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List of Acronyms

AADT – Average Annual Daily Traffic
AIP – Airport Improvement Program
ATRI – American Transportation Research Institute
BNSF – BNSF Railway
CBP – Customs and Border Protection
CMAQ – Congestion Mitigation and Air Quality
CMV – Commercial Motor Vehicle
DCIS – Design and Construction Information System
DOD – Department of Defense
DPS – Department of Public Safety
FAA – Federal Aviation Administration
FAF – Freight Analysis Framework
FHWA – Federal Highway Administration
FIT – Freight and International Trade
FRATIS – Freight Advanced Traveler Information System
FTZ – Foreign Trade Zone
GIWW – Gulf Intracoastal Waterway
GSP – Gross State Product
HSIP – Highway Safety Improvement Program
ITFWG – Internal Technical Freight Working Group
ITS – Intelligent Transportation Systems
KCS – Kansas City Southern Railway
KCSM – Kansas City Southern de Mexico
LNG – Liquefied Natural Gas
LOS – Level-of-Service
MAP-21 – Moving Ahead for Progress in the 21st Century Act
MPO – Metropolitan Planning Organization
NAFTA – North American Free Trade Agreement
NHS – National Highway System
NTSB – National Traffic Safety Board
PMIS – Pavement Management Information System
POE – Port-of-entry
RHiNO – Road-Highway Inventory Network
RMA – Regional Mobility Authority
RRIF – Rail Relocation and Improvement Fund
RRTD – Rural Rail Transportation District
SAMv3 – Statewide Analysis Model version 3
SH – State Highway
SPOE – Seaports of Embarkation
STP – Surface Transportation Program
STRACNET – Strategic Rail Corridor Network
STRAHNET – Strategic Highway Network
TCEQ – Texas Commission on Environmental Quality
TDA – Texas Department of Agriculture
TIGER – Transportation Investment Generating Economic Recovery
TM – Texas Mexican Railway
TPP – Transportation Planning and Programming Division
TTI – Texas Transportation Institute
TTP – Texas Transportation Plan 2040
TxDMV – Texas Department of Motor Vehicles
TxDOT – Texas Department of Transportation
TxFAC – Texas Freight Advisory Committee
UP – Union Pacific
U.S. – United States
USACE – U.S. Army Corps of Engineers
UTP – Unified Transportation Plan
VMT – Vehicle Miles Traveled
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The Texas Freight Mobility Plan (Freight Plan) provides a blueprint for boosting economic growth potential in Texas through a solid but flexible strategy for addressing freight transportation needs throughout the state.

With nearly half of Texas’ economy directly impacted by freight transportation, the importance of setting the right course for and investing in our state’s mobility improvements can’t be understated.

*"The future stability of the state’s economy will rely on businesses, workers and consumers being able to connect through all modes of transport."* – Lt. Gen J.F. Weber, USMC (Ret), Former TxDOT Executive

### 1.1 Texas Freight Transportation Overview

Goods movement is crucial to the Texas economy. Texas’ ability to maintain its position as a leader in the global economy depends on the strength of its freight mobility. An efficient freight transportation system in Texas connects rural and urban areas, economic activity and production and consumption centers. It 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 up with increasing demands from businesses, manufacturers and residents. The movement of freight through, from, within and into Texas will continue to expand, thanks to a robust economy, population growth, increased trade and growing energy production. In 2014, more than 2 billion tons of freight moved in Texas, and this volume is anticipated to increase to nearly 3.8 billion tons by 2040.¹ To meet this demand and to support current and future trade opportunities, Texas must continue to make strategic investments in its transportation system.

#### 1.1.1 Economy

The efficient and safe 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 prosperity. If Texas were a nation, it would rank as the 14th largest economy in the world.² In 2014, the state’s annual Gross State

¹ The estimated tonnage in 2040 does not account for pipeline. IHS/Global Insight TRANSEARCH, 2010.


*"Developing a state-of-the-art transportation system in Texas is the most important thing we can do. Our state alone is one of the top economies in the world, and we are continuing to make sure that all our economic centers are linked together by efficient highway, rail, port and airport activity."* – Mike Berry, President, Hillwood Properties
Product was nearly $1.6 trillion.\(^3\) Texas is also home to more than 10 percent of the nation’s Fortune 500 companies.\(^4\) Nearly 7 million Texans’ jobs rely on freight transportation and in 2014, these employees earned nearly $419 billion, while generating over $671 billion in value-added production. In total, industries directly and indirectly impacted by freight transportation represent approximately 43 percent of the state’s economy.\(^5\)

### 1.1.2 Population

Texas is the second most populated state in the nation, with 26.4 million people as of 2013. The state’s population has grown at a rapid pace, with the addition of over 4 million people between 2000 and 2010 and approximately 45 million people projected to live in Texas by 2040.\(^6\) This increase in population will place further demand on the transportation system—more people means more consumers who rely on the state freight transportation system to deliver goods and commodities.

### 1.1.3 Trade

In 2014, Texas was ranked number one in the nation in exports by the U.S. Census Bureau, a position it has maintained for 13 consecutive years. In the same year, the state’s export revenues amounted to nearly $288 billion, up 3.1 percent from 2013 and outpacing total U.S. export growth.\(^7\) To maintain its status as the leader in exports, Texas must continue to invest in an efficient and safe multimodal freight transportation system.

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 at the center of the north-south North American Free Trade Agreement (NAFTA) corridor, with IH-35 running from the Texas/Oklahoma border to the Texas/Mexico border. Approximately 60 percent of U.S.-Mexico trade (in terms of value) crossed at Texas-Mexico land ports-of-entry between 2004 and 2012.\(^8\)

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\(^5\) Based on 2010 HIS/Global Insight TRANSEARCH data and IMPLAN model.
\(^6\) Texas State Data Center. Retrieved July 2014 from [http://txsdc.utsa.edu/data/TPEPP/Projections/Index.aspx](http://txsdc.utsa.edu/data/TPEPP/Projections/Index.aspx)
1.1.4 Energy Production and Development

Texas leads the nation in crude oil and natural gas production. Final production for 2014 was more than 900 million barrels of crude oil and over 6.2 billion thousand cubic feet of natural gas (Mcf).\(^9\) The latest Texas oil and gas boom has occurred largely in rural areas – specifically the Permian Basin and Eagle Ford Shale in West and South Texas. Access to these areas is largely constrained to roadways and highways, with limited connectivity to other modes, such as pipelines or freight rail. Because of the potential for new energy development in other areas of the state, oil and natural gas production is projected to remain strong.

In addition, as of January 2013, the 27 oil refineries located in Texas had a capacity of nearly 5.1 million barrels of oil a day.\(^10\) Exploration and production activities puts additional stress on roads not originally designed to handle heavy truck traffic. Such production requires a robust multimodal freight transportation network to transport the crude oil to the refineries and the refined products to market.

1.1.5 Rural Freight Transportation

Approximately 71 percent of the land area in Texas is classified as rural, according to the U.S. Office of Management and Budget. The quality of life in the state’s rural communities and the health of its economy depend on the quality of the state’s transportation system, particularly its roads, highways and bridges. 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.\(^11\)

1.1.6 Urban Freight Transportation

Growing population and employment in Texas’ urban areas means increased demand for the delivery of goods. Urban areas are large consumers of these final goods, and urban freight distribution is the last mile in the supply chain. 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. In addition, many highway freight bottlenecks and chokepoints are located in Texas’ urban areas. Bottlenecks and chokepoints do not just impact local deliveries; they also affect


\(^11\) TRIP. 2014. “Rural Connections: Challenges and Opportunities in America’s Heartland.”
statewide, national and even international goods movement. In 2014, Texas alone had seven of the top 25 freight bottlenecks in the nation, located in Austin, Dallas, Fort Worth and Houston. These urban areas are not only significant employment and population centers, where last mile deliveries are critical, they are also home to major freight generators and gateways, including ports, airports, manufacturers and distribution centers.

1.1.7 Multimodal Transportation System

To meet the future challenges of moving freight and people, additional strategic investment in the 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, connect the gateways with origins and destinations. Gateways include facilities through which exports/imports flow, such as Mexico border crossings, water ports, inland ports, intermodal transfer facilities, warehouse and distribution facilities and commercial airports.

Highways

Highways are the backbone of the state’s freight movement. Texas has the most extensive highway network of any state with over 312,000 centerline miles of public roadways, more than 3,200 miles of interstate and over 12,000 miles of U.S. highways. Trucks accounted for 52 percent of total tonnage movement in Texas in 2014.12

Railroads

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 in North America. Texas is served by three major (Class I) railroad companies: BNSF Railway, Kansas City Southern and Union Pacific.13 Additionally, Texas has 46 short line railroads (local line haul railroads) that are of strategic importance to the state, and serve as first or last mile railroads for Class I railroads, as well as for Texas’ ports and many of the state’s rail-served industries.

12 IHS/Global Insight TRANSEARCH, 2010.
Ports and Waterways

Texas handles more maritime commerce than any other state in the nation. Its waterways and ports are important economic engines for the state and the nation and play critical roles in the movement of freight. Texas has 11 deep water ports and 15 shallow draft channels. Seven Texas ports rank in the top 50 of all U.S. ports in terms of annual tonnage, including Houston (second), Beaumont (fourth) and Corpus Christi (seventh).\(^\text{14}\)

Integral to the movement of freight within Texas and the Gulf region of the U.S. is the Gulf Intracoastal Waterway. 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 is the longest segment of any of the Gulf states,\(^\text{15}\) handling two-thirds of the waterway's traffic and moves approximately 78 million short tons of cargo a year.\(^\text{16}\)

Airports

Air cargo is a key component of Texas’ multimodal freight transportation system. In 2013, Texas was home to six of the top 50 cargo airports in the U.S. in terms of landed weight.\(^\text{17}\) Those airports include Dallas/Fort Worth International, George Bush Intercontinental/Houston, San Antonio International, Fort Worth Alliance, El Paso International and Austin-Bergstrom International.

Pipelines

Pipelines play a critical role in moving oil, natural gas, petroleum products, carbon dioxide and a variety of other commodities. Texas has the most extensive pipeline network in the nation—approximately 426,000 total miles—of which 59 percent are intrastate and 41 percent are interstate.\(^\text{18}\)

\(^\text{16}\) Texas Department of Transportation, Master Plan for the Gulf Intracoastal Waterway in Texas. August 2014.
\(^\text{17}\) Federal Aviation Administration, 2013.
1.2 Purpose of the Freight Plan

The Freight Plan is the first comprehensive multimodal transportation plan that focuses on the needs of the state’s freight industry and businesses. The Freight Plan for Texas identifies 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.

With this plan, the Texas Department of Transportation (TxDOT) has developed a comprehensive approach for facilitating the efficient and safe movement of people and freight. The Freight Plan establishes a framework for Texas’ comprehensive freight planning program and decision-making by:

- Outlining high-, medium- and low priority plans for freight investments and planning activities.
- Identifying freight transportation facilities critical to economic growth and goods movement.
- Providing strategies to enhance economic growth and competitiveness.
- Assessing the economic impact of all freight modes on Texas and its economy.
- Developing policies and investment strategies to enhance Texas’ freight transportation system.
- Ensuring consistency with other state and federal goals and objectives.
- Providing a realistic implementation plan to ensure prioritized needs will be addressed within an acceptable timeframe.

The Freight Plan builds upon a decade of multimodal strategic planning at the statewide, regional and local levels. However, those planning efforts have not specifically addressed or identified freight needs. By focusing on the needs of freight shippers and carriers, the Freight Plan outlines the needs and potential solutions for the state’s comprehensive and multimodal freight transportation system.

The Freight Plan development process involved a number of steps, including analyzing the current and future freight transportation system, identifying needs and gaps and developing recommendations. Stakeholder engagement was incorporated throughout the entire process. A key outcome of the Freight Plan is an implementation plan—a prioritized list of projects, funding considerations, and performance measures. Exhibit 1-1 displays the Freight Plan’s development process.
1.3 Organization of the Freight Plan

This Freight Plan has been developed to meet the recommendations of the previous federal transportation bill, the Moving Ahead for Progress in the 21st Century Act (MAP-21). Enacted in 2012, MAP-21 encouraged each state to develop a comprehensive statewide freight plan for guiding state freight transportation investments.

The recommended MAP-21 Interim Guidance State Freight Plan elements included:

- An identification of significant freight system trends, needs and issues with respect to the state.
- A description of the freight policies, strategies and performance measures that will guide the freight-related transportation investment decisions of the state.
- A description of how the Freight Plan will improve the ability of the state to meet national freight goals.
- Evidence of consideration of innovative technologies and operational strategies—including Intelligent Transportation Systems—that improve the safety and efficiency of freight movement.
- A description of improvements that may be required to reduce or impede the deterioration of roadway conditions, specifically on travel routes for heavy vehicles (e.g., mining, agricultural, energy cargo, equipment and timber vehicles).
- An inventory of facilities with freight mobility issues, such as truck bottlenecks, within the state and a description of the strategies the state is employing to address those issues.
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: Economic Context of Freight Transportation Planning** - Discusses the importance of freight to the Texas economy.

**Chapter 4: Freight Policies, Strategies 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 5: State Freight Transportation Assets** - Provides a statewide inventory of critical multimodal freight transportation infrastructure assets.

**Chapter 6: Conditions and Performance of the State’s Freight System** - Analyzes the conditions and performance of the Texas freight system, including bottlenecks, level-of-service, safety, crashes and pavement and bridge conditions.

**Chapter 7: Freight Forecast** - Analyzes the anticipated amount of freight by mode in the future to determine the impacts on the freight system across the state.

**Chapter 8: Trends, Issues and Needs** - Explains, based on current and future projections, the needs and issues to be addressed in the future.

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

**Chapter 10: The State’s Decision-Making Process** - 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 Transportation Improvement Strategy** - Provides recommendations for programs, policies and projects that will address identified needs.

**Chapter 12: Freight Transportation Implementation Plan** - Identifies a schedule, funding considerations, potential revenue-generating projects, proposed partners, performance measures and prioritization to ensure the continued efficient movement of freight in Texas.
The details of the Freight Plan – the analysis of current and future conditions, as well as recommended investment levels, policies and data needs – are outlined in the chapters that follow. The purpose of this Freight Plan is to not only identify a path for economic growth through transportation improvements, but to clearly define the priorities and funding.
Texas Freight Mobility Plan

Chapter 2: Strategic Goals

Final January 25, 2016
Texas’ freight transportation investment decisions require an approach with clear goals and objectives, to develop an efficient and safe multimodal transportation system that improves mobility and enhances the state’s economic competitiveness.

Developing these goals and objectives was a key focus of crafting this Freight Plan. The Freight Plan’s goals and objectives have been aligned with Texas’ other statewide modal planning efforts to ensure continuity and a strategic direction for the future.

### 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 management and infrastructure improvements, the goals of the Freight Plan are informed by MAP-21 at the federal level, as well as the Texas Department of Transportation (TxDOT) 2015-2019 Strategic Plan and the Texas Transportation Plan 2040 (TTP). These documents provided guidance to ensure that the Freight Plan has consistent and achievable goals.

#### 2.1.1 National Freight Goals

MAP-21 established seven national freight goal areas, as shown in Exhibit 2-1.

"MAP-21 puts new emphasis on freight."
Harris County Judge Ed Emmett, Texas Freight Advisory Committee Chair
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.

Consistency with these goals ensures that the Freight Plan is compliant with MAP-21 guidance.

### 2.1.2 TxDOT Strategic Plan

The 2015-2019 TxDOT Strategic Plan is the overarching document that provides direction for all of the agency’s activities. The goals established in the Strategic Plan are not mode-specific, but they provide high-level targets for system safety, mobility, economic benefit and institutional advances. These goals and their corresponding objectives are shown in **Exhibit 2-2**.

<table>
<thead>
<tr>
<th>Goals</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain a Safe System</td>
<td>▪ Reduce crashes and fatalities on the system through innovation, technology and public awareness.</td>
</tr>
<tr>
<td></td>
<td>▪ Maintain and preserve the transportation assets of the state.</td>
</tr>
<tr>
<td>Address Congestion</td>
<td>▪ Partner with local officials to develop and implement congestion mitigation plans in Texas.</td>
</tr>
<tr>
<td></td>
<td>▪ Consider all modes of transportation in the development of more reliable solutions for moving people and goods.</td>
</tr>
<tr>
<td>Connect Texas Communities</td>
<td>▪ Support efficient multimodal options that serve the transportation needs of metropolitan, urban and rural communities and their economies.</td>
</tr>
<tr>
<td></td>
<td>▪ Improve freight movement, enhance international trade and expand access to markets to support the economic competitiveness of Texas.</td>
</tr>
</tbody>
</table>

**Exhibit 2-2: TxDOT Strategic Plan’s Goals and Objectives**
<table>
<thead>
<tr>
<th>Goals</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Become a Best-in-Class State Agency</td>
<td>▪ Deploy TxDOT’s resources responsibly and have a customer-service mindset.</td>
</tr>
<tr>
<td></td>
<td>▪ Focus on work environment, safety, succession planning and training to develop a superior workforce.</td>
</tr>
</tbody>
</table>

### 2.1.3 Texas Transportation Plan

In 2014, TxDOT updated 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 Management:** 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.

### 2.2 Texas Freight Mobility Plan Goals

The Freight Plan’s goals are aligned with national freight goals and are consistent with the TxDOT 2015-2019 Strategic Plan and the TTP. This alignment provides several benefits for the Freight Plan:

- Ensures that the Freight Plan recommendations support the TxDOT Strategic Plan and the TTP goals.
- Ensures that the Freight Plan recommendations support the national freight plan initiative and national freight goals.
- Establishes goals that have been shared with the public and stakeholders and thus already have substantial buy-in.
- Enhances TxDOT’s strategic direction and ensures consistency and alignment of the goals across different transportation plans.

This Freight Plan will help Texas potentially receive federal transportation funds by meeting federal criteria and integrating existing state modal plans into a single statewide freight plan. **Exhibit 2-3**
illustrates the alignment between the Freight Plan, Strategic Plan, TTP and MAP-21 goals. A majority of the Freight Plan’s goals align with the national freight goals.

Exhibit 2-3: Freight Plan/TTP Goal Alignment with MAP-21 and TxDOT Strategic Plan

In addition to goals, a set of freight-specific objectives have been identified. These objectives articulate TxDOT’s freight investment priorities, help define freight system investment needs and identify the desired future performance of the multimodal Texas Freight Network (discussed in Chapter 5). 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, which is located in the Appendix A.

The Freight Plan’s nine goals and associated objectives are:

**Goal 1: Safety** – Improve multimodal transportation safety. The safety objectives are to:

- Reduce rates of crashes, injuries and fatalities on the Texas Highway Freight Network.
- Increase the resiliency and security of the state’s freight transportation system.
Goal 2: Asset Management – Maintain and preserve infrastructure assets using cost-beneficial treatment. The asset management objectives are to:

- Achieve and maintain a state of good repair for all freight transportation modes.
- Improve the overall ratings of bridges on the Texas Highway Freight Network.
- Improve the pavement conditions on the Texas Highway Freight Network.
- Utilize technology to provide for the resiliency and security of the state’s freight transportation system.

Goal 3: 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.
- Improve travel time reliability on the Texas Highway Freight Network.
- Utilize the most cost-effective methods to improve system capacity (including technology and operations).
- Partner with federal and Mexican officials to resolve border crossing challenges.

Goal 4: 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 generators and gateways.
- Improve connectivity between rural and urban freight centers.
- Improve access into and out of Texas’ ports to facilitate projected future growth.
- Improve ground access to cargo airports to enhance truck access and connectivity.
- Improve highway and rail connectivity to major freight gateways and generators through increased capacity improvements or additional rail connections.
- Improve connectivity to Texas-Mexico border crossings through increased modal options.
Goal 5: Stewardship – Manage resources responsibly and be accountable in decision-making. Stewardship objectives are to:

- Lead efforts to foster greater coordination among the agencies responsible for freight system investment.
- Reduce project delivery delays.
- Coordinate project planning and delivery with all planning partners and stakeholders.
- Reduce adverse environmental and community impacts of the freight transportation system.

Goal 6: Customer Service – Understand and incorporate citizen desires in decision-making processes and be open and forthright in all agency communications. Customer service objectives are to:

- Implement a performance-based prioritization process for freight system investment.
- Develop and sustain partnerships with private-sector industries, communities, agencies and other transportation stakeholders.
- Increase freight expertise in TxDOT districts, across departments and among elected officials.
- Enhance workforce recruitment and retention in the transportation and logistics industry.

Goal 7: Sustainable Funding – Identify and sustain funding sources for all modes. Sustainable funding objectives are to:

- Identify potential public and private revenue sources to fund priority 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.
Goal 8: Economic Competitiveness – Improve the contribution of the Texas freight transportation system to economic competitiveness, productivity and development. Economic competitive objectives are to:

- Strengthen Texas’ position as a trade and logistics hub by improving and maintaining Texas Freight Network infrastructure and connectivity to enhance trade routes and increase the flow of goods.
- Expand public-private partnerships to facilitate investments in freight projects that enhance economic development and global competitiveness.
- Identify critical freight infrastructure improvements necessary to support the capacity requirements of future supply chain, logistics and consumer demands.
- Conduct outreach activities and develop an educational campaign 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, agriculture and automotive production.

Goal 9: Technology – Improve the safety and efficiency of the Texas Freight Network through the development and utilization of innovative technological solutions. Technology objectives are to:

- Integrate existing traffic management centers to facilitate statewide dissemination of real-time traveler information to improve safety and travel time reliability.
- Support development and deployment of integrated border crossing management through the integration of intelligent transportation systems across international borders.
- Support deployment of innovative technologies to enhance the safety and efficiency of the Texas Freight Network.
- Improve management and operations of the existing transportation system to enhance freight network performance and to improve safety and travel time reliability.

The strategic goals and objectives serve as critical building blocks for the development of the Freight Plan and its implementation. Together, they formalize the direction and priorities for the evaluation of the freight transportation system.
Texas Freight Mobility Plan

Chapter 3: Economic Context of Freight Transportation Planning

Final January 25, 2016
Competing in the rapidly changing global economy requires knowledge of the goods produced throughout Texas; evolving trends in economic development, including domestic and international trade; and supply chains that enhance the economic value created in various locations, often by different companies in the production of a single finished product.

Understanding Texas’ freight-oriented economy and how it is supported by the freight transportation system provides the Freight Plan with important inputs for guiding transportation investment decisions. This chapter provides an economic context for freight transportation—specifically how the movement of freight influences the Texas economy, as well as its importance as a tool for economic development. It also provides several simplified examples of industry supply chains to show the interrelationship between the economy and the freight transportation system. Finally, this chapter highlights those industries reliant on freight transportation and how they contribute to the Texas economy.

### 3.1 Freight and the Texas Economy

The movement of goods is a major contributor to the Texas economy; therefore, it is important that the relationship between freight transportation and the economy is understood. The Texas freight transportation system enables the movement of billions of tons of freight each year and employs millions of Texans in freight-related sectors and industries. In fact, it is estimated that nearly 7 million Texans are employed directly in freight transportation services or employed in a freight-dependent industry. This equates to 44 percent of all Texas workers. Collectively, these 7 million employees earned nearly $419 billion, or 43 percent, of total state income and have generated more than $671 billion of Texas’ Gross State Product (GSP) in 2014.¹ Freight transportation’s economic impact in Texas totals nearly $1.6 trillion.

Companies compete on the basis of product quality and cost, as well as the access, reliability and timeliness of deliveries to customers. Texas’ geographic location, freight transportation system and population give the state a competitive advantage for both transportation firms and the markets they serve.

The scale and complexity of Texas’ industries require a reliable multimodal freight transportation system. Key industries, such as oil and gas production, depend on this system for exploration, production and export. Other key industries that rely heavily on the Texas freight transportation system include manufacturing, retail, warehousing and food services.² These industries represent some of the top sectors in the state’s economy with the highest employment impact.

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¹ Source: 2010 TRANSEARCH® data and IMPLAN® model.

² Year 2014 figures.
3.1.1 Economic Development

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. Today, Texas consumers and businesses demand a wider range of goods and services. As a result, the state’s economic development is supported by a multimodal transportation infrastructure that provides efficient access to global markets and a skilled labor force. Understanding 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.

The state’s freight transportation system is also an important component of business retention and attraction. According to the Area Development 2013 Corporate Site Survey, an annual questionnaire to identify the key factors influencing site location decisions, several site selection factors identified in the survey were related to transportation. Some of these factors include:

- Highway accessibility.*
- Availability of skilled labor.
- Inbound/outbound shipping costs.
- Proximity to major markets and suppliers.
- Raw material availability and access.
- Accessibility to major airports.
- Railroad service.
- Waterway or ocean port accessibility.

*Highway accessibility ranked first or second for each of the 26 years the study has been conducted.

Economic Development Vision

Texas’ current economic vision continues to focus on building a competitive advantage in six target industry clusters identified by the Governor’s Office. 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. These industry clusters, the majority of which are highly dependent upon freight transportation, include:

- Advanced technology and manufacturing.
- Aerospace, aviation and defense.
- Biotechnology and life sciences.
- Information and computer technology.
- Petroleum refining and chemical products.
- Energy.

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Economic Development and Freight Transportation

A key component of Texas’ economic success is the state’s multimodal freight transportation network, which provides its users with efficient access to domestic and global suppliers, facilities and markets.

Transportation costs, reliability 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.

Some business sectors use freight transportation facilities and services more extensively than others. This dependence is measured by examining the amount the sector spends on transportation as a share of its total output. The transportation cost per dollar of product output for important Texas economic sectors typically ranges from 5 to 15 cents. Per the State of Logistics Report, June 2015, logistics costs as a percentage of the U.S. Gross Domestic Product is 8.3%. Transportation comprises approximately 90% of total logistics costs in the U.S.¹

Current Texas Industry Targets

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, competitively priced products and reliable transportation systems—to ensure they remain profitable and customers receive quality goods when expected.

Manufacturing is the largest single sector contributor to Texas’ freight-related economy. Manufactured goods, including those categorized as energy products, accounted for 90 percent of Texas’ exports in 2014.² Manufactured goods include products like consumer goods, machinery and the refinement of raw materials to produce energy products and chemicals.

In addition to serving the domestic economy, many of these goods are exported throughout the world. Exports contribute to a strong economy by driving profitability, job creation, private investment and public revenues. With $61.7 billion in exports in 2014, Texas’ energy sector, including petroleum and coal products, contributed the greatest share of the state’s exports.³ Texas’ top six non-energy export industries accounted for another 59 percent of the state’s total export dollars, as shown in Exhibit 3-1.⁴

³ Ibid.
⁴ Ibid.
Other exported manufactured goods include aircraft engines and parts, computer and electronic products, machinery, fabricated metal products, food and beverage products, transportation equipment and plastic and rubber products.

### 3.1.2 Economic Impacts

The economic impacts of freight activity stem from firms providing transportation services and industries trading goods. An analysis of various freight data sources identifies how commodity movements generate economic impacts in Texas. These impacts include:

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5 To develop this multimodal freight plan, a wide range of data sources and analytical tools were gathered, examined and integrated. Many of the data sources and databases are limited to certain modes or commodities given the varying time periods and geographies. Consequently, combining or integrating the data sources into a comprehensive, coherent and consistent database was a challenging task. Where possible, gaps in data were supplemented with industry-level data.

7 cont’d The most significant data resources for the Freight Plan are summarized below. Other specific data and information resources are identified in relevant sections of the Freight Plan.

1. Economic Conditions and Trends – This analysis incorporates data from a number of readily available data sources such as the Texas Workforce Commission, the U.S. Census Bureau, the Bureau of Labor Statistics, the Bureau of Economic Analysis and the IMPLAN economic model for Texas.

2. Trade Flow Analysis – The major data sources to examine the movement of goods by tonnage and value were:

   a) 2010 Global Insight TRANSEARCH data for county-level goods movement by mode, weight and commodity. This is a detailed, county-level data set purchased specifically for this Freight Plan. It provides estimates of all goods movement (inbound, outbound, internal and through-trips) across all modes by tonnage for the year 2010. It includes information on domestic and North American Free Trade Agreement (NAFTA) trade flows for origins and destinations that are both internal and/or external to Texas. 2040 forecasts of Texas freight flows were also obtained from Global Insight.
- **Direct Impacts**: These include the provision of freight transportation, as well as shippers and receivers.

- **Multiplier Impacts**: Multiplier impacts are associated with indirect suppliers and the induced income re-spending is also quantified.

- **Total Economic Impacts**: The combination of the direct and multiplier impacts comprises the total economic impacts, with each measured in terms of employment, income, value-added (i.e., GSP), output and taxes.

### Employment Impacts by Type

Of the 6.9 million Texas jobs stemming from freight movements, more than 2.7 million were direct job impacts from the firms/industries that provide transport services or use freight transportation to ship and receive goods. 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 another 4.2 million jobs, as illustrated in **Exhibit 3-2**.

The comparatively larger share of multiplier-related freight job impacts demonstrates how freight activity benefits other non-freight users.

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**Exhibit 3-2: Employment Impacts by Type, 2014**

- **Direct**: 2,737,700 jobs, (40%)
- **Multiplier**: 4,160,700 jobs, (60%)

*Source: Based on TRANSEARCH® data 2010 and IMPLAN® model

*Includes direct and multiplier effects

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3. **Modal Assessments – TxDOT** provided critical information on infrastructure, operations, traffic volumes, truck routes and other factors. Information was also gathered directly from railroads, ports and other industry associations. A key national source was the Bureau of Transportation Statistics (BTS), including such databases as the 2013 National Transportation Atlas Database (NTAD) and Border Crossing/Entry Data.
**Total Impacts by Mode**

The jobs associated with freight transportation in 2014 earned $419 billion in labor income, and generated $671 billion in GSP, as shown in Exhibit 3-3. Comparatively, employment, income and GSP impacts represented approximately 43 percent of respective state totals.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Employment</th>
<th>Labor Income</th>
<th>Gross State Product</th>
<th>Output</th>
<th>Taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck</td>
<td>4,058,100</td>
<td>$238,704</td>
<td>$378,299</td>
<td>$830,703</td>
<td>$29,849</td>
</tr>
<tr>
<td>Rail</td>
<td>1,176,600</td>
<td>$71,376</td>
<td>$115,915</td>
<td>$265,275</td>
<td>$9,871</td>
</tr>
<tr>
<td>Waterway</td>
<td>987,900</td>
<td>$64,438</td>
<td>$108,239</td>
<td>$242,494</td>
<td>$9,057</td>
</tr>
<tr>
<td>Air</td>
<td>201,900</td>
<td>$13,765</td>
<td>$22,005</td>
<td>$40,470</td>
<td>$2,864</td>
</tr>
<tr>
<td>Pipe</td>
<td>473,900</td>
<td>$30,539</td>
<td>$46,638</td>
<td>$104,030</td>
<td>$3,465</td>
</tr>
<tr>
<td>Total</td>
<td>6,898,400</td>
<td>$418,822</td>
<td>$671,096</td>
<td>$1,482,972</td>
<td>$55,105</td>
</tr>
</tbody>
</table>

Source: Based on TRANSEARCH®, FAF and USACE data and IMPLAN® model

*a* Includes direct and multiplier effects

The provision, use and related multiplier effects of truck transportation generated the majority of freight transportation-related employment at 59 percent, followed by rail at 17 percent and water at 14 percent. Pipeline transportation of petroleum and chemical products also generated substantial employment impacts at 7 percent, with air freight transportation generating the balance of 3 percent, as shown in Exhibit 3-4.

**Exhibit 3-4: Total Freight Employment Impacts by Mode, 2014**

Source: Based on TRANSEARCH®, data 2010 and IMPLAN® model

*a* Includes direct and multiplier effects

*6 Support numbers presented previously in Exhibit 3-4.*
**Truck Economic Impacts**
In Texas, trucks carry the most freight tonnage and value of any mode, provide the most accessibility and play a critical part in first and last mile deliveries. Trucking impacts totaled 4.1 million jobs with labor income of $239 billion in 2014. Truck-related activity generated $378 billion in GSP, resulting in a tax revenue impact of approximately $30 billion, as summarized in Exhibit 3-3.

**Rail Economic Impacts**
Rail is critical to the delivery of numerous commodities and is especially important for long-distance and interstate movements. Additionally, intermodal rail often provides an alternate corridor to a congested roadway system. Rail provides access to key gateways, such as maritime ports and international border crossings, as well as critical freight generators such as those in the agricultural and energy sectors. In 2014, rail-related impacts totaled 1.2 million jobs, labor income of $71 billion and $116 billion of GSP. In total, the rail industry generated $265 billion of economic output in 2014, yielding an additional tax impact of $10 billion to various local, state and federal governments. Total rail freight impacts are summarized in Exhibit 3-3.

**Waterborne Economic Impacts**
Texas’ maritime ports are critical to international trade. The energy industry is dependent on waterborne transportation, with ports providing critical import, export, storage and refining gateways for oil, natural gas and petrochemicals. 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 employment impacts of 1 million jobs, $64 billion in labor income and $108 billion in GSP activity in 2014. Economic output totaled $243 billion, with a tax impact of $9 billion, as summarized in Exhibit 3-3.

**Air Freight Economic Impacts**
Air carries the smallest amount of freight by tonnage but transports the highest value and most time-sensitive goods, such as electronics and pharmaceuticals. More than 200,000 jobs were attributable to air freight service providers, users and multiplier-related activity in 2014. These employees earned $14 billion in labor income and generated $22 billion in GSP. Economic output totaled $41 billion with $3 billion in local, state and federal taxes (Exhibit 3-3).

**Pipeline Economic Impacts**
 Pipelines are important to the energy industry, as they are the most efficient mode of transportation for oil, gas and certain energy products. In 2014, total impacts associated with pipelines generated nearly 500,000 jobs, earning $31 billion in labor income and contributing $47 billion in GSP. Economic output totaled $104 billion with $3.5 billion to local, state and federal taxes (Exhibit 3-3).

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7 Federal, state and local tax revenues on production and imports.
Employment Impacts by Industry
Half of the 6.9 million job impacts stemming from freight movements in 2014 were concentrated within manufacturing, retail trade, health and social services, transportation and warehousing and accommodation and food services, as seen in Exhibit 3-5. The large number of health and social services jobs related to transportation goes beyond the material deliveries shipped and includes the indirect and induced multiplier-related impacts associated with both suppliers and the re-spending of income. These jobs in related industries illustrate how freight transportation impacts the economy far beyond employment associated with physical goods transport.

Exhibit 3-5: Total Employment Impacts by Industry, 2014

3.2 Critical 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 raw materials and locating manufacturing facilities.

3.2.1 Overview and Influences
Understanding the concept of a supply chain provides a better grasp of freight transportation’s impact on the Texas’ economy. The supply chain includes the moving of goods during the processes that transform raw materials to finished products, and ultimately, deliver them to the consumer.

The reliability of the freight transportation network is critical when planning raw material sources and the distribution of finished products. Unexpected delays can result in slowing or halted manufacturing processes and decreasing productivity, which increases manufacturing costs and prices for the end consumer.
To enhance future economic growth, Texas must invest and implement strategies to support the increasing demand for a safe and reliable multimodal transportation infrastructure.

3.2.2 Supply Chain Examples
In this section, five supply chains are described to provide a context for the role of the multimodal transportation system in the Texas economy.

Texas Supply Chain: Automotive
The automotive industry is responsible for a significant amount of job growth in Texas. In the parts manufacturing sector, jobs have increased by 29 percent in the past 5 years. Overall, the Texas automotive workforce is the sixth largest in the nation with more than 36,000 employees in the final quarter of 2013. Since a single automobile consists of many thousands of individual parts that must be assembled, by necessity, the automotive industry is on the leading edge of supply chain optimization. Today, these systems result in the creation of a just-in-time automotive supply chain, where resiliency, timing and limiting the work-in-progress inventory are critical to success in the marketplace.

As illustrated in Exhibit 3-6, multiple levels of automotive suppliers and manufacturers exist throughout North America, although many suppliers locate within close proximity to an assembly facility. Tier 1 suppliers provide major components, such as navigation systems, and Tier 2 suppliers provide critical parts, such as processing chips, to Tier 1 suppliers. A breakdown among any of these activities can lead to an overall failure of the supply chain and, ultimately, halt vehicle production. In Texas, this supply chain operates on both sides of the Texas-Mexico border. Additionally, many other production processes occur on both sides of the Texas-Mexico border and require efficient border crossings and transportation through Texas. Legal arrangements and trade agreements allow these cross-border flows to occur in an organized manner, however, many challenges can inhibit the supply chain efficiency. Chief among these are border-crossing delays and inconsistent truck regulations.

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9 Includes NAICS codes 3361-motor vehicle manufacturing, 3362- motor vehicle body and trailer manufacturing and 3363-motor vehicle parts manufacturing, retrieved August 2014 from http://socrates.cdr.state.tx.us/iSocrates/Targeting/TGTssAnalysisFour.asp
Critical Transportation Linkages in the Automotive Supply Chain

- Truck and rail border crossings, capacity and reliability are critical.
- Key transportation corridors, like IH-35, and last mile connections are also important.
- General reliability of the system must be maintained and improved.
- Dedicated rail facilities at manufacturing facilities are needed.
- Class II and III railroad sidings must be maintained at Tier 1 and Tier 2 facilities.

Texas’ Automotive Transportation Network
The complexity of the automotive supply chain results in significant use of the Texas freight transportation system, as presented in Exhibit 3-7. Interstates, U.S. highways and state highways accommodate freight for this industry, while railroads are also vital to the success of this supply chain. Access to truck border crossings at Brownsville, El Paso and Laredo and rail crossings are critical for raw materials and finished goods. Additionally, the state’s port facilities provide a cost-
effective means to export automotive products globally. The automotive supply chain also relies on intermodal containers shipped from U.S. West coast ports to Texas’ intermodal hubs.

Exhibit 3-7: Texas’ Automotive Industry Transportation Network

Source: Based on TRANSEARCH® data for 2010 and Texas Workforce Commission

Texas Supply Chain: Beef
Texas is the number one beef producing state in the nation, raising more than 14 million head of cattle annually.¹⁰ More than 17,000 employees worked in the cattle ranching and farming industry during the final quarter of 2013.¹¹ Employment in this industry is typically under-reported, as less than one-third of cattle operators claim farming as their primary occupation.¹² This employment number does not include transportation workers, processing plant workers or grocery store workers, all of whom play an important role in the supply chain.


¹¹ Based on NAICS code 1121- Cattle Ranching and Farming, retrieved August 2014 from http://socrates.cdr.state.tx.us/iSocrates/Targeting/TGTssAnalysisFour.asp

Texas beef products are consumed both domestically and internationally. This overview of the supply chain begins at Texas cattle yards, where inputs like feed, medicine and cattle are received via trucks and railroad sidings. The regular delivery of feed is critical to the operation of feedlots, since they typically only maintain a few days’ supply. Any significant delay in feed deliveries, such as inclement weather, could lead to economic losses. Once the cattle are ready for processing, trucks and railroads provide critical shipping linkages. Refrigeration is crucial at both processing and distribution centers, but also during the transportation of processed beef. The beef supply chain is illustrated in Exhibit 3-8.

Transportation linkages to and from processing sites—including railroads utilizing refrigerated cars to haul meat products to export gateways—must be maintained for the future success of this sector.

Exhibit 3-8: Texas’ Beef Industry Supply Chain

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13 A siding is a low-speed track section distinct from a running line or through-route, such as a main line or branch line or spur. Sidings often have lighter rails, meant for lower speed or less heavy traffic, and few, if any, signals. Common sidings store stationary rolling stock, especially for loading and unloading. Industrial sidings go to factories, mines, quarries, wharves and warehouses, while some of them are essentially links to industrial railways. [Jackson, Alan A. (2006). The Railway Dictionary, 4th ed., Sutton Publishing, Stroud].
Critical Transportation Linkages in the Beef Supply Chain

- Rural roadway capacity to move beef to processing areas is critical.
- Railroads provide a valuable service to take products from agricultural areas to processing and provide access for processed goods to markets across the nation.
- Transportation infrastructure linked to federally approved beef processing sites must be maintained to capture and grow basic economic activities for the Texas beef industry.

Increased consumer demand for chain-of-custody and knowledge of food sourcing (e.g., local food, U.S.-based food, etc.) will require thorough supply chain visibility.

Texas' Beef Transportation Network
The beef industry primarily uses trucks and trains to move products (Exhibit 3-9). This industry supply chain touches almost every roadway on the Texas Highway Freight Network, with heavy concentrations in the northern Panhandle. Interstates are the primary links to processing plants, with IH-10, IH-20, IH-27, IH-37 and IH-40 accommodating the majority of beef-related truck traffic. US 54, US 70, US 87 and US 287 also provide the beef industry with significant supply chain access.

Exhibit 3-9: Texas' Beef Industry Transportation Network

Source: Based on TRANSEARCH® data for 2010 and Texas Workforce Commission
Texas Supply Chain: Cotton

Texas farmers produce more cotton than any other state. In 2014, Texas produced over 6 million bales of cotton. In terms of Texas agricultural output, cotton produces the second highest value. Despite producing a quarter of the nation’s cotton output, only 7,845 workers were employed in the category of other crop farming, which includes cotton farming. This figure does not include the workers required to transport the cotton, operate cotton gins or distribution centers and other domestic processing. This category plays a role in converting the cotton into fabric, and ultimately, into clothing and other products.

As presented in Exhibit 3-10, the supply chain begins at Texas farms where seeds, fertilizer and other agricultural inputs must be received at the right place and time. These critical inputs are typically shipped within Texas via rail. However, final delivery is made by trucks using rural roadways.

Trucks and trains usually carry the raw cotton to cotton gins and yarn spinners via local roadways, Farm-to-Market roads and highways. Once the yarn is spun, it is then shipped to a port by truck. These trucks traverse Texas roadways to meet tight ship-loading deadlines. Throughout the process, quality and climate must be carefully controlled as cotton is organic and it can mold without proper care. Once overseas, transparency within the supply chain must be increased to maintain chain-of-custody and to document any overseas sourcing. This transparency is important to maintain the marketability of cotton products.

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14 Texas Farm Bureau, retrieved August 2014 from http://www.beagsmart.org/a-look-at-texas-ag/crops/cotton
16 Based on NAICS code 1119- Other Crop Farming, retrieved August 2014 from http://socrates.cdr.state.tx.us/iSocrates/Targeting/TGTssAnalysisFour.asp
Critical Transportation Linkages in the Cotton Supply Chain

- Rural roadways’ capacity to move cotton is critical.
- Texas Farm-to-Market roads must be maintained.
- Because a large portion of cotton is exported, the supply chain requires greater use of containerized freight.
- Rail linkages support the delivery of pesticides and other chemicals necessary to grow cotton.

Texas’ Cotton Transportation Network
The cotton industry primarily uses trucks and rail to move its product, as shown in Exhibit 3-11. Farm-to-Market and local roads are used as collectors from the fields to cotton gins and yarn spinners for processing. Interstates and certain state highways are used to transport the material to textile mills and to the remainder of the supply chain.
Rail provides the industry with the mobility needed to transport raw product to market. The BNSF Railway rail line between Oklahoma and New Mexico through Amarillo and the Union Pacific rail line between San Antonio and the Arkansas border serve as important transportation linkages for the Texas cotton industry. In particular, Texas cotton is containerized and shipped by train through the Port of Houston to Central America and South America. Because approximately 70 percent of Texas' cotton is being exported to textile production facilities around the world, these links are critically important.17

Texas Supply Chains: Electronics
Numerous computer and electronics manufacturers call Texas home or have facilities in the state.18 Texas is the leading exporter of electronics in the nation and is second in terms of electronics employment. During the final quarter of 2013, there were more than 85,000 employees working in the electronics industry.19

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17 Based on 2012 revenue figures from the TX Department of Agriculture, retrieved August 2014 from https://www.texasagriculture.gov/About/TexasAgStats.aspx
The electronics technology supply chain is shown in Exhibit 3-12. The cost and time-sensitive nature of electronic components and devices requires a lean, consumer-driven supply chain. Unlike the other supply chains described in this chapter, production is often triggered by actual customer demand (i.e. purchases) and not by forecasts. Because of these constraints, the supply chain relies heavily on air cargo and trucking because of speed, security and sensitivity, the products short shelf-life including climate and damage control, as well as the high value and low weight of the products. Most often, time is the factor driving supply chain decisions.

**Exhibit 3-12: Texas’ Electronics Industry Supply Chain**

**Critical Transportation Linkages in the Electronics Supply Chain**

- Dedicated air cargo facilities provide freight services necessary for large-scale growth in this sector.
- Passenger flights provide opportunities to ship small batches of components by air freight to maintain the lean supply chain.
- Growth and expansion in both cargo and passenger flights and air cargo infrastructure help position Texas to continue capitalizing on the strength of these linkages.
- Last mile connectivity expedites the movement of this highly time-sensitive commodity.
This sector is heavily reliant on the ability of trucks to move components and final goods between supply chain activities. In addition, the use of trucks is a critical step in overcoming the short life-cycle of micro-processors.

**Texas’ Electronics Transportation Network**

Because of the high value and time sensitivity of the electronics supply chain, components and finished products rely heavily on Texas highways as a surface transportation option, as illustrated in Exhibit 3-13. Heavy concentrations of suppliers in major metropolitan regions trade among themselves, particularly in Austin, Dallas-Fort Worth, Houston and San Antonio.

**Exhibit 3-13: Texas’ Electronics Industry Transportation Network**

Source: Based on TRANSEARCH® data for 2010 and Texas Workforce Commission
Texas Supply Chains: Gasoline

Texas generates nearly 35 percent of the nation’s total petroleum production. As such, the oil and natural gas industry accounts for one-third of the state’s overall economy. More than 57 percent of the extracted oil and natural gas is shipped to other states. Of the remainder, 92 percent is shipped via pipeline to one of 26 refineries near the Gulf of Mexico. The majority of this product is refined into gasoline and various consumer products. In the final quarter of 2013, more than 233,000 employees reported working in the petroleum industry.20

As illustrated by Exhibit 3-14, gasoline has a unique supply chain. Unlike other supply chains, gasoline is mainly shipped by pipeline. From the oil fields to the refineries and from the refineries to the tank farms, this hazardous liquid commodity is generated at such a volume that pipeline is the primary mode for moving it quickly and safely.

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Critical Transportation Linkages in the Gasoline Supply Chain

- The last mile is vital, particularly the link from the tank farm to the final customer.
- Pipelines, railroads and trucks connect the oil fields to Texas refineries and ports and pipelines and trucks connect refineries to tank farms.
- Port facilities transfer gasoline to barges and tanker ships.
- Interstate pipelines and railroads carry crude oil to other states.

Texas' Gasoline Transportation Network

The gasoline industry supply chain relies on all modes of the Texas Freight Network except for air, as shown in Exhibit 3-15. Railroads play a significant role in gasoline (crude oil) supply chain activities. Until new pipelines are constructed to service new oil fields, railroads and trucks are expected to continue to carry increasing levels of crude oil.

Exhibit 3-15: Texas' Gasoline Industry Transportation Network

Source: Based on TRANSEARCH® data for 2010 and Texas Workforce Commission
As Texas plans for the future of its multimodal freight transportation network, understanding the logistical needs of freight-reliant industries will assist with economic competitiveness, while also sustaining and creating quality jobs. Although Texas is well-positioned to benefit from several important trends, such as a growing workforce and increasing productivity, the state’s leaders must continue to focus on the mobility, safety and maintenance of its multimodal transportation corridors to ensure this economic prosperity continues into the future.
Texas’ freight institutions, policies and strategies guide the state’s freight transportation investment decisions, while also influencing freight movement and operations. This chapter discusses these institutions and the various financing programs available to fund freight policies and investments.

State agencies and authorities responsible for maintaining the freight 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 lack of freight-specific policies or strategies guiding investment decisions. Partnerships and effective coordination among agencies and institutions are critical elements for targeting freight infrastructure investments and addressing these challenges.

### 4.1 Freight Policies and Strategies

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

Chapter 2 detailed the statewide freight strategic goals and objectives and discussed how the Freight Plan goals align with federal transportation 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 by TxDOT, other local, regional and state agencies and private-sector users of the freight transportation network. These policy recommendations support current statewide goals and incorporate strategies identified in other plans.

### 4.2 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 infrastructure that impacts the efficient and safe movement of people and freight. These institutions are discussed below.

#### 4.2.1 Texas State Legislature

The Texas State Legislature sets statutory guidelines for 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.
4.2.2 Texas Transportation Commission
The Texas Transportation Commission provides leadership and oversight of TxDOT's activities. The Commission consists of five Governor-appointed members and manages TxDOT with the advice and consent of the Senate. 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.
- Overseeing the development of a statewide transportation plan encompassing infrastructure and several modes of transportation, including highways and toll facilities, aviation, mass transportation, railroads, high-speed railroads and water traffic.
- Approving contracts for the improvement of the state-maintained highway system.
- Overseeing the development of public transportation.
- Adopting rules for the operation of TxDOT.

4.2.3 Texas Department of Transportation
TxDOT is responsible for the planning, development, funding, construction and management of the state’s transportation infrastructure. TxDOT works with private-sector entities and regional and local planning authorities to develop plans and funding strategies and to provide efficient and safe passenger and freight transportation throughout the state, including 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 4-1.

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### Exhibit 4-1: Key TxDOT Committees

<table>
<thead>
<tr>
<th>Committee</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas Freight Advisory Committee</td>
<td>The committee advises TxDOT on freight issues, priorities, projects and funding needs for freight improvements and elevates freight transportation as a critical component of the state’s economic vitality and competitiveness.</td>
</tr>
<tr>
<td>Port Authority Advisory Committee</td>
<td>The committee provides a broad perspective on ports and transportation-related matters for TxDOT policies concerning the Texas port system.</td>
</tr>
<tr>
<td>Border Trade Advisory Committee</td>
<td>The committee provides a broad perspective on the effect of transportation choices on border trade in general and on particular communities.</td>
</tr>
<tr>
<td>Aviation Advisory Committee</td>
<td>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.</td>
</tr>
<tr>
<td>Energy Sector Impacts Task Force</td>
<td>The task force was created to “address the impact on the state's infrastructure of increased energy exploration and production.” It has issued important recommendations, including enhancing penalties for oversize/overweight vehicle violations, dedicating severance taxes from royalties to their counties of origin and authorizing certain county mineral rights.</td>
</tr>
<tr>
<td>2030 Committee</td>
<td>This volunteer committee of experienced and respected business leaders was charged with providing an independent, authoritative assessment of the state’s transportation infrastructure and mobility needs from 2009 to 2030. An initial report was completed in February 2009. The committee reconvened in 2010 to develop an updated analysis, which was completed in March 2011.</td>
</tr>
<tr>
<td>Task Force on Texas’ Energy Sector Roadway Needs</td>
<td>TxDOT created this Task Force—comprised of representatives from state agencies, local governments and the energy industry—to address the impact on the state's infrastructure of increased energy exploration and production.</td>
</tr>
<tr>
<td>Corridor Committees</td>
<td>These committees assist TxDOT in corridor-specific planning and development initiatives. Usually composed of citizens, community leaders and business owners, the committees provide guidance on how to improve safety, mobility and economic development along a corridor. Examples include the IH-69, IH-35 and IH-20 East Texas Corridor Committees.</td>
</tr>
</tbody>
</table>

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5 Ibid.


TxDOT Offices, Divisions and Districts
TxDOT offices and divisions are involved in planning, developing and implementing freight policies and strategies. Their responsibilities impact statewide freight movement through identifying challenges and setting infrastructure funding and financing guidelines, developing and enforcing operational and regulatory statutes and implementing transportation planning and policy guidance.

4.2.4 Transportation Planning and Programming Division
TxDOT’s Transportation Planning and Programming Division (TPP) administers planning and programming for TxDOT. The TPP is responsible for the statewide Long-Range Transportation Plan, Unified Transportation Plan (UTP), State Transportation Improvement Program, Freight Mobility Plan, Rail Plan, Port Capital Plan, Resiliency Plan, Rural Transportation Plan and major corridor plans.

The Freight and International Trade Section is responsible for overseeing:

- Freight planning activities, including the development of the Freight Plan.
- Department functions, operations and information related to international trade and relations activities.
- The Texas Freight Advisory Committee.
- 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 and trade transportation considerations into TxDOT’s planning, programming and implementation process.
- Providing technical assistance to districts, Metropolitan Planning Organizations (MPOs) and other agencies.

4.2.5 Other Divisions
The TPP coordinates with other TxDOT divisions and districts when developing transportation plans, policies and goals related to freight movement. TxDOT divisions impact statewide freight movement through a combination of policy, regulatory and enforcement responsibilities; infrastructure funding guidance, design and construction; and maintenance and operation of the roadway transportation system.
Other TxDOT divisions and offices include the following:

- Aviation Division.
- Bridge Division.
- Construction Division.
- Design Division.
- Environmental Affairs Division.
- Innovative Financing/Debt Management Office.
- Maintenance Division.
- Maritime Division.
- Rail Division.
- Right-of-Way Division.
- Strategic Projects Division.
- Toll Operations Division.
- Traffic Operations.
- Travel Information.

4.2.6 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 implement efforts that improve freight mobility, infrastructure and operations. Districts are also responsible for the design, construction and maintenance of the multimodal freight transportation system’s highways in their respective areas. Area offices provide construction, engineering and maintenance on an even smaller geographic scale within the districts.

4.2.7 Other Texas 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.

**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.\(^1\) 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.\(^2\)

**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 and distribution industry. It also registers commercial vehicles, provides permits for oversize/overweight loads and

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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.³

**Texas Department of Public Safety**
Administered by the Public Safety Commission, the Texas Department of Public Safety (DPS) is responsible for statewide law enforcement and vehicle regulation. Within the DPS, the Commercial Vehicle Enforcement Service administers motor carrier safety regulations, weight and size laws, hazardous material regulations, registration laws applicable to commercial vehicles, traffic laws and criminal law.

**Texas Commission on Environmental Quality and the Texas Department of State Health Services**
Texas regulates the transportation of hazardous waste and certain nonhazardous 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.⁴

**Texas Department of Agriculture**
The Texas Department of Agriculture (TDA) ensures that safe and efficient transportation routes are available for the movement of agricultural products. Its Regulatory Division oversees various commodity programs, such as organic certification, handling and marketing of perishable goods, grain warehouses and aquaculture.⁵ The TDA inspects and monitors weighing and measuring devices for accurate performance. Inspected devices include service station fuel pumps, airport bulk meters for re-fueling planes and liquefied petroleum gas meters for storage tanks at businesses or homes.⁶

**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.

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³ Texas Department of Motor Vehicles, Strategic Plan Fiscal Years 2015-2019.
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.

4.2.8 Private Owners

A brief description of private organizations that own key freight transportation infrastructure in Texas follows, with a detailed discussion of specific assets provided in Chapter 5.

Texas Port Authorities

A port authority, also known as a navigation district (authorized in the Texas Constitution, Article XVI, Section 59), is a governmental or quasi-governmental public authority formed to operate ports and other transportation infrastructure. There are 11 deep water ports and 15 shallow draft channels operated by port authorities and navigation districts in Texas. Most of these ports are governed by a 5- or 7-member commission or a board with appointed or elected members.

Texas Airports

The most common airport ownership and operational arrangements involve traditional municipal or county governments. 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. However, Alliance Air Services, a subsidiary of the Perot Company, which operates Fort Worth’s Alliance Airport provides an example of a private entity operating an airport. 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.

Texas Railroads

Most state rail infrastructure is privately owned and operated. Three Class I railroads operate in Texas – BNSF Railway (BNSF), Kansas City Southern (KCS) and Union Pacific (UP). UP and KCS are publicly traded, while BNSF is a subsidiary of Berkshire Hathaway, Inc.

Forty-six short line railroads operate in Texas, with one being state-owned. The South Orient Rail Line is a state-owned facility that runs from Presidio, on the Mexican border, to San Angelo Junction. The line interchanges with UP at Alpine and with BNSF and the Fort Worth and Western Railroad at San Angelo Junction. Texas Pacifico Transportation Ltd. operates the South Orient Rail Line under a lease and operating agreement with TxDOT.

Class III railroads, or short lines, are of strategic importance because, along with the Class I railroads, they are first or last mile railroads for Texas’ ports and many of the state’s rail-served industries. Typically, these railroads engage in specialized services and are

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7 Texas Gulf Intracoastal Waterway Master Plan, August 2014, p. 6.
geographically concentrated. Short lines are usually privately owned to serve a specific company or industry or several of them.  

**Texas Pipelines**

Pipelines in Texas are privately owned, operated and maintained. Many of these companies also provide storage, refining and treatment of liquid natural gas (LNG), crude oil and other petrochemicals. According to the Pipeline Safety Division of the 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. The largest intrastate pipelines in Texas are operated by the Enterprise Texas Pipeline Company (8,750 miles) and the Energy Transfer Partners LP (8,800 miles).

**Toll Road Authorities**

Toll roads are operated by the state, Regional Mobility Authorities (RMAs), county toll authorities and private entities. Toll facilities operated by TxDOT or by private contract with TxDOT include the Central Texas Turnpike System, which consists of three contiguous toll highways serving the Austin metropolitan region and the Austin-San Antonio corridor: State Highway (SH) 45 North, Loop 1 and SH 130 (Segments 1-4), as well as sections 5 and 6 of SH 130.

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

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County toll road authorities 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.

The state’s 61 statewide toll facilities—under various forms of ownership, management and operation—include 27 operating road facilities, nine road facilities under construction, 24 bridge facilities and one tunnel.  

4.2.9 Partnerships, Advocacy and Other Public Institutions
TxDOT coordinates with a number of 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’s Texas Transportation Institute (TTI), the University of Texas Center for Transportation Research (CTR), University of Texas at El Paso (UTEP), and University of North Texas (UNT).

Business and Industry Associations
- Gulf Intracoastal Canal Association.
- Texas Association of Business and Chambers of Commerce.
- Texas Good Roads.
- Texas Pipeline Association.
- Texas Ports Association.
- Texas Railroad Association.
- Texas Trucking Association.

Regional, National or International Freight Planning Partnerships
- Alliance for I-69 Texas.
- Border Trade Alliance.
- Ports-to-Plains Alliance.

Metropolitan Planning Organizations
Federal law requires that an MPO be designated for each urban area with a population of

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50,000 or more.\textsuperscript{12} Texas’ 25 MPOs receive federal funding for transportation planning; several MPOs also receive state and local funds to achieve their mandated planning activities. MPOs undertake localized planning processes to develop multimodal plans consistent with TxDOT plans. The plans identify transportation improvements and services within the metropolitan area boundaries for the next 20 to 25 years.

**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). The only statutory funding source available to RRTDs, other than receiving donations of cash and real property, is to issue revenue bonds and the use of anticipation notes. This revenue assists RRTDs with preserving rail infrastructure and promoting economic development.\textsuperscript{13} Counties can establish RRTDs to acquire abandoned rail lines, construct new lines or rehabilitate existing lines.\textsuperscript{14} They can also 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 42 RRTDs, with only 13 active districts.\textsuperscript{15} These include:

- Centex (Brown, Comanche, Erath, Hood and Johnson counties).
- Ellis County.
- Fannin County.
- Galveston County.
- La Entrada Al Pacifico (Ector and Midland counties).
- North Texas (Archer and Wichita counties).
- Northeast Texas (Collin, Franklin, Hopkins, Hunt and Titus counties).
- Nueces County.
- Pecos County.
- Presidio County.
- Rusk County.
- San Patricio County.
- Top of Texas (Hansford, Lipscomb and Ochiltree counties).

\textsuperscript{12} Association of Texas Metropolitan Planning Organizations. Retrieved August 2014 from http://www.texasmpos.org/about.html


A number of RRTDs, including Calhoun County, Gregg County, Gulf Link (Brazoria and Fort Bend counties), Liberty County, Matagorda County, McLennan County, Van Zandt County and Webb County, are considered semi-active and have boards in place to reactivate for a viable opportunity.\textsuperscript{16}

The TTI/TxDOT study noted that “measuring progress of RRTDs toward outcomes related to their original motivation for forming is difficult based on the limited information available regarding RRTD activities.”\textsuperscript{17} 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.\textsuperscript{18}

4.3 Freight Infrastructure Funding and Financing

There are various sources for funding and financing options for freight 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 focuses on statewide funding and financing programs and sources; however, federal funding for statewide transportation infrastructure is also crucial.

4.3.1 Federal Freight Transportation Infrastructure Funding and Financing

Federal funding comprised nearly 38 percent of TxDOT funding sources for fiscal year 2014-2015, at over $8.5 billion. The majority of federal funding for freight-related improvements is administered through the U.S. Department of Transportation Federal Highway Administration (FHWA). Federal funding sources include:

- Federal core FHWA highway formula programs:
  - Congestion Mitigation and Air Quality Improvement Program (CMAQ).
  - Highway Safety Improvement Program (HSIP).
  - National Highway Performance Program.
  - Surface Transportation Program (STP).

Other federal funding sources/programs:
  - Federal Airport Improvement Program.


\textsuperscript{17} Texas A&M Transportation Institute, Rural Rail Transportation Districts (RRTDs) Update, 2013. Retrieved September 2014 from \url{http://ftp.dot.state.tx.us/pub/txdot-info/rail/rural/rrtd-update.pdf}

\textsuperscript{18} Ibid.
— Private Activity Bonds.
— Railway-Highway Crossing (Section 130) Program.
— Railroad Rehabilitation and Improvement Financing Program.
— The Transportation Infrastructure Finance and Innovation Act.
— Transportation Development Credits.

MAP-21 included a number of provisions to improve the condition and performance of the national freight network and support investment in freight-related surface transportation projects. As part of these provisions, freight-related project opportunities are now eligible and available in core highway formula programs:

- Truck parking facilities are eligible to receive funding through STP. Eligible facilities include surface transportation infrastructure located within a port or intermodal terminal that enables direct intermodal interchange, transfer or access into and out of the port.
- Truck parking facilities are eligible to receive funding under Section 1401 of HSIP.
- The CMAQ allows the use of funds to establish electric vehicle recharging stations.

States can leverage their own dedicated transportation funding with these federal sources, as well as with other local, regional and private-sector funding.

4.3.2 State Freight Transportation Infrastructure Funding and Financing

State agencies are appropriated funds by the Texas 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 2014-2015 funding sources total more than $22 billion and include:

- State highway funds: $9,034 million (40.9 percent).
- Federal funds: $8,550 million (38.7 percent).
- Bond proceeds: $3,423 million (15.5 percent).
- Texas mobility funds: $689 million (3.1 percent).
- General revenue funds: $379 million (1.7 percent).
- Interagency contracts: $9 million (<0.1 percent).

The Design and Construction Information System (DCIS) is TxDOT's automated information system used for planning, programming and developing projects. Project information—
including work descriptions, funding requirements and dates for proposed activities—is listed in the DCIS. For fiscal years 2010-2014, 11,530 projects were listed in the DCIS and are shown in Exhibit 4-2.

Mobility projects add capacity to the transportation system, while preservation projects include maintenance and rehabilitation efforts. TxDOT’s commitment to investment in the state’s transportation infrastructure is underscored by the large number of projects in DCIS from fiscal years 2010-2014, with a total cost of over $25 billion.

Exhibit 4-2: TxDOT DCIS Projects (FY 2010-2014, millions of dollars)

![Bar chart showing TxDOT DCIS Projects (FY 2010-2014, millions of dollars)](image)

Source: TxDOT Finance Division, 2014

4.3.3 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 programs to support the Texas Traffic Safety Program and to implement provisions of its Strategic Highway Safety Plan. In 2013, the program provided communities with more than $25 million in state and federal grant funding for traffic safety projects. Its goal is to identify traffic safety problem areas and implement programs to reduce the number and severity of vehicular crashes.19

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,20

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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.21

**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.22

**Community Development Fund**
The TDA oversees the Texas Community Development Block Grant Program, which uses federal funds to provide assistance to smaller communities.23 Eligible activities include infrastructure projects, such as sewer and water system improvements; street, bridge and drainage improvements; and housing rehabilitation.

4.3.4 **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 the issuance of revenue bonds. Revenue can be used for transportation improvements.24 Many cities also impose additional sales taxes in varying amounts of up to 1 percent—these are known as dedicated taxes because their proceeds may be spent only for certain purposes.25

The largest portion of a county’s revenue comes from property taxes.26 Counties may also hold an election to create county assistance districts and adopt sales taxes to fund those districts.27 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.

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Counties can also issue bonds supported by taxes or commitments by TxDOT to provide pass-through tolls to fund highway projects that are part of the state highway system, including Farm-to-Market roads. The pass-through toll method requires a county to finance and construct a project. TxDOT pays for a percentage of the cost over time via pass-through toll reimbursement payments.

**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 Agreement.
- Exempt Facility Bonds.
- Industrial Revenue Bond Program.
- Public Improvement Districts.
- State Infrastructure Bank.
- Tax Increment Financing.

**4.3.5 Private-Sector Investment**

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

**Railroads**

Railroads are largely privately funded. Operating revenues include charging for rail movement by commodity and distance, intermodal operations, rail line leases, supplemental services (e.g., storage or overload fees), tariff fees and fuel charges. Railroads also invest considerably in railroad infrastructure. For example:

- In Texas alone, UP provided $589 million in capital investment in 2013.\(^\text{28}\)
  Additionally, UP planned to spend $4.1 billion system wide on capital improvements in 2014.\(^\text{29}\)

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BNSF committed $5 billion in 2014 to its capital program. Of its 2013 capital expenditures, BNSF invested an estimated $240 million on maintenance and rail capacity expansion projects in Texas.

KCS was expected to provide between $545 million and $565 million in 2014 on capital expenditures. While the Texas share of that investment is not known, KCS planned to expand intermodal facilities in Kendleton and begin construction of a new intermodal facility in Wylie in 2014.

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 is funded with matching contributions, including $1 million from TxDOT, $1 million from the City of Fort Worth and $65 million from BNSF and UP.

Ports
Ports are funded with public funds, port revenue 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 can also operate shipping terminals, airports and railroads.

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. 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.

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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 $300 million since 2010, to meet customers’ current and future needs. Nearly all of the petrochemical and LNG industries located along the Texas coast are undergoing major expansion and investing billions of private dollars in their facilities. Roughly $50 billion is being invested in petrochemical manufacturing along the Houston Ship Channel, as well as $30 billion along the Freeport Channel. According to the American Chemistry Council, U.S. petrochemical companies recently proposed 100 new major projects totaling $71 billion. Many of those developments are planned along the Texas Gulf Coast.

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. For large and medium primary hub airports, the grant covers 75 percent of eligible costs or 80 percent for noise program implementation. For small primary, reliever and general aviation airports, the grant covers a range of 90 to 95 percent of eligible costs. 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 Dallas/Fort Worth International Airport has more than $400 million invested by developers in cargo/warehouse buildings. George Bush Intercontinental/Houston is undergoing a $3.1 billion renovation of facilities through the Houston Airport System, including a new $180 million air cargo distribution center. Additionally, total investment in the AllianceTexas Global Logistics Hub in Fort Worth was $8.05 billion from 1990 to 2013, with 94.4 percent ($7.6 billion) put forth by Hillwood Properties and its partners and $452 million coming from public resources for roads, infrastructure and schools.

38 Texas Department of Transportation, Texas Port Report, June 2014, p. ix.
4.4 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.

4.4.1 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 $800 million in fiscal year 2013, are allocated to the Available School Fund.\(^4\) Examples of transportation-related taxes and fees that could be re-directed to the State Highway Fund include:\(^5\)

- Fees for oversize/overweight truck permits.
- Motor vehicle seller-financed sales tax.
- Motor vehicle rental gross receipts tax.
- Motor vehicle sales and use tax.

These revenues are collected from Texas taxpayers and are currently spent on other state government programs. The TxDOT 2030 Committee estimated that capturing this existing transportation-related revenue from the general fund and directing it to the State Highway Fund could amount to more than $3.6 billion a year (2013).\(^6\)

There are direct appropriations of $10.8 billion to the State Highway Fund, excluding federal receipts and bond proceeds for the 2014-2015 biennium. Appropriations to TxDOT represent approximately 83 percent of the total, or about $9 billion. Approximately $1.8 billion of the State Highway Fund is expected to be used by agencies and institutions other than TxDOT for activities that, nominally, support the state’s surface transportation system, including the DPS and the Department of Insurance.

4.4.2 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


\(^5\) Texas 2030 Committee, retrieved August 2014 from [http://texas2030committee.tamu.edu/](http://texas2030committee.tamu.edu/)

\(^6\) Texas 2030 Committee, retrieved August 2014 from [http://texas2030committee.tamu.edu/](http://texas2030committee.tamu.edu/)
amounts for a given 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.
- District discretionary.
- Strategic priority.

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.

4.4.3 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 transit, rail, aviation, ports and bridges. Examples of opportunities to fund other
modes include the Rail Relocation and Improvement Fund (RRIF) and the Port Access
Account Fund. However, both of these programs are currently unfunded by the Texas
Legislature.

Rail Relocation and Improvement Fund
The RRIF 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 Legislature. The RRIF is designed similarly to the Texas Mobility Fund. However, the Legislature has yet to dedicate a revenue source to the fund.

**Port Access Account Fund**

The Port Access Account Fund, an account in the general revenue fund, provides a means for funding the expansion and upgrading of Texas public port facilities. Money in the fund may be appropriated only to TxDOT to perform duties concerning port transportation and economic development. As with the RRIF, the Legislature has yet to dedicate a revenue source to the fund.

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 RRIF and Port Access Account Fund have not been funded.

> Many users, owners and operators—as well as state, federal, regional, county, city and private funding programs—are involved in providing freight-related transportation infrastructure. The policies and strategies of these institutions, agencies, private operators and users guide not only freight-related transportation investment decisions in Texas, but also the broader operational strategies and policy changes.

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48 Texas Department of Transportation, Texas Ports 2015-2016 Capital Program.

49 Ibid.
More than 26 million residents and 2.8 million businesses depend on the efficiency of the Texas transportation system. Texas freight assets represent a significant portion of the state’s total transportation investment and support freight movement vital to many key industries, including energy, manufacturing, automotive, agriculture and the retail industry.

The Texas multimodal freight transportation system supports the world’s 14th largest economy with a Gross State Product of nearly $1.6 trillion. Nearly 2 billion tons of freight valued at over $2.4 trillion moves on and through these transportation assets annually. Identification of the state’s freight transportation assets enables the Texas Department of Transportation (TxDOT) and other freight partners to prioritize transportation investments given increasing budget constraints. Assets include an extensive multimodal network of 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.

This chapter discusses the state’s freight transportation assets by mode, as well as specific modal assets that are part of the Texas Freight Network.

### 5.1 Texas Highway Freight Transportation Assets

Texas has more than 312,000 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. TxDOT is responsible for more than 80,000 miles of roadway.

As shown in Exhibit 5-1, approximately 51 percent of these roadways are Farm-to-Market roads and spurs, which 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; 9 percent are frontage roads; 4 percent are interstate highways; and the remaining are park and recreational roads.¹

¹ TxDOT Pocket Facts, 2013.
Texas’ interstates handle the majority of truck traffic, due to their connectivity to major population centers, businesses, logistics centers, military installations, international and domestic gateways and inland ports.

- IH-35 is a key North American Free Trade Agreement (NAFTA) corridor connecting Mexico with San Antonio, Austin, Dallas-Fort Worth and states to the north.
- IH-37 from Corpus Christi and IH-45 from Houston serve as critical connectors to major international border and freight gateways.
- IH-10, IH-20, IH-30 and IH-40 provide east-west connectivity through the state and connect major gateways, urban centers and other major developments and freight generators.

**Bridges**

Texas has 52,000+ bridges and 66 percent are “on-system” bridges owned and maintained by the state. Nineteen percent are owned by counties, and 13 percent are owned by cities. Other entities own the remaining “off-system” bridges, which are not part of the state’s designated highway system and are under the direct jurisdiction of local governments, such as a county, city, another political subdivision of the state or a special district.

**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 connections.

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2 Federal Highway Administration, retrieved July 2014 from https://www.fhwa.dot.gov/bridge/owner.cfm
for freight movement. A total of 191 National Highway System (NHS) intermodal connectors, more than 180 miles, are recognized by the Federal Highway Administration (FHWA). Freight intermodal connectors in Texas include 23 airport/truck, 39 port/truck, 18 truck/pipeline and 20 truck/rail connectors.4

**Rest Areas and Truck Parking Facilities**

Rest areas and truck stops enable truck drivers to work efficiently within federal regulations for hours-of-service. According to TruckMaster® Fuel Finder™, Texas has more than 840 truck parking facilities, including public rest areas and private truck stops.5 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 Dallas, Houston and San Antonio.6

**5.1.1 Commodity Flows on Highway Assets**

In 2014, trucks moved 1.04 billion tons of goods, comprising 52 percent of total freight movement in the state and 58 percent of the value of the total freight movements.7

MAP-21 placed emphasis on transportation infrastructure used for energy, mining, agriculture and timber production. Exhibits 5-2 through 5-5 provide a snapshot of the most utilized highway and rail corridors for these commodities/resources in 2010. Energy sector commodities include crude petroleum or natural gas and petroleum/coal products, which are transported via roadways primarily in east and central Texas. Texas mining commodity highway movements are primarily consolidated in the eastern part of the state. However, more commodity tonnage—including metallic ores, nonmetallic minerals and coal—traverses the state on roadways, when compared to energy commodities. Because of the rural nature of the timber and agricultural industries, these commodities are shipped on interstates, U.S. highways and rural roads. Timber is mainly moved in the eastern part of the state and agricultural movements are concentrated in east and south Texas and the Panhandle.

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7 This excludes pipelines.
Exhibit 5-2: Truck and Rail Tonnage for Energy Commodities

Source: Based on TRANSEARCH® data for 2010

Exhibit 5-3: Truck and Rail Tonnage for Mining Commodities

Source: Based on TRANSEARCH® data for 2010
Exhibit 5-4: Truck and Rail Tonnage for Timber Commodities

Source: Based on TRANSEARCH® data for 2010

Exhibit 5-5: Truck and Rail Tonnage for Agricultural Commodities

Source: Based on TRANSEARCH® data for 2010
Texas’ highway assets are critical to all freight modes and connect to key freight gateways, including sea ports, airports and international and interstate border crossings. Various commodities enter and/or exit the state through the interstate and international border crossings shown in Exhibit 5-6.

Exhibit 5-6: Texas Highways and Gateways

5.1.2 International Border Crossings: Truck Freight

Trucks remain the dominant mode of transportation at the U.S.-Mexico border. This critical gateway includes 13 Texas truck border crossings serving 69 percent of the trucks coming from Mexico into the U.S. (Exhibit 5-7). In 2013, the Texas international border crossings allowed for more than $195 billion in U.S. trade with Mexico, 73 percent of which was moved by truck.8

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Twenty-eight bridges connect the U.S. to Mexico along the 1,254-mile Texas border, with 13 serving commercial traffic. The remaining bridges serve automobile, rail and pedestrian traffic. **Exhibit 5-8** shows the 2014 volume of trucks entering Texas from Mexico.

**Exhibit 5-8: Truck Crossings and Volumes at Texas-Mexico Border, 2014**

<table>
<thead>
<tr>
<th>City</th>
<th>Trucks</th>
<th>Bridges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laredo</td>
<td>1,947,846</td>
<td>World Trade Bridge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laredo-Colombia Solidarity (H)</td>
</tr>
<tr>
<td>El Paso</td>
<td>759,125</td>
<td>Bridge of the Americas (H)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ysleta-Zaragoza Bridge (H)</td>
</tr>
<tr>
<td>Pharr</td>
<td>530,093</td>
<td>Pharr-Reynosa Intl. Bridge (H)</td>
</tr>
<tr>
<td>Brownsville</td>
<td>209,989</td>
<td>Veterans Bridge at Los Tomates (H)</td>
</tr>
<tr>
<td>Eagle Pass</td>
<td>136,506</td>
<td>Camino Real Intl.</td>
</tr>
<tr>
<td>Del Rio</td>
<td>69,048</td>
<td>Del Río-Ciudad Acuña</td>
</tr>
<tr>
<td>Nuevo Progreso</td>
<td>41,416</td>
<td>Weslaco-Progreso Intl. (H)</td>
</tr>
<tr>
<td>Rio Grande City</td>
<td>32,459</td>
<td>Río Grande City-Camargo (H)</td>
</tr>
<tr>
<td>Presidio</td>
<td>10,584</td>
<td>Presidio Bridge</td>
</tr>
<tr>
<td>Roma</td>
<td>7,556</td>
<td>Roma-Ciudad Miguel Alemán</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,744,622</strong></td>
<td></td>
</tr>
</tbody>
</table>

H=Hazardous Materials Crossing  
Source: Bureau of Transportation Statistics

Border crossing data are collected at border ports by U.S. Customs and Border Protection (CBP), and thus only reflect incoming (northbound) crossings. While all border crossings do not report outbound volume, the impact of outbound trucks to Mexico can be significant. For example, in Laredo, total volume (inbound and outbound) was nearly four million trucks in 2014.

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Exhibit 5-9 shows the international truck border crossings between Texas and Mexico in 2013. Approximately 52 percent of the daily volume traveled through Laredo, followed by El Paso at 20 percent, Pharr at 14 percent, Brownsville at 6 percent and Eagle Pass at 4 percent. A small percentage of trucks utilized the crossings at Del Rio, Nuevo Progreso, Rio Grande City, Presidio and Roma. Over half of the total tonnage (22.3 of 43.2 million tons) moving across the Texas-Mexico border is through-traffic to and from Mexico. This freight movement highlights the importance of the Texas international border crossings to the nation, since more than half of freight carried by truck across the U.S.-Mexico border at a Texas port-of-entry (POE) originates in or is destined for another state.

Exhibit 5-9: Texas-Mexico Truck Ports-of-Entry, 2013

Source: National Transportation Atlas, Bureau of Transportation Statistics, 2013

5.1.3 Highway Issues and Challenges
Highway congestion and roadway restrictions, including low-clearance bridges or weight-restricted roadways, affect the timeliness and reliability of freight movement and translate directly into higher costs for businesses and consumers. Roadways and bridges are the largest share of Texas’ freight transportation assets; therefore, pavement preservation and bridge maintenance are critical components for efficient and safe movement of people and goods. The assessment of conditions and performance of highway assets will be further discussed in Chapter 6.
5.2 Texas Rail Freight Transportation Assets

Rail is a major component of freight movement throughout Texas. In 2014, freight rail assets accounted for 20 percent of the total freight tonnage movement and 25 percent of the value of total freight movements\(^{10}\). Rail transportation provides low-cost, high-capacity and low environmental impact solutions for the movement of goods, particularly as the travel distance increases. Rail cars have numerous configurations and to accommodate various capacities, trains can consist of more than 100 cars.

In 2012, Texas led the nation in total rail tons terminated (206.6 million tons) and was third in total rail tons originated, with 92.9 million tons. Railroads moved the equivalent of more than 20.7 million truckloads of freight in or through the state in 2012.

As noted in Chapter 1, Texas has more than 10,000 total rail miles, the most of any state. These rail lines are owned by three Class I railroads—BNSF Railway (BNSF), Kansas City Southern (KCS) and Union Pacific (UP)—and 46 short line (Class III) railroads, which also operate 20 rail intermodal facilities. Totaling more than 8,000 miles of rail line, Class I railroads provide connections to shippers and to many of the water ports and international ports-of-entry in Texas. Short line railroads operate on nearly 2,000 miles of track, connecting Class I railroads to shippers and receivers.\(^{11}\)

Additionally, TxDOT owns the South Orient Rail Line that runs from Presidio, on the Mexican border, to San Angelo Junction. The South Orient Rail line is operated by the Texas Pacifico Transportation Ltd. under a lease and operating agreement with TxDOT. Its interchange points are detailed in Chapter 4.

Other key rail assets include intermodal terminals located near urban centers and along major highways; these terminals accommodate the transfer of goods from rail to other freight modes. Major intermodal rail facilities are located in Amarillo, Dallas, El Paso, Fort Worth, Houston and Laredo.

5.2.1 Commodities Carried on Rail Freight Assets

Exhibits 5-2 through 5-5 provide a snapshot of the most heavily utilized rail and highway corridors for energy, mining, timber and agriculture in 2010. Energy sector commodity movements consisted of crude petroleum or natural gas and petroleum or coal products as well as frac sand and pipes. The rail lines most heavily used to transport these products were the BNSF lines between Fort Worth and Amarillo and between Fort Worth and Houston. The UP line between Dallas and San Antonio also accommodated a large amount of the energy sector tonnage in 2010, as did the KCS line on the Arkansas and Louisiana borders. Amarillo was also a major hub for energy commodities by rail.

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\(^{10}\) This excludes pipelines.

Texas mining commodity movements are primarily consolidated in the eastern part of the state and the Panhandle. The bulk of these commodities is moved by truck with rail movement concentrated between Austin, Dallas, Houston and San Antonio. The timber industry does not use Class I rail lines; however, rail movements of agricultural products are heavy on BNSF and UP between Houston and Fort Worth and on UP and Texas Mexican (TM) rail lines between Laredo and Corpus Christi.

5.2.2 International Border-Crossing Rail Freight
Efficient customs processing at border entry ports is critical to maintaining the flow of goods at rail crossings. Texas is home to five of the seven U.S. rail border crossings with Mexico (Exhibit 5-10), located in Brownsville (B&M Bridge), Laredo (Texas Mexican Railway International Bridge), Eagle Pass (Camino Real International Bridge), Presidio (the Presidio Rail Bridge closed because of a fire in February 2008) and El Paso (Bridge of the Americas, which is two separate structures). In 2013, Texas handled 90 percent of loaded containers crossing the U.S.-Mexico border.12 The crossings are maintained by the private railroads and provide important links for a wide variety of commodities. In 2010, approximately 9.1 million tons of freight crossed the Texas-Mexico border by rail. Laredo is the leading POE for rail freight in terms of total trains (36 percent of the U.S.-Mexico total) and loaded rail containers (54 percent of the U.S.-Mexico total).13

5.2.3 Rail Freight Issues and Challenges
As volumes on the rail system increase, congestion could also increase in certain locations, particularly in urban areas of the state. This increase is primarily due to incompatible land use policies, which inhibit the growth and expansion of private rail infrastructure. Examples of incompatible land use include commercial or residential development adjacent to rail lines/yards and the encroachment of road infrastructure or other facilities onto private railroad property. When this occurs, the ability for private investment into rail growth is hindered physically and politically. Other rail issues include at-grade highway-rail crossings and multimodal connectivity improvements to industrial facilities, which include ports, industrial parks and transloading facilities.

Rail is and will continue to be vital to the economic growth of Texas, and supportive policies and public-private partnerships are needed to support the private-sector’s ability to make the needed investments into the Texas rail system.

12 http://transborder.bts.gov/programs/international/transborder/TBDR_BC/TBDR_BC0.html
5.3 Texas Seaport and Waterway Transportation Assets

Water transportation is the most fuel-efficient mode of freight transportation and produces the least emissions per ton of cargo carried. The Texas port and waterway system is critical to statewide and national economic vitality, handling high volumes of oil, chemicals, stone, cement, machinery, steel, automobiles and intermodal containers. These inputs and outputs are important for Texas’ industrial, commercial and consumer markets. Texas’ waterborne transportation is also critical in the movement of U.S. and Texas agricultural products—including wheat, cotton, fruits and vegetables—throughout the world. Additionally, Texas’ ports are national leaders in the movement of higher-weight, lower-value commodities such as crude petroleum, and chemicals.

In 2013, the U.S. Army Corps of Engineers (USACE) ranked seven of Texas’ customs ports among the top 50 nationally in terms of tonnage. These customs ports and their rankings include Houston (second), Beaumont (4th), Corpus Christi (7th), Texas City (13th), Port Arthur (18th), Freeport (32nd) and Galveston (49th). Along with the ports located in Victoria and Orange, these ports are served by critical rail and roadway connections.

The state’s maritime freight transportation assets are its deep water ports and its shallow draft ports, including more than 1,000 private terminal facilities, ship channels, and the Gulf Intracoastal
Waterway (GIWW). Texas’ waterborne infrastructure is comprised of 11 deep water ports with channels at least 25 feet deep, as well as the GIWW. **Exhibit 5-11** illustrates the current maritime infrastructure in the state. In addition to the seaports and waterways, part of the M-10 Marine Highway Corridor lies within Texas. The M-10 corridor stretches from Brownsville, Texas to Jacksonville and Port Manatee, Florida. This corridor parallels the IH-10 corridor and includes the Gulf of Mexico and GIWW, connecting commercial navigation channels, ports and harbors.¹⁴

**Exhibit 5-11: Texas Freight Port Gateways**

![Texas Freight Port Gateways](image)

Source: National Transportation Atlas Database, 2013

The Port of Houston handled more than 229 million tons of freight in 2013. The ports of Beaumont and Corpus Christi each handled more than 50 million tons. Although other ports do not handle the same quantity of freight, many are critical to freight movement in Texas. These other seaports—including Texas City, Port Arthur, Freeport and Galveston—handled between 10 million and 100 million tons of freight each.

A brief description of the top three ports in Texas, which also rank in the top 10 nationally, follows.

**Houston**
The Port of Houston is a 25-mile-long complex of 150-plus diversified facilities, including nine public terminals managed or leased by the Port of Houston Authority, along with a majority of private industrial facilities located along the Houston Ship Channel in Harris County. The Houston Ship Channel is 52 miles long with a depth ranging from 45 feet at the Gulf of Mexico to 36 feet at the farthest inland deep-water navigation point. Channel widths are between 300 and 600 feet. The port is consistently ranked first in the nation in foreign waterborne tonnage, first in U.S. imports, first in U.S. export tonnage and second in the country in total tonnage. It is home to the largest petrochemical complex in the nation and moves more than 200 million tons of cargo annually.

As one of the world’s busiest ports, the Port of Houston handles more than 8,000 vessels annually, with another 200,000 barge movements. A 2012 economic impacts study found that ship channel-related businesses contributed over 1 million jobs throughout Texas and generated nearly $180 billion in statewide economic impact. Additionally, $4.5 billion in state and local tax revenues were generated by business activities related to the port.15

**Beaumont**
The Port of Beaumont is located adjacent to downtown Beaumont, approximately 1 mile south of IH-10 on the Sabine Neches Waterway and approximately 40 miles inland from the Gulf of Mexico. The Sabine Neches Waterway is a minimum of 400 feet wide and maintained at a depth of 40 feet (50 feet authorized). In 2012, there were 270 vessel calls at the Port of Beaumont, the majority of which were tankers associated with crude oil or refined petroleum products.

**Corpus Christi**
The Port of Corpus Christi is located in Nueces County close to downtown Corpus Christi. It is 45 feet deep (52 feet authorized), with more than 295,500 square feet of covered dockside storage and 125 acres of open storage. In 2011, most vessel calls were tankers associated with crude oil or refined petroleum products. Wind turbines were also an important cargo moving through the port.

The ports of Beaumont and Corpus Christi are also considered strategic installations by the U.S. Department of Defense (DOD) for moving military cargo to support U.S. military operations overseas. These top-ranked ports are each served by at least one Class I railroad, and most are connected to the highway network by an interstate, U.S. route or state highway.

**Gulf Intracoastal Waterway**
The GIWW is a 1,100-mile-long, shallow-draft, man-made, protected waterway that connects ports along the Gulf of Mexico from St. Marks, Florida to Brownsville, Texas. As the nation’s third busiest inland waterway, it is an essential component of the nation’s transportation network. In addition to the economic benefits derived from cargo carried on the GIWW, traffic on the waterway reduces highway and rail congestion, decreases maintenance costs and extends the life of these systems.

The Texas portion of the GIWW traverses 379 miles of Texas’ coastline and handles 67 percent of the entire waterway’s traffic. It links 11 deep water ports and 15 shallow draft channels. Maintenance of the GIWW is the responsibility of the USACE. Texas’ local sponsorship of the waterway is governed through the Texas Transportation Code and the Texas Administrative Code. In 1975, TxDOT was named the official non-federal sponsor for the Texas portion of the GIWW via the Texas Coastal Waterway Act. The primary responsibilities of TxDOT under the act are to provide right-of-way and disposal areas for byproducts of operations and maintenance.16

The state’s portion of this waterway plays a large role in facilitating commerce throughout the Texas Gulf Coast region. In 2012, it moved nearly 78 million short tons, 91 percent of which fell within the categories of petroleum-related and chemical-related products.17 Texas ranked second in the nation in 2013 for total waterborne tonnage moved on the GIWW, with 492 million tons of cargo and more than one-fifth of the total U.S. maritime freight and vessel volume on its waterways.18 In terms of economic importance, the Texas component of the GIWW is one of the most utilized corridors in the U.S. inland waterway commerce network. Along the waterway, manufactured goods, farm products, machinery, petroleum products and chemicals are transported into and out of the region.

5.3.1 Port and Waterway Issues and Challenges
The expansion of the Panama Canal is expected to result in larger-sized ships calling at Texas ports. Dredging on these waterways must occur regularly to maintain waterways at the appropriate depth. Dredging is also an issue on the GIWW. Though designed to be 125 feet wide and 12 feet deep, the waterway is not being maintained properly due to insufficient federal funding.19

Current revenue streams for some Texas ports are insufficient to execute needed capital improvements. Many ports in other states receive state government-funded subsidies to attract new tenants and have access to grants and loans for capital improvement projects. These publicly funded port enhancements can make non-Texas ports more attractive to shippers and potential tenants and can contribute to businesses choosing to locate outside of Texas.

17 Ibid.
18 Ibid.
19 Texas Department of Transportation, August 2014 Master Plan for the Gulf Intracoastal Waterway in Texas.
5.4 Texas Air Freight Transportation Assets

Air cargo is typically lightweight, time-sensitive and high-value. Air cargo service provides a region with access to fast delivery of highly perishable or high-value goods and critical components. It moves on dedicated, cargo-configured aircrafts or in the “belly” or luggage compartment of passenger aircrafts. This service gives industries the ability to ship and receive time-sensitive or critical components and finished products. Air freight includes perishables, such as fish and produce, computers and parts, telecommunications equipment, vehicle parts, oil and gas drilling equipment, pharmaceuticals, clothing and medical supplies, as well as many other products. However, costs for aircraft, fuel and terminals exceed those of other modes, so the financial impact of using air carriers to shippers is extremely high.

Texas is home to 23 commercial service airports, including six of the top 50 cargo airports in the U.S. in terms of landed weight in 2013. 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.

Dallas/Fort Worth International and George Bush Intercontinental/Houston each landed more than 1 billion pounds of cargo in 2013. Other airports landing more than 500 million pounds of cargo in 2013 included San Antonio International and Fort Worth Alliance Airport. Texas highways connect major air cargo airports, as well as a number of smaller airports that still handle a significant amount of air cargo. While the majority of these smaller airports moved less than 400 million pounds of freight in 2013, connections to these airports are critical to the efficient movement of air cargo freight across the state.

With the economic development of high-tech industries, the need for accessible air transport, passenger and cargo is a high priority in business site selection. Locations of major Texas commercial airports are shown in Exhibit 5-12.

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20 Federal Aviation Administration, 2013.
Dallas/Fort Worth International
Dallas/Fort Worth International is the primary airport serving the Dallas-Fort Worth metropolitan area. Located approximately 5 miles west of downtown Dallas, it has seven runways and is the busiest airport in Texas for both passenger enplanements and annual air cargo tonnage. In 2013, over 3 billion pounds of freight and mail passed through Dallas/Fort Worth International, which ranked 10th in the U.S.

This airport is one of the largest inland global distribution centers in the region, encompassing more than 18,000 acres of land. Its cargo facilities offer direct airside access with an interior airport road system that connects to four major interstate highways. The airport has designated more than 2,000 acres of airport land for future air cargo facility development.

George Bush Intercontinental/Houston
George Bush Intercontinental/Houston was the second busiest airport in Texas in terms of annual air cargo tonnage. In 2013, it handled more than 1.5 billion pounds of freight and mail and ranked 17th in the U.S. In recent years, the Houston Airport System has built a new air cargo distribution center, bringing the airport’s total to 1 million square feet of dedicated cargo space, including refrigerated storage space and specialized animal and plant inspection facilities.
George Bush Intercontinental/Houston is served by more than 20 passenger airlines, as well as several cargo only carriers. Common goods shipped through the airport include oil field equipment, computers, auto parts, medical/biotech goods and perishables. Air cargo growth at George Bush Intercontinental/Houston is largely attributed to the global expansion of oil/gas exploration, given that Houston has numerous oil field supply firms. Houston also has a significant high-tech and biomedical sector, which contributes to the air cargo demand.

San Antonio International
San Antonio International was the third busiest airport in Texas in 2013, with more than 700 million pounds of air cargo, making it the 29th busiest in the nation. Current air cargo facilities at San Antonio International include more than 173,000 square yards of apron and 888,000 square feet of building space for the transfer and storage of freight. U.S. Department of Agriculture and U.S. CBP are located at the airport. Other attributes include two Foreign Trade Zones (FTZs) designated facilities and highway and rail access.

Fort Worth Alliance
In 2013, Fort Worth Alliance handled over 630 million pounds of air cargo and ranked fourth in the state and 36th in the U.S. The airport is home to several major tenants, including Cardinal Distribution and Galaxy Aerospace, along with a Naval Air Station Joint Reserve Base and Bell Helicopter Textron Inc. Special facilities at the airport include an FTZ. FedEx Express operates its southwest regional hub at this airport, from which it provides domestic cargo capacity to various domestic markets, including a wide body route to Anchorage, Alaska, where cargo feeds into aircraft bound for Asia. Other freight transportation modes located near the airport include an adjacent rail terminal and IH-35 within 2 miles of Fort Worth Alliance.

El Paso International
El Paso International handled over 480 million pounds of air cargo in 2013 and ranked as the fourth busiest airport in Texas and 43rd in the U.S. With recent investments, the airport has developed air cargo facilities to create the largest fully integrated transportation center on the U.S.-Mexico border. This development includes two 144,000-square-foot air cargo buildings, more than 34 acres of aircraft parking and 6.4 miles of roadways. These new facilities are tailored to the just-in-time market in the U.S. and Mexico and are also part of an FTZ that provides several advantages for users, including deferred or reduced customs duties on goods shipped within the zone. This is particularly useful for the international trade between businesses in El Paso, Texas and Ciudad Juarez, Mexico.

Austin-Bergstrom International
Austin-Bergstrom International handled nearly 440 million pounds of air cargo in 2013, ranking fifth busiest among Texas airports and 49th in the U.S. The airport’s cargo warehouse facilities are located at the northern end of the property, allowing for quick access to IH-35 and State Highway (SH) 130 via SH 71.
5.4.1 Texas Air Freight Issues and Challenges
During the Freight Plan development process, stakeholders identified access to air cargo facilities as an issue. Continued coordination between airports and infrastructure owners is critical to improving off-airport access, especially at designated NHS intermodal connectors.

5.5 Texas Pipeline Transportation Assets
Approximately 426,000 miles of pipelines (Exhibit 5-13) carry a very specific group of commodities in Texas: petroleum-based or natural gas. Pipeline commodity movements are comprised of three commodity groups: crude petroleum or natural gas, petroleum or coal products and refined chemicals or allied products.

Statewide transmission pipelines include those with a diameter of 16 inches or greater, which are operated by more than 1,700 companies in Texas. Transmission pipelines are critical for moving large volumes of commodities. This extensive pipeline network connects to roadways at truck/pipeline terminals where these products are transferred from the pipelines to trucks for further transport on the Texas Highway Freight Network. The FHWA classifies 11 truck/pipeline intermodal terminals as NHS intermodal connectors; these are located in Amarillo, Dallas-Fort Worth, El Paso, San Antonio, Houston and Sweeny.

Exhibit 5-13: Statewide Transmission Pipelines, 2013

Source: The Railroad Commission of Texas, 2013
5.5.1 International Border-Crossing Pipeline Freight

Eleven pipelines cross the Texas-Mexico border. They are located at El Paso, Clint, Del Rio, Eagle Pass (two pipelines), Salineno, Penitas, McAllen, Hidalgo, Rio Bravo and Alamo (Donna). In 2010, 5.7 million tons of cargo crossed the Texas-Mexico border via pipelines. Key mobility challenges include aging and insufficient infrastructure, lack of coordination among the various agencies and cross-border administrative issues which delay the movement of energy commodities. These challenges significantly impact international trade, supply chains and the economic competitiveness of the state and the nation.

5.6 Other Freight Generators

Military installations, warehouses, distribution centers and industry clusters also generate large traffic volumes within the state for both inbound and outbound freight.

5.6.1 Texas Military Installations

The state’s 15 military installations serve as major freight generators and consumer markets (Exhibit 5-14). Access to the installations is critical for national defense purposes; therefore, it is important to consider military freight mobility needs in the Freight Plan. The U.S military depends on Texas’ freight system to move cargo not only to serve the installations, but also to deploy it for national defense. To underscore this importance, FHWA and the DOD developed the Strategic Highway Network (STRAHNET) and the Strategic Rail Corridor Network (STRACNET). STRACNET consists of 38,800 miles of rail lines important to national defense and provides service to 193 defense installations whose mission requires rail service.21 STRAHNET is a system of public highways, which provides access, continuity and emergency transportation of personnel and equipment in times of peace and war.22 STRAHNET is complemented by approximately 1,700 miles of connectors and additional highway routes linking more than 200 military installations and ports to the network. FHWA and DOD identified 17 major military deployment sites linked via STRAHNET. Two of these major deployment sites are in Texas: Fort Hood and Fort Bliss.23 Maintaining connectivity from the STRAHNET and STRACNET to these military installations is critical.

21 http://www.globalsecurity.org/military/facility/stracnet.htm
22 http://www.globalsecurity.org/military/facility/strahnet.htm
Additionally, Fort Hood and Fort Bliss have associated seaports of embarkation (SPOE), which serve as unloading and temporary storage of munitions from depots and loading and shipping munitions from the port to the installation. The Port of Beaumont serves as the SPOE for Fort Hood and the Port of Corpus Christi is the SPOE for Fort Bliss. Access between these installations and the associated SPOE should be maintained and preserved as key cargo corridors for defense purposes.

5.6.2 Warehousing, Distribution and Industry Clusters

Warehousing and distribution centers provide a vital link between businesses and the consumer. Items from a distribution center are shipped to retailers, wholesalers or directly to the consumer. Warehouse facilities are usually located near major market areas and in proximity to major roadway facilities. Exhibit 5-15 displays the major warehousing facilities by commodity group in Texas. As may be expected, the facilities are clustered in and around the urban areas of the state and along major highways. Texas represents one of the largest industrial real estate markets in the U.S. The Dallas-Fort Worth market has an inventory of over 762 million square feet making it the third largest industrial real estate market behind Chicago and the Inland Empire California. Houston has

24 [http://www.globalsecurity.org/military/facility/spoe.htm](http://www.globalsecurity.org/military/facility/spoe.htm)
over 508 million square feet, San Antonio over 105 million square feet, and Austin with over 83 million square feet.  

Exhibit 5-16: Major Warehousing Facilities by Commodity Group

Source: Texas Workforce Commission, 2013

As shown in Exhibit 5-16, concentrations of industry are important to Texas. These goods and raw materials are transported either to the next phase of production or to the consumer; therefore, the reliability and convenience of the transportation system affect both the producer and the consumer.

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5.7 Texas Freight Network

Defining the assets on the Texas Freight Network provides more focus for freight transportation priorities. The Freight Plan identifies key transportation corridors to create the Texas Freight Network, based on current and future needs and trends, and defines specific criteria for each freight mode.

Exhibit 5-17 shows the defined Texas Freight Network, which includes major highways, railroads, waterways and airports. Pipelines are also included but not represented on the map. The Texas Freight Network is consistent with the national freight goals and the draft national Primary Freight Network developed by the FHWA.
The Texas Freight Network includes corridors that:

- Carry the highest freight volumes.
- Connect key highway, rail and waterway corridors.
- Connect to key gateways, such as water ports, rail terminals, airports and international border crossings.
- Connect to key generators serving local, regional, statewide, intrastate, interstate and international trade and economic development areas.
- Connect to military installations, distribution centers, oil and gas terminals, agricultural regions, intermodal centers and other economic regions and commodity centers.
- Connect to markets and population centers.

### 5.7.1 Texas Highway Freight Network

The Texas Highway Freight Network is comprised of a Primary Freight Network and a Secondary Freight Network/Emerging Freight Corridors. It includes interstates, the NHS and the Texas Trunk System.¹

The Primary Freight Network comprises nearly 6,400 miles of highways, which are projected to carry more than 10 million tons of cargo by 2040. It includes connections to major freight generators, gateways and ports-of-entry. The majority of the Primary Freight Network is also designated by the FHWA as Corridors of National Significance, indicating that this network is not only critical to Texas, but to the nation as a whole.

The Secondary Freight Network/Emerging Freight Corridors includes nearly 13,400 miles of highways. It represents connections to rural areas and energy sector corridors and is projected to carry more than 10 million tons or more by 2040.

### 5.7.2 Texas Rail Freight Network

The Texas Rail Freight Network is composed of the rail assets most important to freight movement throughout Texas. Although most of the network is comprised of privately owned rail lines, these are the facilities on which TxDOT will focus their freight planning and coordination efforts. The Texas Rail Freight Network includes Class I rail lines, the South Orient Rail Line and 46 class III or short line rail lines. Exhibit 5-18 illustrates this network. Similar to the highway network, the rail network has major north-to-south and east-to-west connections that serve major urban areas, ports and border crossings.

¹ [http://onlinemanuals.txdot.gov/txdotmanuals/pln/texas_highway_trunk_system.htm](http://onlinemanuals.txdot.gov/txdotmanuals/pln/texas_highway_trunk_system.htm)
5.7.3 Texas Ports and Waterway Network
All major seaports and waterways are included in the Texas Freight Network. Oceans and inland waterways, including the GIWW, provide access to markets overseas and low-cost solutions via barge and short sea shipping, both domestically and regionally. With increasing globalization of supply chains, the ability to transport materials and goods between continents via waterway has flourished.

5.7.4 Texas Air Freight Network
The Texas Air Freight Network consists of the major airports detailed previously in Section 5.4: Texas Air Freight Transportation Assets. These airports handle a significant amount of cargo traffic from both domestic and international locations.

5.7.5 Texas Pipeline Freight Network
The Texas Pipeline Freight Network is comprised of the pipeline assets discussed in Section 5.5: Texas Pipeline Transportation Assets. Transmission pipelines are the most critical for moving large volumes of commodities and are therefore a major focus within the Texas Freight Network.
Key freight highways, railroads, sea ports and waterways, inland ports, airports, gateways and intermodal transfer facilities have been identified to focus efforts on the infrastructure most critical to the efficient movement of goods in Texas. These assets serve as the Texas Freight Network, due to their statewide, national and international importance.
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Improving the condition and operation of the Texas Freight Network through targeted management ensures that the state’s infrastructure supports current and future demands. This chapter provides an understanding of the physical condition and performance of the freight system’s assets. It also outlines the performance management framework and measures to monitor system performance moving forward.

Tracking and analyzing freight system conditions and performance ensures that management, operations and capital improvements are based on comprehensive data and analysis. In Chapter 11, a strategic approach for addressing the state’s current and future freight transportation needs is presented, along with specific conditions and performance that closely align with the Texas Department of Transportation’s (TxDOT) strategic goals, asset management objectives and performance measures.

Four freight system elements for each asset category are discussed in this chapter:

1. **System Condition**: The condition of the freight infrastructure, historical trends, purpose and geography.
2. **System Performance**: Usage, congestion, reliability and implications for the state’s economic competitiveness.
3. **Safety Analysis**: Crashes for all modes and contributing factors.
4. **Freight Performance Measures**: Targeted freight performance measures established to guide the efficient management of the Texas Freight Network.

### 6.1 Highways

#### 6.1.1 Condition

Texas’ extensive network of highways moves millions of people and billions of tons of freight. Adequately maintaining the conditions of Texas’ highways and bridges is critical to the safe and efficient movement of people and freight.

A recent report by TRIP, a national transportation research group, estimated that in 2014, deficient roads and bridges, congestion and lack of desirable safety features cost Texas motorists a total of $25.1 billion statewide and approximately $1,800 per driver in some areas. This is due to higher vehicle operating costs, traffic crashes and congestion delays.¹ Trucks navigating a network in disrepair can damage equipment and cargo, require costly detours to avoid height or weight restrictions and increase the overall cost of transportation.

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Pavement Conditions

Texas highways are considered to be some of the best maintained in the nation. TxDOT uses an automated Pavement Management Information System (PMIS) for storing, retrieving, analyzing and reporting pavement condition information. PMIS is used to retrieve and analyze pavement information to compare maintenance and rehabilitation treatment alternatives, monitor current pavement conditions and estimate total pavement needs. The database includes various roadway condition evaluation factors, such as distress, rutting, ride quality, deflection and skid resistance. The PMIS uses this evaluation data to assign each roadway segment a condition score from 0 to 100, where 100 is the best quality pavement.

In 2013, 88 percent of total lane miles in Texas were in “good” or better condition. By comparison, 82 percent of the Texas Highway Freight Network is currently in “good” or better condition, slightly lower than the total lane miles. However, further analysis reveals some concerns:

- Texas’ interstate highways, the most important part of the Texas Highway Freight Network, have a smaller percentage of roadways in “good” condition and a larger percentage in “very poor” condition when compared to overall network averages.
- More than 16 percent of the state’s major urban roadways and highways have pavement in “poor” condition, 51 percent of urban roadways have “fair” pavement condition and 33 percent are considered to have “good” pavement condition.
- Among urban areas in the state, the Dallas area has the most miles of roadways with pavement conditions of “poor” and “very poor.”

Exhibit 6-1 shows the pavement conditions within the state. 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 on highway users 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.

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Several issues can impact pavement condition:

- Traffic factors such as number of vehicles, vehicle weight and axle load.
- Material properties and composition (e.g., strength bearing capacity of materials used).
- Environmental factors like temperature, precipitation, soils, humidity and groundwater quality.
- Other factors, such as maintenance level, geometric features and construction.

**Lane Conditions**

The Primary Freight Network includes nearly 6,400 miles of highways, most of which are 4-lane limited access routes, as shown in Exhibit 6-2. The Secondary Freight Network/Emerging Freight Corridors include nearly 13,400 miles, with 2-lane roadways making up more than half of these, as shown in Exhibit 6-3. The width of lanes has a direct impact on the capacity of the network and on its safety. Older roadways often do not meet current standards or the requirements of modern truck equipment. On high-speed roadways with narrow lanes and narrow shoulders, the risk of severe lane-departure crashes increases.3

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Other Highway Conditions

The horizontal alignment, or curves in the roadway, affects the speed at which trucks can travel safely. At ramps and loops, a lack of deceleration 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 of their higher center of mass, they are more susceptible to overturning.

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

Another problematic highway condition on Texas interstates is two-way frontage roads. This type of roadway is outdated and creates unsafe conditions for the movement of people and freight. A significant number of interchanges on Texas interstates are the original designs dating back more than 40 years.

Bridge Conditions

Bridges in poor condition contribute to congestion if vehicles must reduce their roadway speed to cross. Bridge repair can also slow down traffic or restrict movement, resulting in congestion. Bridge conditions may affect transportation costs, since substandard bridges may require trucks to use longer routes or require more trucks for the same cargo because of load restrictions.
In 2012, Texas had over 52,000 bridges, 59 percent more than any other state. That constitutes 9 percent of the nation’s entire bridge inventory.\(^4\) More than 81 percent of Texas bridges were in “good” or better condition in 2012, which is slightly higher than the TxDOT goal of 80 percent of bridges in Texas in “good” or better condition by 2011.\(^5\) The average age of Texas bridges is 41 years on the state highway system and 30 years for other bridges.

In 2012, the condition of the state’s bridges was as follows\(^6\):

- 42,359 bridges were classified as sufficient, meaning more than 81 percent of Texas’ bridges met or exceeded all state and federal safety requirements.
- 1,292 bridges were structurally deficient.\(^7\)
- 7,453 bridges were functionally obsolete.\(^8\)
- 1,118 bridges were sub-standard for load only.

Adequate bridge heights are important for safety and traffic operations. Many older structures or overpasses were constructed with vertical clearances less than current TxDOT requirements. The addition of pavement overlays over the years may have further reduced these clearances. Bridges with a clearance of less than 15’ are more likely to be struck and damaged by trucks.

Bridge clearances on the Texas Highway Freight Network are summarized below:

- 66 bridges on the interstates have a vertical clearance of less than 15 feet.
- On the Texas Highway Freight Network, 1,180 bridges are between 15 feet and 16’6”; 438 of these are on interstates.
- On the interstates, 844 bridges are between 16’6” and 17’6”.
- Additionally, 273 bridges on the interstates are between 17’6” and 18’6”.

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. Exhibit 6-4 shows a decline in the number of structurally deficient bridges over the last decade.

\(^4\) 2012 data is used to show the improvements over time and provide a general overview of all bridges.

\(^5\) Report on Texas Bridges as of September 2012. Prepared by the Bridge Division, Texas Department of Transportation.

\(^6\) Ibid.

\(^7\) According to the American Society of Civil Engineers, structurally deficient bridges require significant maintenance, rehabilitation or replacement. These bridges must be inspected at least every 24 months, or more frequently if conditions warrant.

\(^8\) According to the American Society of Civil Engineers, functionally obsolete bridges are bridges that no longer meet the current standards. Examples are narrow lanes or low load-carrying capacity.
Exhibit 6-5 shows the bridges on the highway network identified as being in “poor” or “very poor” condition. Thirty-eight bridges in poor condition were identified on the Primary Freight Network, along with 18 on the Secondary Freight Network/Emerging Freight Corridors.

Source: Report on Texas Bridges, 2012

Exhibit 6-5: Texas Highway Freight Network Bridges in Poor Condition

Source: TxDOT Bridge Division Data as of June 2014
6.1.2 Performance

Analysis of the Texas Highway Freight Network's operational performance is critical to understanding the overall performance of the Texas freight transportation system.

Texas Highway Freight Network Mobility and Congestion

Congestion on the highway 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 (LOS). LOS is a qualitative measure of traffic operating conditions on a roadway. LOS 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. LOS C to D are generally considered acceptable for traffic operations.

In 2013, more than 63 percent of the state’s interstate mainlanes operated at a LOS A or B and over 90 percent of U.S. routes and state highways in Texas operated at LOS C or better, as shown in Exhibit 6-6.

Exhibit 6-6: Texas Highway Freight Network Level-of-Service, 2013
Interstates, U.S. Highways and State Highways

<table>
<thead>
<tr>
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<th>Interstate Highways</th>
<th>U.S. Highways</th>
<th>State Highways</th>
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<tbody>
<tr>
<td>Level of Service</td>
<td>A/B</td>
<td>C/D</td>
<td>E/F</td>
</tr>
<tr>
<td>Percentage</td>
<td>63%</td>
<td>95%</td>
<td>86%</td>
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</tbody>
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Source: TxDOT RHINO Database, 2013

Bottlenecks

According to the American Transportation Research Institute (ATRI), nationwide congestion added more than $9.2 billion in operational costs to the trucking industry and 141 million hours of lost productivity in 2013. On average, congestion added over $860 in costs per truck in 2013 across the 10.7 million registered trucks nationally. Texas had more than $1 billion in congestion costs, ranking only behind California. Of the 10 metropolitan areas with
the highest costs of congestion, Dallas ranked fourth with over $406 million and Houston ranked sixth with more than $373 million in 2013.\(^9\)

Highway freight bottlenecks on the Texas Highway Freight Network were identified utilizing the Federal Highway Administration (FHWA) Office of Freight Management and Operations’ annual Freight Performance Measures analysis, which assesses the level of truck-oriented congestion at 250 locations on the National Highway System. It uses onboard global positioning systems from trucks to gather information on vehicle location, unique vehicle identification, time/date and vehicle spot speed. Each bottleneck is assigned a “total freight congestion value” that measures the impact of congestion on average commercial truck speeds in the study area.

Seven of the top 25 freight bottlenecks nationwide, as identified by ATRI for FHWA, are located in Texas. They are clustered in Austin, Dallas and Houston and their location and national rankings are shown in Exhibit 6-7.

Exhibit 6-7: Top U.S. Freight Bottlenecks in Texas, 2014

Source: American Transportation Research Institute

Each year, the Texas A&M Transportation Institute (TTI) produces a list of the 100 most congested roadways for TxDOT. Because the analyzed roadways differ in length, rankings are produced based on the total delay per mile measured. 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, for the top 10 most congested segments are shown in Exhibit 6-8. All 10 segments are located in four urban areas.

The most congested roadway segment in Texas, based on trucking delays, is IH-35 through downtown Austin, with about 116,000 hours of delay. TTI also identified the top 50 most congested roadways based on trucking delays, called the “Freight 50.” Thirty-eight percent of the annual hours of delay in the Freight 50 occurred in the top 10 most congested locations. Houston had four of the top 10 most congested locations for truck travel in 2014, while Austin had only one—the aforementioned IH-35 segment.

<table>
<thead>
<tr>
<th>Urban Area</th>
<th>Rank</th>
<th>Roadway</th>
<th>From</th>
<th>To</th>
<th>Truck Person-Hours of Delay Per Mile (000)</th>
<th>Annual Truck Congestion Cost ($ Mil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austin</td>
<td>#1</td>
<td>IH-35</td>
<td>US-290</td>
<td>SH-71</td>
<td>116</td>
<td>72</td>
</tr>
<tr>
<td>Houston</td>
<td>#2</td>
<td>US-59</td>
<td>IH-610W</td>
<td>SH-288</td>
<td>73</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>#3</td>
<td>IH-10</td>
<td>Eldridge</td>
<td>Beltway-8</td>
<td>72</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>#4</td>
<td>IH-610W</td>
<td>IH-10</td>
<td>US-59</td>
<td>71</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>#8</td>
<td>US-59</td>
<td>IH-10E</td>
<td>SH-288</td>
<td>55</td>
<td>14</td>
</tr>
<tr>
<td>Dallas</td>
<td>#5</td>
<td>IH-35E</td>
<td>SH183</td>
<td>IH-30</td>
<td>70</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>#7</td>
<td>IH-635</td>
<td>IH-35E</td>
<td>US-75</td>
<td>61</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>#10</td>
<td>IH-35E</td>
<td>IH-635</td>
<td>Beltway-12N</td>
<td>49</td>
<td>11</td>
</tr>
<tr>
<td>Fort Worth</td>
<td>#6</td>
<td>IH-35W</td>
<td>SH-183</td>
<td>IH-30</td>
<td>66</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>#9</td>
<td>IH-35W</td>
<td>US-287</td>
<td>SH-183</td>
<td>54</td>
<td>25</td>
</tr>
<tr>
<td>Total (Top 10 most congested segments)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>687</td>
<td>280</td>
</tr>
<tr>
<td>Total (Top 50 most congested segments)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9,482</td>
<td>738</td>
</tr>
</tbody>
</table>

Source: Texas A&M Transportation Institute

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6.2 Railroads

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

The North American rail network has a standardized shipment weight limit of 286,000 pounds per carload, which is approximately 110 tons of cargo on four axles. Some markets are expanding the standard to a gross weight of 315,000 pounds. Class III short lines have reduced capacity on rail corridors not rated for 286,000-pound axle loads because hopper cars or other heavy bulk commodities cannot be loaded to full capacity. Public-private investment, where practical, would be beneficial to upgrading lines that do not meet the 286,000-pound weight limit to support a range of modes and the economic competitiveness of both the Texas Rail Freight Network and the overall Texas Freight Network.

6.2.2 Performance

Mobility and Congestion
In 2014, rail carried 20 percent of freight traffic in Texas, and that volume is projected to increase. The railroads already invest millions of dollars annually in Texas infrastructure and will need to continue significant levels of investment to meet the projected demand. Recent successful public-private partnership projects, such as the reconfiguration of Tower 55 in Fort Worth, serve as a model for future efforts to identify and address constraints on the Texas Rail Freight Network.

As volumes on the rail system increase, congestion could increase where incompatible land use inhibits the growth and expansion of private rail infrastructure. Other rail issues and challenges include at-grade road-railroad crossings; improving multimodal connectivity to industrial facilities including ports, industrial parks and transloading facilities; and overall rail connectivity throughout the state.

Bottlenecks
Rail bottlenecks cause cascading impacts and further contribute to congestion and delays, which can result in higher costs for both shippers and consumers. As an example, Beaumont is served by the state’s three Class I railroads, which all cross the Neches River on a single bridge owned by the Kansas City Southern Railway (KCS). The bridge is a key link in the former Southern Pacific Sunset Route from California to New Orleans and is a principal freight route. Between 50 and 60 freight trains—largely Union Pacific (UP)—and Amtrak’s Sunset Limited cross the bridge daily. The bridge was identified as a landside chokepoint in

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11 Excludes Pipelines.
the 2010 Texas Rail Plan. It requires that trains be held in Beaumont, interfering with local switching and access to the Port of Beaumont’s north yard.

6.3 Ports and Waterways

6.3.1 Seaport Conditions

Texas has 11 deep water ports and 15 shallow draft channels handling mostly barge traffic on the Gulf Intracoastal Waterway (GIWW). These ports are discussed in detail in Chapter 5. Exhibit 6-9 includes the channel length, depth and width for each of the major Texas ports. Ports may experience capacity constraints from increased energy-related traffic due to projected energy sector growth. Container terminals are also expected to see increases in traffic.

Exhibit 6-9: Port Channel Information, 2012

<table>
<thead>
<tr>
<th>Port/City Name</th>
<th>Channel</th>
<th>Length (miles)</th>
<th>Depth (feet)</th>
<th>Width (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Houston</td>
<td>Houston Ship Channel</td>
<td>52</td>
<td>45</td>
<td>530</td>
</tr>
<tr>
<td>Beaumont</td>
<td>Sabine Neches Waterway a</td>
<td>42</td>
<td>40</td>
<td>400</td>
</tr>
<tr>
<td>Corpus Christi</td>
<td>Corpus Christi Ship Channel</td>
<td>34</td>
<td>45</td>
<td>500</td>
</tr>
<tr>
<td>Texas City</td>
<td>Texas City Ship Channel a</td>
<td>9.4</td>
<td>45</td>
<td>500</td>
</tr>
<tr>
<td>Port Arthur</td>
<td>Sabine Neches Ship Channel</td>
<td>42</td>
<td>40</td>
<td>400</td>
</tr>
<tr>
<td>Freeport</td>
<td>Freeport Harbor Channel a</td>
<td>8.5</td>
<td>45</td>
<td>400</td>
</tr>
<tr>
<td>Galveston</td>
<td>Galveston Channel a</td>
<td>9.3</td>
<td>45</td>
<td>1,200</td>
</tr>
<tr>
<td>Brownsville</td>
<td>Brownsville Ship Channel a</td>
<td>17</td>
<td>42</td>
<td>1,200b</td>
</tr>
<tr>
<td>Victoria</td>
<td>Victoria Barge Canal a</td>
<td>35</td>
<td>12</td>
<td>125</td>
</tr>
<tr>
<td>Port Isabel</td>
<td>Port Isabel Ship Channel a</td>
<td>0.77</td>
<td>36</td>
<td>200</td>
</tr>
<tr>
<td>Orange</td>
<td>Sabine Neches Ship Channel</td>
<td>42</td>
<td>40</td>
<td>400</td>
</tr>
</tbody>
</table>

a Direct access to the Gulf Intracoastal Waterway – Texas portion (379 miles, 12-foot depth, 125-foot width)
b Turning basin width

Source: Panama Canal Stakeholder Working Group, 2012

The U.S. Army Corps of Engineers (USACE) is responsible for maintaining navigation channels and may fund between 50 and 65 percent of the cost of channel deepening or widening projects, subject to congressional approval.12 It is estimated that $5.75 billion is needed for maintenance and operations of the ports through 2035, not including expansions necessary to handle larger “New Panamax” ships at some Texas ports.13

Exhibit 6-10 includes the critical roadway connections to major ports, and Exhibit 6-11 shows the critical rail connections to major ports. These connectors help move freight more efficiently from port to final destination. However, several of these top U.S. ports are not

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12 Texas 2030 Committee Final Report.
13 Ibid.
adjacent to the interstate highway system, highlighting the importance of the entire roadway and rail network to the efficient movement of freight.

### Exhibit 6-10: Top Texas Water Ports Roadway Connections, 2013

<table>
<thead>
<tr>
<th>Port</th>
<th>Interstate Highways</th>
<th>U.S. Highways</th>
<th>State Highway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaumont</td>
<td>10</td>
<td>69, 96, 287</td>
<td>380, 347</td>
</tr>
<tr>
<td>Brownsville</td>
<td>69</td>
<td></td>
<td>48, 511, 313</td>
</tr>
<tr>
<td>Corpus Christi</td>
<td>37, 69</td>
<td>181</td>
<td>44, 51, 286, 358, 407</td>
</tr>
<tr>
<td>Freeport</td>
<td></td>
<td></td>
<td>36, 288, 332, 523, 1495</td>
</tr>
<tr>
<td>Galveston</td>
<td>45</td>
<td></td>
<td>87</td>
</tr>
<tr>
<td>Houston</td>
<td>10, 610, 69</td>
<td>90</td>
<td>146, 225</td>
</tr>
<tr>
<td>Orange</td>
<td>10</td>
<td>90</td>
<td>73, 87</td>
</tr>
<tr>
<td>Port Arthur</td>
<td></td>
<td></td>
<td>73, 82, 823, Spur 215</td>
</tr>
<tr>
<td>Port Isabel</td>
<td></td>
<td></td>
<td>48, 100</td>
</tr>
<tr>
<td>Texas City</td>
<td></td>
<td>59, 87</td>
<td>3, 6, 146, 519</td>
</tr>
<tr>
<td>Victoria</td>
<td>69</td>
<td>59, 87</td>
<td>185</td>
</tr>
</tbody>
</table>

Sources: USACE, TxDOT, 2010, TxDOT RHINO database, Google Maps

### Exhibit 6-11: Top Texas Water Ports Rail Connections, 2014

<table>
<thead>
<tr>
<th>Port</th>
<th>No. of Class I Railroads</th>
<th>Short line/Terminal Railroad</th>
<th>Within a Rail District</th>
<th>Can Handle Unit Train Within Port (over 60 cars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaumont</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Brownsville</td>
<td>3&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>X</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Corpus Christi</td>
<td>3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Freeport</td>
<td>1</td>
<td>-</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Galveston</td>
<td>2</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Houston</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td>2</td>
<td>X</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Port Arthur</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Port Isabel</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Texas City</td>
<td>2</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Victoria</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> 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.

<sup>b</sup> 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: Texas Port Report, June 2014
6.3.2 Waterway Conditions

Approximately 379 miles of the GIWW, at 125 feet wide and 12 feet deep, runs along the Texas coastline. Insufficient federal funding is impacting proper maintenance of the waterway, resulting in costly shipping inefficiencies for Texas businesses and lost revenue for the state. At 2013 traffic levels, losing just 1 foot of draft would have increased the cost of doing business by roughly $58.7 million for carriers, or nearly 15 percent.

The GIWW handles commercial navigation traffic equivalent to the fourth largest port in the U.S.14 Texas’ portion of the waterway handles more than half of all the traffic along the entire length of the waterway. In 2012, more than 119 million short tons (2,000 pounds) of cargo moved through the GIWW, with more than 78 million short tons, or 67 percent, traveling through the Texas portion.15

The condition of locks for barge traffic is also a major issue for the waterways. The Brazos River Floodgates and the Colorado River Locks are more than 60 years old and are limited to smaller barge tow size configurations, requiring them to break barges for passage of locks before assembling them again for the remainder of the journey.16 Additional operating costs of $11.4 million are incurred when tow operators break up their tows to accommodate the facility. Floodgate damages caused by strikes from towboats and barges account for almost $12.2 million in annual costs because of inefficient floodgate design.17

6.3.3 Seaport Performance

Exhibit 6-12 shows the total tonnage of freight shipped through Texas ports, the overall ranking of those ports within the top 100 U.S. ports (in 2013) and a breakdown by domestic and foreign tonnage.

14 USACE.

15 Texas Department of Transportation, August 2014 Master Plan for the Gulf Intracoastal Waterway in Texas.


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.

- **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 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.

### 6.4 Airports

#### 6.4.1 Condition

A number of factors, including runway lengths, can impact air cargo service. Runway lengths determine the size of aircraft that can land at an airport. A runway length of 8,000 feet is required for most domestic cargo planes, while a runway of 10,000 feet is generally required for most international operations. As shown in Exhibit 6-13, each of Texas’ top cargo airports...
can handle domestic cargo planes, while more than half are able to handle international operations.

<table>
<thead>
<tr>
<th>ID</th>
<th>Airport Name</th>
<th>Number of runways</th>
<th>Longest runway length (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFW</td>
<td>Dallas/Fort Worth International</td>
<td>7</td>
<td>13,401</td>
</tr>
<tr>
<td>IAH</td>
<td>George Bush Intercontinental</td>
<td>5</td>
<td>12,001</td>
</tr>
<tr>
<td>AFW</td>
<td>Fort Worth Alliance</td>
<td>2</td>
<td>9,600</td>
</tr>
<tr>
<td>SAT</td>
<td>San Antonio International</td>
<td>3</td>
<td>8,502</td>
</tr>
<tr>
<td>ELP</td>
<td>El Paso International</td>
<td>3</td>
<td>12,010</td>
</tr>
<tr>
<td>AUS</td>
<td>Austin-Bergstrom International</td>
<td>2</td>
<td>12,248</td>
</tr>
</tbody>
</table>

Source: 2012 Texas Airport Directory

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-airport 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.

### 6.4.2 Performance

In 2013, Texas ranked sixth among U.S. states in total annual air cargo tonnage loaded and unloaded on aircraft. States with a higher rank, such as Alaska and Tennessee, are key gateways for foreign air cargo and serve as hubs for major integrators like Federal Express (FedEX) and the United Parcel Service of America (UPS). Texas is home to six of the top 50 cargo airports in the U.S. in terms of landed weight in 2013, as shown in Exhibit 6-14.

<table>
<thead>
<tr>
<th>ID</th>
<th>Airport Name</th>
<th>2013 Landed Weight (lbs.)</th>
<th>U.S. Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFW</td>
<td>Dallas/Fort Worth International</td>
<td>3,062,528,160</td>
<td>10th</td>
</tr>
<tr>
<td>IAH</td>
<td>George Bush Intercontinental</td>
<td>1,704,234,283</td>
<td>17th</td>
</tr>
<tr>
<td>SAT</td>
<td>San Antonio International</td>
<td>737,330,634</td>
<td>29th</td>
</tr>
<tr>
<td>AFW</td>
<td>Fort Worth Alliance</td>
<td>636,920,725</td>
<td>36th</td>
</tr>
<tr>
<td>ELP</td>
<td>El Paso International</td>
<td>480,568,188</td>
<td>43rd</td>
</tr>
<tr>
<td>AUS</td>
<td>Austin-Bergstrom International</td>
<td>442,476,680</td>
<td>47th</td>
</tr>
</tbody>
</table>

Source: Federal Aviation Administration, All-Cargo Airports by Landing Weight
The declared capacity of an airport and its capability to move cargo is limited by performance issues. At a busy airport, air traffic controllers have to tactically manage the traffic demand, balancing arrivals and departures to ensure efficient operation. If the spacing between aircraft on final approach is not delivered consistently, larger gaps will lead to increased delays and lower runway throughput.

### 6.5 Pipelines

#### 6.5.1 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 growth in several areas of Texas. The continued success of this sector will be reliant on investment in pipeline infrastructure. Between 2010 and 2014, more than 16,000 miles of new pipeline were built, almost all to enhance transportation within the state. As a result, Texas has the largest oil and natural gas pipeline system in the nation with approximately 426,000 miles.  

Improvements to the privately owned pipeline infrastructure are critical to the performance of the Texas Freight Network as the role of pipelines grows. The extensive amount of crude oil and natural gas has created a need for both pipelines and alternative shipping modes. A number of privately owned pipelines are either coming online, under construction or in the first stages of development. Before construction of a pipeline can begin, legal requirements, including acquiring the rights to private land and obtaining government permits, must be addressed. Materials, equipment and workers must also be available.

Alleviating newly found pipeline bottlenecks and chokepoints will take time. The scale and speed with which tight-shale oil development has occurred, combined with growth from the Canadian oil sands, has made it difficult for many pipeline companies to adequately respond to quick growth. Pipeline permitting, private development and construction, coupled with increasingly remote production locations, contribute to inefficiencies as the state’s infrastructure and regulations catch up with development.

### 6.6 Safety

Improving Texas’ current safety record is critical to the performance of the Texas Freight Network. Driver behavior, vehicle characteristics and roadway features all contribute to

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vehicle crashes and fatalities. A safety analysis provides a snapshot of the performance of highways and at-grade highway-rail crossings on the Texas Highway Freight Network and Texas Rail Freight Network. Crash and incident data for commercial motor vehicles, at-grade highway-rail crossings and mainline railroad incidents provides the background for identifying problem areas.

### 6.6.1 Highways

As shown in Exhibit 6-15, the total number of commercial motor vehicle crashes and incapacitating injury crashes decreased on the Texas Highway Freight Network in 2011, as compared to 2010. However, there was a slight increase from 2011 to 2012. Sixty-two percent of the total commercial motor vehicle crashes occurred on the Texas Highway Freight Network, while 69 percent of commercial motor vehicle fatalities occurred on the Texas Highway Freight Network.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>15,880</td>
<td>272</td>
<td>535</td>
</tr>
<tr>
<td>2011</td>
<td>14,880</td>
<td>280</td>
<td>479</td>
</tr>
<tr>
<td>2012</td>
<td>16,356</td>
<td>303</td>
<td>541</td>
</tr>
<tr>
<td>Total</td>
<td><strong>47,116</strong></td>
<td><strong>855</strong></td>
<td><strong>1,555</strong></td>
</tr>
</tbody>
</table>

Source: TxDOT Crash Records Information System (CRIS)

Of the crashes involving commercial vehicles on the Texas Highway Freight Network between 2010 and 2012, 1.8 percent involved a fatality. For the same period, 28.7 percent of commercial motor vehicle crashes included an incapacitating, non-incapacitating or possible injury. Commercial vehicle crashes were more likely to happen in rural areas—almost 71 percent—while 55 percent of commercial motor vehicle crashes including a fatality occurred in urban areas. Sixty-eight percent of the roadway miles on the Texas Freight Highway Network are classified as rural, which explains why most commercial vehicle crashes take place in rural areas.

Since most of the commercial motor vehicle travel between 2010 and 2012 took place on higher classification roadways such as interstates with high daily traffic volumes, the majority of commercial vehicle crashes in Texas also happened on interstate facilities, particularly in rural areas. Additionally, most commercial motor vehicle crashes in Texas occurred on mainline roadways rather than at intersections.
Commercial Motor Vehicle Rollovers

Historical crash data from 2005 to 2009 indicates that large trucks are prone to roll over at particular speeds and locations.21 Exhibit 6-16 identifies the top commercial motor vehicle rollover locations. While several are near major urban areas, particularly Dallas-Fort Worth, many of the top rollover locations are outside of large cities, with the top location being at US 59/SL 224/South Street in Nacogdoches.

Exhibit 6-16: Commercial Motor Vehicle High Frequency Rollover Locations on Texas Highway Freight Network, 2005-2009

Source: American Transportation Research Institute

6.6.2 Railroads

Crash records from the Federal Railroad Administration Office of Safety Analysis show that the total annual number of crashes and resulting fatalities and injuries at highway-rail grade crossings in Texas has remained fairly stable since 2010. Exhibit 6-17 shows that most at-grade crashes occur on Class I tracks. This is to be expected, as Class I rail lines account for approximately 80 percent of track miles in the state.

21 ATRI, 2013.
Exhibit 6-17: At-Grade Railroad Accidents, 2010 and 2013

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th></th>
<th>2013</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Short line</td>
<td>Class I</td>
<td>Total</td>
<td>Short line</td>
</tr>
<tr>
<td>Crashes</td>
<td>28</td>
<td>185</td>
<td>213</td>
<td>33</td>
</tr>
<tr>
<td>Fatalities</td>
<td>3</td>
<td>21</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>Injuries</td>
<td>10</td>
<td>97</td>
<td>107</td>
<td>15</td>
</tr>
</tbody>
</table>

Source: Federal Railroad Administration

At-grade crossings are a primary safety concern for both the public and the freight railroads. More than 15,000 public and private at-grade rail crossings exist in Texas, with 75 highway-rail grade crossings on the Texas Highway Freight Network. Forty-eight at-grade rail crossings have a daily average of more than 500 commercial motor vehicle traffic crossing over the rail line. In the past 3 years, 17 crashes took place at nine of these crossings, resulting in no injuries or fatalities.

Passive and active crossings provide a minimum level of safety to alert motorists of oncoming trains. A robust at-grade crossing elimination plan is paramount to ensuring a safe, efficient and effective freight rail system in Texas.

6.6.3 Ports and Waterways

The responsibility for marine incident safety investigations is shared between the National Traffic Safety Board (NTSB) and the U.S. Coast Guard; 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 accidents 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.

For the GIWW, safe navigation in the narrow waterway is one of the most important issues for maritime authorities, waterway users and researchers. Accidents in narrow waterways include collisions between two vessels, single vessels striking fixed objects, groundings, fire and explosions, etc. Exhibit 6-18 summarizes the factors in Texas that can cause vessel incidents.
### Exhibit 6.18: Categories of Factors Causing Vessel Accidents

<table>
<thead>
<tr>
<th>Type</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geometric factor</td>
<td>Channel depth, width and length, structures, etc.</td>
</tr>
<tr>
<td>Traffic factor</td>
<td>Traffic volume, vessel speed, etc.</td>
</tr>
<tr>
<td>Weather factor</td>
<td>Visibility, wind direction, wind speed, etc.</td>
</tr>
<tr>
<td>Vessel design parameters and equipment failure</td>
<td>Radar failure, engine failure, vessel structure failure, etc.</td>
</tr>
<tr>
<td>Human factors</td>
<td>Inattentive officer of the watch, lack of communication, etc.</td>
</tr>
</tbody>
</table>


#### 6.6.4 Airports

The NTSB has the primary role of investigating every civil aviation accident 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 aircrafts rather than in dedicated air cargo freighters, 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 obtain, crashes could be linked to cargo weight balance, heavy loads, unsecured loads leading to cargo shift, crew error or fatigue.

#### 6.6.5 Pipelines

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 is responsible for documenting and investigating pipeline incidents and accidents. Exhibit 6.19 shows that pipeline incidents—including spills, injuries and fatalities—have remained stable over the last 10 years.

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6.7 Performance Measures

Transportation performance measures provide a framework to assess how a transportation system and/or a transportation agency is functioning and operating. Targeted performance measures established during the Freight Plan’s development support the identification of freight deficiencies 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:

1. **Plan Development:** Provide a method to quantify baseline system performance and the impacts of the Freight Plan’s options to support trade-off decisions and to communicate the anticipated impacts of different investment strategies.

2. **Plan Implementation:** Support the Freight Plan’s implementation by emphasizing agency goals/objectives and integrating those into budgeting, program structure, project selection and project/program implementation policies.

3. **Accountability:** Facilitate tracking and reporting on system performance relative to the Freight Plan’s goals and objectives to support accountability for implementation and results.
The development of performance measures was based on key elements identified through the Freight Plan planning process:

- Travel time reliability and predictability are critically important to shippers and receivers.
- Reliability and delays at border crossings for both trucks and rail are major system performance issues.
- Performance associated with highway-rail grade crossings is a concern relative to safety and the delays that incidents can cause to freight movement.
- Lane widths that follow existing design standards for high-volume truck routes are a safety performance consideration.
- Multimodal connectivity and the quality of access to freight facilities affect performance for trucking, ports and rail.
- Reduction of freight bottlenecks for all modes is a high priority.
- Upgrading short line rail capacity for speed and weight could positively influence the performance of the overall freight system.

The identified performance measures outlined in Exhibit 6-20 are based on stakeholder input 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 6-20 also identifies which performance measure(s) apply to each objective. Where objectives do not show a performance measure, TxDOT coordination with the respective lead agency is required to determine the performance measure. These objectives are noted with an asterisk.

Related to forecasting freight movement, the performance measures listed are consistent with the measures identified during Freight Plan development. Specific modal performance measures were omitted, as only performance measures that TxDOT can control and monitor are included in Exhibit 6-20.

### Exhibit 6-20: Performance Measures

<table>
<thead>
<tr>
<th>Goal</th>
<th>Objective</th>
<th>TxDOT's Role</th>
<th>Performance Measure</th>
</tr>
</thead>
</table>
| Safety | Reduce rates of crashes, fatalities and injuries on the Texas Freight Network. (All measures apply) | Lead / Support | 1. Truck-related crashes and fatalities  
2. Rail-related incidents/accidents  
3. At-grade rail crossing safety |
<p>|      | Increase the resiliency and security of the state’s freight transportation system. (All measures apply) | Lead |</p>
<table>
<thead>
<tr>
<th>Goal</th>
<th>Objective</th>
<th>TxDOT’s Role</th>
<th>Performance Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asset Management</strong></td>
<td>Achieve and maintain a state of good repair for all freight transportation modes. (Measure 1 applies)</td>
<td>Lead / Support</td>
<td>1. State of good repair on the Texas Highway Freight Network</td>
</tr>
<tr>
<td></td>
<td>Improve the overall ratings of bridges on the Texas Highway Freight Network. (Measure 1 applies)</td>
<td>Lead</td>
<td>2. Percent of Texas Highway Freight Network covered by targeted technologies</td>
</tr>
<tr>
<td></td>
<td>Improve the pavement conditions on the Texas Highway Freight Network. (Measure 1 applies)</td>
<td>Lead</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Utilize technology to provide for the resilience and security of the state’s freight transportation system. (Measure 2 applies)</td>
<td>Lead / Support</td>
<td></td>
</tr>
<tr>
<td><strong>Mobility and Reliability</strong></td>
<td>Reduce the number of Texas Highway Freight Network miles at unacceptable congestion levels. (All measures apply)</td>
<td>Lead</td>
<td>1. Annual hours of truck delay</td>
</tr>
<tr>
<td></td>
<td>Improve travel time reliability on the Texas Highway Freight Network. (All measures apply)</td>
<td>Lead</td>
<td>2. Truck reliability index</td>
</tr>
<tr>
<td></td>
<td>Utilize the most cost-effective methods to improve system capacity including technology and operations. (All measures apply)</td>
<td>Lead</td>
<td>3. Reduction in freight bottlenecks</td>
</tr>
<tr>
<td></td>
<td>Partner with federal and Mexican officials to resolve border-crossing challenges. (Not measured) *</td>
<td>Support</td>
<td>4. LOS</td>
</tr>
<tr>
<td><strong>Multimodal Connectivity</strong></td>
<td>Increase Texas supply chain efficiencies by improving connectivity between modes. (All measures apply)</td>
<td>Lead / Support</td>
<td>1. Annual hours of truck delay</td>
</tr>
<tr>
<td></td>
<td>Improve first/last mile connectivity between freight modes and major generators and gateways. (All measures apply)</td>
<td>Lead / Support</td>
<td>2. Truck reliability index</td>
</tr>
<tr>
<td></td>
<td>Improve connectivity between rural and urban freight centers. (Measures 1, 2 and 3 apply)</td>
<td>Lead / Support</td>
<td>3. Reduction in freight bottlenecks</td>
</tr>
<tr>
<td></td>
<td>Improve access into and out of Texas’ ports to facilitate projected future growth. (Not measured) *</td>
<td>Support</td>
<td>4. Number of airport cargo-access issues addressed</td>
</tr>
<tr>
<td></td>
<td>Improve ground access to cargo airports to enhance truck access and connectivity. (Measure 4 applies)</td>
<td>Lead / Support</td>
<td>5. Annual level of investment in rail access/increased capacity at major freight gateways and border crossings</td>
</tr>
<tr>
<td></td>
<td>Improve highway and rail connectivity to major freight gateways and generators through increased capacity improvements or additional rail connections. (Measure 5 applies)</td>
<td>Lead / Support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improve connectivity to Texas-Mexico border crossings through increased modal options. (Measures 1, 2 and 3 apply)</td>
<td>Support</td>
<td></td>
</tr>
<tr>
<td>Goal</td>
<td>Objective</td>
<td>TxDOT’s Role</td>
<td>Performance Measure</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>--------------</td>
<td>---------------------</td>
</tr>
<tr>
<td><strong>Stewardship</strong></td>
<td>Lead efforts to foster greater coordination among the agencies responsible for freight system investment. (Measure 3 applies)</td>
<td>Lead</td>
<td>1. Percent of design projects on the Texas Highway Freight Network delivered on time and within budget</td>
</tr>
<tr>
<td></td>
<td>Reduce project delivery delays. (All measures apply)</td>
<td>Lead</td>
<td>2. Percent of construction projects completed on the Texas Highway Freight Network delivered on time and within budget</td>
</tr>
<tr>
<td></td>
<td>Coordinate project planning and delivery with all planning partners and stakeholders. (All measures apply)</td>
<td>Lead</td>
<td>3. Number of workshops/meetings held with agencies</td>
</tr>
</tbody>
</table>
| | Reduce adverse environmental and community impacts of the freight transportation system. (All measures apply) | Lead / Support | 1. Status of freight prioritization process implementation  
2. Number of formal partnerships developed with private-sector industries, communities, agencies and other transportation stakeholders  
3. Number of educational materials distributed and workshops/meetings held with TxDOT districts, departments and elected officials |
| **Customer Service** | Implement a performance-based prioritization process for freight system investment. (Measure 1 applies) | Lead | 1. Status of freight prioritization process implementation  
2. Number of formal partnerships developed with private-sector industries, communities, agencies and other transportation stakeholders  
3. Number of educational materials distributed and workshops/meetings held with TxDOT districts, departments and elected officials |
| | Develop and nurture partnerships with private-sector industries, communities, agencies and other transportation stakeholders. (Measure 2 applies) | Lead | 1. Status of freight prioritization process implementation  
2. Number of formal partnerships developed with private-sector industries, communities, agencies and other transportation stakeholders  
3. Number of educational materials distributed and workshops/meetings held with TxDOT districts, departments and elected officials |
| | Increase freight expertise in TxDOT districts, across departments and among elected officials. (Measure 3 applies) | Support | 1. Status of freight prioritization process implementation  
2. Number of formal partnerships developed with private-sector industries, communities, agencies and other transportation stakeholders  
3. Number of educational materials distributed and workshops/meetings held with TxDOT districts, departments and elected officials |
| | Enhance workforce recruitment and retention in the transportation and logistics industry. (Not measured) * | Support | 1. Status of freight prioritization process implementation  
2. Number of formal partnerships developed with private-sector industries, communities, agencies and other transportation stakeholders  
3. Number of educational materials distributed and workshops/meetings held with TxDOT districts, departments and elected officials |
| **Sustainable Funding** | Identify potential public and private revenue sources to fund priority freight projects. (Measure 1 applies) | Lead | 1. Amount of net new funding made available for freight projects  
2. Amount from assessment of the state’s transportation infrastructure and mobility needs |
| | Identify and document the needed transportation investment costs to meet the state’s future freight transportation needs. (Measure 2 applies) | Lead / Support | 1. Amount of net new funding made available for freight projects  
2. Amount from assessment of the state’s transportation infrastructure and mobility needs  
3. Compare annual projected vs. actual state and federal revenue projections |
| | Educate the public and stakeholders on the costs of constructing and preserving the system. (Measure 4 applies) | Lead | 1. Amount of net new funding made available for freight projects  
2. Amount from assessment of the state’s transportation infrastructure and mobility needs  
3. Compare annual projected vs. actual state and federal revenue projections  
4. Number of workshops/meetings held with the public and stakeholders |
| | Improve predictive capabilities for revenue forecasting and long-term needs assessments. (Measure 3 applies) | Lead | 1. Amount of net new funding made available for freight projects  
2. Amount from assessment of the state’s transportation infrastructure and mobility needs  
3. Compare annual projected vs. actual state and federal revenue projections  
4. Number of workshops/meetings held with the public and stakeholders |
<table>
<thead>
<tr>
<th>Goal</th>
<th>Objective</th>
<th>TxDOT’s Role</th>
<th>Performance Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic Competitiveness and Efficiency</strong></td>
<td>Strengthen Texas’ position as a trade and logistics hub by improving and maintaining Texas Freight Network infrastructure and connectivity to enhance trade routes and increase the flow of goods. (Measures 2 and 3 apply)</td>
<td>Lead / Support</td>
<td>1. LOS on key trade routes 2. Annual hours of truck delay 3. Pavement conditions</td>
</tr>
<tr>
<td></td>
<td>Expand public-private partnerships to facilitate investments in freight projects that enhance economic development and global competitiveness. (Measure 4 applies)</td>
<td>Lead / Support</td>
<td>4. Number of public-private partnerships 5. Number of educational materials distributed 6. Number of stakeholder meetings conducted</td>
</tr>
<tr>
<td></td>
<td>Identify critical freight infrastructure improvements necessary to support the capacity requirements of future supply chain, logistics, and consumer demands. (Measures 1, 4, 5 and 6 apply)</td>
<td>Lead / Support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conduct outreach activities and develop an educational campaign to increase awareness of the importance of freight to the Texas economy. (Measures 5 and 6 apply)</td>
<td>Lead</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Support strategic transportation investments to address the rapid increase in key industries, such as energy, agriculture and automotive products. (Measures 1 and 2 apply)</td>
<td>Lead / Support</td>
<td></td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Integrate existing traffic management centers to facilitate statewide dissemination of real-time traveler information to improve safety and travel time reliability. (Measures 1, 2 and 3 apply)</td>
<td>Lead</td>
<td>1. Number of dynamic messaging signs 2. Annual hours of truck delay 3. Truck reliability index 4. Reduced border wait times</td>
</tr>
<tr>
<td></td>
<td>Support development and deployment of integrated border-crossing management through the integration of intelligent transportation systems across international borders. (Measure 4 applies)</td>
<td>Support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Support deployment of innovative technologies to enhance safety and efficiency of the Texas Freight Network. (Measures 2 and 3 apply)</td>
<td>Lead / Support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improve management and operations of the existing transportation system to improve freight network performance and improve safety and travel time reliability. (Measures 2 and 3 apply)</td>
<td>Lead</td>
<td></td>
</tr>
</tbody>
</table>

* TxDOT coordination with respective lead agency is required to determine performance measure
Understanding the condition and performance of Texas’ freight transportation assets helps identify Texas Freight Network needs and issues, highlights the strengths and problems of the freight system and aids in developing Freight Plan recommendations. This information also provides a baseline for tracking progress toward meeting TxDOT’s strategic goals. The complexity of the Texas Freight Network, and the interconnection of modes, requires close coordination between all stakeholders to ensure strong performance across the network.
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Texas Freight Mobility Plan

Chapter 7: Freight Forecast

Final January 25, 2016
Efficient goods movement in Texas is dependent on an integrated and constantly improving freight system that keeps up with growing demand from businesses and consumers. Freight demand is closely tied to population and employment growth, which for Texas, are expected to grow to 45 million people and 15.8 million jobs by 2040. The state also serves as a hub for national and international freight flows. These characteristics make future freight forecasts critical in planning for transportation mobility and economic vitality in Texas. This chapter discusses:

- **The Big Picture:** This section describes the freight modes and tonnage estimates for 2014 and 2040; the movements of freight out of, into, within and through Texas; the key commodities being transported; and the key drivers of freight.

- **Forecasts by Mode:** Significant freight movement modes and border crossings are discussed, and summaries of commodities, freight flows and a brief “bottom line” evaluation of each mode with respect to growth are also outlined.

These forecasts provide the Texas Department of Transportation (TxDOT) and its partners with the critical information needed to plan for future improvements to Texas’ freight transportation system.

### 7.1 The Big Picture

Population and employment estimates are based on the Texas Statewide Analysis Model version 3 (SAMv3 dated Sept 2013). 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. The 2014 and 2040 forecasts are primarily based on the 2010 Texas TRANSEARCH® database and 2011 data from the U.S. Army Corps of Engineers (USACE).

The TRANSEARCH® database is a comprehensive source of freight data by mode, movement and commodity. For Texas, this data is provided at the county level for 2010 and 2040. With the limitations of the TRANSEARCH® database for the water mode, USACE data was used. Detailed analysis and comparison of freight tonnage and growth rates with other data sources revealed these two data sources provide the most reasonable freight forecasts. Technical details of the forecasting analysis can be found in Technical Memorandums associated with the Freight Plan.

#### 7.1.1 Texas Freight Modes

Freight in Texas consists of five major surface modes: highway, rail, water, air and pipelines. Exhibit 7-1 shows the relative freight tons and value per mode in 2014. Highway transport accounts for the majority of tonnage (52 percent) carried on the system and most of the value (58 percent) carried on the system. Rail transport has the second highest freight by value at $589.9 billion (25 percent) and 397.5 million tons (20 percent). Water transport is
significant, at 556.7 million tons (28 percent) and $414.4 billion (17 percent) of freight value carried on the system. Air transport is comparatively small in terms of tonnage and value.

Pipeline conveyance tonnage is significant and is covered separately in Section 7.2.

Exhibit 7-1: Texas Total Freight Tons and Value by Surface Modes, 2014

<table>
<thead>
<tr>
<th>Mode</th>
<th>2014 Tonnage (Thousands of Tons)</th>
<th>2014 Value ( Millions of $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>1,219 (&lt;1%)</td>
<td>$7,296 (&lt;1%)</td>
</tr>
<tr>
<td>Rail</td>
<td>397,538 (20%)</td>
<td>$589,893 (25%)</td>
</tr>
<tr>
<td>Truck</td>
<td>1,043,284 (52%)</td>
<td>$1,400,092 (58%)</td>
</tr>
<tr>
<td>Water</td>
<td>556,666 (28%)</td>
<td>$414,399 (17%)</td>
</tr>
</tbody>
</table>

Exhibit 7-2 shows the projected relative freight tons and value per mode in 2040. In 2040, the truck mode is forecast to be the dominant mode, carrying 59 percent of the total tonnage and 65 percent of the cumulative freight value. Water and rail are estimated to be equal, carrying 21 and 20 percent of tonnage, respectively. However, the value of freight carried on rail is projected to be significantly higher than water. Air transport is forecast to be comparatively small in terms of tons and value at less than 1 percent of the total.
Tonnage across the Texas Freight Network for highway, rail, water and air is forecast to grow from 2 billion tons to 3.76 billion tons, which is an 88 percent growth between 2014 and 2040. An additional 1.76 billion tons of freight is projected to move on the freight system in 2040. This growth is further detailed below:

- **Truck:** Truck volumes are expected to double from 1.04 billion tons in 2014 to 2.19 billion tons in 2040—an increase of 1.15 billion tons and a projected average annual growth of 2.9 percent.

- **Rail:** The share of statewide freight tonnage moved by rail is expected to increase from 15 percent to 17 percent by 2040. Rail is expected to almost double in tonnage from 397.5 million tons to 764.3 million tons by 2040—a projected increase of 366.8 million tons and an average annual growth of 2.5 percent.

- **Water:** Water tonnage is projected to grow from 556.7 million tons to 797 million tons by 2040, an increase of 240.3 million tons and a growth of 43 percent—a projected average annual growth of 1.4 percent.

- **Air:** Air is estimated to yield the fastest growth, from 1.2 million to 3.6 million tons—an increase of 2.4 million tons between 2014 and 2040. This is a total growth of 197 percent at an average annual growth of 4.3 percent. While the growth rate is the highest of all modes, air carries the least amount of freight.

The expected high growth across all modes is indicative of the diversity and strength of the Texas Freight Network. The high growth in freight movements also creates extensive demand for new and improved freight infrastructure and highlights the importance of aligning the freight system with this projected growth.
7.1.2 Texas Freight Movements

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.
- **Intra**: Freight transported between origins and destinations entirely within Texas.
- **Through**: Freight transported to origins and destinations outside of Texas but passing through the state.

Texas freight forecasts by movement show that intrastate movements have the largest projected tonnage increase from 821 million tons in 2014 to 1.64 billion tons in 2040. Although relatively small in terms of tonnage, through-traffic is forecast to increase the most at 141 percent growth, followed by outbound, intrastate and inbound (Exhibit 7-3). Factors contributing to these projections include anticipated population and employment growth, increases in consumption per person, the state’s oil and gas development and the growth of manufacturing and trade with Mexico. Intrastate trucking forecasts the largest tonnage growth; it is predicted to increase by 770 million tons, or almost half of the 1.76 billion ton growth for all flows and surface freight modes. Almost half of the total freight tonnage growth is projected to be transported via trucks between origins and destinations within the state.

![Exhibit 7-3: Texas Total Freight Tons by Movement, 2014 and 2040](source: Based on TRANSEARCH® and USACE data)
### 7.1.3 Texas Freight Commodities

Petroleum or coal products are the top commodity tonnages in 2014 for highway, rail, water and air, followed by nonmetallic minerals, chemicals or allied products and crude petroleum or natural gas, as shown in Exhibit 7-4. The projected statewide top commodities in 2040 are evenly distributed at 12 to 13 percent for nonmetallic minerals, chemicals or allied products, petroleum or coal products and secondary traffic. Petroleum or coal products are predicted to decrease by 7 percent as other commodities increase between 2014 and 2040.

#### Exhibit 7-4: Texas Freight Forecasts – Tonnage by Top Commodities, 2014

<table>
<thead>
<tr>
<th>Commodity</th>
<th>2014 Total Tonnage Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum or Coal Products</td>
<td>19%</td>
</tr>
<tr>
<td>Nonmetallic Minerals</td>
<td>13%</td>
</tr>
<tr>
<td>Chemicals or Allied Products</td>
<td>11%</td>
</tr>
<tr>
<td>Crude Petrol. or Natural Gas</td>
<td>10%</td>
</tr>
<tr>
<td>Secondary Traffic</td>
<td>8%</td>
</tr>
<tr>
<td>Food or Kindred Products</td>
<td>6%</td>
</tr>
<tr>
<td>Clay, Concrete, Glass or Stone</td>
<td>6%</td>
</tr>
<tr>
<td>Farm Products</td>
<td>6%</td>
</tr>
<tr>
<td>Coal</td>
<td>5%</td>
</tr>
<tr>
<td>Misc Mixed Shipments</td>
<td>3%</td>
</tr>
<tr>
<td>Remaining Commodities</td>
<td>13%</td>
</tr>
</tbody>
</table>

Source: Based on TRANSEARCH® and USACE data

Exhibit 7-5 illustrates significant differences of the top commodities by transport mode for 2014. Petroleum or coal products, which have the highest tonnage movements, were primarily moved by water and truck. Trucks led many of the top commodity movements, especially nonmetallic minerals; chemicals or allied products; secondary traffic; food or kindred products; and clay, concrete, glass or stone, as well as the category for remaining commodities. Comparatively, rail was the dominant mode for coal and miscellaneous mixed shipments, while also carrying a significant share of chemicals or allied products, nonmetallic minerals and farm products.

1 Secondary traffic is mainly last mile or warehousing and distribution delivery shipments. It is reasonable that only the truck mode moves secondary traffic freight due to the nature of this mode.
7.1.4 *Drivers of Freight*

Freight is demand driven and is closely tied to population and employment, and it has a large impact on the Texas transportation system. Access to homes and businesses is important for mobility and economic prosperity for shippers and carriers.

Exhibit 7-6 and Exhibit 7-7 show that the majority of Texas’ population (72.5 percent) and employees (82.2 percent) are projected to be living within 5 miles of the Primary Freight Network in 2040. Higher percentages of the future population (87.2 percent) and employment (92.4 percent) are located within 5 miles of the Secondary Freight Network/Emerging Freight Corridors. This proximity demonstrates the importance of the freight system to businesses and residents and the need for an accessible and well-maintained transportation network.
Exhibit 7-6: Population Density within 5-Mile Buffer of the Primary Freight Network, 2040

Exhibit 7-7: Employment Density within 5-Mile Buffer of the Primary Freight Network, 2040
Exhibit 7-8 compares the projected growth of population and employment with vehicle miles traveled (VMT). The projection includes automobiles and light trucks (vehicle classes 1 through 7); heavy trucks (vehicle classes 8 through 14); and freight tonnage between 2014 and 2040. Heavy truck VMT growth, estimated at 89 percent between 2014 and 2040, exceeds the growth for all other categories. With this growth outpacing total VMT, heavy truck traffic will be more visible on Texas roadways, indicating the importance of strategies to minimize conflict points between trucks and passenger vehicles, improve truck accessibility on the network and provide other modal options (beyond trucks) to address the growth in freight movements.

Exhibit 7-8: Statewide Growth Rates, 2014 to 2040

<table>
<thead>
<tr>
<th>Growth (2014-2040)</th>
<th>Population</th>
<th>Employment</th>
<th>VMT (Total)</th>
<th>VMT (Auto &amp; Light Truck)</th>
<th>VMT (Heavy Truck)</th>
<th>Total Freight</th>
</tr>
</thead>
<tbody>
<tr>
<td>48.8%</td>
<td>62.4%</td>
<td>50.2%</td>
<td>46.6%</td>
<td>89.3%</td>
<td>69.5%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Based on TX SAMv3 data for population, employment, and VMT; Freight Plan Forecast Framework data for VMT; and TRANSEARCH®, FAF, and USACE data for freight estimated growth

Texas’ position as a national and international trading gateway is another driver for growth. Total freight tonnage is expected to outpace population and employment growth due to goods from Texas—such as manufacturing, electronics, oil/energy, etc.—being moved out of the state. Freight tonnage growth is also projected to result from goods imported to Texas at major gateways, such as the Port of Houston and the Port of Beaumont, international POEs and the World Trade Bridge and Pharr-Reynosa International Bridge, international POEs, with destinations within and outside of Texas.
Exhibit 7-9 and Exhibit 7-10 show the forecast population and employment growth by county between 2014 and 2040.

- The highest growth in population is projected in the following areas:
  - Urbanized areas including Bexar, Collin, Dallas, Harris, Hidalgo, Tarrant and Williamson counties anticipate high growth. Significant growth is also projected in many border counties, including El Paso, Webb and Cameron counties.
  - Population will continue to grow in the IH-35 corridor between Dallas-Fort Worth and San Antonio.

- Employment growth is focused in Bexar, Dallas, Harris, Tarrant and Travis counties, which overlap with many of the state’s key freight corridors.

Exhibit 7-9: Change in Population, 2014 to 2040

Source: Based on TX SAM v3 projections
A large increase in freight movements for areas with high population and employment growth is also forecast. Exhibit 7-11 shows the projected county level changes in freight between 2014 and 2040 across all modes.

- Freight tonnage is projected to increase through most of the state.
- The change in freight tonnage is consistent with the changes in population and employment.
- As with population and employment growth, projected freight tonnage growth in urban areas and along the IH-35 corridor is high. The growth along the IH-35 corridor is also an indication of its importance as a North American Free Trade Agreement (NAFTA) corridor.
- High freight tonnage growth in Webb County and along the Eagle Ford Shale deposits is also reflected in the projected population, employment and freight tonnage growth maps.
- Counties in the Permian Basin are expected to experience more freight growth by 2040 than population and employment growth.
Dense urban areas that outpace statewide employment and population growth rates will see the highest percentage of freight tonnage increase. Areas serving as major freight gateways and generators show heavy freight growth. These include the manufacturing and distribution centers of Dallas-Fort Worth Metroplex; the Port of Houston; the Laredo and El Paso border crossings; and agricultural and energy gateways in Lubbock, Amarillo and Midland-Odessa.

These forecast drivers of freight are consistent across multiple sources of data and give a realistic snapshot of the expected 2040 freight flows.

7.2 Forecasts by Mode

The 2014 and 2040 freight forecasts are provided in this section by mode. Major commodity totals and directional movements of freight flows are examined by mode and a summary of the freight bottom line is also provided.

7.2.1 Highways

Truck tonnage is forecast to increase from 1.04 billion in 2014 to 2.19 billion in 2040, a cumulative increase of 110 percent. This translates into an increase of 44.9 million heavy truck VMT between 2014 and 2040 for an estimated total of 95.1 million heavy truck VMT.
on Texas roadways in 2040. In 2014, an estimated 587,900 daily truck trips occurred on Texas roadways, and this is projected to almost double to 1,084,500 daily truck trips in 2040.

**Commodities**

Exhibit 7-12 compares major commodity tonnage movements by truck in 2014 and 2040.

- **Total Tonnage:** Major commodities transported by truck in 2040 are projected to include secondary 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 2014 and 2040.

**Exhibit 7-12: Texas Truck Freight Forecast by Major Commodity, 2014 and 2040 Tonneage**

<table>
<thead>
<tr>
<th>Commodity</th>
<th>2014 Tonnage Share</th>
<th>2040 Tonnage Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary Traffic</td>
<td>15%</td>
<td>20%</td>
</tr>
<tr>
<td>Nonmetallic Minerals</td>
<td>19%</td>
<td>18%</td>
</tr>
<tr>
<td>Clay, Concrete, Glass or Stone</td>
<td>10%</td>
<td>12%</td>
</tr>
<tr>
<td>Chemicals or Allied Products</td>
<td>9%</td>
<td>6%</td>
</tr>
<tr>
<td>Food or Kindred Products</td>
<td>9%</td>
<td>4%</td>
</tr>
<tr>
<td>Petroleum or Coal Products</td>
<td>12%</td>
<td>6%</td>
</tr>
<tr>
<td>Agriculture Products</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>Lumber or Wood Products</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Waste or Scrap Materials</td>
<td>6%</td>
<td>4%</td>
</tr>
<tr>
<td>Electrical Equipment</td>
<td>1%</td>
<td>3%</td>
</tr>
<tr>
<td>Remaining Commodities</td>
<td>13%</td>
<td>13%</td>
</tr>
</tbody>
</table>

Source: Based on TRANSEARCH® data

**Movements**

Exhibit 7-13 shows the directional composition of truck movements in Texas for 2014 and 2040. Truck movements are predicted to be relatively constant in the future. However, intrastate truck movement is projected to double between 2014 and 2040.
**Bottom Line**

Exhibit 7-14 shows the total highway freight tonnage in 2010, and Exhibit 7-15 compares the projected tonnage flows in 2040. These maps indicate that the highest increases in truck volumes are on IH-10, IH-35, IH-40 and IH-45, with more than 50 million tons of freight moving by trucks on these corridors annually.

Exhibit 7-14: Texas Highway Freight Tonnage, 2010

Source: Based on TRANSEARCH® data for 2010 and 2040
Truck tons on Texas highways are expected to increase by 110 percent to 2.19 billion tons in 2040. A detailed corridor-level assessment of the highway Primary Freight Network indicates that 19.4 percent centerline miles are considered unacceptable in 2014, as shown in Exhibit 7-16, and 45.7 percent of the centerline miles will be considered unacceptable by 2040, as shown in Exhibit 7-17. This indicates that additional lane miles are necessary to maintain adequate level-of-service (LOS) conditions in 2040, defined as LOS of C or better. Highway corridor sections predicted as unacceptable LOS in 2040 include:

- IH-10 from IH-20 to El Paso.
- IH-10 from Houston to San Antonio.
- IH-20 from Fort Worth to US 84.
- IH-35 from Dallas-Fort Worth to Laredo.
- IH-45 from Dallas-Fort Worth to Galveston.
- US 59 from IH-20 to Houston.
Some corridor sections show improved LOS between 2014 and 2040 because of projects with programmed funds. Locations on IH-35 in San Antonio and in Dallas-Fort Worth to the Oklahoma state line have committed funding to increase capacity.

Exhibit 7-16: Highway Primary Freight Corridors Level-of-Service Map, 2014

Source: Based on Forecast Framework analysis
A detailed assessment of the highway Secondary Freight Network/Emerging Freight Corridors also indicates some deficiencies in 2040. These forecasts show that 11 percent of the overall highway Secondary Freight Network/Emerging Freight Corridors will be unacceptable in 2040 (Exhibit 7-18). Most of the 2040 deficiencies are forecast for urbanized areas.

Further details of the forecasting analysis for both the highway Primary Freight Network and Secondary Freight Network/Emerging Freight Corridors can be found in Technical Memorandums associated with this Freight Plan.
7.2.2 Railroads

In 2014, rail accounted for 20 percent, or 397.5 million tons, of total freight movement in Texas. Rail tonnage is estimated to increase to 764.3 million in 2040 and remain at 20 percent of total freight movements.
Commodities

Exhibit 7-19 highlights major commodity tonnage movements by rail in 2014 and 2040.

- **Total Tonnage:** Major rail commodities transported by rail in 2040 are projected to include miscellaneous mixed shipments, chemicals or allied products and farm products.

- **Tonnage Growth:** Waste or scrap materials, transportation equipment and miscellaneous mixed shipments are the top commodities transported by rail with the highest tonnage growth rates between 2014 and 2040.

Exhibit 7-19: Texas Rail Freight Tonnage Forecast by Commodity, 2014 and 2040 Tonnage

<table>
<thead>
<tr>
<th>2014 Rail Tonnage Share by Commodity</th>
<th>2040 Rail Tonnage Share by Commodity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal 19%</td>
<td>Coal 6%</td>
</tr>
<tr>
<td>Food or Kindred Products 8%</td>
<td>Food or Kindred Products 8%</td>
</tr>
<tr>
<td>Nonmetallic Minerals 10%</td>
<td>Nonmetallic Minerals 10%</td>
</tr>
<tr>
<td>Farm Products 11%</td>
<td>Farm Products 11%</td>
</tr>
<tr>
<td>Transportation Equipment 3%</td>
<td>Transportation Equipment 5%</td>
</tr>
<tr>
<td>Remaining Commodities 11%</td>
<td>Remaining Commodities 10%</td>
</tr>
<tr>
<td>Miscellaneous Shipment 14%</td>
<td>Miscellaneous Shipment 25%</td>
</tr>
<tr>
<td>Chemicals or Allied Products 17%</td>
<td>Chemicals or Allied Products 17%</td>
</tr>
<tr>
<td>Waste or Scrap Materials 2%</td>
<td>Waste or Scrap Materials 3%</td>
</tr>
<tr>
<td>Primary Metal Products 3%</td>
<td>Primary Metal Products 3%</td>
</tr>
<tr>
<td>Clay, Concrete, Glass or Stone 2%</td>
<td>Clay, Concrete, Glass or Stone 2%</td>
</tr>
<tr>
<td>Remaining Commodities 11%</td>
<td>Remaining Commodities 10%</td>
</tr>
</tbody>
</table>

Source: Based on TRANSEARCH® data

Movements

Exhibit 7-20 shows the relatively constant directional composition of rail movements, with respect to value composition, in Texas between 2014 and 2040. Directional volume composition alters over the same period, with the relative share of inbound traffic decreasing from 45 percent to 35 percent and through-traffic volumes increasing from 29 percent to 36 percent.
**Exhibit 7-20: Texas Rail Freight Tonnage Forecast by Direction, 2014 and 2040 Tonnage**

![Bar chart showing freight tonnage forecast by direction for 2014 and 2040.](chart)

**Source:** Based on TRANSEARCH® data

**Bottom Line**
The number of rail tons is expected to increase by 366.8 million tons, or 92 percent, resulting in 764.3 million tons in 2040. **Exhibit 7-21** depicts the 2010 freight tonnage on the Texas Rail Freight Network. As shown in **Exhibit 7-22** for 2040 projected rail freight tonnage, rail lines are expected to handle the greatest increase in freight movements in Texas. These connections include Fort Worth and El Paso, Fort Worth and Amarillo and the northeast/southwest line traversing the Panhandle through Amarillo.

The rail lines expected to handle the greatest increase in freight movements in Texas are between:

- BNSF Railway lines between the Texas state line and Amarillo and between Amarillo and Fort Worth.
- Various Union Pacific lines between Texas cities, including Abilene to/from Fort Worth, Brownsville to/from Corpus Christi, Flatonia to/from Caldwell, Laredo to/from San Antonio and Marshall to/from Jefferson.
- Through-rail traffic, which is projected to be the largest rail movement in 2040 at 276.1 million tons and 36 percent of total rail movements.

Future freight demand is subject to private investment, which could alter demand and travel patterns. System capacity improvements were not considered in these forecasts and may also alter these estimates.
Exhibit 7-21: Texas Rail Freight Tonnage, 2010

Source: Based on TRANSEARCH® data

Exhibit 7-22: Projected Texas Rail Freight Tonnage, 2040

Source: Based on TRANSEARCH® data
7.2.3 Ports and Waterways

Based on USACE data and TRANSEARCH® data, Texas water tonnage is estimated to increase from 556.7 million in 2014 to 797.0 million in 2040—an increase of 43.2 percent.

Commodities

Exhibit 7-23 summarizes major commodity tonnage movements by water in 2014 and 2040.

- **Total Tonnage:** In 2040, the largest commodities transported by water are projected to include crude petroleum or natural gas and chemicals or allied products.

- **Tonnage Growth:** Of the top 10 commodities transported by water, farm products, waste or scrap materials and remaining commodities have the highest rates of tonnage growth between 2014 and 2040.

Exhibit 7-23: Texas Water Freight Tonnage Forecast by Commodity, 2014 and 2040 Tonnage

**2014 Water Tonnage Share by Commodity**

- Crude Petrol. or Natural Gas: 59%
- Chemicals or Allied Products: 21%
- Nonmetallic Minerals: 6%
- Farm Products: 4%
- Waste or Scrap Materials: 3%
- Remaining Commodities: 7%

**2040 Water Tonnage Share by Commodity**

- Crude Petrol. or Natural Gas: 44%
- Chemicals or Allied Products: 30%
- Nonmetallic Minerals: 6%
- Farm Products: 7%
- Waste or Scrap Materials: 5%
- Remaining Commodities: 8%

Source: Based on TRANSEARCH® and USACE data

Movements

Exhibit 7-24 shows the forecast directional composition of water movements in Texas between 2014 and 2040. 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 along the Gulf Intracoastal Waterway (GIWW). Directional composition shows a shift in water freight to more outbound movements from 2014 to 2040. Inbound traffic is projected to be more prevalent than any other movement in both years, although inbound and outbound movements are relatively equal in 2040. Outbound traffic grows 92 percent from 2014 to 2040, while inbound and intrastate traffic increase approximately 19 and 18 percent, respectively. Less waterborne freight will move intrastate along the GIWW. However, system capacity improvements may alter these forecast estimates.
Bottom Line
Water tonnage is expected to increase by 43 percent from 2014 totals to 797 million tons in 2040:

- Cameron and Chambers counties are projected to double in water tonnage between 2014 and 2040.
- Galveston, Harris and Jefferson counties have the highest magnitudes of water tonnage.
- Combined, these counties are projected to have more than half of the state’s water tonnage in 2040 at 602.5 million projected tons.
- Galveston County is expected to grow from approximately 74 million tons in 2014 to 112 million tons in 2040, and Harris County, containing the Port of Houston, is expected to grow from 223.7 million tons to just over 305 million tons between 2014 and 2040.
- Nueces County is forecast to increase from approximately 75.3 million tons in 2014 to 95 million tons in 2040.
- San Patricio County is projected to increase from approximately 19.5 million tons in 2014 to 27.7 million tons in 2040.
7.2.4 Air

Air tonnage is forecast to increase from 1.2 million in 2014 to 3.6 million in 2040, which is an increase of 197.4 percent.

Commodities

Exhibit 7-25 summarizes forecast major commodity tonnage movements by air in 2014 and 2040.

- **Total Tonnage:** The major air commodity in 2040 is projected to be miscellaneous mixed shipments (3.4 million tons or a 95.1 percent share), growing from a 2014 base of 1.1 million tons for a cumulative growth of 204.7 percent.

- **Tonnage Growth:** The majority of air freight is classified as miscellaneous mixed shipments. The other commodity showing a projected growth rate between 2014 and 2040 is remaining commodities.

Exhibit 7-25: Texas Air Freight Tonnage Forecast by Commodity, 2014 and 2040 Tonnage

Movement

Exhibit 7-26 shows the relatively constant directional composition of air freight movements in Texas between 2014 and 2040. Inbound movements carry the largest share of air freight, and intrastate movements have the highest percent increase between 2010 and 2040, at 348 percent.
**Bottom Line**

Air tonnage is expected to increase by 197 percent, or 2.41 million tons, in 2040. Tarrant County, home to Alliance airport, is forecast to transport approximately half of the airport freight tonnage in 2040. Furthermore, Tarrant County and Bexar County, home to San Antonio airport, are projected to more than triple the amount of air tonnage that was transported in 2014.

### 7.2.5 Pipeline

Pipelines are a complex mode and are treated separately. The Freight Analysis Framework (FAF) estimates that Texas has 38 percent of the nation’s pipelines, which are privately owned. The 2014 estimated tonnage was 654.6 million, also from FAF. There is currently no reliable means to develop future forecasts. Combined with the four major surface modes, pipeline freight movement resulted in a 25 percent share of overall Texas freight movement in 2014, as shown in Exhibit 7-27.
Exhibit 7-27: Texas Total Freight Tons and Value by Mode Including Pipeline, 2014

2014 Tonnage (Thousands of Tons)

- Air: 1,219 (<1%)
- Water: 556,666 (21%)
- Pipe: 654,635 (25%)
- Truck: 1,043,284 (39%)
- Rail: 397,538 (15%)

2014 Value (Millions of $)

- Air: $7,296 (<1%)
- Water: $314,914 (12%)
- Pipe: $414,399 (15%)
- Rail: $1,400,092 (51%)
- Truck: $414,399 (22%)

Source: Based on TRANSEARCH®, FAF and USACE data

Commodities

Exhibit 7-28 shows major commodity tonnage movements by pipeline in 2014. These movements are comprised of three commodities: crude petroleum or natural gas, petroleum or coal products and chemicals or allied products. Pipelines carry 64 percent of crude petroleum or natural gas, 43 percent of petroleum or coal products and 13 percent of chemicals or allied products.

Exhibit 7-28: Texas Pipeline Tonnage Forecast by Commodity, 2014 Tonnage

2014 Pipeline Tonnage Share by Commodity

- Crude Petrol. or Natural Gas: 52%
- Petroleum or Coal Products: 43%
- Chemicals or Allied Products: 5%

2040 Pipeline Tonnage Share by Commodity

- Crude Petrol. or Natural Gas: 59%
- Petroleum or Coal Products: 36%
- Chemicals or Allied Products: 5%

Source: Based on TRANSEARCH® and FAF data
Movements

Exhibit 7-29 depicts the directional composition of pipeline movements in Texas for 2014.

![Exhibit 7-29: Texas Pipeline Forecast by Direction, 2014 Tonnage](chart)

**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, it is a challenge to develop a reliable forecast for 2040. However, most experts project steady growth.

**7.2.6 International Border Crossings**

International border-crossing movements at the 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. Specific U.S.-Mexico border crossing movements through Texas are presented in this section.

Nearly 61.7 million tons of highway and rail freight crossed the Texas-Mexico border in 2014, valued at more than $246.7 billion. More than 182.4 million tons of highway and rail freight are projected to cross the international border in 2040. Approximately 95 percent of Texas’ northbound freight movement by trucks in 2014 was concentrated in five ports: Laredo, El Paso, Brownsville, Eagle Pass and El Paso. Trucks are predicted to be the dominant mode for cross-border freight movement, accounting for 83 percent in 2014 and 84 percent in 2040.

**Commodities**

Commodities for international border crossings are presented for both inbound and outbound movements for the highway and rail modes.
Highways
The top inbound commodity movements by highway for 2014 were food or kindred products, farm products and petroleum or coal products. These commodities made up half of the inbound highway tonnage crossing from Mexico to Texas. Top outbound commodity movements included chemicals or allied products, petroleum or coal products and food or kindred products, which totaled approximately 40 percent of the outbound highway tonnage crossing from Texas to Mexico.

Railroads
Approximately 85 percent of the total inbound rail tonnage crossing from Mexico to Texas included Petroleum or coal products and primary metal products. Electrical equipment, transportation equipment and chemicals or allied products also generated significant tonnage. Top outbound commodity movements included petroleum or coal products, at approximately 30 percent of the total outbound rail tonnage crossing from Texas to Mexico. Chemicals or allied products; farm products; and pulp, paper or allied products followed with 50 percent of the total outbound rail tonnage crossing from Texas to Mexico.

Movements
In both 2014 and 2040, Highways are projected to be the major mode for cross-border freight movements, followed by railroads. Exhibit 7-30 and Exhibit 7-31 reference data derived from TRANSEARCH®. Cross-border trade by tonnage for highway and rail is expected to increase by 196 percent by 2040 to 182.4 million tons, far outpacing statewide freight growth at 70 percent. These gains are led by outbound highway and rail freight from Texas to Mexico—a 238 percent increase in tonnage, from 13.7 million tons to 46.4 million tons. Through-highway and rail freight to Mexico is projected to increase 214 percent from 20.5 million tons to 64.4 million tons. 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.
In 2040, border-crossing movements for highway and rail modes are projected to comprise 4.9 percent, or 3.76 billion tons, of freight in Texas for the four surface modes. Through-state international border-crossing movements for highway and rail modes (104.6 million tons) are forecast to encompass more than half (57.4 percent) of border-crossing movements.
movements. Outbound movements from Texas for highway and rail modes, at 46.4 million tons, are more than 32 percent greater than inbound movements, at 31.4 million tons.

**Bottom Line**
Texas highway and rail freight crossings at international borders are summarized below.

**Highway**
Exhibit 7-32 provides a snapshot of highway international border crossing locations in Texas. Border crossings at the Bridge of the Americas in El Paso, the World Trade Bridge in Laredo, the Pharr-Reynosa International Bridge on the Rise and the Veterans International Bridge in Brownsville are forecast to have high tonnage volume and growth between 2014 and 2040. Average inbound daily heavy truck volume at the border is expected to increase from 18,350 to 51,000 by 2040—a 178 percent increase. Total inbound truck volumes at the border are projected to increase from 6.7 million to 18.6 million tons per year.

- World Trade Bridge is predicted to be the largest and most important international gateway to Texas. In 2014, the bridge had more than 7,600 daily truck crossings from Mexico into Texas, and inbound truck traffic is projected to increase to 25,300 by 2040. The World Trade Bridge accounts for almost 50 percent of the total projected daily heavy truck traffic at the Texas-Mexico crossings.
- Bridge of the Americas had approximately 1,800 inbound daily truck crossings in 2014. Truck crossings are estimated to increase to about 5,000 daily trucks by 2040.
- Pharr-Reynosa International Bridge on the Rise had 2,600 inbound daily truck crossings in 2014. This is projected to increase to 9,500 daily trucks by 2040.
- Veterans International Bridge had 960 inbound daily truck crossings in 2014 and is projected to handle more than 4,000 trucks daily, or an increase of 315 percent, in 2040. This is the largest percentage increase in truck traffic of any border crossing on the Texas-Mexico border.

These crossings accounted for 59 percent of total inbound truck crossings between Texas and Mexico in 2014 and are predicted to increase to 76 percent in 2040.

**Rail**
Approximately 99 percent of all rail crossings are concentrated at four ports-of-entry: Brownsville, Eagle Pass, El Paso and Laredo. These four primary rail border crossings are collectively projected to increase throughput tonnage by 18.4 percent from 2014 to 2040. The most significant international border crossing is the Webb to Tamaulipas crossing in Laredo, where more than 40 percent of all rail crossings between Texas and Mexico occurred in 2014. Rail international border-crossing locations are shown in Exhibit 7-32.
Freight tonnage is expected to double between 2014 and 2040, outpacing population and employment growth as Texas’ industries face increased consumption and trade. This chapter provides a realistic, data-driven forecast for movement on the Texas Freight Network in 2040.

Analyzing future demands and where those demands originate enables TxDOT to identify improvements needed to satisfy freight mobility and accessibility demands. The forecasts and bottom line analysis, as summarized in Exhibit 7-33, identify deficiencies and can be used to prioritize projects that will maintain an efficient and economically viable freight system.
### Exhibit 7-33: Texas Bottom Line Freight Analysis Summary

<table>
<thead>
<tr>
<th>Mode</th>
<th>Mode Share (2014/2040)</th>
<th>Statewide Growth (Percent/Volume from 2014 to 2040)</th>
<th>Take Away</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highways</td>
<td>52% / 59%</td>
<td>110% / 1.15 billion tons</td>
<td>▪ 19% Primary Freight Network unacceptable, 2014.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ 46% Primary Freight Network unacceptable, 2040.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ 11% Secondary Freight Network/Emerging Freight Corridors deficient, 2040.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Intrastate trucks double between 2014 and 2040.</td>
</tr>
<tr>
<td>Rail</td>
<td>20% / 20%</td>
<td>92% / 366.8 million tons</td>
<td>▪ Increase to 764.3 million tons in 2040.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Through-movement is the largest at 36 percent share of all rail movements.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Inbound movements remain high at 35 percent share of all rail movements.</td>
</tr>
<tr>
<td>Water</td>
<td>28% / 21%</td>
<td>43% / 240.3 million tons</td>
<td>▪ Galveston, Harris and Jefferson counties have large increases.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Cameron and Chambers counties double.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Outbound movement has the highest growth at 92 percent from 2014 to 2040.</td>
</tr>
<tr>
<td>Air</td>
<td>0.1% / 0.1%</td>
<td>197% / 2.4 million tons</td>
<td>▪ Tarrant County/Alliance Airport will account for about half of airport freight by 2040.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Intrastate movement has the highest growth at 348 percent between 2014 and 2040.</td>
</tr>
<tr>
<td>U.S.-Mexico Border Crossing</td>
<td></td>
<td>Trucks: 256% / 110.7 million tons</td>
<td>▪ Cross-border tonnage increases by 250 percent by 2040, especially in export direction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rail: 213% / 19.4 million tons</td>
<td>▪ Truck is the dominant mode of cross-border freight movements at 80.5 percent.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Through-state border-crossing movements are estimated to be more than half of the total border crossing movements.</td>
</tr>
</tbody>
</table>

Source: Based on TRANSEARCH®, USACE and Forecast Framework analysis
Understanding freight transportation’s current and future trends, needs and issues is critical to maintaining and expanding Texas’ freight transportation network. By identifying significant freight system issues, the Texas Department of Transportation (TxDOT), along with federal 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) discusses how they can be addressed.

**8.1 Significant Freight System Trends**

Texas’ freight transportation issues and needs were identified through analysis of the transportation system inventory, commodity and system performance data (summarized in Chapters 4 through 7), as well as stakeholder input (to be discussed in Chapter 10) and were vetted through the Texas Freight Advisory Committee. An analysis of trends and issues most likely to impact the future of freight transportation in Texas has revealed four key trends that traditional forecasting techniques are not likely to capture (Exhibit 8-1).

<table>
<thead>
<tr>
<th>Categories</th>
<th>Trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade and Employment</td>
<td>Key international trade markets – Mexico, Canada, China, India, Brazil, Europe, the rest of Asia and Latin America</td>
</tr>
<tr>
<td></td>
<td>Panama Canal expansion</td>
</tr>
<tr>
<td></td>
<td>Employment and industry trends</td>
</tr>
<tr>
<td>Demographics</td>
<td>Significant population growth</td>
</tr>
<tr>
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<td>Mega-regions</td>
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<td>Energy</td>
<td>Texas oil and gas production</td>
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<td></td>
<td>Wind energy</td>
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<td></td>
<td>Alternative transportation fuels</td>
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<tr>
<td>Technology</td>
<td>Intelligent Transportation Systems (ITS)</td>
</tr>
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<td></td>
<td>Dedicated truck lanes</td>
</tr>
<tr>
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<td>Autonomous freight vehicles</td>
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<td>E-commerce</td>
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**8.1.1 Trade and Employment**

Texas’ natural advantages include its large geographical size, large population, central location, Gulf coastline, energy resources, extensive infrastructure and low taxation and cost of doing business—all of which make it an economic leader.¹ In 2013, Texas ranked second in Gross State Product in the nation, with an economy valued at nearly $1.5 trillion. According to *Forbes*’ list of *Best States for Business*, Texas ranks first in ‘Economic Climate,’

second in ‘Growth Prospects’ and seventh overall.² Fifty-two Fortune 500 companies and 116 of the largest 1,000 companies in the nation are headquartered in Texas.³

**Key International Trade Markets**

With its historic ties with 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 consumes 36 percent of Texas’ total exports, Canada follows with 9 percent and China accounts for 4 percent. Exhibit 8-2 shows the export growth between Texas and the top five countries receiving Texas exports.⁴

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**Exhibit 8-2: Top Five Countries Receiving Texas Exports, 2008 and 2012**

![Bar chart showing exports by country from Texas for 2008 and 2012](chart.png)

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

NAFTA partners are important exporters to Texas, providing nearly 35 percent of imported goods by value. Mexico is the top country providing imports to Texas, while Canada is fifth, as shown in Exhibit 8-3. This exhibit also includes the top five countries importing to Texas and their growth since 2008. As a result of this expanded international trade, freight imports and exports through Texas’ ports and at border crossings with Mexico continue to grow.

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³ Ibid.

NAFTA has grown Texas trade, and Mexico remains the state’s largest trading partner. After sharp decreases caused by the global economic downturn in 2009, U.S. imports from Mexico increased from $176.5 billion in 2009 to $280.5 billion in 2013. The leading U.S. import item from Mexico in 2013 was motor vehicles, followed by motor vehicle parts, oil and gas, computer equipment, audio and video equipment. The leading U.S. export item to Mexico in 2013 was motor vehicle parts, followed by petroleum and coal products, computer equipment, semiconductors and other electronic components and basic chemicals.

Mexico’s export-oriented assembly plants are closely linked to U.S.-Mexico trade in labor-intensive manufacturing industries like auto parts and electronic goods. These plants generate a large amount of intra-industry and intra-firm trade, moving intermediate goods across the border during the production process. The border region has the highest concentration of assembly plants and workers.

Exhibit 8-4 displays the inbound growth in truck and rail containers from Mexico between 1995 and 2013. By the end of 2014, rail exceeded 400,000 containers and truck volumes reached more than 3.7 million. The number of loaded trucks increased sharply following the economic downturn in 2008 and 2009, which in turn increased the need for efficient border

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6 Ibid.
7 Ibid.
crossings without compromising safety. These additional volumes on Texas’ highway and rail freight systems have increased system capacity pressures both at border crossings and throughout the freight system.

Exhibit 8-4: Freight Movement Inbound from Mexico, 1995-2013

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, the canal is undergoing a $5.25 billion expansion to increase capacity and accommodate larger ships. The expanded canal is expected to open in 2016 and will allow for deeper, longer and wider “New Panamax” vessels, doubling existing throughput capacity. The expansion will reduce delays and potentially reduce shipper costs. In 2012, the Panama Canal Stakeholder Working Group studied the expansion’s impact on the state and identified four principal findings:8

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8 Report from the Texas Panama Canal Stakeholder Working Group, November 2012.
1. “The Panama Canal expansion...represents opportunities to expand Texas’ position as a global gateway for the nation. By providing a low-cost, reliable, safe, secure, multimodal and environmentally sustainable supply chain, the state can increase its global trade, create new jobs and expand the economy of the state and nation.”

2. As the leading goods export state in the U.S., Texas is well-positioned to take advantage of the Panama Canal expansion and other opportunities to increase exports to both new and existing markets. The emerging liquefied natural gas (LNG) export market represents another major opportunity for Texas.

3. “To increase global trade and economic development, Texas must develop processes that provide a transportation system focused on commerce, including Texas ports, the Gulf Intracoastal Waterway, the roadway system, the rail system and the pipeline network. It is critical that Texas accelerate investments in freight transportation infrastructure to grow commerce and increase the tax base of the state.”

4. The potential for increased freight traffic through Texas’ ports may require system preservation and capacity improvements to rail, water and highway infrastructure.

**Employment and Industry Trends**

Texas is expected to be a leading job growth state over the next several years. Employment in Texas was projected to grow by 2.3 percent in 2014 and is forecast to increase by 2.4 percent in 2015.\(^9\) While employment expansion may slow, Texas is a top performer nationwide, as one of only seven states to see employment return to its pre-recession level.\(^10\) The state continues to attract high-tech companies that manufacture and/or develop semiconductors, telecommunication equipment, video games, software, food products and computer products.\(^11\)

Machinery manufacturing employment has grown in recent years. Machinery manufacturers have built new factories or have expanded plants across Texas. Transportation equipment manufacturing in the state is projected to grow as Americans replace their vehicles. Employment in this sector has been forecast to grow by almost 6 percent per year through 2014.\(^12\)

Texas is a key link between Mexico’s automotive plants and the rest of the U.S. automotive industry. The state is home to the rapidly growing “Texas-Mexico NAFTA Automotive Corridor” (I-35) with vehicle assembly and automotive parts plants clustered along the corridor. The state has become a key player in the realigned North American “auto alley,” stretching from

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\(^10\) Ibid.

\(^11\) Ibid.

\(^12\) Ibid.
Mexico through Texas to many southern and Midwestern U.S. states. Texas’ automotive manufacturing sector is well-established and growing. In 2013, Texas ranked fifth nationally for automotive manufacturing establishments.13

8.1.2 Demographics

Significant Population Growth

Freight is demand-driven. 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, behind California.14 The Texas State Data Center projects that the population of Texas will increase 47 percent between 2010 and 2040, from 25 million to 45 million people.15

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 1.6 billion tons in 2010 to 3.3 billion tons in 2040—moved in Texas.16

Mega-Regions

The State Data Center 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.”17 Eleven mega-regions in the U.S. have been identified by the Regional Plan Association. They are shown in Exhibit 8-5.18

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14 Texas State Data Center. http://txsdc.utsa.edu/data/TPEPP/Projections/Index.aspx
15 Ibid.
18 America 2050: A Prospective, page 4.
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 Texas Triangle.

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.

### 8.1.3 Energy

**Oil and Gas Production**

Oil has been a major industry in Texas since the early 20th century. It spurred the rapid growth of cities like Houston and the development of refineries and other petroleum-related facilities throughout the state. Oil production totals declined over the last 2 decades until...
new technologies—namely the combination of hydraulic fracturing (fracking) with horizontal drilling—were broadly implemented in the past 4 to 5 years.

Texas currently accounts for approximately 20 percent of oil extraction and 33 percent of natural gas extraction in the U.S. Among the 254 counties in Texas, 223 are actively producing oil or natural gas.\textsuperscript{19} While the oil and natural gas extraction industry accounts for less than 1 percent of employment in Texas, this energy extraction supply chain has a broad impact on employment for the retail, wholesale, manufacturing, transportation, construction, government and agriculture industries.\textsuperscript{20}

The need for trucks supplying well equipment, frac sand, water and chemicals for fracking increases demands on the existing highway system. The Energy Sector Task Force, created by TxDOT in 2012 to address energy sector roadway needs, noted that one oil or gas well requires 1,184 loaded trucks to start production, 353 loaded trucks a year to maintain production and 997 loaded trucks once every 5 years to re-frac the well. This level of heavy truck activity correlates to a cost of $4 billion a year to repair roadway infrastructure from drilling damage.\textsuperscript{21} This is especially true in rural areas where local roads were not designed to handle these heavier freight loads.

\subsection*{Wind Energy}

Texas is the leading wind energy producer in the U.S. While growth in generating capacity may continue long-term, the growth in new wind turbine installation slowed significantly in 2013 due to expiration of the Federal Renewable Electricity Production Tax Credit.\textsuperscript{22} As a result, the number of wind turbines—in Texas—has tapered off. Since electricity prices are largely affected by natural gas prices,\textsuperscript{23} it is difficult for renewable technologies to remain price competitive. As a result, further increases in consumption of renewable energy will depend on improvements in production efficiency of renewable technologies.

The outlook for construction of more wind turbines on the Texas plains remains limited during the next 2 years.\textsuperscript{24} Freight impacts in Texas may include fewer wind turbines and parts being transported from Texas’ ports to West Texas.

\begin{footnotesize}
\begin{itemize}
\item[\textsuperscript{20}] Ibid.
\item[\textsuperscript{22}] U.S. DOE Department of Energy Efficiency and Renewable Energy. Available at \url{http://energy.gov/savings/renewable-electricity-production-tax-credit-ptc}
\item[\textsuperscript{24}] Ibid.
\end{itemize}
\end{footnotesize}
Alternative Transportation Fuels

In 2011, transportation use accounted for less than 1 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. 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’ ports 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.

Texas is the nation’s largest producer of biodiesel, with about 20 biodiesel plants across the state and a production capacity of more than 100 million gallons per year. 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.

8.1.4 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. Specifically, advances in ITS, dedicated truck lanes and autonomous freight vehicles may change the safety and efficiency of goods movement along roadways.

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.

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The Dallas-Fort Worth area has an ongoing demonstration project called Freight Advanced Traveler Information System (FRATIS). 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, traffic and weather data.
- 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 through:

- Monitoring traffic incidents with closed circuit television cameras.
- Dispatching vehicles to remove debris or hazardous materials.
- Communicating the most direct routes to emergency vehicles to help them arrive more quickly at accident scenes.
- Displaying information on dynamic message signs to alert travelers of any issues.

According to the Texas Transportation Institute, Transtar has saved commuters nearly $2.5 billion in reduced traveler delays and fuel costs.\(^28\) ITS is rapidly developing and changing. As new ITS technology is developed and approved they should be considered for integration into the freight transportation system.

**Dedicated Truck Lanes**

Dedicated truck lanes physically separate commercial vehicles from passenger vehicles or mixed traffic flows. In recent years, California, Florida, Georgia, Missouri and Texas, as well as a number of multistate corridor coalitions such as IH-70 and IH-10, have studied dedicated truck lane concepts. Separating vehicle streams introduces a new level of complexity in highway design (e.g., on-/off-ramps) and operations (dealing with incidents or breakdowns). Existing truck lanes in the U.S. are short routes serving ports or border crossings. Currently, there are no dedicated truck lanes in Texas. Benefits associated with dedicated truck lanes include safety gains, the potential of adopting high productivity vehicle configurations\(^29\) and the possibility of infusing advanced technologies, such as Intelligent Vehicle Initiatives and autonomous truck or self-driving truck technology.

**Autonomous Freight Vehicles**

The development of a self-driving truck or autonomous truck continues to advance significantly. Current technology for this type of truck uses a Highway Pilot system, which enables the human driver to switch control over to the truck's embedded system after

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\(^28\) [http://www.houstontranstar.org/about_transtar/](http://www.houstontranstar.org/about_transtar/)

\(^29\) Combination vehicles, or doubles and triples
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.\textsuperscript{30} Regulatory issues that would allow for the widespread commercial use of this technology could be realized by 2025.\textsuperscript{31} However, the general implementation would require provision of the physical highway infrastructure and additional safety improvements to accommodate these vehicles.

**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 5.5 percent in the first quarter of 2013.\textsuperscript{32} Traditional retailers have implemented new strategies including “buy on-line pick up in store” and have established local distribution centers to expedite supply chains. E-retailers have also constructed a series of centralized distribution centers. This 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.

### 8.2 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. Need, both current (Chapter 6) and projected (Chapter 9) have been used to develop strategies (Chapter 11) that Texas can employ to improve freight mobility. These strategies include broad-based policies and programs and specific projects that address the state’s freight movement challenges. 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 developing a statewide freight network and a comprehensive incident management system, addressing oversize/overweight/over-dimensional trucks and updating and maintaining aging infrastructure.


\textsuperscript{31} Ibid.

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; and increasing education/awareness of the public about commercial vehicle needs.

4. **Intermodal Connectivity:** Identifying regional corridors, improving port-rail connections and increasing the number of intermodal connection points will improve intermodal 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/Ports-of-Entry:** Key issues that must be addressed for improved NAFTA and border/ports-of-entry include congestion at the border, customs processing time, border-crossing staffing issues and implementing cross-border technologies. Needs that also must be evaluated include promoting public awareness of changing policies in Mexico (e.g., legislative, economic and funding policies), improving the connection of U.S. interstates to Mexico’s infrastructure and determining the impact of Mexican infrastructure improvements on the U.S.

7. **Public/Private-Sector Coordination:** Enhanced connection with neighboring states’ infrastructure, increased political and legislative support for freight issues, improved communications within public agencies and collaboration on technology between the public- and private-sectors are all needs that must be looked at to build public-private synergy. In addition, coordination on varying planning horizons, a better understanding of market conditions that impact long-term efforts and coordinating on real-time travel conditions with neighboring states are also important.

8. **Education/Public Awareness:** Communicating the importance of freight movement to the public, improving the public’s understanding of commercial vehicle 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 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. In addition, exploring alternative funding mechanisms and promoting the importance of freight transportation to elected officials are also priorities.

10. **Energy/Environmental:** Supporting and implementing policies and activities that reduce the cost of alternative fuels, streamlining the environmental review process and understanding the impact of shale production on infrastructure are important energy/environmental issues that need to be reviewed.
Chapter 9 will explore the major issues and needs in greater detail.

8.3 Addressing Needs and Issues

The impacts of the freight transportation trends identified in this chapter will require additional consideration by TxDOT and other stakeholders. Understanding and addressing the needs and issues of the Texas Freight Network will help meet future system capacity demands. Chapter 11 will outline the recommendations to address the needs and issues discussed above.

Identifying significant system trends; the key issues impacting the system’s capacity, preservation and expansion; and the needs related to population, employment and the energy industry (among other needs) can help Texas prepare and manage those 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.
An important element in developing Texas’ Freight Plan was recognizing the strengths and weaknesses of the existing freight transportation system based on identified trends, issues and needs.

This chapter is outlined as follows:

- **How the Freight System Meets State Goals**: A brief summary on how the state’s freight system is currently meeting the Freight Plan goals outlined in Chapter 2 and identification of opportunities for improvement.

- **Modal Strengths and Weaknesses**: Details on specific strengths and weaknesses of the Texas freight transportation system by mode.

- **Non-Modal Strengths and Weaknesses**: Details on specific strengths and challenges of the Texas freight transportation system for non-modal categories.

- **Potential Future Weaknesses**: Potential future opportunities for improving the Texas freight transportation system.

### 9.1 How the Freight System Meets State Goals

The Freight Plan goals identified and described in Chapter 2 set the direction for the state’s freight transportation priorities. Strengths and opportunities for improvement are briefly summarized for each goal area.

#### 9.1.1 Safety

Addressing safety across all freight transportation modes is one of the needs identified by stakeholders during the Freight Plan development process. Similarly, improving safety is a major focus of the Texas Department of Transportation (TxDOT) and private-sector freight stakeholders.

The Freight Plan outlines policies and strategies to address safety and emphasizes the need to build upon the strengths of the existing efforts outlined in TxDOT’s Strategic Highway Safety Plan to support the objectives of the safety goal.

Several safety concerns identified by stakeholders and crash data analysis include urban and rural area crash rates, truck rollovers, at-grade crossing incidents and rail equipment incidents. Concerns also included the lack of truck parking, a comprehensive statewide traffic incident management program or a statewide traffic management center. Implementing policies, programs and projects outlined in the Freight Plan—such as developing and implementing Texas Highway Freight Network design guidelines—addresses these safety concerns across all modes and is critical in meeting the objectives of the safety goal.
9.1.2 Asset Management
Building on the strengths of TxDOT asset management planning, the state can meet its goal to preserve and maintain the existing multimodal freight transportation system using cost-effective asset management practices. The implementation of numerous policies, programs and projects will help TxDOT to address the goal to preserve freight assets. These include the identification of a freight network and specific design guidelines, fostering innovative asset management strategies between the public- and private-sectors and specific rehabilitation projects along the Texas Freight Network.

9.1.3 Mobility and Reliability
The state can achieve the mobility and reliability goal by efficiently utilizing capacity on the existing freight transportation system and addressing congestion and bottleneck locations to improve the freight network’s performance. The reliability of the system also depends on the reduction of travel times and delays. Implementing statewide traffic and incident management centers will improve communications and aid in congestion management.

9.1.4 Multimodal Connectivity
The multimodal connectivity goal aims to improve both multimodal and intermodal connectivity for freight movements. The Freight Plan identifies several opportunities for improving connectivity between the various freight transportation modes. Landside connections to seaports, inland ports, airports and border crossings; interactions between modes; and first and last mile connections are critical to achieving this goal. Policy recommendations outline the need for the state to invest in strategies and solutions that link the different freight transportation modes. Specific programs, such as conducting an air cargo landside needs assessment and coordinating with railroads to improve access to intermodal facilities, are examples of recommendations identified in the Freight Plan that support this goal.

9.1.5 Stewardship
Stewardship looks to manage resources responsibly and ensure accountability in decision-making. Public- and private-sector coordination is an important factor for meeting the Freight Plan’s stewardship goal. Specific policies identified include coordinating project planning and delivery among agencies tasked with freight transportation system investment, adopting freight performance measures to inform TxDOT decision-making and encouraging a transparent project selection
process responsive to business needs. As an example, one recommendation is to explore public-private partnerships to identify enhanced connectivity opportunities. By fostering these partnerships, TxDOT can provide leadership to manage resources responsibly.

9.1.6 Customer Service

The customer service goal seeks to understand and incorporate customer desires in the decision-making process and to be transparent in all agency communications. The Freight Plan outlines both policies and programs to address education and public awareness, including the continued engagement of the Texas Freight Advisory Committee (TxFAC), the Freight Leadership Summit, sustained public and private stakeholder involvement and partnering with the private-sector to develop strategies.

Additionally, opportunities for improvement include supporting customer service needs in future projects by nurturing private-sector partnerships, increasing freight expertise in TxDOT districts and departments and educating elected officials. Policies and programs for improving engagement will help TxDOT be transparent in agency communications and incorporate customer requests into the decision-making process.

9.1.7 Sustainable Funding

The sustainable funding goal identifies funding sources for all modes of freight transportation. A number of policies and programs in the Freight Plan support this goal. These policies include improving and supporting freight projects and recommendations to identify opportunities for public-private partnerships in multimodal projects. These partnerships are imperative for continued private investment in the Texas Freight Network.

9.1.8 Economic Competitiveness

The economic competitiveness goal aims to enhance productivity and hub development by maintaining Texas Freight Network infrastructure, enhancing trade route connectivity and increasing the flow of goods and services. Specific recommendations identified in the Freight Plan include developing a marketing campaign to communicate the importance of freight related to the economy, conducting studies to assess freight clusters and their role in Texas’ economic competitiveness and maintaining Texas’ role in the energy production sector. The Freight Plan emphasizes the need for transportation investments to keep pace with projected freight growth, population growth, energy sector development, Panama Canal expansion, trade growth with Mexico and other emerging trends.
9.1.9 Technology
Leveraging technology and innovation to improve the safety and efficiency of freight transportation is an important goal. The Freight Plan outlines policies and strategies, including development of statewide traffic and incident management centers, implementation of technology-based solutions for international border crossings and the development of a statewide freight data collection program. These strategies support the goal to advance freight transportation using technology.

9.2 Modal Strengths and Weaknesses
This section briefly describes important strengths and weaknesses of the Texas’ freight transportation system by mode.

9.2.1 Highway
Strengths of the highway network are:
- Texas has an extensive highway network in good condition.
  - With more than 312,000 centerline miles of public roadways, Texas has the most extensive highway network in the U.S.
  - A majority of the Texas Highway Freight Network roadways and bridges are currently in “good” or better condition.
- Texas’ highway network has available capacity.

The Freight Plan identified some weaknesses of the state’s highway network:
- Congestion and bottlenecks impact economic growth, particularly on main corridors in large metropolitan areas with significant freight movements.
  - Texas has seven of the 25 nationally significant freight bottlenecks, costing the industry over $1 billion each year in wasted time and fuel.
  - In 2013, congestion on Texas roadways added $9.2 billion in operating costs to the trucking industry and 141 million hours of lost productivity.
  - By 2040, it is projected that congested highway miles along the state’s Primary Freight Highway Network will more than double.
- Outdated design standards and aging infrastructure limit truck traffic on some corridors.
  - Some roadways and bridges cannot accommodate the federal commercial vehicle maximum weight of 80,000 pounds for freight transport.
  - Improvements are needed to last mile connections.
High crash rates may indicate safety issues, and the aftermath of crashes often causes delays and congestion as the incident is cleared. According to TxDOT Crash Records Information System data from 2010 to 2012, 24 of the top 25 locations with the highest commercial vehicle crash rates on the Texas Highway Freight Network are located in urban areas.

A lack of viable alternate routes along the Texas Highway Freight Network compounds congestion.

Currently, there is no statewide freight network.

Both a statewide traffic management system and an incident management system are needed.

### 9.2.2 Rail

Strengths related to the Texas rail system are:

- Texas is a major freight rail hub for North America, has the most extensive rail system of any state with more than 10,000 miles of track\(^1\) and is home to 46 short line railroad operators, second in the nation to Pennsylvania.
- The rail network is connected to major markets via three Class I railroads: BNSF Railway, KCS and Union Pacific.
- Texas is the leader in rail traffic between U.S. and Mexico.
- Private investment by railroads is critical to maintaining the freight rail system. The Tower 55 project described in [Chapter 4](#) is an example of a successful public-private partnership.
- The private-sector invests in this infrastructure to meet current and future needs.

Weaknesses related to rail are:

- Rail bottlenecks including at-grade highway/rail crossings, sections of single-track along double-track lines and bridges with weight and speed restrictions are issues that must be addressed.
- Connectivity between north-south rail connections in West Texas is a challenge.
- Heavily used at-grade highway/rail crossings create safety concerns.
- Under-investments, particularly on short lines, could cause efficiency and safety concerns.
- Multimodal terminals face congestion issues.

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\(^1\) State rankings. Association of American Railroads, 2011. [https://www.aar.org/keyissues/Pages/Railroads-And-States.aspx](https://www.aar.org/keyissues/Pages/Railroads-And-States.aspx)
9.2.3 **Ports/Waterways**

Strengths of the ports and waterways in Texas are:

- Texas has the most extensive port and waterway network in the nation.
- The Gulf Intracoastal Waterway (GIWW) is a critical piece of the U.S. waterway network, connecting large ports to small ports and Gulf of Mexico ports with inland river ports. More than one-third, or 379 miles, of the entire waterway is in Texas. Approximately 78 million short tons of goods per year move through the GIWW, which is equivalent to 20 percent of total U.S. inland waterway traffic. Of this total tonnage, more than half moves within the Texas portion of the waterway.

Opportunities for improvement of the ports and waterways in Texas include:

- Landside access and intermodal connectivity are needed to address aging infrastructure.
- Congestion on roadways with landside access inhibits efficient connections between the highway and water modes.
- The GIWW needs dredging to allow for more freight movements through Texas ports.
- Lack of funding for harbor maintenance, dredging and maintenance of the GIWW and aged locks are issues for ports and waterways. Recouping the full Texas share of the Harbor Maintenance Tax is also a challenge.

9.2.4 **Airports**

Important strengths of the airport system in Texas are:

- Texas has one of the largest state airport systems in the U.S.
  - Texas is home to nearly 300 airports open to the public and 23 commercial airports.
  - Six of the top 50 cargo airports in the U.S. in terms of landed weight in 2013, as identified by the Federal Aviation Administration, are located in Texas.
- Private investment supports maintenance of airport assets.
- Many cargo airports in Texas are adjacent to or in close proximity to the Texas Highway Freight Network and are linked with last mile connections.

Issues for the airport system in Texas include:

- Last mile connectivity to the freight network must be addressed at cargo airports.
- The largest airports in the state are also located in rapidly growing, highly congested metropolitan areas. This can affect efficiency and reliability.
9.2.5 Pipelines
Texas’ pipelines key strengths are:

- Texas has the most extensive pipeline network in the U.S. with over 426,000 miles of pipelines privately operated by more than 1,700 companies.
- The private-sector invests in this infrastructure to meet current and future needs.
- Pipelines are vital in the movement of energy products and are important to the Texas economy.
- Pipelines provide connectivity to ports.

Some weaknesses identified for Texas pipelines are:

- The growing energy industry will require increased capacity and construction of new pipelines.
- The pipeline infrastructure improvements required to keep pace with increased industry needs will be a challenge.

9.3 Non-Modal Strengths and Weaknesses
This section briefly describes some strengths and challenges of the Texas’ freight transportation system for non-modal categories.

9.3.1 NAFTA and Border/Ports-of-Entry
Border strengths include:

- Mexico is Texas' largest trading partner and trade is projected to increase.
- Texas is a gateway to the U.S.

Border challenges are:

- Congestion at border crossings impedes international commerce.
- Cross-border technology applications must be implemented.
- Operating and staffing issues at border crossings must be addressed.
- Lack of coordination between different agencies involved in border crossings and the lack of singular statewide agency border oversight are challenges.
- Streamlining permitting regulations for border crossing is imperative.
- Texas is negatively impacted by border-crossing through-movements.

9.3.2 Intermodal Connectivity
The strengths identified for intermodal connectivity in Texas are:
Texas has an extensive multimodal network that provides connectivity to major freight gateways and generators, including marine ports, warehousing/distribution centers, airports, ports-of-entry and intermodal sites.

The Federal Highway Administration has identified 20 National Highway System rail-truck intermodal connectors in Texas—more than any other state.

Texas’ top cargo airports are located near major metropolitan areas and adjacent to the Texas Freight Network.

The extensive pipeline network is connected to the rail and highway network.

Weaknesses of intermodal connectivity are:

- Intermodal connectors are located in highly congested areas and compete with passenger movements.
- Emerging energy industry infrastructure needs related to intermodal connections have a difficult time keeping pace.
- Coordination and funding is a challenge because intermodal connectors have various owners.
- Outdated design standards and aging infrastructure along the last mile connections are problematic.
- Port and rail connections need improvement.
- Additional freight ports-of-entry at the border must be addressed.
- Improved rail connectivity between western and eastern Texas is needed.

9.3.3 Rural Connectivity

Strengths of rural connectivity are:

- More than 40,000 centerline miles of Farm-to-Market or Ranch-to-Market roads and spurs provide connectivity to freight generators, including oil, energy and agriculture.
- Rural areas have the capacity to handle additional trucks on the Texas Freight Network.

Some weaknesses of rural connectivity are:

- Aging infrastructure along the rural routes needs attention.
- Rural areas are challenged to keep pace with infrastructure improvements needed due to increased agriculture and energy industry activity.
- Project selection criteria in the allocation of transportation funding for rural areas must be improved.
9.3.4 **Public- and Private-Sector Coordination and Collaboration**  
The strengths related to public- and private-sector coordination are:

- Public- and private-sector collaboration between TxDOT and other modal providers is facilitated through the TxFAC.
- TxDOT districts provide local level coordination.
- TxDOT coordinates with Metropolitan Planning Organizations (MPOs), community stakeholders and corridor groups.
- TxDOT coordinates internationally through the U.S./Mexico Joint Working Committee on Transportation Planning.

Weaknesses related to public- and private-sector collaboration are:

- Collaboration between public- and private-sector infrastructure owners, operators, and users must be improved.
- Collaboration related to enforcement between TxDOT, other state departments of transportation and Mexico needs to be addressed.
- Political support for freight issues is critical and must be addressed through continued education and awareness.
- The various planning horizons between public (long-term) and private (short-term) entities is a challenge.
- Poor collaboration between the public- and private-sector decision-makers delays the project development process and slows the progress of necessary improvements.

9.3.5 **Education/Public Awareness**  
The strengths of education and public awareness are:

- Private-sector involvement communicates the role of freight in the public’s lives.
- Partnerships with trucking agencies improve public education about the trucking industry and movement of freight.

The weaknesses related to education and public awareness are:

- There is a lack of awareness by the general public regarding the importance of freight movement in their daily lives (e.g., getting goods/products to their work, homes and businesses).
- The general public also lacks awareness of laws and/or safety issues related to large trucks and at-grade highway/rail crossings.
9.3.6 Funding/Financing

Strengths related to funding and financing are:

- Transportation districts, MPOs and local agencies assist with addressing regional funding/financing issues.
- 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.

Funding and financing weaknesses are:

- Because of 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.
- Need to focus future funding on high-priority freight corridors.

Addressing the challenges identified in each of these categories is vital to developing a safe and efficient freight transportation system.

9.4 Potential Future Weaknesses

Increased demand for freight transportation is projected due to population and economic growth. This chapter has identified a number of strengths and weaknesses associated with that growth, and addressing the challenges is critical to the future efficiency of the Texas Freight Network.

9.4.1 Safety

Expanded freight traffic will increase potential passenger vehicle and freight transportation conflicts in both the truck and rail modes. A safer and more resilient transportation system will reduce crashes on the Texas Highway Freight Network, improve efficiency and reduce congestion. Mitigating at-grade highway/rail crossings, providing redundant or bypass routes on key corridors and improving statewide incident management are proactive actions to enhance transportation safety.
9.4.2 Capacity
Freight traffic continues to compete with passenger traffic in urban areas. Significant and costly expansions are needed to address capacity constraints on Texas’ roadways. Innovative strategies—such as off-peak deliveries and dedicated truck lanes—should be considered on sections of the Texas Freight Network that are currently at or over capacity.

9.4.3 Congestion and Bottlenecks
Congestion and bottlenecks will continue to escalate, especially in urban areas. Congestion on key corridors and bottlenecks can be mitigated by leveraging technology and providing timely incident notifications to drivers. Notifying drivers of designated and clearly identified alternate routes is also important to capacity improvement.

9.4.4 Energy Sector and Other Emerging Industries
The response of the public-sector, including transportation agencies like TxDOT, is critical to addressing the current and future transportation needs of Texas’ rapidly emerging industries. Specifically, energy sector development will require Texas to respond quickly to planning, funding and constructing necessary infrastructure improvements. Establishing a comprehensive process for the private-sector and industries to contribute to necessary improvements is strongly recommended if their development directly impacts the Texas Freight Network.

9.4.5 Funding and Financing
The funding shortfall in the Highway Trust Fund is expected to continue, especially with the reliance on the gas 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.

Understanding how Texas is currently meeting its freight goals through the identified strengths and realizing the areas of improvement through the identified weaknesses are both critical steps for maintaining and enhancing the state’s multimodal freight system. TxDOT will work toward building on the existing freight system’s strengths and addressing its weaknesses.
Texas Freight Mobility Plan

Chapter 10: The State’s Decision-Making Process

Final January 25, 2016
To establish support for the Freight Plan’s recommendations through the creation of a transparent policy, program and project selection process, it is important to outline the decision-making process that led to the recommendations.

In applying a holistic approach to the state’s decision-making process for freight transportation improvements, the Texas Department of Transportation (TxDOT) leveraged a variety of stakeholder outreach activities—including Texas Freight Advisory Committee (TxFAC), public listening/dialogue sessions, an executive forum and technology-based activities—to gain across-the-board perspectives. Additionally, a prioritization process was developed and applied to ensure a strategic approach to ranking projects in the most cost-effective manner. The vast size and extent of the various modes in the Texas Freight Network also highlights the importance of project prioritization. Finally, both freight movements and associated job influences were analyzed to evaluate the economic impact. This 3-pronged approach to the decision-making process ensures that the Freight Plan provides a flexible and sustainable approach to the state’s economic vitality.

10.1 Stakeholder Engagement

Stakeholder involvement in the development of the Freight Plan was of paramount importance. TxDOT understands the need for coordination between the public- and private-sectors to address challenges and recognize opportunities in the freight transportation system. First, stakeholders needed to clearly understand the important connection between freight transportation and economic growth in Texas. It was crucial to engage people who use the freight network every day, on all levels and all modes. The success of the Freight Plan depends on responding to real challenges and opportunities, as well as recommendations that are supported by private- and public-sector interests.

Stakeholders played a critical role in identifying issues, prioritizing projects and supporting freight infrastructure improvements and policies. TxDOT’s stakeholder engagement process created and coordinated opportunities for direct dialogue between local, state, federal and private stakeholders.

TxDOT offered multiple opportunities for all stakeholders to provide input about freight transportation issues, needs, challenges, opportunities and potential strategies for implementation and to identify the state’s short-, medium- and long-term freight infrastructure and policy needs. The participation of the private-sector—including those businesses directly involved in the freight transportation industry and those that depend on the timely delivery of goods—in developing the recommendations is essential to the success of the Freight Plan.

TxDOT employed a multi-faceted outreach process to engage stakeholders from diverse modes and geographies throughout the state, as outlined in Exhibit 10-1. This approach used the following outreach methods:
- TxFAC.
- Statewide listening sessions.
- Surveys and interviews.
- Texas Freight Leadership Summit.
- Technology-based outreach, including websites, newsletters and other printed materials.
- TxDOT Internal Technical Freight Working Group (ITFWG).
- Speaking engagements.
- Public comment period of Draft Freight Plan document

This grassroots and executive level stakeholder approach provided a clearer understanding of how Texas’ existing transportation infrastructure is used, as well as the system’s strengths and weaknesses.
Exhibit 10-1: Stakeholder Outreach Planning

**Exhibit 10-1: Stakeholder Outreach Planning**

**TxFAC**

- **KEY ROLE** (Review, Revise, Approve)
  - Goals & Objectives
  - Needs and Challenges
  - Priority Freight Network
  - Performance Measures
  - Project Prioritization
  - Key Policies
  - Final Freight Plan

**Statewide Listening Sessions #1**

- **KEY ROLE** (Experiences, Knowledge, Recommendations)
  - Current Conditions
  - Future Conditions
  - Freight Plan Recommendations

**Surveys and Interviews**

- **KEY ROLE** (Experiences, Knowledge, Recommendations)
  - Travel Patterns, Freight Flows and Volume
  - Verification of Data Analysis
  - Key Challenges

**Freight Leadership Summit**

- **KEY ROLE** (Expertise, Insight, Vision)
  - Freight Transportation System in 2040
  - Texas’ Growth and Economic Competitiveness Policies, Projects, Funding

**Statewide Listening Sessions #2**

- **KEY ROLE** (Review, Revise, Recommendations)
  - Draft Policies/Projects
  - Prioritization
  - Recommendations
10.1.1 Texas Freight Advisory Committee

MAP-21 encouraged each state to establish a freight advisory committee comprised of a representative cross section of public- and private-sector freight stakeholders. Along with TxDOT’s goal for an inclusive and transparent process and in keeping with MAP-21 guidance, the Texas Transportation Commission established the TxFAC in January 2013 as part of the Freight Plan development process. Its members include private-sector business leaders, modal representatives and elected officials. The TxFAC was established to serve as a sounding board for ideas and opportunities identified in the development of the Freight Plan.

During the development of the Freight Plan, the TxFAC met quarterly (a total of eight times since its inception) in various locations across Texas. Each TxFAC meeting was planned around a key focus area (such as freight network designation, rural and multimodal connectivity borders/ports-of-entry, freight technology, the energy sector, etc.), which allowed members to learn about specific aspects of the Texas Freight Network and to provide comments and insight on the Freight Plan’s structure and content. Committee members were presented with regular updates and their input was requested at all meetings throughout the Freight Plan development process. The TxFAC was instrumental in guiding the direction of the Freight Plan, which included data analysis, goals and objectives, freight network recommendations, performance measures and content for final plan development.

Specific roles and responsibilities of the TxFAC include:

- Advising TxDOT on freight-related policies, priorities, issues, projects and funding.
- Serving as a forum for discussing transportation decisions that affect freight mobility.
- Communicating and coordinating statewide freight priorities with other organizations.
- Sharing freight-related information between the private- and public-sectors.
- Participating in the development of the first comprehensive, statewide, multimodal Freight Plan.
- Assisting TxDOT in understanding the concerns of the freight industry and the business community.
- Promoting the logistics industry and freight movement needs to enhance Texas’ economic development.
- Educating the public and elected officials on how freight is directly tied to the economy.
The TxFAC was formed as a permanent advisory body to support TxDOT’s freight-related planning and investment decisions, not only during the development of the Freight Plan, but well beyond. This committee will provide consistency to ensure a long-term and viable Freight Plan.

10.1.2 Statewide Listening Sessions

The listening sessions were designed to engage a cross section of public- and private-sector freight stakeholders in urban, suburban and rural communities across Texas with the goal of incorporating local issues and concerns into the Freight Plan. The main objective was to provide a forum for stakeholders to voice their opinions on the current freight network and offer recommendations for the future. The sessions allowed for a variety of perspectives to be incorporated into the Freight Plan, including the private-sector freight community, economic development organizations, local government representatives, elected officials and other transportation-related interests. Two rounds of listening sessions were conducted around the state at key points in the process, allowing session input to be directly incorporated into the development of the Freight Plan.

The initial round of 11 listening sessions occurred early in the Freight Plan process, between May 14, 2013 and June 20, 2013. The goal of these sessions was to identify local perspectives on issues, needs, challenges and potential solutions across the freight network. Participants were invited to discuss:

- Views on current conditions.
- Perspectives on future conditions.
- Recommendations to consider for the Freight Plan’s development.

Approximately 250 people attended the first round of listening sessions and provided more than 900 comments. These listening sessions provided the foundation for the Freight Plan by identifying specific issues, needs and challenges and suggesting potential solutions. The observations and comments captured were categorized and classified into 10 focus areas. The outcome was a solid understanding of diverse industry viewpoints that provided a framework for Freight Plan development.

The next round of 12 listening sessions occurred a year later, from June 10, 2014 through July 9, 2014, following development of the draft Freight Plan recommendations. The goal of the second round was to share draft recommendations with stakeholders and use their input to refine and finalize the Freight Plan recommendations.
These sessions encouraged stakeholders to discuss:

- Draft Freight Plan recommendations – should they be revised, and or have any recommendations been omitted?
- Prioritizing Freight Plan recommendations.

Approximately 300 people attended the second round of listening sessions and provided more than 700 comments. The outcome was a comprehensive set of stakeholder comments on the draft plan recommendations, which allowed the Freight Plan team to develop a refined set of recommendations. Participants were most concerned about the demands of future growth on the Texas freight transportation system.

To further enhance TxDOT’s efforts for an extensive and inclusive stakeholder engagement process, remote listening sessions were conducted during both rounds to provide an additional opportunity for stakeholders who were unable to attend the meetings in-person.

### 10.1.3 Surveys and Interviews

TxDOT reached out to motor carriers and commercial vehicle operators to better understand their experiences and ideas for improving the Texas freight transportation system. The goal of this process was to gather data on travel patterns and volumes and to learn how front-line operators, who have first-hand experience with the Texas Freight Network, viewed the network’s challenges and opportunities.

A 3-week, online motor carrier survey was conducted by the American Transportation Research Institute from November to December 2013 to identify basic carrier demographic data (e.g., size and sector), as well as to solicit input on a variety of issues related to operating in Texas, including infrastructure conditions, regulatory barriers and industry economic conditions. A total of 88 individuals completed the survey.

While the survey indicated that the trucking industry was performing well in Texas, there were also strong indications that the growth in the state was placing strains on its transportation infrastructure. To sustain recent and future growth, Texas will need to remain vigilant about providing a safe, reliable and efficient transportation network for freight movement.

In September 2013, 1,195 commercial vehicle operator interviews were conducted by TxDOT representatives at 10 locations across Texas. The purpose of the interviews was to gain insight into the commercial truck traffic flow movements in Texas and validate the Texas Statewide Analysis Model version 3. The interviews also supported data analysis from previously conducted research and modeling as it relates to the origins and destinations of truck freight, equipment, cargo type and areas of congestion.
The survey and interview results were used to verify data analysis and identify freight transportation system needs and issues to be addressed in the Freight Plan.

10.1.4 Texas Freight Leadership Summit

While the listening sessions served to engage stakeholders involved with actual freight system operations and usage, TxDOT also needed to reach the private-sector strategic visionaries, decision-makers, advocacy groups and business leaders in a forum conducive to maximizing private corporate-sector involvement. To this end, TxDOT, in partnership with North America Strategy for Competitiveness, hosted its first Texas Freight Leadership Summit on April 3, 2014, in Houston. More than 300 industry leaders convened to provide insight for enhancing the state’s freight transportation system and facilitating economic growth, trade and commerce.

Key goals for the summit were to identify:

- An ideal Texas multimodal freight transportation system in 2040.
- Needs to enhance the state’s growth and economic competitiveness.
- Other strategic initiatives (such as policies, projects and funding) to promote improvements in Texas’ freight transportation system.

The outcome of the summit was an improved understanding among freight leaders regarding the challenges and opportunities across Texas, including energy sector freight challenges, new advances in streamlining border crossings and issues unique to each mode.

Strategic recommendations that emerged from the Texas Freight Leadership Summit and are addressed in the Freight Plan include:

- Technology-based solutions.
- Innovative funding options.
- Dedicated truck-only lanes.
- Alternate corridors to mitigate congestion.
- Border/ports-of-entry collaboration and efficiency.

TxDOT will continue to convene Texas Freight Leadership Summit events regularly to build and maintain relationships with the freight community and to keep abreast of ideas, innovations and advances in the industry.
10.1.5 Technology-Based Stakeholder Outreach

In addition to the aforementioned platforms for stakeholder engagement, the Freight Plan leveraged the far-reaching ability of technology through electronic media. The website www.MoveTexasFreight.com was created to aid and increase information sharing. There, stakeholders could stay abreast of the development of the Freight Plan and were also afforded an opportunity to provide comments via the website. This approach was important, as it enabled fast, convenient distribution of information to all stakeholders and allowed for input to be received outside of an in-person meeting.

Following each round of the statewide listening sessions, the Freight Plan team held a remote session via videoconference, targeting areas of the state that did not host a nearby session. These videoconference sessions maximized the participation range of the sessions and provided the team with input from all areas across the state. Other media included newsletters, a project brochure and 1-page project fact sheets, which were distributed both electronically and posted on the project website, along with meeting presentations and other project documentation. These outreach platforms provided additional avenues for ongoing engagement in the development of the Freight Plan. This independent stakeholder engagement process enabled online participants to ensure their voices were heard.

10.1.6 TxDOT Internal Freight Working Group

The ITFWG was formed in 2013 to solicit feedback and recommendations from internal stakeholders within TxDOT and the Texas Department of Motor Vehicles to integrate into the Freight Plan. TxDOT representatives included staff from planning, aviation, rail, traffic and safety, maritime, toll operations, design, construction, bridge, state legislative affairs, federal affairs, and international relations. The goals for the ITFWG were to:

- Open the lines of communication among different divisions and staff members.
- Build advocacy for integrating freight issues throughout TxDOT.
- Highlight process improvements to enhance the integration of freight within TxDOT.
- Improve, integrate and institutionalize freight planning within TxDOT and provide informational support to the TxFAC.
- Develop a structure to describe how freight planning activities fit within existing TxDOT planning.

The ITFWG met six times from 2013 to 2014 and made valuable contributions by highlighting important issues affecting the transportation system. Establishing the ITFWG provided internal stakeholders with the opportunity to comment on the Freight Plan and build consensus.
10.1.7 Speaking Engagements
In addition to the listening sessions and other outreach efforts, TxDOT conducted extensive speaking engagements across the state to different organizations, including the Alliance for I-69, economic development groups and Metropolitan Planning Organizations (MPOs) through the Texas Association of MPOs (TEMPO). Presentations were given during several key milestones of the Freight Plan and focused on an overview of the Freight Plan, key freight transportation challenges and preliminary recommendations.

Speaking to these organizations on the local, regional and national levels provided a platform to deliver an integrated, intermodal transportation system for the safe, efficient and economic movement of people and goods across Texas. The speaking engagement outreach also offered stakeholders another opportunity to provide input on the development of, and build consensus for, the Freight Plan.

Exhibit 10-2 shows the different outreach methods and how they contributed to the development of the Freight Plan.

10.1.8 Public Comment Period of Draft Freight Plan Document
TxDOT held a 30-day public comment period following the availability of the Draft Freight Plan document from October 9, 2015 to November 9, 2015. During this time period, the Draft Freight Plan document was available on the website www.MoveTexasFreight.com. Stakeholders were informed of its availability. Following the public comment period, TxDOT compiled the comments and refined the Draft Freight Plan document based on the comments. The refined Freight Plan was adopted by the Texas Transportation Commission.

The comments from the public comment period are contained in Appendix H.
### Exhibit 10-2: Stakeholder Outreach and Freight Plan Development

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<tbody>
<tr>
<td>TxFAC</td>
<td>Diverse perspectives from public- and private-sector representatives on key freight issues and stakeholder identification</td>
<td>Input on development and review of draft goals, objectives and performance measures</td>
<td>Input into development and review of draft policies and recommendations</td>
<td>Input on priorities for Freight Plan recommendations and implementation</td>
</tr>
<tr>
<td>Statewide Listening Sessions – Round 1</td>
<td>Input to identify key issues and concerns relevant to their region, mode or type of business</td>
<td>Input on freight network goals for future conditions</td>
<td>Input on broad potential policy issues and recommendations</td>
<td>Preliminary input into potential solutions and priorities</td>
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<tr>
<td>Statewide Listening Sessions – Round 2</td>
<td>Input on alignment of recommendations and issues</td>
<td>Input on alignment of goals and recommendations</td>
<td>Review and input on draft recommendations</td>
<td>Input on Freight Plan recommendations prioritization</td>
</tr>
<tr>
<td>Surveys and Interviews</td>
<td>Input on travel patterns, freight flows and volumes and key issues and concerns across the network</td>
<td>Data informed development of goals, objectives and performance measures</td>
<td>Data informed development of policies and recommendations</td>
<td>Data informed prioritization process</td>
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<tr>
<td>Freight Leadership Summit</td>
<td>Input on issues relevant to various modes, regions and business sectors from executive-level freight stakeholders</td>
<td>Input on goals for the future multimodal freight network</td>
<td>Input influenced the direction of the Freight Plan development</td>
<td>Input on the top issues for Freight Plan development and implementation</td>
</tr>
<tr>
<td>Internal Technical Freight Working Group</td>
<td>Input on identifying key challenges for integrating freight into planning, programming and implementation</td>
<td>Input on goals, objectives and performance measures</td>
<td>Guidance for the Freight Plan framework</td>
<td>Input on the top issues for Freight Plan development and implementation</td>
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<tr>
<td>Technology</td>
<td>Regularly updated Freight Plan information and invitations to participate in outreach events and provided input on development of the Freight Plan</td>
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10.2 Project Identification and Prioritization Process

TxDOT can improve the efficiency and reliability of the movement of freight in and through Texas through the identification, prioritization and implementation of freight improvement projects. The project selection process documented freight needs based on various inputs and guidelines, including the goals of the Freight Plan and the identification of the Texas Freight Network, as shown in Exhibit 10-3. To create a list of potential freight improvement projects and future freight planning priorities, 10 broad need categories were identified and compared to projects under development by TxDOT and other entities.

Exhibit 10-3: Plan Development and Project Selection Process

Stakeholder engagement occurred throughout the Freight Plan development process and provided freight network users with an opportunity to identify needs, roles of responsibility and recommendations. To provide specific actions for achieving a particular policy, the recommendations are broken down into policies and associated programs and projects (Chapter 11). These recommendations are also prioritized and incorporated into the implementation plan (Chapter 12), which provides specifics such as timeline and project cost.

The project identification and prioritization process discussed in this section was used not only to recognize needs, but also to match those needs with projects and to support implementation of the freight policy and program recommendations.
10.2.1 Importance of the Texas Freight Network for Project Selection

The Texas Freight Network is comprised of facilities critical to freight movement throughout the state. This network was used as the basis for identifying and prioritizing recommendations for the Freight Plan. The Texas Freight Network includes approximately 20,000 miles of roadway on the Primary Freight Network and Secondary Freight Network/Emerging Freight Corridors, 4,600 miles of rail on the Texas Rail Freight Network, 426,000 miles of pipeline and 379 miles along the Gulf Intracoastal Waterway (GIWW). This network facilitates the majority of the freight movements in and through Texas and connects freight generators and gateways, such as 11 deep water ports, six major cargo airports, 13 truck and five rail international border crossings/ports-of-entry and numerous major warehousing/distribution facilities.

Recommendations and projects were analyzed to ensure that they address at least one of the Freight Plan goals discussed in Chapter 2. Texas Freight Network needs and projects include potential highway, rail, waterway and border/ports-of-entry projects.\(^1\)

Highway projects were identified with input from stakeholders and through a quantitative process of identifying highway system needs and matching them with planned TxDOT projects. Rail, port/waterway and border/ports-of-entry (POE) projects were ascertained through input from stakeholders, as well as through the review of current TxDOT legislative appropriation requests and projects recommended in previous plans (such as border master plans and the Port Capital Plan). Additional details on the processes used for each mode are described in the sections below.

10.2.2 Identification and Prioritization Process for Highway Projects

Identification of Highway Freight Network Needs

Identification of highway freight needs focused only on the Texas Highway Freight Network, as these facilities have been recognized as carrying most of the freight movements throughout the state. Freight-related highway needs were identified by evaluating the conditions and performance of the Texas Highway Freight Network based on the goals of the Freight Plan (Chapter 2) and through the stakeholder engagement process. Specific goals related to highway infrastructure and the data evaluated to identify needs based on each goal are included below, along with maps depicting the roadways pinpointed by this analysis.

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\(^1\) Pipelines are not included, as they are privately owned and operated and TxDOT has no control over investments in capital projects.
Safety – Improve multimodal transportation safety.

- **Commercial truck crash hot spots**: Crash hot spots on the Primary Freight Network were determined based on analysis of the total number of commercial motor vehicle crashes per mile, commercial vehicle crash rate, crash severity and roadway classification.

- **At-grade rail crossings**: All at-grade highway/rail crossings on the Texas Highway Freight Network were identified.

- **Commercial truck rollover locations**: Locations with the highest number of commercial motor vehicle rollover incidents in 2012 were identified.

The results of the safety needs assessment are shown in **Exhibit 10-4**.
Mobility and Connectivity – Reduce congestion and improve system efficiency and performance. Provide transportation choices and improve system connectivity for all passenger and freight modes. This criterion is a combination of two Freight Plan goals: Mobility/Reliability and Multimodal Connectivity. For this analysis, it was concluded that since many of the issues and measures related to each goal overlapped, a combined metric would suffice to identify needs related to both goals. The needs identified are combinations of the data included below.

- **Commercial truck bottleneck locations:** Commercial motor vehicle bottlenecks (delays) were identified based on data collected from global positioning system receivers.

- **High percentage of trucks:** Portions of the Texas Highway Freight Network with more than 50 percent trucks were identified, based on TxDOT’s 2011 Road-Highway Inventory Network (RHINO) data.

- **Level-of-service (LOS):** Portions of the Texas Highway Freight Network with at least 25 percent trucks and operating at a LOS E were identified.

- **Average annual daily traffic (AADT):** Two-lane portions of the Texas Highway Freight Network with at least 25 percent trucks and an AADT of at least 10,000 were identified, as were 4-lane portions of the network with at least 25 percent trucks and an AADT of at least 20,000.

- **Top congested truck corridors:** TxDOT lists the 100 Most Congested Truck Roadways annually by combining roadway inventory and traffic volume data with speed data from INRIX, a private company that provides data to several navigation and traveller information services.

- **On or connected to intermodal connector:** Intermodal connectors are roads that provide access between major intermodal facilities and the National Highway System. The Federal Highway Administration maintains a listing of all intermodal connectors.

- **Alternate routes:** A network of alternate routes for the Primary Freight Network was identified.

- **Connecting to freight gateways:** Roadway sections within 10 miles of major seaports, freight airports and international border crossings were identified, with a focus on last mile connections.

- **Connecting to employment centers:** Roadway sections adjacent to employment centers (at least 100 employees in rural areas and 10,000 employees in urban areas), with a focus on last mile connections, were identified based on Global Insight’s Freight Finder data.
The results of the mobility and connectivity needs assessment are shown in Exhibit 10-5.

Exhibit 10-5: Mobility and Connectivity Needs

- **Asset Management** – Maintain and preserve infrastructure assets using cost-beneficial treatment.

  TxDOT has a statewide pavement management program in place to address pavement issues; therefore, asset management needs for the Freight Plan focused on bridges on the Texas Highway Freight Network or those that cross it. Bridges identified with asset management needs included:

  - **Bridges restricted to loads less than 80,000 pounds.**
  - **Bridges in poor condition.**
  - **Bridges with less than 15-foot clearance.** Bridges with a clearance of less than 15 feet are more likely to be struck and damaged by trucks.
  - **Bridges with less than 16’6” clearance.** Current design standard for bridges crossing an interstate highway is 16’6”.
  - **Bridges with less than 18’6” clearance.** One of the long-range policies of the Freight Plan is for all bridges crossing the Texas Highway Freight Network to have a minimum clearance of 18’6”.
All bridge data was based on TxDOT’s Texas Bridge Inventory and Inspection Database, June 15, 2014.

The results of the asset management needs assessment are shown in Exhibit 10-6.

Exhibit 10-6: Asset Management Needs

Identification and Prioritization of Highway Improvements
TxDOT maintains a project database to track the development of projects on the state’s highway system. This project database is instrumental in TxDOT’s project development process and includes projects in various stages of development:

- **Unified Transportation Plan (UTP):** Projects for which funding has been identified and that are anticipated to be completed within 10 years.
- **Development Authority:** Projects that are over and above the UTP’s fiscally constrained funding limit.
- **PLAN:** Projects for which a need has been identified and that are in the initial stages of development.

The Texas Highway Freight Network’s freight-related needs were compared to the projects in this database to pinpoint current TxDOT projects that may address the identified freight...
needs. This comparison also identified those needs for which there were not any projects currently planned. A process was developed to identify which projects may address the freight needs and which of the projects and additional needs are high-priority in regards to freight movements. Districts and 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.

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 improvements to the Texas Highway Freight Network.

In addition to the potential projects identified through the Freight Plan’s goal-based evaluation, all Intelligent Transportation Systems projects on the Texas Highway Freight Network were included in the list of potential freight improvement projects. This addresses the Technology goal of the Freight Plan, which aims to “improve the safety and efficiency of freight transportation through the development and utilization of innovative technological solutions.”

The results of the identification and prioritization process are discussed in Chapters 11 and 12.

Exhibit 10-7 depicts all projects and additional needs identified on the Texas Freight Highway Network.
10.2.3 Selection and Prioritization Process for Other Modes

The project selection process for other modes—including rail, waterway, air and pipeline—differed from that developed for highway projects because the infrastructure for these modes is largely privately owned. Project selection relied on extensive stakeholder input, publicly available transportation plans and documents and analysis completed as part of the Freight Plan.

Stakeholder Input

Stakeholder input was critical in developing recommendations. Listening session participants reviewed and commented on initial recommendations, which assisted in further refining and prioritizing the programs and projects. The TxFAC also provided input on recommendations and helped identify critical freight infrastructure projects. Input was solicited directly from private freight infrastructure owners and operators, such as Class I railroads and ports, to pinpoint infrastructure projects. Throughout the Freight Plan development process, input was also directly solicited from other stakeholders, including MPOs and transportation advocacy groups, like the I-69 Alliance, North American Strategy for Competitiveness and the Ports-to-Plains Alliance. Finally, TxDOT divisions and

2 Does not include potential future corridors.
departments, including the Rail and Maritime divisions, assisted in further refining recommendations.

**Other Plans and Documents**

A number of transportation and modal plans were consulted to identify any applicable programs and projects. Reviewed plans included but were not limited to:

- **Legislative Appropriations Request for Fiscal Years 2016 and 2017 (August 2014):** 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 2015-2016 Capital Program (September 2014):** The Port Authority Advisory Committee develops the Capital Program annual report that details various projects and funding needs submitted by Texas public 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 Security and Exchange Commission Company Annual Reports, company media releases and trade publications such as the Journal of Commerce.

- **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:
  3. Laredo District Coahuila/Nuevo León/Tamaulipas Border Master Plan (June 2012).
- **Metropolitan Transportation Plans**: These plans classify 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 freight-specific plans—the Houston-Galveston Area Council and the North Central Texas Council of Governments.

- **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 (2010)**: 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.

Other transportation-related documents reviewed included:

- TxDOT Waterborne Freight Corridor Study (2011).
- Gulf Intracoastal Waterway Legislative Reports.
- Border Trade Advisory Committee Reports.
- International Trade Corridor Plan (2012).

**Performance and Conditions Analysis**
The performance and conditions data analysis conducted as part of this study assisted primarily in pinpointing highway recommendations. The analysis also aided in validating modal projects identified by public- and private-sector stakeholders and projects from other plans, reports or documents. This process included identifying at-grade highway/rail crossings on the Texas Highway Freight Network and incorporating connectivity or mobility issues that impact access to/from marine ports, intermodal sites or identify other modal gateways.

**Air Cargo Projects**
Air cargo projects were identified by mapping all the planned highway improvement projects and current needs within 5 miles of the major cargo airports. The projects identified—along with addressing the current needs—will help improve access to the airports, thus ensuring freight can continue to move efficiently. Additionally, a survey was sent to the major cargo airports to capture any ongoing or planned projects at the airports or specific needs.
10.2.4 Economic Development Analysis Consideration in Project Selection

Although not specifically evaluated during the freight project identification process, the goal of economic competitiveness was intertwined throughout the process. Maintaining a safe, reliable and efficient Texas Highway Freight Network that connects freight gateways and freight generators to employment centers and consumers boosts the economic competitiveness of the state. Strategic enhancements, such as improving connections to ports, cargo airports and freight routes, make Texas a more attractive logistics hub.

The knowledge and wisdom of Texans on matters of freight mobility were brought to bear throughout this planning process. The decision-making process that evolved has many owners and reflects an unbiased, fair and transparent process, which TxDOT can utilize to select and prioritize freight projects.

Economic opportunities are often fast and fleeting, so it is important to have a process that allows short-, medium- and long-term needs to be considered simultaneously. Texas must have a flexible and efficient process to prioritize and select projects for the collective economic needs of the state and the nation. This planning process fits this need, and over time it can be revised as needs and issues change.
On a daily basis freight movement in Texas consists of hundreds of thousands of complex and multifaceted decisions and actions. The Freight Transportation Improvement Strategy reflects the scale and complexity of goods movement in Texas, and it provides a framework for freight transportation investment decision-making.

Numerous challenges to the state’s freight transportation network have been identified in previous sections of this Freight Plan, including aging infrastructure, urban congestion and bottlenecks, safety concerns, system capacity constraints, systems management and operations issues, rural and multimodal connectivity challenges, border and POE challenges, lack of public education and awareness, lack of institutional coordination, and funding challenges. Therefore, the recommendations presented in this Freight Plan are multimodal, multifaceted and provide a comprehensive approach.

The recommended improvement strategy outlines statewide freight transportation system enhancements that will:

- Strengthen Texas’ freight and logistics industry by improving mobility, reliability, efficiency and safety.
- Support long-term population, freight and economic growth; economic competitiveness; and quality of life.

The recommendations reflect an unprecedented stakeholder engagement process that included the Texas Freight Advisory Committee (TxFAC), two rounds of listening sessions throughout the state, a Freight Leadership Summit, electronic communications and input from public and private agencies and entities, as discussed in Chapter 10.

Freight transportation improvements were identified based on information from current freight transportation system conditions analyses, needs assessment, stakeholder input and performance gaps. The recommendations highlight the importance of continued investment, coordination, maintenance, system management and operations and innovation.

The Freight 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 freight planning is approached in Texas.
- **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 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 the 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, Metropolitan Planning Organizations (MPOs), local governments, private-sector entities such as railroads and other organizations. Therefore, a strong partnership and collaboration between all agencies and stakeholders will be required to effectively and successfully implement the Freight Plan recommendations.

This chapter discusses the development of recommendations and the Freight Transportation Improvement Strategy; Freight Plan coordination with other transportation plans; coordination with adjacent states and Mexico; and strategies important to key industries.

11.1 Recommendations and Freight Transportation Improvement Strategy

The designation of the Texas Freight Network, which consists of the Texas Highway Freight Network, Texas Rail Freight Network, Gulf Intracoastal Waterway (GIWW), major seaports, major cargo airports and the Pipeline Network, was a critical first step in developing the Freight Plan. The purpose of designating the Texas Freight Network was to focus the Freight Plan and guide future freight transportation investments in the most strategic facilities. The Texas Freight Network identifies the key freight transportation assets on which the bulk of the state’s freight moves. The Texas Freight Network was designated based on freight tonnage moved and the Texas Trunk system, and it connects major freight generators and gateways, such as major sea ports, cargo airports, international border crossings/ports-of-entry and numerous warehousing/distribution facilities.

The Texas Freight Network was vetted with the TxFAC and stakeholders throughout the state during the Freight Plan development. It 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 Freight Plan goals, as well as other state and federal goals discussed in Chapter 2, provided the foundation for developing the policy, program and project recommendations and for setting priorities for future freight transportation improvement implementation. These goals were used as the basis for verifying how well the current freight system meets the stated goals and for understanding the system’s deficiencies, needs and gaps.
Recommendations that support multiple goals were highlighted because they have the potential to benefit freight movement the most.

**Exhibit 11-1** illustrates the three broad-based improvement strategies: policies, programs and projects that form the framework for the Freight Plan recommendations and provide a guide for successful implementation.

### 11.2 Coordination with Other Transportation Plans

The Freight Plan development process reviewed other relevant statewide and regional transportation plans to identify other applicable freight policies, programs or projects. This coordination and information, along with the stakeholder input and data analysis, was considered in developing the state’s Freight Transportation Improvement Strategy. **Chapter 10** outlines other transportation plans used in developing the Freight Plan recommendations.

### 11.3 Coordination with Other Adjacent States and Mexico

The state’s Freight Transportation Improvement Strategy 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.

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 bridge replacements and upgrades.

In addition, information was gathered through the state’s partnerships on freight and transportation planning initiatives with MPOs in neighboring states. For example, the New Mexico Department of Transportation is developing a state long-range plan, which
incorporates freight, with the participation of the El Paso MPO and TxDOT El Paso District, along with other regional stakeholders.¹

The advent of NAFTA greatly expanded the scope of international activities for TxDOT, particularly through the TxDOT Freight and International Trade (FIT). 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 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 ports-of-entry, resulting 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).

11.4 Strategies and Recommendations for Key Industries

MAP-21 placed particular emphasis on infrastructure for transporting mining, agricultural, energy and timber equipment and products. MAP-21 highlighted the need for state freight plans to support freight systems serving those industries. These industries are strong contributors to Texas’ economy, as discussed in Chapter 3.

The analysis of the state’s agricultural, petroleum, mining and timber supply chains recognizes that deteriorating infrastructure is the most significant freight transportation problem facing these industries. The Freight Plan recommends preservation strategies for state highways, improved rural transportation and connectivity strategies and improved understanding of the impact of oversize/overweight (OS/OW) vehicles on the freight transportation network. The Freight Plan also outlines recommendations to improve safety on the Texas Freight Network, focusing on addressing at-grade highway/rail crossings, bridge design standards and high commercial motor vehicle crash and rollover locations.

Key improvements to the energy and agricultural sectors include building on ongoing energy sector transportation and safety initiatives and conducting a rural and agriculture transportation needs assessment. Project recommendations include increasing

infrastructure capacity and preservation for bridges and key corridors, as well as marine ports, the GIWW, railroads and intermodal connectors.

11.5 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 are also 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.

These policies were 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. The policies are outlined below.

11.5.1 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 planning and project selection process.
- Ensure effective implementation of the Freight Plan through a commitment to appropriate staffing and resources.
- 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, the Freight Leadership Summit and other outreach efforts.

11.5.2 Freight Network Designation and Investment

TxDOT should adopt the Texas Freight Network as the strategic framework for statewide transportation investment decisions.

The objectives of this policy are to:
- Provide an integrated and managed statewide system that links freight gateways and generators, labor force, population centers, available land and suppliers through a network of highways, railways, waterways, seaports, inland ports, pipelines, airports and ports-of-entry, consistent with supply chain operational requirements.
- Direct and prioritize federal, state and local investment in freight infrastructure to enhance the movement of freight throughout Texas and the nation.
- Support investment in the Texas Freight Network as a critical component of the state’s economy and to enhance economic vitality.
- Provide analysts, managers and policy-makers with a clear understanding of the areas of critical need for improving goods movement throughout the state.

### 11.5.3 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 TxDOT 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).
- Increase TxDOT’s current vertical clearance standard from 16 feet 6 inches to 18 feet 6 inches on the Highway Freight Network to accommodate oversize/overweight vehicles and military transportation needs and facilitate efficient movement of people and goods.
- Address the impact of the energy sector on the transportation network and the industry’s importance to the Texas economy by accounting for the impact of oversize/overweight commercial vehicles and hazardous materials transport.
- Harmonize truck-related requirements and laws of the state with those in neighboring states and provide guidance to local jurisdictions, including consistent designated routes and/or restrictions for trucks carrying oversize/overweight loads and hazardous materials.
- Assess opportunities to provide greater separation between truck and passenger vehicles on interstate segments of the Texas Highway Freight Network to promote efficient freight movement, decrease congestion and improve safety and quality of life.

### 11.5.4 System-Based Approach

TxDOT should continue efforts to implement a comprehensive, system-wide freight planning program.
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.
- Promote public education highlighting the close relationship between supply chain operation costs and the cost of living.
- Encourage efficient freight operations that minimize community impacts and meet business needs through improved modal options, innovative operational approaches and regulations.

### 11.5.5 Multimodal Connectivity

The state should invest in strategies and solutions that link the different freight transportation modes.

The objectives of this policy are to:

- Ensure the development of a system with adequate and available access points that facilitates the use of alternative modes beyond trucking to alleviate capacity concerns on highways (e.g., truck-rail facilities).
- 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.
- Emphasize project selection criteria in the TxDOT planning process that support and prioritize funding of first and last mile connectors in locations with regional, statewide and national significance, including both urban and rural connectors.
- Identify, preserve, protect and invest in first or last mile connector routes from the Texas Freight Network to freight gateways and generators, such as ports, international ports-of-entry and intermodal facilities.

### 11.5.6 Rural Connectivity

The state should continue to identify freight transportation issues critical to Texas’ rural areas and invest in infrastructure improvements that support economic development.

The objectives of this policy are to:

- Improve and strengthen Texas’ rural freight transportation system to enable the transport of energy, food and other critical raw materials.
Strengthen rural economic development opportunities through alternative modal options and connectivity.

11.5.7 Economic Development and Economic Competitiveness
TxDOT 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 public investments that keep pace with the projected freight growth, population growth, energy sector development, Panama Canal expansion, increasing trade with Mexico and other emerging issues.
- Support the strategies and initiatives of the Governor’s Office of Economic Development & Tourism and collaborate with relevant stakeholders to identify and implement transportation investments that support economic development.
- Support industry efforts to enhance workforce recruitment and retention in the transportation and logistics industries.

11.5.8 Texas as a North American Trade and Logistics Hub and Gateway
The state should continue to invest in strategic transportation solutions that enable Texas to maintain its position as the nation’s 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 trade with other states, Mexico, Canada and globally, while promoting Texas’ strategic location in national and international trade.
- Emphasize to elected officials and public planning managers the importance of freight-related planning partnerships, especially with neighboring states, Mexico and Canada.
- Link Texas’ top energy and agricultural regions to markets and gateways through the Texas Freight Network.
- Promote the state’s economic development and advance the “Texas Global Gateway” concept to provide a one-stop, unified, coordinated and comprehensive information portal for all transportation modes.

11.5.9 Safety, Security and Resiliency of the Freight Transportation System
TxDOT should identify and implement strategies that will improve safety and reduce crash rates, fatalities and injuries associated with freight movement on the Texas Freight Network.

The objectives of this policy are to:
• Prioritize funding for the elimination of freight movement safety “hot spots” (locations with high truck-related crashes) and identify potential crash remediation strategies.

• Improve safety along the Texas Freight Network, especially for the movement of hazardous materials and oversize/overweight loads, through clear route designation and signage, increased educational and training programs and accurate/timely communication with operators of the freight system.

• Build safety, security and resiliency factors into transportation infrastructure designs and investment decisions and ensure all the Primary Texas Highway Freight Network have alternate routes, especially for oversize/overweight vehicles, in the event of natural or man-made disasters.

• Recommend the development of new or expanded truck rest stops in the Highway Freight Network, in partnership with local agencies and the private-sector.

11.5.10 Freight Transportation Asset Management

TxDOT should continue to invest in innovative asset management strategies that facilitate the Texas Freight Network’s state-of-good repair, maintenance, management and operational improvements.

The objectives of this policy are to:

• Develop optimal asset management programs to protect existing infrastructure investments and maximize the capacity of the existing freight transportation assets.

• Maintain transportation facilities and services to preserve their function, extend their useful life, eliminate maintenance backlogs, improve bridge ratings and improve pavement condition.

• Identify constraints that lead to increased congestion, longer trip times and higher costs for businesses, which all impact industry productivity and competitiveness.

• Foster innovative asset management strategies between the public- and private-sectors, such as joint funding/financing options, data sharing and development trends.

11.5.11 Freight-Based Technology Solutions and Innovation

TxDOT should continue to be a leader in developing and implementing innovative transportation technologies, techniques, research and methods.

The objectives of this policy are to:

• Develop and expand partnerships with public- and private-sector stakeholders to implement proven freight-based technology solutions and foster emerging transportation technologies.
• Expand the development of sophisticated real-time information systems and increase the dissemination of dynamic travel information to improve freight movement mobility and reliability.

• Provide a seamless 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.

11.5.12 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:

• Reduce project delivery delays, coordinate project planning and delivery among agencies tasked with freight transportation system investment.

• Because of limited resources, establish a prioritized, financially constrained and needs-based freight network improvement program to optimize investments.

• Adopt freight performance measures that inform TxDOT decision-making, improve accountability and transparency to stakeholders and support performance-based planning.

• Encourage a transparent project selection process that is responsive to Texas’ business and community needs, resulting in the retention and creation of sustainable jobs and improved quality of life.

11.5.13 International Border/Ports-of-Entry
The state should invest in and facilitate international border coordination strategies to improve freight mobility and eliminate barriers to trade.

The objectives of this policy are to:

• Strengthen coordination between TxDOT and the Texas Secretary of State’s office on border management.

• Improve cross-border goods movement, support technology development and deployment of integrated border-crossing management through the application of Intelligent Transportation Systems (ITS) across international borders.

• Identify operational measures to improve border-crossing procedures for goods, particularly for urgent consignments such as live animals and perishables.

• Encourage standardization of regulations among federal, state, regional and local agencies, such as weighing and inspection operations and procedures to minimize repetitive inspections.
- 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.
- Expedite the execution of port-of-entry (POE) projects and identify bi-national mechanisms to coordinate planning and construction timelines for projects.
- Bring public- and private-sector stakeholders together to identify, develop and prioritize solutions for truck and rail border crossing challenges.

**11.5.14 Energy Sector Development Transportation**

TxDOT and the state should continue to identify and address current and future energy freight transportation needs and impacts and incorporate them into the planning and project selection process.

The objectives of this policy are to:

- Ensure a robust freight transportation network to safely and efficiently transport oil and gas to refineries and markets, and ensure well-maintained roadways serving those production areas, especially for first and last mile connections to these facilities.
- Encourage public-private coordination to develop alternative corridors and modes (e.g., roadway, rail, pipeline and intermodal) to transport oil and energy commodities.
- Strengthen partnerships between TxDOT, industry officials and local officials to fund, manage, repair and maintain roads heavily used for energy sector transportation.
- Assess and adequately prepare for potential infrastructure and economic impacts of new and increasing oil and natural gas production expected in other areas of the state and Mexico.

**11.5.15 Rail Freight Transportation**

TxDOT should continue to work with 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:

- Support partnerships for public-private funding and financing opportunities that expand rail capacity and connectivity.
- Highlight the importance of the rail industry to 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.
Foster rail freight as a practical modal alternative that could potentially relieve freight congestion on Texas highways.

**11.5.16 Port and Waterway Freight Transportation**

TxDOT should continue to work with the Texas ports, the U.S. Army Corps of Engineers (USACE) and other stakeholders to pursue strategies to strengthen and improve maritime freight, including identifying and supporting port improvement, access and channel deepening projects.

The objectives of this policy are to:

- Support public-private partnership opportunities that expand port capacity and connectivity, particularly through the identification of improvements for enhanced rail and truck access to Texas ports.
- Highlight the importance of Texas ports and the maritime industry to the economy of Texas through their position as critical national and international freight gateways.
- Promote the importance, awareness and use of the GIWW as a key component of the Texas Freight Network.
- Develop and present a coordinated and unified approach in federal funding for port-related projects.

**11.5.17 Air Cargo Transportation**

TxDOT should integrate the needs of the Texas aviation system, especially major air cargo centers, into state planning activities, initiatives and projects.

The objectives of this policy are to:

- Support public-private partnership opportunities that expand air cargo capacity and connectivity.
- Highlight the significance of air cargo transportation to 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 that will facilitate efficient air cargo movement at key air cargo airports, thus improving operational efficiency and enhancing truck access and connectivity.
- Incorporate air cargo needs, issues and recommendations in future updates of the TxDOT Texas Airport System Plan.
11.5.18 **Pipeline Infrastructure**
The state should work with the public- and private-sectors to support strategies that address pipeline capacity expansion to meet the needs of growing oil and gas development and production.

The objectives of this policy are to:
- Encourage, where feasible, modal collaboration for commodities that can be shipped by pipelines and minimize the impact of oil and gas development and production on roadway and rail infrastructure.
- Maintain Texas’ role as the leading oil and gas producing state through a comprehensive interconnected pipeline system.

11.5.19 **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.
- Support funding for existing freight programs, such as the Texas Rail Relocation Fund and Port Access Account Fund.
- Pursue the full return of Harbor Maintenance Tax fees to Texas.

11.5.20 **Institutional Coordination and Collaboration**
TxDOT should coordinate with industries and international, national, state, regional and local agencies.

The objectives of this policy are to:
- Advance the development of a “one-stop shop” permitting and compliance agency in Texas, empowered to coordinate permitting reviews within the state and with other permitting agencies at the local, regional, state and federal levels.
- Address intrastate and interstate policies and procedures (e.g., hours of service, truck weight, tolling, etc.) to ensure the expedited movement of freight.
- 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 significance.
11.5.21 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 with the public- and private-sectors to develop and implement the most effective public education and awareness strategy to communicate the importance of freight.
- Expand outreach efforts that educate the public about safety issues related to freight transportation, such as how to drive safely around commercial vehicles and heed rail crossing warnings.

11.5.22 Policies Conclusion

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 multi-jurisdictional nature of freight movement. These policy recommendations are used as the basis for the program and project recommendations, discussed in the following sections.

11.6 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/POE issues, institutional coordination, education, public awareness and funding.

The recommendations include several initiatives requiring public- and private-sector coordination and partnership 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.
Further details of the programs are provided in Appendix B and are summarized below.

11.6.1 **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 to improve the freight transportation system and on better ways to link transportation investments to the state’s economic development goals. The state should also pursue freight-related studies to address key issues and challenges identified in the Freight Plan.

11.6.2 **Freight Movement Education and Public Awareness**
The state should develop a Freight Movement Public Education and Awareness Program to educate the public, elected officials, policy-makers and other stakeholders on the economic benefits of freight and safety-related issues.

11.6.3 **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 management.

11.6.4 **Texas Border/Ports-of-Entry Transportation and Trade**
The state should establish a Texas Border Freight Transportation and Trade Management Program that would enhance international border coordination strategies to improve freight transportation safety, mobility and efficiency and to facilitate trade and travel without compromising security.

11.6.5 **Highway Safety, Design, Construction, Bridge, Interchange Improvement**
TxDOT should develop a Texas Highway Freight Network Safety Program focused on improving safety by minimizing conflicts between trucks and passenger vehicles on the network.

TxDOT should develop a Design, Construction and Safety Standards Program focused on reviewing and modifying standards to address safety and mobility needs for truck movements, increasing connectivity and increasing Texas Highway Freight Network efficiency and operations.

TxDOT should develop a Bridge Reconstruction and Replacement Program to address deficient bridges, increase vertical clearance to 18 feet 6 inches to accommodate
oversize/overweight vehicles and military transportation needs and facilitate efficient movement of people and goods.

TxDOT should develop an Interchange Reconstruction and Upgrade Program for all interstates to address obsolete designs and left exits to improve safety and mobility.

TxDOT should develop a Statewide Construction Management and Coordination Program to proactively minimize traffic impacts and improve safety and mobility for motorist and trucks.

**11.6.6 Rail Development and Improvement**

The state should 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.

**11.6.7 Port and Waterway Development and Improvement**

The state should develop and administer a comprehensive Maritime Freight Development Program focused on working with Texas ports and other stakeholders to identify strategies that expand port and waterway capacity and improve waterway infrastructure.

**11.6.8 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.

**11.7 Project Recommendations**

This section presents recommendations that resulted from the project identification and prioritization process discussed in *Chapter 10*. The Freight Plan project recommendations was a coordinated effort with input from TxFAC; stakeholders throughout Texas, including TxDOT districts and divisions, and MPOs; freight transportation system conditions; performance analysis; and existing documents and initiatives.

The project recommendations reflect the magnitude and complexity of moving freight in Texas and the needs identified by this Freight Plan. They help the state focus on short- and mid-term strategies, as well as plan for the longer term strategic freight transportation investments needed to address future freight movements and to enhance the state’s economic competitiveness. Implementing these recommendations will help achieve the Freight Plan goals, as well as the objectives of the policies and programs. The project recommendations are organized into four modal categories, as well as border/ports-of-entry:
While the Freight Plan addresses multimodal freight needs, it is largely oriented to highway-related project opportunities that can be addressed through traditional federal and state transportation funding. This funding is largely limited by federal and state laws and regulations to transportation infrastructure investment on the federal and state highway systems.

The Freight Plan identifies over 1,200 freight-related projects currently under development or in the planning phase (Exhibit 11-2). The total estimated cost of these projects is more than $49 billion. The majority of these projects are not fully funded, but there is significant interest from TxDOT, MPOs, the private-sector and the public-sector in developing these projects, given the importance of freight movement to the statewide economy.

Some of the projects with identified costs are based upon preliminary estimates. Therefore, as additional project development efforts take place, the total cost estimate of project improvements is likely to be higher than what is summarized here. This underscores the need for TxDOT, MPOs, local governments and other partners to better incorporate freight considerations in the project development process.

### Exhibit 11-2: Project Recommendations by Mode

<table>
<thead>
<tr>
<th>Mode</th>
<th># of Projects</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highway</td>
<td>878 (71%)</td>
<td>$36,585 (74%)</td>
</tr>
<tr>
<td>Rail</td>
<td>34 (3%)</td>
<td>$545 (1%)</td>
</tr>
<tr>
<td>Port and Waterway</td>
<td>130 (10%)</td>
<td>$3,014 (6%)</td>
</tr>
<tr>
<td>Air Cargo</td>
<td>44 (4%)</td>
<td>$2,794 (6%)</td>
</tr>
<tr>
<td>Border/POE</td>
<td>154 (12%)</td>
<td>$6,203 (13%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,240</strong></td>
<td><strong>$49,141</strong></td>
</tr>
</tbody>
</table>

Cost estimates for some of the other modal projects are not available. The values for the non-highway modes are not completely indicative of the level of investment in infrastructure needed to address freight needs specific to those modes. Much of that investment is private-sector funded, such as marine terminals, airport facility improvements and rail maintenance. Thus, the level of investment indicated in Exhibit 11-2 is a conservative estimate.
A detailed list of the project recommendations is included in Appendix C1 through Appendix G2.

11.7.1 Highway Projects

The Texas Highway Freight Network is the dominant infrastructure for freight movement in the state via truck, accounting for over 52 percent of total freight tonnage moved in Texas in 2014. The highway recommendations are comprised of two types of projects:

1. Current/Planned Projects: Includes those in TxDOT’s Unified Transportation Plan (UTP), Develop Authority and Planning Authority project databases. This did not include projects currently under construction. It’s important to note that these projects were identified and focused on meeting the mobility needs of commuters and not specifically freight needs.

2. Additional Needs: Includes projects where a freight transportation need was identified but there is no current planned project addressing that need.

The Texas Highway Freight Network is used as the framework for the project recommendations. The recommended highway projects span both urban and rural areas and address the needs related to the following set of Freight Plan goals:

- Mobility/Connectivity.
- Alternate Routes.
- Commercial Motor Vehicle (CMV) Bottlenecks.
- At-Grade Rail Crossings.
- Truck Rollovers/CMV Hot Spots.
- Asset Management.
- Technology and Operational Improvements.

Details on the identification process for these projects and needs are outlined in Chapter 10.

There are currently 878 highway projects, with an estimated cost of more than $36 billion, under planning or development to address freight transportation needs. While the majority of these projects are not fully funded, they provide an illustration of the work and initial investment that TxDOT, MPOs, and other planning partners already have underway to improve the Texas Highway Freight Network.

However, there are 768 segments on Texas Highway Freight Network with identified freight transportation needs that do not yet have a planned project. These needs have an
estimated cost of approximately $25.9 billion. Additional studies and analysis would be required to assess the scope for these projects.

The following sections provide an additional summary of highway project recommendations.

**Planned Freight Highway Projects**

Exhibit 11-3 shows the location of planned freight highway projects. Freight highway projects under development by districts are spread across the state, with the greatest concentration in the Texas Triangle region, which is comprised of projects within the Austin, Bryan, Dallas, Fort Worth, Houston, San Antonio and Waco districts. This region accounts for over $27.5 billion, or 76 percent, of the total $36 billion of freight highway projects currently under development.

**Exhibit 11-3: Planned Freight Highway Projects**

Exhibit 11-4 shows that of the 878 projects under development, 551 projects (63 percent) are in urban areas. Projects in urban areas account for 79 percent of total estimated cost, as compared to 21 percent for rural areas.
Exhibit 11-4: Current Projects under Development by Urban and Rural Region

<table>
<thead>
<tr>
<th>Region</th>
<th># of Projects</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>551 (63%)</td>
<td>$28,869 (79%)</td>
</tr>
<tr>
<td>Rural</td>
<td>327 (37%)</td>
<td>$7,716 (21%)</td>
</tr>
<tr>
<td>Total</td>
<td>878</td>
<td>$36,585</td>
</tr>
</tbody>
</table>

As shown in Exhibit 11-5, 487 of the total projects under development are on the Primary Freight Network, and 391 are on the Secondary Freight Network/Emerging Freight Corridors.

Exhibit 11-5: Current Freight Projects by Primary and Secondary Network

<table>
<thead>
<tr>
<th>Corridors</th>
<th># of Projects</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>487 (55%)</td>
<td>$28,650 (78%)</td>
</tr>
<tr>
<td>Secondary</td>
<td>391 (45%)</td>
<td>$7,935 (22%)</td>
</tr>
<tr>
<td>Total</td>
<td>878</td>
<td>$36,585</td>
</tr>
</tbody>
</table>

Projects on the Primary Freight Network account for a 78 percent share of the total estimated cost, as compared to 22 percent on the Secondary Freight Network/Emerging Freight Corridors.

Additional Needs on the Texas Highway Freight Network
Additional needs on the Highway Freight Network include projects where a need was identified but there is no current project under planning or 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/ports-of-entry. This reflects the importance of freight and trade gateways and the need for continued planning for transportation improvements at seaports (such as Houston and Corpus Christi), borders and ports-of-entry (such as El Paso and Laredo) and energy and agricultural regions (such as Midland/Odessa, San Angelo and Amarillo).

Exhibit 11-6 shows the segments of the Texas Highway Freight Network with additional freight mobility needs.
Of the 768 segments on the Texas Highway Freight Network with an identified freight transportation need, only 257 are in urban areas, as compared to 511 in rural areas (Exhibit 11-7).

<table>
<thead>
<tr>
<th>Region</th>
<th># of Segments</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>257 (33%)</td>
<td>$9,917 (38%)</td>
</tr>
<tr>
<td>Rural</td>
<td>511 (67%)</td>
<td>$16,037 (62%)</td>
</tr>
<tr>
<td>Total</td>
<td>768</td>
<td>$25,954</td>
</tr>
</tbody>
</table>

The majority of highway freight infrastructure needs are on the Secondary Freight Network/Emerging Freight Corridors (Exhibit 11-8). The Primary Freight Network has 243 highway segments identified with additional needs, as compared to 525 on the Secondary Freight Network/Emerging Freight Corridors.
The recommendations show that the majority of highway freight infrastructure needs identified are in rural areas and on the Secondary Freight Network/Emerging Freight Corridors. This emphasizes the importance of continued planning for infrastructure improvements in these areas to address freight mobility throughout the state.

**Recommendations Compared to Goal Area**

Projects were assessed as to which goal area they addressed. These goal areas are:

- **Mobility and Connectivity**: Mobility and connectivity projects include capacity expansion, such as lane widening or additions and new freeway or highway construction.

- **Alternate Routes**: The alternate route network is critical for providing redundancy and resiliency for interstate corridors, especially when an incident occurs. Addressing alternate route needs helps improve roadways along the Secondary Freight Network/Emerging Freight Corridors.

- **At-Grade Rail Crossings**: At-grade rail crossings can represent potential safety concerns by creating conflict points between trains and commercial/passenger vehicles, and they also impact the efficient movement of freight.

- **Bottlenecks**: Bottlenecks along the Texas Highway Freight Network impact the efficient movement of freight, resulting in increased cost for both the freight industry and consumers. Bottlenecks can delay shipments and decrease reliability, which is a critical component for the movement of freight.

- **CMV Hot Spots/Truck Rollovers**: CMV hot spots and rollover locations are areas along the Texas Highway Freight Network where CMV crashes or CMV rollovers have occurred most frequently in recent years.

- **Technology**: Technology projects include improved signalization wireless ITS and traffic management systems, as well as dynamic message signage.

**Planned Projects**

The vast majority of projects (81 percent) address only one goal, while a small number address two to four goals and none address more than four goals. (Exhibit 11-9).
The highest share of projects help improve alternate routes (48 percent), followed by those that improve mobility and connectivity (34 percent), address bottlenecks (16 percent) and address CMV hot spots/truck rollovers (15 percent). Identifying and prioritizing projects that meet multiple freight goals increases their overall impact on the Texas Highway Freight Network, thus providing additional value to the investment.

**Highway Segments with Additional Freight Transportation Needs**

As shown in Exhibit 11-10, there are 768 highway segments that have additional freight needs. Future projects on 687 of these segments would address a single freight goal. Future projects on 73 of the segments would address two goals, and future projects on seven of the segments would address three goals. Only a single segment would have a project that addresses four of the goals.

Future projects on segments addressing a single goal account for 89 percent of the total cost, followed by future projects on segments addressing two goals accounting for 9 percent of the total cost. Those segments with more than one or two needs should be identified and prioritized, since addressing these issues would increase the overall impact on the Texas Highway Freight Network.

Sixty percent of the segments had an alternate route need, followed by those segments with mobility and connectivity needs (23 percent).
**Mobility and Connectivity**

Exhibit 11-11 shows the segments of the network with additional mobility and connectivity needs. The needs may be related to locations with poor levels-of-service, capacity constraints, a high percentage of trucks or important connections to intermodal facilities, warehousing and distribution centers or economic and employment centers. Further analysis along these roadways is recommended to identify potential freight improvements to address the identified needs.

Exhibit 11-11: Mobility and Connectivity Needs

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**Alternate Routes and Frontage Roads**

Exhibit 11-12 shows the segments of the network with alternate route needs. These needs include alternate routes to address capacity constraints and improvements to reliever routes adjacent to interstate corridors. Additionally, many segments of interstates do not have parallel frontage roads, meaning that primary lane closures may not have a detour option. Further planning should be undertaken to identify those alternate route corridors and frontage road gaps requiring immediate improvements.
Along interstate corridors, especially in urban areas, the closest alternate route may be an adjacent parallel street or a frontage road. Frontage roads separate traffic and reduce congestion from the main highway. In addition, if the highway is closed or obstructed for whatever reason, frontage roads provide an easy alternate route for through traffic. Frontage roads also help keep traffic off local roads during an incident.

Lack of connectivity on frontage roads can result in mobility and congestion issues, especially in urban areas or along interstates connecting major urban centers. Exhibit 11-13 summarizes the total miles and mileage percentage of interstate corridors without frontage roads. As shown, IH-30 is missing frontage roads along 35 percent of the corridor—this is the lowest frontage road coverage in the state. IH-27 and IH-610 have the highest frontage road coverage in the state.
### Exhibit 11-13: Percentage of Interstates without Frontage Roads

<table>
<thead>
<tr>
<th>Interstate</th>
<th>Miles of Interstate without Frontage Road</th>
<th>Percentage of Interstate without Frontage Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>IH-2</td>
<td>1</td>
<td>2 %</td>
</tr>
<tr>
<td>IH-10</td>
<td>293</td>
<td>33%</td>
</tr>
<tr>
<td>IH-20</td>
<td>109</td>
<td>16%</td>
</tr>
<tr>
<td>IH-27</td>
<td>&lt;1</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>IH-30</td>
<td>78</td>
<td>35%</td>
</tr>
<tr>
<td>IH-35</td>
<td>15</td>
<td>4%</td>
</tr>
<tr>
<td>IH-35E</td>
<td>30</td>
<td>30%</td>
</tr>
<tr>
<td>IH-35W</td>
<td>27</td>
<td>32%</td>
</tr>
<tr>
<td>IH-37</td>
<td>29</td>
<td>19%</td>
</tr>
<tr>
<td>IH-40</td>
<td>29</td>
<td>16%</td>
</tr>
<tr>
<td>IH-44</td>
<td>&lt;1</td>
<td>3%</td>
</tr>
<tr>
<td>IH-45</td>
<td>40</td>
<td>13%</td>
</tr>
<tr>
<td>IH-69*</td>
<td>3</td>
<td>17%</td>
</tr>
<tr>
<td>IH-110</td>
<td>&lt;1</td>
<td>3%</td>
</tr>
<tr>
<td>IH-410</td>
<td>&lt;1</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>IH-610</td>
<td>&lt;1</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>IH-635</td>
<td>8</td>
<td>21%</td>
</tr>
<tr>
<td>IH-820</td>
<td>4</td>
<td>19%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>668</strong></td>
<td><strong>20%</strong></td>
</tr>
</tbody>
</table>

*Does not include recent IH-69 designations

The estimated cost to add one-way frontage roads on both sides of the interstate is over $2 billion.

### At-Grade Rail Crossings

**Exhibit 11-14** shows the segments of the network with at-grade crossing needs. The greatest needs for improvement projects are in the Houston metro area and around the Port of Houston, as well as on corridors connecting the Port of Corpus Christi to San Antonio. Further study is required to assess the need for and scope of improvements necessary for these locations.
**Bottlenecks**

Exhibit 11-15 shows the locations of the Texas Highway Freight Network with bottleneck issues. In particular, the Houston, San Antonio and Austin metro areas have the greatest need for planning projects to address these issues. Further analysis along these roadways is recommended to identify potential freight improvements to address bottlenecks.
Commercial Motor Vehicle Hot Spots/Truck Rollovers

Exhibit 11-16 shows the segments of the network with additional CMV hot spot/truck rollover needs. In particular, segments with higher crash rates and a high number of rollovers include rural areas along IH-10 and IH-20; secondary routes connecting to IH-35 between Austin and the Dallas-Fort Worth region; and IH-30 at IH-35E in Dallas.

Technology

While segments of the Texas Highway Freight Network with unmet ITS needs were not identified, it is recommended that as segments of the highway infrastructure network are improved—especially on the Primary Freight Network—technology and other operational improvements should be integrated into the projects where feasible.
Asset Management

The asset management goal of the Freight Plan is focused on the bridges along and crossing the Texas Highway Freight Network. The Freight Plan’s asset management recommendations are comprised of 3,337 projects, with a total estimated cost of more than $4.5 billion. These include bridge replacements and roadway improvement projects, which are summarized in Exhibit 11-17.
Exhibit 11-17: Bridge Needs on the Texas Highway Freight Network

<table>
<thead>
<tr>
<th>Bridge Issue</th>
<th>Primary</th>
<th></th>
<th></th>
<th></th>
<th>Secondary</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># of</td>
<td>Estimated Cost</td>
<td># of</td>
<td>Estimated Cost</td>
<td># of</td>
<td>Estimated Cost</td>
<td></td>
<td></td>
<td>Estimated Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bridges</td>
<td>(in millions)</td>
<td>Bridges</td>
<td>(in millions)</td>
<td>Bridges</td>
<td>(in millions)</td>
<td></td>
<td></td>
<td>(in millions)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 15 feet</td>
<td>122</td>
<td>$557</td>
<td>123</td>
<td>$298</td>
<td>245</td>
<td>$855</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 15 feet and 16'6&quot;</td>
<td>754</td>
<td>$783</td>
<td>426</td>
<td>$504</td>
<td>1,180</td>
<td>$1,287</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 16'6&quot; and 18'6&quot;</td>
<td>1,021</td>
<td>$1,049</td>
<td>821</td>
<td>$1,008</td>
<td>1,842</td>
<td>$2,056</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor Condition</td>
<td>43</td>
<td>$249</td>
<td>20</td>
<td>$73</td>
<td>63</td>
<td>$322</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load Restriction</td>
<td>2</td>
<td>$5</td>
<td>4</td>
<td>$14</td>
<td>6</td>
<td>$20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Narrow Width</td>
<td>N/A</td>
<td>N/A</td>
<td>1</td>
<td>$4</td>
<td>1</td>
<td>$4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,942</td>
<td>$2,643</td>
<td>1,395</td>
<td>$1,901</td>
<td>3,337</td>
<td>$4,544</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The location of these bridges is presented in Exhibit 11-18. A key policy recommendation of the Freight Plan is that all bridges crossing interstates have a minimum clearance of 18’6”. Achieving this clearance is a long-range goal, as currently there are more than 1,800 bridges crossing the Primary Freight Network with clearances of less than 18’6”. Raising bridge clearances should be considered during design of all freight network corridors in conjunction with other roadway improvements.

There are 876 bridges crossing the Primary Freight Network and 549 bridges crossing the Secondary Freight Network/Emerging Freight Corridors that are below the current minimum vertical clearance of 16’6”. Raising these bridge clearances to the recommended 18’6” vertical clearance will enhance the safe and efficient movement of freight and will bring these interstate corridors up to current design standards. The highest priority bridge clearance projects should be on the interstate system.

As these projects are constructed, it is recommended that every effort should be made to address bridge load or clearance restrictions. Further analysis is recommended in the Freight Plan programs (Appendix B) to develop a long-term strategy and prioritize improvements to the remaining bridges on the Primary Freight Network and Secondary Freight Network/Emerging Freight Corridors.

As with vertical bridge clearances, remediation of these bridges should be considered during design, in conjunction with other roadway improvements, as well as identification of improvements along critical corridors.
Summary of Highway Recommendations
This section highlighted the freight needs on the Texas Highway Freight Network beyond those which may be addressed by the currently planned highway investments. The planned projects represent an emphasis on infrastructure improvements in urban areas, as well as on the Primary Freight Network. However, the majority of needs identified were in rural areas and on the Secondary Freight Network/Emerging Freight Corridors. This indicates that improvements to the current project planning process should be considered to better integrate freight mobility needs. Finally, identifying projects that can meet multiple freight goals represents an opportunity to better leverage infrastructure investments.

11.7.2 Rail Projects
Rail recommendations were identified by the railroads operating within the state and through input from stakeholders. The projects discussed in this section focus on high-priority rail projects; a more comprehensive list of rail projects can be found in the 2010 Texas Rail Plan, as well as in the respective capital plans of the railroads.

The Freight Plan reflects 34 rail projects with a total estimated cost of $545 million. However, estimates for most of the projects were not available. The majority of the
estimated rail improvement cost comes from the TxDOT Legislative Appropriations Request for Fiscal Years 2016 and 2017 and border master plans. **Exhibit 11-19** shows the breakout of the rail projects by source.

<table>
<thead>
<tr>
<th>Source</th>
<th># of Projects</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I Railroads*</td>
<td>19</td>
<td>$32**</td>
</tr>
<tr>
<td>Freight Plan Listening Sessions</td>
<td>3</td>
<td>TBD</td>
</tr>
<tr>
<td>Panama Canal Stakeholder Working Group</td>
<td>1</td>
<td>TBD</td>
</tr>
<tr>
<td>TxDOT Legislative Appropriations Request for Fiscal Years 2016-2017</td>
<td>10</td>
<td>$508</td>
</tr>
<tr>
<td>CapMetro</td>
<td>1</td>
<td>$5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34</strong></td>
<td><strong>$545</strong></td>
</tr>
</tbody>
</table>

* Class I includes BNSF Railway (BNSF), Kansas City Southern (KCS) and Union Pacific (UP)

**Estimates were not available for all projects**

The Freight Plan provides recommendations to improve mobility and increase capacity through double-tracking existing rail lines and the addition of new rail lines. Additionally, the railroads and public agencies are collaborating to improve rail bottlenecks.

Improved connectivity is another important goal. This includes connections to ports, intermodal yards and improved rail access to facilities. Improving connectivity means goods can transfer from one mode to another seamlessly, thereby reducing transit time to final markets.

At-grade rail crossings pose safety and mobility concerns. Removing at-grade rail crossings will reduce the number of incidents that occur, eliminate bottlenecks and allow trains to operate more efficiently. A number of rail grade separation projects are identified. The Freight Plan includes over $1.7 billion for 65 highway/rail grade separations projects from TxDOT’s UTP, under preliminary planning efforts. 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 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.

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.

11.7.3 Port and Waterway 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.

The Freight Plan reflects 130 port and waterway projects with a total estimated cost of more than $3 billion (Exhibit 11-20). These projects have been identified through various sources that include:

- Texas Port Report (June 2014).
- Individual Texas ports.
### Exhibit 11-20: Port and Waterway Project Recommendations (by Port)

<table>
<thead>
<tr>
<th>Port</th>
<th># of Capital Projects</th>
<th>Estimated Cost (in millions)</th>
<th># of Access Projects</th>
<th>Estimated Cost (in millions)</th>
<th># of Other Projects*</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Arthur</td>
<td>4</td>
<td>$70</td>
<td>6</td>
<td>$25</td>
<td>1</td>
<td>TBD</td>
</tr>
<tr>
<td>Beaumont</td>
<td>26</td>
<td>$649</td>
<td>7</td>
<td>$39</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Brownsville</td>
<td>5</td>
<td>$58</td>
<td>3</td>
<td>$35</td>
<td>1</td>
<td>$1</td>
</tr>
<tr>
<td>Calhoun</td>
<td>4</td>
<td>$650</td>
<td>1</td>
<td>&lt;$1</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Corpus Christi</td>
<td>3</td>
<td>$131</td>
<td>4</td>
<td>$84</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Freeport</td>
<td>9</td>
<td>$396</td>
<td>2</td>
<td>$1</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Galveston</td>
<td>4</td>
<td>$112</td>
<td>0</td>
<td>$0</td>
<td>1</td>
<td>&lt;$1</td>
</tr>
<tr>
<td>Harlingen</td>
<td>2</td>
<td>$7</td>
<td>2</td>
<td>$3</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Houston</td>
<td>3</td>
<td>$338</td>
<td>14</td>
<td>$261</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Port Isabel</td>
<td>1</td>
<td>$1</td>
<td>3</td>
<td>$1</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Mansfield</td>
<td>2</td>
<td>$9</td>
<td>0</td>
<td>$0</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Orange</td>
<td>1</td>
<td>TBD</td>
<td>0</td>
<td>$0</td>
<td>1</td>
<td>TBD</td>
</tr>
<tr>
<td>Palacios</td>
<td>2</td>
<td>$5</td>
<td>2</td>
<td>TBD</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Victoria</td>
<td>5</td>
<td>$33</td>
<td>2</td>
<td>$12</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>West Calhoun</td>
<td>1</td>
<td>$3</td>
<td>0</td>
<td>$0</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Ports (statewide)</td>
<td>1</td>
<td>$30</td>
<td>0</td>
<td>$0</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>GIWW</td>
<td>6</td>
<td>$60</td>
<td>0</td>
<td>$0</td>
<td>1</td>
<td>TBD</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>79</strong></td>
<td><strong>$2,552</strong></td>
<td><strong>46</strong></td>
<td><strong>$461</strong></td>
<td><strong>5</strong></td>
<td><strong>$1</strong></td>
</tr>
</tbody>
</table>

* Other projects include planning studies and a Gulf Intracoastal Waterway project to designate the Texas portion of the waterway as the M-69

Replacing the floodgates and locks along the GIWW is identified as a pressing need, and the related projects are a priority. These projects not only address the asset management goal, but also the safety and mobility goals by improving barge traffic along the waterway.

Improved intermodal connectivity is a high priority for ports. This includes increased rail access to the ports, improved highway and roadway access and highway capacity projects on roadways in and around ports. Additionally, several ports are investigating the development of oversize/overweight corridors.

Port mobility goals are addressed through projects that alleviate congestion at ports and capacity improvements. A number of projects are recommended to address overall operations, such as improvements to ports and the GIWW through continued maintenance and dredging. An additional example is the replacement of bridges that serve the ports. Modification or replacement of such a bridge could allow an increase in height and air draft.
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.

### 11.7.4 Air Cargo Highway Access Projects

The Additional needs and projects discussed in this section relate to improving access between Texas commercial airports and the Texas Highway Freight Network.

The Freight Plan reflects 44 access projects for eight commercial air cargo airports with a total estimated cost of almost $2.8 billion (Exhibit 11-21).

<table>
<thead>
<tr>
<th>Airport</th>
<th># of Access Projects</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austin-Bergstrom International</td>
<td>5</td>
<td>$412</td>
</tr>
<tr>
<td>Dallas/Fort Worth International</td>
<td>8</td>
<td>$1,425</td>
</tr>
<tr>
<td>El Paso International</td>
<td>12</td>
<td>$324</td>
</tr>
<tr>
<td>Fort Worth Alliance</td>
<td>2</td>
<td>$10</td>
</tr>
<tr>
<td>George Bush International/Houston</td>
<td>2</td>
<td>$8</td>
</tr>
<tr>
<td>Laredo International</td>
<td>11</td>
<td>$131</td>
</tr>
<tr>
<td>Lubbock Preston Smith International</td>
<td>1</td>
<td>$2</td>
</tr>
<tr>
<td>San Antonio International</td>
<td>3</td>
<td>$482</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>44</strong></td>
<td><strong>$2,794</strong></td>
</tr>
</tbody>
</table>

The projects encompass highway improvements such as roadway widening, interchange improvements and ITS installation. All of the projects are detailed in Appendix F1, and they 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.

The Freight Plan identified 31 additional needs for seven commercial air cargo airports with a total estimated cost of almost $36 million (Exhibit 11-22).
### Exhibit 11-22: Air Cargo Additional Needs (by Airport)

<table>
<thead>
<tr>
<th>Airport</th>
<th># of Additional Needs</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austin-Bergstrom International</td>
<td>6</td>
<td>$30</td>
</tr>
<tr>
<td>Easterwood Airport (College Station)</td>
<td>1</td>
<td>$&lt;1</td>
</tr>
<tr>
<td>El Paso International</td>
<td>12</td>
<td>$1</td>
</tr>
<tr>
<td>George Bush International/Houston</td>
<td>4</td>
<td>TBD</td>
</tr>
<tr>
<td>Laredo International</td>
<td>1</td>
<td>$&lt;1</td>
</tr>
<tr>
<td>Lubbock Preston Smith International</td>
<td>3</td>
<td>$1</td>
</tr>
<tr>
<td>San Antonio International</td>
<td>4</td>
<td>$4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>31</strong></td>
<td><strong>$36</strong></td>
</tr>
</tbody>
</table>

The additional needs include highway improvements that address the following freight mobility goals: Mobility/Connectivity, Alternate Routes, Bottlenecks and/or Hotspots. All of the additional needs are detailed in the Appendix F2.

#### 11.7.5 Border/POE Projects

The Texas-Mexico border is critical for international trade and economic competitiveness not just for Texas but for the entire nation and North America. Effectively addressing the freight transportation needs of the border is paramount to the continued economic vitality of Texas.

The Freight Plan includes 154 border/POE projects identified based on existing planned projects in the border master plans, with a projected cost of more than $6 billion. The projects were broken down into three categories, as shown in Exhibit 11-23. A list of the border projects is included in Appendix G1 and Appendix G2.

- POE: 42 projects with an estimated cost of more than $600 million.
- Road and Interchange: 107 projects estimated at over $5 billion.
- Rail: Five projects at an estimated cost of more than $400 million.
11.8 Next Steps

The recommendations outlined thus far have focused on policies, program and projects. These include recommendations identifying current planned projects, as well as the additional needs of the system. This chapter provided three multimodal and broad-based improvement strategies for addressing freight transportation challenges in Texas:

- **Policies** – Broad policy recommendations to help change the way that freight planning is approached in Texas.
- **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 movements along the Texas Freight Network.

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 high-, medium- and low-priorities outlined in Chapter 12.

Implementation of these policies, programs and projects requires TxDOT leadership, as well as partnerships and collaboration with other federal, state, regional and local agencies and the private-sector. These responsibilities, and the implementation schedule, are discussed in Chapter 12.
The recommendations discussed in Chapter 11 enable the safe and efficient movement of freight through 2040. This chapter, and accompanying Appendices, details project prioritization and timeframes and serves as a guide for implementing the Freight Plan’s policies, programs and projects.

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. While this chapter provides a summary of the implementation plan, a complete list of projects, including the implementation timeframe, is located in the Appendices.

The implementation plan includes a summary of the programs and projects, estimated costs (when available) and prioritization (high, medium and low) of the needs identified in Chapter 11. The identified priorities are target objectives, but the actual implementation is heavily dependent on available resources, other competing transportation priorities and the changing dynamics of transportation needs around the state. The Freight Plan will need to be updated regularly to adapt to these issues and adjust priorities as may be appropriate.

### 12.1 Program Recommendations

Program recommendations were discussed in detail in Chapter 11. For the complete list of programs and their associated timeframes, refer to Appendix B.

Many of the freight programs identified as high priority 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.

### 12.2 Project Recommendations

#### 12.2.1 Highway Projects

The following sections summarize the projects under development and additional freight needs on the Texas Highway Freight Network by priority.

Exhibit 12-1 shows that the highest percentage of projects under development on the Texas Highway Freight Network are located on segments with high-priority freight transportation needs (38 percent), followed by low-priority needs (36 percent) and medium-priority needs (26 percent).
### Exhibit 12-1: Projects under Development by Priority

<table>
<thead>
<tr>
<th>Priority of Need</th>
<th>Projects</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>% of Total</td>
</tr>
<tr>
<td>High</td>
<td>329</td>
<td>38%</td>
</tr>
<tr>
<td>Medium</td>
<td>230</td>
<td>26%</td>
</tr>
<tr>
<td>Low</td>
<td>319</td>
<td>36%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>878</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

### Priority Highway Segments with Additional Needs

*Exhibit 12-2* shows that of the 768 segments identified with additional needs (and without a planned project), the majority of relevant freight projects were identified as low-priority at 61 percent, followed by medium-priority at 25 percent and high priority at 14 percent.

<table>
<thead>
<tr>
<th>Priority of Need</th>
<th>Segments With Additional Needs</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>% of Total</td>
</tr>
<tr>
<td>High</td>
<td>104</td>
<td>14%</td>
</tr>
<tr>
<td>Medium</td>
<td>195</td>
<td>25%</td>
</tr>
<tr>
<td>Low</td>
<td>469</td>
<td>61%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>768</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Highway projects increase roadway capacity and also provide operational improvements. Examples of highway capacity projects include construction of new main and passing lanes, widening and expansion of roadways and construction of new frontage roads. These projects allow for additional through traffic on the facility. *Exhibit 12-3* shows the capacity projects which share segments with freight needs, as well as segments with needs and no accompanying freight projects. High-priority capacity projects are distributed throughout the state, with a concentration in urban areas, along major freight highway corridors and in or near freight gateways and generators.
Non-capacity/operational projects consist of other improvements which may not necessarily add capacity but will improve overall mobility and safety. Examples of non-capacity/operational projects include signalization improvements, addition of shoulders and medians, realignment of roadways and enhanced Intelligent Transportation Systems (ITS).

Exhibit 12-4 shows the non-capacity/operational projects by priority and segments with additional freight needs. Similar to capacity projects, these projects are also distributed throughout the state.
12.2.2 Rail Projects

The Freight Plan identifies 34 rail projects with a total estimated cost of $545 million. As shown in Exhibit 12-5, 14 projects are high-priority. As noted in Chapter 11, estimates were not available for a number of projects.

<table>
<thead>
<tr>
<th>Priority</th>
<th># of Projects</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>14 (41%)</td>
<td>$508</td>
</tr>
<tr>
<td>Medium</td>
<td>5 (15%)</td>
<td>$37</td>
</tr>
<tr>
<td>Low</td>
<td>15 (44%)</td>
<td>TBD</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>$545</td>
</tr>
</tbody>
</table>

The full list of prioritized rail projects is included in Appendix D.
12.2.3 **Port and Waterway Projects**

The Freight Plan contains 130 port and waterway projects with a total estimated cost of over $3 billion (Exhibit 12-6). Approximately 56 percent of these projects are high-priority, with an estimated cost of over $1.4 billion, 11 percent are medium-priority at over $1 billion and 33 percent are low-priority at over $500 million.

<table>
<thead>
<tr>
<th>Priority</th>
<th># of Projects</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>73 (56%)</td>
<td>$1,457</td>
</tr>
<tr>
<td>Medium</td>
<td>14 (11%)</td>
<td>$1,043</td>
</tr>
<tr>
<td>Low</td>
<td>43 (33%)</td>
<td>$514</td>
</tr>
<tr>
<td>Total</td>
<td>130</td>
<td>$3,014</td>
</tr>
</tbody>
</table>

Exhibit 12-6: Seaports and Waterway Projects by Priority

The full list of prioritized port and waterway projects is included in Appendix E.

12.2.4 **Air Cargo Highway Access Projects**

The Freight Plan reflects 44 air cargo highway access projects with a total estimated cost of almost $2.8 billion. Exhibit 12-7 shows that nearly half of the projects are identified as high-priority with an estimated cost of over $1.2 billion.

<table>
<thead>
<tr>
<th>Priority</th>
<th>Segments With Additional Needs</th>
<th>Estimated Cost (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>% of Total</td>
</tr>
<tr>
<td>High</td>
<td>21</td>
<td>48%</td>
</tr>
<tr>
<td>Medium</td>
<td>9</td>
<td>20%</td>
</tr>
<tr>
<td>Low</td>
<td>14</td>
<td>32%</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>100%</td>
</tr>
</tbody>
</table>

Exhibit 12-7: Air Cargo Projects by Priority

The full list of prioritized air cargo projects is included in Appendix F1.

12.2.5 **Border/Port-of-Entry Projects**

The Freight Plan identifies 154 border projects with a total estimated cost of more than $6.2 billion. Fifty-two projects are considered high-priority, with an estimated cost of more than 1.4 billion. The majority of these projects are port-of-entry (POE) and road and interchange projects. There are five rail projects, three of which are considered high-priority.

A summary of the timeframe of these projects is found in Exhibit 12-8.
The full list of prioritized border projects is included in Appendix G1 and Appendix G2.

12.3 Strategic/Future Freight Transportation Improvements

The recommendations outlined thus far have focused on policies, program and projects, including identifying current planned projects and additional system needs. These recommendations help address the state’s future freight transportation demands.

The strategic areas discussed in this section assist in identifying future needs and create a foundation for setting the priorities outlined in this chapter. The areas reflect the most critical components of the statewide freight transportation system, including:

- Highway.
- Operational and Technology.
- Rail.
- Port and Waterway.
- Air Cargo.
- Border/Ports-of-Entry.

These strategic areas combine elements of the policies, programs and projects previously discussed and provide a holistic approach to managing future issues on the state’s freight transportation system.

12.3.1 Highway Projects

Keeping Texas economically competitive will require strategic investments on the Texas Highway Freight Network. This will involve expanding the network to include new facilities required, as well as better managing and operating existing corridors to meet the increased demand for goods movement as the state’s population grows. To implement the identified policies, programs and project recommendations, investments should focus on several
components of the Texas Highway Freight Network. The project recommendations do include numerous investments along these strategic facilities, but they should also remain a focus for project development activities.

Primary Freight Network

Interstate Corridors

Interstate corridors are the backbone of the state’s highway freight network. These corridors connect major urban centers, provide access to rural areas and serve as critical corridors for national and international freight movement by truck. Specific priorities for the Primary and Secondary Highway Freight Network are itemized below:

- Prioritize investment in existing major freight interstates:
  - Invest in existing facilities to maintain them in a state of good repair.
  - Identify needs for increased capacity, operational or technological improvements.

- Develop and complete new corridors:
  - Develop additional freight conduits to relieve congestion on these routes and provide more efficient access to areas outside those currently served by these interstates. An example is continued upgrades to complete IH-69 along the US 59, US 77 and US 281 corridors.
  - Give additional consideration to the extension or designation of other interstate routes. Examples include IH-27 and upgrades to portions of US 190 to interstate standards.

- Improve alternate routes:
  - Consider frontage road construction at locations where none exist on interstate corridors.
  - Convert two-way frontage roads to one-way where feasible.
  - Designate alternate routes for all the Primary Texas Freight Network, especially for use by oversize/overweight vehicles and hazardous cargo.

- Repair structurally deficient bridges and increase bridge vertical clearances.

- Adopt freight-centric design standards, including but not limited to:
  - Bridge clearances of 18’6”.
  - Appropriate turning radii.
  - Superelevation.
  - Roadway grades.
Implement ITS as additional improvements are made, such as freight traveler information system, dynamic messaging signs, truck platooning and Intelligent Vehicle Initiative.

Expand safety improvements, including median barriers and rumble strips.

Improve freight bottlenecks.

Upgrade and improve interchanges.

Improve signage and truck route designation on corridors, especially for the movement of hazardous materials and oversize/overweight loads.

Non Interstate Corridors
Many U.S., state and other highways on the Primary Freight Network provide connections between interstate corridors and other areas of the state. They also provide alternate routes for trucks to avoid recurring congestion, roadway construction or traffic incidents. For example, US 281, US 75, US 79, State Highway (SH) 288, US 290 and Ports-to-Plains roadways (US 277 and US 287) are vital non-interstate Primary Freight Network corridors.

Identify relief routes along major cities:

Provide alternatives to those corridors that cause delays because of increased traffic or numerous traffic signals. Examples are IH-69 East relief route through Houston providing access to the Port of Houston and the petroleum industries southeast of the Houston area and SH 130 south relief route connecting to IH 35 south of San Antonio to provide bypass for truck traffic from and to Laredo.

Repair structurally deficient bridges and increase bridge vertical clearances.

Adopt freight-centric design standards, including but not limited to:
- Bridge clearances of 18'6”.
- Appropriate turning radii.
- Superelevation.
- Roadway grades.

Implement appropriate ITS as additional improvements are made.

Expand safety improvements, including median barriers and rumble strips.

Remove freight bottlenecks.

Upgrade and improve interchanges.

Improve signal timing/coordination.

Improve signage and truck route designation on corridors, especially for the movement of hazardous materials and oversize/overweight loads.
- Standardize access management standards.

**Secondary Freight Network/Emerging Freight Corridors**

Many of the vital last mile connections and major routes through rural portions of Texas for freight are provided by the Secondary Freight Network/Emerging Freight Corridors. Examples of vital Secondary Freight Network/Emerging Freight Corridors include:

- SH 146 providing connections to the Port of Houston.
- US 83 connecting to several Ports of entry at the Texas-Mexico border
- US 87 a Ports-to-Plains roadway running north-south from the Texas-Mexico border to Lubbock.

This network also provides alternate routes for many interstates on the Primary Freight Network.

- Although not anticipated to convey as many trucks as Primary Freight Network roadways, all potential investments on Secondary Freight Network/Emerging Freight Corridors highways should still adopt freight-centric design standards, including but not limited to:
  - Bridge clearances of 18’6”.
  - Appropriate turning radii.
  - Superelevation.
  - Roadway grades.
  - Minimum of four lanes or Super 2s.

- Implement appropriate ITS as additional improvements are made.
- Expand safety improvements, including median barriers and rumble strips.
- Improve signal timing/coordination.
- Improve signage and truck route designation on corridors, especially for the movement of hazardous materials and oversize/overweight loads.
- Standardize access management standards.

**12.3.2 Strategic/Future Operational and Technology Improvements**

Operational and technology strategies should focus on improving freight transportation system management.

- Expand and deploy ITS technologies to make better use of the network, reduce congestion and increase mobility.
- Develop a statewide traffic management center, integrating existing regional traffic management centers.
- Adopt statewide traffic incident management standards to comprehensively address commercial vehicle incidents.
- Improved freight movement signal timing/coordination to increase CMV throughput and improve safety.

12.3.3 Strategic/Future Rail Improvements

Railways are crucial to the state’s position in domestic and global networks. TxDOT should coordinate with the railroad companies on strategies to improve movements on the rail network.

- Continue to work with the railroads through public-private partnership opportunities.
- Improve overall rail connectivity and mobility. Some examples include:
  - Improvements to the Neches River rail bridge, a major rail bottleneck in the Beaumont area.
  - Reduce the number of at-grade crossing in the Laredo and Houston areas.
- Identify rural access needs and improvements.
- Identify priority rail corridors.
- Improve multimodal connectivity to industrial facilities, including ports, industrial parks and transloading facilities.
- Increase integration of rail freight movement with other modes of transportation.
- Reduce the number of at-grade crossings statewide.
- Enhance/expand the role of short line railroads.
- Expand TxDOT’s coordination with Rural Rail Transportation Districts.
- Expand rail capacity and ease rail congestion through increasing double-track and double-stack routes.

12.3.4 Strategic/Future Port and Waterway Improvements

The Texas seaport and waterway system is critical to statewide and national economic vitality. TxDOT should coordinate with the ports on several strategies to improve movement to and through the ports and waterways.

- Continue port improvements, access and channel deepening projects.
- Increase dredging and maintenance on Texas waterways and channels, including the Gulf Intracoastal Waterway (GIWW).
- Present a coordinated and unified approach in federal funding for port-related projects, including dredging and maintenance.
- Expand the use of the GIWW to transport cargo by actively partnering with shippers, ports and other transportation entities.
- Continue improving port and waterway infrastructure along the GIWW. Examples of critical projects include:
  - Update or replace the Brazos River Floodgates.
  - Update or replace the Colorado River Lock.
- Expand port capacity and connectivity, including:
  - Improve truck access and maintain landside access to ports and facilities.
  - Provide direct rail connections to ports.

### 12.3.5 Strategic/Future Air Cargo Improvements
Air transport is the priority system for the timely transport of valuable and perishable products. TxDOT should coordinate with the airports on several strategies to improve movement to and through the airports.

- Improve airport landside access and connectivity, especially to designated National Highway System intermodal connectors and the Texas Freight Network.
- Incorporate air cargo needs, issues and recommendations in future updates of the Texas Department of Transportation’s (TxDOT) Texas Airport System Plan.
- Integrate airport and air cargo planning initiatives into local, regional and statewide planning efforts.

### 12.3.6 Strategic/Future Border and POE Improvements
Enhance international border coordination strategies to improve freight transportation safety, mobility and efficiency and facilitate trade and travel. TxDOT should coordinate with the Mexican government on strategies to improve movement to and through the borders.

- Develop a comprehensive and coordinated Texas-Mexico border strategy to:
  - Promote trade and commerce.
  - Facilitate border infrastructure development.
- Increase the development and deployment of integrated border-crossing management.
- Increase the application of ITS and other technology improvements, including:
  - Electronic screening.
  - Cargo inspection.
  - Advanced traveler and trucker information.
- Identify major statewide rail and highway trade corridors to the Mexican border.
Invest and expand border transportation infrastructure, including rail corridors, highways and bridges.

### 12.4 Next Steps

The Freight Plan is TxDOT’s first statewide freight-centric transportation plan that provides a vision for a safe, reliable and efficient freight transportation system that supports Texas’ economic growth and global competitiveness. It identifies Texas’ freight transportation challenges and outlines the investment strategies and policies needed to address them.

Implementation of this Freight Plan will only be successful with the participation and collaboration of all users and owners of the transportation system, both public and private. 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 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 was fortunate to have the support of the Texas Freight Advisory Committee (TxFAC) throughout the development of this Freight Plan. The Committee’s insight was instrumental in guiding the Freight Plan’s content and recommendations. Of note, TxFAC members highlighted the following key themes:

- The current highway system will not be able to keep pace with projected freight growth, and a comprehensive multimodal strategy is necessary in order to meet future demand. **Exhibit 12-9** shows the projected interstate congestion levels in 2040 and **Exhibit 12-10** shows the anticipated freight tonnage in 2040.
Exhibit 12-9: Projected Congestion Levels on Interstate Highways in 2040

Source: 2013 TxDOT Roadways Inventory / Statewide Analysis Model (SAM) v.3
Investment in the Texas Freight Network is a critical component of the state’s economy and enhances economic vitality.

TxDOT needs to work more proactively in partnership with public and private stakeholders to address freight infrastructure issues, especially other freight system owners and operators, such as railroads, ports and airports.

Texas’ freight infrastructure system must be maintained and improved in order to: preserve its position as the North American trade and logistics center, increase exports and global trade, and foster job creation and economic development.

The state must focus not only on improving existing facilities, but also developing future freight corridors to move products to markets.

A balanced approach to freight transportation system improvement is required, including fostering innovative strategies and technology solutions.

TxDOT can help leverage public and private investments to improve the freight transportation system.
Freight does not stop at jurisdictional boundaries and, thus, a multi-agency and multi-institutional approach is needed to prepare and plan for freight demand.

Last-mile and first-mile connectors to population and business centers, freight gateways, and freight generators are critical to freight movement, and TxDOT must work closely with local jurisdictions and the freight industry to minimize congestion at these connectors.

The state must be prepared to address the increase in goods that accompany population, business, and international and national trade growth. The Freight Plan identifies a balanced, comprehensive, and multimodal freight improvement 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.

The key next step to carry the Freight Plan effort forward to successful implementation is for TxDOT to continue to convene the TxFAC and undertake a stakeholder-led process to understand which of the currently planned projects best address identified freight needs. This process should be multimodal and include improvements discussed in Chapter 11 as well the initiation of new statewide freight programs. This effort should focus on the following:

- Assess how these projects can be given additional priorities based on freight needs.
- Identify potential investments or strategies to address the identified freight transportation needs which do not have a currently planned project.
- Outline how to advance these freight projects through project development and implementation.

The next step is crucial not only to responding to the regulations set forth in new federal transportation legislation, the Fixing America’s Surface Transportation Act; but also to communicate to the private-sector and the general public the state’s commitment to support economic development and addressing freight transportation needs.

Implementing the identified projects poses a formidable challenge. TxDOT must continue to work together with its private-sector partners, as well as other federal, state, regional and local agencies, to plan and fund these priority freight transportation infrastructure improvements. Fortunately, there has never been a better time for action.
The Freight Plan helps integrate the freight transportation needs of the public and private sectors and assigns genuine importance to freight transportation as a common good. Implementing this plan, and embracing its holistic view of the state’s transportation system, will help maintain Texas’ economic prosperity and promote its healthy expansion in the future.