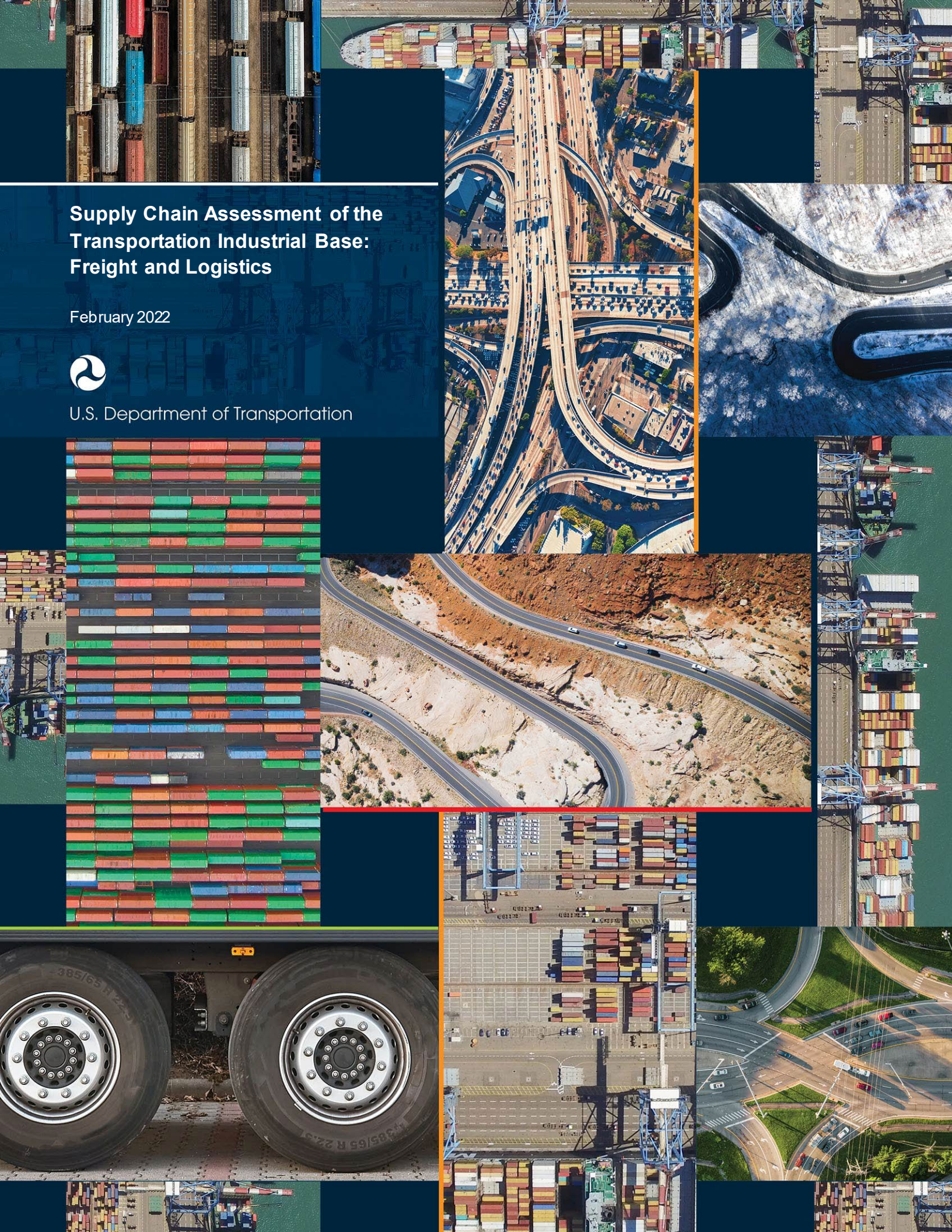

Supply Chain Assessment of the Transportation Industrial Base: Freight and Logistics

February 2022

U.S. Department of Transportation

Cover Photos: Adobe Stock

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Acronyms

AAR	Association of American Railroads
ACSCC	Advisory Committee on Supply Chain Competitiveness
ARTBA	American Road & Transportation Builders Association
ASCE	American Society of Civil Engineers
ASCENT	Center of Excellence for Alternative Jet Fuels and Environment
BCO	Beneficial Cargo Owners
BIL	Bipartisan Infrastructure Law
BLS	Bureau of Labor Statistics
BTS	Bureau of Transportation Statistics
CBO	Congressional Budget Office
CBP	Customs and Border Protection
CDL	Commercial Driver's License
CFS	Commodity Flow Survey
CISA	Cybersecurity and Infrastructure Security Agency
CLEEN	Continuous Lower Energy, Emissions and Noise Program
COVID-19	Coronavirus Disease 2019
CPIU	Consumer Price Index for All Urban Consumers
CRISI	Consolidated Rail Infrastructure and Safety Improvements Grants
DHS	United States Department of Homeland Security
DOC	United States Department of Commerce
DOD	United States Department of Defense
DOE	United States Department of Energy
DOL	United States Department of Labor
ED	United States Department of Education
EIA	Energy Information Agency
EPA	Environmental Protection Agency
ES	Executive Summary
FAA	Federal Aviation Administration
FAC	Freight Advisory Committee
FAF	Freight Analysis Framework
FAR	Federal Acquisition Regulations
FHWA	Federal Highway Administration
FMC	Federal Maritime Commission
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FRED	Federal Reserve Economic Data
GAO	Government Accountability Office
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HME	Hazardous Materials Endorsement
HPMS	Highway Performance Monitoring System
IEP	Intermodal Equipment Providers
INFRA	Infrastructure for Rebuilding America Grant Program
IoT	Internet of Things
ITS	Intelligent Transportation Systems

MARAD	United States Maritime Administration
MIAO	White House Made in America Office
MPO	Metropolitan Planning Organization
MTO	Marine Terminal Operator
NBI	National Bridge Inventory
NEPA	National Environmental Policy Act
NFSP	National Freight Strategic Plan
NGA	National Geospatial-Intelligence Agency
NHFN	National Highway Freight Network
NHFP	National Highway Freight Program
NHI	National Highway Institute
NHPN	National Highway Performance Network
NHS	National Highway System
NMCFRP	National Multimodal Cooperative Freight Research Program
NOAA	National Oceanic and Atmospheric Administration
OMB	Office of Management and Budget
OPM	Office of Personnel Management
PHMSA	Pipeline and Hazardous Materials Safety Administration
PCS	Port Community Systems
PIDP	Port Infrastructure Development Program Grants
PNT	Position, Navigation, and Timing
PTC	Positive Train Control
PTP	PortTruckPass
RAISE	Rebuilding American Infrastructure with Sustainability and Equity Grant Program
RFI	Request for Information
RFID	Radio Frequency Identification
SAF	Sustainable Aviation Fuel
STB	Surface Transportation Board
TEU	20-Foot Equivalent Units
TSA	Transportation Security Administration
TSMO	Transportation System Management and Operations
TWIC	Transportation Worker Identification Credential
ULCV	Ultra Large Container Vessels
USACE	United States Army Corp of Engineers
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
USTR	United States Trade Representative
VA	United States Department of Veterans Affairs
VIUS	Vehicle Inventory and Use Survey

Foreword from the Secretary

Over the past year, every American has felt, in one way or another, the impact of the ongoing strain on our national supply chains. Although the COVID-19 pandemic accelerated the problem, in many ways, the supply chain issues we are facing today have been decades in the making.

A confluence of short-term shocks and long-term stresses have put our supply chains to the test. Decades of underinvestment in our transportation infrastructure have forced us to move an unprecedented volume of goods on infrastructure that was not built to handle it. Nearly a half century of deregulation and consolidation has, in certain sectors, led to worse service, higher costs, and poorer working conditions. The rise of e-commerce has changed our lives for the better, but the reality is that our freight system was not built for a world where anyone can order anything to be delivered to their door with a couple of taps on their phone. The climate crisis has caused disruptions and delays worldwide. And of course, the pandemic continues to cause outages all over the world.

At the same time, thanks to the historic success of the American Rescue Plan and other Administration actions, our economy saw more than 6 million jobs created last year—the fastest growth since the 1980s. This recovery has also led to unprecedented consumer demand, which meant people have faced higher prices and longer delays as our supply chains struggled to keep up.

Despite these challenges, our country is, in fact, moving more goods than we have ever seen, thanks to the essential workers who keep our supply chains running every day: the longshore workers, truck drivers, railroad operators, retail and warehouse workers, pilots, and more. We owe these workers a debt of gratitude, as well as a commitment to strengthening the supply chain infrastructure their jobs depend on, improving working conditions, and supporting their chance to join a union.

In America, most of the links in our supply chains fall under the purview of the private sector—and rightly so. But government still has an important role to play, both in acting as an honest broker to coordinate efforts to alleviate the short-term disruptions to our supply chains, and in repairing the public infrastructure that holds every link in that chain together.

That's why the Supply Chain Disruptions Task Force—which I co-chair together with Secretary Raimondo and Secretary Vilsack—is using every tool at the government's disposal to address these present-term disruptions. Already, the Task Force has moved our ports toward 24/7 operations, reduced long-dwelling containers sitting on the docks, convened stakeholders to discuss how to strengthen the trucking workforce, and worked to increase freight rail service.

For the long-term, we are thankful for the historic investments in President Biden's Bipartisan Infrastructure Law (BIL), which provide a once-in-a-generation opportunity to modernize the critical, but outdated, infrastructure our supply chains depend on every day. The BIL makes the largest single Federal investment in our ports in American history, on top of new funds for airports, freight rail, and other critical supply chain infrastructure, which will create jobs and strengthen our economy.

Looking to the future, to drive down prices and strengthen our economy, we need to bring back manufacturing jobs to the United States. That means we need more of our supply and production capacity here in the United States, rather than outsourced abroad.

To strengthen our economy and build more here at home, we need to take an integrated view that recognizes the inextricable links between our transportation and logistics supply chains, our ability to produce goods domestically, and the investments we make in our infrastructure. This report offers a comprehensive strategy to do just that by investing in America to drive demand for American-made goods and jobs.

The Administration's foresight in calling for this report a year ago is a reflection of our commitment to addressing these disruptions. And the recommendations in this report form a crucial roadmap to help prioritize our investment decisions as we work to implement the historic infrastructure law.

This report, which reflects feedback from more than 400 industry, labor, and other stakeholders, identifies key policy recommendations across five areas: infrastructure investment, planning and technical assistance, research and data, rules and regulations, and coordination and partnerships. These policy recommendations are meant not only to address the current disruptions, but to help us plan for the future and are designed to stand the test of time, by building modern supply chains that can withstand future disruptions, strengthen our economy, and keep goods moving—affordably—to American families.

This is not a partisan issue; we all benefit from having food on the table and goods on the shelves. And we all play a role in improving our supply chains. Solving these issues requires a wide range of public and private sector partners. Americans will depend on Congressional action to update our laws and provide funding for needed investments, like those authorized in the Bipartisan Infrastructure Law. Federal, State, and local agencies must design and implement new policies and programs. And private

companies and organized labor must work together to find fair solutions and ensure goods make it through each link in our supply chain to reach the places where they are needed most.

The challenges before us are historic, but they are matched by an equally historic opportunity. Through our combined efforts, we can build better, more efficient, more resilient supply chains that secure America's economic future and ensure every American shares in the benefits.

Executive Summary

Our national economic strength and quality of life depend on the safe and efficient movement of goods throughout our nation's borders and beyond. Supply chains—the interconnected webs of businesses, workers, infrastructure processes, and practices that underlie the sourcing, manufacturing, transportation, and sale of goods—are vital to our everyday lives. In the past they have been invisible to consumers, but the pandemic and its consequences have made clear their vital importance to our daily lives, livelihoods, and basic day-to-day convenience and well-being.

To perform well, supply chains require success in transportation, in production, and in sourcing. Americans pay lower prices and face fewer disruptions when goods move efficiently and reliably and businesses and consumers have predictable access to goods and materials. Americans benefit when we bring manufacturing jobs, production, and sourcing to the United States rather than outsourcing them abroad. Onshoring can drive down prices, add resilience, and let America own the industries of the future. When supply chains are disrupted by events such as public health crises, extreme weather, workforce challenges, or cyberattacks, goods are delayed, costs increase, and Americans' daily lives are affected. While these disruptions cannot be avoided altogether, we can build supply chains that nimbly and effectively respond to minimize interruptions and keep goods moving under all conditions.

The Administration has taken aggressive action to respond to supply chain disruptions stemming from the current pandemic. But even before these disruptions worsened over the course of the past year, the President issued Executive Order 14017[1] calling for a review of the transportation and logistics industrial base. These recommendations are meant not only to respond to the current disruptions, but to stand the test of time by building supply chains resilient to future disruptions, in whatever form they take.

Building Resilient Supply Chains to Address Disruptions

While the COVID-19 pandemic has highlighted and intensified challenges in global supply chains, this is not a new phenomenon. America's supply chains have faced mounting challenges for several decades, including:

- Growing freight demand.
- Changing consumer preferences, including demand for rapid delivery.
- Attracting, training, and retaining a qualified workforce.
- Increasingly complex, global supply chains where many products are manufactured abroad.
- Rising frequency of disruption caused by climate change.
- Adapting to new technology while maintaining security.

Over the past two years, the pandemic has compounded these issues and caused temporary port closures, worker and equipment shortages, increased levels of congestion and delay, and led to fluctuating prices. Significant progress has been made to address the disruptive effects of the COVID-19 pandemic, but many challenges remain. To guard against the impacts of future disruptions over the long term, we must enhance our nation's supply chain resilience.

Resilience refers to the ability of a system to adapt to changing conditions as well as withstand and rapidly recover from disruption (see Figure ES-1). Building the resilience of supply chains requires Federal leadership to coordinate efforts across a wide range of freight and logistics stakeholders. As these efforts progress, we must also recognize that more resilient supply chains should recognize and mitigate long-standing pollution and economic issues that negatively impact communities of color, low-income, and indigenous communities. The workforce on which a resilient supply chain is built is drawn heavily from these vulnerable communities.

Figure ES-1: Properties of a Resilient System

Source: USDOT John A. Volpe National Transportation Systems Center, (no date).

Properties of Resilient Systems

Resilient systems exhibit several key properties. They have access to **diverse** components (e.g., materials, suppliers, carriers, and routes) that provide **redundancy** in case one component in the system fails. They are also highly **connected** yet secure, **flexible,** and **adaptive** to enable easy transitions from one component to another when needed. Finally, they are capable of being quickly **repaired** or restored to limit the duration of any one disruption.

Responding to Current Supply Chain Disruptions

The U.S. Department of Transportation (USDOT) developed this Freight and Logistics Supply Chain Assessment in response to Executive Order 14017: America's Supply Chains. The Biden-Harris Administration identified that the COVID-19 pandemic was putting America's supply chains to the test and issued this Executive Order in February 2021 to better understand this important issue and develop a coordinated Federal response.

The Administration has actively coordinated with private industry and State and local government to understand on-the-ground conditions and determine how best to employ Federal Government policy levers to address disruptions. The Administration created a Supply Chain Disruptions Task Force convening key stakeholders representing ports, labor, the trucking industry, and affected businesses, and assigned a Special Ports Envoy to help advance short-term actions. In recent months, Federal leadership has resulted in significant improvements, including:

- Achieving commitments from the Ports of Los Angeles and Long Beach—which handle 40 percent of our country's containerized imports—labor, and our largest retailers to move toward a 24/7 supply chain system to unlock bottlenecks.
- Reducing the number of long-dwelling containers at the Ports of Los Angeles and Long Beach by 65 percent through a new fee on ocean carriers leaving import containers at the ports for too long.
- Working with the Georgia Ports Authority to address congestion at the Port of Savannah through a $7 million investment in "pop-up" inland ports that help relieve capacity in Savannah and have led to decreases in container dwell times and the number of ships at anchor outside the port.
- Working with the U.S. Department of Agriculture (USDA) and the Port of Oakland to invest in pop-up container yards to help reduce congestion caused by empty containers and make it easier for agricultural exporters to utilize the empties.
- Launching a Trucking Action Plan to both recruit more truck drivers and improve the quality of existing jobs to retain more drivers in the profession. This includes partnering with the Department of Labor (DOL) on a Registered Apprenticeship Program, a pilot program for truck drivers between the ages of 18-21, which incorporates Registered Apprenticeships to ensure safety through rigorous training standards, driver compensation studies, a driver leasing task force, and more.
- Providing a toolkit to States detailing specific actions that can be taken to expedite the licensing of commercial drivers and announcing over $30 million in funding to support this effort.
- Developing a "fast pass" system to expedite global transportation of essential medical products.

To complement these near-term actions, this Supply Chain Assessment addresses longer-term resilience challenges facing the American transportation industrial base and supply chains; it also makes policy recommendations to strengthen these systems. The Assessment draws on lessons from the Administration's current efforts as well as extensive public and private stakeholder outreach. It also highlights ways in which the Administration is leveraging new resources made available through the historic Bipartisan Infrastructure Law (BIL) to make significant investments in ports and improve supply chain resilience.

The recommended policy responses described in detail in this report spotlight a range of actions that USDOT envisions as supporting a resilient 21st-century freight and logistics supply chain for America, including:

- Investing in freight infrastructure, such as ports, bridges, and railroads, to enhance capacity and connectivity.
- Providing technical assistance to support the planning and coordination of freight investments and operations and supporting the workers employed in this sector.
- Improving data and research into supply chain performance.
- Strengthening and streamlining governance to improve efficiency, build the workforce, increase competitiveness, and reduce safety and environmental risks.
- Partnering with stakeholders across the supply chain, including coordination with both the public and private sector.

Roles of the Federal Government and Its Partners

The Federal Government, and USDOT specifically, must play a leadership role in building the long-term resilience of America's supply chains, but a robust response will require action by a wide range of Federal, State, and local agencies and the private sector. In some cases, robust action may take acts of Congress to reform laws and provide funding. In the near term, the Federal Government can provide leadership by convening stakeholders across the freight and logistics industry to coordinate actions in response to current congestion and build a foundation for long-term supply chain resilience.

The collective focus on ensuring a safe and efficient supply chain necessary to support the multiple goals articulated in this report must also include critical stakeholders in communities affected by the pollution that results from the movement of freight. Many communities, especially majority-minority and low-income communities, are already overburdened with health, environmental and quality of life impacts from pollution sources related to movement of freight through various transportation modes. The Community Port Collaboration Toolkit and other resources offered through the Environmental Protection Agency's (EPA's) Ports Initiative program can help support effective and meaningful communication and engagement between freight and logistics stakeholders and members of these impacted communities to promote environmental justice while developing a more resilient supply chain.

Table ES-1 describes policy roles to strengthen supply chain resilience. These roles include: infrastructure investment; planning and technical assistance; research and data; rules and regulations;

and coordination and partnership with non-Federal stakeholders. The roles are also paired with specific policy goals detailing how these elements support resilient supply chains.

Table ES-1: Federal Role in Addressing Supply Chain Disruptions: Policy Roles and Goals

Federal Policy Roles	Policy Goals
Infrastructure Investment: Identify and prioritize freight needs and provide funding for investments	• Identify and fund freight system and capacity needs • Address supply chain bottlenecks • Reduce emissions and mitigate climate change impacts
Planning and Technical Assistance: Support State and local agencies to address supply chain challenges	• Strengthen public sector freight planning and knowledge • Mitigate freight impacts on communities • Improve supply chain security • Strengthen freight workforce and development
Research and Data: Improve supply chain data and develop tools and best practices to quickly diagnose and address disruptions	• Increase understanding of supply chain performance • Improve transparency of supply chain data • Improve data sharing capabilities
Rules and Regulations: Streamline regulations, improve competition and fairness, and reduce health, safety, and environmental risks	• Increase freight capacity and efficiency • Support domestic production of critical equipment • Reduce bureaucratic inefficiencies • Strengthen market competition and fairness • Speed disaster response and recovery
Coordination and Partnerships: Support cross-sector, multijurisdictional, and multimodal coordination to address supply chain resilience	• Convene supply chain stakeholders to enhance USDOT's supply chain work • Support the actions of non-Federal partners through continued coordination

Recommendations for Resilient Supply Chains

To address the supply chain challenges and vulnerabilities that this Assessment identified, USDOT has identified a host of policy recommendations to resolve current disruptions and build more resilient supply

chains for the future. Tables ES-5 through ES-9 summarize the Assessment's recommendations, which are also discussed in greater detail in Section 4 of this report. The recommendations are also characterized by their expected level of complexity and cost to implement, as well as the magnitude of their potential impact (see Tables ES-2, ES-3, and ES-4, below, for how these are defined). Each recommendation also notes the approximate time frame for completion (e.g., near-term (0-2 years), medium-term (3-5 years), and long-term (5+ years)). The table also identifies the Federal and other public and private sector parties that would be involved in implementing the recommendation, along with any transportation modes (trucking, rail, or maritime) or industry (logistics) that would be specifically affected by those actions.

Table ES-2: Recommendation Implementation: Impact

Moderate	High	Highest
• Actions that are more targeted in scope to existing/near-term supply chain challenges	• Actions that address current challenges and are expected to address future supply chain and logistics challenges over the next 10 years	• Actions that have wide-ranging scope beyond the immediate supply chain challenges and will influence policymaking around supply chains and logistics for decades to come

Table ES-3: Recommendation Implementation: Cost

$ (Low)	$$ (Medium)	$$$ (High)
• One-time, low levels of funding and/or staff time required	• One-time, higher levels of funding and/or staff time • Recurring/sustained programming, low-medium levels of funding and/or staff time required	• Significant, recurring/sustained programming, medium-high levels of funding and/or staff time required

Table ES-4: Recommendation Implementation: Level of Complexity

Low	Medium	High
• One-off studies, plans, or reports • Actions that can occur under existing authorities and funding • Actions that can be taken by a single agency • Low-level coordination and communication efforts	• New policies, regulations, or processes • Sustained coordination efforts, working groups, etc. • Actions involving some interagency and inter-governmental coordination	• New datasets, tools, or systems • New data standards and/or harmonization • Congressional action required • Actions involving significant interagency and inter-governmental coordination

Table ES-5: Infrastructure Investment Policy Recommendations

Policy Goal: Identify and fund freight system and capacity needs			
No.	Policy Recommendation	Impact	Actor(s)
1	Use funds provided under the Bipartisan Infrastructure Law (BIL) to invest in projects (including identified projects of national and regional significance) that support supply chain resilience, promote domestic manufacturing, plan for future growth, and address intermodal and inland storage capacity needs while simultaneously reducing existing environmental justice issues that freight infrastructure may create on adjacent communities. Complexity: Medium Cost: **$ $ $** (High) Approximate Timing: Medium-Term Mode(s): All	Highest	USDOT, DOC

Policy Goal: Identify and fund freight system and capacity needs			
No.	Policy Recommendation	Impact	Actor(s)
2	Invest in Intelligent Transportation Systems (ITS) infrastructure to enhance port and trucking operations. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Medium-Term Mode(s): Trucking, Maritime	High	USDOT
3	Invest in the inland waterway system to enhance its performance and capacity. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Long-Term Mode(s): Maritime	High	USDOT, USACE, USDA
4	Coordinate with States, local governments, and port authorities, as well as Federal partners such as the Department of Defense (DoD), to identify temporary solutions to ease congestion, such as "pop-up" intermodal yards. Complexity: Low Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): Rail, Trucking	Moderate	USDOT, DoD, DOC, States, Local gov't's, Port authorities

Policy Goal: Reduce emissions and mitigate climate change impacts			
No.	Policy Recommendation	Impact	Actor(s)
5	Invest in battery electric, hybrid equipment, and zero-emission fueling infrastructure to combat climate change and further reduce emissions of dangerous pollutants such as diesel particulate matter in adjacent communities that suffer a disproportionate impact from goods movement related activities. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): Trucking, Maritime	High	USDOT, DOE, EPA
6	Invest in mitigating freight impacts on adjacent communities. Complexity: Medium Cost: **$ $ $** (High) Approximate Timing: Medium-Term Mode(s): All	Highest	USDOT
Policy Goal: Address supply chain bottlenecks			
No.	Policy Recommendation	Impact	Actor(s)
7	Explore the potential to increase U.S.-flagged ships, shipping companies, and shipbuilding. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Long-Term Mode(s): Maritime	High	USDOT, DOC, Congress
8	Support State DOTs and the private sector to develop and implement strategies that expand truck parking availability consistent with local land use considerations and address safety of rest areas. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): Trucking	High	USDOT, State DOTs, Private sector

Policy Goal: Address supply chain bottlenecks			
No.	Policy Recommendation	Impact	Actor(s)
9	Explore the feasibility of financial incentives to improve warehousing capabilities. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): Logistics	Moderate	USDOT, Congress, Private sector

Table ES-6: Planning and Technical Assistance Policy Recommendations

Policy Goal: Strengthen public sector freight planning and knowledge			
No.	Policy Recommendation	Impact	Actor(s)
10	Implement BIL's freight policy and planning provisions with an emphasis on supporting supply chain resilience in the United States consistent with/aligned with other Administration priorities surrounding climate, equity, etc. Complexity: Low Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): All	Highest	USDOT
11	Update USDOT's existing guidance on State Freight Plans. Complexity: Low Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	High	USDOT, States

Policy Goal: Strengthen public sector freight planning and knowledge			
No.	Policy Recommendation	Impact	Actor(s)
12	Work with States, Metropolitan Planning Organizations (MPOs), and municipal freight planners to strengthen freight planning and supply chain expertise across the United States. These efforts should include supporting meaningful community engagement in State and local decision-making with a focus on equitable and just outcomes from investments and improvements. Complexity: Low Cost: **$** (Low) Approximate Timing: Medium-Term Mode(s): All	High	USDOT, DOC, States, MPOs, Local gov’ts
13	Provide guidance to States and local governments on implementing measures to protect freight routes and industrial lands. Complexity: Medium Cost: **$** (Low) Approximate Timing: Medium-Term Mode(s): All	Moderate	USDOT, States, Local gov’ts
14	Continue USDOT support of and investment in training, research, and other technical support initiatives to assist those seeking to plan, develop, and implement projects and programs that can facilitate efficient supply chains. Complexity: Low Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	Moderate	USDOT

Policy Goal: Strengthen freight workforce and development			
No.	Policy Recommendation	Impact	Actor(s)
15	Support the unionized labor force to ensure maintenance and further development of the skills and expertise necessary to support the efficient flow of freight in the future as well as to work through labor-management partnerships to support talent development and retention. Complexity: Low Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): All	High	USDOT, DOL
16	Support workforce public health and public health protocols to minimize disruptions at key locations Complexity: Low Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	High	USDOT, DOL
17	Undertake a review of current job training and Registered Apprenticeship programs, to identify how they can be leveraged and improved to advance the transportation industrial base workforce, especially with regard to connecting members of vulnerable communities to supply chain jobs. Complexity: Low Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	High	USDOT, DOL, DOC
18	Leverage the experience of military veterans to fill civilian logistics jobs. Complexity: Medium Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	Moderate	USDOT, DOL, DoD

Policy Goal: Strengthen freight workforce and development			
No.	Policy Recommendation	Impact	Actor(s)
19	Improve workforce's quality of life, including by improving workforce access to reliable, affordable, and safe transportation to access jobs. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): All	Highest	USDOT, DOL
20	Ensure all applicants for and recipients of Federal financial assistance (including subrecipients) comply with Federal civil rights laws, including Title VI of the Civil Rights Act of 1964, that prohibit discrimination on the basis of race, color, national origin (including limited English proficiency), and other civil rights laws that prohibit discrimination on the basis of disability, sex, and age. Complexity: Low Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	Moderate	USDOT

Policy Goal: Improve supply chain security			
No.	Policy Recommendation	Impact	Actor(s)
21	Support public and private sharing of cyber-incident data to enhance supply chain cybersecurity, including providing supply chain stakeholders access to cybersecurity tools and education that allow them to improve their cybersecurity posture in concert with partners and freight facilities. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): All	High	USDOT, DHS/CISA, DOE, DoD

Policy Goal: Improve supply chain security			
No.	Policy Recommendation	Impact	Actor(s)
22	Develop a National Transportation System Security and Resilience Plan. Complexity: High Cost: **$** (Low) Approximate Timing: Medium-Term Mode(s): All	Highest	USDOT, DOC, DHS, States, Private sector
23	Prioritize sea, land, and airport facilities and staffing to jointly consider resource needs between agencies to maintain CBP inspection facilities and adequate staffing levels. Complexity: Medium Cost: **$$** (Medium) Approximate Timing: Medium-Term Mode(s): Trucking, Rail, Maritime	High	USDOT, DHS
24	Improve the security, resilience, reliability, and redundancy of Position, Navigation and Timing (PNT) services, including Global Positioning Systems (GPS)/Global Navigation Satellite Systems (GNSS), alternatives and complements to GPS/GNSS, and related navigation and tracking systems. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Medium-Term Mode(s): All	High	USDOT, DoD, DOE
25	Determine which elements of the transportation supply chain should be prioritized for domestic manufacturing, ally-shoring, or nearshoring, including cybersecurity elements of critical infrastructure. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): All	Highest	USDOT, DOC

Policy Goal: Mitigate freight impacts on communities			
No.	Policy Recommendation	Impact	Actor(s)
26	Coordinate Federal support for brownfield and superfund redevelopment to advance national transportation policies. Coordinate these efforts with impacted communities. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): All	High	USDOT, EPA

Table ES-7: Research and Data Policy Recommendations

Policy Goal: Increase understanding of supply chain performance			
No.	Policy Recommendation	Impact	Actor(s)
27	Invest in an applied freight research program. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Long-Term Mode(s): All	Moderate	USDOT
28	Invest in energy and transportation research and data to better understand the interplay of the energy sector and transportation. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Medium-Term Mode(s): All	High	USDOT, DOE

Policy Goal: Increase understanding of supply chain performance			
No.	Policy Recommendation	Impact	Actor(s)
29	Provide funding to restart, maintain, and expand existing programs that collect or provide supply chain data. Examples include the Commodity Flow Survey, Freight Analysis Framework, TransBorder Freight Data dashboard, and the Vehicle Inventory and Use Survey. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Long-Term Mode(s): All	Highest	USDOT, DOC, USDA, USACE
30	Work with Congress to update mandatory response authority for freight data collection. Complexity: High Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	High	USDOT, Congress, Private sector
Policy Goal: Improve data sharing capabilities			
No.	Policy Recommendation	Impact	Actor(s)
31	Invest in and facilitate the use of communications systems to provide visibility into the location of products or next loads for truckers, terminal managers, and/or beneficial cargo owners (BCOs). Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Medium-Term Mode(s): Trucking, Rail, Maritime	High	USDOT, DOC

Policy Goal: Improve data sharing capabilities			
No.	Policy Recommendation	Impact	Actor(s)
32	Encourage greater standardization and foster interoperability of data among States and between the multimodal transportation networks and the private sector. Complexity: High Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	High	USDOT, DOC, OPM, USDA, CBP, States, Private sector
33	Develop a national freight portal to share key data among stakeholders and an electronic information exchange standard for critical product flow tracking. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Long-Term Mode(s): All	High	USDOT
34	Partner and collaborate with government agencies and the private sector to establish a national supply chain forensics/monitoring program and develop analytical tools to monitor supply chains for impending threats or security issues. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Long-Term Mode(s): All	High	USDOT, DOC, DHS, DoD/NGA, Private sector
35	Invest in technology and information technology systems, in collaboration with labor organizations, to provide better insight and visibility into end-to-end supply chain movements to improve performance. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Medium-Term Mode(s): All	High	USDOT, Labor orgs

Policy Goal: Improve the transparency of supply chain performance			
No.	Policy Recommendation	Impact	Actor(s)
36	Develop national freight modeling and freight fluidity tools. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Long-Term Mode(s): All	Moderate	USDOT
37	Establish a dedicated freight and supply chain data performance program under the Bureau of Transportation Statistics (BTS) with support from the other modal administrations to develop and share data supporting both public and private sector stakeholders with supply chain resilience data. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Medium-Term Mode(s): All	Highest	USDOT, Congress
38	Support deployment of technology to track containers and chassis and coordinate with CBP on data collection efforts. Complexity: Medium Cost: **$ $** (Medium) Timing: Medium-Term Mode(s): Trucking, Rail, Maritime	Moderate	USDOT, CBP, Private sector
39	Partner with Federal and non-Federal partners to collect data that describe flows of major commodities, raw ingredients, and finished products, and identify potential points of disruption, issues in common across sectors, reliance on transportation and other supply chain factors. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Medium-Term Mode(s): All	High	USDOT, Federal agencies, Private sector, Academic partners

Table ES-8: Rule and Regulations Policy Recommendations

Policy Goal: Speed disaster recovery response			
No.	Policy Recommendation	Impact	Actor(s)
40	Urge Congress to eliminate the Fair Labor Standards Act motor carrier exemption. Complexity: Medium Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): Trucking	Moderate	DOL, USDOT, Congress
41	Work with Congress to grant FHWA additional emergency response special permitting and regulatory relief for supply chain emergencies. Complexity: High Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): Trucking	Moderate	USDOT, Congress
Policy Goal: Strengthen market competition and fairness			
No.	Policy Recommendation	Impact	Actor(s)
42	In taking trade policy actions, consider the ways in which those actions might impact relevant supply chains, as appropriate and consistent with applicable legal authority. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): All	Moderate	USTR, DOC

Policy Goal: Strengthen market competition and fairness			
No.	Policy Recommendation	Impact	Actor(s)
43	Support the Federal Maritime Commission (FMC) in regulating ocean carriers to promote free and fair competition. Complexity: High Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): Maritime	High	USDOT, FMC
44	Urge Congress to enact ocean shipping regulatory reform. The House has already passed legislation that would increase FMC resources and provide FMC with additional authorities to protect exporters, importers, and consumers from unfair practices. Complexity: High Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): Maritime	Highest	USDOT, Congress
45	Encourage the STB to require railroad track owners to provide rights of way to passenger rail and to strengthen their obligations to treat other freight companies fairly. Complexity: High Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	High	STB

Policy Goal: Support domestic production of critical equipment			
No.	Policy Recommendation	Impact	Actor(s)
46	Focus on increasing domestic manufacturing of new chassis, containers, zero-emission equipment, and gantry cranes, including consideration of enhanced price preference in Federal Acquisition Regulations (FARs) updates. Complexity: Medium Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): All	Highest	DHS, DOC, OMB
47	Consider opportunities to develop a domestic supply base for specialized cargo handling equipment and gantry cranes that are not currently available from a U.S. manufacturer. Complexity: High Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): Maritime	High	USDOT, DOC
Policy Goal: Increase freight capacity and efficiency			
No.	Policy Recommendation	Impact	Actor(s)
48	Promote, incentivize, and facilitate alignment of operational hours at warehousing facilities, seaports, rail facilities, and intermodal transfer facilities, and other stakeholders, including labor, to help mitigate congestion. While coordinating with the relevant private stakeholders who control these processes, the Federal government should take steps to ensure supply chain efforts align with and advance civil rights compliance. Complexity: High Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): Trucking, Rail, Maritime, Logistics	Moderate	USDOT, DOC, DOL, Private sector

Policy Goal: Increase freight capacity and efficiency			
No.	Policy Recommendation	Impact	Actor(s)
49	Continue partnering with the regulated hazardous materials community to improve the efficiency of packaging design that can allow for greater quantities of hazardous materials goods shipped without additional physical shipping space. Complexity: Low Cost: **$** (Low) Approximate Timing: Medium-Term Mode(s): All	High	USDOT
Policy Goal: Reduce bureaucratic inefficiencies			
No.	Policy Recommendation	Impact	Actor(s)
50	Harmonize the appropriate roles of the Surface Transportation Board, Federal Maritime Commission, and DOT with respect to regulating and providing oversight for the freight and logistics industry. Complexity: High Cost: **$** (Low) Approximate Timing: Medium-Term Mode(s): Rail, Maritime	High	USDOT, STB, FMC
51	Investigate ways to expedite the Transportation Security Administration's (TSA) Transportation Worker Identification Credential (TWIC®) approval process. As part of the development of the action plan, conduct outreach to relevant stakeholders and communities to receive input that informs the action plan. Complexity: Medium Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	Moderate	USDOT, TSA

Table ES-9: Coordination and Partnerships Recommendations

Policy Goal: Convene supply chain stakeholders to enhance USDOT's supply chain work			
No.	Policy Recommendation	Impact	Actor(s)
52	Develop an action plan to implement these policy recommendations and set up a comprehensive and inclusive interagency group to support their implementation. Complexity: Medium Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	High	USDOT
53	Collaborate with partners on the Motor Carrier Safety Advisory Committee Driver Subcommittee when implementing any proposals that will impact the nation's professional driver fleet. Complexity: Low Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): Trucking	Moderate	USDOT
54	Work with State DOTs and the private sector to develop a national inventory of available warehouse space to help plan and shape an ongoing transition of facilities. Complexity: High Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): Logistics	Moderate	DOC, USDOT, State DOTs, Private sector
55	Continue coordination with freight industry stakeholders. Complexity: Low Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): All	High	USDOT, DOC, States, Local gov'ts, Private sector

Policy Goal: Convene supply chain stakeholders to enhance USDOT's supply chain work			
No.	Policy Recommendation	Impact	Actor(s)
56	Work with partner agencies to improve U.S. transportation infrastructure connections with Mexico and Canada, to help shorten supply chains, and promote domestic and near-shoring production shifts. Complexity: High Cost: **$ $** (Medium) Approximate Timing: Near-Term Mode(s): All	High	USDOT
57	Convene a Supply Chain Workforce Summit with the Departments of Labor, Transportation, Education, Commerce, Veterans' Affairs, and Defense and workers across the freight and logistics sector. Complexity: Low Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	High	USDOT, DOL, ED, DOC, VA, DoD, labor unions, private sector
58	Improve communications with applicants on the status of Hazardous Materials Endorsement (HME) or TWIC® security threat assessments. As part of this, implement efficiencies to enhance equity, increase security, and reduce cost and time burdens associated with enrollment and credentialing. Complexity: Medium Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): All	Moderate	USDOT, TSA

Policy Goal: Support the actions of non-Federal partners through continued coordination			
No.	Policy Recommendation	Impact	Actor(s)
59	Encourage all ports to create port stakeholder committees with wide representation, including residents of port-adjacent communities. Complexity: Low Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): Maritime	High	USDOT, Port authorities, USCG
60	Explore standardization of 53-foot marine container sizes for international trade to support more efficient movement of goods. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Long-Term Mode(s): Maritime, Rail, Trucking	Moderate	USDOT, DOC
61	Encourage reciprocity among States related to obtaining truck driver credentialing and provide aid to State Departments of Motor Vehicles to hire more commercial driver's license test examiners. Complexity: Low Cost: **$** (Low) Approximate Timing: Near-Term Mode(s): Trucking	High	USDOT, States
62	Improve last-mile access to freight-oriented developments, use of near-dock cargo handling facilities, land-use strategies to support warehousing in appropriate locations, and goods movement integration into Smart Streets/Complete Streets development to increase safety. Complexity: High Cost: **$ $ $** (High) Approximate Timing: Medium-Term Mode(s): Trucking, Rail, Maritime, Logistics	Highest	USDOT

1.0 Introduction

The safe and efficient movement of freight across domestic and international supply chains is vital to the nation's economic health and to maintaining and improving quality of life for all Americans. The U.S. freight and logistics sector uses a complex network of public and private infrastructure and systems to move raw materials and products throughout the nation. When this system performs well, freight moves efficiently, and transportation costs are low. When the performance of the system breaks down, it can cause delays and cost increases that drive inflation, reduce productivity, and hinder economic growth and conditions for workers and families.

Many different types of events, including natural disasters, extreme weather, acts of terrorism, transportation infrastructure failures, safety incidents, labor and material shortages, and geopolitical events can disrupt supply chains. These disruptions undermine the distribution of goods and resources on which businesses and consumers rely. The U.S. Department of Transportation (USDOT) and its Federal agency partners can help to mitigate the effects of those disruptions and accelerate recovery through policies and investments that strengthen the resilience of America's supply chains.

The pandemic-induced supply chain challenges that have occurred between 2020 and 2022 illuminate the importance of supply chains and the transportation industrial base to everyday Americans and to our shared economic and national security. Despite historic increases in imports, shipments, and throughput at the ports, Americans faced challenges from delays in deliveries and increasing prices, due in part to supply chain constraints.

In response to these challenges, the Biden-Harris Administration has coordinated both short-term and long-term responses, across USDOT and in collaboration with non-Federal partners. The President convened a Supply Chain Disruption Task Force led by the Secretaries of the Departments of Agriculture, Commerce, and Transportation. The Task Force successfully fostered collaboration to meet the challenges associated with the unprecedented demand during the 2021 holiday season, when record retail sales volumes of cargo moved through the U.S. freight and logistics system. The President also

assigned a Special Ports Envoy to help advance short-term actions. This coordination alone will not solve supply chain inefficiency, particularly in the long term. There is significant work ahead to address congestion and other more structural challenges in the system.

This Freight and Logistics Supply Chain Assessment focuses on the longer-term strength and resilience of the American transportation industrial base and supply chains, drawing on the lessons of the Administration's short-term efforts, new resources including record investments in ports in the President's historic Bipartisan Infrastructure Law, and additional public and private outreach and analysis, so that we can build them back better in the face of future disruptions and challenges that are sure to arise.

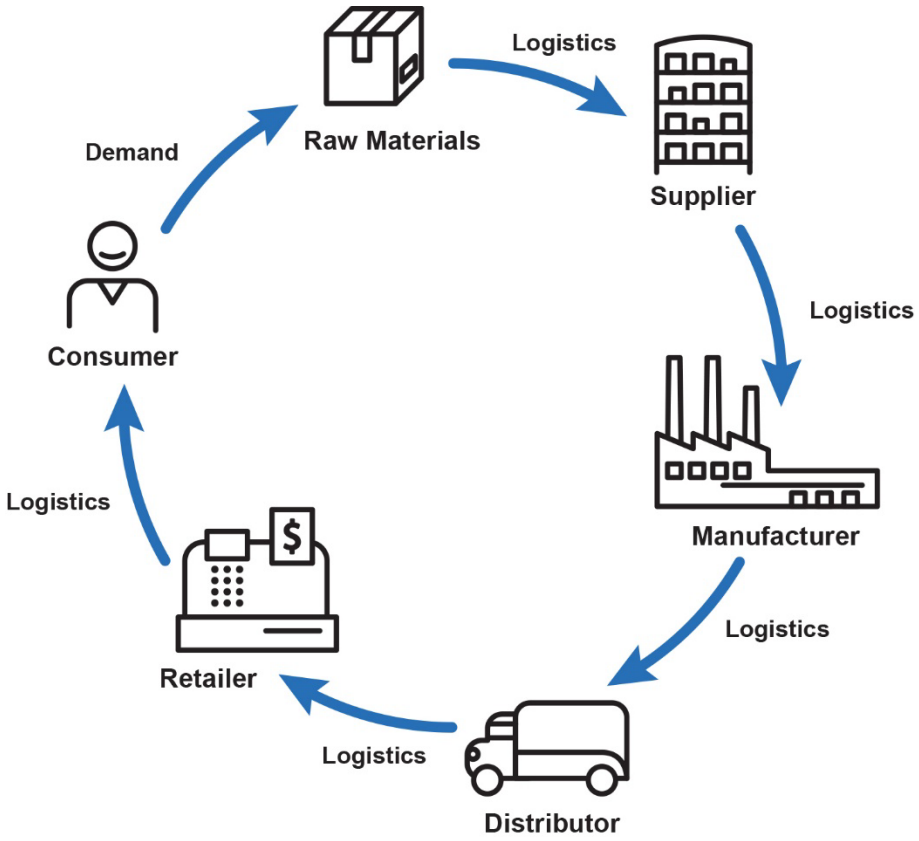
1.1 Purpose

USDOT developed this Freight and Logistics Supply Chain Assessment (Assessment) in response to *Executive Order 14017: America's Supply Chains*.[2] This sectoral assessment of the freight industrial base identifies and addresses current transportation supply chain vulnerabilities and challenges. It also identifies potential policy responses to strengthen the resilience of the freight system and reduce impacts from future disruptions. Specifically, this Assessment informs the following questions to shape the Federal Government's work to create more resilient supply chains:

- What are the critical supply chain vulnerabilities that affect economic security and resilience?
- What tools and policy recommendations could USDOT employ to address supply chain vulnerabilities?
- How can USDOT partner with other Federal agencies and non-Federal stakeholders to mitigate supply chain vulnerabilities?

The freight and logistics industry is just one critical component of a much larger supply chain system, much of which extends beyond the purview of USDOT. The freight and logistics network enables private firms to transport raw materials, intermediate components, and final products from a complex global network of suppliers and manufacturers to reach retail consumers (Figure 1). All the elements of supply chains (ports, ocean shipping, trucking, warehousing rail, etc.) must be viewed as part of an integrated system in which the Federal Government regulates and coordinates so that all aspects function safely and efficiently.[3] This Assessment focuses specifically on how freight, logistics, and distribution elements affect supply chain resilience.

Figure 1: The Role of Freight and Logistics in Supply Chains



Source: Graphic developed by USDOT based on data from Corporate Finance Institute, (no date), "What is a Supply Chain," https://corporatefinanceinstitute.com/resources/knowledge/strategy/supply-chain/

1.2 Background

All parts of our economy depend on functional supply chains. When our supply chains are disrupted, goods are delayed, costs increase, and Americans' daily lives are affected. Economic volatility, such as that caused by the COVID-19 pandemic, magnifies supply chain vulnerabilities across the nation and the world. Insufficient investment in infrastructure makes our supply chains vulnerable. Labor markets have also been affected as some workers have left the workforce, delayed returning to work, or switched careers as the result of the pandemic.

Volatile economic conditions have persisted throughout the pandemic. The surge in demand for goods, coupled with unpredictable interruptions to manufacturing and port operations, has caused a rapid rise in shipping prices. Workforce shortages prompted by public health measures and other factors

compounded these effects and helped contribute to unprecedented levels of congestion at ports and rail terminals. Supply chains did show a degree of resilience during these disruptions, however. For instance, passenger airlines converted empty flights to freight cargo routes, making up for lost passenger traffic revenue and providing shippers an alternative to ocean shipping.[4] This type of flexible response helped to reduce the enormous supply shortages of essential goods seen early in 2020, such as food products and personal protective equipment. Despite these adaptations, more than two years into the pandemic, supply chain disruptions continue, proving that the system needs to be much more resilient.

While the scale of disruption caused by the COVID-19 pandemic is enormous, it is not the first event to disrupt supply chains and it will not be the last. In the past, infrastructure failures, workforce challenges, natural disasters, cybersecurity breaches, changing international trade policies, and global conflicts have upset supply chains, causing price fluctuations, unfilled orders, challenges for workers and families, and lost economic productivity (see Table 1).

Table 1: Examples of Transportation System Disruptions with Freight Movement Implications

Type of Disruption	Example
Infrastructure Failures	In May 2021, a crack in a steel beam forced the closure of the Interstate 40 bridge that connects Arkansas and Tennessee over the Mississippi River at Memphis, a critical freight hub. Hundreds of barges were held up on the Mississippi River for days and the more than 35,000 vehicles that cross the bridge daily—about a third of them commercial traffic—had to rely on the only other nearby bridge or reroute more than 100 miles north.[5]
Transportation Safety Incidents	When the Ever Given, one of the largest container ships ever built, became stuck in the Suez Canal for 6 days in March 2021, it inhibited worldwide shipping and froze nearly $10 billion in trade a day.[6] At peak, at least 366 vessels were stuck waiting to pass through the Suez Canal.[7]
Severe Weather	In early 2021, unusually cold temperatures in Texas led to energy outages that affected chemical manufacturing facilities and other supply chains in Houston, Texas. The energy outages caused facilities to shut down for months and led to one of the most expensive weather events in U.S. history. The Texas freeze impacted 25-33 percent of the chemical industry; one example was a glue shortage for the cardboard box industry.[8]

Type of Disruption	Example
Cyberattacks	A ransomware attack on the Colonial Pipeline halted pipeline operations for several hours on May 7, 2021. Delays in restoring pipeline operations threatened fuel supplies and refinery operations leading to panic buying.[9] In response to the delays, the Federal Motor Carrier Safety Administration (FMCSA) issued a regional emergency declaration to keep fuel supply lines open for 17 States.[10]
Terrorism	The terrorist attacks on the United States on September 11, 2001, killed nearly 3,000 people. This attack severely disrupted aviation as well as the flow of both people and goods along the eastern seaboard in the weeks and months after the attacks.
Workforce Challenges	The COVID-19 pandemic exacerbated longstanding workforce challenges in the trucking industry, including high turnover rates, an aging workforce, long hours away from home, and time spent waiting—often unpaid—to load and unload at congested ports, warehouses, and distribution centers.
Changes to International Trade Regimes	Changes in trade and immigration rules in the United Kingdom related to its withdrawal from the European Union on January 31, 2020, resulted in shortages of critical goods, and severely disrupted the regional and international economy.
Public Health	Strict COVID-19 restrictions in southeastern Asia caused widespread closures of port facilities in 2020 and 2021, resulting in shipping bottlenecks in the South China Sea and intermittent disruptions in manufacturing and port operations in China.

1.3 Freight and Logistics System Resilience

Resilience refers to the ability of a system to adapt to changing conditions or withstand and rapidly recover from disruption due to emergencies or shocks. Disruptions to freight systems alter the flow of goods, affecting business operations by causing delays and missed shipments, and incurring costs borne by businesses, workers, and consumers. Increasing freight flows place strain on the nation's transportation system. When coupled with aging transportation infrastructure and constrained capacity, increased flows can contribute to reducing the resilience of the nation's freight system, increasing the effects of disruptions, and slowing recovery from disruptive events.

Resilient systems allow for reliable service after small disruptions and a quick return to service after large disruptions (see Figure 2). Properties of resilient systems include maintaining excess capacity or adaptive strategies that enable systems to absorb shocks. Resilient systems are less dependent on single nodes, conduits, or sources that can become bottlenecks or points of failure during a disruption. Resilient systems may instead rely on **diverse** and often **redundant** sources or conduits that provide alternatives should one node or conduit fail. Resilient systems tend to be highly **connected** yet secure and are **flexible** and **adaptive** so that they can easily switch from one option to another. Resilient systems are also **repairable** and can also be quickly restored to limit the duration of a disruption. It is worth noting that resilience describes how a system—not its component parts—performs or functions. Resilience is a characteristic of the long-term performance of a system. A system's resilience is generally only tested and known when that system is subject to a disruption or changed conditions.

Figure 2: Properties of a Resilient System

Source: USDOT John A. Volpe National Transportation Systems Center, (no date).

A resilient freight system should:

- Demonstrate responsive and flexible operations, such as an ability to reroute supply chains quickly and add capacity where needed in response to surges in demand.
- Have infrastructure capable of maintaining performance and security, and resisting damage under stress and, when damaged, be able to be repaired quickly.
- Demonstrate a high degree of connectivity to enable the shifting of supply chains to alternative routes or modes.

Building the resilience of the nation's supply chains requires Federal leadership to coordinate efforts across a wide range of freight and logistics stakeholders, including coordination among and between the public and private sectors to ensure efficient freight transportation flows for both emergency response and economic recovery activities. Business strategies to strengthen supply chain resilience include diversifying sources of supplies and routes, improving the ability of the private sector to pivot to alternative processes and products, and, relatedly, increasing the visibility of supply chains and freight movements.[11] The public sector can support supply chain resilience by improving the connectivity, capacity, and resilience of freight infrastructure, adapting regulations and policies that affect (or constrain) freight movements, convening stakeholders and conducting contingency planning to coordinate

responses in case of disruption, and enhancing freight data and data accessibility. As these efforts progress, we must also recognize that a more resilient supply chain should recognize and mitigate long-standing pollution and economic issues that negatively impact communities of color, low-income, and indigenous communities. The workforce on which a resilient supply chain is built also draws largely from these vulnerable communities.

1.4 Federal Role in Freight and Supply Chains

The Federal Government plays an important role in supporting and overseeing our nation's freight transportation system. This role is enumerated in the U.S. Constitution's Commerce Clause, which authorizes Congress to regulate commerce among the States and with foreign nations.[12] Interstate and international commerce are major components of the nation's economy: more than half (52 percent) of all freight by value crosses State lines and more than a quarter (27 percent) of freight movement is attributed to international imports and exports.[13]

Broadly, the Federal role in freight and logistics can be described by the following activities:

- **Funding**: Provide funds to construct, maintain, and rehabilitate highways, bridges, railroads, tunnels, ports, locks, and other public transportation infrastructure.
- **Regulation**: Establish rules and standards to ensure safety and efficient interstate commerce.
- **Oversight and enforcement:** Ensure all stakeholders follow the laws, rules, and regulations that make the freight and logistics system safe and fair.
- **Data**: Compile and publish data describing freight system performance to support decision-making.
- **Cooperation**: Improve coordination among freight stakeholders to identify freight policy priorities and enhance operational communications.
- **Technical support and guidance**: Provide training, share notable practices, and offer other technical assistance to State, regional, and local governments to enhance public sector freight expertise as well as to relevant private sector entities (e.g., railroads, pipelines).

Due to the interconnected nature of supply chains, the Federal Government's role in supporting resilient freight and logistics systems extends beyond the purview of any one department or agency. The Departments of Commerce, Labor, and Homeland Security, and independent regulatory agencies such

as the Federal Maritime Commission and the Surface Transportation Board, and others, each play a significant role in supporting supply chain resilience.

The Federal Government cannot do this work without the support of non-Federal partners, however. Many freight facilities are owned by State, regional, or local governments or by private industry. Most supply chain operations are handled by the private sector. The public sector manages, funds, and oversees some of the transportation infrastructure that connect these nodes, with the notable exceptions of railroads and the logistics sector (e.g., warehousing, distribution centers, etc.). Government agencies must work closely with—and ensure proper oversight and regulation of—private sector supply chain stakeholders to support a resilient supply chain.

2.0 Freight and Logistics Trends

The demand for consumer goods has surged during the COVID-19 pandemic as consumers have shifted their spending from services to goods. Many of these goods are imported or rely on parts or materials sourced from abroad. At the same time, the pandemic has created disruptions in supply chains, including for businesses and workers. Surging demand for imported containerized goods and supply chain disruptions are among the numerous factors that have contributed to unprecedented levels of congestion at ports and intermodal facilities. These short-term changes have been coupled with long-term, macro-scale trends in the freight and logistics industry, brought on by deregulation of the ocean shipping industry, that have produced conditions that make the nation's freight system more vulnerable to disruption than in the past. As one industry expert noted, "[this current supply chain challenge] is 40 years in the making."[14]

Over time, increased international trade, rising demand for consumer goods, sustained macroeconomic growth, and other factors have increased demands on our transportation industrial base. U.S. manufacturers and retailers increasingly rely on global supply chains for products and resources. In recent decades, U.S. firms trying to lower their labor and inventory costs have turned to strategies such as outsourcing, offshoring, and "lean manufacturing," which optimizes processes and limits waste. While these strategies have in some circumstances reduced prices for consumers and increased profits, contributing to economic growth, they have also contributed to increasing the vulnerability of supply chains to disruption. Rising e-commerce and increased consumer demand for rapid home delivery have led to significant changes in how supply chains operate, as retailers seek to increase the speed and efficiency of their networks to distribute goods directly to consumers.

The evolution of supply chain distribution has led to rising consumer expectations for rapid delivery, and this demand has put increasing pressures on logistics, warehousing, and last-mile delivery services.

Retailers face steep competition to move goods efficiently to consumers at increasing speed. This dynamic is driving demand for land to support distribution centers for both retail and last-mile delivery, and for labor to stock warehouse shelves and make deliveries. At the same time, the labor force has aged, and parts of the logistics industry have increasingly struggled to recruit and retain new workers due to challenging working conditions and reductions in take-home pay, especially in industries like trucking. In addition to demographic and economic changes, climate change—particularly the increased frequency and severity of extreme weather events—has increased the potential for disruptions to supply chains.

2.1 Globalization of Supply Chains and Growing International Trade

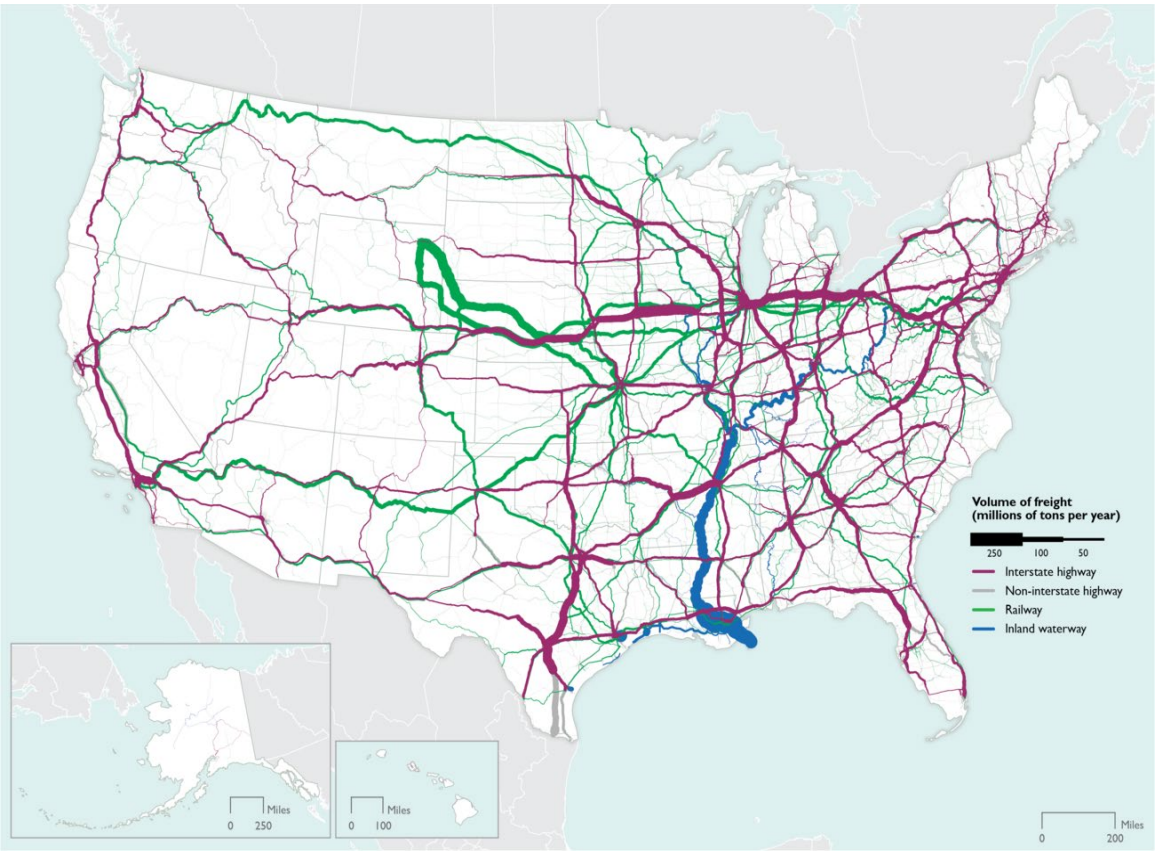
Over time, businesses have become increasingly dependent on a mix of global and domestic supply chains to provide products and services that meet the demands of U.S. consumers. Increasingly, U.S. supply chains rely on materials, technologies, labor, and production facilities located abroad. Since 1970, trade relative to gross domestic product (GDP) has more than doubled, growing from 10.7 percent of GDP to 26.3 percent of GDP in 2019.[15]

America's ports, airports, border crossings, and intermodal corridors facilitate much of this international trade. For example, of the roughly 2.1 billion tons of goods imported to and exported from the United States in 2020, 70 percent passed through American seaports.[16] A significant portion of these goods arrive and depart from U.S. ports in 40-foot containers stacked onto large cargo ships. An increase in trade with China has resulted in more trade moving through Pacific coast ports, and the newly expanded Panama Canal allows larger vessels to transit between the Atlantic and Pacific Oceans. From 2015 to 2019, the number of 20-foot equivalent units (TEUs) of containerized cargo handled by the top 25 U.S. ports increased by 18.6 percent.[17]

As global container trade has grown, container ships have steadily increased in size. Modern ultra large container vessels (ULCVs) can carry more than 21,000 TEUs of containerized cargo. Many U.S. ports have bridge height or channel depth limitations that restrict their ability to receive the largest classes of vessels. Many U.S. ports also lack the capacity and equipment to efficiently dock, unload, and load larger vessels. The surge of cargo coming off larger vessels can also strain landside infrastructure and operations. As a result, more container traffic flows through a smaller number of U.S. ports with the offshore and onshore capacity to handle the largest vessels and their cargo. Today, about more than 95 percent of containers handled in the U.S. flow through the top 25 container ports, with almost 80 percent coming from the top 10.[18] Forty percent of these containers flow through just two ports—Los Angeles and

Long Beach.[19] See Figures 3 and 4 for additional context on how freight flows through the transportation system.

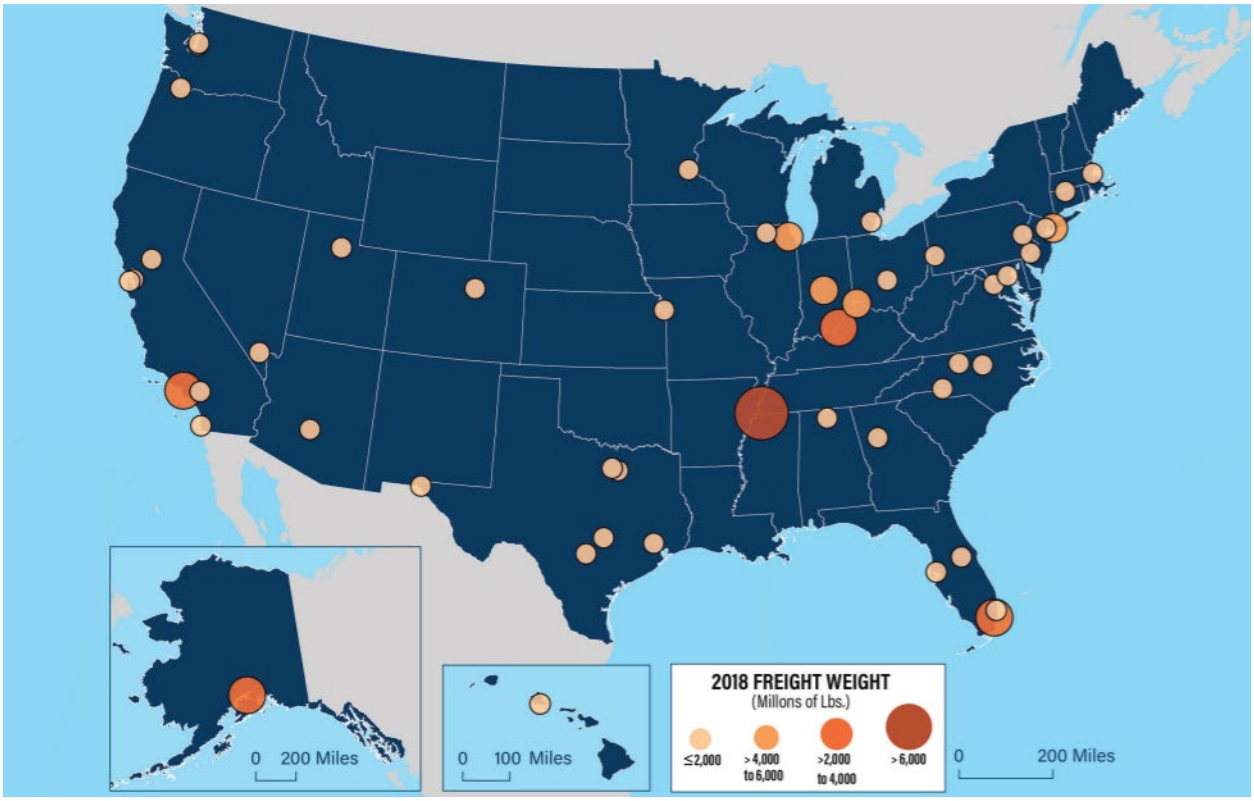
Figure 3: Freight Flows by Highway, Railroad, and Waterway, 2017



Notes: Waterway and port tonnages are based on data for 2017 and rail is based on 2016 data. One short ton = 2,000 lbs.

Sources: Bureau of Transportation Statistics (BTS) Freight Facts and Figures 2018, Figure 3-3. Highway: U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 4.5, 2019. Rail: USDOT, Federal Railroad Administration, 2019. Inland Waterways: U.S. Army Corps of Engineers, Institute of Water Resources, Annual Vessel Operating Activity and Lock Performance Monitoring System data, 2018.

Figure 4: Top Air Cargo Airports by Weight of Cargo, 2018



Note: Data from Bureau of Transportation Statistics, Air Carrier Statistics: T-100 Domestic Market (All Carriers), https://www.bts.gov/browse-statistical-products-and-data/bts-publications/%E2%80%A2-data-bank-28dm-t-100-domestic-market-data-us

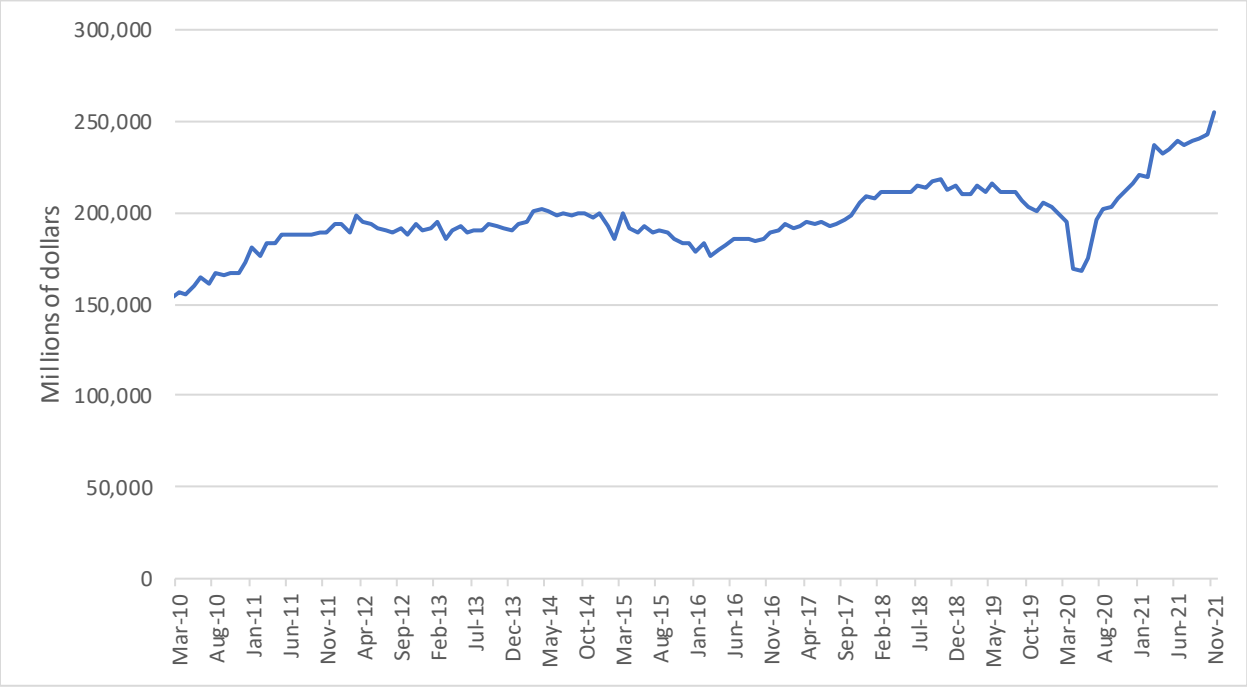
Source: National Freight Strategic Plan, (2020), https://www.transportation.gov/sites/dot.gov/files/2020-09/NFSP_fullplan_508_0.pdf

Domestically, trucks carry the most freight as measured by tonnage and value. Trucks are also essential for drayage operations at ports, which involves moving containers short distances to storage facilities or intermodal terminals. Railroads and waterways also carry significant volumes of freight, particularly for freight moving longer distances and for international trade. Increasing international trade has spurred demand for intermodal traffic on railroads, where trains carry trailers or containers on flatcars. According to the Association of American Railroads (AAR), at least 42 percent of the carloads and intermodal units that railroads carry are directly associated with international trade. U.S. rail intermodal volume grew from 9 million containers and trailers in 2000 to 14.5 million units in 2018. While intermodal traffic declined on an annual basis in 2020, demand for intermodal traffic at West Coast ports surged in the second half of 2020.[20]

Our neighboring countries are the nation's biggest trading partners. Trade with Mexico and Canada accounted for nearly 30 percent of U.S. foreign trade in 2019.[21] North American trade increased

significantly in recent decades, intensifying congestion at border crossings. Between 2008 and 2018, total North American trade increased by 27 percent[22] and the weight of goods shipped to and from our North American neighbors by truck and train increased by 28 percent.[23] The most heavily trafficked border crossings for truck freight are in Laredo, Texas, and Detroit, Michigan. A 2019 Government Accountability Office (GAO) report cited several infrastructure constraints at land border crossings including limited inspection capacity, technology challenges, and security limitations.[24]

Figure 5: Value of U.S. Monthly Imported Goods, 2010-2021



Source: U.S. Census Bureau, (No Date), "U.S. International Trade Data," https://www.census.gov/foreign-trade/data/index.html

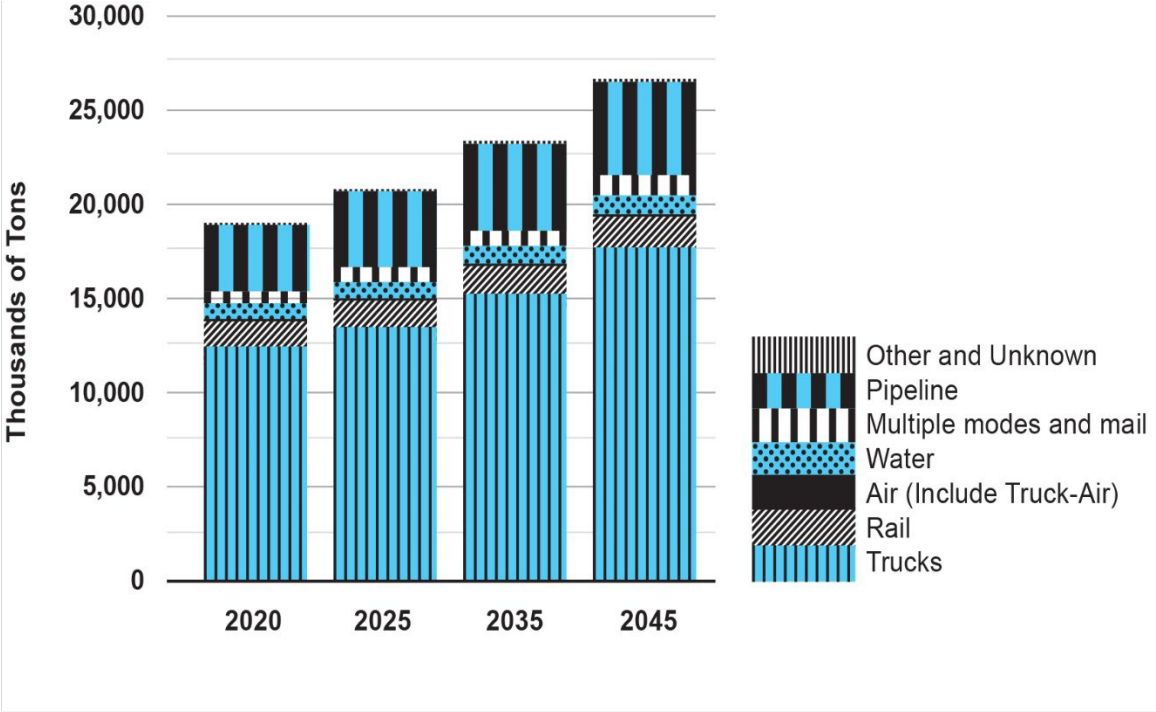
2.2 Overall Growth in Freight Demand

Population and economic growth are increasing demand for goods and freight transportation. The U.S. population has grown by about 18 percent since 2000, adding about 50 million additional people.[25] Meanwhile, freight demand grew by more than 16 percent as measured by total ton-mileage moved since 1997.[26]

Freight demand has grown even more rapidly during the COVID-19 pandemic. As Americans spent more time at home, consumers have shifted spending on services like dining out, traveling, and gym memberships to the purchase of physical goods such as home gym and office equipment and yard

furniture. Goods consumption has risen by 23 percent above pre-pandemic levels and new orders for products have continued to be placed at record levels in late 2021.[27] While increased goods consumption has contributed significantly to COVID-19 related freight bottlenecks, this trend may only be temporary. While most economists expect consumer spending to revert to services in the future as the pandemic wanes,[28] the lasting impacts of this public health crisis are difficult to predict.

Figure 6: Projected U.S. Freight Growth by Mode, 2020-2045



Notes: FAF5 projections are based on 2017 base year data. FAF aggregates data from the Commodity Flow Survey (CFS), Census Foreign Trade Statistics; Economic Census data; the Department of Agriculture's Census of Agriculture; Vehicle Inventory and Use Survey (VIUS), National Highway Planning Network (NHPN); Highway Performance Monitoring System (HPMS), Energy Information Administration (EIA), and other industrial data. Additional documentation and technical specification for how these data are aggregated for base year values and projections can be found at: https://faf.ornl.gov/faf5/data/FAF5_Base_Year_Method_12-2021_FINAL.pdf

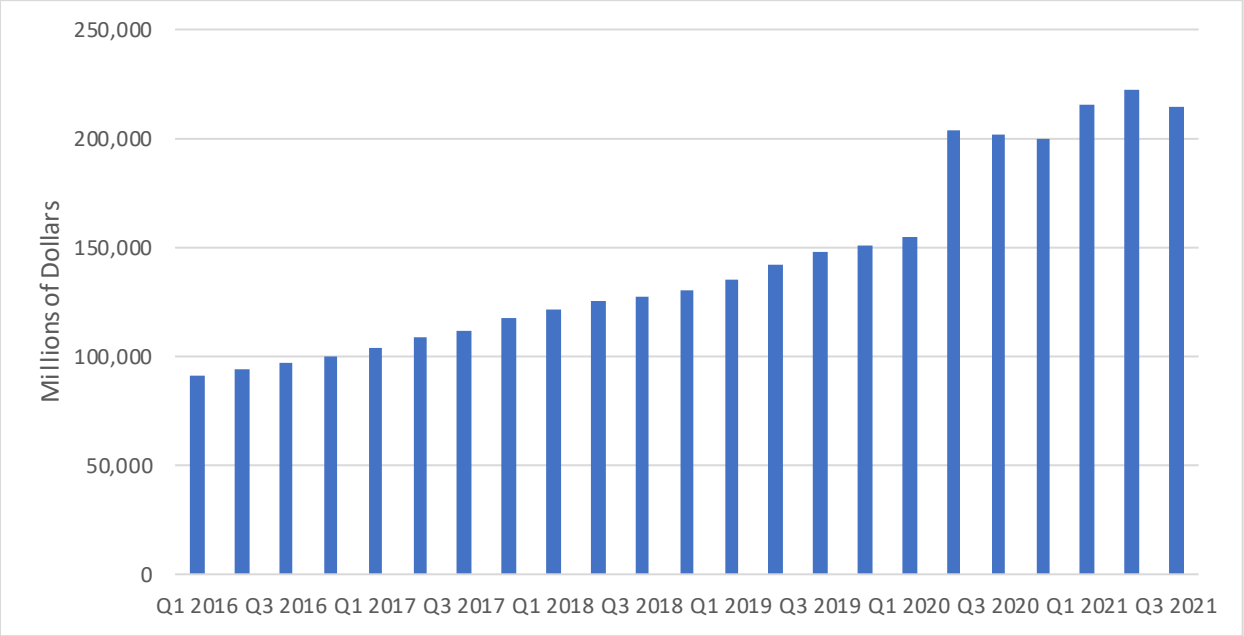
Source: Federal Highway Administration, (no date), "Freight Analysis Framework 5," https://faf.ornl.gov/faf5/dtt_total.aspx

Demand for freight is expected to grow by about 40 percent by 2045. Air cargo (a projected 84 percent increase by tonnage), shipping by multiple modes (58 percent increase), and truck freight (42 percent) are projected to grow at the fastest rates during this time. Even as these modes grow rapidly in the coming decades, trucking is projected to remain the predominate method of shipping in the U.S., moving 66 percent of total volume in 2045.[29] If demand for truck and air transportation grow faster than demand for other modes, as expected, it may generate more congestion on heavily traveled truck routes and increase airspace and runway competition at major distribution hub airports.

2.3 Increased E-Commerce and Direct-to-Consumer Logistics

The rise of e-commerce has changed how retailers and consumers interact with each other. Increasingly, consumers purchase goods online and retailers deliver purchases directly to the consumer's home. In 2019, e-commerce sales grew by more than 16 percent and accounted for more than 11 percent of all retail sales, but in 2020, e-commerce sales increased by more than 30 percent and comprised 14 percent of all retail sales.[30] This trend has increased the number of short-haul and last-mile truck trips. It has also spurred demand for warehousing, especially at sites near urban consumer markets, resulting in rising warehouse purchase and development costs.

Figure 7: Quarterly E-Commerce Retail Sales



Source: Federal Reserve Economic Data (FRED) and U.S. Census Bureau.
https://www.census.gov/retail/ecommerce/historic_releases.html

As retailers seek to deliver products to consumers as quickly as possible, same-day delivery is now the fastest-growing service type for e-commerce deliveries. According to a 2020 survey, 67 percent of U.S. consumers expect either same-, next-, or two-day delivery. The pressures associated with shorter delivery windows and just-in-time inventory management have emphasized last-mile delivery. However, increased time pressures on delivery can incentivize the use of more costly or less-efficient freight

transportation services, such as truckload carrier services and air freight. Furthermore, an estimated 15 to 30 percent of all online orders are returned, placing further demands on delivery services and warehouses.[31]

2.4 Changing Workforces and Technology

Transportation industry activities represent more than 8 percent of U.S. GDP.[32] Approximately 14.5 million jobs—about 9 percent of the U.S. civilian workforce—are transportation related, including approximately 2.7 million people employed as truck drivers.[33] Millions of new workers will be needed to fill vacancies as the industry grows and the current workforce ages. Yet many freight industry employers are experiencing challenges recruiting and retaining qualified applicants due to challenging working conditions.

As e-commerce creates additional demand for warehousing jobs and short-haul freight, long-haul trucking positions may become harder to fill. The barriers for new drivers entering the workforce are also high: there are age and licensing requirements for commercial truck drivers due to the safety sensitivity of the job, and it takes time, training, and money to obtain a commercial driver's license (CDL). Challenging working conditions, including long hours spent away from home, have contributed to high turnover rates in long-haul trucking.[34] Coupled with increasing wages in other sectors, such as construction, warehousing, local truck transportation, and an aging workforce; these factors may result in many potential truck driver applicants looking elsewhere for employment.

Adoption of new technologies and business practices promises to reduce waste and improve safety and efficiency, but poor implementation can come at the cost of jobs and resilience, as workers are asked to do more with less. For example, the number of Class I railroad employees has declined by nearly 25 percent over the past two years.[35] Railroads have increasingly adopted precision railroading, due at least partially to pressure from investors seeking to prioritize reducing operating ratios and increasing stock value over transportation efficiency and resilience. This business practice relies on longer trains to reduce costs; however, some shippers have complained that the practice has reduced performance and resilience, disrupted service schedules, and increased demurrage charges.[36] In addition, as the freight and logistics industry becomes increasingly reliant on interconnected systems to track global supply chains and meet the demands of just-in-time logistics, these systems also become more vulnerable to risks associated with cyberattacks or other outages. Trucking, shipping, and pipeline companies have become a target for attacks that have crippled critical information technology systems and cost firms millions of dollars.

2.5 Increased Disruption Caused by Climate Change

Environmental factors—specifically climate change—further stress our nation's freight and logistics system. Increases in heavy precipitation events, coastal flooding, heat, wildfires, and other extreme weather threaten our aging and deteriorating transportation infrastructure. Much of our nation's critical freight infrastructure is in regions vulnerable to flooding, including many ports, airports, and rail lines. Storm-related flooding—exacerbated by rising sea levels in coastal areas—can close railyards, low-lying roads, and maritime port cargo facilities. High temperatures can accelerate the deterioration of pavement on roads and runways, and cause railroad track failure.[37] Beyond affecting physical infrastructure, extreme weather events can disrupt the supply of equipment, technology, and labor on which our freight system depends. To address the threats from climate change, freight and logistics systems will need to both reduce emissions to keep climate disruptions from becoming worse and build them to withstand the climate disruptions that are already occurring.

Transportation accounted for the largest portion (29 percent) of total U.S. greenhouse gas (GHG) emissions in 2019. More than one-third of that amount came from freight transportation, especially medium and heavy trucks, which accounted for 24 percent of U.S. transportation sector GHG emissions despite making up only 9 percent of total vehicle travel.[38] Concerns about freight-related emissions have led consumers, shareholders, local communities, and governing bodies to increase pressure on shippers and carriers to reduce their environmental impacts, including by optimizing their operations to lower greenhouse gas emissions and shifting to clean vehicles and fuels. As part of this effort, the Biden-Harris Administration has set an ambitious goal that at least half of all new vehicles (including both light- and heavy-duty vehicles) sold in the United States by 2030 will be zero-emissions vehicles, including battery electric, plug-in hybrid electric, or fuel cell electric vehicles.[39] In addition, the Administration has announced a comprehensive approach to addressing emissions from cargo and passenger aviation with a goal of net-zero emissions by 2050.[40] The approach includes the Sustainable Aviation Fuel (SAF) Grand Challenge,[41] setting ambitious goals for three billion gallons of SAF by 2030 and 35 billion gallons of SAF by 2050, enough to supply 100 percent of U.S. fuel demand in 2050.

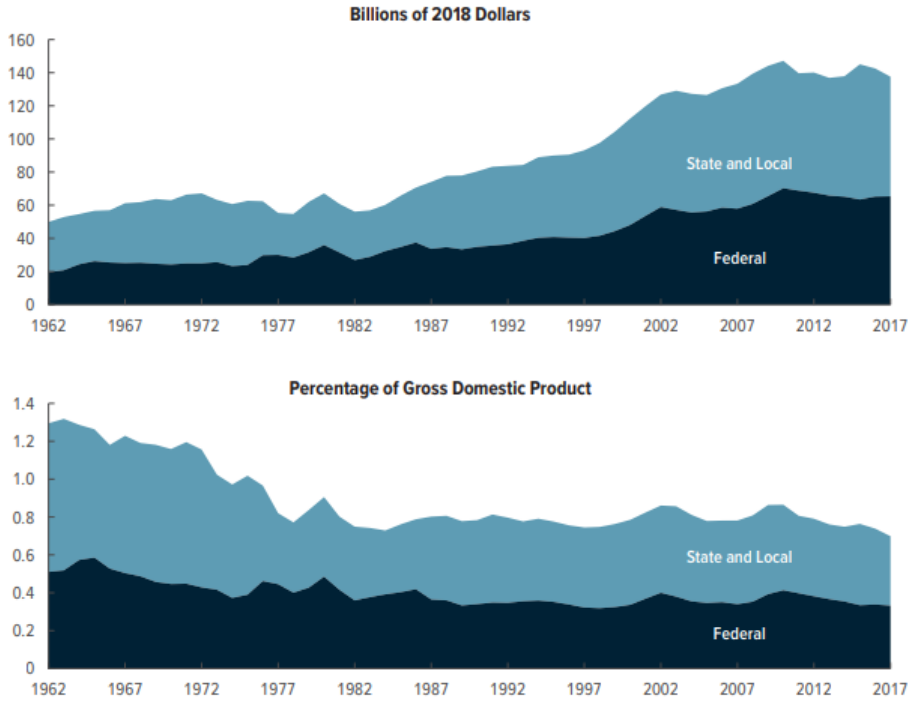
In response, carriers are exploring the use of electric and alternative fuel vehicles and making sustainability commitments. Examples include United becoming the first airline to use 100 percent SAF for a demonstration flight[42] and Maersk planning to operate its first zero-emission container ship starting in 2023.[43] Major U.S. cargo and passenger airlines have committed to net-zero carbon emissions by

2050.[44] Furthermore, as the demand for short-haul trucking increases due to e-commerce and home delivery trends, the use of bicycles and smaller electric vehicles to deliver cargo in dense urban areas have been identified as options to reduce truck-related fuel consumption and emissions.

2.6 Public Disinvestment in Infrastructure

Investment in the roads, bridges, canals, ports, and other infrastructure that freight moves through, on, and over has not kept pace with the growth of the U.S. economy. While nominal investment in the nation's transportation system has steadily increased since 1980, the economy has grown faster, as shown in Figure 8. Without investment in upgrades, aging infrastructure can result in unanticipated repair costs and reduce the efficiency of supply chains. For example, weight-restricted bridges may lead to route detours for large trucks and uneven pavement conditions (e.g., potholes) cause lower travel speeds for goods-carrying vehicles traveling by road.

Figure 8: Transportation Infrastructure: Sources of Nondefense Nominal Investment and as a Percent of Gross Domestic Product, 1962 to 2017



Source: Congressional Budget Office, using data from the Office of Management and Budget, the Census Bureau, and the Bureau of Economic Analysis.

Most state governments and many localities use a fiscal year that starts on July 1 and ends on June 30. CBO adjusted the data to report spending by those governments during the federal fiscal year, which begins on October 1 and ends on September 30.

Source: Congressional Budget Office, (2019). "Federal Investment, 1962 to 2018," https://www.cbo.gov/system/files/2019-06/55375-Federal_Investment.pdf, 24

The nation's aging inland waterway system is a source of major delay for its users, particularly U.S. agriculture and chemical industries. The U.S. Army Corps of Engineers reported in 2017 that the average age of all locks in the nation was 62 years.[45] In 2020, nearly half (47 percent) of all vessels traveling through public locks experienced delays, and the average delay for a locked vessel was over two hours.[46] Investment in the nation's inland ports and facilities has steadily decreased since the 1960s, and State and local governments have taken on an increasing burden to invest in the facilities.[47] The Congressional Budget Office reported that public investment in waterborne infrastructure as a share of GDP was at a 55-year low in 2017.[48]

Public investment has lagged in all parts of the transportation system, though the extent of disinvestment varies by mode and region. Limited data availability makes it difficult to precisely measure freight network conditions. For example, while the Federal Government collects and publishes data on bridge and pavement conditions on roads and runways, data on rail and pipeline conditions (which are typically privately owned) are far more limited. Even when data is publicly available, the processes to collect, standardize, vet, and publish are lengthy, and data are often several years out of date by the time they are published.

The American Society of Civil Engineers (ASCE) estimates that the deficient and declining state of surface transportation could cost Americans almost $3 trillion in declining business productivity and personal budget impacts by 2040.[49] In addition to declines in infrastructure investments, expenditures related to infrastructure operations and maintenance have increased by nearly 10 percent over the past decade.[50] This means that the nation now spends more money to maintain existing infrastructure across the country than to build new facilities or invest in significant upgrades to infrastructure.

While public investment in infrastructure has declined, infrastructure needs have continued to grow. Consistent and predictable investments across the freight and logistics sector are necessary to adapt to changing business trends and new technologies to secure and upgrade data and collection systems to gather more frequent metrics and to enhance physical and cybersecurity systems. Investments are also needed to ensure adequate capacity and system connectivity, and to create more resilient infrastructure in response to climate change impacts like storm surge, sea level rise, and extreme weather events.

Investment in the nation's freight transportation system is set to increase over the next decade due to funding provided by the Bipartisan Infrastructure Law (BIL), the single largest investment in repairing and reconstructing the country's roads, and bridges since the construction of the Interstate Highway System. The BIL includes a 40 percent increase to Federal-aid funding programs, $17 billion in port infrastructure

and waterways funding, and $25 billion in airport funding to address maintenance backlogs and reduce congestion.[51]

2.7 Industry Consolidation

Large sectors of the freight market have experienced significant consolidation over the last several decades, leading to increased shipping rates. Freight carriers across these sectors have merged to form fewer, larger companies—nearly all of which are foreign-owned—that control larger market shares. These massive companies can use their large market shares to influence shipping capacity and rates and disadvantage American exporters.[52]

The ocean carrier industry is essential to our supply chains because it carries the majority of the nation's international trade. Today, the vast majority of oceangoing international trade moves in containers, which has streamlined costs by limiting the number of times a product is handled in transport, reducing liability costs, and enabling goods to be easily transferred to trucks or rail for movement to customers.[53] Over the past 20 years, vessel sizes have increased dramatically, with the largest vessels growing from around 15,000 containers in 2006 to more than 24,000 today.[54]

As in other industries, maritime shipping firms have pursued mergers and alliances between carriers to gain economies of scale and competitive advantages in the global marketplace. In 2000, the ten largest ocean shipping companies controlled 51 percent of the shipping market. Today, that figure is more than 80 percent.[55] Major ocean carriers—none of which are U.S. owned—have also formed alliances through which they pool vessels and capacity along defined routes. This allows them to reduce the total number of ships needed to operate and facilitates the use of increasingly large ships. Ocean carriers, both alone and through their operating alliances, use their market power to control capacity and maintain shipping rates.[56] For example, many container exporters and importers have raised concerns about ocean carriers and marine terminal operators charging high detention and demurrage fees, which are often passed onto shippers and cannot be avoided due to a lack of suitable alternative carriers at a given port.[57]

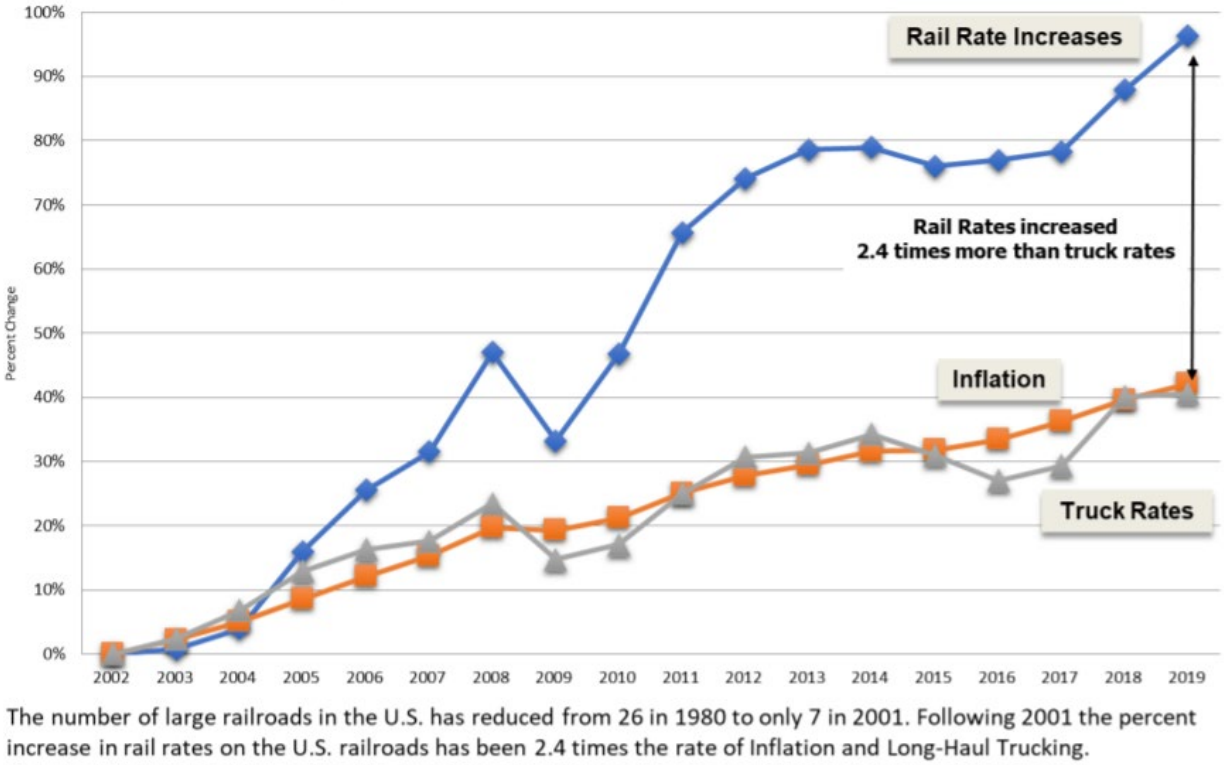
In the global maritime container manufacturing industry, China has near-total control of production. Three Chinese companies account for 96 percent of the world's dry cargo containers and 100 percent of the refrigerated containers.[58] While shipping container shortages dominated news coverage during the early days of the COVID-19 pandemic, overall global supply of containers was likely adequate to meet demand, however, containers were not located where they were needed (see Section 3.7: Container Availability). However, the concentrated control Chinese firms have over the container market creates

supply chain vulnerabilities, given that the entire global container market may be affected by an emergency shutdown or reduced production capacity at just a handful of manufacturing plants.

Both the concentration of container chassis ownership and changing corporate equipment leasing strategies have contributed to bottlenecks in the supply chain that predate the COVID-19 pandemic. Prior to the 2008 recession, ocean carriers generally owned and provided container chassis as part of their overall shipping packages and rates.[59] Since that time, most ocean carriers have shifted their business models to use third-party intermodal equipment providers (IEPs) to provide chassis.[60] Today just three companies own and lease nearly all international container chassis in the U.S. and these businesses maintain exclusivity clauses in their agreements with the major ocean carriers. As an analysis by the Maritime Transportation Research & Education Center concluded, this means "…a motor carrier with permission to pick up a container from one ocean carrier would not have permission to use another's chassis, despite complete interchangeability [of equipment.]"[61]

U.S. freight rail has also seen significant consolidation in the past several decades. Congress largely deregulated the rail industry in 1980 under the Staggers Act, due in part to concerns about the long-term economic stability of the 26 Class I railroads that existed at the time. Initially, rail shipping rates dropped quickly. However, subsequent mergers among carriers in the 1980s and 1990s left just seven Class I railroads by 2001. Today, across much of the country, Class I railroads have few competitors within the geographies they serve. One analysis by a rail industry advocacy group indicates that rail shippers are bearing the financial burden of railroad consolidation (Figure 9). Between 2002 and 2019, long-distance trucking rates increased by 40 percent, at a similar rate to economy-wide inflation, while rail rates increased 96 percent, and non-competitive revenue has increased 230 percent on average since 2004.[62]

Figure 9: Rail Industry Consolidation Has Allowed Railroads to Increase Rates Dramatically More than Inflation and Trucking (Based on Cents per Revenue Ton-Mile 2002-2019)



Note: Author cites the following data sources: Rail Rate Increases are taken from the AAR Railroad Facts Books. Trucking Rates utilize the BLS Long Haul Truck Rate Index. Inflation uses the Consumer Price Index for All Urban Consumers (CPIU)

Source: Rail Customer Coalition, (2021), "Economic Analysis: Consolidation and Increasing Freight Rail Rates" https://www.freightrailreform.com/wp-content/uploads/2021/07/Economic-Analysis-Consolidation-and-Increasing-Freight-Rail-Rates.pdf

3.0 Challenges in Supply Chain Resilience

The resilience of America's supply chains relies on quality physical infrastructure, access to human capital, and a growing need for technologies and data that support how goods are moved. These facets of the nation's supply chains face numerous challenges, many of which have been exacerbated by the COVID-19 pandemic. They include congestion, last-mile freight delivery, chassis and container availability, infrastructure outages, warehousing capacity, workforce conditions, regulatory flexibility, and data availability. The current pandemic-induced supply chain congestion has highlighted many weaknesses in our freight system, many of which predated the existing disruptions. If not addressed, these weaknesses will continue to undermine the resilience of supply chains. This section briefly describes some of the major challenges facing supply resilience, including both the short-term impacts and the longer-term roots of these challenges.

3.1 Physical Infrastructure

Freight and logistics infrastructure requires improvements to existing facility and site conditions to address deterioration caused by historic disinvestment. There is also a need to invest in infrastructure mitigation and adaptation measures to respond to projected climate change impacts.

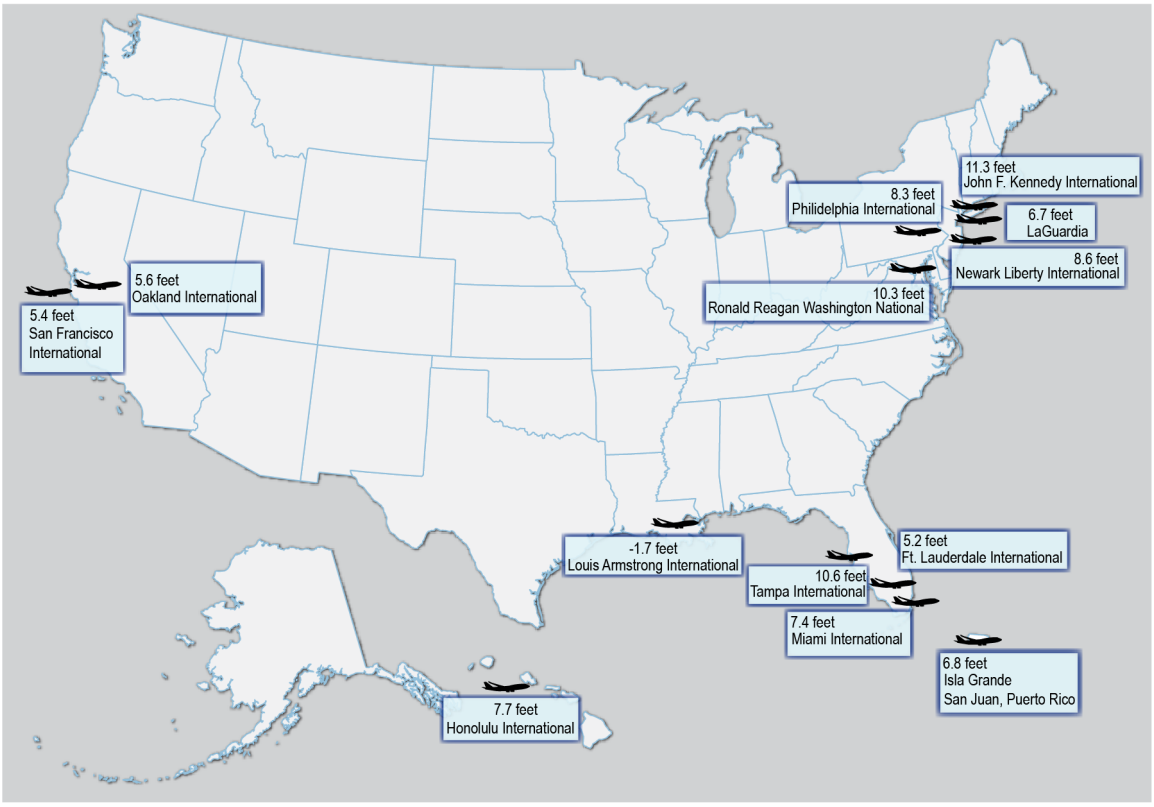
Challenges:

- **Degraded infrastructure conditions.** America's infrastructure has faced historic disinvestment, leading to poor infrastructure conditions.
- **Low levels of climate resilience.** Sea-level rise, storm surge, and other extreme weather events from climate change have the potential to disrupt freight operations or damage freight and logistics facilities.

ASCE's 2021 ratings of U.S. public infrastructure, including transportation infrastructure, highlight the need for significant improvements. ASCE's assessment of freight-related infrastructure conditions varies greatly by infrastructure type: the nation's inland waterways, levees, and roads received a low score of "D," while airports received a "D+," port infrastructure and rail received a "B," and the nation's bridges received a "C."[63] Federal infrastructure metrics also show opportunities for improving the condition of key assets. A 2017 FHWA study of intermodal connectors, which are last-mile connections to freight facilities, found 37 percent of these facilities to be rated in poor condition, and another 19 percent to be in "mediocre" condition. These conditions indicate major problems with potholes, pavement rutting, and cracking, which can cause moderate to substantial reductions in truck operating speeds. Fewer than 10 percent of these facilities are rated in "good" or "very good" condition.[64] Similarly, about one in ten bridges nationally were posted with weight or clearance limits in 2021, restricting heavy or large vehicles.[65] Many of these infrastructure ratings represent improvements from previous years, and BIL aims to support future significant investments in infrastructure. However, lagging investment has created conditions that hinder supply chain operations.

Freight and logistics facilities are also increasingly affected by climate change and must rapidly respond to changing environmental conditions. Climate change impacts, particularly effects from storm surge and sea-level rise, have the potential to damage or destroy transportation equipment and infrastructure, close freight facilities, or delay freight operations. Direct impacts from flooding and storm surge on freight and logistics infrastructure are particularly likely since many facilities, such as ports on waterfronts or river basins, are in areas at high risk of climate impacts and cannot be easily relocated or elevated. For example, many of the nation's largest ports are on the Gulf Coast, which is particularly vulnerable to sea-level rise and land subsidence.[66] Additionally, 13 of the 47 largest airports in the nation have at least one runway that is at risk from storm surge due to an elevation within 12 feet of existing sea levels (Figure 10).[67]

Figure 10: Airports Vulnerable to Storm Surge



Note: Data from the Federal Aviation Administration, 2012.

Source: U.S. Global Change Research Program, 2014. *Climate Change Impacts in the United States: The Third National Climate Assessment*, https://nca2014.globalchange.gov/report/sectors/transportation

Inland facilities "face similarly uncertain futures, given the threats posed by extreme precipitation in the form of catastrophic riverine flooding, disruptive stormwater flooding," and localized flooding can also close streets.[68] For example, the Great Lakes and Saint Lawrence Seaway could experience lower water levels, leading to reduced vessel navigability during certain seasons.[69] Effects of changing weather can impact a broad array of freight operations across modes, such as prevailing wind changes that reduce airplane performance and airplane runway utilization, or extreme hot weather that increases the length of runway needed for planes to take off,[70] and flash floods, mud slides, and high crosswinds that can threaten railroad operations and safety.[71]

In addition to direct physical impacts to infrastructure and operations from storm surge and other extreme weather, climate change-related events can also lead to significant secondary disruptions and impacts. These include increased national, regional, or local economic costs, limitations on access to goods, and

barriers to delivering critical emergency supplies to affected communities.[72] For example, Winter Storm Uri, also known as the "Texas freeze," brought abnormally cold weather to Texas in February 2021, disrupting the power grid, and causing severe impacts on supply chains, particularly for the chemical industry. This event caused $80 to $130 billion in direct and indirect economic losses[73] and caused blackouts that disrupted equipment and supply chains for chemical plants in Texas, which represent about 75 percent of the nation's chemical production.[74]

The costs of capital improvements to adapt to climate change and build a more resilient freight system are also significant. Many freight facilities are retrofitting existing infrastructure to improve resilience and investing in electrification to mitigate climate change impacts. Retrofits include hardening critical infrastructure, raising finished floor elevations, developing seawalls, elevating, or relocating roads and rail lines to limit flooding impacts, and deploying temporary barricades during weather events. However, there are currently no formal national standards for climate-resilient infrastructure that have been uniformly adopted by engineering professionals to guide needed infrastructure investment,[75] and the costs of these retrofits can be prohibitive.

The emerging transition to freight electrification also requires resilience considerations. Some facilities are replacing diesel-powered cranes, vehicles, and other ground transportation equipment with equipment that runs on electricity, and several private companies are also exploring opportunities to create zero-emission container ships and to reduce GHGs released by airplanes. Work under the Federal Aviation Administration (FAA) Continuous Lower Energy, Emissions and Noise (CLEEN) program and the Center of Excellence for Alternative Jet Fuels and Environment, known as the Aviation Sustainability Center (ASCENT), advance lower-emission technologies and support the testing and approval of alternative jet fuels to ensure their safety and performance in today's aircraft fleet. Resiliency considerations must be balanced with the need to decarbonize the transportation system. For example, backup generators often cannot produce enough power to keep electric cranes and other port infrastructure operational during disruptions.[76] Additionally, some freight equipment, such as cranes, face supply challenges since domestic manufacturing is limited, and production is limited to a handful of foreign-owned companies. Domestically produced alternative fuels, including sustainable aviation fuels, minimize reliance on foreign energy suppliers, providing enhanced supply chain resilience as well as domestic workforce opportunities. They also expand the geographic footprint of energy production in the U.S., thus lessening the risks of natural disasters affecting any one part of the country.

3.2 Congestion

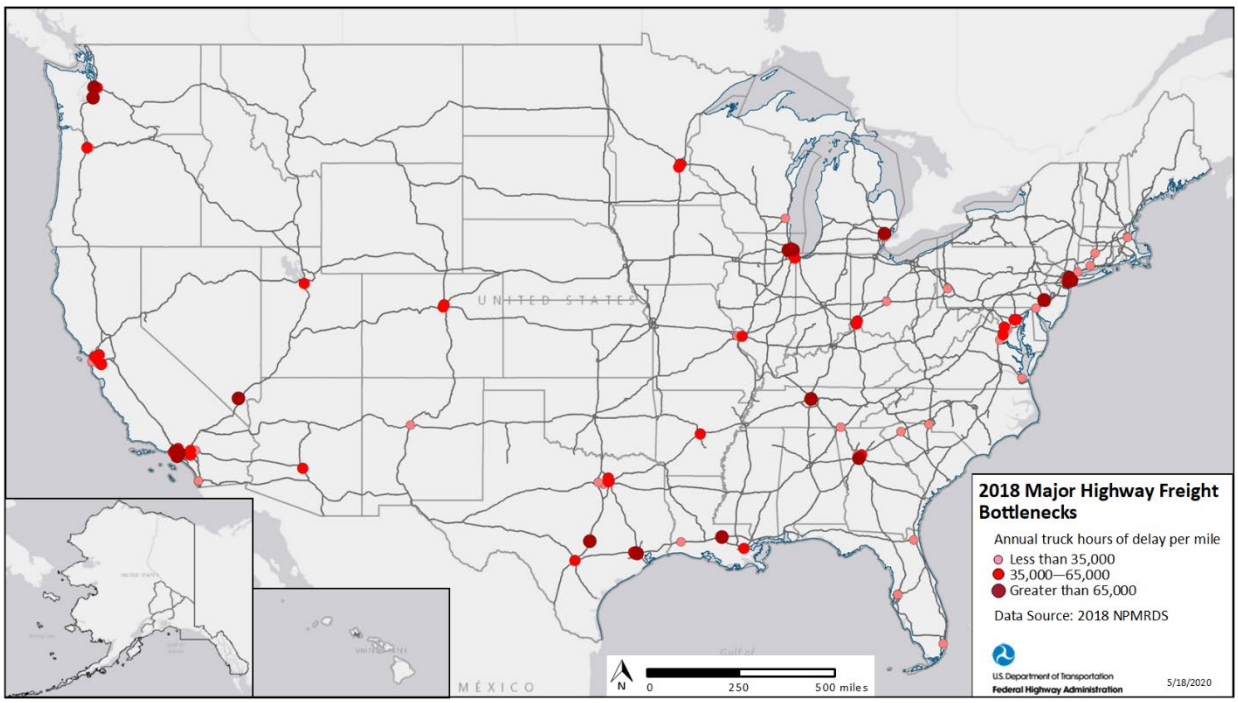
Congestion occurs when available capacity is unable to service the current level of demand. This can lead to disruptions in supply chain flows that take the form of delays, unreliability, routing inefficiencies, and increased costs. Supply chain congestion can come from limitations on physical transportation infrastructure, inefficient exchange of information, or from other factors such as shortages of equipment and labor. The ability of the freight and logistics system to respond to incidents of congestion and to address its causes can limit the costs and cascading impacts of this disruptive factor.

Challenges:

- **Bottlenecks and physical infrastructure constraints.** Some parts of the freight system are not well designed for current and future freight needs, and do not have adequate infrastructure capacity to meet fluctuating demand.
- **Operational inefficiencies.** Operational processes, maintenance activities, or equipment and labor shortages can lead to inefficiencies.
- **Ripple effects across supply chains and transportation modes**. Congestion in one location can impact other areas.

Congestion can be attributed to many factors, including weather events, maintenance activities, equipment or labor shortages, or spatial mismatches in equipment location. Bottlenecks are physical locations where available transportation infrastructure cannot meet traffic demand for extended periods of time,[77] causing congestion and delay. Examples of bottlenecks include low-ceiling tunnels or low-clearance overcrossings that impede railcar movements;[78] port channels where depth or width may constrain the number or type of vessels that can access port terminals;[79] air cargo facilities that may have insufficient space for truck parking;[80] and, in urban areas, locations where narrow streets or tight turning radii lead to constrained truck movement. Many States have also identified highway freight bottlenecks (see Figure 11).[81] Labor and operational considerations such as shortages of equipment or staff to screen and move goods can also create bottlenecks that limit the resilience of supply chains.

Figure 11: Examples of Major Highway Freight Bottlenecks by Number by Truck Hours of Delay per Mile



Note: As part of their State Freight Plans, States are required to identify freight bottlenecks, although they use different processes for determining them and the lack of a uniform approach makes it difficult to compare bottlenecks at a national level.

Source: Federal Highway Administration, (2018), "National List of Major Freight Highway Bottlenecks and Congested Corridors," https://ops.fhwa.dot.gov/freight/freight_analysis/mobility_trends/national_list_2018.htm

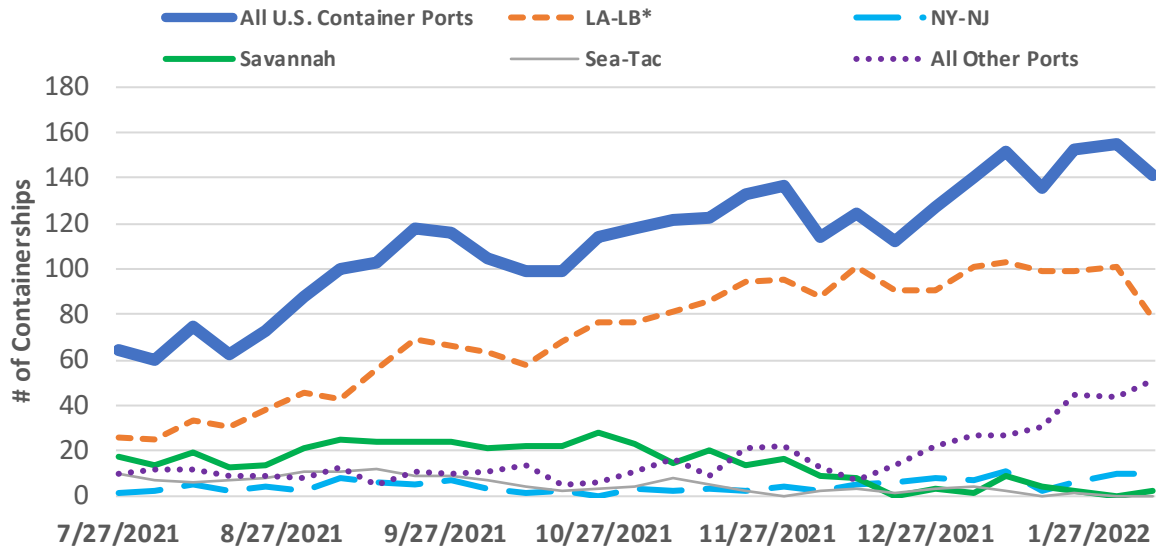
Congestion has a cost. On the Interstate Highway System alone, the cost of congestion grew 25 percent over two years—from $12 billion in 2017 to over $15 billion in 2019, according to the American Road and Transportation Builders Association (ARTBA).[82] Additionally, in 2019, highway freight shipments experienced almost 660 million hours of delay on the nation's roadways.[83] The cumulative long-term (30-year) cost of congestion on intermodal connectors alone has been valued at $6.4 billion.[84] The impacts of congestion are also felt beyond the Interstate Highway System: maritime congestion at ports, idling equipment, and queuing trucks at ports contribute to reduced operational efficiency and worsened environmental conditions around facilities. For example, the Ports of Los Angeles and Long Beach can produce as much as 100 tons of smog and other chemicals each day, contributing to poor air quality that negatively impacts adjacent communities.[85]

Congestion can also negatively impact supply chain resilience and can lead to cascading disruptive effects on supply chains across all transportation modes. For example, during the COVID-19 pandemic,

increased demand for containerized freight and delays in berth access for vessels led to increased container port traffic (see Figure 12) and severe backlogs in getting goods to customers. At peak, more than 100 container vessels were queued offshore to enter the Port of Los Angeles and Port of Long Beach—due to increased ocean cargo volumes from Asia coupled with limitations in other parts of the supply chain, including the ports' ability to unload cargo and truckers' ability to "turn" containers, warehouse capacity limitations, and issues in trucking and rail transportation beyond the terminals.

Congestion also results in an undesired shift in transportation safety risk. For instance, the backlog of containers awaiting rail transportation in the Ports of Los Angeles and Long Beach resulted in an increased safety risk from the millions of pounds of fireworks contained in many of those containers. The Pipeline and Hazardous Materials Safety Administration's (PHMSA's) efforts to raise awareness with port authorities, and resulting cooperative solutions, helped ensure that local communities were not unnecessarily burdened with cost should an incident occur: risks of incidents increase with shipping containers standing idle with hazardous materials for long periods of time.

Figure 12: Container Ships Awaiting Berths at all U.S. Ports, July 2021 – February 2022



Datapoints are weekly observations of anchored container ships, typically made each Tuesday.
*The Ports of Los Angeles and Long Beach (LA-LB) count includes ships that are deliberately slow-steaming and at drift, as well as those anchored.

Source: USDOT, Maritime Exchange of Southern California

Ocean shipping delays have also impacted other parts of the supply chain, such as by increasing demand for air freight and contributing to freight congestion in the global aviation system.[86] For example, in April 2021, Chicago O'Hare International Airport experienced such severe cargo congestion that air freight staff rented warehouses in surrounding areas to hold overflow cargo, and several logistics companies moved their operations to different facilities in the Chicago region.[87] Moreover, the ability of air freight to accommodate shifts in demand is limited by the lack of U.S. heavy-lift cargo aircraft, and by the reliance on a single foreign air carrier with limited capacity for oversize air cargo shipments to and within the U.S. Similarly, delays in rail service have also had subsequent impacts on port cargo movements. In July 2021, cargo awaiting railcars at the Port of Long Beach sat on the docks for up to 12 days, as compared to a pre-pandemic norm of 3.5 days.[88] Numerous similar examples have been reported across the U.S. freight transportation system over the last two years.

Resilient Approach: Flexible Hours of Operation

In response to recent congestion across multiple freight modes, the Federal Government has worked with the Ports of Los Angeles and Long Beach to advance 24-hour, seven days per week operations at the port terminals to address backlogs. Leaders of the union labor forces working at these terminals agreed to the increased hours to help clear cargo in a "ninety-day sprint."[89] Notably, several major importers, including Walmart, UPS, and FedEx, also agreed to implement round-the-clock operations to move goods coming in from the two ports seamlessly through the freight and logistics system beyond the port facilities. While the effort toward round-the-clock operations is in its infancy, this strategy highlights that flexibility in operations can help to address congestion when it arises and should be a long-term goal for the country's freight moving system.

3.3 Data Availability and Knowledge Gaps

In an increasingly on-demand freight and logistics system, agencies, businesses, and consumers expect frequent or even real-time data to inform decision-making. Private sector logistics firms rely on data to effectively manage their supply chains on a daily basis, to respond to issues as they arise, and to assess potential implications of future disruptions.[90] Similarly, the public sector needs data to assess vulnerabilities in existing transportation networks; adapt to disruptions in real-time through emergency management responses and recovery planning; enact regulatory and policy changes to support critical supply chain flows and economic continuity; identify mitigation strategies and evaluate effectiveness of past efforts, plans, or programs; and target investment priorities to enhance resilience.[91]

Challenges:

- **Real-time information.** Real time or regularly updated information about key supply chain components is not currently available to track trends in and respond to disruptions.
- **Ongoing analysis.** Few data collection efforts have been undertaken to analyze disruptions and project future incidents.
- **Public versus private data.** Much private freight data is proprietary or too expensive for some public sector agencies to purchase. Using private data may require specialized expertise that is difficult for the public sector to access or procure.
- **Level of detail.** Existing publicly accessible freight data and models are inadequate to permit detailed analysis of supply chains or effects of disruptions.

Inadequate access to data impacts supply chain stakeholders' ability to respond to disruptions. In a 2016 study, the GAO found that information on freight and end-to-end supply chains was critical to addressing constraints at ports and to improving coordination among the various public and private actors involved in freight and logistics.[92] Relevant data for monitoring supply chain resilience includes travel time, travel time reliability, risks, safety conditions, and costs[93] as well as the locations of certain critical equipment like containers and chassis. For example, the Federal Government does not currently have information to identify and respond to bottlenecks or to assess metrics of delay and congestion, like truck turn times at ports across multiple facilities on an ongoing basis.

Several challenges limit the public sector's ability to access, collect, share, and analyze freight data. Data is often collected or produced by the private sector and can be proprietary. When the private sector

shares data with the public sector, the scale may not be appropriate and can require specialized expertise to analyze; privately maintained freight databases generally include very granular data.[94] It can be particularly challenging for public sector officials to access and analyze supply chain data immediately after an incident affecting the transportation system occurs.[95] USDOT has begun to address this by developing data spotlight case studies analyzing recent supply chain disruptions, such as the Suez Canal blockage[96] and the I-40 bridge failure in 2021.[97] At the State and regional level, models used by State DOTs and MPOs to inform transportation planning do not always adequately capture "real world" behavior in response to disruptions, particularly freight actors' behavior.[98]

In recent years, the public sector has increasingly recognized the importance of improved freight transportation and supply chain data and modeling tools, though additional tools and data sharing are needed. New technologies and approaches including wireless connectivity applications, machine learning, and artificial intelligence could improve the public sector's ability to track freight movements and optimize supply chains. Radio-frequency identification, license plate recognition, and other innovations also support improved supply chain data transparency. Additional coordination between public and private sector stakeholders could help to address some data challenges and enhance the ability of all parties to support resilient supply chains. For example, the Federal Government could develop improved national level supply chain data and State DOTs and MPOs could work with private sector partners to identify regional economic impacts, to model goods movement, and to address freight bottlenecks and congested areas where the effects of disruptive events may be magnified.[99] At a local level, freight facilities could also use Port Community Systems or other data sharing dashboards to improve operational efficiencies by sharing information about goods movement at ports between and among public and private stakeholders (see text box below).

Resilient Approach: Port Community Systems

Port Community Systems (PCSs) are software platforms that connect actors at ports, enabling information exchange between a port and a variety of stakeholders. Many U.S. ports have developed these systems to share supply chain information among and between various stakeholders including but not limited to the Port Authority of New York and New Jersey and the Port of Los Angeles.

For example, the Port Authority of New York and New Jersey is using a PCS (Advent eModal) along with a mobile app, PortTruckPass (PTP), to share booking and appointment information across all six of the port's terminals.[100] The PTP system uses Radio Frequency Identification (RFID) tags to

measure and report on truck activities through real time information on metrics like turn times and congestion on roadways surrounding the terminals. The system also provides users with real-time information about container availability, traffic conditions, equipment availability, and alerts about current conditions.

Similarly, the Port of Los Angeles launched Port Optimizer,[101] a cloud-based data portal, to share maritime shipping data with cargo owners and supply chain stakeholders. Port Optimizer compiles and aggregates previously disparate and conflicting data sources to provide a more comprehensive picture of the maritime supply chain and improve port operations, asset utilization, and planning. The system helps businesses understand what the opportunities are for moving freight and what the current and future conditions are (such as level of congestion). The Port of Los Angeles has also released four additional tools under the Port Optimizer umbrella. These tools depict data on inbound cargo (updated daily), empty returns (updated every 5 minutes), real-time truck turn times, and forecasted cargo movements. Some of these tools are publicly available while others are available only to port business partners.

3.4 Supply Chain Security

Challenges:

- **Increasing cybersecurity threats.** New and evolving technologies, including connections through the Internet of Things can create vulnerabilities.
- **Theft of goods.** With more cargo stopping multiple times in congested conditions, there are increasing opportunities for theft.

Security—of supply chain operations, physical infrastructure, and technology—is a critical facet of resilience. Terrorism and theft are ongoing threats to freight operations, as is cybersecurity given the increasing adoption of technology in freight and logistics operations.

Because of their importance to the national economy, physical infrastructure such as freight and logistics facilities may be targeted by maligned actors, including terrorists or organized crime networks.[102] Threats may be posed by insiders with access to facilities or outside actors who gain access through lawful or unlawful means. To minimize and mitigate these threats, government officials and freight and logistics stakeholders can

take ongoing precautions such as strict identification requirements, implementing background checks, and coordinating with law enforcement to respond to emerging threats.

Truck parking is a concern for both the security of freight workers and cargo security. Section 1401 of the Moving Ahead for Progress in the 21st Century, or Jason's Law, was enacted in 2012 to provide "national priority on addressing the shortage of long-term parking for commercial motor vehicles on the National Highway System (NHS) to improve the safety of motorized and non-motorized users and for commercial motor vehicle operators."[103] Jason's Law has increased public sector awareness of the value of increasing investment in truck parking. The Bipartisan Infrastructure Law continues to build on the legacy of Jason's Law by requiring States to assess commercial vehicle parking facilities as part of their State Freight Plans.

Cargo theft, a $15 to $35 billion industry, is a rising concern for freight and logistics.[104] In addition to the costs of stolen goods, negative impacts to businesses for cargo theft can include loss of market share, rising insurance premiums, and loss of consumer confidence.[105] According to one supply chain security firm, the vast majority (87 percent) of cargo thefts occur at unsecured truck parking sites.[106] With more cargo sitting in congestion through the supply chain in 2021, reports of such cargo thefts have increased.[107] For instance, rail carrier Union Pacific reported a 160 percent year-over-year increase in rail car theft in Los Angeles County from 2020 to 2021.[108]

Supply chains are increasingly dependent on technology for their operations. Cybersecurity attacks are relatively rare, but they are increasing in frequency.[109] Security systems are increasingly dependent on networked, internet-based technologies, many of which are also connected as part of the Internet of Things (IoT).[110] While new technologies create opportunities for connection and efficiencies within the supply chain, these highly connected networks can also generate new vulnerabilities. Ransomware, a type of cyberattack in which hackers disrupt operations by locking out access to a facility or site until a ransom is paid, has become an increasing threat to transportation facilities and in recent years has impacted multiple transportation firms, including trucking companies[111] and rail lines.[112] For example, in May 2021 the Colonial Pipeline, which carries almost half of the fuel used on the Eastern Seaboard, was shut down by a ransomware attack, causing limited fuel availability and rising prices.[113]

New and increasing security threats highlight the importance of a multipronged approach to supply chain security. Freight and logistics stakeholders must be conscious of the ongoing risks posed by terrorism, organized crime, and insider threats. In an increasingly technologically connected supply chain, many operations and security managers need training and support to increase cybersecurity and assess a changing landscape of technological risks.[114] Supply chain security can incorporate resilience by building

redundancy into physical, operational, and technological systems to address disruptions when and if they occur.[115]

3.5 Last-Mile Freight Delivery

The "last-mile," or final leg of the supply chain, describes the movement of freight from a distribution center to an end consumer or a store. Last-mile freight delivery is one of the most complex and costly elements of freight delivery,[116] especially in dense, highly populated urban areas,[117] so challenges with this part of the supply chain can have serious implications for resilience.

Challenges:

- **Increased e-commerce demand.** Increased e-commerce demand and subsequent truck traffic have placed additional stress on the local streets that handle last-mile freight deliveries.
- **Access in dense, urban areas.** Population density, infrastructure constraints, and competition between freight and other uses for right-of-way can lead to additional strains.
- **Regulations and restrictions.** Regulations, routing restrictions, and ineffective enforcement policies can lead to inefficiencies and reduced freight access.

Several features of the public realm can exacerbate the challenges of last-mile deliveries. Highway interchanges and streets in urban areas may have geometries that are difficult for trucks to navigate.[118] Low overhead clearances and weight-restricted bridges may limit truck movement.[119] Curb regulations, truck bans, and ineffective enforcement also pose challenges that include delays, increased costs, and reduced reliability in freight movement.[120] Streets designed without curb cuts and inadequate truck parking and loading spaces may cause trucks to park in unauthorized locations, to double-park on busy streets, or to illegally park on sidewalks or in bike lanes.[121,122] Trucks may also face limitations due to routing restrictions. Without effective enforcement, trucks may not be able to access loading zones or designated parking areas. These challenges make it harder for trucks to reliably deliver goods to consumers.

In recent years, e-commerce demand and other trends in consumer expectations (e.g., next-day and same-day delivery) have significantly shaped the landscape of last-mile freight delivery. Increased e-commerce demand and growing urban populations are straining infrastructure and reshaping industry trends in warehouse siting, logistics needs, delivery approaches, and technology applications.[123] In some

areas, demand for e-commerce also increases safety conflicts because more trucks are sharing already limited right-of-way and curb space with other users including personal vehicles, bicycles, and pedestrians.[124] This competition for scarce resources has grown alongside expanded curbside uses like pick-up and drop-off space for ride-hailing and transportation network companies, micromobility, and on-street bus and bicycle lanes.[125]

During the COVID-19 pandemic, an exponential surge in e-commerce demand has exacerbated these and other resilience challenges.[126] To meet pandemic-induced freight demand, the number of trucks making last-mile deliveries, the number of truck stops, and attendant congestion (especially in urban areas) have increased.[127] Industry has sought to respond to some of these trends by retooling delivery options, building more warehouses, or increasing current warehouse capacity when and where possible. However, the lack of warehouse real estate, disruptions in upstream supply chains, and other factors are leading to constraints and challenges in how quickly these changes can be put into place, with subsequent delays and other impacts on goods movement.[128] (See also Section 3.8: Warehousing).

3.6 Chassis Availability

Limited supply of chassis, the steel frames that carry containers on trucks and rail cars, can create a serious bottleneck in national and international supply chains, leading to delays moving goods out of ports and railyards, to container congestion within ports, and congestion on surrounding roads. Transfer facilities have also experienced delays in accessing chassis and have even run out of chassis.[129] Chassis have moved more slowly through congested supply chains. In some locations, chassis are also being used to house containers as auxiliary warehouse space due to a lack of available alternatives. The inaccessibility of chassis can have ripple effects on the supply chain system since containers cannot be transferred from ship to truck or rail without an appropriate chassis. The resilience of America's supply chain systems depends on an adequate supply of chassis in the right locations at the right time, as well as a robust strategy to track, relocate, share, or produce more chassis in response to shortages and disruptions.

Challenges:

- **Changing business models.** Shifting chassis ownership from ocean carriers to third-party providers has added complexity to equipment provision.
- **Spatial mismatch.** Available chassis may not be positioned where they are needed most.
- **Condition of equipment.** Poor equipment condition reduces the supply of available chassis and may be challenging to address, depending on ownership model.
- **Rising prices.** The price of replacement equipment has skyrocketed due to pandemic shortages and rising material prices.

While chassis delays and shortages have stymied ports and intermodal terminals throughout the COVID-19 pandemic, the issue predated the current challenges. Historically, chassis were owned by shipping companies, and their use was included in shipping rates. In the last decade, however, most ocean carriers shifted their business models, enabling third-party IEPs to supply chassis.[130] Many ocean carriers have shifted to this IEP business model since chassis are challenging to maintain and store.[131] Most chassis are leased from private companies, which can exacerbate local traffic congestion as drivers travel to specific locations across a region to rent equipment and then return to ports.[132] In addition to supply and demand mismatches, the poor physical condition of chassis can lead to delays moving goods if drivers must wait for equipment to be repaired or replaced before transporting a container.[133]

Increasing material prices and rising costs to import foreign chassis frames are additional challenges to maintaining an adequate supply of chassis to meet the nation's needs. Shortages in and spatial mismatches in chassis supply combined with rising steel and rubber prices, have led to price increases of over 30 percent over the last year.[134] There have been challenges with importing new chassis from China, where most chassis are produced, due in part to tariffs imposed because of China's trade practices. A reduced supply of Chinese-made chassis in the United States has not yet been replaced by domestically made chassis since currently only a handful of domestic options exist for producing and procuring chassis equipment.[135] However, several domestic manufacturers are on target to deliver thousands of chassis by the fourth quarter of 2022, alleviating some current bottlenecks.

Chassis supply shortages have obstructed freight and logistics facilities across the country and led to rolling disruptions. At the Ports of Los Angeles and Long Beach, chassis dwell times have dramatically increased. In summer 2021, dwell times for about 2,500 chassis exceeded 30 days, substantially exceeding the preferred dwell time of three to four days in a well-functioning supply chain.[136] Chassis availability has also impacted intermodal terminals, especially in the South and Midwest.[137] For example, in summer 2021, several Class I railroads that transport goods from Southern California to transfer points in Chicago temporarily suspended service from the West Coast to Chicago in order to address service backlogs. They also implemented metering to address the flow of containers from coastal ports.[138]

Resilient Approaches: Chassis Operational Models

Different models for chassis supply can impact the long-term availability of equipment. While most chassis are owned by a single chassis provider (IEP) or by a motor carrier, some ports and intermodal facilities are shifting to models that pool equipment resources to create a more resilient model for chassis operations. Approaches include:

- A **gray pool model**, where one pool manager oversees pooled equipment contributed by multiple IEPs.[139] The Port Authority of New York and New Jersey has implemented this model, where chassis can be rented by any trucker.
- A **pool of pools model,** in which several chassis providers agree to coordinate. Providers operate their own pools, but truckers can pick up or return equipment to any of the participating providers. As with the gray pool, chassis in the pool of pools model are considered "gray" and interoperable. However, unlike in the gray pool model, each IEP is

responsible for maintaining, operating, and repairing its own chassis fleet.[140] The Ports of Los Angeles and Long Beach currently use a pool of pools model.

In addition to models for chassis pools, ports can work to create equilibrium in the chassis system by **prioritizing "two-way" transactions**. In Southern California, the Port of Long Beach has worked with terminal operators and truckers to pair container pickups with an export drop-off in the same trip, using an appointment system.[141]

3.7 Container Availability

Shortages and mismatches in the locations of containers, the steel boxes that carry goods and form a basic unit of transportation and global trade, contribute to port congestion, delays in getting products onto shelves, and rising prices for consumers. Since more than three-quarters (77 percent) of U.S. waterborne imports by value in 2020 moved in containers,[142] the availability of containers to move these goods is crucial to the reliability of the nation's freight system.

Challenges:

- **Spatial mismatch.** Containers are being left behind as shippers rush to deliver products.
- **Congestion.** Container dwell times are susceptible to delay and congestion in other parts of the supply chain system.
- **Overseas production.** Containers are primarily produced by a handful of foreign companies.

The primary issue underlying container shortages is a spatial mismatch in where existing containers are located and where they are needed at any given moment. The supply of shipping containers is increasing—shipping container production is expected to reach a record 5.4 million TEUs in 2021, nearly double the amount produced two years ago[143]—but moving those containers to the locations where they are most needed and out of bottlenecks in the freight system has proven challenging. The U.S. also has little control over the supply of this critical building block of trade to offset future disruptions and shortages, since container production is limited to a few companies, primarily in China.

The current spatial mismatch in container supply and demand largely stems from the effects of COVID-19 pandemic and related national lockdowns that stranded many containers at ports in China and in inland terminals and cargo ports across North America.[144] Empty boxes have been piled high on overflow sites adjacent to ports like the Port of Los Angeles, waiting to be recovered by shipping lines.[145] As

shipping lines prioritize a rapid return trip to pick up more goods in Asia and take advantage of high shipping rates they could garner, vessels have been loaded with empty containers, rather than with U.S. exports.[146] Meanwhile, spot rates for 40-foot containers moving from Asia to the U.S. West Coast were 5 times higher in the fall of 2021 than in the fall of 2020 and 14 times higher than in the fall of 2019.[147] Spot rates for containers have improved somewhat in recent months; however, trucking spot rates remain high.[148]

Capacity constraints at ports frequently impact container dwell times as workers must carefully move stacks of boxes multiple times to access a single container. Due to the interconnected nature of the supply chain system, container dwell times in one part of the system can rise due to delays, congestion, and shortages in another location. For example, one major truckload carrier reported in August 2021 that average unload times for containerized goods had increased by 70 percent due to congestion and worker shortages.[149] Worker shortages in the trucking industry, particularly in the drayage sector, have further compounded bottlenecks and delays throughout the freight system.[150] The Ports of Los Angeles and Long Beach, working with the Federal Government, have recently introduced new fees to carriers charged for long-dwelling containers in order to disincentivize idling cargo, though these fees to date have not been implemented.[151] Visibility into where and why containers are getting stuck remains limited, however. Truckers returning boxes to overstuffed terminals struggle to secure appointments to return equipment.[152] Currently, there is no way for the Federal Government, a port, or a shipping company to track the location of individual containers or container bottlenecks throughout the freight and logistics system.

3.8 Warehousing

Industry trends in freight and logistics markets, particularly the rapid growth in e-commerce, have driven demand for warehousing space.[153] As business models shift to support increasing demand for e-commerce and rapid delivery, companies need additional warehousing space close to population centers, distribution hubs, ports, and rail hubs. By some estimates, the e-commerce distribution model requires three times as much warehousing space as brick-and-mortar retail stores.[154] The additional demand is directly connected to port and rail congestion experienced in other parts of supply chains. Scarcer and more expensive warehousing has incentivized the use of port docks as warehouse space, which slows unloading of ships.[155] The ships and the Pacific Ocean itself become warehouse space. This is one of the major causes of port congestion.

Challenges:

- **Changing business models.** Increased e-commerce and just-in-time delivery are adding pressures.
- **Development lead time.** Entitlement and development processes can take years, limiting the ability to quickly respond to changing demand.
- **Local land use constraints.** There may be limited availability of land zoned for industrial uses; some locations may also be constrained by competing uses.

The COVID-19 pandemic has also created specific warehousing demands, such as a need for increased cold storage to support vaccine distribution.[156] With more consumers shopping online than ever before in response to public health concerns, demand for durable goods has increased and placed pressure on warehousing facilities. Demand has increased significantly in the market for large floorplate facilities of more than 500,000 square feet.[157] Competition for urban last-mile transfer facilities has also grown with the increase in just-in-time delivery models (see also Section 3.5 on last-mile freight delivery challenges).

While there is growing demand for warehouse space, there is also tremendous competition for industrial zoned land to support development of these facilities.[158] Vacancy rates have reached one of their lowest points this decade and industrial rents have risen 5 percent in the last year to $6.62 per square foot[159] though they have increased substantially more in some high-demand freight markets, such as in Northern New Jersey (up 33 percent year-over-year) and in California's Inland Empire (up 24 percent).[160] Industrial rents may grow another 4 to 7 percent in the next year, as well.[161] Land is limited in the places where new warehousing is needed, and cities have often targeted industrial land for rezoning in favor of other types of development, yielding higher rents.[162] Further, entitlement and real estate development

processes may take years, meaning that warehousing space is not always readily available to address needs. In some regions, warehousing development may compete for space with other uses, such as lab or research and development space, which has seen a 34 percent increase in demand in major market areas since mid-2020,[163] and data centers, which were projected to grow by 13.8 percent in 2021.[164]

While warehousing capacity is constrained both in key markets and nationwide, the Federal role in addressing this issue is limited and indirect. Spatial constraints may be driven by two factors not generally addressed by Federal policy. First, the market drives warehousing demand and may be constrained by competing demand for other uses such as other commercial space, office space, and housing, which may command higher rates per square foot. Secondly, warehousing constraints may be driven by local land use and zoning laws and decisions that may prioritize other land uses or prohibit industrial uses in certain areas. For example, waterfront areas are increasingly popular for commercial and residential uses, which can create pressure to rezone or convert industrial land to other uses. The Federal Government can support local warehouse development through financial incentives, coordination with local communities about the importance of industrial land use, and research to support ways to limit the local impacts of warehousing.

Resilient Approach: New Solutions for Warehousing

Solutions to increased warehousing capacity may exist in collaboration between the public and private sectors. For example, there may be opportunities to support development of new warehousing typologies and adaptive reuse of existing commercial and industrial buildings. Amazon has converted at least 25 shopping malls into distribution centers including in Baton Rouge, Louisiana; Knoxville, Tennessee; and Worcester, Massachusetts.[165] There are solutions to permitting and implementing this approach in more mixed-use areas. Typologies for multistory urban facilities are being explored and some companies have explored underground development on brownfield sites as well. In addition to land use and development solutions, technology may play a role in warehousing resilience. By knowing what goods will arrive when and from where, warehousers can better anticipate inventory storage, shortages, and prepare for disruptions.

3.9 Freight and Logistics Workforce

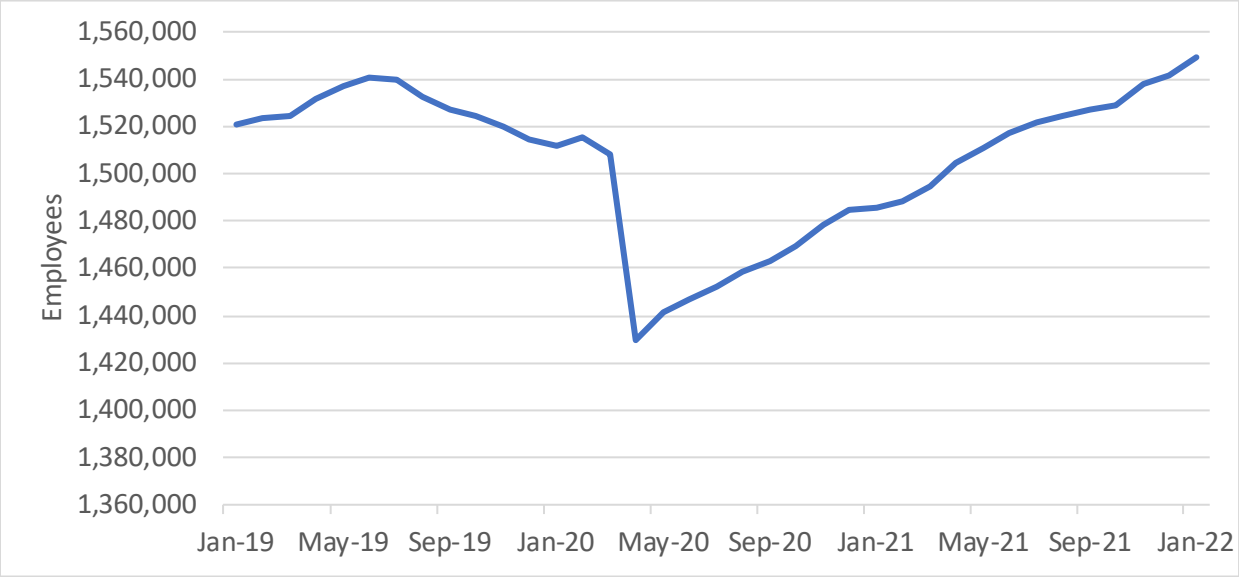
About 10 percent of the nation's population works in transportation and related fields.[166] Increasingly, the freight and logistics workforce faces challenges, including an aging workforce, job quality concerns, and worker retention issues, driven by factors including challenging working conditions and costs that reduce take-home pay. Despite a growing demand for freight and logistics and a rapidly growing workforce, the industry faces challenges in recruiting and retaining workers needed to manage both existing conditions and future growth in freight and logistics—and needs to provide pathways to and training for high-quality jobs with the free and fair choice to join a union, to ensure worker capacity.

Challenges:

- **Aging workforce.** Nearly half of the transportation workforce is nearing retirement.
- **Need for high-quality jobs and commensurate training.** Ensuring high-quality jobs with key pre-apprenticeship, Registered Apprenticeship, and other training measures.
- **Recruitment.** Quality of life and regulatory considerations make it challenging to recruit new workers.

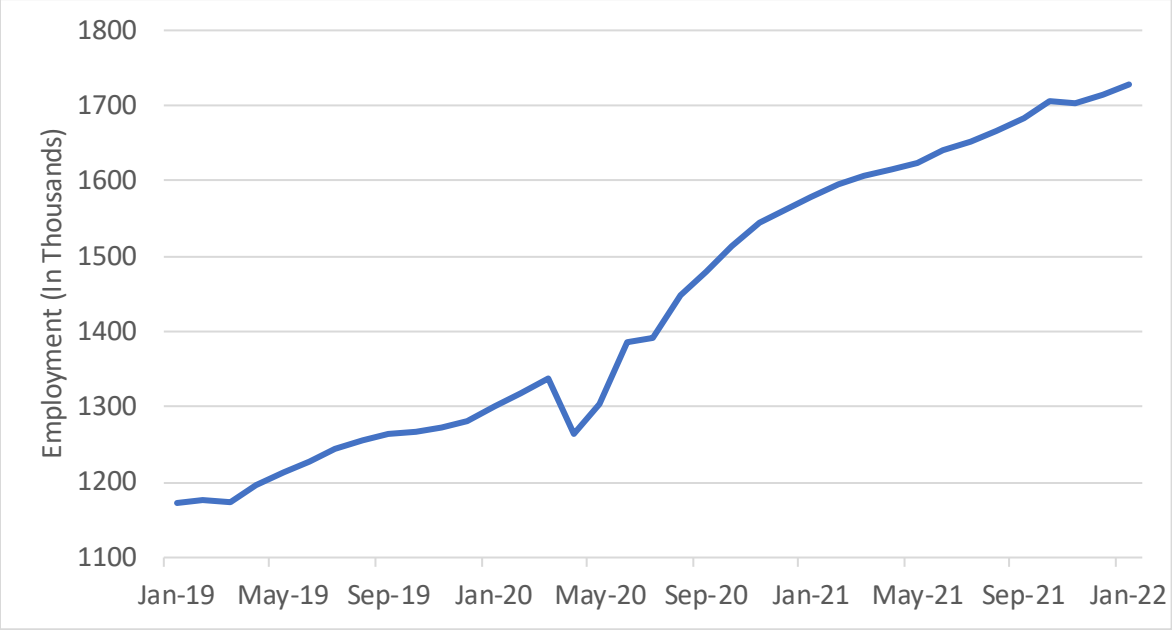
Growth in demand for transportation employees remains strong. Freight jobs contracted in 2020 at the start of the COVID-19 pandemic have since rebounded and saw steady growth in 2021 (see Figures 13, 14, and 15). Job openings in the transportation and trucking, warehousing, and utilities sectors have risen sharply, though turnover has also increased. Demand for trucking continues to experience rapid growth, paralleling increased demand for e-commerce. Trucking demand is expected to continue to grow more rapidly than other modes of freight, at a rate of 1.5 percent annually, or by 35 percent by the year 2040.[167] While many transportation and logistics fields are growing, labor to fill existing and future job growth presents challenges. The transportation workforce is aging, and a significant portion of this workforce is either currently eligible for retirement or rapidly approaching this milestone.[168]

Figure 13: Truck Transportation Employees



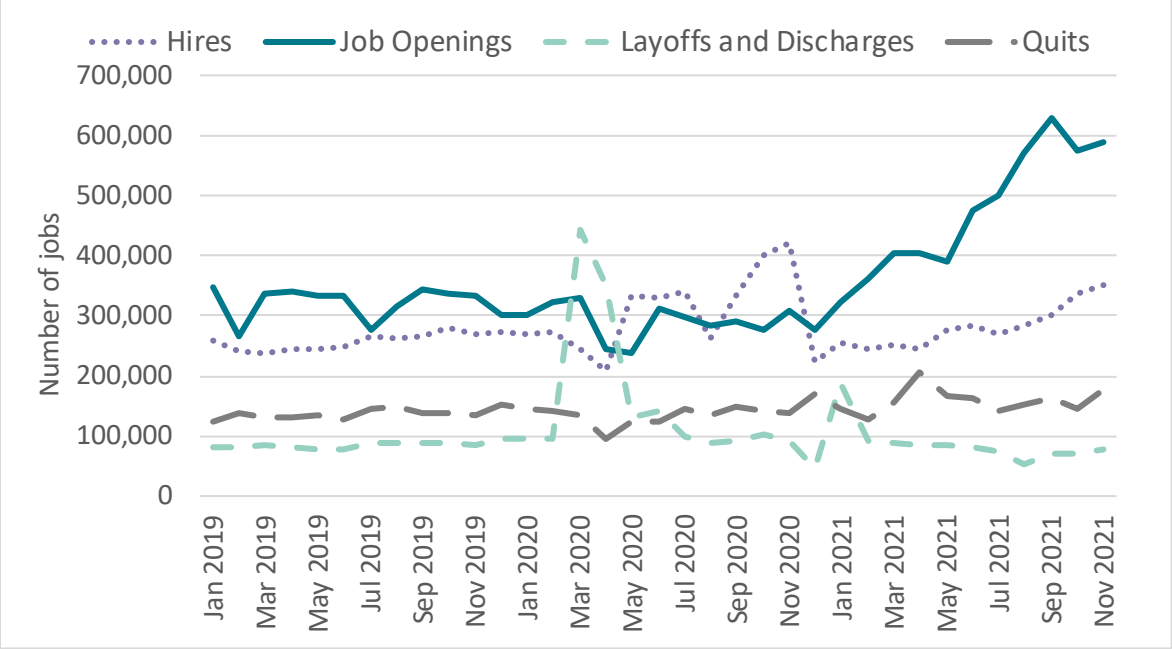
Source: U.S. Bureau of Labor Statistics, All Employees, thousands, Truck Transportation seasonally adjusted [series ID: CES4348400001], from the Current Employment Statistics survey (National), https://data.bls.gov/timeseries/CES4348400001?amp%253bdata_tool=XGtable&output_view=data&include_graphs=true

Figure 14: Warehousing and Storage Employees



Source: U.S. Bureau of Labor Statistics, All Employees, thousands, Warehousing and Storage, seasonally adjusted [Series ID: CES4349300001], https://data.bls.gov/timeseries/CES4349300001?amp%253bdata_tool=XGtable&output_view=data&include_graphs=true

Figure 15: Job Openings and Labor Turnover: Transportation, Warehousing, and Utilities Sector (Seasonally Adjusted)



Note: Data in this chart represents wage and salary workers only and exclude owner operators and independent contractors.
Source: U.S. Bureau of Labor, (no date), "Job Openings and Labor Turnover Survey," https://www.bls.gov/jlt/

Most commercial transportation jobs such as truck driver, commercial mariner, airline pilot, and locomotive engineer require applicants to gain certifications and licenses before employment. While these credentials help to ensure safety and consistent training, the time and cost of completing certification programs may be a barrier of entry for some populations. Additionally, the transportation industry faces worker retention challenges due to quality-of-life issues such as long hours, extended periods away from home, and low pay.

Reducing barriers to drivers getting CDLs and launching initiatives to create an equitable and inclusive work environment to support drivers' quality of life, as outlined in President Biden's Trucking Action Plan, will support the economic recovery and lay the foundation for a next generation trucking workforce that will strengthen U.S. competitiveness and support millions of good driving jobs for years to come.[169] In January 2022, USDOT and the U.S. Department of Labor (DOL) announced the launch of several initiatives to implement the Trucking Action Plan,[170] including:

- Expanding Registered Apprenticeship programs; more than 100 employers and industry partners stepped forward to work to expand Registered Apprenticeships in the first 30 days.
- Creating the Women of Trucking Advisory Board mandated in the Bipartisan Infrastructure Law.
- Creating a new task force, mandated by the Bipartisan Infrastructure Law, to investigate predatory truck leasing arrangements with DOL and the Consumer Financial Protection Bureau.
- Beginning two studies to explore truck driver pay and unpaid detention time.
- Launching the Safe Driver Apprenticeship Pilot—an under-21 pilot program for truck drivers that the Bipartisan Infrastructure Law mandated.
- Allocation of over $32 million in funding to States to improve CDL licensing process.

3.10 Regulations and Unfair Business Practices

Government regulations can play an important role in protecting public safety and the environment and in ensuring fairness for workers and consumers. To the extent that those regulations affect the efficient delivery of freight, the development of new infrastructure, and the adoption of new freight technologies, they may have (often unintended) consequences for freight and logistics system resilience. This observation demonstrates the need to coordinate and weigh those interests from a regulatory perspective. In other cases, existing regulations may need to be strengthened to address competition (such as economic regulation of railroads or ocean carriers) or other marketplace issues that are only revealed when the system is under extreme supply and demand pressures. Due to the patchwork of international, Federal, State, and local authorities, regulatory requirements and policies across modes, sectors, and jurisdictions also may not be aligned, resulting in confusion and delays. In some cases, short-term disruptions may warrant temporary suspension or enhancement of certain policies or regulations until the challenges can be resolved, allowing for a return to the status quo.

Challenges:

- **Rules vary by jurisdiction.** Regulations across jurisdictions and modes are not always aligned.
- **Balancing policy goals.** Policy goals and public interests can create regulatory barriers.
- **Flexibility in response**. Disruption responses can require waivers and regulatory flexibility.

Resilient Approach: Flexibility in Response to the COVID-19 Pandemic

The Federal Government's response to the COVID-19 pandemic is an example of a resilient approach to provide flexibility in regulations in response to a crisis requiring a rapid and flexible response. Different Federal agencies responded with flexibilities and waivers to specific conditions impacting their areas of regulatory oversight. FMCSA issued an emergency declaration providing relief to hours of service regulations in order to facilitate the movement of critical materials and products and respond to the public health emergency.[171] FMCSA also offered flexibility with requirements for CDL licensing[172] and was able to increase issuance of CDLs and Learners Permits by more than 20 percent compared to 2019, and 72 percent compared to 2020 monthly averages.[173] The Federal Railroad Administration (FRA) provided temporary flexibility in regulations addressing inspections, maintenance, testing, and certifications.[174] Similarly, PHMSA suspended some enforcement and employer training function due to workforce constraints.[175] The Federal Aviation Administration (FAA) also relaxed regulations to enable passenger airlines to carry more freight.[176] Many Federal agencies also enabled remote operations and electronic delivery of documents to limit in-person contact. Similar flexible operating procedures may be necessary in future disruptive events as well.

Some stakeholders have alleged that certain business practices have contributed to supply chain disruptions and should be evaluated for possible regulatory changes. USDOT heard from stakeholders about several practices that have hindered U.S. exports and increased costs for shippers, including high fees being charged (often without advanced notice) and a lack of timely information exchange about blanked sailings, port bypasses, and changing schedules that result in shippers paying detention and demurrage for containers already waiting at port. In March 2020, FMC initiated a fact finding to identify operational solutions to address these practices and disruptions.[177] In December 2021, the Departments of Transportation and Agriculture urged ocean carriers to adjust certain business practices "that have made fewer containers available for U.S. agricultural commodities …[and] short-circuited the usual pathways and rushed containers back to be exported empty."[178]

4.0 Ensuring Resilience in Our Nation's Supply Chains: Policy Responses

The COVID-19 pandemic has served as a nearly two-year "stress test" that has underscored vulnerabilities in America's supply chains—many of which had existed for years. The pandemic and the supply chain challenges that have resulted from it are a reminder that "perfect storm" events *can* occur and cause enormous, sustained disruptions. America's supply chains must be able to respond and adapt to future disruptions more quickly and flexibly. To ensure supply chains remain resilient in the future, the United States must invest in freight infrastructure, promote competition and fair markets, and enhance cooperation and information sharing across stakeholders, modes, and firms.

Without a robust policy response, the underlying vulnerabilities that led such severe disruptions are likely to remain as risks beyond the resolution of the COVID-19 pandemic. The goods distribution system's focus on precision is vulnerable to minor variances in consumer preferences or economic uncertainty. Over-reliance on a handful of ports without a plan for alternatives leaves the continuing risk for freight bottlenecks and congestion to arise again in the future. Increasingly severe and more frequent weather events due to climate change will continue to threaten the infrastructure upon which freight moves, thus emphasizing the need for system redundancy. It will take time to provide high-quality jobs that improve recruitment and retention into the freight and logistics industry. The need for improved data and information-sharing to understand where goods are moving and to anticipate future challenges will remain.

The Administration's Approach to Supply Chain Disruptions

Our national economic strength and quality of life depend on the safe and efficient movement of goods throughout our nation's borders and beyond. Supply chains—the interconnected webs of businesses, workers, infrastructure processes, practices that underlie the sourcing, manufacturing, transportation, and sale of goods—are vital to our everyday lives. In the past they have been invisible to consumers, but the pandemic and its consequences have made clear their vital importance to our daily lives, livelihoods, and basic day-to-day convenience and well-being.

For supply chains to perform well, they require effective transportation, production processes, and sourcing of inputs. Americans pay lower prices and face fewer disruptions when goods move efficiently and reliably, which provides businesses and consumers with predictable access to goods and materials. Americans benefit when we bring manufacturing jobs, production, and sourcing to the United States rather than outsourcing them abroad, which we can do by reducing transportation costs, adding resilience, and owning the industries of the future. When supply chains are disrupted by events such as public health crises, extreme weather, workforce challenges, or cyberattacks, goods are delayed, costs increase, and Americans' daily lives are affected. While these disruptions cannot be avoided altogether, we *can* build supply chains that nimbly and effectively respond to minimize interruptions and keep goods moving under all conditions.

The Roles of the Federal Government and Its Partners

The Federal Government, and USDOT specifically, must play a leadership role in building the long-term resilience of America's supply chains, but a robust response will require action by a wide range of Federal, State, and local agencies and the private sector. In some cases, robust action may take acts of Congress to reform laws and provide funding. In the near term, the Federal Government can provide leadership by convening public and private stakeholders across the freight and logistics industry to coordinate actions in response to current challenges and build a foundation for long-term supply chain resilience.

The collective focus on ensuring a safe and efficient supply chain necessary to support the multiple goals articulated in this report must also appropriately include critical stakeholders in communities affected by the pollution that results from the movement of freight. Many communities with environmental justice

concerns are already overburdened with health, environmental, and quality of life impacts from pollution sources related to movement of freight through various transportation modes. The Community-Port Collaboration Toolkit and other resources offered through the Environmental Protection Agency's (EPA's) Ports Initiative program can help support effective communication and engagement with stakeholders to promote environmental justice while developing a more resilient supply chain.

Table 2 describes policy roles to strengthen supply chain resilience. These roles include: infrastructure investment; planning and technical assistance; research and data; rules and regulations; and coordination and partnership with non-Federal stakeholders. The roles are paired with specific policy goals detailing how these elements support resilient supply chains.

Table 2: Federal Role in Addressing Supply Chain Disruptions: Policy Roles and Goals

Federal Policy Roles	Policy Goals
Infrastructure Investment: Identify and prioritize freight needs and provide funding for investments	• Identify and fund freight system and capacity needs • Address supply chain bottlenecks • Reduce emissions and mitigate climate change impacts
Planning and Technical Assistance: Support State and local agencies to address supply chain challenges	• Strengthen public sector freight planning and knowledge • Mitigate freight impacts on communities • Improve supply chain security • Strengthen freight workforce and development
Research and Data: Improve supply chain data and develop tools and best practices to quickly diagnose and address disruptions	• Increase understanding of supply chain performance • Improve transparency of supply chain data • Improve data sharing capabilities
Rules and Regulations: Streamline regulations, improve competition and fairness, and reduce health, safety, and environmental risks	• Increase freight capacity and efficiency • Support domestic production of critical equipment • Reduce bureaucratic inefficiencies • Strengthen market competition and fairness • Speed disaster response and recovery
Coordination and Partnerships: Support cross-sector, multijurisdictional, and multimodal coordination to address supply chain resilience	• Convene supply chain stakeholders to enhance USDOT's supply chain work • Support the actions of non-Federal partners through continued coordination

Recommendations for Resilient Supply Chains

To address the supply chain challenges and vulnerabilities that this Assessment identified, USDOT has identified a host of policy recommendations to resolve current disruptions and build more resilient supply chains for the future. These recommendations are meant not only to respond to the current challenges, but to stand the test of time by building a supply chain resilient to future disruptions, in whatever form they take. Tables 6–10 summarize the Assessment's recommendations. The recommendations are also characterized by their expected level of complexity and cost to implement, as well as the magnitude of their impact (see Tables 3, 4, and 5 below). Each recommendation also notes the approximate time frame for completion (e.g., near-term (0-2 years), medium-term (3-5 years), and long term (5+ years)). The tables also identify the Federal and other public and private sector parties that would be involved in implementing the recommendation, along with any transportation modes (trucking, rail, or maritime) or industry (logistics) that would be specifically affected by those actions.

Table 3: Recommendation Implementation: Impact

Moderate	High	Highest
• Actions that are more targeted in scope to existing/near-term supply chain challenges	• Actions that address current challenges and are expected to address future supply chain and logistics challenges over the next 10 years	• Actions that have wide-ranging scope beyond the immediate supply chain challenges and will influence policymaking around supply chains and logistics for decades to come

Table 4: Recommendation Implementation: Cost

$ (Low)	$$ (Medium)	$$$ (High)
• One-time, low levels of funding and/or staff time required	• One-time, higher levels of funding and/or staff time • Recurring/sustained programming, low-medium levels of funding and/or staff time required	• Significant, recurring/sustained programming, medium-high levels of funding and/or staff time required

Table 5: Recommendation Implementation: Level of Complexity

Low	Medium	High
• One-off studies, plans, or reports • Actions that can occur under existing authorities and funding • Actions that can be taken by a single agency • Low-level coordination and communication efforts	• New policies, regulations, or processes • Sustained coordination efforts, working groups, etc. • Actions involving some interagency and inter-governmental coordination	• New datasets, tools, or systems • New data standards and/or harmonization • Congressional action required • Actions involving significant interagency and inter-governmental coordination

4.1 Infrastructure Investment

Stakeholders advocated for many recommendations that proposed increased Federal funding for ports, intermodal connectors, truck parking, inland waterway locks and dams, shipping channel dredging, and freight rail. In addition, stakeholders recommended a range of policies to accelerate delivery of freight investments to address bottlenecks, speed disaster recovery, improve connectivity, expand warehouse availability, reduce carbon emissions, and improve cybersecurity.

Public sector infrastructure investment to enhance the efficiency, connectivity, and productivity of the overall freight network were among the most common types of policy solutions submitted by RFI commenters. Commenters recommended new or increased public funding to address specific pinch points in the supply chain based on infrastructure deficiencies, and suggested the following recommendations to address these issues across multiple modes:

Table 6: Infrastructure Investment Policy Recommendations

Policy Goal: Identify and fund freight system and capacity needs							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
1	**Use funds provided under the Bipartisan Infrastructure Law (BIL) to invest in projects (including identified projects of national and regional significance)** that support supply chain resilience, promote domestic manufacturing, plan for future growth, and address intermodal and inland storage capacity needs while simultaneously reducing existing environmental justice issues that freight infrastructure	Highest	$$$	Medium	Medium-Term	All	USDOT, DOC

Policy Goal: Identify and fund freight system and capacity needs							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	may create on adjacent communities. Specific actions include: • Support supply chain resilience and climate resilience under USDOT discretionary grant programs by prioritizing investments in freight and logistics facility resilience to climate change; transportation links to critical infrastructure; supply chain reliability improvements; connections to and from ports/intermodal facilities; lower-carbon supply chain infrastructure; and mitigation of impacts of freight movement, including for climate change, environmental justice, and equity, in consultation and coordination with DOC's National Oceanic and Atmospheric Administration (NOAA). • Encourage short line railroads to submit rail bottleneck reduction projects for USDOT discretionary grant programs. Encourage and provide technical assistance to short line railroads to submit rail bottleneck removal projects for consideration under USDOT						

Policy Goal: Identify and fund freight system and capacity needs							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	discretionary funding programs such as the Consolidated Rail Infrastructure and Safety Improvements (CRISI), Infrastructure for Rebuilding America (INFRA), and Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grants. Short line railroad priority projects include those to ensure short line railroad infrastructure meets Class I network standards and receives other necessary upgrades to move increased freight volume and reduce bottlenecks on the nation's rail networks. • Continue to invest in rail projects that will support the nation's supply chain. Projects that increase rail and container capacity at port facilities, such as increasing and lengthening sidings, support more efficient train movements, ease congestion, and reduce emissions. • Develop inland ports and warehouse locations. Projects that allow for expanded cargo staging						

Policy Goal: Identify and fund freight system and capacity needs							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	help to alleviate port and supply chain congestion points and infrastructure congestion. • Target investment in intermodal freight connectors. Identify funding mechanisms to maintain and improve freight intermodal connectors, particularly those to port and rail facilities. Most of these facilities are locally owned, but regionally important. Many are in poor condition and contribute to performance challenges in first- and last-mile movements. • Identify bottlenecks at port facilities and between ports and cargo owners, and develop a national strategy to address them, in collaboration with ports and port authorities, terminal operators, States, local governments, the U.S. Army Corps of Engineers, DOC, and relevant supply chain stakeholders and interagency partners. Include potential Federal funding options, such as the Port Infrastructure Development Grant and America's Marine Highways programs						

Policy Goal: Identify and fund freight system and capacity needs							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	administered by the Maritime Administration (MARAD). • Work with Class I railroads and short-line railroads to identify planned and proposed rail investments. Understanding how privately operated railroads are planning to make investments in their systems is essential for the U.S. Government to effectively allocate discretionary resources available under the BIL to projects that address multimodal supply chain issues. • Encourage State DOTs to include in their State Freight Plans all multimodal freight projects that expand intermodal capacity, and not just projects that are proposed to utilize National Highway Freight Program funding. Every State is required to develop a State Freight Plan that identifies key industries and freight needs for the State. These plans should include all planned freight projects and not just projects the State plans to use formula funding to complete.						

Policy Goal: Identify and fund freight system and capacity needs							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	• Incorporating environmental justice considerations into freight project development. Balancing new infrastructure construction with community needs by reducing existing and future environmental justice issues that freight infrastructure may create on adjacent communities (e.g., increased pollution, etc.) and ensuring these communities benefit from the economic gains of the projects in their neighborhoods. • Evaluate the role of productivity-enhancing operational mechanisms, such as active traffic management, dynamic pricing systems, and predictive maintenance of assets to improve productivity of new and existing investments.						

Policy Goal: Identify and fund freight system and capacity needs							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
2	**Invest in Intelligent Transportation Systems (ITS) infrastructure to enhance port and trucking operations.** Promote investment in ITS infrastructure such as port truck appointment systems and communications systems to provide better visibility into the location of incoming cargo for truckers, terminal managers, and/or beneficial cargo owners (BCOs).	High	$$	Medium	Medium-Term	Trucking, Maritime	USDOT
3	**Invest in the inland waterway system** to enhance its performance and capacity.	High	$$$	High	Long-Term	Maritime	USDOT, USACE, USDA
4	**Coordinate with States, local governments, and port authorities, as well as Federal partners such as the Department of Defense (DoD), to identify temporary solutions to ease congestion, such as "pop-up" intermodal yards.** Container congestion on-dock and at intermodal yards has created significant bottlenecks; many stakeholders have suggested that identifying space to store containers off-dock or outside existing intermodal yards would help improve throughput efficiency. "Pop-up" intermodal yards can foster longer-term investments in resiliency and reduce the	Moderate	$	Low	Long-Term	Rail, Trucking	USDOT, DoD, DOC, States, Local gov'ts, Port authorities

Policy Goal: Identify and fund freight system and capacity needs							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	environmental impact of freight movement. In 2021, the Port of Savannah, Georgia, worked with the Federal Government to fund several "pop-up" inland port facilities to relieve congestion and more quickly unload vessels.[179] USDOT will also evaluate how to further engage short line railroads in development of these sites.						

Policy Goal: Reduce emissions and mitigate climate change impacts							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
5	**Invest in battery electric, hybrid equipment, and zero-emission fueling infrastructure to combat climate change and further reduce emissions of dangerous pollutants such as diesel particulate matter in adjacent communities that suffer a disproportionate impact from goods movement related activities.** To help lessen the wholescale disruption that climate change would pose to the supply chain if left unchecked, promote investment in battery electric trucks and other alternative fuel vehicles, bi-directional electric vehicle charging infrastructure, and hybrid and electric equipment, using domestic manufacturing where applicable and including at ports and	High	$$	Medium	Near-Term	Trucking, Maritime	USDOT, DOE, EPA

Policy Goal: Reduce emissions and mitigate climate change impacts							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	other freight facilities to help freight facilities reduce their carbon footprints.						
6	**Invest in mitigating freight impacts on adjacent communities.** Take steps to reduce the environmental and safety implications of freight facilities and critical freight routes on neighboring communities to enable the freight system to coexist with surrounding uses.	Highest	$$$	Medium	Medium-Term	All	USDOT

Policy Goal: Address supply chain bottlenecks							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
7	**Explore the potential to increase U.S.-flagged ships, shipping companies, and shipbuilding.** Currently, less than 2 percent of cargo in U.S./international trade moves on U.S.-flagged ships. America's international trade consists of a fleet that is mostly foreign-built, leaving the country vulnerable to international disruptions. Investing in the portion of trade on U.S.-flagged ships would provide more reliability for a critical portion of the supply chain both inside and outside U.S. borders while strengthening economic and national security. Investing in U.S. ships could also speed	High	$$$	High	Long-Term	Maritime	USDOT, DOC, Congress

Policy Goal: Address supply chain bottlenecks							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	offshore wind deployment. Action could also include working to improve enforcement of the Cargo Preference Act to stimulate demand side for U.S. ships.						
8	**Support State DOTs and the private sector to develop and implement strategies that expand truck parking availability consistent with local land use considerations and address safety of rest areas.** Provide technical assistance in areas such as project development and delivery and preparing applications for competitive grant programs; conduct research focused on how truck parking impacts system efficiency and road-user safety; and work with State DOTs and the private sector to develop and implement strategies to expand truck parking opportunities, consistent with local land use considerations.	High	$$	Medium	Near-Term	Trucking	USDOT, State DOTs, Private sector
9	**Explore the feasibility of financial incentives to improve warehousing capabilities.** Examine the effectiveness of providing financial assistance (e.g., loans, grants, tax incentives) to importers and railroads to convert existing warehouses and rail terminals to grounded container terminal operations. Consider using	Moderate	$$	Medium	Near-Term	Logistics	USDOT, Congress, Private sector

Policy Goal: Address supply chain bottlenecks							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	government funds for additional reserve off-dock storage facilities, which would be maintained at key intermodal locations to address seasonal or sustained volume surges or other disruptions.						

4.2 Planning and Technical Assistance

Stakeholders recommended strengthening freight planning at all levels of government to improve supply chain security and resilience, identify freight bottlenecks, and mitigate the impacts of freight on communities.

Table 7: Planning and Technical Assistance Policy Recommendations

Policy Goal: Strengthen public sector freight planning and knowledge							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
10	**Implement BIL's freight policy and planning provisions with an emphasis on supporting supply chain resilience in the United States consistent with/aligned with other Administration priorities surrounding climate, equity, etc.** The BIL's provisions, including the establishment of the Office of	Highest	$$	Low	Near-Term	All	USDOT

Policy Goal: Strengthen public sector freight planning and knowledge							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	Multimodal Freight Infrastructure and Policy and related activities, will support a resilient system.						
11	**Update USDOT's existing guidance on State Freight Plans.** The Bipartisan Infrastructure Law updates requirements for State Freight Plans and many States are beginning or already updating their State Freight Plans per the previous statutory update cycle. As part of this update, USDOT could encourage States to incorporate supply chain and port congestion analysis into their State Freight Plans.	High	$	Low	Near-Term	All	USDOT, States
12	**Work with States, metropolitan planning organizations (MPOs), and municipal freight planners to strengthen freight planning and supply chain expertise across the United States.** These efforts should include supporting meaningful community engagement in State and local decision-making with a focus on equitable and just outcomes from investments and improvements. This could include supporting the development of freight and supply chain expertise, coordinating land use transportation interfaces and	High	$	Low	Medium-Term	All	USDOT, DOC, States, MPOs, Local gov'ts

Policy Goal: Strengthen public sector freight planning and knowledge							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	regionally significant freight projects, and encouraging additional investment in academic research. • Encourage State DOTs to establish State Freight Advisory Committees that meet regularly. State Freight Advisory Committees bring together a diverse group of supply chain stakeholders that can offer States' perspectives on current challenges and help prioritize infrastructure investment decisions. It is important for these committees to meet regularly (quarterly, semi-annually) as supply chains are constantly changing. In addition to working with USDOT, States can also coordinate with the Department of Commerce's Advisory Committee on Supply Chain Competitiveness. • Support training opportunities to develop supply chain/logistics expertise for public-sector employees at all levels of government. Increasing the knowledge base and understanding of complex supply						

Policy Goal: Strengthen public sector freight planning and knowledge							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	chain/logistics issues will help public-sector agencies better use data to inform policymaking and infrastructure investment decisions.						
13	**Provide guidance to States and local governments on implementing measures to protect freight routes and industrial lands.** Affordable land is becoming a rarity in many metropolitan regions and developers often redevelop industrial land for other uses. Local land use authorities should consider how to preserve these areas, which are vital to freight staging and operations.	Moderate	$	Medium	Medium-Term	All	USDOT, States, Local gov'ts
14	**Continue USDOT support of and investment in training, research, and other technical support initiatives to assist those seeking to plan, develop, and implement projects and programs that can facilitate efficient supply chains**. • Expand USDOT-sponsored freight-focused training courses, such as through the NHI, which currently includes training on integrating freight into transportation planning processes.	Moderate	$	Low	Near-Term	All	USDOT

Policy Goal: Strengthen public sector freight planning and knowledge							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	• Continue development of approaches to analyze and quantify significant multimodal freight bottlenecks that impede the performance of the freight movement system, to assist in identifying locations that would be especially suited for targeted investment or other operational strategies.						

Policy Goal: Strengthen freight workforce and development							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
15	**Support the unionized labor force to ensure maintenance and further development of the skills and expertise necessary** to support the efficient flow of freight in the future as well as to work through labor-management partnerships to support talent development and retention.	High	$$	Low	Near-Term	All	USDOT, DOL
16	**Support workforce public health and public health protocols to minimize disruptions at key locations.** Develop operational workplace guidelines and standards to protect supply chain employees and employers who are providing essential services. Consider efforts to	High	$	Low	Near-Term	All	USDOT, DOL

Policy Goal: Strengthen freight workforce and development							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	create national stockpiles of supplies, such as respirators and face masks required for application of certain pesticides, to ensure continuity in the agricultural labor force. Consider the efficacy of vaccine mandates on the supply chain workforce.						
17	**Undertake a review of current job training and Registered Apprenticeship programs, to identify how they can be leveraged and improved to advance the transportation industrial base workforce, especially with regard to connecting members of vulnerable communities to supply chain jobs.** Ensuring that the freight and logistics sector has adequate job training and Registered Apprenticeship programs can help meet current and future workforce needs in this sector. As part of this review, USDOT/DOL/DOC will pilot driver training programs that could bring more drivers into the workforce. Example actions include: • Convene a new workforce partnership aimed at connecting prospective employees to good jobs.	High	$	Low	Near-Term	All	USDOT, DOL, DOC

Policy Goal: Strengthen freight workforce and development							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	• Develop strategies for diversifying the freight transportation industry workforce, expanding professional capacity, and creating a workforce capable of designing, deploying, and operating emerging technologies. • Develop and implement strategies that will foster the training and development of the freight and supply chain workforce to acquire the skills and capabilities to meet the current and future needs of the freight industry. Collaborate with Federal partners, universities, and industry stakeholders to achieve this goal. • Invest in the development of supply chain career pathways, including but not limited to highlighting the importance and opportunities of supply chain occupations; funding skills-oriented training programs throughout the country; expanding the demographic pools attracted to the profession; expanding transportation, logistics, distribution, and production/manufacturing Registered						

Policy Goal: Strengthen freight workforce and development							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	Apprenticeship programs; and encouraging transferable credentials. • Invest in workforce training, including training on new technologies.						
18	**Leverage the experience of military veterans to fill civilian logistics jobs.** Many veterans have gained experience in logistics, equipment operations, and truck driving while completing their military service, and are often good candidates to serve these duties in the private sector. However, records of their experience while in the armed services are often insufficient for them to be hired in the private sector. Aligning military and civilian credentials and record keeping to match with requirements of private sector employers would facilitate veterans' post-service employment.	Moderate	$	Medium	Near-Term	All	USDOT, DOL, DoD
19	**Improve workforce's quality of life, including by improving workforce access to reliable, affordable, and safe transportation to access jobs.** Improve the driver experience through addressing truck parking shortages and safety concerns, and by exploring changes to regulations to improve public health and	Highest	$$	Medium	Near-Term	All	USDOT, DOL

Policy Goal: Strengthen freight workforce and development							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	encourage more people to join the supply chain workforce (for example, by providing options for truck drivers to hand off goods to another trucker and stay within a region).						
20	**Ensure all applicants for and recipients of Federal financial assistance (including subrecipients) comply with Federal civil rights laws, including Title VI of the Civil Rights Act of 1964,** that prohibit discrimination on the basis of race, color, national origin (including limited English proficiency), and other civil rights laws that prohibit discrimination on the basis of disability, sex, and age. Supply chain efforts should align and advance civil rights compliance.	Moderate	$	Low	Near-Term	All	USDOT

Policy Goal: Improve supply chain security							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
21	**Support public and private sharing of cyber-incident data to enhance supply chain cybersecurity**, including providing supply chain stakeholders access to cybersecurity tools and education that allow them to	High	$$	Medium	Near-Term	All	USDOT, DHS/CISA, DOE, DoD

Policy Goal: Improve supply chain security							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	improve their cybersecurity posture in concert with partners and freight facilities. As part of this, evaluate the risk of disruption or compromise to transportation assets due to IT hardware, software, and connectivity throughout the information stack.						
22	**Develop a National Transportation System Security and Resilience Plan.** USDOT and the Department of Homeland Security (DHS) should work with States to identify major natural- and human-caused threats to the transportation system's performance, define institutional structures for planning for and responding to disruptions, and identify mitigation strategies in a national plan. This will include studying the need for Federal funding to support security infrastructure development.	Highest	$	High	Medium-Term	All	USDOT, DOC, DHS, States, Private sector
23	**Prioritize sea, land, and airport facilities and staffing** to jointly consider resource needs between agencies to maintain CBP inspection facilities and adequate staffing levels.	High	$$	Medium	Medium-Term	Trucking, Rail, Maritime	USDOT, DHS
24	**Improve the security, resilience, reliability, and redundancy of Position, Navigation and Timing (PNT)**	High	$$$	High	Medium-Term	All	USDOT, DoD, DOE

Policy Goal: Improve supply chain security							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	services, including Global Positioning Systems (GPS)/Global Navigation Satellite Systems (GNSS), alternatives and complements to GPS/GNSS, and related navigation and tracking systems. This will ensure protected, resilient, and reliable PNT services and prevent malicious actors from interrupting the nation's supply chain by attacking its PNT systems.						
25	**Determine which elements of the transportation supply chain should be prioritized for domestic manufacturing, ally-shoring, or nearshoring,** including cybersecurity elements of critical infrastructure. Utilize these priorities when implementing Buy America and Buy American policies.	Highest	$$	Medium	Near-Term	All	USDOT, DOC

Policy Goal: Mitigate freight impacts on communities							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
26	**Coordinate Federal support for brownfield and superfund redevelopment to advance national transportation policies.** Brownfield sites often exist adjacent to major freight facilities, such as ports and container terminals, and could be developed into	High	$$	Medium	Near-Term	All	USDOT, EPA

Policy Goal: Mitigate freight impacts on communities							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	additional capacity for operations. Coordinating stakeholders and funding remediation of these sites would increase the availability of industry land and port capacity. Communities impacted by this work should be meaningfully engaged and benefit from any new construction.						

4.3 Research and Data

Data development and data sharing are critical to improving coordination between USDOT, State and local governments, and the private sector in support of supply chain resilience. Data-sharing tools can provide more regular transfer of information between supply chain stakeholders and help identify efficiencies or solutions that can address challenges. Some stakeholders called for more funding for freight research and to support the development of freight data and tools. Many commenters noted the important role that USDOT can play as a conduit for sharing and synthesizing freight data and research, though some commenters also noted that new technologies and tools must be appropriately vetted to be useful.

Table 8: Research and Data Policy Recommendations

Policy Goal: Increase understanding of supply chain performance							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
27	**Invest in an applied freight research program.** Invest in applied research and technology transfer to support the deployment of technically feasible but outside-the-box solutions to ensure world-class freight performance and truck availability. A potential avenue for this is the new National Multimodal Cooperative Freight Research Program (NMCFRP) authorized in the BIL.	Moderate	$$	Medium	Long-Term	All	USDOT
28	**Invest in energy and transportation research and data to better understand the interplay of the energy sector and transportation.**	High	$$	Medium	Medium-Term	All	USDOT, DOE

Policy Goal: Increase understanding of supply chain performance							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
29	**Provide funding to restart, maintain, and expand existing programs that collect or provide supply chain data.** Examples include the Commodity Flow Survey, Freight Analysis Framework, TransBorder Freight Data dashboard, and the Vehicle Inventory and Use Survey.	Highest	$$$	High	Long-Term	All	USDOT, DOC, USDA, USACE
30	**Work with Congress to update mandatory response authority for freight data collection.** Ask Congress to modify 49 U.S.C. 6313 to require any entity involved in the supply chain (including companies, businesses, institutions, establishments, or organizations) that provides, supports, or consumes freight transportation services and is subject to surveys and censuses authorized by Title 13, U.S.C. to be included in mandatory reporting.	High	$	High	Near-Term	All	USDOT, Congress, Private sector
Policy Goal: Improve data sharing capabilities							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
31	**Invest in and facilitate the use of communications systems to provide visibility into the location of products or next loads for truckers, terminal**	High	$$	Medium	Medium-Term	Trucking, Rail, Maritime	USDOT, DOC

Policy Goal: Improve data sharing capabilities							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	managers, and/or BCOs. Examples include Port Community Systems (PCS), Intelligent Transportation Systems (ITS), and Transportation Management and Operations (TSMO). This could include facilitating the development and/or adoption of data standards for these systems.						
32	**Encourage greater standardization and foster interoperability of data among States and between the multimodal transportation networks and the private sector.** Standardized data, end-to-end visibility, security, and privacy are all increasing concerns from supply chain practitioners. Real-time information that can be received, interpreted, and acted on by parties throughout a supply chain allows for efficiencies that can increase effective throughput capacity without new physical infrastructure. • Leverage connections and partnerships with supply chain stakeholders, including large companies, to incentivize sharing supply chain data while ensuring this data is protected against disclosure of business-confidential information. Data sharing among actors in the	High	$	High	Near-Term	All	USDOT, DOC, OPM, USDA, CBP, States, Private sector

Policy Goal: Improve data sharing capabilities							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	supply chain would support national-level supply chain monitoring and information-sharing tools.[180] • Work across the interagency to develop strategies on how the Federal Government can support increased data sharing between government agencies (i.e., single window) and the multimodal transportation network.						
33	**Develop a national freight portal to share key data among stakeholders and an electronic information exchange standard for critical product flow tracking.** This national portal could be: • A public database, website, map, dashboard, or "truck air traffic control" data interface tool to share key data elements between public and private stakeholders. While the scope of this portal could vary, suggested data elements could include estimated loading, unloading, and delay times at shipping/receiving facilities, which could help lessen detention times throughout the marketplace as drivers and motor carriers are	High	$$$	High	Long-Term	All	USDOT

Policy Goal: Improve data sharing capabilities							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	likely to avoid certain locations that consistently produce longer delays. • A tool that could provide real-time visibility into supply chain capacity, monitor leading supply chain inputs, and provide connectivity across shippers, truckers, and receivers. • A voluntary, nationwide port community system and an electronic information exchange standard for critical product flow tracking that would optimize and improve the resilience of national supply chains, logistics, trade, and competitiveness. • A tool to support the production and distribution of products critical to the health and safety of American citizens and U.S. security.						
34	**Partner and collaborate with government agencies and the private sector to establish a national supply chain forensics/monitoring program and develop analytical tools to monitor supply chains for impending threats or security issues**. Identify and apply methods to appropriately classify maps, lists, essential	High	$$$	High	Long-Term	All	USDOT, DOC, DHS, DoD/NGA, Private sector

Policy Goal: Improve data sharing capabilities							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	industries, and other information on critical goods and their supply chains to prevent disclosure to U.S. adversaries. This effort should be supported by the Department of Commerce in partnership with DHS and the National Geospatial Intelligence Agency.						
35	**Invest in technology and information technology systems, in collaboration with labor organizations, to provide better insight and visibility into end-to-end supply chain movements to improve performance.** Specific technologies noted that could support a resilient supply chain include communications technology for multimodal operations, freight signal priority, "contactless delivery," dynamic traffic routing, and flood-level sensors in transportation infrastructure.	High	$$$	High	Medium-Term	All	USDOT, Labor orgs

Policy Goal: Improve the transparency of supply chain perfomance							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
36	**Develop national freight modeling and freight fluidity tools.** Make these tools widely available to State DOTs, MPOs, regional, and local partners to help identify necessary updates to the multimodal transportation	Moderate	$$$	High	Long-Term	All	USDOT

Policy Goal: Improve the transparency of supply chain perfomance							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	system that account for potential changes in State or global economic conditions, logistics patterns, transportation infrastructure or funding, and land use scenarios. One example would be to model scenarios of climate impact on the quality and availability of transportation assets, including surface transportation, warehousing, and other logistics assets.						
37	**Establish a dedicated freight and supply chain data performance program under the Bureau of Transportation Statistics (BTS) with support from the other modal administrations to develop and share data supporting both public and private sector stakeholders with supply chain resilience data.** Program elements would include the following and could encompass specific data development ideas suggested by stakeholders. Specific actions include: • Benchmarking freight statistics to capture freight statistics over time. This would include existing data products collected by BTS.	Highest	$$$	High	Medium-Term	All	USDOT, Congress

Policy Goal: Improve the transparency of supply chain perfomance							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	• Freight system and supply chain performance element to capture supply chain performance data and modeling, freight fluidity data, and weekly indicators to regularly track supply chain disruptions. • Geospatial data on freight system, freight flow, and intermodal facilities to support network analysis, connectivity assessment, and scenario analysis. • E-Commerce: Household Logistics Data Program to develop data related to the impacts of e-commerce. • Improve data collection to better understand the truck driver workforce and ongoing labor capacity, recruitment, and retention issues in collaboration with the Bureau of Labor Statistics (BLS). • Develop new data sources to track and better understand warehouse capacity.						

Policy Goal: Improve the transparency of supply chain perfomance							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
38	**Support deployment of technology to track containers and chassis and coordinate with CBP on data collection efforts at entry at ports and other agencies/stakeholders to determine how many chassis and/or containers are being used**. Tracking could help identify bottlenecks, determine future needs or future equipment projections, and to track utilization to address underutilized chassis. GPS or electronic logging records and existing geolocation technologies could be used.	Moderate	$$	Medium	Medium-Term	Trucking, Rail, Maritime	USDOT, CBP, Private sector
39	**Partner with Federal and non-Federal partners to collect data that describe flows of major commodities, raw ingredients, and finished products, and identify potential points of disruption, issues in common across sectors, reliance on transportation and other supply chain factors.**	High	$$$	High	Medium-Term	All	USDOT, Federal agencies, Private sector, Academic partners

4.4 Rules and Regulations

Stakeholders made numerous recommendations to revise a wide range of Federal policies and regulations that affect supply chain operations, including those related to safety, pricing, labor, and the environment. The recommendations aim to increase capacity and efficiency, support domestic production of critical equipment, streamline bureaucratic processes, improve fairness, strengthen competition, speed disaster response and recovery, support workforce development, and incentivize clean energy.

Table 9: Rules and Regulations Policy Recommendations

Policy Goal: Speed disaster recovery response							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
40	**Urge Congress to eliminate the Fair Labor Standards Act motor carrier exemption.** Under the current exemption, employers are not required to pay overtime to many truck drivers.	Moderate	$	Medium	Near-Term	Trucking	DOL, USDOT, Congress
41	**Work with Congress to grant FHWA additional emergency response special permitting and regulatory relief for supply chain emergencies.** This would allow FHWA to offer additional flexibilities from certain regulations during supply chain emergencies.	Moderate	$	High	Near-Term	Trucking	USDOT, Congress

Policy Goal: Strengthen market competition and fairness							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
42	**In taking trade policy actions, consider the ways in which those actions might impact relevant supply chains, as appropriate and consistent with applicable legal authority.** American manufacturing capability for this equipment is extremely limited and the tariffs and duties charged on chassis imported from China are reducing supply in the short term. Recognizing that many trade policy actions are designed to remedy injury to domestic industry and respond to unfair or unreasonable foreign trade practices, in taking trade policy actions, the U.S. Government should consider, as appropriate and consistent with applicable legal authority, the ways in which those actions might impact relevant supply chains.	Moderate	$$	Medium	Near-Term	All	USTR, DOC
43	**Support the Federal Maritime Commission (FMC) in regulating ocean carriers to promote free and fair competition.** The FMC has the jurisdiction to regulate ocean carriers and consistent with President Biden's "Executive Order on Promoting Competition in the	High	$$	High	Near-Term	Maritime	USDOT, FMC

Policy Goal: Strengthen market competition and fairness							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	American Economy," the FMC has already begun an inquiry into excessive shipping fees. Specific actions include: • Support the FMC's ability to review existing carrier alliances to determine these alliances do not unreasonably reduce transportation service, increase transportation cost, or substantially lessen competition. The alliances between carriers receive statutory immunity from antitrust laws; however, the FMC can challenge these agreements if they result in reduced transportation service, increases in transportation cost, or substantially reduced competition. • Support the FMC in their efforts to look for opportunities to improve transparency in service contract rates through regulation or other inquiries. • Support the FMC using all available tools to lower shipping costs and get supply chains moving.						

Policy Goal: Strengthen market competition and fairness							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
44	**Urge Congress to enact ocean shipping regulatory reform.** The House has already passed legislation that would increase FMC resources and provide FMC with additional authorities to protect exporters, importers, and consumers from unfair practices.	Highest	$	High	Near-Term	Maritime	USDOT, Congress
45	**Encourage the STB to require railroad track owners to provide rights of way to passenger rail and to strengthen their obligations to treat other freight companies fairly.**	High	$	High	Near-Term	All	STB

Policy Goal: Support domestic production of critical equipment							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
46	**Focus on increasing domestic manufacturing of new chassis, containers, zero-emission equipment, and gantry cranes, including consideration of enhanced price preference in Federal Acquisition Regulations (FARs) updates.**	Highest	$$	Medium	Near-Term	All	DHS, DOC, OMB
47	**Consider opportunities to develop a domestic supply base for specialized cargo handling equipment and gantry cranes that are not currently available from a U.S. manufacturer.**	High	$$	High	Near-Term	Maritime	USDOT, DOC

Policy Goal: Increase freight capacity and efficiency							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
48	**Promote, incentivize, and facilitate alignment of operational hours at warehousing facilities, seaports, rail facilities, and intermodal transfer facilities, and other stakeholders, including labor, to help mitigate congestion**. This could include promoting 24/7 operations or extended hours during periods of congestion. These issues are under the jurisdiction and control of private sector supply chain stakeholders. Alignment in this case is crucial but can only be achieved through public-private sector cooperation, coordination, and collaboration.	Moderate	$$	High	Near-Term	Trucking, Rail, Maritime, Logistics	USDOT, DOC, DOL, Private sector
49	**Continue partnering with the regulated hazardous materials community** to improve the efficiency of packaging design that can allow for greater quantities of hazardous materials goods shipped without additional physical shipping space.	High	$	Low	Medium-Term	All	USDOT

Policy Goal: Reduce bureaucratic inefficiencies							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
50	**Harmonize the appropriate roles of the Surface Transportation Board, Federal Maritime**	High	$	High	Medium-Term	Rail, Maritime	USDOT, STB, FMC

Policy Goal: Reduce bureaucratic inefficiencies							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
	Commission, and DOT with respect to regulating and providing oversight for the freight and logistics industry. Look for opportunities to consolidate relevant authorities to improve transparency, access to data, and standardize reporting, including considering STB regulatory oversight of intermodal freight movements.						
51	**Investigate ways to expedite the Transportation Security Administration's (TSA) Transportation Worker Identification Credential (TWIC®) approval process.**	Moderate	$	Medium	Near-Term	All	USDOT, TSA

4.5 Coordination and Partnerships

A number of commenters made recommendations about how coordination and partnership can enhance USDOT's supply chain work. Some of these made direct recommendations about enhancing USDOT's role in convening supply chain stakeholders and pushing for policy changes to respond to disruptions, such as convening public and private sector stakeholders to address short-term changes to hours of operations throughout the supply chain when challenges arise. Other recommendations focused on USDOT's role as a convener who can help shape and support the actions of non-Federal partners, including State and local governments, private industry, and international partners through continued coordination.

Table 10: Coordination and Partnerships Policy Recommendations

Policy Goal: Convene supply chain stakeholders to enhance USDOT's supply chain work							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
52	**Develop an action plan to implement these policy recommendations and set up a comprehensive and inclusive interagency group to support their implementation.** As part of the development of the action plan, conduct outreach to relevant stakeholders and communities to receive input that informs the action plan.	High	$	Medium	Near-Term	All	USDOT
53	**Collaborate with partners on the Motor Carrier Safety Advisory Committee Driver Subcommittee when implementing any proposals that will impact the nation's professional driver fleet.**	Moderate	$$	Low	Near-Term	Trucking	USDOT

Policy Goal: Convene supply chain stakeholders to enhance USDOT's supply chain work							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
54	**Work with State DOTs and the private sector to develop a national inventory of available warehouse space to help plan and shape an ongoing transition of facilities.** National real estate brokerage firms could also provide valuable assistance.	Moderate	$	High	Near-Term	Logistics	DOC, USDOT, State DOTs, Private sector
55	**Continue coordination with freight industry stakeholders, including potentially reconvening a National Freight Advisory Committee, national task forces, or supply chain stakeholder roundtables.** Coordination should include public sector, private industry, and increased engagement with the Department of Commerce's Advisory Committee on Supply Chain Competitiveness to address resilient supply chains and port performance.	High	$$	Low	Near-Term	All	USDOT, DOC, States, Local gov'ts, Private sector
56	**Work with partner agencies to consider how to improve U.S. transportation infrastructure connections with Mexico and Canada, to help shorten supply chains and promote domestic and near-shoring production shifts.**	High	$$	High	Near-Term	All	USDOT

Policy Goal: Convene supply chain stakeholders to enhance USDOT's supply chain work							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Mode(s)	Actor(s)
57	**Convene a Supply Chain Workforce Summit with the Departments of Labor, Transportation, Education, Commerce, Veterans' Affairs, and Defense and workers across the freight and logistics sector.**	High	$	Low	Near-Term	All	USDOT, DOL, ED, DOC, VA, DoD, labor unions, private sector
58	**Improve communications with applicants on the status of Hazardous Materials Endorsement (HME) or Transportation Worker Identification Credential (TWIC®) security threat assessments.** As part of this, implement efficiencies to enhance equity, increase security, and reduce cost and time burdens associated with enrollment and credentialing.	Moderate	$	Medium	Near-Term	All	USDOT, TSA

Policy Goal: Support the actions of non-Federal partners through continued coordination							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Modes(s)	Actor(s)
59	**Encourage all ports to create port stakeholder committees with wide representation, including residents of port-adjacent communities.**	High	$	Low	Near-Term	Maritime	USDOT, Port authorities, USCG

Policy Goal: Support the actions of non-Federal partners through continued coordination							
No.	Policy Recommendation	Impact	Cost	Complexity	Approx. Timing	Modes(s)	Actor(s)
60	**Explore standardization of 53-foot marine container sizes for international trade to support more efficient movement of goods.**	Moderate	$$$	High	Long-Term	Maritime, Rail, Trucking	USDOT, DOC
61	**Encourage reciprocity among States related to obtaining truck driver credentialing and provide aid to the State Department of Motor Vehicles to hire more commercial driver's license test examiners.** Use the Federal Motor Carrier Safety Administration's Commercial Driver License Program Implementation grant program to help improve information technology systems to fix licensing backlog.	High	$	Low	Near-Term	Trucking	USDOT, States
62	**Improve last-mile access to freight-oriented developments, use of near-dock cargo handling facilities, land-use strategies to support warehousing in appropriate locations, and goods movement integration into Smart Streets/Complete Streets development to increase safety.**	Highest	$$$	High	Medium-Term	Trucking, Rail, Maritime, Logistics	USDOT

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