WELCOME

OKLAHOMA Transportation

Oklahoma Freight Plan
Freight Advisory Committee

Tuesday, September 20, 10-11:30 A.M.

Oklahoma Freight Plan FAC

Agenda

- Recap from FAC #1
- Freight Trends
- Future Freight Flows
- Freight Bottlenecks and Mobility Issues
- Critical Urban and Rural Freight Corridor Designations
- Next Steps and Wrap Up

Website: www.odot.org/2023-2030FreightPlan

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Timeline

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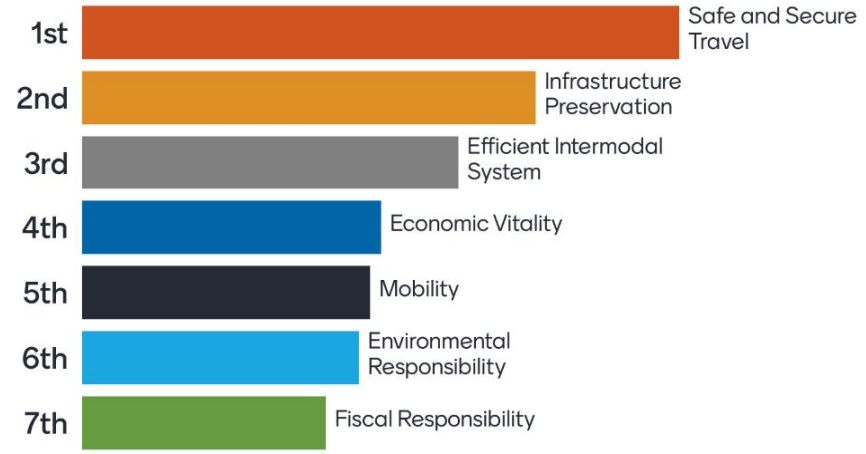
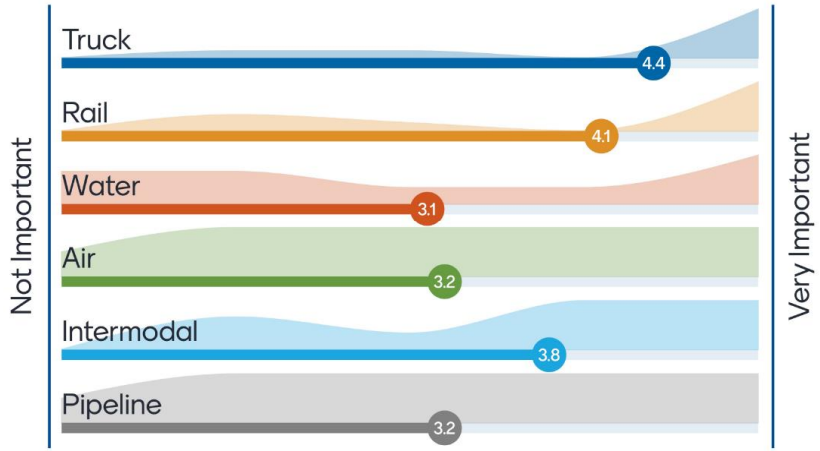
FAC Meeting #1

- Top 3 Goal Priorities (Chapter 1)
  - Safe and Secure Travel
  - Infrastructure Preservation
  - Efficient Intermodal System
- Mode Importance:
  - Truck
  - Rail
  - Intermodal
- Challenges related to congestion, rising costs, staffing, funding





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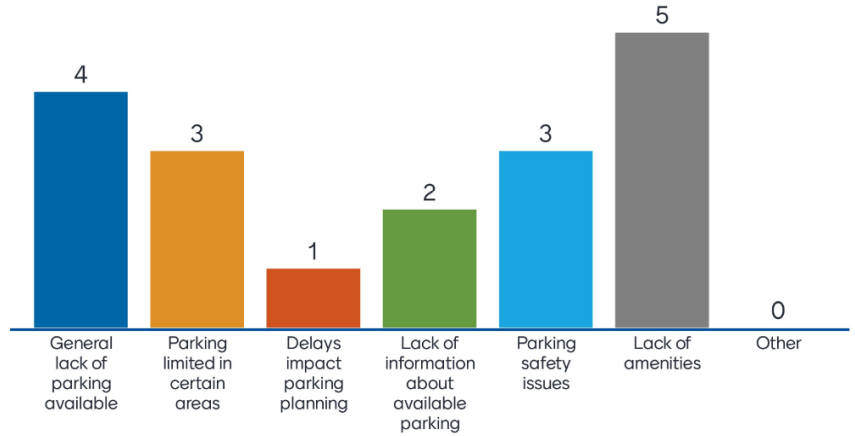
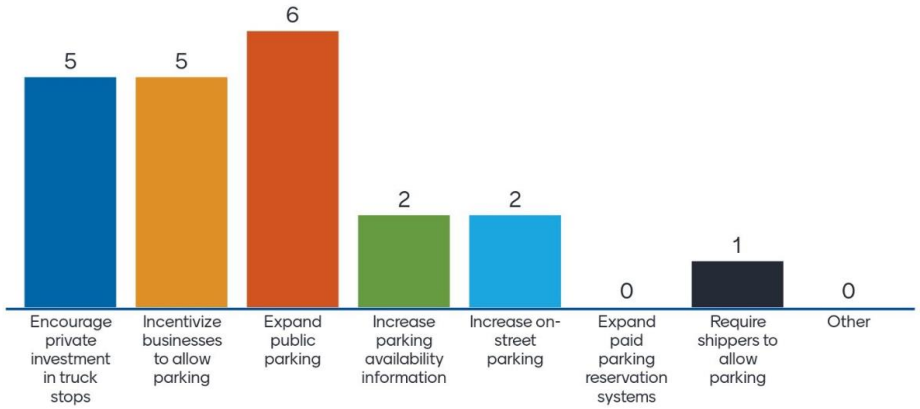
FAC Meeting #1

- Truck Parking Challenges (Chapter 2)
  - Lack of amenities
  - General lack of parking
  - Parking safety
- Truck Parking Strategies
  - Expand public parking
  - Encourage private investment in truck stops
  - Incentive businesses to allow truck parking





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Freight Trends

Energy – Oil and Gas

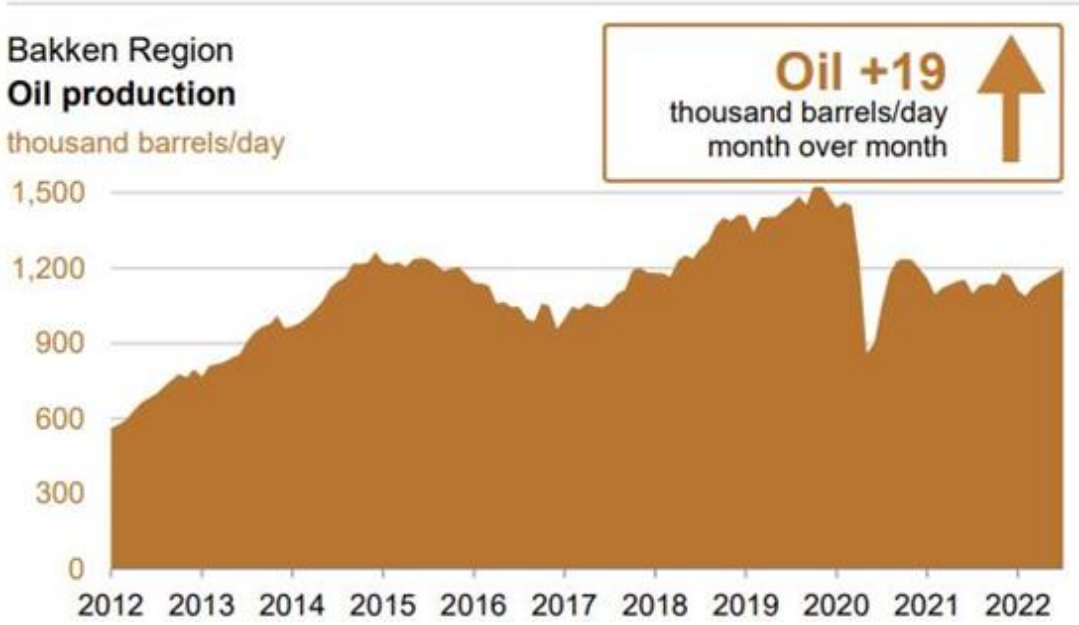
Oklahoma is home to 15% of the nation's oil storage capacity, oil stored here comes from two main sources:

- Extracted in OK: 4% of U.S. oil reserves and 4% of annual production
  - 143 million barrels in 2021
- Out of state, primarily the Bakken in ND, as well as Canada

The EIA forecasts that production will reach pre-pandemic levels by 2023 before stabilizing through 2050

- Petroleum and natural gas will remain the most consumed sources of energy in the U.S. but renewable sources will be the fastest growing

Historic Oil Production in the Bakken Region



Source: U.S. EIA Drilling Productivity Report, June 2022

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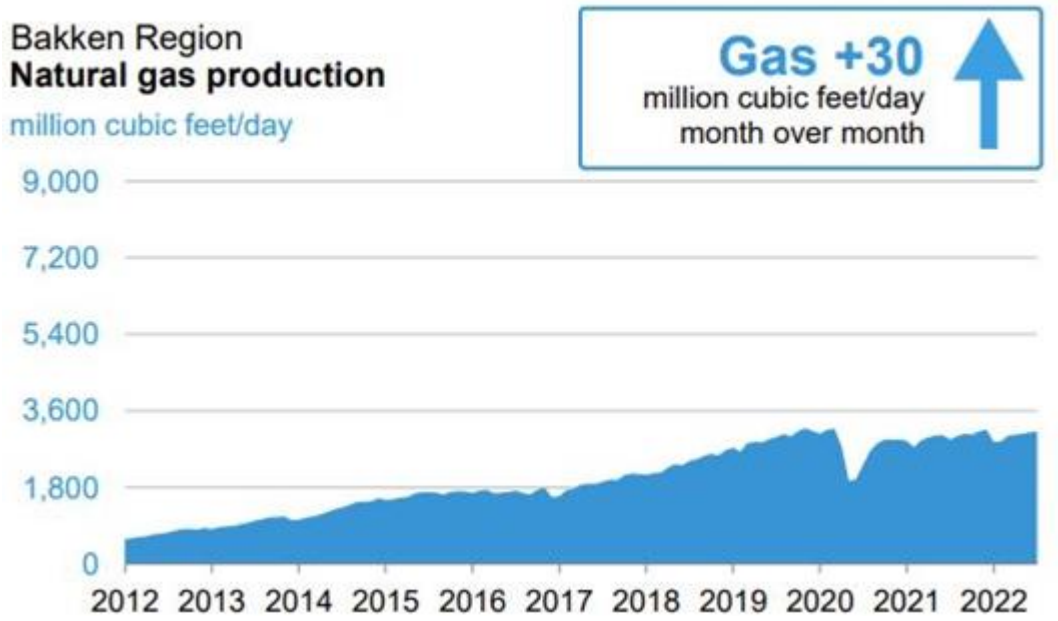
Freight Trends

Energy – Oil and Gas

OK is the nation's fifth largest producer of natural gas, primarily extracted in the Anadarko Basin.

- Natural gas is shipped by pipeline
- Extraction inputs such as sand, gravel, water, and equipment are moved primarily by rail and truck

Historic Natural Gas Production in the Bakken Region



Source: U.S. EIA Drilling Productivity Report, June 2022

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Freight Trends

Energy - Wind

In 2021, OK was third in net electricity generation from wind

- The state's wind farms produced 9% of total U.S. wind power
- Wind power provided over 41% of the state's electricity

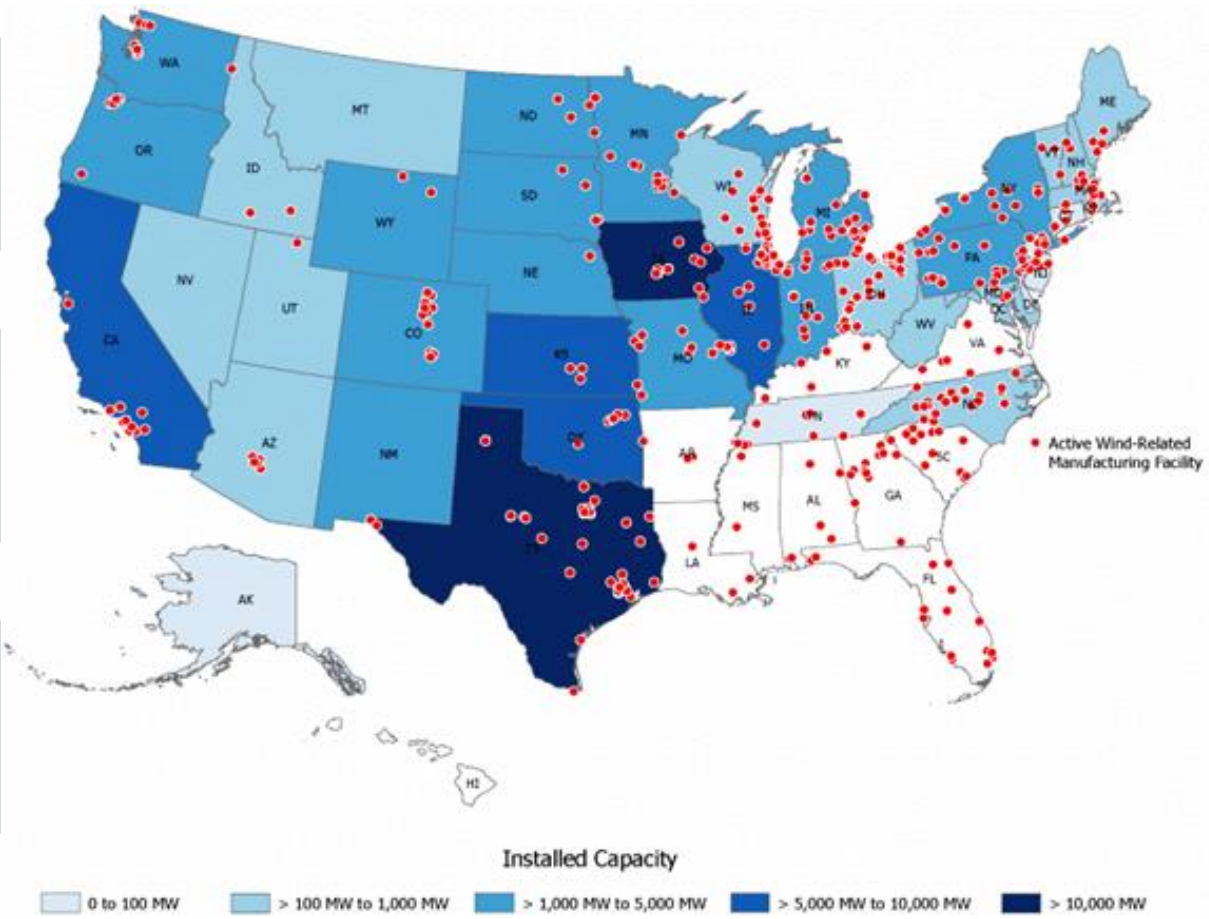
Wind farms generate significant levels of freight during their construction:

- The average utility-scale wind turbine contains about 8,000 parts
- Involves rail, truck, and sometimes, ship

Another sources of wind related freight is in-state wind turbine manufacturing

- OK has about a half dozen wind turbine manufacturing outfits
- Ensure rail connections and strength of roads and bridges for larger components

National Turbine Manufacturing Capacity



Source: Office of Energy Efficiency & Renewable Energy, 2022

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Freight Trends

Demographic and Economic

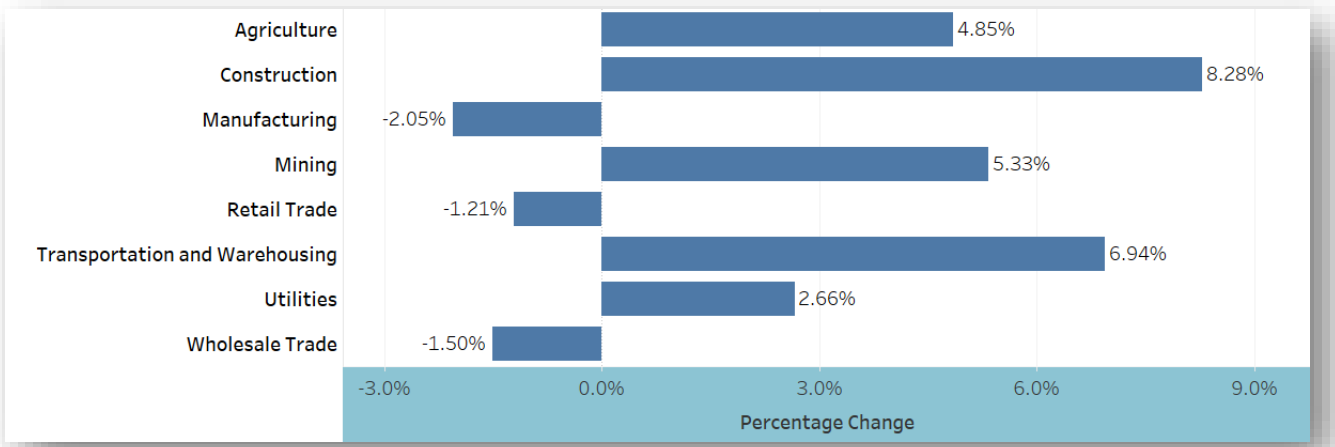
The state's population is expected to grow to 4.4 million people by 2040.

- Growth likely centered in existing metro areas
  - Tulsa
  - OKC
- Growth will drive demand for goods and increase truck traffic

In 2022, OK's unemployment rate 2.8% and expected to drop further.

- Key growth industries are Construction, Transportation & Warehousing, and Agriculture
- Manufacturing, retail, and wholesale employment to decrease
  - Driven by reduction in apparel and computer/electronics manufacturing

Projected Employment Growth (2018 through 2028)



Source: Oklahoma Employment Security Commission, August 2020.

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Agricultural Products

Agriculture accounts for about 1.4% of OK's GDP

- Agriculture is a critical user of the state's transportation system
- State's wheat crops are grown primarily in the western areas of the state. Trucks and short-line railroads are key connections.

There are two key methods for agricultural products to be shipped:

- Containerized, or intermodal, methods (including tanks). These containers can then be moved easily by rail, water, or truck
- Noncontainerized, or bulk. Bulk freight may be moved by any mode, though rail and water are the most efficient.

BNSF Intermodal Logistics Center, OKC

Source: BNSF Railway Co.

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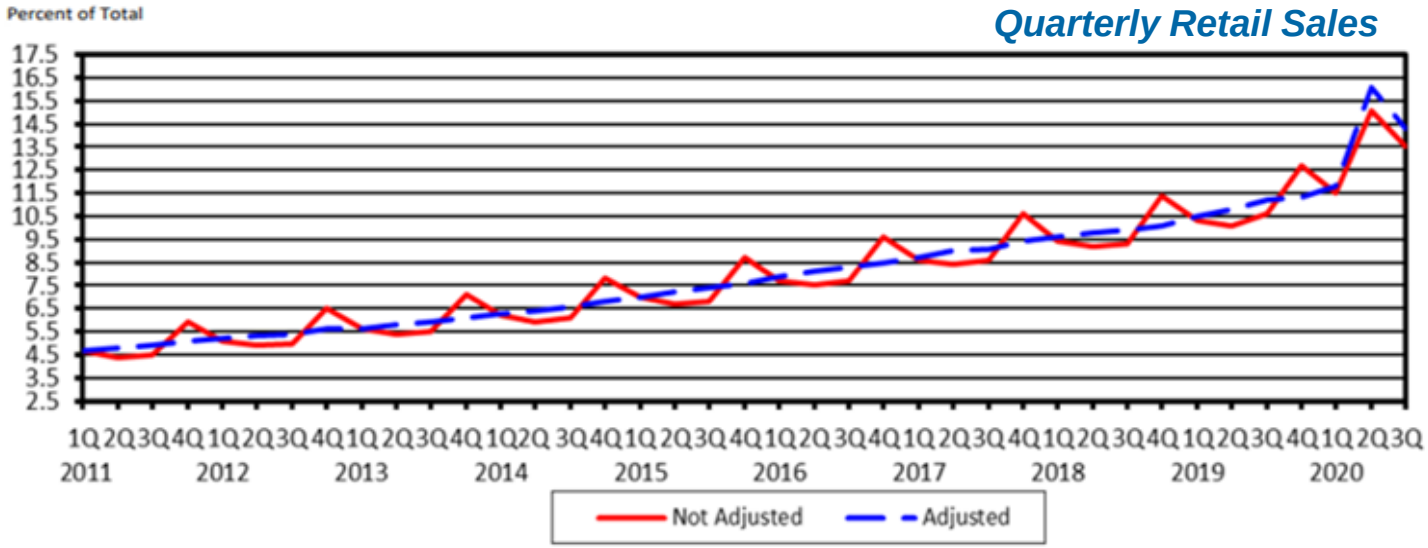
Freight Trends

Supply Chains – E-Commerce

Source: The Oklahoman

Estimated Quarterly U.S. Retail E-Commerce Sales as a Percentage of Total Quarterly Retail Sales



Source: U.S. Bureau of the Census, 2022

E-commerce as a share of total retail sales has grown steadily since the early 2000s

- COVID-19 encouraged fast and widespread adoption of home delivery, buy online and pick up in-store, and cashless/touchless transactions

Short delivery times are resulting in more and shorter truck trips

- Significant growth of warehousing and distribution & fulfillment centers
- More facilities being built close to urban centers for last-mile delivery

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Freight Trends

Technology and Innovation – Connected and Automated Vehicles

Ceva and Kodiak Automated Tractor Trailer

Source: Ceva Logistics, 2022

- Connected and automated vehicle (C/AV) technologies are evolving quickly.
  - Driver assist offers safety benefits
  - Fully autonomous vehicle tech adoption has not moved as quickly as initially predicted
- Companies developing C/AV are working to make the tech function in existing physical conditions.
- Infrastructure providers and policy makers are working to adapt to new tech:
  - In 2022, OK legislature allowed fully automated vehicles to operate on public roads, with safety plan.
  - SB189 provides for truck platooning for up to two vehicles

Additional Commercial Vehicle Technologies

- Truck and Trailer Information Systems
- Electronic signage and parking availability VMS
- Real time load access
- Electronic logging
- Virtual weigh stations

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Freight Trends

Technology and Innovation- Electrification

National Electric Vehicle Infrastructure (NEVI) formula program

- Funding to states for charging stations and data collection
  - OK will receive $66 million between 2022-2026
  - Nomination of Alternative Fuel Corridors (AFCs)

OK EV Deployment Program

- OK released state NEVI Plan in July 2022
- Aims to stay in the top 10 states for EV charging stations per capita
- Plan identifies gaps and needs along interstates and AFCs to prioritize investment

Oklahoma Interstate Charger Coverage Gaps

Source: Oklahoma NEVI Plan, 2022

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Freight Trends

Source: Google Maps – BNSF Flynn Yard, Oklahoma City

Technology and Innovation - Railroads

Railroads and FRA are implementing technologies to improve safety and efficiency:

- **Positive Train Control:** Connects train's throttle and braking systems, and monitors track conditions to ensure train separation and avoid derailment. Mandated by FRA for certain freight commodities.
- **Grade crossing safety:** USDOT authorized $573 million for the new Railroad Crossing Elimination grant program.
- **Precision Scheduled Railroading:** Focus on moving cars rather than trains can decrease the dwell time of rail cars. However, may reduce headcount, which can have safety implications.

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Menti Questions

Instructions

Go to

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Enter the code

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Or use QR code

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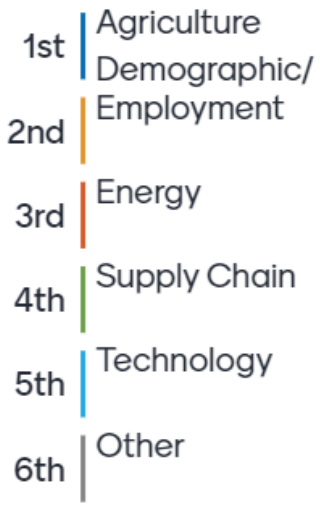
Rank the identified trends most significant to your company/agency.



Freight Flows

Data Source and Base Volumes

- USDOT Freight Analysis Framework
  - Years
    - 2017 base year data
    - 2045 forecast year
  - Attributes
    - Tons and Value
    - Origin, Destination, and Direction of Flow
    - Domestic and International
    - Domestic and International Modes
- In 2017, OK handled 435.5 million tons of freight worth 300.1 billion dollars

	% of Tons 2017	% of Value 2017
Inbound	29.7%	41.9%
Outbound	34.0%	33.0%
Internal	36.3%	25.1%

	% of Tons 2017	% of Value 2017
Truck	48.2%	69.1%
Pipeline	37.4%	14.5%
Rail	8.7%	2.4%
Multiple Modes	4.3%	12.1%
Water	1.5%	0.6%
Air	0.0%	1.2%
Other/Unknown	0.0%	0.0%

	% of Tons 2017	% of Value 2017
Fuels	53.3%	24.3%
Gravel, Minerals, Metals	15.3%	3.8%
Industrial Products	6.9%	17.4%
Agriculture and Livestock	6.0%	4.1%
Food	4.9%	7.0%
Chemicals	4.1%	7.2%
Consumer Goods	3.6%	32.7%
Logs, Wood, Paper	3.1%	3.1%
Waste/scrap	2.7%	0.4%

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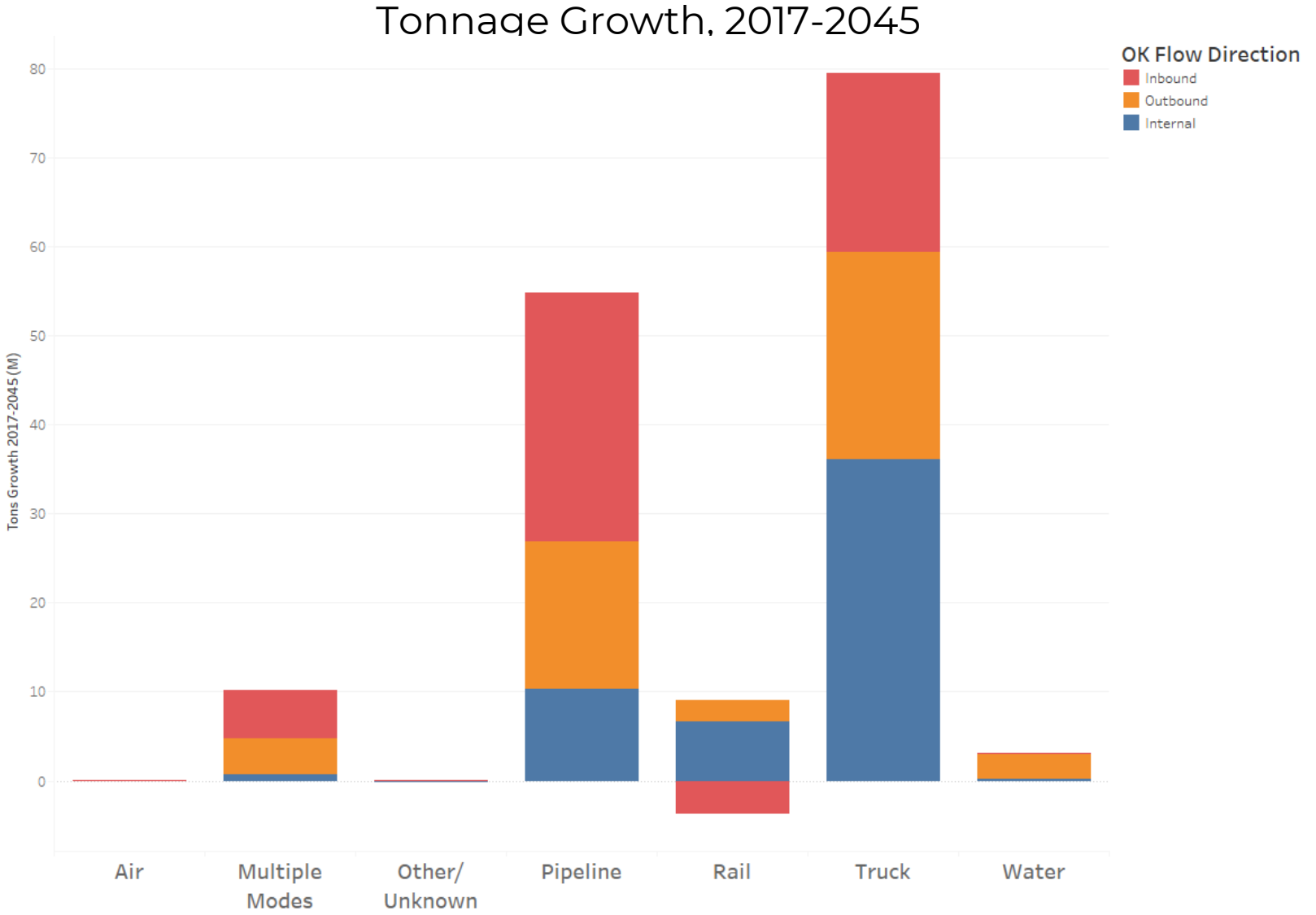
Freight Flows

- Oklahoma adds 153 million tons in annual tonnage by 2045, a 35 percent increase.
- 79.5 million tons for trucking
- 54.8 million tons for pipeline
- 10.2 million tons for multiple modes
- 5.4 million tons added for rail, even with the loss of inbound coal.
- 3.1 million tons added for water



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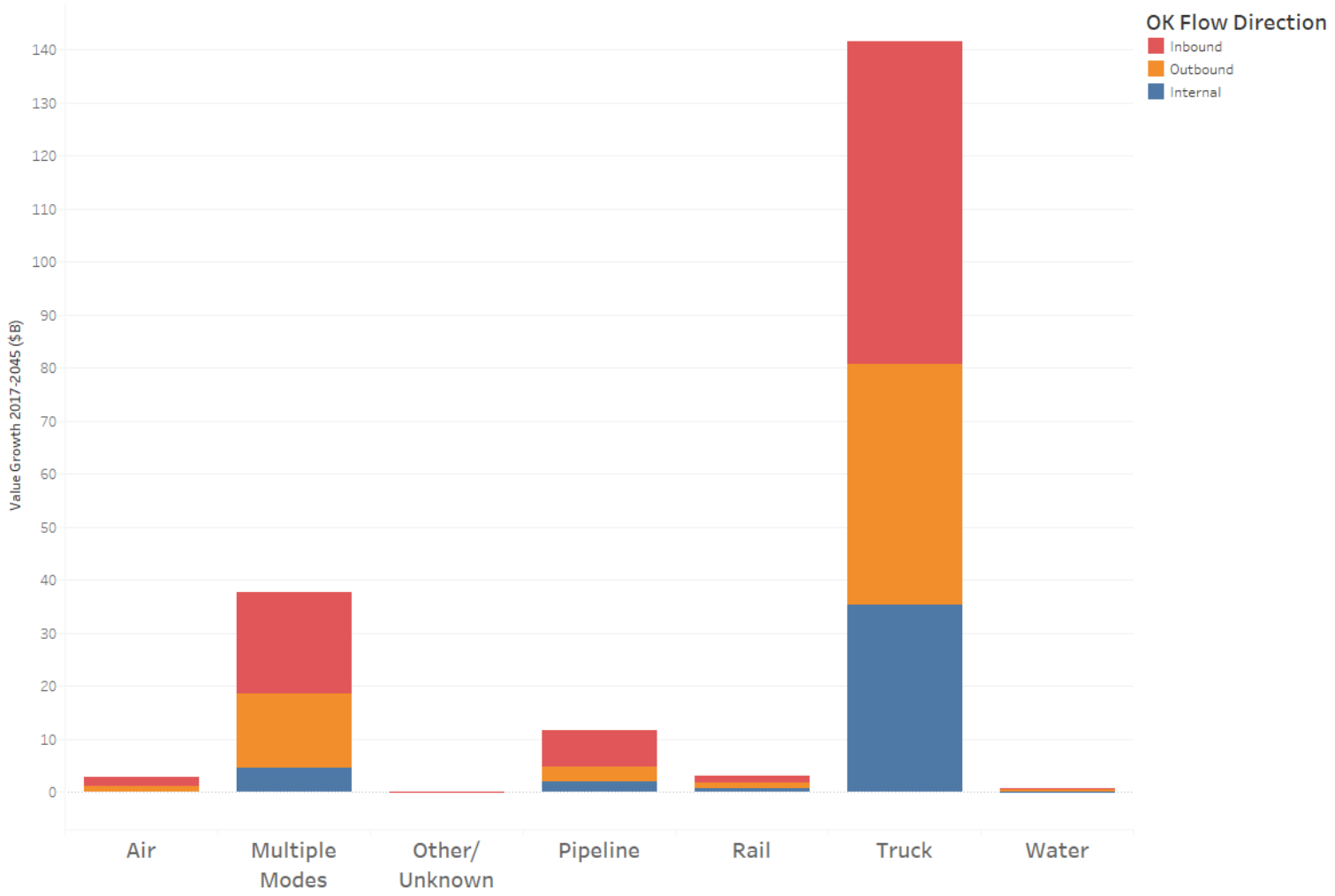
Freight Flows

- Oklahoma adds 198 billion dollars in annual value by 2045, a 66 percent increase.
- $142 billion for trucking
- $38 billion for multiple modes
- $3 billion for rail
- $3 billion for air
- $1 billion for water

Value Growth, 2017-2045



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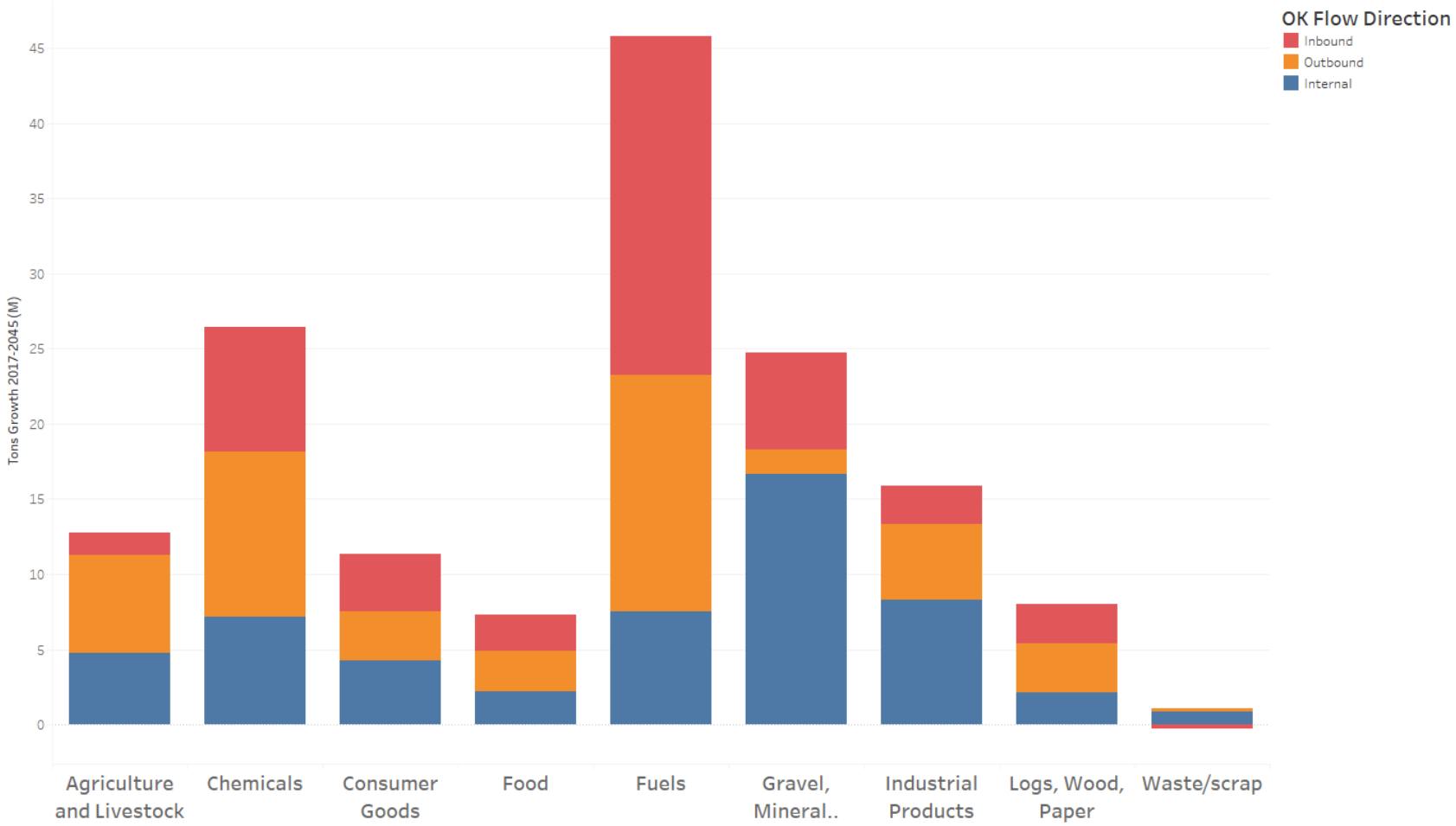
Freight Flows

- Petroleum and coal products account 30 percent of projected tonnage growth
- Other leading growth commodities include gravel, chemicals, nonmetallic mineral products, fertilizers, mixed freight, sands, live animals and fish, crude petroleum, and animal feed
- Fuel oils, coal, and gasoline tonnages are projected to decline.

Tonnage Growth by Commodity, 2017-2045



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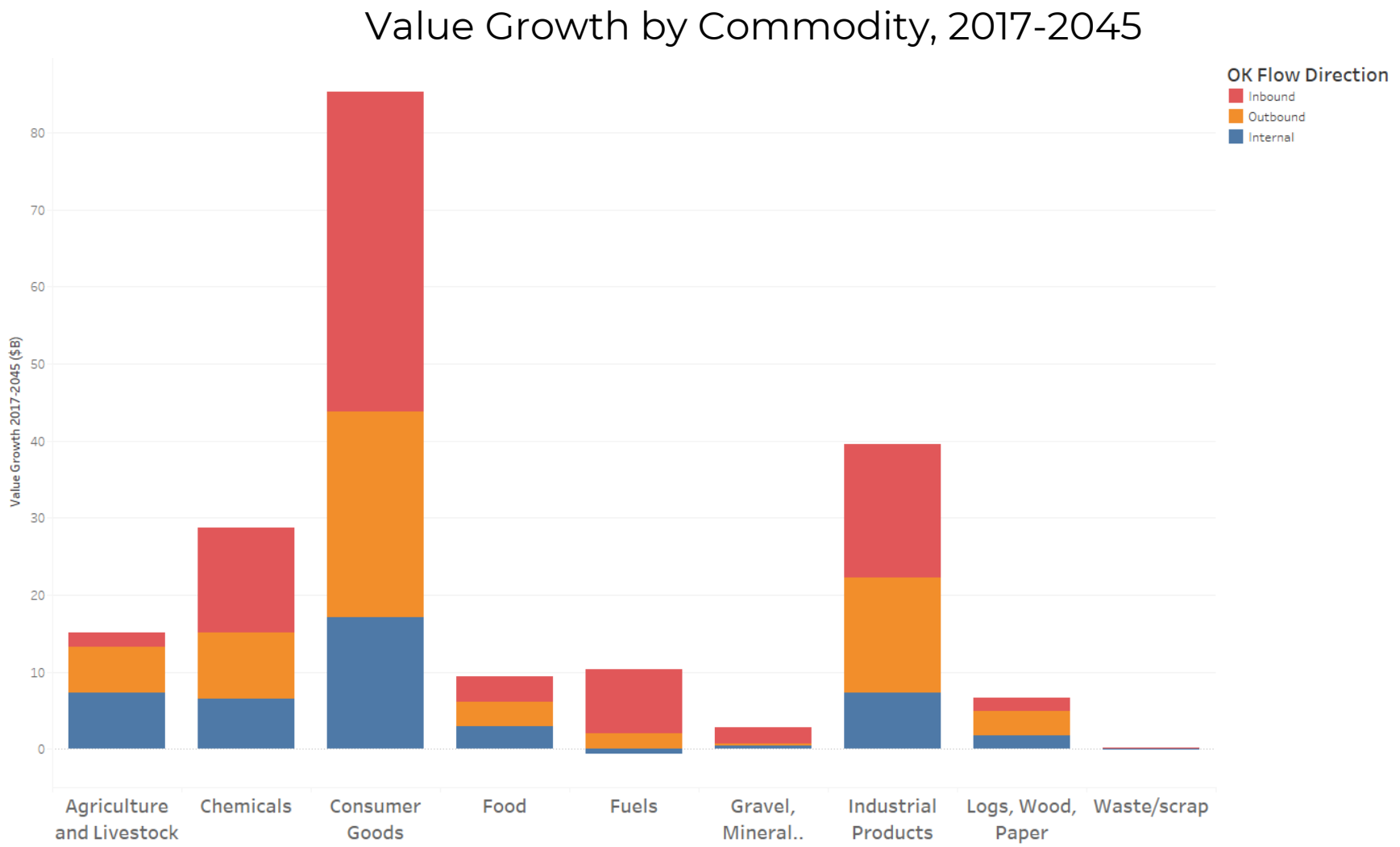
Freight Flows

- Value growth is distributed across a diverse range of leading commodities
- Leading groups include consumer goods, industrial products, chemicals, and agriculture
- Fuel value increases due to LNG but coal, fuel oils, and gasoline projected to decline.



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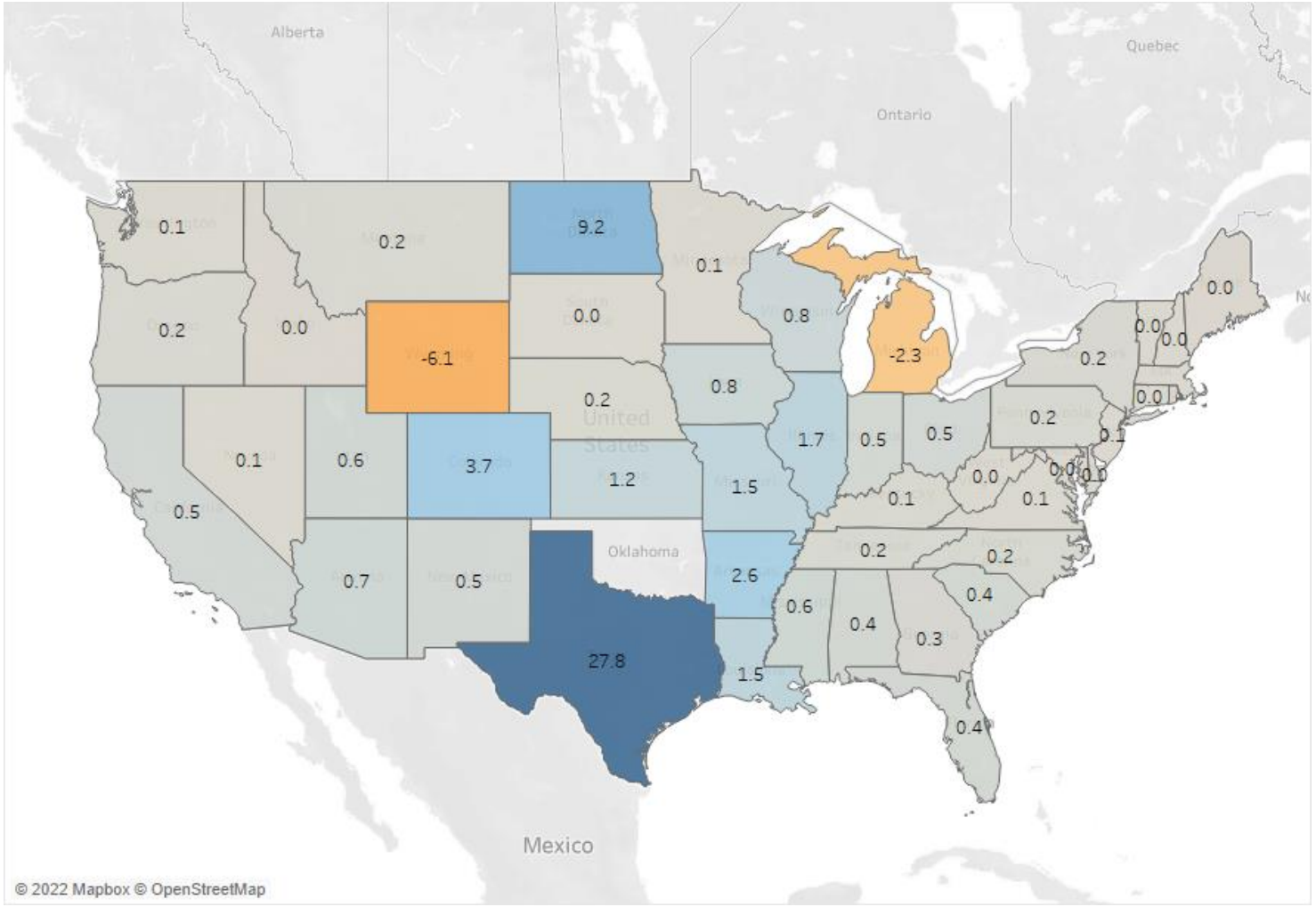
Freight Flows

- Tonnage inbound to Oklahoma is expected to grow by 49.9 million tons between 2017 and 2045
- Texas accounts for 56 percent of inbound tonnage growth, followed by North Dakota, Colorado, and Arkansas
- Tonnage declines are projected from Wyoming (due to reduced coal tonnage by rail) and Michigan (due to reduced crude oil tonnage by pipeline)

Inbound Tonnage Growth 2017-2045 by Origin State



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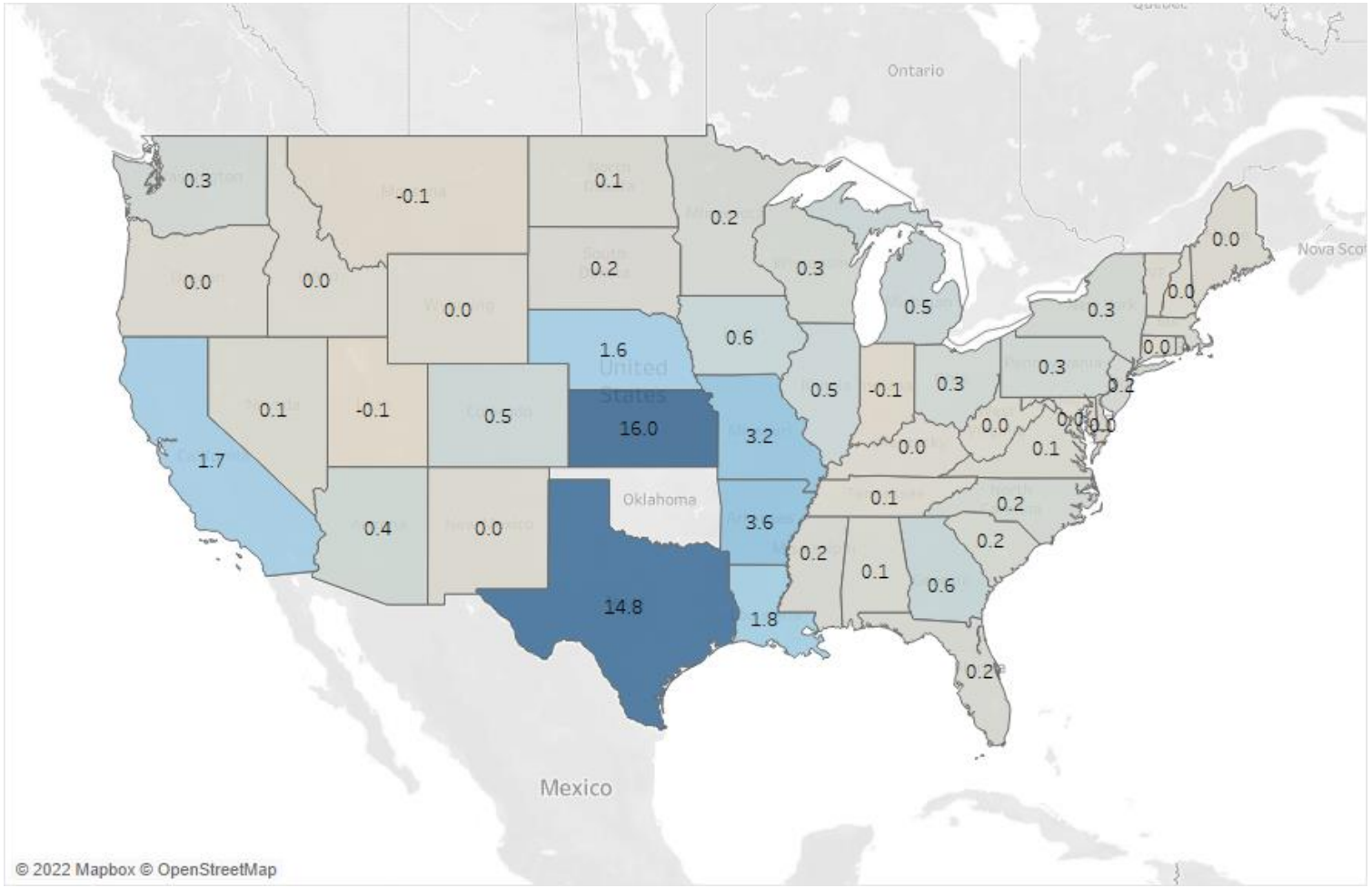
Freight Flows

- Tonnage outbound from Oklahoma is expected to grow by 49.0 million tons between 2017 and 2045.
- Kansas accounts for 16.0 million tons and Texas accounts for 14.8 million tons, representing a combined 63 percent of tonnage growth.
- Other significant growth states include Arkansas, Missouri, Louisiana, California, and Nebraska.

Outbound Tonnage Growth 2017-2045 by Destination State



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System Performance – Truck Bottlenecks

Analysis Approach

- National Performance Management Research Data Set (NPMRDS) is the primary dataset used
- Package of vehicle probe data on NHS across the U.S.
  - Archived travel time and speed at 5-minute intervals
  - Truck-specific data available
- Calculate daily and hourly values for
  - 10th percentile travel time (free flow) (τ_{ff})
  - Average travel time (τ_{avg})
  - 95th percentile travel time ($\tau_{95\%}$)
- Vehicle Excess Hours of Travel (recurring congestion)
  - VEHT = Volume*(τ_{avg}- τ_{ff})
- Vehicle Hours of Unreliability (nonrecurring congestion)
  - VHU = Volume*($\tau_{95\%}$ - τ_{avg})

Monetizing User Costs

- Values from NCHRP 925 to derive user costs of recurring and non-recurring congestion
- Derived from survey of shippers and industry supply chain managers and analytical modeling
- Recurring congestion (Delay)
  - $66/hr.
- Non-recurring congestion (Unreliability)
  - $160/hr.
- Total User Congestion Cost = VEHT*($66/hr.) + VHU*($160/hr.)

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System Performance – Truck Bottlenecks

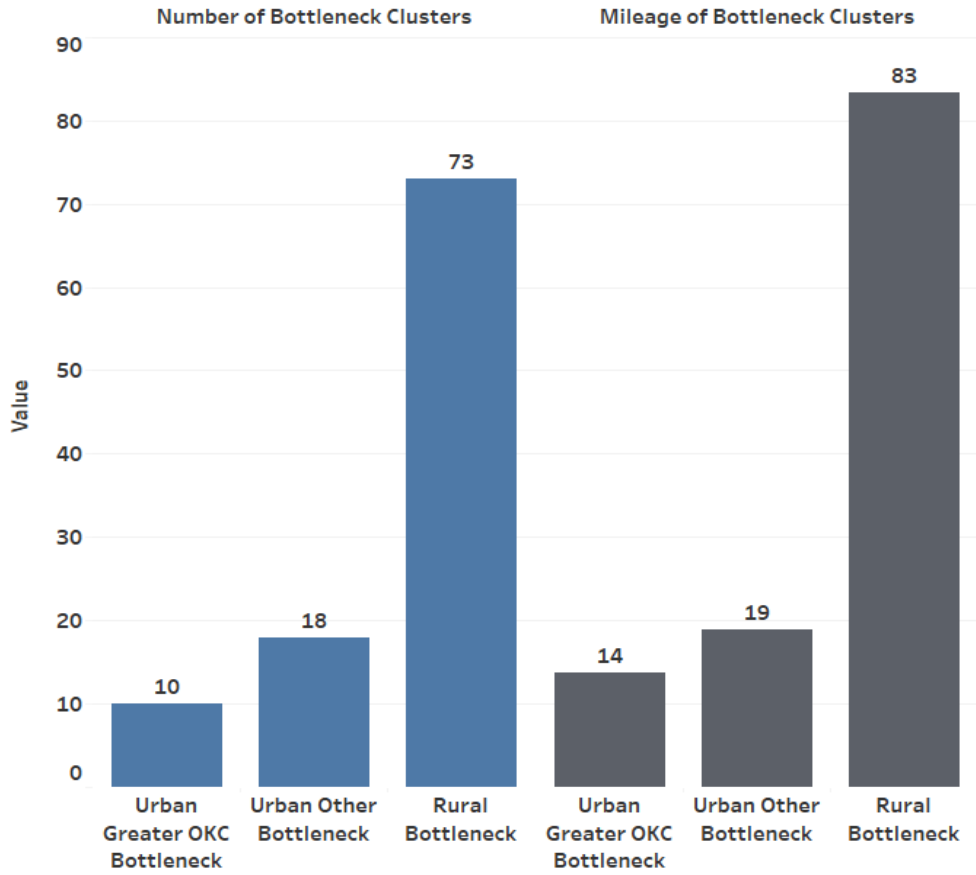
Preliminary Bottleneck Identification

- Congestion costs vary widely by location
- Roadway segments classified into 3 categories:
  - Urban Oklahoma City
  - Urban Other
  - Rural
- Roadway segments with total user congestion costs above 95th percentile considered bottlenecks

Bottleneck Type	User Cost Threshold (95th percentile) ($/mile-day)	Number of Bottleneck Segments (TMCs)	Bottleneck Centerline Roadway Miles
Urban Oklahoma City	17,325	37	14
Urban Other	7,335	44	19
Rural	7,557	127	83
Total	**N/A**	**208**	**116**

Final Bottleneck Identification

- Adjacent bottlenecks were clustered as they are likely caused by the same sources of congestion
- Excluded bottlenecks likely caused by construction



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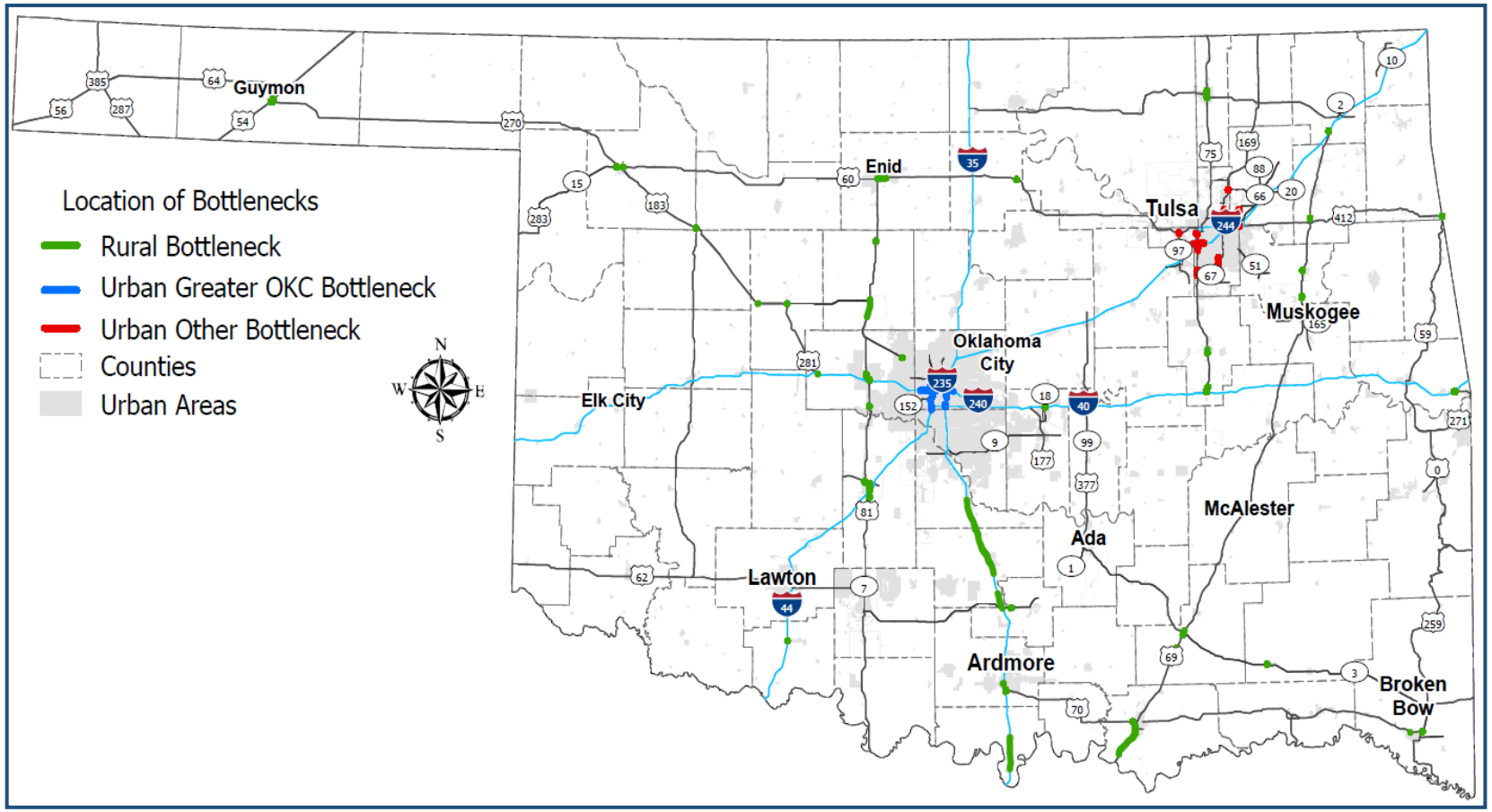
Final Bottlenecks Locations

- Bottlenecks congregate around urban areas
- Many rural bottlenecks in southern part of state along I-35
- Airport access impacts:
  - Will Rogers World Airport near the interchange of I-44 and I-240 proximate to a bottleneck
  - Tulsa International Airport access affected by bottlenecks on US-169 north of I-244
  - Access to DFW impacted by bottlenecks on I-35



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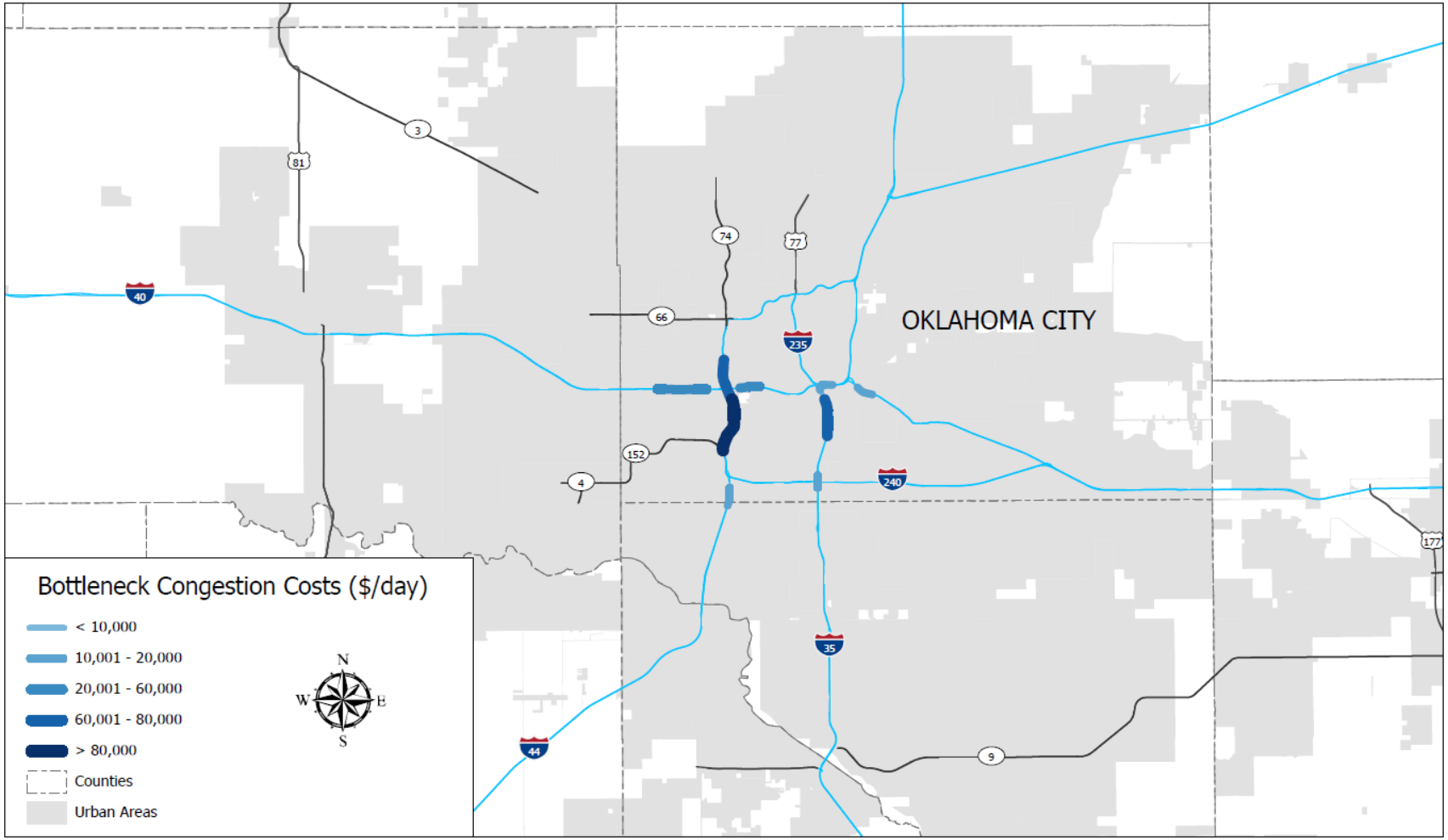
Bottleneck Congestion Costs - Top Urban OKC

- A number of bottlenecks especially around interchanges, including stretches of:
  - I-35
  - I-44
  - I-40
  - and US-77
- Highest costs around interchanges of I-44 and I-40
- I-35 also has high-cost bottleneck segments

Figure: Top 10 Urban Other Oklahoma City Bottleneck Clusters



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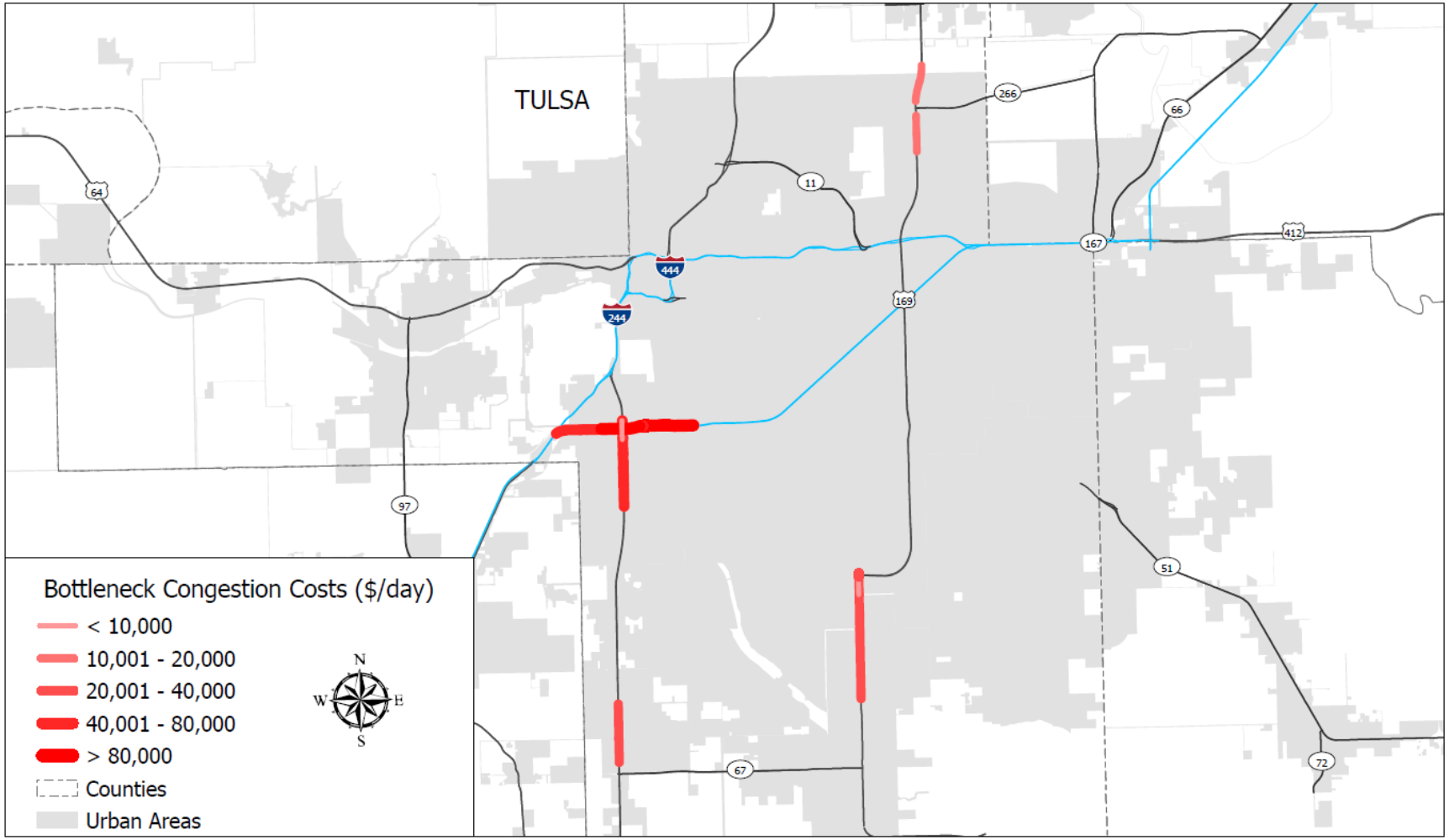
Bottleneck Congestion Costs - Urban Other (Tulsa)

- Several bottlenecks, especially around interchanges, including stretches of:
  - I-44
  - US-75
  - US-64
  - and US-169
- Highest costs at intersection of I-44 and US-75
- US-64 also has high-cost bottleneck segments

Top 10 Urban Other (Tulsa) Bottleneck Clusters



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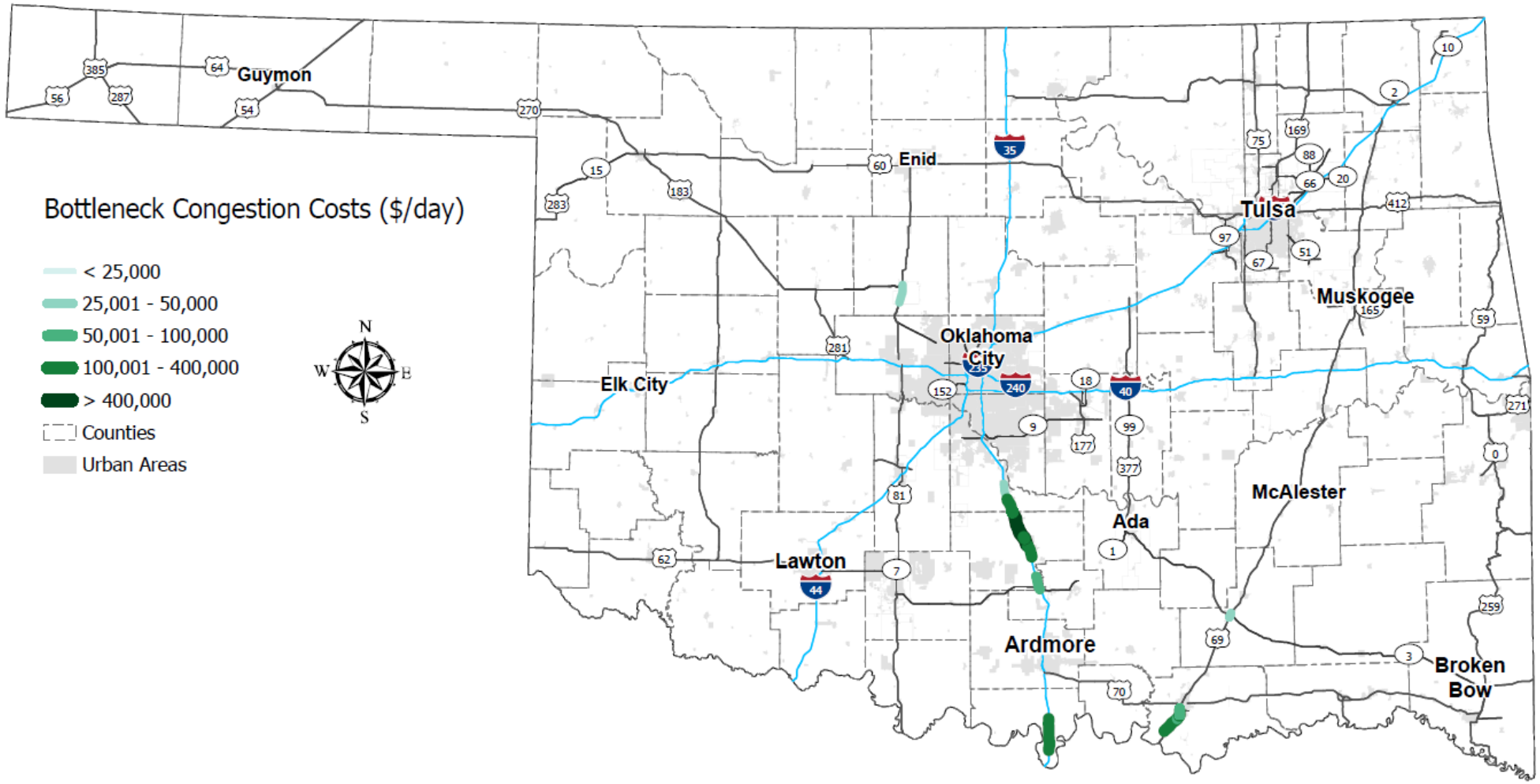
Bottlenecks Congestion Costs – Top 10 Rural

- Highest costs on I-35

Top 10 Rural Bottleneck Clusters



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Heavy-Haul Freight-Related Bottlenecks

- Heavy-haul traffic can create bottlenecks that affect other highway users
- ODOT tracks vehicle volumes by route for trucks with OSOW permits or with special superload permits.
- Also examined pavement condition along heavy-haul routes to note infrastructure impact of heavy traffic

- Locations where truck bottlenecks are close to freight generators:
  - US-54/ US-412 (US-64) intersection – Texas County
  - US-81 between SH-33 and SH-3 – Kingfisher County
  - US-81 just north of the I-40 intersection – Canadian County
  - US-81 at SH-33 intersection – Kingfisher County
  - I-44 east of US-75 intersection – Tulsa County
  - SH-7 and I-35 interchange – Murray County
  - I-35 south of I-40 interchange – Oklahoma County

System Performance – Safety

Analysis Approach

- Crashes on roadways can cause slowing and backups that affect all traffic.
- Locations of frequent crashes affect reliability, a key issue for trucks
- Crashes were evaluated for the entire NHS network
- Crash risks tend to cluster around urban segments in OKC and Tulsa
- High crash segments also identified in sections of highways in rural areas such as US-60, US-412, US-75, US-81 and SH-3

Metrics

- Identified most impacted 10 percent of mileage in terms of:
  - Crash density (total crashes per mile)
  - Crash rate per million Vehicle-Miles Traveled (VMT)
- In 2019, approximately 390 miles of roadways recorded 13 crashes per mile or more and 2.1 crashes per 1M VMT or more

Worst 10 Percent of Crash Locations Statewide (2019)

Bottleneck Type	Crashes Per Mile	Crashes Per 1M VMT
Threshold (top 10 percent)	13.0	2.1
Miles over threshold	393	386
Percentage of total miles	10.3	10.2

Freight Railroad

Rail Plan Identified Concerns and Needs

- Conflict with motor vehicle traffic
- Increased volumes and train lengths
- Infrastructure (bridges or track structure) unable to support current generation railcars
  - Generally affects short-line (Class 3) railroads.
  - Restricts customers to using cars with 263,000-pound loading capacity, as opposed to cars with 286,000-pound capacity. This puts the customers at a commercial disadvantage.

BNSF Cherokee Yard in Tulsa

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Waterways

- MKARNS system needs
  - Critical lock & dam maintenance
    - Gates at Locks 14, 15, 16, 18
    - Wall repairs at Lock 17
  - Maintenance and deepening
    - Maintain 9-foot operating depth
    - Implement 12-foot channel project
- Tulsa Port of Catoosa, Muskogee, Port 33
  - Dredging, mooring, highway access

Tulsa Port of Catoosa

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Menti Question #2

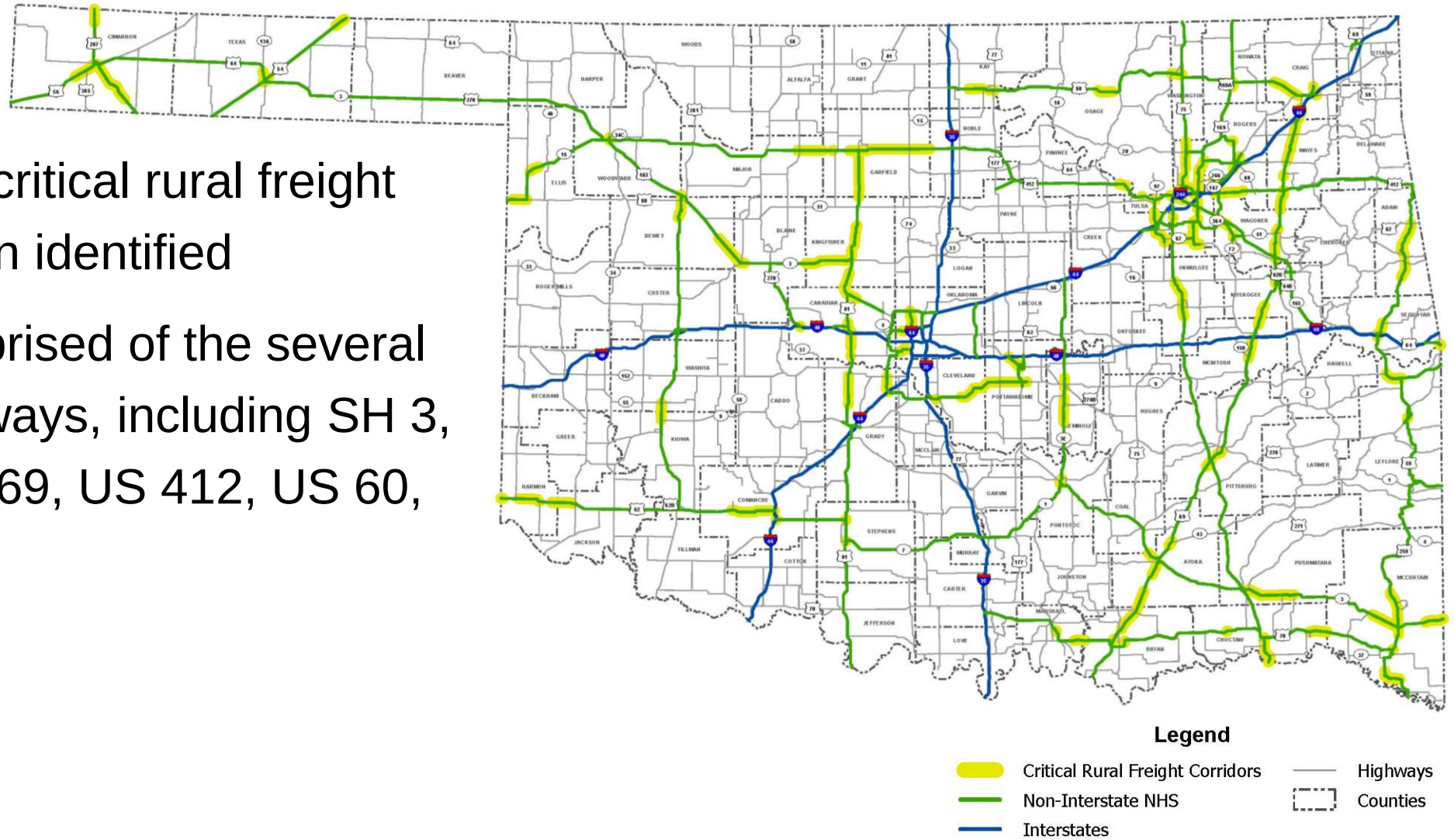
Go to www.menti.com and use the code 7210 8188

The code lets your audience join the presentation and expires in 14 days.

What locations do you see as the most significant bottlenecks (any mode)?

Critical Rural Freight Corridors

- Preliminary (draft) critical rural freight corridors have been identified
- Corridors are comprised of the several state and US highways, including SH 3, SH 66, SH 7, US 169, US 412, US 60, and US 75



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OK Freight Plan Update

Next Steps

- Freight Investment Plan (FIP)
  - Includes a list of priority projects and describes how funds will be invested and matched.
- Public Review of Plan
  - Expected in October 2022. Email notification will be sent to FAC.

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OK Freight Plan Update

Follow Up Questions or Comments

- Email freightplanok@odot.org anytime
- Website www.odot.org/2023-2030FreightPlan

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