ITTS
INSTITUTE FOR TRADE AND TRANSPORTATION STUDIES

ITTS REGIONAL BOTTLENECK ANALYSIS & TOOL UPDATE

Technical Memo

Evolving Truck Bottlenecks:

A Comparative Analysis of the Southeast Region

Prepared by

cpcs

ITTS Regional Bottlenecks Assessment for Goods Movement (Work Order 3)

As part of a five-year Master Contract for ITTS on freight research, data, planning and engagement, CPCS assessed the changes in truck bottlenecks across the Southeast Region between 2019 and 2023 and updating the GIS Planning Tool to integrate the latest data and analysis results.

Technical Memo

This Technical Memo documents the findings of the assessment on the changes in regional bottlenecks across the Southeast Region since 2019.

The 2022 ITTS Bottlenecks Findings and Methodology Technical memo can be accessed from the ITTS library.[1]

Acknowledgements

The CPCS Team acknowledges and is thankful for the input of ITTS member states who provided data and input, as well as the guidance and input of the ITTS Regional Bottlenecks Study Steering Committee and the Technical Advisory Committee.

Opinions and limitations

Unless otherwise indicated, the opinions herein are those of the authors and do not necessarily reflect the views of ITTS or any other member states consulted in the development of this memo.

[1] The 2022 ITTS Bottlenecks Findings & Methodology Tech Memo, ITTS, July 18, 2022. Retrieved from https://drive.google.com/file/d/1Kttr1bqK54j9z1pm8zKw96MEm3xdvo_n/view, accessed September 2024

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Acronyms / Abbreviations

Acronym	Definition
AADT	Average Annual Daily Traffic
AL	Alabama
AM	Morning
AR	Arkansas
ATRI	American Transportation Research Institute
COVID-19	Coronavirus disease 2019
DFW	Dallas Fort Worth International Airport
EIA	Energy Information Administration
EPA	Environmental Protection Agency
FAF	Freight Analysis Framework
FHWA	Federal Highway Administration
FL	Florida
GA	Georgia
GIS	Geographic Information System
HPMS	Highway Performance Monitoring System
INRIX	INRIX, Inc.
ITTS	Institute for Trade and Transportation Studies
KY	Kentucky
LA	Louisiana
MO	Missouri
MS	Mississippi
NC	North Carolina
NHS	National Highway System
NPMRDS	National Performance Management Research Data Set
OH	Ohio
PM	Afternoon
RITIS	Regional Integrated Transportation Information System
SC	South Carolina
STRAHNET	Strategic Highway Network
TAC	Technical Advisory Committee
TMC	Traffic Message Channel
TTTR	Truck Travel Time Reliability
TX	Texas
VA	Virginia
VMT	Vehicle-Miles Traveled
TN	Tennessee

Executive Summary

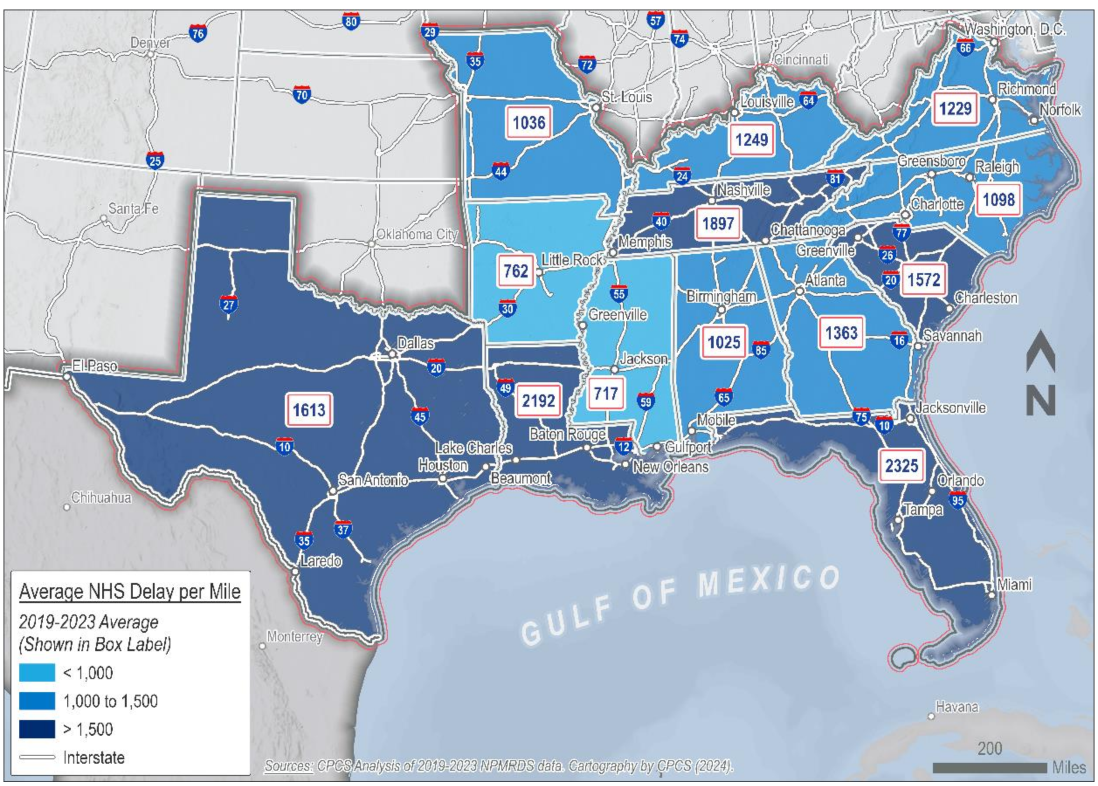
Between 2021 and 2022, the Institute for Trade and Transportation Studies (ITTS) conducted a regional truck bottleneck assessment across the Southeast Region (the 2022 Study). The study encompassed the National Highway System (NHS) across 13 states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas, and Virginia.

Since the development of the 2022 Study, the Southeast Region has witnessed numerous changes that may have significant implications for truck bottlenecks in the region. These changes include infrastructure investments on the region's critical freight corridors, the proliferation of e-commerce, the COVID-19 pandemic, the trade war with China, and the nearshoring of industries.

Against the backdrop of these changes in the region, ITTS recognized the importance of updating the regional truck bottleneck assessment. By incorporating more recent data, this study builds upon the foundation laid by the 2022 Study and offers a comprehensive overview of the evolving truck bottleneck landscape through a comparative analysis of truck congestion measures between 2019 and 2023.

Bottleneck Impacts by State

Figure 1: Average Annual NHS Truck Delay per Mile (in Hours) by State (2019-2023 Average)



Over the five years between 2019 and 2023, the Region experienced 225.2 million hours of total truck delay annually, amounting to 413.9 million gallons of wasted fuel and $18.8 billion in economic costs per year.

This accumulates to 1.1 billion hours of total truck delay, resulting in 2.1 billion gallons of wasted fuel and close to $94 billion in economic costs over these five years combined.

All Southeast states experience bottlenecks on the NHS. During these five years, Florida and Louisiana consistently experienced the highest **average truck delay per mile** among the Southeast states, followed by Tennessee, Texas, and South Carolina, at over 1,500 hours of delay per mile annually (Figure 1). Conversely, Arkansas and Mississippi maintained the lowest average truck delay per mile, at below 800 hours per mile annually. Figure 2 provides a breakdown of the bottleneck impacts by states:

- In terms of **truck travel time reliability**, Florida, Virginia, Texas, Georgia, and Tennessee had the least reliable truck travel times on the NHS.
- Florida and Texas were the most severely affected by **annual total truck delay hours, wasted fuel due to delay**, and **incurred costs,** accounting for approximately 44% of the regional total. This can be attributed to the high volume of truck traffic on the extensive NHS networks in these two states.
- In contrast, Arkansas and Mississippi experienced the least amount of truck hours, fuel, and cost wasted due to delay, contributing only 4%-5% of the regional total combined, while accounting for around 12% of the total NHS mileage and truck Vehicle Miles Traveled (VMT) in the region.
- Considering all **the delay impact measures collectively**, Florida, Texas, and Tennessee experienced the most significant impact due to truck delays, ranking in the top three in most cases.

Figure 2: Southeast Region Bottleneck Impacts by State (2019-2023 Average)

State	Truck Delay per Mile (Hours)	Average Truck Travel Time Reliability	Annual Total Truck Delay (Million Hours)	Annual Truck Fuel Wasted (Million Gallons)	Annual Cost of Truck Delay (Million Dollars)
Alabama	1,025	1.47	8.9	17.0	$734.2
Arkansas	762	1.41	5.1	8.5	$411.2
Florida	2,325	1.84	40.9	81.7	$3,524.4
Georgia	1,363	1.64	19.1	35.7	$1,591.4
Kentucky	1,249	1.46	8.2	14.6	$681.2
Louisiana	2,192	1.58	13.2	25.6	$1,113.2
Mississippi	717	1.52	5.6	9.2	$453.1
Missouri	1,036	1.50	11.7	18.2	$943.5
North Carolina	1,098	1.60	12.5	23.8	$1,048.4
South Carolina	1,572	1.59	11.3	24.3	$935.3
Tennessee	1,897	1.64	19.9	41.0	$1,674.8
Texas	1,613	1.66	57.9	94.3	$4,764.1
Virginia	1,229	1.68	11.0	20.0	$914.4
Southeast Region	1,391	1.58	225.2	413.9	$18,789.2

Note: The difference between the congestion measure results reported in this table and the values submitted by states to the FHWA are primarily due to the differences in the TMC segment aggregation approaches employed.
The green bars provide a visual comparison of values within each column: longer bars represent higher values relative to other states; shorter bars indicate lower values compared to other states.
Source: CPCS Analysis of 2019-2023 NPMRDS Data.

Freight congestion in the Southeast Region has far-reaching consequences. It hampers economic competitiveness, compromises safety, accelerates the deterioration of roadway infrastructure, contributes to air pollution and carbon emissions, and negatively impacts the quality of life for more than one-third of the U.S. population.

The following pages highlight the top congested interstates, segments by county, and trade lanes.

Top Congested Interstates

The top congested interstates are either beltways or auxiliary routes near major metropolitan areas. While they account for 11% of the total NHS mileage, the 19 top congested interstates contribute to over one-third of the total hours of truck delay, wasted fuel, and associated costs of all the interstates in the Southeast Region during the 2019-2023 period (Figure 3 and Figure 4). The top five congested interstates were I-610, I-285, I-635, I-495, and I-270.

Figure 3: Top Congested Interstates (2019-2023 Average, Map)

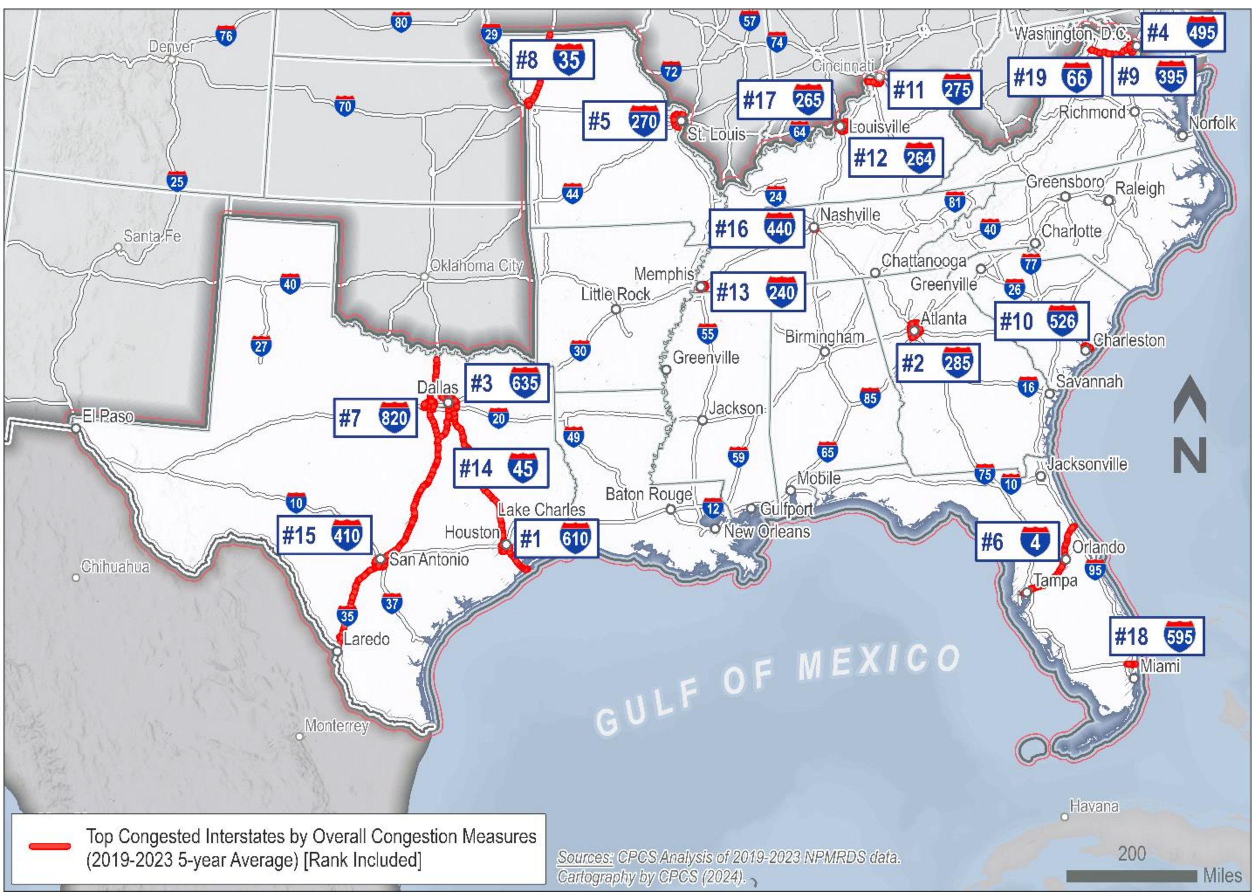


Figure 4: Top Congested Interstates (2019-2023 Average, Table)

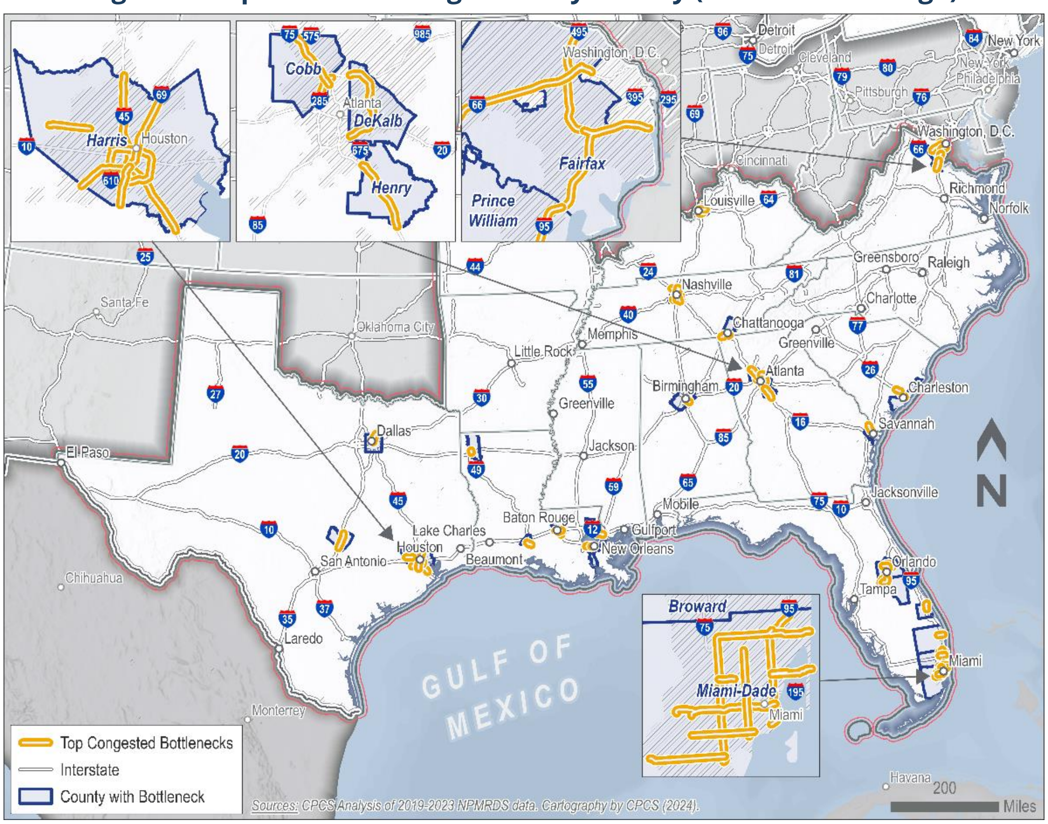
Overall Rank	Interstate	Truck Delay per Mile (Hours)	Rank by Truck Delay per Mile	Average Truck Travel Time Reliability	Annual Total Truck Delay (Thousand Hours)	Annual Truck Fuel Wasted (Thousand Gallons)	Annual Cost of Truck Delay (Million Dollars)	Average Annual Daily Truck Traffic
1	Interstate-610	14,640	2	2.6	1,252.4	1,940.7	103.6	12,678
2	Interstate-285	11,647	4	2.1	1,935.9	3,051.0	152.7	13,653
3	Interstate-635	11,180	5	2.3	1,303.7	2,189.1	109.9	13,431
4	Interstate-495	9,970	6	2.8	326.8	492.9	27.6	9,151
5	Interstate-270	8,662	7	1.7	601.0	698.4	46.9	22,798
6	Interstate-4	7,343	8	1.9	1,934.5	3,341.5	161.8	12,516
7	Interstate-820	5,003	12	1.8	394.4	620.1	33.3	8,792
8	Interstate-35	4,311	15	1.5	6,137.9	9,672.8	507.6	13,646
9	Interstate-395	4,153	16	3.0	134.6	219.6	11.4	4,716
10	Interstate-526	3,753	19	2.5	130.2	191.8	10.7	4,418
11	Interstate-275	3,611	20	1.8	623.6	984.2	51.7	6,625
12	Interstate-264	3,577	21	1.7	332.6	378.9	27.1	8,660
13	Interstate-240	3,478	22	1.5	205.8	238.1	16.1	8,609
14	Interstate-45	3,310	24	1.6	2,109.5	3,390.8	170.6	11,716
15	Interstate-410	2,847	27	1.8	281.0	416.3	23.7	7,109
16	Interstate-440	2,514	30	1.8	156.6	210.7	12.4	8,760
17	Interstate-265	2,214	34	1.8	108.2	142.9	8.8	7,282
18	Interstate-595	2,120	37	2.2	89.3	137.0	7.6	10,909
19	Interstate-66	1,908	46	1.7	278.2	406.5	22.0	5,209

Note: The difference between the congestion measure results reported in this table and the values submitted by states to the FHWA are primarily due to the differences in the TMC segment aggregation approaches employed.
Source: CPCS Analysis of 2019 -2023 NPMRDS data.

Top Bottleneck Segments by County

The top 52 bottleneck segments accounted for only 1.2% of the total NHS mileage in the region. However, between 2019 and 2023, these segments contributed to about 8.5% of the regional total truck delay hours, as well as the resulting fuel wasted, and costs incurred (Figure 5).

Figure 5: Top Bottleneck Segments by County (2019-2023 Average)



Top Congested Multi-State Trade Lanes

The study identified top trade lanes based on multi-state commodity flow data. Between 2019 and 2023, the top 11 congested trade lanes, which account for less than 4% of the NHS mileage in the Southeast Region, contributed to between 8% to 9% of the total hours of truck delay and the resulting fuel wasted, and costs incurred (Figure 6). Some of the most congested trade routes in the region start, end, or cross Atlanta, Nashville, Louisville, Houston, and several cities in Florida.

Figure 6: Top Congested Trade Lanes (2019-2023 Average, Map)

Next Steps:

Following this memo, the Project Team will use the results of this assessment to update the ITTS Regional Bottlenecks Assessment GIS Planning Tool, which provides a visual representation of truck congestion performance measures along all Southeast Regional NHS routes. An updated GIS Tool User Guide and a one-page Quick Start guide for the updated GIS Planning Tool will also be developed. These additional resources will incorporate the NPMRDS data from the years 2019 to 2023, further enhancing the GIS Planning Tool's utility and relevance for member states in understanding and addressing the evolving truck bottleneck landscape in the Southeast Region.

1 Introduction

1.1 Project Background

The Institute for Trade and Transportation Studies (ITTS) conducted a regional truck bottleneck assessment for the Southeast Region between 2021 and 2022 (the 2022 Study).

- The primary objectives of the 2022 Study were to measure the extent, duration, and severity of truck bottlenecks in the Southeast Region for the year 2019 and to facilitate multi-state collaboration on potential recommendations to mitigate the top bottlenecks.
- Rather than replicating existing bottleneck analyses conducted by FHWA or individual states, the 2022 Study aimed to assist the states in developing a shared understanding of truck bottlenecks throughout the Southeast Region by employing a unified methodology.
- The study encompassed the National Highway System (NHS) across 13 states in the Southeast U.S.: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas, and Virginia.

The results of the assessment from the 2022 Study were further integrated into an ITTS Regional Bottlenecks Assessment GIS Planning Tool, which provides a visual representation of truck congestion performance measures along all Southeast Regional NHS connections.

ITTS Regional Bottlenecks Assessment GIS Planning Tool

The ITTS GIS Planning Tool is designed to serve as a planning and information-sharing resource for ITTS member states. It features interactive maps, tables, and statistics that offer information on top bottlenecks, select origin/destination pairings, performance measures, and foundational network attributes. Additionally, the tool includes a data download function for easy access to the relevant information.

The ITTS GIS Planning Tool consists of two main components:

- **Segments-based tool:** This tool allows users to explore segment-based congestion measure results by state. Users can access bottleneck information and performance measure results for each segment within a selected region, enabling a detailed analysis of specific road segments.
- **Trips-based tool:** This tool enables users to investigate bottlenecks on select multi-state trade lanes within the Southeast Region. It provides performance measure results for segments along the route. Furthermore, it offers travel time distribution for each trade lane based on the departure time from the origin point, allowing users to assess the impact of bottlenecks on travel times for specific routes.

By providing these two distinct tools, the ITTS GIS Planning Tool offers a comprehensive and user-friendly platform for analyzing and understanding truck bottlenecks and their effects on regional connectivity and trade within the Southeast Region.

1.2 Purpose of this Study

Since the development of the 2022 Study and the ITTS Regional Bottlenecks Assessment GIS Planning tool, the Southeast Region has witnessed numerous changes that may have significant implications for truck bottlenecks in the region. These changes include, but are not limited to:

Infrastructure investments: Various infrastructure projects aimed at improving regional goods movement infrastructure may have helped alleviate some bottlenecks, while construction activities related to these projects might have temporarily created new ones.

E-commerce proliferation: The continued growth of e-commerce has likely increased the demand for truck transportation, potentially exacerbating existing bottlenecks or creating new ones in areas with high concentrations of distribution centers and delivery points.

COVID-19 pandemic: The pandemic disrupted supply chains, altered consumer behavior, and led to shifts in freight patterns, which may have affected the location and severity of truck bottlenecks in the region.

Trade war with China: Changes in trade policies and tariffs may have influenced the flow of goods and the routes taken by trucks, potentially impacting bottlenecks in the region.

Nearshoring of industries: As companies seek to shorten supply chains and reduce reliance on overseas production, the nearshoring of industries may have altered freight flows and contributed to changes in truck bottlenecks.

These changes, among others, highlight the need for ongoing monitoring and analysis of truck bottlenecks in the Southeast Region to ensure that transportation planning and infrastructure investments are responsive to the evolving landscape of goods movement.

Against the backdrop of these changes in the region, ITTS recognized the importance of updating the regional truck bottleneck assessment. By incorporating more recent data into the 2022 Study, ITTS aims to provide member states with the opportunity to compare results and gain insights into the multi-year and multi-state impacts of truck bottlenecks since 2019.

This study builds upon the foundation laid by the 2022 Study and offers a comprehensive overview of the evolving truck bottleneck landscape through a comparative analysis of truck congestion measures between 2019 and 2023.

2 Top Truck Bottlenecks

Over the five-year period between 2019 and 2023, the Southeast Region experienced 225.2 million hours of total truck delay annually, amounting to 413.9 million gallons in wasted fuel and $18.8 billion in economic costs per year. Florida, Texas, and Tennessee experienced the most significant impact across various congestion measures.

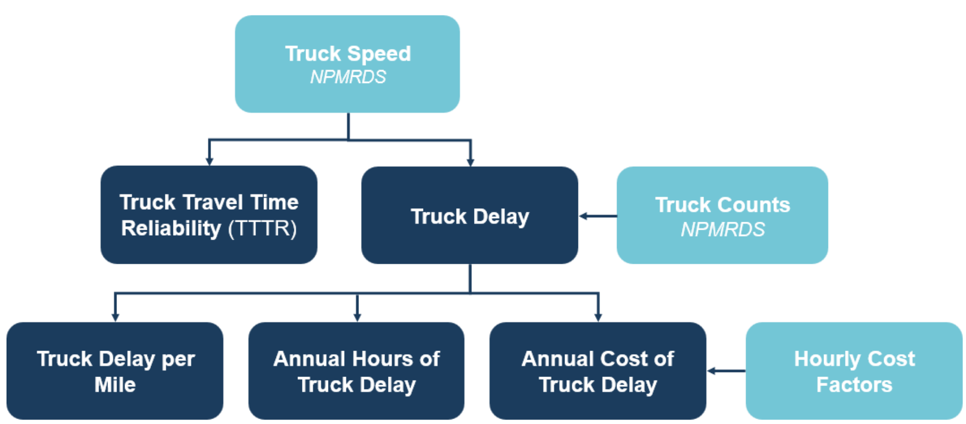
The top five congested interstates were I-610, I-285, I-635, I-495, and I-270. Despite accounting for only 1% of the total length of the interstates in the region, these highways were responsible for nearly 8% of the total hours of truck delay, as well as the resulting fuel wasted, and costs incurred. The top bottleneck segments were concentrated in nine states, led by Florida and Texas.

2.1 Introduction

This study provides an analysis of the changes in truck traffic bottlenecks in the Southeast Region between 2019 and 2023. The Southeast Region includes the following states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas, and Virginia.

The study measures truck-based congestion across the entire NHS using two primary data sources: truck volume data and vehicle probe-based speed data estimated from 5-minute average travel times. Both datasets are included in the National Performance Management Research Data Set (NPMRDS).

Figure 7: ITTS Truck-Based Congestion Measures



Source: CPCS, 2024

The ITTS truck-based congestion measures used in this analysis are presented in Figure 7, and include the following:

The Truck Travel Time Reliability Index (TTTR) is a federally required performance measure and illustrates the uncertainty of truck travel times. Larger values indicate less reliability in truck travel times, while values closer to 1.0 indicate a relatively predictable travel time. This study calculates TTTR measures for all segments of the NHS in the Southeast Region for each year between 2019 and 2023. The truck speed data from NPMRDS is the primary data input.

NPMRDS Dataset Overview

The NPMRDS is a national database compiled by INRIX under contract to FHWA and includes historical average travel time from vehicle probe data by all vehicles, passenger vehicles, and freight trucks. INRIX's travel times are based on actual observed speeds, rather than on estimated or modeled values. Travel times are reported in the NPMRDS where there are statistically significant sample sizes for freight and passenger traffic at the following geographic coverages: U.S. interstate system, NHS including intermodal connectors, Strategic Defense Network Roadways (STRAHNET), and border crossings on principal arterials, with a spatial resolution defined by Traffic Message Channel (TMC) location codes. The TMC network shows short directional roadway segments that have been defined by commercial traffic information providers. Travel times are compiled on TMC network segments every 5 minutes across a calendar year. The project team collected and processed the NPMRDS data for all TMC segments on the NHS in the Southeast Region for each year between 2019 and 2023.

Figure 8 depicts the sample size by functional class for truck speeds. While the coverage of truck speed data has improved over time, there are still large gaps, especially for smaller roads such as collectors and local roads. The Project Team followed a six-step process to create estimates for the missing speed data.[2] Because the sample sizes get smaller as roadway functional class drops, while the combined results include all functional classes, the top bottlenecks presented in this chapter focuses on interstates, U.S. highways, and state routes (functional classes 1-3).

Figure 8: NPMRDS Truck Data Sample Sizes by Functional Class (2019-2023)

Functional Classification System	2019	2020	2021	2022	2023
1 (Interstate)	84.9%	86.0%	90.2%	88.1%	87.3%
2 (Principal Arterial –Other Freeways and Expressways)	47.9%	47.5%	63.0%	59.3%	60.7%
3 (Principal Arterial – Other)	18.2%	18.3%	33.2%	31.3%	34.1%
4 (Minor Arterial)	10.4%	9.8%	21.0%	20.3%	23.1%
5 (Major Collector)	6.8%	7.1%	11.6%	11.5%	13.6%
6 (Minor Collector)	1.9%	1.6%	3.5%	3.7%	15.4%
7 (Local)	5%	4.7%	9.9%	10.8%	10.9%

Source: CPCS Analysis of NPMRDS 2019-2023 Data

[2] This process is developed by the he Texas A&M Transportation Institute (TTI) and is documented in the 2022 ITTS Bottleneck Findings and Methodology document.

Truck Delay is the excess truck travel time, calculated as the difference between actual truck travel time and the travel time based on reference speeds for each segment. This measure uses both the truck speed data and the estimated truck traffic volume from the NPMRDS for each segment.

The other three measures are derived from the Truck Delay measure results:

- **Truck Delay per Mile** takes the excess truck travel time for each segment (Truck Delay) and normalizes this based on the length of each segment to allow for comparisons.
- **Annual Hours of Truck Delay** measures the aggregated annual hours of truck delay for each segment.
- **Annual Cost of Truck Delay** is a measure that incorporates the cost of truck delay based on two factors: the value of truck travel time and the wasted truck fuel costs. These cost factors were sourced from the American Transportation Research Institute (ATRI)[3] and the U.S. Energy Information Administration (EIA)[4].

The methodology for preparing the data and calculating the truck-based congestion measures adopted in this study is largely consistent with the 2022 Study[5], except for the source of the truck traffic volume data used in the analysis.

- The 2022 study directly sourced the Annual Average Daily Traffic (AADT) data from the Highway Performance Monitoring System (HPMS). However, HPMS data is not consistently available for all states and all analysis years (2019-2023) required for this study.
- To ensure a consistent data source across analysis years, this study utilizes AADT data from the NPMRDS. Although NPMRDS also sources truck traffic volume data from HPMS, it does so with a two-year lag.
- While assessing the NPMRDS data, the Project Team identified several states with problematic truck AADT data, which was traced back to the HPMS data. In consultation with the ITTS Regional Bottlenecks Study Steering Committee, the Project Team made necessary adjustments to address these data issues.

In addition to the speed data sample size limitation discussed earlier in this chapter and the AADT data time lag, other challenges that impact the analysis include:

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[3] The value of truck time is sourced from ATRI's An Analysis of the Operational Costs of Trucking: 2023 Update report (https://irp.cdn-website.com/7bc682fd/files/uploaded/ATRI-Operational-Cost-of-Trucking-06-2023.pdf, accessed May 2024). ATRI's estimates for 2023 have not been published. For 2023 value of truck travel time, the project team used 2022 estimates multiplied by the change in the Producer Price Index for Truck Transportation of Freight sourced from the Bureau of Labor Statistics https://fred.stlouisfed.org/series/WPU3012, accessed May 2024.

[4] US Energy Information Administration, Gasoline and Diesel Fuel Update, Diesel Fuel Release Date May 28, 2024. https://www.eia.gov/petroleum/gasdiesel/, accessed May 2024.

[5] The 2022 ITTS Bottlenecks Findings & Methodology Tech Memo, ITTS, July 18, 2022. Retrieved from https://drive.google.com/file/d/1Kttr1bqK54j9z1pm8zKw96MEm3xdvo_n/view, accessed September 2024.

- **Poor performance at intersections:** Intersections often exhibit low travel speeds due to a combination of small segments and operational characteristics. This complicates the identification of true bottlenecks, as the speed data at an intersection may not reflect the actual congestion experienced by trucks along the entire segment. Consequently, these short segments with low speeds can create noise, making it difficult to highlight the most problematic bottlenecks.
- **Inaccurate speed data assignment:** In some cases, the speed data may not be accurately assigned to the correct roadway segment. The NPMRDS data assigns speeds to segments based on GPS probes, and in areas with multiple segments in close proximity (e.g., mainline, HOV lane, exit ramp, and entrance ramp), the speed data for one segment may be influenced by probes from nearby segments. This can result in extreme values that do not accurately reflect the real conditions.
- **Different time lags in the impact of COVID on congestion measures:** The impact of COVID on different congestion measures has varying time lags, depending on the congestion measures. For example, the TTTR measure captures changes in speed without time lag, as it uses 5-min speed data from NPMRDS. However, other congestion measures, like the delay per mile, rely not only on speed data but also on estimated truck traffic volume from the NPMRDS. The NPMRDS sources its traffic volume data from the HPMS, which has a two-year lag. As a result, the AADT data used in 2022 is from 2020. This means that the truck delay per mile measure shows a dip in 2022, even though the actual impact on traffic volume occurred in 2020, two years prior.

When comparing the results of the TTTR and other delay measures from this study to those from FHWA's Freight Mobility Trends Tool[6] and states' submittals to FHWA Transportation Performance Management Program[7], states should anticipate some differences. The primary reason for these discrepancies lies in the treatment of road segments. The FHWA tool aggregates the TMC segments whereas in this study, the TMC segments are not aggregated during analysis. This is to facilitate the usage of the dataset for each member state's planning purposes. Consequently, the different segmentation approaches lead to differences between the results reported.

For more details on methodologies used for data processing, network conflation for routing analysis, accounting for missing speed data, and calculating truck congestion measures, ITTS member states can refer to the 2022 ITTS Bottleneck Findings and Methodology document.

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[6] FHWA, Freight Mobility Trends Tool, https://ops.fhwa.dot.gov/freight/freight_analysis/mobility_trends/, accessed June 2024.

[7] FHWA, Transportation Performance Management, State Performance Dashboard and Reports, https://www.fhwa.dot.gov/tpm/reporting/state/, accessed June 2024.

2.2 Bottleneck Impacts by State

From 2019 to 2023, the Southeast Region continued to face significant challenges due to truck delays on the NHS. On average, the region experienced 225.2 million hours of total truck delay annually, resulting in 413.9 million gallons of wasted fuel and $18.8 billion in costs per year.

This accumulates to 1.1 billion hours of total truck delay, resulting in 2.1 billion gallons of wasted fuel and close to $94 billion in economic costs over these five years combined.

During these five years, Florida and Louisiana consistently experienced the highest average truck delay per mile among the Southeast states, followed by Tennessee, Texas, and South Carolina, at over 1,500 hours of delay per mile (Figure 9). Conversely, Arkansas and Mississippi maintained the lowest average truck delay per mile, at below 800 hours per mile.

Figure 9: Average NHS Truck Delay per Mile (in Hours) by State (2019-2023 average)

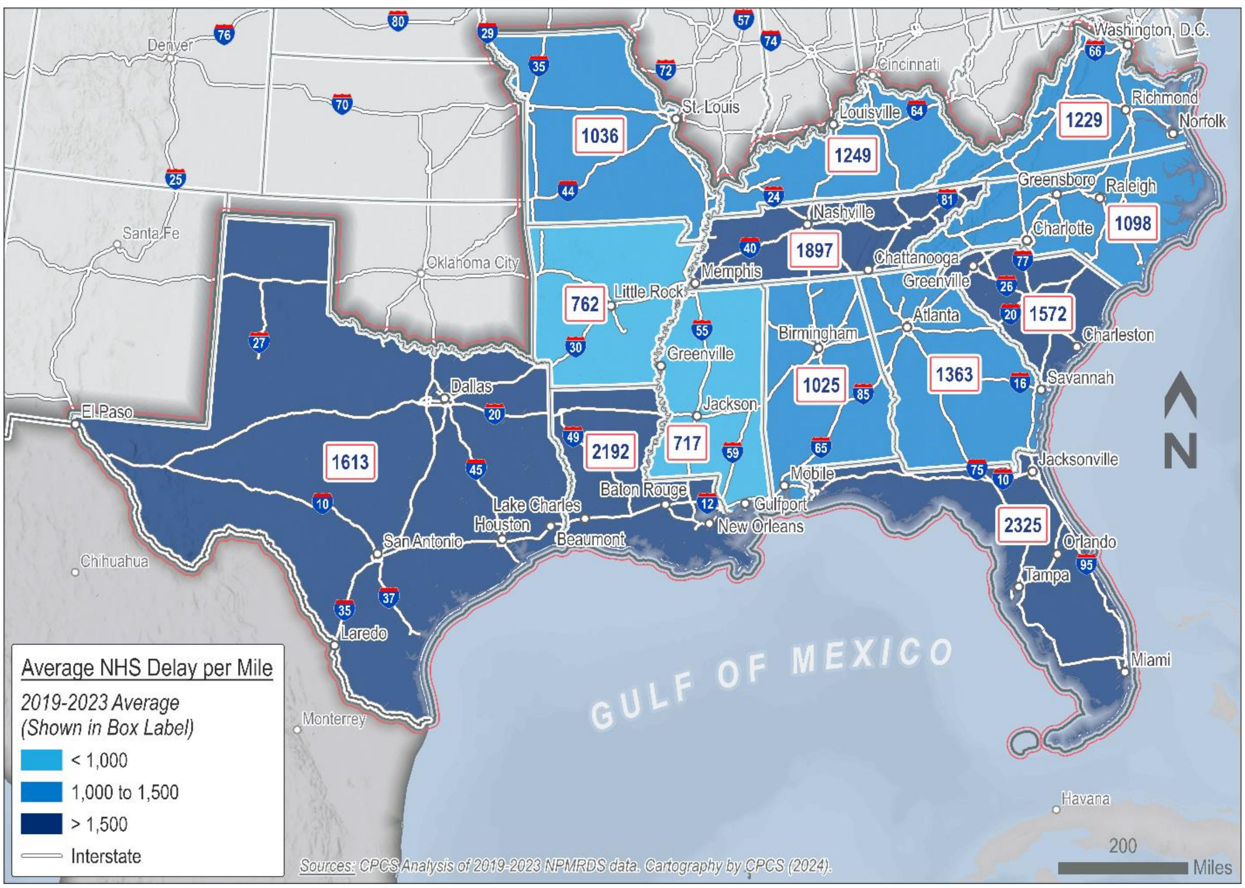

Figure 10 provides a detailed breakdown of the bottleneck impacts by state for the Southeast Region over the five years. In addition to the truck delay per mile, this table highlights how the states compare with their peers across different congestion measures.

- In terms of **TTTR**, Florida, Virginia, Texas, Georgia, and Tennessee had the least reliable truck travel times on the NHS, although states generally fared similarly. Truck travel times were relatively more reliable on the NHS in Alabama, Arkansas, and Kentucky, though not perfect.
- Texas and Florida were the most severely affected by **annual total truck delay hours**, **wasted fuel due to delay**, and **incurred costs**, accounting for approximately 44% of the regional total. This can be partially attributed to the high volume of truck traffic on the extensive NHS networks in these two states, which together account for nearly 35% of the total NHS mileage and over 37% of the truck vehicle miles traveled (VMT) on the NHS in the Southeast Region.
- In contrast, Arkansas and Mississippi experienced the least amount of truck hours, fuel, and cost wasted due to delay, contributing only 4%-5% of the regional total combined, while accounting for around 12% of the total NHS mileage and VMT in the region.
- Considering **all the delay impact measures collectively**, Florida, Texas, and Tennessee experienced the most significant impact due to truck delays, ranking in the top three in most cases.

Figure 10: Southeast Region Bottleneck Impacts by State (2019-2023 average)

State	Truck Delay per Mile (Hours)	Average Truck Travel Time Reliability	Annual Total Truck Delay (Million Hours)	Annual Truck Fuel Wasted (Million Gallons)	Annual Cost of Truck Delay (Million Dollars)
Alabama	1,025	1.47	8.9	17.0	$734.2
Arkansas	762	1.41	5.1	8.5	$411.2
Florida	2,325	1.84	40.9	81.7	$3,524.4
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Kentucky	1,249	1.46	8.2	14.6	$681.2
Louisiana	2,192	1.58	13.2	25.6	$1,113.2
Mississippi	717	1.52	5.6	9.2	$453.1
Missouri	1,036	1.50	11.7	18.2	$943.5
North Carolina	1,098	1.60	12.5	23.8	$1,048.4
South Carolina	1,572	1.59	11.3	24.3	$935.3
Tennessee	1,897	1.64	19.9	41.0	$1,674.8
Texas	1,613	1.66	57.9	94.3	$4,764.1
Virginia	1,229	1.68	11.0	20.0	$914.4
Southeast Region	1,391	1.58	225.2	413.9	$18,789.2

Note: The difference between the congestion measure results reported in this table and the values submitted by states to the FHWA are primarily due to the differences in the TMC segment aggregation approaches employed.
The green bars provide a visual comparison of values within each column: longer bars represent higher values relative to other states; shorter bars indicate lower values compared to other states.
Source: CPCS Analysis of 2019-2023 NPMRDS Data in the Southeast Region

The following sections dive into the trends observed for each of the bottleneck impact measures.

Truck Delay per Mile

Figure 11 lists the truck delay per mile (in number of hours) on the NHS by state from 2019 to 2023, along with the five-year average for each state and the region as a whole. The key takeaways are as follows:

Regional Overview: The Southeast Region experienced fluctuations in truck delay per mile from 2019 to 2023, with an overall increase of 11.9% regionwide. The five-year average for the Southeast Region is 1,391 hours of truck delay per mile, with Florida having the highest five-year average at 2,325, followed by Louisiana at 2,192. Mississippi and Arkansas had the lowest five-year averages at 717 and 762, respectively, indicating a 224% difference between the states with the highest and lowest delays per mile.

Significant Increases and Decreases: Among the 13 states in the Southeast Region, Florida, and Louisiana experienced the most significant increases in truck delay per mile during the five years between 2019 and 2023. Florida's truck delay per mile surged by 65.8% from 2019, reaching 3,081 in 2023, and Louisiana saw a notable increase of 28.3% during the same period. Conversely, Missouri and Mississippi exhibited the most significant decreases. On average, Missouri's truck delay per mile measured on its NHS dropped by 19.5% from 2019 to 2023, while Mississippi's NHS experienced a 16.3% reduction during the same period.

Intermediate Fluctuations: The Southeast Region saw a general reduction in truck delay per mile from 2019 to 2020 at 18.5%, with Virginia leading the drop at 32.4%, followed by Texas at 24.7%. The Southeast Region then experienced a rebound in the delay per mile trucks experienced on the NHS from 2020 to 2021 with a 26% increase regionwide. In 2022, truck delay per mile fell back to near pre-pandemic levels before increasing again in 2023.

Stable States: Relative to other states, Alabama and Kentucky were somewhat stable in the delay per mile experienced by trucks on their respective NHS segments.

How did overall truck traffic change during this period?

From 2019 to 2023, the Southeast Region experienced a slight overall increase in truck AADT at 7%. The biggest increase in overall truck traffic volume on the NHS is driven by Texas (16.1%), Florida (11.5%), and Louisiana (11.3%). Several states, including Alabama, Arkansas, Kentucky, North Carolina, and South Carolina, maintained relatively stable truck traffic volumes with less than 5% increase during the same period. All states observed a drop in truck traffic in 2020, with an overall reduction of 8.6% in the region compared to 2019. However, truck traffic volumes on the NHS in all states quickly returned to pre-pandemic levels in 2021.

Figure 11: Truck Delay per Mile by State (Hours, 2019-2023)

State	2019	2020	2021	2022	2023	5-Year Average	Trend	2019-2023 % Change
Alabama	1,119	988	1,001	967	1,047	1,025		-6.4%
Arkansas	873	716	828	623	771	762		-11.8%
Florida	1,859	1,556	2,570	2,560	3,081	2,325		65.8%
Georgia	1,430	1,100	1,414	1,300	1,572	1,363		10.0%
Kentucky	1,273	1,214	1,311	1,270	1,174	1,249		-7.8%
Louisiana	2,113	1,757	2,293	2,087	2,711	2,192		28.3%
Mississippi	828	729	699	636	693	717		-16.3%
Missouri	1,283	1,027	972	866	1,033	1,036		-19.5%
North Carolina	1,150	887	1,120	1,110	1,223	1,098		6.3%
South Carolina	1,483	1,671	2,328	1,109	1,268	1,572		-14.5%
Tennessee	1,872	1,603	2,063	1,805	2,141	1,897		14.4%
Texas	1,787	1,345	1,555	1,480	1,899	1,613		6.3%
Virginia	1,372	927	1,261	1,201	1,382	1,229		0.7%
Southeast Region	1,509	1,230	1,550	1,409	1,689	1,391		11.9%

Note: The difference between the congestion measure results reported in this table and the values submitted by states to the FHWA are primarily due to the differences in the TMC segment aggregation approaches employed.
Blue bars: percentage increases from 2019 to 2023 (longer bars indicate larger increases).
Red bars: percentage decreases from 2019 to 2023 (longer bars indicate larger decreases).
Source: CPCS Analysis of 2019-2023 NPMRDS Data in the Southeast Region.

Average Truck Travel Time Reliability (TTTR)

Figure 12 displays the average TTTR on the NHS by state from 2019 to 2023, along with the five-year average for each state and the region as a whole. While states also reported their TTTR values to the FHWA for 2021[8], the ITTS results are generally higher due to differences in the TMC segment aggregation methodologies used.

To assess states' progress towards their 2023 TTTR targets, the percentage change between the states' 2021 FHWA submissions and their 2023 targets was applied to the ITTS's 2021 results. The resulting adjusted 2023 values were then compared to the ITTS's actual 2023 findings.

This comparison revealed that all states in the region met their adjusted 2023 TTTR targets, with the exception of Tennessee. However, even in Tennessee's case, the difference between the ITTS's 2023 TTTR value and the adjusted 2023 target was minimal.

Other The key takeaways are as follows:

Regional Overview: The Southeast Region exhibited minimal fluctuations in the TTTR from 2019 to 2023, with an overall decrease of 1.9% during this period and the five-year average of TTTR of 1.58. Florida had the highest five-year average TTTR, indicating less reliability in truck travel times, followed by Virginia. Arkansas and Kentucky had the lowest five-year averages, suggesting more predictable truck travel times. The difference between the top and bottom states is 31%, highlighting variability in travel time reliability across the region.

[8] FHWA Transportation Performance Management, State Performance Dashboard and Reports, accessed from https://www.fhwa.dot.gov/tpm/reporting/state/index.cfm

Significant Increases and Decreases: Most states experienced an overall improvement in the TTTR, with the most significant improvements observed in Virginia (6.5% reduction) followed by Missouri (3.8% reduction) and Texas (3.5% reduction). Alabama and Arkansas saw a slight increase in TTTR at 1.8% and 2.6%, respectively.

Intermediate Fluctuations: The Southeast Region saw a significant improvement in TTTR in 2020 compared with 2019, with all states experiencing a reduction in TTTR ranging from 3.8% in Alabama and 11.5% in Virginia, indicating a substantial improvement in the travel time reliability trucks experience on the NHS. While the states saw an overall rebound in TTTR in 2021, the biggest increase happened between 2021 and 2022 with Florida and Texas leading the increase in TTTR at 6.9% and 5.9%, respectively.

Stable States: Many states' TTTR remained stable during this period, including Georgia, Kentucky, South Carolina, and Tennessee.

Figure 12: Average TTTR by State (2019-2023)

State	2019	2020	2021	2022	2023	5-Year Average	Trend	2019-2023 % Change
Alabama	1.47	1.42	1.44	1.49	1.50	1.47		1.8%
Arkansas	1.42	1.35	1.41	1.41	1.46	1.41		2.6%
Florida	1.91	1.78	1.77	1.89	1.87	1.84		-1.7%
Georgia	1.68	1.57	1.60	1.68	1.68	1.64		0.2%
Kentucky	1.48	1.39	1.45	1.49	1.48	1.46		0.3%
Louisiana	1.62	1.54	1.54	1.60	1.58	1.58		-2.4%
Mississippi	1.54	1.48	1.51	1.55	1.51	1.52		-1.8%
Missouri	1.57	1.44	1.46	1.53	1.51	1.50		-3.8%
North Carolina	1.67	1.52	1.55	1.63	1.64	1.60		-2.0%
South Carolina	1.64	1.51	1.54	1.61	1.64	1.59		-0.1%
Tennessee	1.69	1.57	1.59	1.68	1.68	1.64		-0.1%
Texas	1.73	1.59	1.61	1.70	1.67	1.66		-3.5%
Virginia	1.80	1.59	1.66	1.70	1.68	1.68		-6.5%
Southeast Region	1.67	1.55	1.58	1.65	1.64	1.58		-1.9%

Note: The difference between the congestion measure results reported in this table and the values submitted by states to the FHWA are primarily due to the differences in the TMC segment aggregation approaches employed.
Blue bars: percentage increases from 2019 to 2023 (longer bars indicate larger increases).
Red bars: percentage decreases from 2019 to 2023 (longer bars indicate larger decreases).
Source: CPCS Analysis of 2019-2023 NPMRDS Data in the Southeast Region.

Annual Total Truck Delay

Figure 13 displays the yearly total truck delay (in million hours) on the NHS by state from 2019 to 2023, along with the five-year average for each state and the region as a whole. The key takeaways are as follows:

Regional Overview: The Southeast Region experienced fluctuations in annual hours of delay from 2019 to 2023, with a five-year average of 225.2 million hours. In 2023, there were 30 million more hours of delay in the Region compared to 2019. Texas had the highest average annual delay at 57.9 million hours, followed by Florida at 40.9 million hours. These two states account for 44% of the total annual hours of delay trucks experience in the Southeast Region. This is partly due to the substantial truck traffic volume on their extensive NHS networks. Mississippi and Arkansas had the lowest five-year averages at 5.6 and 5.1 million hours, respectively, accounting for 5% of the total truck delay hours on the NHS in the Southeast Region combined.

Significant Increases and Decreases: Florida, Louisiana, and Tennessee experienced the biggest increases in annual hours of delay over the five years. Florida saw a massive 68.7% increase from 2019 to 2023, peaking at 54.7 million hours in 2023. Conversely, Mississippi and Missouri showed the most notable decreases. Missouri's delay hours for trucks on the NHS dropped by 19.3% from 2019 to 2023, while Mississippi saw a reduction of 14.3% over the same period.

Intermediate Fluctuations: The Southeast Region experienced a significant reduction in annual hours of delay in 2020 compared to 2019, with the region-wide delay dropping by 19.4%. This trend was consistent across all states, with the most notable reduction in Virginia (33.8%). However, this improvement was followed by a rebound in delay hours in 2021, which continued into 2022. Nearly all the states in the region, except for Kentucky, experienced a surge in total truck delay hours from 2022 to 2023, with the regional overall increase at 21.7%.

Stable States: Several states exhibited relatively stable delay hours over the period. Alabama, Arkansas, Kentucky, North Carolina, and Tennessee maintained consistent performance with relatively smaller fluctuations.

Figure 13: Annual Total Truck Delay by State (Million Hours, 2019-2023)

State	2019	2020	2021	2022	2023	5-Year Average	Trend	2019-2023 % Change
Alabama	9.6	8.5	8.6	8.4	9.2	8.9		-4.6%
Arkansas	5.8	4.7	5.5	4.1	5.1	5.1		-11.1%
Florida	32.4	27.2	44.9	45.4	54.7	40.9		68.7%
Georgia	20.4	15.0	19.6	17.8	22.5	19.1		10.4%
Kentucky	8.3	8.0	8.6	8.4	7.8	8.2		-5.8%
Louisiana	12.6	10.8	13.8	12.9	16.0	13.2		27.3%
Mississippi	6.4	5.6	5.4	5.0	5.5	5.6		-14.3%
Missouri	14.5	11.6	10.8	9.9	11.7	11.7		-19.3%
North Carolina	13.0	10.1	12.6	12.8	14.1	12.5		8.4%
South Carolina	10.6	12.2	16.5	8.1	9.3	11.3		-11.6%
Tennessee	19.5	16.5	21.0	19.3	22.9	19.9		17.7%
Texas	64.6	47.2	54.4	52.4	70.7	57.9		9.4%
Virginia	12.3	8.2	11.0	10.8	12.5	11.0		1.3%
Southeast Region	230.0	185.5	232.7	215.4	262.1	225.2		13.9%

Note: The difference between the congestion measure results reported in this table and the values submitted by states to the FHWA are primarily due to the differences in the TMC segment aggregation approaches employed.
Blue bars: percentage increases from 2019 to 2023 (longer bars indicate larger increases).
Red bars: percentage decreases from 2019 to 2023 (longer bars indicate larger decreases).
Source: CPCS Analysis of 2019-2023 NPMRDS Data in the Southeast Region

Other Truck Congestion Measures

Overall, the Southeast Region experienced a close to 22% increase in the total fuel wasted (around 90 million gallons) due to truck delays from 2019 to 2023 (Figure 14). Florida, Louisiana, and Tennessee are the states leading the biggest increase. Missouri and South Carolina saw a modest decrease during the same period (Figure 15).

When expressing the wasted truck travel time and fuel in monetary terms, the trucks traveling on the NHS in the Southeast Region experienced a substantial increase in congestion incurred costs of over 60% (around $9.2 billion) during the five years (Figure 15). Every single state saw the total delay cost increase, ranging from 13% in Missouri to close to 138% in Florida. This is partially due to the overall increase in delays and the increase in the cost of trucking during the same period, reflecting the ever-increasing burden truck delay imposes on the industry.[9]

Figure 14: Annual Wasted Fuel by State (Million Gallons, 2019-2023)

State	2019	2020	2021	2022	2023	5-Year Average	Trend	2019-2023 % Change
Alabama	17.8	15.9	16.6	16.5	18.3	17.0		2.5%
Arkansas	10.0	7.4	9.1	7.2	9.0	8.5		-9.8%
Florida	60.7	51.0	91.5	92.7	112.3	81.7		85.0%
Georgia	37.0	27.4	37.1	34.0	42.9	35.7		15.7%
Kentucky	14.4	13.9	15.3	14.9	14.7	14.6		2.0%
Louisiana	22.7	20.0	27.5	25.9	31.7	25.6		39.4%
Mississippi	10.4	8.8	9.2	8.3	9.5	9.2		-8.9%
Missouri	22.7	17.2	16.4	15.7	18.8	18.2		-16.9%
North Carolina	23.3	18.1	24.6	25.1	28.1	23.8		20.8%
South Carolina	22.0	26.3	36.5	17.2	19.4	24.3		-12.0%
Tennessee	37.9	33.7	44.6	40.2	48.5	41.0		28.0%
Texas	105.6	71.4	88.2	86.7	119.6	94.3		13.3%
Virginia	22.1	14.2	20.3	19.9	23.2	20.0		4.7%
Southeast Region	406.7	325.3	436.9	404.5	496.0	413.9		21.9%

Note: The difference between the congestion measure results reported in this table and the values submitted by states to the FHWA are primarily due to the differences in the TMC segment aggregation approaches employed.
Blue bars: percentage increases from 2019 to 2023 (longer bars indicate larger increases).
Red bars: percentage decreases from 2019 to 2023 (longer bars indicate larger decreases).
Source: CPCS Analysis of 2019-2023 NPMRDS Data in the Southeast Region

Figure 15: Annual Total Delay Cost by State (Million Dollars, 2019-2023)

State	2019	2020	2021	2022	2023	5-Year Average	Trend	2019-2023 % Change
Alabama	640.8	596.1	708.5	865.1	860.5	734.2		34.3%
Arkansas	383.7	328.4	447.8	418.2	477.7	411.2		24.5%
Florida	2,163.6	1,900.3	3,732.8	4,677.9	5,147.4	3,524.4		137.9%
Georgia	1,359.3	1,047.9	1,617.9	1,824.8	2,106.9	1,591.4		55.0%
Kentucky	551.5	557.2	708.0	857.6	731.8	681.2		32.7%
Louisiana	836.3	754.1	1,145.5	1,329.3	1,501.1	1,113.2		79.5%
Mississippi	420.6	389.3	441.9	506.7	506.8	453.1		20.5%
Missouri	956.9	798.1	882.2	998.3	1,082.1	943.5		13.1%
North Carolina	864.1	703.2	1,040.8	1,311.4	1,322.5	1,048.4		53.0%
South Carolina	712.6	859.3	1,382.9	840.6	881.1	935.3		23.7%
Tennessee	1,299.1	1,163.8	1,753.3	1,992.9	2,164.8	1,674.8		66.6%
Texas	4,268.0	3,258.1	4,445.3	5,300.2	6,548.9	4,764.1		53.4%
Virginia	821.2	569.2	911.0	1,103.9	1,166.5	914.4		42.0%
Southeast Region	15,277.6	12,925.0	19,217.8	22,027.2	24,498.2	18,789.2		60.4%

Note: The difference between the congestion measure results reported in this table and the values submitted by states to the FHWA are primarily due to the differences in the TMC segment aggregation approaches employed.
Blue bars: percentage increases from 2019 to 2023 (longer bars indicate larger increases).
Red bars: percentage decreases from 2019 to 2023 (longer bars indicate larger decreases).
Source: CPCS Analysis of 2019-2023 NPMRDS Data in the Southeast Region

The yearly patterns of annual truck fuel wasted, and cost of delay follow very similar patterns and trends as the total truck delay hours:

- Texas and Florida are the top two states with the highest amount of wasted fuel and total delay cost due to truck delays during the five years between 2019 and 2023.

[9] The American Transportation Research Institute (ATRI), An analysis of the Operational Costs of Trucking: 2023 Update, June 2023, retrieved from https://truckingresearch.org/wp-content/uploads/2023/06/ATRI-Operational-Cost-of-Trucking-06-2023.pdf, accessed July 2024.

Together, these two states account for 44% of the Southeast Region's total fuel wasted and costs incurred due to truck delays. As discussed earlier in this chapter, the expansive sizes of the two states and their extensive NHS networks contribute to their substantial share of the total wasted fuel and costs incurred due to truck congestion in the Southeast Region.

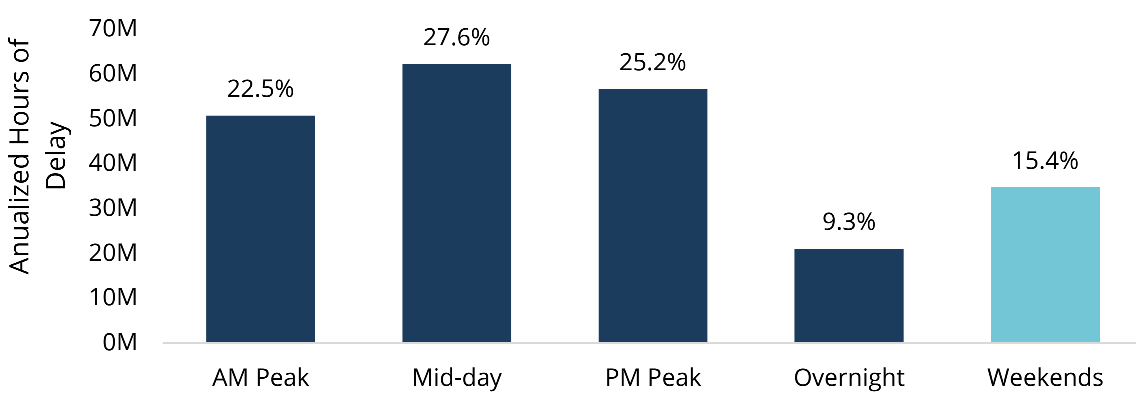
- Arkansas and Mississippi saw the least amount of wasted fuel and total truck delay cost, contributing to 4%-5% of the regional total combined. This aligns with their relatively smaller population sizes relative to the other states in the Southeast Region.
- The significant drop from 2019 to 2020 is consistent for both the total fuel wasted and total truck delay cost incurred, followed by an even higher increase from 2020 to 2021. Although the pace of increase slowed down since 2022, the trend continues to move upward into 2023.

Bottleneck Duration

Congestion on corridors in the Southeast Region builds up throughout the day. Roadways experience accumulated truck delays during morning (AM) hours and reach peak congestion during the mid-day period. The delays remain high during the afternoon (PM) period and decline overnight as traffic volumes decrease.

Figure 16 illustrates these trends by showing the annual hours of truck delay by the time of day in the Southeast Region between 2019 and 2023. As shown, 27.6% of the total hours of truck delay occurred during the mid-day period, with only 9.3% of total truck delays occurring overnight. The peak period distribution pattern fluctuated minimally over the analysis period for the states.

Figure 16: Annual Hours of Truck Delay by Time of Day (2019-2023 Average)



Source: CPCS Analysis of 2019-2023 NPMRDS Data

2.3 Bottlenecks Impacts by Interstate

During the five years between 2019 and 2023, the top five congested interstates in the Southeast Region were I-610, I-285, I-635, I-495, and I-270. Despite accounting for only 1% of the total length of the interstates in the region, these highways were responsible for nearly 8% of the total hours of truck delay, as well as the resulting fuel wasted, and costs incurred.

Figure 17 and Figure 18 show the top 19 congested interstates in the Southeast Region, sorted from high to low by truck delay per mile. These interstates were selected based on their ranking in the top 50 across all bottleneck impact measures. The top congested interstates are either beltways or auxiliary routes near major metropolitan areas. While they account for 11% of the total NHS mileage, these 19 top congested interstates contribute to over one-third of the total hours of truck delay, wasted fuel, and associated costs of all the interstates in the Southeast Region during the 2019-2023 period.

I-610, a highway beltway around the City of Houston, Texas, ranked second[10] by truck delay per mile out of the 120 interstates analyzed, averaging 14,640 hours of delay per mile annually over the five years. This translates to over 1.2 million hours of truck delay, wasting over 1.2 million gallons of fuel and generating costs of $103.6 million per year.

I-285, a beltway encircling Atlanta, Georgia, experienced an average of 1.9 million hours of truck delay, wasting 3.1 million gallons of fuel and generating costs of $152 million annually. It also ranked fourth[11] by truck delay per mile out of the 120 interstates analyzed.

I-635 is a 37-mile-long partial loop around Dallas, Texas connecting I-20 in Balch Springs and the north entrance of the Dallas Fort Worth International Airport (DFW Airport) in Grapevine. During the 2019–2023 period, an annual average of 1.3 million hours of truck delay led to $110 million in costs and 2.2 million gallons of wasted fuel.

I-495, commonly known as the Capital Beltway, encircles the Washington, D.C. metropolitan area, passing through Northern Virginia. On average, the portion of I-495 in Virginia costs truck drivers 9,970 hours of delay per mile annually, resulting in a total of 0.6 million hours of truck delay, close to 0.5 million gallons of wasted fuel, and $28 million in costs.

I-270 is a portion of the beltway in Greater St. Louis, stretching 50.59 miles from the junction with I-55 and I-255 in Mehlville, Missouri to the junction with I-55 and I-70 north of Troy, Illinois. During the 2019–2023 period, an annual average of 0.6 million hours of truck delay led to $47 million in costs and 0.7 million gallons of wasted fuel.

[10] The interstate with the highest truck delay per mile is I-345, an auxiliary interstate in the city of Dallas and connects I-45 with US-75. However, due to its short length (1.4 miles) and the limited total traffic affected, it does not rank among the top 19 most congested interstates when considering all congestion measures collectively.

[11] The third ranking interstate by truck delay per mile is I-670, a connector highway between I-70 in Kansas City, Kansas, and I-70 in Kansas City, Missouri. However, due to its short length (2.8 miles) and the limited total traffic affected, it does not rank among the top 19 most congested interstates when considering all congestion measures collectively.

Figure 17: Top Congested Interstates (2019-2023 Average, Map)

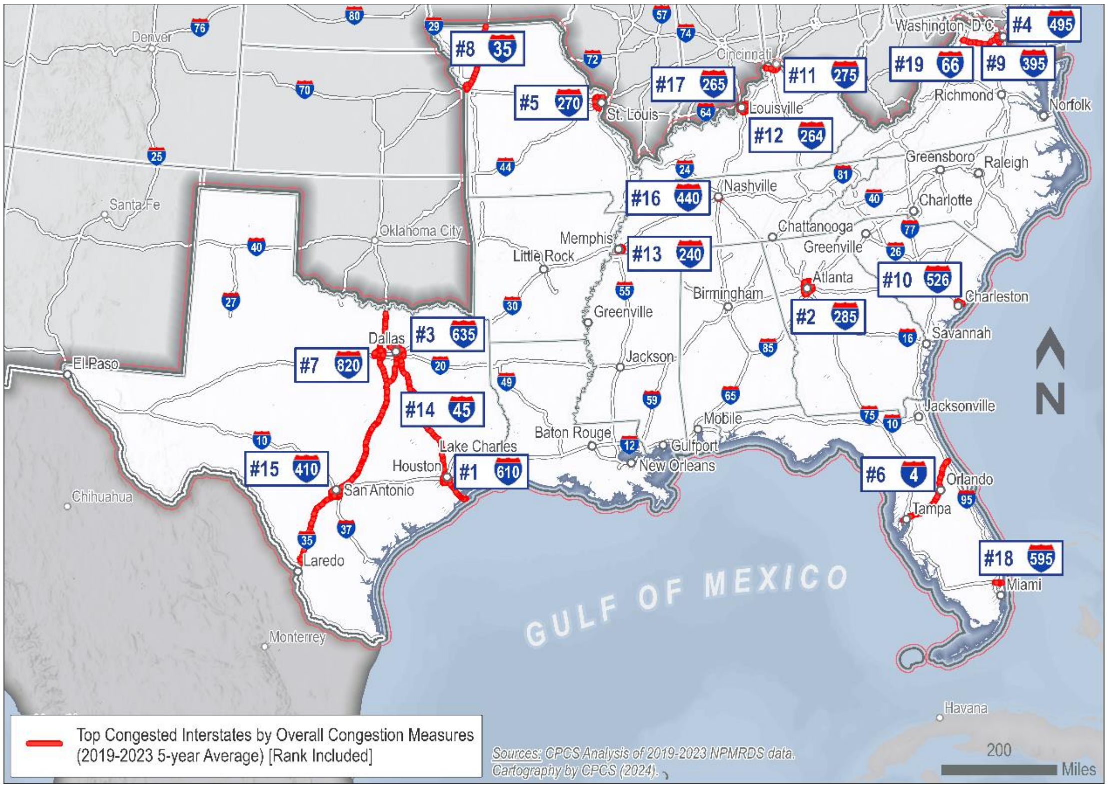


Figure 18: Top Congested Interstates (2019-2023 Average, Table)

Overall Rank	Interstate	Truck Delay per Mile (Hours)	Rank by Truck Delay per Mile	Average Truck Travel Time Reliability	Annual Total Truck Delay (Thousand Hours)	Annual Truck Fuel Wasted (Thousand Gallons)	Annual Cost of Truck Delay (Million Dollars)	Average Annual Daily Truck Traffic
1	Interstate-610	14,640	2	2.6	1,252.4	1,940.7	103.6	12,678
2	Interstate-285	11,647	4	2.1	1,935.9	3,051.0	152.7	13,653
3	Interstate-635	11,180	5	2.3	1,303.7	2,189.1	109.9	13,431
4	Interstate-495	9,970	6	2.8	326.8	492.9	27.6	9,151
5	Interstate-270	8,662	7	1.7	601.0	698.4	46.9	22,798
6	Interstate-4	7,343	8	1.9	1,934.5	3,341.5	161.8	12,516
7	Interstate-820	5,003	12	1.8	394.4	620.1	33.3	8,792
8	Interstate-35	4,311	15	1.5	6,137.9	9,672.8	507.6	13,646
9	Interstate-395	4,153	16	3.0	134.6	219.6	11.4	4,716
10	Interstate-526	3,753	19	2.5	130.2	191.8	10.7	4,418
11	Interstate-275	3,611	20	1.8	623.6	984.2	51.7	6,625
12	Interstate-264	3,577	21	1.7	332.6	378.9	27.1	8,660
13	Interstate-240	3,478	22	1.5	205.8	238.1	16.1	8,609
14	Interstate-45	3,310	24	1.6	2,109.5	3,390.8	170.6	11,716
15	Interstate-410	2,847	27	1.8	281.0	416.3	23.7	7,109
16	Interstate-440	2,514	30	1.8	156.6	210.7	12.4	8,760
17	Interstate-265	2,214	34	1.8	108.2	142.9	8.8	7,282
18	Interstate-595	2,120	37	2.2	89.3	137.0	7.6	10,909
19	Interstate-66	1,908	46	1.7	278.2	406.5	22.0	5,209

Note: the AADT data represents the truck traffic volume for each direction of travel, weighted by the length of the TMC segments that make up the interstate highway.
The difference between the congestion measure results reported in this table and the values submitted by states to the FHWA are primarily due to the differences in the TMC segment aggregation approaches employed.
Source: CPCS Analysis of 2019 -2023 NPMRDS data.

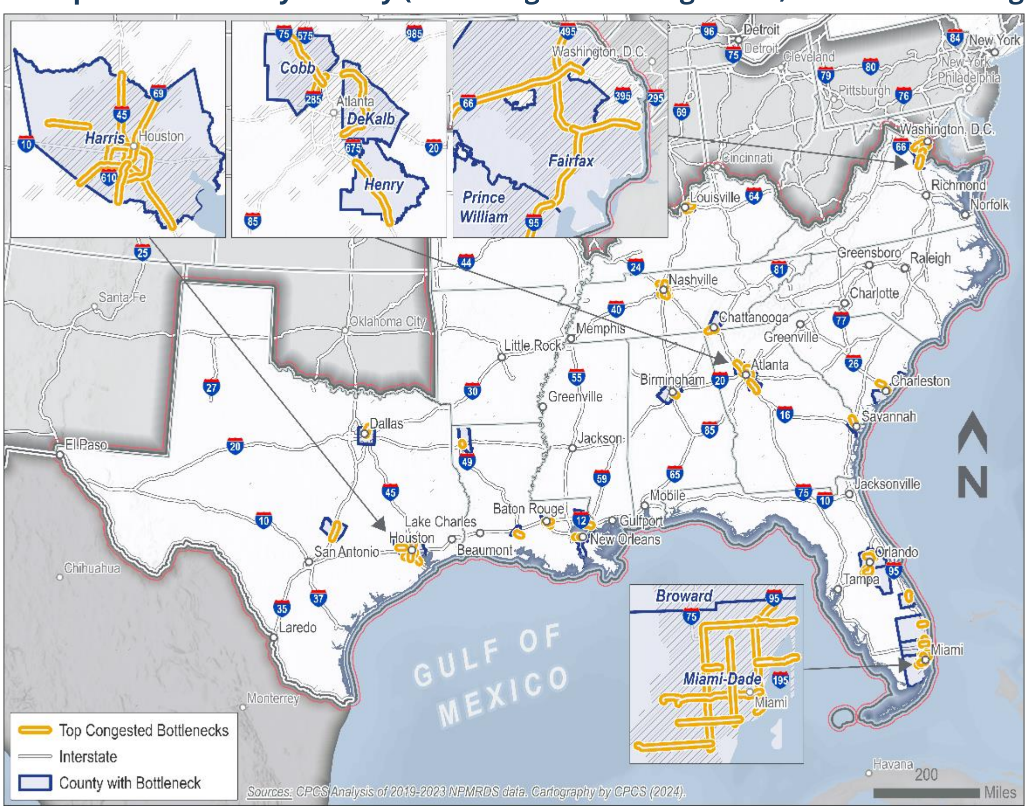
2.4 Top Bottlenecks

The top bottleneck segments accounted for only 1.2% of the total NHS mileage in the Southeast Region. However, during the five years between 2019 and 2023, these segments contributed to approximately 8.5% of the regional total hours of truck delay, as well as the resulting fuel wasted, and costs incurred.

Figure 19 and Figure 20 show the top bottlenecks by county in the Southeast Region. These segments were selected based on their ranking in the top 10% of the more than 4,800 unique roadways analyzed by county across all bottleneck impact measures.[12] Combined, these top bottlenecks resulted in over 19 million hours of truck delay annually, leading to around 33 million gallons of fuel wasted and nearly $1.6 billion in costs per year.

These top bottlenecks are concentrated in nine states: Florida (with seven segments in Miami-Date County and four segments in Broward County), followed by Texas (with five segments in Harris County and two in other counties), Louisiana (seven segments), Tennessee (six segments), Georgia and Virginia each with five bottleneck segments, Kentucky (two segments), South Carolina (two segments), and Alabama (one segment).

Figure 19: Top Bottlenecks by County (excluding <1-mile segments, 2019-2023 Average, Map)



Source: CPCS Analysis of 2019 – 2023 NPMRDS Data.

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[12] To minimize the impact of outlier results, bottlenecks were aggregated by county, and segments under 1 mile in length were excluded from the analysis. The top bottlenecks analysis focused on interstates, U.S. highways, and state routes due to data quality issues for lower functional class roadways

Figure 20: Top Bottlenecks by County (excluding <1-mile segments, 2019-2023 average, Table)

Overall Rank	Road	County	State	Truck Delay per Mile (Hours)	Average Truck Travel Time Reliability	Annual Total Truck Delay (Thousand Hours)	Annual Truck Fuel Wasted (Thousand Gallons)	Annual Cost of Truck Delay (Million Dollars)	Average Annual Daily Truck Traffic
1	Interstate-35	Travis	Texas	24,457	2.7	1,432.5	2,416.9	117.3	8,562
2	Interstate-4	Osceola	Florida	23,053	3.2	373.2	649.6	31.4	7,190
3	Interstate-10	East Baton Rouge	Louisiana	22,443	2.6	552.9	918.8	47.0	12,794
4	Interstate-24	Hamilton	Tennessee	20,502	2.9	593.2	946.9	48.8	11,816
5	Interstate-95	Fairfax	Virginia	19,671	2.9	728.0	1,118.8	59.8	8,297
6	Interstate-10	Jefferson	Louisiana	19,623	2.6	377.9	578.4	31.0	12,901
7	Interstate-285	Dekalb	Georgia	19,447	2.9	946.0	1,500.3	74.5	8,271
8	Interstate-285	Cobb	Georgia	19,149	3.2	286.2	470.1	22.2	8,568
9	Interstate-24	Davidson	Tennessee	17,016	2.5	922.1	1,519.9	75.9	9,369
10	State-826	Miami-Dade	Florida	16,543	2.7	1,004.2	1,466.0	83.6	4,987
11	U.S.-75	Dallas	Texas	15,186	3.0	590.3	805.4	46.5	5,314
12	Interstate-95	Prince William	Virginia	15,084	2.7	388.5	627.7	32.4	7,503
13	Interstate-610	Harris	Texas	14,906	2.6	1,129.5	1,762.3	93.5	6,126
14	State-3105	Bossier	Louisiana	14,340	2.7	114.0	213.0	10.1	1,843
15	Interstate-610	Orleans	Louisiana	12,800	3.0	121.8	177.4	10.0	7,914
16	State-280	Jefferson	Alabama	12,515	2.7	143.6	333.6	12.2	3,092
17	Interstate-95	Stafford	Virginia	12,103	3.0	370.2	652.7	30.5	7,489
18	Interstate-75	Henry	Georgia	11,884	2.7	491.9	860.4	42.2	7,879
19	State-288	Harris	Texas	11,447	2.8	256.2	322.5	20.5	5,084
20	State-255	Davidson	Tennessee	10,676	2.6	235.9	542.5	20.0	2,146
21	Interstate-69	Harris	Texas	10,465	2.6	934.2	1,443.0	77.0	6,385
22	Interstate-95	Miami-Dade	Florida	10,046	3.3	591.7	1,054.3	51.8	4,262
23	Interstate-495	Fairfax	Virginia	9,970	2.8	326.8	492.9	27.6	4,604
24	Interstate-12	East Baton Rouge	Louisiana	9,965	3.1	138.2	214.3	11.5	8,397
25	Interstate-75	Cobb	Georgia	9,335	2.9	332.5	541.0	27.9	6,607
26	Interstate-45	Harris	Texas	9,263	2.7	1,524.8	2,514.7	122.5	6,207
27	State-3073	Lafayette	Louisiana	9,050	2.9	170.3	379.9	15.2	3,085
28	State-934	Miami-Dade	Florida	8,759	2.7	155.2	309.7	13.4	1,220
29	State-713	St Lucie	Florida	8,235	2.7	168.5	365.4	14.0	978
30	U.S.-78	Charleston	South Carolina	7,587	2.8	123.8	280.6	10.0	1,609
31	State-976	Miami-Dade	Florida	7,408	2.7	125.6	244.5	11.2	1,323
32	U.S.-17	Osceola	Florida	7,108	2.8	188.9	419.4	16.7	1,160
33	State-21	Chatham	Georgia	6,899	2.6	134.9	327.7	11.6	1,534
34	Interstate-440	Davidson	Tennessee	6,738	2.7	98.4	147.3	7.7	3,502
35	State-845	Broward	Florida	6,332	2.8	168.7	366.8	14.7	1,178
36	State-816	Broward	Florida	6,203	2.7	107.8	218.7	9.5	1,183
37	State-953	Miami-Dade	Florida	6,133	2.6	144.3	284.9	12.3	1,060
38	State-870	Broward	Florida	5,933	2.5	103.9	222.2	9.3	1,217
39	State-834	Broward	Florida	5,889	2.6	111.8	236.2	9.9	1,178
40	U.S.-60	Jefferson	Kentucky	5,830	3.0	143.4	298.7	12.1	1,286
41	U.S.-31	Davidson	Tennessee	5,767	2.6	571.1	1,256.2	49.1	1,259
42	State-436	Seminole	Florida	5,690	2.5	142.5	321.3	13.2	1,179
43	State-704	Palm Beach	Florida	5,517	2.5	102.5	243.0	9.2	1,294
44	State-94	Miami-Dade	Florida	5,381	2.7	110.4	232.6	9.7	1,233
45	State-434	Seminole	Florida	4,935	2.6	150.9	343.4	13.6	1,259
46	Interstate-66	Fairfax	Virginia	4,881	2.5	204.2	323.3	16.2	2,666
47	State-1747	Jefferson	Kentucky	4,456	2.8	159.8	340.5	13.6	1,048
48	State-529	Harris	Texas	4,365	2.8	100.6	227.0	8.7	1,015
49	State-836	Miami-Dade	Florida	4,350	2.7	129.3	186.3	11.5	1,748
50	State-254	Davidson	Tennessee	4,330	2.7	149.1	357.2	13.8	906
51	U.S.-190	St Tammany	Louisiana	4,216	2.6	328.9	712.0	29.3	1,209
52	Interstate-26	Charleston	South Carolina	4,150	2.6	118.8	185.3	9.9	3,932

Note: the AADT data represents the truck traffic volume for each direction of travel, weighted by the length of the TMC segments that make up the roadway within each county.

Note: The difference between the congestion measure results reported in this table and the values submitted by states to the FHWA are primarily due to the differences in the TMC segment aggregation approaches employed.

Source: CPCS Analysis of 2019-2023 NPMRDS Data

3 Top Congested Truck Trade Lanes

During the five-year period between 2019 and 2023, the top 11 congested trade lanes, which account for less than 4% of the NHS mileage in the Southeast Region, contributed to between 8% to 9% of the total hours of truck delay and the resulting fuel wasted, and costs incurred.

3.1 Introduction

In the 2022 Study, ITTS identified 66 truck trade lanes in the Southeast Region that extend beyond individual state boundaries. The trade lanes were identified based on a comprehensive review of the top trade lanes nationwide using data from the FreightWaves database[13] and the FHWA Freight Analysis Framework (FAF) V5.2 database[14], as well as the top origin-destination pairings cited in the Southeast Region's state freight plans and consultations with Southeast states. Despite comprising less than 10% of the total roadway length in the entire Southeast US, these existing trade lane corridors accounted for over a third of the total truck commodity flows in the region and carried more than four times the commodity tonnage per mile compared to non-trade lane corridors.

For this study, the 66 truck trade lanes were revisited using the most recent FAF data (V5.5.1), resulting in the identification of 13 additional origin-destination pairs. These new pairs were subsequently added to the ITTS trade lanes list. Figure 21 (table) and Figure 22 (map) present the expanded set of top Southeast Region truck trade lane connection cities used for the ITTS bottlenecks study.[15]

Figure 21: Southeast Region Top Truck Trade Lane Connection Cities and Corridors (List)

Origin/Destination	Destination/Origin	Corridor(s)
Atlanta, GA	Birmingham, AL	I-20
Atlanta, GA	Charlotte, NC	I-85
Atlanta, GA	Chattanooga, TN	I-75
Atlanta, GA	Cincinnati, OH	I-75
Atlanta, GA	Dallas, TX	I-20
Atlanta, GA	Orlando, FL	I-75/Florida's Turnpike
Atlanta, GA	Tampa, FL	I-75

[13] Freight Waves SONAR offers insight to domestic and global data to provide insight on the freight market economy in real time. In the 2022 Study, the Project Team used Freight Waves to obtain volumes for the top trade lanes nationwide, and identified the top origin and destination markets, as defined by Freight Waves, in the Southeast Region.

[14] The Freight Analysis Framework (FAF), produced through a partnership between Bureau of Transportation Statistics (BTS) and Federal Highway Administration (FHWA), integrates data from a variety of sources to create a comprehensive picture of freight movement among states and major metropolitan areas by all modes of transportation.

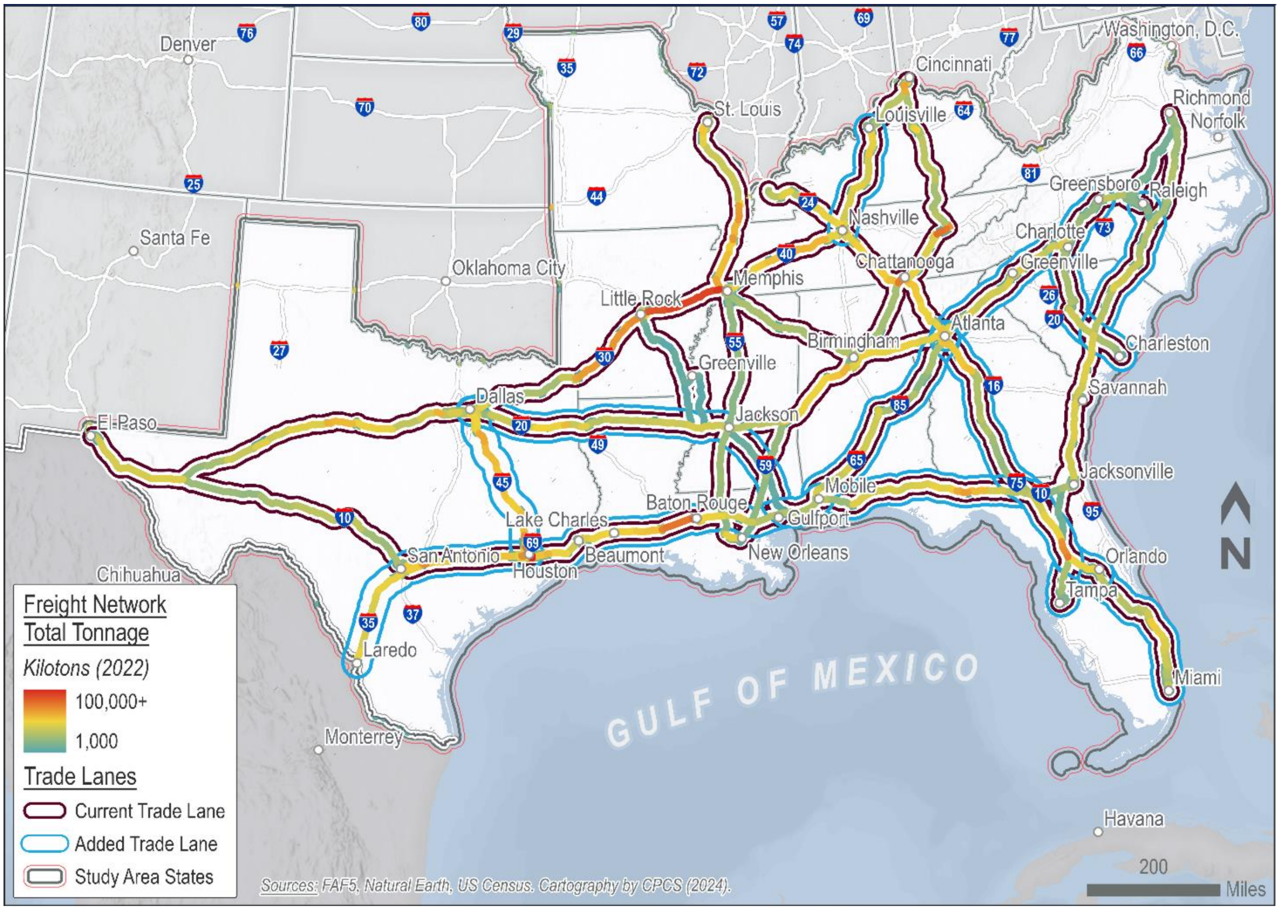
[15] Note there are 47 city-pairs listed but they represent 79 unique origin-destination combinations.

Origin/Destination	Destination/Origin	Corridor(s)
Laredo, TX	Atlanta, GA	US59/I-10/I-12/I-65/I-85
Atlanta, GA	Greenville, SC	I-85
Atlanta, GA	Louisville, KY	I-75/I-24/I-65
Atlanta, GA	Memphis, TN	I-20/I-22
Atlanta, GA	Miami, FL	I-75/Florida's Turnpike/I-95
Atlanta, GA	Mobile, AL	I-85/I-65
Atlanta, GA	Nashville, TN	I-75/I-24
Baton Rouge, LA	Beaumont, TX	I-10
Birmingham, AL	Chattanooga, TN	I-59
Birmingham, AL	Jackson, MS	I-20
Birmingham, AL	New Orleans, LA	I-20/I-59
Birmingham, AL	Dallas, TX	I-20
Charleston, SC	Greensboro, NC	I-26/I-95
Charleston, SC	Raleigh, NC	I-26/I-95
Dallas, TX	Houston, TX	I-45
Dallas, TX	Little Rock, AR	I-30
Dallas, TX	Miami, FL	I-20/I-10/I-75
Dallas, TX	Nashville, TN	I-30/I-40
Dallas, TX	Raleigh, NC	I-20/I-85/I-40
Greensboro, NC	Atlanta, GA	I-85
Lake Charles, LA	Houston, TX	I-10
Louisville, KY	Nashville, TN	I-65
Nashville, TN	Little Rock, AR	I-40
Nashville, TN	Miami, FL	I-24/I-75/FL Turnpike/I-95
Nashville, TN	St. Louis, MO	I-24/I-57/I-64
Jackson, MS	El Paso, TX	I-20/I-10
Jackson, MS	Little Rock, AR	I-20/US 65/I-530
Jackson, MS	New Orleans, LA	I-55/I-10
Memphis, TN	Gulfport, MS	I-55/US 49
Memphis, TN	New Orleans, LA	I-55/I-10
Memphis, TN	St. Louis, MO	I-55
Jacksonville, FL	El Paso, TX	I-10
Jacksonville, FL	Mobile, AL	I-10
Jacksonville, FL	Savannah, GA	I-95
Charlotte, NC	Charleston, SC	I-77/I-26
Charlotte, NC	Richmond, VA	I-85/I-95

Origin/Destination	Destination/Origin	Corridor(s)
Houston, TX	Baton Rouge, LA	I-10
Houston, TX	Mobile, AL	I-10
Cincinnati, OH	Louisville, KY	I-71
Richmond, VA	Tampa, FL	I-95/US 301/I-75

Source: CPCS analysis of FAF5.5.1 data, 2024. Note there are 47 city-pairs listed but they represent 79 unique origin-destination combinations. New trade lanes added in this study are highlighted in green cells.

Figure 22: Southeast Region Top Truck Trade Lanes (Map)



3.2 Top Congested Truck Trade Lanes

During the five years between 2019 and 2023, the top 11 congested trade lanes, which account for less than 4% of the NHS mileage in the Southeast Region, contributed to between 8% to 9% of the total hours of truck delay, as well as the resulting fuel wasted, and costs incurred.

Figure 23 and Figure 24 show the top congested trade lanes in the Southeast Region. These trade lanes were selected based on their ranking in the top 30% of all the trade lanes analyzed across all bottleneck impact measures. Combined, these top trade lanes experienced over 18 million hours of truck delay annually, resulting in around 28 million gallons of fuel wasted and nearly $1.5 billion in costs per year.

Some of the most congested trade routes in the region start, end, or cross Atlanta, Nashville, Louisville, as well as Houston and several cities in Florida. The truck delay on these trade lanes ranges from 3,000 to nearly 5,000 hours of truck delay per mile annually, highlighting the significant impact of congestion on these critical corridors.

Figure 23: Top Congested Trade Lanes (2019-2023 Average, Map)

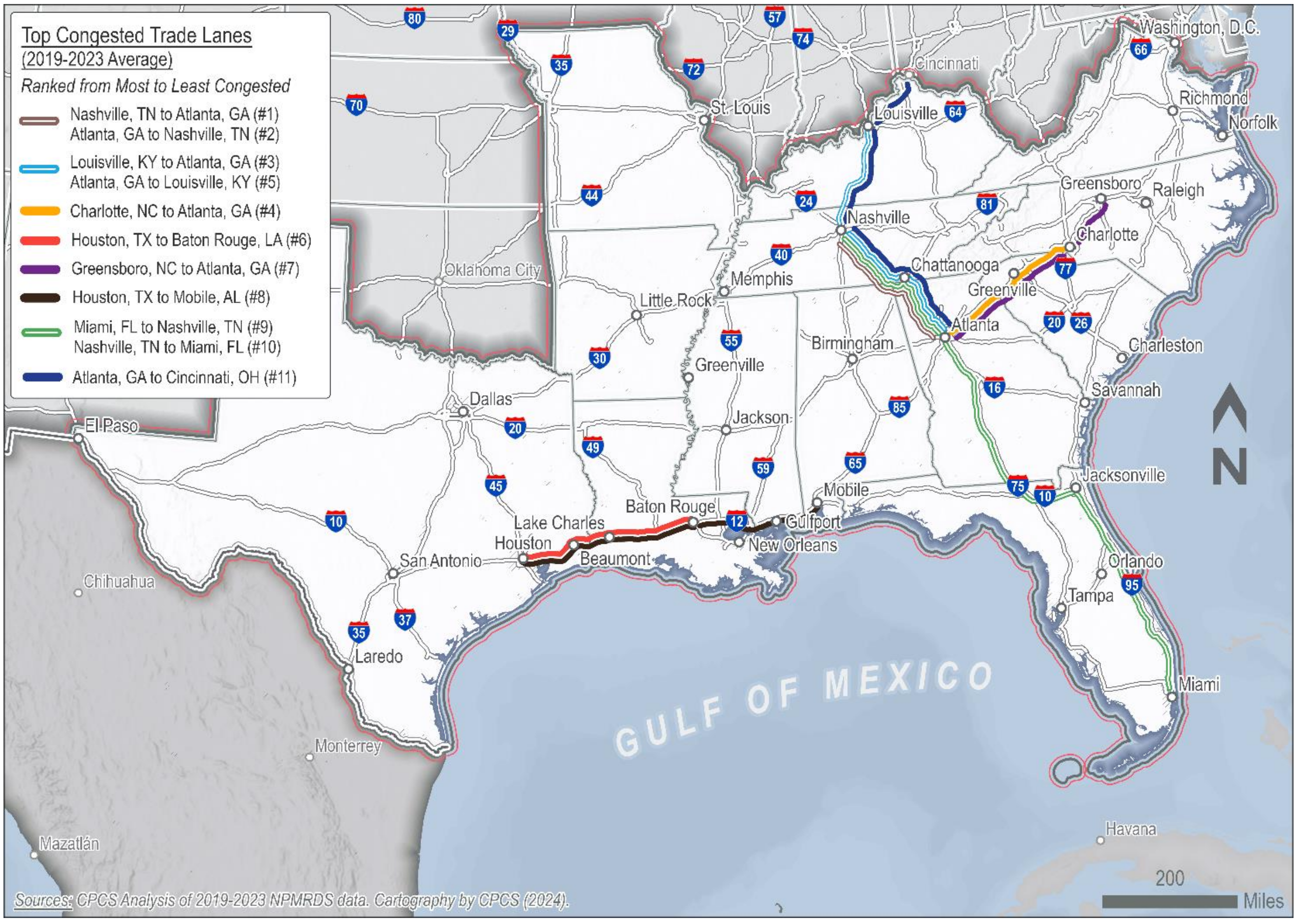


Figure 24: Top Congested Trade Lanes (2019-2023 Average, Table)

Overall Rank	Trade Lane	Main Corridors	Truck Delay per Mile (Hours)	Average Truck Travel Time Reliability	Annual Total Truck Delay (Million Hours)	Annual Truck Fuel Wasted (Million Gallons)	Annual Cost of Truck Delay (Million Dollars)	Average Annual Daily Truck Traffic
1	Nashville, TN - Atlanta, GA	I-75/I-24	4,831	1.6	1.2	2.1	101.2	15,475
2	Atlanta, GA - Nashville, TN	I-75/I-24	4,532	1.6	1.2	2.0	99.2	14,689
3	Louisville, KY - Atlanta, GA	I-65/I-24/I-75	4,389	1.5	1.9	3.2	158.2	16,066
4	Charlotte, NC - Atlanta, GA	I-85	4,338	1.6	1.1	1.6	88.0	10,034
5	Atlanta, GA - Louisville, KY	I-65/I-24/I-75	4,018	1.5	1.8	2.9	147.7	15,557
6	Houston, TX - Baton Rouge, LA	I-10	3,982	1.4	1.1	1.6	85.9	14,421
7	Greensboro, NC - Atlanta, GA	I-85	3,505	1.5	1.2	1.7	95.9	10,124
8	Houston, TX - Mobile, AL	I-10	3,487	1.4	1.6	2.5	130.4	13,680
9	Miami, FL - Nashville, TN	I-24/I-75/FL Turnpike/I-95	3,224	1.4	3.0	4.3	243.0	12,045
10	Nashville, TN - Miami, FL	I-24/I-75/FL Turnpike/I-95	3,010	1.4	2.7	4.0	225.4	12,250
11	Atlanta, GA - Cincinnati, OH	I-75	2,969	1.4	1.4	2.2	116.4	12,968

Note: the AADT data represents the truck traffic volume for each direction of travel, weighted by the length of the TMC segments that make up the trade lanes.

Source: CPCS Analysis of 2019-2023 NPMRDS Data

3.3 Next Steps

This technical memo serves as an internal deliverable designed to facilitate timely reviews and feedback between the Project Team and the ITTS Regional Bottlenecks Study Steering Committee. The Project Team revised the memo based on comments and suggestions provided by ITTS.

Following this memo, the Project Team will use the results of this assessment to update the ITTS Regional Bottlenecks Assessment GIS Planning Tool. An updated GIS Tool User Guide and a one-page Quick Start guide for the updated GIS Planning Tool will be developed. These additional resources will incorporate the NPMRDS data from the years 2019 to 2023, further enhancing the GIS Planning Tool's utility and relevance for member states in understanding and addressing the evolving truck bottleneck landscape in the Southeast Region.