Austin had one.

Exhibit 7-12: Texas Top 10 Congested Truck Locations in 2016

Rank	Roadway	From	To	Truck Person-Hours of Delay Per Mile (Thousands)	Annual Truck Congestion Cost (Million Dollars)
Austin					
#1	I-35	US 290	SH 71	108	72
Houston					
#2	I-610W	I-10	US 59	69	21
#3	US 59	I-610W	SH 288	52	24
#5	I-10	Eldridge Pkwy	Beltway 8 W	49	13
#7	US 59	I-10E	SH 288	45	12
#8	I-10	I-610	I-45	44	21
#9	I-45	Beltway 8 N	I-610	40	31
#10	I-10	Beltway 8 W	I-610	38	21
Dallas					
#4	I-635	I-35E	US 75	50	34
#6	I-45/I-345	Spur 366	US 175	47	9
Total (Top 10 most congested segments)				542	258
Total (Top 50 most congested segments)				1,393	670

Source: Texas A&M Transportation Institute.

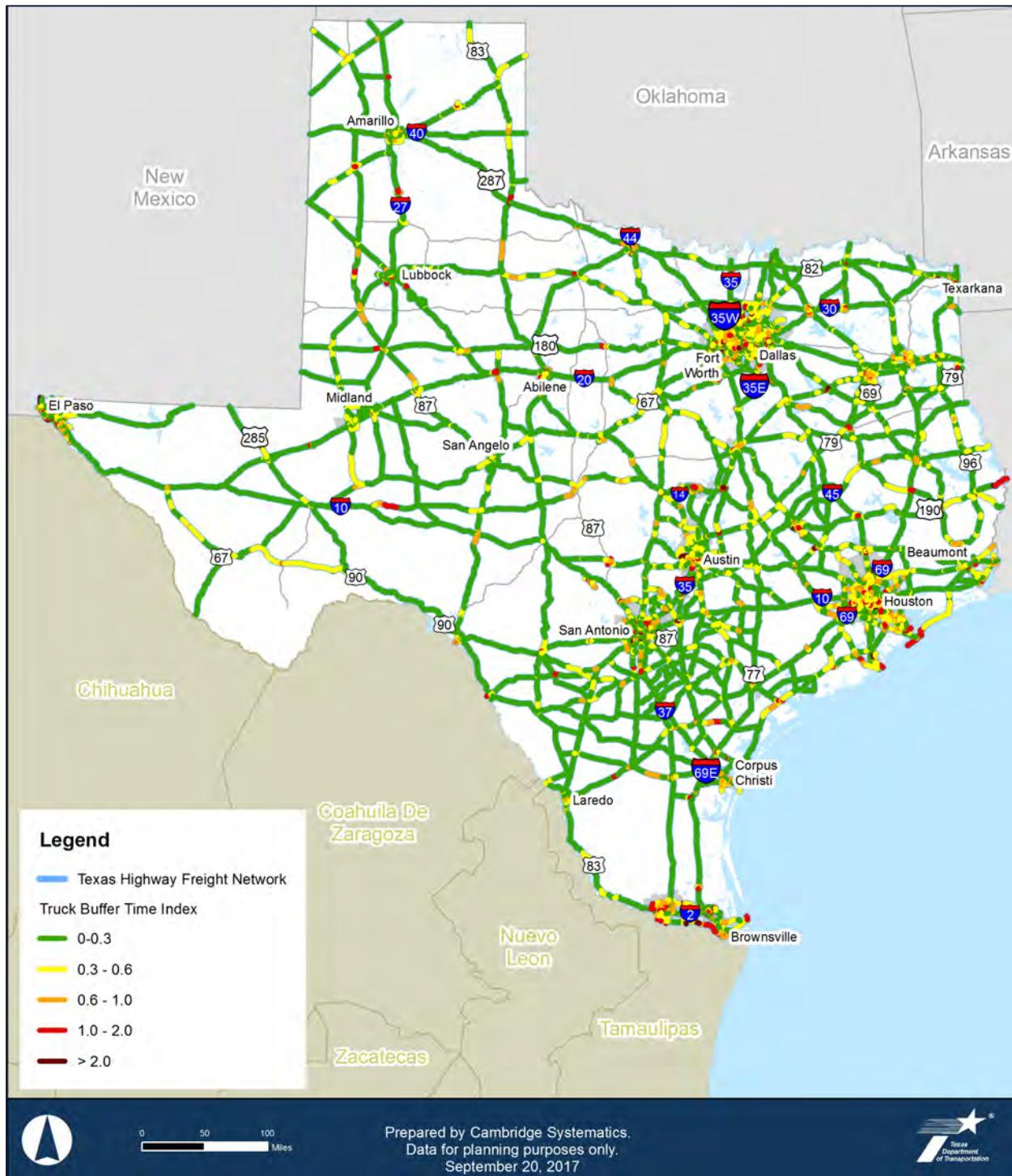
¹⁴⁰ <https://www.texastribune.org/2012/09/07/texas-releases-list-most-congested-roads-state/>.

As noted above, the Texas Clear Lanes program is designed to address congestion in the metro areas of Austin, Dallas, Fort Worth, Houston and San Antonio. In **Chapter 13, Exhibits 13-11 and 13-12** provide a summary of the Clear Lanes congestion mitigation projects on the top 10 congested freight segments in Texas included in the 5-Year Freight Investment Plan. Additionally, TxDOT is developing technology-based congestion mitigation strategies. For example, the Texas Connected Freight Corridors project seeks to create a sustainable connected vehicle deployment in Texas by showcasing connected vehicle applications along the Texas triangle, connecting Houston, San Antonio, Austin and Dallas/Fort Worth, using I-35, I-10 and I-45 as proving grounds. The project will deploy vehicle-to-vehicle and vehicle-to-infrastructure applications to help improve safety and mobility and reduce bottlenecks. Furthermore, the I-35 Connected Corridor program is an advanced construction traveler information system to keep the public informed and help improve safety and mobility during the 8-year construction horizon on I-35. Portable dynamic message signs provide real time travel time information to the nearest major destination on the corridor and alert drivers of slow or stopped traffic ahead. This provides travelers the option to avoid the area and find alternate routes if necessary and helps to eliminate some of the congestion during construction on one of the highest ranked freight bottlenecks in the nation.

Reliability is a major requirement of the freight industry, so the Federal Highway Administration has made it one of the primary national freight performance measures. This is measured by determining the extra time that most travelers add to their average travel time when planning trips to ensure on-time arrival. This extra time is added to account for any unexpected delay. This is expressed as a percentage and its value increases as reliability gets worse and represents the additional time needed to ensure on-time travel 95 percent of the time. For example, a calculation of 40 percent (.40) means that, for a 20-minute average travel time, a traveler should budget an additional 8 minutes ($20 \text{ minutes} \times 40 \text{ percent} = 8 \text{ minutes}$) to ensure on-time arrival most of the time. In this example, the 8 extra minutes is called the buffer time.

Exhibit 7-13 displays the truck buffer time index for the Texas Highway Freight Network. As expected, the system is less reliable in the large urban metro regions. There is a correlation between reliability and higher crash rates, which is one of the major causes of unexpected delays. There are also some reliability hotspots in the rural areas and international border regions. Unexpected delays at international border crossings is a major contributor in the border regions whereas the rural truck travel time variability issues are primarily on two-lane rural freight corridors.

Exhibit 7-13: Truck Buffer Time Index on the Texas Highway Freight Network, 2016



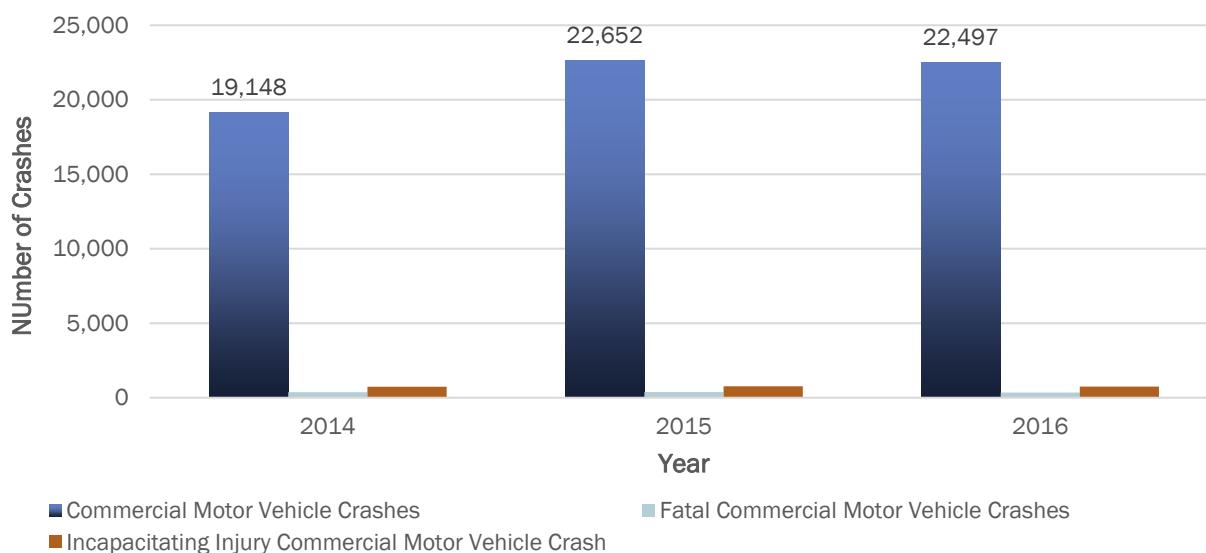
Source: Texas Statewide Analysis Model version 3 (SAM-V3), 2016.

Safety

Improving the current traffic safety record in Texas is critical to the performance of the Texas Highway Freight Network, as well as for the safe and efficient movement of people and goods. Driver behavior, vehicle characteristics and roadway features all contribute to vehicle crashes and fatalities.

As shown in **Exhibit 7-14**, the total number of commercial motor vehicle crashes and incapacitating injury crashes on the Texas Highway Freight Network varies from year to year. For the three-year period from 2014 through 2016, 56 percent of the total commercial motor vehicle crashes occurred on the Texas Highway Freight Network, while 71 percent of commercial motor vehicle fatalities occurred on the Texas Highway Freight Network.¹⁴¹ This includes a significant increase occurring between 2014 and 2015. However, there was a slight decrease from 2015 to 2016 with 155 fewer commercial motor vehicle crashes (0.7 percent), 17 fewer fatalities (4.5 percent) and 19 fewer incapacitating injuries (2.5 percent).

Exhibit 7-14: *Number of Commercial Motor Vehicle Crashes on the Texas Highway Freight Network, 2014 to 2016*



Source: TxDOT Crash Records Information System (CRIS).

Between 2014 and 2016, of the crashes involving commercial vehicles on the Texas Highway Freight Network, a fatality occurred in 1.7 percent of total crashes. For the same

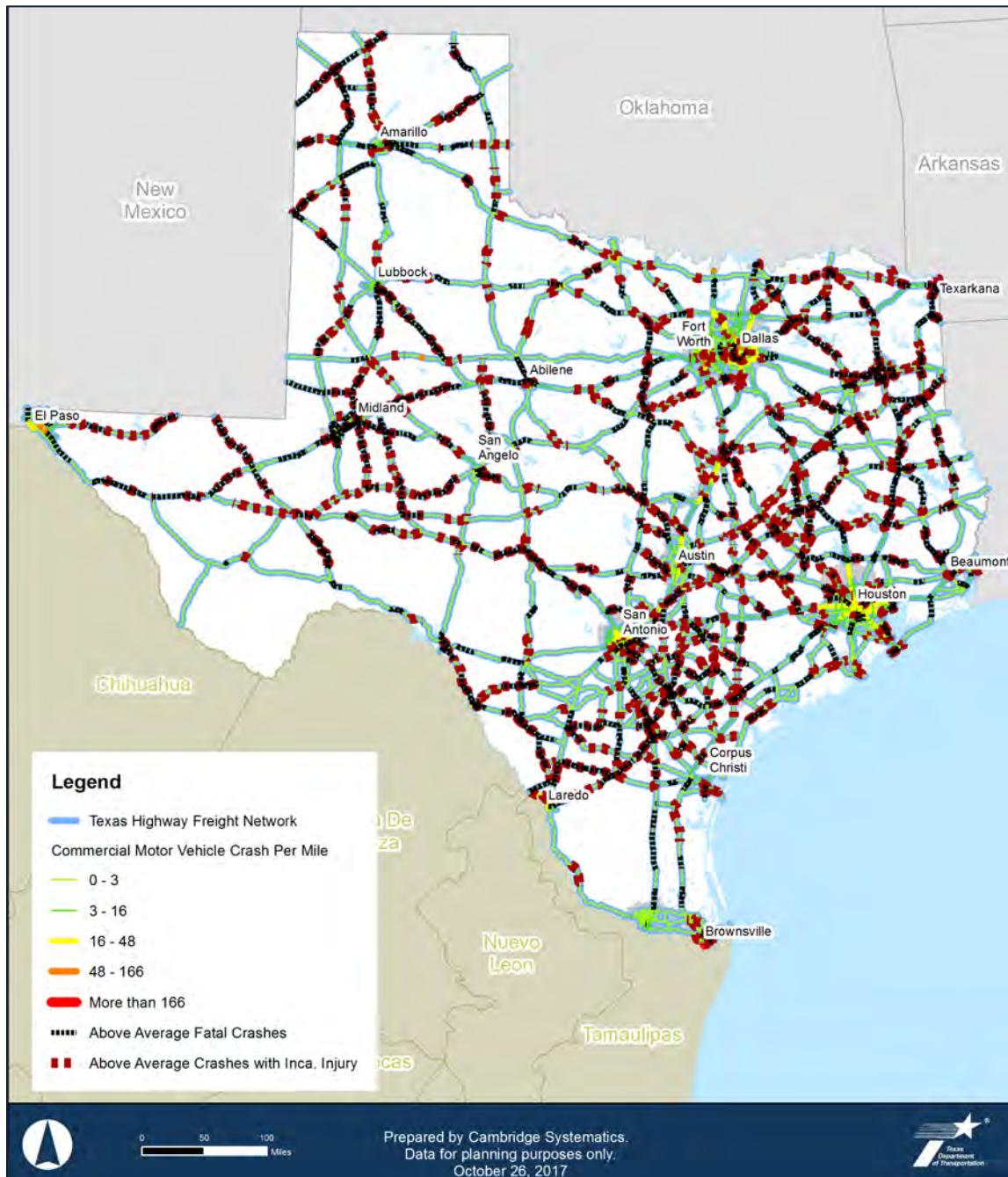
¹⁴¹ Note that “commercial motor vehicle” is used here instead of referencing “trucks.” This is a difference in terminology based on how vehicles are classified within the Crash Records Information System. While this does include mostly freight traffic, some amount of passenger vehicles, such as large buses, are also included in this classification. For this reason, the distinction here is made to refer to “commercial motor vehicles.”

time period, 26.6 percent of commercial motor vehicle crashes included an incapacitating, non-incapacitating or possible injury. Commercial vehicle crashes were more likely to happen in urban areas – nearly 70 percent – but only 44 percent of all fatalities from commercial vehicle crashes occur in urban areas. Although 62 percent of the roadway miles on the Texas Highway Freight Network are classified as rural, only 31 percent of commercial vehicle crashes take place in rural areas.¹⁴²

Exhibit 7-15 combines several safety factors to provide a more comprehensive examination of potential safety bottlenecks with a focus on commercial vehicle crash rates over the three-year time frame of 2014 to 2016 as well as segments which had a higher than average number of crashes resulting in incapacitating injuries and/or fatalities. A significant number of crashes occur in more urbanized areas due to higher vehicle traffic counts. However, serious injuries and fatalities occur across the network signifying that there is no one singular cause of such accidents.

¹⁴² TxDOT Crash Records Information System (CRIS).

Exhibit 7-15: Commercial Vehicle Safety Factors on the Texas Highway Freight Network



Source: TxDOT Crash Records Information System (CRIS), 2014-2016.

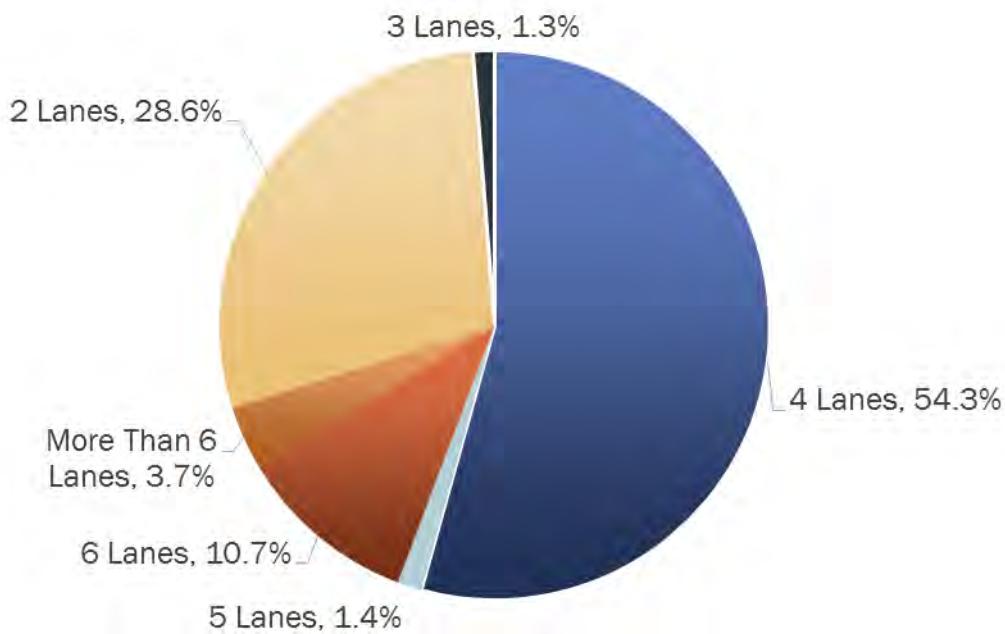
While freight safety concerns are present throughout the state, there are a few notable trends. Major urban areas consistently experience higher than average truck-involved crashes which is a contributing factor to reliability issues. The Midland area also has truck safety issues, which might be due to the fast growth of truck traffic from increased fracking activity. Another noteworthy observation is the number of safety hotspots on facilities connecting Texas to trading partners, both domestic and international.

Safety was rated as one of the most significant considerations for freight project prioritization, discussed in **Chapter 10**. It is also a primary goal for the private freight industry. To address freight safety needs, 284 safety projects are in the 5-Year Freight Investment Plan (see **Chapter 13**).

Lane Conditions

The Texas Highway Freight Network includes 21,794 miles of highways, the majority, or 54.3 percent, are four-lane limited access routes, as shown in **Exhibit 7-16**. However, almost 29 percent of the Texas Highway Freight Network miles are two-lane facilities which can limit efficient freight movements due to factors such as passing restrictions.

Exhibit 7-16: Percentage of Texas Highway Freight Network by Number of Lanes, 2016



Source: Texas Statewide Analysis Model version 3 (SAM-V3), 2016.

In addition to the number of lanes, lane width has a direct impact on the capacity of the network and on its safety. Older roadways often do not meet current design standards or the requirements of truck equipment, which is larger than a standard passenger car and

requires more space for maneuverability. On high-speed roadways with narrow lanes and narrow shoulders, the risk of severe lane-departure crashes increases.¹⁴³

Rest Areas and Truck Parking Facilities

Rest areas and truck stops contribute to truck drivers operating safely and efficiently within federal regulations for hours-of-service. According to TruckMaster® Fuel Finder™, Texas has 920 truck parking facilities, including public rest areas and private truck stops. TxDOT currently owns 80 safety rest areas and 12 travel information centers and the remaining facilities are privately owned. The largest concentrations of truck parking facilities are in Houston, Dallas and San Antonio. Although Texas is among the states with the highest number of truck parking facilities in the nation, it has one of the lowest ratios of number of spaces to National Highway System miles. Texas is also one of many states to report a shortage in private truck parking spaces. As part of the Texas Freight Transportation Implementation Plan, presented in **Chapter 14**, TxDOT will conduct a truck parking study to identify truck parking needs and strategies to address them. Public truck parking on the Texas Highway Freight Network is shown in **Exhibit 7-17**.

Exhibit 7-17 also shows where existing Weigh-in-Motion stations are located which have replaced traditional weigh stations. The stations serve to monitor freight vehicles to ensure that they are not over their size limitations, which can have a larger impact on roadway conditions. While Weigh-In-Motion stations enhance the flow of freight movement by eliminating delays caused by having to exit the main lanes of the highway, the closure of traditional weigh stations has reduced the availability of some public CMV parking.

¹⁴³ Federal Highway Administration. Retrieved May 2017 from
http://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/chapter3/3_lanewidth.htm.

Exhibit 7-17: *Public Truck Parking Facilities on the Texas Highway Freight Network*



Source: TxDOT, 2017.

Frontage Roads

Frontage roads are an important component of the Texas highway system. Texas interstate highways rely in part on the ability of traffic to detour onto frontage roads when blockages occur on the main lanes.

Exhibit 7-18 shows that there are 686 miles or 5.8 percent of Texas interstates that do not have frontage roads. Approximately one-quarter of this mileage is in urban areas, while three-quarters is in rural areas. Of the Texas interstates that do have frontage roads, 2,670

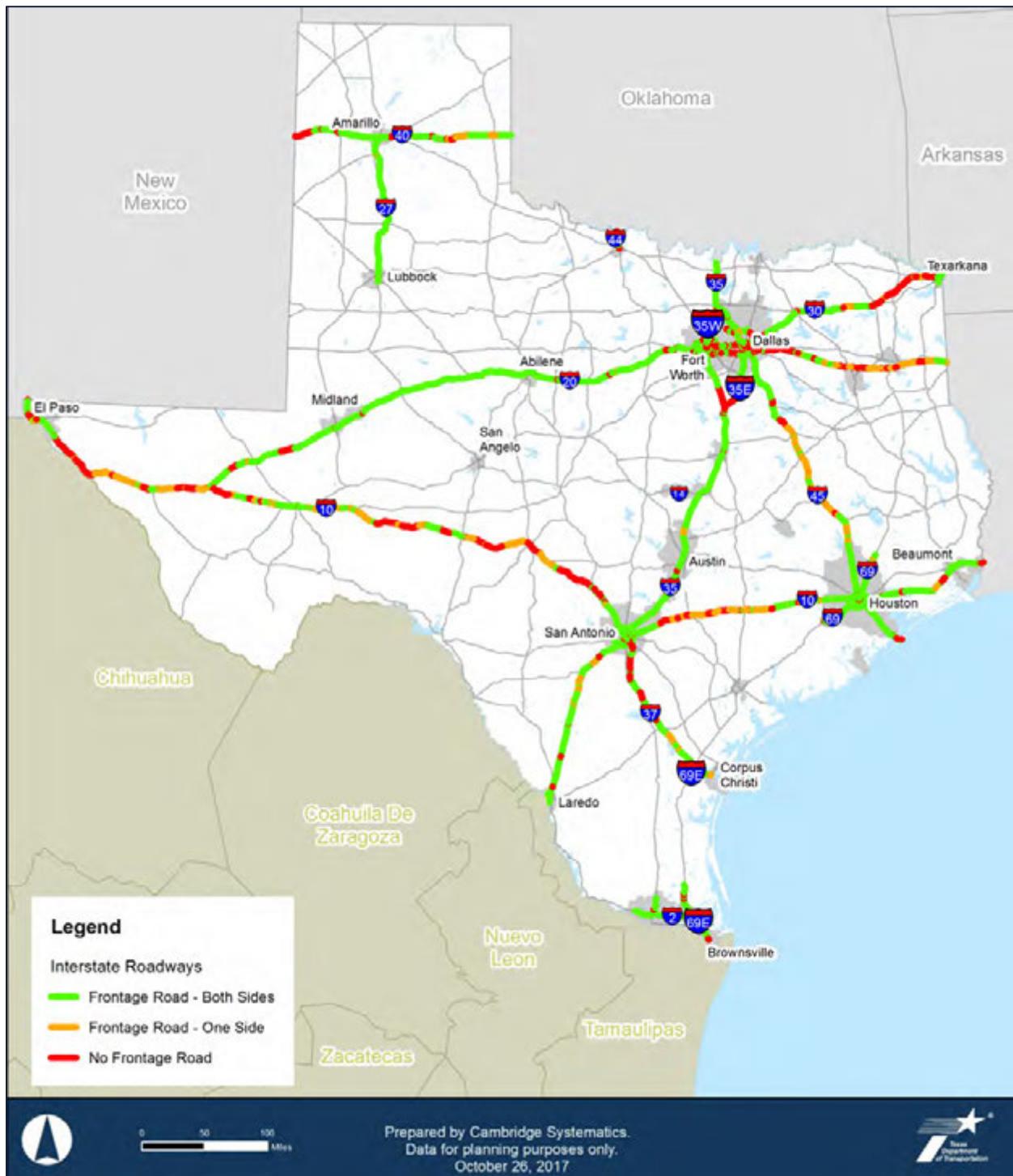
miles centerline miles consist of two-way frontage roads on Texas interstates. This type of roadway is outdated and creates unsafe conditions for the movement of people and freight.

Other Highway Conditions

The horizontal alignment, or curve in the roadway, affects the speed at which trucks can travel safely. At places such as ramps, a lack of deceleration lane length can contribute to drivers running off the first curve after exiting a freeway. Curves present a special safety issue for trucks and large vehicles because their higher center of mass makes them more susceptible to overturning.

Vertical alignment includes grade and vertical curvature (both crest and sag), which affect the distance that is visible to the driver, or stopping sight distance. Addressing vertical alignment issues is critical for larger vehicles, which require additional length for braking.

Exhibit 7-18: Status of Frontage Roads on Texas Interstates



Source: TxDOT Roadway Inventory, 2015.

7.2 Railroads

Freight railroads are a key component of moving goods in Texas. Texas' rail interests even extend across the international borders because of coordination agreements with Mexican railroad operators. Ports and rail bridges on the Texas-Mexico border are critical trade gateways, linking Texas industries with markets and suppliers located throughout the world. Class III, or shortline railroads, also serve agricultural shippers and receivers by providing services in lower-density rail corridors and smaller markets.

7.2.1 *Freight Rail Assets*

As part of the designation process of the Texas Multimodal Freight Network, all rail lines were determined to be a part of the Texas Multimodal Freight Network. As such, no additional assets are identified here.

7.2.2 *Condition*

Track condition ratings place restrictions on rail operation speeds and weight capacity. As Texas rail facilities are owned by private companies, information on specific privately owned track conditions is not public.

The North American Class I rail network has a standardized shipment weight limit of 286,000 pounds per carload, which is about 110 tons of cargo on four axles. Some markets are expanding the standard to a gross weight of 315,000 pounds. Shortlines have reduced capacity on corridors not rated for 286,000-pound axle loads, as hopper cars or other heavy bulk commodities cannot be loaded to full capacity.

7.2.3 *Performance*

Mobility and Congestion

As discussed in **Chapter 8**, rail accounted for 441 million tons of freight in Texas in 2016 and is estimated to grow at a faster rate than truck traffic into 2045. Intermodal transportation can replace many truck trips as trains are able to transport either van trailers or intermodal containers, which can be transferred to trucks, ships or even barges for the “last mile” to the destination.

By 2045, rail tonnage in Texas is forecasted to grow significantly, particularly for outbound movements. The expected growth in Texas rail traffic is a reflection of the growth in international trade, containerized traffic, key industries including petrochemical and manufacturing and traffic between freight generators and attractors in Texas, including seaports, international border crossings, intermodal facilities and logistics centers. As volumes on the rail network increase, the railroads will need to increase capacity and coordinate development within the constraints of existing and possibly incompatible land uses. At-grade highway/rail crossings and limited connectivity to seaports, industrial parks

and transloading facilities could contribute to congestion that may need to be addressed by the railroads.

Shortline Railroad Needs

Shortline rail operations generally involve moving commodities from manufacturing sites to interchange points with Class I rail operations where the goods can be transported to national or international markets. Shortlines serve “first mile” and the “last mile” of a longer rail movement. In comparison with the well-maintained, high volume Class I rail corridors, most shortlines have maintained their infrastructure instead of upgrading as a result of their lower density operations and railcars of lighter weight (263,000-pound and 268,000-pound gross weight capacity based on common railcar sizes when the track was built). Therefore, shortline railroads typically have more limited capacity at yards for building trains, switching and staging cars. A limited number, length or location of sidings also dampens their ability to accommodate the demands of current train operations and schedules. Additional delays are associated with interchanging railcars with another carrier or in the use of trackage rights to access an isolated rail segment.¹⁴⁴

Exhibit 7-19 shows the results of a survey conducted in 2016 to identify improvements to potentially benefit shortline railroads. The most important capital improvements identified by the shortline railroads include bridge repair and upgrade, land acquisition, track expansion and upgrade and new interchange points with Class I carriers.¹⁴⁵ Furthermore, several shortlines stated that they would need between \$200,000 to \$1 million per year to enhance their rail and tie infrastructure.

¹⁴⁴ Texas Department of Transportation. 2016 Texas Rail Plan Update. May 2016.

¹⁴⁵ Fengxiang Qiao, et al. Transportation and Economic Impact of Texas Short Line Railroads. Texas Department of Transportation (TxDOT). FHWA/TX-0-6887. September 2016.

Exhibit 7-19: *Capital Improvements Needed and Identified by Shortline Railroads in Texas*

Issues/Needs	
<ul style="list-style-type: none"> ▪ Bridge repair/replacement ▪ Limited track space ▪ Limited storage space ▪ Capacity upgrade to 286,000 pounds ▪ New interchange with other rail carriers ▪ Crossings upgrade 	<ul style="list-style-type: none"> ▪ Rail and tie enhancement ▪ Rail reutilization or restoration of unused lines ▪ Limited grant opportunity ▪ Develop and properly fund a public-private shortline infrastructure grant program ▪ Increase funding of the Railway-Highways Crossing (Section 130) Program

Source: Qiao, Fengxiang, et al. Transportation and Economic Impact of Texas Short Line Railroads. Texas Department of Transportation (TxDOT). FHWA/TX-0-6887. September 2016.

7.2.4 Safety

Crash records from the Federal Railroad Administration (FRA) for the state of Texas and the U.S. were used to examine the historical trend in the number of fatalities or injuries in rail crashes. As shown in **Exhibit 7-20**, for 2010 through 2016, the fewest injuries, both in Texas and in the U.S., occurred in 2016. In contrast, the number of fatalities in the U.S. reached a peak in 2016 while the Texas trend has fluctuated with increases and decreases over the last seven years.

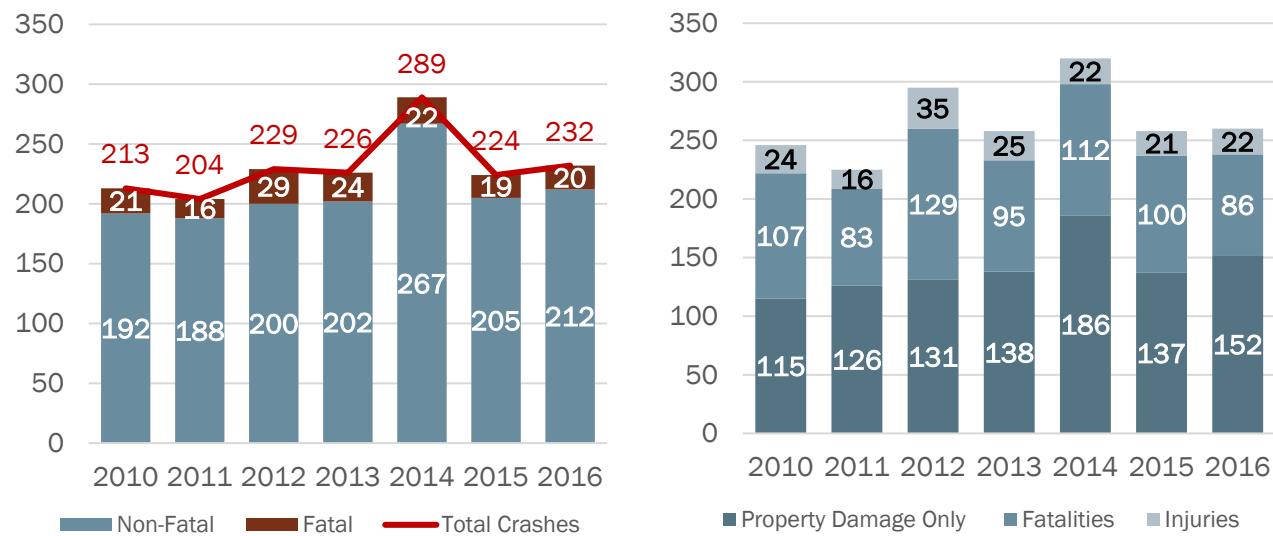
Exhibit 7-20: *Fatalities and Injuries from Rail Crashes, 2010–2016*

	2010	2011	2012	2013	2014	2015	2016	Average 2010-2016
U.S., Fatal	735	682	674	700	766	747	792	728
U.S. Nonfatal	8,378	8,438	8,454	8,747	8,793	9,109	8,231	8,593
Texas, Fatal	55	52	67	52	64	56	64	59
Texas, Nonfatal	519	470	456	453	497	450	393	463

Source: Federal Railroad Administration (FRA), Office of Safety Analysis. Available at <http://safetydata.fra.dot.gov/officeofsafety/publicsite/summary.aspx>.

Texas' rail program and the private railroad partners are committed to continuous improvement of safety and efficiency of traffic movement across the 15,042 at-grade highway/rail crossings in the state.¹⁴⁶ These crossings are equipped with passive or active warning devices. Sixty four (64) percent (5,800 crossings) of 9,150 public crossings are equipped with active warning devices.¹⁴⁷ There are 258 at-grade highway/rail crossings on the Texas Highway Freight Network. **Exhibit 7-21** presents the annual number of crashes and resulting fatalities or injuries at highway/rail at-grade crossings for 2010 through 2016. The total number of incidents reached a peak in 2014, was lower in 2015 and increased again in 2016. On average, 22 fatal crashes and 210 non-fatal crashes were reported annually over the seven year stretch shown below. By annual average, these crashes have injured 102 people and killed 24 others.

Exhibit 7-21: At-Grade Highway/Railroad Crashes in Texas, 2010-2016



Source: Federal Railroad Administration (FRA), Office of Safety Analysis.

Exhibit 7-22 shows that most at-grade highway/railroad crashes in Texas occur on Class I tracks. This is to be expected as Class I rail lines account for nearly 85 percent of trackage miles in the state. On Class I tracks, the number of fatalities slightly decreased, while the number of injured people decreased significantly in 2016 compared to 2010. Over the same period, on shortline railroad tracks, the number of fatalities also slightly decreased but the number of injuries increased. On both Class I and shortline rail tracks the number of property-damage only crashes increased in 2016 compared to 2010. A robust at-grade

¹⁴⁶ Texas Department of Transportation. 2016 Texas Rail Plan Update, Chapter 2: Texas's Existing Rail System. May 2016.

¹⁴⁷ Ibid.

highway/railroad crossing elimination plan is paramount to ensuring a safe, efficient and effective freight rail system in Texas. For those grade crossings that cannot be closed or separated, maintaining and upgrading warning systems can also improve safety. The *Texas Highway-Rail Grade Crossing Safety Action Plan* by TxDOT has already started the groundwork to address such issues.

Exhibit 7-22: At-Grade Railroad Incidents on Class I and Shortline Rail Lines in Texas, 2010 and 2016

	2010			2016			Change 2010-2016		
	Short line	Class I	Total	Short line	Class I	Total	Short line	Class I	Total
At-grade incidents	28	185	213	31	201	232	3	16	19
Fatal Incidents	3	18	21	2	18	20	-1	0	-1
Non-fatal Incidents	25	167	192	29	183	212	4	16	20
Injuries	10	97	107	13	73	86	3	-24	-21
Fatalities	3	21	24	2	20	22	-1	-1	-2
Property Damage Only	17	98	115	24	128	152	7	30	37

Source: Federal Railroad Administration (FRA), Office of Safety Analysis.

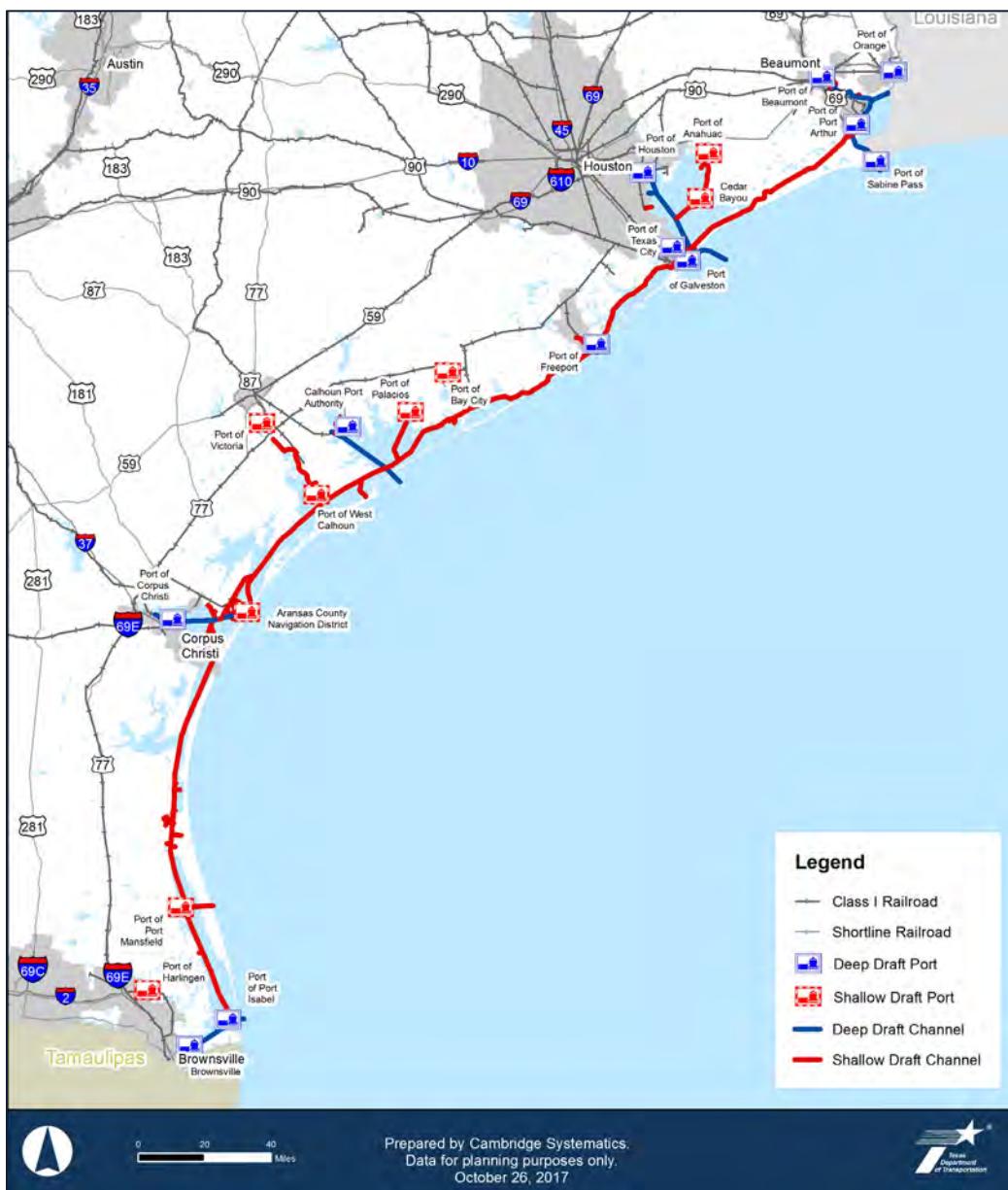
7.3 Ports and Waterways

7.3.1 Assets

The designation of the Texas Multimodal Freight Network for Texas maritime ports followed the same criterion as the national level which included ports handling at least two million short-tons of cargo annually. This results in the designation of 10 Texas ports, although port assets in Texas consist of twelve deep draft and nine shallow draft facilities, ranging from some of the largest ports in the country to small facilities supporting fishing and local agriculture. Eight of the 21 Texas ports qualify based on tonnage of over 10 million tons per year as High Use Harbors under the Federal Water Resources Reform and Development Act

of 2014 (WRRDA). These ports and their national rankings by 2015 tonnage¹⁴⁸ are Houston (second), Beaumont (fifth), Corpus Christi (sixth), Texas City (15th), Port Arthur (19th), Freeport (32nd), Calhoun Port Authority (46th) and Galveston (51st).

Exhibit 7-23: Texas Ports and Waterways



¹⁴⁸ Tonnages are reported by the U.S. Army Corps of Engineers and are compiled in the TxDOT report "Texas Port Profiles, 2017."

The U.S. Army Corps of Engineers (USACE) reports volumes for the top 150 ports in the country. In addition to the High Use Harbors, three other Texas facilities are in the top 150 national ports: Brownsville (ranked 66th nationally), the Port of Victoria (71st) and Orange (150th). Ten of these top national ports in Texas are deep-water facilities with channel depths of at least 25 feet; one – the Port of Victoria – is a shallow draft facility. All 11 of these ports are served by rail and roadway connections. The locations of all 21 port facilities in Texas as well are illustrated in **Exhibit 7-23**.

Freight volumes for the remaining ten Texas ports are not reported by the U.S. Army Corps of Engineers, either because their volumes are small, or because the facilities are not cargo ports and have minimal freight activity. Harlingen is an example of the former, with 900,000 tons of freight reported. Port Isabel is an example of the latter as it is a deep draft port that functions as a supply base for the offshore oil and gas industry and also serves fishing interests. Most of these ports do not report freight tonnage.

7.3.2 Port and Waterway Conditions

Texas' ports and waterways constitute the biggest port system on the Gulf with a large and growing share of total U.S. waterborne freight cargo. **Exhibit 7-24** includes channel characteristics of the Texas High Use Harbor ports and other top volume ports as reported by the Army Corps of Engineers. The eight High Use Harbors all have channel depth of 36 feet with most at 40 to 45 feet. Additionally, three ports have been approved to deepen their channels (Brownsville, Corpus Christi and Freeport) while a fourth, the Matagorda Ship Channel, is under study by the U.S. Army Corps of Engineers as of January 2017. The Sabine-Neches waterway, serving Beaumont and Port Arthur, is also authorized for deepening. This depth is important as it gives ports the capability of handling larger vessels, in particular those that can now transit the newly expanded Panama Canal.

Exhibit 7-25 includes channel characteristics for an additional four shallow draft Texas ports. In addition to the descriptive information provided about these larger ports involved in freight movement, there are five Texas ports for which limited freight-related information is available. These are the Anahuac, Cedar Bayou, Aransas, Port Mansfield and Sabine Pass ports; with the exception of Sabine Pass, these are all shallow draft facilities and are generally considered recreational.

Ports are preparing for capacity pressure from increased traffic in the energy sector, notably for export, in crude oil, plastic resins, related chemicals and liquefied natural gas (LNG). Three ports, Corpus Christi, Port Author and Freeport, have new or expanded LNG facilities. Scheduled crude oil exports commenced at the end of 2015 for the first time in 40 years with the lifting of the Crude Oil Export Ban. This growth may affect containerized as well as bulk products.

An assessment of port conditions extends well beyond specific port facilities to the highway and rail networks that connect ports to inland regions. Port throughput is affected by the existence and condition of these landside connections. All Texas ports depend on U.S. and state highways for access to their facilities. Of the twelve major Texas ports, 10 are served by one or more of the interstate highways: I-10, I-45 and I-69, highlighting how the interstate network provides market connections for most facilities. With respect to rail connections, **Exhibit 7-26** presents the rail connections to these ports. Eleven ports are served by Class I railroads and nine are served by two or more railroads. The freight rail network therefore provides essential service across the ports and waterway system and is another critical link supporting the petroleum industry.

Exhibit 7-24: *Characteristics of Texas High Use Harbors and Other Top Volume Ports^a*

U.S. Rank By Tonnage	Port/City Name	Channel	Length (Miles)	Depth (Feet)	Width (Feet)
High Use Harbors					
2	Houston	Houston Ship Channel ^b	52	45	530
5	Beaumont	Sabine Neches Ship Channel ^b	42	40	400
6	Corpus Christi	Corpus Christi Ship Channel ^b	34	45 ^c	300
15	Texas City	Texas City Ship Channel ^b	9.4	40-45	1,200
19	Port Arthur	Sabine Neches Ship Channel ^b	42	40	450
32	Freeport	Freeport Harbor Channel ^b	8.5	45 ^c	400
46	Calhoun	Matagorda Ship Channel ^b	24	36 ^c	200
51	Galveston	Galveston Channel ^b	9.3	45	1,200
Other U.S. Army Corps of Engineers Top 150 Ports					
66	Brownsville	Brownsville Ship Channel ^b	17	42 ^c	250
71	Victoria	Victoria Barge Canal ^b	35	12	125
150	Orange	Sabine Neches Ship Channel ^b	42	30	200

^a Dimensions are authorized and actual conditions may vary.

^b Direct Access to the Gulf Intracoastal Waterway – Texas Portion (379 miles, 12 foot depth, 125 foot width).

^c Channel deepening: Brownsville 52' (approved); Calhoun 45' (under study); Corpus Christi 52' (approved); Freeport 55' (approved).

Sources: TxDOT Texas Port Profiles, 2017; TxDOT Texas Port Access Study, 2017 (draft); Calhoun port website accessed May 2017.

Exhibit 7-25: *Characteristics of Select Texas Shallow Draft Ports*

Port/City	Channel	Depth (Feet)	Width (Feet)
Bay City	Matagorda Harbor	12	125
Harlingen	Harlingen Channel	12	125
Palacios	Palacios Channel	12	400
West Calhoun	Victoria Barge Canal	12	125

Exhibit 7-26: *Top Texas Water Ports with Rail Connections, 2017*

Port	Number of Class I Railroads	Shortline/Terminal Railroad	Within a Rail District	Can Handle Unit Train within Port (>60 cars)
Beaumont	3	-	-	X
Brownsville	3 ^{a,b}	X	-	-
Calhoun	1	X	X	-
Corpus Christi	3 ^a	X	X	X
Freeport	1	-	X	-
Galveston	2	X	X	X
Houston	3	X	X	X
Orange	2	X	-	X
Port Arthur	2	-	-	X
Port Isabel	-	-	-	-
Texas City	2	X	X	-
Victoria	2	-	-	X

^a UP provides direct service to the port or direct service via a terminal operator. BNSF has trackage rights on UP track and can also provide service to the port

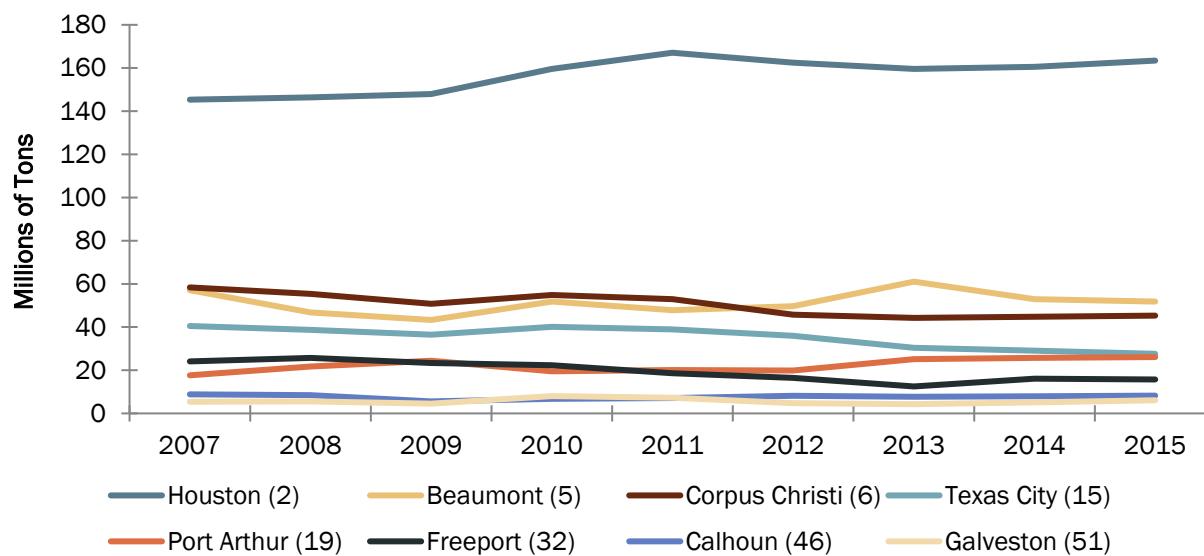
^b The Kansas City Southern de Mexico (KCSM) provides rail service into Mexico from the Port of Brownsville. KCS can only provide direct domestic rail service by traversing Mexico on KCSM track.

Source: TxDOT Texas Port Profiles, 2017; Calhoun port website; TxDOT Texas Port Report, 2014.

7.3.3 Seaport Performance

Capacity and throughput are two key measures of port performance. Capacity is reflected by channel depth (as detailed above) and by facilities such as berths, terminals and cranes that are dependent on the types of cargo handled. Throughput is captured by qualities such as tonnage and vessel calls. **Exhibit 7-27** depicts the recent trends in total tonnage of freight shipped through the eight largest Texas ports, along with the national rankings of those ports in 2015 (shown in parentheses). Trends in throughput can be indicators of where capacity may become constrained as cargo growth continues. The Texas Chemical Council reports nearly \$50 billion in new plants and expansions involving 84 facilities in the state, with a large concentration within a 75-mile radius of Port Houston.¹⁴⁹

Exhibit 7-27: Total Tonnage at Top Eight Texas Ports, 2015



Source: Army Corps of Engineers Waterborne Commerce of the United States.

The efficiency and performance of a port depends on several factors, including maritime, terminal and inland operations. These operations are interrelated, as inefficiencies in one area are likely to impact the others.

- **Maritime Operations.** The efficiency of maritime access includes anchorage, or ships waiting for an available berthing slot. A lack of berthing slots for specific ship classes, such as draft and cargo types, leads to long wait times at anchorage and terminal productivity issues, such as reduced crane operations or truck idling.

¹⁴⁹ "Texas Port Transportation Corridors – Critical for Industry Economic Success", Hector L. Rivero, Texas Chemical Council and the Association of Chemical Industry of Texas, February 3, 2017, available at: https://associationdatabase.com/aws/TCC/pt/sd/news_article/134716_PARENT/layout_details/false.

- **Terminal Operations.** This is the most common performance indicator used to assess port efficiency. For container terminal operations, this commonly involves crane performance, container or cargo transportation to and from a storage yard, transloading operations, gate performance, hours of operation and rail loading/unloading operations.
- **Inland Operations.** Inland operations can involve the transportation and distribution activities servicing the port's customers, largely in areas adjacent to the port. The key factor in inland operations is the capacity of the local road network in port-adjacent areas. Congestion and bottlenecks at street intersections impair the port's performance. Intermodal connectivity is also key to the efficient movement of freight in and out of the ports.

7.3.4 Waterway Conditions

The Gulf Intracoastal Waterway runs 379 main channel miles along the full length of the Texas Gulf Coast. Authorized to be 12 feet deep and 125 feet wide, the GIWW connects all Texas ports and provides essential service to the petroleum industry. The entire GIWW from Florida to Brownsville handled about the same cargo tonnage in 2015 as the third largest port in the U.S. The Texas portion of the waterway carried 82 million tons in 2015, representing 65 percent of the GIWW's 126 million tons total.¹⁵⁰

Three major concerns about conditions on the GIWW were identified in TxDOT's 2016 *Gulf Intracoastal Waterway Legislative Report*:¹⁵¹

1. An average of 38 tows¹⁵² pass the Brazos River Floodgates and Colorado River locks daily, but these aging facilities and inadequate channel dimensions reduce the ability to navigate the waterway and cause costly traffic delays. A feasibility study to address this began in 2016 by the U.S. Army Corps of Engineers.
2. There is inadequate space between bridge columns at the Caney Creek Bridge in Sargent. As a result of this spacing, coupled with a high level of development in the area, the bridge is often struck. Barges are also unable to pull to the side to wait out inclement weather or difficult situations. TxDOT has a planned project to replace the bridge.
3. The width and depth of the waterway have become less capable of handling increasing volumes, larger vessels and longer and larger barge tows. These limitations make it difficult for barge traffic to pass in opposite directions and to otherwise operate without significant delays.

¹⁵⁰ U.S. Army Corps of Engineers Waterborne Commerce Statistics, 2015.

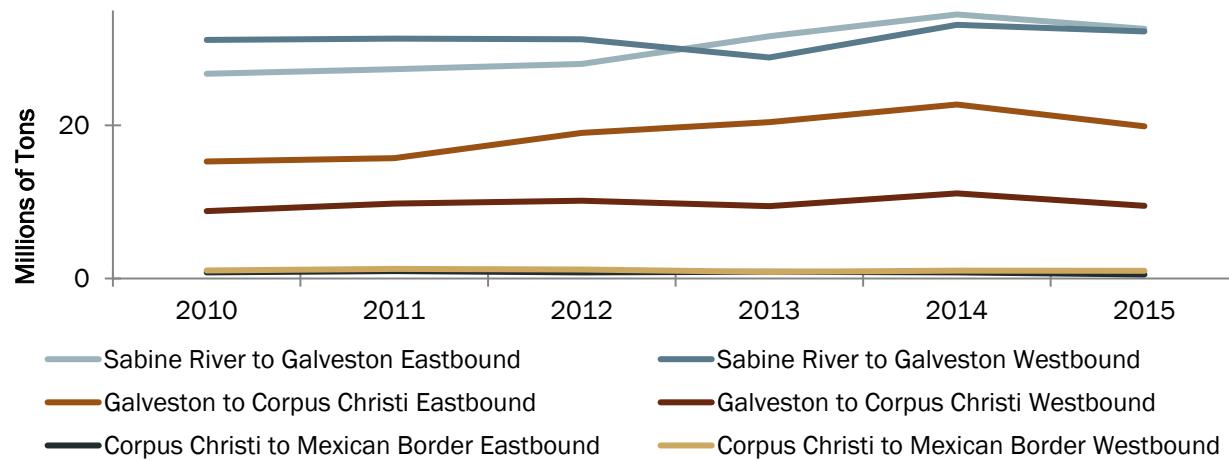
¹⁵¹ See <https://ftp.dot.state.tx.us/pub/txdot-info/tpp/giww/legislative-report-85.pdf>.

¹⁵² A "tow" refers to a combination of barges, with a single tow consisting of anywhere from 4 barges on smaller waterways to 40 on the Mississippi River.

7.3.5 Waterway Performance

Capacity and throughput are again key measures of performance. Maintenance of channel capacity on the shallow GIWW is a critical and underfunded federal responsibility and bottlenecks have arisen along the waterway, both of which have been noted above. Throughput has increased in this decade nevertheless, although growth in oil and gas industry traffic is a continuing source of pressure. Volumes on the GIWW represent domestic movements and are highest on the Sabine River, which is located on the border between Texas and Louisiana, to Galveston segment with eastbound tonnage climbing in recent years and now slightly exceeding westbound, as shown at the top of **Exhibit 7-28**. On the Galveston to Corpus Christi segment, eastbound volumes grew substantially from 2010 through 2014 and significantly exceed westbound volumes. Volumes between Corpus Christi and the Mexican border are much smaller than on the other segments.

Exhibit 7-28: *Gulf Intracoastal Waterway Volumes by Segment and Direction*



Source: Army Corps of Engineers Waterborne Commerce Statistics.

7.3.6 Safety

The responsibility for marine incident safety investigations is shared between the National Traffic Safety Board (NTSB) and the U.S. Coast Guard (USCG); therefore, a comprehensive picture of marine incidents is difficult to obtain. The adoption of double hulled barges and the infrequent interaction with other modes allows for fewer incidents. While ship and barge incidents happen less frequently than highway and rail, the volume of oil and energy commodities going into and out of Texas ports means that collisions and incidents involving waterborne vessels not only risk human injury, facility and vessel damage, but they also risk environmental damage if there are spills in the port or waterway. In addition, ports are the location for transloading of often hazardous commodities between vessels and landside transport, contributing to the potential for mishap.

For the GIWW, safe navigation in the narrow waterway is one of the most important issues for maritime authorities, waterway users and researchers. Incidents in narrow waterways include collisions between two vessels, single vessels striking fixed objects, groundings, fire and explosions.

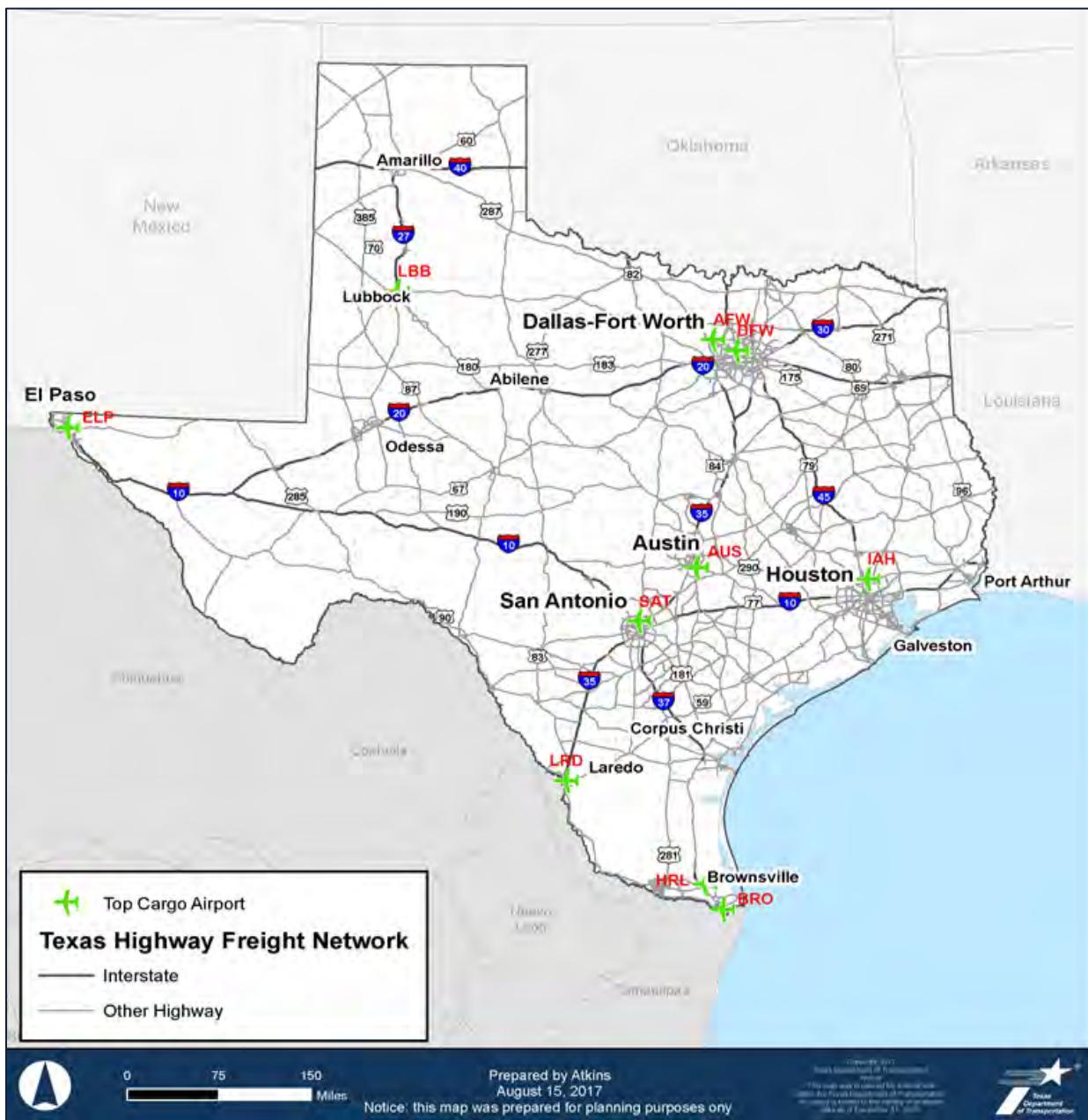
In conclusion, the GIWW plays a critical role in Texas in moving freight and providing relief to ever growing demand for multimodal freight coordination and connectivity. Potential growth of freight movements on the GIWW through interconnectivity with ports and coordination with the oil and gas industry will help to relieve congestion and needs of other modes.

7.4 Airports

7.4.1 Assets

Similar to the port designation, airports included as part of the Texas Multimodal Freight Network were limited to those which ranked in the top 50 by landed weight nationwide in 2016, including Laredo International due to its consistent ranking in the low 50's. Based on data from the Federal Aviation Administration, three additional airports handle significant amounts of cargo and should be considered part of Texas' freight assets: Lubbock Preston Smith International, Valley International and Brownsville/South Padre Island International. The locations of these airports, as well as those on the Texas Multimodal Freight Network, can be seen in **Exhibit 7-29**.

Exhibit 7-29: Texas Top Cargo Airports, 2016



Source: Federal Aviation Administration, 2016.

7.4.2 Condition

One of the most critical conditions that impacts air cargo service is runway length, which can limit the size of aircraft that can operate at an airport. Runway lengths of 8,000 feet are required for most domestic cargo planes, while 10,000 feet is generally required for most international operations. However, weather conditions may increase the required runway length for a given aircraft weight. Runway length is critical for air cargo aircraft takeoff because of the heavy weight caused by a full fuel load and cargo. Heavy lift air cargo aircraft

can only operate at airports that have longer runways such as Dallas-Fort Worth (DFW), George Bush Intercontinental (IAH), El Paso International (ELP), Fort Worth Alliance (AFW) and Austin-Bergstrom International (AUS.) **Exhibit 7-30** demonstrates that all the top cargo airports in Texas have sufficient runway lengths to accommodate domestic cargo planes, while DFW, IAH, ELP, AFW and AUS can accommodate the larger international aircraft.

Exhibit 7-30: *Characteristics of Texas' Top Air Cargo Airports*

ID	Airport Name	Number of Runways	Longest Runway Length (Feet)
DFW	Dallas/Fort Worth International	7	13,401
IAH	George Bush Intercontinental	5	12,001
AFW	Fort Worth Alliance	2	11,010
SAT	San Antonio International	3	8,505
ELP	El Paso International	3	12,020
AUS	Austin-Bergstrom International	2	12,250
LRD	Laredo International	3	8,743
LBB	Lubbock Preston Smith International	3	11,500
HRL	Valley International	3	8,301
BRO	Brownsville/South Padre Island International	2	7,399

Source: Federal Aviation Administration/Air Traffic Division, 2017.

Other factors that can impact air cargo service include:

- Ramp Area: A sufficient amount of ramp area is necessary to park one or more aircraft, and to provide space for equipment loading, cargo staging and truck access.
- Available Facilities or Land for Development: Handling large amounts of specialized air cargo may require additional on-site facilities. Land adjacent to runways and taxiways may be necessary to attract aviation-related air cargo shippers seeking to construct a cargo ramp, sort center, maintenance hangar or factory. Transportation infrastructure is also critical for the intermodal connectivity to support air cargo service.

7.4.3 Performance

Exhibit 7-31 shows the 2013 and 2016 U.S. rankings of the top Texas air cargo airports by landed weight. Landed weight includes the total weight of the airplane, cargo, passengers and fuel. Maximum landed weight is specified by aircraft manufacturers and is regulated for

aircraft to prevent damage to runways. Of note, landed weight increased at all airports presented here with the exception of George Bush Intercontinental.

Exhibit 7-31: Texas' Top Freight Airports Tonnage and Ranking, 2013 and 2016

ID	Airport Name	2013		2016	
		Landed Weight (Pounds)	U.S. Rank	Landed Weight (Pounds)	U.S. Rank ^b
DFW	Dallas/Fort Worth International ^a	3,062,528,160	10	3,328,784,075	9
IAH	George Bush Intercontinental (Houston)	1,704,234,283	17	1,636,306,553	17
AFW	Fort Worth Alliance	737,330,634	29	897,408,852	28
SAT	San Antonio International	636,920,725	36	791,990,700	31
ELP	El Paso International	480,568,188	43	510,464,050	41
AUS	Austin-Bergstrom International	442,476,680	47	483,753,210	45
LRD	Laredo International	392,958,665	56	450,435,440	52
LBB	Lubbock Preston Smith International	333,349,705	66	351,748,770	65
HRL	Valley International	241,949,350	79	263,356,300	79
BRO	Brownsville/South Padre Island International	14,994,882	121	16,228,017	125

^a Dallas/Fort Worth International Landed Weight and Ranking are based on 2015 statistics as this information is not available for 2016

^b U.S. Rank for 2016 excludes two high cargo airports - Dallas/Fort Worth International and Ontario International. Including these two airports in the All-Cargo Data report would lower the ranking of the remaining Texas airports presented here by two each (i.e. George Bush Intercontinental would be ranked 19th instead of 17th).

Source: Federal Aviation Administration/Air Traffic Division, 2017.

Ranking improvements, coupled with increases in total landed weight, indicate that the majority of airport improvements are properly managed and allow for growth in this area. Each airport in Texas is responsible for developing its own Capital Improvement Plan or Master Plan based on their passenger and air cargo forecasts and for managing their operations and capacity, which affects their performance. The key to continued air cargo

performance and operations is the concentration of freight forwarders and cargo support facilities (e.g., cold storage, warehousing) around the airports to form a transportation nexus for multi-modal freight movement. Local and arterial street development around airports will be essential to future growth of this transportation nexus.

7.4.4 Safety

The NTSB has the primary role of investigating every civil aviation crash in the U.S. and the Federal Aviation Administration also provides input. Safety data for air cargo is difficult to differentiate from other commercial/passenger incidents for two reasons: 1) a large portion of air cargo, 40 percent, is transported in commercial passenger aircraft rather than in dedicated air cargo freighters;¹⁵³ and 2) the NTSB does not differentiate between a passenger/commercial aircraft and a dedicated air cargo freighter. With these data limitations, a downward trend in aviation incidents has been noted at Texas airports. Most incidents occur in smaller, general aviation airports and are equipment-related incidents. Although specific air cargo incident information is difficult to differentiate, causes of crashes are similar to passenger aircraft with these notable additions: cargo weight balance, overweight aircraft and unsecured loads leading to cargo shift and crew error or fatigue.

7.5 Pipelines

7.5.1 Assets

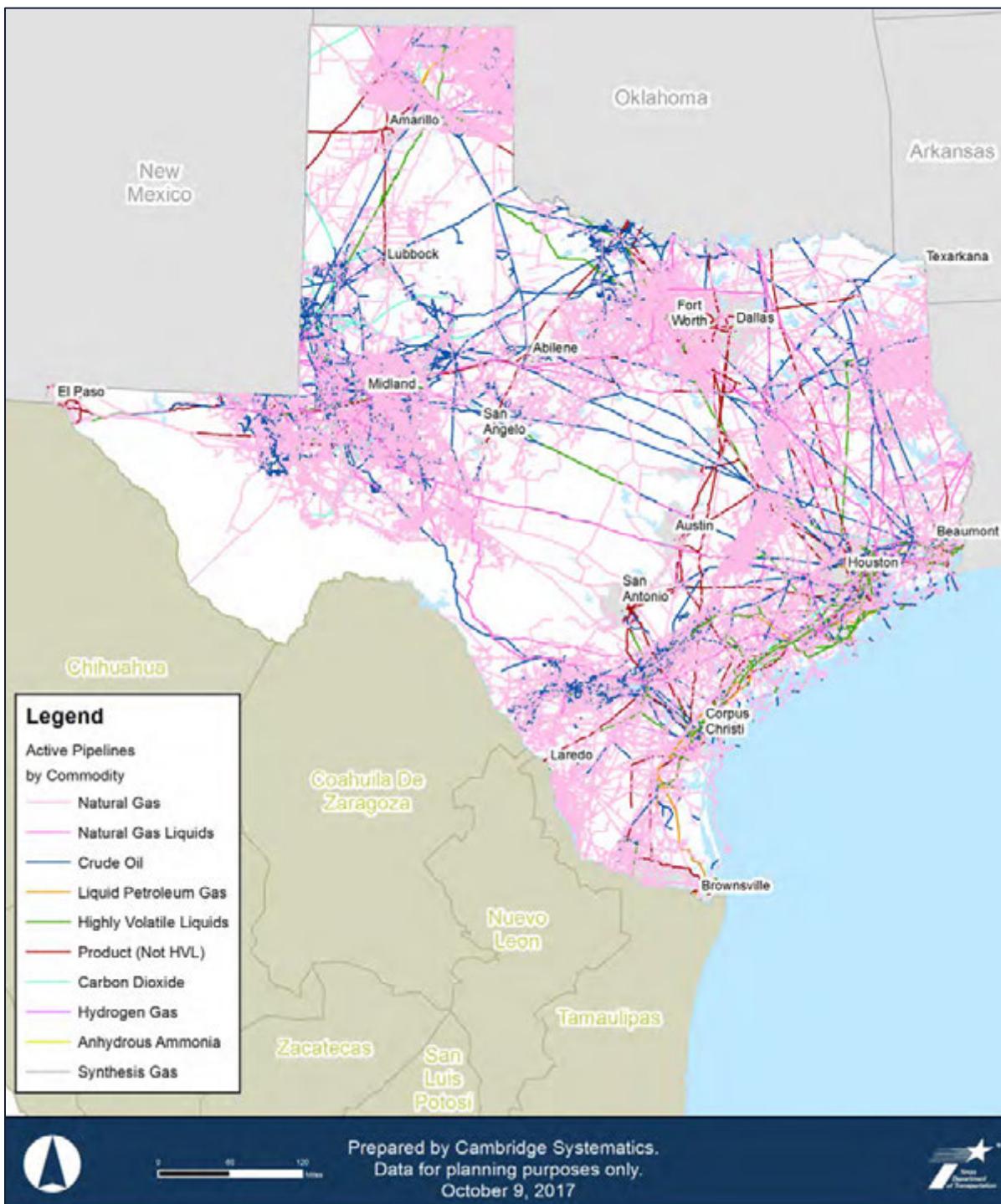
Pipelines are not included in the designation of the Texas Multimodal Freight Network. This infrastructure is extremely expansive and, due to the sensitive nature of transport, does not lend itself to the standard evaluation of critical elements. However, based on the high economic impact of the oil and gas industry on the state of Texas, pipelines should not be excluded from an inventory of Texas' freight asset discussion.

There are 448,446 miles of pipelines operated by more than 1,280 companies in Texas that moved natural gas, crude oil, chemicals and petroleum products to locations within the state and the rest of the U.S.¹⁵⁴ (**Exhibit 7-32**). Pipeline commodity movements comprise three commodity groups: crude petroleum or natural gas, petroleum or coal products and refined chemicals or allied products.

¹⁵³ Air Cargo News. Retrieved August 2014 from <http://www.aircargonews.net/news/single-view/news/what-boeing-got-right.html>.

¹⁵⁴ Railroad Commission of Texas, Data Updated 08/23/2017.

Exhibit 7-32: Texas Pipelines, 2017



Source: The Railroad Commission of Texas, 2017.

There are over 67,350 miles of transmission pipelines, those with a diameter of 15 inches or greater, with the remainder of the system miles made up of gathering and distribution pipelines.¹⁵⁵ Transmission pipelines are critical for moving large volumes of commodities over long distances between the gathering systems and distribution systems. This extensive pipeline network connects to other modes of transportation at 171 terminals. Most of these terminals are multimodal. One-hundred and fourteen multimodal terminals connect to roadways at truck/pipeline terminals where these products are transferred from the pipelines to trucks for further transport on the highway network. Twenty-nine intermodal terminals have truck, rail and pipeline access. Sixteen have pipeline, truck, rail and barge access, and twelve terminals have pipeline, truck, rail, barge and ship access.¹⁵⁶

International Border-Crossing Pipeline Freight

Fifteen pipelines cross the Texas-Mexico border. They are located at Brownsville, Alamo City, Rio Bravo, Laredo, Hidalgo, Penitas (two pipelines), Rio Grande, Roma, Eagle Pass, Del Rio, Clint and El Paso (three pipelines). Of these fifteen pipelines, four move refined products and eleven move natural gas. The natural gas pipelines have a capacity to transport 4,438 million cubic feet per day.¹⁵⁷ In 2016, \$3.25 billion of mineral fuels, mineral oils and products of their distillates, oils and waxes were exported from Texas to Mexico via pipelines.¹⁵⁸ Key pipeline mobility challenges are aging and insufficient infrastructure, lack of coordination among the various agencies and cross-border administrative issues which delay the movement of energy commodities. The administrative challenges experienced in the past should improve due to Mexico adopting large scale reforms in the energy sector. These reforms include the end of Mexican Petroleum's (PEMEX) monopoly of the oil and gas industry. This may allow U.S. based companies to develop mid and downstream activities including transportation, pipelines and storage.¹⁵⁹

7.5.2 Condition

In 2014, oil and gas production was at a 30-year high. The plays in the Barnett Shale Formation, Eagle Ford Shale and Permian Basin regions have led to enormous pipeline growth in several areas of Texas. The continued success of this sector will be reliant on investment in pipeline infrastructure. Between 2014 and August 2017, more than 22,000 miles of new pipeline have been built, almost all to enhance transportation within the state.

¹⁵⁵ Ibid.

¹⁵⁶ TankTerminals.com, February 2017 Data.

¹⁵⁷ U.S. Energy Information Administration, 2017 Data.

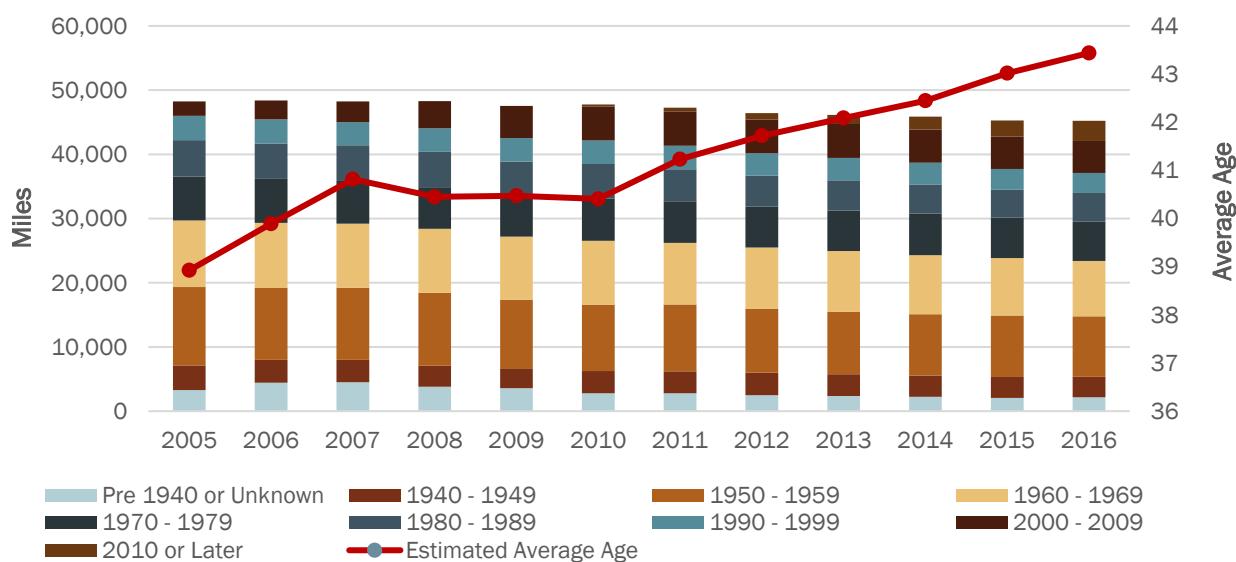
¹⁵⁸ U.S. Bureau of Transportation Statistics, 2016, North American Transborder Freight Data, Texas Exports.

¹⁵⁹ Export.gov - MexicoOpportunities_2.

As a result, Texas has the largest oil and natural gas pipeline system in the country with about 450,000 miles.¹⁶⁰

To assess the condition and potential risk of incidents of this large pipeline network, age and material are the two most important factors. As shown in **Exhibit 7-33**, the mileage of natural gas transmission pipeline is slowly decreasing as old pipelines retire. However, the overall trend for the age is heading towards a higher average age.

Exhibit 7-33: *Age and Miles of Natural Gas Transmission Pipeline in Texas by Installation Decades*

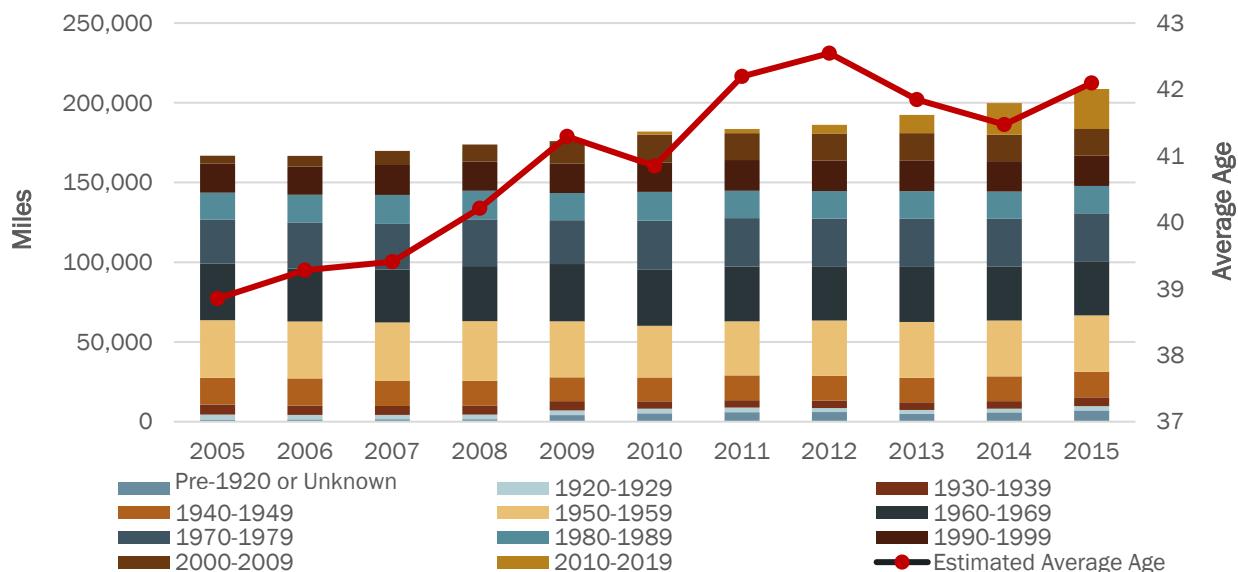


Source: Pipeline and Hazardous Materials Safety Administration.

On the other hand, the mileage of hazardous liquid pipeline is increasing, as evident in **Exhibit 7-34**. Overall the average age of hazardous liquid pipelines in Texas has decreased since 2012, due in part to the *Pipeline Safety, Regulatory Certainty and Job Creation Act of 2011* and the boom in the oil and gas industry from 2010 to 2015, which increased investment in Texas pipelines. However, that trend toward a lower average age began to reverse in 2015, even as the proportion of pipelines constructed since 2010 continued to grow. This increase in the average age in 2015 may be a consequence of a data adjustment, as the total miles of pre-1920 or unknown year also increased over previous years.

¹⁶⁰ Railroad Commission of Texas. Texas Pipeline System Mileage. Retrieved July 2014 from <http://www.rrc.state.tx.us/pipeline-safety/reports/texas-pipeline-system-mileage/>.

Exhibit 7-34: Age and Miles of Hazardous Liquid Pipeline in Texas by Installation Decades



Source: Pipeline and Hazardous Materials Safety Administration.

Pipelines may be built with a variety of materials including cast or wrought iron, bare steel and plastic. With increased federal and state safety initiatives and pipeline operators' replacement efforts, the number of cast or wrought iron pipelines has declined significantly in recent years. (Iron pipelines are typically replaced by plastic or steel pipelines.) In 2016 the length of main iron pipelines has decreased to 612 miles. This effort is supported by the fact that the number of pipeline service lines made of iron has remained at zero since 2012.

Uncoated steel natural gas and hazardous liquids pipelines are also known as bare steel pipelines. While many of these pipelines have been taken out of service, some of them continue to operate today. The typical age and the lack of a protective outer coating put them at a higher risk of incidents due to deterioration. Since 2008, significant efforts have been put into reducing the number of pipelines made of bare steel.

7.5.3 Performance

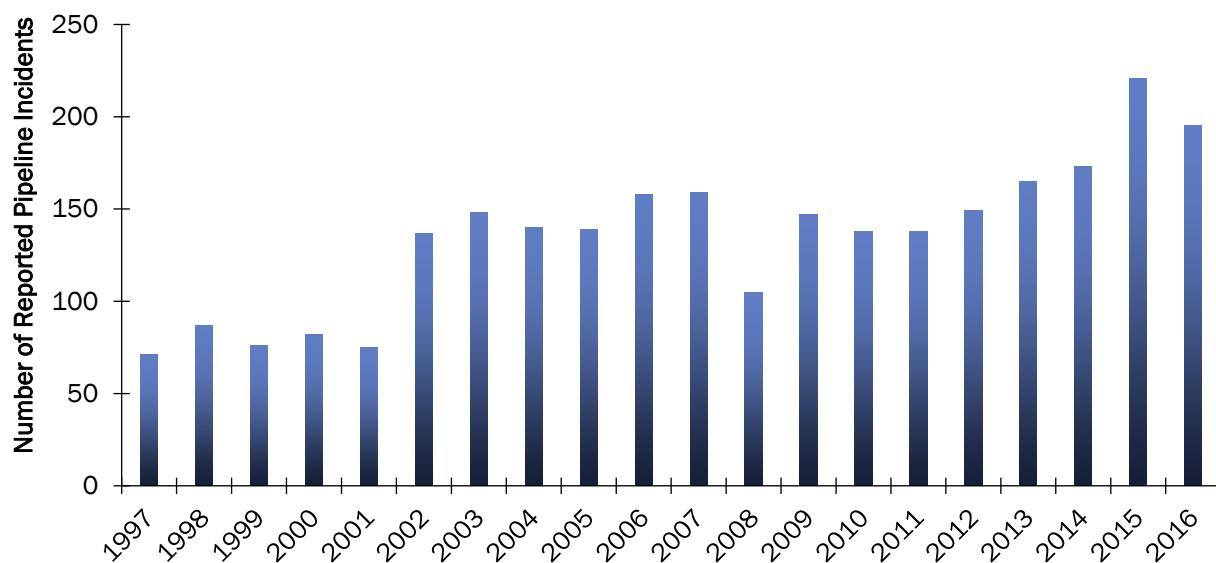
Pipelines in Texas are operated at or near their capacities to meet the growing demand for transporting crude oil, natural gas, refined petroleum products and other commodities. Of these products, natural gas accounts for nearly 100 percent of the 22 quadrillion standard cubic feet of gas transported in Texas pipelines. Hazardous liquid movements are more varied with crude oil accounting for 48 percent of the 6 trillion barrel-miles, refined petroleum products with a 31 percent share and HVL with a 19 percent share. The scale and speed with which tight-shale oil development has occurred, combined with growth from the Canadian Oil Sands, has made it challenging for many pipeline companies to adequately respond to quick growth. Improvements to the privately owned pipeline infrastructure are

critical to the performance of the Texas Multimodal Freight Network as the role of pipelines grows. A number of privately owned pipelines are either coming online, under construction, or in the first stages of development.¹⁶¹

7.5.4 Safety

While pipelines are considered the safest method for transporting energy products, pipeline incidents can present significant risks to the public and the environment. The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) is responsible for documenting and investigating pipeline incidents. **Exhibit 7-35** shows the total number of reported pipeline incidents from 1997 to 2016. The number has slightly increased since 2011. Pipeline incidents which resulted in injuries and fatalities are variable from year to year.

Exhibit 7-35: Texas Pipeline Incidents, 1997 to 2016



Source: Pipeline and Hazardous Materials Safety Administration.

7.6 Performance Measures

The condition and performance of the Texas Multimodal Transportation Network and other freight assets provide a critical understanding of how the network functions today, how it compares to prior conditions and how it may be expected to operate in the future. Examining these attributes on a routine basis allows TxDOT to determine how effective improvements, or lack thereof in some places, impact performance. Establishing a meaningful performance monitoring process is pivotal to maintaining a world class transportation system.

¹⁶¹ Railroad Commission of Texas. New Pipeline Construction Reports. Retrieved October 26, 2017 from <http://www.rrc.state.tx.us/pipeline-safety/permitting/new-construction-reports/>

Transportation performance measures provide a framework to assess how a transportation system and/or a transportation agency is functioning and operating. Performance management of the nation's transportation network was a key provision of the Moving Ahead for Progress in the 21st Century Act (MAP-21). Goal areas identified through MAP-21 include: Safety, Infrastructure Condition, Congestion Reduction, System Reliability, Freight Movement and Economic Vitality, Environmental Sustainability and Reduced Project Delivery Delays. The final measure as it relates directly to freight performance management is shown in **Exhibit 7-36**. For this measure, State DOTs must establish two and four year targets in May 2018 to be reported in the State's baseline performance period report. DOTs will have the option to adjust four year targets in their mid-performance period progress report in October 2020.¹⁶²

Exhibit 7-36: *Summary of Final Freight Measures in the Third Federal Performance Measure Final Rule*

Performance Measures	Measure/Target Applicability	Metric Data Source & Collection Frequency	Metric
Truck Travel Time Reliability (TTTR) Index	Mainline of the Interstate System within a State or each metropolitan area	Truck data in National Performance Measure Research Data Set or equivalent data set – every 15 minutes	Truck Travel Time Reliability index

Source: Federal Register document number 2017-00681. <https://www.federalregister.gov/documents/2017/01/18/2017-00681/national-performance-management-measures-assessing-performance-of-the-national-highway-system>.

As these performance measures were only recently put into effect, TxDOT took steps to begin incorporating some aspects of the anticipated requirements. Specifically, TxDOT determined the results for Truck Hours of Delay¹⁶³ on the interstate system and the Truck Reliability Index.¹⁶⁴ These results, shown in **Exhibits 7-37 and 7-38** display the targets and results for 2014 as well as the targets for 2018 (the end of the then-current Statewide Transportation Improvement Plan) and 2025 (the end of the then-next Unified Transportation Program). In general, these graphics indicate increases and less reliable conditions across both measures for urban, rural and statewide roadway systems, thus a lower than expected desired outcome. For instance, in the case of annual hours of truck

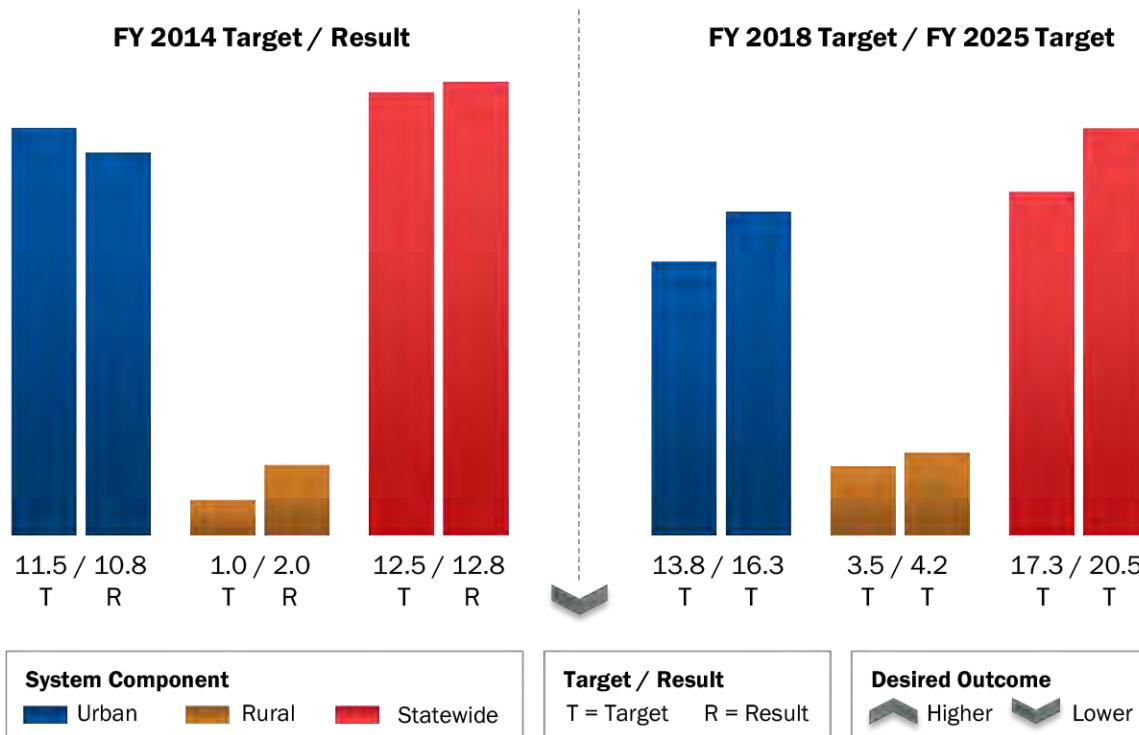
¹⁶² Federal Highway Administration. Freight Fact Sheet. Retrieved October 26, 2017 from <https://www.fhwa.dot.gov/tpm/rule/pm3/freight.pdf>.

¹⁶³ Truck Hours of Delay is defined as the time it takes to travel a given roadway minus how long it would take at the posted speed limit if there were no interference or congestion.

¹⁶⁴ Truck Reliability Index is defined as the ratio of the 80th percentile travel time to the free-flow travel time.

delay, rural roadways expected 2 million hours of delay when a target of 1 million was established. An exception is the Statewide Truck Reliability Index which was 0.1 lower than the 2014 target and urban roadways which were below the target set for 2014.¹⁶⁵

Exhibit 7-37: Annual Hours of Truck Delay – Interstates (Millions), 2014

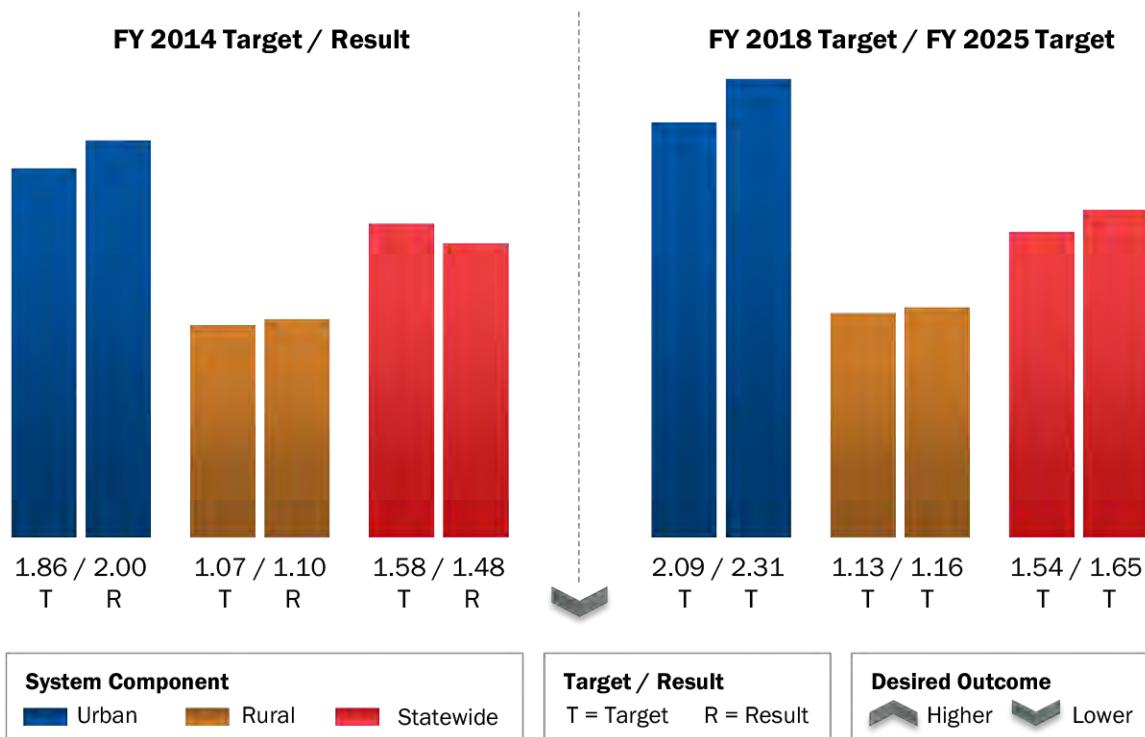


Source: Texas Department of Transportation.

¹⁶⁵ Texas Department of Transportation, Preliminary MAP-21 Texas Transportation System Performance Results: Freight.

<http://www.txdot.gov/government/legislative/federal-affairs/preliminary-performance/freight.html>.

Exhibit 7-38: Truck Reliability Index, 2014



Source: Texas Department of Transportation.

While FHWA requires the monitoring of truck travel time reliability, additional targeted performance measures established during the Texas Freight Mobility Plan's development support the identification of deficiencies on the Texas Multimodal Freight Network and provide TxDOT with a framework to conduct performance-based planning and to monitor freight system performance. Performance measures will enable TxDOT to track trends, focus on problem areas and improve public communication and education related to freight.

The performance measures serve three key functions:

- Plan Development:** Provide a method to quantify baseline system performance and the impacts of the TFMP's options to support trade-off decisions and to communicate the anticipated impacts of different investment strategies.
- Plan Implementation:** Support the implementation of the TFMP by emphasizing agency goals/objectives and integrating those into budgeting, program structure, project selection and project/program implementation policies.
- Accountability:** Facilitate tracking and reporting on system performance relative to the goals and objectives of the TFMP to support accountability for implementation and results.

The identified performance measures outlined in **Exhibits 7-39 through 7-47** are based on stakeholder input gathered from the workshops conducted as part of the 2017 TFMP and best practices from around the U.S. They are closely integrated with the Freight Plan's goals and objectives to monitor system performance and implementation progress.

Exhibit 7-39: Safety Performance Measures

Safety Performance Measures
<ul style="list-style-type: none"> ▪ Truck-related crashes per truck-miles traveled on the Texas Highway Freight Network ▪ Percent of all fatal motor vehicle crashes involving trucks on the Texas Highway Freight Network ▪ Number of rail-related crashes ▪ Number of at-grade highway/rail crossing closures or grade separations ▪ Truck-related fatalities per truck-miles traveled on the Texas Highway Freight Network ▪ Number of injuries and fatalities from rail-related crashes ▪ Number of crashes at at-grade highway/rail crossings

Exhibit 7-40: Asset Preservation and Utilization Performance Measures

Asset Preservation and Utilization Performance Measures
<ul style="list-style-type: none"> ▪ Percent of pavement lane-miles in good repair on the Texas Highway Freight Network ▪ Number of load restricted bridges on the Texas Highway Freight Network ▪ Percent of bridges with vertical clearance less than 16.5 feet on the Texas Highway Freight Network ▪ Percent of bridges in poor condition on the Texas Highway Freight Network

Exhibit 7-41: Multimodal Connectivity Performance Measures

Multimodal Connectivity Performance Measures
<ul style="list-style-type: none"> ▪ Number of airport cargo-access issues addressed ▪ Number of port-access issues addressed ▪ Volume of international cross-border freight moved by rail ▪ Percent of intermodal connectors in fair or better pavement condition

Exhibit 7-42: Mobility and Reliability Performance Measures

Mobility and Reliability Performance Measures
<ul style="list-style-type: none"> ▪ Annual hours of truck delay on the Texas Highway Freight Network ▪ Number of projects addressing freight bottlenecks on the Texas Highway Freight Network annually ▪ Reduction in average wait times at international commercial border crossings ▪ Truck Travel Time Reliability index on the Texas Highway Freight Network ▪ Percent of lane-miles at a level-of-service D or higher on the Texas Highway Freight Network ▪ Incident clearance time on the Texas Highway Freight Network

Exhibit 7-43: Customer Service Performance Measures

Customer Service Performance Measures
<ul style="list-style-type: none"> ▪ Completion of annual freight project prioritization ▪ Number of workshops/meetings held with non-TxDOT agencies responsible for freight system investment ▪ Completion of annual update of educational materials related to freight by TxDOT ▪ Percent completion of annual meetings with each TxDOT district and department

Exhibit 7-44: Stewardship Performance Measures

Stewardship Performance Measures
<ul style="list-style-type: none"> ▪ Percent of design projects on the Texas Highway Freight Network delivered on time and within budget ▪ Percent of construction projects completed on the Texas Highway Freight Network delivered on time and within budget

Exhibit 7-45: Sustainable Funding Performance Measures

Sustainable Funding Performance Measures	
<ul style="list-style-type: none"> ▪ Amount of net new funding made available for freight projects ▪ Percent of annual state and federal revenue projections met ▪ Number of public private partnerships for freight investments 	<ul style="list-style-type: none"> ▪ Percent of transportation budget invested on the Texas Multimodal Freight Network annually ▪ Percent of freight funding spent

Exhibit 7-46: Economic Competitiveness Performance Measures

Economic Competitiveness Performance Measures	
<ul style="list-style-type: none"> ▪ Percent growth in freight export value ▪ Percent of national employment in strategic freight supply chain industries 	<ul style="list-style-type: none"> ▪ Percent of GSP in strategic freight supply chain industries

Exhibit 7-47: Technology Performance Measures

Technology Performance Measures	
<ul style="list-style-type: none"> ▪ Number of dynamic messaging signs – hard wired/permanent and temporary ▪ Percent of weigh stations on Texas Highway Freight Network with Weigh in Motion (WIM) 	<ul style="list-style-type: none"> ▪ Percent of Texas Highway Freight Network covered by ITS technologies

7.7 Summary

This chapter provided an overview of the conditions of freight assets in Texas. All elements of the Texas Multimodal Freight Network developed in **Chapter 6** were analyzed to understand their current condition, level of traffic or congestion, safety concerns, and other performance measures. Understanding the condition and performance of Texas' freight transportation assets helps identify needs and issues on the Texas Multimodal Freight Network. Highlighting the strengths and problems of the freight system aids in developing recommendations for improvement. This information also provides a baseline for tracking progress toward meeting TxDOT's strategic goals. Strategies to address needs on and improve the condition and performance of the Texas Multimodal Freight Network, to ensure

that the state's infrastructure supports current and future freight demands and continues to support the state's economic goals, are discussed in **Chapters 11-14**.



Texas Freight Mobility Plan

Chapter 8: Freight Demand and Forecasts



Efficient movement of goods in Texas is dependent on an integrated and constantly improving freight system that keeps up with growing demand from businesses and consumers. TxDOT uses current and forecasted data on population, employment and freight movements to understand the present and future challenges to safe, efficient freight movement. The purpose of this chapter is to characterize existing freight flows and predict how these may change by 2045. This information will be used along with other factors to plan and prioritize projects, programs and policies that will enhance freight mobility and support Texas' continued economic growth and competitiveness.

8.1 The Big Picture

Freight forecasts are estimates based on the best available data and present a glimpse of how the freight system may operate in the future in conjunction with population and employment growth in Texas. The forecasts do not take into account future infrastructure improvements and trends that may alter these forecast estimates. They also do not project the effects of modal competition. Any shifts in modal share are simply the result of different growth rates in the commodities handled by each of the modes as the forecasts assume that commodities will move the same way in 2045 that they currently move.

8.1.1 Drivers of Freight Demand

Freight is demand driven and is closely tied to population and employment and access to homes and businesses is important for mobility and economic prosperity for shippers and carriers.

Population and Employment Forecast

Population growth is an important contributor to freight growth because residents consume commodities that must be transported from throughout the state and beyond. Goods purchased in stores, building materials, energy sources and other commodities are all in demand by the state's residents and visitors. The statewide travel-demand model, which uses population estimates from the Texas Demographic Center, estimates the 2016 population of Texas at approximately 28 million people in the state's 254 counties. Almost half of the state's population lived in the five most populous counties in 2016 — those containing the cities of Austin, Dallas, Fort Worth, Houston and San Antonio — and the 24 largest counties held three-quarters of the population. By 2045, the population is expected to grow by 40 percent to nearly 39 million. Texas' population is expected to further concentrate in urbanized areas and existing population centers; by 2045, three-quarters of the population will live in the 19 largest counties. The highest growth in population is projected in the following areas:

- Urbanized areas in the Texas Triangle with Bexar, Collin, Dallas, Harris and Tarrant counties growing by at least one million people each.
- Border counties, with Cameron, El Paso, Hidalgo and Webb counties growing by a combined 1.7 million.

While changes in population can help predict the amount of freight demanded in the state, changes in employment can indicate changes to both supply and demand for freight. Some industries influence the amount of freight generated in the state with intrastate, domestic and foreign destinations, and all establishments require resources and supplies to conduct their business. In 2016, there were an estimated 10 million employees in the state of Texas. While nearly half of the population was located in the state's five largest counties, more than

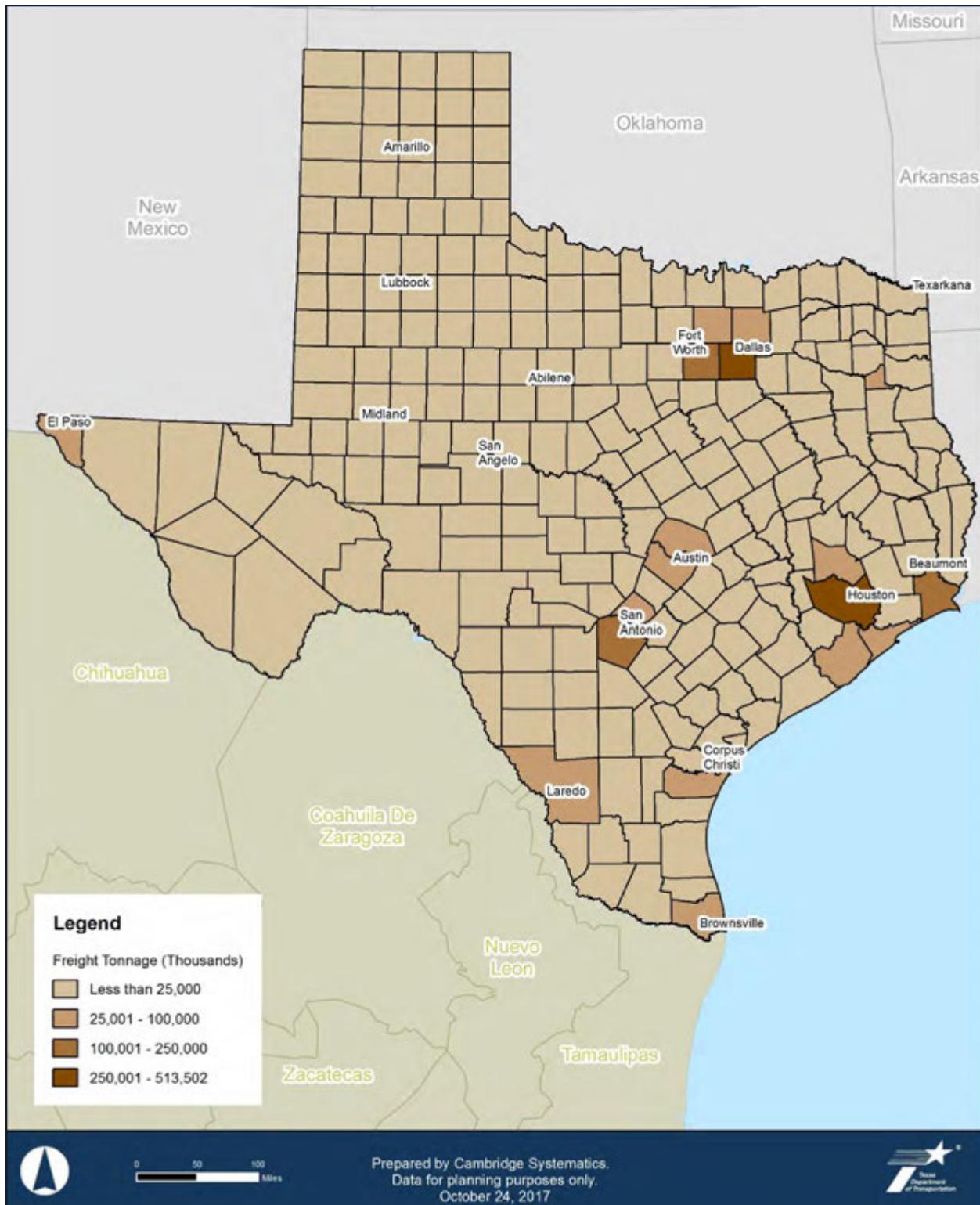
half its employment was located in the same five. Statewide employment is expected to grow by 72 percent to 17 million by 2045. As with population, growth is expected to further concentrate in the most populous regions. In 2045, three-quarters of jobs are projected to be located in the 15 largest of the state's 254 counties, compared to the 17 largest counties in 2016.

Change in Freight Tonnage

Exhibit 8-1 shows the projected changes in tonnage originating in or destined for a county between 2016 and 2045 across all modes. Through-traffic on highways and railroads is not displayed in this exhibit. However, the impacts of through-traffic on the Texas Multimodal Freight Network are evaluated by modeling freight flows on the highway and rail networks in **Section 8.2**. Key observations include:

- Counties with the largest projected growth in freight tonnage are often those with the highest projected population and employment growth, particularly in the Texas Triangle and along the border.
- Port counties, including those containing the Ports of Corpus Christi and Beaumont, are projected to have large freight tonnage growth compared to their population or employment growth.
- Many counties in the western side of the state are forecasted to experience freight growth despite modest changes in population and employment.

Exhibit 8-1: *Change in Freight Tonnage with Origin or Destination in County, 2016 to 2045*



Source: TRANSEARCH® and U.S. Army Corps of Engineers data.

8.1.2 Texas Freight Movements

Tonnage across the Texas Multimodal Freight Network for highway, rail, water and air is forecasted to grow from 2.2 billion tons (worth \$2.9 trillion in 2016) to 4.0 billion tons (worth \$7.5 trillion in 2045). This change represents a 79 percent growth in tonnage (2.0 percent annually) and 159 percent growth in value (3.3 percent annually).

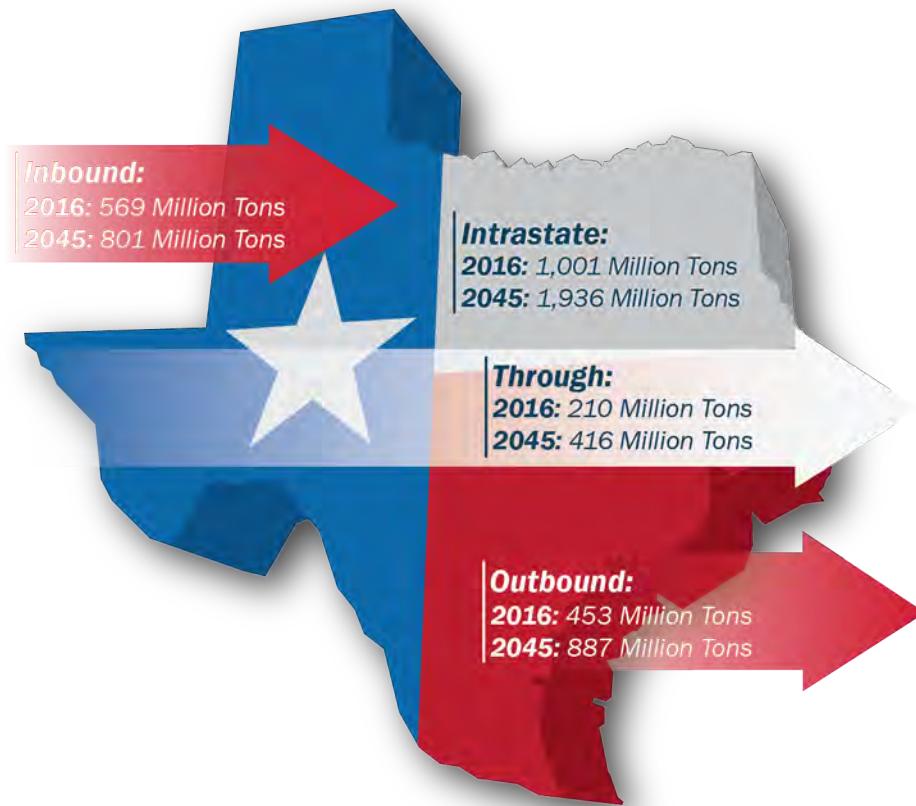
Directional freight movements include freight transported out of, into, within and through the state of Texas and are defined as follows:

- **Outbound.** Freight originating within the state and transported to destinations outside of Texas.
- **Inbound.** Freight originating outside of Texas and transported to destinations within the state.
- **Intrastate.** Freight transported between origins and destinations entirely within Texas.
- **Through.** Freight transported between origins and destinations outside of Texas but passing through the state.

Texas freight forecasts by movement show that intrastate movements on all modes have the largest projected tonnage increase from 1 billion tons in 2016 to 1.9 billion tons in 2045. This growth particularly drives the projected growth in truck freight. Intrastate traffic is also the most dominant movement in Texas, accounting for more than 45 percent of tonnage in 2016. Intrastate trucking forecasts have the largest tonnage growth; it is predicted to increase by 862 million tons, or almost half of the 1.8 billion tons of growth for all flows and surface freight modes. This growth will not occur unless investment is made in the infrastructure and the truck driver shortage issue is addressed. Otherwise, it is likely part of the traffic will divert to rail and other modes.

The largest percentage growth is projected to occur in through traffic. This movement is expected to grow by 98 percent between 2016 and 2045 (from 210 million tons to 416 million tons). Change in tonnage by movement for all directions is shown in **Exhibit 8-2**. Factors contributing to these projections include anticipated population and employment growth, the state's oil and gas development, and the growth of manufacturing and trade with Mexico.

Exhibit 8-2: Texas Total Freight Tons by Direction,
2016 and 2045



Source: TRANSEARCH®, STB Waybill and USACE Data.

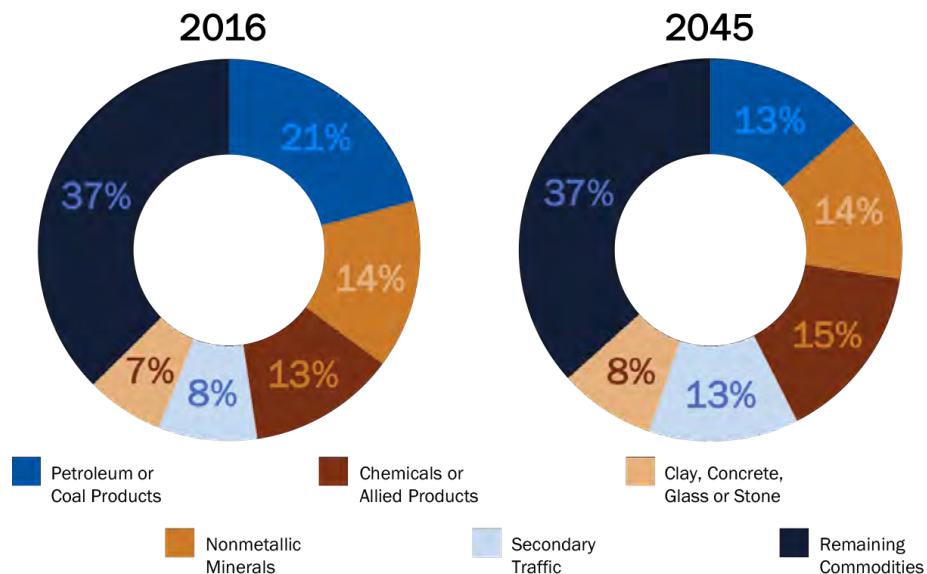
8.1.3 Texas Freight Commodities

The petroleum or coal products¹⁶⁶ commodity group was the top commodity by tonnage in 2016 for highway, rail, water and air, followed by nonmetallic minerals, chemicals or allied products, and secondary traffic,¹⁶⁷ as shown in **Exhibit 8-3**. The projected statewide top commodities in 2045 are evenly distributed at 13 to 15 percent for chemicals or allied products, petroleum or coal products, nonmetallic minerals, and secondary traffic. The share of tonnage in petroleum or coal products is predicted to decrease by 8 percent as other commodities including chemicals or allied products and secondary traffic experience larger growth between 2016 and 2045.

¹⁶⁶ Coal itself is a separate commodity group from Petroleum and Coal Products.

¹⁶⁷ Secondary traffic is mainly last mile or warehousing and distribution delivery shipments.

Exhibit 8-3: All Modes Tonnage Forecast by Commodity, 2016 and 2045



Source: TRANSEARCH®, STB Waybill and USACE Data.

8.2 Forecasts by Mode

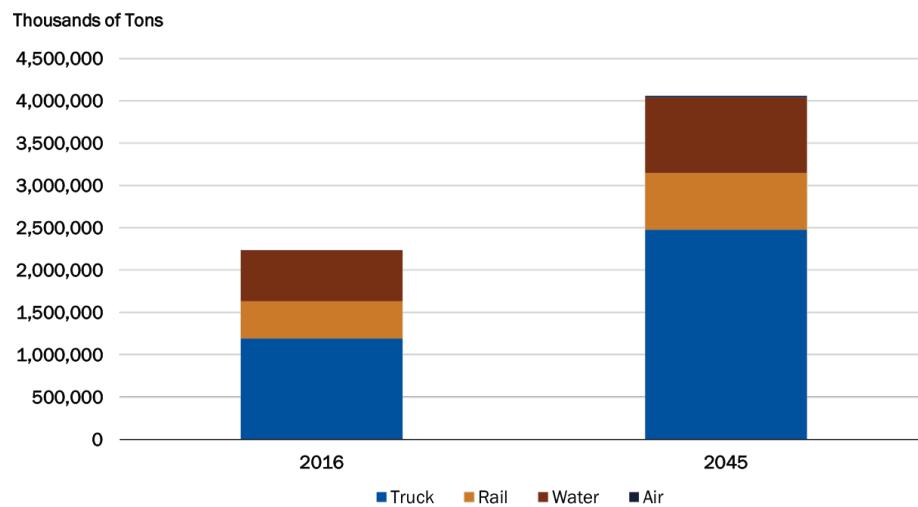
Freight in Texas consists of five major modes: highway, rail, water, air and pipeline. The following section focuses on highway, rail, water and air, while pipeline is covered separately later in this section. The forecasts presented here are based on macroeconomic trends and are the result of many assumptions. Important limitations of these long-term, demand-driven forecasts include:

- These planning-level forecasts are not meant for project-level analysis but rather to examine the overall trend in freight demand.
- The forecasts do not attempt to predict shifts between modes for a given commodity; they assume commodities will move similarly to how they do today.
- Private-sector infrastructure owners, such as railroads or pipelines, develop their own forecasts which may be significantly different from those presented here due to more intimate knowledge of strategic investments and initiatives.
- Infrastructure investments are not taken into consideration, and tonnage predictions are based only on demand for commodities. This can result in modal forecasts that are too high if future investment is insufficient to meet demand, or in forecasts that are too low if future investment significantly increases the ability of a mode to carry freight.
- Emerging trends such as growing exports of liquefied natural gas and the increases in plastics manufacturing may be undercounted by available forecasts.

Further detail on the forecasts are provided below and shown in **Exhibit 8-4** and **Exhibit 8-5**.

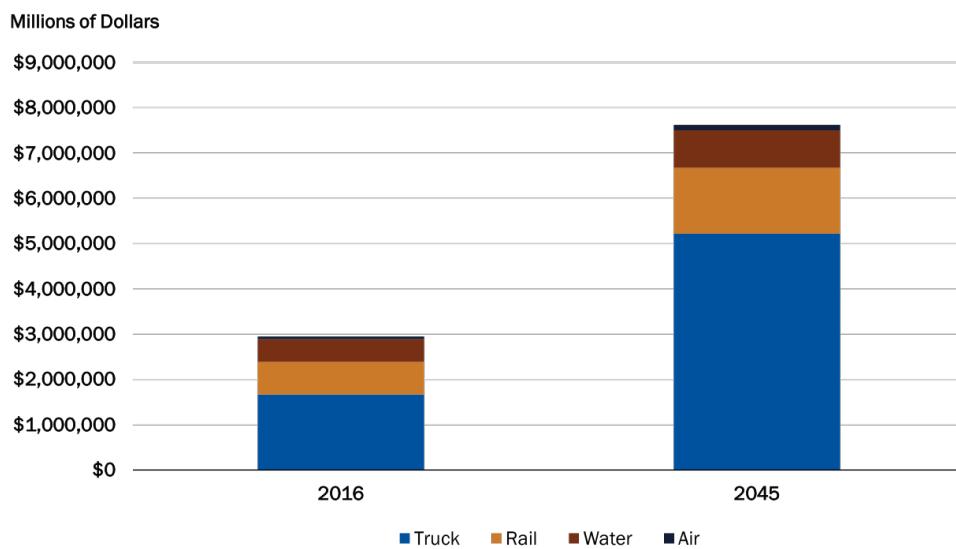
- **Highway.** Highway tonnage is expected to double from 1.2 billion tons in 2016 to 2.5 billion tons in 2045 – an increase of 1.3 billion tons and a projected growth of 108 percent (2.6 percent annually). During this period, value is forecasted to grow by 213 percent from \$1.7 trillion to \$5.2 trillion.
- **Rail.** Rail is expected to increase from 441 million tons in 2016 to 668 million tons by 2045 – a projected increase of 227 million tons and an average annual growth of 1.4 percent. Rail value is projected to increase by 102 percent from \$719 billion in 2016 to \$1.5 trillion in 2045.
- **Water.** Water tonnage is projected to grow from 598 million tons to 889 million tons by 2045 – an increase of 291 million tons and a growth of 49 percent – a projected average annual growth of 1.4 percent. This expected tonnage growth results in a 65 percent increase in value during the same period from \$501 billion to \$828 billion.
- **Air.** Air is estimated to yield the fastest growth, from 1.8 million to 4.2 million tons – an increase of 2.4 million tons between 2016 and 2045. This is a total growth of 129 percent at an average annual growth of 2.9 percent. While the growth rate is the highest of all modes, air carries the least amount of freight at less than 1 percent of all freight. The value of air cargo is forecasted to increase from \$11 billion to \$37 billion – a 225 percent increase.
- **Modal Shifts.** The forecast does not account for modal shifts. The resulting share of tonnage between modes changes because of relative growth rates, with highway tonnage outpacing other modes due particularly to its strength in the intrastate market. However, factors such as increased highway congestion, industry challenges such as truck-driver shortages and the potential for new services from other modes mean the forecast might underestimate growth in non-highway modes as shippers seek alternatives.

Exhibit 8-4: *Forecasted Total Freight Tons by Mode,
2016 and 2045*



Source: TRANSEARCH®, STB Waybill and USACE Data.

Exhibit 8-5: *Forecasted Total Freight Value by Mode,
2016 and 2045*



Source: TRANSEARCH®, STB Waybill and USACE Data.

The projected high growth across all modes is representative of the diversity and strength of the Texas economy. This high growth in freight movements also creates extensive demand for new and improved freight infrastructure and highlights the importance of aligning investment in the freight transportation system with this projected growth. The following sections describe forecasts for each mode.

8.2.1 Highways

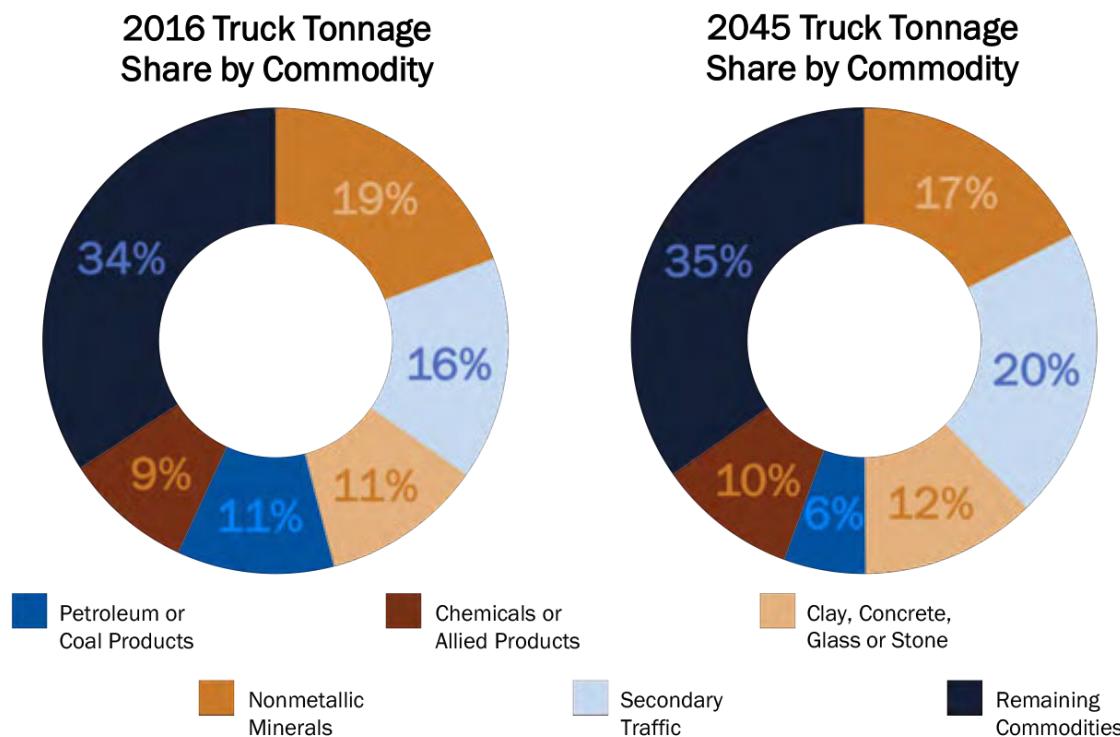
This section discusses highway forecasts by commodity and direction and presents the results of modeling movements on the Texas Highway Freight Network. Truck tonnage is forecasted to increase from 1.19 billion tons in 2016 to 2.48 billion tons in 2045, a cumulative increase of 108 percent. This increase is expected to result in a near fifty percent increase of truck trips on Texas roadways. In 2016, an estimated 745,800 daily truck trips occurred on Texas roadways, and this is projected to increase to 1,117,600 daily truck trips in 2045.

Commodities Moved by Truck

Exhibit 8-6 compares major commodity tonnage movements by truck in 2016 and 2045.

- **Total Tonnage.** Major commodities transported by truck in 2045 are projected to include secondary or warehouse and distribution traffic; nonmetallic minerals; and clay, concrete, glass or stone.
- **Tonnage Growth.** Of the top 10 commodities transported by truck, electrical equipment, waste or scrap materials, and secondary traffic are projected to have the highest tonnage growth rates between 2016 and 2045.

Exhibit 8-6: *Truck Tonnage Forecast by Commodity, 2016 and 2045*

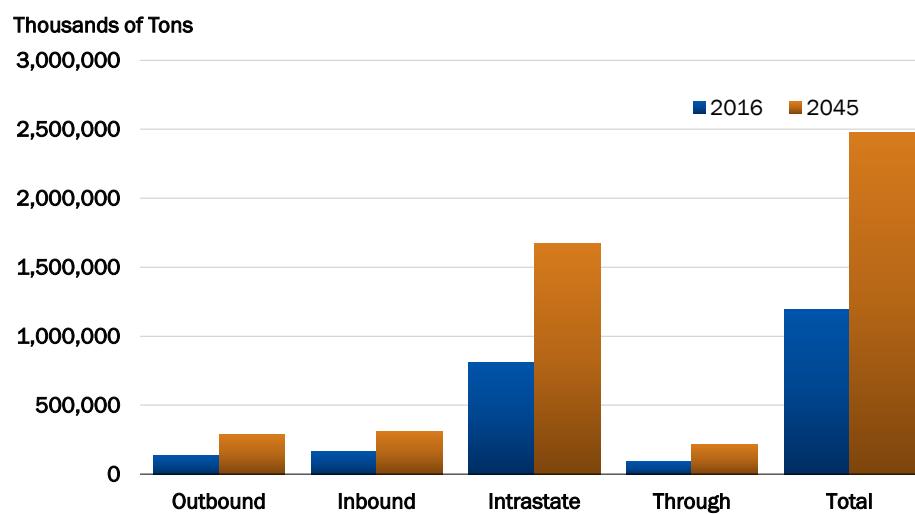


Source: TRANSEARCH® Data.

Freight Movements by Truck

Exhibit 8-7 shows the directional composition of truck movements in Texas for 2016 and 2045. Shares of truck tonnage by movement are predicted to be relatively constant in the future, with intrastate movements as the dominant movement. Through movements are forecasted to maintain the smallest share of total highway freight, but this direction is forecasted to have the highest percentage growth, partially due to the fact that it is a small value to begin with.

Exhibit 8-7: *Texas Truck Freight Forecast by Direction, 2016 and 2045*



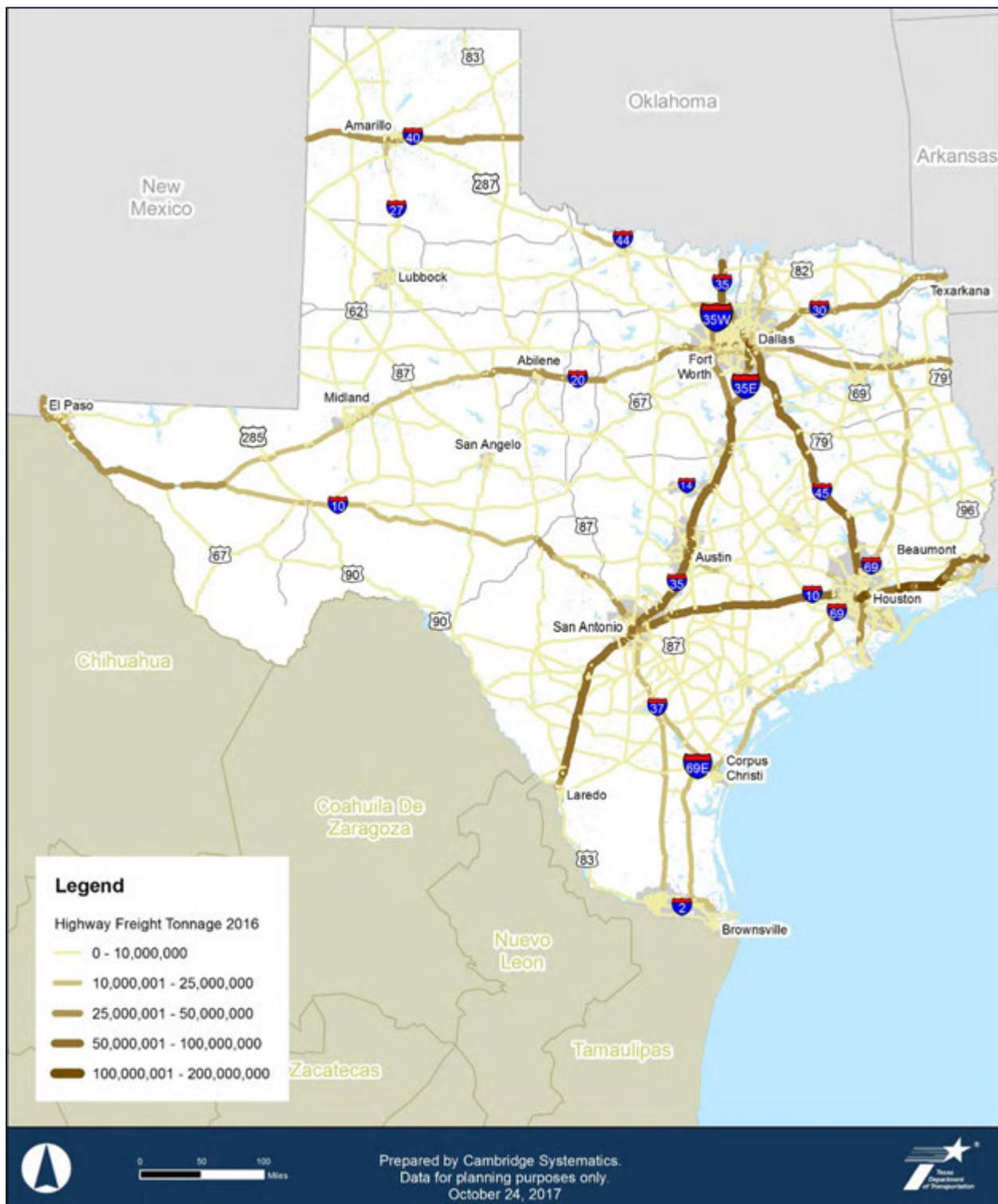
Source: TRANSEARCH® data.

Modeling Growth on the Texas Highway Freight Network

Estimated and forecasted freight flows were modeled using the Texas Statewide Analysis Model to determine how future freight movements will impact the Texas Highway Freight Network. In 2016, the roadways carrying the most freight tonnage were in the eastern half of the state on I-10 between San Antonio and Louisiana, I-35 from Laredo to Dallas/Fort Worth, and I-45 from Houston to Dallas/Fort Worth, as shown in **Exhibit 8-8**. The corridors are near population centers and connect border crossings and ports to markets within and outside of the state. Interstates throughout the state also carried a significant amount of freight.

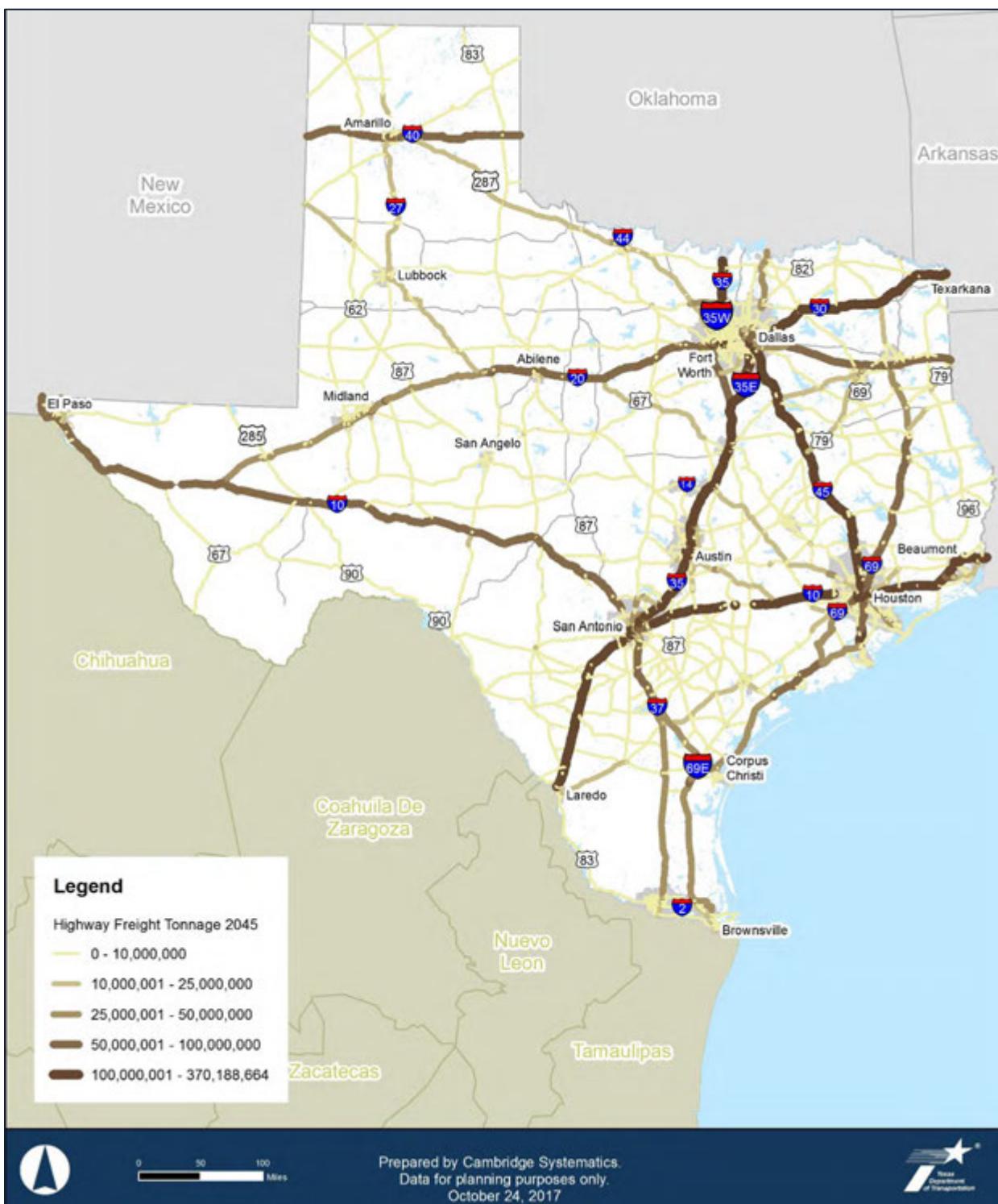
By 2045, corridors throughout the state are expected to carry more freight. **Exhibit 8-9** shows the projected tonnage flows in 2045. I-10, I-35 and I-45 in the eastern section of the state are expected to continue to carry the most tonnage. I-10 from El Paso to San Antonio and I-40 from New Mexico to Oklahoma, both through or cross-state routes, are forecasted to grow and to carry more than 50 million tons annually. The I-69 corridor connecting ports to inland markets is also forecasted to grow.

Exhibit 8-8: Texas Highway Freight Tonnage, 2016



Source: TRANSEARCH® data and Texas Statewide Analysis Model Version 3 analysis.

Exhibit 8-9: Forecasted Texas Highway Freight Tonnage, 2045



Source: TRANSEARCH® data and Texas Statewide Analysis Model Version 3 analysis.

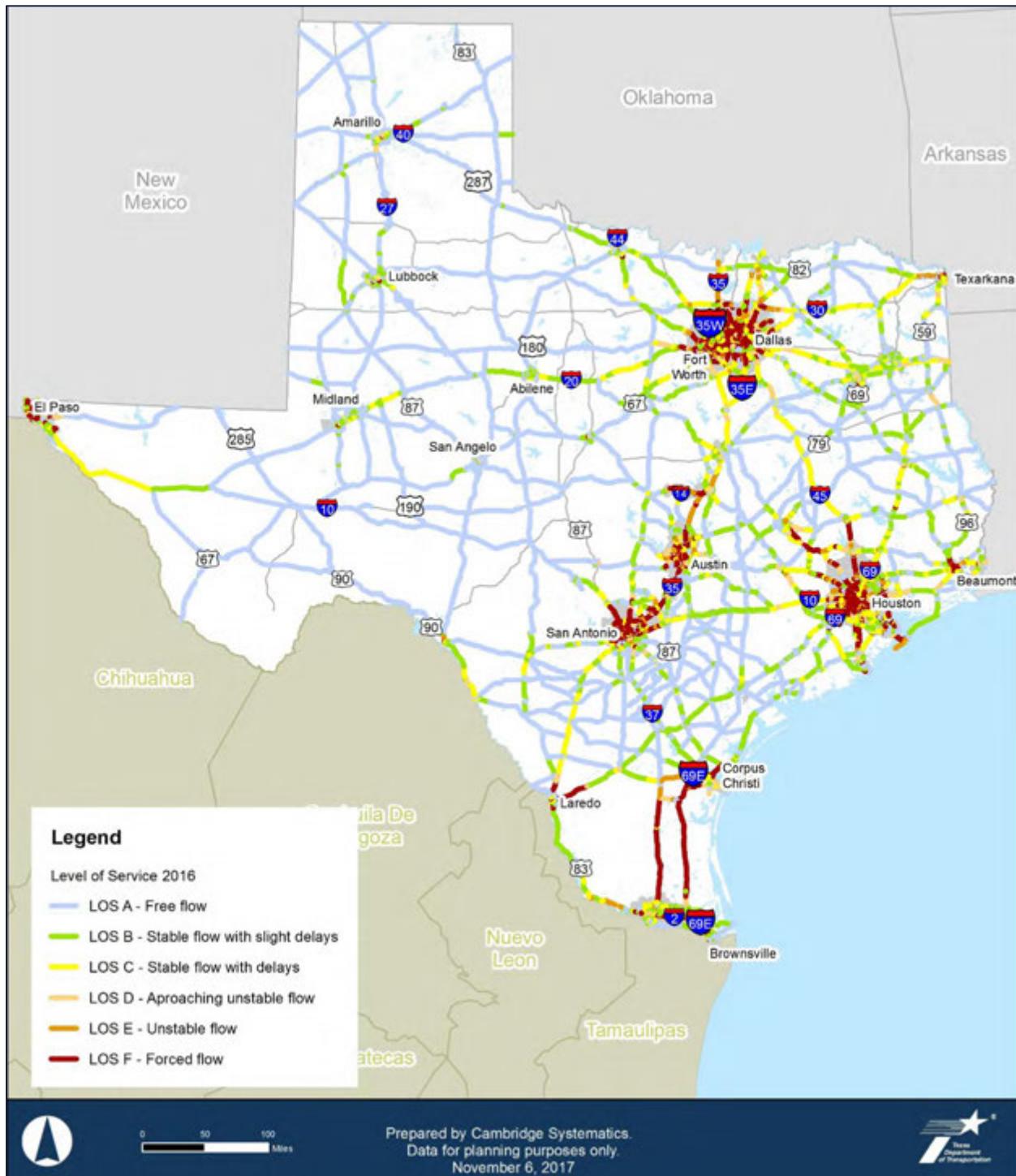
Increased freight tonnage on the Texas Highway Freight Network means more truck travel on Texas roadways, which can result in increased congestion if capacity and operational improvements are insufficient to keep up with demand. Level-of-service, used here as the ratio of volume to capacity, is one measure of congestion on the roadway network. A detailed corridor-level assessment of the Texas Highway Freight Network indicates that 16 percent of the centerline miles had periodic congestion or worse in 2016, as shown in **Exhibit 8-10**, and 31 percent of the centerline miles will have at least periodic congestion by 2045, as shown in **Exhibit 8-11**. This indicates that additional lane miles and traffic management solutions are necessary to maintain adequate conditions in 2045.

Major highway corridor sections predicted to have significant congestion in 2045 include:

- I-10 from I-20 to El Paso.
- I-10 from Houston to San Antonio.
- I-20 from Odessa to Big Spring.
- I-35 from Dallas-Fort Worth to Laredo.
- I-45 from Dallas-Fort Worth to Galveston.
- US 59 (future I-69) from I-20 to Houston.

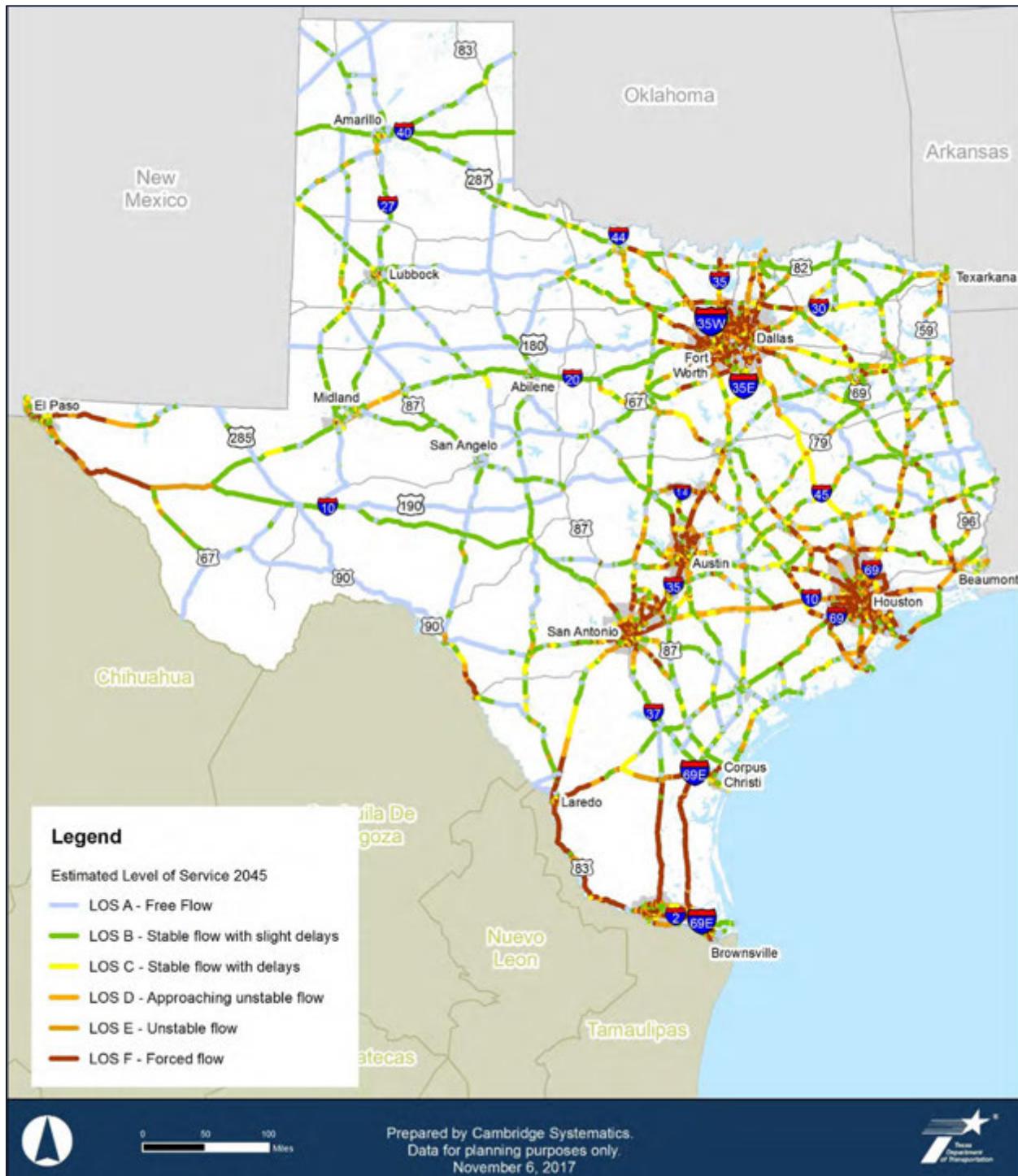
TxDOT will continue pursuing innovative programs, policies, and projects to help prepare for the large increase in highway freight. As discussed in **Chapters 12 and 13**, to help mitigate existing conditions as well as prepare for future growth, TxDOT has implemented the Texas Clear Lanes program, targeting congestion and freight bottlenecks in the large metro areas of Austin, Dallas, Fort Worth, Houston and San Antonio. Texas is also working to implement a new vertical clearance minimum on the Texas Highway Freight Network, as recommended in the 2016 Texas Freight Mobility Plan, which will help prepare the state for forecasted tonnage and potential growth in size of shipments. Specific projects to address current and future congestion are discussed in **Chapters 12 and 13** and listed individually in **Appendices B and C**. Specifically, **Exhibits 13-11 to 13-13** display projects in the 5-Year Freight Investment Plan that address the most congested highway segments and most impactful freight bottlenecks. These programs, policies and projects will increase capacity and advance technology solutions on key freight corridors with the ultimate result of improving safety and freight flow on Texas' highways.

Exhibit 8-10: Texas Highway Freight Network Level-of-Service Map, 2016



Source: TRANSEARCH® and Texas Statewide Analysis Model Version 3 analysis.

Exhibit 8-11: Forecasted Texas Highway Freight Network Level-of-Service Map, 2045



Source: TRANSEARCH® and Texas Statewide Analysis Model Version 3 analysis.

8.2.2 Rail

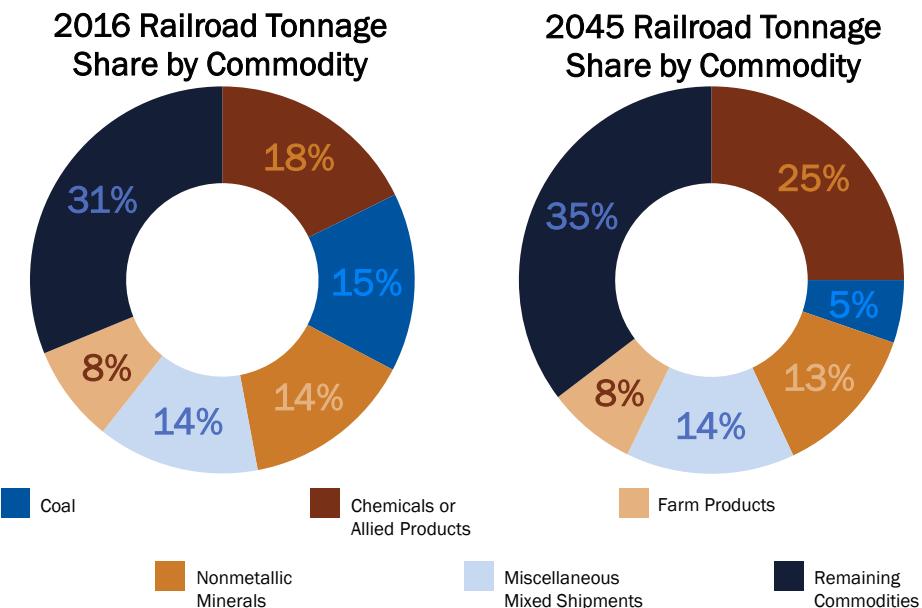
Railroads are primarily private companies, and they develop internal forecasts based on data not available to outside forecasters. The forecast presented here is intended to be used by TxDOT for planning purposes only, and it is not meant for comparison to the internal forecast of individual railroads. They represent aggregate forecasts of the demand for rail in Texas based on current shipping patterns. In 2016, 441 million tons of freight moved by rail in Texas. Rail tonnage statewide is estimated to increase to 668 million tons in 2045. The STB Confidential Waybill data was used for this analysis. Only railroads carrying 4,500 or more revenue cars annually are required to report to the STB. Therefore, most shortlines are not required to report. This leads to an underreporting of rail volumes. The underreporting issue is somewhat mitigated by the fact that a majority of shortlines interchange their traffic with Class I railroads; therefore, it is reported in the Class I traffic.

Commodities Moved by Rail

Exhibit 8-12 highlights major commodity movements by rail tonnage in 2016 and their forecasted growth through 2045.

- **Total Tonnage.** Major commodities transported by rail in 2045 are projected to include chemicals or allied products, miscellaneous mixed shipments, and nonmetallic minerals.
- **Tonnage Growth.** Chemicals or allied products, food or kindred products, and transportation equipment are the commodities transported by rail with the highest tonnage growth rates between 2016 and 2045. Each of these is forecasted to grow by at least 2.6 percent annually.

Exhibit 8-12: *Rail Tonnage Forecast by Commodity, 2016 to 2045*

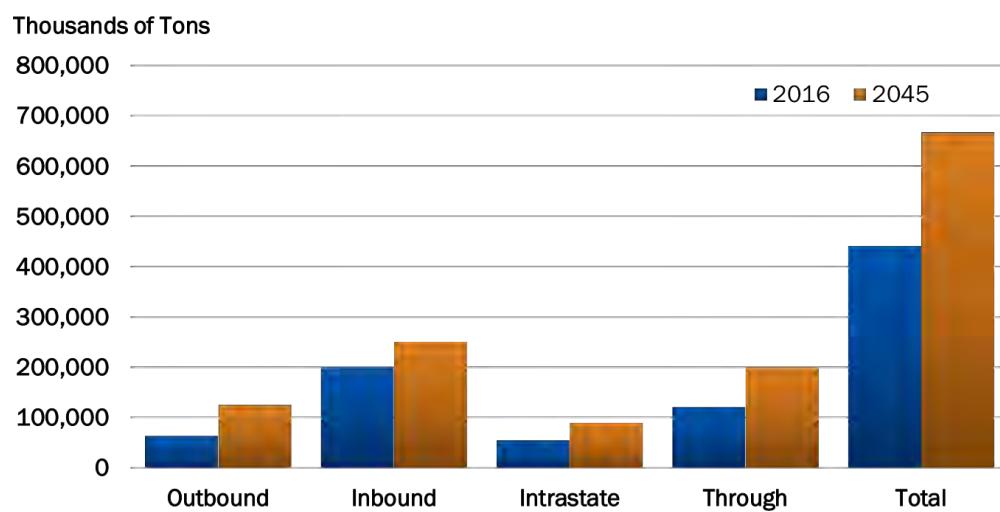


Source: 2014 Surface Transportation Board Waybill data and the Freight Analysis Framework, version 4.3.

Freight Movements by Rail

Exhibit 8-13 shows a relatively constant directional composition of rail movements with respect to tonnage composition in Texas between 2016 and 2045. Intrastate traffic was the dominant rail movement but through-traffic is forecasted to experience the largest growth of any direction by total net tonnage gain.

Exhibit 8-13: *Rail Tonnage Forecast by Direction, 2016 and 2045*



Source: 2014 Surface Transportation Board Waybill data and the Freight Analysis Framework, Version 4.

Bottom Line

The forecast is a planning level forecast of the statewide rail movements and is not meant to capture specific investments or strategies of any specific railroad. The number of rail tons is expected to increase by 176 million tons, or 40 percent, resulting in 668 million tons in 2045.

8.2.3 Ports and Waterways

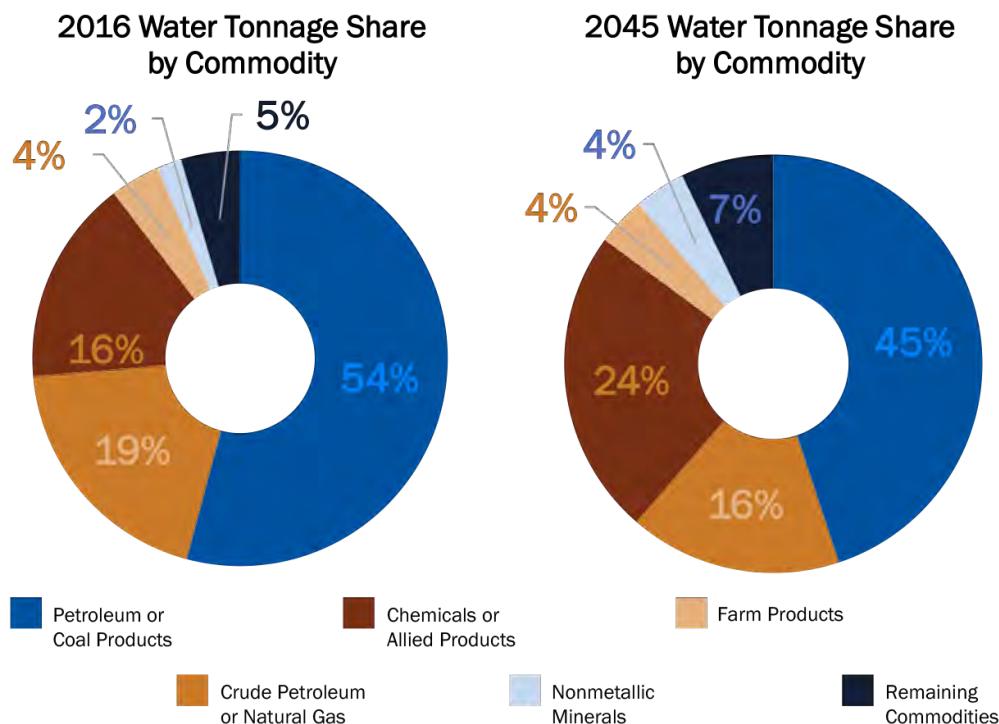
Based on USACE data and TRANSEARCH® data, Texas water tonnage is estimated to increase from 598 million tons in 2016 to 889 million tons in 2045—an increase of 49 percent.

Commodities Moved by Water

Exhibit 8-14 summarizes major commodity tonnage movements by water in 2016 and 2045.

- **Total Tonnage.** In 2045, the largest volume commodities transported by water are projected to include petroleum or coal products, chemicals or allied products, and crude petroleum or natural gas. These three commodity groups are forecasted to grow 1 percent per year between 2016 and 2045.
- **Tonnage Growth.** Of the top 10 commodities transported by water, farm products, waste or scrap materials, and food or kindred products have the highest rates of tonnage growth between 2016 and 2045.

Exhibit 8-14: Water Tonnage Forecast by Commodity, 2016 and 2045



Source: TRANSEARCH® and USACE data.

There are a number of factors that could significantly affect the aggregate projected volumes presented above, increasing the aggregate volumes of freight moved by water. The rapid growth in natural gas production in Texas and the U.S. as a whole is expected to result in the U.S. becoming a significant net exporter of natural gas beginning in 2018. The U.S. Energy Information Administration's 2017 Annual Energy Outlook includes a projection that U.S. liquefied natural gas exports will grow to 1.02 trillion cubic feet in 2018 quadrupling to 4.4 trillion cubic feet in 2040. Depending on the pace of Texas' construction and planned development of LNG export terminals, the state will transport a large share of these growing exports through its major ports.

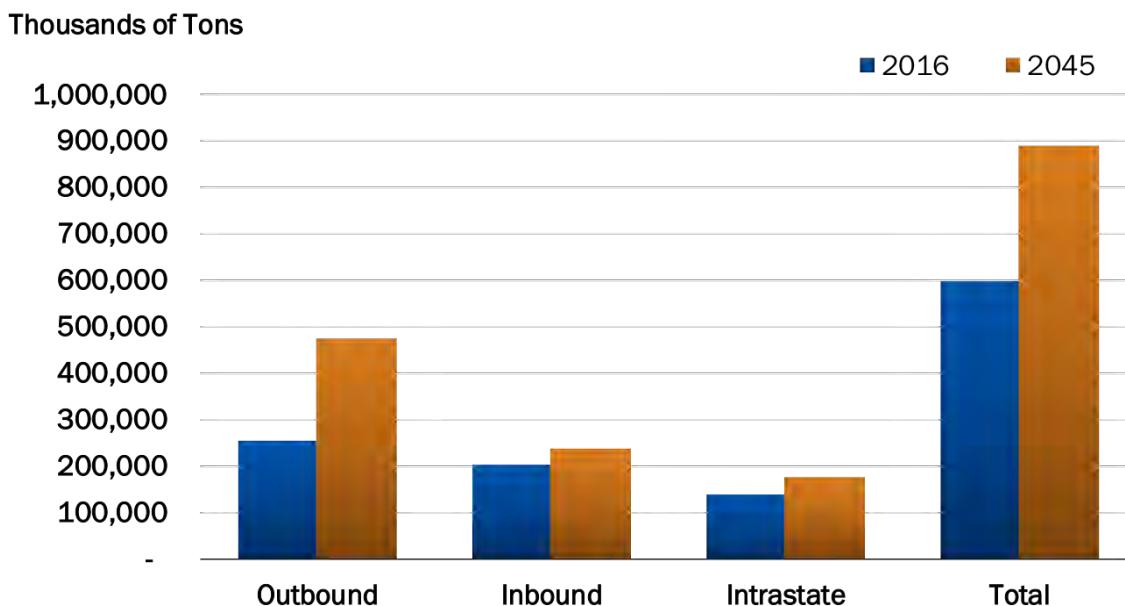
The increasing production of natural gas in Texas will also lead to significant volume growth for products such as plastic resins that use natural gas as feed stocks for production. Resulting increases in volumes may be transported to domestic locations by rail or truck, but growth in containerized export volumes are likely to increase containerized exports through Texas ports.

Freight Movements by Water

Exhibit 8-15 shows the forecasted directional composition of water movements in Texas between 2016 and 2045. Inbound and outbound movements reflect shipments between Texas water ports and both U.S. and international water ports. Intrastate movements reflect

shipments between Texas water ports primarily along the Gulf Intracoastal Waterway (GIWW). Directional composition shows a shift in water freight to more outbound movements from 2016 to 2045. Outbound traffic was more prevalent than any other movement in 2016 and maintains this status through 2045. Outbound traffic grows 86 percent from 2016 to 2045, while inbound and intrastate traffic increase by 17 and 27 percent, respectively. However, system-capacity improvements may alter these forecasted estimates.

Exhibit 8-15: Water Forecast by Direction, 2016 and 2045



Source: TRANSEARCH® and USACE data.

Bottom Line

Water tonnage is expected to increase by 49 percent from 598 million tons in 2016 to 889 million tons in 2045. Areas projected to have the largest growth include:

- Cameron and Chambers counties which are projected to more than double in water tonnage between 2016 and 2045.
- Harris and Jefferson counties which are projected to handle the highest magnitudes of water tonnage in 2045. Combined, these counties are projected to have over 60 percent of the state's water tonnage in 2045 at 495 million projected tons.
- Harris County, containing the Port of Houston, which is expected to grow from 230 million tons to approximately 303 million tons by 2045.
- Nueces County which is forecasted to increase from approximately 77 million tons in 2016 to 98 million tons in 2045.
- San Patricio County which is projected to increase from approximately 20 million tons in 2016 to 29 million tons in 2045.

8.2.4 Air Cargo

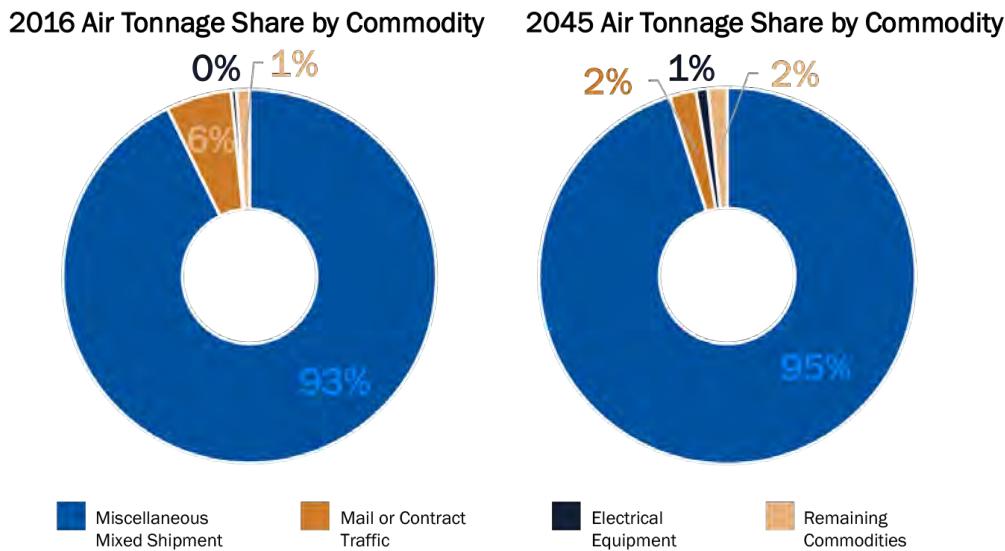
Air tonnage is forecasted to increase from 1.8 million tons in 2016 to 4.2 million tons in 2045, an increase of 129 percent.

Commodities Moved by Air

Exhibit 8-16 summarizes forecasted air commodity tonnage in 2016 and 2045.

- **Total Tonnage.** The major air commodity in 2045 is projected to be miscellaneous mixed shipments (4 million tons or a 95 percent share), growing from a 2016 base of 1.7 million tons for a cumulative growth of 135 percent.
- **Tonnage Growth.** Miscellaneous mixed shipments, the largest commodity by weight, is forecasted to grow 3 percent annually between 2016 and 2045. While accounting for a smaller share of total tonnage, electrical equipment is forecasted to grow at the fastest rate: 6 percent annually between 2016 and 2045.

Exhibit 8-16: *Air Tonnage Forecast by Commodity, 2016 and 2045*

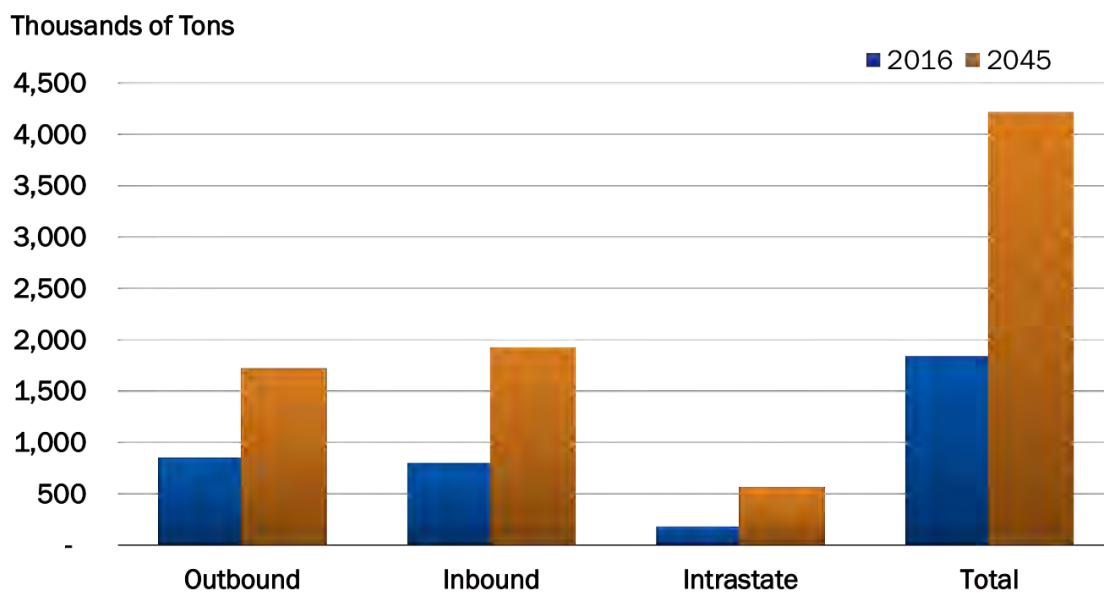


Source: TRANSEARCH® data and Air Carrier Statistics.

Freight Movements by Air

Exhibit 8-17 shows the relatively constant directional composition of air freight movements in Texas between 2016 and 2045. Inbound movements carry the largest share of air freight in the 2045 forecast, and intrastate movements exhibit the highest percentage increase between 2016 and 2045, at 209 percent.

Exhibit 8-17: Air Freight Forecast by Direction, 2016 and 2045



Source: TRANSEARCH® data and Air Carrier Statistics.

Bottom Line

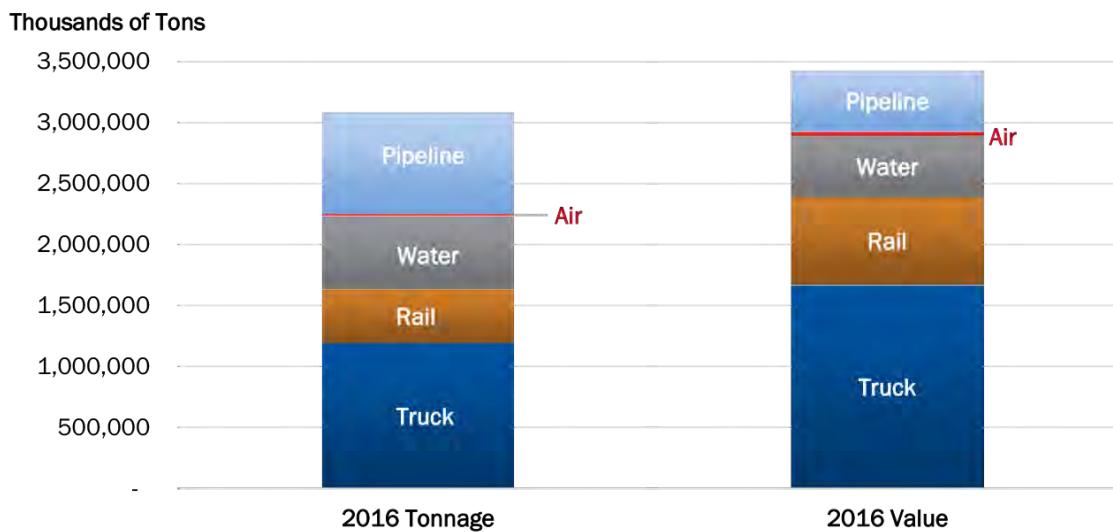
Air tonnage is expected to increase by 129 percent, or 2.4 million tons, by 2045. Tarrant County, home to Dallas-Fort Worth International Airport¹⁶⁸ and Fort Worth Alliance Airport, is forecasted to transport nearly half of the airport freight tonnage in 2045. Furthermore, air tonnage transported at San Antonio International Airport in Bexar County is forecasted to nearly triple by 2045. Cameron and Webb counties, home to Brownsville/South Padre International and Laredo International Airports, are expected to grow rapidly at 6 percent and 5 percent annually.

8.2.5 Pipeline

Pipelines are a complex mode requiring a separate analysis. The Pipeline and Hazardous Materials Safety Administration (PHMSA) estimates that Texas has 10 percent of the nation's pipelines, including 8 percent of gas pipelines and 31 percent of liquid pipelines. Pipeline tonnage in 2016 is estimated at 837 million tons based on the FAF. A forecast is not presented due to the unreliability of forecasts for this mode. Combined with the four major surface modes, pipeline freight movement resulted in a 27 percent share of overall Texas freight movement in 2016, as shown in **Exhibit 8-18**.

¹⁶⁸ Dallas Fort-Worth International Airport is located on the line dividing Tarrant and Dallas Counties.

Exhibit 8-18: Texas Total Freight Tons and Value by Mode, 2016

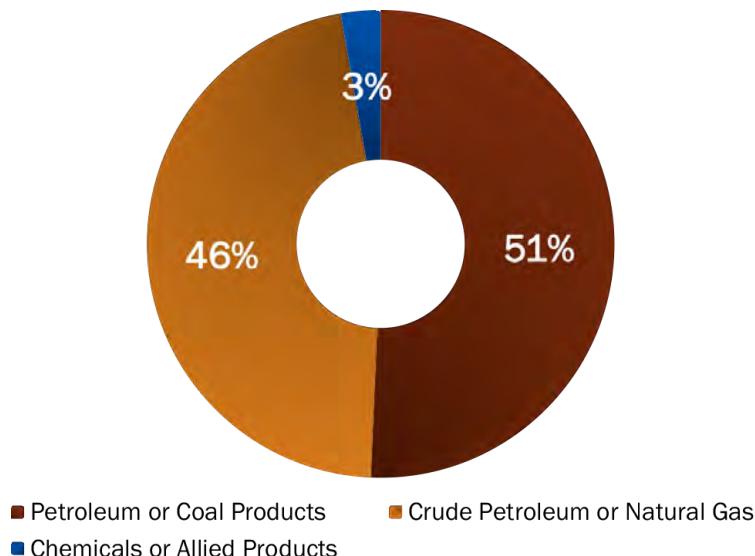


Source: TRANSEARCH®, Surface Transportation Board Waybill data, Air Carrier Statistics, Freight Analysis Framework.

Commodities

Exhibit 8-19 shows major commodity tonnage movements by pipeline in 2016. These movements comprise three commodities: crude petroleum or natural gas, petroleum or coal products, and chemicals or allied products. Pipelines carry 51 percent of crude petroleum or natural gas, 46 percent of petroleum products and 3 percent of chemicals or allied products.

Exhibit 8-19: Pipeline Tonnage by Commodity, 2016

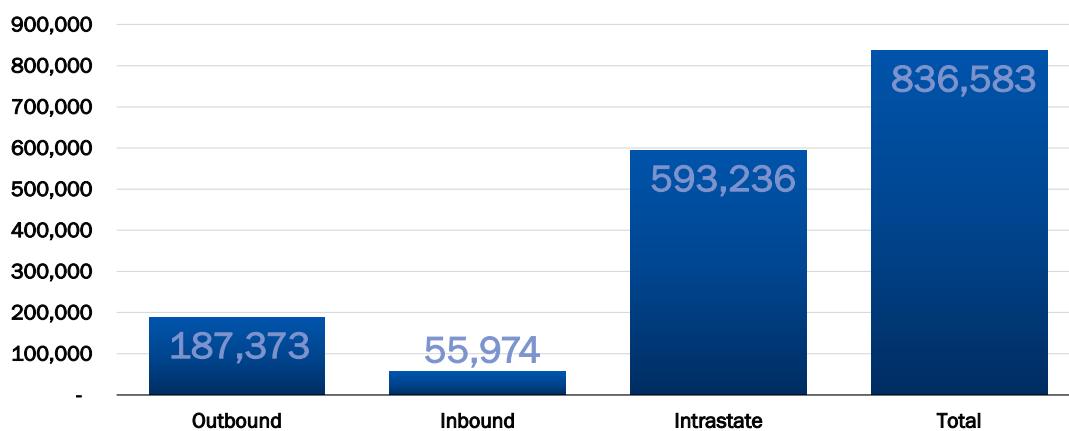


Source: Freight Analysis Framework data.

Movements

Exhibit 8-20 depicts the directional composition of pipeline movements in Texas for 2016. Most pipeline tonnage in the state is intrastate, connecting sources, refineries, ports and customers within the state.

Exhibit 8-20: *Texas Pipeline Forecast by Direction, 2016 Tonnage*



Source: Freight Analysis Framework.

Bottom Line

Pipelines are critical to Texas' energy sector and carry a substantial amount of crude petroleum or natural gas, as well as petroleum or coal products. Because of the rapid change of these industries and the reliance on private-sector investment, it is a challenge to develop a reliable forecast for 2045. However, most experts anticipate steady growth, assuming pipeline investment can keep pace.

8.2.6 *International Border Crossings*

Texas is a gateway for trade with Mexico, supporting not only its own economy but also providing access for states throughout the country. International border-crossing movements at the Texas-Mexico border are included in the through-movement statistics presented earlier in this chapter, including U.S. state-to-state movements. Mexico is Texas' most important trading partner.

Nearly 73.5 million tons of highway and rail freight crossed the Texas-Mexico border in 2016, valued at more than \$318.8 billion. More than 211 million tons of highway and rail freight are projected to cross the international border in 2045.¹⁶⁹ Approximately 97 percent of Texas' northbound freight movement by trucks in 2016 was concentrated at five

¹⁶⁹ Some commodity groups exhibit very high growth over this period. These findings may vary once more recent data is available.

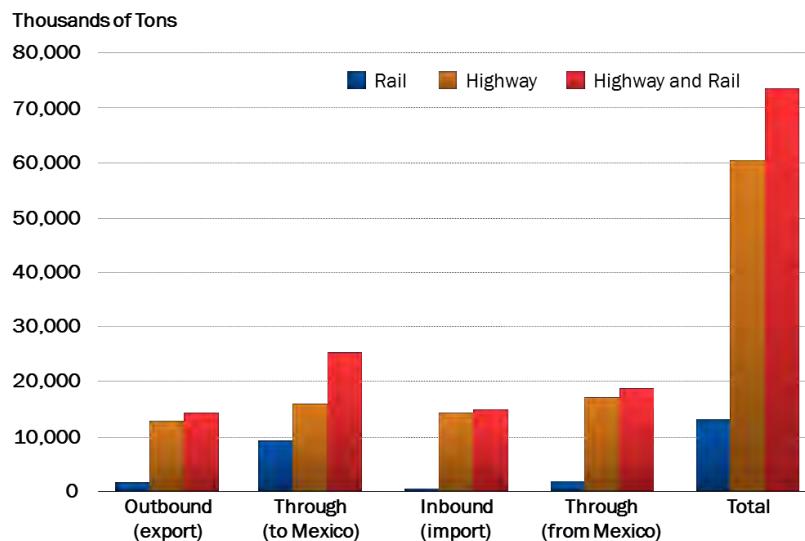
commercial border crossings: Laredo, El Paso, Hidalgo, Brownsville and Eagle Pass. Additionally, four rail crossings are operational in Texas: Brownsville, Eagle Pass, El Paso and Laredo. Trucking accounted for 82 percent of cross-border freight movement by weight in 2016, and is predicted to continue to be the dominant mode at border crossings.

Movements

In both 2016 and 2045, highways were and are projected to be the major mode for cross-border freight movements, followed by railroads, as shown in **Exhibit 8-21** and **Exhibit 8-22**. Cross-border trade by highway and rail tonnage is expected to increase by 188 percent from 73 million tons in 2016 to 211 million tons in 2045, far outpacing the statewide freight tonnage growth of 79 percent (excluding pipelines).

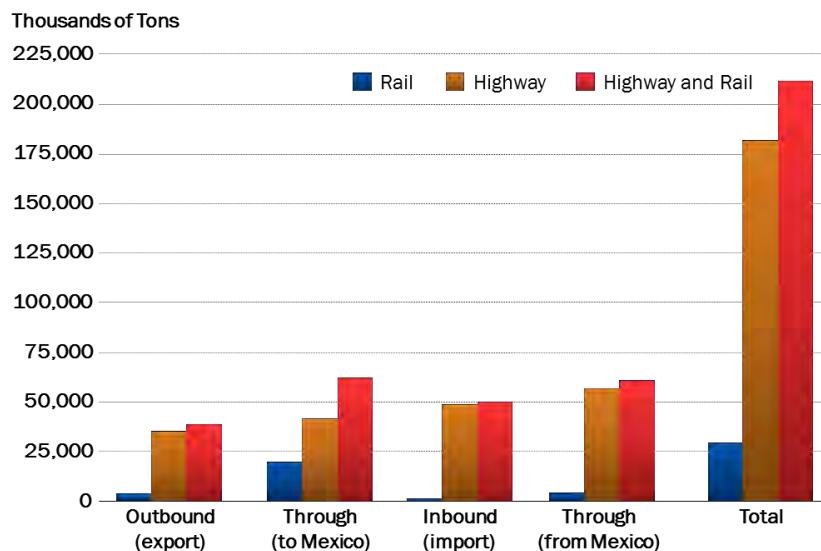
- These gains are led by inbound highway and rail freight from Mexico through Texas border crossings – a 229 percent increase in tonnage from 34 million in 2016 tons to 111 million tons in 2045.
- Tonnage originating in Texas and destined for Mexico is forecasted to grow by 170 percent by 2045 (from 14 million tons to 39 million tons), while through-traffic to Mexico is forecasted to grow by 143 percent (from 25 million tons to 62 million tons).
- These movements combined result in total movements to Mexico through Texas border crossings growing to 100 million tons by 2045.
- These projections are indicative of continued export activity from Texas to Mexico, with substantial increases in freight originating in Texas and going to Mexico and freight originating elsewhere in the U.S. but traveling through a Texas border crossing.

Exhibit 8-21: *Texas Border-Crossing Freight by Direction, 2016 Tonnage*



Source: Freight Analysis Framework, STB Waybill data and TRANSEARCH® data.

Exhibit 8-22: Forecasted Texas Border-Crossing Freight by Direction, 2045 Tonnage



Source: Freight Analysis Framework, Surface Transportation Board Waybill data and TRANSEARCH® data.

In 2045, border-crossing movements for highway and rail modes are projected to comprise 5.3 percent of freight in Texas for the four surface modes. Through-state international border-crossing movements for highway and rail modes (123 million tons) are forecasted to encompass more than one-half (58 percent) of border-crossing movements. Inbound and outbound movements were similar in 2016, though inbound movements on the highway and rail systems are forecasted to grow more quickly than outbound, reaching 50 million and 39 million tons in 2045, respectively.

Border Crossing Forecasts by Mode

Highway Border Crossings

The top inbound commodity movements by highway in 2016 at international border crossings were food or kindred products, farm products, electrical equipment, and machinery. These commodities made up nearly half of the inbound highway tonnage crossing from Mexico to Texas. Top outbound commodity movements included chemicals or allied products, food or kindred products, and primary metal products, which totaled approximately 40 percent of the outbound highway tonnage crossing from Texas to Mexico.

Average inbound daily heavy truck volume at the Texas border is expected to increase from 10,900 to 25,000 by 2045—a 130 percent increase. Total inbound truck tonnage at the Texas border is projected to increase from 34 million to 111 million tons per year.

Key observations for border crossing forecasts include:

- The Laredo port of entry is predicted to remain the largest and most significant international trade gateway to Texas. In 2016, there were more than 5,700 daily truck crossings from Mexico into Texas, and it was the top commercial border port of entry in the U.S. Total daily cross-border truck traffic in Laredo is projected to increase to 8,340 by 2045.
- The El Paso port of entry had approximately 2,000 inbound daily truck crossings in 2016. Truck crossings in El Paso are estimated to increase to about 4,300 daily trucks by 2045.
- The Hidalgo port of entry had 1,600 inbound daily truck crossings in 2016. This port is projected to handle 6,800 daily trucks by 2045.
- The Brownsville port of entry had 600 inbound daily truck crossings in 2016 and is projected to handle more than 2,800 trucks daily in 2045.

Rail Border Crossings

Transportation equipment was the top inbound commodity by tonnage in 2016 with over 30 percent of total inbound rail tonnage. Electrical equipment, waste or scrap materials, and food or kindred products followed. Top outbound commodity movements were led by farm products at approximately 40 percent of the total outbound rail tonnage crossing from Texas to Mexico.

Texas has four commercial rail ports of entry: Brownsville, Eagle Pass, El Paso and Laredo. Rail crossings in Texas are projected to more than double throughput tonnage between 2016 and 2045. The most significant international border crossing is the Webb to Tamaulipas crossing in Laredo, where more than 20 percent of all rail crossings between Texas and Mexico occurred in 2016. TxDOT has also received a \$7 million FASTLANE grant to rebuild 72 miles of track on the South Orient Rail from the border to near Coleman, Texas, while Texas Pacifico Transportation's matching contribution will rebuild the Presidio-Ojinaga International Rail Bridge at an estimated cost of about \$10 million.

Bottom Line

Border crossings are critical to international trade and to supporting the state and national economies. While through movements from Mexico represented the largest movement in 2016, movements in other directions are forecasted to grow more quickly and result in more even tonnage movement in each direction. Future international trade is subject not only to demand and business patterns, but also to international trade policy. The forecasted volumes at border crossings may change based on whether infrastructure and policies facilitating movement across the border are implemented.

8.2.7 Summary of Modal Forecasts

Exhibit 8-23 presents a summary of the bottom line freight analysis by mode.

Exhibit 8-23: Texas Bottom Line Freight Analysis Summary

Mode	Mode Share (2016)	Statewide Growth (Percent/Volume from 2016 to 2045)	Take Away
Highways	54%	108%/ 1.29 billion tons	<ul style="list-style-type: none"> ▪ 16 percent of Texas Highway Freight Network level-of-service D or worse, 2016. ▪ 31 percent of Texas Highway Freight Network level-of-service D or worse, 2045. ▪ Intrastate truck tonnage to double between 2016 and 2045.
Rail	20%	51%/ 226.4 million tons	<ul style="list-style-type: none"> ▪ Increases to 667 million tons in 2045. ▪ Inbound movement is the largest at 38 percent share of all rail movements in 2045. ▪ Through movements remain high with a 30 percent share of all rail movements.
Water	26%	49%/ 291.3 million tons	<ul style="list-style-type: none"> ▪ Harris and Jefferson counties have large increases. ▪ Cameron and Chambers counties more than double in tonnage. ▪ Outbound movement has the highest growth at 99 percent from 2016 to 2045.
Air	0.1%	129%/ 2.4 million tons	<ul style="list-style-type: none"> ▪ DFW Airport and Alliance Airport will account for about half of Texas airport freight by 2045. ▪ Intrastate movement has the highest growth at 209 percent between 2016 and 2045.
U.S.-Mexico Border Crossing		Trucks: 202%/ 122.0 million tons Rail: 123%/ 16.0 million tons	<ul style="list-style-type: none"> ▪ Cross-border tonnage increases by 188 percent by 2045. ▪ Truck is the dominant mode of cross-border freight movements at 82 percent in 2016. ▪ Through-state border-crossing movements are estimated to be more than half of the total border-crossing movements in 2045.

8.3 Summary

This chapter provided data for the movement of commodities on the Texas Multimodal Freight Network in 2016 compared with planning-level forecasts for the year 2045. This analysis shows that overall freight tonnage is expected to nearly double between 2016 and 2045, with the trucks seeing the largest increase (108 percent). This growth in freight tonnage is expected to outpace population and employment growth in Texas as the state's industries handle increased consumption and trade. By analyzing the level and location of future demands, TxDOT can identify improvements and future multimodal partnerships (to supplement the Texas Freight Advisory Committee) needed to enhance freight mobility. The forecasts and bottom line analyses presented in this chapter can be used to identify deficiencies and prioritize projects that will maintain an efficient and economically viable freight system. More information on programs, policies, and projects to improve freight flow in Texas are discussed further in **Chapters 11-14** and related **Appendices**.



Texas Freight Mobility Plan

Chapter 9: Strengths and Weaknesses of the State's Freight Transportation System



Understanding the strengths and weaknesses of the Texas Multimodal Freight Network allows Texas Department of Transportation (TxDOT) — in coordination with its planning partners and the private sector— to make more informed investment decisions that maximize the return of limited transportation funds. The process for identifying strengths and weaknesses of the Texas Multimodal Freight Network is tied directly to the Freight Plan goals and builds on the work presented in previous chapters. The designation of the Texas Multimodal Freight Network in **Chapter 6** combined with inventory of freight assets and assessment of their conditions and performance in **Chapter 7** provides a profile of the freight transportation system and services in Texas. Combining this information with the freight demand and forecasts presented in **Chapter 8** allows for the identification of strengths and weaknesses presented in this chapter.

9.1 Modal Strengths and Weaknesses

Using the goals and objectives from **Chapter 2**, combined with the conditions, performance and needs assessment of the Texas Multimodal Freight Network in **Chapter 7**, this section summarizes specific modal strengths and weaknesses. Strategies to address the weaknesses and leverage the strengths are presented in **Chapters 11-14**.

9.1.1 Highway

Texas highways form the backbone of the state's freight transportation system. They provide first- and last-mile connections for most goods and provide connections to other modes. The key strengths of the highway network can be summarized as quantity and quality. Specific strengths include the following:

- Texas has an extensive highway network in good condition.
 - With more than 313,000 centerline miles of public roadways (over 80,000 maintained by TxDOT), Texas has the most extensive highway network of any state in the U.S.
 - The pavement condition of the majority of the Texas Highway Freight Network (85 percent) is currently in “fair” or better condition.¹⁷⁰
- A majority of all state-maintained bridges (44,195 bridges or 82 percent) are in “good” or better condition.¹⁷¹
- Most of the Texas Highway Freight Network has available capacity, particularly outside the urban areas. In 2016, approximately 72 percent of the state’s interstate highway mainlines operated at a peak level-of-service D or better, and approximately 85 percent of U.S. routes and 76 percent of state highways in Texas operated at level-of-service A or B.

Traffic Level of Service (LOS):

- LOS A = Free flow
- LOS B = Stable flow with slight delays
- LOS C = Stable flow with delays
- LOS D = Approaching unstable flow
- LOS E = Unstable flow
- LOS F = Forced flow

Despite the overall positive features of the system, there are weaknesses that significantly impact freight transportation and the motoring public including congestion, aging infrastructure and safety. Specific weaknesses include the following:

¹⁷⁰ Conditions of Texas Pavements. Pavement Management Information System. Retrieved May 2017.

¹⁷¹ TxDOT. Bridge Facts 2016.

- Congestion and bottlenecks impact economic growth, particularly on main corridors in large metropolitan areas with significant freight movements.
 - Texas has 14 of the top 100 nationally significant freight bottlenecks in 2016, with six falling in the top 25.¹⁷²
 - In 2015, congestion on Texas roadways added \$5.1 billion in operating costs to the trucking industry, accounting for over 8 percent of all congestion costs nationally. This represents an increase of over \$1.0 billion in congestion costs from 2014 to 2015.¹⁷³
 - In 2015, of the 10 metropolitan areas nationwide with the highest costs of congestion to the trucking industry, Dallas-Fort Worth ranked fifth with over \$1.3 billion and Houston ranked eighth with more than \$1.1 billion in 2015.¹⁷⁴ Congestion-related costs continue to rise and impact key supply chains.
 - By 2045, it is projected that congested highway miles along the Texas Highway Freight Network will increase by nearly 60 percent. A majority of U.S. highways and state highways will operate at peak level-of-service in the A to B range. However, interstate highways are expected to experience higher levels of congestion, with nearly 43 percent reaching peak level-of-service in the E to F range.¹⁷⁵
- Outdated design standards and aging infrastructure limit truck traffic on some corridors.
 - 13 bridges on the Texas Highway Freight Network cannot accommodate the federal commercial vehicle maximum weight of 80,000 pounds for freight transport.¹⁷⁶
 - 291 bridges on the Texas Highway Freight Network have a vertical clearance of less than 15 feet.
 - Improvements, including updated geometry and elimination of vertical and horizontal clearance restrictions, are needed to last mile connections.
- High crash rates may indicate safety issues, and crashes often result in delays and congestion as the incident is cleared. According to TxDOT Crash Records Information System data from 2014 to 2016, 23 of the top 25 locations with the highest commercial vehicle crash rates on the Texas Highway Freight Network are located in urban areas.

¹⁷² American Transportation Research Institute. Available at <http://atri-online.org/2017/01/17/2017-top-100-truck-bottleneck-list/>. Accessed May 2017

¹⁷³ American Transportation Research Institute (ATRI). *Cost of Congestion to the Trucking Industry: 2017 Update*.

¹⁷⁴ Ibid.

¹⁷⁵ SAMv3 model

¹⁷⁶ TxDOT Bridge Division Data. Retrieved May 2017.

- A lack of viable alternate routes along the Texas Highway Freight Network compounds congestion in urban areas. Furthermore, a lack of alternative routes impedes freight mobility and reliability especially in the rural western portion of the state.
- Although several metropolitan areas have regional traffic and incident management systems, much of the Texas Highway Freight Network is in rural regions without such systems. A statewide system could help to mitigate congestion and assist in identifying alternate routes for congested corridors.
- Growing volumes of U.S./Mexico trade are putting more pressure on the border regions. Limited connectivity and capacity of highway networks linking border regions and east-west trade corridors impact the overall mobility, safety and costs of cross-border trade for Texas and the entire country.

Programs, policies, and projects to address these weaknesses are summarized in **Chapters 11-14** and listed in **Appendices B and C**. Some programs and policies, such as the Clear Lanes program and the 18 feet 6 inches minimum vertical clearance on the Texas Highway Freight Network are already being implemented while others (shown in Exhibits 14-1 and 14-2) will be pursued within the next five years. Regarding projects, in total, there are 508 highway projects totaling nearly \$7.5 billion in the 5-Year Freight Investment Plan. These projects are fully funded and include 232 safety projects, 155 mobility and reliability projects, 61 alternative routes projects, 53 asset preservation projects and 7 technology projects (see Exhibit 13-10). It should be noted that many of these projects address multiple needs and are listed based on their primary objective.

9.1.2 Rail

Texas has the most expansive rail network in the U.S., a definite strength of the system and the state for business attraction. Strengths related to the Texas rail system include:

- Texas is a major North American freight rail hub with over 10,539 miles of track.¹⁷⁷ Texas also has the largest number of railroads with 52 freight rail operators, including three Class I – BNSF Railway, Kansas City Southern and Union Pacific - and 49 shortlines.
- Each of the three Class I railroads have state-of-the-art intermodal facilities that connect the state to international gateways and markets as well as the domestic hinterland.
- Five of the seven rail border crossing cities between the U.S. and Mexico are located in Texas, allowing the state to lead the nation in rail traffic between the two countries.
- Railroads make significant investments as private entities to strengthen their systems. Union Pacific Railroad is planning to spend \$452 million in its Texas infrastructure in

¹⁷⁷ Association of American Railroads (AAR), Freight Railroad in Texas, *Rail Fast Facts for 2015* (February 2017).

2017, BNSF Railway is planning to spend \$255 million in Texas and Kansas City Southern Railway continues to invest in new rail facilities and upgrades to accommodate its growing Mexico trade volumes moving through Texas. Shortline railroads also plan to make investments in expanding capacity and upgrading track in 2017. Private-sector investment is driven by the current and future needs of the railroads' customers.

Despite continued investment by the railroads, growth and changes in the state's economy and local land uses have led to pressures on certain parts of the network, giving rise to system weaknesses. Concerns expressed at stakeholder workshops related to potential weaknesses related to freight rail include:

- Rail bottlenecks may occur at sections of single-track along double-track lines and bridges with weight and speed restrictions.
- Only 64 percent (5,800 public at-grade highway/rail crossings) of 9,150 at-grade highway/rail crossings in the state are equipped with active warning devices.¹⁷⁸
- Safety concerns related to high traffic at-grade highway/rail crossings and the recent gradual increase in the number of incidents at at-grade highway/rail crossings.¹⁷⁹
- Roadway congestion and development encroachment issues at multimodal terminals.

Rail projects to help address these needs are discussed in **Chapters 12 and 13** and listed in **Appendix D**. In total, the 2017 Freight Plan identifies 90 rail projects with 7 projects totaling over \$30 million being fully funded and included in the 5-Year Freight Investment Plan.

9.1.3 Ports and Waterways

Ports and waterways provide the state and its businesses with access to markets around the world, and they have been instrumental in establishing Texas as a global energy hub.

Strengths of the ports and waterways in Texas include:

- Texas has an extensive port and waterway network, handling a large and growing share of U.S. waterborne commerce.
- Texas ports are the principal gateway for the nation's oil and gas industry, supporting its exports and imports, and providing waterborne access to domestic markets.
- Most Texas deep-water ports are served by one or more interstate highways and one or more Class I railroad.

¹⁷⁸ Texas Department of Transportation. 2016 Texas Rail Plan Update, Chapter 2: Texas's Existing Rail System. May 2016.

¹⁷⁹ Ibid.

- The Gulf Intracoastal Waterway (GIWW)/Marine Highway 69 is a critical component of the Texas and U.S. waterway network, connecting Texas ports and Gulf of Mexico ports to inland river ports. Freight tonnage moving through the GIWW equates to 20 percent of total U.S. inland waterway tonnage with more than half of it moving within the 379-mile Texas portion of the waterway.
- New, higher container weight limits for permitted loads near Texas' Gulf of Mexico ports will enhance the competitiveness of state facilities.
- Competition for port traffic is significant and the widening of the Panama Canal and expanding use of the Suez Canal raises the stakes even more as ships are getting larger. Any port weakness can shift the competitive landscape.

In Texas, weaknesses of the ports and waterways include:

- Limitations in highway and rail access inhibit intermodal connectivity between the landside surface transportation system and some ports.
- Congestion on roadways with landside access inhibits efficient connections between the highway and water modes.
- Rail connections may require significant investment to improve. Of the \$159 million in deep-water port investments identified in the Texas Ports 2017–2018 Capital Program, almost 80 percent is for rail-related projects at Beaumont, Brownsville, Corpus Christi and Port Arthur.
- Depth of the GIWW limits freight movement. Dredging this waterway would accommodate more freight movements through Texas ports.
- Lack of funding and spending for harbor maintenance, dredging and maintenance of the GIWW, and aged locks, are issues for shippers using ports and waterways. Diversion of the Harbor Maintenance Tax to other federal purposes will not be completely prohibited until 2025, and recouping the full Texas share of this tax is a challenge.

Projects addressing port and waterway needs are discussed in **Chapters 12 and 13** and listed in **Appendix E**. There are twenty-six projects with an estimated cost of \$670 million, of which nine projects totaling \$490 million are fully funded.

9.1.4 Airports

Despite the relatively low volume of total tonnage moved via air, air cargo's role in freight transportation and economic development is unique and critical. Important strengths of the commercial air cargo system in Texas include:

- Texas has the largest number of airports in the U.S.

- Texas is home to 391 public use airports and 24 commercial airports.
- Six of the top 50 air cargo airports in the U.S. in terms of landed weight in 2016, as identified by the Federal Aviation Administration, are located in Texas.
- Public and private investment supports maintenance of airport assets.
- All the major air cargo airports in Texas, as listed in **Chapter 7**, are adjacent to the Texas Highway Freight Network with many linked with Critical Urban Freight Corridors.

Given the nearly singular focus on efficiency, any weaknesses of the airport system can be detrimental. Weaknesses in air cargo facilities in Texas include:

- Last-mile highway connectivity to the Texas Highway Freight Network must be addressed at air cargo airports.
- The largest airports in the state, based on landed weight, are also located in rapidly growing, highly congested metropolitan areas. This can affect efficiency and reliability.
- Highway access maintenance and expansion in part because airport revenues cannot be used for off-airport purposes.

Projects addressing air cargo access weaknesses are discussed in **Chapters 12 and 13** and listed in **Appendix F**. Eighteen projects with an estimated cost of \$812 million are identified, of which nine projects totaling \$213 million are fully funded.

9.1.5 Pipelines

Given the importance of the petrochemical and natural gas industry in Texas, the state's transportation network would struggle to function without pipelines. Strengths of the Texas pipeline system include:

- Texas has the most extensive pipeline network in the U.S. with over 448,446 miles of pipelines privately operated by more than 1,280 companies in 2017.¹⁸⁰
- The private-sector continues to invest in the pipeline infrastructure to meet current and future needs.
- Pipelines are vital in the movement of energy products and are important to the Texas economy.
- The vast network of pipelines provides connectivity to ports.

¹⁸⁰ Railroad Commission of Texas. *Texas Pipeline System Mileage*. Retrieved September 2017 from <http://www.rrc.state.tx.us/pipeline-safety/reports/texas-pipeline-system-mileage/>.

Weaknesses identified for Texas pipelines include:

- The growing energy industry will require increased capacity and construction of new pipelines to keep pace with increased industry needs.
- Pipeline infrastructure improvements and added capacities will require additional funding.
- With the expansive pipeline system, keeping communities and residents informed must be a priority.
- Local government land-use planners need to be aware of all pipeline easements and potential public safety risks.

9.2 Non-Modal Strengths and Weaknesses

The modes form the network of gateways and corridors that comprise the multimodal freight system. However, other infrastructure and institutions also are important to freight transportation. This section describes strengths and weaknesses of Texas' freight transportation system for non-modal categories.

9.2.1 North American Free Trade Agreement and Border Crossings

The North American Free Trade Agreement (NAFTA) eliminated all tariffs and trade restrictions on NAFTA-qualified products between the U.S., Canada and Mexico. In the first years after the agreement came into effect, Mexican tariffs on American exports, which on average had been much higher than those applied by the U.S. to Mexican goods, were removed for about half of the products.¹⁸¹ Other tariffs were phased out in the following years. By January 1, 2008, all tariffs and quotas were eliminated on NAFTA-qualified goods traded between the U.S., Mexico and Canada. Today, there are virtually no tariffs on goods flowing between NAFTA partners. Twenty-four years after the implementation of the North American Free Trade Agreement, the Texas-Mexico border region continues to work through the opportunities and challenges of free trade in North America.

Border strengths include:

- Mexico is Texas' largest trading partner and trade is projected to increase. The projected increase in trade is a result of the interdependence of Texas and Mexican companies that have been developed over the years, working and producing goods together, and relying on multinational supply chains for the movement of intermediate inputs and the distribution of the finished product to markets.

¹⁸¹ Office of the United States Trade Representatives.

- The value of trade between Texas and Mexico highlights the multinational integration of key industrial sectors in both countries, including computer and electronic products, transportation equipment, machinery, electrical equipment and appliances and components.
- Texas and its border crossings serve as critical trade gateways to U.S. trade with Mexico, as well as the rest of Central America. Both the Texas and U.S. economies depend on efficient and secure freight movements through the border crossings.

Border weaknesses include:

- Increasing congestion and wait times at border crossings impede international trade and Texas and U.S. economic competitiveness.
- Limited implementation of cross-border technology applications and lack of standardizations among border crossings will impact efficient and safe movement of goods. The absence of a single statewide agency to address border issues as well as insufficient coordination between different agencies involved in border crossings adds to this weakness.
- Permitting regulations for border crossing are inefficient.
- Continued operational and staffing issues at border crossings will reduce the efficiency and safety of goods movement.
- Border crossings and trade corridor infrastructure and operations lack sufficient funding for improvements.
- There is inadequate data for planning and effective decision-making on the types of investment and improvements needed to enhance freight processing at the border.
- There is insufficient binational dialogue and coordination between public and private sectors to address border crossings and trade corridor needs. The national benefits and costs to the state of Texas for accommodating border trade often goes unrecognized.

9.2.2 *Intermodal Connectivity*

A significant amount of freight uses multiple modes to get from its origin to its destination, and most supply chains have multimodal components, making intermodal connectivity a necessity. The strengths identified for intermodal connectivity in Texas include:

- Texas has an extensive intermodal network that provides connectivity to major freight gateways and generators, including marine ports, warehousing/distribution centers, airports, international border crossings and intermodal sites.
 - The Federal Highway Administration shows 14 intermodal connectors on the Texas portion of the National Highway Freight Network connecting major rail facilities to the roadway network. These are a subset of the 20 National Highway

System (NHS) rail-truck intermodal connectors in Texas – more than any other state.

- Texas' top air-cargo airports are located near major metropolitan areas and are connected to the Texas Highway Freight Network. The National Highway Freight Network in Texas includes seven intermodal connectors specifically for the following airports: Fort Worth Alliance, Dallas Love Field, Laredo, McAllen Miller, San Antonio, El Paso and Houston Intercontinental. This is a subset of the 23 truck-air intermodal connectors on the Texas portion of the NHS.
- The extensive pipeline network is connected to the rail and highway network, as well as seaports through nine intermodal connectors on the NHFN and 18 on the NHS.
- New, higher container weight limits near ports will improve intermodal connectivity by facilitating access to roadways, between road links and rails and the use of the GIWW for connections to main container terminals.

Weaknesses of intermodal connectivity in Texas, as identified by stakeholders at public hearings, include:

- Many intermodal connectors are located in highly congested urban areas and compete with passenger movements.
- Emerging energy industry infrastructure needs related to intermodal connections have a difficult time keeping pace with growth.
- Coordination among the various modes and agencies and funding is a challenge because intermodal connectors have various owners and some connectors have multiple owners.
- Numerous port and rail connections need improvement, especially to accommodate higher volumes of energy industry products.
- Improvements to rail connectivity between western and eastern Texas.
- Increasing volumes and capacities of the pipeline system will require new safe and efficient intermodal connection facilities with highway and rail systems.

9.2.3 *Rural Connectivity*

Rural regions in Texas are home to some of the state's most strategic exporting industries, including agricultural and energy. These industries depend on connections between rural production sites to urban areas and gateways. Strengths of rural connectivity include:

- More than 40,900 centerline miles of Farm-to-Market or Ranch-to-Market roads and spurs provide connectivity to freight generators, including oil, energy, agriculture, and mining.

- Rural areas have the capacity to handle additional trucks on the Texas Highway Freight Network.

Weaknesses of rural connectivity include:

- Many rural roadways were not designed or constructed to accommodate repeated heavy truck traffic or oversized vehicles, particularly the state's Farm-to-Market and Ranch-to-Market road network. This has generated a logistical and financial burden for local and state governments.
- Rural areas are challenged to keep pace with infrastructure improvements needed due to continued growth in agriculture, energy and mining industry activity.
- Project selection-process criteria in the allocation of transportation funding should include specific consideration for rural transportation needs, rural-urban connectivity, connectivity to seaports and connectivity to international borders for exports.

9.2.4 *Public- and Private-Sector Coordination and Collaboration*

The Texas Multimodal Freight Network is comprised of publicly and privately owned assets. Ensuring seamless connectivity and efficient operations requires public- and private-sector coordination and collaboration. The strengths related to public- and private-sector coordination in Texas include:

- The state, primarily through TxDOT, has many public- and private-sector partners collaborating to pursue Texas' freight transportation goals.
- Public- and private-sector collaboration between TxDOT and other modal providers is facilitated through the Texas Freight Advisory Committee and the Border Trade Advisory Committee.
- TxDOT districts coordinate with TxDOT divisions and offices, metropolitan planning organizations (MPOs), local officials, community stakeholders and corridor groups when opportunities for building partnerships with the public and private sectors arise. Coordination with these entities helps the districts in their responsibility for the design, location, construction and maintenance of area transportation systems.
- Texas has participated in the U.S./Mexico Joint Working Committee on Transportation Planning since its inception and meets with U.S. and Mexican federal and border state transportation agencies, customs agencies, immigration and public works agencies. The goal of this committee is to cooperate on land transportation planning and the facilitation of efficient, safe and economical cross-border transportation movements. At present, TxDOT representation on the committee includes the Director of Freight and

International Trade and the Transportation and Planning Division's Freight and International Trade Office.¹⁸²

Weaknesses related to public- and private-sector collaboration include:

- Collaboration between public- and private-sector infrastructure owners, operators and users must be improved for the sake of overall system performance. For example, port growth affects traffic on access roads (public), rail lines and grade crossings (private) and multimodal interstate corridors (public and private).
- Need for stronger and sustained collaboration between TxDOT, other state departments of transportation and Mexico to maximize the effectiveness of investment.
- Potential differences in planning horizons between public and private entities is a challenge.
- Lack of dedicated funding source and flexibility in existing funding that would enable TxDOT to leverage private investment dollars on multimodal projects.

9.2.5 Education/Public Awareness

Freight is often viewed negatively, due in large part to lack of awareness and education on the role it plays in our daily lives as well as how passenger vehicles can more peacefully coexist with freight-related activities and traffic. Mitigating negative perceptions of freight requires public education and awareness. The strengths of education and public awareness of freight in Texas include:

- Ongoing community outreach activities increase awareness and understanding of freight issues, policies and regulations, funding and the importance of freight to the Texas economy.
- Existing partnerships with trucking, rail and port industries improve public education about these industries and movement of freight.
- An increasing understanding of freight issues yields more robust transportation planning results, benefiting all users.

The weaknesses related to education and public awareness include:

- A lack of awareness by the general public regarding the importance of freight movement in their daily lives (e.g., transporting goods/products to work, homes and businesses).
- A lack of awareness by the general public of laws and/or safety issues related to large trucks, heavyweight trucks and at-grade highway/rail crossings.

¹⁸² FHWA. https://www.fhwa.dot.gov/planning/border_planning/us_mexico/members/.

- Freight transport remains a mystery for most people and the lack of understanding leads to unrealistic expectations and demands on the industry such as truck prohibitions, railroad bypasses and relocation of facilities, off-peak operating hours and local codes that impede freight operations.

9.2.6 *Funding/Financing*

Demand and needs for freight transportation have significantly outpaced investment across the U.S. Fortunately, Texas has been successful in identifying new revenue streams for transportation investment and has many strengths related to funding and financing including:

- TxDOT districts, MPOs and local agencies assist with addressing regional funding/financing issues.
- The FAST Act established a National Highway Freight Program. The development of a FAST Act-compliant state freight plan will secure NHFP funds for Texas.
- The competitive Infrastructure for Rebuilding America discretionary grants (INFRA formerly FASTLANE grants), also established by the FAST Act, provide additional funding opportunities for freight projects in Texas.
- TxDOT's most recent Unified Transportation Program was updated in March 2017 and includes more than 12,000 projects and estimates greater than \$70 billion of available funding for fiscal years 2017-2026.
- Railroad, pipeline and port owners in Texas invest privately in infrastructure to maintain, preserve and improve this portion of the freight system and to provide capacity for clients into the future.
- Railroads invest considerably in railroad infrastructure. In Texas alone, Union Pacific Railroad plans to spend \$452 million in capital investment in 2017, while BNSF Railway will invest an estimated \$255 million on maintenance and rail capacity expansion projects.
- Texas ports have invested over \$1.1 billion in capital projects since 2010, chiefly to accommodate expansion in the energy sector and containerized cargo.

Despite the success in raising new revenue, demand and needs continue to outpace funding. Funding and financing weaknesses in Texas include:

- State agencies and authorities responsible for maintaining the transportation infrastructure face limited or non-dedicated funding source constraints. Statutory and constitutional constraints also limit some infrastructure investments. These funding and financing challenges are compounded by a historic lack of freight-specific policies or strategies guiding investment decisions, although this has subsided in recent years through increased freight planning efforts at the local, state and national levels.

- The growth in freight volume and transportation needs outpaces available funding. The funding shortfall in the Highway Trust Fund is expected to continue, especially with the reliance on the fuel tax. Texas' economic growth has placed it in a better position than other states; however, transportation needs far outweigh available funds and will continue to do so. Narrowing the gap between transportation needs and available funding will require leadership, innovation and partnerships between the public and private sectors.
- Due to transportation funding constraints, identifying innovative and alternative funding sources is crucial.
- The lack of flexibility in transportation funding and identifying other means to fund non-highway projects is important. For example, the Texas Port Access Account Fund, which was abolished through the fund consolidation process during the same session it was created, lacked a dedicated revenue source and depended upon appropriations.
- Lack of a dedicated funding source makes it difficult for TxDOT to leverage private investment.

9.3 Summary

This chapter identified strengths and weaknesses of the highways, rail lines, seaports and waterways, airports and pipelines which have been designated as part of the Texas Multimodal Freight Network. Additionally, strengths and weaknesses of outside influences including the North American Free Trade Agreement and connectivity issues were also analyzed for their impact on the movement of freight. Understanding how Texas is currently meeting its goals for freight transportation through the identified strengths and realizing the areas of needed improvement through the identified weaknesses are both critical steps for maintaining and enhancing the state's multimodal freight system. More information on programs, policies, and projects to improve freight flow in Texas are discussed further in **Chapters 11-14** and related **Appendices**.



Texas Freight Mobility Plan

Chapter 10: Freight Project Identification and Prioritization

Texas has one of the largest and robust freight networks in the nation. The network benefits from significant public and private sector investment each year. However, despite continual improvements and record-setting investment, there are significant needs, challenges and opportunities, as identified in **Chapters 7 and 9**. The state can improve the efficiency and reliability of the movement of freight through the identification, prioritization and implementation of freight improvement projects, programs and policies.

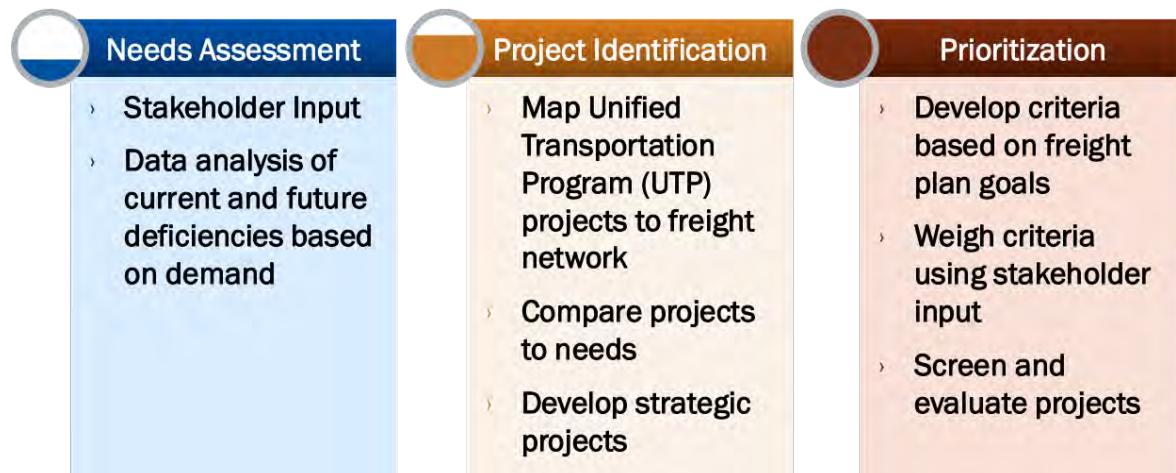
This chapter focuses on the processes and findings for identifying and prioritizing freight improvement projects. **Chapter 11** discusses programs and policies.



10.1 Overview of the Freight Investment Planning Process

TxDOT takes a transparent, data-driven and stakeholder-informed approach to decision-making for freight transportation improvements. The process, summarized in **Exhibit 10-1**, leveraged a variety of stakeholder outreach activities to gain varied perspectives. This input was combined with an assessment of needs, project identification and gap analysis, and project prioritization process to develop a strategic and cost-effective approach to freight investment in Texas. To facilitate the process, a comprehensive spatial analysis database and evaluation tool was developed. The Freight Analysis System for Texas combines transportation, economic, industry and other relevant data in a geographic information system (GIS) platform. The tool was developed to aid in the 2017 Freight Plan, but it was also designed to guide the plan's implementation.

Exhibit 10-1: *Texas Freight Mobility Plan Investment Planning Process*



While TxDOT leads this process for projects on the Texas Highway Freight Network, project identification and prioritization for other modes often relies on independent evaluation of needs by the owners and operators responsible for performance on those modes. The 2017 Freight Plan used surveys, interviews and recent planning documents to develop a list of projects for non-highway modes (**Section 10.4**).

10.1.1 Stakeholder Input

Stakeholder input was critical throughout the update of the Freight Plan, but perhaps the most critical input was in project identification and prioritization. Twenty-three stakeholder workshops were held throughout the state in February and June 2017. At these workshops, stakeholders provided input on key needs and issues. The needs identified ranged from general economic trends they observed in their regions and the state, as well as specific projects. In addition, stakeholders evaluated project prioritization criteria and were polled on the relative weights the criteria should have in terms of evaluating the impact of projects. This input was used to designate the Texas Highway Freight Network and to identify and prioritize projects on the Texas Highway Freight Network.



A workshop participant uses an online polling platform to provide input on prioritization criteria

10.1.2 Texas Freight Advisory Committee

The Texas Freight Advisory Committee (TxFAC) is a body of public- and private sector leaders who advise TxDOT on freight issues in the state. This body meets quarterly; however, the TxFAC met monthly during plan development to ensure that the goals, trends, projects and prioritization reflect the challenges facing the state. The TxFAC helped identify critical freight infrastructure projects and provided input on strategic projects that addressed gaps where needs are not currently being addressed. Through the TxFAC membership, input was solicited directly from private freight infrastructure owners and operators, such as Class I and Class III, or shortline, railroads, ports, and airports, to identify multimodal infrastructure projects under development on their assets as well as those on the adjacent Texas Highway Freight Network.

Texas Freight Advisory Committee	
BNSF Railway	Border Trade Alliance
Brogioitti Construction	Cameron County
City of Laredo	Coco-Cola
Dallas County	Governor's Office of Economic Development and Tourism
Gulf Winds International	Harris County
H-E-B	Hillwood Properties
IBC Bank	Kansas City Southern
Killam Development	Kirby Corporation
Lubrizol Corporation	McAllen Economic Development Corporation
McLane Global Logistics	Port of Corpus Christi
Port of Houston Authority	Tecma Group
Texas Association of Business	Texas Economic Development Council
Texas Farm Bureau	Texas House of Representatives
Texas International Freight	Texas Motor Transportation Association
Texas Ports Association	Texas State Senate
TNW Corporation	Trinity Industries
Uni-Trade Forwarding	Union Pacific Railroad
United Parcel Service	Waco MPO

10.1.3 Other Plans and Documents

A number of transportation and modal plans were consulted to identify applicable programs and projects. Reviewed plans included:

- **Legislative Appropriations Request for Fiscal Years 2016 and 2017.** Maritime Division and Rail Division requests were submitted to the Governor's Office of Budget, Planning and Policy and the Legislative Budget Board by TxDOT.
- **Texas Port Report (June 2014).** This report developed a baseline understanding of the volume and types of maritime cargo handled at Texas ports, existing infrastructure, and the current needs and concerns among port administrators.
- **Texas Ports 2017-2018 Capital Program.** The Port Authority Advisory Committee develops the Capital Program biennial report that details various projects and funding needs submitted by Texas ports. The report focuses on high-priority projects that Texas ports need to implement.
- **Texas Gulf Intracoastal Waterway Master Plan and Technical Report (August 2014).** This report presents the issues surrounding the ongoing, unmet maintenance needs of the Texas portion of the GIWW. It also presents recommendations for next steps to address those needs.
- **Private Industry Reports.** These are publicly available reports or information regarding private-sector investment in infrastructure, including company annual reports submitted to the Security and Exchange Commission, company media releases, and trade

publications such as the *Journal of Commerce*. The annual reports for each of the Class I railroads operating in Texas were reviewed.

- **Regional Border Master Plans.** The U.S./Mexico Joint Working Committee on Transportation Planning led a comprehensive and prioritized assessment of multimodal transportation needs along the border, including at the ports-of-entry, which resulted in the identification of short-, medium-, and long-term needs. The Texas Border Master Plans reviewed included:
 - Laredo District Coahuila/Nuevo León/Tamaulipas Border Master Plan (June 2012).
 - El Paso/Santa Teresa-Chihuahua Regional Border Master Plan (October 2013).
 - Lower Rio Grande Valley-Tamaulipas Border Master Plan (October 2013).
- **Metropolitan Transportation Plans.** These plans list needed transportation improvements and services within the various metropolitan area boundaries for the next 20 to 25 years. There are 25 MPOs in Texas, but only two have stand-alone, freight-specific plans—the Houston-Galveston Area Council (2013) and the North Central Texas Council of Governments (Dallas-Fort Worth region) (2013).
- **Texas Transportation Plan (TTP).** The TTP provides a 24-year “blueprint” for the multimodal planning process that identifies needed transportation projects and services across the state.
- **Texas Rural Transportation Plan.** This plan functions as an additional standalone component of the TTP to address multimodal rural transportation issues and to provide strategies for improving rural transportation.
- **Texas Rail Plan (2016).** This plan inventories passenger and freight rail conditions throughout the state and identifies future investment opportunities.
- **Texas Airport System Plan (2010).** This plan identifies airports and heliports that perform an essential role in the economic and social development of Texas.
- **TxDOT Port Connectivity Study (2017).** This study examines roadside and rail access at Texas ports and identifies needs and projects through interviews and analysis.

Other transportation-related documents reviewed included:

- The Panama Canal Stakeholder Working Group Report (2012).
- TxDOT Waterborne Freight Corridor Study (2011).
- Gulf Intracoastal Waterway Legislative Reports.
- Border Trade Advisory Committee Reports.
- International Trade Corridor Plan (2012).

10.2 Freight Project and Gap Identification for Highways

Two project lists were used to identify projects on the Texas Highway Freight Network: the draft 2018 Unified Transportation Program (UTP) that was published for public review in mid-July 2017 and the TxDOT Project Tracker Database. The UTP is updated annually and approved by the Texas Transportation Commission before the end of each fiscal year. The draft 2018 UTP contains projects for which partial or complete funding has been identified from certain funding categories and which are anticipated to begin within 10 years.

Projects which are not funded by the categories included in the UTP were identified through Project Tracker.¹⁸³ Project Tracker contains a broader range of projects being developed by TxDOT and its partners in transportation planning and is updated as projects progress.

Projects already under development by TxDOT can be implemented within a shorter timeframe than new projects. Many early project development processes, such as right-of-way acquisition or environmental clearances, may have already been initiated or completed for these projects. Selecting these projects allows TxDOT to review them based on Freight Plan policies. TxDOT can thus ensure that the projects meet the Freight Plan's recommendations for improving the Texas Highway Freight Network. In addition, strategic freight mobility projects were identified. These are critical freight related projects, but are not included in any plans or program elements at this time.

Exhibit 10-2 summarizes the highway freight project identification process. First, a needs assessment was conducted to identify safety, mobility and reliability, alternate route/frontage road, asset preservation, and rural highway needs. Needs on the Texas Highway Freight Network were compared to the projects in the draft UTP and Project Tracker to match current TxDOT projects to the identified freight needs. This comparison also identified gaps where there are needs, but no projects are currently planned to address those needs. TxDOT districts and metropolitan planning organizations (MPOs) were also given the opportunity to include additional freight-related needs that may not have been identified based on analysis of the existing Texas Highway Freight Network. These projects may include, for example, roadway construction on a new location or improvements to an existing roadway that is not currently a significant freight corridor, but the improvements would result in the roadway becoming a more highly utilized freight corridor.

¹⁸³ Projects with funding from Categories 2, 4 and 12 are included in the draft 2018 UTP. Project Tracker was used to identify projects which do not have funding from these three categories. The UTP project list was dated July 18, 2017, and the Project Tracker list was dated July 31, 2017.

Exhibit 10-2: Highway Freight Project Identification Process



Chapters 7 and 9 identified the needs on the Texas Highway Freight Network. The following sections present the results of the needs assessment, project identification and gap identification process for each of the need areas: safety, mobility and reliability, alternate routes/frontage roads, asset preservation and rural highway needs.

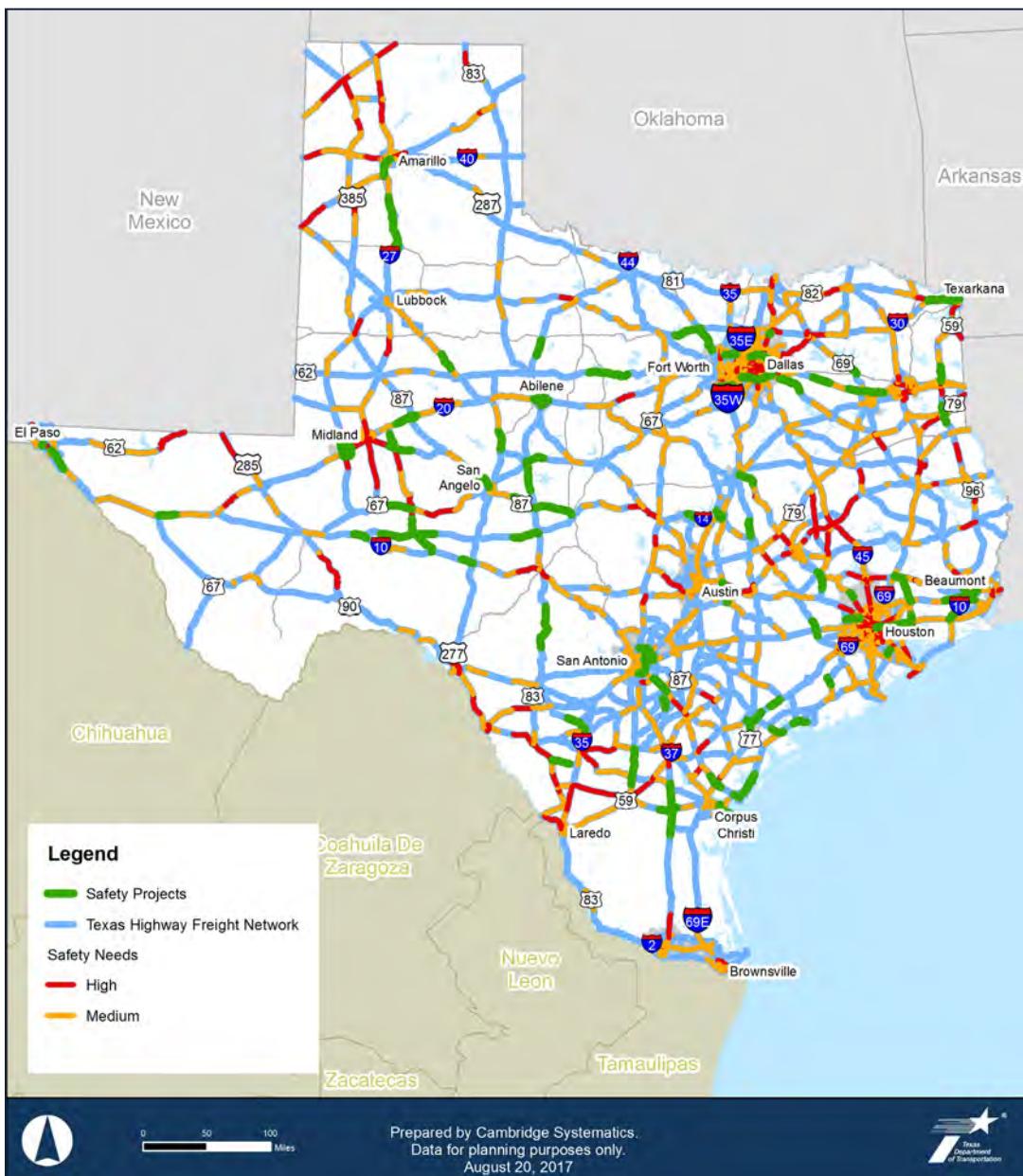
10.2.1 Highway Safety

Safety is the first goal identified in the TFMP. Highway safety projects and gaps were identified using an assessment of safety needs on the Texas Highway Freight Network and comparing projects on the draft 2018 UTP and Project Tracker lists.

Safety projects serve to reduce the frequency and/or severity of crashes on the Texas Highway Freight Network. Safety projects may involve a wide range of improvements including traffic signal changes, changes to lane configuration, highway/rail grade separations or the addition of physical barriers. Safety needs were categorized as high, medium and low based on the truck-involved crash rate and truck severity. If the rates are above average, the need is high. If the rates are about average, the needs are medium and if the rates are below average, the needs are low. **Exhibit 10-3** shows the location of safety projects on the Texas Highway Freight Network, which are spread throughout the state.

Exhibit 10-3 also shows gaps where a medium or high safety need was identified, but no safety project is currently planned. Safety need gaps are located throughout the state, and they are more prevalent in rural areas. These needs could be met by another project, such as one with a primary focus on reducing congestion. Additionally, driver behavior (such as distracted driving) or congested conditions can also impact safety. Therefore, most of the mobility projects will also address safety hotspots and a program recommendation related to driver outreach and education will address the driver behavior need.

Exhibit 10-3: Highway Safety Needs and Projects

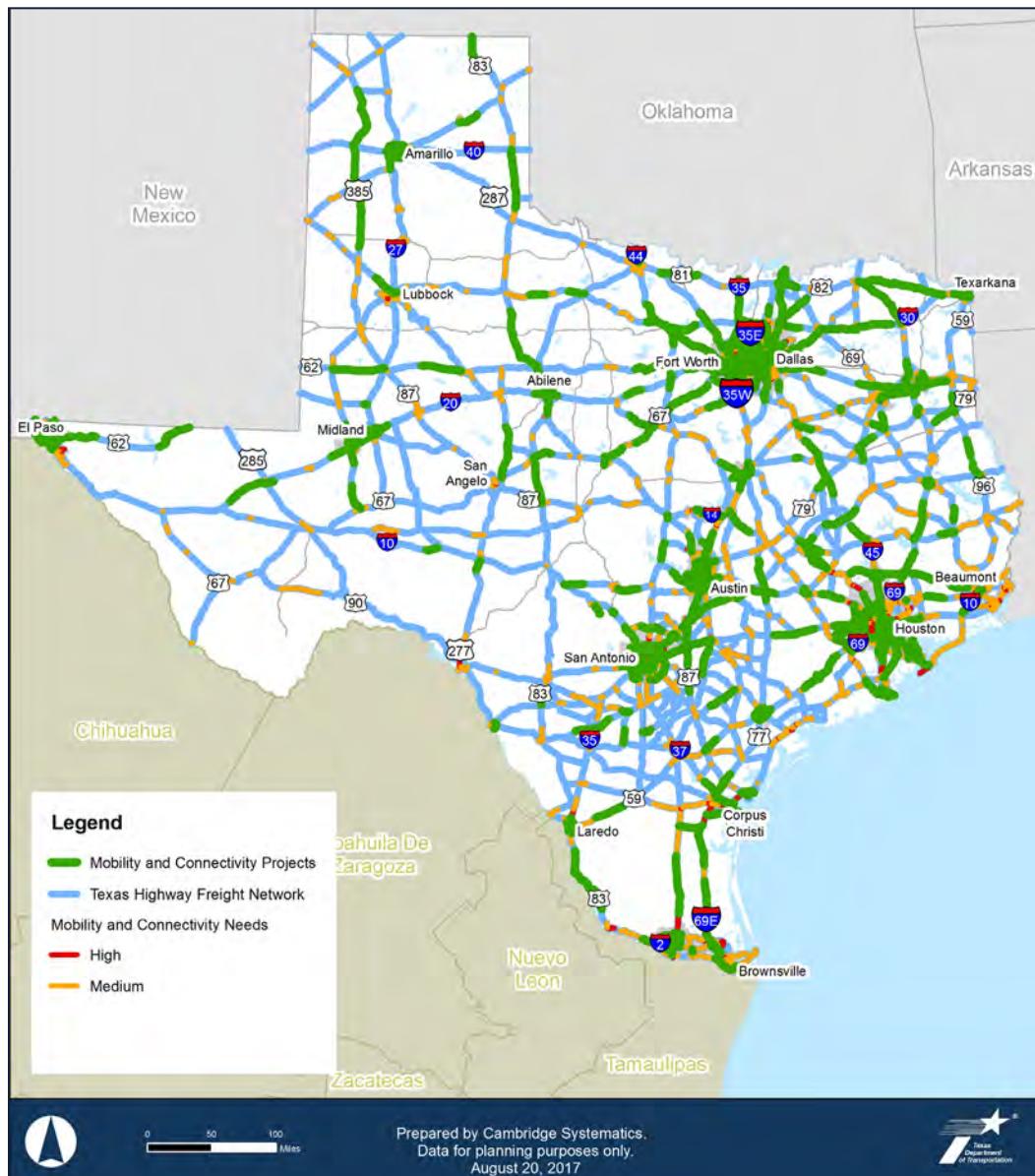


10.2.2 Highway Mobility and Reliability

Freight relies on reliable and predictable travel times to operate effectively. Highway mobility and reliability projects and gaps were identified using an assessment of mobility and reliability needs on the Texas Highway Freight Network measured by level-of-service, travel time reliability, and connectivity to freight generators. These high, medium or low needs were compared to projects on the draft 2018 UTP and Project Tracker lists.

Mobility and reliability projects serve to enhance the ability of freight to reach its destination efficiently. These projects include roadway widening, addition of turn lanes, ramp reversals or operational improvements. **Exhibit 10-4** displays the mobility and reliability projects on the Texas Highway Freight Network. These projects are located through the state, and few locations with high mobility or connectivity needs do not have projects planned. Most locations with unmet needs are in urbanized areas and along the Texas-Mexico border.

Exhibit 10-4: *Highway Mobility and Reliability Needs and Projects*

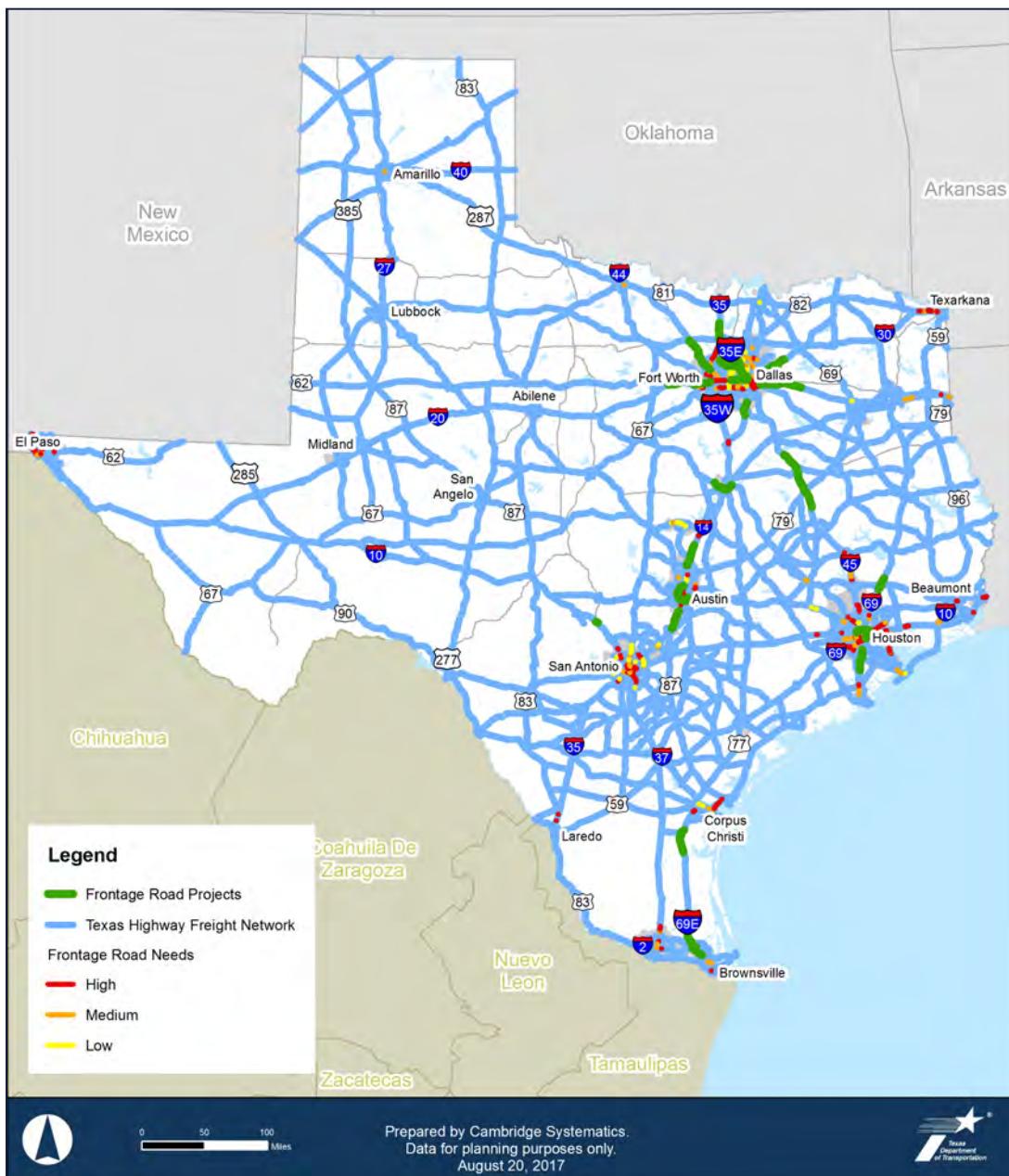


10.2.3 Highway Alternate Routes/Frontage Roads

Frontage roads provide an alternate route in the event of a disruption in traffic flow on a highway, improving reliability on the Texas Highway Freight Network. Frontage roads also provide access to local routes and establishments along controlled-access highways. Highway alternate route or frontage road projects and gaps were identified using an assessment of frontage road status and significance of the corridors to identify high, medium and low needs on the Texas Highway Freight Network. These needs were compared to projects on the draft 2018 UTP and Project Tracker lists.

Exhibit 10-5 shows the frontage road projects on the Texas Highway Freight Network. Projects are concentrated in Houston, Dallas-Fort Worth, and on I-35 between San Antonio and Waco. Additional needs without projects exist primarily in urban areas where frontage roads may be difficult to construct due to existing development adjacent to the highway and other ROW constraints.

Exhibit 10-5: Highway Frontage Road Needs and Projects



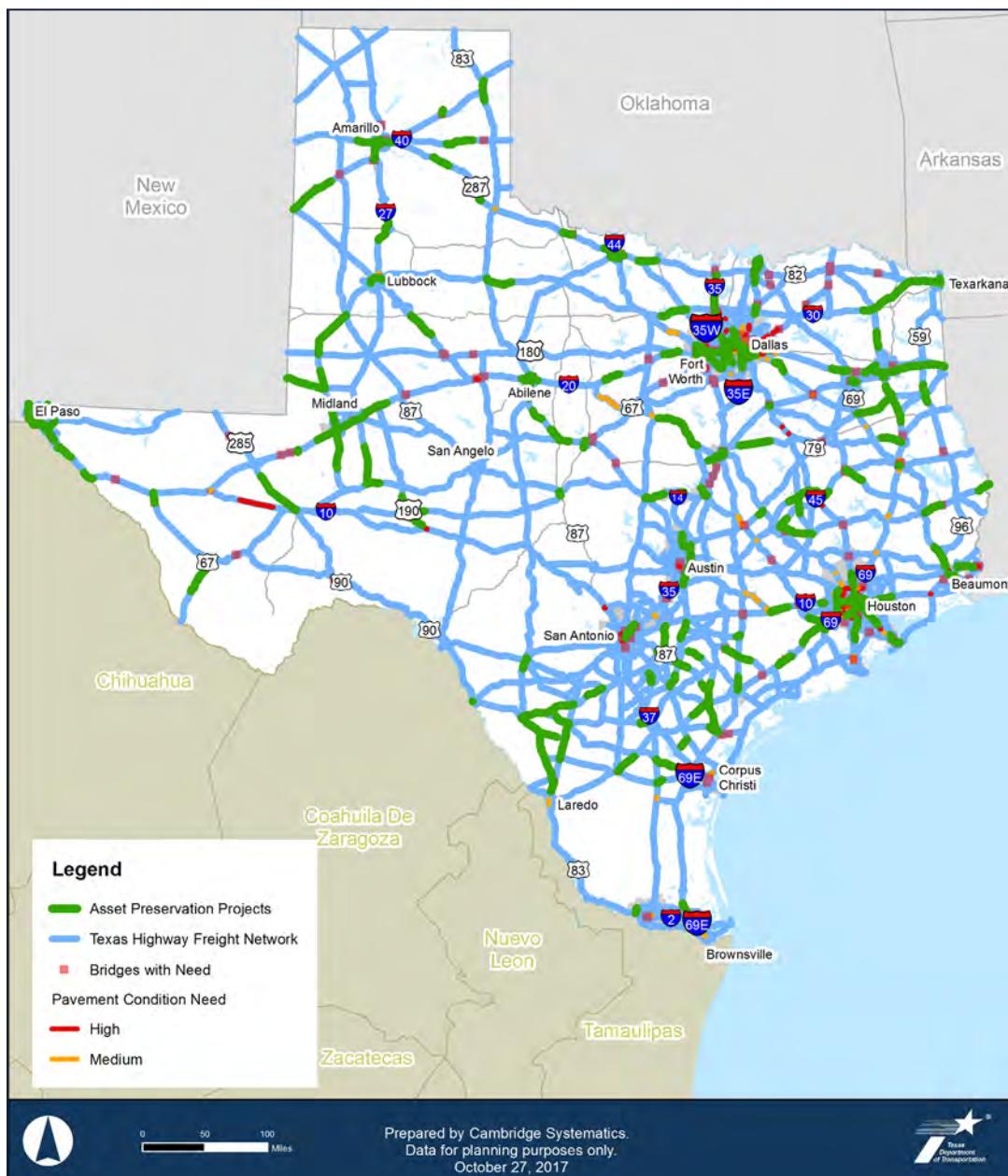
10.2.4 Highway Asset Preservation

The condition of roadways that make up the Texas Highway Freight Network play an important role in facilitating the movement of freight. Highway asset preservation projects and gaps were identified using an assessment of needs on the Texas Highway Freight Network and comparing projects on the draft 2018 UTP and Project Tracker lists.

The asset preservation projects shown in **Exhibit 10-6** met many of the identified pavement or bridge condition needs. Examples of these projects include bridge rehabilitation,

replacement or maintenance, existing roadway restoration, rehabilitation, or reconstruction, widening of existing roadways, and widening shoulders. I-10 in West Texas and locations in urbanized areas have gaps where a high priority need does not currently have an asset preservation project. However, projects aimed at improving mobility or other objectives can also address asset preservation needs. For example, the program of I-35 mobility projects may address the bridge conditions on I-35 south of Waco. This includes the replacement of bridges at US 79 and RM 620 in Round Rock to increase bridge clearances.

Exhibit 10-6: Highway Asset Preservation Needs and Projects



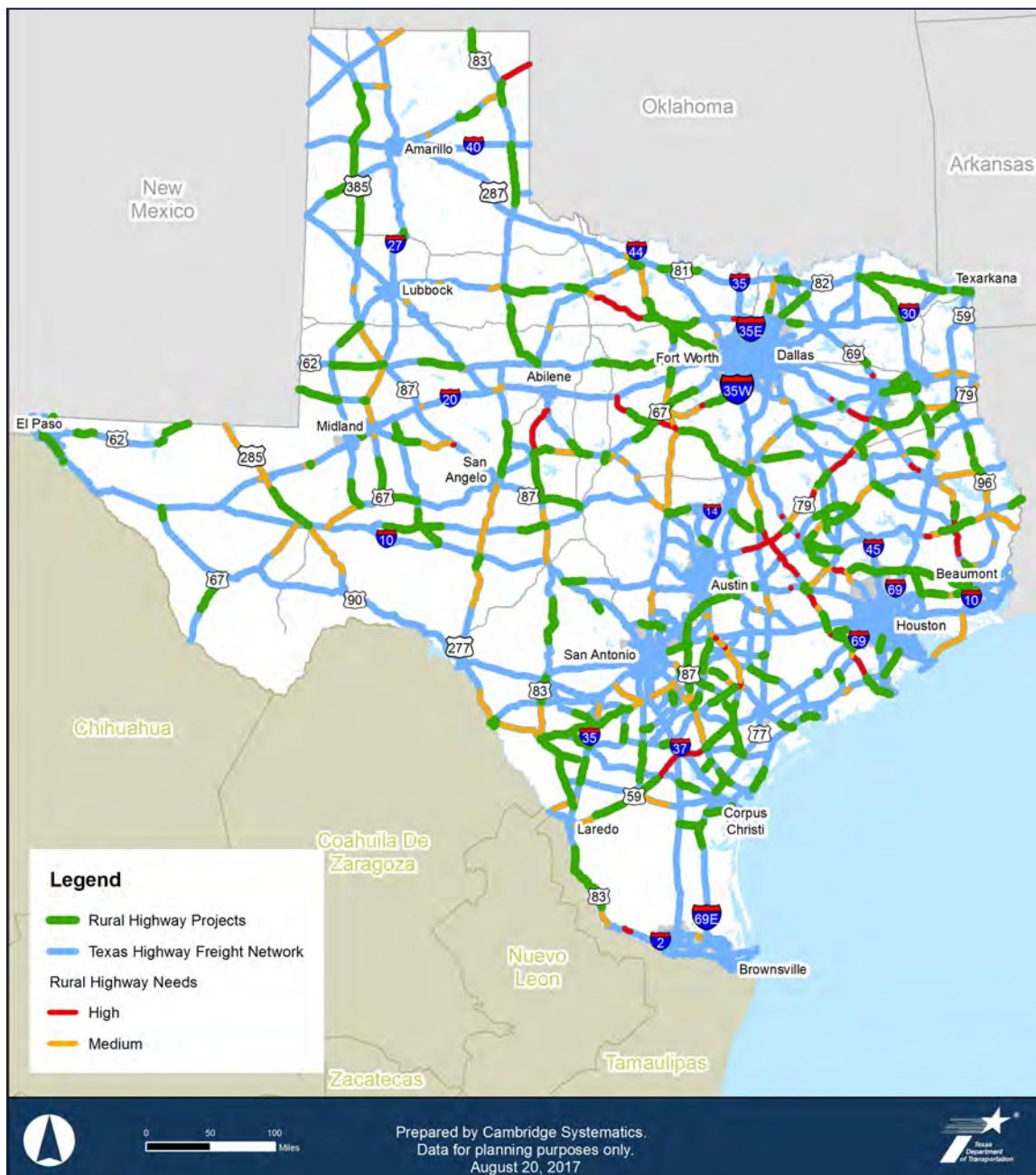
10.2.5 Rural Highway Needs

Twenty-nine percent of the Texas Highway Freight Network consists of rural two-lane highways. These roadways are important to the movement of freight throughout the state, and play a key role in providing access to energy exploration and production activities. There is a range of projects that can be identified to improve rural two-lane highways to better accommodate the movement of freight.

Rural Highway Projects and Gaps

Projects on the state's rural highway system are shown in **Exhibit 10-7**. Despite investment to increase mobility and safety on two-lane rural routes on the Texas Highway Freight Network, medium and high-level needs without projects remain. Examples include SH 36 north of Brenham, SH 82 east of Seymour and US 83 south of Abilene.

Exhibit 10-7: Rural Highway Projects and Gaps

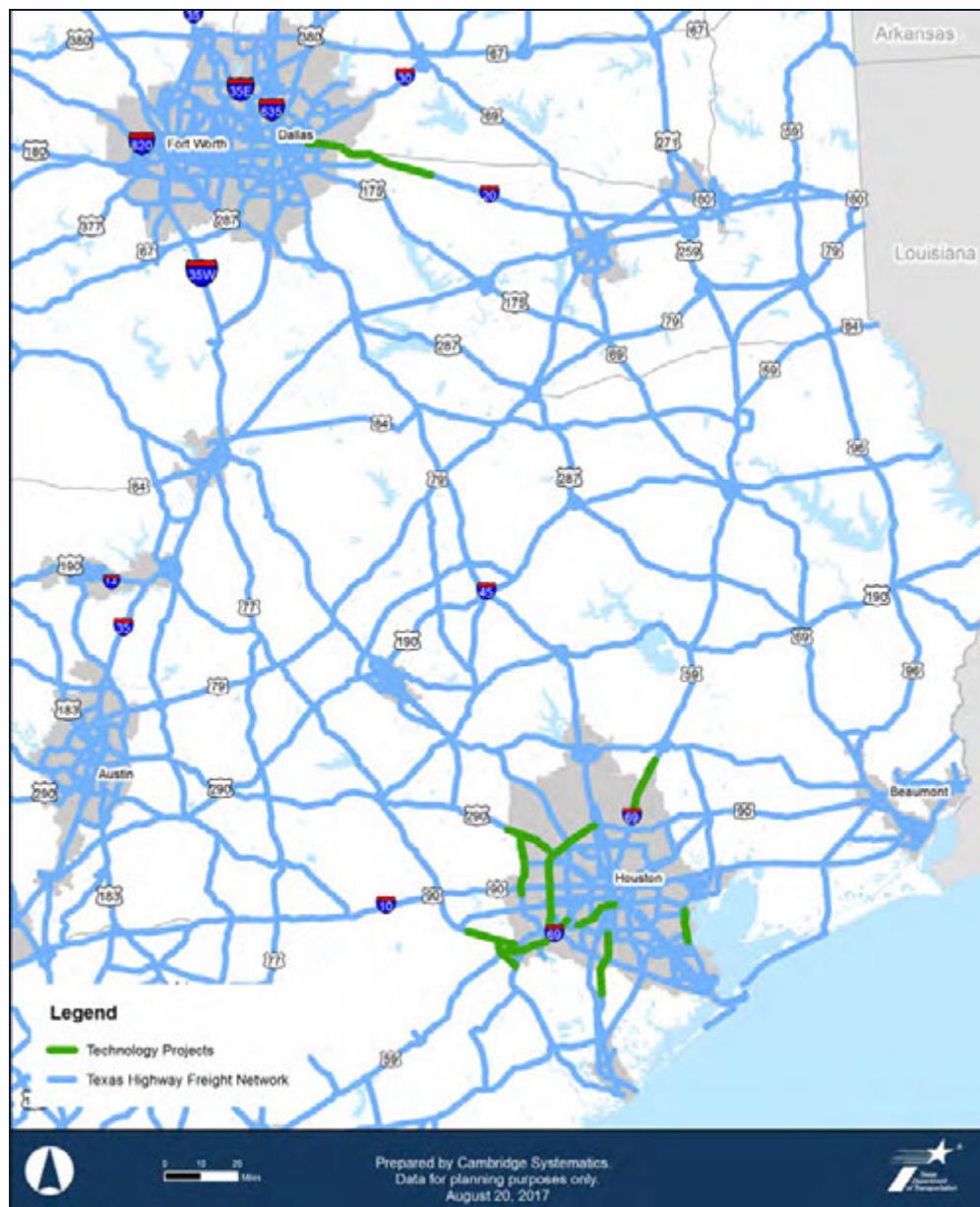


10.2.6 Highway Technology Projects

Finally, TxDOT identified projects leveraging technology, such as Intelligent Transportation Systems (ITS) including weigh-in-motion or route planning systems, which can improve traffic operations without requiring significant construction and which can often be implemented more quickly as a result. **Exhibit 10-8** shows projects leveraging technology on the Texas Highway Freight Network. These projects are concentrated near Dallas-Fort Worth and

Houston. Urbanized areas are best poised to take advantage of these technologies as they often have parallel highway routes on which to divert traffic.

Exhibit 10-8: Highway Technology Projects



10.2.7 Summary of Projects on the Texas Highway Freight Network

The combined list of draft UTP and Project Tracker projects yielded over 8,000 planned projects. Two primary attributes were used to identify freight projects for inclusion in the plan: whether the project was on the Texas Highway Freight Network and whether the

project could benefit freight. After limiting the list to those on the network, over 4,000 projects were located on the Texas Highway Freight Network.

Projects were categorized into five groups defined earlier in this chapter: safety; mobility and reliability; alternate routes/frontage roads; asset preservation; and technology. The project list was filtered to only those projects falling into one of these groups. The result was over 2,500 pending projects that were on the Texas Highway Freight Network and that addressed one of the needs and project categories.

Construction cost and funding status were determined using information from the draft UTP or Project Tracker documents. The draft UTP lists the amount TxDOT is authorized to spend on a project. This was considered the estimated cost to provide a conservative estimate for the 2017 Freight Plan. Project Tracker lists a construction cost estimate that was used in the plan. Both databases list the funding allocated to a project by funding category. These values are summed to determine how much funding has been allocated to a project. The funding status of a project is determined by whether the allocated funding met the estimated or authorized cost of the project.

10.3 Prioritization of Freight Projects

Section 10.2 identified the suite of projects that address at least one of the Freight Plan goals discussed in **Chapter 2**. This section describes the evaluation process to identify what projects should be priorities for TxDOT, beginning with stakeholder-driven criteria and resulting in an objective rating of highway projects.

10.3.1 Developing Highway Prioritization Criteria

Project evaluation involved developing a set of potential criteria based on the Freight Plan goals of economic competitiveness, mobility and reliability, safety, asset preservation, stewardship, and sustainable funding. Use of technology is included here as well based on stakeholder input and increased technology implementations for transportation related projects. Stakeholders provided input via the TxFAC and stakeholder workshops, and MPO staff contributed to the revision and refinement of the final criteria. The proposed evaluation criteria are shown in **Exhibit 10-9** along with their corresponding primary goal area. Note that some criteria will encompass multiple goal areas, but only the primary one is included here.

Exhibit 10-9: Highway Freight Project Evaluation Criteria

Criteria	Goal Area
Project supports growth in freight volumes for targeted supply chains	Economic Competitiveness
Project supports access to Megasite ¹⁸⁴ or other certified development site	Economic Competitiveness
Project improves facility design for more efficient freight movement	Asset Preservation and Utilization
Project improves freight travel time reliability	Mobility & Reliability
Project improves access to freight generator/terminal	Multimodal Connectivity
Project reduces freight travel time	Mobility & Reliability
Project enhances the state of good repair on the Texas Multimodal Freight Network	Asset Preservation and Utilization
Project improves facility that is structurally deficient or functionally obsolete for freight vehicles on the Texas Multimodal Freight Network (vertical clearance, posted weights, etc.)	Asset Preservation and Utilization
Project addresses a freight safety hotspot	Safety
Project enhances safety on a high volume Hazardous Material Route	Safety
Project eliminates at-grade crossings on the Texas Multimodal Freight Network	Safety
Project encourages truck to rail diversion	Multimodal Connectivity
Project has some funding from an alternative source	Sustainable Funding

Once the criteria were defined, stakeholder input was used to developed weights for each category of criteria. Participants in the stakeholder workshops rated all of the criteria at least “somewhat relevant.” Generally, criteria in the mobility and reliability category ranked highest. The top rated factor overall was “Project improves freight travel time reliability,” followed by “Project reduces freight travel time.” **Exhibit 10-10** shows the highest-ranking project evaluation criteria for each workshop.

¹⁸⁴ A Megasite is a parcel that has been developed by a public or private entity to encourage clustering of businesses. For example, an economic development corporation may conduct the initial steps of site development to make a location more attractive to prospective businesses.

Exhibit 10-10: Highest Ranking Project Evaluation Criteria

Workshop	Top Criteria
El Paso	Project reduces freight travel time
Midland	Project improves facility that is structurally deficient or functionally obsolete for freight vehicles on the Texas Multimodal Freight Network
Lubbock	Project improves freight travel time reliability
Fort Worth	Project improves freight travel time reliability
Laredo	Project improves freight travel time reliability
Brownsville	Project reduces freight travel time
Corpus Christi	Project addresses a freight safety hotspot
Houston	Project improves freight travel time reliability
Texarkana	Project improves freight travel time reliability
Dallas	Project improves freight travel time reliability
San Antonio	Project improves freight travel time reliability

At the El Paso and Brownsville workshops, a reduction in freight travel time was rated as the most important criterion for project selection. In Midland, a smaller urbanized region with periodic booms in heavy freight traffic, projects improving existing conditions in structurally deficient or functionally obsolete infrastructure were the top priorities identified by workshop attendees. Participants in the Corpus Christi workshop selected safety hotspots as the top priority, consistent with the region's strong preference for the safety category in online polling. In all other workshop locations, improving freight travel time reliability was the criterion with the highest ranking.

The lowest ranking selection criterion was "Project has some funding from an alternative source." This criterion was among the bottom in each of the workshops and received an average score below "somewhat relevant" in five locations. Truck-to-rail diversion, access to a Megasite or other development opportunity, and at-grade crossing removal also received relatively low rankings.

Similarly, the TxFAC discussed the relative importance of these criteria. Based on the statewide input, goal areas were weighted and used in the project prioritization process. The resulting weights used to screen the identified projects are shown in **Exhibit 10-11**.

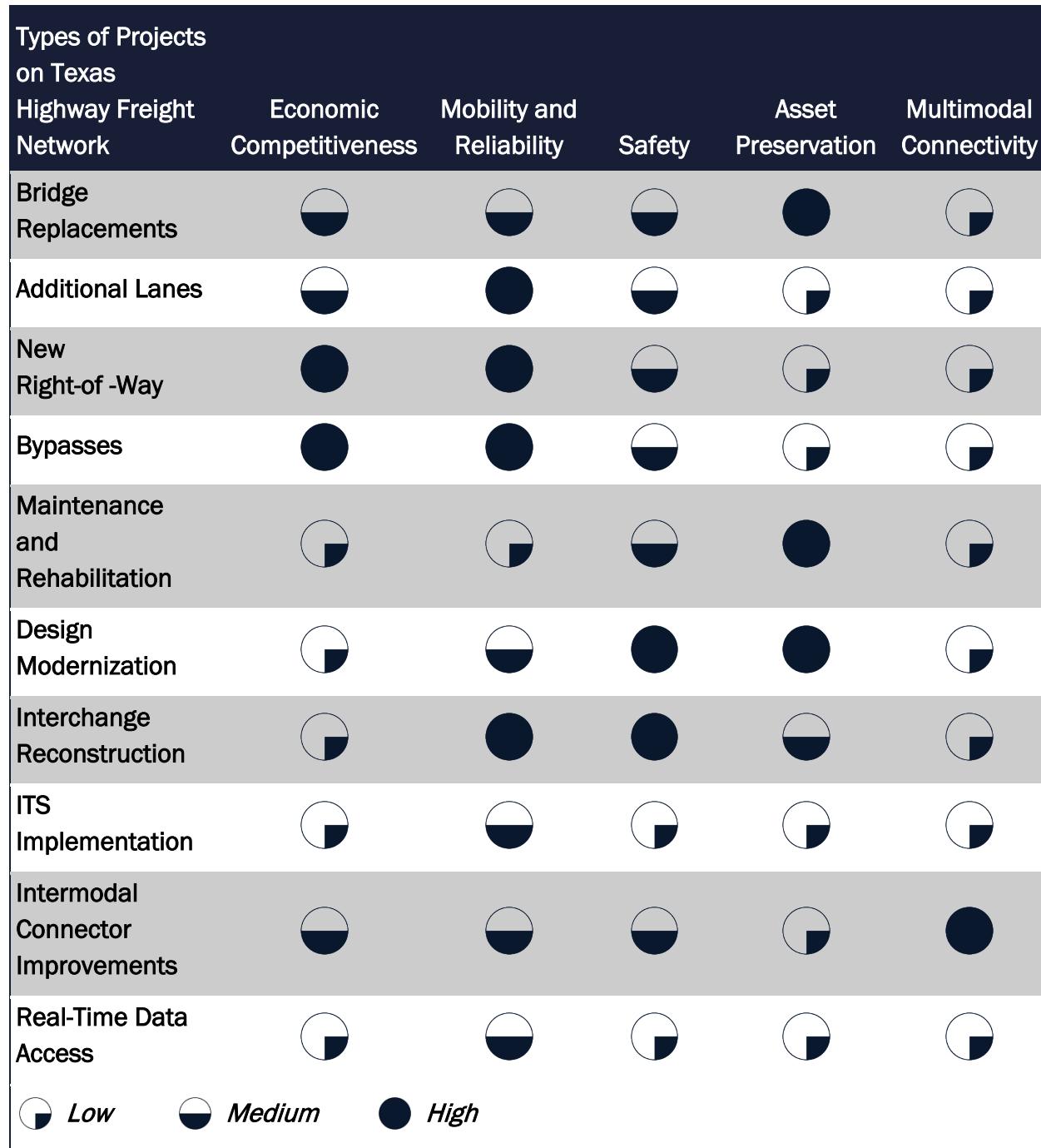
Exhibit 10-11: *Weighting of Highway Project Prioritization Criteria by Goal Area*

Goal Area	Weight
Mobility and Reliability	25%
Safety	20%
Economic Competitiveness	20%
Asset Preservation and Utilization	15%
Multimodal Connectivity	10%
Sustainable Funding	5%
Technology	5%

After identifying the projects, a high-level screening using the goal area criteria was conducted. Due to the magnitude of the plan, the screening was not done at the project level, but rather by project type. It is understood that the qualitative evaluation methodology employed will not produce results suitable for documenting project-specific feasibility, nor will the qualitative evaluations result in a true cost-benefit analysis of various projects or strategies. However, the analysis does provide generalizations about the types of impacts that can be expected from alternative categories of projects.

The results of the qualitative evaluation are meant to offer comparisons between each project and strategy category for each specific evaluation criteria. The evaluation, summarized in **Exhibit 10-12** provides insight into the trade-offs of alternative strategies, allowing policymakers to move forward with the projects most consistent with their goals and objectives.

Exhibit 10-12: *Summary of High-Level Highway Project Screening*



As a result of the screening, 223 routine maintenance projects were removed. Asset preservation projects rank relatively low in three of the five goal areas in screening and these projects were on segments with no or "Low" Asset Preservation need as determined through the needs assessment process. This results in 2,370 freight highway project

recommendations on the Texas Highway Freight Network that have not been let, are on the Texas Highway Freight Network and fall into one of needs and project categories.

Exhibits 10-13 and 10-14 summarize the source and type of identified highway freight projects to be considered for prioritization. More detailed analysis of the projects in the TFMP Update can be found in **Chapters 12 and 13**.

Exhibit 10-13: Planned Highway Freight Projects by Source

Source	Number of Projects	Cost (Thousand Dollars)
2018 Draft UTP	449	\$22,222,299
Project Tracker	1,893	\$41,730,584
Other	28	\$705,772
Total	2,370	\$64,658,655

Exhibit 10-14: Planned Highway Freight Projects by Category

Project Category	Number of Projects	Cost (Thousand Dollars)
Alternative Routes	325	\$15,645,872
Asset Preservation and Utilization	370	\$2,402,473
Mobility and Reliability	801	\$45,758,222
Safety	847	\$693,461
Technology and Ops. Improvements	27	\$158,626
Total	2,370	\$64,658,655

Exhibit 10-15 presents a summary comparison between projects identified in the 2017 Freight Plan and the 2016 Freight Plan. The number of projects increased significantly primarily because the 2017 Freight Plan expanded the planned projects to include projects outside of the UTP and the Texas Highway Freight Network was expanded by nearly 3,000 miles. Since 2016, 136 projects have been let and another 557 dropped out.

Exhibit 10-15: Comparison of the Projects in the 2017 Plan and the 2016 Plan

Description	Number of Highway Projects
2016 Texas Freight Mobility Plan	877
2017 Texas Freight Mobility Plan	2,370
Added since 2016 Plan	2,186
Removed since 2016	557
Let	136

Multimodal Highway Freight Projects

TxDOT afforded special attention to highway projects on the Texas Highway Freight Network interacting with another mode, including at-grade rail crossings, port access, airport access, and access to commercial vehicle border crossings. These were identified based on project location, project description, the concurrent port access study and surveys of airports.

Exhibit 10-16 lists the number of highway projects providing access to each of the other modes. Additional information can be found in **Chapters 12 and 13**.

Exhibit 10-16: Summary of Planned Multimodal Highway Freight Projects

Mode	Number of Projects	Cost (Thousand Dollars)
Air Cargo	13	\$504,571
Border Crossing	84	\$938,894
Port Access	25	\$641,416
Rail Grade Separation	34	\$332,358
Multiple Modes	8	\$443,431
Total	164	\$2,860,670

10.3.2 Prioritization Process and Results

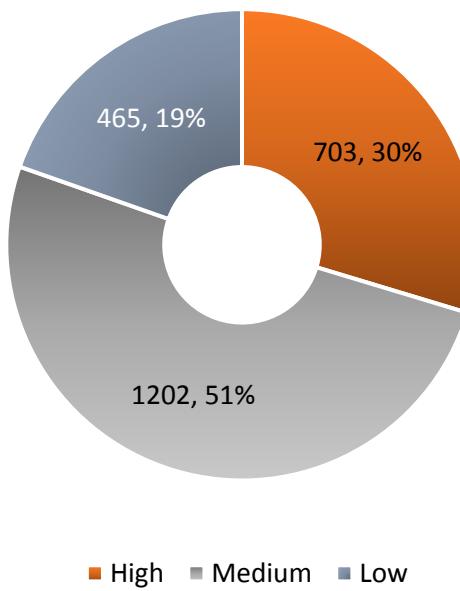
For each segment of the Texas Highway Freight Network, needs were identified in each of categories described in Section 10.2. "High", "Medium" and "Low" ratings were converted to a numerical rating to enable comparison of segments with different need types. Projects addressing "High" needs received 5 points while those addressing "Medium" needs received 3 points. One point was assigned for projects addressing "Low" needs. Projects often address more than one need and goal and this is recognized within the prioritization process. For example, if a project is addressing "High" mobility needs and "Low" safety needs on a roadway segment connecting to a port on the Texas Multimodal Freight Network, it would receive 5 points for mobility goal area, 1 point for the safety goal area and 5 points for the multimodal connectivity goal area.

The awarded points were then weighted based on the final prioritization weighting presented in **Exhibit 10-11**. Mobility and reliability points are weighted at 25 percent, economic competitiveness and safety are each weighted at 20 percent, asset preservation and utilization are weighted at 15 percent, multimodal connectivity at 10 percent and technology and sustainable funding are each weighted at 5 percent. Given that all of the projects being evaluated have some level of funding, with many being fully funded, the sustainable funding criteria was not used in the weighting. The weighting was applied to all the raw project scores.

Based on the distribution of final weighted scores, the highway projects were categorized as high, medium and low priorities. The scores ranged from less than 1 to 18.1 with the average score being 7.6. All projects scoring 10 and above are categorized as high priority. Projects scoring between 4.75 and 10 are deemed medium priority, and those scoring below 4.75 are considered low priority.

Exhibit 10-17 summarizes the results of the prioritization of highway freight projects. In total, 703 projects are high priority, 1,202 are medium priority and the remaining 465 projects are low priority.

Exhibit 10-17: *Summary of Planned Highway Freight Projects by Priority*



10.4 Freight Project Identification Process for Other Modes

The project selection process for other modes—including rail, waterway and air—differed from that developed for highway projects because the infrastructure for these modes is largely privately owned. TxDOT did not attempt to develop priorities for assets it does not

own. Instead, project selection relied on extensive stakeholder input, publicly available transportation plans, and documents and analysis completed as part of the 2017 Freight Plan. A summary of the process for each mode is provided below.

10.4.1 Railroad Needs and Project Identification

A meeting between the Class I railroads, TxDOT, the Houston-Galveston Area Council and the North Central Texas Council of Governments was convened in June 2017 to discuss the railroad needs and project lists. The group agreed that only rail projects with significant public benefit and public sponsor would be included in the Freight Plan. Both Class I and shortline railroads took the lead on developing and refining the rail project list with input from public-sector partners.

The updated rail project list reflects 90 rail projects with a total estimated cost exceeding \$1.3 billion. However, estimates for many of the projects are not available. The majority of the estimated rail improvement cost comes from projects on the Class I railroads, identified by the railroads, TxDOT, MPOs, Gulf Coast Rail District and the ports. Projects on the Class I railroads consist of 23 grade-crossing separations, 3 rail-bridge projects, 5 mainline rail expansion projects and 5 various other projects. Shortline projects consist of upgrading rail to 286,000-pound capability, new track for interchanges with the Class I railroads, improvements to grade crossings and general upgrades. The ports also identified some significant rail projects, some of which are inside their gates and some outside. More information on these projects can be found in **Chapters 12 and 13**.

10.4.2 Port Needs and Project Identification

The 2017-2018 Texas Ports Capital Program includes 20 high-priority capital projects at a cost of \$217.2 million. The projects include rail spurs and rail improvements, bulk and liquid bulk terminals, dredging, truck queueing area, repairs and other miscellaneous investments.

The Freight Plan reflects only the port and waterway access projects and not projects on port property. TxDOT focused on the "outside-the-gate" projects based on input from the ports. The 2017 Freight Plan drew heavily from the on-going Port Connectivity Study being conducted by the TxDOT Maritime Division. Following the compilation of the draft list of needs and projects, a meeting was convened with the ports and TxDOT to finalize the lists. This was combined with data analysis from the Texas Highway Freight Network needs assessment to identify bottlenecks and needs on key access routes. The result is 8 projects on the Texas Highway Freight Network with projects currently on the draft UTP or in Project Tracker. An additional 29 projects not on Texas Highway Freight Network roads were identified along with 47 proposed projects not currently in the planning or development process. More information on these projects can be found in **Chapters 12 and 13**.

10.4.3 Air Cargo Access Needs and Project Identification

Each of the airports included on the Texas Multimodal Freight Network participated in a survey and interview to discuss current and future needs and projects. This outreach was then compared to highway projects on the Texas Highway Freight Network within one mile of the Texas Multimodal Freight Network air cargo airports. Additional projects not included in the interviews, but located within one mile, were added to the airport access project list. This results in 20 currently planned highway projects. More information on these projects can be found in **Chapters 12 and 13**.

10.4.4 Commercial Vehicle Border Crossings

Representatives from the border regions participated in two rounds of workshops to identify key freight needs and projects. In addition, the MPOs representing border regions participated in workshops and webinars to identify needs. This was combined with data analysis from the Texas Highway Freight Network needs assessment to identify bottlenecks and needs on key access routes. This resulted in 92 planned projects near commercial vehicle border crossings. More information on these projects can be found in **Chapters 12 and 13**.

10.4.5 Prioritization for Non-Highway Modes

Infrastructure investment for rail, ports and airports is often led by an entity other than TxDOT, whether by a private company or separate public entity such as a port authority or airport. For this reason, project selection for other modes was led by stakeholder outreach and based on interviews, concurrent studies and representation on the TxFAC.

For rail projects, the prioritization in the updated Freight Plan reflects the following:

- Class I railroad projects. For projects on the Class I railroads, the prioritization reflects the priorities of the public sector and may not reflect the railroad's priority.
- Shortline railroad projects are prioritized by the shortline railroad.
- TxDOT-sponsored railroad projects reflect TxDOT priorities.
- Port-identified rail projects are prioritized by the ports.

The port, airport and border crossing access projects are prioritized using the same method for all highway projects discussed above. The results of the project identification and prioritization process feed directly into the 5- Year Financially Constrained Freight Investment Plan and Unconstrained Freight Investment Plan, which are presented in **Chapters 12 and 13**. The implementation of these projects hinge on having policies and programs that encourage multimodal freight investments in place. Recommendations for freight policies and programs are presented in **Chapter 11**.

10.4.6 Future Updates to Freight Project Needs

Throughout the freight project identification and prioritization process, needs and gaps in the freight transportation network became apparent and strategic projects were defined that did not exist on previous project lists or plans. These are aspirational projects that address a critical need as demand grows and the volume of freight moving in and through the state increases. Recognizing that these projects are not at a point of advancing in the plan prioritization, these strategic projects are identified and listed to move these projects forward for future development and funding.

The strategic projects are freight centric and are designed to enhance freight mobility and provide effective alternate options for moving freight in and out and through the state. As the Texas Freight Mobility Plan is updated and prioritized projects are implemented, the strategic projects will have advanced in concept, design and plan and appropriately added to the plan for prioritization and implementation. Due to the critical nature of these strategic freight projects, the development of these projects could advance and be considered for timely implementation.

10.5 Summary

This chapter described the manner in which individual freight projects were identified, selected and prioritized for implementation. The knowledge and local insight of Texans on matters of freight mobility were brought to bear throughout this planning process through stakeholder workshops and meetings of the Texas Freight Advisory Committee. This input was critical in developing the needs assessment, prioritization criteria and weighting for particular goal areas, resulting in a decision-making process that is data-driven, fair and transparent. TxDOT must have an open and efficient process to prioritize and select projects that advance the economic interests of the state and the country. This planning process fits this need, and over time it can be revised as needs and issues change.



Texas Freight Mobility Plan

Chapter 11: Freight Policy and Program Recommendations

This 2017 Freight Plan identifies numerous challenges to the state's freight transportation network including aging infrastructure, urban congestion and bottlenecks, safety concerns, system capacity constraints, systems management and operations issues, rural and multimodal connectivity challenges, international border crossing challenges, lack of public education and awareness, lack of institutional coordination and funding challenges. Meeting these challenges requires the recommendations presented in this Freight Plan to be multimodal, multifaceted and to provide a comprehensive approach. The recommended freight improvement strategy outlines statewide freight policy and program enhancements that will:

- Strengthen the freight and logistics industry in Texas by promoting a multimodal approach to freight mobility, reliability, efficiency and safety.
- Support long-term population, freight and economic growth, economic competitiveness and quality of life.



11.1 Overview of the Recommendations

The Texas Freight Mobility Plan provides three multimodal and broad-based improvement strategies for addressing freight transportation challenges in Texas:

- Policies. Broad policy recommendations to help change the way Texas approaches freight planning.
- Programs. A collection of programs and initiatives that can be undertaken to achieve policy goals.
- Projects. Specific infrastructure projects that support policy goals and improve freight movement along the Texas Multimodal Freight Network.

These three strategies are necessary to address the magnitude and complexity of freight transportation challenges confronting the state. The policy, program and project recommendations are not exclusive. Instead, the success of one strategy will significantly depend on the successful implementation of another, thus underscoring the need for a well-coordinated and simultaneous implementation of the recommendations. Additionally, a continuous and sustained implementation of these strategies is necessary for Texas to remain economically competitive.

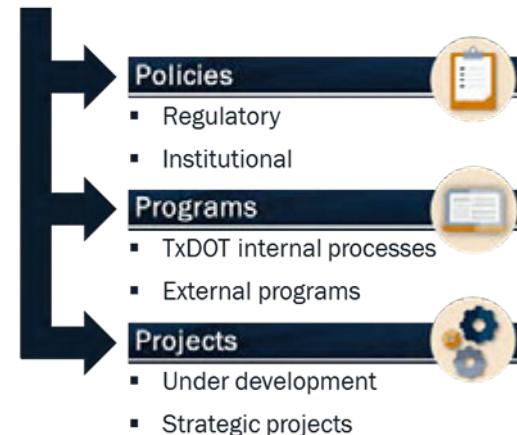
Not all policy and program recommendations outlined in this Freight Plan fall under the jurisdiction of the Texas Department of Transportation (TxDOT). Implementation of many of the recommendations is the responsibility of other state and federal agencies, MPOs, local governments, private-sector entities, such as railroads, and other organizations. Some will require legislative action. Therefore, a strong partnership and collaboration between all agencies and stakeholders is required to effectively and successfully implement the Freight Plan policy and program recommendations.

This chapter discusses the policy and program recommendations. The project recommendations are discussed in **Chapter 12**.

11.1.1 Stakeholder Engagement

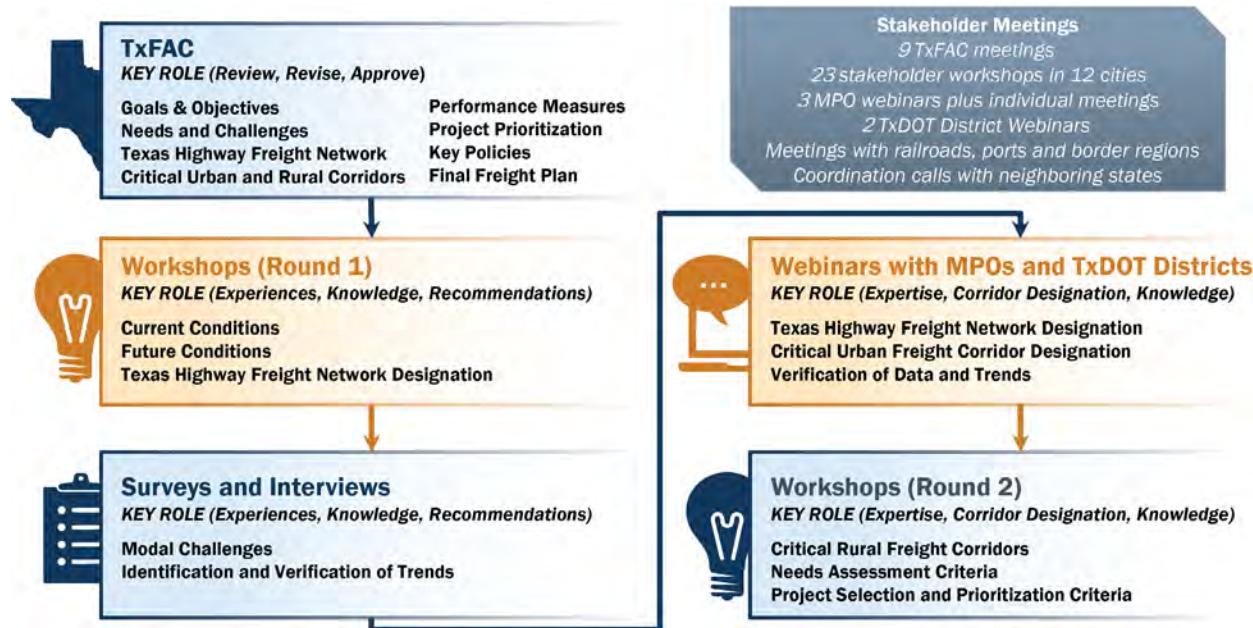
The update of the 2016 recommendations reflects an extensive stakeholder engagement process (see **Exhibit 11-1**). The process included the Texas Freight Advisory Committee (TxFAC), two rounds of stakeholder workshops held in 12 cities throughout the state, a

Texas Freight Mobility Plan



series of webinars with the TxDOT Districts and Metropolitan Planning Organizations (MPOs) and public input solicited throughout the update at the <https://www.MoveTexasFreight.com> web site.

Exhibit 11-1: Summary of Stakeholder Engagement Used to Development Recommendations



11.1.2 The Texas Multimodal Freight Network

The designation of the Texas Multimodal Freight Network, which consists of the Texas Highway Freight Network, Texas Rail Freight Network, Gulf Intracoastal Waterway (GIWW), major seaports, major cargo airports and commercial border crossings, was a critical first step in developing the Freight Plan (see **Chapter 6**) and a priority policy recommendation. The purpose of designating the Texas Multimodal Freight Network is to focus the Freight Plan and guide future freight transportation investments to the most strategic facilities. The network is instrumental in guiding current and future strategic transportation investment decisions, enhancing safe and efficient movement of freight and supporting the state's economic development goals. The remaining recommendations—policy, programmatic, and projects—focus on the Texas Multimodal Freight Network.

The Freight Plan goals, as well as other state and federal goals discussed in **Chapter 2**, provide the foundation for developing the policy, program and project recommendations and for setting priorities for future freight transportation improvement implementation.

11.1.3 Coordination with Adjacent States and Mexico

The state's freight planning process includes coordination with organizations in adjacent states and in Mexico, including a review of freight-related plans. Representatives of these

various organizations participated in stakeholder engagement activities and provided input on freight movement in, out and through Texas that impact transportation infrastructure. Discussions focused on interstate corridors, the North American Free Trade Agreement (NAFTA) and cross-border freight movement. These organizations included:

- Alliance for I-69 Texas.
- Ports-to-Plains Alliance.
- Texas Border Trade Advisory Committee.

TxDOT districts involved in joint multistate corridor studies and projects with neighboring states provided input on project planning and development initiatives that address freight transportation. Examples of these types of projects include a rail bypass study in the El Paso District, I-10 corridor improvements in the Beaumont District and border-crossing improvement projects in the Laredo District.

In addition, information was gathered on freight and transportation planning initiatives in neighboring states. New Mexico and Arkansas officials attended stakeholder workshops in El Paso and Texarkana, respectively. A series of conference calls also were conducted with New Mexico, Oklahoma, Arkansas and Louisiana in August 2017 to coordinate on the freight system designation and multistate needs and projects.

The advent of NAFTA greatly expanded the scope of international activities for TxDOT, particularly through the TxDOT Freight and International Trade (FIT) Office. Over the past several years, the office's role in providing support and advice to TxDOT on international activities has increased along with TxDOT's role in transportation planning along the Texas-Mexico border. The FIT office attempts to ensure that national and international communications are consistent and activities are coordinated and centralized. It performs facilitative, liaison and research functions and hosts international transportation officials to exchange technical information and share common practices.

TxDOT is a member of the U.S./Mexico Joint Working Committee on Transportation Planning. This Committee led a comprehensive and prioritized assessment of multimodal transportation needs along the border, including the border crossings, resulting in the identification of short-, medium-, and long-term needs. TxDOT also oversees the Texas Border Trade Advisory Committee (BTAC), which serves as a forum for agency transportation decisions affecting trade and the movement of freight at the border. Proceedings from the BTAC meetings were reviewed as part of the 2017 Freight Plan. In addition, Texas Border Master Plans were reviewed including:

- Laredo District Coahuila/Nuevo León/Tamaulipas Border Master Plan (June 2012).
- El Paso/Santa Teresa-Chihuahua Regional Border Master Plan (October 2013).
- Lower Rio Grande Valley-Tamaulipas Border Master Plan (October 2013).

11.2 Policy Recommendations

The Freight Plan policy recommendations address freight transportation challenges confronting Texas. The main purpose of the policy recommendations is to provide an overall framework for freight transportation investment decision-making. The policies provide the basis for aligning this investment with the state's economic goals to enhance economic competitiveness. The adoption and implementation of these policies will ensure the continued efficient and safe movement of people and goods. The policies also are consistent with the multi-institutional and multimodal nature of freight transportation in Texas. Additionally, the policies guide programs and projects and will direct implementation of the Freight Plan recommendations. For the update, the policy recommendations were reviewed to ensure continued relevancy and consistency with the latest federal and state legislation and TxDOT policy.

These policies, originally developed based on TxFAC and stakeholder input gathered through extensive outreach efforts, as well as analysis of data and critical issues and challenges facing freight movement in Texas, were reaffirmed with modest modifications through the stakeholder and TxFAC vetting during the update. Modifications also were made based on a review of the most recent legislation. The policy recommendations are outlined below.

11.2.1 TxDOT Freight Planning Capacity and Activities

The state should continue to support and expand freight planning capacity and activities.

The objectives of this policy are to:

- Expand TxDOT's support and technical capacity roles in modes other than highways by integrating the needs of the entire multimodal freight transportation system in the planning, project selection and implementation processes.
- Continue to develop and administer a comprehensive and multimodal freight-planning program that integrates freight considerations and needs within TxDOT's performance-based project selection process.
- Ensure effective implementation of the Freight Plan through a commitment to appropriate staffing and resources, subject to legislative appropriations.
- Promote TxDOT's long-term freight planning efforts through internal and external outreach efforts with an emphasis on a multimodal approach, including continued

engagement of the freight industry and businesses through TxFAC and other outreach efforts.

- Employ scenario-planning approaches to evaluate how the Freight Plan recommendations ensure Texas is prepared for alternative economic futures.

11.2.2 Freight Network Designation and Investment

TxDOT should use the adopted Texas Multimodal Freight Network as the strategic framework for statewide transportation investment decisions.

The objectives of this policy are to:

- Target federal and state investment in freight infrastructure to enhance the movement of freight throughout Texas and the nation, as part of TxDOT's performance-based project selection process.
- Support investment in the Texas Multimodal Freight Network as a critical component of the state's economy and to enhance economic vitality.
- Provide analysts, managers and policymakers with a clear understanding of the areas of critical need for improving goods movement throughout the state.
- Comply with federal requirements for freight planning and future project funding eligibility.

11.2.3 Texas Highway Freight Network Design Guidelines and Implementation

TxDOT should review and modify design standards on the Texas Highway Freight Network to facilitate safe and efficient movement of people and goods.

The objectives of this policy are to:

- Evaluate applicable geometric design standards with respect to commercial vehicle movement on portions of the Texas Highway Freight Network (e.g., turning radii, number of turning lanes, ramp configurations, capacity, frontage road connectivity and clearance or width for oversize loads).
- Continue implementing the new vertical clearance standard of 18 feet 6 inches on the Texas Highway Freight Network.

11.2.4 Multimodal Freight Planning, Programming and Implementation

TxDOT should implement multimodal freight planning, programming and implementation guidelines for integrating freight into the TxDOT investment decision-making process.

The objectives of this policy are to:

- Address freight movement challenges confronting the state through a holistic approach, reflecting the diverse private- and public-sector roles in improving freight movement, safety and efficiency.
- Develop public- and private-sector partnerships that target the various modes and users of the freight transportation network.
- Integrate freight considerations into TxDOT district and MPO planning, project development, programming and implementation efforts.
- Ensure freight considerations are included in the UTP project development and prioritization process.

11.2.5 Multimodal Connectivity

The state should invest in strategies and solutions that link the different freight transportation modes.

The objectives of this policy are to:

- Support multimodal opportunities to address current and projected freight flows.
- Prioritize improving intermodal connectivity between railroads and seaports, airports and highways and highway and rail connections to the international border to alleviate congestion at key freight gateways, freight generators and ports of entry.
- Identify, preserve, protect and invest in the Texas Multimodal Freight Network across the state.

11.2.6 Urban Freight Movement

The state should continue to address freight transportation issues critical to the urban areas in Texas that support mobility and economic growth. The FAST Act placed particular emphasis on addressing congestion and freight bottlenecks which are primarily in the state's largest urban areas. This highlights the need for state freight plans to support freight programs and projects on the state's most congested freight corridors and major freight bottlenecks.

The objectives of this policy are to:

- Encourage and support MPO freight planning efforts.

- Partner with local governments on strategies to address urban freight congestion and bottlenecks.
- Seek multimodal mobility solutions, especially in the urbanized areas.
- Invest in the state's Critical Urban Freight Corridors.
- Facilitate growing e-commerce and urban freight deliveries necessary to meet the demands arising from growing urban populations.

11.2.7 Rural Connectivity

The state should continue to address freight transportation issues critical to the rural areas in Texas that support economic development. The FAST Act placed particular emphasis on infrastructure for transporting mining, agricultural, energy and timber equipment and products, highlighting the need for state freight plans to support freight systems serving those industries.

The objectives of this policy are to:

- Invest in the state's Critical Rural Freight Corridors
- Invest in the Texas Trunk system to enable the transport of energy, food and other critical raw materials.
- Strengthen rural economic development opportunities through alternative modal options and connectivity.
- Increase access for rural populations to e-commerce.

11.2.8 Economic Development and Economic Competitiveness

The state should align investments in the transportation system with the state's vision for economic growth and global competitiveness.

The objectives of this policy are to:

- Make investments that keep pace with the projected freight growth, population growth, increasing global trade and other emerging trends.
- Support strategic initiatives of the Governor's Office of Economic Development & Tourism.
- Support industry efforts to enhance workforce training, recruitment and retention in the transportation and logistics industries.

11.2.9 Texas as a Global Trade and Logistics Hub and Gateway

The state should invest in strategic transportation solutions to ensure Texas is the leader in North American trade and a top international trade gateway and national logistics hub,

The objectives of this policy are to:

- Strengthen the state's economy through increased international and domestic trade, while promoting Texas' strategic location in national and international trade.
- Advance a Texas Global Gateway concept of a one-stop, unified, coordinated and comprehensive information portal for all transportation modes.
- The state should focus multimodal solutions on strategic freight hubs.

11.2.10 Safety, Security and Resiliency of the Freight Transportation System

TxDOT should identify and implement strategies that will improve safety, security and resiliency on the Texas Multimodal Freight Network.

The objectives of this policy are to:

- Address freight movement safety "hot spots" (locations with high truck-related crashes) and identify potential crash remediation strategies as part of TxDOT's Strategic Highway Safety Plan.
- Improve safety and security along high-volume hazardous material routes.
- Develop and incorporate resiliency measures in transportation planning, policy and infrastructure investment decisions.
- Facilitate the development of new or expanded truck rest stops and related parking availability communications systems along the Texas Highway Freight Network.

11.2.11 Freight Transportation Asset Preservation

TxDOT should continue to invest and pursue innovative strategies in asset preservation on the Texas Highway Freight Network. TxDOT should also work closely with the private sector to identify and implement highway and multi-modal preservation strategies. TxDOT's existing asset management policy is known as ServiceNow, which is discussed in detail in **Chapter 7**.

The objectives of this policy are to:

- Develop optimal asset preservation programs to protect existing infrastructure investments and maximize the capacity of the existing freight transportation assets.
- Maintain transportation facilities and services to preserve function, extend useful life, eliminate maintenance backlogs, improve bridge ratings and improve pavement condition.
- Identify asset-related constraints that lead to increased congestion, longer trip times and higher costs for businesses, which all impact industry productivity and competitiveness.

11.2.12 Freight-Based Technology Solutions and Innovation

TxDOT should develop and implement innovative transportation technologies, techniques, research and methods.

The objectives of this policy are to:

- Develop and expand cooperation with public- and private-sector stakeholders to implement freight-based technology solutions and foster emerging transportation technologies across all modes.
- Expand the development of sophisticated real-time information systems and increase the dissemination of dynamic travel information.
- Build towards a statewide traffic management system by integrating existing traffic management centers to provide comprehensive traveler information, such as weather-related information, construction, incident management, emergency management coordination and identification of alternative routes.

11.2.13 Stewardship and Project Delivery

TxDOT should continue to identify and adopt strategies to improve the management of freight transportation resources and promote accountable, transparent decision-making.

The objectives of this policy are to:

- Advance the highest priority projects on the Texas Multimodal Freight Network by ensuring they are fully funded.
- Incorporate freight performance into the TxDOT performance-based project selection process.

11.2.14 International Border Crossings

The state should invest in transportation strategies to improve freight mobility across international border crossings.

The objectives of this policy are to:

- Strengthen coordination between federal, state, regional and local agencies, stakeholders and the private-sector on border management.
- Support technology and operational strategies and deployment of integrated border-crossing management solutions.
- Support integrated cargo security strategies, such as the single-window program that enables inspections to occur prior to the cargo reaching the border, thus reducing congestion at the crossings.

- Improve binational coordination and planning to expedite the delivery of border crossing projects.

11.2.15 Energy Sector Development Transportation

TxDOT and the state should continue to identify and address current and future energy freight transportation needs and impacts.

The objectives of this policy are to:

- Ensure a robust multimodal transportation network to safely and efficiently transport oil and gas to refineries and markets.
- Strengthen partnerships between TxDOT, state and local agencies, and industry to identify and invest in the transportation system that supports the energy sector.
- Identify and invest in potential infrastructure needed to support new and increasing oil and natural gas activity expected in new areas of the state and Mexico.

11.2.16 Rail Freight Transportation

TxDOT should continue to work with the private-sector rail industry and other stakeholders to identify strategies that expand rail capacity, improve rail fluidity and ease traffic congestion to accommodate projected growth in imports and exports.

The objectives of this policy are to:

- Foster rail freight as a practical modal option that relieves freight congestion on Texas highways.
- Support partnerships for public-private funding and financing opportunities that expand rail capacity and connectivity.
- Highlight the importance of the rail industry to the Texas economy and its role in moving freight efficiently.
- Support strategies that reduce the number of at-grade highway/rail crossings, improve the efficient movement of freight and increase the quality of life through reduced congestion and improved safety.

11.2.17 Port and Waterway Freight Transportation

TxDOT should continue to work with the Texas ports through the Texas Port Authority Advisory Committee, Texas Port Association, the U.S. Army Corps of Engineers and other stakeholders to pursue strategies to strengthen and improve maritime freight operations and efficiencies.

The objectives of this policy are to:

- Support public-private partnership opportunities that expand port capacity and connectivity.
- Highlight the importance of Texas ports and waterways and the maritime industry to the state and national economies.
- Promote the importance, awareness and use of the GIWW as a key component of the Texas Multimodal Freight Network.
- Develop and present a coordinated and unified approach for federal funding for port-related projects.

11.2.18 Air Cargo Transportation

TxDOT should integrate air cargo needs, into state planning activities, initiatives and project development.

The objectives of this policy are to:

- Highlight the significance of air cargo transportation to the Texas economy and quality of life through its role in transporting high-value and time-sensitive goods.
- Partner with airports and local, regional and other statewide agencies to identify critical airport landside access improvements.
- Incorporate air cargo needs, issues and recommendations in future updates of the TxDOT Texas Airport System Plan and other planning activities.

11.2.19 Pipeline Infrastructure

TxDOT and the Texas Railroad Commission should work with the public and private sectors in support of strategies that address pipeline needs.

The objectives of this policy are to:

- Encourage modal collaboration for commodities that can be shipped by pipelines.
- Support Texas' role as the leading oil and gas producing state through a comprehensive interconnected pipeline system.

11.2.20 Funding and Financing

The state should investigate additional options for funding and financing flexibility for transportation projects that impact freight movement.

The objectives of this policy are to:

- Encourage a unified and statewide list of projects with clearly identified funding schemes, including private-sector investment.
- Work with state legislators to identify funding for existing freight programs, such as the Texas Rail Relocation Fund, Port Access Account Fund and the Ship Channel Improvement Fund.
- Pursue the full return of Harbor Maintenance Tax fees to Texas.

11.2.21 Institutional Coordination and Collaboration

TxDOT should coordinate with international, national, state, regional and local agencies and private sector stakeholders.

The objectives of this policy are to:

- Improve communication between public agencies to streamline project delivery and build consistency among various jurisdictions in regulations, permitting, planning and preservation of the freight network.
- Enhance coordination with MPOs and local governments to identify freight infrastructure needs of statewide importance.

11.2.22 Public Education and Awareness

In partnership with the public and private sectors, TxDOT should lead education and communication efforts that build awareness of the importance of efficient freight movement to the state's economy and quality of life.

The objectives of this policy are to:

- Educate local jurisdictions, businesses, communities, TxDOT districts and decision-makers about the economic importance of moving freight efficiently.
- Create partnerships to develop and implement public education and awareness strategies on the importance of freight.
- Educate the public about safety issues related to multimodal freight transportation.

11.2.23 Policies Summary

This section summarized the key policy recommendations of the Freight Plan, including the process and input that assisted in developing these recommendations. Additionally, through a review of other statewide plans, as well as coordination with other states and Mexico, policies were developed consistent with the multimodal and multijurisdictional nature of freight movement. These policy recommendations are used as the basis for the program and project recommendations, discussed in the following sections.

11.3 Freight Program Recommendations

The program recommendations support the policies outlined above and also address the freight transportation challenges identified in this Freight Plan. These challenges include system capacity constraints, system operations, safety issues, rural connectivity, congestion and bottlenecks, border-crossing issues, institutional coordination, education, public awareness and funding.

The recommendations include several initiatives requiring public- and private-sector coordination and partnerships to effectively address identified freight transportation challenges to enhance freight mobility and support the state's economic development goals and competitiveness. The program categories are:

- Strategic Freight Planning Initiatives and Studies.
- Education and Public Awareness.
- Technology and Operations.
- Border/Ports-of-Entry.
- Highway.
- Rail.
- Ports and Waterways.
- Aviation.

Further details of the programs are provided in **Appendix H** and are summarized below.

11.3.1 TxDOT Multimodal Freight Planning

The state should continue to develop and administer a comprehensive and multimodal TxDOT Freight Planning Program, focused both on developing strategies, policies and methodologies for improving the freight transportation system and linking transportation investments to the state's economic development goals. The state should also consider freight-related studies such as regional freight rail studies for the Houston-Galveston and Dallas-Fort Worth metropolitan regions to address key issues and challenges identified in the Freight Plan.

11.3.2 Freight Movement Education and Public Awareness

The state should develop a Freight Movement Public Education and Awareness Program to educate the public, elected officials, policymakers and other stakeholders on the economic benefits of freight and safety-related issues.

11.3.3 Freight-Based Technology and Operations

The state should develop and implement a statewide Freight Technology-Based Solutions Program focused on enhancing freight transportation system safety, management, operations and asset preservation.

11.3.4 Texas Border-Crossing Transportation and Trade

The state should continue to work with the Border Trade Advisory Committee to enhance international border coordination strategies to improve freight transportation safety, mobility and efficiency and to facilitate trade and travel without compromising security, through the adoption of a Border Strategic Transportation Blueprint and a Border Master Plan.

11.3.5 Highway Development and Improvement

The state should continue to advance safety and mobility on the Texas Highway Freight Network through the development of a Texas Highway Freight Network Safety Program, a Freight Network Bridge Reconstruction and Replacement Program, an Interchange Reconstruction Program, and a Statewide Construction Management and Coordination Program.

11.3.6 Rail Development and Improvement

The state should continue to update its Texas State Rail Plan, prepared in accordance with federal regulations and through the involvement of passenger and freight railroad stakeholders.

11.3.7 Port and Waterway Development and Improvement

The state should continue working with Texas ports and other stakeholders to identify strategies that expand port and waterway capacity and improve waterway infrastructure through the Texas Port Authority Advisory Committee, through its Maritime Ports Strategic Mission Plan and biennial Texas Ports Capital Program.

11.3.8 Aviation-Air Cargo Development and Improvement

The state should develop a comprehensive Air Cargo Development and Improvement Program focused on working with Texas airports and other stakeholders to identify strategies that expand air cargo capacity and improve air cargo transportation infrastructure.

11.4 Summary

This chapter detailed a list of recommended policies and programs which would complement the projects described in **Chapter 10** in addressing freight transportation challenges in Texas. These elements are defined as:

- Policies. Broad policy recommendations to help change the way that Texas approaches freight planning.

- Programs. A collection of programs and initiatives that can be undertaken to achieve policy goals.

The strategic areas discussed in this chapter assist in not only identifying future needs but, more importantly, set a strategic foundation for setting priorities for infrastructure investments outlined in **Chapters 12 and 13**.



Texas Freight Mobility Plan



Chapter 12: The State's Unconstrained Freight Investment Plan

The Unconstrained Freight Investment Plan represents TxDOT's comprehensive plan for longer range investment in the Texas Multimodal Freight Network, identifying 2,594 projects at a cost of \$66 billion. It is comprehensive in that it is multimodal, includes projects regardless of funding status and is not restricted to a certain time period. TxDOT investments not on the Texas Multimodal Freight Network, local projects and solely privately funded projects, all of which will have significant impacts on freight transportation in Texas, are not included.

12.1 Development of the Unconstrained Freight Investment Plan

TxDOT takes a transparent, data-driven and stakeholder-informed approach to decision-making. The project recommendations in this plan are the product of both on-going and targeted stakeholder engagement as well as a robust needs assessment analysis process discussed in **Chapters 7 and 9**.

12.1.1 Importance of the Texas Multimodal Freight Network for Project Selection

The Texas Multimodal Freight Network is composed of facilities critical to freight movement throughout the state. This network was used as the basis for identifying and prioritizing recommendations for the 2017 Freight Plan. This network facilitates the majority of the freight movements in and through Texas and connects freight generators and gateways with markets. As discussed in **Chapter 6**, the Texas Multimodal Freight Network includes:

- Approximately 22,000 miles of roadway on the Texas Highway Freight Network
- Nearly 10,600 miles of rail on the Texas Rail Freight Network
- Ten ports each handling more than 2 million short tons per year
- Texas' portion of the Gulf Intracoastal Waterway, or GIWW (379 miles)
- Seven major cargo airports
- Fourteen commercial vehicle border ports of entry and 5 rail border crossings

Projects were analyzed to ensure that they address at least one freight need. The Texas Multimodal Freight Network needs and projects include potential highway, rail, port and waterway, airport, and international border crossing projects.

12.1.2 Role of Stakeholders in Identifying and Prioritizing Projects

Stakeholders played a critical role throughout the 2017 Freight Plan, most notable in identifying needs and issues and identifying and prioritizing freight projects. TxDOT's stakeholder engagement process created and coordinated opportunities for direct dialogue between local, state, federal and private stakeholders. TxDOT employed a multi-faceted outreach process to engage stakeholders throughout the state during this update, as outlined in **Exhibit 12-1**. This approach used the following outreach methods:

- TxFAC
- Statewide workshops
- Surveys and interviews
- Technology-based outreach, including websites and webinars
- Public comment period for the Draft Freight Plan document

Exhibit 12-1: Stakeholder Input on Project Identification and Prioritization

Outreach Method	Fact-Finding and Issue Identification	State and National System Designation	Prioritization of Needs and Projects
 TxFAC	Diverse perspectives from public- and private-sector representatives on key freight issues and trends	Input on and approval of the Texas Multimodal Freight Network and Critical Rural/Urban Freight Corridors	Input on needs assessment methods and criteria and project selection criteria
 Workshops: Round 1	Input to identify regional and statewide trends in freight movement	Input on significant regional freight corridors and criteria used to designate the Texas Highway Freight Network	Input on general needs and concerns as well as emerging trends
 Workshops: Round 2	Input on regional and statewide opportunities and needs	Review of and edits to draft Multimodal Freight Network	Input on preliminary needs assessment results and project selection criteria
 TxDOT Freight Planning Partners	Includes TxDOT Modal Divisions, Districts and Metropolitan Planning Organizations Continuous input, needs identification and plan implementation through internal collaboration within TxDOT		

Specific to project identification and prioritization, stakeholders provided input on prioritization criteria and their relative importance, identified needs and potential projects to address those needs and reviewed and provided input on the project lists developed by TxDOT. This grassroots and executive level stakeholder approach provided a clearer understanding of the existing Texas transportation system's strengths and weaknesses and the investments necessary to meet the Freight Plan goals.

12.2 Projects in the Unconstrained Freight Investment Plan

There are a total of 2,594 projects costing \$66 billion in the multimodal Unconstrained Freight Investment Plan, not including cost for projects for which there are no cost estimates such as stakeholder proposed projects and some rail projects.

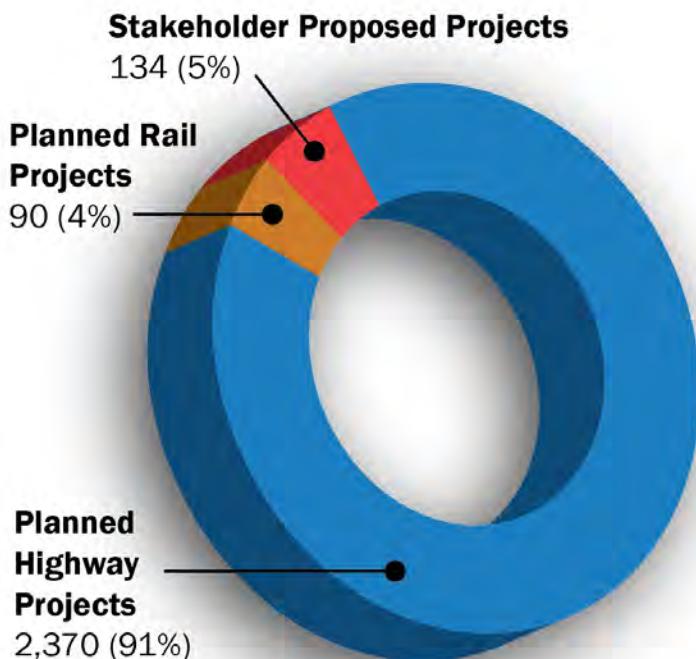
The Unconstrained Freight Investment Plan is composed of projects on the Texas Multimodal Freight Network and includes:

- All planned projects in the 2018 Unified Transportation Program and TxDOT Project Tracker including both partially and fully funded projects.
- Private-sector rail projects identified by the railroads and public-sector partners regardless of funding status.
- Projects proposed by stakeholders that are not yet in any TxDOT plans.

The 2017 Freight Plan identifies 2,594 freight projects costing \$66 billion.

As summarized in **Exhibit 12-2** below, 2,370 (91 percent) projects are planned highway projects, 90 (4 percent) are planned rail projects, and the remaining 134 (5 percent) are proposed projects, many of which are multimodal.

Exhibit 12-2: Summary of Projects in the Unconstrained Freight Investment Plan



The Unconstrained Freight Investment Plan has a conservative estimated cost of \$66 billion. However, the available funding is only \$24.5 billion, leaving a funding gap of \$41.4 billion for the entire plan. **Exhibit 12-3** summarizes the Unconstrained Freight Investment Plan projects by priority and funding status. Some notable trends include:

- There are 259 high priority projects costing \$28.5 billion that are only partially funded. These projects represent an opportunity for TxDOT to focus implementation on advancing these high priority freight projects by reassessing funding priorities and/or identifying new funding sources.
- There are 322 low priority projects that are fully funded at a cost of \$1.9 billion and 143 low priority projects that are partially funded. These projects represent a potential opportunity for TxDOT to refocus funding to higher priority projects, especially moving funds from partially funded low priority projects since the funds are being tied up without actually advancing the project.

Exhibit 12-3: *Projects in the Unconstrained Freight Investment Plan by Priority and Funding Status*

Priority	Partially Funded		Fully Funded		Total	
	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)
High	259	\$28,540	451	\$10,869	710	\$39,409
Medium	412	\$13,830	790	\$6,265	1,202	\$20,095
Low	143	\$3,276	322	\$1,909	465	\$5,185
Not Prioritized ^a	217	\$1,279	-	-	217	\$1,279
Total	1,031	\$46,925	1,563	\$19,043	2,594	\$65,968

^a Stakeholder proposed projects and non-TxDOT rail projects were not prioritized. Costs for many proposed projects have not been developed, and the full cost to implement all projects will be higher.

A complete list of the projects is provided in **Appendix B**. Additional detail on the projects by mode is provided below.

12.3 Highway Freight Projects

12.3.1 Planned Highway Freight Projects

There are 2,370 planned highway freight projects costing an estimated \$64.7 billion in the Unconstrained Freight Investment Plan. There is only \$24.5 billion in funding identified for

the projects, leading to a \$40.2 billion shortfall. The lack of funding places greater importance on the prioritization of projects. As discussed in **Chapter 10**, the highway projects are prioritized as high, medium and low priority. **Exhibit 12-4** summarizes the projects by priority and funding status. Notable takeaways include:

- Only 28 percent, or 444 of the 1,556 fully funded highway projects are high priority. However, this represents 57 percent, or \$10.8 billion of the \$19.0 billion cost of the fully funded highway projects.
- Given there is a \$40 billion funding shortfall for the highway projects, implementation of the plan should focus on fully funding the higher priority freight projects to have the greatest impact on addressing freight needs and increasing the state's return on investment.
- Funds are being tied up and high priority projects are being delayed due to the allocation of funding across many medium and low priority projects. A total of 555 medium and low priority highway projects are partially funded while 259 high priority highway projects are partially funded. Implementing a more rigorous project prioritization process focused on fully funding the highest priority projects first could lead to more high priority projects being implemented more quickly.
- The focus of TxDOT in implementing the Freight Investment Plan should be on ensuring high- and medium-priority freight projects receive more weight in the overall investment decision-making process and that projects move from programming to implementation.
- Projects that are not fully funded are at greater risk of not being implemented, especially given the size of the funding shortfall.

72 percent of the fully funded highway projects are medium and low priority.

A total of 555 medium and low priority highway projects are partially funded

Exhibit 12-4: *Planned Highway Freight Projects in the Unconstrained Freight Investment Plan by Priority and Funding Status*

Priority	Number of Projects	Partially Funded			Fully Funded			% of Cost (Millions)	% of Cost
		% of Projects	Cost (Millions)	% of Cost	Number of Projects	% of Projects			
High	259	32%	\$28,540	63%	444	28%	\$10,839	57%	
Medium	412	50%	\$13,830	30%	790	51%	\$6,265	33%	
Low	143	18%	\$3,275	7%	322	21%	\$1,909	10%	
Total	814	100%	\$45,645	100%	1,556	100%	\$19,013		100%

Projects are planned across all components of the Texas Highway Freight Network including the Texas portion of the National Highway Freight Network, the designated Critical Urban and Rural Freight Corridors and many sections of the remaining network. Nearly two-thirds of projects and 85 percent of cost are located in the state's urban areas, defined by the MPO boundaries, as shown in **Exhibit 12-5**. By network component, the parts of the Texas Highway Freight Network which are not Critical Freight Corridors or on the Primary Highway Freight System have the highest number of projects. However, 65 percent of project cost is located on the National Primary Highway Freight System, as shown in **Exhibit 12-6**.

Exhibit 12-5: *Planned Highway Projects in the Unconstrained Freight Investment Plan by Location*

	Number of Projects	% of Projects	Cost (Millions)	% of Cost
Urban*	1,486	63%	\$54,862	85%
Rural	884	37%	\$9,796	15%
Total**	2,370	100%	\$64,658	100%

* Urban is defined as location within an MPO planning boundary.

** Total does not include proposed projects.

Exhibit 12-6: *Planned Highway Projects in the Unconstrained Freight Investment Plan by Network Component*

	Number of Projects	% of Projects	Cost (Millions)	% of Cost
National Primary Highway Freight System	705	30%	\$41,838	65%
Critical Urban Freight Corridors	139	6%	\$3,397	5%
Critical Rural Freight Corridors	64	3%	\$956	1%
Rest of Texas Highway Freight Network	1,462	61%	\$18,468	29%
Total*	2,370	100%	\$64,659	100%

* Total does not include proposed projects.

Addressing congestion and mitigating bottlenecks for freight and passenger travel are among TxDOT's top priorities and have led to the development of programs specifically targeting projects that address mobility needs. The Texas Clear Lanes program is one example. This program's primary goal is to improve mobility and provide congestion relief on the most congested corridors in the metro areas of Austin, Dallas, Fort Worth, Houston, and San Antonio. These projects will help mitigate congestion in key freight corridors including I-10, I-20, I-35, I-45 and I-69 and address many freight bottlenecks, congestion, level of service, and other freight network weaknesses discussed previously in Chapters 7, 8 and 9. Project level information for the Texas Clear Lanes program is presented in Chapter 13.

Exhibit 12-7 shows the congestion mitigation projects included in the Unconstrained Freight Investment Plan that are specific to the top ten most congested highway segments for trucks, identified by the Texas Transportation Institute (TTI) and previously shown in **Exhibit 7-12**. These projects range from improved incident management to expanded capacity.

Exhibit 12-7: *Projects in the Unconstrained Freight Investment Plan Identified on TTI's Top 10 Congested Truck Locations*

Bottleneck	Number of Projects	Project Types
I-35 from US 290 to SH71	6	Integrated Corridor Management, Interchange/Intersection Improvements, Signal Operations/Management, Operation Improvements, Incident Management, Capacity Expansion
I-610W from I-10 to US 59	6	Capacity Expansion, Interchange/Intersection Improvements, Bus Only Lanes, Express Bus Service, Operation Improvements, Integrated Corridor Management, ITS, Managed Lanes/Toll
US 59 from I-610W to SH 288	3	Interchange/Intersection Improvements, Managed Lanes/Toll, Operation Improvements, Capacity Expansion, Other System Modification, ITS, Integrated Corridor Management, Managed Lanes/Toll
I-10 from Eldridge Pkwy to Beltway 8 W	3	Interchange/Intersection Improvements, Operation Improvements, Travel Options
US 59 from I-10E to SH 288	2	Capacity Expansion, Integrated Corridor Management, Intelligent Transportation Systems, Interchange/Intersection Improvements, Managed Lanes/Toll, Operation Improvements, Other System Modification
I-10 from I-610 to I-45	4	Managed Lanes/Toll, Study, Capacity Expansion, Integrated Corridor Management, Intelligent Transportation Systems, Interchange/Intersection Improvements, Managed Lanes/Toll, Operation Improvements, Other System Modification
I-45 from Beltway 8 N to I-610	3	Capacity Expansion, Operation Improvements, Intelligent Transportation Systems, Interchange/Intersection Improvements, Managed Lanes/Toll

Bottleneck	Number of Projects	Project Types
I-10 from Beltway 8 W to I-610	3	Capacity Expansion, Interchange/Intersection Improvements, Operation Improvements, Integrated Corridor Management, Intelligent Transportation Systems, Managed Lanes/Tolls, Other System Modification
I-635 from I-35E to US 75	1	Capacity Expansion, Managed Lanes/Toll
I-45/I-345 from Spur 366 to US 175	1	Interchange/Intersection Improvements, Operation Improvements

Exhibit 12-8 displays the location of the planned highway projects in the Unconstrained Freight Investment Plan. In total, about 17,650 miles, or 80 percent of the 21,861 miles on the Texas Highway Freight Network has a planned project in the Unconstrained Freight Investment Plan.

Exhibit 12-8: Location of Planned Highway Freight Projects in the Unconstrained Freight Investment Plan

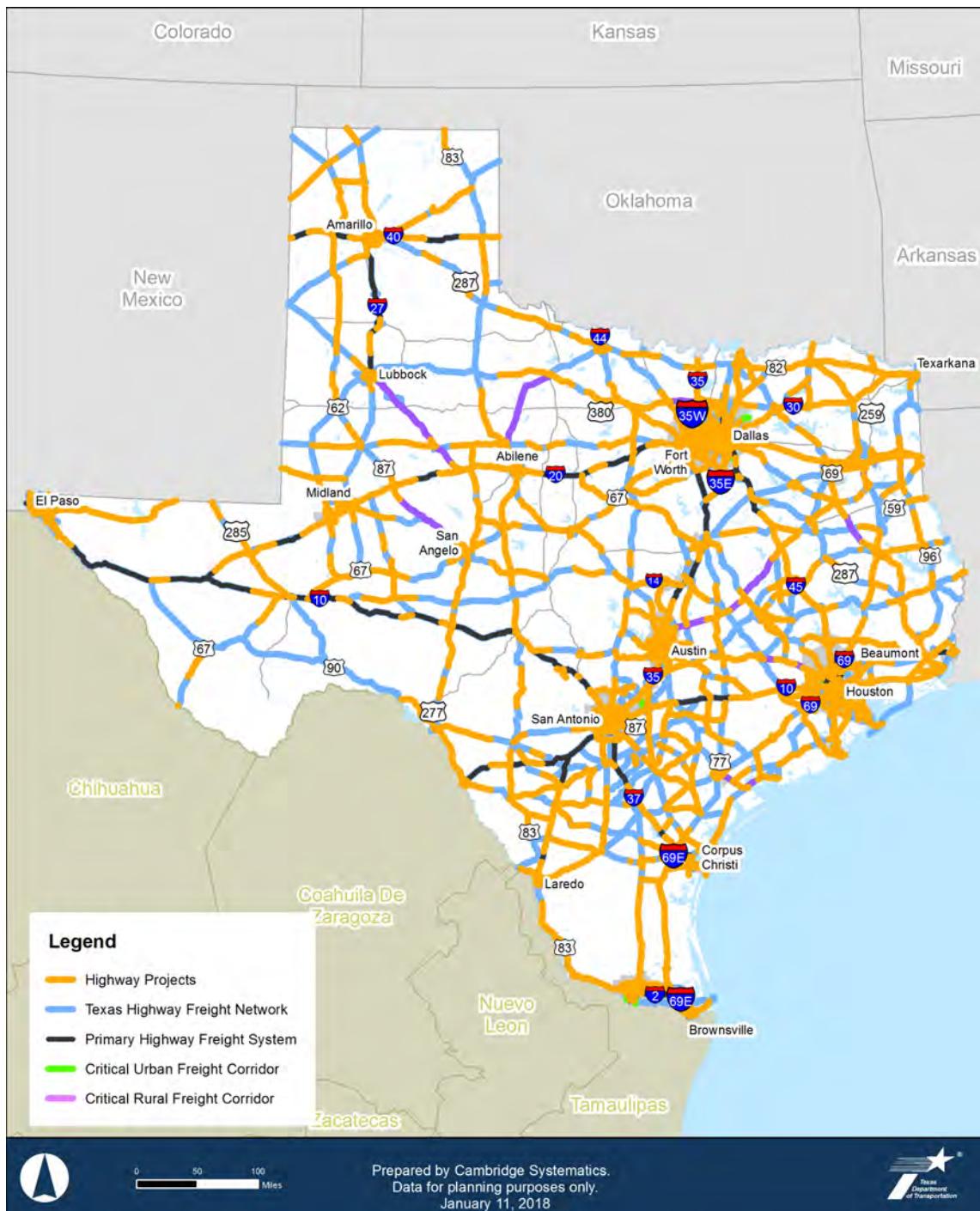


Exhibit 12-9 displays the fully funded projects in the Unconstrained Freight Investment Plan and **Exhibit 12-10** displays the partially funded projects. In general, the number of fully funded projects exceeds the number of partially funded projects in the long-term strategy. However, the sheer number of partially funded projects indicates a need to ensure a sustainable funding source for freight network investments. Additional maps showing fully and partially funded projects on key freight corridors in the state's five largest urban regions are provided in **Appendix B**. Analysis of the maps in **Appendix B** reveals:

- There are fully funded high priority projects on I-2 in Brownsville, I-20 and I-30 in Dallas, I-610, I-69, I-45 and I-10 in Houston, I-37 and I-10 in San Antonio and I-35 in San Antonio and Austin.
- There are numerous fully funded medium priority projects on interstates in the large urban areas including on I-69, I-35, I-20, I-45, I-30 and I-10.
- The only low priority interstate projects that are fully funded are in the Houston area on I-10.
- Every interstate in the Dallas-Fort Worth region has high priority freight projects that are only partially funded.
- Every interstate in Houston except I-69 has high priority projects that are only partially funded.
- I-35 and I-410 in central Texas have high priority projects that are only partially funded.

Exhibit 12-9: Fully Funded Highway Projects in the Unconstrained Freight Investment Plan

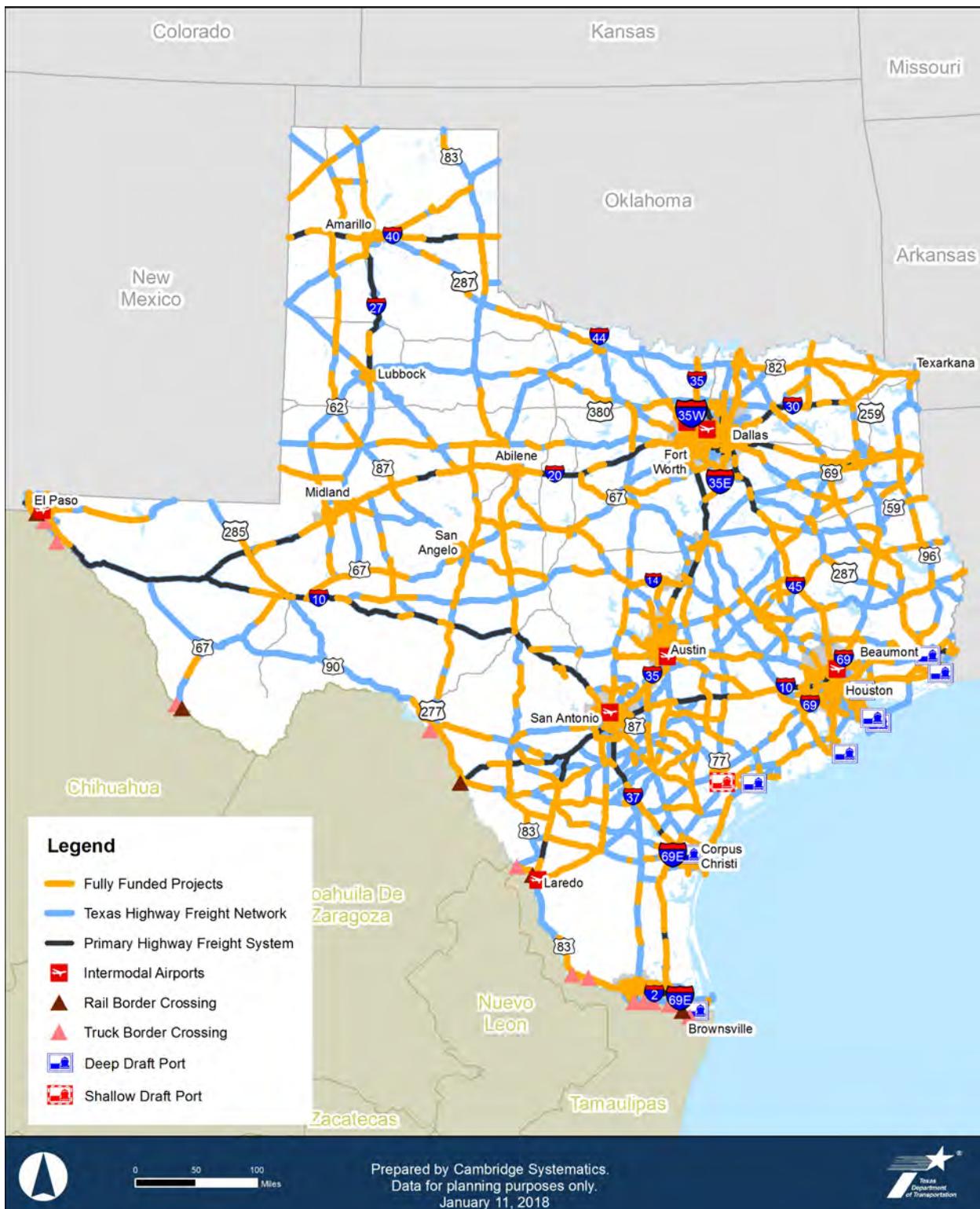
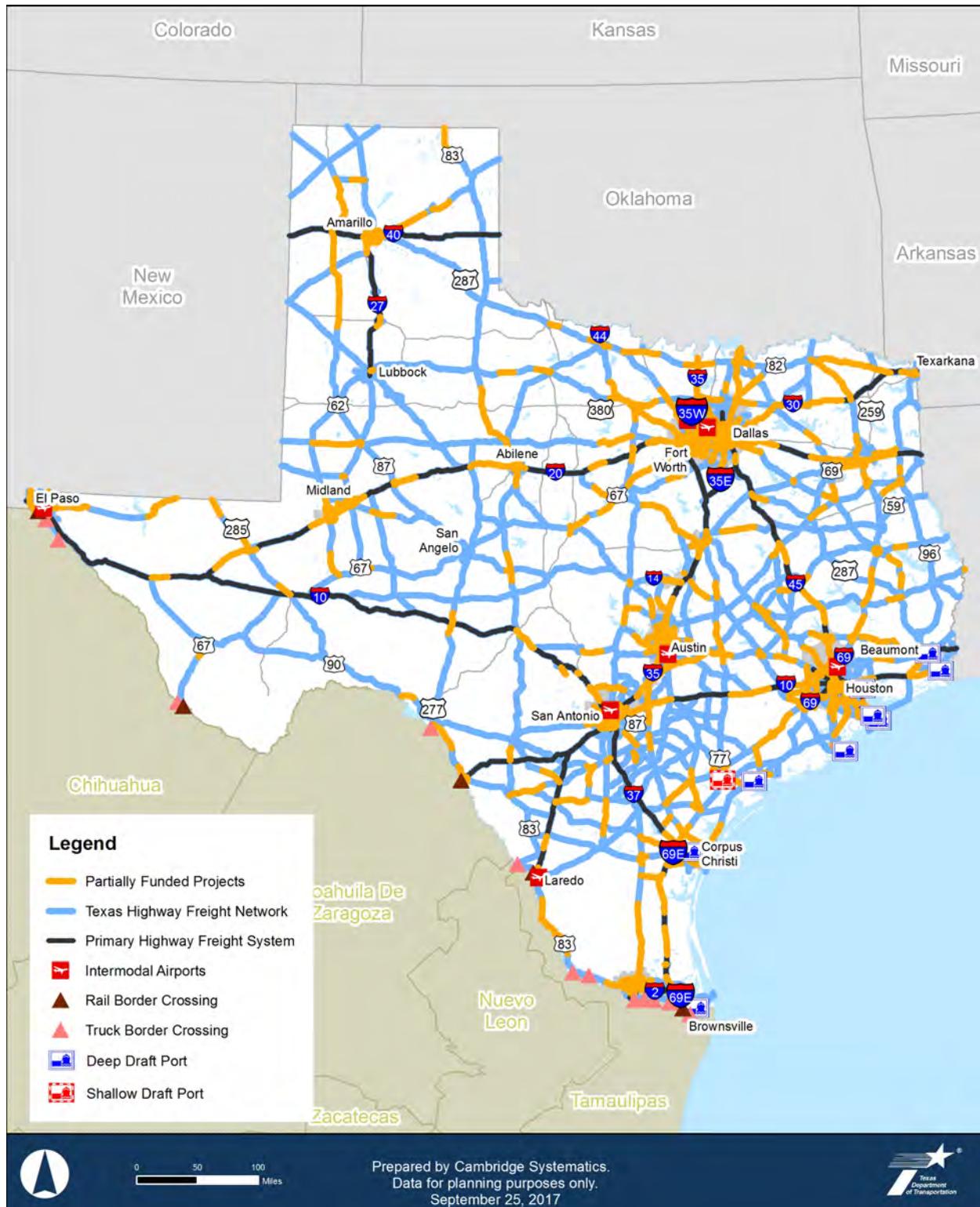


Exhibit 12-10: Partially Funded Highway Projects in the Unconstrained Freight Investment Plan



A summary of the planned highway projects in the Unconstrained Freight Investment Plan by need category is shown in **Exhibit 12-11**. Key observations include:

- 34 percent of the highway projects are mobility or congestion relief projects. These projects represent 71 percent of the cost.
- 36 percent of the projects are safety projects and represent only one percent of the cost, suggesting safety projects are most often lower cost operational improvements.
- Projects on rural and alternative routes account for 14 percent of the projects and 24 percent of the total costs. Typical projects in this category include passing lanes, turn lanes and widening projects.

Exhibit 12-11: *Planned Highway Projects in the Unconstrained Freight Investment Plan by Category*

Project Category	Number of Projects	% of Projects	Cost (Millions)	% of Cost
Alternate Routes	325	14%	\$15,646	24%
Asset Preservation	370	15%	\$2,402	4%
Mobility and Reliability	801	34%	\$45,758	71%
Safety	847	36%	\$693	1%
Technology	27	1%	\$159	<1%
Total	2,370	100%	\$64,658	100%

12.4 Planned Multimodal Freight Projects in the Unconstrained Freight Investment Plan

There are 254 planned multimodal projects in the Unconstrained Freight Investment Plan with a cost of \$4.2 billion. **Exhibit 12-12** summarizes the multimodal projects in the Unconstrained Freight Investment Plan by funding status and priority. The 83 projects that are not prioritized are rail projects that will require the participation of private rail companies. Since these private companies have their own internal investment prioritization process, these projects were not prioritized by TxDOT. Notable observations include:

- 69 percent of the fully funded projects representing 82 percent of the costs are high priority projects. This is a much higher ratio than the unconstrained plan as whole.
- 47 percent of the projects representing 36 percent of the costs are fully funded. The remaining 53 percent of the projects are partially funded.

Exhibit 12-12: *Summary of Planned Multimodal Projects in the Unconstrained Freight Investment Plan*

Priority	Partially Funded		Fully Funded		Total	
	Number	Cost (Millions)	Number	Cost (Millions)	Number	Cost (Millions)
High	32	\$1,080	82	\$1,239	114	\$2,319
Medium	15	\$260	33	\$223	48	\$483
Low	5	\$39	4	\$50	9	\$89
Not Prioritized ^a	83	\$1,279	-	-	83	\$1,279
Total	135	\$2,658	119	\$1,512	254	\$4,170

^a Non-TxDOT rail projects were not prioritized. Costs for many proposed projects have not been developed, and the full cost to implement all projects will be higher.

12.4.1 Planned Freight Rail Projects

Input from railroads operating within the state, and other stakeholders, identified the rail recommendations. The projects discussed in this section focus on rail projects that have substantial public benefits and a public sponsor. A more comprehensive list of rail projects can be found in the 2016 Texas Rail Plan, as well as in the respective capital plans of the railroads.

In addition to the 83 non-TxDOT freight rail projects, the Unconstrained Freight Investment Plan includes 7 freight rail projects in which TxDOT will have a primary role. This reflects a total of 90 rail projects with a total estimated cost of \$1.3 billion. However, estimates for many of the projects are not available. The majority of the estimated rail improvement cost comes from projects identified by the Class I railroads and MPOs. Additionally, projects from the TxDOT Rail Division and grade separation projects from the Unified Transportation Program and Project Tracker are included.

The rail projects are summarized in **Exhibit 12-13**. There are seven fully funded rail projects on the South Orient Railroad, including two projects funded by a federal FASTLANE grant and a matching contribution. The reason for the lack of fully funded freight rail projects is twofold: 1) a majority of the rail projects are at-grade separation projects that require public private partnering and 2) there is a prescribed need-based prioritization process for grade crossing projects as discussed below. Both of these factors can lead to long lead times in completing grade crossing projects.

Exhibit 12-13: Summary of Planned TxDOT Rail Projects in the Unconstrained Freight Investment Plan by Funding Status

	Partially Funded		Fully Funded		Total	
	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)
Total	83	\$1,279	7	\$30	90	\$1,309

At-grade highway/rail crossings pose safety and mobility concerns. Grade separating the crossings will reduce the number of incidents that occur, eliminate bottlenecks and allow trains to operate more efficiently. The Freight Plan includes 23 highway/rail grade-separation projects identified by the TxDOT Rail Division and MPOs as having substantial public and private sector benefits, with many of the projects consisting of multiple at-grade crossings. The ports and TxDOT identified additional at-grade highway/rail crossings. These projects are eligible for funding through TxDOT's railroad grade-separation program.

TxDOT's railroad grade-separation program addresses:

- Construction of new grade-separation structures at existing at-grade highway/rail grade crossings.
- Rehabilitation or replacement of deficient highway underpasses of railroads on the state highway system.

State highway system routes eligible to be included in the railroad grade-separation program must be of a classification greater than local road or rural minor collector on the functional classification scale—in other words, they must be classified as federal-aid highways.

Selected and prioritized highway/rail grade-separation projects are targeted for each of the following:

- New grade-separation structures.
- Remedy of deficient railroad underpasses.

Candidate projects for construction of new grade-separation structures are prioritized using a cost-benefit index, and projects for railroad underpass replacement/rehabilitation are prioritized using a priority rating. Since the prioritization of these projects is guided by federal railroad grade-separation programs, the process is different than that used for highway freight projects.

The projects noted above and in **Appendix D** are in addition to the extensive investment railroads have already made to maintain and expand the Texas Rail Freight Network. Partnerships between the rail industry and the public-sector allow for greater funding and financing options, while also addressing multiple statewide freight goals, such as safety, mobility and economic competitiveness.

12.4.2 Ports and Waterway System Access and Connectivity Projects

The Texas port and waterway system generally provides sufficient access to regional, statewide, national and global markets. However, existing waterside and landside physical and operational chokepoints may prevent this system from effectively absorbing future growth in freight traffic and will have other economic, social and environmental impacts. As noted in **Chapter 10**, the 2017-2018 Texas Port Capital Program includes 20 high-priority capital projects at a cost of \$217.2 million, of which the ports are requesting \$132.9 million in state funds.

The 2017 Freight Plan reflects only the port and waterway access and connectivity projects and not projects inside the port gates. TxDOT focused on the "outside-the-gate" projects based on input from the ports. Given that TxDOT state funds can only be used on the state maintained roadway system, focusing on these access routes was deemed most productive. In total, there are 26 projects costing \$670 million in the plan. There are 8 port access and connectivity projects on the Texas Highway Freight Network, two of which also serve other modes. In addition to the 8 projects on the Texas Highway Freight Network, 18 additional planned projects not on the Texas Highway Freight Network were identified by Texas ports. Proposed projects, discussed later, were also identified, adding 47 more projects to the list of port projects shown in **Appendix E**.

Exhibit 12-14 summarizes the projects based on funding status and priority.

- The majority, 24 out of 26, of the port access projects are high priority projects.
- Of the 24 high priority port access projects, 12, or 50 percent, are fully funded.
- 1 of the 2 medium priority projects is fully funded.

Exhibit 12-14: *Planned Port Access and Connectivity Projects in the Unconstrained Freight Investment Plan by Funding Status and Priority*

Priority	Partially Funded		Fully Funded		Total	
	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)
High	12	\$140	12	\$486	24	\$626
Medium	1	\$40	1	\$4	2	\$44
Low	-	-	-	-	-	-
Total	13	\$180	13	\$490	26	\$670

Improved intermodal connectivity is a high priority for ports. This includes increased rail access to the ports. Rail projects identified by the ports are included in the rail section and in **Appendix D**.

Exhibit 12-15 summarizes the planned highway port access and connectivity projects by port and **Appendix E** provides a listing of these projects.

Exhibit 12-15: *Planned Port and Waterway Highway Access and Connectivity Projects by Port*

Port	Partially Funded		Fully Funded		Total	
	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)
Beaumont	4	\$5.000	-	-	4	\$5.000
Brownsville	2	\$13.560	6	\$90.844	8	\$104.404
Corpus Christi	2	\$40.000	2	\$14.000	4	\$54.000
Houston	2	\$121.097	5	\$384.957	7	\$506.054
Palacios	2	TBD	-	-	2	TBD
Port Arthur	1	TBD	-	-	1	TBD
Total	13	\$179.657	13	\$489.801	26	\$669.458

While specific projects for the Gulf Intracoastal Waterway (GIWW) are not identified at this time, the Water Resources Reform and Development Act, the Water Infrastructure for Improvements to the Nation (WIIN) Act, the annual Energy and Water Appropriations Act or other legislation under U.S. Army Corps of Engineers authorizing projects such replacing the

floodgates and locks along the GIWW should be monitored. These projects not only address the asset preservation goal, but also the safety and mobility goals by improving barge traffic along the waterway.

Ultimately, all of the projects noted above and detailed in **Appendix E** help support the economic competitiveness and efficiency goal by improving the Texas freight maritime transportation system.

12.4.3 Air Cargo Access and Connectivity Projects

The projects discussed in this section relate to improving access to Texas airports on the Texas Multimodal Freight Network. The Unconstrained Freight Investment Plan reflects 18 airport access and connectivity projects for seven commercial air cargo airports with a total estimated cost of about \$812 million. Five of these projects also serve other modes.

Exhibit 12-16 summarizes the projects by funding status and priority.

- 14 of the 18 projects are high priority and 7 of those are fully funded.
- 50 percent of all airport access and connectivity projects are fully funded.

Exhibit 12-16: *Summary of Planned Air Cargo Access and Connectivity Projects in the Unconstrained Freight Investment Plan by Funding Status and Priority*

Priority	Partially Funded		Fully Funded		Total	
	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)
High	7	\$517	7	\$179	14	\$696
Medium	1	\$75	-	-	1	\$75
Low	1	\$7	2	\$34	3	\$41
Total	9	\$599	9	\$213	18	\$812

The projects encompass highway improvements such as roadway widening, interchange improvements and ITS installation. These projects, detailed in **Appendix F**, will help support the Freight Plan's goals of mobility and reliability, multimodal connectivity, economic competitiveness and/or technology by improving the Texas Highway Freight Network with efficient linking to commercial airports.

12.4.4 International Border Crossing Access and Connectivity Projects

The international commercial border crossings are a freight and economic asset for the state of Texas and the nation as a whole. Safe, secure and efficient roadways connecting businesses along the border with the crossings impact the transportation system and the economy in these regions and beyond. Highway projects directly impacting the border crossings were identified based on stakeholder input and an examination of projects on connecting facilities. There are 90 border-crossing access projects totaling over \$1.3 billion in the Unconstrained Freight Investment Plan. Six of these projects also serve other modes. A summary of projects by funding status and priority appears in **Exhibit 12-17**.

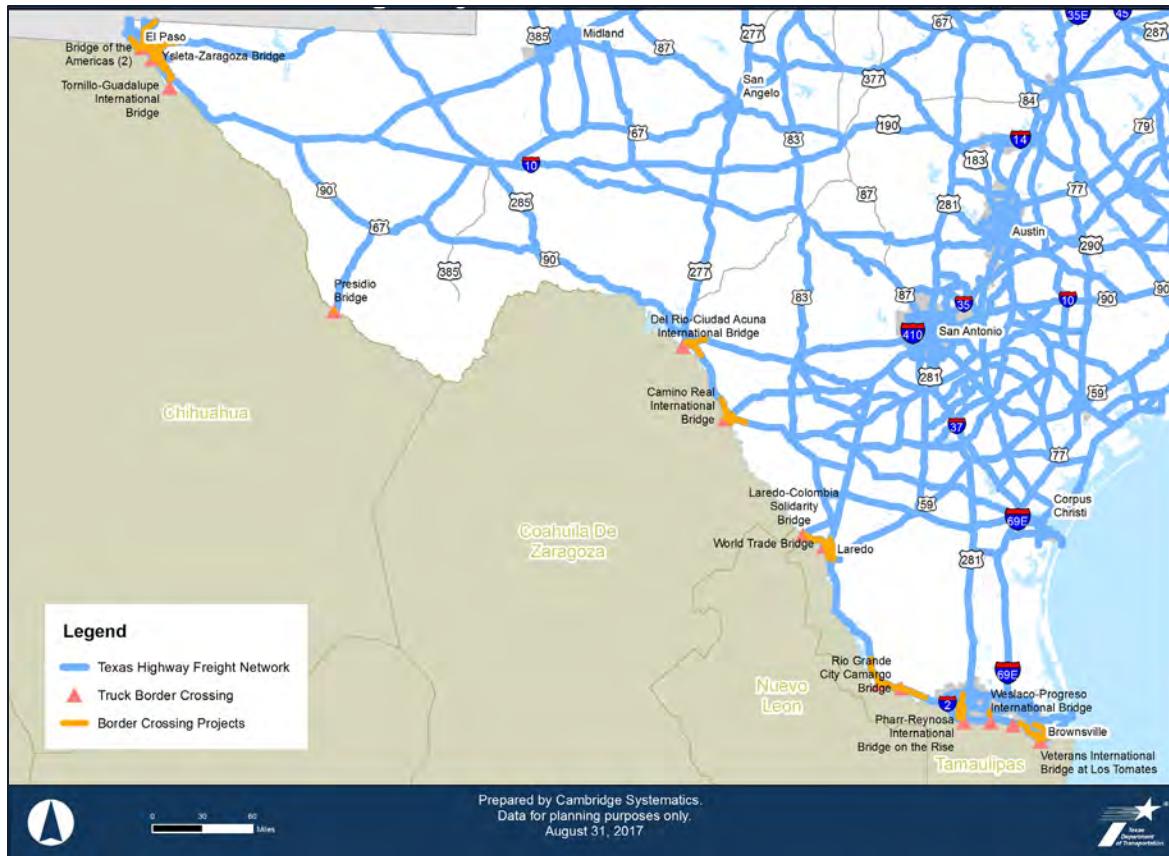
- 61 of the 90 projects are high priority, of which 47 are fully funded.
- 14 high-priority projects are only partially funded.
- There are only two low-priority projects with one fully funded and one partially funded.

Exhibit 12-17: *Summary of Planned Border Crossing Access and Connectivity Projects in the Unconstrained Freight Investment Plan by Funding Status and Priority*

Priority	Partially Funded		Fully Funded		Total	
	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)
High	14	\$682	47	\$353	61	\$1,035
Medium	7	\$39	20	\$144	27	\$183
Low	1	\$22	1	\$34	2	\$56
Total	22	\$743	68	\$531	90	\$1,274

Exhibit 12-18 displays the locations of these projects relative to the international border crossings and **Appendix G** provides a complete list.

Exhibit 12-18: *Planned Highway Projects Improving Freight Access and Connectivity to International Border Crossings*



12.5 Unmet Freight Needs

In addition to the \$66 billion Unconstrained Freight Investment Plan which has a \$40 billion funding shortfall, there are still freight needs on the Texas Multimodal Freight Network with no planned projects. Unmet needs, identified through the needs assessment and project identification process discussed in **Chapter 10**, provide the opportunity for information from the Freight Plan to inform the project development process carried out by TxDOT and MPOs, leading to the identification and planning of projects to meet the unmet needs.

Additional needs on the Texas Highway Freight Network include corridor segments where a need is identified but there is no planned project under development. Most freight transportation needs on the Texas Highway Freight Network are located along corridors connecting major metropolitan areas, trade gateways and freight generators, such as ports, energy sector regions and border crossings. This reflects the importance of freight and trade gateways and the need for continued planning for transportation improvements at ports, international border crossings and energy and agricultural regions (such as

Midland/Odessa, San Angelo and Amarillo). Gaps between needs and current projects are identified in **Chapter 10. Exhibits 12-19 to 12-21** display the portions of the Texas Highway Freight Network with unmet needs in the three highest weighted goal areas of mobility and reliability, safety and asset preservation and utilization. In total, there are 14,640 miles on the Texas Highway Freight Network with identified freight needs and over 5,990 miles with no identified project to meet those needs. There are 2,792 miles on the Texas Highway Freight Network with medium and high priority mobility and reliability needs with no identified projects. There are 5,899 miles on the Texas Highway Freight Network with unmet safety needs with no identified project and 133 miles with unmet asset preservation needs with no identified project.

In total, there are 14,640 miles on the Texas Highway Freight Network with identified freight needs and over 5,990 miles with no identified project to meet those needs.

Exhibit 12-19: Freight Mobility and Reliability Needs on the Texas Highway Freight Network with No Planned Project

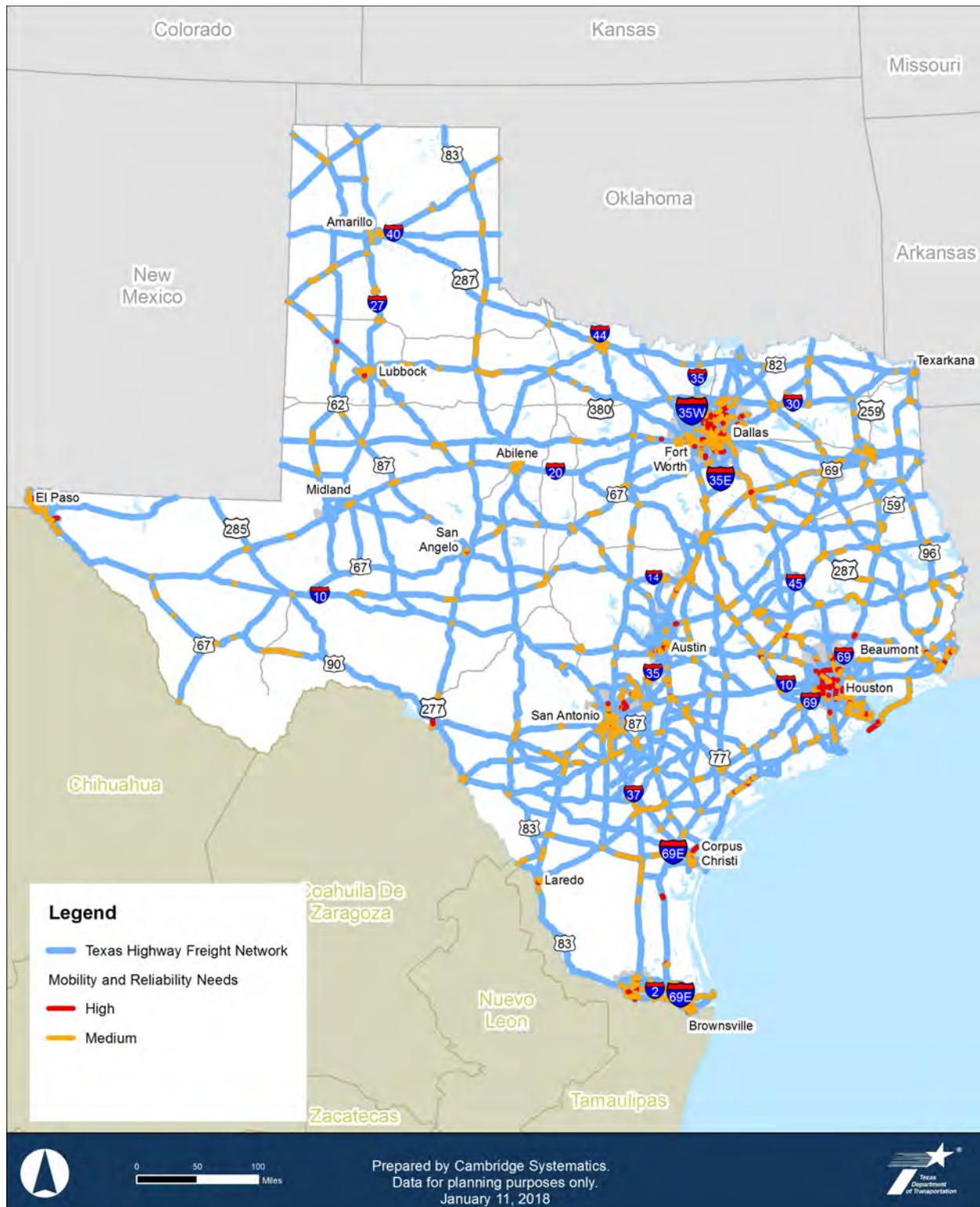


Exhibit 12-20: Freight Safety Needs on the Texas Highway Freight Network with No Planned Project, by Priority

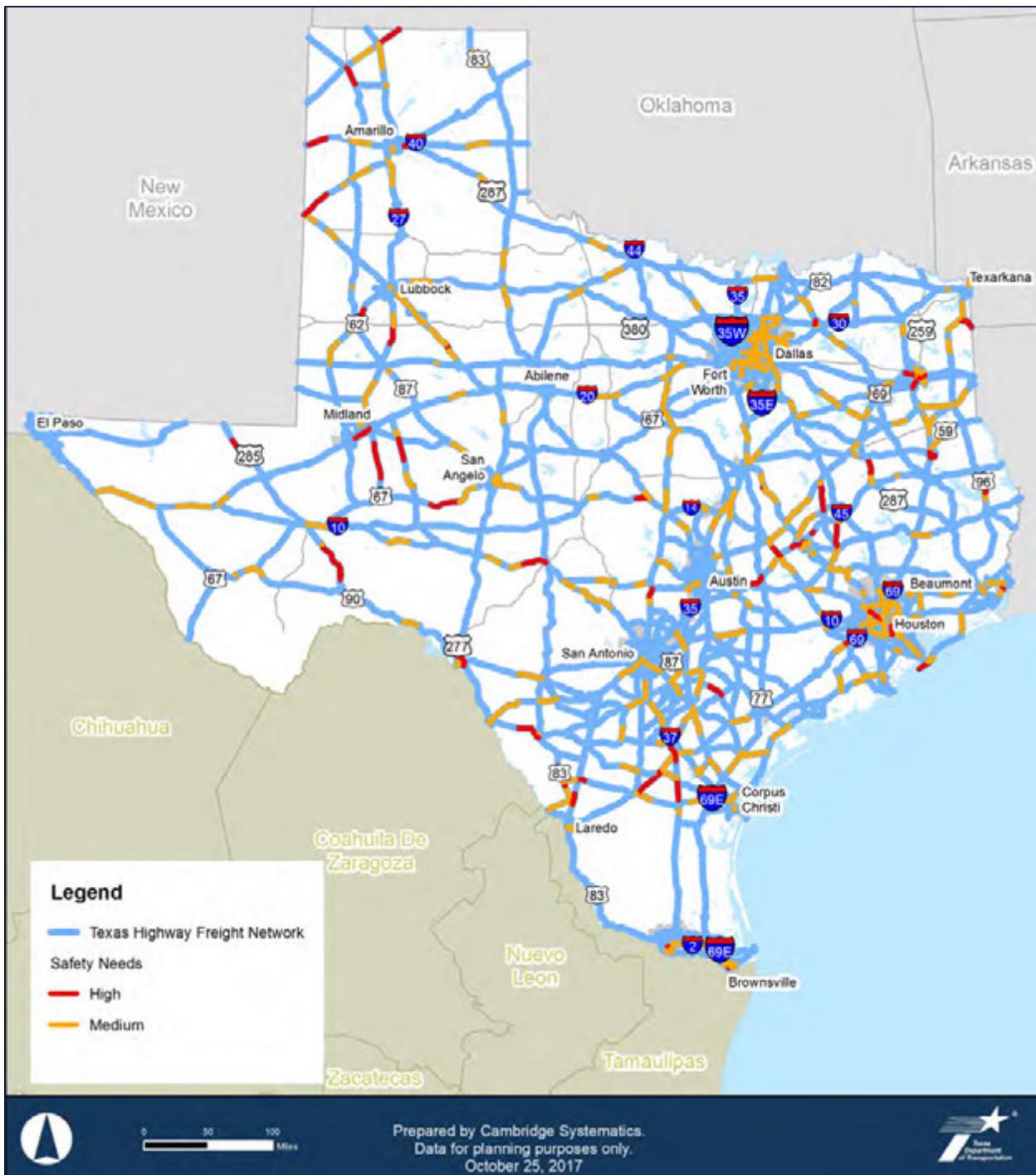
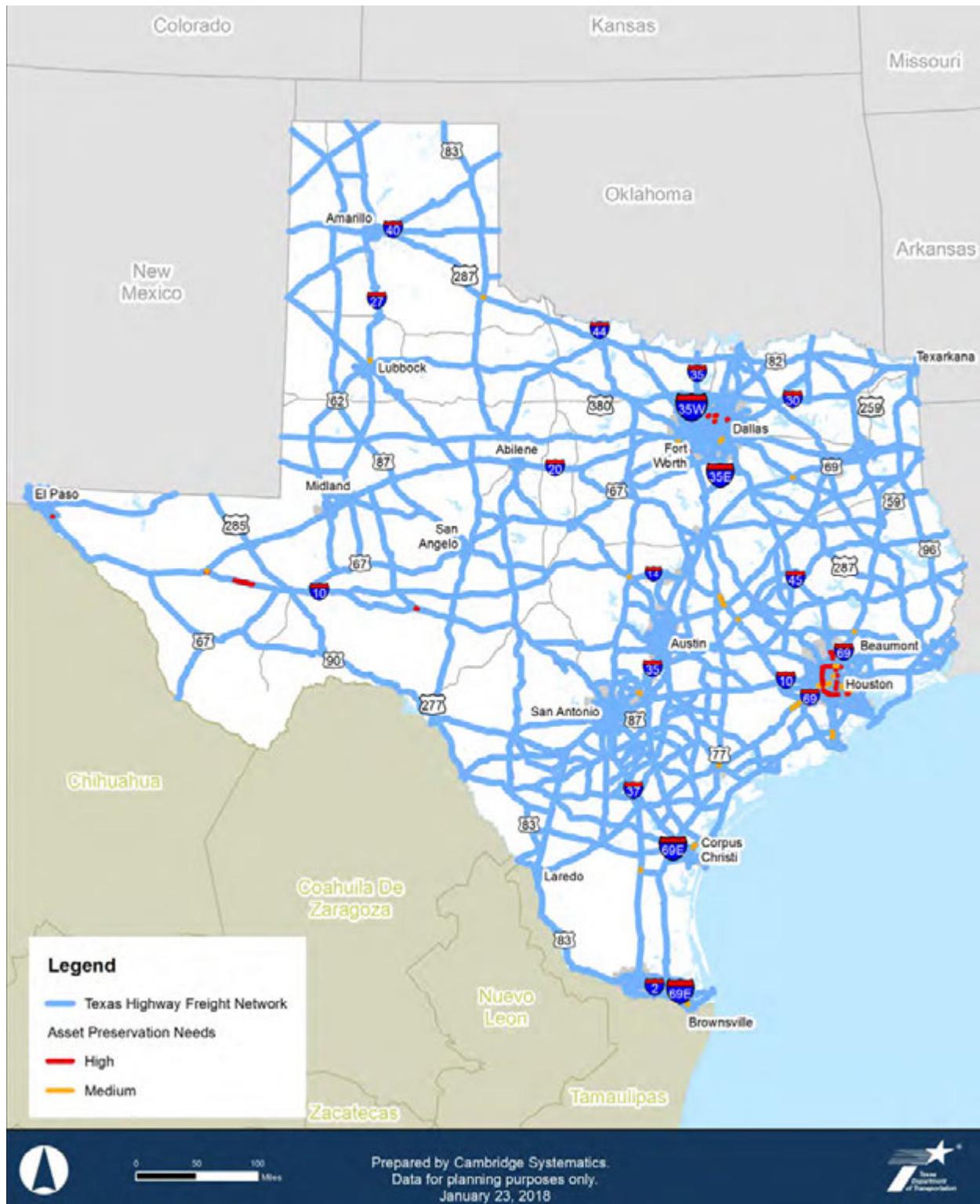


Exhibit 12-21: Asset Preservation Needs on the Texas Highway Freight Network with No Planned Project by Priority



12.6 Stakeholder Proposed Freight Projects

In addition to the projects in the Unconstrained Freight Investment Plan, stakeholders proposed projects that are not yet in any TxDOT plans. Some of these projects were proposed to meet existing unmet needs while others focused on meeting future or anticipated needs. The following sections discuss the proposed projects by mode.

12.6.1 Stakeholder Proposed Highway Freight Projects

A key source for proposed projects was the stakeholder workshops. Participants worked with online maps to identify needs and proposed projects. A summary of the number of proposed projects by workshop is presented in **Exhibit 12-22**. The proposed highway projects include projects that provide multimodal access including airport, border crossing and port access. A full listing of proposed projects is provided in **Appendix B**.

Exhibit 12-22: *Summary of Unplanned, Stakeholder Proposed Highway Projects*

Workshop	Number of Projects
Beaumont Workshop	1
Brownsville Workshop	5
Corpus Christi Workshop	3
Dallas Workshop	3
El Paso Workshop	4
Fort Worth Workshop	2
Houston Workshop	8
Laredo Workshop	14
Lubbock Workshop	6
Midland Workshop	14
San Antonio Workshop	3
Texarkana Workshop	2
Total	65

The most common need referenced with proposed projects was congestion and the need for additional capacity to enhance mobility and reliability. This was especially true in west Texas in the Midland/Odessa area where they continue to experience increasing local freight volumes tied to the energy boom and in Lubbock which is a crossroads for east-west and north-south freight flows. The large urban areas and border regions also had proposals for

new projects to address congestion and servicing high growth areas. Example proposed projects include:

- A new outer loop from New Pope to I-35 mile 13 proposed at the Laredo workshop.
- A SH 158 bypass around Garden City was proposed at the Midland workshop.
- Alternate route for I-30 for accessing Dallas.

The ports proposed a total of 47 port access and connectivity projects, costing more than \$17.6 billion for those projects with cost estimates available. **Exhibit 12-23** summarizes the number and costs of proposed port access projects by port. Houston has the highest number (20) of projects, followed by Corpus Christi with eight projects.

Exhibit 12-23: *Summary of Unplanned, Stakeholder Proposed Highway Port Access and Connectivity Projects*

Port	Number of Projects	Cost (Millions)
Beaumont	1	\$0.900
Calhoun	2	\$3.150
Corpus Christi	8	\$165.976
Freeport	1	TBD
Galveston	6	\$38.928
Houston	20	\$1,453.600
Orange	1	TBD
Port Arthur	2	\$4.000
Victoria	6	\$90.300
Total	47	\$1,756.854

12.6.2 Proposed Freight Rail Projects

As discussed in **Chapter 10** and above, rail project identification is primarily a private sector responsibility, although the public sector is sometimes involved when projects will have significant public benefit. To facilitate the identification of additional rail projects, a series of rail studies have been proposed by the railroads and the MPOs. Specifically, studies to examine freight rail needs in the Houston-Galveston and Dallas-Fort Worth regions have been recommended. In addition to the studies, the ports also identified proposed rail projects (see **Appendix D**).

12.7 Strategic Freight Projects and Initiatives

Strategic recommendations are significant investments that will shape the state's *future* freight transportation demands as well as address *current unmet needs*. Some strategic projects rise to a higher level due to the potential impact they have on statewide freight movements and economic competitiveness. The Texas Freight Advisory Committee played a key role in identifying priority strategic projects and initiatives based on current and future freight volumes, trends and economic opportunities. Key strategic projects and initiatives are summarized below.

Strategic Projects

I-69 Bypass – from Grand Parkway to I-69 in Wharton County

The I-69 corridor traverses over 1,000 miles in Texas, including the US 59 corridor in the Houston area. This section of I-69 passes through the most congested areas in Houston, and a bypass has been proposed to improve mobility between Texas ports and markets throughout the state and beyond. The bypass would connect Wharton County, southwest of Houston, to Grand Parkway (SH 99). The bypass would start south of Houston, go east and then turn north, and would connect the ports of Freeport, Galveston and Houston together before connecting back in north of Cleveland. That bypass will guarantee that those ports continue to be a dominant gateway in North America. The I-69 bypass addresses critical current and future needs and given the statewide and national importance of the Texas gulf region ports and energy cluster, is a high priority. The 2017 Freight Plan recommends that planning and conceptual design for the bypass be undertaken in the near-term.

"This bypass will be the most important transportation project in our region for decades."
Ed Emmett, Harris County Judge and Chair, Texas Freight Advisory Committee

I-27 Extension – from Lubbock to Laredo

The Ports-to-Plains (I-27) corridor from Laredo to Denver was designated as a high-priority corridor on the National Highway System in 1998, and in 2015, a TxDOT initial assessment report on the I-27 corridor found it to be critical to linking the energy and agricultural sectors to state, national and international trade. The corridor would be a catalyst to spur economic development in this part of the state and support agricultural and energy sector development, the state's economic engine. The I-27 extension would provide the only major north-south corridor in Texas west of I-35, and it would intersect three major east-west routes: I-10, I-20 and I-40. Currently, nearly 125 miles between Amarillo and Lubbock are designated as I-27. The I-27 extension would upgrade approximately 500 miles from Lubbock to Laredo at a conceptual cost estimate of \$5.2 billion. TxDOT has recommended more detailed study of the extension to determine whether an incremental improvement approach or a complete interstate facility approach would meet safety and mobility needs.

Strategic Initiatives

Texas Global Gateway Concept

The Global Gateway Concept is envisioned as a program of projects, policies and actions necessary to expand Texas' role as gateway for North American trade. It aims to improve Texas' standing as a leader in global and North American trade. Texas has led the country in exports for fourteen consecutive years and is a gateway for trade to and from other states to the rest of the world. Its many competitive ports, highway and rail border crossings and international pipelines continue to drive Texas' success. However, transportation and technology projects, programs and policies can be leveraged to further increase the contribution of global trade to the economic well-being of Texas and of the nation.

Alternate Multimodal Freight Delivery Corridors Connecting the Seaports and International Border Regions

Multimodal freight corridors have been implemented across the U.S. to ease congestion, reduce emissions and enhance safety. Examples include the Alameda corridor in southern California and the Heartland Corridor in Virginia, West Virginia and Ohio. These corridors most often are enhanced rail corridors designed to be feasible for shorter distance hauls for high volume origin and destination pairs. TxDOT should explore the feasibility of similar corridors but they should also include examining alternative freight delivery systems and technology as part of the corridor approach. Advancement in autonomous and connected technologies enable new delivery systems in addition to enhancing existing ones. Drones, freight shuttles (such as the systems proposed by the Texas A&M Transportation Institute and the Center for Transportation Research) and other alternate delivery systems have been proposed to provide new modal options. If these options are designed to be unaffected by congestion on existing networks, they could provide more reliable and lower cost transportation solutions. The port and border regions of Texas may see the largest benefits from such a system as these are two areas with recurring freight bottlenecks.

12.8 Summary

This chapter detailed the Unconstrained Freight Investment Plan, which represents TxDOT's comprehensive plan for longer range investment in the Texas Multimodal Freight Network, identifying 2,594 projects at a cost of \$66 billion. About 60 percent of the projects are fully funded. However, that 60 percent represents only 29 percent of the total costs. The remaining projects, which cost nearly \$47 billion, have either partial or no funding at all. In fact, the funding gap is in excess of \$40 billion. This creates a real challenge for TxDOT and the state because if freight transportation needs are not met, the impacts spill over to passenger travel and will have negative economic, environmental, safety and quality of life implications throughout the state.

The project recommendations assist in not only addressing existing and future needs but, more importantly, set a strategic foundation for setting priorities for short-, medium- and long-term implementation strategies. The first of those strategies is a short-term project implementation plan, the 5-Year Financially Constrained Freight Investment Plan, which is a subset of the Unconstrained Freight Investment Plan, and is discussed in **Chapter 13**.



Texas Freight Mobility Plan

Chapter 13: The State's 5-Year Financially Constrained Freight Investment Plan



The 5-Year Financially Constrained Freight Investment Plan (5-Year Freight Investment Plan) is a subset of the Unconstrained Freight Investment Plan and consists of fully funded projects to be implemented during the 2016-2020 time period. It is a new element in the 2017 Freight Plan and its purpose is twofold- 1) Meet the FAST Act requirement and 2) Document the immediate multimodal recommendations necessary to address current freight needs and deficiencies. Therefore, the TxDOT 5-Year Freight Investment Plan goes beyond the federal requirements and is a critical implementation tool.

13.1 Overview of 5-Year Freight Investment Plan

The Texas 5-Year Freight Investment Plan was developed based on two primary factors: 1) mapping fully funded projects in the Unified Transportation Program and Project Tracker against identified freight needs on the Texas portion of the National Highway Freight Network, including the designated Critical Urban and Rural Freight Corridors from **Chapter 6**; and 2) mapping fully funded freight projects from the Unified Transportation Program, Project Tracker and TxDOT modal divisions against identified freight needs on the entire Texas Multimodal Freight Network. The first component represents the National Highway Freight Program eligible freight projects and the second represents the comprehensive set of freight projects over the 2016-2020 duration of the FAST Act.

The Freight Plan goals, as well as other state and federal goals discussed in **Chapter 2**, provide the foundation for developing the project recommendations and for setting priorities for future freight transportation improvement implementation.

13.1.1 FAST Act Requirement

As noted in **Chapter 1**, the FAST Act established the National Highway Freight Program fund, which makes funds available for obligation for 2016-2020. The National Highway Freight Program (NHFP) obligations are reimbursed from the Highway Account of the Highway Trust Fund. They come with contract authority and are subject to the annual obligation limitation imposed on the Federal-Aid Highway Program. Texas' estimated apportionment of the National Highway Freight Program funds for the period spanning 2016–2020 is \$540.3 million, or an average of about \$108.1 million per year. This represents about 3 percent of Texas' estimated total federal apportionment.

The state freight plan must provide a financially constrained Freight Investment Plan that includes a description of how the National Highway Freight Program funds will be invested from fiscal years 2016 to 2020. All projects with existing or planned NHFP funds, beginning with fiscal year 2016 to 2020, are listed in the 5-Year Freight Investment Plan. In addition, the 5-Year Freight Investment Plan includes projects that will not receive NHFP funding, due to needs exceeding Texas' estimated NHFP apportionment, but which will be funded through other sources.

The federal share for National Highway Freight Program-eligible projects is generally 80 percent, but certain types of improvements (predominately safety improvements) may have a federal share of up to 100 percent. Beginning December 4, 2017, a state may not obligate apportioned National Highway Freight Program funds unless the state has developed a FAST Act-compliant State Freight Plan that provides for the immediate and long-range planning activities and investments of the state with respect to freight. Projects must be identified in the State Transportation Improvement Program or the Metropolitan Planning Organization's Transportation Improvement Program. They must also show improvement to the flow of freight on the National Highway Freight Network.

The National Highway Freight Program funds can only be used on the following Freight Network components:

- The Texas portion of the National Primary Highway Freight System which includes primarily interstate highways and intermodal connectors and consists of about 3,728 centerline miles.
- Critical Rural Freight Corridors discussed in **Chapter 6**.
- Critical Urban Freight Corridors discussed in **Chapter 6**.

In addition, up to ten percent of the program funds can be used on non-highway modes.

13.1.2 Summary of Projects in the 5-Year Freight Investment Plan

The 5-Year Freight Investment Plan covers the period of 2016-2020 and consists of 515 projects at a cost of \$7.5 billion. This includes 508 highway projects and 7 freight rail projects. Of these, only 199 are eligible for National Highway Freight Program funding and only 31, including 5 of the 7 rail projects, were selected to receive these funds. The remaining 316 freight projects in the 5-year Freight Investment Plan are not on the National Highway Freight Network and will be funded by other funding sources. The full list of projects in the 5-Year Freight Investment Plan is included in **Appendix C**.

The 31 National Highway Freight Program funded projects were selected based on their priority, cost and ability to improve freight bottlenecks, congestion, level of service, and other factors in freight mobility. Projects include innovative technology solutions (ITS), operational improvements, roadway widening, interchange construction, bridge replacements, and railroad rehabilitation. While the current 5-Year Freight Investment Plan allocates over 90 percent of the state's National Highway Freight Program funds to highway projects, TxDOT reserves the authority to allocate up to ten percent on non-highway modes and will amend the 5-Year Freight Investment Plan accordingly. **Exhibit 13-1** summarizes projects listed in **Appendix C** which are planned to receive National Highway Freight Program funds.

5-Year Freight
Investment Plan
includes 515
projects that are
fully-funded at a cost
of \$7.5 billion.

Exhibit 13-1: *Summary of Projects in the 5-Year Freight Investment Plan Receiving National Highway Freight Program Funding*

Fiscal Year	Number of Projects	NHFP Funding Programmed (Millions)
2016	7	\$69.5
2017	9	\$112.6
2018	8	\$137.5
2019	2	\$110.1
2020	5	\$110.6
Total	31	\$540.3

Exhibit 13-2 lists the highway and rail projects receiving National Highway Freight Program funds by the primary freight need being addressed. Of these 31 projects, 17 address freight congestion and bottlenecks, primarily in the Austin, Dallas, and Houston areas, as identified in **Chapters 7 and 9**. The remaining 14 address asset preservation or asset connectivity needs identified in **Chapter 7**.

Exhibit 13-2: *Projects in the 5-Year Freight Investment Plan Receiving National Highway Freight Program Funding*

TIP/Project Number	Project Name	Need Addressed	Fiscal Year
Highway Projects			
0271-17-145	I-610 (Southbound): At I-69 - Construct Direct Connector (I-610 Southbound to I-69 Northbound)	Access and Connectivity	2017
0047-14-084	US 75: North of FM 455 to CR 370 - Construct Interchange	Access and Connectivity	2018
0275-01-173	I-40: At Arthur Street - Replace Existing Bridge And Approaches for eastbound lanes	Asset Preservation	2016
0275-01-174	I-40: At Arthur Street - Replace Existing Bridge And Approaches for Westbound lanes	Asset Preservation	2016
0275-01-175	I-40: At Ross Street - Replace Existing Bridge And Approaches for Eastbound lanes	Asset Preservation	2016

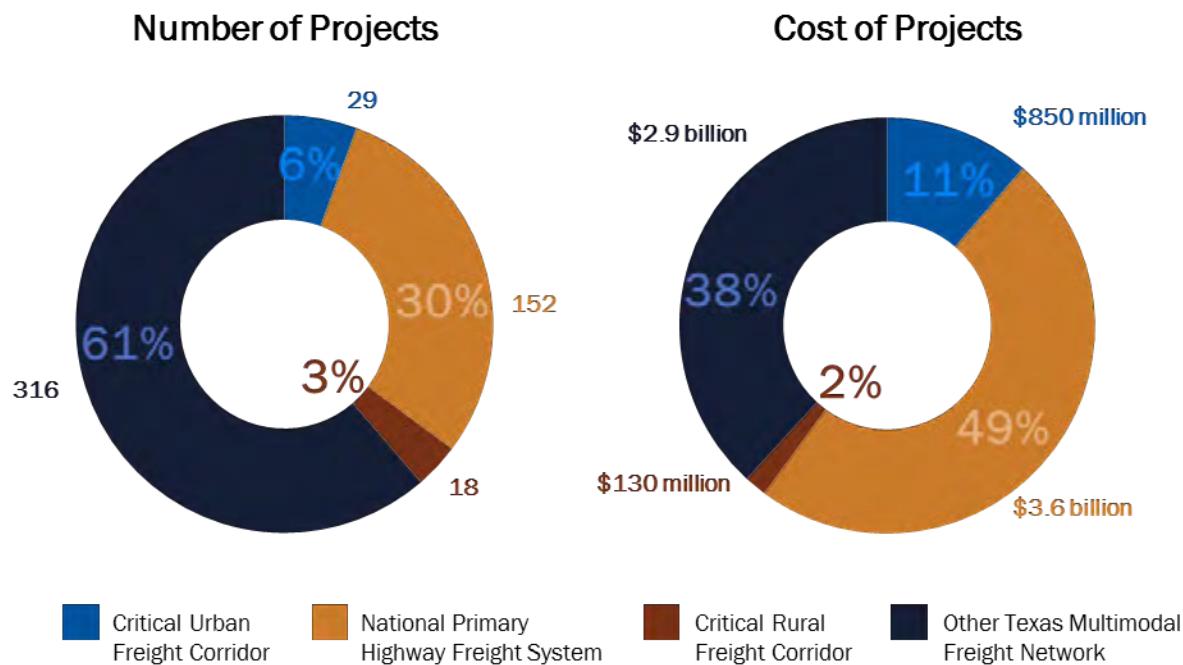
TIP/Project Number	Project Name	Need Addressed	Fiscal Year
0275-01-176	I-40: At Ross Street - Replace Existing Bridge And Approaches for Westbound lanes	Asset Preservation	2016
0017-10-273	I-35: At New Braunfels Avenue - Replace Bridge And Approaches	Asset Preservation	2016
0015-08-140	I-35: At CR 305 - Bridge Replacement	Asset Preservation	2018
0027-13-221	I-69: At McGowan, Tuam and Elgin - Construct 3 Bridges	Asset Preservation	2020
0015-13-380	I-35: North of 51st Street to South of 51st Street - Add Shoulders, Auxiliary Lanes and Ramp Improvements	Congestion/Bottleneck	2016
0015-13-378	I-35: North of Oltorf to South of Oltorf - Add Shoulders, Auxiliary Lanes and Ramp Improvements	Congestion/Bottleneck	2016
0271-17-157	I-610: Reconstruct I-69 SW Freeway NB (EB) to I-610 Southbound Direct Connector	Congestion/Bottleneck	2017
0271-17-161	I-610: At I-69 - Reconstruction of I-610 Main Lane Bridge Within The Interchange	Congestion/Bottleneck	2017
0027-13-210	I-69 Southwest Freeway Southbound to I-610 Southbound Connector - Reconstruction of Direct Connector	Congestion/Bottleneck	2017
0027-13-211	I-69 Southwest Freeway Northbound to I-610 Northbound Connector - Reconstruction of Direct Connector	Congestion/Bottleneck	2017
0739-02-161	I-10: 0.64 Miles West of Hamshire Rd, East to 0.76 Miles East of FM 365 - Widen Freeway From 4 To 6 Lanes	Congestion/Bottleneck	2017
0675-07-096	I-45: The Montgomery County Line to 0.5 mi North of Vick Spring Rd - Widen Freeway	Congestion/Bottleneck	2017
0102-03-083	US 77: S of CR 28 to CR 16 - Construct Relief Route Around Driscoll	Congestion/Bottleneck	2018

TIP/Project Number	Project Name	Need Addressed	Fiscal Year
0200-11-095	US 69: LNVA Canal, South to I-10 - Widen Freeway From 4 to 6 Lanes	Congestion/Bottleneck	2018
2452-03-112	SL 1604: I-35 to FM 78 - Expand From 4 Lane Divided to 4 Lane Expressway	Congestion/Bottleneck	2018
0005-14-084	I-20: At CR 1250 - Construct New Interchange	Congestion/Bottleneck	2019
0500-04-105	I-45: FM 519 to FM 1764 - Reconstruct to 8 Main Lanes and two 2-Lane Frontage Roads	Congestion/Bottleneck	2019
0015-10-064	I-35: At Wells Branch Pkwy - Operational Improvements-Interchange	Congestion/Bottleneck	2020
0275-01-199	I-40: Reconstruct Bridge at SL 335 (2nd Level) For Future Freeway	Congestion/Bottleneck	2020
0610-07-113	I-30: FM 989 to Arkansas State Line - Widen Existing Interstate From 4 Lanes to 6 Lanes	Congestion/Bottleneck	2020
0016-03-110	I-35: Loop 82 to South of Loop 82 - Reconstruct Ramps	Congestion/Bottleneck	2020
Railroad Projects			
7107-07-003	South Orient Railroad: Irion County - Rehabilitate South Orient Railroad	Access and Connectivity	2017
7107-08-004	South Orient Railroad: Irion County - Rehabilitate South Orient Railroad	Access and Connectivity	2017
7106-05-001	South Orient Railroad: Upton County Line to Crockett County Line - Rehabilitation of South Orient RR To 25 Mph Track Speeds	Access and Connectivity	2018
7106-06-003	South Orient Railroad: Reagan County Line to Crane County Line - Infrastructure Rehabilitation	Access and Connectivity	2018
7107-04-001	South Orient Railroad: Crane County Line to Pecos County Line - Rehabilitation of South Orient RR To 25 Mph Track Speeds	Access and Connectivity	2018

As stated previously, the 5-Year Freight Investment Plan consists of 515 projects at a cost of \$7.5 billion, including 31 projects receiving National Highway Freight Program funds. All remaining projects in the 5-year Freight Investment Plan will be funded by other funding sources. The full list of projects in the 5-Year Freight Investment Plan is included in **Appendix C** and the highway portion is summarized by National Highway Freight Network component in **Exhibit 13-3**:

- Thirty-nine percent of projects and 62 percent of project cost in the 5-Year Freight Investment Plan are eligible for National Highway Freight Program funds.
- Sixty-one percent of projects and 38 percent of project cost in the 5-Year Freight Investment Plan are ineligible for National Highway Freight Program funds.

Exhibit 13-3: *Summary of the Texas 5-Year Freight Investment Plan by Network Component*



All projects in the 5-Year Freight Investment Plan meet at least one identified freight need discussed in previous Chapters and shown in **Exhibit 13-4**. Alternate routes projects, such as constructing additional frontage roads, improve system reliability by increasing route options. Asset preservation projects rehabilitate infrastructure such as bridges, pavement, or railways for safe and efficient freight movement. Mobility and reliability projects can ease congestion and bottlenecks by adding capacity or improving operational efficiency. Safety projects include a wide range of project types to address an identified safety need.

Technology projects improve reliability of freight movement through enhanced traffic management and operations.

- Safety and Mobility and Reliability are the two need categories with the most projects; each has more than 30 percent of the projects in the 5-Year Freight Investment Plan.
- Two-thirds of funding is programmed for Mobility and Reliability projects addressing multimodal bottlenecks and congestion needs on the Texas Highway Freight Network.

Exhibit 13-4: Summary of the Texas 5-Year Freight Investment Plan by Identified Freight Needs

Project Category	Number of Projects	Percent of Projects	Cost Estimate (Millions)	Percent of Cost
Alternate Routes	61	12%	\$1,956.1	26%
Asset Preservation	60	12%	\$421.4	6%
Mobility and Reliability	155	30%	\$4,965.2	66%
Safety	232	45%	\$108.4	1%
Technology	7	1%	\$37.3	<1%
Total	515	100%	\$7,488.4	100%

13.2 Highway Projects in the 5-Year Freight Investment Plan

As stated previously, the 5-Year Freight Investment Plan consists of 508 highway projects. These highway projects cost approximately \$7.47 billion. The full list of projects in the 5-Year Freight Investment Plan is included in **Appendix C**.

13.2.1 Summary of Highway Projects

The 5-Year Freight Investment Plan represents the projects that are already fully funded. TxDOT evaluated how these projects address freight needs in terms of need category and priority to provide insight into how well the department's current project selection and prioritization process addresses freight.

Exhibit 13-5 shows the results of the highway project prioritization process described in **Chapter 10**. Analysis of the 508 highway projects in the 5-Year Freight Investment Plan reveals:

- High priority projects represent only 23 percent of total projects but account for more than half of the funding in the 5-Year Freight Investment Plan.

- Medium priority projects represent nearly half of all projects in the 5-Year Freight Investment Plan but account for only one-third of estimated costs.
- Low priority projects represent 30 percent of projects but account for only 14 percent of estimated costs in the 5-Year Freight Investment Plan.

Exhibit 13-5: *Highway Projects in the 5-Year Freight Investment Plan by Priority*

Priority	Number of Projects	Percent of Projects	Cost Estimate (Millions)	Percent of Cost
High	119	23%	\$3,850.0	52%
Medium	238	47%	\$2,535.1	34%
Low	151	30%	\$1,072.9	14%
Total	508	100%	\$7,458.0	100%

As shown in **Exhibit 13-6**, both urban and rural areas have roughly equal numbers of projects. However, urban areas account for 71 percent of the estimated costs compared to only 29 percent in rural areas. This disparity can be attributed to the complexity of projects in urbanized areas, with factors including concentration of congestion forming bottlenecks and acquisition of right-of-way. Maps depicting interstate projects in the 5-Year Freight Investment Plan in the state's five largest metropolitan areas are available in [Appendix C](#).

Exhibit 13-6: *Highway Projects in the 5-Year Freight Investment Plan by Location*

	Number of Projects	Percent of Projects	Cost Estimate (Millions)	Percent of Cost
Urban*	256	50%	\$5,272.4	71%
Rural	252	50%	\$2,185.6	29%
Total	508	100%	\$7,458.0	100%

* Urban is defined as location within an Metropolitan Planning Organization (MPO) planning boundary.

The majority of projects in the 5-Year Freight Investment Plan are located off the Texas portion of the National Primary Highway Freight System and Critical Freight Corridors. Projects on the National Primary Highway Freight System account for nearly half of the total project cost in the 5-Year Freight Investment Plan and 90 percent of National Highway

Freight Program funding. **Exhibit 13-7** shows the number and cost of projects by network component.

Exhibit 13-7: *Highway Projects in the 5-Year Freight Investment Plan by Network Component*

	Number of Projects	Percent of Projects	Cost Estimate (Millions)	Percent of Total Cost	Projects Receiving NHFP Funds	Total NHFP Funds (Millions)
National Primary Highway Freight System	145	28%	\$3,618	49%	24	\$479
Critical Urban Freight Corridors	29	6%	\$850	11%	1	\$32
Critical Rural Freight Corridors	18	4%	\$130	2%	1	\$19
Rest of Texas Highway Freight Network	316	62%	\$2,860	38%	0	\$0
Total	508	100%	\$7,458	100%	26	\$530

Exhibit 13-8 displays the location of the 192 highway projects eligible for the National Highway Freight Program at an estimated cost of \$4.6 billion. Of these, 26 highway projects are programmed for National Highway Freight Program funding. The remaining 166 highway projects will be funded through other programs.

- Nearly 80 percent of the Texas portion of the National Primary Highway Freight System has a fully funded project planned between 2016 and 2020.
- About 60 percent of the 372 miles of Critical Urban Freight Corridor miles and 30 percent of the 744 miles of Critical Rural Freight Corridor miles have fully funded projects planned between 2016 and 2020.

Exhibit 13-8: National Highway Freight Program Eligible Projects in the 5-Year Freight Investment Plan

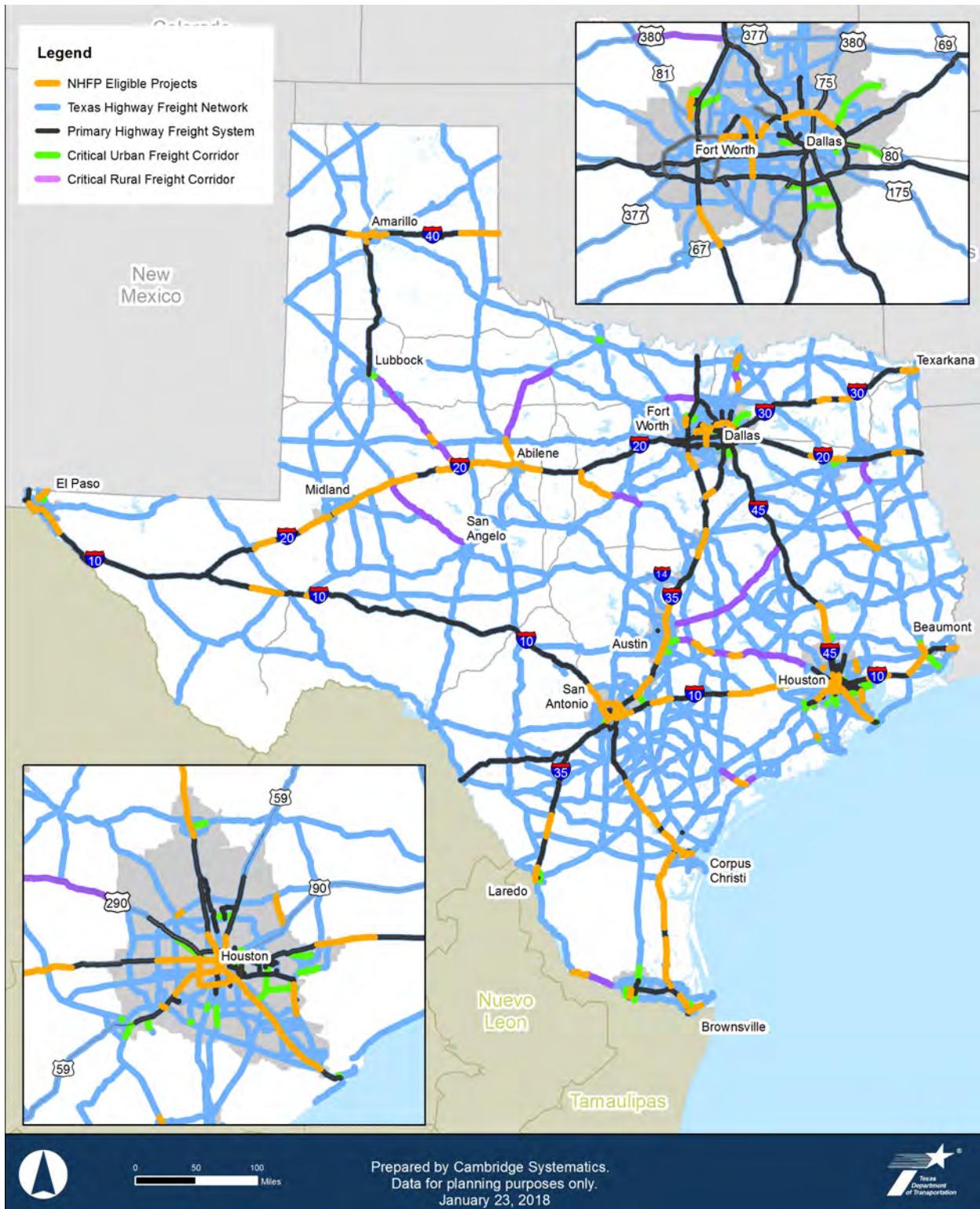


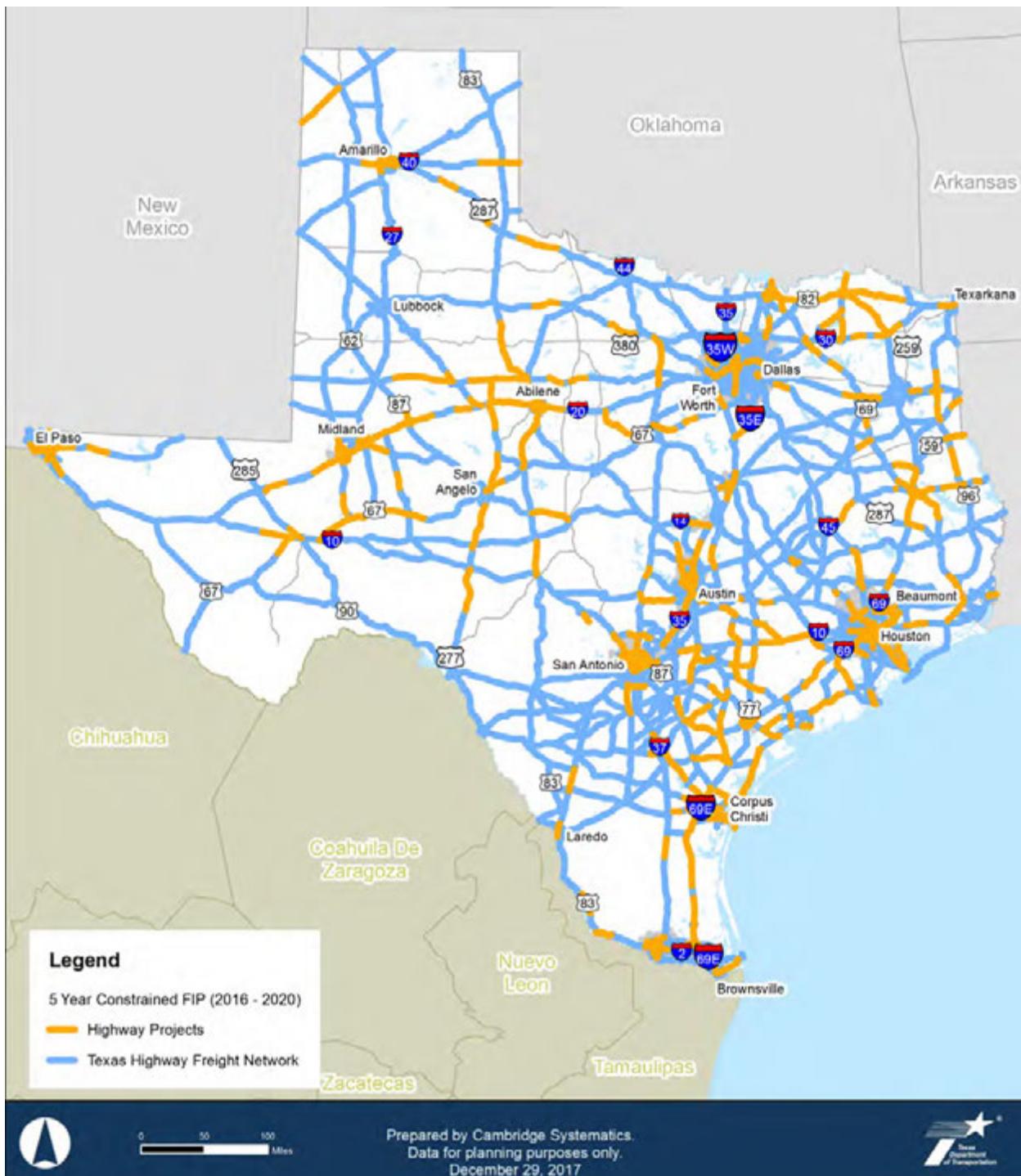
Exhibit 13-9 displays the location of all 508 highway projects in the 5-Year Freight Investment Plan. In total, about 40 percent of the Texas Highway Freight Network has a fully funded project in the five-year period. Much of the remaining 60 percent has identified projects that are either partially funded or beyond the five-year timeframe.

Summary of the fully funded projects on the Texas Highway Freight Network from 2016 to 2020 include:

- High priority projects on I-45, I-610, and I-69 in Houston; I-69E in Brownsville; I-35 in Austin, and I-10 in Beaumont, San Antonio, and El Paso.
- No high priority freight projects on interstates are fully funded in the 5-Year Freight Investment Plan for the Dallas-Fort Worth region.
- I-35 has fully funded medium and high priority freight projects in San Antonio, Austin and the Dallas-Fort Worth region.
- Low priority freight projects are fully funded for I-20 in Abilene and I-10 in Houston.

In total, about 40 percent of the Texas Highway Freight Network has a fully funded project over the next five years, compared to 60 percent of the Network with partially funded or unfunded freight needs.

Exhibit 13-9: All Highway Projects in the 5-Year Freight Investment Plan

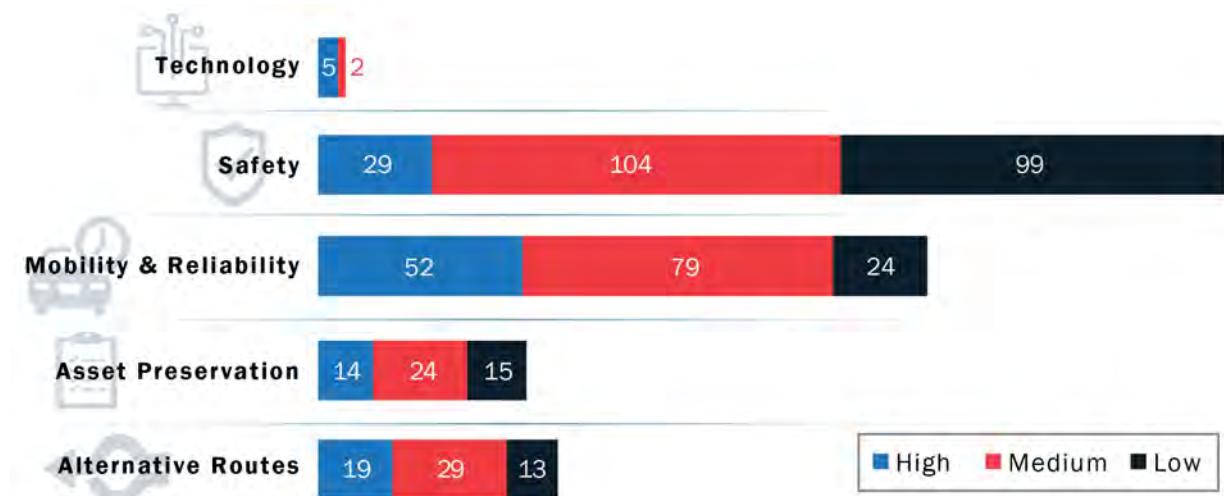


13.2.2 Evaluating How the 5-Year Freight Investment Plan Highway Projects Address Highway Freight Needs

The 5-Year Freight Investment Plan is an important tool for TxDOT in meeting existing and immediate freight needs. Its effectiveness hinges on how well the projects align with freight needs and priorities. **Exhibit 13-10** summarizes the 5-Year Freight Investment Plan highway projects by need category and priority. Analysis of the project types and priority shows:

- While mobility and reliability and safety were the two most important goal areas to stakeholders, most fully funded projects in these categories are medium priority.
- Technology is the only area where the number of high priority projects being implemented exceeds the combined number of medium and low priority projects.

Exhibit 13-10: 5-Year Freight Investment Plan Highway Projects by Need Category and Priority



The majority of projects are addressing safety and mobility and reliability needs, followed by alternate routes and then asset preservation. These projects, located both in urban and rural areas, include innovative technology solutions (ITS), added capacity, operational improvements, infrastructure rehabilitations, and others that will continue to allow TxDOT to enhance safety, address congestion and freight bottlenecks, and improve the overall condition of the Texas Highway Freight Network throughout the state.

Exhibit 13-11 depicts the location of the mobility and reliability projects that are addressing congestion and freight bottleneck needs in the state's large urban areas, at the commercial border crossings, in key energy and petroleum regions in West Texas and along key non-interstate routes. Key observations include:

- The majority of fully funded mobility and reliability projects are high and medium priority, which signals that funding is well aligned with priorities for this project type.
- The fully funded high priority mobility projects are located in larger urban areas, which are where the majority of freight bottlenecks are located.
- The fully funded low priority mobility projects are in less developed areas and primarily on non-interstate corridors.

As discussed throughout this plan, most thorough in **Chapters 7, 8, and 9**, congestion and freight bottlenecks are two of Texas' most significant challenges to freight mobility. TxDOT has taken significant steps in addressing these challenges. For example, the Texas Clear Lanes program described in **Chapter 12** specifically targets congestion and bottlenecks, with projects that aim to improve mobility and provide congestion relief on the most congested corridors in Austin, Dallas, Fort Worth, Houston, and San Antonio. Of the 23 Clear Lanes congestion relief projects located in the five large metropolitan areas of Austin, Dallas, Fort Worth, Houston and San Antonio in fiscal years 2016-2020, 11 totaling almost \$1.2 billion are in the financially constrained investment plan. These projects address freight bottlenecks and congestion issues discussed previously in **Chapters 7, 8 and 9**.

Exhibit 13-11: Mobility and Reliability Highway Projects in the 5-Year Freight Investment Plan

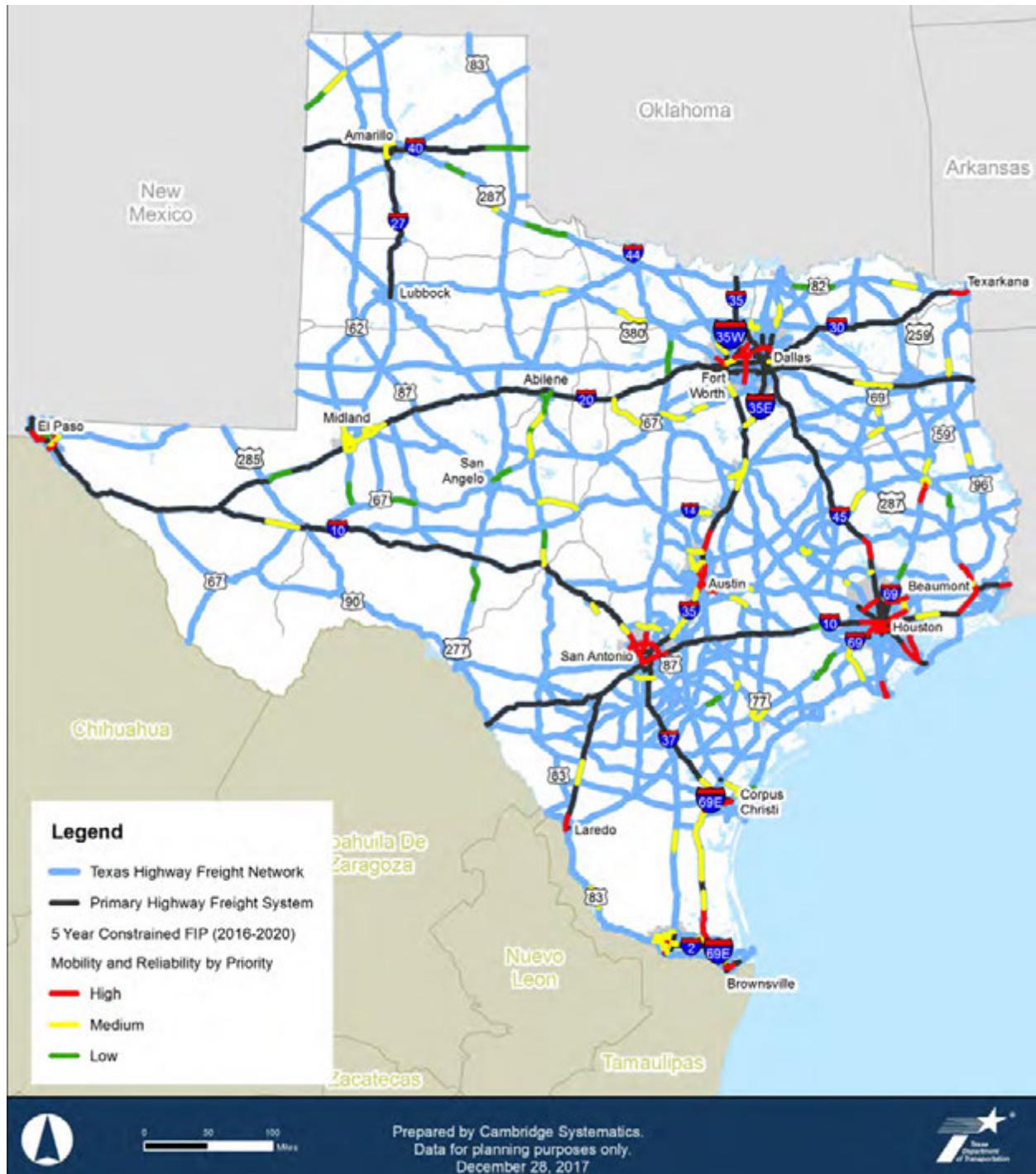


Exhibit 13-12 shows the breakdown of Clear Lanes projects in the 5-Year Freight Investment Plan by metro area and **Exhibit 13-13** provides a summary of these projects by fiscal year. There are four Texas Clear Lanes projects that are receiving National Highway Freight Program funds, two in FY 2016, one in FY 2018 and one in FY 2020. The projects include widening roadways, adding frontage roads and auxiliary lanes, and bridge reconstructions.

Exhibit 13-12: *Texas Clear Lanes Projects in the 5-Year Freight Investment Plan by Metro Area*

	Number of Projects	Percent of Projects	Cost Estimate (Millions)	Percent of Cost
Austin	3	23%	\$582	28%
Dallas	0	0%	\$0	0%
Fort Worth	1	8%	\$56	3%
Houston	4	31%	\$650	32%
San Antonio	5	38%	\$772	37%
Total	13	100%	\$2,060	100%

Exhibit 13-13: Texas Clear Lanes Projects in the 5-Year Freight Investment Plan by Fiscal Year

Fiscal Year	District	NHFP Funding	Description
2016	Austin	Yes	I-35 add Shoulders, Auxiliary Lanes, Ramp Improvements, Pavement Rehab, Frontage Road from North of Oltorf Street to South of Oltorf Street
2017	Austin	Yes	I-35: Add shoulders, auxiliary lanes, ramp improvements, pavement rehabilitation, & frontage road improvements
	Austin	No	US 183: Widen from 3 to 4 general purpose lanes from RM 640/SH 45 to Travis County line
	Fort Worth	No	SH 121: Construct deferred connections from SH 121 to I-635 and FM 2499
	Houston	No	I-610: Reconstruct mainlanes and frontage road. Construct overpass at Cambridge Street/Almeda Road/UPRR from west of Cambridge to west of Scott Street
2018	San Antonio	Yes	US 281: Expand to 6 lanes with frontage roads (4 general purpose and 2 HOV lanes) from 0.8 miles north of Stone Oak to Bexar/Comal County line
	San Antonio	No	SL 1604: Expand from 4 lanes to divided 4 lane expressway from I-35 to FM 78
	San Antonio	No	I-10: Expand from 4 to 6 lanes from I-410 to SL 1604
2019	Austin	No	US 183: Widen from 3 to 4 general purpose lanes from Williamson County line to SL 1
	Houston	No	I-69: Reconstruct to 10 main lanes from SH 288 to SL 527
2020	Houston	Yes	I-59: Reconstruct 3 bridges at McGowen, Tuam and Elgin

As noted in **Chapter 7**, nine of the nation's top 50 freight bottlenecks are located in Texas, as identified in 2016 by the American Transportation Research Institute (ATRI). The 5-Year Freight Investment Plan includes seven projects with an estimated cost of nearly \$341 million that directly address four of the nine freight bottlenecks. As shown in **Exhibit 13-14**, the projects include road widenings, frontage road and auxiliary lane improvements and bridge reconstructions. Of the seven projects, three are being funded with National Highway Freight Program funds. Refer to **Exhibit 7-11** for specific locations of the ATRI Top 50 National Bottlenecks in Texas.

Exhibit 13-14: *Projects in the 5-Year Freight Investment Plan to Improve Top National Freight Bottlenecks in Texas*

ATRI Top 50 National Bottleneck in Texas	City	Location	Description	Cost (Millions)	NHFP
#28 - I-35 in Austin	Austin	North and South of Oltorf Street	Add Shoulders and Auxiliary Lanes; Ramp and Frontage Rd Improvements	\$44.658	Yes
#28 - I-35 in Austin	Austin	North and South of 51st Street	Add Shoulders and Auxiliary Lanes; Ramp and Frontage Rd Improvements	\$16.490	Yes
#28 - I-35 in Austin	Austin	At Parmer Ln	Reconstruct Intersection	\$24.159	No
#25 - I-45 at I-610 (North)	Houston	I-45 NB From Detroit to Berkley and I-610 WB From Berkley to Broad	Reconstruct Frontage Roads	\$7.800	No
# 8 - I-45 at US 59	Houston	SH 288 to SP 527	Reconstruct to 10 Main Lanes	\$192.000	No
# 8 - I-45 at US 59	Houston	At McGowen, Tuam and Elgin	Construct 3 Bridges	\$55.800	Yes
#13 - I-10 and US 59	Houston	US 59 North East of I-10 to I-10	High Friction Surface Treatment on Curve	\$0.081	No

Exhibit 13-15 displays the location of safety projects in the 5-Year Freight Investment Plan. A majority of the safety projects are addressing rural route safety needs on the fringes of urban areas. The majority of fully funded safety projects are medium or low priority. The high priority safety projects are in urban areas.

Exhibit 13-15: Safety Highway Projects in the 5-Year Freight Investment Plan

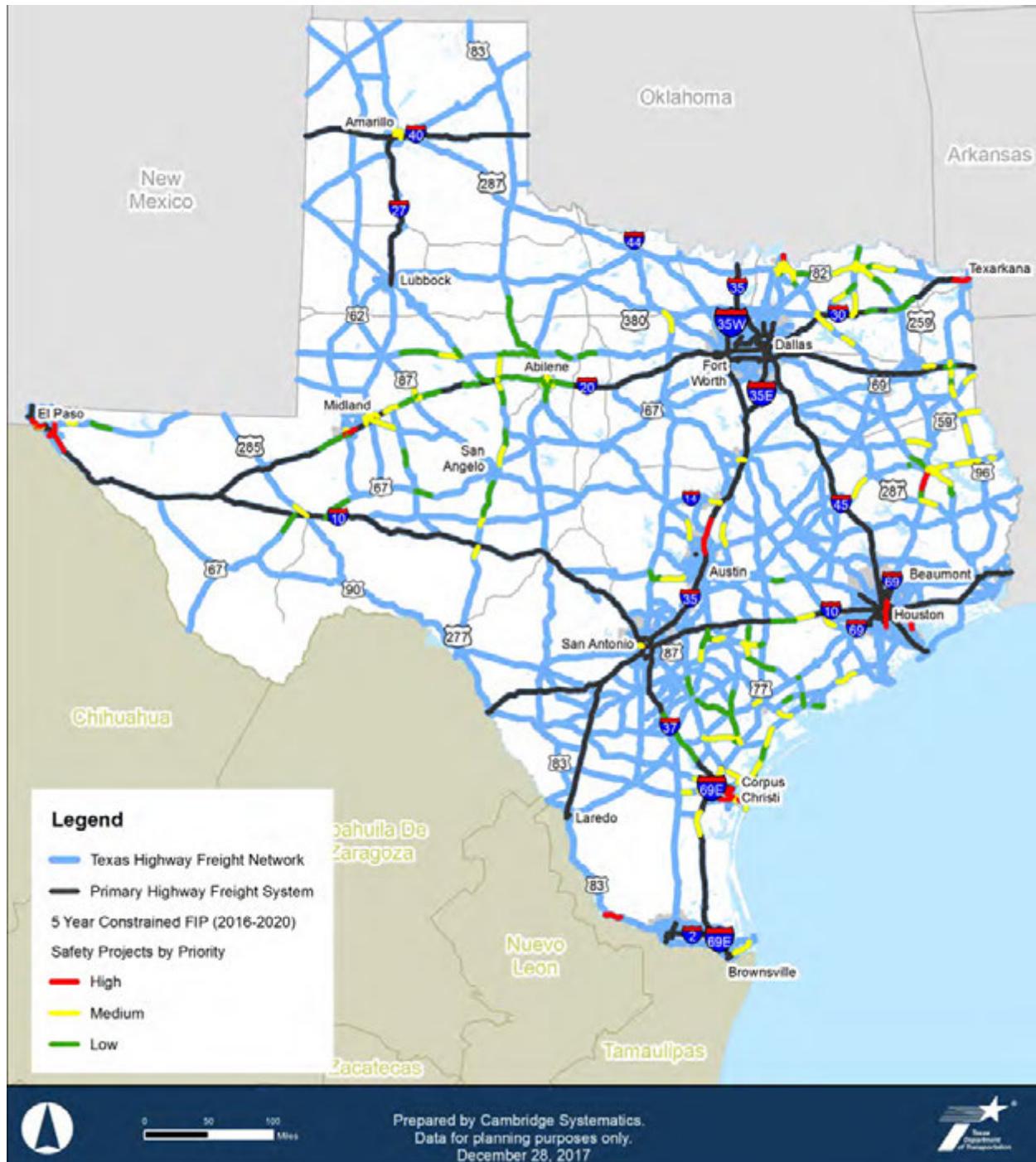
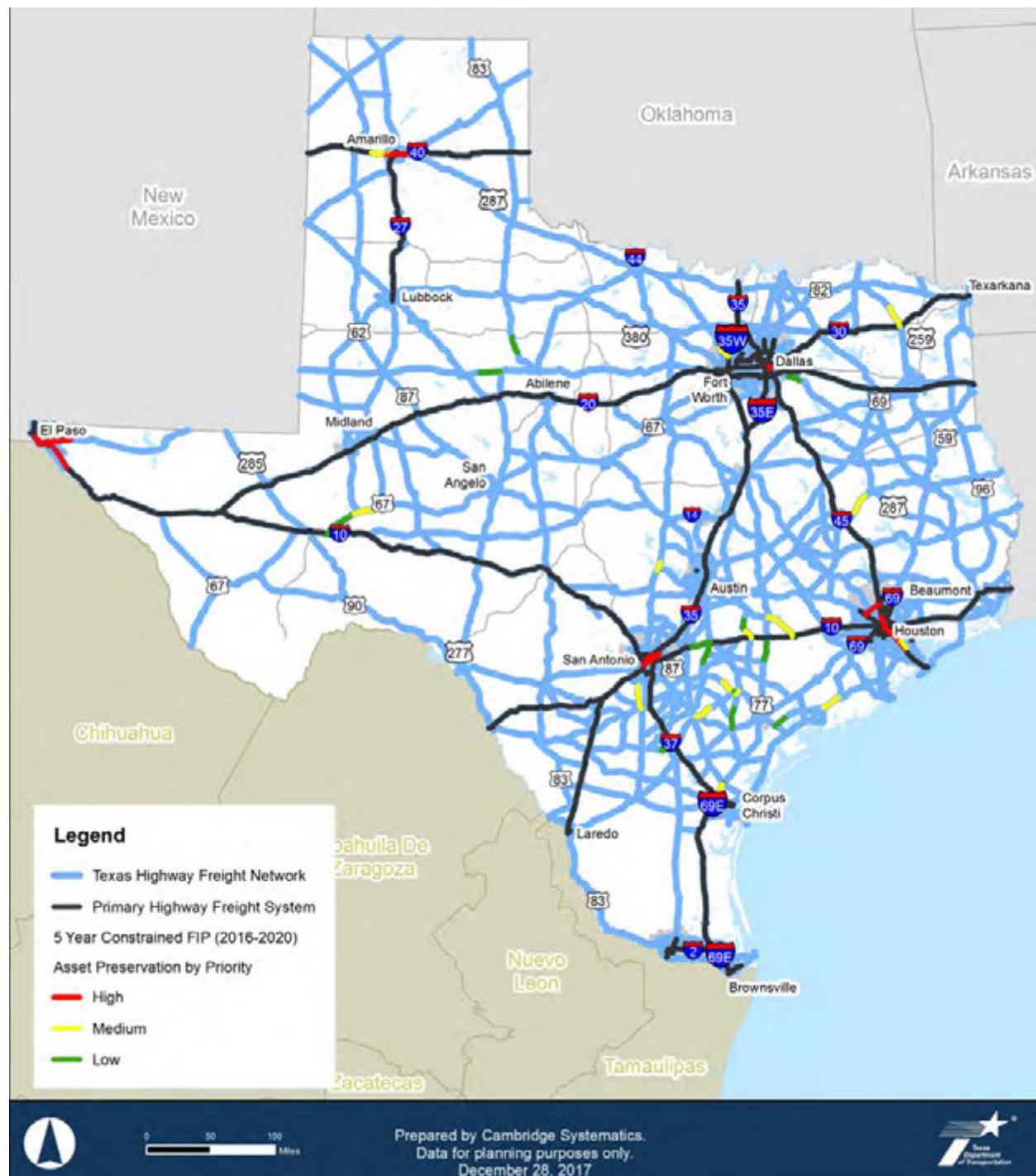


Exhibit 13-16 shows the asset preservation projects, which are primarily bridge repair and replacements, and are a mixture of urban and rural projects with the majority being off interstate. The majority of fully funded asset preservation projects are medium priority. Most of the high priority projects are in the large urban areas.

Exhibit 13-16: Asset Preservation Highway Projects in the 5-Year Freight Investment Plan



13.3 Multimodal Freight Projects in the 5-Year Freight Investment Plan

The 5-Year Freight Investment Plan is multimodal and includes 42 projects to improve rail facilities, ports, airports, and border crossings, as summarized in **Exhibit 13-17**. These 42 multimodal projects, which include 7 freight rail improvement projects without a highway connection, are a subset of the 515 projects in the 5-Year Freight Investment Plan.

Exhibit 13-17: *Multimodal Projects in the 5-Year Freight Investment Plan by Modal Connection*

Mode	Number of Projects	Cost (Millions)
Freight Rail Projects	7	\$30.4
Multimodal Highway Projects		
Rail Grade Separation Projects	6	\$105.9
Port Access and Connectivity Projects	2	\$33.0
Border Crossing Access and Connectivity Projects	22	\$133.0
Air Cargo Access and Connectivity Projects	3	\$168.0
Multiple Modes	2	\$61.4
Total	42	\$531.7

13.3.1 Freight Rail Projects

As shown in **Exhibit 13-18**, there are 7 TxDOT freight rail projects in the 5-Year Freight Investment Plan, totaling \$30.4 million. The projects span three TxDOT districts on the South Orient Railroad and do not directly involve highways. Additionally, six highway projects address rail-grade crossings. It is important to note that these 13 rail and grade separation projects represent freight rail investments for which TxDOT is participating and do not include investments that are entirely privately funded by the freight railroads.

The South Orient Railroad projects include the construction and reestablishment of a border crossing from Ojinaga, Mexico to Presidio, Texas and track tie and surfacing, switch replacement, timber bridge component replacements and drainage improvements along the existing line. These projects span from the new international rail bridge, north to the Union Pacific Railroad (UP) crossing near Paisano Junction, Texas, for approximately 72 miles in total. These projects will enhance multimodal connectivity and access to the international border, enhance safety of freight operations, and provide alternative corridors for freight.

The highway-rail crossing projects are in the Dallas-Fort Worth and Houston metropolitan regions and enhance safety and mobility for both freight and passenger traffic.

Exhibit 13-18: Summary of Rail Projects in the 5-Year Freight Investment Plan

Project Type	Number of Projects	Cost (Millions)	Priority
Rail Projects	7	\$30.4	High
Highway/Rail-Grade Separations (maintenance on existing)	3	\$62.8	High
Highway/Rail-Grade Separations (new grade separations) ^a	3	\$43.0	High
Total of Rail-Related Projects	13	\$136.2	

^a Highway projects impacting rail are included in this table due to their impact on both modes.

From the public sector perspective, these projects are all high priority with an end result of enhancing mobility and multimodal connectivity. Because rail projects most often involve privately-owned and maintained infrastructure, the implementation of these and almost all freight rail projects will require coordination between TxDOT, Metropolitan Planning Organizations and private freight rail companies.

13.3.2 Port Access and Connectivity Projects

There are only two fully funded port access and connectivity projects in the 5-Year Freight Investment Plan: one at Port Houston and one in Brownsville. These two projects have a combined cost of \$33 million. Port access projects are often needed on small or local roads which may have difficulty competing with major corridors for funding, despite their essential role in accessing major economic generators for the state. Both projects are high priority, but the lack of more port-access projects suggests pressure from competing priorities between regional freight needs and statewide freight needs. This signals the need for additional consideration of freight needs and benefits in the project identification and prioritization process.

13.3.3 Air Cargo Airport Access and Connectivity Projects

The 5-Year Freight Investment Plan includes three projects with a cost of \$168 million that will enhance air cargo airport access: one each for Austin Bergstrom Airport, Dallas-Fort Worth International Airport and George Bush Intercontinental Airport in Houston. All three projects are high priority based on the overall impact they will have on freight movement.

13.3.4 International Border Crossing Access and Connectivity Projects

A total of 22 international border crossing access and connectivity projects costing more than \$133 million are included in the 5-Year Freight Investment Plan. There are 14 international border-crossing projects in the El Paso district, 7 in the Pharr district and one in the Laredo district. Eighty percent of the international border-crossing access projects are high priority and the remaining are medium priority. In terms of meeting the identified freight needs, most projects are related to mobility and reliability or alternate routes needs (12 of 22). The remaining projects are split between asset preservation and safety with one technology project.

13.3.5 Multiple Modes Projects

One project in the El Paso district will improve mobility near both the Bridge of the Americas border crossing and the El Paso International Airport. This project costs nearly \$34 million and is a high priority direct connector project. A second project in El Paso is estimated at \$27 million and reconfigures ramps near the Ysleta-Zaragoza Bridge and creates a new highway-rail grade separated crossing.

13.4 Funding for the 5-Year Freight Investment Plan

Exhibit 13-19 summarizes TxDOT's funding sources and categories. TxDOT receives funding from federal, state and nontraditional sources and is required to distribute funds into 12 prescribed funding categories. A project's funding may be assigned from multiple funding categories, based on the type of project and its characteristics. Projects on the Texas Highway Freight Network may receive funding from all of these categories, but categories 2, 4, 6 and 12 are especially important to freight.

Exhibit 13-19: Summary of TxDOT's Funding Sources and Categories



Source: TxDOT, 2018 Unified Transportation Program.

The 12 funding categories are summarized below.

- Category 1: Preventive Maintenance and Rehabilitation – Preventive maintenance and rehabilitation on the existing state highway system, including minor roadway modifications to improve operations and safety.
- Category 2: Metropolitan and Urban Area Corridor Projects – Mobility and added capacity projects along a corridor that improve transportation facilities in metropolitan and urbanized areas.
- 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.
- Category 4: Statewide Connectivity Corridor Projects – Mobility and added capacity projects on major state highway system corridors that provide statewide connectivity between urban areas and corridors and projects designed to create a highway connectivity network composed of the Texas Highway Trunk System and the National Highway System, and connections from those two systems to major ports of entry on international borders and Texas water ports.

- Category 5: Congestion Mitigation and Air Quality Improvement – Congestion mitigation and air quality improvement area projects to address attainment of a national ambient air quality standard in nonattainment areas of the State.
- 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.
- Category 7: Metropolitan Mobility and Rehabilitation – Transportation needs within the boundaries of designated metropolitan planning areas of metropolitan planning organizations located in a transportation management area.
- Category 8: Safety – Safety-related projects both on and off the state highway system.
- Category 9: Transportation Alternatives Program – Transportation-related activities as described in the Transportation Alternatives Set-Aside Program.
- Category 10: Supplemental Transportation Projects – Transportation-related projects that do not qualify for funding in other categories such as replacement of railroad crossing surfaces, maintenance of railroad signals, and miscellaneous federal programs.
- Category 11: District Discretionary – Projects eligible for federal or state funding selected at the district engineer's discretion.
- 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 and maintain the ability to respond to both manmade and natural emergencies.

The total 2018 Unified Transportation Program budget is more than \$71 billion, of which over 67 percent is in Categories 1, 2, 4 and 12. The National Highway Freight Program funds are part of the federal portion. As noted above, the 5-Year Freight Investment Plan costs \$7.5 billion, making the \$540.3 million National Highway Freight Program portion of the 5-Year Freight Investment Plan about seven percent.

Exhibit 13-20 summarizes the TxDOT funding for the 5-Year Freight Investment Plan for the projects in the Unified Transportation Program. The key funding categories for the 5-Year Freight Investment Plan include Category 4 (Statewide Connectivity Corridor Projects) and Category 2M (Metropolitan Area Corridor Projects). Together, Categories 2M and 4 account for 63 percent of the total 5-Year Freight Investment Plan funding sources. The TxDOT funding summarized below is combined with federal, local and nontraditional funding sources to fully fund the 5-Year Freight Investment Plan.

Together, Categories 2M and 4 account for 63 percent of the total 5-Year Freight Investment Plan funding sources.

Exhibit 13-20: *TxDOT Funding Sources for the 5-Year Freight Investment Plan Projects Identified from the Unified Transportation Program*

Category	Description	Cost
1	Preventive Maintenance and Rehabilitation	\$25,063,000
2M	Metropolitan Area Corridor Projects	\$1,909,811,845
2U	Urban Area Corridor Projects	\$330,460,000
3	Nontraditionally Funded Transportation Projects	\$139,085,485
4	Statewide Connectivity Corridor Projects	\$2,333,260,096
5	Congestion Mitigation and Air Quality Improvement	\$10,108,085
6	Structure Replacement and Rehabilitation	\$3,142,200
7	Metropolitan Mobility and Rehabilitation	\$29,756,381
10	Supplemental Transportation Projects	\$31,157,850
11	District Discretionary	\$31,380,000
12	Strategic Priority	\$1,852,363,750
Total		\$6,695,588,692

13.5 Summary

This chapter outlined the project recommendations in the 5-Year Freight Investment Plan. The 5-Year Freight Investment Plan is a subset of the broader Unconstrained Freight Investment Plan discussed in **Chapter 12**. Unlike the Unconstrained Plan, this 5-Year Freight Investment Plan is composed only of currently planned highway and non-highway projects that are fully funded. The 5-Year Freight Investment Plan is a new component of the freight plan that meets the FAST Act requirement and represents an important implementation tool for TxDOT.

The 5-Year Freight Investment Plan identifies 515 fully funded freight projects with an estimated cost of \$7.5 billion. Of these, 199 projects are eligible for National Highway Freight Program funding but only 31 projects are programmed for Texas' \$540.3 million apportionment of National Highway Freight Program funding.

The projects in the 5-Year Freight Investment Plan provide near-term investments (to be implemented from 2016 to 2020) to address existing freight needs that will help TxDOT meet the freight plan goals and enhance the Texas Multimodal Freight Network. However, they only meet a portion of the freight needs. Implementation of these projects and the 2017 Freight Plan recommendations is critical, as discussed in **Chapter 14**.



Texas Freight Mobility Plan

Chapter 14: Freight Transportation Implementation Plan



The recommendations discussed in **Chapters 11, 12 and 13** were developed to ensure the safe and efficient movement of freight through 2045 and beyond by addressing the needs identified in **Chapters 7, 8 and 9**. An effective implementation plan ensures that the Freight Plan is dynamic and offers a continuous cycle of improvement based on the recommendations outlined. The implementation plan should be re-evaluated on a regular basis to adapt to freight user needs and changes in priorities, funding sources and resources. This chapter provides a summary of the implementation plan that categorizes the recommendations as short, medium and long term based on their priorities. A complete list of projects, including the priorities, is located in the **Appendices**.

14.1 Implementation of Recommendations

14.1.1 Implementation of Policy Recommendations

The Freight Plan's 22 policy recommendations are broad-based strategies designed to meet Texas' institutional, regulatory and systemic challenges and bottlenecks. These policies were developed using extensive stakeholder input, especially from the Texas Freight Advisory Committee, private-sector stakeholders, TxDOT districts and Metropolitan Planning Organizations (MPOs) and through rigorous data analysis and system evaluation.

Exhibit 14-1 provides an implementation timeline for 18 actions to implement these policies based on overall need, input from the TxFAC and stakeholders and overall feasibility. The implementation of freight policies begins with the adoption of the 2017 Freight Plan and the updated Texas Multimodal Freight Network. The short-term actions should begin immediately and be implemented in full over the next three years. Early planning for the medium-term actions should begin within the next 12 months, and the full implementation should be completed with the next five years.

Exhibit 14-1: Policy Recommendations

Recommended Freight Policy Actions – Short Term
<ul style="list-style-type: none"> ▪ Adopt the updated Texas Freight Mobility Plan and Texas Multimodal Freight Network as the strategic framework for statewide freight-related transportation investment decisions. ▪ Investigate options to enhance flexibility for funding and financing multimodal freight projects. ▪ Develop and adopt multimodal freight planning, programming and implementation guidelines for integrating freight into the TxDOT investment decision-making process. ▪ Develop and adopt freight centric design guidelines for the Texas Highway Freight Network. ▪ Invest in multimodal solutions that leverage all the freight transportation modes. ▪ Align transportation investments with the state's vision for economic growth. ▪ Pursue strategies to reduce crash rates and fatalities on the Texas Multimodal Freight Network. ▪ Partner with public and private sectors to educate and build awareness of the importance of freight movement to the state's economy. ▪ Partner with railroads to develop rail solutions to ease highway traffic congestion.

Recommended Freight Policy Actions – Medium Term

- Invest in the preservation of the Texas Multimodal Freight Network.
- Establish TxDOT as a leader in developing and implementing freight-based technology solutions and innovation.
- Address air cargo needs, issues and recommendations in the next update of the TxDOT Texas Airport System Plan.
- Identify and adopt strategies to improve the operational management of the Texas Highway Freight Network.
- Identify current and continue to monitor future energy transportation needs and impacts.
- Support strategies that address pipeline capacity needs and challenges.
- Collaborate with maritime stakeholders to identify strategies to expand and improve maritime freight movements.
- Coordinate with industries and international, national, state, regional and local agencies to address multijurisdictional freight needs and challenges.
- Facilitate international border coordination to improve mobility and eliminate transportation related barriers to trade.

14.1.2 Implementation of Program Recommendations

Many of the freight programs are identified as high priority and can begin implementation. Some of these include improving stakeholder outreach and education, establishing and strengthening public-private partnerships, developing network design guidelines and standards and increasing freight planning knowledge and capacity. For the complete list of programs and their associated timeframes, refer to **Appendix H**. **Exhibit 14-2** provides a list of key program recommendations and the general implementation schedule.

Exhibit 14-2: Program Recommendations

Recommended Freight Program Actions – Short Term
<ul style="list-style-type: none">▪ Develop and administer a comprehensive and multimodal TxDOT Freight Planning Program, focused on developing strategies, policies and methodologies that work to improve the freight transportation system in Texas.▪ Develop a Freight Movement Public Education and Awareness Program to educate the public, elected officials, policy-makers and other stakeholders on the economic benefits of freight and safety-related issues.▪ Conduct a comprehensive and coordinated Texas-Mexico border master plan, promoting trade and commerce and facilitating border infrastructure development.▪ Conduct a Statewide Truck Parking and Rest Stop Study to evaluate the current condition of truck parking within the state, analyze the impact of hours-of-service on trucker operations, identify potential community and safety impacts of inadequate truck parking facilities and develop strategies to meet current trucking needs and future demands.▪ Develop, in cooperation with the freight industry, a comprehensive Rail Freight Development and Improvement Program to expand rail freight capacity and improve rail freight mobility.▪ Continue to implement Freight Network Bridge Reconstruction and Replacement Program to address deficient bridges, increase vertical clearance to accommodate oversize/overweight vehicles and facilitate efficient freight movement.▪ Develop resiliency strategies to mitigate impact of man-made or natural disruptions of the Texas Multimodal Freight Network.

Recommended Freight Program Actions – Medium Term

- Develop a Statewide Traffic Management Center Concept of Operations and implementation Plan that integrates existing regional Traffic Management Centers across the state to facilitate dissemination of real-time traffic information, including traffic incidents, construction, weather and special events, etc.
- Develop a Statewide Commercial Vehicle Traffic Incident Management Program to address commercial vehicle crashes and improve safety and mobility for the motoring public and trucks.
- Develop a Statewide Construction Management and Coordination Program to proactively minimize traffic impacts and improve safety and mobility for all users of the highway network.
- Develop a Highway Freight Network Design, Construction and Safety Guidelines Program focused on addressing safety and mobility needs for truck movements, increasing connectivity, and increasing freight network efficiency and operations.
- Conduct a comprehensive statewide HAZMAT Transportation Study to ensure the safe and secure transportation of hazardous materials, including identifying dedicated routes, signage improvements and community impacts.
- Develop an Off-Peak and 24-hour Operation Pilot Program in cooperation with the freight industry and the metropolitan planning organizations to maximize the existing capacity on the Texas Highway Freight Network.

14.1.3 Implementation of Project Recommendations

The 2017 Freight Plan identifies a total of 2,594 projects costing nearly \$66 billion. The Unconstrained Freight Investment Plan is a comprehensive plan that includes all projects regardless of funding status and implementation timeline. The 5-Year Freight Investment Plan is a subset of the unconstrained plan and it addresses FAST Act requirements. It provides TxDOT with an important implementation plan.

Unconstrained Freight Investment Plan

The Unconstrained Freight Investment Plan is the primary long-term freight planning tool for TxDOT. As described in **Chapter 12**, the Unconstrained Freight Investment Plan includes both funded and partially funded projects and includes all planned projects in the Unified Transportation Program and Project Tracker and the rail projects identified by the railroads and public-sector partners. There are a total of 2,460 planned projects in the Unconstrained Plan costing \$66 billion. There are an additional 134 projects proposed by freight stakeholders that are not currently in any TxDOT plans. Many of these unplanned projects do not have cost estimates. From an implementation perspective, the Unconstrained Freight

Investment Plan provides a challenge since there is a \$40 billion funding gap between the projects identified and the funding available. As a result, these projects face higher risk of not being implemented and will require more focus on the part of TxDOT and the stakeholders in terms of ensuring that projects remain in the Unified Transportation Program and other project development plans as long as they are critical to freight movement.

Exhibit 14-3 summarizes the implementation schedule of planned TxDOT multimodal projects in the Unconstrained Freight Investment Plan by year and funding status and **Exhibit 14-4** summarizes the projects by priority and funding. The full list of projects is provided in **Appendix B**.

Exhibit 14-3: *Implementation Schedule for Projects in the Unconstrained Freight Investment Plan by Year and Funding Status*

Year	Partially Funded		Fully Funded		Total	
	Number	Cost (Millions)	Number	Cost (Millions)	Number	Cost (Millions)
2016	-	\$0	7	\$78	7	\$78
2017	-	\$0	10	\$427	10	\$427
2018	46	\$1,158	215	\$2,190	261	\$3,348
2019	33	\$775	184	\$2,357	217	\$3,132
2020	17	\$1,812	101	\$2,455	118	\$4,267
2021	17	\$751	60	\$3,132	77	\$3,883
2022	14	\$1,056	52	\$1,374	66	\$2,430
2023	12	\$493	25	\$651	37	\$1,144
2024	6	\$883	16	\$825	22	\$1,708
2025	8	\$3,222	11	\$219	19	\$3,441
TBD	878	\$36,775	882	\$5,335	1,760	\$42,110
Total	1,031	\$46,925	1,563	\$19,043	2,594	\$65,968

Note: Projects in the Unconstrained Freight Investment Plan include projects and funding sources beyond the National Highway Freight Program

Exhibit 14-4: *Projects in the Unconstrained Freight Investment Plan by Priority and Funding Status*

Priority	Partially Funded		Fully Funded		Total	
	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)	Number of Projects	Cost (Millions)
High	259	\$28,540	451	\$10,869	710	\$39,409
Medium	412	\$13,830	790	\$6,265	1,202	\$20,095
Low	143	\$3,276	322	\$1,909	465	\$5,185
Not Prioritized ^a	217	\$1,279	-	\$0	217	\$1,279
Total	1,031	\$46,925	1,563	\$19,043	2,594	\$65,968

^a Stakeholder proposed projects and non-TxDOT rail projects were not prioritized. Cost for many proposed projects have not been developed, and the full cost to implement all projects will be higher.

The challenge of addressing freight transportation needs identified in the plan will require a concerted effort and framework for moving the 259 partially funded high priority projects to implementation. This will require TxDOT, planning partners and the private sector repurposing existing funds or identifying new revenue sources. There are 322 low priority projects at a cost of \$1.9 billion and 790 medium priority projects at a cost of \$6.3 billion that are fully funded and another 555 medium and low priority projects with some partial funding. There may be opportunity for TxDOT to use the freight plan prioritization to refocus existing funds and incorporate freight considerations into future funding decisions.

5-Year Freight Investment Plan Implementation

The 5-Year Freight Investment Plan represents immediate strategies that are already being implemented or are scheduled for implementation. The projects in the 5-Year Freight Investment Plan have a high probability of being constructed but there is no guarantee that projects will be let. Implementation of the 5-Year Freight Investment Plan will require continued planning and availability of the National Highway Freight Program funds. Ongoing tracking of the Unified Transportation Program updates and project tracker and coordination with the districts will facilitate the construction of these projects.

Chapter 13 discusses the 5-Year Freight Investment Plan, which includes 508 highway projects and seven freight rail projects. Of the highway projects, there are six highway-rail grade separation projects, two port access projects, three airport access projects, 22 border crossing access projects and two multiple mode access projects. There are 199 projects that are eligible for National Highway Freight Program funding, and 31 are programmed for this funding source for 2016-2020. **Exhibit 14-5** summarizes the number and cost of the 5-

Year Freight Investment Plan projects by year. Details on project implementation by year and funding sources are provided in [Appendix C](#).

Exhibit 14-5: *Summary of Implementation Schedule of the 5-Year Freight Investment Plan*

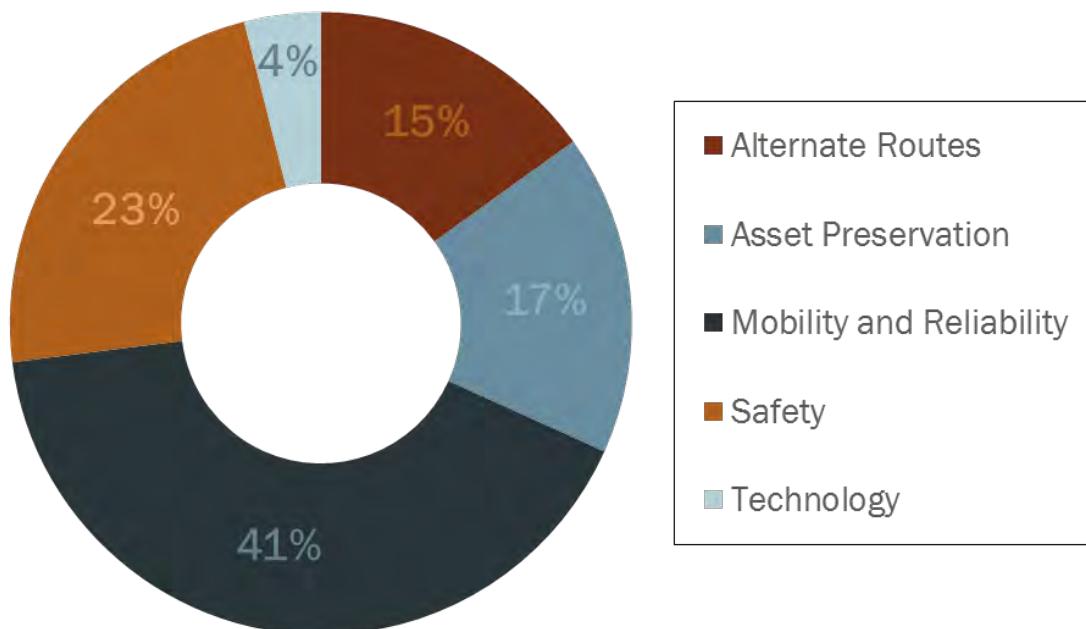
Year	5-Year Freight Investment Plan		National Highway Freight Program	
	Number of Projects	Cost (millions)	Number of Projects	Funding Programmed (millions)
2016	7	\$77.5	7	\$69.5
2017	10	\$427.5	9	\$112.6
2018	214	\$2,180.3	8	\$137.5
2019	183	\$2,347.8	2	\$110.1
2020	101	\$2,455.4	5	\$110.6
Total	515	\$7,488.4	31	\$540.3

High priority projects in the 5-Year Freight Investment Plan represent 24 percent of the total number of projects and 52 percent of the cost. Nearly half of these address congestion and freight bottlenecks by enhancing mobility and reliability. A summary of the 5-Year Freight Investment Plan by priority is shown in [Exhibit 14-6](#). A further breakdown of the high priority projects is shown in [Exhibit 14-7](#).

Exhibit 14-6: *Projects in the 5-Year Freight Investment Plan by Priority*

Priority	Number of Projects	Cost (millions)
High	131	\$3,880.3
Medium	238	\$2,535.1
Low	151	\$1,073.0
Total	515	\$7,488.4

Exhibit 14-7: *High Priority Projects in the 5-Year Freight Investment Plan by Need Category*



14.2 Summary and Next Steps

The development of the 2017 Freight Plan started just 10 months following the adoption of the 2016 Freight Plan, which was TxDOT's first statewide freight-centric transportation plan. The 2017 Plan builds on the strong foundation of the 2016 Freight Plan by updating the data, tools, processes and approaches to enhance the original plan and to lay the groundwork for the challenging job ahead- implementation. The update also had a significant level of stakeholder engagement and was guided by the Texas Freight Advisory Committee. The updated plan reaffirms Texas' freight transportation challenges and outlines updated investment strategies and policies needed to address them.

Continued Collaboration

Implementation of the 2017 Freight Plan will only be successful with the participation and collaboration of all public- and private-sector users and owners of the transportation system. TxDOT has an important role to play in maintaining and expanding the state's freight transportation infrastructure. However, TxDOT cannot be solely responsible for implementing all of the policy, program and project recommendations. These recommendations can only become actionable with strong coordination and cooperation with railroads, ports, airports and other freight industry stakeholders, as well as with other public agencies, such as Federal, other state agencies, Metropolitan Planning Organizations, cities and counties and

other entities. TxDOT will continue to convene the TxFAC, the Border Trade Advisory Committee, the Port Authority Advisory Committee and engage other stakeholders in the implementation of the Freight Plan.

Multimodal and Balanced Approach

The state must be prepared to address the increase in goods that accompany population, business and international and national trade growth. The 2017 Freight Plan identifies a balanced, comprehensive and multimodal freight investment plan and implementation strategy that the state will follow in order to meet future demands and maintain its position as a global trade hub.

The Freight Plan highlights the importance of freight to the economy and quality of life in Texas. Freight considerations need to be taken into account during the project selection and prioritization process to ensure future safe and efficient movement of freight. Furthermore, the freight mobility needs of Texas are dynamic, and the programs and priorities outlined in the Freight Plan will need to be amended or updated regularly to adapt to changes and adjust priorities as may be appropriate.

Key to Successful Implementation

The implementation of the 2017 Freight Plan must be multimodal and include improvements discussed in the plan as well as the initiation of new statewide freight programs. Current and future efforts should focus on:

1. **Policy and Program Recommendations:** Take short- and medium-term actions to fully implement freight policy and program recommendations outlined in the Freight Plan.
2. **5-Year Freight Investment Plan:** Full implementation of projects outlined in the 5-Year Freight Investment Plan.
3. **Unconstrained Freight Investment Plan:**
 - Moving high priority partially funded projects to implementation by refocusing existing funding tried to low or medium priority projects.
 - Addressing the estimated \$40 billion funding shortfall for freight projects in the freight plan to facilitate implementation of freight projects.
 - Ensuring that the high priority strategic projects and initiatives advance in the near-term.
 - Ensuring that UTP project prioritization incorporates freight considerations such as economic competitiveness, supply chain, market access, and goods movement criteria.
 - Outlining how to advance the freight projects in the Unconstrained Freight Investment Plan through project development and implementation.

- Assessing how these projects can be given additional priorities based on freight needs.
- Identifying potential investments or strategies to address freight transportation needs which do not have a currently planned project.
- Focusing efforts at the district and MPO levels on developing freight-centric projects.

These steps are crucial to the state's commitment to support economic development, environmental sustainability and quality of life by addressing freight transportation needs. Implementing the recommended policies, programs and projects outlined in this freight plan is critical to the continued economic prosperity of the state of Texas.



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