Chapter 5 - Needs Assessment and Freight Forecast

KEY POINTS

- Missouri's central location in the United States was consistently identified as a top strength of the State's freight system and an asset for attracting new businesses.
- The sheer size of Missouri's highway system is a strength and challenge. While the highway system is well- connected for handling traffic, maintaining and upgrading that system is difficult.
- Freight tonnage is forecast to grow 37 percent from 2011 to 2030 with truck and rail continuing to dominate freight transportation in Missouri.

Introduction

Missouri has an integrated multimodal freight system that facilitates the efficient, reliable, and safe movement of freight. The challenge will be to maintain and expand the system to meet future needs.

To help Missouri plan and respond more effectively and create a transportation system prepared for the future, it is important to thoroughly assess needs for freight movement and forecast future demands related to freight by:

- Identifying the strengths and challenges of the existing system.
- Discussing freight system goals and objectives.
- Forecasting future freight transportation demands for highways, rail lines, ports, airports, and pipelines over the next 20 years.
- Considering emerging trends—issues outside traditional forecasting methods, but which could impact the future of freight in the State.

Freight movement is vital to Missouri's economy. A detailed assessment of future freight transportation needs will help Missouri prepare to keep freight moving smoothly.

Strengths and Challenges

A review of the State's competitive advantages and critical challenges helps identify the strengths and problems in the Missouri freight system. These strengths and challenges can be grouped into four categories: system capacity, system operations, safety, and connectivity.

System Capacity

The size of Missouri's transportation system is a strength. There is a well-connected system for handling highway freight traffic. Missouri has significant freight rail infrastructure with six Class I freight railroads and five short line railroads. These railroads provide important freight connections with the other freight transportation modes. Designated marine highways transport freight along the Missouri and Mississippi Rivers. Missouri also has 3 of the top 110 cargo airports in North America.

The size of the system also presents challenges. Maintaining and upgrading numerous miles of highways can be an issue, especially as funding continues to diminish. Roadway congestion, bottlenecks, and infrastructure that is nearing the end of its useful life are challenges. The annual hours and cost of truck delays are significant. For example, delay on I-44 is approximately 422,000 hours each year, costing the economy $38.6 million annually[1]. Capacity upgrades are already needed for I-70 between Kansas City and St. Louis, but I-44 was also identified as a key corridor for continued investment based on future volume projections. St. Louis and Kansas City contain 81 of Missouri's most congested truck bottlenecks; seven are located in Springfield. Missouri's rail lines are reaching maximum capacity at several locations. Missouri's waterways have adequate capacity but are often seen as unreliable due to inconsistent water levels and the lack of improvements to the lock and dam system. Air cargo facilities are limited and outdated; they need to be updated to accommodate changes in technology, security, and handling of larger cargo.

System Operations

Missouri currently ranks fifth best in the nation for transportation infrastructure[2]. Due to the two statewide road improvement programs in the last decade, more than 89 percent of Missouri's major highways are rated in good condition. Similarly, other bridge-related programs dramatically decreased the number of bridge structures in poor condition. Less than one percent of the bridges in the State have low vertical clearance and only three percent of the load restricted bridges cross Missouri interstates.

Missouri has made great progress in addressing the condition of the transportation system, but there are still needs for maintenance and capacity improvements. Minimizing travel times and delays on the State's most traveled routes are essential to operating a reliable transportation system. Individual roadways within St. Louis and Kansas City experienced longer travel times than the regional averages. Columbia and Springfield also experience delays. Due to Missouri's central geographic location, when

[1] Missouri Department of Transportation, Tracker Report, April 2014
[2] Missouri Department of Transportation, Tracker Report, April 2014

interstates are shut down, it can be difficult to move freight east/west across the country. In 2013, I-70 experienced 26 complete closures and I-44 experienced 22[3]. While the number of bridges in poor condition decreased, the number of bridge structures in good condition also dropped over a five-year period.

The service discontinuance and abandonment of short-line rail track creates an almost irreversible situation for rail freight to reach adjacent businesses. Further, this may interrupt some last-mile and intermodal connections. Private ownership and operation of rail lines makes track monitoring and upgrades difficult.

Much of the lock and dam system on the inland waterway system is in need of major rehabilitation or replacement. The lack of dredging to maintain navigable channels and harbors on both the Missouri and Mississippi Rivers hinders efficient and reliable waterborne freight movements.

Safety

Improvements in safety have been a strength of the highway system over the last decade. Roadway safety improvements helped reduce overall roadway fatalities from 1,200 in 2005 to less than 800 in 2013, the lowest level since the 1940s. There were 82 Commercial Motor Vehicle (CMV) crashes through the fourth quarter of 2013, which is 22 fewer than reported in 2012. Between 2009 and 2013, fatal crashes involving CMV decreased by 8.9 percent, and the number of CMV serious injury crashes decreased by 21.3 percent.

Diminished funding will hamper MoDOT's ability to make significant safety improvements in the future. Key issues include: the lack of an information system that conveys available truck parking locations to commercial drivers, need for safety and security at truck parking locations, numerous at-grade rail crossings and roadway design improvements to facilitate safety. In particular, at-grade rail crossings continue to present a safety issue and improvements are needed. In 2011 and 2012, Missouri had 50 highway-rail incidents each year, while in 2013 there were 53 highway-rail incidents.

Connectivity

Missouri's central location in the United States is consistently identified as a top strength of the State's freight system and an asset for attracting new business. The Kansas City area is one of the largest rail freight and trucking hubs in the country, while St. Louis is the third largest for rail. St. Louis is working diligently to develop into a freight hub as well. The Springfield/Joplin area is near major truck freight operations in Northwest Arkansas. The Missouri River and Lower Mississippi River are key assets due to their central location and because they are lock-free. The expansion of the Panama Canal may have some impact on freight movements in Missouri. This change could manifest itself in various ways to include some directional freight flow changes, shifting among transportation modes, and overall freight volume changes.

[3] Missouri Department of Transportation, Tracker Report, April 2014

One of the biggest problems with connectivity is that some transportation modes are not readily accessible or in close proximity to other modes (e.g., rail to water ports). Major freight generator sites have been identified throughout the State. Improving freight modal connections, including short line rail connections, to freight generator sites is important for providing options for businesses to improve their supply chains and their competitiveness in the marketplace. Stakeholders at regional workshops indicated that future growth is threatened by railroads closing local crossings and spurs and removing scales.

Freight System Goals and Objectives

After examining the strategic frameworks from relevant State plans, other statewide and regional plans, and the new federal requirements as defined by *Fixing America's Surface Transportation (FAST) Act*, MoDOT determined that the goal areas developed for Missouri's Long Range Transportation Plan should also be adopted as the freight plan goals. The goals focus on maintenance, safety, economy, and connectivity/mobility. The Freight Plan looks at these goals in more detail as they directly relate to freight movement. Three strategic considerations have also been incorporated in this Freight Plan: environmental, organizational/process, and customers/partners. **Figure 1-4** in Chapter 1 shows the relationship between the Freight Plan goals and the FAST Act goals.

Stakeholder input and a review of other freight-related plans helped craft a group of objectives, which are listed below according to goal.

Goal 1: Maintenance

The maintenance goal aims to ensure that the freight system and services are maintained in good condition by:

- Keeping the highways and bridges in good condition
- Supporting and encouraging the maintenance of railways, waterways, airports, and multimodal connections

The good condition level will be increasingly difficult to maintain for all freight modes because of a lack of consistent, reliable, and dedicated funding.

Goal 2: Safety

The safety goal looks to improve safety on the highway and rail freight system by:

- Decreasing the number and severity of crashes involving CMVs
- Improving safety at railroad crossings

While the instances of CMV highway crashes has trended downward, highway-rail crossing incidents have slightly increased over the last several years. MoDOT continually strives to decrease the number and severity of incidents across all transportation modes. However, diminished funding will hamper MoDOT's ability to make significant safety improvements in the future. There currently is not a need

for additional freight-related safety goals that address the other transportation modes (i.e., air, water, and pipeline).

Goal 3: Economy

The economy goal supports economic growth and competitiveness as well as job growth in Missouri by:

- Improving the economic competitiveness in Missouri through improvements to the freight system
- Enhancing and supporting opportunities for economic development and job growth through improvements to the freight system

While the cost to ship several of Missouri's major export commodities (e.g., soybeans, automobiles, and chemicals) is relatively low compared to competing states, MoDOT has recently begun quantifying and calculating costs as a reflection of goods movement and competitiveness. The bulleted items above have been identified as performance measures in the Missouri State Freight Plan and will continue to be monitored in relation to meeting economic goals.

Goal 4: Connectivity and Mobility

The connectivity and mobility goal seeks to improve the connectivity and mobility of the freight system throughout the State by:

- Improving the multimodal connectivity of the freight system
- Reducing congestion and increasing reliability on roadways
- Supporting and encouraging improved efficiency of rails, waterways, and airports
- Improving connections to freight generators

MoDOT recently began measuring annual hours of truck delay and calculating the truck reliability index in their quarterly performance tracker report. These parameters have been identified as performance measures in the Freight Plan and will continue to be monitored in relation to meeting the connectivity and mobility goal.

20-Year Freight Forecast

A vast amount of freight traverses Missouri's infrastructure annually. This freight includes finished goods, materials, and supplies. In the future, highway and rail systems will continue to be relied on as Missouri's primary freight transportation modes. Missouri continues to accommodate a large percentage of through freight movements, defined as movements that neither originate nor have destinations in Missouri. This places strain on the Missouri system because through freight movements cause wear-and-tear on the transportation system but do not provide the economic benefits that normally accompany freight movements that originate or end within Missouri.

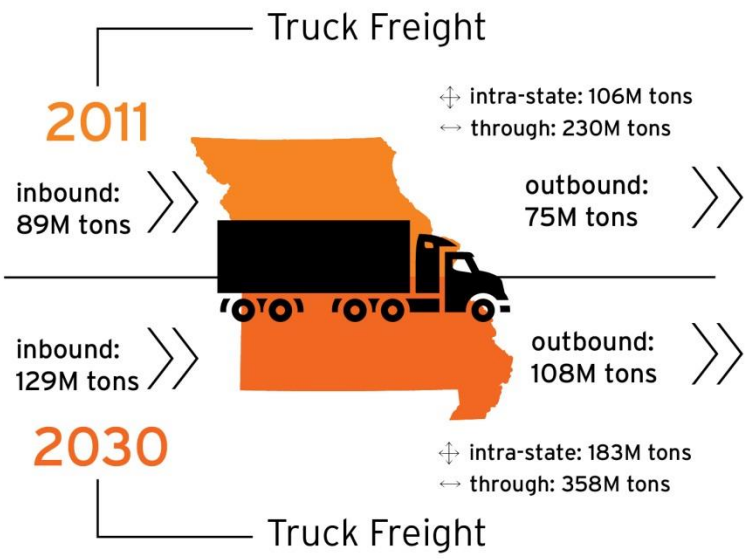
Freight tonnage across the Missouri freight network is forecast to grow by 378.8 million tons, a 37.3 percent increase from 2011 to 2030 (1.7 percent increase annually)[4]. Truck and rail are the dominate modes of freight transportation in Missouri. Truck movements account for 49 percent of the total freight tonnage, and rail movements account for 45 percent. Trucking is forecast to grow by 55.5 percent (2.4 percent annually), from 500.4 million tons in 2011 to 778.1 million in 2030, a 277.7 million ton increase. The 277.7 million ton increase in truck freight movement accounts for 73.3 percent of the total growth and about half of truck movements are attributable to through movements. While rail growth is forecast to grow by 19 percent (0.9 percent annually), from 458.1 million tons in 2011 to 545.2 million tons in 2030, it still constitutes 40 percent of the total tonnage moved through Missouri. Additional details are available in the Appendix A.

[4] TRANSEARCH Data, 2011

Truck Forecast

Figure 5-1 depicts the directions of truck freight movements in Missouri between 2011 and 2030. Truck tonnage is forecast to increase 55.6 percent between 2011 and 2014. Truck commodity value is forecast to increase from $710.9 billion in 2011 to $1.20 trillion by 2030, a cumulative increase of 68.4 percent (2.8 percent annually).

Figure 5-1: Missouri Truck Tonnage Forecast by Direction, 2011 and 2030



Total Truck Freight Growth by 2030:

+ 55.6%

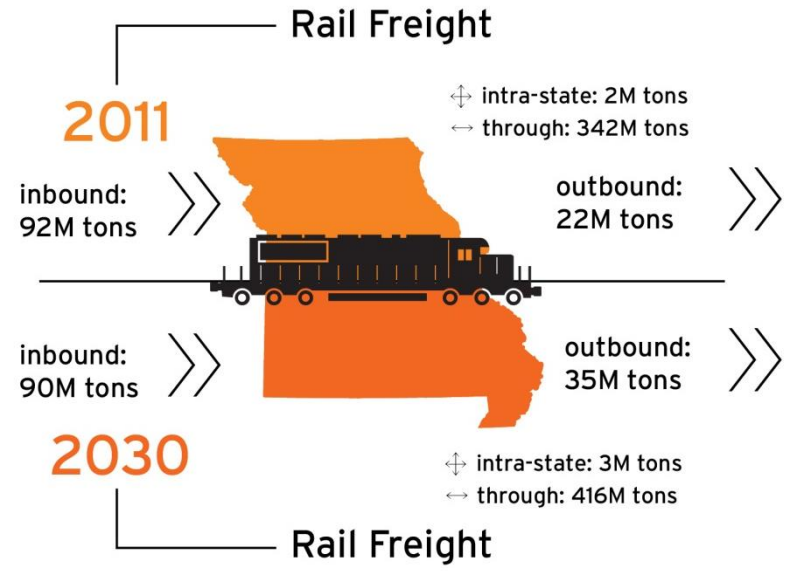
inbound » + 44.6% outbound » + 44.0%

intra-state » + 72.9% through » + 55.5%

Rail Forecast

Figure 5-2 depicts the directions of rail freight movements in Missouri between 2011 and 2030. Rail tonnage is forecast to increase from 458.1 million in 2011 to 545.2 million in 2030, a cumulative increase of 19.0 percent (0.9 percent annually). Rail commodity value is forecast to increase from $465.0 billion in 2011 to $790.6 billion by 2030, a cumulative increase of 70.0 percent (2.8 percent annually). Note that inbound tonnage is forecast to decline, primarily due to less coal consumption for power plants as use of natural gas increases, renewable energy sources increase, and other power technologies improve.

Figure 5-2: Missouri Rail Tonnage Forecast by Direction, 2011 and 2030



Total Rail Freight Growth by 2030:

+ 19.0%

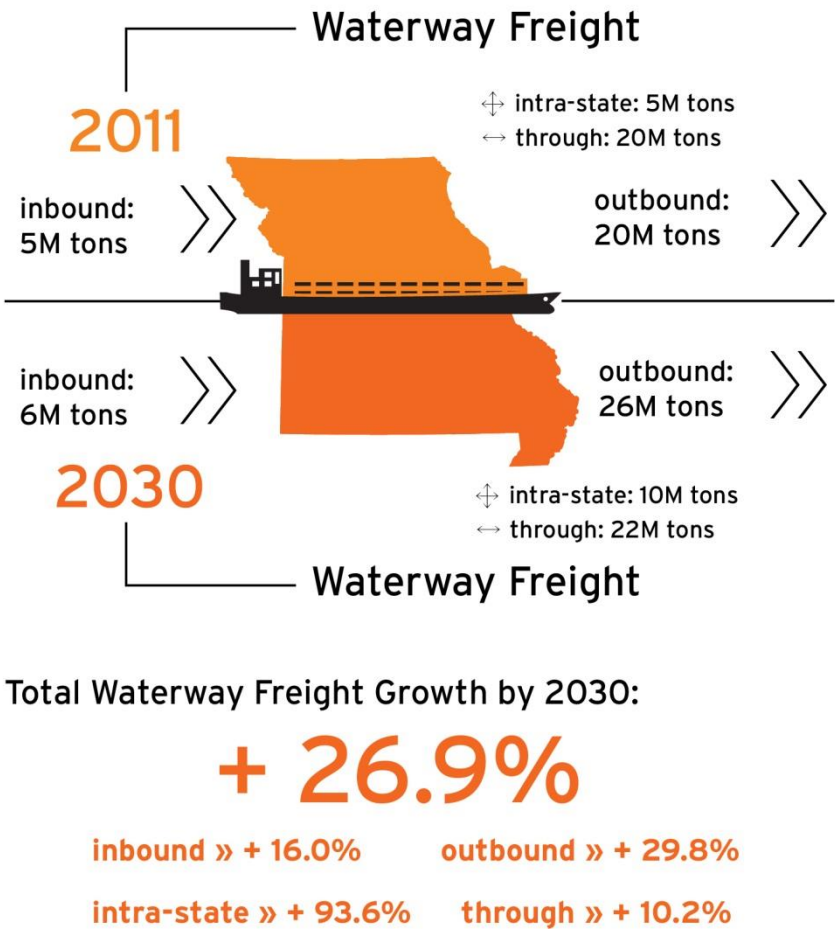
inbound » - 2.3% outbound » + 64.4%

intra-state » + 32.9% through » + 21.8%

Port Forecast

Figure 5-3 depicts the direction of port freight movements in Missouri between 2011 and 2030. Port tonnage is forecast to increase from 49.9 million in 2011 to 63.3 million in 2030, a cumulative increase of 26.9 percent (1.3 percent annually). Port commodity value is forecast to increase from $12.5 billion in 2011 to $15.4 billion by 2030, a cumulative increase of 23.1 percent (1.1 percent annually).

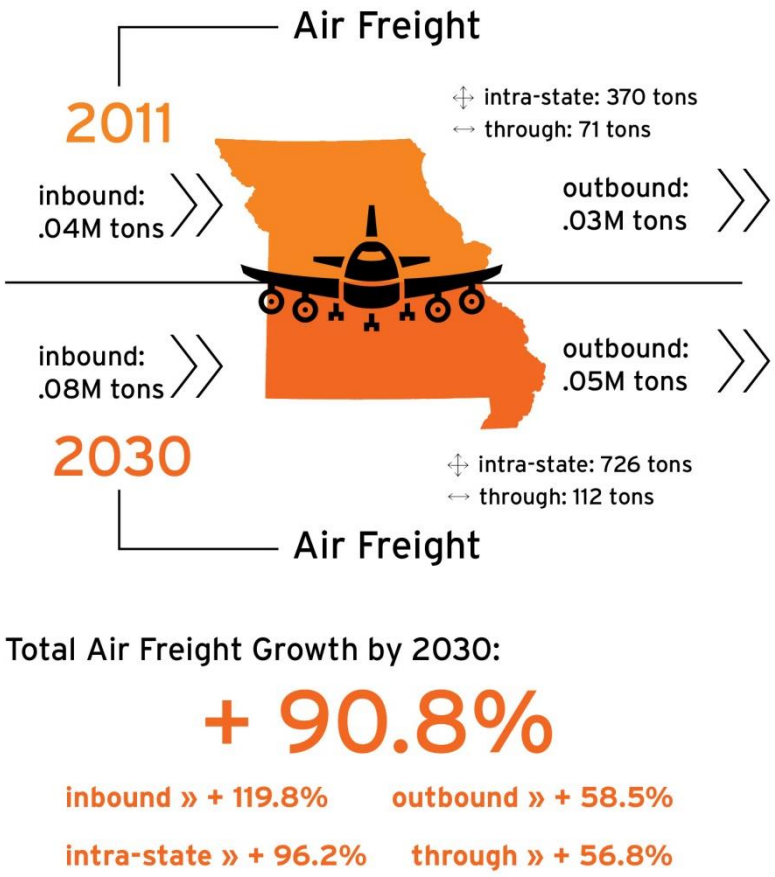
Figure 5-3: Missouri Waterway Tonnage Forecast by Direction, 2011 and 2030



Air Forecast

Figure 5-4 depicts the direction air freight movements in Missouri between 2011 and 2030. In this time period, outbound freight movements decrease in relative proportion, while inbound movements increase. Air tonnage is forecast to nearly double from 73,003 in 2011 to 139,296 in 2030, a cumulative increase of 90.8 percent (3.5 percent annually). Air commodity value is forecast to increase from $11.4 billion in 2011 to $27.5 billion by 2030, a cumulative increase of 141.8 percent (4.8 percent annually).

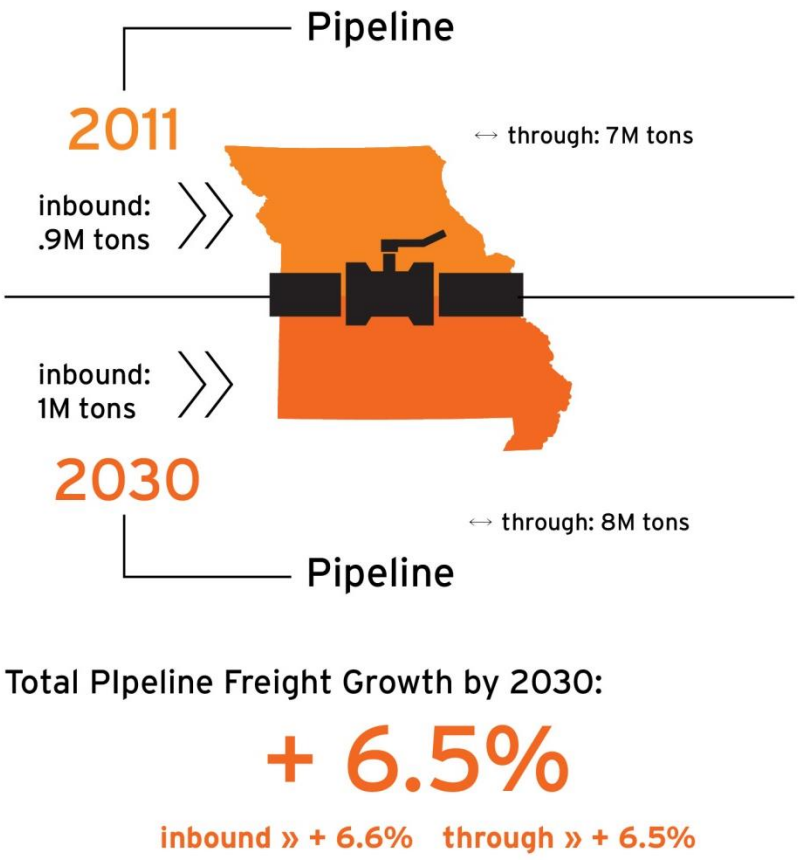
Figure 5-4: Missouri Air Tonnage Forecast by Direction, 2011 and 2030



Pipeline Forecast

Figure 5-5 depicts the direction of pipeline freight movements in Missouri between 2011 and 2030. Pipeline freight movements are only inbound, and that is expected to remain unchanged over the future analysis horizon. Pipeline tonnage is forecast to increase from 8.3 million tons in 2011 to 9.0 million in 2030, a cumulative increase of 6.5 percent (0.3 percent annually). Pipeline commodity value is forecast to increase from $5.8 billion in 2011 to $6.1 billion by 2030, a cumulative increase of 6.5 percent (0.3 percent annually).

Figure 5-5: Missouri Pipeline Tonnage Forecast by Direction, 2011 and 2030



Growth in freight movements across all modes of freight transportation requires continued improvements and maintenance to the freight system to accommodate this growth. Chapter 9 discusses the specific projects and programs identified for maintaining and improving the freight system.

Emerging Trends

This section discusses the emerging freight trends in the State. Identifying these trends helps to anticipate needs and develop programs and policies to address them.

Trade and Industry Growth

There is a close relationship between industrial health and vitality and transportation. Industries need parts and supplies to manufacture products (i.e., agricultural grains, food products, and automobiles) that are then transported across Missouri, the country, and the world. Transportation is responsible for bringing supplies into Missouri as well as exporting the products of Missouri industries.

Manufacturing productivity in the U.S. increased 73 percent between 1993 and 2011, according to the U.S. Department of Commerce. Today, U.S. manufacturing accounts for 20 percent of the world's manufacturing output, and U.S. manufacturing is greater than that of China, India, Brazil and Russia combined.

Many of Missouri's exports have increased in the last decade. Exports of aircraft have doubled since 2009 and the global demand for aircraft is expected to double over the next twenty years, which translates to significant business opportunities for the Missouri aerospace and aviation sector. Chemicals are Missouri's second largest international export and the chemical industry employs over 17,000 workers. Missouri food and food ingredient exports have increased 148 percent since 2005. There has been an increased demand for U.S. agricultural products due to higher quality standards and greater variety. Export industries in Missouri account for 95,000 direct jobs.

The expansion of the Panama Canal, which is expected to be completed in 2015, will likely have some impact on future freight flows. The timing and scale of the impacts on Missouri freight flows are unknown but it is anticipated that there will be some change in the demands on transportation networks, service, and operations.

All of these factors lead to a growth in freight movements in Missouri. In turn, the growth in freight movements will result in increased demands on the highways, rail lines, port facilities, and airports that handle freight.

Institutional and Regulatory Trends

Federal, institutional, and regulatory trends may affect Missouri freight transportation. Examples of these trends and their potential effects are:

- Federal regulation of trucking/trucker safety could affect costs and cause driver shortages
- Public-private partnership financial market trends for private capital in transportation infrastructure projects
- Federal water resource policy trends could impact waterborne freight
- U.S. Department of Agriculture food product traceability requirements could make bulk food shipping less attractive
- U.S. Department of Homeland Security requirements for electronic pre-filing of export documentation could take additional time and cause delays
- U.S. Environmental Protection Agency emission requirements for marine diesel barge engines and rail locomotive engines could require retrofitting existing equipment
- At the local and state level, the acceptance of "Complete Streets" policies could impact the movement of freight, particularly in the last mile of delivery

Population Trends

As Missouri's population and employment grows, the demand for and production of finished goods will increase throughout the State, and the transportation of these goods will increase accordingly. According to economic data, Missouri is expected to have an annual population growth rate of 0.62 percent from 2012 to 2040. This results in more than a million additional Missouri residents by 2040. Additional information can be found in Appendix B.

Logistical Challenges

A number of logistical challenges face shippers in Missouri and throughout the Midwest:

- Variable shipping rates as they relate to the variability of fuel costs and truck driver availability
- Growing shortage of labor for trucking, rail, and water
- Availability of truck and rail equipment

In particular, recruiting trained labor is becoming increasingly difficult due to experience and training requirements and an aging workforce. Labor shortages will impact what happens in the industry as shippers continue to try to keep costs down and become more efficient.

Technology Trends

Technology trends could impact freight movement in Missouri:

- Dedicated truck lanes could improve safety and allow for the potential use of advanced technology to move more freight. However, there is not a consensus on how to develop, fund, or finance a dedicated truck lane project.

- A Freight Shuttle System would use autonomous transporters to move trailers or containers in a highway median, but the technology likely will not be available for some time.
- E-commerce requires fast, on-time deliveries, but is affected by distance and travel direction. E-commerce also brings more parcel delivery vehicles into neighborhoods, causing congestion and wear-and-tear on the local road network.
- Natural gas is the fastest-growing fuel in the transportation sector due to its comparatively lower price, but there is a high initial cost to retrofit or replace existing equipment. The high demand for natural gas from the trucking industry has prompted the fuel retail industry to provider compressed natural gas (CNG) and liquefied natural gas (LNG) at fuel stations on major truck corridors.
- The use of container-on-vessel (COV) for moving containers on the inland waterway can, in certain situations, be an alternative to truck and rail transport. However, there are problems with port readiness, delivery requirements to sustain service, and inefficiencies in backhauling and positioning empty containers.

Some of these concepts, such as dedicated truck lanes, have been studied in Missouri. Other concepts would need additional planning to determine their viability, cost-benefit ratio, and overall applicability to the freight network in Missouri.

Identified Needs

Freight network needs were identified through an analysis of the strengths and challenges of the Missouri freight system, 20-year freight forecast, and emerging trends. The identified needs are discussed below according to freight transportation mode. Each identified need falls into one of six categories: system capacity, system operations, freight network, safety, connectivity, and policy regulations.

Highway

The identified highway transportation needs are:

- Improved corridor capacity
- First and last mile connectors
- Improved freight movement through bottlenecks (see **Figure 4-3** in Chapter 4 for the locations of the 100 most congested bottlenecks in Missouri)
- Safety improvements such as sufficient numbers of safe truck parking spots at rest areas and weigh stations, reduction in the number of at-grade rail crossings, and improved roadway design and geometrics
- Connectivity to major freight generator sites, including last mile connections

While Missouri did not have a designated freight network, this Missouri State Freight Plan identifies the designated Missouri Freight Network to help prioritize improvements for all modes of freight transportation, including highways (see Chapter 3).

Rail

The identified rail transportation needs are:

- There are congestion and capacity issues on numerous rail lines throughout the State. Improvements to the rail lines with congestion and capacity issues are needed.
- The Kansas City area currently has a bottleneck at intersecting rail lines. St. Louis also faces issues because rail lines historically connected at Union Station for passenger rail, resulting in a network of multiple connections which can require days to switch rail cars across the region.[5] Coordination with the rail companies that own these rail lines and a solution to eliminate these bottlenecks is needed.
- At-grade rail crossings throughout the State present a safety issue. Improvements at all at-grade rail crossings with safety issues are needed.
- In the Northwest and Northeast MoDOT districts, short line rail lines are being removed, adversely affecting economic development in these areas. Coordination with the short line rail companies is needed to craft a different solution than removal of rail lines.
- At the Howard/Cooper Regional Port, rail access to and from this port is needed.
- St. Louis has two rail bridges across the Mississippi River that support all Class I railroad crossings, the Merchants Bridge and the MacArthur Bridge. Both bridges are more than 100 years old and require major work to strengthen and reinforce capacity.

Air

The identified air transportation needs are:

- The cargo facilities at the St. Louis Airport (STL) are limited and outdated. These facilities need to be updated and expanded.
- The Springfield Airport (SGF) has been identified as an airport that may have its tower hours reduced by the FAA. Reduction of the tower hours could reduce the airport's capacity to handle freight at key nighttime hours.
- The safety and perimeter security at the Kansas City International Airport (MCI) is in need of additional, updated, and improved fencing and gates.

Water

The identified waterborne transportation needs are:

- At ports throughout the State, increased maintenance activities are needed on both the land and water sides of the operations.
- Upgrades and rehabilitation is needed on many of the locks and dams in the State. Coordination with the U.S. Army Corps of Engineers will be needed.

[5] *St. Louis Regional Freight Study*, June 2013

- Sufficient depth for navigation is needed in channels and at harbors. This is achieved through additional dredging or through increased water releases from upstream dams.
- Numerous emerging ports have been identified throughout the State. Support for their development is needed.

Pipeline

There are no freight system needs identified for the pipeline mode of transportation.

Intermodal

The identified intermodal needs are:

- New intermodal connection points are needed.
- Improved intermodal road connections to ports are needed at several locations in the State.
- First and last mile intermodal connections are needed.

Funding

The majority of Missouri transportation funds come from fuel taxes. State fuel tax rates have not increased since 1993, and Missouri has one of the lowest state fuel tax rates in the nation. This has put pressure on the transportation sector to find alternative funding sources for highway projects. Funding is also an issue in upgrading and expanding ports, locks and dams, airports, and intermodal facilities in order to stay competitive. There is need to identify innovative and alternative funding sources. These issues have created project funding challenges for MoDOT.

Conclusions

The purpose of identifying needs as seen through the lens of the identified strengths and challenges of Missouri's transportation system, the future forecast of freight in the state and other emerging trends is to better inform the decision-making process. The needs discussed in this chapter have been considered as the strategies and recommendations of the Freight Plan contained in subsequent chapters and will help to make implementation of the outcomes more successful.