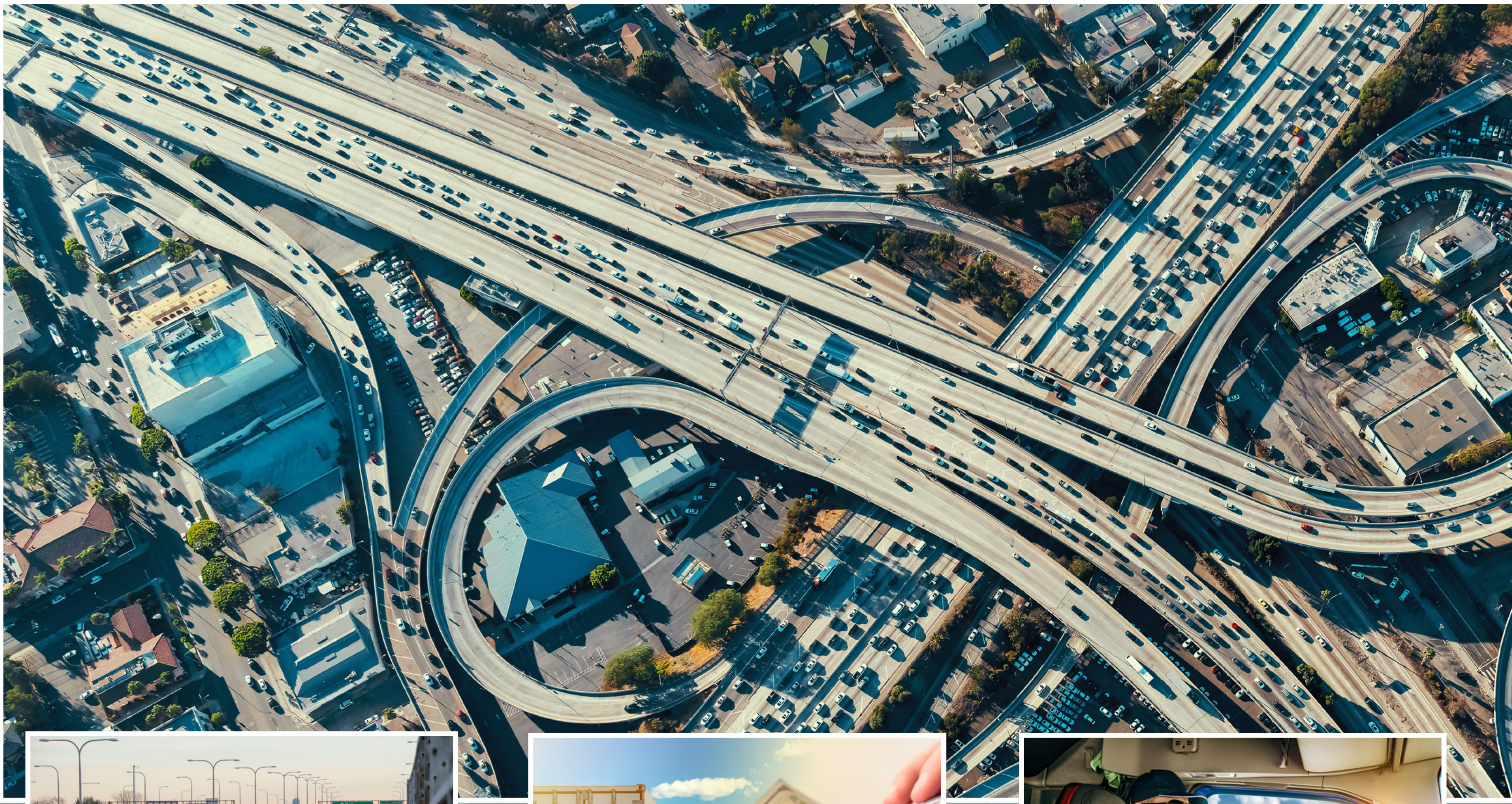
Cost of Congestion to the Trucking Industry: 2023 Update

October 2023



Prepared by the American Transportation Research Institute

ATRI American Transportation Research Institute

Cost of Congestion to the Trucking Industry: 2023 Update

October 2023

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TruckingResearch.org

ATRI RESEARCH ADVISORY COMMITTEE

LIST OF ACRONYMS

ATRI	**American Transportation Research Institute**
COVID-19	**Coronavirus Disease 2019**
CPH	**Cost per Hour**
CPI	**Consumer Price Index**
EIA	**Energy Information Administration**
FAF	**Freight Analysis Framework**
FHWA	**Federal Highway Administration**
FMI	**Freight Mobility Index**
GDP	**Gross Domestic Product**
GPS	**Global Positioning System**
IHS	**Interstate Highway System**
IIJA	**Infrastructure Investment and Jobs Act**
INFRA	**Infrastructure for Rebuilding America**
MPG	**Miles Per Gallon**
MPH	**Miles Per Hour**
MMT	**Million Metric Tons**
NHS	**National Highway System**
NOLA	**Port of New Orleans**
NPMRDS	**National Performance Management Research Data Set**
ORNL	**Oak Ridge National Laboratory**
OPEC	**Organization of Petroleum Exporting Countries**
RAC	**Research Advisory Committee**
SD	**Standard Deviation**
U.S. DOT	**United States Department of Transportation**
VMT	**Vehicle Miles Traveled**

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INTRODUCTION

Traffic congestion levels and related costs to the trucking industry have varied widely in recent years. The unprecedented COVID-19 pandemic – and subsequent travel behavior shifts, supply chain issues and high inflation have led to both financial volatility and changing highway conditions. Recognizing that this volatility has greatly impacted the industry, the American Transportation Research Institute (ATRI) revisited past work on the cost of traffic congestion-related delay to the trucking industry. Through this report ATRI provides a continuation of annual congestion cost figures last published for 2016, now covering the years 2017 through 2021.[1]

As shown in this report, the year 2021 had the highest congestion costs to date, fueled by a number of factors:

1) High GDP Growth. At 5.7 percent, 2021 saw the highest GDP growth since 1984.[2]
2) Consumer Spending. Due to COVID-19 stimulus money, as well as travel and dining restrictions during 2020, consumers had large amounts of expendable cash by 2021.[3] This jump-started a consumer spending wave that drove up prices, ultimately leading to inflation.
3) Jump in Diesel Prices. Diesel prices rapidly increased throughout 2021 from lows hit in 2020.[4] This was due in part to OPEC oil production cuts, as well as executive orders from the White House curbing domestic production.[5]
4) Trucking Rate and Volume Increases. Truck traffic was generally healthy in many sectors of the trucking industry during 2020, though some sectors came to a near stand-still; volumes and rates grew in 2021 as the industry worked to meet both shipper and consumer demand for truck capacity.[6]
5) Commuter Traffic. 2021 also saw an increase in commuter traffic congestion as companies and governments lifted work-from-home requirements.[7]

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[1] Alan Hooper, *Cost of Congestion to the Trucking Industry: 2018 Update*, American Transportation Research Institute (October 2018), https://truckingresearch.org/2018/10/cost-of-congestion-to-the-trucking-industry-2018-update/.

[2] Rachel Siegel and Andrew Van Dam, "U.S. economy grew 5.7 percent in 2021, fastest full-year clip since 1984, despite ongoing pandemic," *The Washington Post* (January 27, 2022), https://www.washingtonpost.com/business/2022/01/27/gdp-2021-q4-economy/.

[3] U.S. Bureau of Labor Statistics, "Consumer Expenditures in 2021" (January 2023), https://www.bls.gov/opub/reports/consumer-expenditures/2021/home.htm.

[4] U.S. Energy Information Administration, "U.S. No 2 Diesel Ultra Low Sulfur (0-15 ppm) Retail Prices" (accessed on October 6, 2023), https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2DXL0_PTE_NUS_DPG&f=M.

[5] Natasha Turak, "OPEC and allies target full end to oil production cuts by September 2022, increase supply limits as prices climb", *CNBC* (July 18, 2021), https://www.cnbc.com/2021/07/18/opec-allies-agree-to-fully-end-oil-production-cuts-by-september-2022.html;
U.S. President, Executive Order, "Executive Order 14008 of January 27, 2021: Tackling the Climate Crisis at Home and Abroad," *Federal Register* 86, no. 19 (February 1, 2021): 02177, https://www.govinfo.gov/content/pkg/FR-2021-02-01/pdf/2021-02177.pdf.

[6] Cass Information Systems, Inc., "A Measure of North American Freight Volumes" (accessed on October 6, 2023), Cass Freight Index – Shipments, Expenditures and Inferred Freight Rates: January 2010 - August 2023 (01'1990=1.00), https://www.cassinfo.com/freight-audit-payment/cass-transportation-indexes/cass-freight-index.

[7] Johnathan M. Gitlin, "Traffic bounces back in year two of the pandemic, minus the commuters," *Ars Technica* (December 7, 2021), https://arstechnica.com/cars/2021/12/road-traffic-increased-this-year-but-not-to-pre-pandemic-levels/.

BACKGROUND

In 2012 ATRI's Research Advisory Committee (RAC) recognized the serious impact that traffic congestion had on the trucking industry and thus ranked an analysis of the cost of congestion on trucking as a top priority.[8] Subsequently, from 2013 to 2016 a series of annual reports were produced using an empirical formula for calculating congestion delays and related costs.

ATRI's first *Cost of Congestion* report found that congestion costs for trucking on just the Interstate Highway System (IHS) were $9.2 billion in 2013.[9]

In the years that followed, the geographic scope of this research was expanded to include the entire National Highway System (NHS) and freight-related critical infrastructure. Analyses of this expanded network identified significant congestion costs for the trucking industry for the years 2014 through 2016:

- 2014 – $49.6 billion
- 2015 – $63.4 billion
- 2016 – $74.5 billion

A key input to the *Cost of Congestion* formula for these reports was the truck performance metrics within the National Performance Management Research Data Set (NPMRDS), which is managed by the Federal Highway Administration (FHWA) of the U.S. Department of Transportation (U.S. DOT). Unfortunately, in 2017 FHWA changed the truck data used in NPMRDS, thus requiring ATRI to modify its congestion cost calculation formulas.

To address this change ATRI developed an indexing methodology – described in this report – that builds upon previous congestion cost calculations and findings. These updated calculations utilize an annual average delay measurement at key high-volume, high-congestion U.S. locations to identify changes from the 2016 baseline measurements.

Through the use of this indexing methodology, this new congestion research extends the 2014-2016 cost calculations into a new five-year time period for 2017-2021. This updated research covers a time period of great volatility; numerous economic externalities came into play, as well as the significant societal effects of COVID-19.

Since this indexing methodology no longer requires the use of the NPMRDS, the *Cost of Congestion* methodology can be applied to future years as well, ensuring a continuation of this important U.S. infrastructure performance metric for 2022 and beyond.

[8] ATRI's Research Advisory Committee RAC is comprised of industry stakeholders representing motor carriers, trucking industry suppliers, government agencies, professional truck drivers, law enforcement, and academia. The RAC is charged with annually recommending a research agenda for the Institute.
[9] Dave Pierce and Dan Murray, *Cost of Congestion to the Trucking Industry*, American Transportation Research Institute (April 2014), https://truckingresearch.org/2014/04/cost-of-congestion-to-the-trucking-industry-report-request.

UNDERSTANDING THE FOUNDATIONAL METHODOLOGY

Highway Congestion

Highway congestion occurs when the free-flow speed of traffic is impeded, resulting in delayed travel that is often well below posted speed limits. Highway congestion typically occurs when there are more vehicles on a segment of highway during a time period than the infrastructure can process at free-flow speeds.[10] Whether it is recurring congestion or incident-related, the result is reduced capacity and a slowdown in vehicle speeds, which adds time to a trip. These delays increase the trucking industry's operational costs. Traffic congestion increases direct industry costs such as driver compensation, fuel, and repair and maintenance. It also generates indirect and/or societal costs such as supply chain disruptions, inefficient use of fuel and diminished air quality.[11]

Key Components of Congestion Cost Calculations

As background, the key components used to determine the cost of congestion are:

- Cost per Hour. The marginal unit cost per hour to operate a Class 7/8 combination truck, which can be multiplied by hours of delay, resulting in a total congestion cost.
- Volume/Vehicle Miles Traveled (VMT). The volume of combination truck traffic by geographic and temporal segment measures the number of trucks that are impacted by delay. Truck VMT is the total of all truck miles traveled in a given year in a corridor, state, region or nationally.
- Speed. Average highway speeds for combination trucks by geographic and temporal segment identifies the deviation from free flow speed (and thus additional travel time).[12]

ATRI's past research incorporated four key data sources for the metrics described above.[13]

1. Operational Cost of Trucking Metrics. Industry financial statistics were utilized from ATRI's annual *An Analysis of the Operational Costs of Trucking* publication.[14]
2. NHS Truck Volume Data. Past research utilized commercial truck volumes from FHWA's Freight Analysis Framework (FAF) Version 4.

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[10] Cambridge Systematics and Texas Transportation Institute, *Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation* (September 1, 2005), prepared for the Federal Highway Administration, https://ops.fhwa.dot.gov/congestion_report/congestion_report_05.pdf.

[11] Mike Tunnell, *Fixing The 12% Case Study: Atlanta, Georgia Fuel Consumption and Emissions Impacts*, American Transportation Research Institute (February 2019), https://truckingresearch.org/wp-content/uploads/2019/04/ATRI-Fixing-the-12-Bottleneck-Case-Study-FINAL.pdf

[12] For a description of calculating free flow speeds for the baseline dataset (2016), a step conducted in past research, please see: Alan Hooper, *Cost of Congestion to the Trucking Industry: 2018 Update*, American Transportation Research Institute (October 2018), https://truckingresearch.org/2018/10/cost-of-congestion-to-the-trucking-industry-2018-update/.

[13] Alan Hooper, *Cost of Congestion to the Trucking Industry: 2018 Update*, American Transportation Research Institute (October 2018), https://truckingresearch.org/2018/10/cost-of-congestion-to-the-trucking-industry-2018-update/.

[14] American Transportation Research Institute, *Operational Cost of Trucking*, Annual Reports (2017-2023), https://truckingresearch.org/atri-research/operational-costs-of-trucking/.

3. NHS Average Travel Time Data. ATRI's research utilized commercial truck travel times from FHWA's NPMRDS through 2016.
4. Truck GPS Data. Freight truck GPS data from ATRI's Freight Mobility Initiative (FMI) database were also utilized in past iterations to estimate speed and volume.

As noted, in 2017 FHWA changed truck data sources for their NPMRDS Average Truck Travel Time Data. In addition, there were other fundamental changes to the NPMRDS product.[15] These included:

- A change in the road network used by NPMRDS, including the use of a different shapefile with different road segments; and
- The incorporation of highway performance monitoring system (HPMS) highway volume data into the NPMRDS.

Corroborating the Need for a Modified Methodology

As a prerequisite to developing updated annual cost of congestion figures for 2017 through 2021, ATRI analyzed FHWA's new national NPMRDS dataset, using the test year 2019. ATRI applied its well-established methodology from prior *Cost of Congestion* reports and found that using the new NMPRDS product created unusual and unrealistic increases and decreases in congestion levels and costs on a state-by-state basis, as compared to previous ATRI reports. In particular, the research team found in several sample bottleneck locations that average truck speeds were higher in the NPMRDS than in the ATRI FMI dataset.

In response to this insupportable outcome, ATRI next contracted with a nationally recognized traffic data expert, Chen-Fu Liao, to: a) corroborate that the new NPMRDS truck data possessed different attributes from the previous NPMRDS truck data; and b) assist in identifying a modified methodology that would analogously relate the historical truck congestion metrics with future congestion reports.[16]

Dr. Liao confirmed and documented that the new NPMRDS dataset average speeds varied substantially from ATRI's freight truck GPS dataset's average speeds. A summary of the assessment can be found in Appendix A. Consequently, the new NPMRDS could not be utilized to update ATRI's annual *Cost of Congestion* report, and a modified approach was needed to update the cost of congestion calculations and to ensure consistency and a focus on combination trucks.

[15] National Performance Management Research Data Set. "NPMRDS ANALYTICS" (accessed on October 9, 2023), https://npmrds.ritis.org/analytics/; NPMRDS data from 2011 through January 31, 2017 were provided by HERE. Data from 2017 forward are provided by a team led by of the CATT Lab at the University of Maryland.
[16] At the time of his analysis, Dr. Liao was a Senior Research Associate and CTS Research Scholar at the University of Minnesota with 20 years of experience in data analysis, focusing on traffic data.

KEY COMPONENTS OF THE 2017-2021 CONGESTION FIGURES

Due to the differences between the new and previous NPMRDS truck data, the research team developed, tested and finalized an indexing approach that built upon ATRI's earlier congestion research. This methodology utilized an indexing approach that employed the 2016 *Cost of Congestion* report findings as a baseline, and calculated changes to that baseline over the 2017-2021 time period using updated annual analyses of trucking industry operational costs, truck volumes and truck speeds.

The end result was a cost measurement for 2017 through 2021 based on annual changes in average operational cost, volume and speed.

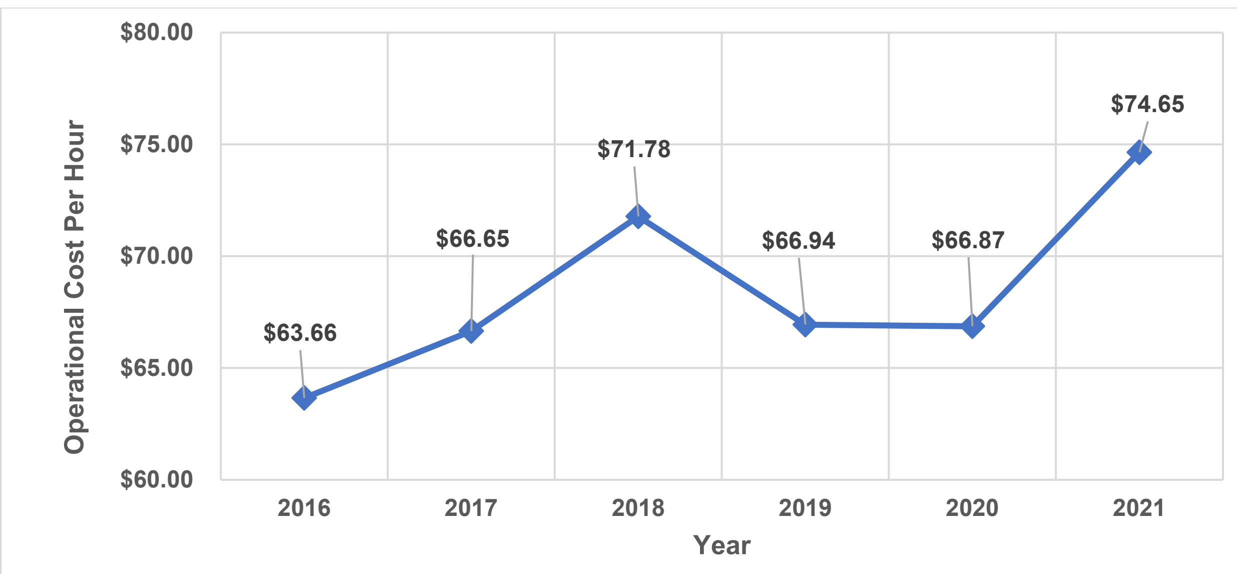
Trends within the three components are described below. The full indexing methodology, including the development of each of the three components, is described in Appendix B.

It should be noted that ATRI calculations in this research utilize multiple decimal places in the various analyses; however, the research tables and figures are typically rounded to the nearest tenths place for clarity and presentation purposes. Tables and figures that include rounded numbers are marked in the report with an asterisk (*).

Component One: Operational Cost Measurement Overview and Trends

The hourly operational cost figures for 2016 through 2021 are shown in Figure 1 and are drawn directly from ATRI's annual *Operational Costs of Trucking* report.[17]

Figure 1: Annual Operational Cost Per Hour (CPH) – 2016 to 2021*



These marginal operational costs reflect a variety of factors including freight demand, global oil production, equipment and parts availability, labor markets, and broader economic conditions across the study period.

[17] American Transportation Research Institute, *Operational Cost of Trucking*, Annual Reports (2017-2023), https://truckingresearch.org/atri-research/operational-costs-of-trucking/.

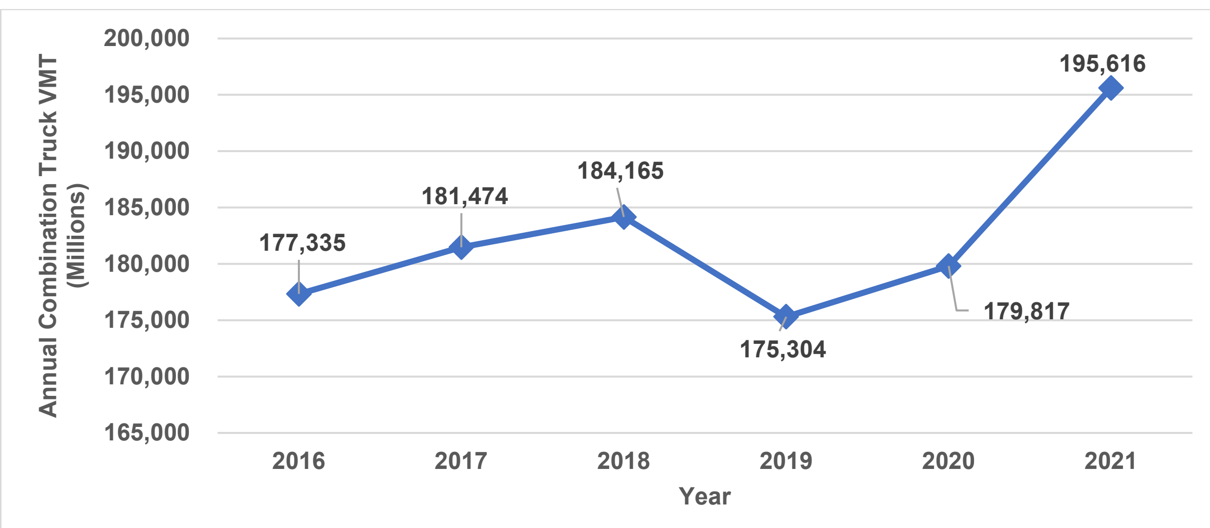
The six years (2016 to 2021) shown in Figure 1 illustrate multiple countervailing cost trends:

- After the base year of 2016, rising fuel prices and driver wages contributed to rising costs in 2017 and 2018. Many fleets increased overall spending during this period due to a freight market boom that began in mid-2017 and continued through 2018.
- The freight market then softened considerably in 2019, leading to a drop in capacity and truck volumes (as will be discussed later in this section). In response to these changes, motor carriers were forced to make cuts in many cost centers in which they had increased spending in 2017-2018, including driver compensation, truck/trailer payments, and repair and maintenance.
- In 2020 the freight market rebounded to record highs fueled by COVID-19 pandemic-related consumer spending. At the same time costs remained low; COVID-19 restrictions decreased demand for fuel and pulled diesel and gasoline prices lower than recent averages. There was also a slight retrenchment in driver compensation.
- Truck and parts shortages in 2021, combined with a highly competitive labor market and substantial increases in diesel prices caused a spike in costs. Together, these heightened costs erased the savings of the preceding two years, resulting in an average annual increase of 3.5 percent across the six-year period.

Component Two: Truck Volume Measurement Overview and Trends

Changes in annual volume measurements for combination trucks were sourced from FHWA's *Highway Series*, which includes several metrics that can be combined to calculate the number of U.S. combination truck vehicle miles traveled (VMT) annually, shown in Figure 2.[18]

Figure 2: Annual Combination Truck VMT*



The truck volume data show an increase in truck traffic from 2016 to 2018, followed by a reduction in freight volume during the soft market in 2019. Volumes partly rebounded in 2020 but remained lower than the 2016-2018 trendline due to the COVID-19 pandemic and resulting

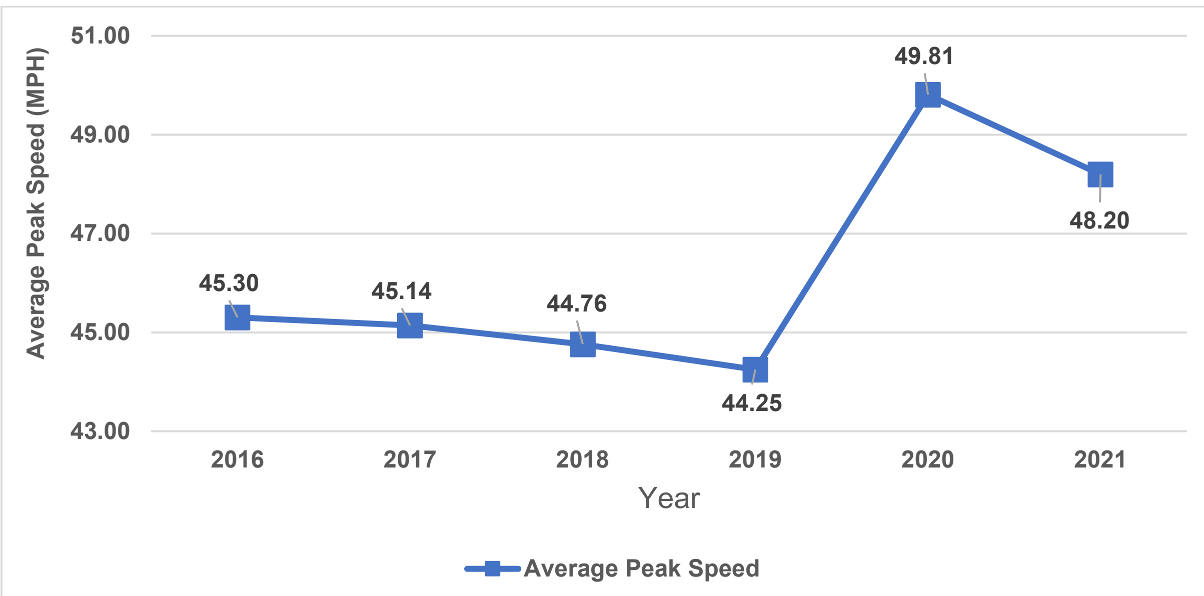
[18] Federal Highway Administration, *Highway Statistics Series: Table VM-2 and VM-4*, Annual Report (2016-2021), https://www.fhwa.dot.gov/policyinformation/statistics.cfm.

supply chain issues. Volumes reached their peak during the study period in 2021 at 195,616 million VMT.

Component Three: Speed Measurement Overview and Analysis

Figure 3 illustrates the average annual peak-hour speed measurements nationally, which were derived from ATRI's freight truck GPS data. Speeds were averaged from over 300 highway segments, called "expanded bottlenecks." These expanded bottlenecks represent key freight-significant infrastructure in all states and major metro areas. The expanded bottleneck location analysis is described within Appendix B.

Figure 3: Annual Average of Peak Speed Measurements for Expanded Bottleneck Locations*



In 2020, however, the COVID-19 pandemic and associated workplace closures took car traffic – particularly that of commuters – off urban highways. This lowered truck congestion levels, and greatly increased the average peak speed. Some normalization in traffic volumes occurred in 2021 as workplace commuting and the service industry recovered, yet depending on geographic location, much of the pandemic-related soft traffic effect persisted.

FINDINGS AND DISCUSSION

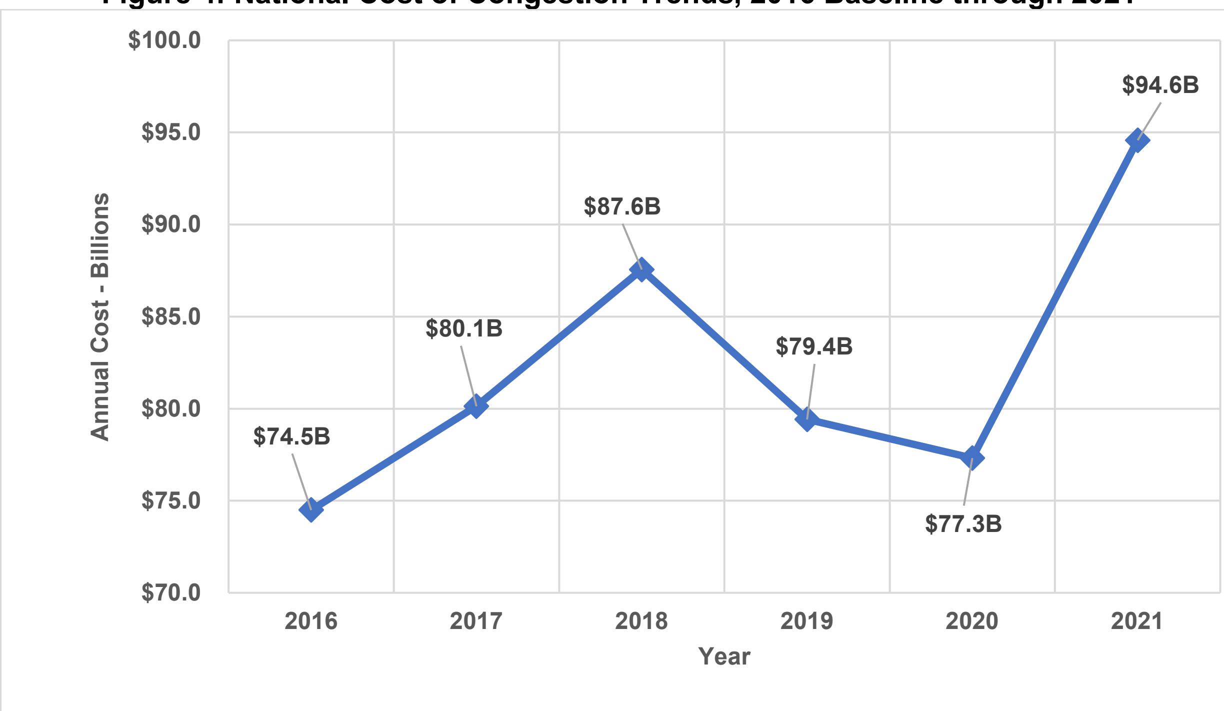
Using the methodology described in Appendix B, the three cost of congestion components were employed in final calculations for national, regional, state and metropolitan areas.

National Findings

First, national metrics for each year were calculated, as shown in Figure 4. The analysis found that congestion costs increased from $74.5 billion in the 2016 baseline analysis to $87.6 billion in 2018. Due to the economic downturn in 2019, truck congestion costs then dropped to $79.4 billion, and then further receded in 2020 to $77.3 billion due to reduced congestion during the COVID-19 pandemic.

Reflecting the dramatic post-COVID economic recovery, annual truck congestion costs in 2021 hit a peak of $94.6 billion.

Figure 4: National Cost of Congestion Trends, 2016 Baseline through 2021*



The 2021 congestion cost figure is an increase of $20.1 billion in annual congestion costs from the 2016 baseline, representing a 27.0 percent increase from 2016 to 2021. During this same five-year period the Consumer Price Index (CPI), a measure of inflation, increased only 12.9 percent.[19] Thus, congestion costs for trucks rose at more than twice the rate of the CPI as a result of increased industry costs, congested roadways and a record high national truck VMT in 2021.

Increased congestion results in truck drivers spending more time in stop-and-go traffic conditions. To quantify the workforce impact equivalency of these wasted hours, the research

[19] Bureau of Labor Statistics, "Historical Consumer Price Index for All Urban Consumers: U.S. city average, all items, by month" (2023), https://www.bls.gov/cpi/tables/supplemental-files/historical-cpi-u-202307.pdf.

team once again utilized the driver hours of delay first calculated in the previous 2018 *Cost of Congestion* report. In 2021, total hours of delay experienced by truck drivers due to congestion were the equivalent of 460,716 commercial truck drivers sitting idle for an entire working year.[20] This equates to 24 percent of the Class A-licensed commercial driver workforce.[21] The American Trucking Associations (ATA) estimates a driver shortage of over 78,000 drivers, which could be significantly reduced if the existing drivers' productivity was not impacted by congestion.[22]

Additionally, when the total congestion costs of $94.6 billion are distributed across all registered tractor-trailers in the U.S., the average annual cost of congestion per truck is $6,824. This is equivalent to three percent of the average annual revenue generated per truck in the truckload sector in 2021.[23]

Table 1 compares these national congestion-related statistics to illustrate increases from 2016 to 2021.

Table 1: Cost of Congestion National Statistics, 2016 and 2021*

Congestion Metric	2016	2021	Percent Increase
Total Cost of Congestion	$74,492,621,027	$94,579,256,586	27.0%
Hours of Delay	1,170,214,985	1,266,969,278	8.3%
Annual Number of Idle Drivers	425,533	460,716	8.3%
Registered Trucks	11,498,561	13,859,181	20.5%
Average Congestion Cost per Truck	$6,478	$6,824	5.3%

National Impacts of Congestion on Fuel Consumption and the Environment

In addition to operational cost increases, there are environmental impacts that are a direct consequence of congested infrastructure. To quantify these impacts, ATRI reviewed past research and available data that related impeded travel to additional fuel consumption and excess CO_2 emissions.

The ATA Technology and Maintenance Council (TMC), comprised of fleet maintenance professionals from across the country, regularly convenes study groups to develop Recommended Practices (RP) to "assist equipment users, vehicle/component manufacturers and other industry suppliers in the maintenance of commercial vehicles."[24] One of the RP documents from 2019 illustrates the severity of fuel loss related to congestion. The report

[20] A working year is defined as driving 11 hours a day, 5 days a week, for 50 weeks per year. For more information please see: Alan Hooper, *Cost of Congestion to the Trucking Industry: 2018 Update*, American Transportation Research Institute (October 2018), https://truckingresearch.org/2018/10/cost-of-congestion-to-the-trucking-industry-2018-update/.

[21] Bureau of Labor Statistics, "Occupational Employment and Wages Statistics: Heavy and Tractor-Trailer Truck Drivers, May 2021 Period," (accessed on December 2022), https://data.bls.gov/oes/#/home.

[22] Connor D. Wolf, "Driver Shortage Decreases Slightly to 78,000, ATA Says," *Transport Topics* (October 25, 2022), https://www.ttnews.com/articles/driver-shortage-decreases-slightly-78000-ata-says.

[23] Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: 2023 Update* (June 2023), https://truckingresearch.org/2023/06/an-analysis-of-the-operational-costs-of-trucking-2023-update/.

[24] Technology & Maintenance Council, "Recommended Practices" (accessed on October 6, 2023), American Trucking Associations, https://tmc.trucking.org/TMC-Recommended-Practices#.

indicates that urban stop-and-go driving (which is similar to congested highway travel) can decrease fuel economy by 31.0 to 62.2 percent.[25] Therefore, a truck that operates at approximately 7 miles per gallon (MPG) on a flat interstate would achieve somewhere between 2.64 and 4.83 MPG in urban stop-and-go, thus wasting a large quantity of fuel.

While low MPGs offer insight into fuel consumption issues, the central metric for measuring the environmental impacts of congestion is the number of gallons of additional diesel needed per hour of delay. This is ultimately the fuel consumed while operating in inefficient, stop-and-go bottlenecks instead of travelling at free-flow highway speeds. An ATRI analysis of fuel consumption and emissions indicated that congestion created more than 5.8 gallons of wasted diesel per hour of delay in 2016.[26]

Additional evidence is found in an Oak Ridge National Laboratory (ORNL) report which estimated the fuel economy for a Class 8 truck operating at 15 to 20 miles per hour (MPH) at 3.73 MPG.[27] Dividing the delay speed of 20 MPH by this MPG figure equates to 5.362 lost gallons of diesel per hour during delay. It should be noted that the 20 MPH figure is a close approximation to ATRI's calculations for delayed travel on highway bottlenecks. As is shown in ongoing performance measurement research at the nation's bottlenecks, a given truck speed during peak delay hours may operate at a variety of stop-and-go speeds (e.g., ranging from 1 MPH to 40 MPH) – with an average of 20 MPH.[28]

Using the figure derived from the ORNL data, along with ATRI hours of delay from this report, it is estimated that 6.793 billion extra gallons of diesel were unnecessarily consumed in 2021 due to congestion. According to the U.S. Energy Information Administration (EIA) the average 2021 price of a gallon of diesel was $3.29. Therefore, the industry experienced an additional cost of $22.3 billion in lost fuel that year.[29]

Finally, from an environmental perspective, the fuel that was wasted due to congestion delays resulted in the release of approximately 69 million metric tons (Mmt) of excess CO_2 in 2021. For perspective, fuel consumption for all U.S. medium- and heavy-duty trucks is estimated to be 407.8 Mmt of CO_2 annually.[30]

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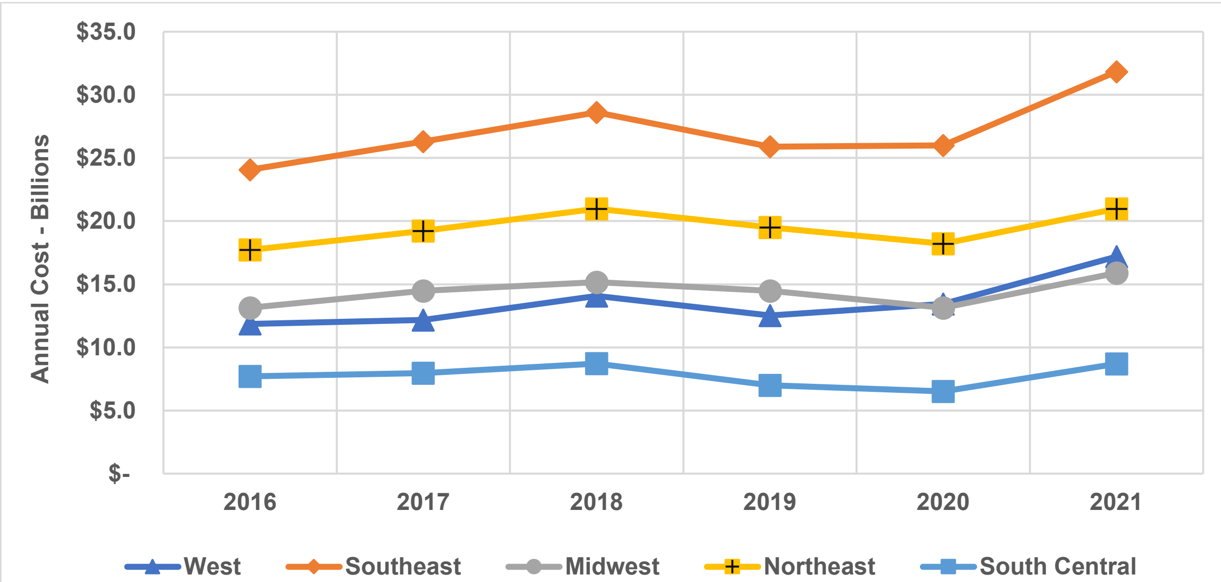
[25] Technology & Maintenance Council, "Relationships Between Truck/Trailer Components and Fuel Economy," TMC 2018-2019 Recommended Practices Manual, RP 1111C, American Trucking Associations (2019).
[26] Mike Tunnell, *Fixing The 12% Case Study: Atlanta, Georgia Fuel Consumption and Emissions Impacts*, American Transportation Research Institute (February 2019), https://truckingresearch.org/wp-content/uploads/2019/04/ATRI-Fixing-the-12-Bottleneck-Case-Study-FINAL.pdf
[27] Gary Capps et al., *Class-8 Heavy Truck Duty Cycle Project Final Report*, Oak Ridge National Laboratory (December 2008), ORNL/TM-2008/122, cited in Stacy C. Davis and Robert G. Boundy, *Transportation Energy Data Book Edition 40*, Oak Ridge National Laboratory (June 2022), https://tedb.ornl.gov/wp-content/uploads/2022/03/TEDB_Ed_40.pdf.
[28] American Transportation Research Institute, "Bottlenecks/Congestion/Infrastructure Funding," (accessed September 20, 2023), https://truckingresearch.org/atri-research/bottlenecks-congestion-infrastructure-funding/.
[29] U.S. Energy Information Administration, "U.S. No 2 Diesel Retail Prices" (accessed on September 28, 2023), https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=A.
[30] U.S. Environmental Protection Agency, "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 to 2021." EPA 430-R-23-002 (accessed on September 29, 2023), https://www.epa.gov/system/files/documents/2023-04/US-GHG-Inventory-2023-Main-Text.pdf.

Regional Findings

Regional trends show a pattern similar to the national trend, with congestion costs rising into 2018, then dropping in 2019 and 2020, with a visible rise in congestion costs in 2021 (Figure 5).

Figure 5: Congestion Cost Trends by Region, 2016 – 2021

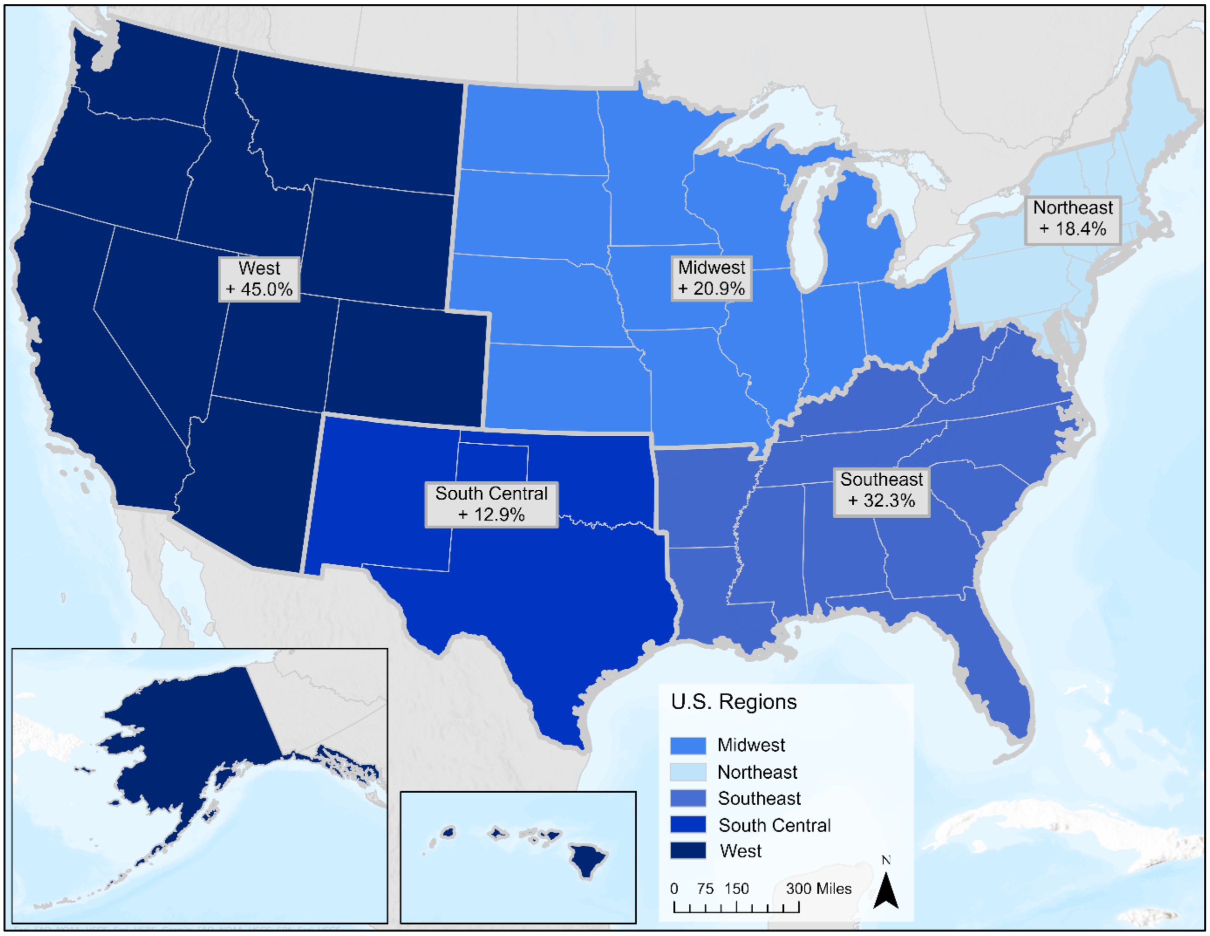


Differences in trends across regions can be explained by unique economic, infrastructure and traffic conditions that exist across these geographies. The region with the highest congestion costs remained the Southeast, followed by the Northeast. The West, however, saw the largest percentage increase in congestion costs from 2016 to 2021, followed by the Southeast (Figure 6). The South Central region saw the smallest percentage increase in congestion costs from 2016 to 2021.

There may be some relationship between GDP growth and congestion cost increases. The West had the highest increase in congestion costs and the highest GDP growth (31.3%) over the 5-year time period – driven in part by growth in California, Oregon, Washington, Nevada and Arizona.[31] The second highest region for percentage growth, the Southeast, also saw the second highest GDP growth (27.4%), a figure driven by growth in Florida and Georgia.

[31] Bureau of Economic Analysis, "Gross Domestic Product by State, 4th quarter 2016 and annual 2016" (May 1, 2018), https://www.bea.gov/news/2017/gross-domestic-product-state-4th-quarter-2016-and-annual-2016; Bureau of Economic Analysis, "Regional Data GDP and Personal Income" (September 29, 2023), https://apps.bea.gov/itable/?ReqID=70&step=1.

Figure 6: Percent Increase in Congestion Costs by Region, 2016 - 2021



State Findings

California's congestion costs climbed 77.9 percent from 2016 to 2021, moving the state from third place to first place in total congestion costs (Table 2). Other noteworthy increases in congestion costs were found in Louisiana and Georgia, both of which rose six spots in the ranking.

Table 2: Top Ten Highest Statewide Congestion Costs, 2021*

2021 Rank	State	Statewide Costs 2016	Statewide Costs 2021	Percent Increase/ Decrease	2016 Rank
1	California	$5,059,865,874	$9,000,397,702	77.9%	3
2	Texas	$6,370,989,857	$7,256,430,452	13.9%	1
3	Florida	$5,637,019,695	$7,157,229,169	27.0%	2
4	New York	$4,347,935,514	$4,917,126,628	13.1%	4
5	Louisiana	$2,300,466,035	$4,217,050,404	83.3%	11
6	Georgia	$2,217,832,813	$4,021,578,225	81.3%	12
7	New Jersey	$3,350,935,617	$3,838,944,444	14.6%	5
8	Illinois	$2,903,204,885	$3,379,889,793	16.4%	6
9	Pennsylvania	$2,885,362,103	$3,268,381,038	13.3%	7
10	Tennessee	$2,838,362,606	$3,154,354,178	11.1%	8

In 2021, two states moved off of the 2016 top ten list. Ohio and North Carolina were ranked 9 and 10 in 2016 but rank 11 and 12, respectively in 2021. Congestion costs for all 50 states can be found in Appendix C.

<u>States with the Highest Percentage Increase in Congestion Costs</u>

Table 3 lists the states with the largest percentage increase in congestion costs from 2016 to 2021. The largest percentage increase was found in Nevada, followed by Louisiana, Georgia and California. In all four of these states, congestion cost increases were fueled by substantial increases in truck volumes during 2020 and 2021, even though all four saw slight increases in average truck speeds during the same years. Slower truck speeds explained the higher congestion costs in just two of the ten states with the highest percentage increase, Indiana and Delaware.

Table 3: Top Ten States by Percentage Increase in Truck Congestion Costs, 2016-2021*

State	Statewide Costs 2016	Statewide Costs 2021	Percent Increase
Nevada	$293,020,626	$636,383,942	117.2%
Louisiana	$2,300,466,035	$4,217,050,404	83.3%
Georgia	$2,217,832,813	$4,021,578,225	81.3%
California	$5,059,865,874	$9,000,397,702	77.9%
Indiana	$1,456,572,175	$2,398,138,214	64.6%
Nebraska	$235,221,302	$373,049,995	58.6%
Maryland	$2,024,487,867	$2,857,975,431	41.2%
Iowa	$384,196,365	$542,135,781	41.1%
Delaware	$356,919,675	$485,229,868	35.9%
Maine	$441,427,416	$595,958,354	35.0%

Nevada experienced an increase in congestion costs of 117 percent between 2016 and 2021. Similarly, Nevada commuters experienced an 8.0 percent increase in delay times.[32] Southern Nevada alone saw a 26.7 percent increase in warehousing total square footage between 2016 and 2021, while warehousing vacancy rates fell by more than half.[33] Nevada is in close proximity to large population centers and ports on the west coast, and is also ranked fifth in population growth rate between the 2010 and 2020 censuses.[34] All of these factors contributed to higher truck VMT, and therefore increased congestion, during the research period.

Both Louisiana's Port of Cado-Bossier (within the Shreveport metro) and Port of New Orleans (NOLA) have seen major growth between 2016 and 2021.[35] Port NOLA saw double-digit growth in the volume of cargo containers between 2018 and 2019, continuing a trend that began in 2010.[36] At the same time, Louisiana's road and bridge infrastructure has worsened, with a 2017 TRIP report finding that "nearly half of major locally and state-maintained roads are in poor or mediocre condition, 13 percent of locally and state-maintained bridges (20 feet or more in

[32] Steven Horsford, "The Infrastructure Investment and Jobs Act: Creating Jobs and Rebuilding Nevada's Economy," Congressman Steven Horsford Serving the 4th District of Nevada (accessed September 22, 2023), https://horsford.house.gov/issues/infrastructure.
[33] Eli Segall, "Las Vegas Valley experiences explosion as distribution hub," *Las Vegas Review-Journal* (December 3, 2022), https://www.reviewjournal.com/business/las-vegas-valley-experiences-explosion-as-distribution-hub-2687693/.
[34] "Empowering Success, Nevada Advantage", Nevada Governor's Office of Economic Development, (accessed September 22, 2023), https://goed.nv.gov/; Elliott Davis Jr., "2020 Census Shows Fastest-Growing States," *U.S. News* (April 28, 2021), https://www.usnews.com/news/best-states/slideshows/these-are-the-10-fastest-growing-states-in-america?onepage.
[35] Frank McCormack, "Port Of Caddo-Bossier Sees Surge In Barge Traffic," *The Waterways Journal Weekly* (May 7, 2018), https://www.waterwaysjournal.net/2018/05/07/port-of-caddo-bossier-sees-surge-in-barge-traffic/.
[36] Port NOLA, "Port of New Orleans Set to Acquire Property for Potential New Container Terminal" (December 17, 2020), https://portnola.com/info/news-media/press-releases/port-of-new-orleans-set-to-acquire-property-for-potential-new-container-terminal.

length) are rated poor/structurally deficient."[37] This combination of rising truck volumes and inadequate infrastructure caused one of the largest congestion cost increases in the country.

Georgia has seen significant growth in cargo movement throughout the state from multiple sources. The Port of Savannah handled a record number of 4.6 million TEUs in 2019 even before a 26 percent spike between that year and 2022 as import volumes shifted to east coast ports during the COVID-19 pandemic.[38] Additionally, record numbers were also set for intermodal transport through Atlanta with a 34 percent increase in cargo in August of 2018.[39] Georgia is also one of the fastest growing states in terms of population; its increase in cargo traffic coincided with that of passenger vehicle traffic.[40]

In 2021, California had eight different corridors identified on ATRI's Top 100 Truck Bottlenecks, as shown in Table 4.[41]

Table 4: Top Truck Bottleneck Locations in California 2021

National Congestion Ranking	Location	Average Peak Speed
7	Los Angeles, CA: SR 60 at SR 57	35.7
8	Los Angeles, CA: I-710 at I-105	28.5
10	San Bernardino, CA: I-10 at I-15	34.1
40	Oakland, CA: I-880 at I-238	34.2
41	Corona, CA: I-15 at SR 91	41.7
58	Los Angeles, CA: I-110 at I-105	31.6
85	Oakland, CA: I-80 at I-580/I-880	29.0
93	Los Angeles, CA: SR 91 at SR 55	40.5

[37] TRIP, "News Release: Louisiana Motorists Lose $7.6 Billion per Year on Roads that are Rough, Congested & Lack Some Desirable Safety Features," *TRIP News* (April 14, 2021), https://tripnet.org/reports/louisiana-transportation-by-the-numbers-statewide-news-release-04-14-2021/.
[38] Twenty-foot Equivalent Unit; Georgia Ports, "GPA unveils major expansions" *GA Ports* (February 4, 2020), https://gaports.com/press-releases/gpa-unveils-major-expansions/; Greg Miller, "East Coast container imports still far above pre-pandemic levels," *FreightWaves* (January 20, 2023), https://www.freightwaves.com/news/east-coast-container-imports-still-far-above-pre-pandemic-levels
[39] DeAnn Komanecky, "Savannah Port Extends Volume Growth," *Transport Topics* (September 18, 2018), https://www.ttnews.com/articles/savannah-port-extends-volume-growth.
[40] Dave Williams, "Georgia population growth outstrips most states," *Albany Herald* (December 21, 2021), https://www.albanyherald.com/news/georgia-population-growth-outstrips-most-states/article_0b566ef6-6284-11ec-a3ea-53af9a085859.html.
[41] American Transportation Research Institute, "Top 100 Truck Bottlenecks – 2023" (accessed on October 10, 2023), https://truckingresearch.org/2023/02/top-100-truck-bottlenecks-2023/.

Rising consumer demand for goods during COVID-19 and operational changes resulting from the state's new truck-related regulations all led to cargo accumulation and significant supply chain disruptions at California's ports and other hubs.[42]

Finally, according to the Indiana Department of Transportation, the state has 1.5 billion tons of freight traveling through each year, and it experienced significant economic and supply chain growth during the research period. [43]

States with Decreasing Congestion Costs

There were a small number of states that experienced a decrease in congestion, with Alaska and Wyoming experiencing the largest drop in congestion costs (Table 5).

Table 5: States with Decreases in Truck Congestion Costs, 2016 – 2021

State	Statewide Costs 2016	Statewide Costs 2021	Percent Decrease
Alaska	$77,750,155	$62,164,857	-20.0%
Wyoming	$208,294,896	$170,380,662	-18.2%
Hawaii	$98,926,900	$89,586,374	-9.4%
Minnesota	$844,217,064	$800,431,419	-5.2%
South Carolina	$1,807,419,435	$1,805,631,555	-0.1%

Alaska struggled with a declining retail sector from 2015 through 2020.[44] The COVID-19 pandemic also had a more negative impact in the state, where low oil prices and fewer tourists hurt two of the state's key industries.[45] Another key industry, fishing, has faced several significant harvest disruptions since 2016 due to environmental factors.[46] Though truck VMT did increase somewhat in 2021 over 2020, it remained lower than previous years.

Wyoming experienced slight (though consistent) annual increases in truck speeds during the research period. It also saw a decline in truck traffic, corroborated by the Bureau of Transportation Statistics estimate of freight flows by state, which lists Wyoming ton-miles as decreasing by 22.22 percent between 2016 and 2021.[47] Wyoming Gross Domestic Product (GDP) also declined during the period, by 1 percent, whereas neighboring states like Colorado,

[42] Budget and Policy Post, "Overview of California's Ports," Legislative Analyst's Office, (August 23, 2022), https://lao.ca.gov/Publications/Report/4618.
[43] Eric Holcomb, "Next Level Indiana," Indiana Department of Transportation (accessed September 22, 2023), https://secure.in.gov/indot/maintenance-operations/next-level-preservation/next-level-indiana/.
[44] St. Louis Federal Reserve Economic Data, "All Employees: Retail Trade in Alaska" (accessed on September 21, 2023), https://fred.stlouisfed.org/series/MSRSAK445.
[45] Scott Cohn, "Alaska, in 'hard-core survival mode,' is America's worst state for business in 2021," *CNBC* (July 13, 2021), https://www.cnbc.com/2021/07/13/why-oil-rich-alaska-is-americas-bottom-state-for-business.html.
[46] U.S. Department of Commerce, National Oceanic and Atmospheric Administration, "Snow Crab and Salmon Declines in Alaska" (accessed September 21, 2023), https://www.fisheries.noaa.gov/alaska/bycatch/frequent-questions-snow-crab-and-salmon-declines-alaska.
[47] U.S. Bureau of Transportation Statistics, "Freight Flows By State" (accessed on September 20, 2023), https://www.bts.gov/browse-statistical-products-and-data/state-transportation-statistics/freight-flows-state.

Idaho, and Montana all saw GDP increases of at least 2 percent.[48] Another contributing factor is likely a decline in coal production due to decreasing coal demand.[49]

Hawaii's economy was particularly vulnerable to the COVID-19 pandemic due to its reliance on the tourism industry and air travel; thus, its recovery was slow.[50] Fewer tourists resulted in lower demand for most goods. Overall, traffic and truck VMT in Hawaii declined with the COVID-19 pandemic and had not yet recovered by the end of 2021, which led to an average truck speed increase of 7.8 percent between 2016 and 2021.

Minnesota's changes may be due in part to fewer cars on the road during rush hour, thus raising truck speeds. Prior to the pandemic, only 6.4 percent of Minnesota residents worked from home; in 2021, this number rose to 20.6. [51] The state's urban center, Minneapolis-St. Paul, saw even greater work from home percentages, rising to 26.0 percent by 2021.[52]

Figure 7 shows the state-by-state congestion cost increases and decreases between 2016 and 2021.

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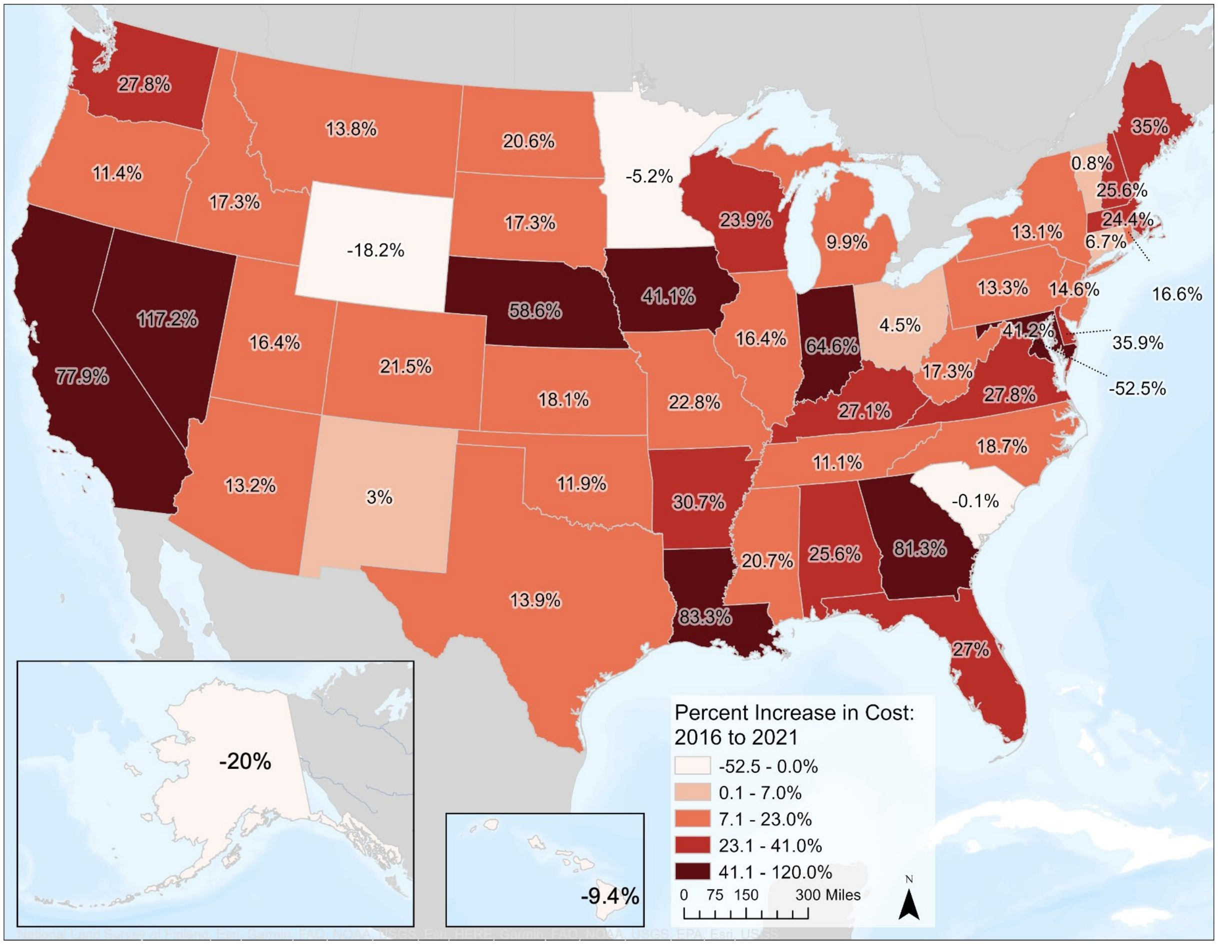
[48] U.S. Bureau of Economic Analysis, "SAGDP1 State annual gross domestic product (GDP) summary" (accessed on September 20, 2023), https://www.bea.gov/itable/regional-gdp-and-personal-income.
[49] State of Wyoming, "Wyoming State Geological Survey: Coal Production and Mining" (accessed October 3, 2023), https://www.wsgs.wyo.gov/energy/coal-production-mining.aspx.
[50] Steven Bond-Smith and Peter Fuleky, "The effects of the pandemic on the economy of Hawaii," The Economic Research Organization (July 31, 2022), University of Hawaii, https://uhero.hawaii.edu/wp-content/uploads/2022/09/UHEROwp2204.pdf.
[51] Michael Burrows, Charlynn Burd, and Brian McKenzie, "Home-Based Workers and the COVID-19 Pandemic", American Community Survey Reports, (April 2023), https://www.census.gov/content/dam/Census/library/publications/2023/acs/acs-52.pdf.
[52] Ibid.

Figure 7: Changes in Truck Congestion Costs by State



Metropolitan Area Findings

Congestion cost trends for 104 metropolitan areas were also analyzed. All of the top ten most congested metro areas in the 2016 report remained in the top ten list in 2021, though there were some slight changes in rank as shown in Table 6.

Table 6: Top Ten Metropolitan Areas by Total Cost of Congestion

2021 Rank	Metro	2016 Costs	2021 Costs	Percent Increase	2016 Rank
1	New York City Metro	$4,932,953,601	$5,491,372,273	11.32%	1
2	Miami Metro	$2,242,274,080	$2,618,229,310	16.77%	3
3	Chicago Metro	$2,277,859,490	$2,570,539,181	12.85%	2
4	Philadelphia Metro	$1,662,591,687	$2,101,897,497	26.42%	4
5	Los Angeles Metro	$1,634,100,455	$1,804,864,142	10.45%	5
6	Dallas Metro	$1,381,875,913	$1,795,595,925	29.94%	7
7	Houston Metro	$1,359,055,928	$1,633,751,272	20.21%	8
8	Washington DC Metro	$1,408,773,640	$1,613,805,707	14.55%	6
9	Nashville Metro	$1,105,626,789	$1,440,765,701	30.31%	10
10	Atlanta Metro	$1,114,969,089	$1,393,415,723	24.97%	9

Miami, Dallas, Houston and Nashville all moved up one spot, the Washington D.C. metro fell two spots, and Chicago and Atlanta each fell one spot. New York, Philadelphia and Los Angeles saw no change.

Metro Areas with the Highest Percentage Increase in Congestion Costs

In terms of percentage change, the metro areas with the largest increases are shown in Table 7. Shreveport topped the list, followed by Little Rock, Memphis, Reno and Chattanooga.

Table 7: Metro Areas with the Highest Percent Increase in Congestion Costs

Metro	2016 Costs	2021 Costs	Percent Increase
Shreveport-Bossier City, LA Metro	$373,511,743	$572,103,859	53.17%
Little Rock, AR Metro	$328,408,589	$467,074,314	42.22%
Memphis, TN Metro	$408,754,574	$568,936,403	39.19%
Reno, NV Metro	$15,670,804	$21,777,348	38.97%
Chattanooga, TN Metro	$391,094,415	$541,175,865	38.37%
Ashville, NC Metro	$197,837,991	$271,396,749	37.18%
San Antonio, TX Metro	$381,050,796	$522,405,622	37.10%
Greensboro, NC Metro	$154,190,643	$210,979,249	36.83%
Louisville, KY Metro	$581,528,231	$791,011,238	36.02%
Columbia, SC Metro	$334,887,831	$451,040,751	34.68%

Four of the metro areas with the highest percentage increase in congestion costs saw average truck speeds improve between 2016 and 2021 but saw truck volumes increase at a much greater rate. Those metro areas were Reno, Chattanooga, Asheville and Columbia.

Additionally, many of the metro areas on the list have inland ports or intermodal hubs that saw growth during the COVID-19 pandemic.

The Shreveport metro area (Louisiana) is home to the Port of Caddo-Bossier, which has undergone significant growth since 2016 including a 193 percent increase in barge cargo in 2017.[53] Other major projects totaling over $750 million near the port were announced in 2021, all of which indicate continued growth.[54] This increase in freight activity coincided with poor road and bridge infrastructure, to further worsen truck congestion.[55]

[53] Frank McCormack, "Port Of Caddo-Bossier Sees Surge In Barge Traffic," *The Waterways Journal Weekly* (May 7, 2018), https://www.waterwaysjournal.net/2018/05/07/port-of-caddo-bossier-sees-surge-in-barge-traffic/.
[54] Robert J. Wright, "3 Big Reasons the Shreveport – Bossier Economy is About to Explode," *KEEL* (December 22, 2021), https://710keel.com/3-big-reasons-the-shreveport-bossier-economy-is-about-to-explode/.
[55] Scott Ferrell, "Study says road and bridge conditions in Shreveport costing drivers more than $2K per year," *Shreveport Times* (April 15, 2021), https://www.shreveporttimes.com/story/news/local/2021/04/15/study-shows-bad-roads-cost-shreveport-drivers-more-than-2000-annually/7228653002/.

Little Rock, an intermodal hub serviced by multiple Class I railroads and barge traffic, has experienced significant freight growth over the past several years as well, which has resulted in increased congestion. In response to this growth, the Port of Little Rock is currently building a new 64-acre industrial park.[56] Additional factors leading to increased volume-based congestion include the city's central location and high truck traffic on I-40 which links it to Memphis, another intermodal hub among the metros with the most increased congestion.[57]

Memphis is widely considered one of the most critical supply chain hubs in the U.S.; the metro area includes the operations of five Class I railroads, the busiest cargo airport in the country, and a major inland port.[58] This metro area has experienced a greater share of national freight volume growth and delays over the past half decade, especially as imports shifted to southern and east coast ports when western port costs and congestion increased.[59] The growth of supply chain jobs in Memphis, accordingly, has outpaced the nation as a whole over the last decade.[60]

Reno was a major contributor to Nevada's overall congestion cost increase. One cause of lower truck speeds was roadwork pertaining to the Reno's Spaghetti Bowl project at the key juncture of I-80 and I-580.[61] At the same time, economic, warehousing, and population booms have fueled greater freight volumes in the city over the past five years.[62]

Truck VMT increased in Chattanooga between 2016 and 2021 for many of the same reasons as in Memphis. The city is at the center of the regional network that links the supply chain hubs of Atlanta and Nashville as well as the Port of Savannah. With a disproportionately high share of national freight movement, Chattanooga was positioned to experience a higher share of growth.[63] Congestion also increased due to construction at the key interchange between I-24 and I-75 – a location that jumped in ATRI's top truck bottlenecks from 51st in 2019 to 7th in 2021 as average speeds decreased by nearly 6 MPH since 2016.[64]

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[56] Heather Ervin, "Groundbreaking of new facility at Port of Little Rock underway," *Marine Log* (July 14, 2022), https://www.marinelog.com/inland-coastal/inland/groundbreaking-of-new-facility-at-port-of-little-rock-underway/.
[57] Dean Croke, "Little Rock isn't so little anymore," DAT Freight & Analytics (August 3, 2022), https://www.dat.com/blog/little-rock-isnt-so-little-anymore,
[58] Business Facilities Editors, "Top Logistics Hubs: Links to Success," *Business Facilities* (May/June 2023), https://businessfacilities.com/top-logistics-hubs-links-to-success/.
[59] Almas Palsani, "Intermodal Congestion: What is Happening in Memphis, Tennessee?" *More Than Shipping* (August 2, 2021), https://www.morethanshipping.com/intermodal-congestion-what-is-happening-in-memphis-tennessee/; Lori Ann LaRocco, "East Coast ports including New York are winning a domestic trade war at the expense of California," *CNBC* (December 15, 2022), https://www.cnbc.com/2022/12/15/east-coast-ports-like-new-york-are-winning-trade-war-over-california.html.
[60] Ryan Poe, "Report: Memphis No. 1 in the Nation for its Supply Chain & Logistics Concentration," Greater Memphis Chamber (April 19, 2023), https://blog.memphischamber.com/report-memphis-no.-1-in-the-nation-for-its-supply-chain-logistics-concentration.
[61] Nevada Department of Transportation, "Spaghetti Bowl Xpress; Safety, Congestion and Community Improvements," (accessed September 21, 2023), https://www.dot.nv.gov/home/showpublisheddocument/21664/638174107551130000.
[62] Paul Farrell, "Reno is named America's latest boom-town," *Daily Mail UK* (October 14, 2022), https://www.dailymail.co.uk/news/article-11316283/Reno-named-Americas-latest-boom-town-house-prices-70-four-years.html.
[63] FreightWaves, "Freight Alley: a region where logistics contributes to more than 40% of the economy" (September 19, 2018), https://www.freightwaves.com/news/freight-alley-where-its-at.
[64] Trista Pruitt, "What's going on with the road construction in Chattanooga, TN?" *Nooga Today* (April 29, 2021), https://noogatoday.6amcity.com/road-construction-chattanooga-tn; American Transportation Research Institute, "Top 100 Truck Bottlenecks – 2021" (February 2021), https://truckingresearch.org/2021/02/2021-top-truck-bottlenecks/.

Metro Areas with Decreasing Congestion Costs

There were three metro areas out of 104 that had decreases in congestion costs (Table 8).

Table 8: Metro Areas with Decreases in Congestion Costs

Metro	2016 Costs	2021 Costs	Percent Decrease
Buffalo Metro	$336,609,622	$322,063,522	-4.32%
San Francisco Metro	$713,670,963	$703,019,056	-1.49%
Tulsa Metro	$92,566,482	$92,024,449	-0.59%

The Buffalo metro area had the highest percentage decrease in congestion, followed by San Francisco and Tulsa. Truck traffic volume (measured in VMT) in these metro areas had not yet recovered to pre-pandemic levels by the end of 2021.

In Buffalo, average truck speeds increased by 6.3 percent between 2016 and 2021, resulting from reduced traffic caused by a decline in cross-border passenger vehicle traffic during COVID-19 pandemic restrictions.[65] The slight decrease in truck congestion is corroborated by FAF projections, which estimate a decline in freight volumes along highways with existing bottlenecks.[66]

While California saw an increase in congestion costs since 2016, the city of San Francisco has experienced a decrease. Major contributors to this decrease were reduced consumer spending and the abundance of work-from-home activity within the metro area, where 35.1 percent of residents worked remotely in 2021. Additionally, the city led the U.S. in commercial vacancy rates.[67] As a result, traffic volumes declined significantly in downtown San Francisco.[68]

Truck VMT declined in Tulsa specifically and Oklahoma more broadly during the first years of the research period, in conjunction with declines in the state's oil industry.[69] Average truck speeds also improved with the completion of several construction projects on key Tulsa highways, including I-244, between 2016 and 2018.[70]

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[65] Charlotte Keith, "Decline in cross border traffic 'very significant'," *Investigative Post* (May 23, 2018), https://www.investigativepost.org/2018/05/23/decline-in-cross-border-traffic-very-significant/.

[66] Greater Buffalo-Niagara Regional Transportation Council, *Buffalo-Niagara Regional Freight Plan* (May 2021), https://static1.squarespace.com/static/56ccbbfd3c44d8670dbd1d84/t/60c7a58573164e7d58d0d12a/1623696784079/Final+Report+%28Web+Version%29.pdf.

[67] Michael Burrows, Charlynn Burd, and Brian McKenzie, "Home-Based Workers and the COVID-19 Pandemic", American Community Survey Reports, (April 2023), https://www.census.gov/content/dam/Census/library/publications/2023/acs/acs-52.pdf; Avery Koop, "Ranked: The U.S. Cities with the Most Vacant Offices," *Visual Capitalist* (August 2, 2023), https://www.visualcapitalist.com/us-cities-most-vacant-offices/.

[68] Ibid; James Salazar, "Study: Downtown SF had worst traffic drop of 20 biggest in US," *SF Examiner* (July 26, 2023), https://www.sfexaminer.com/news/business/downtown-sf-traffic-drop-post-covid-worst-of-20-major-cities/article_71eee976-2be7-11ee-bb48-bb92fa4b06f3.html.

[69] Mike W. Ray, "Trucking industry on the skids due to Oklahoma's oil decline," *Southwest Ledger News* (December 23, 2019), https://www.southwestledger.news/trucking-industry-skids-due-oklahomas-oil-decline.

[70] Oklahoma Department of Transportation, "Highway Construction Update: Tulsa Metro" (Summer 2015), https://www.odot.org/newsmedia/ohcu/tulsa.htm; Interstate-Guide, "Interstate 244 Oklahoma" (accessed September 21, 2023), https://www.interstate-guide.com/i-244-ok/.

Infrastructure Funding Available to Reduce Congestion

The U.S. Congress passed the Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law, in November 2021.[71] This bill provides approximately $1.2 trillion in infrastructure investments from 2022 through 2026 and includes approximately $350 billion that is dedicated to federal highway programs.[72] Most of the highway funds are allocated to states based on existing funding formulas (90% federal funding with 10% state match), though some funds are available through competitive grant programs.[73]

This infrastructure funding is critical to addressing the congestion costs documented in this report. According to a White House report, "one-in-five miles of our roadways and more than 45,000 bridges in the United States [are] rated as 'in poor condition.'"[74] Along with congestion issues, this type of infrastructure deficiency often creates safety hazards, road-related vehicle damage and repair costs, and road and bridge restrictions that negatively impact the supply chain.

The new IIJA provides numerous funding programs that states can use to target congestion chokepoints and traffic bottlenecks. For example, some of the key funding programs within IIJA that can be used to reduce congestion include:[75]

[71] Federal Highway Administration, "Bipartisan Infrastructure Law" (accessed on October 3, 2023), U.S. Department of Transportation, https://www.fhwa.dot.gov/bipartisan-infrastructure-law/; Jonathan Ponciano, "Everything In The $1.2 Trillion Infrastructure Bill: New Roads, Electric School Buses And More," *Forbes* (November 15, 2022), https://www.forbes.com/sites/jonathanponciano/2021/11/15/everything-in-the-12-trillion-infrastructure-bill-biden-just-signed-new-roads-electric-school-buses-and-more/?sh=16a3a231161f.
[72] Federal Highway Administration, "Bipartisan Infrastructure Law: Funding" (accessed on October 3, 2023), U.S. Department of Transportation, https://www.fhwa.dot.gov/bipartisan-infrastructure-law/funding.cfm.
[73] American Road & Transportation Builders Association, "Highway Dashboard - IIJA: Tracking Infrastructure Investment & Jobs Act Highway and Bridge Resources" (accessed on October 3, 2023), https://www.artba.org/economics/highway-dashboard-iija/.
[74] The White House, "A Guidebook to the Bipartisan Infrastructure Law" (accessed on October 3, 2023), https://www.whitehouse.gov/build/guidebook/.
[75] Ryan Levandowski, "Issue Brief: Flexible Federal Funding Opportunities for State and Local Clean Transportation Investments," Georgetown Climate Center (February 3, 2023), https://www.georgetownclimate.org/blog/federal-transportation-funding-flexibility.html; Federal Highway Administration, "Biden-Harris Administration Opens Applications for Nearly $10 Billion in Funding to Improve Nation's Bridges" (September 29, 2023), U.S. Department of Transportation, https://highways.dot.gov/newsroom/biden-harris-administration-opens-applications-nearly-10-billion-funding-improve-nations; U.S. Department of Transportation, "Biden-Harris Administration Announces $1.5 Billion from the Bipartisan Infrastructure Law for 26 Transportation Projects Nationwide" (September 15, 2022), https://www.transportation.gov/briefing-room/biden-harris-administration-announces-15-billion-bipartisan-infrastructure-law-26; Federal Highway Administration, "President Biden, USDOT Announce New Guidance and $6.4 Billion to Help States Reduce Carbon Emissions Under the Bipartisan Infrastructure Law" (April 21, 2022), U.S. Department of Transportation, https://highways.dot.gov/newsroom/president-biden-usdot-announce-new-guidance-and-64-billion-help-states-reduce-carbon; U.S. Senate Committee on Commerce, Science, & Transportation, "Cantwell's Megaprojects Program Will Move Hudson Tunnel & 8 Other Major Projects Forward, Creating Jobs, Improving Supply Chain, Easing Commuters' Lives" (January 31, 2023), https://www.commerce.senate.gov/2023/1/cantwell-s-megaprojects-program-will-move-hudson-tunnel-8-other-major-projects-forward-creating-jobs-improving-supply-chain-easing-commuters-lives.

- $148 billion for National Highway Performance funding
- $13.2 billion for Congestion Mitigation and Air Quality Improvements
- $40 billion for dedicated bridge repair and replacement
- $7.15 billion for the National Highway Freight Program
- $8 billion for Infrastructure for Rebuilding America (INFRA)
- $6.4 billion for Carbon Reduction project funding
- $5 billion for "megaprojects"

Given that many of these funding programs require cost-sharing from the applicant, the scale of the total investment being proposed goes up substantially. It should be noted that additional economic benefits come with infrastructure investment. FHWA estimates that every $1 billion in road and/or bridge investment supports the creation of 13,000 jobs.[76]

Fortuitously, this 2023 ATRI *Cost of Congestion* report provides states with both a blueprint and the rationale for utilizing IIJA funding to target congestion. Table 9 shows the IIJA resources that are available to the top ten most congested states.[77]

Table 9: Congestion Costs vs IIJA Resources by State*

	Statewide Congestion Costs – 2021	IIJA Resources Available 2022-2026
California	$9.00 B	$29.93 B
Texas	$7.25 B	$27.84 B
Florida	$7.15 B	$13.51 B
New York	$4.91 B	$13.64 B
Louisiana	$4.21 B	$5.93 B
Georgia	$4.02 B	$9.26 B
New Jersey	$3.83 B	$8.14 B
Illinois	$3.37 B	$11.32 B
Pennsylvania	$3.26 B	$13.12 B
Tennessee	$3.15 B	$6.22 B

For a list of congestion costs, IIJA funding levels, and the number of projects supported in all states, see Appendix C.

[76] American Road & Transportation Builders Association, "Highway Dashboard - IIJA: Tracking Infrastructure Investment & Jobs Act Highway and Bridge Resources" (accessed on October 3, 2023), https://www.artba.org/economics/highway-dashboard-iija/.
[77] Invest.gov, "Investing in America Map", The White House (updated October 3, 2023), https://www.whitehouse.gov/wp-content/uploads/2023/10/Invest.gov_PublicInvestments_Map_Data_Updated10032023.xlsx.

CONCLUSION

This *Cost of Congestion* research generated a series of index-based truck congestion cost datasets – ultimately providing insight into national, state and metro area congestion cost trends for the trucking industry from 2016 through 2021.

National Findings

Based on this analysis, the cost of congestion to the trucking industry is at its highest level to-date. In 2021, the annual cost of congestion to the U.S. trucking industry reached an all-time high of $94.6 billion, up from $74.5 billion in 2016.

This $20.1 billion increase in trucking industry congestion costs equates to a 27.0 percent increase. This percentage increase is more than twice that of inflation during the same time period. Additionally, the 2021 national congestion figure of 1.27 billion hours of delay is the equivalent of more than 460,000 truck drivers sitting idle for one year. On average, annual congestion costs per truck were $6,824.

These congestion delays generate fuel and environmental consequences. This report estimates that in 2021 6.793 billion additional gallons of diesel were wasted due to congestion, costing the industry more than $22.3 billion. The CO_2 production associated with additional fuel use is substantial at 69 million metric tons.

While costs increased in all regions of the county, the congestion cost increases by percentage were highest in the West (45.0%) and the Southeast (32.3%).

State Findings

The congestion cost increases experienced by individual states were primarily driven by truck volume increases resulting from economic growth and increased consumer spending. From a supply chain efficiency standpoint, it is clear nonetheless that work-from-home policies were a benefit to the trucking industry, improving average truck speeds well into 2021. As work from home policies are lifted, and more drivers choose to commute via car, it is likely that congestion costs will continue to increase.

Specifically at the state level, the four states with the highest congestion costs were ranked as follows:

1. California
2. Texas
3. Florida
4. New York

These four states alone make up 30.0 percent of national congestion costs and, not surprisingly, this ranking aligns exactly with state population rankings. California had the largest congestion cost increase – growing nearly $4 billion from 2016 to 2021. The largest congestion cost increases by percentage were found in Nevada (117.2%), Louisiana (83.3%), Georgia (81.3%) and California (77.9%) – fueled in large part by growth in freight-related sectors.

Metropolitan Findings

Congestion costs were highest in the New York City, Miami and Chicago metropolitan areas, though cost increases in these leading metros were modest – landing between 11 and 17 percent. Several smaller metro areas had costs increase at a much greater rate, including Shreveport (53.17%), Little Rock (42.22%) and Memphis (39.19%). These cities contain ports and major intermodal hubs that experienced an increased share of freight volumes beginning with the COVID-19 pandemic.

Infrastructure Spending

While the federal fuel taxes have not been raised since 1993 and most states have been forced to dramatically reduce infrastructure spending relative to needs, the 117th U.S. Congress did pass a landmark infrastructure spending bill that generates more than $350 billion dollars in dedicated transportation spending. By the end of Year 2 of the five-year IIJA program, transportation projects totaling more than $74 billion had been awarded or announced, ostensibly focused on congestion reduction, road safety and/or freight transportation priorities.[78]

Summary

While 2021 was an unprecedented year, 2022 will almost certainly see even greater congestion costs for trucking. The trucking industry's operational costs in 2022 increased 21.3 percent over the prior year.[79] This in part is due to increased fuel and labor costs. Likewise, ATRI's bottleneck analysis for 2022 showed increased congestion, a key driver in the *Cost of Congestion* report calculations, with the average peak hour truck speed across the top bottlenecks dropping 6.1 percent to 36.3 MPH in 2022.[80] What remains to be seen are the final national VMT figures for 2022 – these too are likely to increase. As the necessary data points are available, ATRI plans to continue updating this research annually.

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[78] Invest.gov, "Investing in America Map", The White House (updated October 3, 2023), https://www.whitehouse.gov/wp-content/uploads/2023/10/Invest.gov_PublicInvestments_Map_Data_Updated10032023.xlsx.

[79] Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: 2023 Update* (June 2023), https://truckingresearch.org/2023/06/an-analysis-of-the-operational-costs-of-trucking-2023-update/.

[80] American Transportation Research Institute, "The Nation's Top Truck Bottlenecks 2023," Executive Summary, latest version available https://truckingresearch.org/wp-content/uploads/2023/02/ATRI-2023-Top-Truck-Bottlenecks-Executive-Summary.pdf.

APPENDIX A: COMPARISON OF ATRI FMI AND NPMRDS SPEED DATA

The following analysis was provided to ATRI by Dr. Chen-Fu Liao. The objective of this analysis was to understand and evaluate the speed differences between the ATRI FMI truck GPS data and the hourly average speed reported in the NPMRDS. A sample set of speed data was drawn from both sources covering I-75, I-285, and I-85 in the Atlanta metro area in 2019. Data were loaded in a PostgreSQL DB for processing. Statistical and spatial analyses were conducted using the open-source R and QGIS software, respectively.

Data Analysis Summary

Figure A1 displays two density plots for the hourly average speed from ATRI FMI truck GPS data and NPMRDS data in the sample area. The FMI data has an average speed of 55.0 MPH (SD=11.1 MPH), and the NPMRDS data has an average speed of 58.5 MPH (SD=9.4 MPH).

Figure A1: Density Plot of FMI and NPMRDS Speed Data

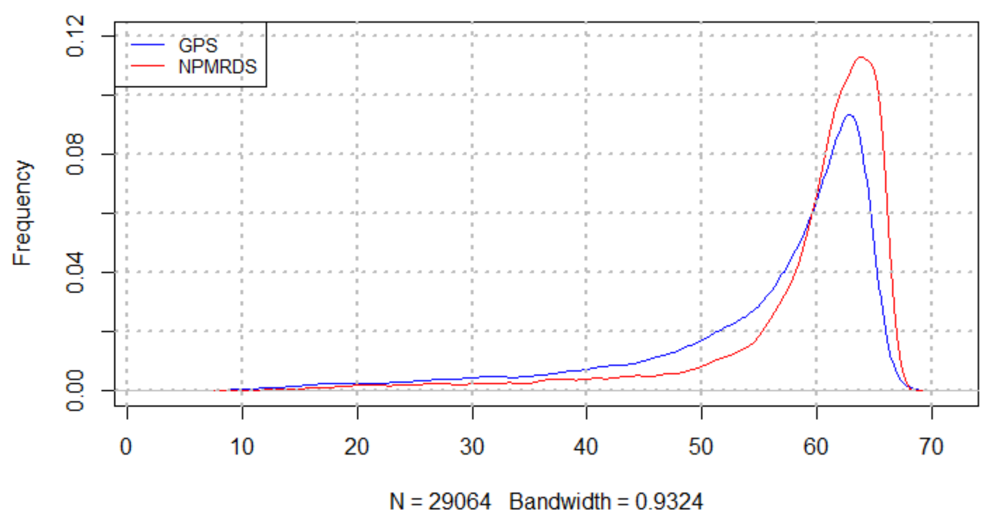

Figure A2 displays a skewed right distribution of the speed difference (NPMRDS-FMI) with 92 percent of the NPMRDS reported speed being higher than the average GPS speed at each corresponding roadway segment.

Figure A2: Density Plot of FMI and NPMRDS Speed Difference

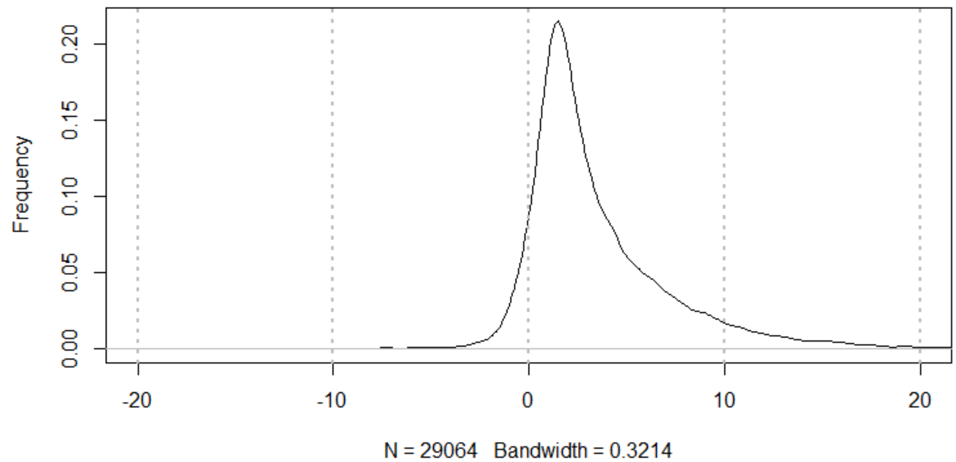

Figure A3 illustrates another view of the data comparison by using a quantile plot of the FMI vs NPMRDS speed distribution. Most of the red scattered dots are above the diagonal blue line, indicating that NPMRDS speed is higher than the FMI speed.

Figure A3: Quantile Plot of GPS vs NPMRDS Speed

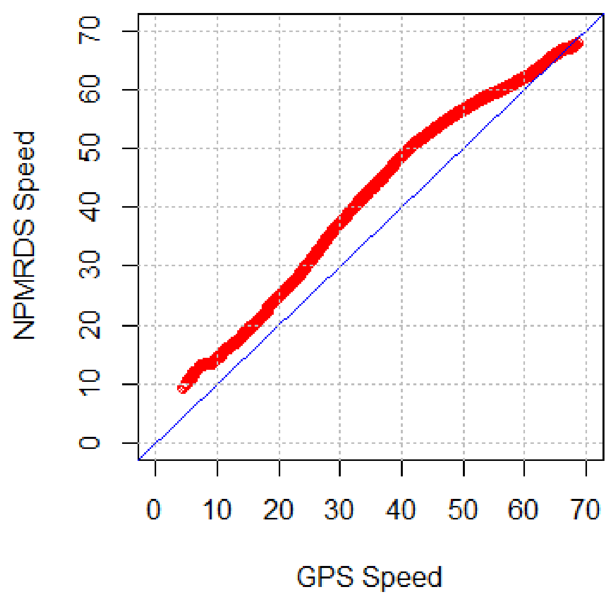

Table A1 lists a summary of speed difference (GPS vs NPMRDS) statistics. In general, the FMI speed is about 1.2 to 4.9 MPH slower than the speed reported in NPMRDS.

Table A1: FMI vs NPMRDS Speed Difference

Comparison	Speed Difference Statistics (MPH)						
	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	N
NPMRDS/GPS Differences	-10.92	1.16	**2.38**	**3.55**	4.90	34.98	29,064

On the basis of these substantial speed differences throughout the data, the researchers concluded that NPMRDS speed data from the research period was inconsistent with the speed data used in previous *Cost of Congestion* studies.

APPENDIX B: INDEXING METHODOLOGY

A more detailed description of the indexing methodology and three-related data components is provided in this appendix.

Calculation of Three Key Components

Component One: Operational Costs

ATRI annually collects and publishes these data for all time periods, represented as a marginal cost per hour, as part of its annual *Analysis of the Operational Costs of Trucking*.[81] Detailed operating costs are submitted by motor carriers from all sectors and regions of the country, representing between 120,000 and 180,000 Class 7/8 combination trucks annually. The marginal cost per hour for each year was used as one of the three components in the final indexing methodology.

Component Two: Truck Volumes

As part of the indexing methodology, changes in annual volume measurements for combination trucks were sourced from FHWA's *Highway Series*, which includes a measure of U.S. combination truck vehicle miles traveled (VMT) annually, shown in Figure 2.[82] The analysis described in this report utilizes the annual VMT values to estimate the fluctuation in the number of trucks and drivers impacted by congested roadway segments each year.

FHWA's *Highway Series* tracks two relevant state-level metrics, separately for urban and rural areas: VMT per road type for all vehicles and the distribution of VMT traveled by each vehicle type on each road type. Combination truck VMT for each state were calculated by multiplying the total VMT for each road type by the share of combination truck volume in each road type and then summing across all road types. Road types are defined differently by *Highway Series* for these two data points, but they correspond as shown in Table B1 (categories and their correspondences are the same for urban and rural areas).

[81] Alex Leslie and Dan Murray, *An Analysis of the Operational Costs of Trucking: 2023 Update*, American Transportation Research Institute (June 2023), https://truckingresearch.org/2023/06/an-analysis-of-the-operational-costs-of-trucking-2023-update/.
[82] Federal Highway Administration, *Highway Statistics Series: Table VM-2 and VM-4*, Annual Report (2016-2021), https://www.fhwa.dot.gov/policyinformation/statistics.cfm.

Table B1: Highway Statistics Road Category Correspondences

Functional System Mileage Category	Vehicle Mileage Distribution Category
Interstate	Interstate System
Other Freeways and Expressways	Other Arterials
Other Principal Arterials	Other Arterials
Minor Arterials	Other Arterials
Major Collectors	Other
Minor Collectors	Other
Local	Other

Changes in truck volume did not contribute to delay calculations if the average speed remained at free-flow, as a sustained year-over-year average speed at free-flow indicates that the highway system is successfully handling any increases in volume.

Finally, for each state, researchers calculated the percent change between the total combination truck VMT of each year and that of the base year.

These volume measures were ultimately used as the second of the three components in the final indexing methodology.

Component Three: Speed

To develop speed measurements and ultimately changes in delay from the 2016 baseline, a sample of roadways was utilized for the years 2017 through 2021. This sample focused on those roadways that are most critical to the trucking industry. Using this sampling approach was ideal since it: 1) decreased data processing times; 2) focused on U.S. highway segments with high truck volume; and 3) focused on U.S. highway segments where congestion is the biggest problem.

It was noted in the last *Cost of Congestion* report that travel delay is "concentrated on a relatively small portion of U.S. roadways, with just 17.2 percent of NHS segment miles representing almost 87 percent of total congestion costs nationwide in 2016."[83]

ATRI's bottleneck monitoring program was utilized as the foundation of the sampling approach. This program monitors congestion at more than 300 U.S. locations, drawn from all 50 states as

[83] Alan Hooper, *Cost of Congestion to the Trucking Industry: 2018 Update*, American Transportation Research Institute (October 2018), https://truckingresearch.org/2018/10/cost-of-congestion-to-the-trucking-industry-2018-update/.

well as the District of Columbia.[84] For the purposes of this report, these locations were expanded in geographic size to increase sample size.[85] The geographic increase is described as the "expanded bottleneck" monitoring data.

Data for the years 2016 through 2021 were next processed to identify speed fluctuations for the indexing methodology.

Calculation of Total Delay and Congestion Costs using the Three Components

The total delay calculation is a function of the speed of freight movement and the amount of freight impacted. Changes in speed, as measured by the average truck speed per hour, correspond to changes in delay. Changes in volume as measured by the total truck VMT correspond to changes in the impact of that delay. Using truck speed and truck volume figures for each state, and for each year, it was possible to estimate total delay time in hours by indexing to the base year (2016) delay time as described below.

- First, each state's base year total delay time was multiplied by the percent change in its average speed; this calculation represents the year-to-year change in hours of delay measured by increasing or decreasing average speeds.

- Second, each state's base year total delay time was multiplied by the percentage change in its combination truck VMT; this calculation represents the year-to-year change in the impact of delay on motor freight.

Total annual delay for each state was determined by adding the change in its combination truck VMT to the base year delay and then subtracting the change in its speed. This calculation can be represented as:

$$delay_{sy} = delay_{sb} + delay_{sb}\frac{vmt_{sy}-vmt_{sb}}{vmt_{sb}} - delay_{sb}\frac{speed_{sy}-speed_{sb}}{speed_{sb}}$$

Where:
- $delay$ is
- s is a single state
- y is a single year
- b is the base year of 2016
- $speed$ is the average truck speed
- vmt is the vehicle miles traveled by combination trucks

Operational costs data were next used to determine the costs incurred by delays. Each state's total annual delay time was multiplied by the industry average marginal cost of operating a truck per hour to determine its congestion cost for each respective year.

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[84] ATRI, "Top 100 Truck Bottlenecks – 2023" (February 2023), https://truckingresearch.org/2023/02/top-100-truck-bottlenecks-2023/.
[85] To ensure a representative sample of data beyond just the bottleneck congestion, the research team altered each bottleneck by doubling its roadway "footprint" in all directions. For example, if the original bottleneck consisted of 2.5 miles of roadway in both the northern and eastern directions, each leg of the bottleneck was doubled for a total of five miles in each direction. Performing this exercise for each of the more than 300 truck bottleneck locations ensures that a varied dataset was collected and processed, not just the area of roadway in which highly congested traffic occurs.

The total national delay time and cost of congestion for each year were calculated by summing the delays and costs of all states.

Continuity Testing

The indexing methodology used in this report was evaluated for continuity with the methodology of previous *Cost of Congestion* reports. An indexing approach was chosen precisely to ensure a direct link between the two methods.

Each of the three components used in calculating delay costs was selected for consistency and assessed separately. The data source and application of costs per hour remained entirely unchanged between the methodology of the previous report and the indexing methodology used in this report. The selection of expanded bottleneck segments used for calculating average speeds was informed by the areas that had the highest congestion and truck volume in previous *Cost of Congestion* reports. Volume data was drawn from FHWA's *Highway Series*, which the previous methodology had used to adjust FAF volumes.

The indexing methodology was tested by using the 2015 results from the previous methodology (as published in *Cost of Congestion to the Trucking Industry: 2017 Update*) as a base year to generate indexed 2016 results for comparison with the 2016 results from the previous methodology, as published in *Cost of Congestion to the Trucking Industry: 2018 Update*.[86] On average, state congestion delay results were 5 percent higher in the indexing method.

Required Modifications for Metropolitan Area Costs

Total delay time and congestion costs for metropolitan areas required a unique processing approach for two reasons. First, FHWA only publishes total traffic VMT by road type at the metro-level, without any statistics on the distribution of VMT by vehicle type. Second, many metropolitan areas span multiple states.

To address these gaps, metropolitan-level truck VMT was estimated using total VMT data from each metropolitan area and a national average of combination trucks' percent share of total VMT on each road type in each state. Only urban road type data was used in metropolitan area analysis. While the resulting averages are not metro-specific, they do represent changes in trucking's percent share of total traffic that can be combined with metro-specific data in a reliable and consistent manner. The national average of combination trucks' share of VMT on each urban road type was multiplied by each metro's total VMT in the corresponding urban road type (Table 1). Finally, VMT figures were summed across all road types to determine the estimated combination truck VMT for each metropolitan area in each year.

Aside from this change to truck VMT calculation, the method for calculating metropolitan area delays and costs was identical to that for calculating state delays and costs.

[86] W. Ford Torrey, *Cost of Congestion to the Trucking Industry: 2017 Update*, American Transportation Research Institute (May 2017), https://truckingresearch.org/2017/05/cost-of-congestion-to-the-trucking-industry-2017-update/. and;
Alan Hooper, *Cost of Congestion to the Trucking Industry: 2018 Update*, American Transportation Research Institute (October 2018), https://truckingresearch.org/2018/10/cost-of-congestion-to-the-trucking-industry-2018-update/.

APPENDIX C: CONGESTION COSTS, IIJA FUNDING AND IIJA FUNDED HIGHWAY PROJECTS BY STATE

Below is a state-by-state list of congestion costs, IIJA funding levels and projects with a nexus to highways that have been funded under IIJA.[87]

State	2021 Statewide Cost of Congestion	IIJA Resources Available 2022-2026	Number of Funded Projects
Alabama	$1,304,300,321	$5,530,000,000	594
Alaska	$62,164,857	$3,730,000,000	428
Arizona	$811,125,558	$5,350,000,000	301
Arkansas	$1,058,280,618	$3,900,000,000	282
California	$9,000,397,702	$29,930,000,000	1,063
Colorado	$1,068,223,039	$4,010,000,000	459
Connecticut	$1,361,412,548	$4,080,000,000	290
Delaware	$485,229,868	$1,410,000,000	86
District of Columbia	$39,368,853	$1,340,000,000	94
Florida	$7,157,229,169	$13,510,000,000	1,213
Georgia	$4,021,578,225	$9,260,000,000	826
Hawaii	$89,586,374	$1,520,000,000	80
Idaho	$272,190,029	$2,230,000,000	240
Illinois	$3,379,889,793	$11,320,000,000	1,023
Indiana	$2,398,138,214	$7,070,000,000	1,169
Iowa	$542,135,781	$3,870,000,000	313
Kansas	$409,523,739	$2,870,000,000	113
Kentucky	$2,411,968,336	$5,090,000,000	426
Louisiana	$4,217,050,404	$5,930,000,000	501
Maine	$595,958,354	$1,520,000,000	295
Maryland	$2,857,975,431	$4,620,000,000	396
Massachusetts	$2,246,162,535	$5,380,000,000	224
Michigan	$631,505,950	$7,930,000,000	1,122
Minnesota	$800,431,419	$4,870,000,000	347
Mississippi	$804,395,379	$3,610,000,000	333
Missouri	$1,257,534,466	$7,110,000,000	889
Montana	$204,516,802	$3,100,000,000	442
Nebraska	$373,049,995	$2,250,000,000	148
Nevada	$636,383,942	$2,770,000,000	101
New Hampshire	$749,400,041	$1,380,000,000	149

[87] This includes projects that are designated "Roads, Bridges and Major Projects" and safety programs within the Federal Highway Administration. The source of these projects is: Invest.gov, "Investing in America Map", The White House (updated October 3, 2023), https://www.whitehouse.gov/wp-content/uploads/2023/10/Invest.gov_PublicInvestments_Map_Data_Updated10032023.xlsx.

State	2021 Statewide Cost of Congestion	IIJA Resources Available 2022-2026	Number of Funded Projects
New Jersey	$3,838,944,444	$8,140,000,000	348
New Mexico	$596,534,233	$2,800,000,000	349
New York	$4,917,126,628	$13,640,000,000	1,167
North Carolina	$2,883,892,272	$7,760,000,000	688
North Dakota	$239,540,537	$1,960,000,000	281
Ohio	$2,893,319,844	$9,860,000,000	1,621
Oklahoma	$837,704,495	$4,710,000,000	599
Oregon	$962,769,911	$3,770,000,000	332
Pennsylvania	$3,268,381,038	$13,120,000,000	1012
Rhode Island	$411,188,165	$1,770,000,000	116
South Carolina	$1,805,631,555	$4,960,000,000	236
South Dakota	$285,411,348	$2,200,000,000	180
Tennessee	$3,154,354,178	$6,220,000,000	508
Texas	$7,256,430,452	$27,840,000,000	1,622
Utah	$2,459,281,995	$2,660,000,000	319
Vermont	$198,195,961	$1,650,000,000	247
Virginia	$2,056,503,955	$7,660,000,000	731
Washington	$1,449,959,454	$5,350,000,000	656
West Virginia	$964,842,265	$3,570,000,000	422
Wisconsin	$2,681,755,455	$5,490,000,000	615
Wyoming	$170,380,662	$2,020,000,000	210

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