5.0 Freight Bottlenecks and Mobility Issues

5.1 HIGHWAY

5.1.1 Truck Bottlenecks

For the purposes of this analysis, a bottleneck is defined as part of the transportation system that imposes disproportionately high costs in the movement of freight. A specific approach was followed to identify truck freight bottlenecks on the Legacy Oklahoma National Highway System (Oklahoma NHS or NHS).[39]

Some of the adopted bottleneck identification concepts were based on guidance recently published by the FHWA.[40] This guidance stresses the importance of thinking about bottlenecks from the perspective of system users, leading to indicators that approximate user impacts and costs.

The FHWA guidance also highlights the importance of delving into additional data sources to investigate potential causes of performance issues. Therefore, in addition to the performance measures, the analysis included consideration of other indicators such as crashes, pavement conditions, curves, grades, and congestion. The results of these analyses were utilized in freight plan efforts to identify potential solutions and investment priorities.

In addition to evaluating performance based on measures estimated from data, it is also important to consider experience of, and comments from, stakeholders who use the roadway network. System users can identify issues not captured by the data.

MOBILITY/SYSTEM PERFORMANCE

Two performance measures were used to identify mobility and system performance issues: average delay of trucks and the travel time reliability of trucks. The definitions and results for each indicator are described below.[41]

Delay Measure and Results

Delay is a planning measure for talking about recurring congestion. Delay is calculated as the difference between travel time in average conditions and travel time under free-flow conditions. This indicator measures the additional hours that a truck spends traversing a roadway segment. This delay directly translates into additional costs such as additional driver wages, vehicle operations, and fuel consumption.

Average delay was calculated for the NHS from the National Performance Management Research Data Set (NPMRDS)[42]—presented in Technical Report 5, Goals and Performance Measures, Policies and Strategies—and average annual daily truck traffic (AADT) data from traffic counts in Oklahoma's federal Highway Performance Monitoring System (HPMS).[43] The NPMRDS provides actual truck travel times across individual segments of the network continuously throughout the year.

Reliability Index and Results

The reliability measure demonstrates how bad travel conditions can be on a given highway segment. Reliability is a measure of unpredictable or non-recurring congestion. It is calculated by the ratio of the worst-case travel time to the median travel time. The miles-weighted average truck travel time reliability (TTTR) index for interstate highways in Oklahoma is 1.27. This means that a trucker should plan 38 minutes for a trip that takes 30 minutes in free-flow conditions (30 minutes multiplied by 1.27 equals 38 minutes).

It is calculated from the same data sources as the average delay measure. Like the delay measure, the TTTR index incorporates truck volume in order to provide greater weight to locations that have higher truck volumes.

As the index gets higher, it indicates greater reliability problems on that segment. Thus, a larger number of trucks need to plan more time into their schedules to guarantee on-time delivery. The analysis found the worst delay and reliability problems for trucks in and around the major metropolitan areas of Oklahoma City and Tulsa.

Preliminary Identification of Bottlenecks

Thresholds were set for the average delay and reliability measures to identify areas with the worst performance in the state for trucks. If a segment was in the worst 5 percent for the state in terms of average delay or in terms of reliability, it was identified as a truck bottleneck location that merited further analysis and proposed solutions in the freight plan.

STAKEHOLDER INPUT

Stakeholder perspective on system problems and needs was solicited early in this planning effort. This input provided insight as to the location and severity of problems from the perspective of system users. Stakeholder perceptions are useful in identifying and prioritizing system needs. At the first FAC meeting in the fall 2016, committee members flagged locations with freight issues, bottlenecks, or concerns. In addition, ODOT staff solicited comments from MPOs and rural area planners, and interviewed individual stakeholders to obtain their perspectives.

Like the data-driven performance measures, stakeholders identified clusters of bottlenecks in urban areas, particularly Oklahoma City and Tulsa. There was a great deal of overlap in the identified needs in these areas. Like the data-driven analysis, stakeholders also identified interchanges throughout the state as having congestion and delay. Stakeholders noted many more problems in rural areas, including slowing speeds along two-lane stretches of highway and through small towns, poor pavement conditions and intersection delay issues.

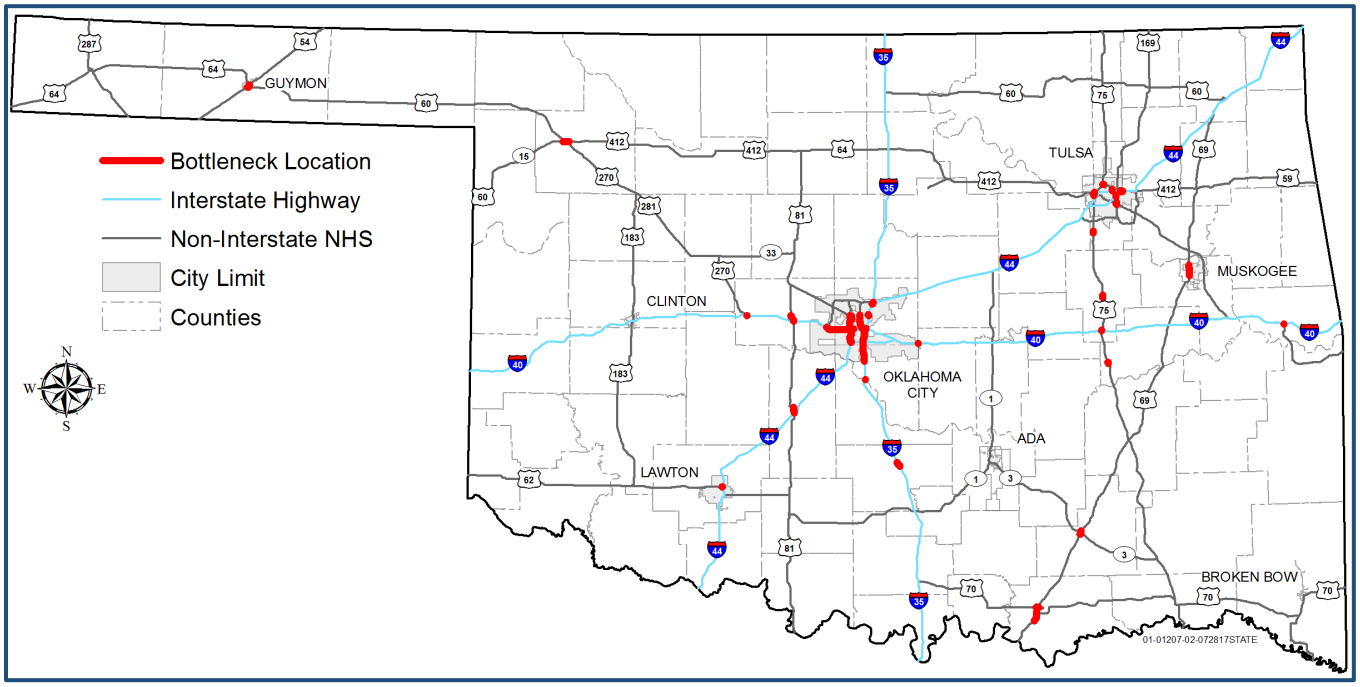
In addition to the suggestions provided by the FAC, three public meetings were held in June 2017 to elicit input from the broader public. Overall, most comments validated the bottlenecks identified through the data. Frequently, comments provided perceptions about observed problems and explained the causes behind slowdowns.

There were several instances where construction was mentioned as the main cause behind slowdowns. Since construction is a temporary condition, construction-related delays were removed from the list of bottlenecks.

FINAL BOTTLENECK IDENTIFICATION

Approximately 150 individual segments were identified as bottlenecks for trucks. **Figure 23** shows the results statewide. As can be seen, the bottlenecks tend to cluster in and around the urban areas of Oklahoma City and Tulsa, although there are some bottleneck locations in the western part of the state, along U.S. 81, and U.S. 75 and U.S. 69.

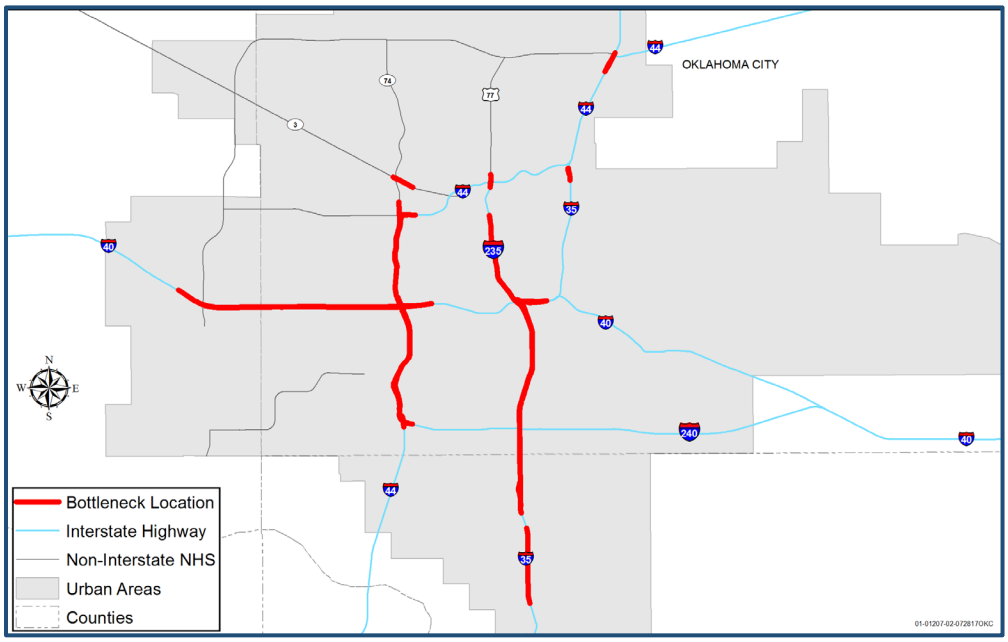
Figure 23. Final Bottleneck Locations – Top 5 Percent



Source: WSP analysis of Highway Performance Monitoring System and National Performance Management Research Data Set data

Figure 24 and **Figure 25** show these results in more detail for Oklahoma City and Tulsa, respectively. As can be seen on **Figure 24**, in Oklahoma City much of the highway system has bottlenecks including long stretches of I-35, I-44, I-40, and U.S. 77 as well as several interchanges.

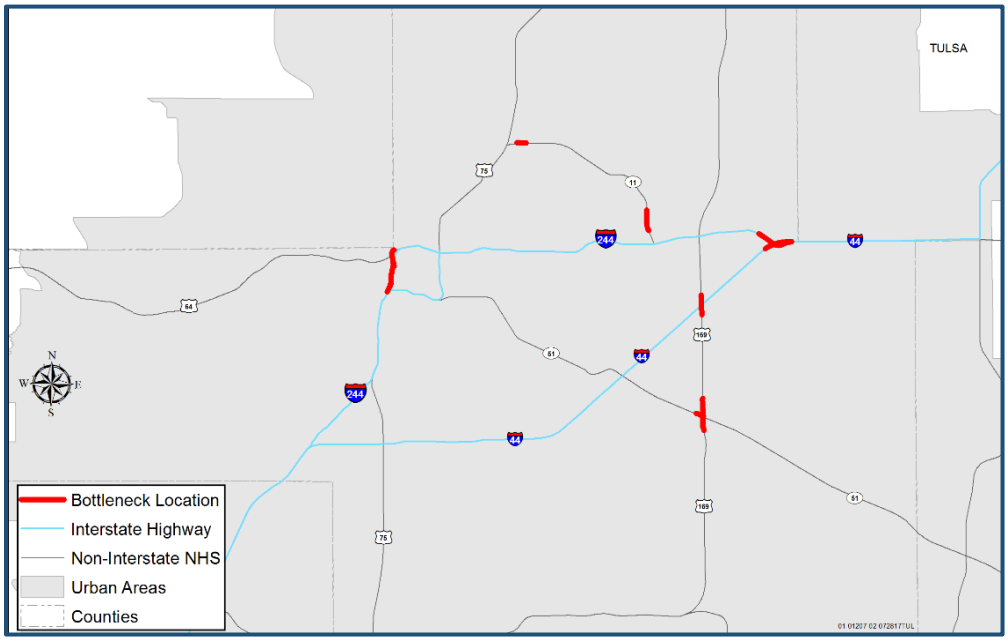
Figure 24. Final Bottleneck Locations, Top 5 Percent – Oklahoma City Area



Source: WSP analysis of Highway Performance Monitoring System and National Performance Management Research Data Set data

In the Tulsa area (**Figure 25**), there are several bottlenecks, and they tend to be located near interchanges.

Figure 25. Final Bottleneck Locations, Top 5 Percent – Tulsa Area



Source: WSP analysis of Highway Performance Monitoring System and National Performance Management Research Data Set data

5.1.2 Safety

In addition to presenting a safety risk, crashes on a facility can cause slowing and backups that affect all traffic. Locations of frequent crashes affect reliability—a key issue for trucks. To identify areas of safety issues, crashes were evaluated for the entire NHS network. Locations that were in the top 10 percent for the state (**Table 8**)—in terms of crash density (crashes per mile) and crash rate per million VMT—were identified.

Table 8. Mileage in the Worst 10 Percent of Crash Locations Statewide

	Crashes Per Mile	Crashes Per 1M VMT
Threshold (top 10 percent)	27	2.6
Miles over threshold	139	232
Percentage of total miles	1.9	3.2

Source: ODOT Traffic Engineering Division, 2017

Crashes per mile are a good indication of the potential for delays that could occur on a particular stretch of roadway. Crashes per mile tend to cluster in metropolitan areas and near the interchanges where freeways and highways intersect. For safety analysis, crashes are typically normalized by VMT. Crashes per million VMT points to locations where safety conditions exist that might result from roadway configuration or other physical conditions. The top 10 percent of crashes per million VMT identified problematic stretches of highways in rural areas including segments of U.S. 69, U.S. 412, U.S. 75, and U.S. 81.

5.1.3 State of Good Repair

Locations with deteriorated pavement conditions can present hazards and slow travel. The International Index ratings for 2014 through 2015 were calculated according to the federal standards in the HPMS. A small fraction of Oklahoma's NHS mileage is categorized as having "poor" pavement conditions under this federal specification. The pavement quality on these segments affects freight movement and should be considered along with other needs as part of the state's freight investment strategy.

Other factors on the transportation system, including but not limited to roadway geometry or outdated design features, may contribute to freight bottlenecks as well.

5.1.4 Freight-Related Bottlenecks on Highways

Heavy-freight traffic can also create bottlenecks that affect other highway users. To identify potential locations where delay is exacerbated by freight transportation, the study team examined locations on or near the network that are within 0.25 mile of an area with significant truck delay. The areas that have both freight generation and significant freight delay are locations where freight could be affecting other users.

The following locations are areas where high freight delay intersects with close proximity to identified freight generators:

- U.S. 54/U.S. 412 (U.S. 64) intersection – Texas County
- U.S. 81 between S.H. 33 and S.H. 3 – Kingfisher County
- U.S. 81 and I-40 Intersection – Canadian County
- U.S. 81 just south of the I-40 intersection – Canadian County
- S.H. 7 and I-35 interchange – Murray County

General traffic congestion or delay issues in these areas could be caused by freight. Solutions to these issues should consider resolution of freight conflicts as well.

5.1.5 Heavy-Load Route Issues

HEAVY-HAUL IN OKLAHOMA

This OFTP is intended to develop an improved understanding of the impact of heavy-haul vehicles on the highway system and to identify strategies to reduce deterioration. Most heavy-haul traffic moves within established weight limits, but with payloads and gross vehicle weights at the upper limits. In Oklahoma, a vehicle that exceeds the legal statutory dimensions usually requires an OSOW permit, and must pay associated additional fees to legally travel on designated highways.[44] An OSOW permit typically includes the conditions related to route specifics, dates of load travel, times of load travel, and escort vehicles. Channeling the heavy loads to fewer routes is one mechanism states use to minimize the impact of heavy loads on the highway system. Another strategy is to direct as much heavy cargo as possible to the rail and water modes. Even in the case of primary transport by rail of water however, trucks often complete the first and last moves for water and rail shipments.

ROUTE DEFINITION FOR HEAVY-HAUL VEHICLES

Heavy-haul routes, for the purposes of this plan, are highway locations where travel by heavy commercial motor vehicles (including agriculture, energy, mining, or timber cargo) is projected to substantially deteriorate the condition of the roadways. These routes may be traversed by regulation-size vehicles at or near the gross-vehicle-weight limits carrying heavy cargo, or by OSOW vehicles, or superloads.

S.H. 18 at the Arkansas Red River in Pawnee/Osage Counties

As part of the freight plan process, pavement conditions on the heavy-haul designated routes, and areas of freight flows of heavy commodities, were analyzed. Highways that connect to the NHS, which carry bulk products from farm fields, oilfields and wind installations, were also reviewed as part of this analysis. Clearly, heavy loads increase the rate and magnitude of pavement deterioration.

Structurally deficient bridges are problematic across the country, and Oklahoma is no exception. In rural areas, the challenge of travel on inadequate bridges goes beyond truck travel and extends to agricultural equipment transport, where the axle ratios are different from trucks and therefore create special needs. Fields on large farms and ranches can be separated by restricted bridges, creating additional miles to move from field to field. Slurry wagons associated with confinement livestock can be extremely heavy and present a similar challenge in rural areas.

At present, ODOT does not have a method for tracking vehicle volumes by route for trucks with oversize overweight permits or with special superload permits. Tallies of OSOW permits have been 215,000 or more annually for the past four years. Developing a source for permitted volumes will aid ODOT in better defining the required network for OSOW traffic. This data will help prioritize repair, maintenance and improvements in order to provide better conditions for Oklahoma business requiring OSOW transport. More detailed permit information will

also aid ODOT's participation with neighboring states in developing commercial corridors for OSOW traffic and for harmonizing regulations.

HEAVY-HAUL CONCERNS

OSOW shipments present difficulties in managing physical infrastructure, operational processes, and policy. For shipments crossing state lines, the problems are compounded by the need to interact with neighboring states, and/or several states along an extended route.

Physical Infrastructure

OSOW shipments have an impact on physical infrastructure, increasing the need for maintenance and repair to maintain good condition. Bridge conditions are particularly problematic given the need for out-of-route miles to work around restricted bridge locations, although ODOT has steadily expanded the system of unrestricted facilities. Superloads by their nature add clearance considerations to physical design for vertical clearance, turning radius, and other dimensional characteristics.

A related physical aspect has to do with the choice of suitable routes and interaction with other traffic. OSOW freight can impede traffic flow on high-volume corridors and create disruptions in cities and towns. This is particularly true for superloads, which move slowly and require special considerations for clearance such as navigating under power lines and traffic signals.

Policy and Operations Practice

Oklahoma carriers report concerns with the permit system as one particular barrier to efficient operations. Although much of this pertains to regular OSOW shipments, the superload operations are especially affected. While concerns include issues such as the need for individual permits for repetitive loads and for empty returns from the same two locations, the OKiePROS system cited earlier in fact has substantially simplified and expedited the permitting process for carriers.

5.2 RAIL MOBILITY ISSUES/CONCERNS IDENTIFIED

Railroad-related concerns and mobility issues can be attributed to several factors. Inadequate track and a rail yard's physical capacity can produce railroad bottlenecks, as can the crossing of two tracks. Rail bottlenecks in turn, impact rail velocity. Deficient structures such as bridges can introduce speed restrictions that affect freight mobility

These factors not only affect the mobility of rail freight, but can also have an impact on highway traffic. Slow or stopped trains can interfere with motor vehicle traffic at grade crossings. Even fast moving trains in high frequency railroad corridors can create motor vehicle bottlenecks.

Table 9 is an initial summary of locations where stakeholders expressed concern about freight railroad mobility issues in relation to the overall transportation system. A planning level evaluation to assess rail constraints and possible conflicts may be warranted.

Table 9. Possible Railroad Mobility Issues

Concern/Issue	Railroad	Location	Comment
Missing leg of wye* connecting Avard and Red Rock subdivisions	BNSF	Perry	Increased number of trains/day affect local traffic
Red Rock subdivision single track	BNSF	North of Edmond to Flynn Yard (Flynn)	Increased rail traffic
Red Rock subdivision Oklahoma River Bridge	BNSF/SLWC	Oklahoma City	Second river crossing needed to remove SLWC trains from BNSF line
Claremore crossing	BNSF/UP	Claremore	Frequent trains on two tracks in middle of town, local and state freight and other highway traffic at crossings is significant
Cherokee Yard location constraints	BNSF	Tulsa	Recent, and anticipated additional, increased north south rail traffic
Shawnee-McAlester line closed	UP (AOK)	Shawnee/McAlester	Inefficient routing of rail traffic between the two locations
Inability to transport standard 286,000 lbs. freight cars	SKOL	Tulsa	Extra freight cars required to handle traffic; increased cost to railroad and shippers
Inadequate rail truck transfer capacity	SKOL	Tulsa	Increased roadway traffic
Inability to transport standard 286,000 lbs. freight cars	SLWC	Lawton subdivision	Extra freight cars required to handle traffic; increased cost to railroad and shippers
Lack of capacity/rail sidings	Farmrail	Elk City	Increased capacity needed to support energy industry
Inability to transport standard 286,000 lbs. freight cars	Farmrail/ Grainbelt	Western Oklahoma	Extra freight cars required to handle traffic; increased cost to railroad and shippers
Inability to transport standard 286,000 lbs. freight cars	AT&L	Watonga-Geary-El Reno	Extra freight cars required to handle traffic; increased cost to railroad and shippers
Inability to transport standard 286,000 lbs. freight cars	AOK	OKC-Shawnee/McAlester-Howe	Extra freight cars required to handle traffic; increased cost to railroad and shippers
Inability to transport standard 286,000 lbs. freight cars	Kiamichi	Valiant-Arkansas border	Extra freight cars required to handle traffic; increased cost to railroad and shippers
Inability to transport standard 286,000 lbs. freight cars	TSU	Tulsa-Sapulpa	Extra additional freight cars required to handle traffic; increased cost to railroad and shippers
Inability to transport standard 286,000 lbs. freight cars	WTJ	Altus-Texas border	Extra freight cars required to handle traffic; increased cost to railroad and shippers

Source: Oklahoma DOT, Rail Programs Division

* A wye is an arrangement of railroad tracks in the form of a "Y", used for turning engines, cars, and trains

5.3 WATER CONCERNS

Issues and concerns regarding waterway freight transport have been identified. Interviews with port directors and staff at Oklahoma's three largest ports—Tulsa Port of Catoosa, Port of Muskogee, and Port 33—confirmed that reliability and state of good repair for the MKARNS is the shared highest priority for all three ports.

ODOT's Waterways Program concurs in this view, and has noted the following:[45]

> …. The MKARNS has never had a catastrophic failure of the locks and dams causing the system to be shut down for an extended period of time since being dedicated in 1971. There are scheduled maintenance projects that the stakeholders work around when notified by the USACE of the shutdowns, usually months ahead of time for periods up to 2 weeks … lock availability on the 5 locks in Oklahoma over a 10 year period of time (is) 98.7%.

In 2015, the MKARNS was inoperable for 90 days, but this was caused by heavy rains and associated water flows and shoaling, not infrastructure failures.

According to the U.S. Army Corps of Engineers (USACE) Tulsa District, there is a backlog of maintenance projects on the MKARNS. "Critical backlog" projects are those that address infrastructure with an estimated 50 percent chance of failure within a 5-year period. In most cases, any single infrastructure failure would not result in total loss of system operability, but the cumulative effects of multiple failures could be very significant.

ODOT's Waterways Program staff coordinated with USACE to develop a list of the critical backlog projects considered most significant for the continued reliability and operability of the MKARNS, and provided the list for use in the OFTP.[46] The recommendations address the following critical needs:

- Tainter gates rusty and worn out at Robert S. Kerr, Mayo, Webbers Fall Locks and Dams
- Tainter valves corroded and leaky at Graham Lock and Dam
- Lock roofs leaking onto equipment at multiple locations
- Miter gate pintle balls worn and poorly functioning
- Faulty and deteriorated lock control wiring at multiple locations
- Inadequate stop logs at Robert S. Kerr Lock and Dam

5.4 AIRPORT ACCESS CONCERNS

As described in Chapter 2 of this Plan, the state has three primary commercial service airports—Lawton-Fort Sill Regional in Lawton, Will Rogers World Airport in Oklahoma City, and Tulsa International in Tulsa.

The truck bottlenecks identified in section 5.1.1 were reviewed to determine whether any of them affected the airports. Will Rogers World Airport is near the interchange of I-44 and I-240, which is a bottleneck (see **Figure 24** earlier in this report). In addition, on I-44 just north of the interchange is a series of bottlenecks. Trucks accessing Tulsa International Airport could be affected by bottlenecks at the interchange of I-44 and I-244 and on the Gilcrease Expressway just north of the interchange with I-244 (see **Figure 25** earlier in this report). There is a bottleneck at the intersection of U.S. 62 and I-44 that affects trucks accessing the Lawton-Fort Sill Regional Airport (see **Figure 23** earlier in this report).