Georgia Freight Plan

3/21/2023

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1. Introduction

Georgia is the cornerstone of the national freight system in the Southeast, geographically and functionally. No other state combines a manufacturing and distribution powerhouse like Atlanta with a premier container port like Savannah. The pairing of these hubs is symbiotic: their logistical properties and productive capacity form an integrated ecosystem, connected by daily road and rail services and high-speed communications. The overseas capabilities of Georgia's ports are complemented with air cargo capacity at Hartsfield-Jackson Atlanta International Airport, creating global reach for the supply chains of the Southeast. Georgia is the gateway to Florida, the third most populous state in the country but also a peninsula whose access to markets and supplies from the rest of the continent depends on this gateway. And unlike other regional locations, Georgia's geography is relatively protected from worsening storms, reducing risk for businesses who choose it and for the multimodal freight system it provides. That system is extensive, blanketing rural territory with its towns and farms through short and Class I rail lines as well as thousands of miles of roadways. The Georgia workforce is skilled in manufacturing and logistics and kept that way through educational institutions, training programs, and services that link them to employers.

Georgia's infrastructure has boosted freight operations and movements making the state a freight and logistics leader across the US and globe. In 2019, nearly half a billion tons of freight moved on Georgia's multimodal freight transportation network. Based upon population and Gross Domestic Product (GDP), Georgia handles more freight tons per capita and more freight value relative to state GDP than any other Southeastern state. Georgia has a long history of commitment to business and was recently named the best state for business for the ninth consecutive year. Over 379 companies have expanded or located within Georgia, bringing over $11 billion in investment.

1.1. Role of the State Freight Plan

The role of the Georgia Freight Plan is to document freight planning activities and investments in the state, identify and assess current and future freight needs and challenges incorporating both technical analysis and stakeholder engagement, and guide freight-related transportation decisions and investments. The Georgia Freight Plan integrates policy positions and strategies from existing documents to help identify and prioritize freight investments critical to the state's economic growth and global competitiveness. The Georgia Freight Plan is a stand-alone document, but it builds upon previous planning documents. Georgia's Freight Plan establishes specific goals for freight transportation and addresses freight issues that are not covered in other statewide planning documents.

The Bipartisan Infrastructure Law (BIL), signed into law on November 15, 2021, advances the ten (10) requirements for Statewide Freight Plans set forth under the FAST Act and enhances State Freight Plans by requiring the elements shown in **Table 1**. **Table 1** also identifies the section of the document that meets each of the requirements.

Table 1. Federal Requirements and Document Location

FAST Act and BIL Requirements	
(A) IN GENERAL. — Each State that receives funding under section 167 of title 23 shall develop a freight plan that provides a comprehensive plan for the immediate and long-range planning activities and investments of the State with respect to freight.	
(B) PLAN CONTENTS.—A freight plan described in subsection (a) shall include, at a minimum – 1) an identification of significant freight system trends, needs, and issues with respect to the State	Section 2.2; Page 2-2 Section 3.1.6; Page 3-10 Section 4.1; Page 4-1 Section 4.2; Page 4-47
2) A description of the freight policies, strategies, and performance measures that will guide the freight-related transportation investment decisions of the State	Section1.3; Page 1-7 Section 3.1.4; Page 3-8 Section 4.3; Page 4-98 Section 5.1; Page 5-1 Section 5.4.2; Page 5-30 Section 5.4.5; Page 5-38
3) When applicable, a) a listing of multimodal critical rural freight facilities and corridors designated within the State under section 70103 of this title	Section 3.1.4; Page 3-8
b) When applicable, a listing of critical rural and urban freight corridors designated within the State under section 167 of title 23	Not Applicable
4) A description of how the plan will improve the ability of the State to meet the national multimodal freight policy goals described in section 70101(b) of this title and the national highway freight program goals described in section 167 of title 23	Section 1.3; Page 1-8 Section 5.4.5; Page 5-38
5) A description of how innovative technologies and operational strategies, including intelligent transportation systems, that improve the safety and efficiency of freight movement, were considered	Section 4.2.5; Page 4-64 Section 4.2.8; Page 4-87 Section 4.3.2; Page 4-112 Section 4.3.6; Page 4-122 Section 5.3.6; Page 5-25
6) In the case of routes on which travel by heavy vehicles (including mining, agricultural, energy cargo or equipment, and timber vehicles) is projected to substantially deteriorate the condition of roadways, a description of improvements that may be required to reduce or impede the deterioration	Section 2.6; Page 2-102 Section 5.3.1; Page 5-8
7) An inventory of facilities with freight mobility issues, such as truck bottlenecks, within the State, and for those facilities that are State owned or operated, a description of the strategies the State is employing to address those freight mobility issues	Section 4.1.1; Pages 4-2 Section 4.2.8; Page 4-87 Section 4.3.1; Page 4-98 Section 5.2.3; Page 5-5 Section 5.3.1; Page 5-8 Section 5.3.4; Page 5-17 Section 5.3.5; Page 5-21 Section 5.4.2; Page 5-30

8) Consideration of any significant congestion or delay caused by freight movements and any strategies to mitigate that congestion and delay	Section 4.1.1; Page 4-2 Section 4.1.3; Page 4-46 Section 4.2; Page 4-47 Section 4.3.1; Page 4-98 Section 4.3.4; Page 4-118 Section 5.1; Page 5-1 Section 5.2; Page 5-4 Section 5.3; Page 5-8
9) A freight investment plan that, subject to subsection (c)(2), includes a list of priority projects and describes how funds made available to carry out section 167 of title 23 would be invested and matched	Section 5.3; Page 5-8
10) The most recent commercial motor vehicle parking facilities assessment conducted by the State under subsection (f); (f) COMMERCIAL MOTOR VEHICLE PARKING FACILITIES ASSESSMENTS.— As part of the development or updating, as applicable, of a State freight plan under this section, each State that receives funding under section 167 of title 23, in consultation with relevant State motor carrier safety personnel, shall conduct an assessment of: 1) the capability of the State, together with the private sector in the State, to provide adequate parking facilities and rest facilities for commercial motor vehicles engaged in interstate transportation; 2) the volume of commercial motor vehicle traffic in the State 3) whether there exist any areas within the State with a shortage of adequate commercial motor vehicle parking facilities, including an analysis (economic or otherwise, as the State determines to be appropriate) of the underlying causes of such a shortage.	Section 3.1.6; Page 3-10 Section 4.1.2; Page 4-33 Section 4.3.2; Page 4-112 Section 5.3.3; Paqe 5-14 Section 5.4.5; Page 5-38
11) The most recent supply chain cargo flows in the State, expressed by mode of transportation	Section 2.5; Page 2-53
12) An inventory of commercial ports in the State	Section 3.2; 3-21 Section 3.3; Page 3-25
13) If applicable, consideration of the findings or recommendations made by any multi-State freight compact to which the State is a party under section 70204	Section 1.5; Page 1-14 Section 5.4.4; Page 5-38
14) The impacts of e-commerce on freight infrastructure in the State	Section 4.2.7; Page 4-77 Section 2.5.3; Page 2-71
15) Considerations of military freight	Section 5.4.1; Page 5-27
16) Strategies and goals to decrease: A) The severity of impacts of extreme weather and natural disasters on freight mobility	Section 1.3; Page 1-8 Section 5.4.2; Page 5-30

B) Strategies and goals to decrease the impacts of freight movement on local air pollution;	Section 1.3; Page 1-8 Section 5.4.2; Page 5-32
C) Strategies and goals to decrease the impacts of freight movement on flooding and stormwater runoff	Section 1.3; Page 1-8 Section 5.4.2; Page 5-32
D) Strategies and goals to decrease the impacts of freight movement on wildlife habitat loss	Section 1.3; Page 1-8 Section 5.4.2; Page 5-34
17) Consultation with the State freight advisory committee, if applicable.	Section 1.4.2; Page 1-11 Section 4.2.1; Page 4-47
(C) RELATIONSHIP TO LONG-RANGE PLAN.— (1) INCORPORATION. ---A freight plan described in subsection (a) may be developed separate from or incorporated into the statewide strategic long-range transportation plan required by section 135 of title 23.	Section 1.2; Page 1-5 Section 5.3: Page 5-8 Section 5.4.3; Page 5-37
(2) FISCAL CONSTRAINT. ----The freight investment plan component of a freight plan shall include a project, or an identified phase of a project, only if funding for completion of the project can reasonably be anticipated to be available for the project within the time period identified in the freight investment plan.	Section 5.3.3; Page 5-14

The components of the Georgia Freight Plan include:

- Chapter 1 – Plan purpose, Plan goals and objectives and overview of performance measures
- Chapter 2 – Freight economy inclusive of the importance of freight in the state and critical supply chains
- Chapter 3 – Freight transportation infrastructure in the state
- Chapter 4 – Critical freight issues, opportunities and trends
- Chapter 5 – Freight improvement and investment program and additional federal requirements

1.2. Georgia's Commitment to Freight

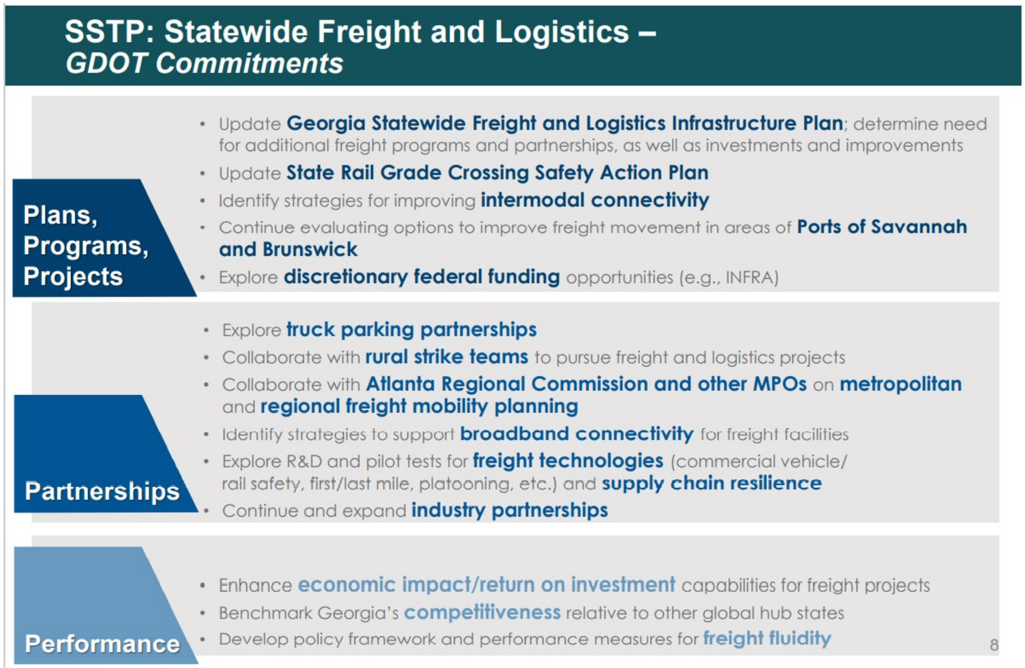
The abundant and effective freight infrastructure in Georgia creates a favorable, attractive, and competitive environment for supply chains across numerous industries to conduct business. Georgia has a robust inventory of multimodal freight assets, including 128,300 miles of highways, 17,923 miles of state routes, 4,222 miles of state freight network, 15 Interstates, 4,607 miles of rail, two deep water seaports, three inland ports, and three major cargo airports.

Georgia's strong economy and population growth continue to put demands on transportation infrastructure that carries freight. The state attracted more than one million new residents over the past decade growing at a rate of one percent annually. Georgia has the second largest workforce in the Southeast and is among the best educated. More than one out of seven jobs in Georgia (and 17 percent of the Southeastern US region's employment) are in freight-intensive industries (agriculture, production and transportation) with a high location quotient, indicating a strong local business base and excellent future career opportunities.

Georgia Governor Brian Kemp, the State Transportation Board, and Department leaders have indicated their prioritization of improving freight movements in the following key GDOT documents:

- Statewide Strategic Transportation Plan (SSTP) – the plan makes a business case for transportation investment based on economic outcomes and includes statewide freight and logistics as one of three major investment categories of Foundational, Catalytic, and Innovation and aligns with the three strategy components of 1) plans, programs, projects; 2) partnerships; and 3) performance.
- 2050 Statewide Transportation Plan (SWTP) – the plan provides the long-range, comprehensive transportation planning requirements required under federal law integrated with the investment categories and strategy components of the SSTP.

Figure 1. The GDOT Statewide Strategic Transportation Plan Outlines the State's Commitment to Freight and Logistics.[1]



Georgia also shows its freight and logistics commitments through deliberative and data-driven maintenance, operations, and mobility improvement programs. A prime example of this commitment is GDOT's intent to invest approximately $2.4 billion annually, through year 2050. These investments include the multi-billion Major Mobility Investment Program (MMIP), which is advancing major freight highway and network improvements with accelerated construction over 10 years. Other critical programs for improvement of freight mobility include the completion of the Governor's Road Improvement Program (GRIP), which began in 1989, and a new Freight Operations Lump Sum Program, to improve freight movement, enhance safety, decrease travel times, and provide transportation improvements and efficiencies within cities, counties, and regions across the state.

In addition to these programs, the state has designated a state freight network (SFN) to complement USDOT's national freight network (NFN) within Georgia. GDOT also initiated an internal statewide truck parking assessment in 2020-21, which is further refined in this plan. Other freight-related strategies and projects within Georgia include strategies to expand the fiber optic network to support future smart mobility technologies and development of a first-of-its-kind 40-mile Commercial Vehicle Lane (CVL) along I-75 within central Georgia.

GDOT has also undertaken a number of studies and coordination efforts related to freight and logistics. In addition to this update of the Georgia Freight Plan, GDOT has completed a State Rail Plan, Broadband Policy Plan, GDOT National Electric Vehicle Infrastructure (NEVI) Plan, GRAD Site Analysis, Savannah River Crossing Feasibility Study, Coastal Empire Study,

[1] https://www.dot.ga.gov/GDOT/Pages/SSTP.aspx

Georgia Rail Crossing State Action Plan, and is participating in the development of Metropolitan Planning Organization (MPO) freight plans across the state. Details on the relationship to other statewide planning efforts are discussed in Section 5.4.3.

1.3. Georgia's Freight Goals and Objectives

Governor Kemp's Strategic Goals guide the actions and investments of state government agencies. GDOT uses these goals as the framework for the SSTP, Freight Plan, and other planning efforts. **Figure 2** displays the Governor's Strategic Goals. The SSTP identifies ways in which GDOT will support these four goals through its transportation programs, and further identifies implications for freight and logistics associated with each of the four goals. Building from the work done in the SSTP, **Figure 3** shows the goals for Georgia's Freight Plan and their alignment with the National Freight Highway Program goals.

The Freight Vision and Mission Statements, also displayed in **Figure 2**, echo the Governor's Strategic Goals by promoting economic development and responsible investment and expand upon these goals by securing Georgia's competitive advantage as a freight hub. The Freight Advisory Committee participated in the development of the Vision and Mission Statement early in the Freight Plan process.

Figure 2. Governor's State Strategic Goals and GDOT's Freight Vision and Mission Statements

Vision Statement

Georgia will be the global gateway of choice, providing reduced time to market, superior supply-chain efficiency, and reliability from destination to end customer.

Mission Statement

The State, in partnership with private-sector and local and Federal governments, will identify and promote the implementation of activities that improve the capacity, capability, and connectivity of today's supply chains. This will leverage intermodal freight connectors to destinations both inside and outside of Georgia to generate a competitive advantage that benefits Georgians.

Figure 3. Georgia Freight Plan Goals with National Freight Highway Program Goals

STATE GOALS

NATIONAL GOALS

	Modernize freight infrastructure and operations	Support efforts to reduce the cost and time of good delivery and to increase the resilience of supply chains	Maintain and improve freight infrastructure for safety and performance	Expand use of existing and new data and technologies to support freight and logistics	Evaluate options for improved connectivity and increased capacity within current revenue streams based on return-on-investment analysis	Support site development and Georgia Port Authority identified rail intermodal "inland ports"	Support growth in manufacturing, agriculture, and distribution	Improve safety and security of commercial vehicle and freight movements	Advance freight through environmental stewardship, equitable policies, and responsible development
Investing in infrastructure and operational improvements that strengthen economic competitiveness, reduce congestion, reduce the cost of freight transportation, improve reliability, and increase productivity;									
Improving the safety, security, efficiency, and resiliency of freight transportation in rural and urban areas;									
Improving the state of good repair of the NHFN;									
Using innovation and advanced technology to improve NHFN safety, efficiency, and reliability;									
Improving the efficiency and productivity of the NHFN;									
Improving State flexibility to support multi-State corridor planning and address highway freight connectivity; and									
Reducing the environmental impacts of freight movement on the NHFN. [23 U.S.C. 167(a) and (b)]									

Georgia has been named the number one state for business by Area Development magazine for nine years running because of advantages like these and the business-friendly policies that support them. The Georgia Freight Plan aims to preserve and enlarge these advantages through focus on performance. Freight volumes in Georgia will double in the next thirty years, posing challenges to performance and opportunities to capitalize on the benefits of growth. Supply chain designs themselves are in flux because of post-pandemic market forces, opening a window for new thinking and approaches. The performance measures utilized in this plan are five Key Performance Indicators (KPIs) widely employed in business for freight transportation management and developed in coordination with the Freight Advisory Committee: Safety, Reliability, Speed, Cost and Risk. The five measures are applied comprehensively throughout the plan: to characterize the conditions currently prevailing, to identify the mounting challenges to industry associated with growth, and to formulate and test the program and policies that will keep Georgia's performance competitive. The definitions of the five KPIs and the measures used to capture them are described in **Table 2**.

Table 2. KPI Performance Measures

KPI	Definition	Performance Measure
Safety	Social cost of crashes	Cost of crashes per vehicle mile traveled
Reliability	Vehicle hours of unreliability	Difference between 95th percentile travel times and average travel times
Speed	Vehicle Speed	Average vehicle speed (mph)
Cost	Cost to shippers and carriers	Total delay cost per vehicle mile traveled
Risk	Potential for interference in operations, cost structure, market, or resource access	Natural hazard exposure, modal and multimodal redundancy, relevant market share

In addition to the Freight Plan KPI/Performance Measures, GDOT also reports federally required performance measures in the System Performance Report[2] published with the FY 2021-2024 STIP. The PM3 measures in this report include Truck Travel Time Reliability Index (TTTR), which directly align with the Freight Plan's reliability performance measure (KPI) in **Table 2**.

The Vision, Mission, Goals, and Performance Measures presented here are used to develop the Freight Plan recommendations and investments, which are presented in Section 5. Section 5 of this Plan displays the current and projected future performance of Georgia's freight network using the measures from **Table 2**.

The Georgia Freight Plan is being conducted in accordance with the goals defined by the National Multimodal Freight Policy as set forth in the Fixing America's Surface Transportation (FAST) Act and the Bipartisan Infrastructure Law (BIL). The national policy goals defined in the federal legislation are summarized in **Table 3**.

[2] GDOT System Performance Report https://www.dot.ga.gov/InvestSmart/STIP/FY21-24/SystemPerformanceReport-2050SWTP_21-24STIP.pdf

The National Freight Strategic Plan (September 2020) groups freight policy goals into Safety, Infrastructure and Innovation, and establishes objectives for each. The Georgia Freight Plan adopts the national goals and objectives to ensure consistency between state efforts and the national policies. The national goals and objectives are the goals and objectives for Georgia's plan, and the performance improvements developed in this plan fulfill those objectives through improvement in KPIs. The correspondence of Georgia's KPI performance measures to the national goals and objectives is presented in **Table 3**.

Table 3. Correspondence of KPIs to National Goals and Objectives

National Freight Strategic Plan Objective	KPI				
Safety	**Safety**	**Reliability**	**Speed**	**Cost**	**Risk**
Support the development and adoption of automation, connectivity, and other freight safety technologies	✓	✓	✓		✓
Modernize safety oversight and security procedures	✓				✓
Minimize the effects of fatigue and human error on freight safety	✓			✓	✓
Reduce conflicts between passenger and freight traffic	✓	✓	✓	✓	✓
Protect the freight system from natural and human-caused disasters and improve recovery speed	✓	✓	✓	✓	✓
Infrastructure	**Safety**	**Reliability**	**Speed**	**Cost**	**Risk**
Fund targeted investments in freight capacity		✓	✓	✓	
Improve considerations of freight in transportation planning	✓	✓	✓	✓	✓
Prioritize projects that improve freight intermodal connectivity, and enhance freight flows on first- and last-mile connectors and at major trade gateways	✓	✓	✓	✓	✓
Advance freight system management and operation practices		✓	✓	✓	
Improve job growth and economic competitiveness in rural and urban communities				✓	✓
Mitigate the impacts of freight movement on communities	✓	✓			✓
Innovation	**Safety**	**Reliability**	**Speed**	**Cost**	**Risk**
Support the development and adoption of automation and vehicle-to-everything technology	✓	✓	✓	✓	
Support the safe deployment of unmanned aircraft system technology	✓	✓	✓	✓	
Streamline regulations to improve governance, efficiency, and economic competitiveness		✓		✓	✓
Improve freight data, modeling, and analysis tools and resources	✓	✓	✓	✓	✓
Strengthen workforce professional capacity				✓	✓
Invest in freight research	✓	✓	✓	✓	✓
Support regulatory frameworks that foster freight innovation		✓		✓	

1.4. Stakeholder Engagement and FAC Consultation

This summary details how GDOT coordinated with stakeholders to develop the Georgia Freight Plan. Recognizing the importance of early and ongoing stakeholder involvement, GDOT initiated outreach at the onset of the planning process and continued efforts throughout. A broad range of stakeholders were identified and invited to participate, including the freight operators and shippers; manufacturers and industrial businesses; economic development and business interests; special interest and advocacy groups; and regional governments. Involvement from these groups included participating in a robust Freight Advisory Committee and individual, comprehensive stakeholder interviews. Their input was instrumental in developing the proposed goals and objectives; identifying freight issues, needs and potential infrastructure investments; and helping to define freight policies and projects.

1.4.1. Approach to Stakeholder Participation

The core goals for the plan's stakeholder outreach were:

- Raise awareness of the state's freight system and Freight Plan process
- Build relationships between government and private business sector leaders and staff
- Identify and engage with key freight stakeholders to identify current conditions and opportunities, trends, and priorities for investment
- Collaborate with stakeholders to create an actionable plan of policies and programs for the state's freight system.

To meet these goals, a comprehensive outreach program was developed consisting of multiple avenues for stakeholders to be informed and updated on the Georgia Freight Plan and provide input. These avenues included a Freight Advisory Committee, virtual stakeholder interviews and a survey.

1.4.2. Freight Advisory Committee

A Freight Advisory Committee (FAC) comprised of major stakeholders was convened for the plan to provide a continuing forum of data collection, exchange, understanding, need identification and clarification. **Table 4** lists the FAC's member organizations, and the interest represented.

Table 4. Freight Advisory Committee Membership

Organization	Interest Represented
AT&T	Private Industry - Technology
Atlanta Regional Commission	Metropolitan Planning Organization
Birdsong Peanuts	Private Industry - Agriculture
Caterpillar	Private Industry - Manufacturer
Chatham County - Savannah MPC/CORE MPO	Metropolitan Planning Organization
Chick-Fil-A Supply	Private Industry - Operator
City Express Fulfillment	Private Industry – Shipper
Coca-Cola	Private Industry - Manufacturer
CRG Development	Private Industry – Real Estate
CSX	Private Industry – Class 1 Railroad
Delta Cargo	Private Industry – Shipper
Georgia Center of Innovation for Logistics	State Government – Logistics
Georgia Motor Trucking Association	Advocacy Group/Association
Georgia Ports Authority	State Government – Ports
Georgia Power	Private Industry – Utilities
Hartsfield Jackson International Airport	Municipal Government - Aviation
Home Depot	Private Industry – Retail
JB Hunt	Private Industry - Operator
JBS Foods	Private Industry – Agriculture/Operator
KBX Logistics	Private Industry - Shipper
KIA	Private Industry - Manufacturer
Kroger	Private Industry - Retail
Maersk	Private Industry - Operator
National Federation of Independent Business	Advocacy Group/Association
Norfolk Southern Corporation	Private Industry – Class I Railroad
Prologis	Private Industry – Real Estate
Saia	Private Industry - Operator
Sandersville Railroad	Private Industry – Short Line Railroad
Shaw Industries	Private Industry – Manufacturer/Shipper
Syfan Logistics	Private Industry – Shipper
UPS	Private Industry – Shipper
Walmart	Private Industry – Retail

The FAC met four (4) times during the development of the plan. The following summary provides a brief synopsis of the each of the meetings including the topics discussed and how input was collected from the members.

FAC #1 – March 8, 2022

At the first committee meeting, attendees were introduced to the planning team and the other committee members. The presentation included details on the role of the FAC; the overall scope and schedule of the plan; Georgia's strategic posture and position as related to freight; initial findings of the freight analysis and complications to consider; and the next steps forward including a freight fluidity analysis. The presentation included multiple opportunities for the attendees to provide input. Interactive exercises conducted via Mentimeter collected information from an ice-breaker activity and a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis. Questions and comments were welcomed throughout the meeting. Discussion also followed the presentation for those with questions and oral comments.

FAC #2 - May 17, 2022

At the second meeting, the project team highlighted the approach of categorizing projects as Foundational, Catalytic and Innovative (FCI) to be consistent with the SSTP/SWTP, and how this framework would be used to guide the meeting's discussion. The presentation highlighted feedback heard from industry stakeholders, both locally and nationally, around the five key factors of reliability, speed, cost, risk and safety; how well businesses are performing today in Georgia; projected future trends; and how Freight Plan outputs will tie into overall performance planning efforts by GDOT. The meeting provided multiple opportunities for the attendees to provide input, including Mentimeter and discussion time during and after the presentation.

FAC #3 – July 14, 2022

The third meeting of the committee focused on the plan's vision and objectives; recap of the FCI framework; presentation of the Key Performance Indicators (KPIs) – safety, reliability, cost, speed and risk - and how they are expected to be affected over time. Breakout sessions then followed with small group discussions on the KPIs and the metrics that matter most to the participants' business operations. The presentation continued with the topic of industry trends, followed by a second set of breakout sessions to discuss the trends and their potential impact on participants' business operations. Input obtained from the group was used to inform the plan's strategies.

FAC #4 – December 12, 2022

The fourth and final meeting of the committee focused on the investment plans and their effect on KPIs. Breakout sessions were conducted by industry to further discuss the investment plans and key considerations. Members from the breakout sessions reported back on the discussions held, and input was favorable to the investment plans. Member concurred with the emphasis on Interstate and state route improvements that benefit the KPIs and in turn provide value to business in the state.

1.4.3. Stakeholder Interviews

From April to early June 2022, interviews were conducted with freight stakeholders including freight operators and shippers, manufacturers, economic development groups, major retailers, railroads operating in Georgia, and other stakeholders with an interest in freight. The purpose of the interviews was to collect information on operations, projects, trends, and needs, and collect their feedback as to what freight investments would help improve the efficiency and success of their businesses. Care was taken to ensure a wide range of stakeholders were engaged to collect a broad base of input. Select stakeholders were also asked through the interviews to participate in the freight fluidity analysis.

Table 5. Stakeholder Interviews

Organization	Sector Represented
SAIA	Operator
Norfolk Southern	Class I Railroad
CSX	Class I Railroad
Delta Cargo	Shipper
UPS	Shipper
Home Depot	Retail
Shaw Industries	Manufacturer
Kia	Automobile
KBX Logistics (a Koch Company)	Shipper
Coca-Cola	Manufacturer
Caterpillar	Manufacturer
Pilgrim's Pride	Agriculture
Georgia Power	Utilities
Prologis	Real Estate
Chick-fil-A Supply	Operator
OmniTrax	Rail & Real Estate
Amazon	Retail/E-Commerce
JB Hunt	Operator
Walmart	Retail
Sandersville Railroad Company	Short Line Railroad/Agriculture
Georgia Center of Innovation for Logistics	State Government
SK Battery	Automobile
Georgia Ports Authority	Port Operator
Representative Beth Camp	Elected Official
Kimberly Clark	Manufacturer
Crider Foods/Coastal Transportation	Agriculture
Georgia Forestry Association	Agriculture

1.5. Participation in Multi-State Compacts

Georgia does not participate in any formal multi-state transportation compacts. Nevertheless, it is an active member in three multi-state arrangements beneficial to regional coordination of freight planning: a rail corridor commission, an Atlantic Coast transportation partnership, and a pool-funded institute concerned with trade and transportation in the Southeast and Gulf.

1.5.1. Southeast Corridor Commission

The Southeast Corridor Commission (SCC) is made up of transportation executive leadership from Washington, DC, Virginia, North Carolina, South Carolina, Tennessee, Georgia, and Florida. Georgia is represented by the Department's Chief Engineer and supported by Division of Intermodal staff. The purpose of the SCC is to develop regional rail planning efforts and coordinate implementation of the Southeast Corridor among member states and the FRA. The Commission recommends priorities and strategies to advancing passenger rail on the corridor and opportunities to pursue federal grants. Recently, the Commission completed an analysis of the economic benefits of rail, concluding that $153 million are expected to be saved due to reduced freight delays associated with rail upgrades in the southeast. The Commission is also exploring potential options for a future multi-state compact, such as the Virginia-North Carolina Interstate High-Speed Rail Compact, which is made up of state elected officials and take an active role in advancing passenger rail projects and seeking funding opportunities.

1.5.2. Eastern Transportation Coalition

The Eastern Transportation Coalition, formerly the I-95 Corridor Coalition, is a partnership of more than 200 public agencies across 17 states from Maine to Florida, who work together to address transportation challenges, with an emphasis on Transportation Systems Management and Operations (TSMO), freight movement, and data sharing. The Department participates in shared data purchases, working groups, and the ETC's Freight Academy. The coalition has made advances to coordinate real time travel information, tolling, and commercial vehicle information sharing among its member states. The ETC is also bringing the states together to set standards for autonomous vehicle lane striping and to explore the feasibility of transitioning to a mileage-based user fees, for which Georgia is participating in a pilot program. Through its participation in ETC, Georgia is especially mindful of the critical roles of its north-south corridors – particularly I-95 and I-75 – in accommodating movement to, from, and between all ETC states, and consideration of these connections has been an important part of the process of developing plan recommendations.

1.5.3. Institute for Trade and Transportation Studies

The Institute for Trade and Transportation Studies (ITTS) is a pooled fund consisting of State DOTs from Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, South Carolina, Texas, and Virginia. ITTS began as the Southern Transportation Alliance and its initial charge was the Latin America Trade Transportation Study, which identified trade opportunities with Latin America and transportation needs. Today, ITTS supports collaboration among member states and conducts research into freight trends. Examples of recent work include a truck parking inventory, an assessment of multimodal bottlenecks affecting goods movement, a regional waterways plan, and an update to the original Latin American Trade and Transportation Study. Ongoing ITTS work related to multistate issues impacting Georgia – particularly in the areas of trends and highway bottlenecks – has been incorporated into the Georgia State Freight Plan development process.

2. Georgia's Freight Economy

2.1. Importance of Freight Movement to the State

Georgia's multimodal transportation network carried nearly half a billion tons of freight in 2019, valued at $673 trillion. Over 100 million additional tons of freight traveling between other states also moved across Georgia highways. The system delivered essentially all of the household goods the people of Georgia needed and used: food for their tables, clothes to wear, cars to drive and fuel to run them, materials for building and repair, telecommunications and entertainment devices, and a host of other consumer products. The businesses of the state received their supplies and shipped goods to markets near and far, and the quality of the system kept businesses competitive and household budgets in line.

Five major industry groups are the sources of this Georgia-based traffic, all of them vital to the state's economy: food and agriculture, manufacturing, distribution and e-commerce, construction, and energy. Forecasts of freight volumes project a 91 percent increase in tonnage and 141 percent increase in the value of goods carried by 2050 – almost doubling today's tonnage and more than doubling today's value over the next three decades. Road traffic passing through the state nearly doubles as well. While some industry volumes grow more than others, all of them grow robustly. Trucks carry more than 80 percent of Georgia's tonnage today and are forecast to carry 87 percent of the new tonnage coming on stream by 2050, indicating that highways will shoulder most of the burden of growth. Even so, traffic by every mode will climb substantially, as Georgia's supply chains continue to take advantage of the state's modal diversity.

This chapter begins with the contribution of freight-supported industries to the Georgia economy. It then describes the composition of Georgia's current and forecast freight activity, with industry and modal detail and portrayal of foreign trade. This is followed by profiles of the five major industry groups, and the chapter concludes with a review of the key traffic patterns by industry.

2.1.1. Sources of Freight Traffic Data

Freight traffic analysis by industry and mode in this plan is based principally on the commercial commodity flow database Transearch, produced by S&P Global (formerly IHS Markit) and used by GDOT in past freight studies. Transearch portrays Standard Transportation Commodity Code (STCC)-level commodity flow volumes nationally by freight mode, with origin and destination by county along with highway and rail routing information. Annual traffic volumes are reported in tons and product value; tons reflect physical demand on infrastructure, and product value reflects economic activity. Data from this source, covering both base year 2019 flows and forecasted 2050 flows, identifies key freight corridors in Georgia, captures volumes passing through the state (such as between Florida and Tennessee) and segregates traffic specifically associated with key Georgia-based supply chains ("Georgia-based" signifies traffic with an origin and/or destination in Georgia, thus contributing directly to the state economy). Data for rail traffic is derived from the federal Surface Transportation Board Carload Waybill Sample for 2019, aggregated and integrated into Transearch.

The Transearch forecast is post-pandemic, meaning that it incorporates up-to-date assumptions about the outlook for industries and trade in the wake of supply chain disruptions associated with COVID-19. S&P Global is one of the country's leading econometric forecasting houses, utilizing linked models of economic activity at the regional, national and worldwide levels to project future volumes. New developments announced in Georgia and other states are incorporated in their models.

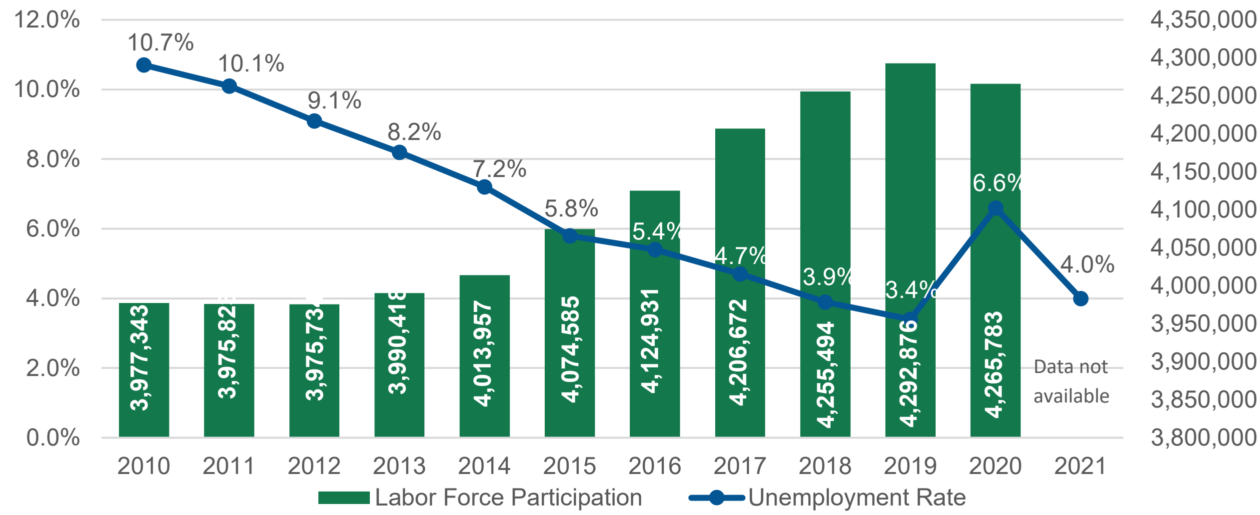
Supplementing Transearch is commodity flow data for foreign trade from the U.S. DOT Freight Analysis Framework (FAF) version 5.2, depicting 2019 annual volumes. While Transearch includes most foreign trade, it does not capture international air cargo, and it does not identify foreign trading partners for any traffic other than with Mexico and Canada. FAF uses a different commodity coding system that is not compatible with the industry groupings employed for analysis with Transearch, and its geographic detail in Georgia is limited to the Atlanta and Savannah metropolitan areas alongside the rest of the state. Nevertheless, its capture of overseas trading partners provides an important baseline from which to understand sourcing and coastal shifts as supply chains now strive to reduce supplier and logistical risks.

2.2. Economic Structure and Freight Supported Industries in Georgia

Georgia's network of roads, bridges, railways, seaports, inland ports and airports plays a critical role in everyday life for residents and businesses across the state and serves as the backbone of the state's robust and resilient freight related economy. The state is home to nearly 900 million square feet of warehouse distribution space, with metro Atlanta – the largest market in Georgia and sixth largest in the U.S. – accounting for 600 million square feet

Labor force participation trends for the population aged 25-64 show a rapid increase in the state's labor force beginning in 2015, with a slight decline in 2020 likely due to the COVID-19 pandemic. Between 2014 and 2019, the state's labor force increased by nearly 300,000, with an average annual growth rate of 1.35 percent. As of 2020, nearly 4.3 million individuals aged 25-64 are in the state's labor force, second only to Florida in the southeast.

Figure 4. Labor Force Participation (Population 25-64 years), 2010-2020 and Unemployment Rate



Sources: 2010 Decennial Census, 1-year ACS Estimates for 2011-2019, 2020 Decennial Census, Bureau of Labor Statistics (BLS), Local Area Unemployment Statistics – Expanded State Employment Status Demographic Data

While the state's unemployment rate has steadily decreased since 2010, 2019 saw Georgia's unemployment rate fall below the southeast average as a whole. Preliminary data from the Bureau of Labor Statistics (BLS) for 2021 estimates the statewide unemployment rate at four percent, slightly below the southeast regional unemployment rate of 4.3 percent, and second only to Alabama at 3.6 percent in the southeast. Since 2010, Georgia's unemployment rate has improved from 43rd ranked in the nation to 16th (2021). This trend was also observed in the southeast, where Georgia improved from 6th in southeast in 2017 to 2nd in 2021.

Employment and unemployment data is available for 2017 through 2020 by county and across Georgia's twelve regional commission areas from Neighborhood Nexus, which was used to identify employment trends. Labor force participation rates are typically highest in the Atlanta Region and Coastal Region, while unemployment rates are typically higher in Southern Georgia. The state's lowest unemployment rates are typically in Georgia Mountains, Central Savannah River Area, and Northwest Georgia counties, while the Coastal Region and Southwest Georgia have continuously had the highest (shown in **Figure 5**). In 2020, 20 Georgia counties had a civilian unemployment rate under 2 percent. Additional details are provided below.

- **Central Savannah River Area** – Glascock and Hancock counties have 2020 civilian unemployment rates under 1 percent.
- **Heart of Georgia Altamaha** – Telfair County has 2020 civilian unemployment rate of 0.6 percent and has been at one percent or under since 2018. This county has a 2020 population of approximately 12,500 and is home to McRae Correctional Facility.
- **River Valley** - Chattahoochee County has the highest rate of labor force participation at 78.3 percent of the population 16+. Chattahoochee County is part of the Columbus Metropolitan Statistical Area and is home to Fort Benning Military Post. They also have the youngest median age of any county in the state, at 24 years of age. The counties of

Quitman and Crisp had the highest civilian unemployment rates at 9.5 percent and 6.9 percent, respectively.

Figure 5. Civilian Unemployment Rate (2020)

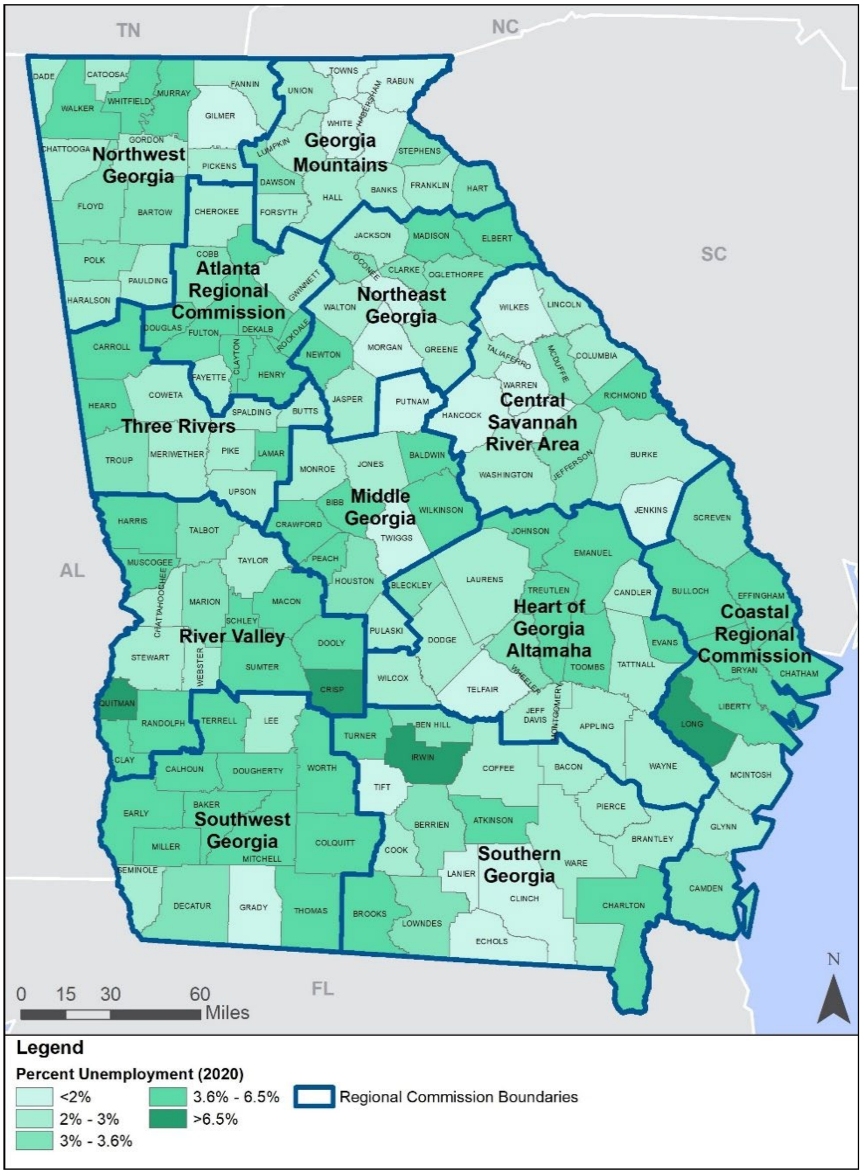


Table 6 shows projected employment growth by the state's 12 regional commissions. Parallel trends for both population and employment are observed across the state, with both the Atlanta Regional Commission (ARC) and Northeast Georgia region expected to contribute nearly 75 percent of total anticipated statewide employment growth. The Three Rivers region southwest of Atlanta is expected to exceed 200,000 people by 2050, with a total anticipated growth of 25 percent.

Table 6. Statewide Employment Growth by Region

Region	2015	2050	Change	Percent Change
Atlanta Regional Commission	**2,156,247**	**2,952,817**	**796,570**	**37%**
Central Savannah River Area	169,765	196,948	27,183	16%
Coastal Regional Commission	263,438	318,347	54,909	21%
Georgia Mountains	157,302	184,176	26,874	17%
Heart of Georgia Altamaha	86,202	101,027	14,825	17%
Middle Georgia	189,574	214,513	24,939	13%
Northeast Georgia	**184,366**	**246,996**	**62,630**	**34%**
Northwest Georgia	254,819	295,428	40,609	16%
River Valley	135,072	157,856	22,784	17%
Southern Georgia	137,115	160,082	22,967	17%
Southwest Georgia	124,416	147,028	22,612	18%
Three Rivers	160,964	201,878	40,914	25%

Sources: Georgia Statewide Travel Demand Model

2.2.1. Occupations

Occupation data was collected from the Georgia Department of Economic Development Site Selector website, which sources its information from JobsEQ, a company that provides data related to the workforce, education, and site selection. Occupation data is broken down into 22 distinct categories, listed in **Table 7**. The top six occupations in terms of size make up 54 percent of labor force. They include:

- Office and Administrative Support
- Sales
- Transportation and Material Moving
- Food Prep and Serving
- Management
- Production

Of these, transportation and material moving, and production related occupations hold a location quotient over 1.3. Other freight-related sectors including construction and extraction and farming, fishing, and forestry also hold a location quotient over 1, demonstrating Georgia's position as a freight intensive economy. An occupation's or industry's location quotient is used to identify sectors that are clustered or specialized in a particular place relative to national benchmarks.

Table 7. Top Occupations by Size of Labor Force

Occupation	Median Wage	Labor Force	LQ
Office and Administrative Support Occupations	$38,363.74	595,441	1.00
Sales and Related Occupations	$39,397.28	494,309	1.09
Transportation and Material Moving Occupations	$35,391.67	454,954	1.32
Food Preparation and Serving Related Occupations	$22,677.02	430,483	1.09
Management Occupations	$109,229.02	308,902	1.02
Production Occupations	$35,955.40	304,296	1.56
Education, Training, and Library Occupations	$50,427.92	277,743	1.11
Business and Financial Operations Occupations	$73,793.17	265,017	1.14
Healthcare Practitioners and Technical Occupations	$81,234.11	255,895	1.04
Installation, Maintenance, and Repair Occupations	$46,510.56	199,673	1.14
Construction and Extraction Occupations	$43,080.14	194,299	1.08
Building and Grounds Cleaning and Maintenance Occupations	$27,431.64	155,243	0.99
Computer and Mathematical Occupations	$87,155.46	149,500	1.33
Healthcare Support Occupations	$29,934.40	148,872	0.77
Personal Care and Service Occupations	$28,307.81	130,378	0.98
Protective Service Occupations	$40,046.95	108,896	1.20
Arts, Design, Entertainment, Sports, and Media Occupations	$58,334.03	88,212	1.14
Community and Social Service Occupations	$47,823.01	67,588	0.90
Architecture and Engineering Occupations	$82,945.79	67,257	0.96
Legal Occupations	$100,090.30	39,196	1.22
Life, Physical, and Social Science Occupations	$70,820.34	32,543	0.93
Farming, Fishing, and Forestry Occupations	$30,925.32	20,546	4.28

Source: Georgia Department of Economic Development, Site Selector.

Other occupations also show a strong concentration across the state, with reported location quotients above 1.2. These include:

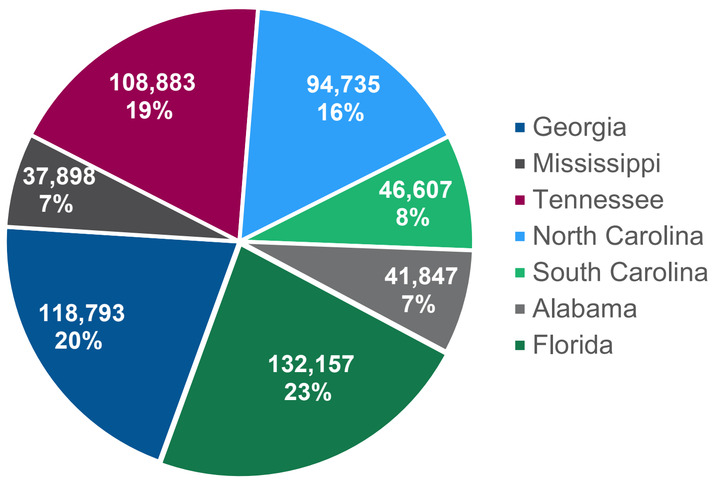
- Computer and Mathematics
- Protective Services
- Legal Occupations
- Farming, Fishing, and Forestry

In total, occupations with a location quotient at or above 1.2 make up approximately 22 percent of the total state's labor force. Three of these provide Georgia workers with median wages over $40,000: Computer and Mathematics, Legal, and Protective Service.

2.2.2. Freight Intensive Employment

Annual averages from the Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW) were used to better understand the role that freight intensive industries (defined as the combination of freight moving and freight generating sectors) play across the state. While Georgia makes up approximately 17 percent of the population in the southeast, defined as Georgia, Mississippi, Tennessee, North Carolina, South Carolina, Alabama, and Florida, it contributes approximately 20 percent (118,793)[34]

Figure 6. Employment in Freight Moving Industries (2020)

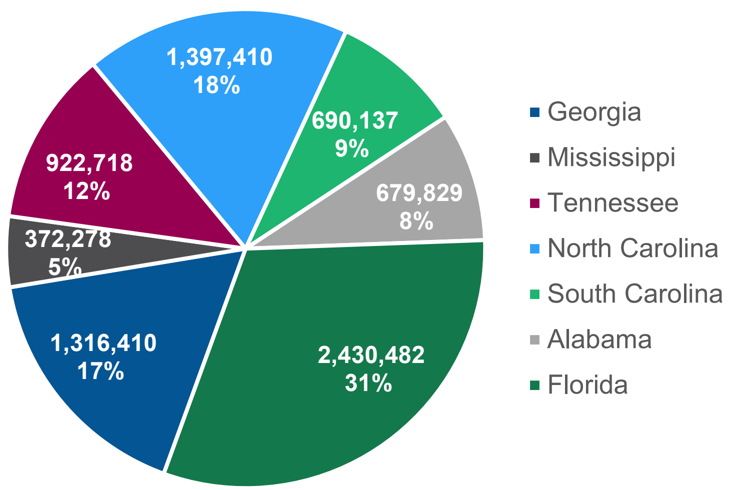


Beyond this, Georgia represents about 17 percent of total employment in freight generating industries, defined as the following NAICS industry sectors:

- Agriculture, Forestry, Fishing, (11)
- Mining (21)
- Utilities (22)
- Construction (23)
- Manufacturing (31-33)
- Wholesale Trade (42)
- Retail Trade (44-45)

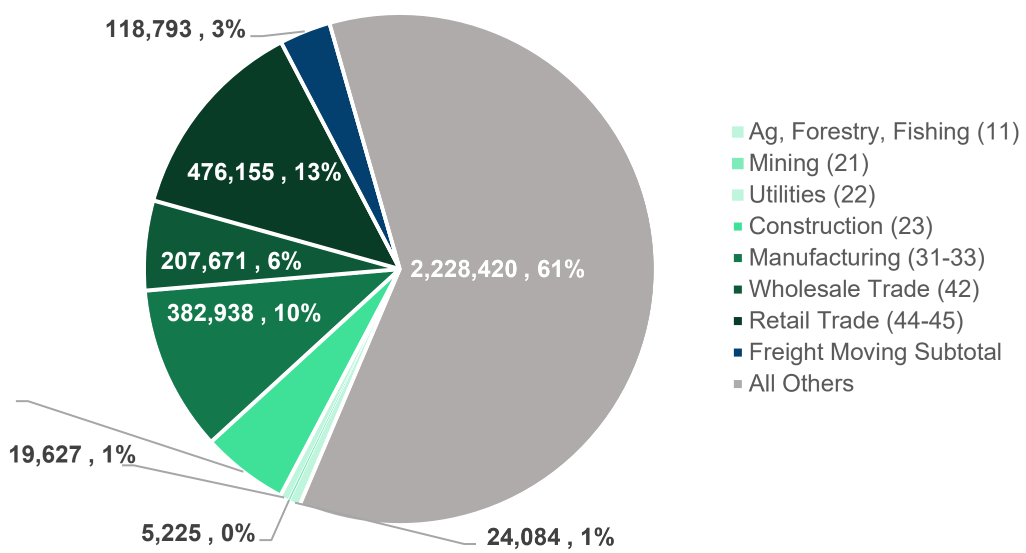
[4] Freight moving industries defined as scheduled freight air transportation (481112), nonscheduled air freight chartering (481212), inland water freight transportation (483211), general freight trucking (4841), specialized freight trucking (4842), pipeline transportation (486), general warehousing and storage (49311), refrigerated warehousing and storage (49312), farm product warehousing and storage (49313), and other warehousing and storage (49319).

Figure 7. Employment in Freight Generating Industries (2020)



Together, freight intensive industries make up approximately 40 percent of total Georgia employment.

Figure 8. Statewide – Freight Intensive Share of Total Employment (2020)



As Georgia continues to grow, maintaining and growing a talented labor pool will be key to continued economic growth and success. The Georgia Freight Advisory Committee ranked workforce as their top concern, while acknowledging that this is a national issue (and the location quotients cited above suggest that Georgia is relatively better off in this regard). In addition, there are a few key factors that may support current and future successes across the state. These include supporting an adequately trained and educated workforce, sustaining high participation in the labor force, and continuing to support industries and occupations in which Georgia is a leader. The Georgia Center of Innovation for Logistics specializes in logistics and serves as a go-between for industry and educators, tapping a network of logistics programs from 30 institutions within the university system, 23 technical colleges, and 37 college and career academies.[5] The state offers programs through the Department of Economic Development's Workforce Division and the Georgia Department of Labor, - notably Georgia Quick Start, which has provided training customized to the needs of employers for five decades.

2.3. Summary and Forecast of Georgia Commodity Flows

This section presents a summary of freight flow in the state of Georgia in 2019 along with a forecast of freight volumes in the state for the year 2050.

As shown in Table 8, Georgia handled more than 585 million tons of freight in 2019. Inbound freight was the largest directional flow by tonnage with 181 million tons, 31 percent of the total. Georgia outbound tonnage was 25 percent of the total at 146 million tons. Inbound traffic is significant in that it supports both the population and Georgia's extensive industrial base. Outbound tonnage represents the materials and products produced by agriculture, food processing, and manufacturing, moved in distribution, or used in construction and energy. The inbound and outbound traffic also includes regional traffic that moves back and forth across state lines between Georgia and the neighboring states.

The total volume of freight movement within Georgia was 143 million tons (24 percent), while 115 million tons (20 percent) of freight volume passed through the state. Intra Georgia traffic reflects both materials and products to supply the population and provision industries throughout the state. The through traffic includes volume moving in all directions coming to and from other states such as that moving on Interstate 75, a primary north-south route from the Midwest to the southern states or Interstate 20 passing east-west between Alabama and South Carolina.

The maps and more detailed information about the five primary industrial groups included in further sections of this chapter show how dependent the state is on highway flow. The Interstate highways are the core of the network but regional and rural roads also are critical, as they carry traffic that is vital to agriculture and forestry and bring goods to rural populations. The highway access to the ports and the intermodal hubs is also crucial as this multi-modal connectivity helps makes Georgia the premier freight and logistics hub in the southeast. The forecasts of freight tonnage shown in 2050 present a challenge if Georgia is to support the predicted level of growth, and a clear economic opportunity.

As will be shown, much of the cargo flow is centered around Atlanta as the largest population center, a hub for intermodal operations and a center for warehousing and logistics. Additionally, the Interstate highways connecting through Atlanta making this region a source for congestion, safety concerns, and environmental impacts.

[5] Georgia Center of Innovation, https://www.georgia.org/center-of-innovation/areas-of-expertise/logistics?gclid=Cj0KCQiA4OybBhCzARIsAIcfn9mUuktBbFaXT-liRLPN3eRPRffvzANPwf3aXQG3tiLVbEVO_px8k90aAivWEALw_wcB

Table 8. Georgia Freight Flow Summary by Tonnage, 2019

Direction of Flow	Tons - 2019	% of Total Tonnage
Inbound to GA	181 M	31%
Outbound from GA	146 M	25%
Within GA	143 M	24%
Through	115 M	20%
Grand Total	**585 M**	**100%**

Source: Analysis of Transearch and STB Waybill Data

By 2050, total freight volume is projected to increase by over 92 percent from 585 million tons to 1,122 million tons. Freight traffic moving within Georgia is projected to increase at the fastest rate from 2019 to 2050 at 117 percent growth, or a Compound Annual Growth Rate (CAGR) of 2.5 percent. Inbound flows are projected to grow at the slowest rate over the forecast period. By volume, inbound flows will still account for the largest directional flow at 319 million tons, followed closely by tonnage within Georgia at 310 million tons.

Table 9. Georgia Freight Flow Summary by Tonnage, 2050

Direction of Flow	Tons - 2050	Tons Growth 2019 - 2050	Tons Growth CAGR 2019 - 2050
Inbound to GA	319 M	76%	1.9%
Outbound from GA	271 M	86%	2.1%
Within GA	310 M	117%	2.6%
Through	222 M	93%	2.2%
Grand Total	**1,122 M**	**92%**	**2.2%**

Source: Analysis of Transearch and STB Waybill Data

By value, Georgia handled more than $906 billion of freight in 2019. Outbound freight was the most valuable directional cargo flow at $276 billion, representing 30 percent of total value. Inbound freight was second at $239 billion (26 percent), followed by passthrough cargo at $233 billion (26 percent).

Table 10. Georgia Freight Flow Summary by Value, 2019

Direction of Flow	Value ($) - 2019	% of Total Value
Inbound to GA	239 B	26%
Outbound from GA	276 B	30%
Within GA	158 B	17%
Through	233 B	26%
Grand Total	**906 B**	**100%**

Source: Analysis of Transearch and STB Waybill Data

The value of Georgia-based cargo is projected to increase by 132 percent between 2019 and 2050, outpacing tonnage growth over the same period, and indicating an expected shift to higher-value commodities and industries in Georgia. The value of freight transported within the state is projected to grow at the fastest rate (CAGR of 3.8 percent) over the forecast period. Outbound flows are expected to account for the highest share of value in 2050 at $591 billion, followed by inbound flows at $526 billion. Again, this points toward increasing value of Georgia produced goods and materials.

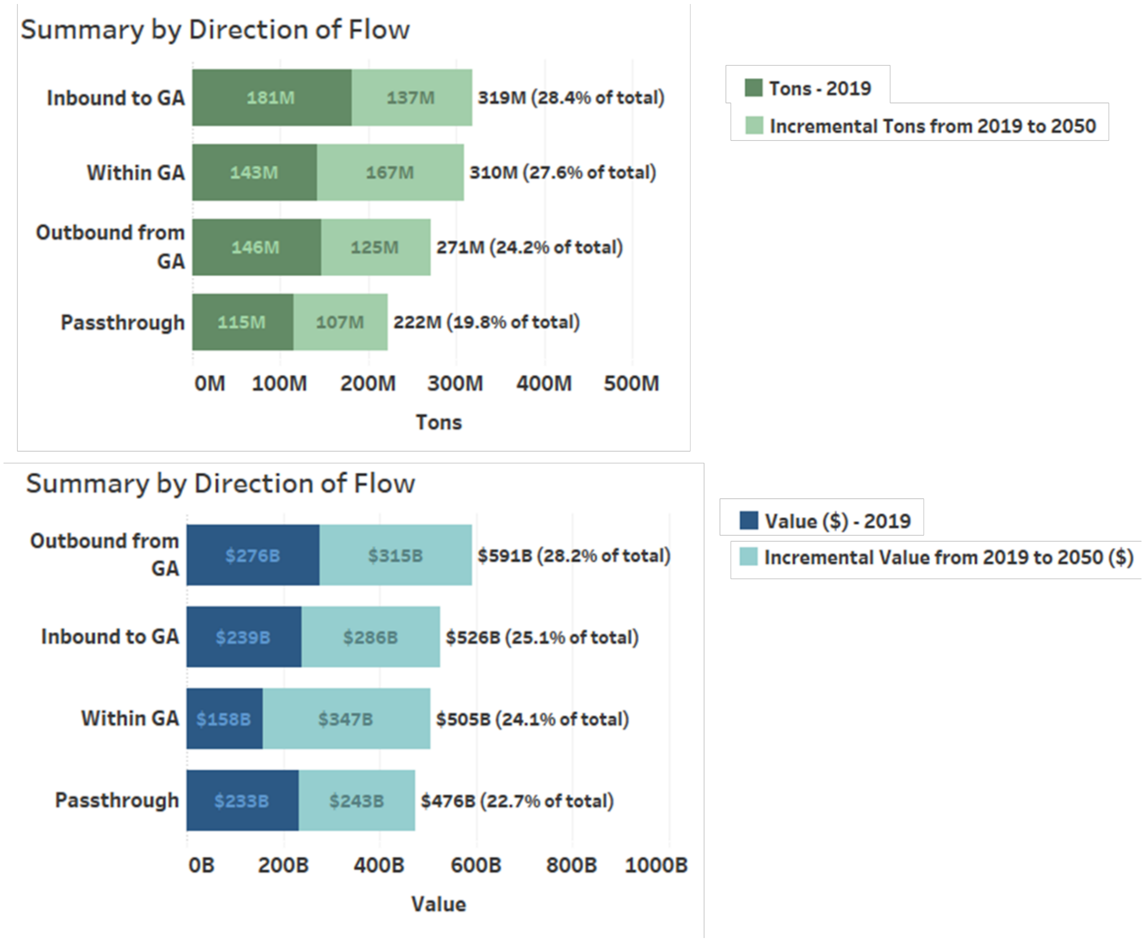
Table 11. Georgia Freight Flow Summary by Value, 2050

Direction of Flow	Value ($) 2050	Value ($) Growth	Value ($) Growth CAGR
Inbound to GA	526 B	120%	2.7%
Outbound from GA	591 B	114%	2.6%
Within GA	505 B	219%	3.9%
Through	476 B	105%	2.4%
Grand Total	**2,098 B**	**132%**	**2.8%**

Source: Analysis of Transearch and STB Waybill Data

Figure 9 shows freight flow in 2019 and the 2050 forecast by direction and tonnage (top chart) and value (bottom chart). By tonnage, inbound traffic will account for the highest share (over 28 percent) by 2050, followed by intrastate traffic (under 28 percent). By value, outbound flow accounts for the largest share of value (over 28 percent) by 2050, followed by inbound flow (just over 25 percent).

Figure 9. Base Year (2019) and Forecast Year (2050) freight flows by direction



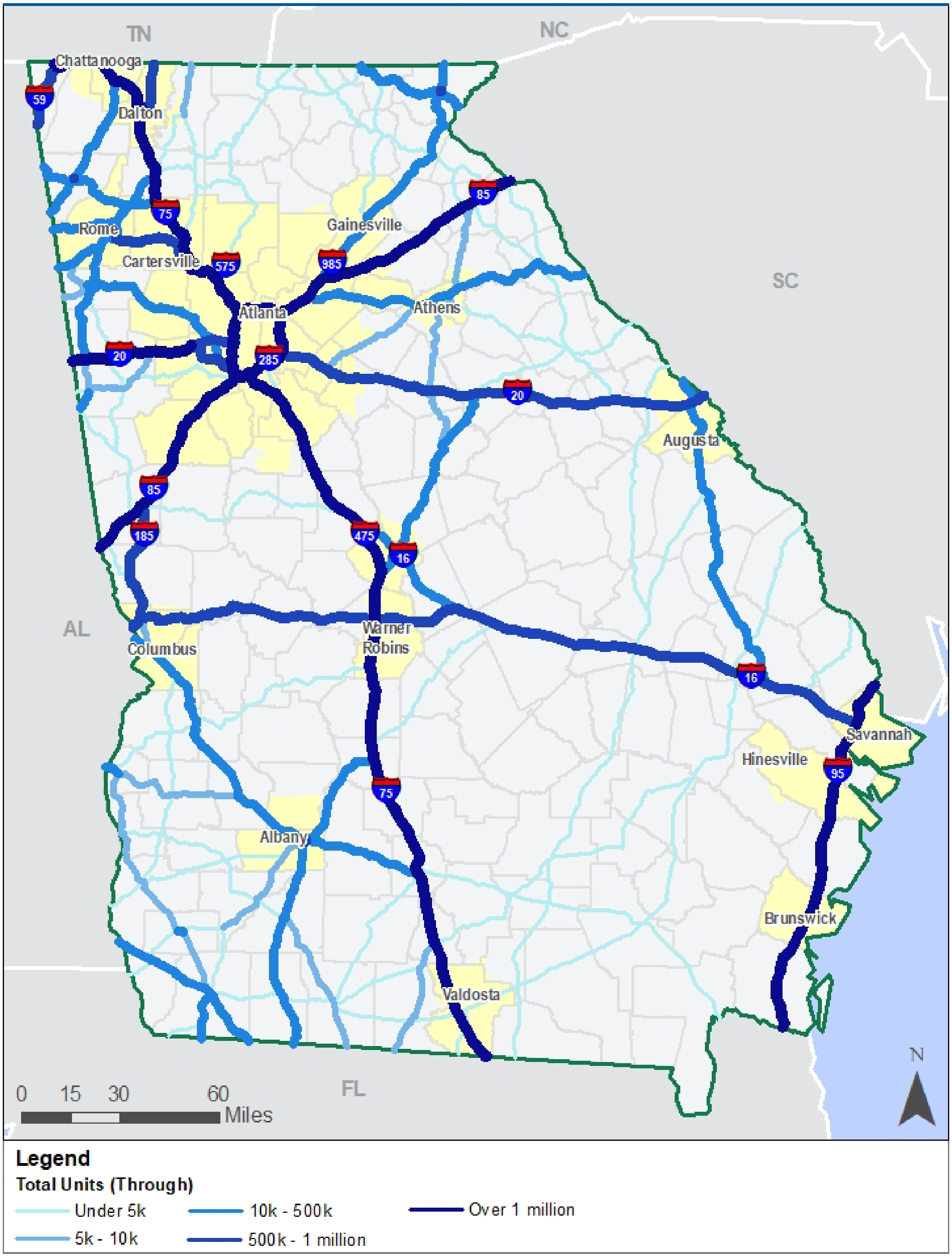
Source: Analysis of Transearch and STB Waybill Data

In terms of both tonnage and value, the Georgia-based freight flow significantly outweighs the passthrough freight. By 2050, passthrough freight is expected to account for less than 20 percent of all tonnage and about 23 percent of value.

Figure 10 shows the passthrough traffic by numbers of trucks in 2019. The darker lines represent more heavily traversed routes. The heaviest passthrough routes are Interstates:

- I-75 which extends north-south across the state, passing through the central Atlanta area, effectively connecting Florida through to Michigan.
- I-85 which extends east-west across the state, also passing through Atlanta, effectively connecting Alabama and states west with South Carolina.
- I-95 along the southeastern coast of the state. The 95 corridor is a primary lane from the northeast through to Florida.

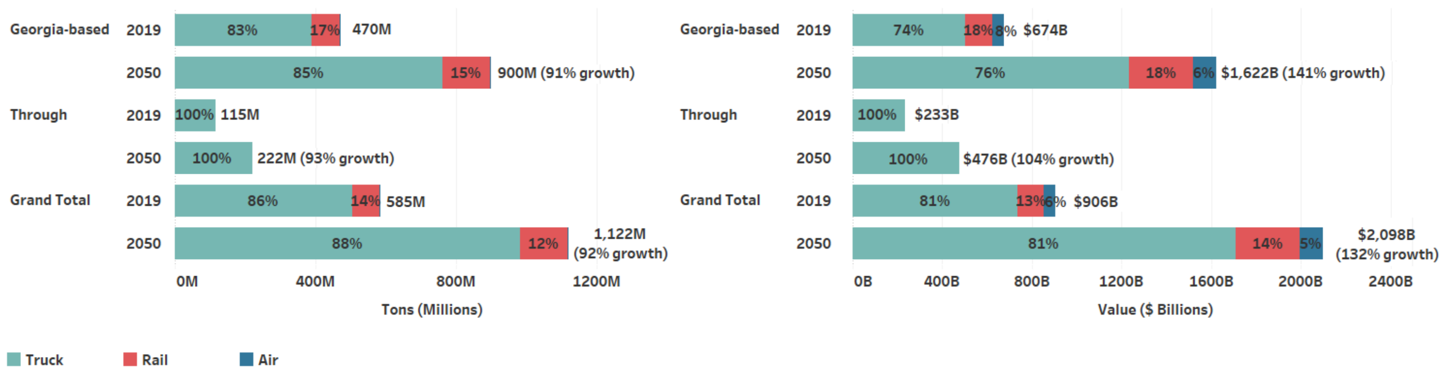
Figure 10. Through traffic by Truck Units (2019)



Source: Analysis of Transearch Data

The majority of Georgia-based freight in 2019 moved by truck, both by tonnage (83 percent of total tonnage) and value (74 percent of total value). These proportions are projected to rise by 2050, as trucking carries 87 percent of the incremental traffic through the forecast horizon and 77 percent of the incremental value. Rail is expected to handle 13 percent of the tonnage growth through 2050 and even more (17 percent) of the value, due to growth in intermodal traffic from Georgia's ports and in domestic lanes. Air cargo, with its high value commodities, accounts for 5 percent of the growth based on value.

Figure 11. Freight Flow by Mode for Non-Through Traffic (Base Year and Forecast Year)

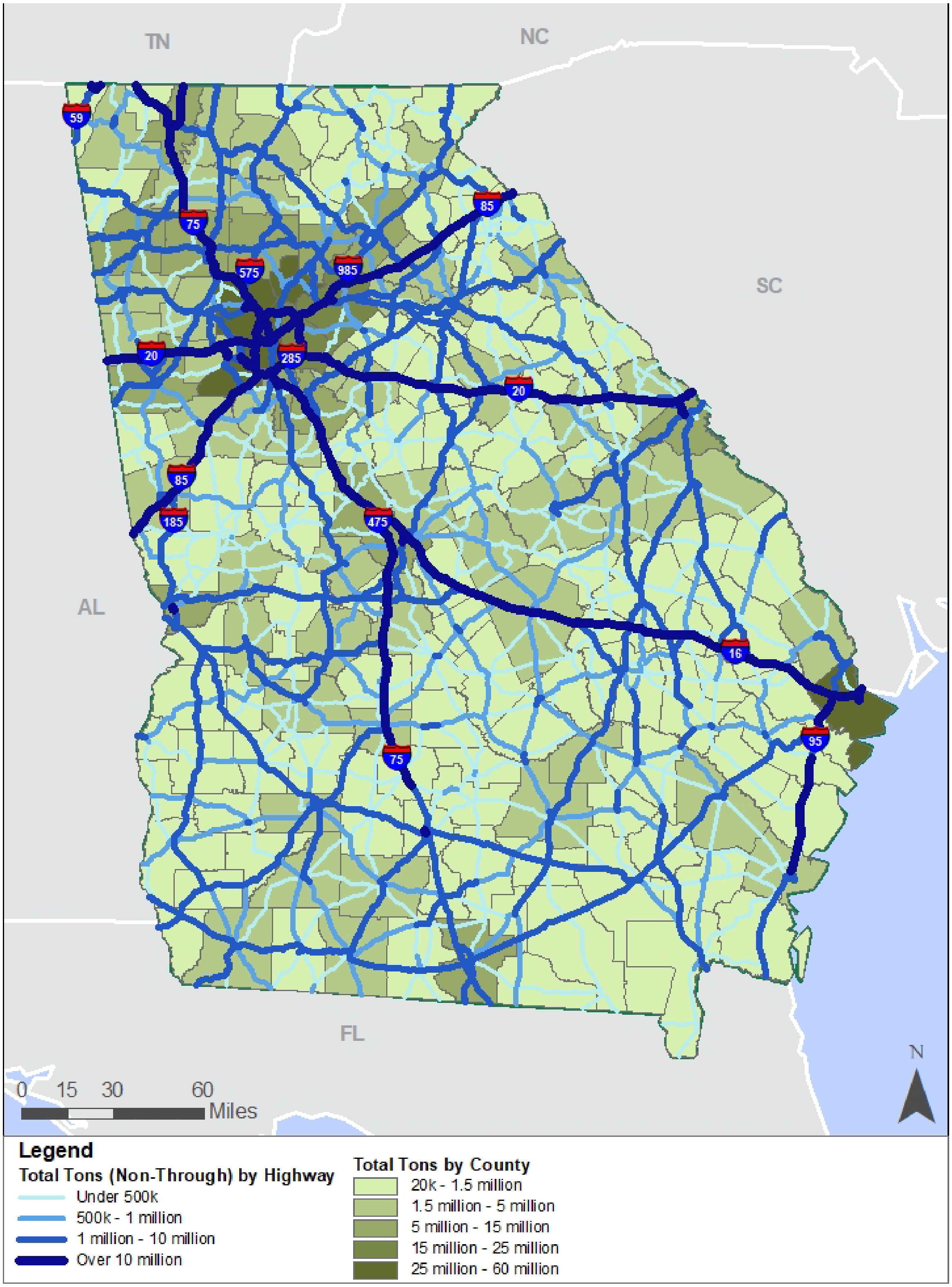


Source: Analysis of Transearch and STB Waybill Data

Routed truck flows by tonnage (Figure 12) show that statewide activity is led by movements in Atlanta and Savannah, with Interstates such as I-20, I-75, I-85, and I-16 forming the backbone of the network. The I-75 corridor is particularly important for automotive traffic as the primary corridor from the southeast to Detroit. Prominent non-Interstate corridors across the southern part of the state include such routes as US-80, US-82, and US-84.

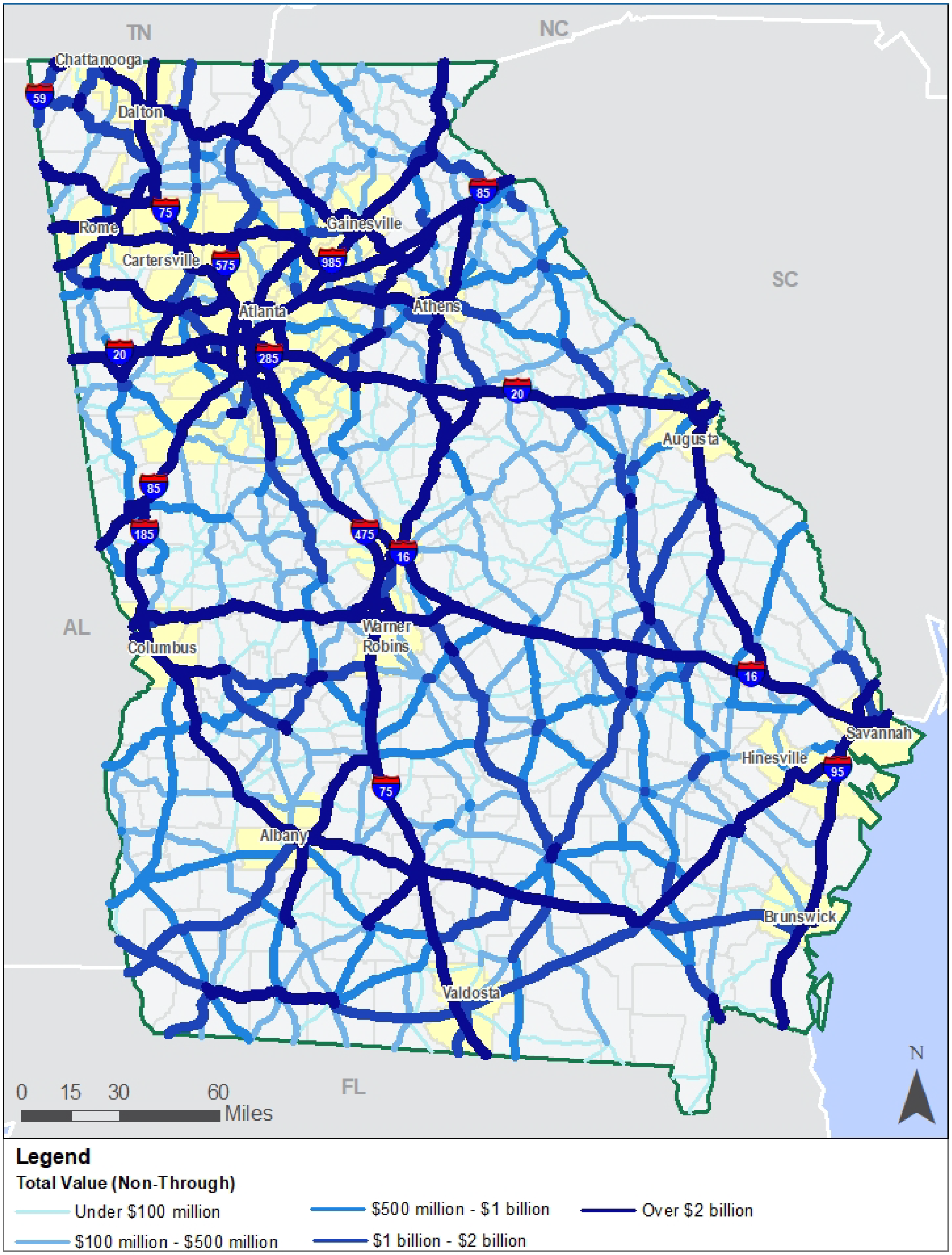
Routed truck flow by value (Figure 13) shows that higher value cargo moves not just on the Interstates but across the entire network, illustrating the interconnection of rural and urban economies in the state.

Figure 12. Total Routed Truck Tonnage Excluding Through Traffic (2019)



Source: Analysis of Transearch Data

Figure 13. Total Routed Truck Flow by Value $ Excluding Through Traffic (2019)



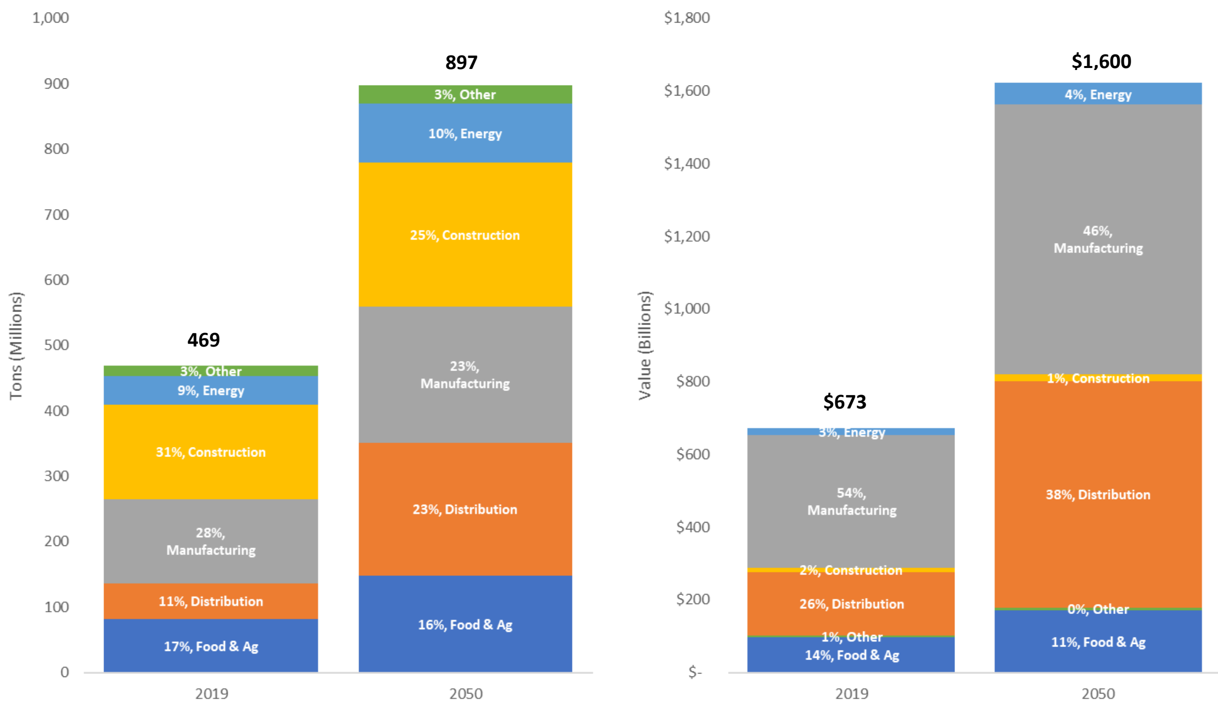
Source: Analysis of Transearch Data

2.3.1. Georgia Volume for Key Industry Groups

The following pages describe the commodity flow of Georgia-based freight and provide a forecast of cargo for the five key industry groups (Food and Agriculture, Distribution, Manufacturing, Construction, and Energy).

Construction, Manufacturing, Food and Agriculture, and Distribution by themselves contributed 87 percent of total tonnage in 2019 and are forecasted to comprise the same percentage of the total in 2050. The total tonnage is expected to nearly double from 469 million in 2019 to 897 million tons in 2050. Manufacturing, Distribution, and Food and Agriculture accounted for 94 percent of the total 2019 freight by value and are forecasted to account for 95 percent of the total in 2050. The total value of the freight flows will increase from 673 billion dollars in 2019 to over 1.6 trillion dollars in 2050.

Figure 14. Freight Flows by Industry Group (2019 and 2050)

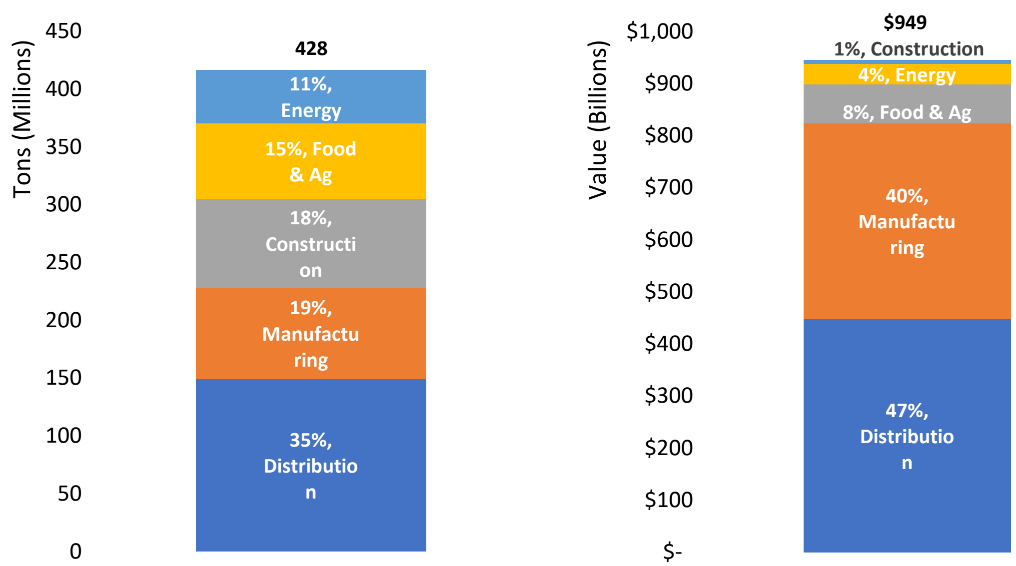


Source: Analysis of Transearch and STB Waybill Data

Figure 15 presents the growth in tonnage and value for the five key industry groups. This chart shows the incremental tonnage and value, or the "delta" in both measures, from the historical activity in 2019 to the forecasted activity in 2050. Based on this analysis, three top industries account for 72 percent of the increase in tonnage (Distribution, Manufacturing and Construction), followed closely by Food and Agriculture as a fourth. Three of the same industries – Distribution, Manufacturing, and Food and Agriculture - account for 95 percent of the increase in value.

Distribution, Manufacturing and Food and Agriculture thus are the principal sources of Georgia's growth in freight, between them accounting for two-thirds of the delta in tonnage and almost all of the delta in value. The performance of the freight transportation system in service to these three growth industries consequently is crucial to the economy of Georgia and the livelihoods it provides to the people of the state. That performance is the focus of evaluation and programs presented in later chapters of this Plan.

Figure 15. Growth in Tonnage and Value for Key Industry Groups (2019 to 2050)

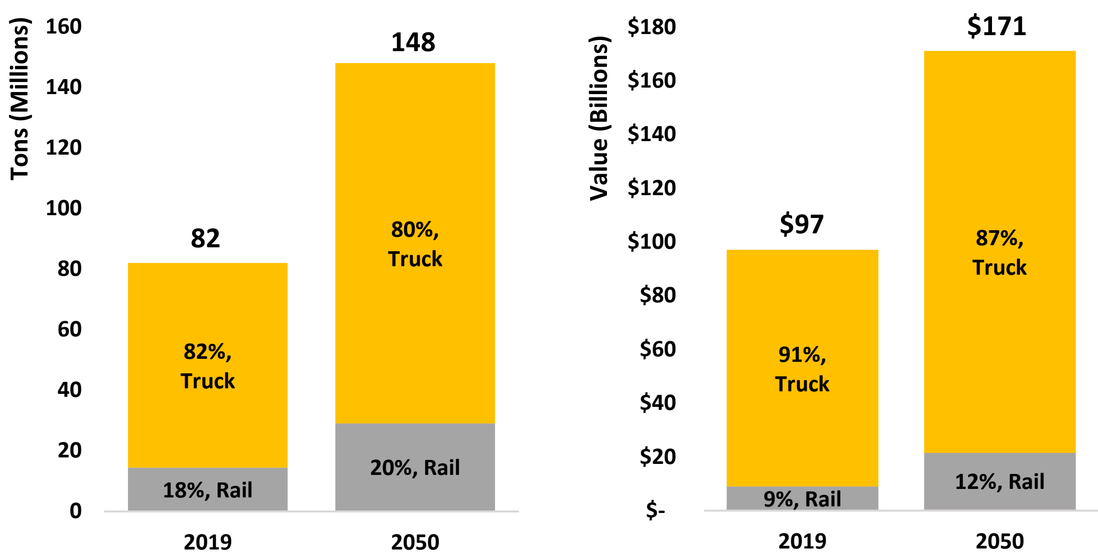


Source: Analysis of Transearch and STB Waybill Data

Figure 16 presents tonnage and value by mode for the Food and Agriculture industry group for 2019 as well as the forecast for 2050. Approximately 82 million tons of food and agriculture cargo moved into, out of, and through the state of Georgia in 2019, of which 82 percent moved by truck and 18 percent by rail. The number is forecasted to grow to 148 million tons by 2050. While the forecast projects a slight decrease in the percentage of cargo moved by truck, the majority of food and agriculture cargo will continue to be moved by truck and this volume is projected to grow significantly in absolute terms.

In terms of value, Food and Agriculture accounted for $97 billion in 2019, a number that is forecasted to grow to $171 billion by 2050. Approximately 91 percent of the value was moved by truck and 9 percent by rail in 2019; the value of cargo moved by truck is expected to decline slightly by 2050 to 87 percent, to the benefit of rail, but the majority of value will continue to be moved by truck. Note that the tonnage and value of cargo moved by air or water was not significant enough to register on the chart.

Figure 16. Food and Agriculture Tonnage and Value, 2019 and 2050

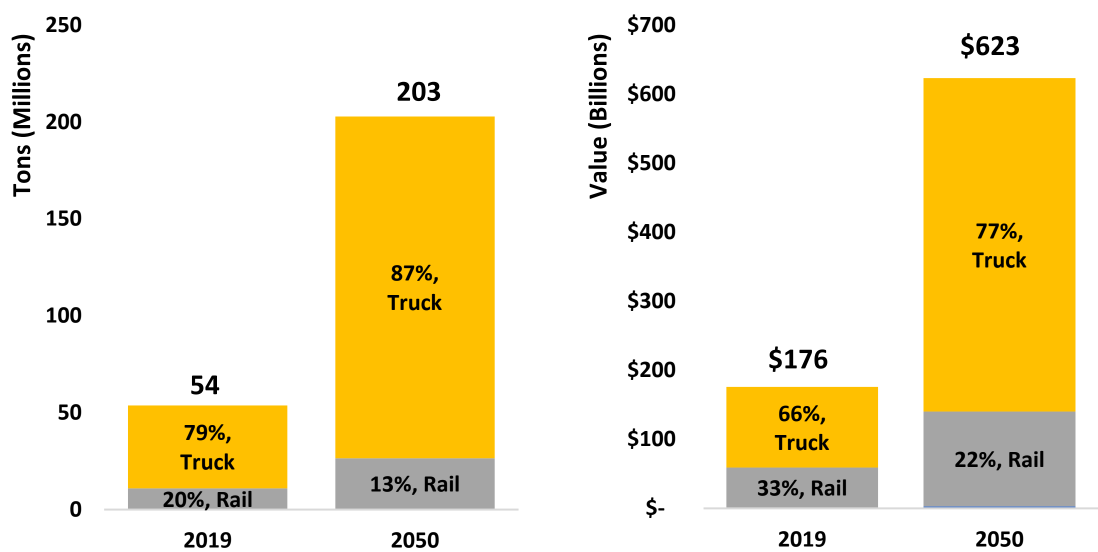


Source: Analysis of Transearch and STB Waybill Data

Figure 17 presents the tonnage and value by mode for the Distribution industry group in 2019 along with the forecast for 2050. In 2019, around 54 million tons of cargo moved into, out of, and through the state. The tonnage is forecasted to increase nearly fourfold by 2050 to 203 million tons. The majority of tonnage is moved by truck and the share of tonnage moved by truck is projected to increase from 79 percent in 2019 to 87 percent in 2050, while the share of tonnage moved by rail is projected to decrease from 20 percent in 2019 to 13 percent in 2050. However, in absolute terms, both truck and rail tonnage are expected to increase significantly.

In terms of value, around $176 billion of Distribution cargo was handled in Georgia in 2019, of which 66 percent was moved by truck and 33 percent by rail. This number is forecasted to increase to $623 billion by 2050, with the percentage moved by truck increasing to 77 percent at the expense of rail, which is projected to decrease to 22 percent. Still, in absolute terms, the forecast shows a significant increase in value of cargo moved by both truck and rail.

Figure 17. Warehousing and Distribution Tonnage and Value, 2019 and 2050

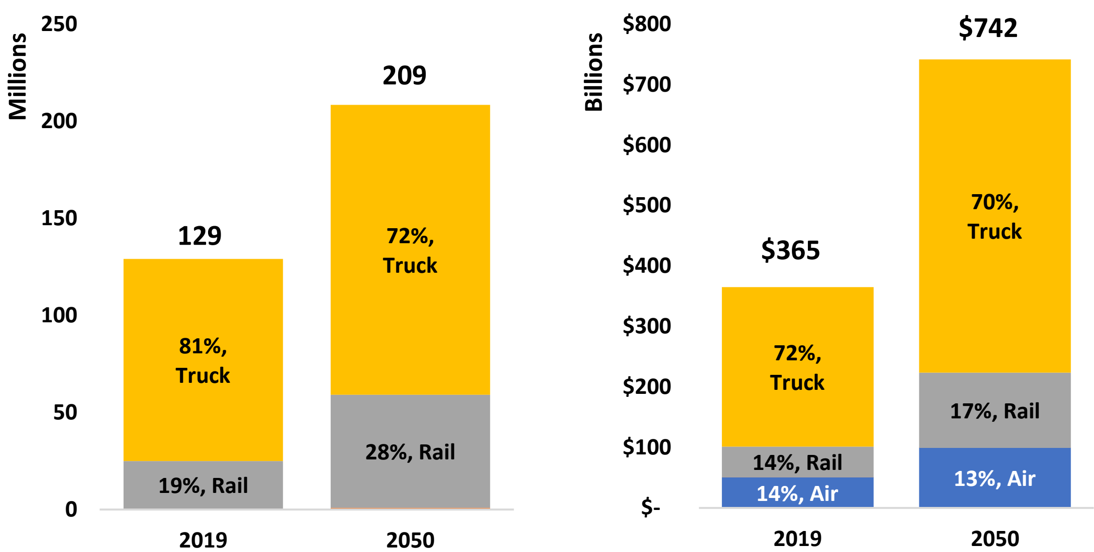


Source: Analysis of Transearch and STB Waybill Data

Figure 18 presents the tonnage and value by mode for the Manufacturing industry group in 2019 as well as the forecast for 2050. In 2019, approximately 129 million tons of cargo moved into, out of, and through the state. 81 percent of the cargo moved via truck and 19 percent by rail. The total tonnage is forecasted to increase to 209 million tons in 2050 with 72 percent by truck and 28 percent by rail. The tonnage of cargo moved by air and water were negligible in 2019 and this is not expected to change in 2050.

In terms of value, 2019 had a total of 365 billion dollars of Manufacturing cargo handled in Georgia with 72 percent via truck, 14 percent via rail, and 14 percent by air. The forecast for 2050 increases to 742 billion dollars with 70 percent by truck, 17 percent by rail and 13 percent by air. While the modal share of value by air decreases somewhat, the dollar value of air cargo is projected to double by 2050.

Figure 18. Manufacturing Tonnage and Value, 2019 and 2050

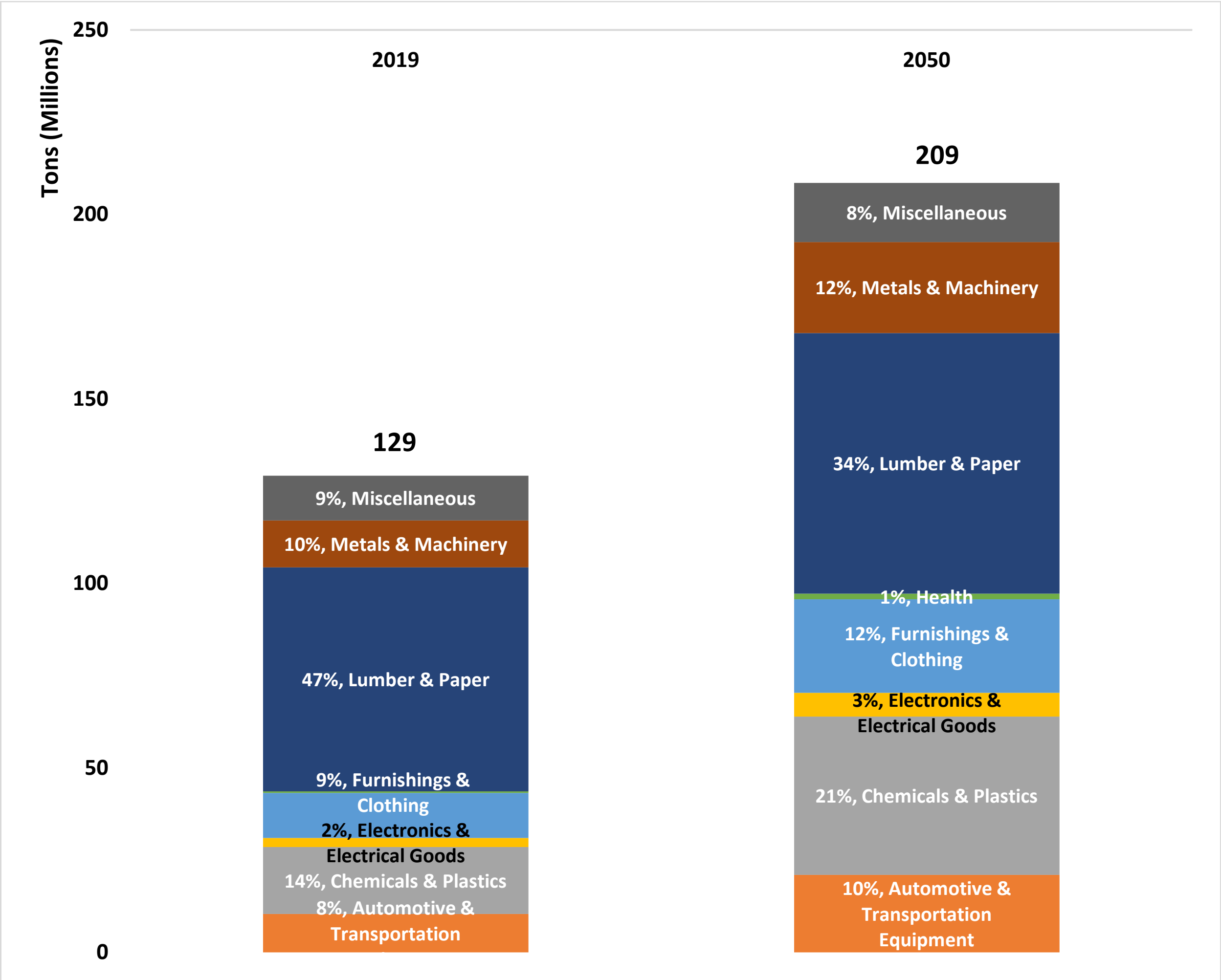


Source: Analysis of Transearch and STB Waybill Data

Figure 19 presents tonnage by manufacturing component for 2019 and a forecast for 2050. The data shows that in 2019 the largest component by tonnage was lumber and paper in 2019 with nearly half of all manufacturing tonnage. The second largest component by tonnage was chemicals and plastics at 14 percent of the total.

The forecast shows a significant decline in the share of lumber and paper tonnage to 34 percent by 2050, although the amount of lumber and paper is expected to increase slightly from 60 million tons in 2019 to 70 million tons in 2050. In absolute terms, the largest increase is projected for chemicals and plastics, with a forecast of 43 million tons in 2050 compared to 18 million tons in 2019. In percentage terms, the largest increase is for the electronics and electrical goods component, which is projected nearly to triple from 2.4 million tons in 2019 to 6.4 million tons in 2050.

Figure 19. Manufacturing Component Tonnage, 2019 and 2050



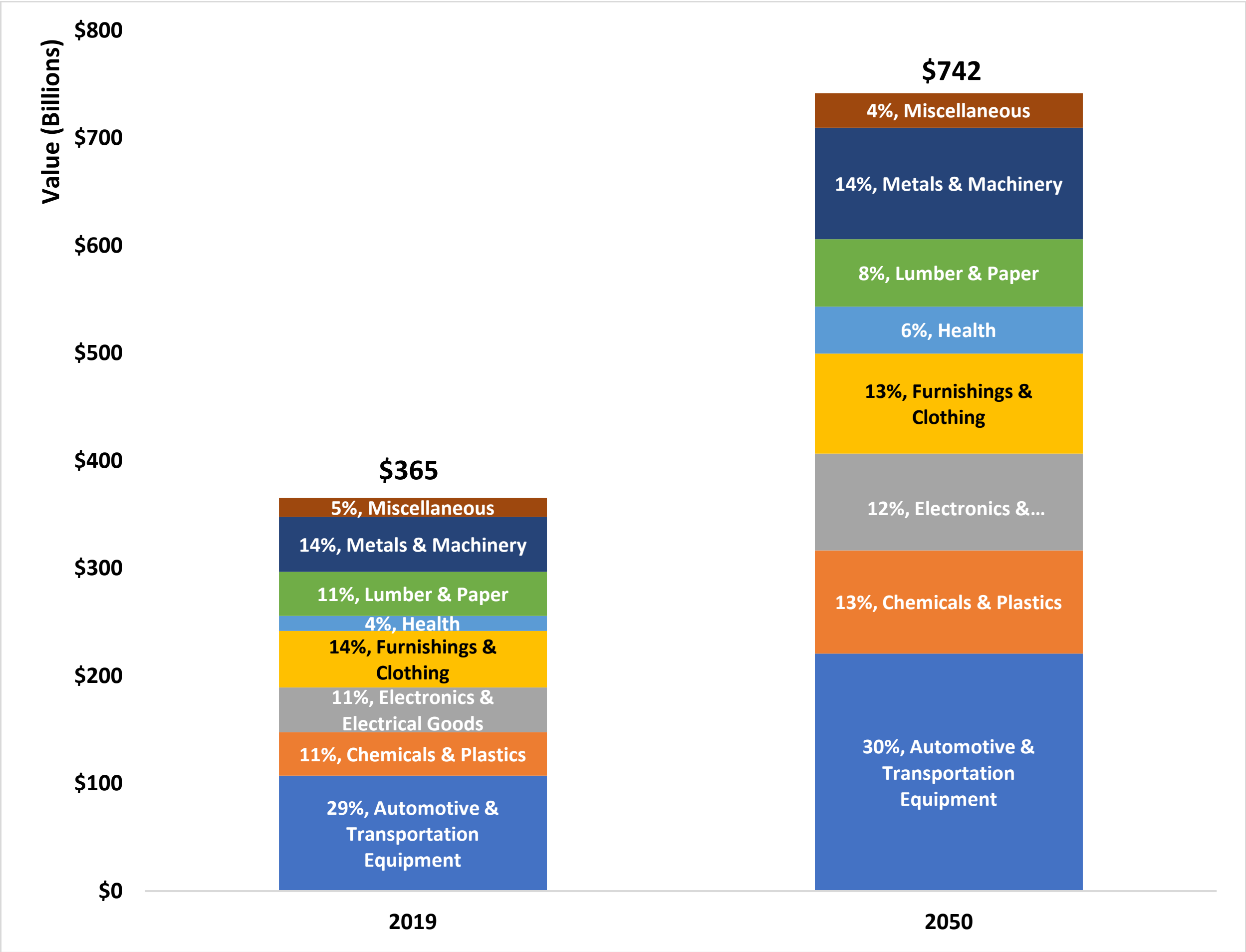
Source: Analysis of Transearch and STB Waybill Data

Note: health component tonnage is represented in green color; as the tonnage is too low to register in the 2019 chart, the label has been removed for visual purposes.

Figure 20 shows value by manufacturing components for 2019 as well as a forecast for 2050. In 2019, the highest value component was automotive and transportation equipment at 107 billion dollars (29 percent of total value in the manufacturing industry group). The second highest value component was home furnishings and clothing (including Georgia's carpet and floor covering industry) at $53 billion, followed by metals and machinery at 51 billion dollars.

The forecast projects automotive and transportation to retain roughly the same share of value in 2050, yet the total value of this component more than doubles to 221 billion dollars by 2050. The component with the highest rate of growth is projected to be health, which is forecasted to grow from 14 billion dollars in 2019 to 44 billion dollars in 2050 (an 200 percent increase to 30 billion dollars).

Figure 20. Manufacturing Component Value, 2019 and 2050

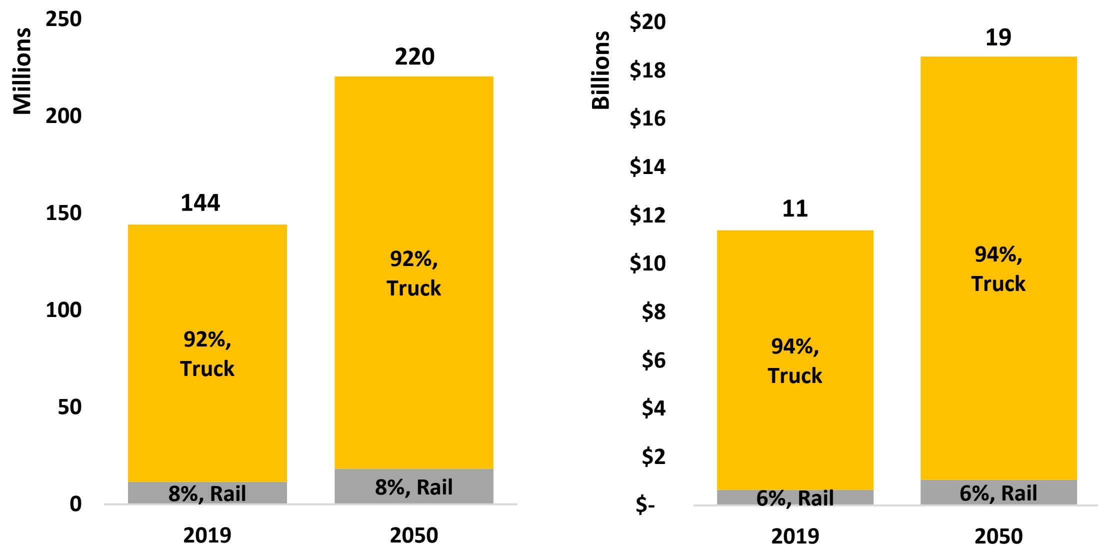


Source: Analysis of Transearch and STB Waybill Data

Figure 21 presents the tonnage and value by mode for the construction industry group in 2019 as well as a forecast for 2050. In 2019, approximately 144 million tons of cargo moved into, out of, and through the state of Georgia. 92 percent of the cargo moved via truck and 8 percent by rail. The total tonnage is forecasted to increase by 52 percent to 220 million tons in 2050 with the same share of transport modes with 92 percent by truck and 8 percent by rail. Weight of cargo moved by air and water were negligible in 2019 and remains insignificant in 2050.

In terms of value, 2019 had a total of 11 billion dollars of construction cargo handled in Georgia with 94 percent via truck and 6 percent via rail. The forecast for 2050 increases by 72 percent to 19 billion dollars, again with the same modal shares of 94 percent by truck, 6 percent by rail.

Figure 21. Construction Tonnage and Value, 2019 and 2050

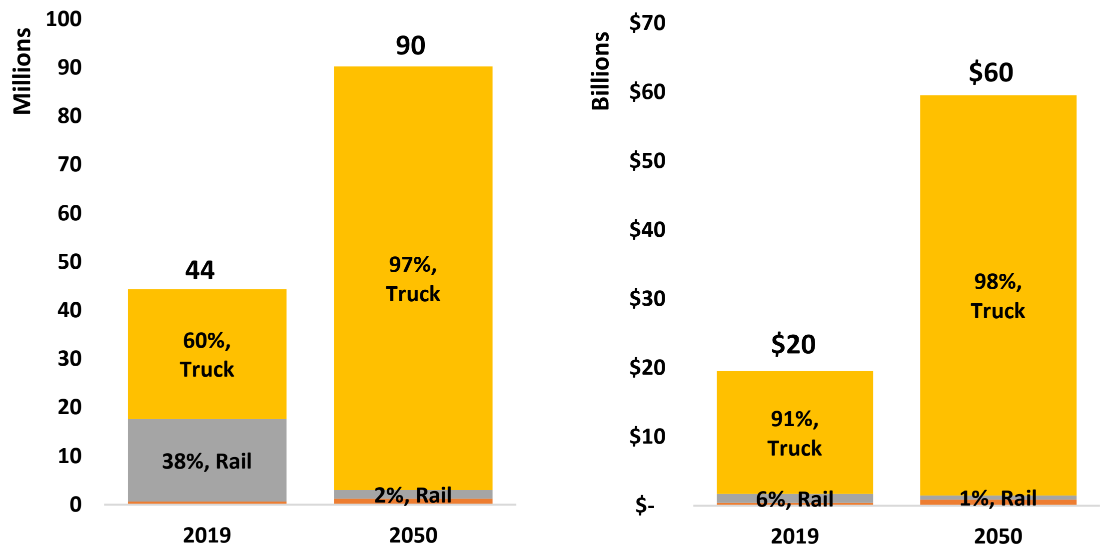


Source: Analysis of Transearch and STB Waybill Data

Figure 22 presents the tonnage and value by mode for the energy industry group in 2019 as well as a forecast for 2050. In 2019, approximately 44 million tons of cargo moved into, out of, and through the state. 60 percent of the cargo moved via truck and 38 percent by rail. The total tonnage is forecasted to approximately double to 90 million tons in 2050 with a drastic modal shift to truck, making up 97 percent of all transport modes and leaving 2 percent by rail. Much of this change can be attributed to the decline in coal as a fuel source.

In terms of value, 2019 had a total of 20 billion dollars of energy cargo handled in Georgia with 91 percent via truck and 6 percent via rail. The forecast for 2050 increases by 300 percent to 60 billion dollars with 98 percent transported by truck and 1 percent by rail. Not labeled in the charts in Figure 22 is a sliver of tonnage and value transported by water.

Figure 22. Energy Tonnage and Value, 2019 and 2050



Source: Analysis of Transearch and STB Waybill Data

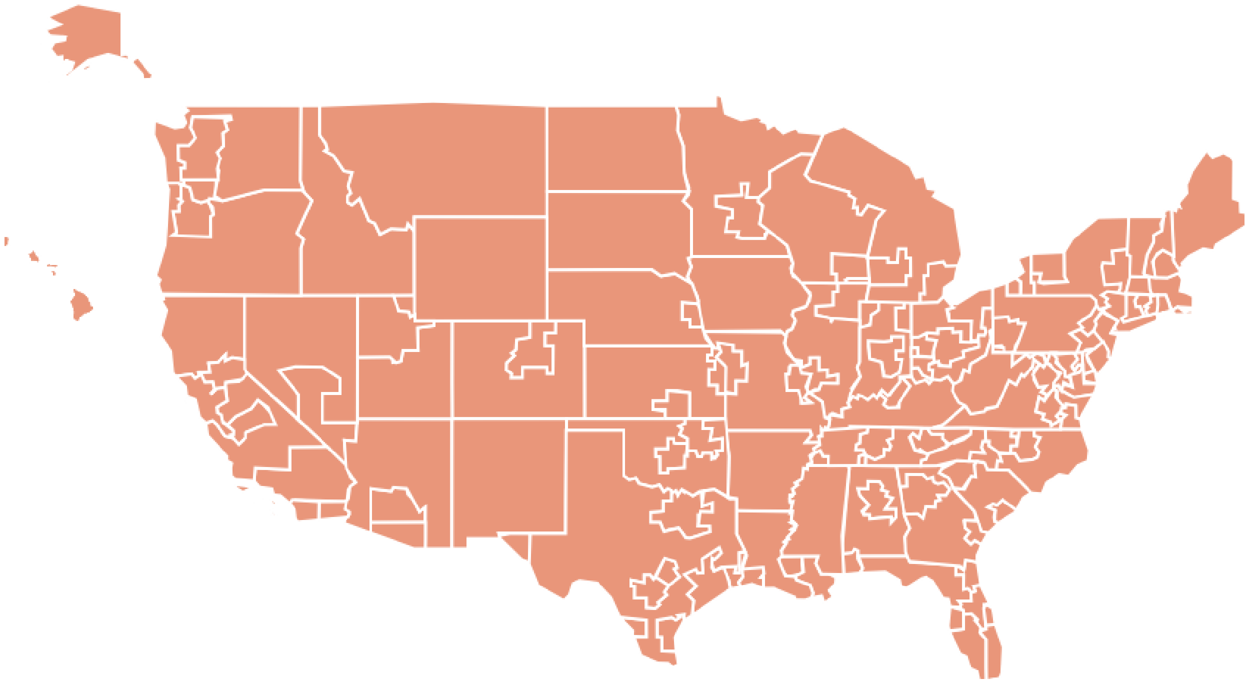
2.3.2. Georgia International Trade Flows

As a home to significant U.S. ports and the Hartsfield-Jackson Atlanta International Airport, Georgia is a major gateway for international trade. However, the impacts of trade flows extend beyond the imports and exports through those gateways. Georgia is also a large destination for imports moving through other U.S ports, and a significant origin of U.S. exports.

This section examines 2019 annual imports and exports into and out of Georgia using data from the US DOT Freight Analysis Framework (FAF). Data includes historical commodity flow data derived from the Commodity Flow Survey, U.S. Census Bureau international trade statistics, and other sources. FAF provides detail for 42 commodity groups defined by the Standard Classification of Transported Goods (SCTG). International trade flows include U.S. exports and imports for eight world regions for tons and value by mode of transport. 132 U.S. regions are defined by FAF as shown in the Figure 23 below. The State of Georgia is broken down into three regions:

- 131 Atlanta-Athens-Clarke County-Sandy Springs, GA CFS Area GA
- 132 Savannah-Hinesville-Statesboro, GA CFS Area GA
- 139 Remainder of Georgia GA (includes the Port of Brunswick)

Figure 23. FAF Defined U.S. Regions



For further information see: https://faf.ornl.gov/faf5/data/FAF5%20User%20Guide.pdf

2.3.3. Imports

Waterborne Imports

Waterborne imports from all foreign countries entering through ports in Georgia and moving to Georgia destinations represent the largest share of U.S. import tons going to Georgia regions, totaling 20.9 million tons in 2019. Georgia import value totaled $56.9 billion in 2019.

In addition, waterborne imports through ports in other regions of the country also represent significant traffic destined to Georgia regions. In 2019 these volumes totaled 4.3 million tons, about half from East Coast ports and 0.9 million tons through both Florida ports and West Coast ports.

Table 12. Waterborne Imports

		Tons 2019 (000)				Value 2019 ($Millions)		
Domestic Origin	**Georgia Total**	**Atlanta GA**	**Rest of GA**	**Savannah GA**	**Georgia Total**	**Atlanta GA**	**Rest of GA**	**Savannah GA**
Georgia	20,949	13,134	6,694	1,120	56,932	35,720	18,198	3,015
Savannah GA	19,788	12,418	6,309	1,061	45,784	28,745	14,603	2,436
Rest of GA	1,161	716	385	59	11,148	6,974	3,595	579
Other Origins	4,295	2,700	1,371	224	11,570	7,272	3,694	604

Savannah Waterborne Imports – Top Commodities and Origin Regions

The table below displays commodity detail for waterborne imports through Savannah, the principal origin for volumes destined for Georgia regions. Top import commodities by volume in 2019 were other foodstuffs, machinery, nonmetallic minerals, and plastics/rubber. Top import commodities by value in 2019 were machinery and textiles/leather.

Table 13. Top Commodities in Savannah Waterborne Imports

		Tons 2019 (000)				Value 2019 ($Millions)			
	Commodity	Georgia Total	Atlanta GA	Rest of GA	Savannah GA	Georgia Total	Atlanta GA	Rest of GA	Savannah GA
	Total	19,788	12,418	6,309	1,061	45,784	28,745	14,603	2,436
07	Other foodstuffs	5,792	3,640	1,849	302	4,381	2,754	1,399	228
34	Machinery	1,613	1,014	515	84	8,265	5,195	2,639	431
13	Nonmetallic minerals	1,244	782	397	65	40	25	13	2
24	Plastics/rubber	1,000	629	319	52	3,611	2,270	1,153	188
22	Fertilizers	978	615	312	51	85	53	27	4
39	Furniture	871	547	278	45	2,432	1,529	777	127
30	Textiles/leather	837	526	267	44	6,179	3,884	1,973	322
32	Base metals	718	451	229	37	821	516	262	43
33	Articles-base metal	632	397	202	33	1,746	1,098	558	91
18	Fuel oils	615	387	197	32	167	105	53	9
20	Basic chemicals	578	364	185	30	1,141	717	364	59
21	Pharmaceuticals	530	333	169	28	1,694	1,064	541	88
19	Coal-n.e.c.	454	285	145	24	46	29	15	2
12	Gravel	402	253	128	21	1	0	0	0
40	Misc. mfg. prods.	396	249	127	21	2,205	1,386	704	115
17	Gasoline	377	237	120	20	174	109	56	9
36	Motorized vehicles	312	196	99	16	4,108	2,582	1,312	214
	Other	2,438	1,513	769	157	8,689	5,429	2,758	502

The top origin region for waterborne imports is Eastern Asia, accounting for 30 percent of tonnage and 46 percent of the value of goods.

Table 14. Origins for Waterborne Imports

Foreign Origin	Tons 2019 (000) Georgia Total	Atlanta GA	Rest of GA	Savannah GA	Value 2019 ($Millions) Georgia Total	Atlanta GA	Rest of GA	Savannah GA
Total	20,949	13,134	6,694	1,120	56,932	35,720	18,198	3,015
Eastern Asia	6,190	3,880	1,971	338	26,079	16,373	8,318	1,388
Europe	4,026	2,511	1,297	218	14,249	8,915	4,580	754
SE Asia & Oceania	5,989	3,763	1,912	314	8,630	5,422	2,754	453
SW & Central Asia	1,466	921	468	78	4,785	3,006	1,527	252
Rest of Americas	2,046	1,284	653	109	1,370	860	437	73
Mexico	446	280	142	23	1,316	827	420	69
Africa	107	68	34	6	436	274	139	23
Canada	679	427	217	36	68	42	22	4

Marine Gateway Imports

Georgia is a marine gateway for imports to other states, most of them in the Southeast. About two-thirds of waterborne imports through Georgia ports are destined to Georgia, while the top 10 states account for over 90 percent. Seven of the top 10 destinations are Southeastern states.

Table 15. Top 10 Destination States for Georgia Imports by Water

Destination State	Tons 2019 (000)	% Total	Value 2019 ($Millions)	% Total
Total	31,072	100%	91,421	100%
GA	20,949	67%	56,932	62%
AL	1,777	6%	7,086	8%
TN	1,676	5%	6,406	7%
NC	1,622	5%	3,887	4%
FL	947	3%	2,332	3%
SC	726	2%	2,508	3%
CA	374	1%	1,837	2%
NY	330	1%	978	1%
IL	321	1%	554	1%
MS	292	1%	1,306	1%
Top 10	29,013	93%	83,825	92%

USMCA Truck Volumes

Imports from USMCA partners Mexico and Canada represent significant flows of inbound truck volumes, with 2.6 million tons in 2019 and $8.3 billion in value. The largest of these volumes destined to Georgia moved through Laredo in 2019, followed by San Diego and Detroit.

Table 16. USMCA Truck Volumes in Georgia

	Tons 2019 (000)				Value 2019 ($Millions)			
Domestic Origin	Georgia Total	Atlanta GA	Rest of GA	Savannah GA	Georgia Total	Atlanta GA	Rest of GA	Savannah GA
Total	2,594	1,631	828	135	8,266	5,195	2,639	431
Laredo TX	1,115	701	356	58	3,280	2,062	1,047	171
Detroit MI	527	331	168	27	1,250	786	399	65
San Diego CA	352	221	112	18	1,651	1,038	527	86
Other	601	378	192	31	2,084	1,310	666	109

Top commodities imported by truck through Laredo to Georgia destinations in 2019 include other foodstuffs, machinery, electronics, motorized vehicles, and furniture.

Table 17. Top Commodities through Laredo Imported by Truck to Georgia

	Tons 2019 (000)				Value 2019 ($Millions)			
SCTG Desc	Georgia Total	Atlanta GA	Rest of GA	Savannah GA	Georgia Total	Atlanta GA	Rest of GA	Savannah GA
Total	1,114.7	700.7	356.0	58.1	3,280.1	2,061.7	1,047.4	171.0
Other foodstuffs	449.2	282.4	143.4	23.4	274.7	172.7	87.7	14.3
Machinery	148.0	93.0	47.3	7.7	663.1	416.8	211.7	34.6
Electronics	117.1	73.6	37.4	6.1	652.0	409.8	208.2	34.0
Nonmetal min. prods.	77.7	48.9	24.8	4.1	46.1	29.0	14.7	2.4
Motorized vehicles	70.5	44.3	22.5	3.7	612.4	384.9	195.6	31.9
Furniture	54.2	34.1	17.3	2.8	414.0	260.2	132.2	21.6
Other	197.9	124.4	63.2	10.3	617.9	388.4	197.3	32.2

Top commodities imported by truck through San Diego in 2019 tons include other foodstuffs and electronics. In terms of 2019 value electronics is the principal import into Georgia.

Table 18. Top Commodities Imported by Truck through San Diego to Georgia

	Tons 2019 (000)				Value 2019 ($Millions)			
SCTG Desc	Georgia Total	Atlanta GA	Rest of GA	Savannah GA	Georgia Total	Atlanta GA	Rest of GA	Savannah GA
Total	351.5	220.9	112.2	18.3	1,651.4	1,038.0	527.3	86.1
Other foodstuffs	146.9	92.3	46.9	7.7	69.0	43.4	22.0	3.6
Electronics	96.1	60.4	30.7	5.0	1,111.8	698.8	355.0	58.0
Other	108.5	68.2	34.6	5.7	470.6	295.8	150.3	24.5

USMCA Rail Volumes

Like truck imports, rail volumes imported into the U.S. enter through border crossings, with most volumes coming through the Canadian border, principally through North Dakota and Detroit. Smaller volumes enter the U.S. through border crossings in New York.

Table 19. USMCA Rail Volumes in Georgia

	Tons 2019 (000)				Value 2019 ($Millions)			
Domestic Origins	Georgia Total	Atlanta GA	Rest of GA	Savannah GA	Georgia Total	Atlanta GA	Rest of GA	Savannah GA
Total	1,440.5	905.4	460.0	75.1	1,034.0	649.9	330.2	53.9
North Dakota	653.8	411.0	208.8	34.1	345.7	217.3	110.4	18.0
Detroit MI	505.4	317.6	161.4	26.3	349.0	219.3	111.4	18.2
Rest of NY	111.3	70.0	35.5	5.8	68.5	43.1	21.9	3.6
Laredo TX	76.5	48.1	24.4	4.0	215.9	135.7	69.0	11.3
Buffalo NY	47.6	29.9	15.2	2.5	26.3	16.5	8.4	1.4
Other	46.0	28.9	14.7	2.4	28.5	17.9	9.1	1.5

Top commodities imported through North Dakota by rail to Georgia include wood products, other food stuffs and plastics/rubber.

Table 20. USMCA Top Commodities through North Dakota

SCTG Desc	Tons 2019 (000) Georgia Total	Atlanta GA	Rest of GA	Savannah GA	Value 2019 ($Millions) Georgia Total	Atlanta GA	Rest of GA	Savannah GA
Total	653.8	411.0	208.8	34.1	345.7	217.3	110.4	18.0
Wood prods.	186.6	117.3	59.6	9.7	67.8	42.6	21.6	3.5
Other foodstuffs	130.4	82.0	41.6	6.8	105.3	66.2	33.6	5.5
Plastics/rubber	95.4	60.0	30.5	5.0	81.9	51.5	26.1	4.3
Fertilizers	82.0	51.5	26.2	4.3	16.8	10.6	5.4	0.9
Newsprint/paper	64.8	40.7	20.7	3.4	36.5	23.0	11.7	1.9
Animal feed	43.2	27.1	13.8	2.3	9.4	5.9	3.0	0.5
Other	51.4	32.3	16.4	2.7	27.9	17.6	8.9	1.5

Top tonnage commodities imported by rail through Detroit also include wood products and plastics/rubber. Base metals were a top import commodity in 2019 value.

Table 21. USMCA Top Commodities through Michigan

	SCTG Desc	Tons 2019 (000) Georgia Total	Atlanta GA	Rest of GA	Savannah GA	Value 2019 ($Millions) Georgia Total	Atlanta GA	Rest of GA	Savannah GA
	Total	505.4	317.6	161.4	26.3	349.0	219.3	111.4	18.2
26	Wood prods.	121.4	76.3	38.8	6.3	40.3	25.4	12.9	2.1
24	Plastics/rubber	104.2	65.5	33.3	5.4	96.4	60.6	30.8	5.0
27	Newsprint/paper	69.4	43.6	22.2	3.6	50.0	31.4	16.0	2.6
32	Base metals	69.0	43.3	22.0	3.6	108.8	68.4	34.7	5.7
20	Basic chemicals	57.3	36.0	18.3	3.0	26.8	16.8	8.5	1.4
31	Nonmetal min. prods.	43.5	27.3	13.9	2.3	3.9	2.5	1.3	0.2
13	Nonmetallic minerals	18.9	11.9	6.0	1.0	1.7	1.1	0.6	0.1
	Other	21.7	13.6	6.9	1.1	21.0	13.2	6.7	1.1

Air Cargo Imports

Air volumes with destinations in Georgia totaled 1.5 million tons in 2019. Almost all volumes came through Atlanta, with a majority of 1.0 million tons destined to the Atlanta region and 0.4 million tons to the Rest of Georgia region.

Table 22. Air Cargo Volumes

	Tons 2019 (000)				Value 2019 ($Millions)			
Domestic Origin	Georgia Total	Atlanta GA	Rest of GA	Savannah GA	Georgia Total	Atlanta GA	Rest of GA	Savannah GA
Georgia Total	1,490	974	444	72	12,332	7,865	3,840	627
Atlanta GA	1,481	969	441	72	12,285	7,835	3,825	625
Savannah GA	8	5	3	0	45	28	14	2
Rest of GA	0	0	0	0	2	1	1	0

The top commodities by value imported by air to Georgia destinations are motorized vehicles, electronics, and machinery.

Table 23. Air Cargo Top Commodities

		Tons 2019 (000)				Value 2019 ($Millions)			
	SCTG Desc	Georgia Total	Atlanta GA	Rest of GA	Savannah GA	Georgia Total	Atlanta GA	Rest of GA	Savannah GA
	Total	1,481	969	441	72	12,285	7,835	3,825	625
36	Motorized vehicles	305	192	97	16	3,643	2,290	1,163	190
43	Mixed freight	110	106	3	0	335	324	9	2
31	Nonmetal min. prods.	167	105	53	9	135	85	43	7
34	Machinery	136	86	44	7	1,360	855	434	71
24	Plastics/rubber	123	77	39	6	552	347	176	29
32	Base metals	109	69	35	6	132	83	42	7
33	Articles-base metal	81	51	26	4	286	180	91	15
35	Electronics	80	50	25	4	2,436	1,531	778	127
	Other	370	233	118	19	3,407	2,141	1,088	178

Europe is the top origin region for Georgia air import value, equaling the total of Eastern Asia and Southeast Asia/Oceania.

Table 24. Top Air Cargo Import Origins

Foreign Origin	Tons 2019 (000) Georgia Total	Atlanta GA	Rest of GA	Savannah GA	Value 2019 ($Millions) Georgia Total	Atlanta GA	Rest of GA	Savannah GA
Total	1,490	974	444	72	12,332	7,865	3,840	627
Europe	760	493	230	38	5,573	3,555	1,735	283
Eastern Asia	421	283	119	19	3,440	2,211	1,056	172
SE Asia & Oceania	196	126	60	10	2,249	1,425	709	116
Canada	7	5	2	0	649	409	207	34
SW & Central Asia	65	41	20	3	313	198	99	16
Rest of Americas	23	15	7	1	55	35	17	3
Africa	14	9	5	1	39	25	12	2
Mexico	3	2	1	0	14	9	4	1

2.3.4. Exports

Exports originating from Georgia regions totaled 24.2 million tons in 2019, with a value of $39.8 billion. Waterborne exports of 20.2 million tons comprised by far the largest share of total export tons, with exports by truck and rail also representing significant volumes. Viewed by value, total exports by air at $15.0 billion in 2019 were close to the $16.5 billion of exports by water. The smaller volumes by land modes were $7.2 billion for truck value and $1.2 billion for rail.

In terms of Georgia's regional shares, the Atlanta region comprised a large majority of the state total across all modes for both tons and value.

Table 25. Waterborne Export Volumes from Georgia

Domestic Origin	Tons 2019 (000) Georgia Total	Water	Air	Truck	Rail		Value 2019 ($Millions) Georgia Total	Water	Air	Truck	Rail
Georgia	24,189	20,174	247	2,202	1,566		39,810	16,522	14,953	7,180	1,156
Atlanta GA	16,159	13,472	179	1,474	1,034		26,705	11,022	10,113	4,801	768
Rest of GA	6,499	5,422	55	590	434		10,599	4,445	3,912	1,927	315
Savannah GA	1,531	1,281	13	139	99		2,507	1,054	928	452	73

As shown in the table below, for waterborne exports from Georgia the large majority of volumes are shipped out of the Savannah region (through the Port of Savannah). A small percentage of exports goes to other U.S. domestic ports, with Charleston the top alternative destination.

Table 26. Gateways for Waterborne Exports from Georgia

Domestic Origin	Domestic Destination	Tons 2019 (000) Water	Value 2019 ($Millions) Water
Atlanta GA	Savannah GA	11,561	8,486
	Other	1,910	2,537
	Charleston SC	659	628
Rest of GA	Savannah GA	4,653	3,424
	Other	769	1,021
	Charleston SC	265	253
Savannah GA	Savannah GA	1,101	816
	Other	62	59
	Charleston SC	62	59

Marine Gateway Exports

Georgia serves as a marine gateway for exports from other states, with greater diversity than for imports. Half the waterborne export tonnage out of Georgia ports originates from Georgia, and two-fifths of the export value. Around 90 percent of the export volume originates in the top 10 states, but these states extend beyond the Southeast to others along the Gulf Coast, reaching as far as Texas.

Table 27. Top 10 Origin States for Georgia Exports by Water

Origin State	Tons 2019 (000)	% Total	Value 2019 ($Millions)	% Total
Total	34,040	100%	33,903	100%
GA	17,508	51%	12,968	38%
TN	3,803	11%	3,674	11%
AL	1,827	5%	5,924	17%
SC	1,608	5%	2,096	6%
TX	1,364	4%	492	1%
FL	1,279	4%	1,311	4%
AR	1,168	3%	431	1%
NC	1,008	3%	882	3%
MS	880	3%	1,113	3%
LA	592	2%	223	1%
Top 10	31,037	91%	29,113	86%

Air Cargo and USMCA Exports

Similar to the pattern for waterborne export volumes, for exports by air from Georgia the Atlanta region is the top export gateway. Other competitive regions/airports include Miami, Louisville, and Memphis (the latter two respectively are global hubs for UPS and FedEx).

International exports by truck and rail from Georgia regions are destined to Canada and Mexico, and the border crossing regions for these exports reflect these destinations (as shown in the table below). Laredo and Detroit are the top two export border crossings for value, while the Rest of Texas region is also a top gateway for rail tons.

Table 28. USMCA Export Gateway Destinations

	Tons 2019 (000)		Value 2019 ($Millions)	
Domestic Destination	**Truck**	**Rail**	**Truck**	**Rail**
Laredo TX	721	388	2,118	306
Detroit MI	649	276	2,090	515
Rest of NY	216	71	626	36
Buffalo NY Area	182	194	603	64
North Dakota	125	159	652	143
San Diego CA	70	1	325	0
Rest of WA	64	10	220	6
Tucson AZ	46	30	93	19
Rest of TX	44	382	163	51
El Paso TX-NM (TX Part)	30	44	88	12
Other	54	11	202	3

Exports by Foreign Destination

As described earlier, exports by truck and rail are largely destined to Canada and Mexico. The table below displays volumes exported by water to all world regions. The leading regions for tons include Eastern Asia, SW and Central Asia and Rest of Americas, while Europe is the top region measured by value, accounting for 26 percent of marine exports.

Table 29. Waterborne Export Destinations

Foreign Destination	Tons 2019 (000)	Value 2019 ($Millions)
Eastern Asia	4,590	2,837
SW & Central Asia	4,086	2,880
Rest of Americas	4,020	3,236
Europe	3,077	4,337
SE Asia & Oceania	2,953	2,201
Africa	1,301	952
Mexico	125	59
Canada	23	19

Destinations by air show that Europe is the leading export destination by tonnage and by value, the latter representing 38 percent of Georgia's total.

Table 30. Export Destinations by Air

Foreign Destination	Tons 2019 (000) Air	Value 2019 ($Millions) Air
Europe	64	5,700
Eastern Asia	46	2,941
SE Asia & Oceania	28	2,460
SW & Central Asia	31	1,578
Rest of Americas	26	1,160
Canada	28	616
Africa	22	332
Mexico	2	166

Top Commodity Exports by Mode

Water: The top 5 commodities by tons exported by water in 2019 were waste/scrap, animal feed, nonmetallic minerals, newsprint/paper, and other foodstuffs. The total of all agricultural and food products, also including meat/seafood, other agricultural products, milled grain products, live animals, and cereal grains, represented 28 percent of total export weight in 2019, and 16 percent of total value. Top export products by value in 2019 also included chemical products and transportation.

Table 31. Top Waterborne Export Commodities

	Commodity	Tons 2019 (000) Water	Value 2019 ($Millions) Water
	Total	20,174	16,522
41	Waste/scrap	4,012	402
04	Animal feed	3,345	369
13	Nonmetallic minerals	3,184	483
27	Newsprint/paper	2,850	2,603
07	Other foodstuffs	985	456
20	Basic chemicals	940	279
26	Wood prods.	936	404
05	Meat/seafood	849	904
30	Textiles/leather	496	659
24	Plastics/rubber	495	651
25	Logs	458	98
03	Other ag prods.	290	785
18	Fuel oils	141	27
23	Chemical prods.	129	1,113
34	Machinery	128	406
	Other	936	6,884

Air: The top ten commodities exported by air are much more concentrated than those exported by water, accounting for almost all value. Machinery is by far the top export commodity. Given the high value of these products the tonnage volumes are much smaller than the weight for waterborne exports.

Table 32. Top Airborne Export Commodities

Sctg2	SCTG Desc	Tons 2019 (000) Air	Value 2019 ($Millions) Air
	Total	247	14,953
34	Machinery	42	5,143
37	Transport equip.	10	2,840
35	Electronics	7	1,285
33	Articles-base metal	34	1,235
38	Precision instruments	6	1,036
31	Nonmetal min. prods.	32	980
32	Base metals	15	504

Sctg2	SCTG Desc	Tons 2019 (000) Air	Value 2019 ($Millions) Air
36	Motorized vehicles	10	441
43	Mixed freight	45	382
23	Chemical prods.	8	291
	Other	38	816

USMCA Truck and Rail: As noted earlier, exports by truck and rail are destined to Canada and Mexico. Top valued exports by truck include machinery and electronics while newsprint/paper is the leading export commodity by weight.

Table 33. Top Truck Export Commodities

Sctg2	SCTG Desc	Tons 2019 (000) Truck	Value 2019 ($Millions) Truck
	Total	2,202	7,180
34	Machinery	104	1,191
35	Electronics	63	1,078
36	Motorized vehicles	113	792
24	Plastics/rubber	180	715
30	Textiles/leather	82	600
23	Chemical prods.	115	368
27	Newsprint/paper	306	290
05	Meat/seafood	88	250
03	Other ag prods.	154	235
32	Base metals	110	218
	Other	887	1,444

The top export commodity transported by rail is motorized vehicles, which is also a leading export commodity shipped by truck, as shown above. The top export commodity by weight is non- metallic minerals.

Table 34. Top Rail Export Commodities

		Tons 2019 (000)	Value 2019 ($Millions)
	Total	1,566.5	1,155.7
36	Motorized vehicles	42.9	549.0
27	Newsprint/paper	284.3	184.5
24	Plastics/rubber	139.0	144.9

07	Other foodstuffs	182.9	50.9
20	Basic chemicals	83.3	49.4
13	Nonmetallic minerals	403.4	32.3
32	Base metals	35.6	28.2
35	Electronics	3.0	19.4
04	Animal feed	152.9	19.0
06	Milled grain prods.	40.3	16.8
	Other	198.8	61.2

2.4. Profile of Key Industries

2.4.1. Food and Agriculture

Approximately one in seven Georgians works in agriculture, forestry, or a related field. According to the most recent Census of Agriculture, Georgia's agricultural producers sold more than 9.57 billion dollars of agricultural products in 2020. Agriculture contributes approximately 69.4 billion dollars annually to Georgia's economy, according to the UGA Center for Agribusiness & Economic Development.[6]

According to the University of Georgia Center for Agribusiness & Economic Development, the state's forest industry accounts for a total economic contribution to Georgia's economy of 12.7 billion dollars and supports more than 70,200 jobs in Georgia. Additional information regarding the products of forestry is included in the manufacturing section below.

In 2020, there were 42,439 farms in Georgia encompassing 9,953,730 acres of land. The average farm size was 235 acres and the total Farm Gate Value for the state was 12.2 billion dollars in 2020. Farm Gate Value is the value of the farm products directly from the farm, not including the costs of transportation, further production and marketing. The farms can be sub-categorized as follows:

- More than 17,000 of those farms raised cattle, either beef cows or dairy cows.
- More than 13,000 farms grew cotton during 2020, planting 810,000 acres.
- Peanut farmers across the southern and eastern areas of Georgia produced 3.3 billion pounds of peanuts.
- Farmers across the state planted over 420,000 acres of corn and produced 70.2 million bushels.

Georgia ranks as the top poultry production state in the nation, based on head produced. The industry employs more than 88,000 in the state and generates more than 4.3 billion dollars in farm gate value and an overall annual economic impact to the state of more than 28 billion

[6] Georgia Farm Bureau, "About Georgia Agriculture", published by gfb.org, accessed October 28, 2022 at https://www.gfb.org/education-and-outreach/about-ga-agriculture.cms

dollars. Three out of four Georgia counties are involved in poultry and egg production.[7] The poultry industry has a high daily demand for feed and for food in colder weather. These trucks operate 24 hours, nearly 365 days per year moving on rural roads doing direct farm delivery. This places significant demand on that infrastructure.

Georgia is one of the top states in the nation in the production of peanuts, pecans, blueberries and spring onions. It is also at or near the top when it comes to cotton, watermelon, peaches, eggs, cucumbers, sweet corn, bell peppers, tomatoes, cantaloupes, rye and cabbage.

Food Processing is Georgia’s leading manufacturing sector in terms of labor and gross state product. Georgia Power’s Community and Economic Development (C & ED) group reports 7,260 new jobs created within the food processing sector between 2018 and 2022. These jobs have come from businesses either expanding or moving to operations to Georgia during that time period. Lightcast 2022.3 shows the value of the Food and Beverage industry to the Georgia State Product (GSP) to be 10.3 billion dollars. Animal Processing is the dominant segment within Georgia's food processing industry. Georgia is the poultry capital of the world with more than 1 billion dollars in annual exports to markets around the U.S. and world.[8]

The Food Processing sector is derived from Georgia’s agricultural industry including varied manufacturing concerns that combine the vast source of raw materials with a diverse network of distributors, using the expansive transportation infrastructure throughout the state.

The map below includes food processing operations and food distribution locations with 50 or more employees. This map shows the presence of the industry across much of the state, with animal processing particularly prominent.

[7] Georgia Extension Supporting County Governments and Poultry Industry | National Institute of Food and Agriculture (usda.gov)

[8] Select Georgia, “Food Processing“, Accessed November 8, 2022 at selectgeorgia.com/discover-georgia/industries/food-process-georgia

Figure 24. Food and Agricultural Industry Prominence in Georgia

Source: https://www.selectgeorgia.com/discover-georgia/industries/food-process-georgia

Table 35 shows that nearly 82 million tons of food and agriculture commodities moved into, out of, and within the state of Georgia in 2019. The largest direction of commodity flow was inbound at approximately 42 million tons, followed by outbound at nearly 28 million tons. Slightly more than 12 million tons moved within the state. Most of the cargo was moved by truck (67.6 million tons), followed by rail (14.4 million tons). A small amount of cargo moved by water (91,000 tons) and air (14,000 tons).

Table 35. Food and Agriculture Tonnage by Mode and Direction of Flow (2019) (Thousands of Tons)

Mode	Inbound	Outbound	Within	Total
Truck	30,055	25,346	12,168	67,569
Rail	11,838	2,550		14,388
Water	90	<1	<1	91
Air	7	7	<1	14
Other		23		23
Total	**41,990**	**27,926**	**12,169**	**82,085**

Source: Transearch 2019 data prepared by WSP USA Inc.

The total value of food and agriculture commodities in the state in 2019 was nearly 97 billion dollars. As opposed to the tonnage, the outbound cargo was more valuable (43.7 billion dollars) than the inbound cargo (37.3 billion dollars). Cargo moved by truck comprised the highest value at 88.1 billion dollars, with rail a distant second at 8.7 billion dollars.

Table 36. Food and Agriculture Value by Mode and Direction of Flow (2019) (Millions of Dollars)

Mode	Inbound	Outbound	Within	Total
Truck	31,801	40,193	16,115	88,109
Rail	5,339	3,375		8,714
Water	33	<1	7	40
Air	86	83	1	170
Other		22		22
Total	**37,259**	**43,673**	**16,123**	**97,055**

Source: Transearch 2019 data prepared by WSP USA Inc.

2.4.2. Manufacturing

Georgia's manufacturing industry employs more than 480,000 people. Georgia is a national leader in advanced manufacturing, outpacing the U.S in 10-year GDP growth in the manufacture of products including machinery, electrical equipment and components, and fabricated metals.[9]

With its extensive workforce training and technical college programs, Georgia is well positioned to be a competitive player in the manufacturing space. Nearly 5,000 engineers graduate from Georgia universities each year and the state’s university engineering programs rank in the Top 5 nationwide. It is no surprise that major corporations like Mitsubishi, Hyundai, Kobayashi, Kia Motors, Gulfstream Aerospace, and Caterpillar chose to locate manufacturing facilities in the state.[10]

The size and scale of these industries is evident in the outbound shipment statistics for these industry groups which are discussed in Section Supply Chain Geography of Key Industries. Some of the other major manufacturing sectors and initiatives in the state are summarized as follows:[11]

- **R&D:** Georgia is home to corporate innovation centers, research universities, investors, and start-up companies. Tech Square is the 8-block area in Midtown Atlanta, home to hundreds of startups plus dozens of innovation labs operated by international brands including Panasonic, Delta Air Lines, and Home Depot. The state’s research universities generate more than 2 billion dollars a year in public and private R&D funding, with 1,600 scientists and engineers working across 8 labs and 15 field offices. There is also a

[9] Select Georgia, “Georgia’s Manufacturing Industry”, published by Georgia Power Community & Economic Development, accessed October 30, 2022 at https://www.selectgeorgia.com/documents/578/Georgia_Manufacturing_Industry.pdf
[10] Georgia Department of Economic Development, “Advanced Manufacturing”, published 2022 by Georgia.org, accessed October 30, 2022 at https://www.georgia.org/industries/advanced-manufacturing
[11] Ibid.

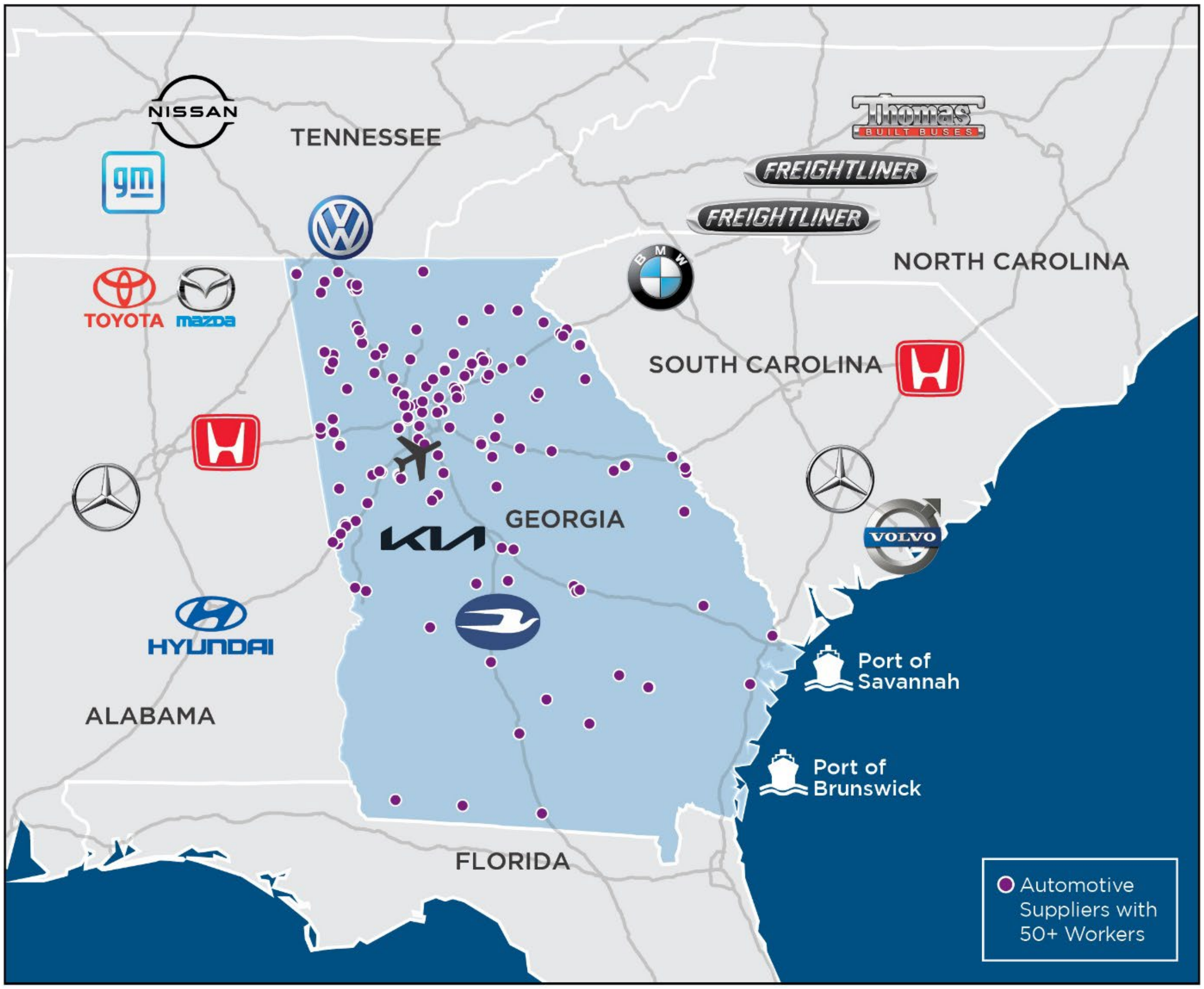
growing portfolio of public and private cybersecurity resources in Augusta, including NSA-Georgia, Unisys and in 2020 the U.S. Army Cyber Command.

- **Defense:** Georgia is ranked 7th in Department of Defense spending nationwide, with the majority of spending allocated to scientific research, engineering, and construction. There are statewide programs designed to assist Georgia aerospace and defense companies who perform Department of Defense related work. Top defense contractors located in the state include Lockheed Martin, Northrop Grumman, General Dynamics, and S&K Aerospace.
- **Automotive:** Georgia has been an established automotive manufacturing center since 1909, when the first automobile was assembled in the state. Leading automotive companies that have chosen Georgia as their home for manufacturing, assembly, headquarters, and innovation centers include Kia, Hyundai, Honda, Kumho Tire, Toyo Tire, and SK Innovations. Bluebird, a manufacturer of busses also has a presence in the state. In December 2021, electric adventure vehicle manufacturer Rivian Inc. announced that it would build its second U.S. plant, a 5 billion dollar carbon-conscious campus, in Georgia.

The following map shows the location of automotive suppliers with more than 50 employees.[12]

[12] Georgia Department of Economic Development, "Advanced Manufacturing", published 2022 by Georgia.org, accessed October 30, 2022 at https://www.georgia.org/industries/advanced-manufacturing

Figure 25. Automotive Suppliers in Georgia with More Than 50 Employees



Source: Georgia Power Community & Economic Development, accessed October 30, 2022 at https://www.georgia.org/industries/automotive

Georgia's major industries include lumber, paper, and home furnishings (including floor coverings). Georgia's forest industry contributed 39.1 billion dollars in revenue output to the state economy. The state has 24.1 million acres of forestland, which is 67 percent of the state's total land area.[13] In 2020, Georgia's forest industry provided 54,185 jobs. Across all producing industries, forestry products ranked second in employment to food processing, providing an estimated 148,000 jobs with compensation of nearly 9 billion dollars. Georgia is home to nearly

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Georgia State and Private Forestry Fact Sheet 2022
https://apps.fs.usda.gov/nicportal/temppdf/sfs/naweb/GA_std.pdf

1,400 forest products manufacturers and is consistently ranked near the top in pulp and paper production and in the top ten lumber-producing states.[14]

In 2019, wood pulp, kraft paper and paperboard were 2 of the top 10 export products from Georgia. Among US states Georgia was #2 in the export of fuel wood and wood pellets. The top export markets include the UK, China and Vietnam.

Forest bioenergy, the use of renewable forestry biomass to produce energy products, is an area of growth within the forest industry and shows promise for future development using the renewable resources of the State's forestland.

Maintaining the forest industry's status as one of the top economic drivers in the state is critical, particularly for rural communities. The Atlanta Regional Commission, Southern Georgia, and Heart of Georgia Altamaha are the top three regions in terms of employment, accounting for 44 percent of the forestry related jobs in Georgia. However, in terms of regional dependence on forestry compared to all other industries, Heart of Georgia Altamaha, Southern Georgia, and Southwest Georgia have the three highest employment percentages at 5.6 percent, 4.2 percent, and 3.7 percent, respectively.[15]

Over 129 million tons of manufacturing tonnage moved within, into and out of the state in 2019. Nearly half of the tonnage was outbound (63 million tons) while a significant amount also moved inbound (45 million tons). Approximately 21 million tons moved within the state. Most of the tonnage was moved by truck (104.2 million tons), followed by rail (24.5 million tons). Very little manufacturing tonnage moved by water or air.

Table 37. Manufacturing Tonnage by Mode and Direction of Flow (2019) (Thousands of Tons)

Mode	Inbound	Outbound	Within	Total
Truck	31,104	52,410	20,672	104,186
Rail	13,887	10,652		24,539
Water	252	2	10	264
Air	111	96	<1	207
Other	<1	2		2
Total	**45,354**	**63,162**	**20,682**	**129,198**

Source: Transearch 2019 data prepared by WSP USA Inc.

Manufacturing cargo in Georgia accounted for more than 365 billion dollars in value in 2019. The highest share of value was attributed to outbound cargo (180 billion dollars), followed by inbound cargo (145.6 billion dollars) and intra-state cargo (39.4 billion dollars). Trucking comprised the largest share of value by mode at 263.8 billion dollars, followed by rail at 51

[14] University of Georgia, "Forestry," published in 2022 by the University of Georgia, Accessed November 7, 2022 at https://extension.uga.edu/topic-areas/environment-natural-resources/forestry.html

billion dollars. Although very little tonnage moved by air, the air cargo accounted for nearly as much value as the rail cargo.

Table 38. Manufacturing Value by Mode and Direction of Flow (2019) (Millions of Dollars)

Mode	Inbound	Outbound	Within	Total
Truck	87,727	136,848	39,240	263,815
Rail	32,451	18,609		51,060
Water	94	5	120	219
Air	25,369	24,945	39	50,353
Other	2	15		17
Total	**145,643**	**180,422**	**39,399**	**365,464**

Source: Transearch 2019 data prepared by WSP USA Inc.

2.4.3. Warehousing and Distribution

The state of Georgia is located within a two-day drive or two-hour flight of 77 percent of the nation's population. The state's favorable geography along with its extensive goods movement infrastructure, including ports, airports and rail hubs, has facilitated significant growth in its warehousing and distribution sector.

Georgia is home to nearly 650 million square feet of warehouse and manufacturing space. Approximately 204 million square feet is dedicated warehouse space; over 70 firms are involved, of which almost 50 have over 1 million square feet. This group includes five firms in Savannah; [16] after the Atlanta metropolitan market, Savannah is the top location for warehousing and logistics deriving from the port and the import-export activity supported therein.

A total of 346,000 people worked in the warehouse and distribution sector in 2021. Included in that number are 107,000 employees specifically in warehousing. Wage rates in warehousing and logistics overall averaged 16.37 dollars per hour. Wages in the warehousing sector were higher, approaching 25 dollars to 30 dollars per hour. Industry employment is forecasted to grow at an average annual rate of 9 percent from 2021 to 2031. There are 78,000 supply chain personnel and over 200 logistics-related technology companies in the state.[17]

Georgia's strengths in the warehousing and distribution sector include the following factors:

- Well-developed transportation infrastructure
- Business-friendly environment
- Low operating costs

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[16] Select Georgia, "Warehousing & Logistics", published by Georgia Power Community & Economic Development, accessed October 28, 2022, at https://www.selectgeorgia.com/discover-georgia/industries/warehouse-dist-georgia
TKG
[17] Ibid.

- Highly-skilled workers
- Established workforce training program
- Excellent accessibility to market

Over the last five years, warehouse distribution operations have added more than 300 million square feet of space in the Atlanta market. An additional 30 million square feet of space has been added in Savannah. **Table 39** presents a list of recently developed and newly announced warehousing facilities in the state with over 1 million square feet according to Georgia Power.

Table 39. Recently Announced Warehouse Distribution Locations in Georgia (2022)

Company	Announced Square Feet	Location	Year
Amazon	2,800,000	Appling	2020
Shaw Industries	1,900,000	Effingham County	2019
Kellogg's	1,400,000	Newnan	2021
OA Logistics/JLA Home Furnishings	1,300,000	Savannah	2018
Wayfair	1,164,800	Savannah	2018
Ace Hardware	1,100,000	Watkinsville	2021
Drive Medical	1,100,000	Palmetto	2018
Safavieh	1,100,000	Savannah	2017
GE Appliances	1,099,880	Commerce	2018
Amazon	1,000,000	Newnan	2020
PVH	1,000,000	Palmetto	2019
A&R Logistics	1,000,000	Effingham County	2019
Amazon.com Inc.	1,000,000	Macon	2017
ASOS	1,000,000	Union City	2017
Ghirardelli	1,000,000	McDonough	2017

Source: Georgia Power Community & Economic Development, accessed October 28, 2022, at https://www.selectgeorgia.com/discover-georgia/industries/warehouse-dist-georgia

The growth of Georgia's warehousing sector has been enabled by and benefited from the state's excellent goods movement infrastructure, including ports, airports and rail hubs. Not only are the state's primary cargo handling facilities capable of moving an ever-increasing amount of cargo, they have been working together to facilitate the efficient intermodal transport of this cargo. One example is the Mason Mega Rail Terminal currently under construction across from the Port of Savannah, a collaborative effort between the Port and major rail operators.

A brief description of the key modes involved with warehousing and distribution is provided below:[18]

- **Rail:** Rail carriers in Georgia serve more than 500 communities across the state and maintain 5,000 miles of rail. Major rail carriers in the state include CSX, whose network includes 70 ports and 166 bulk intermodal terminals in more than 23 states, D.C. and Canada, and Norfolk Southern (NS), which operates 20,000 route miles of track in 22 states, including every major container port in the eastern U.S. The Burlington Northern and Santa Fe also has operations in Georgia and the state is home to multiple short line railroads. Daily trains on CSX and NS connect the Port of Savannah to Atlanta and other points in Georgia and beyond.

- **Ports:** Georgia's ports moved 5.6 million TEUs in 2021, which was an increase of nearly 20 percent from 2020. Georgia's deep-water ports have added the capabilities necessary to remain competitive in international markets. The deepening and widening of the Savannah Harbor allows the passage of much larger cargo vessels traveling from Asia through the expanded Panama Canal. Simultaneous efforts have gone into increasing the ports handling capacity by 1.6 million TEUs.

  The Port of Savannah handled 1.5 million TEUs in the first quarter of 2022 indicating rapid growth over 2021. The Port of Brunswick's 3 terminals provide roll on roll off (RORO) service for the automotive industry and manage a variety of bulk cargo. Brunswick also handles oversize and overweight cargo including off-highway equipment from companies such as Caterpillar and John Deere.

  Northeast Asia was the largest trade lane for imports via Savannah during Calendar Year 2021 (CY21) and had the most growth between CY17 and CY21, increasing by 403,620 TEUs. Other trade lanes with rapid growth between CY17 and CY21 were Southeast Asia (+248,826 TEUs), the Mediterranean (+93,432 TEUs), Southern Asia/Indian Subcontinent (+90,122 TEUs), and Eastern Europe.

- **Airports:** Hartsfield-Jackson is home to 4 charter air cargo carriers and 28 mainline carriers that shipped nearly 600,000 metric tons in 2020. Delta Cargo, UPS, FedEx and DHL move cargo through the airport, which has more than 29 acres of air cargo warehouse space on site. The airport provides USDA inspection, distribution and transportation services. Adjoining the airport is Georgia Foreign Trade Zone #26 which enables companies to reduce their operating costs associated with international trade.

Approximately 54 million tons of warehousing and distribution cargo moved into, out of, and within the state in 2019. More tonnage moved within the state (25 million tons) than either inbound (15.9 million tons) or outbound (12.7 million tons). The majority of cargo was moved by truck (42.7 million tons), followed by intermodal rail (10.9 million tons). A small amount moved by air (103,000 tons).

[18] Ibid.

Table 40. Warehousing & Distribution Tonnage by Mode and Direction of Flow (2019) (Thousands of Tons)

Mode	Inbound	Outbound	Within	Total
Truck	10,539	7,100	25,068	42,707
Rail	5,365	5,571		10,936
Water				0
Air	49	54	<1	103
Other				0
Total	**15,953**	**12,725**	**25,068**	**53,746**

Source: Transearch 2019 data prepared by WSP USA Inc.

The total value associated with warehousing and distribution cargo was nearly 176 billion dollars in 2019. As with tonnage, the highest share of the cargo by value was within the state (86.9 billion dollars) compared to inbound (47.1 billion dollars) or outbound ($41.8 billion) flows. Trucking comprised nearly $117 billion in warehousing and distribution commodity value, which was nearly double the value of cargo moved by rail ($57.7 billion). Air cargo accounted for $1.3 billion or 0.7 percent of total value.

Table 41. Warehousing & Distribution Value by Mode and Direction of Flow (2019) (Millions of Dollars)

Mode	Inbound	Outbound	Within	Total
Truck	17,524	12,436	86,867	116,827
Rail	29,072	28,617		57,689
Water				0
Air	533	721	<1	1,254
Other				0
Total	**47,129**	**41,774**	**86,867**	**175,770**

Source: Transearch 2019 data prepared by WSP USA Inc.

2.4.4. Construction

Construction contributed $29.5 billion (4.7 percent) of the state's GDP of $622.6 billion in 2020. There were 19,413 construction firms in Georgia in 2020. On average, each firm contributes approximately $1.5 million in economic output. Private nonresidential spending in Georgia totaled $10.4 billion in 2020. State and local spending totaled $7.8 billion.[19]

Construction employment in Georgia in January 2022 totaled 210,700, an increase of 3.8 percent from January 2021, and 6.1 percent less than the state's peak in March 2007. In

[19] Ken Simonson, "The Economic Impact of Construction in the United States and Georgia", published 2022 by AGC based on data from the Bureau of Economic Analysis (GDP); Census Bureau (spending); Bureau of Labor Statistics (national and state employment, median wages); and AGC (workforce survey). Accessed October 28, 2022 at https://www.agc.org/sites/default/files/Files/Advocacy/GA.pdf

Georgia, four out of the five construction occupations with the highest employment had higher median pay than the median for all employees in the state in 2020. [20]

Within the construction industry group, the major commodity types are nonmetallic minerals (such as sand and gravel); asphalt; clay, concrete, glass or stone; fabricated metal products; and electrical equipment. The first two types comprise the vast majority of construction materials moving into, out of, and within the state.

Table 42 shows that in 2019, nearly 145 million tons of construction cargo moved in the state, accounting for almost one-third of the total Georgia-based freight tonnage and considerably more than any other industry group. Of this, the vast majority was moved by truck (133.2 million tons), with the remaining tonnage moved by rail (11,535 tons). By direction, the largest share of the tonnage was within the state (62.3 million tons), followed by inbound (52.2 million tons) and outbound (30.2 million tons) cargo. Very little construction cargo was moved by water or air.

Since construction materials tend to be heavy bulk shipments moving short distances, the tonnage of cargo moving within the state exceeds either the inbound or outbound flows.

Table 42. Construction Tonnage by Mode and Direction of Flow (2019) (Thousands of Tons)

Mode	Inbound	Outbound	Within	Total
Truck	48,763	22,113	62,294	133,170
Rail	3,433	8,102		11,535
Water	34	4	7	45
Air	<1	<1		<1
Other		<1		<1
Total	**52,230**	**30,219**	**62,301**	**144,750**

Source: Transearch 2019 data prepared by WSP USA Inc.

Table 43 shows the comparable data by value. In 2019, construction cargo moving in the state was valued at $15.6 billon, accounting for slightly more than 2 percent of the total value of Georgia's freight and indicating the marked disparity between value and weight in the construction industry's role in the state freight system. The majority of value was attributed to truck ($14.9 billion). By direction, the largest share of value was for outbound cargo ($7.4 billion) followed by inbound ($5.1 billion) and then cargo moved within the state ($3 billion).

[20] Ibid.

Table 43. Construction Value by Mode and Direction of Flow (2019) (Millions of Dollars)

Mode	Inbound	Outbound	Within	Total
Truck	4,765	7,101	3,057	14,923
Rail	364	270		634
Water	4	0.45	5	9
Air	9	5		14
Other		<1		<1
Total	**5,142**	**7,376**	**3,062**	**15,580**

Source: Transearch 2019 data prepared by WSP USA Inc.

2.4.5. Energy

Georgia does not have any significant fossil fuel reserves. Natural gas supplies slightly more than half (53 percent) of the net electricity generation in Georgia. This is slightly higher than the U.S. average of 46 percent. Nuclear energy supplies slightly less than one quarter of net electricity generation and coal accounts for 12 percent, with the remaining 12 percent mostly coming from renewables.[21]

Georgia has extensive solar power potential, and the Atlantic Ocean off Georgia's coast presents an opportunity for wind energy generation. Solar and wind energy facilities (also called "farms") require specialized equipment, some of which must be transported using dedicated infrastructure. For example, a wind turbine tower can range from 200-feet in height to more than 400-feet in height and may have a diameter ranging from 130 feet to 300 feet; for its road transportation, it must be conveyed using a modified flatbed carrier over a route that is carefully mapped to avoid overpasses or bridges with height or weight restrictions.

The transportation sector accounts for the largest share of Georgia's end-use energy consumption. Georgia's transportation sector ranked sixth in the nation in energy consumption in 2019. The industrial sector accounts for the second-largest share, largely due to the state's energy-intensive industries including the manufacture of food, beverages, chemicals, and paper. The residential sector's per capita energy consumption is above the national average.[22]

In terms of electricity consumption, Georgia uses more power than it generates. Consequently, about one-seventh of the electricity it has consumed over the past decade was imported from other states. In 2020, Georgia's residential sector accounted for 44 percent of electricity retail sales while the commercial sector accounted for 33 percent of sales and the industrial sector accounted for 23 percent. In 2020, Georgia ranked 10th in the nation in number of registered electric vehicles, and the transportation sector accounted for a small amount of electricity retail sales.

Georgia had 194,908 energy workers statewide in 2021, representing 2.5 percent of all U.S. energy jobs. Of these energy jobs, 17,129 were in electric power generation; 8,007 in fuels;

21 U.S. EIA, "Georgia: State Profile and Energy Estimates", Published December 16, 2021, accessed October 29, 2022 at https://www.eia.gov/state/analysis.php?sid=GA#2
22 Ibid.

35,262 in transmission, distribution, and storage; 53,294 in energy efficiency; and 81,216 in motor vehicles. From 2020 to 2021, energy jobs in the state increased by 6,282 jobs, or 3.3 percent. The energy sector in Georgia represented 4.4 percent of total state employment[23].

Over 44 million tons of energy cargo was moved into, out of, and within the state in 2019. Nearly half of the tonnage was inbound (21.2 million tons) followed by intra-state (17.8 million), most of which was coal as discussed in Section 2.5. The amount of outbound tonnage was much lower at 5.4 million tons. Truck had the largest share of tonnage (26.7 million tons) followed by rail (17 million tons). There was a small amount of energy tonnage moved by water (614,000 tons).

Note that the Transearch data employed in this section for industry analysis does not include pipelines, which are used primarily for the transport of natural gas and inbound fuel. Pipelines are discussed in Section 3.5.

Table 44. Energy Tonnage by Mode and Direction of Flow (2019) (Thousands of Tons)

Mode	Inbound	Outbound	Within	Total
Truck	3,819	5,228	17,671	26,718
Rail	16,925	120		17,045
Water	449	49	116	614
Air	<1	<1		<1
Other				
Total	**21,193**	**5,397**	**17,787**	**44,377**

Source: Transearch 2019 data prepared by WSP USA Inc.

In terms of value, approximately 20 billion dollars in energy cargo was moved into, out of and within the state in 2019. The highest value directional flow was within the state (11.8 billion dollars), which includes truck delivery of products brought into the state by pipelines. Inbound energy cargo was valued at 4 billion dollars while inbound energy cargo was valued at 3.6 billion dollars.

Table 45. Energy Value by Mode and Direction of Flow (2019) (Millions of Dollars)

Mode	Inbound	Outbound	Within	Total
Truck	2,599	3,489	11,743	17,831
Rail	1,181	87		1,268
Water	303	35	92	430
Air	<1	<1		<1
Other				
Total	**4,083**	**3,611**	**11,835**	**19,529**

Source: Transearch 2019 data prepared by WSP USA Inc.

[23] Energy.gov, "USEER State Report: Georgia Energy and Employment – 2022", published in June 2022 by Energy.gov, accessed October 29, 2022 at https://www.energy.gov/sites/default/files/2022-06/USEER percent202022 percent20-percent20Georgia.pdf

2.5. Supply Chain Geography of Key Industries

The preceding section profiled Georgia's five key industry groups in detail. This section provides a discussion of the flow of materials and production goods in their supply chains, described by geography and weight. The analysis is chiefly concerned with tonnage, since that reflects physical demand on Georgia's infrastructure.

2.5.1. Food and Agriculture

The largest amount of food and agricultural products moves inbound to Georgia, supplying the diverse needs of industry and the population. Table 46 shows the inbound tonnage by origin state and mode. In 2019, approximately 42 million tons of these products were transported to the state of Georgia. Out of this total tonnage, approximately 30 million tons moved by truck while 11.8 million tons moved by rail. A negligible amount moved by water and air. The largest inbound commodity flows included the following:

- **Truck:** approximately 15.8 million tons of food products and 12.7 million tons of farm products
- **Rail:** approximately 6.5 million tons of farm products and 4.9 million tons of food products

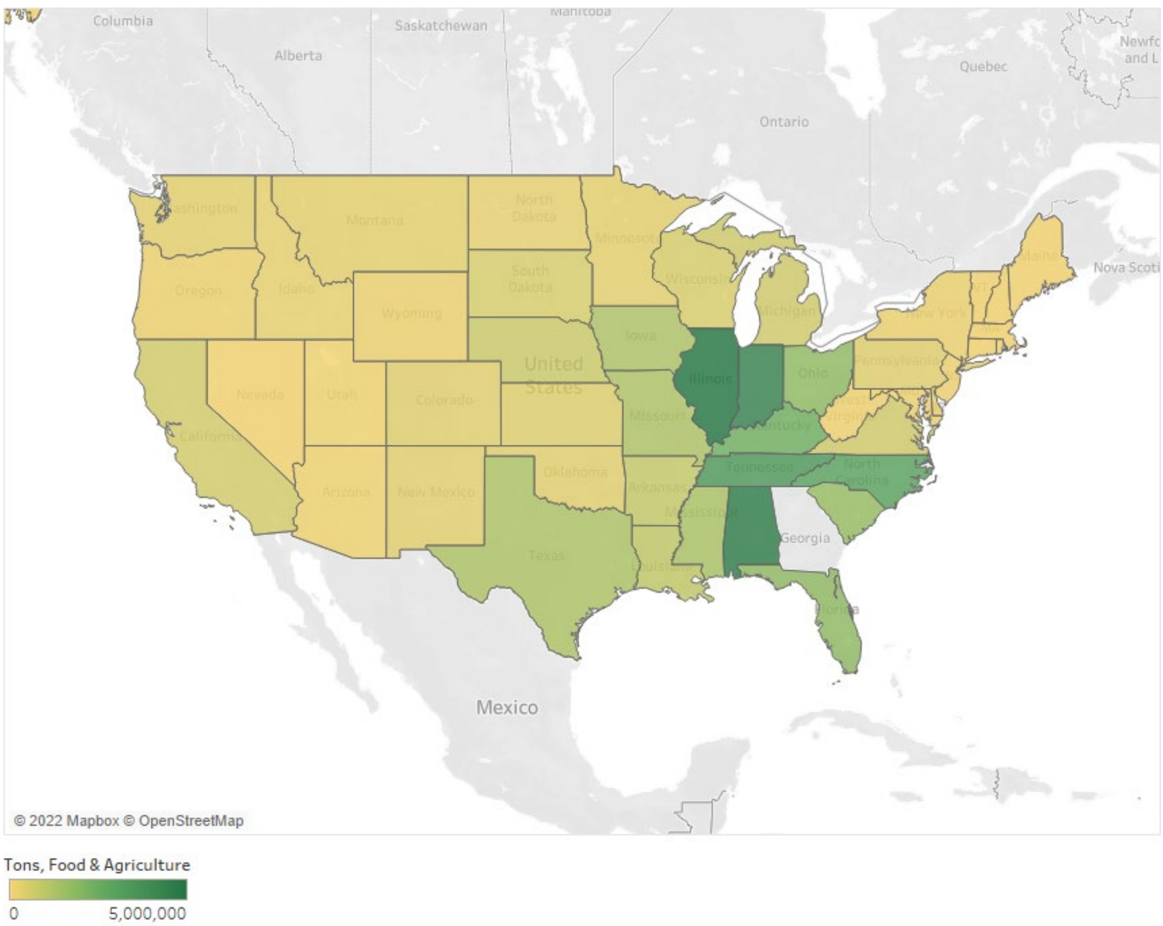
The state with the highest tonnage of inbound food and agriculture products for Georgia was Illinois with approximately 5 million tons. Alabama followed at 4.6 million tons and Indiana at 4.4 million tons. Illinois traffic included grain moving by rail (approx. 2.2 million tons). Live poultry by truck (approx. 920,000 tons) represented the largest volume from Alabama. The inbound cargo from Indiana was bulk grain moving by rail (approx.1.5 million tons). Approximately 27 thousand tons of food and kindred products came via water from Florida. The map in **Figure 26** highlights the product tonnage that is coming into Georgia originating in the Southeast and Midwest regions.

Table 46. Food and Agriculture Inbound Tonnage by Origin State and Mode (2019) (Thousands of Tons)

Origin State	Truck	Rail	Water	Air	Total
IL	729	4,223		<1	4,923
AL	4,174	395		<1	4,569
IN	1,010	3,341		<1	4,351
TN	2,997	372		<1	3,369
NC	2,684	175		<1	2,859
KY	2,030	332		<1	2,363
FL	1,687	63	27	<1	1,778
OH	747	1,006		<1	1,753
SC	1,507	86	<1	<1	1,594
MS	1,253	4		<1	1,257
All Others	11,237	1,841	63	5	13,144
Total	**30,055**	**11,838**	**90**	**7**	**41,990**

Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 26. Food and Agriculture Inbound Tonnage by Origin State (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

As shown in Table 47, approximately 28 million tons of food and agricultural products were transported from the state of Georgia in 2019. Some of this outbound tonnage includes the transformation of raw materials from other states through Georgia's significant food manufacturing segment. Out of this total tonnage, approximately 25.3 million tons moved by truck while 2.55 million tons moved by rail. A negligible amount moved by water and air. The largest outbound cargo commodity flows included the following:

- **Truck:** approx. 15.9 million tons of food products, 7.7 million tons of farm products and 1.4 million tons of chemicals
- **Rail:** approx. 1.5 million tons of food products

The state receiving the highest tonnage of outbound food and agricultural products from Georgia was North Carolina at approximately 3.76 million tons, followed by Florida and Alabama. The largest tonnage headed to North Carolina was live poultry by truck (535,917 tons). Live poultry moves across state lines reflecting proximity of farms and processing facilities reflecting the importance of this industry to the entire region. The second highest volume was prepared or canned food by truck (520,071 tons). The highest amount of tonnage moving to Florida was grain by truck (406,924 tons) followed by miscellaneous food preparations (267,493 tons). Alabama received significant tonnage of live poultry transported by truck (965,129 tons) followed by prepared or canned food (720,720 tons). Georgia is both an origin and a destination for live poultry moving to and from Alabama. This trade is affected by the length of the states' borders and highlights the importance of connectivity of rural markets across state lines.

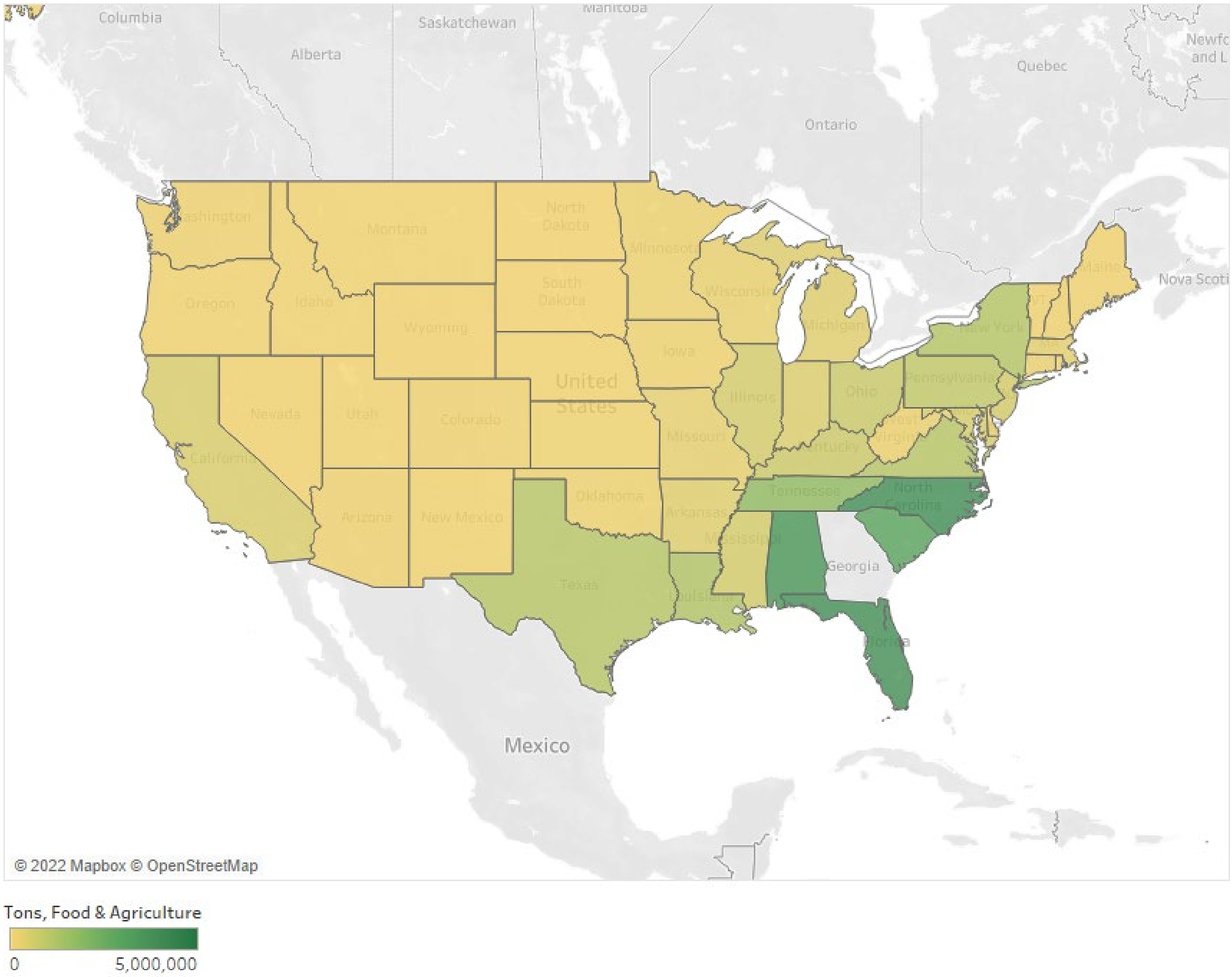
A small but not negligible amount of food and agricultural cargo was exported to Canada and Mexico, totaling 512 thousand tons, moved primarily by truck. This represented less than 2 percent of the total outbound volume. Figure 27 again shows the importance of Georgia's neighbors as consumers of Georgia products.

Table 47. Food and Agriculture Outbound Tonnage by Origin State and Mode (2019) (Thousands of Tons)

	Truck	Rail	Water	Air	Total
NC	3,496	265		<1	3,761
FL	3,577	111	<1	<1	3,689
AL	3,289	98		<1	3,388
SC	2,833	12		<1	2,846
TN	1,405	324		<1	1,729
LA	1,005	141		<1	1,146
NY	898	139		<1	1,038
TX	985	37		<1	1,022
VA	865	141		<1	1,006
PA	747	103		<1	850
All Others	6,246	1,179	<1	6	7,431
Total	**25,346**	**2,550**	**<1**	**7**	**27,903**

Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 27. Food and Agriculture Outbound Tonnage by Destination State (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

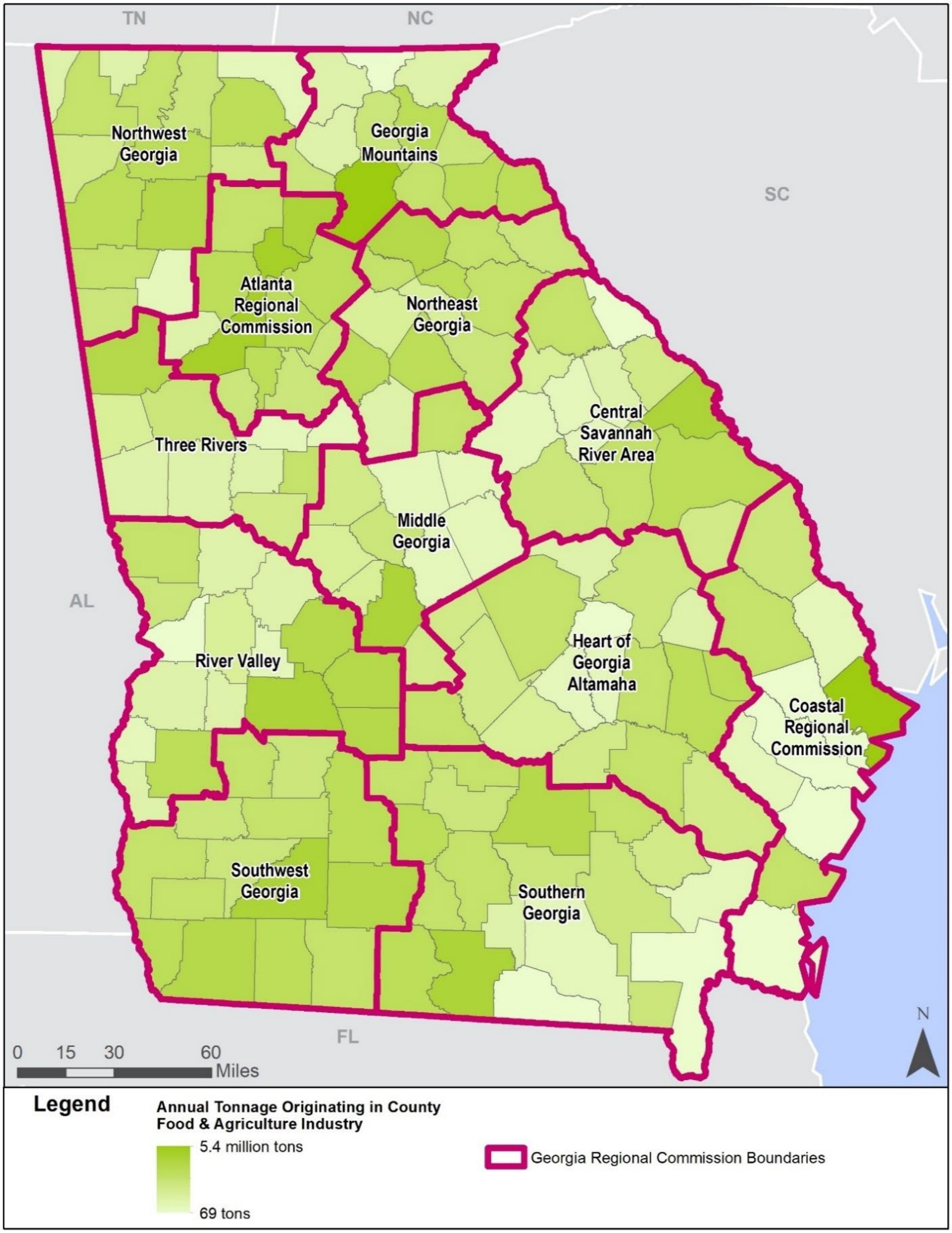
Network volumes defined by the Georgia Regional Commissions reflecting market share for both inbound and outbound traffic are shown in Table 48 and Table 49. The associated maps in Figure 28 and Figure 29 show the importance of the defined regions and the importance of their connectivity to external markets. The Origin-Destination (O-D) pair with the highest tonnage at 834 thousand was Nashville, TN to Northwest Georgia at 2 percent of the total 42 million tons, followed by 768 thousand tons between Indianapolis, IN and Southern Georgia. The bulk of the tonnage coming from Nashville and Indianapolis was farm products with low value bulk materials moving by rail. There was also a significant amount of food products, approximately 581 thousand tons coming from Chicago to the Atlanta Regional Commission.

Table 48. Food and Agriculture Top O-D Pairs – Inbound (2019)

Share	External O	Georgia D	Tons (k)	% Truck
2%	Nashville, TN	Northwest Georgia	834	79%
2%	Indianapolis, IL	Southern Georgia	768	1%
1%	Chicago, IL	Atlanta Regional Commission	601	14%
1%	Champaign, IL	Georgia Mountains	566	2%
1%	Indianapolis, IL	Georgia Mountains	550	8%
1%	Nashville, TN	Atlanta Regional Commission	502	97%
1%	Indianapolis, IN	Georgia Mountains	494	16%
1%	Huntsville, AL	Atlanta Regional Commission	456	87%
1%	Birmingham, AL	Atlanta Regional Commission	364	64%
1%	Fort Wayne, IN	Southern Georgia	302	2%
1%	Evansville, IN	Northwest Georgia	301	47%
1%	Nashville, TN	Georgia Mountains	292	82%
1%	Huntsville, AL	Georgia Mountains	292	83%
85%	All Others	All Others	35,668	
Total			**41,990**	

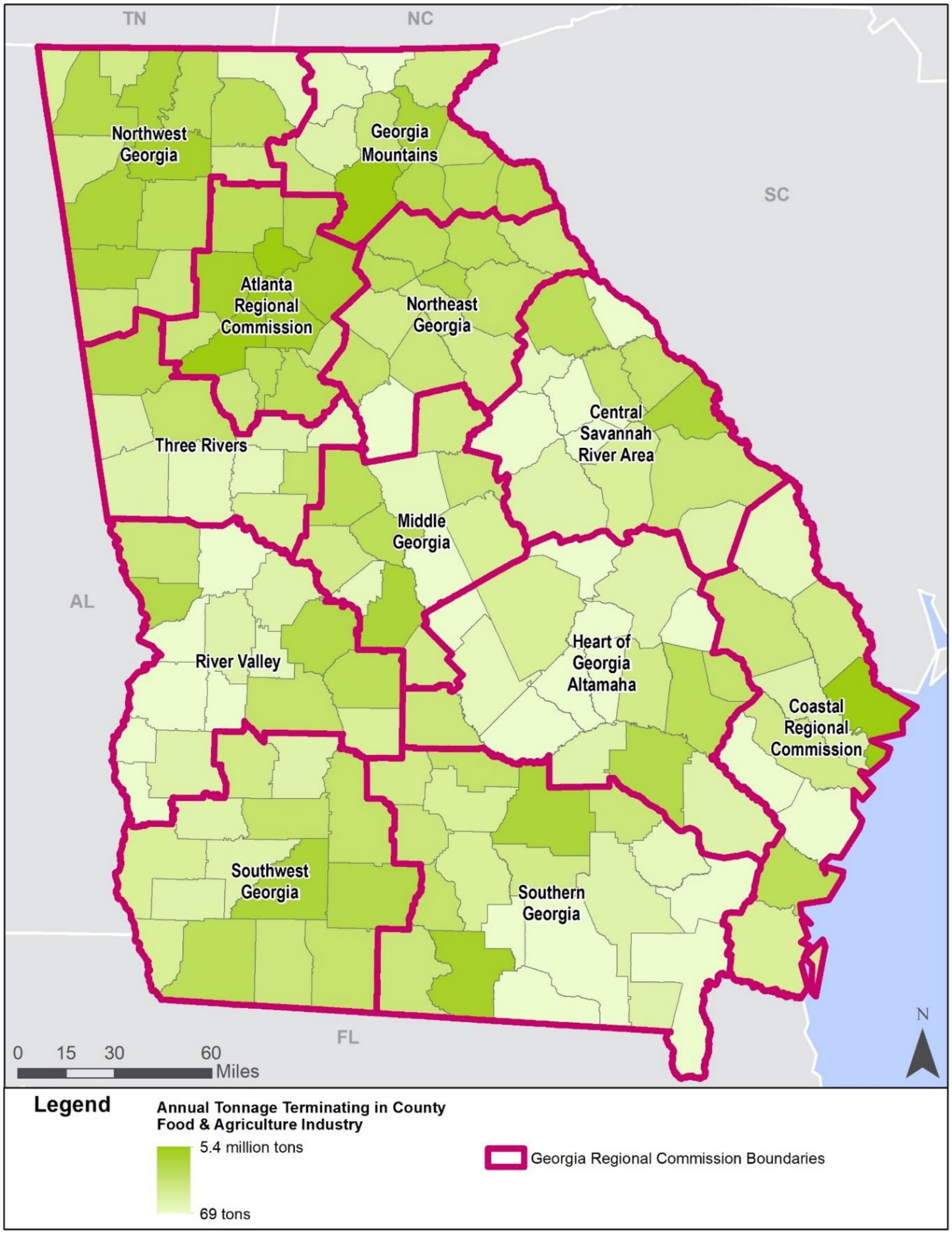
Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 28. Food and Agriculture Top Origin Counties for Tonnage (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 29. Food and Agriculture Top Destination Counties for Tonnage (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Table 49 shows traffic originating in the Georgia Regional Commission areas in 2019. Out of a total of 27.9 million tons, the Coastal Regional Commission to Charlotte, NC ranked at the top with 272 thousand tons, of which 45 percent moved by truck. 86 percent of this was comprised of food products. This is followed by 269 thousand tons from the Georgia Mountains to Huntsville, AL; this tonnage was split evenly between food products and farm products. The shorter distances in these lanes mean they are heavily dependent on trucking and therefore the highway network encompassing more rural areas and infrastructure.

Table 49. Food and Agriculture Top O-D Pairs – Outbound (2019)

Share	Georgia O	External D	Tons (k)	% Truck
1%	Coastal Regional Commission	Charlotte, NC	272	45%
1%	Georgia Mountains	Huntsville, AL	269	100%
1%	Atlanta Regional Commission	New York, NY	258	97%
1%	Coastal Regional Commission	New York, NY	252	100%
1%	Coastal Regional Commission	Orlando, FL	223	100%
1%	Georgia Mountains	Charlotte, NC	220	97%
1%	Southwest Georgia	Jacksonville, FL	210	100%
1%	Coastal Regional Commission	Miami, FL	207	100%
1%	River Valley	New Orleans, LA	204	100%
1%	Northwest Georgia	Huntsville, AL	199	100%
1%	Georgia Mountains	Columbia, SC	194	100%
1%	Southwest Georgia	Orlando, FL	185	100%
1%	Georgia Mountains	Greensboro, NC	180	100%
90%	All Others	All Others	25,053	
Total			**27,926**	

Source: Transearch 2019 data prepared by WSP USA Inc.

The strength of the food industry in Georgia coupled with its significant agricultural production mean that intra-Georgia traffic is a major component in this industry group. Table 50 shows the top O-D Georgia internal pairs in 2019. Out of a total of 12.1 million tons, cargo transported within the Atlanta Regional Commission area ranked at the top with 1.14 million tons. This represented a 9 percent share of the total. This was followed by 454 thousand tons, internally within Southwest Georgia, making up 4 percent of the total share. The top three were followed by 371 thousand tons between Southwest Georgia to Coastal Regional Commission area, at 3 percent of total share. Traffic moving into the Coastal region is largely export traffic including agricultural products and processed food moving over Georgia ports.

Table 50. Food and Agriculture Top O-D Pairs – Internal (2019)

Share	Georgia O	Georgia D	Tons (k)
9%	Atlanta Regional Commission	Atlanta Regional Commission	1,139
4%	Southwest Georgia	Southwest Georgia	454
3%	Southwest Georgia	Coastal Regional Commission	371
3%	Georgia Mountains	Georgia Mountains	314
2%	Coastal Regional Commission	Coastal Regional Commission	301
2%	Georgia Mountains	Atlanta Regional Commission	266
2%	Southern Georgia	Coastal Regional Commission	219
2%	Southwest Georgia	Atlanta Regional Commission	213
2%	Northeast Georgia	Atlanta Regional Commission	204
2%	Northwest Georgia	Atlanta Regional Commission	200
2%	Southwest Georgia	Southern Georgia	198
1%	River Valley	Southwest Georgia	184
1%	Southern Georgia	Southern Georgia	182
65%	All Others	All Others	7,924
Total			**12,169**

Source: Transearch 2019 data prepared by WSP USA Inc.

Among the counties in Georgia, Chatham County (home to the Port of Savannah) had the highest amount of inbound, outbound and within food and agriculture tonnage at 7.9 million tons, or 10 percent of all tonnage. Chatham was followed by Fulton County (6.5 million tons, or 8 percent) and Hall County (6.5 million tons, or 8 percent). The top five counties accounted for only 32 percent of total food and agriculture tonnage in the state, suggesting that the commodity flows are widely distributed across the state.

The majority of Chatham County's tonnage was food and kindred products (6.2 million tons). The same was true for Fulton County (5.7 million tons of food and kindred products) and Hall County (4 million tons of food and kindred products). However, Hall County also had a significant tonnage of farm products (2.4 million tons).

2.5.2. Manufacturing

The manufacturing sector in Georgia is home to a diverse range of industries, including lumber, automotive, home furnishings, scrap materials, chemicals, and many more.

Table 51 shows the inbound manufacturing tonnage by origin state and mode in 2019. Out of the total of 45 million tons of manufacturing traffic in 2019, 31 million tons were transported by truck and 14 million tons by rail. A minimal amount was transported by water and air. The more notable inbound cargo included the following:

- **Truck:** Approximately 10 million tons of lumber, 4 million tons of scrap materials, and 3 million tons of chemicals.

- **Rail:** Approximately 5 million tons of miscellaneous mixed shipments, 4 million tons of chemicals, and 3 million tons of pulp, paper, and related products.

The carpet and flooring industries are a significant share of Georgia's manufacturing sector. This industry group is dependent on component chemicals. Similar to the agricultural industry, the lumber, paper and related products involve traffic moving back and forth across state lines throughout the region.

Alabama ranked at the top of supplier states with 7 million tons, followed by South Carolina with nearly 5 million tons, and North Carolina with 4 million tons, rounding out the top three. The largest cargo flow from Alabama was lumber and wood products by truck (2 million tons), followed by pulp and paper (nearly 800,000 tons) and waste or scrap materials (584,927 tons).

Similarly, the largest cargo flow from South Carolina was lumber and wood products by truck (1.7 million tons), followed by chemicals (1 million tons) and waste or scrap materials (786,986 tons). The largest cargo flow from North Carolina was lumber or wood products by truck (close to 2 million tons).

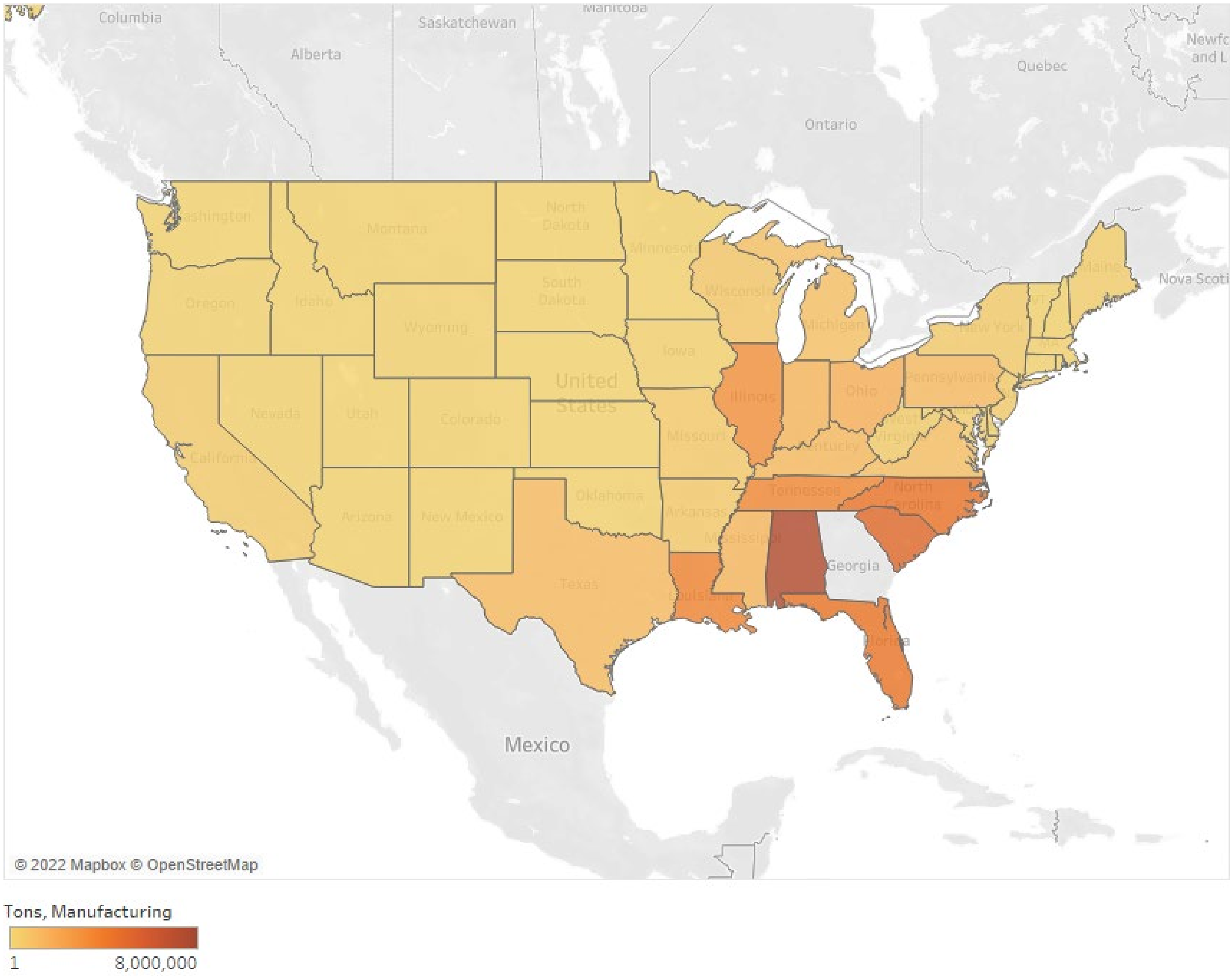
Figure 30 presents a map of the manufacturing inbound tonnage by origin state in 2019. This map clearly reflects the regional nature of the inbound traffic to Georgia. The lumber and related industries are based on the forestry in rural areas of all these states and similar to agriculture it indicates heavy reliance on rural infrastructure in less populated areas of the region.

Table 51. Manufacturing Inbound Tonnage by Origin State and Mode (2019) (Thousands of Tons)

	Truck	Rail	Water	Air	Total
AL	5,394	1,848		<1	7,243
SC	4,148	776	1	<1	4,916
NC	3,542	692		3	4,237
FL	3,202	925		9	4,136
LA	659	2,754	60	<1	3,473
TN	2,661	679		5	3,346
IL	458	2,496		5	2,959
OH	1,021	527		2	1,550
IN	895	420		1	1,316
MS	976	259		<1	1,235
All Others	8,148	2,521		86	10,755
Total	**31,104**	**13,887**	**252**	**111**	**45,354**

Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 30. Manufacturing Inbound Tonnage by Origin State (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Georgia is a primary source of manufactured products to the nation and the world. The outbound traffic utilizes all components of Georgia's robust transportation system. Truck, intermodal rail and water born products moving over Georgia ports. Regional distribution is important in the manufacturing sector and results in the significance of truck transportation as a primary mode.

Table 52 shows manufacturing outbound tonnage flow by destination state and mode in 2019. In total, manufacturing outbound tonnage by truck had the highest tonnage compared to other modes at 52 million tons. There was significantly more outbound manufacturing cargo than inbound manufacturing cargo in 2019, which is a positive sign for the state economy as it shows that the state is producing more than it consumes. This results in higher job generation, increased wages, and higher revenues for state and local governments.

Some of the more notable manufacturing outbound tonnage flows include:

- **Truck:** Lumber led all commodity groups with 14 million tons in 2019, followed by waste or scrap materials (7 million tons). The chemicals and transportation equipment commodity groups had similar outbound cargo tonnage at slightly less than 4 million tons.

- **Rail:** Miscellaneous mixed shipments led all commodity groups with 6 million tons in 2019, followed by pulp and paper (3 million tons) and chemicals (just more than 1 million tons).

Figure 31 depicts the map for state destinations for manufacturing outbound tonnage. The top three destination states were Florida at 8 million tons, Alabama at 7 million tons, and North Carolina at 6 million tons. The largest commodity flow to these states was lumber by truck; Florida had 3 million tons, Alabama also had 3 million tons and North Carolina had 1.8 million tons of lumber by truck. Just as the inbound traffic discussed above the largest markets for Georgia's manufacturing output are regional. This emphasizes the need for regional connectivity, not only on the major highways but on state and rural roads as well.

The data also shows significant automotive[24] outbound flows to Florida (660 thousand tons), Alabama (424 thousand tons), North Carolina (352 thousand tons), and South Carolina (261 thousand tons) as well as inbound flows to Alabama (655 thousand tons), South Carolina (369 thousand tons), Michigan (281 thousand tons) and Tennessee (273 thousand tons).

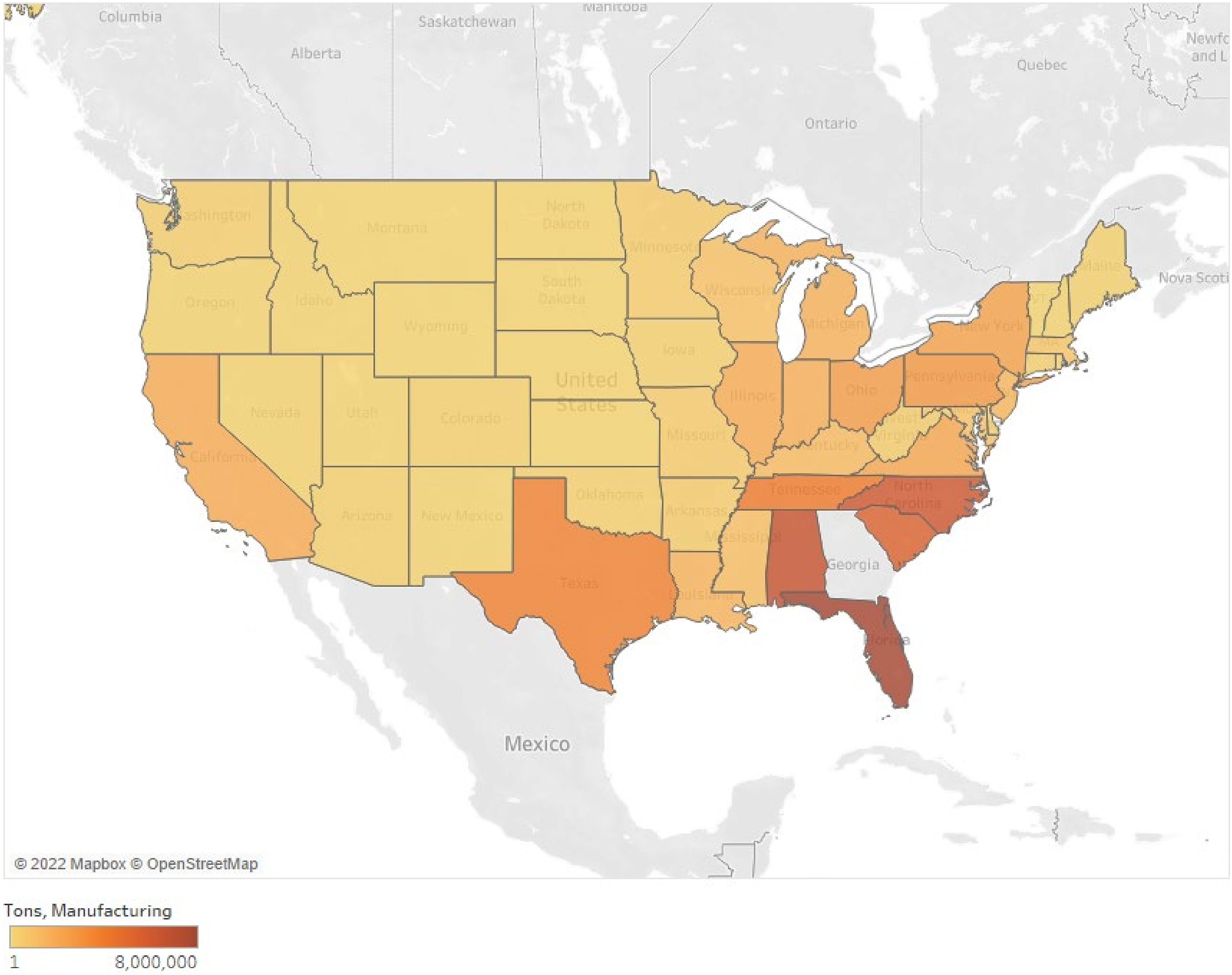
Table 52. Manufacturing Outbound Tonnage by Destination State and Mode (2019) (Thousands of Tons)

	Truck	Rail	Water	Air	Total
FL	7,302	560	2	6	7,869
AL	4,823	1,639		<1	6,461
NC	5,548	481		2	6,031
SC	4,647	700		<1	5,348
TN	3,433	499		3	3,935
TX	3,081	565		10	3,656
PA	2,125	539		3	2,667
OH	1,922	518		2	2,442
NY	2,041	166		3	2,210
VA	1,547	443		1	1,991
All Others	15,941	4,542		66	2,210
Total	**52,410**	**10,652**	**2**	**96**	**63,160**

Source: Transearch 2019 data prepared by WSP USA Inc.

[24] The analysis used STCCs 3711, 3712, 3713, 3714 and 2441 for the automotive

Figure 31. Manufacturing Outbound Tonnage by Destination State (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Table 53 shows the top inbound lanes for the manufacturing sector in 2019 with a total of 45 million tons. The lane from Chicago to the Atlanta region had the highest tonnage. The second highest tonnage pair was from New Orleans, LA, to Atlanta region with 821 thousand tons representing 2 percent share, and 10 percent transported by truck; around 618 thousand tons was chemicals while another 150 thousand tons was comprised of transport equipment. These materials were destined to Atlanta to support other distribution and manufacturing. The chemicals are particularly important to the carpet and flooring industries.

Lumber and related goods from Alabama to the Atlanta region was third highest in share. The remainder inbound lanes represented 1 percent or less of the total tonnage share.

A share of the products inbound to Georgia include goods moving to Georgia ports from other parts of the country shown in the tables as inbound to the Coastal region,

Overall, the Atlanta market dominates as the destination for inbound manufactured products.

Table 53. Manufacturing Top O-D Pairs – Inbound (2019)

Share	External O	Georgia D	Tons (k)	% Truck
3%	Chicago, IL	Atlanta Regional Commission	1,428	13%
2%	New Orleans, LA	Atlanta Regional Commission	821	10%
2%	Birmingham, AL	Atlanta Regional Commission	690	72%
1%	Jacksonville, FL	Coastal Regional Commission	575	85%
1%	Tallahassee, FL	Coastal Regional Commission	524	32%
1%	Nashville, TN	Atlanta Regional Commission	524	99%
1%	Birmingham, AL	Coastal Regional Commission	502	33%
1%	Charlotte, NC	Atlanta Regional Commission	426	72%
1%	New Orleans, LA	Northwest Georgia	422	4%
1%	Wilmington, NC	Coastal Regional Commission	419	36%
1%	Greensboro, NC	Coastal Regional Commission	405	100%
1%	Chicago, IL	Central Savannah River Area	392	3%
1%	Mobile, AL	Atlanta Regional Commission	391	72%
83%	All Others	All Others	37,835	
Total			**45,354**	

Source: Transearch 2019 data prepared by WSP USA Inc.

Table 54 shows the top outbound lanes for the manufacturing sector in 2019. The highest tonnage lane was from the Atlanta Regional Commission to Birmingham, AL. Much of this tonnage was waste or scrap materials (416 thousand tons) moving by truck.

The Coastal Regional Commission to New York, NY, ranked number two with 877 thousand tons. The biggest component of this trade was pulp, paper, and related products (263 thousand tons). Cargo originating from the Coastal Regional Commission includes imports from foreign trade. The Coastal Regional Commission generated 1.4 million tons of automotive outbound cargo in 2019, with Florida being the top destination at 327 thousand tons.

Ranked third was Atlanta Regional Commission to Chicago, IL, with 831 thousand tons, of which 44 percent was transported by truck. A large part of this trade was either waste and scrap materials (264 thousand tons) or pulp, paper, and related products (193 thousand tons).

Georgia ports play a significant role in international trade particularly as many companies are choosing to use east coast ports as a replacement or in addition to the ports in the west. Diverting cargo is seen as a safeguard against disruption, providing shippers some redundancy in their network from abroad. The outbound traffic from the Coastal Regional Commission is reflective of this trend.

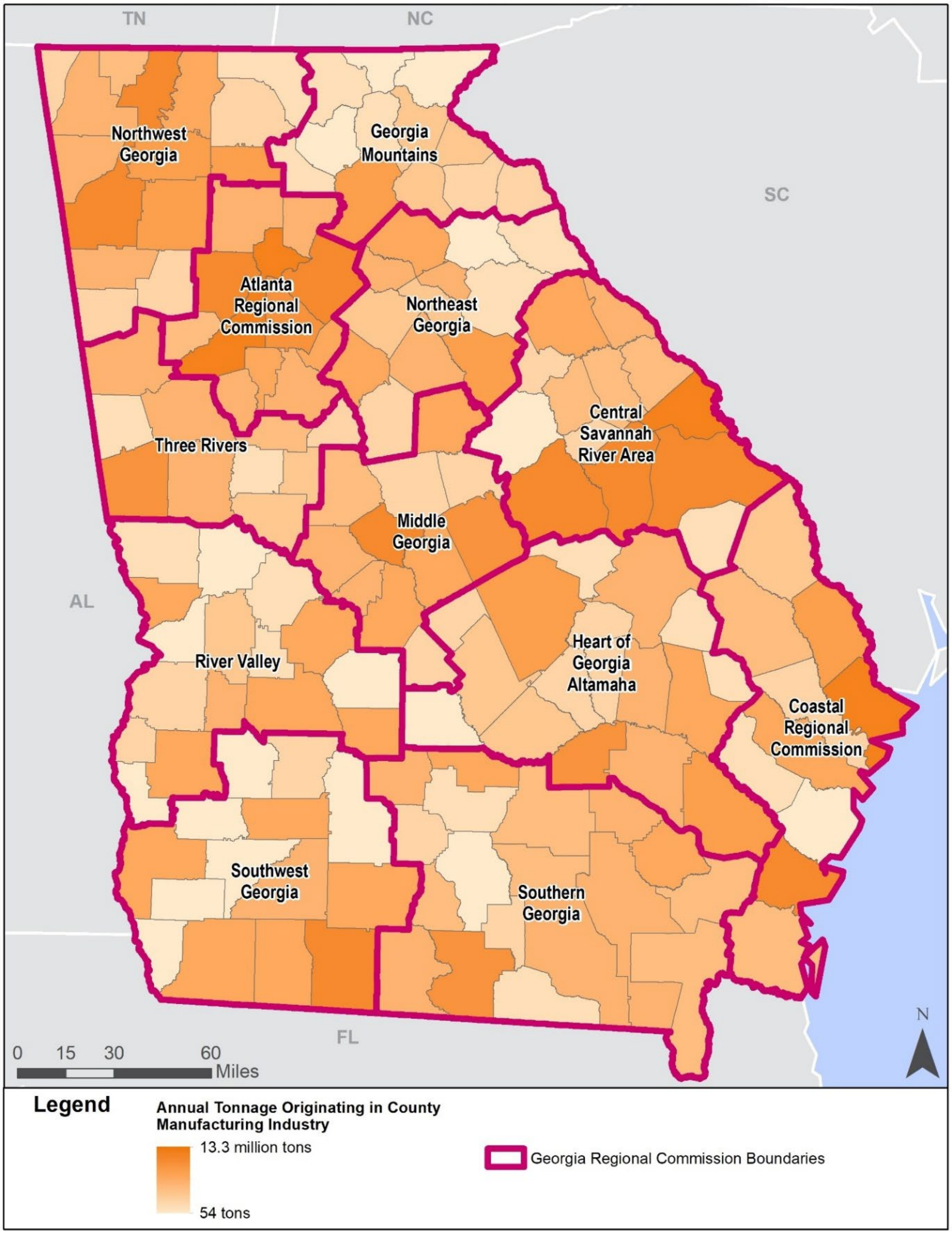
Table 54. Manufacturing Top O-D Pairs – Outbound (2019)

Share	Georgia O	External D	Tons (k)	% Truck
2%	Atlanta Regional Commission	Birmingham, AL	1,253	49%
1%	Coastal Regional Commission	New York, NY	877	97%
1%	Atlanta Regional Commission	Chicago, IL	831	44%
1%	Coastal Regional Commission	Orlando, FL	643	99%
1%	Coastal Regional Commission	Miami, FL	580	98%
1%	Atlanta Regional Commission	New York, NY	573	77%
1%	Central Savannah River Area	Charlotte, NC	498	72%
1%	Coastal Regional Commission	Charlotte, NC	473	86%
1%	Coastal Regional Commission	Columbia, SC	447	84%
1%	Atlanta Regional Commission	Dallas, TX	435	72%
1%	Central Savannah River Area	Greensboro, NC	433	83%
1%	Atlanta Regional Commission	Los Angeles, CA	432	35%
1%	Coastal Regional Commission	Jacksonville, FL	428	91%
87%	All Others	All Others	55,259	
Total			**63,162**	

Source: Transearch 2019 data prepared by WSP USA Inc.

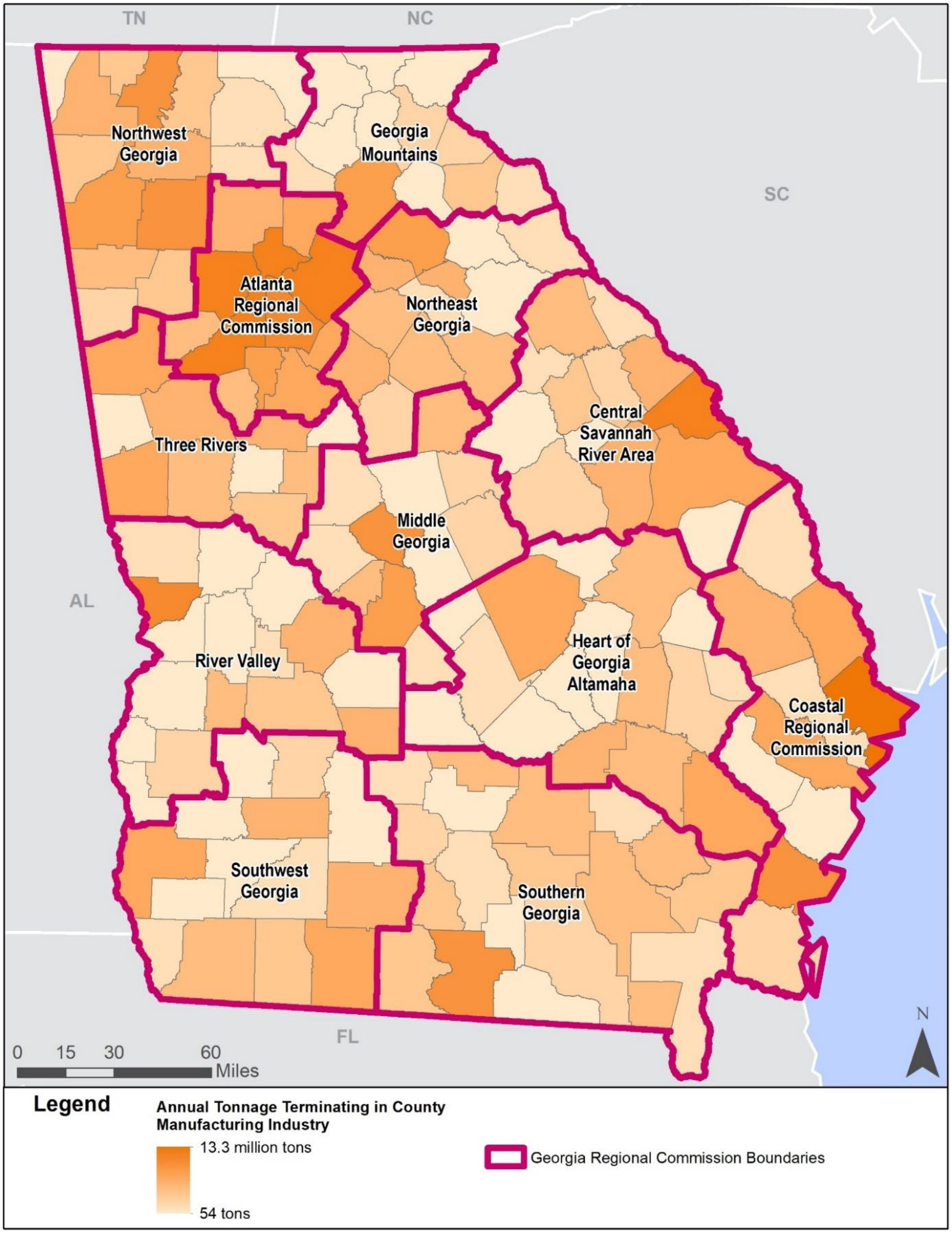
Figure 32 shows the geographic distribution of manufacturing-based product outbound from Georgia. This map shows a wider distribution of originating traffic across the state than the inbound map in Figure 33. These locations are making heavier use of secondary roads as well as the Interstate highways.

Figure 32. Manufacturing Top Origin Counties for Tonnage (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 33. Manufacturing Top Destination Counties for Tonnage (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

In addition to the goods inbound and outbound from Georgia, a considerable amount of traffic occurs within the state moving to and from the various Regional Commission areas. Most of this traffic moves by truck although there are rail connections to and from the Georgia ports. Intraregional movements reflect shipments supporting regional production. It would also include the movement of goods to and from intermodal terminals and port locations by truck to regional warehouse and production facilities.

Table 55 presents the top manufacturing lanes within Georgia in 2019 with a total tonnage of 21 million tons. Traffic within the Atlanta Regional Commission, consisting of 4 million tons and 19 percent of the total tonnage, was the highest tonnage. This concentration of freight in the state's largest population center highlights the potential interaction of freight and personal vehicles and the impact of traffic congestion on industrial transit. Traffic within the Coastal Regional Commission ranked number two. Central Savannah River Area to Coastal Regional Commission was number 3. Coastal traffic includes goods moving to and from manufacturers to the ports.

Table 55. Manufacturing Top O-D Pairs – Internal (2019)

Share	Georgia O	Georgia D	Tons (k)	% Truck
19%	Atlanta Regional Commission	Atlanta Regional Commission	3,852	100%
6%	Coastal Regional Commission	Coastal Regional Commission	1,321	100%
5%	Central Savannah River Area	Coastal Regional Commission	1,111	100%
4%	Middle Georgia	Coastal Regional Commission	816	100%
3%	Atlanta Regional Commission	Northwest Georgia	694	100%
3%	Atlanta Regional Commission	Northeast Georgia	601	100%
3%	Northwest Georgia	Northwest Georgia	598	100%
3%	Central Savannah River Area	Central Savannah River Area	579	100%
3%	Northwest Georgia	Atlanta Regional Commission	553	100%
2%	Coastal Regional Commission	Atlanta Regional Commission	456	100%
2%	Heart of Georgia Altamaha	Coastal Regional Commission	451	100%
2%	Northeast Georgia	Atlanta Regional Commission	431	100%
2%	Atlanta Regional Commission	Georgia Mountains	367	100%
43%	All Others	All Others	8,852	
Total			**20,682**	

Source: Transearch 2019 data prepared by WSP USA Inc.

Among the counties in Georgia, Chatham County had the highest tonnage of inbound, outbound and within manufacturing tonnage at 21 million tons, or 16 percent of all tonnage. Chatham was followed by Fulton County (11 million tons, or 9 percent) and Richmond County (6.6 million tons, or 5 percent). The top five counties accounted for 36 percent of total manufacturing tonnage in the state; while this represents significant concentration of activity, the majority of traffic nevertheless is elsewhere, with relatively wide distribution across the state.

The largest share of Chatham County's tonnage was pulp, paper or allied products (5.5 million tons) followed by chemicals (2.7 million tons) and lumber or wood products (2.3 million tons). For Fulton County, the highest transported manufacturing commodity by tonnage was chemicals or allied products (1.9 million tons) followed by lumber or wood products (1.4 million tons). For Richmond County, the most heavily transported commodity by tonnage was chemicals or allied products (2.2 million tons) followed by clay, concrete, glass or stone (1.9 million tons).

2.5.3. Warehousing and Distribution

Georgia, particularly the areas around the cities of Atlanta and Savannah, is one of the most significant distribution centers in the United States. This situation has developed from Georgia's proximity to other major markets and depends on its effective multimodal network. Warehousing and distribution logistics is a primary industry on its own, employs a large workforce and contributes significantly to the economy. This industry group is the necessary middleman between the producers and consumers of goods in the state, regionally and beyond.

Table 56 depicts warehouse and distribution tonnage inbound to Georgia by origin state and transportation mode in 2019. This industry group includes the movement of goods related to e-commerce business.

Inbound flow of warehouse and distribution traffic moved primarily by truck and intermodal rail, with negligible air and water transport. Tennessee was the state with the highest tonnage of cargo headed for Georgia, followed by Alabama and Illinois. Of the highest tonnage in each state by mode, some of the more notable inbound commodity flows include "secondary traffic" (10 million tons) and miscellaneous mixed shipments (6 million tons). The former is defined as movement of goods between distribution centers and/or retail locations, while the latter includes e-commerce shipments of products by parcel carriers.

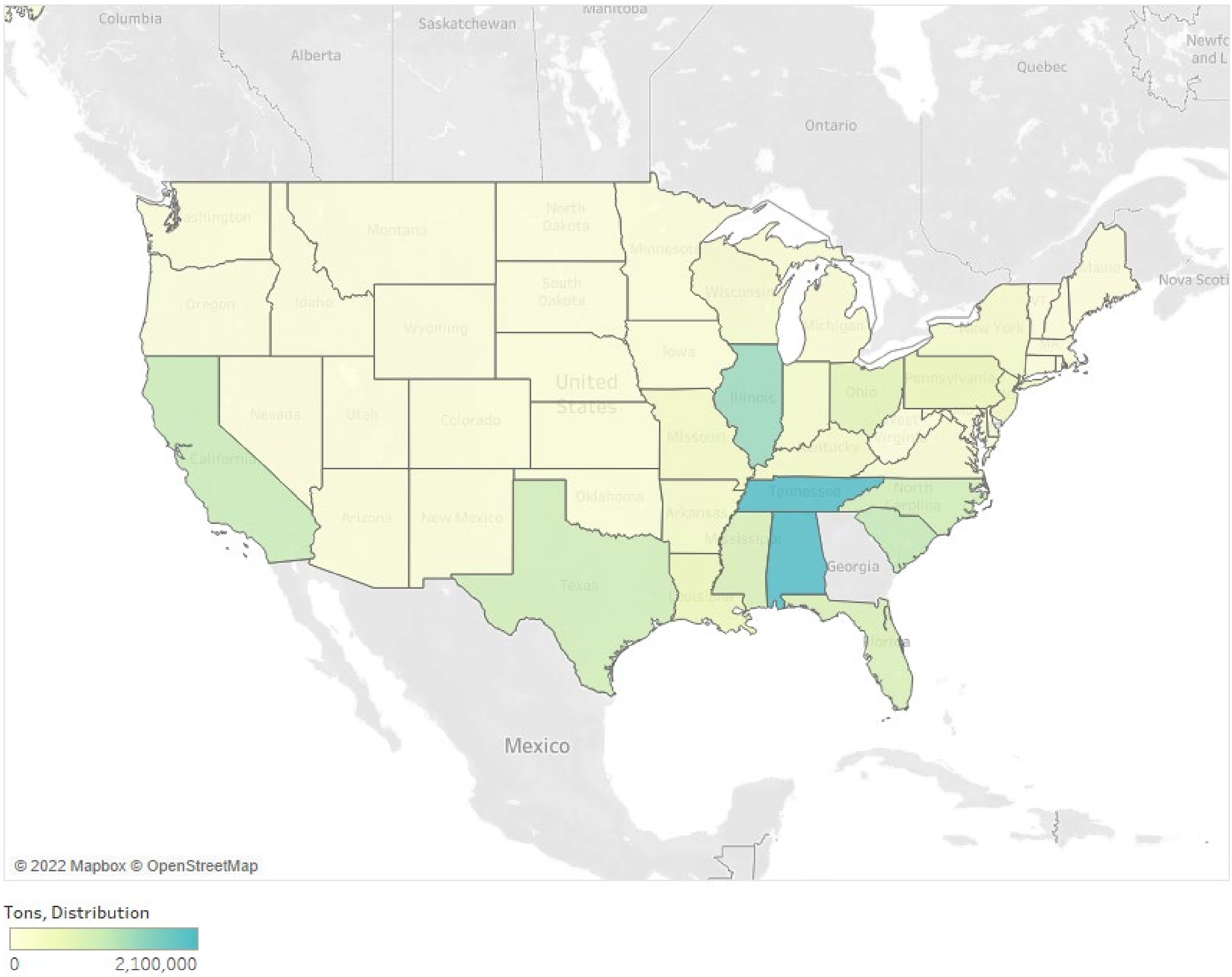
Table 56. Warehousing and Distribution Inbound Tonnage by Origin State and Mode (2019) (Thousands of Tons)

	Truck	Rail	Water	Air	Total
TN	890	1,190		4	2,084
AL	1,251	830		<1	2,0881
IL	418	988		2	1,408
SC	928	138		<1	1,066
CA	92	904		8	1,004
TX	738	169		3	910
NC	799	86		2	887
MS	811			<1	811
FL	705	82		4	791
OH	549	105		<1	654
All Others	3,358	873		26	4,257
Total	**10,539**	**5,365**	**0**	**49**	**15,953**

Source: Transearch 2019 data prepared by WSP USA Inc.

The map in **Figure 34** shows the primary origin states for distribution tonnage inbound to Georgia. The states of California, Illinois, Texas, and Tennessee contain the largest rail intermodal locations in the country, all with connectivity to Georgia either by continuing rail transportation to terminals in Georgia, or by truck from terminals in those states.

Figure 34. Warehousing and Distribution Inbound Tonnage by Origin State (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Table 57 shows warehouse and distribution traffic outbound from Georgia by destination state and mode in 2019. The outbound warehouse and distribution traffic moved by truck and intermodal rail. The highest tonnage commodity group is warehousing and distribution secondary traffic at 6 million tons, and by miscellaneous mixed shipments also at 6 million tons. The former may include direct container shipments from the ports to receiving locations in other states while the latter may include shipments from e-commerce companies to consumers and businesses outside the state. Rail intermodal drayage traffic by itself accounted for 844 thousand tons.

Florida had the highest tonnage of warehousing and distribution tonnage inbound from Georgia, followed by Tennessee, Alabama and North Carolina. The network patterns suggest that distribution cargo is principally regional, with imports from Savannah and other Georgia locations being redistributed to warehouses and businesses in Florida and North Carolina. There are shipments going further outside the region which may be e-commerce, processed food or other products being sent from distribution centers in Georgia to customers in those states. The rail facilities in the state allow for extensive intermodal traffic over longer distances and these rail volumes include containerized traffic.

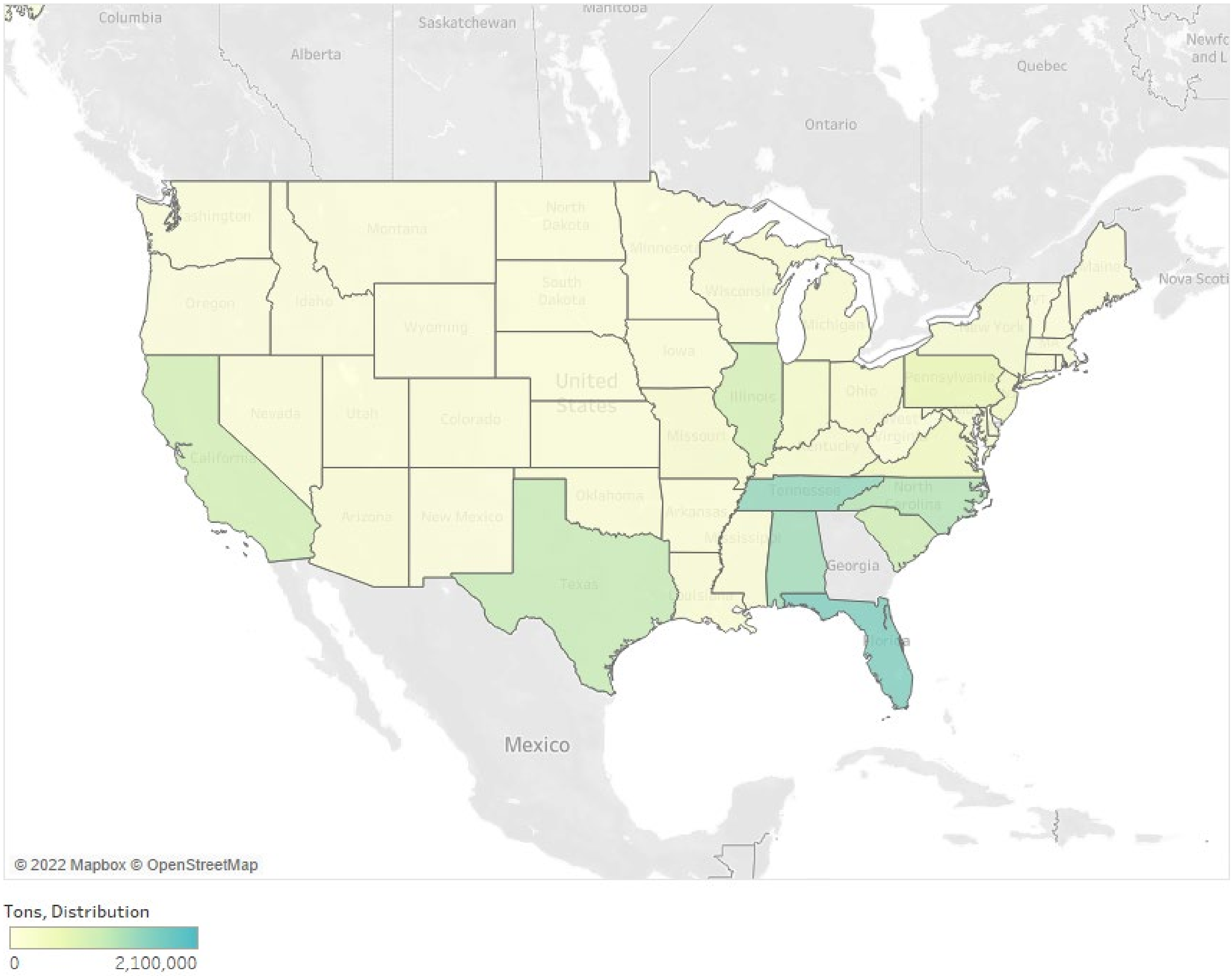
Table 57. Warehousing and Distribution Outbound Tonnage by Destination State and Mode (2019) (Thousands of Tons)

	Truck	Rail	Water	Air	Total
FL	1,114	491		8	1,613
TN	465	981		2	1,448
AL	445	880		<1	1,325
NC	955	207		2	1,164
TX	641	386		7	1,034
SC	648	253		<1	901
CA	36	820		5	861
IL	112	726		2	840
PA	195	347		2	544
VA	345			<1	345
All Others	2,144	480		26	2,650
Total	**7,100**	**5,571**	**0**	**54**	**12,725**

Source: Transearch 2019 data prepared by WSP USA Inc.

The map in **Figure 35** shows the outbound tonnage by destination state in 2019. Again, this includes Tennessee, Illinois, Texas, and California, major intermodal connection points across the country. The other significant destinations, including Tennessee, are regional with truck as the primary mode.

Figure 35. Warehousing and Distribution Outbound Tonnage by Destination State (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Table 58 shows the warehousing and distribution traffic lanes using the regional commission definitions in the state. The largest tonnage lane was Chicago, IL to Atlanta Regional Commission. Most of this tonnage (922 thousand tons) was miscellaneous mixed shipments. For some of this cargo, Atlanta serves as a distribution hub for further transportation to other destinations.

The second ranked O-D pair was Birmingham, AL, to the Atlanta Regional Commission with 942 thousand tons, of which 739 thousand tons was miscellaneous mixed shipments. Rounding out the top three was Los Angeles, CA, to Atlanta Regional Commission with 783 thousand tons, of which 723 thousand tons was miscellaneous mixed shipments. The Coastal Regional Commission includes the Port of Savannah; thus, it is likely that a portion of the cargo represented exports.

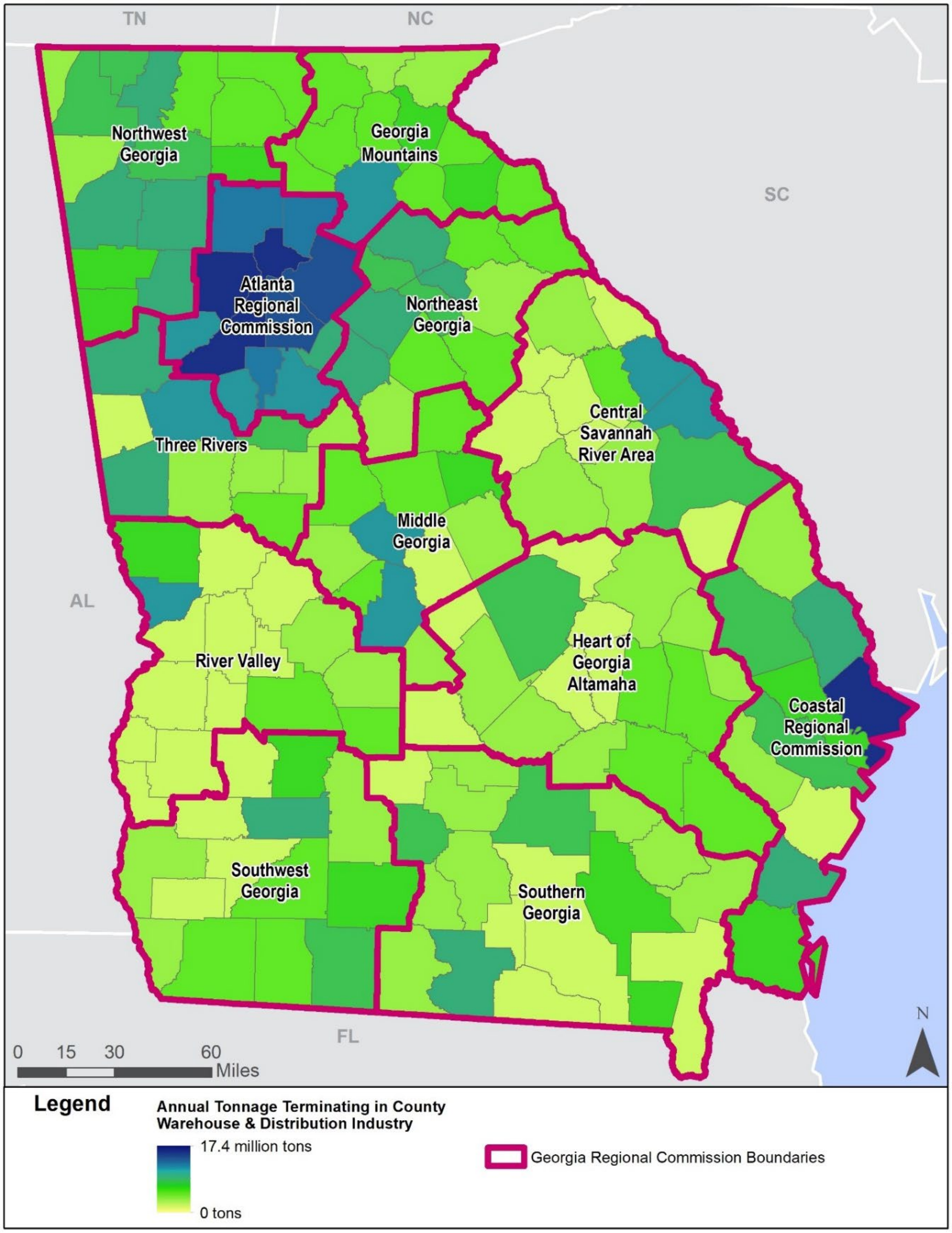
Table 58. Warehousing and Distribution Top O-D Pairs – Inbound (2019)

Share	External O	Georgia D	Tons (k)	% Truck
7%	Chicago, IL	Atlanta Regional Commission	1,107	17%
6%	Birmingham, AL	Atlanta Regional Commission	942	21%
5%	Los Angeles, CA	Atlanta Regional Commission	783	4%
4%	Memphis, TN	Coastal Regional Commission	703	3%
3%	Memphis, TN	Atlanta Regional Commission	474	40%
3%	New York, NY	Atlanta Regional Commission	415	53%
2%	Charlotte, NC	Atlanta Regional Commission	305	94%
2%	Dallas, TX	Atlanta Regional Commission	277	46%
2%	Jackson, MS	Atlanta Regional Commission	267	100%
2%	Nashville, TN	Coastal Regional Commission	246	7%
1%	Shreveport, LA	Atlanta Regional Commission	235	2%
1%	Charleston, SC	Atlanta Regional Commission	228	41%
1%	Mobile, AL	Atlanta Regional Commission	222	100%
61%	All Others	All Others	9,749	
Total			**15,953**	

Source: Transearch 2019 data prepared by WSP USA Inc.

The map in Figure 36 showing the top destination areas of Georgia by regional commission clearly shows the importance of Atlanta and Savannah in this market segment.

Figure 36. Warehousing and Distribution Top Destination Counties for Tonnage (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Table 59 shows the warehousing and distribution's top outbound lanes in 2019 along with the percent transported via truck, totaling 13 million tons. The top ranked lane was from the Atlanta Regional Commission to Birmingham, AL, the second ranked lane was from Atlanta Regional Commission to Chicago, IL. Rounding out the top three was traffic from Atlanta Regional Commission to Los Angeles, CA with 691 thousand tons. Atlanta serves as the distribution point for many goods in the state and the outbound tonnages reflect that. The outbound traffic from the Coastal Regional Commission includes import traffic coming from the ports.

Table 59. Warehousing and Distribution Top Origin Destination Pairs – Outbound (2019)

Share	Georgia O	External D	Tons (k)	% Truck
7%	Atlanta Regional Commission	Birmingham, AL	832	13%
6%	Atlanta Regional Commission	Chicago, IL	717	6%
5%	Atlanta Regional Commission	Los Angeles, CA	691	1%
5%	Atlanta Regional Commission	Dallas, TX	590	37%
4%	Coastal Regional Commission	Nashville, TN	481	3%
3%	Coastal Regional Commission	Memphis, TN	410	1%
3%	Atlanta Regional Commission	New York, NY	374	42%
3%	Atlanta Regional Commission	Harrisburg, PA	344	6%
2%	Atlanta Regional Commission	Charleston, SC	289	17%
2%	Atlanta Regional Commission	Charlotte, NC	280	100%
2%	Atlanta Regional Commission	Jacksonville, FL	264	16%
2%	Atlanta Regional Commission	Orlando, FL	257	41%
2%	Atlanta Regional Commission	Miami, FL	241	78%
55%	All Others	All Others	6,955	
Total			**12,725**	

Source: Transearch 2019 data prepared by WSP USA Inc.

Table 60 shows the warehousing and distribution's top internal O-D pairs totaling 25.1 million tons. With 59 percent share and 14.7 million tons, the top ranked internal O-D pair was within Atlanta Regional Commission, reflecting shipments from Atlanta's many distribution centers to local businesses and consumers. Internal Coastal Regional Commission ranked second with 3.38 million tons at 13 percent share. Rounding out the top three was between Northwest Georgia to Atlanta Regional Commission with 512 thousand tons and 2 percent share.

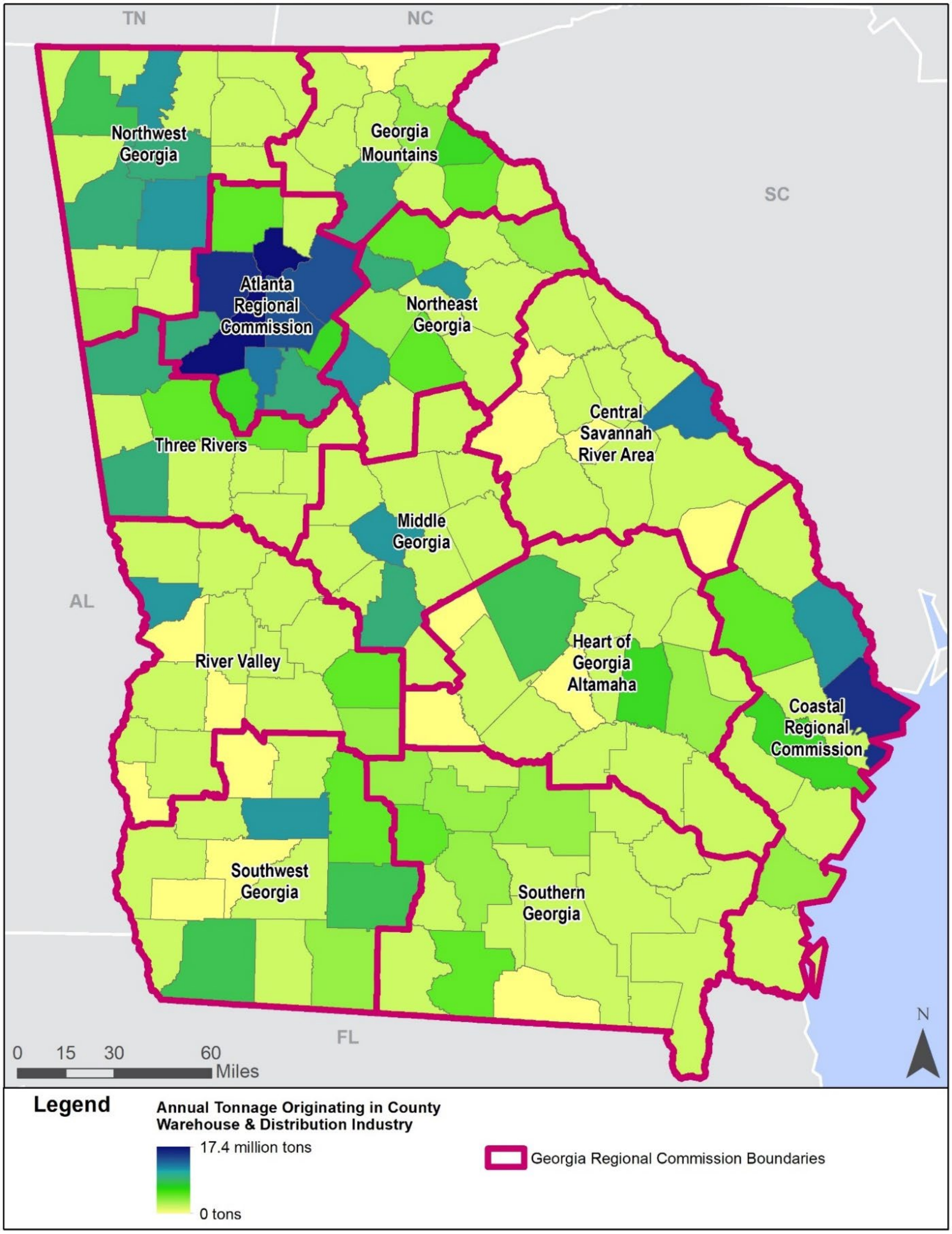
Figure 37 presents a physical representation of the data for internal tonnage in 2019.

Table 60. Warehousing and Distribution Top O-D Pairs – Internal (2019)

Share	Georgia O	Georgia D	Tons (k)
59%	Atlanta Regional Commission	Atlanta Regional Commission	14,735
13%	Coastal Regional Commission	Coastal Regional Commission	3,381
2%	Northwest Georgia	Atlanta Regional Commission	512
2%	Atlanta Regional Commission	Northwest Georgia	494
1%	Atlanta Regional Commission	Coastal Regional Commission	374
1%	Atlanta Regional Commission	Northeast Georgia	339
1%	Atlanta Regional Commission	Three Rivers	325
1%	Atlanta Regional Commission	Atlanta Regional Commission	323
1%	Atlanta Regional Commission	Middle Georgia	315
1%	Atlanta Regional Commission	Georgia Mountains	271
1%	Atlanta Regional Commission	Central Savannah River Area	266
1%	Central Savannah River Area	Atlanta Regional Commission	265
1%	Coastal Regional Commission	Atlanta Regional Commission	240
13%	All Others	All Others	3,228
Total			**25,068**

Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 37. Warehousing and Distribution Top Origin Counties for Tonnage (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Table 61 shows the top 20 origin and destination warehouse and distribution cargo in tons by county in 2019 totaled 69.1 million. Fulton County ranked at the top with 32 million tons. Rounding out the top three were Chatham and Cobb Counties, with 11.0 million and 10 million tons, respectively. Fulton, Chatham, and Cobb Counties totaled 53.8 million tons representing 77.9 percent of the total tonnage in the top 20 warehousing and distribution O+D tonnage. The remainder of the top 20 counties had less than 3.5 million tons each.

Table 61. Warehousing and Distribution Top 20 O+D Tonnage Counties (2019)

County	Origin and Designation Tonnage (Tons)
Fulton	32,482,238
Chatham	11,015,130
Cobb	10,337,768
Gwinnett	3,372,490
DeKalb	2,808,968
Clayton	1,274,085
Richmond	1,077,858
Muscogee	683,110
Bibb	665,911
Hall	628,146
Dougherty	592,596
Henry	546,476
Forsyth	540,629
Cherokee	489,846
Clarke	468,464
Bartow	467,878
Newton	440,354
Whitfield	417,348
Houston	410,773
Effingham	407,042

Source: Transearch 2019 data prepared by WSP USA Inc.

Among the counties in Georgia, Fulton County had the highest amount of inbound, outbound and within warehousing and distribution tonnage at 22 million tons, or 42 percent of all tonnage. Fulton was followed by Chatham County (7.4 million tons, or 14 percent) and Cobb County (6.4 million tons, or 12 percent). The top five counties of warehousing and distribution tonnage (including Gwinnet and DeKalb Counties) accounted for 76 percent of all tonnage in this industry group, demonstrating a high degree of concentration in metropolitan Atlanta and Savannah.

For Fulton County, the largest share of tonnage was for secondary traffic (16 million tons) followed by miscellaneous mixed shipments (6 million tons). For Chatham, the largest share of tonnage was secondary traffic (4.6 million tons) followed by miscellaneous mixed shipments (2.8 million tons). For Cobb County, secondary traffic was also the most significant commodity of warehousing and distribution tonnage (4.3 million tons).

2.5.4. Construction

Construction materials are largely heavy, bulk products that are moved short distances between areas of production and usage. As such, much of the construction cargo is short haul, either transported within the state or to and from nearby states. Much of this industry group is comprised of raw materials and finished products used in the building trades. Finished products in this category include products such as lighting and tile.

Table 62 shows over 52 million tons of construction cargo moved into the state of Georgia in 2019. Most of this cargo moved by truck (49 million tons) while a smaller tonnage moved by rail (3 million tons). The more significant inbound construction cargo flows included the following:

- **Truck:** 40 million tons of nonmetallic minerals moved into Georgia. This industry group includes gravel, sand, and other materials that are used in construction of commercial and residential structures as well as transportation infrastructure. The second highest inbound tonnage was clay, concrete, glass and stone at 5 million tons.
- **Rail:** The largest rail move was clay, concrete, glass, or stone at 2 million tons. An additional 1 million tons of nonmetallic minerals moved by rail.

The largest inbound tonnage was nonmetallic minerals by truck from Alabama (16.9 million tons), Tennessee (9 million tons) and South Carolina (just under 9 million tons).

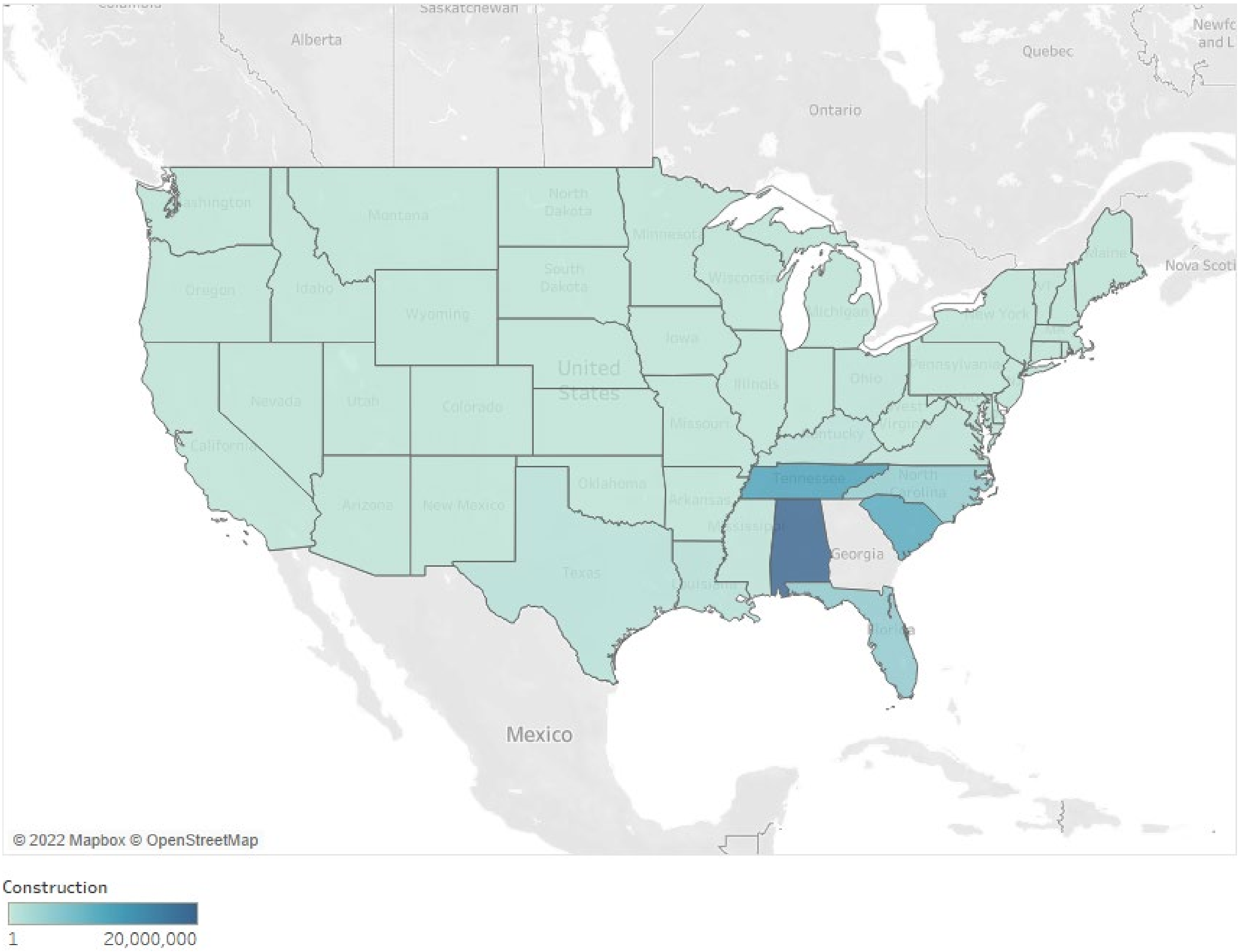
Table 62. Construction Inbound Tonnage by Origin State and Mode (2019) (Thousands of Tons)

	Truck	Rail	Water	Air	Total
AL	17,451	1,979	<1	<1	19,431
TN	10,492	390		<1	10,883
SC	9,441	157	<1		9,599
FL	3,968	378		<1	4,345
NC	3,861	26		<1	3,887
LA	732	46	23		801
TX	693	6	7	<1	706
KY	217	281		<1	498
OH	233	28		<1	261
MS	228				228
All Others	1,447	142		<1	1,589
Total	**48,763**	**3,433**	**34**	**<1**	**52,230**

Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 38 presents a map of the construction inbound tonnage for 2019 and highlights the regional nature of this freight.

Figure 38. Construction Inbound Tonnage by Origin State (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Table 63 shows over 30 million tons of construction cargo moved out of the state of Georgia in 2019. Most of this cargo moved by truck (22 million tons), although a sizeable amount also moved by rail (8 million tons). Some of the more significant outbound construction traffic included the following:

- **Truck:** Nonmetallic mineral shipments led all commodity groups at 14 million tons, followed by 5 million tons of clay, concrete, glass and stone.
- **Rail:** Nonmetallic minerals dwarfed all other outbound construction with 8 million tons moving by rail.

Florida was the primary destination state for the construction tonnage with 9 million tons, followed by South Carolina at 6 million tons and Alabama at 4 million tons. The largest single modal movement were rail shipments of nonmetallic minerals to Florida. There were also significant shipments of nonmetallic minerals to South Carolina, Alabama, and North Carolina.

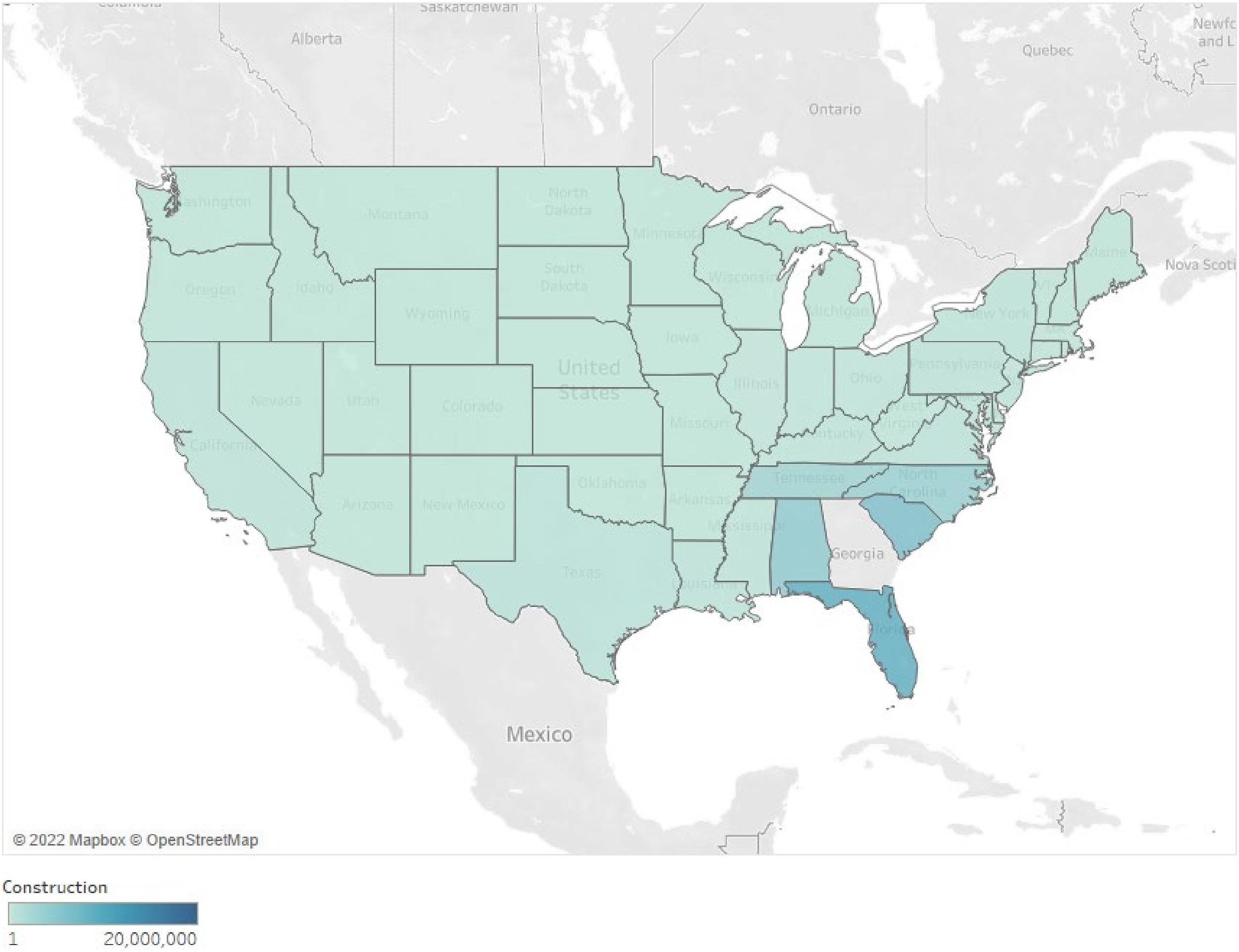
Table 63. Construction Outbound Tonnage by Destination State and Mode (2019) (Thousands of Tons)

	Truck	Rail	Water	Air	Total
FL	2,660	6,104	<1	<1	8,764
SC	4,608	1,529			6,137
AL	4,277	56		<1	4,333
NC	3,405	15	2	<1	3,422
TN	2,909	16		<1	2,925
TX	580	8		<1	589
VA	408	8		<1	416
LA	296	34		<1	330
CA	255	60		<1	315
PA	249	50		<1	298
All Others	2,466	222		<1	2,210
Total	**22,113**	**8,102**	**4**	**<1**	**30,219**

Source: Transearch 2019 data prepared by WSP USA Inc.

The map in **Figure 39** shows the regional nature of the outbound construction traffic from Georgia.

Figure 39. Construction Outbound Tonnage by Origin State (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Table 64 shows top inbound lanes for construction in 2019 along with the percent transported via truck, totaling 52.2 million tons. The highest tonnage inbound lane was from was Birmingham, AL, to the Atlanta Regional Commission Most of this cargo was nonmetallic minerals with the remaining tonnage consisting mostly of clay, concrete, glass, or stone. Chattanooga, TN, to the Atlanta Regional Commission had the second highest tonnage with 3 million tons of nonmetallic minerals. The Atlanta Regional Commission was the destination for 10 of the top 13 lanes, which combined accounted for 52 percent share of all inbound construction tonnage. This is indicative of the strong development and growth in the Atlanta area, reflecting its large population.

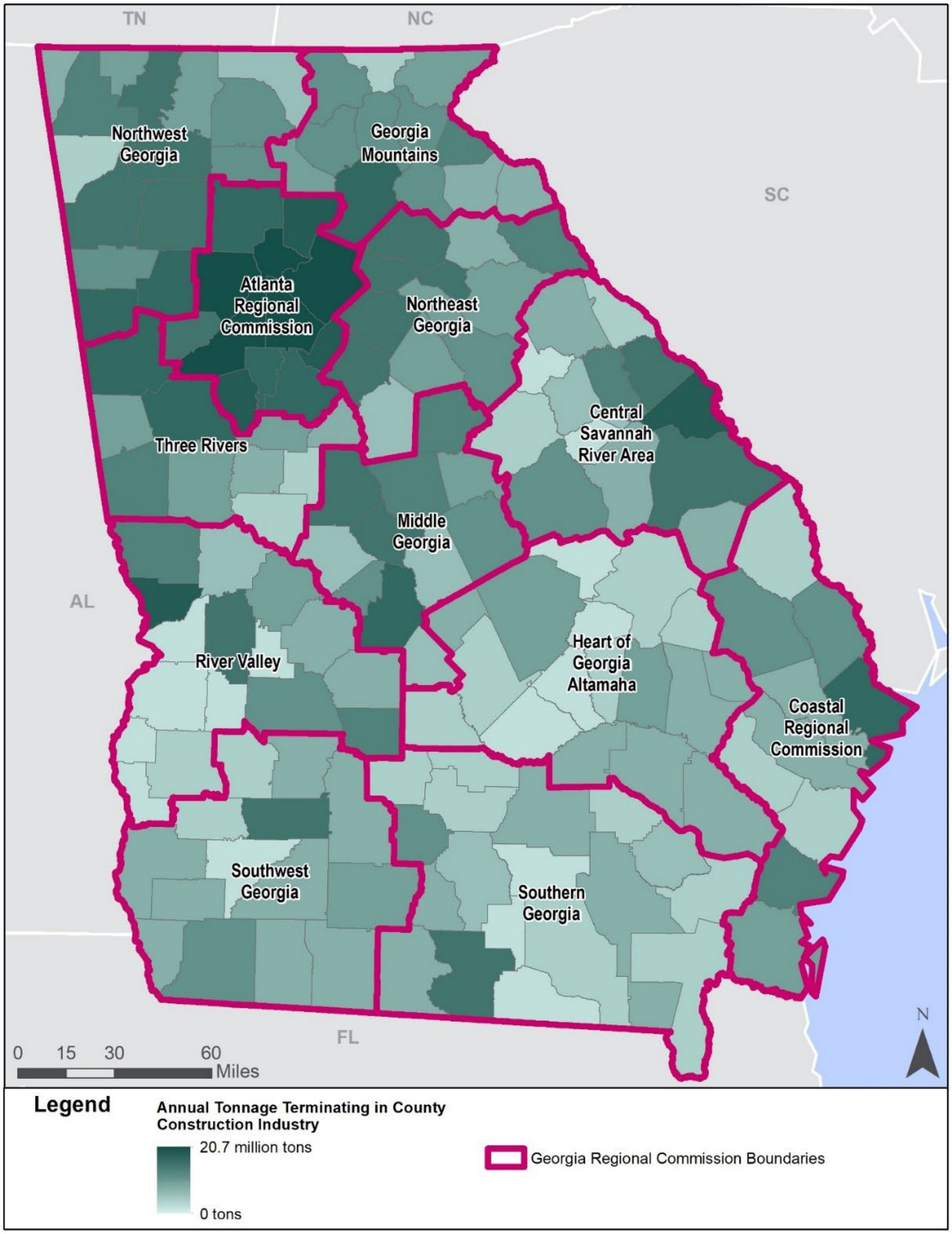
Table 64. Inbound Construction Lanes by Truck (2019)

Share	External O	Georgia D	Tons (k)	% Truck
13%	Birmingham, AL	Atlanta Regional Commission	6,681	89%
6%	Chattanooga, TN	Atlanta Regional Commission	3,134	99%
5%	Nashville, TN	Atlanta Regional Commission	2,739	100%
5%	Greenville, TN	Atlanta Regional Commission	2,620	100%
5%	Huntsville, AL	Atlanta Regional Commission	2,356	100%
3%	Columbus, GA (non-GA part)	Atlanta Regional Commission	1,496	82%
2%	Knoxville, TN	Atlanta Regional Commission	1,080	97%
2%	Atlanta, GA	Atlanta Regional Commission	998	100%
2%	Birmingham, AL	Northwest, GA	961	100%
2%	Asheville, NC	Atlanta Regional Commission	897	100%
2%	Chattanooga, TN	Northwest, GA	846	100%
1%	Birmingham, TN	Three Rivers	782	92%
1%	Columbia, SC	Atlanta Regional Commission	722	94%
52%	All Others	All Others	26,918	
Total			**52,230**	

Source: Transearch 2019 data prepared by WSP USA Inc.

The map in **Figure 40** shows the widespread geography for inbound construction materials. While the traffic is spread across the state, the highest tonnages are in the metropolitan areas led by Atlanta, with a significant amount of cargo also in the developing areas around the ports in the Coastal Regional Commission.

Figure 40. Construction Top Destination Counties for Tonnage (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Table 65 contains the top outbound lanes for construction cargo moving by truck in 2019. The highest tonnage lane was from the River Valley Commission to Orlando, FL, nearly 2 million tons. The largest share of this was nonmetallic minerals. The second ranked lane was from the Central Savannah River Area to Orlando, FL. Nearly all of this tonnage was nonmetallic minerals. The Central Savannah River Area was the main origin for four of the top 13 lanes, accounting for 69 percent of all outbound construction volume. Approximately 4.8 million tons out of the 5.2 million tons of outbound construction cargo (or 92 percent) from the Central Savannah River Area was categorized as limestone, broken stone or riprap, which may be product coming from the Martin Marrieta quarries in the region.

Table 65. Construction Top O-D Pairs – Outbound (2019)

Share	Georgia O	External D	Tons (k)	% Truck
5%	River Valley	Orlando, FL	1,662	4%
4%	Central Savannah River Area	Orlando, FL	1,157	1%
3%	Central Savannah River Area	Charleston, SC	829	7%
3%	Middle Georgia	Jacksonville, FL	783	14%
2%	Central Savannah River Area	Savannah, GA (non-GA part)	736	2%
2%	Atlanta Regional Commission	Birmingham, AL	700	97%
2%	River Valley	Jacksonville, FL	564	17%
2%	Atlanta Regional Commission	Greenville, SC	558	100%
2%	Middle Georgia	Orlando, FL	547	4%
2%	Central Savannah River Area	Jacksonville, FL	539	5%
2%	Northeast Georgia	Greenville, SC	515	100%
2%	River Valley	Tallahassee, FL	476	36%
1%	Northeast Georgia	Charlotte, NC	451	100%
69%	All Others	All Others	20,702	
Total			**30,219**	

Source: Transearch 2019 data prepared by WSP USA Inc.

Table 66 shows the intrastate lanes for construction commodities in 2019. As the largest population and industrial center, the highest tonnage traffic moves within the Atlanta Regional Commission region. The lane from Northwest Georgia to the Atlanta Regional Commission area was second. Third was from Northeast Georgia to the Atlanta Regional Commission area. These three lanes had a 50 percent share of all internal construction tonnage.

Table 66. Internal Construction Lanes (2019)

Share	Georgia O	Georgia D	Tons (k)
37%	Atlanta Regional Commission	Atlanta Regional Commission	23,139
7%	Northwest Georgia	Atlanta Regional Commission	4,514
5%	Northeast Georgia	Atlanta Regional Commission	3,238
5%	Georgia Mountains	Atlanta Regional Commission	2,890
3%	Three Rivers	Atlanta Regional Commission	2,094
3%	Middle Georgia	Atlanta Regional Commission	2,006
2%	River Valley	Atlanta Regional Commission	1,267
2%	Central Savannah River Area	Central Savannah River Area	1,148
2%	Atlanta Regional Commission	Northwest Georgia	1,047
2%	River Valley	River Valley	973
2%	Atlanta Regional Commission	Northeast Georgia	969
2%	Atlanta Regional Commission	Three Rivers	964
1%	Central Savannah River Area	Atlanta Regional Commission	928
27%	All Others	All Others	17,124
Total			**62,301**

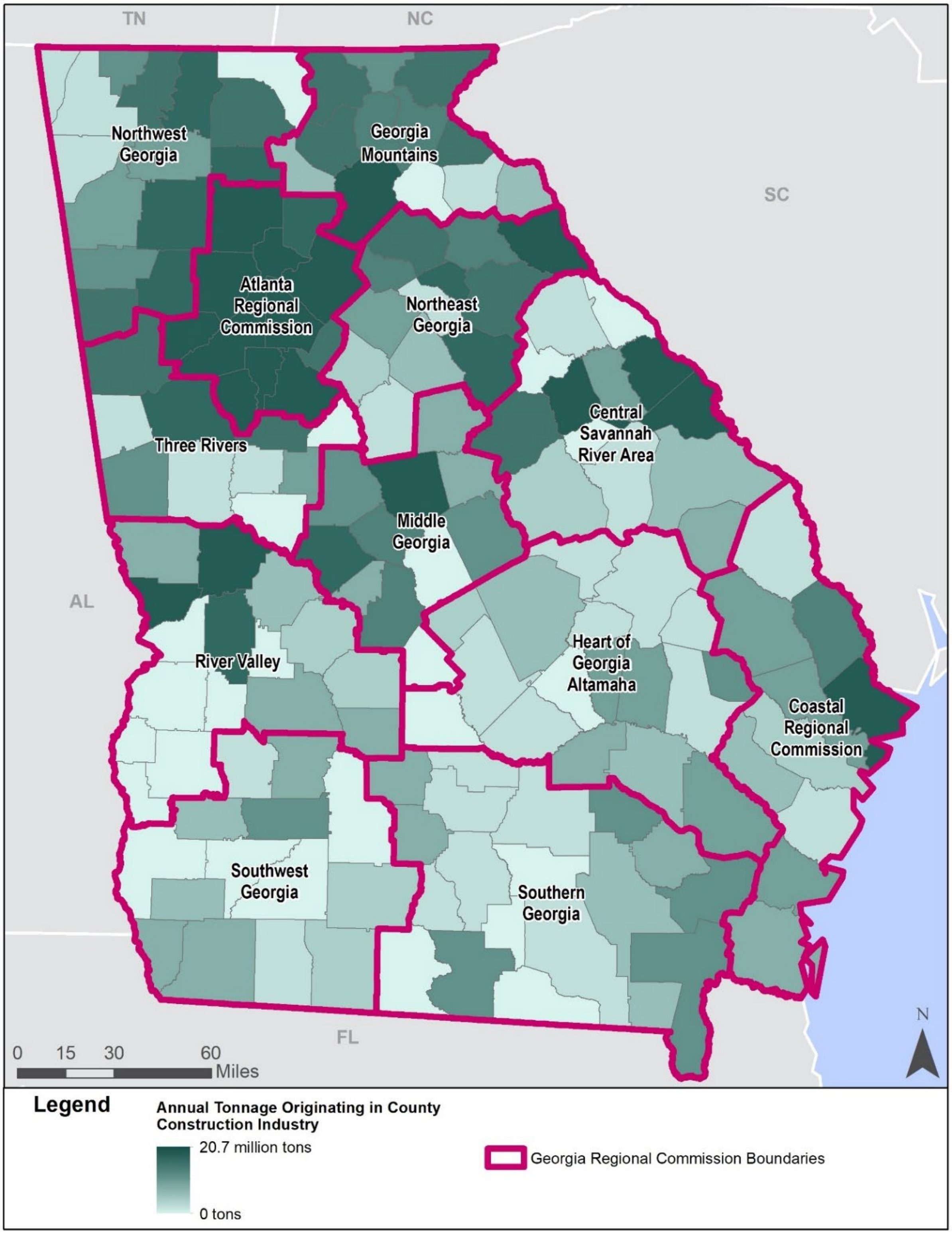
Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 41 and **Figure 42** present maps of the top origin and destination regions, respectively, in Georgia for construction tonnage within the state in 2019.

Among the counties in Georgia, Fulton County had the highest amount of inbound, outbound and within construction tonnage at 12 million tons, or 9 percent of all tonnage. Fulton was followed by Cobb County (11.9 million tons, or 8 percent) and Gwinnet County (10.5 million tons, or 7 percent). The top five counties of warehousing and distribution tonnage (including Dekalb and Muscogee Counties) accounted for 31 percent of all tonnage in this industry group, suggesting that the construction tonnage was widely distributed across the state.

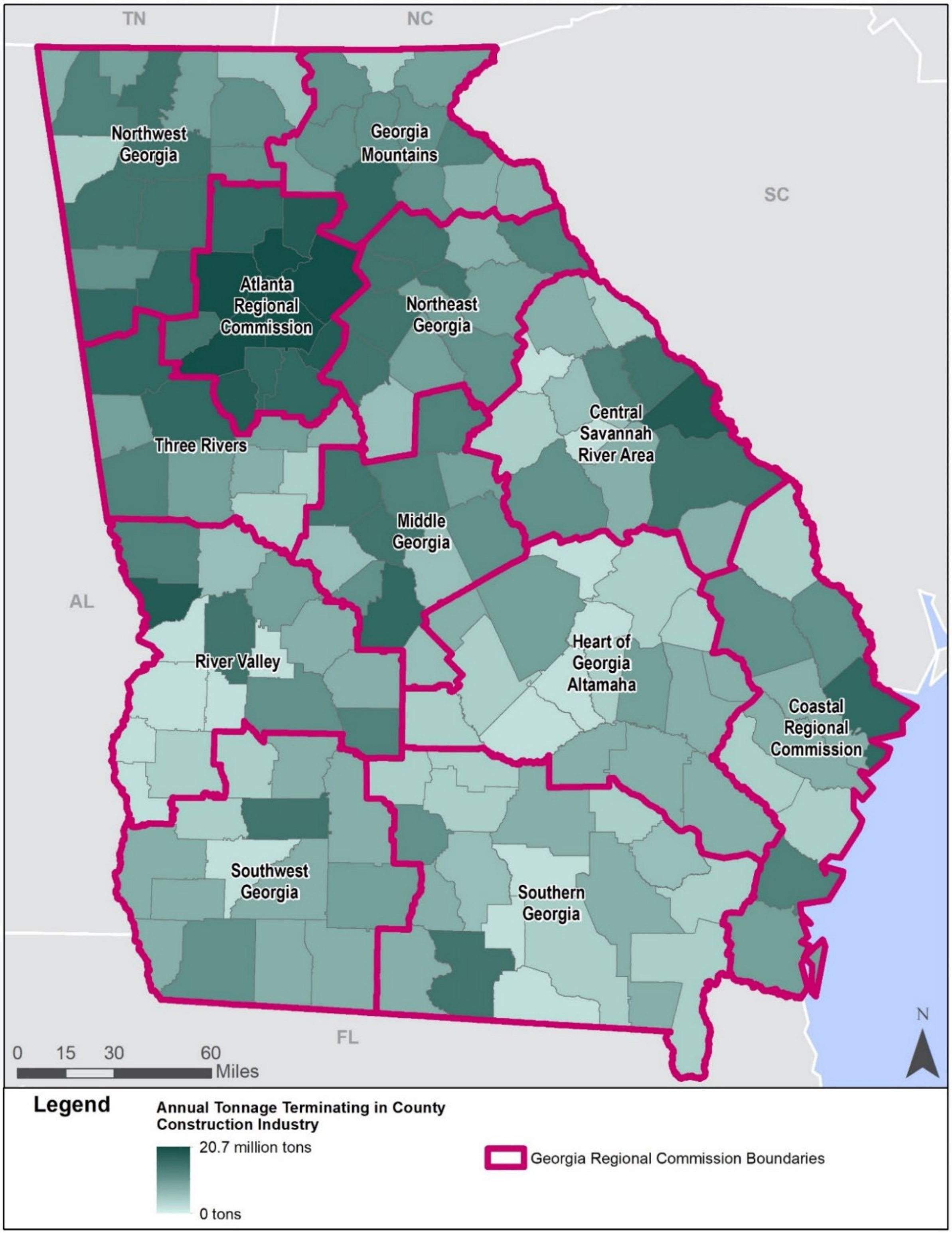
For all three counties, the highest share of construction tonnage was attributed to nonmetallic minerals, followed by clay, concrete, glass or stone. Cobb County had the highest amount of nonmetallic mineral tonnage of the three counties at 9.9 million tons, followed by Fulton County (9 million tons) and Gwinnett County (8.3 million tons).

Figure 41. Construction Top Origin Counties for Tonnage (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 42. Construction Top Destination Counties for Tonnage (2019)



2.5.5. Energy

There are two major types of energy traffic in the state of Georgia: 1) the transport of coal by rail to utilities in the state for electricity generation; and 2) the transport of fuel by truck from pipeline-supplied tank farms moving to gas stations. In the data, fuel is included in a category identified as “petroleum refining products”. In the information presented below, this commodity is referred to as fuel or liquid fuel.

Table 67 shows the inbound energy tonnage by origin state and mode in 2019. Of the total of 21 million tons of inbound energy cargo, 17 million tons were transported by rail. The inbound rail tonnage was dominated by shipments to utilities in the state (16 million tons) whereas virtually all of the inbound tonnage by truck was comprised of liquid fuel (4 million tons).

The top origin state was Tennessee with 10 million tons followed by Indiana. This tonnage moved by rail and was predominately coal. The Tennessee tonnage by rail is a valid flow but the source of the product was elsewhere, most likely rail or barge traffic transferring at a Tennessee exchange location as Tennessee is no longer a coal producing state. South Carolina ranked third in tonnage with the majority being petroleum or coal products transported by truck. Again, this commodity category includes fuel moved by truck.

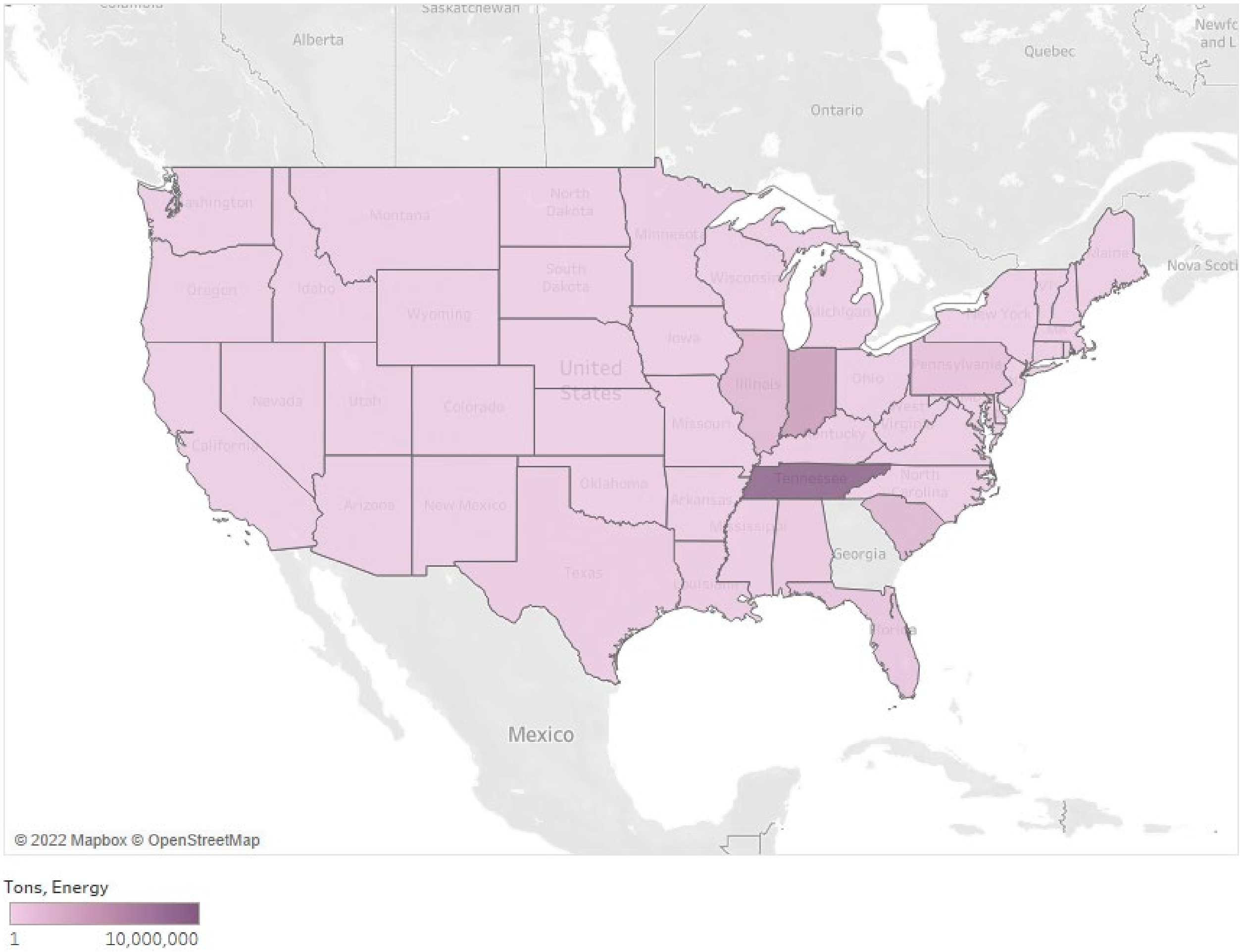
Table 67. Energy Inbound Tonnage by Origin State and Mode (2019) (Thousands of Tons)

	Truck	Rail	Water	Air	Total
TN	677	9,013		<1	9,690
IN	2	4,054		<1	4,056
SC	1,826		<1		1,826
IL	5	1,803		<1	1,808
PA	<1	898	39	<1	937
FL	772		2	<1	774
AL	312	74	6	<1	393
LA	82	152	88		322
TX	99	33	166	<1	298
KY	16	187		<1	203
All Others	28	711			739
Total	**3,819**	**16,925**	**449**	**<1**	**21,193**

Source: Transearch 2019 data prepared by WSP USA Inc

The map **Figure 43** shows the source of inbound energy tonnage by origin state. This map is dominated by Tennessee. This flow has been identified as coming from other locations outside Tennessee but moving from there to Georgia by rail.

Figure 43. Energy Inbound Tonnage by Origin State (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Table 68 shows the outbound energy tonnage by origin state and mode in 2019. Nearly all of the 5 million tons moving out of Georgia was liquid fuel.

Alabama was the number one destination with 2.8 million tons, followed by Florida with 928 thousand tons, and South Carolina was third with 863 thousand tons. Again, nearly all of this tonnage was fuel. Since Georgia does not have oil refineries, this cargo emanates from pipeline terminals and from the ports in Georgia.

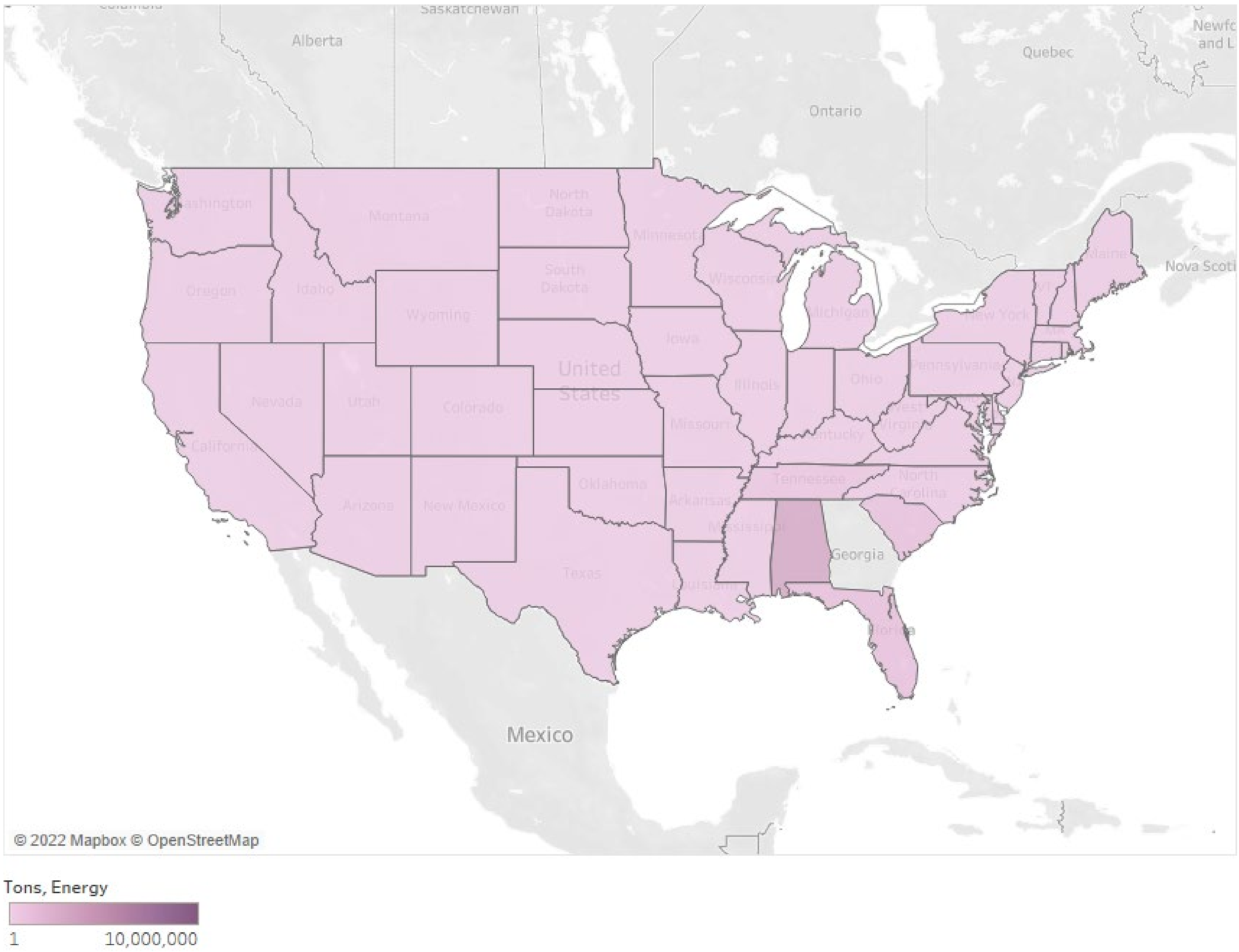
Table 68. Energy Outbound Tonnage by Destination State and Mode (2019) (Thousands of Tons)

	Truck	Rail	Water	Air	Total
AL	2,774			<1	2,774
FL	926		1	<1	928
SC	840	8	16		863
TN	548	11		<1	559
NC	89		1	<1	90
LA	<1	48		<1	48
NJ	5	3	23	<1	32
PA	6	14		<1	19
MD	4	15		<1	19
MA	2		7	<1	10
All Others	34	21			2,210
Total	**5,228**	**120**	**49**	**<1**	**5,397**

Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 44 maps the outbound tonnage by destination state, emphasizing the regional nature of this traffic.

Figure 44. Energy Outbound Tonnage by Destination State (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Table 69 shows the top inbound lanes for energy commodities in 2019, along with the percentage transported by truck. The highest tonnage lane was from Memphis, TN, to Middle Georgia with 9 million tons, nearly all of which was coal.

Second through fourth were Evansville, IN, St. Louis, MO, and Pittsburgh, PA, all to Northwest Georgia, with 3 million, 881 thousand, and 871 thousand tons, respectively. As with the cargo from Memphis, nearly all of this cargo was coal. These origin points reflect waterborne coal along the Ohio river system.

These top four O-D inbound energy lane pairs made up 64 percent of the total 21 million tons in energy cargo.

Table 69. Truck Inbound Energy to Regional Commissions (2019)

Share	External O	Georgia D	Tons (k)	% Truck
42%	Memphis, TN	Middle Georgia	8,969	0%
14%	Evansville, IN	Northwest Georgia	3,008	0%
4%	St. Louis, MO	Northwest Georgia	881	0%
4%	Pittsburg, PA	Northwest Georgia	871	0%
4%	St. Louis, MO	Three Rivers	749	0%
3%	Evansville, IN	Three Rivers	581	0%
2%	Indianapolis, IN	Northwest Georgia	447	0%
2%	Greenville, SC	Atlanta Regional Commission	407	100%
2%	Jacksonville, FL	Coastal Regional Commission	392	100%
1%	Greenville, SC	Georgia Mountains	311	100%
1%	Chattanooga, TN	Northwest Georgia	296	100%
1%	Jacksonville, FL	Southern Georgia	286	100%
1%	Chattanooga, TN	Atlanta Regional Commission	282	100%
18%	All Others	All Others	3,713	
Total			**21,193**	

Source: Transearch 2019 data prepared by WSP USA Inc.

Table 70 shows the top energy outbound lanes moving by truck in 2019. The total outbound tonnage in 2019 for energy was 5 million tons. The primary lane was from Southwest Georgia to Tallahassee, FL. These shipments were mainly liquid fuel. Ranked second was 526 thousand tons of fuel moving from Southwest Georgia to Dothan, AL. Rounding out the top three was traffic from Northwest Georgia to Huntsville, AL.

Table 70. Outbound Energy Lanes (2019)

Share	Georgia O	External D	Tons (k)	% Truck
12%	Southwest Georgia	Tallahassee, FL	649	100%
10%	Southwest Georgia	Dothan, AL	526	100%
8%	Northwest Georgia	Huntsville, AL	421	100%
7%	Coastal Regional Commission	Savannah, GA (non-GA part)	359	100%
6%	River Valley	Montgomery, AL	339	100%
5%	Atlanta Regional Commission	Chattanooga, TN	246	100%
4%	Atlanta Regional Commission	Birmingham, AL	210	100%
4%	Atlanta Regional Commission	Huntsville, AL	191	100%
4%	Northwest Georgia	Birmingham, AL	189	100%
3%	River Valley	Columbus, GA (non-GA part)	185	100%
3%	Southwest Georgia	Columbus, GA (non-GA part)	179	100%
3%	River Valley	Dothan, AL	145	100%
2%	Coastal Regional Commission	Charleston, SC	127	88%
30%	All Others	All Others	1,631	
Total			**5,397**	

Source: Transearch 2019 data prepared by WSP USA Inc.

Energy moving within Georgia is shown in Table 71. Traffic internal to the Atlanta Regional Commission ranked at the top with 8 million tons and 43 percent share. Atlanta's population and demand for fuel drives these movements emanating from pipeline terminals in the region. Shipments within the Coastal Regional Commission made up the second highest tonnage. The third highest intra-Georgia flow moved from River Valley to the Atlanta Regional Commission.

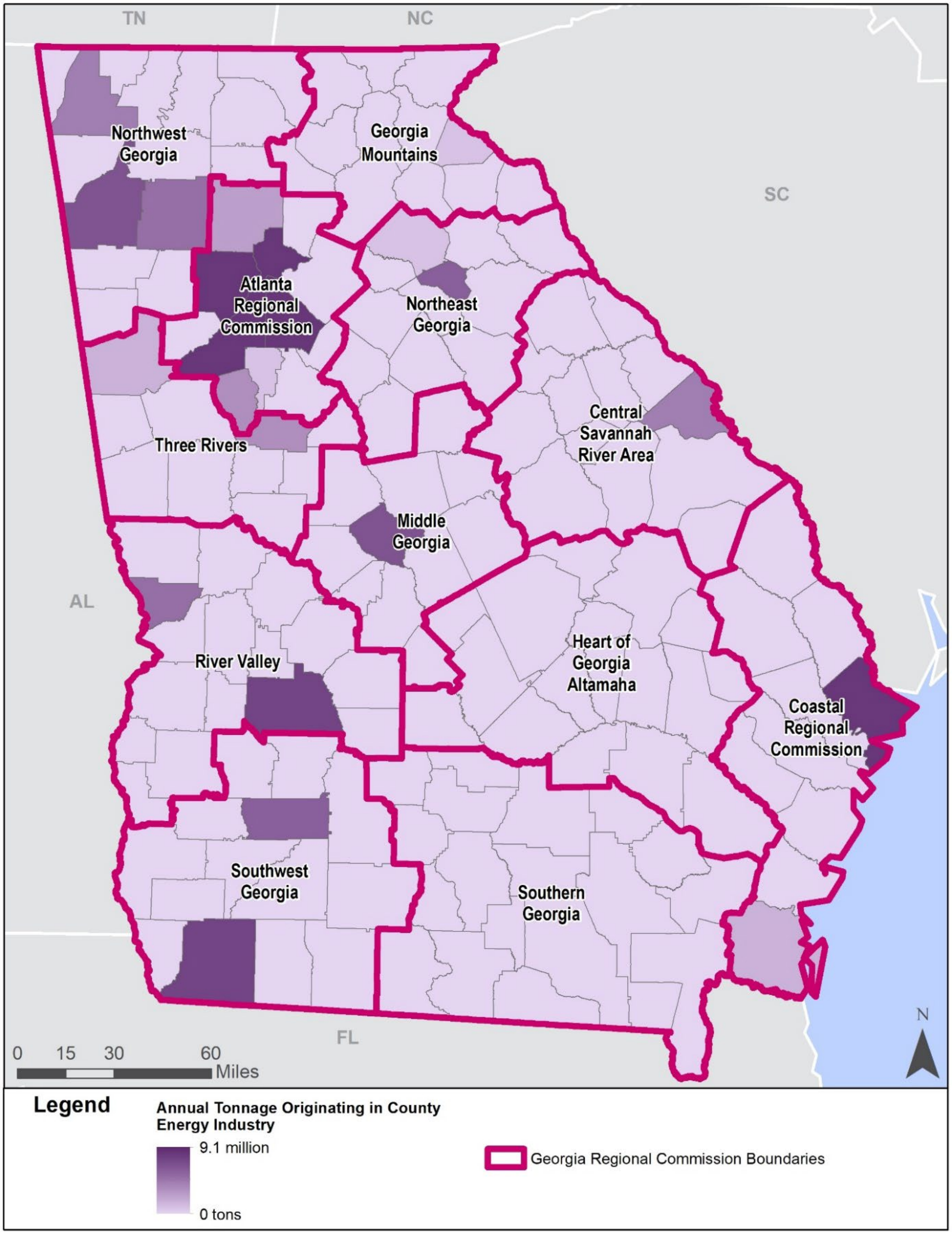
Table 71. Energy Top O-D Pairs – Internal (2019)

Share	Georgia O	Georgia D	Tons (k)
43%	Atlanta Regional Commission	Atlanta Regional Commission	7,639
8%	Coastal Regional Commission	Coastal Regional Commission	1,483
4%	River Valley	Atlanta Regional Commission	757
4%	Middle Georgia	Atlanta Regional Commission	738
3%	Atlanta Regional Commission	Northwest Georgia	491
3%	Northwest Georgia	Atlanta Regional Commission	463
3%	Southwest Georgia	Southwest Georgia	463
2%	Northeast Georgia	Atlanta Regional Commission	395
2%	Middle Georgia	Middle Georgia	332
2%	Northwest Georgia	Northwest Georgia	321
2%	River Valley	River Valley	311
1%	Coastal Regional Commission	Central Savannah River Area	256
1%	River Valley	Middle Georgia	246
22%	All Others	All Others	3,892
Total			**17,787**

Source: Transearch 2019 data prepared by WSP USA Inc.

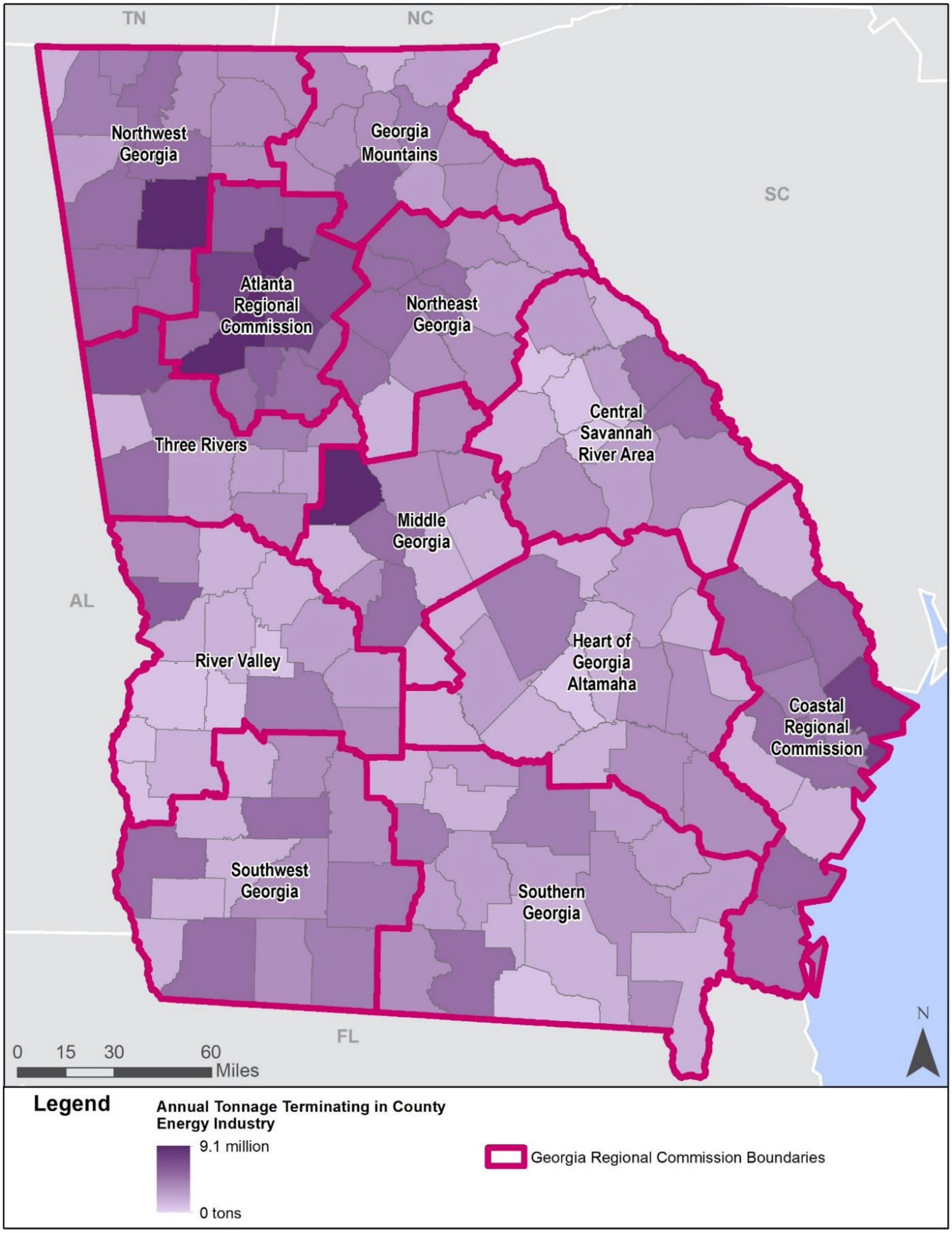
Figure 45 presents a map of the top origin counties and **Figure 46** shows a map of the top destination counties for energy tonnage in 2019. The destination locations are more widely spread throughout the state reflecting the heavy demand for energy products.

Figure 45. Origin Counties for Energy Tonnage (2019)



Source: Transearch 2019 data prepared by WSP USA Inc.

Figure 46. Energy Top Destination Counties for Energy Tonnage (2019)



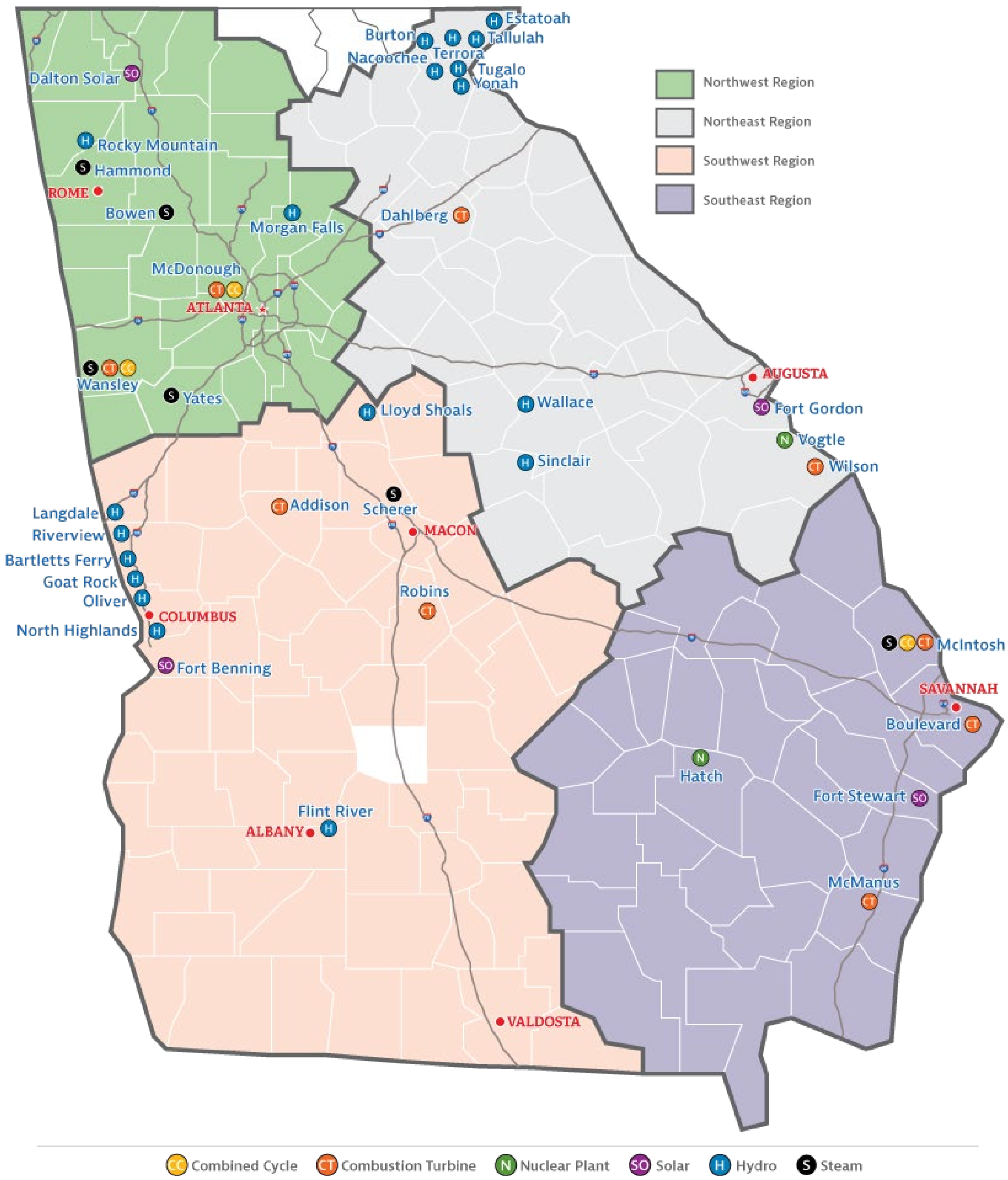
Source: Transearch 2019 data prepared by WSP USA Inc.

Among the counties in Georgia, Monroe County had the highest tonnage of inbound, outbound and within energy tonnage at 9 million tons, or 20 percent of all tonnage. Monroe was followed by Bartow County (5.5 million tons, or 12 percent), Chatham County (3.7 million tons, or 8 percent), Fulton County (3.7 million tons, or 8 percent), and Cobb County (3.6 million tons, or 8 percent). The top five counties as measured by energy tonnage accounted for 57 percent or slightly more than half of all energy tonnage in the state.

For Monroe and Bartow Counties, coal was the predominant form of energy tonnage at 9 million tons and 5 million tons in 2019, respectively. These coal volumes fit with the location of the three operational coal power plants in Georgia, shown in Figure 47, which are: Bowen Steam-Electric Generating Plant in Bartow County, just northwest of Atlanta; Robert W Scherer Power Plant in Monroe County, just northwest of Macon; and Hal B. Wansley Power Plant in Heard County, southwest of Atlanta and close to the border with Alabama.

Chatham, Fulton and Cobb Counties each had much higher amounts of liquid fuel tonnage than coal tonnage.

Figure 47. Electric Generation Plants in Georgia (2022)



Source: Georgia Power, sourced at https://www.georgiapower.com/company/energy-industry/generating-plants.html

2.6. Heavy Haul

The FAST Act identified oversize/overweight (OSOW) as a target for planning as particular attention must be paid to roadways that are utilized by heavy vehicles, because different design standards and maintenance levels could be desirable. Routes that serve heavy-haul equipment are more vulnerable to pavement deterioration and may need higher levels of maintenance. The GDOT State Route Prioritization identifies the State's 18,000 miles in four categories: Critical, High, Medium, and Low. The result of this research is used by GDOT to effectively allocate maintenance funding and ensure a high level of service and quality on Critical and High Priority routes. GDOT focuses its resources on the components of the transportation system that are most important to Georgia's economy, specifically, those that serve a significant role in freight movement, intrastate travel, tourism, and business travel.

Bridge structures are also of increasing importance due to weight limits and overhead clearance restrictions. Routing for cargo in all commodity groups can be affected but shipments in the OSOW category are particularly vulnerable to bridge and overpass related impediments causing rerouting and delay. There are over 14,000 bridges in the state, 2.5 percent of which have been identified as deficient and are slated for repair. The bridge number includes both GDOT and local bridge responsibility. There is an interactive map25 of posted bridge locations that can be viewed on the GDOT website.

OSOW shipments present regulatory challenges as well as physical infrastructure concerns. Shipments moving across state lines require transportation companies to interact with multiple jurisdictions creating a need for harmonization of regulations and processes. As the demand for OSOW shipments increases, the need for attention to these jurisdictional concerns grows.

2.6.1. Commodity Groups

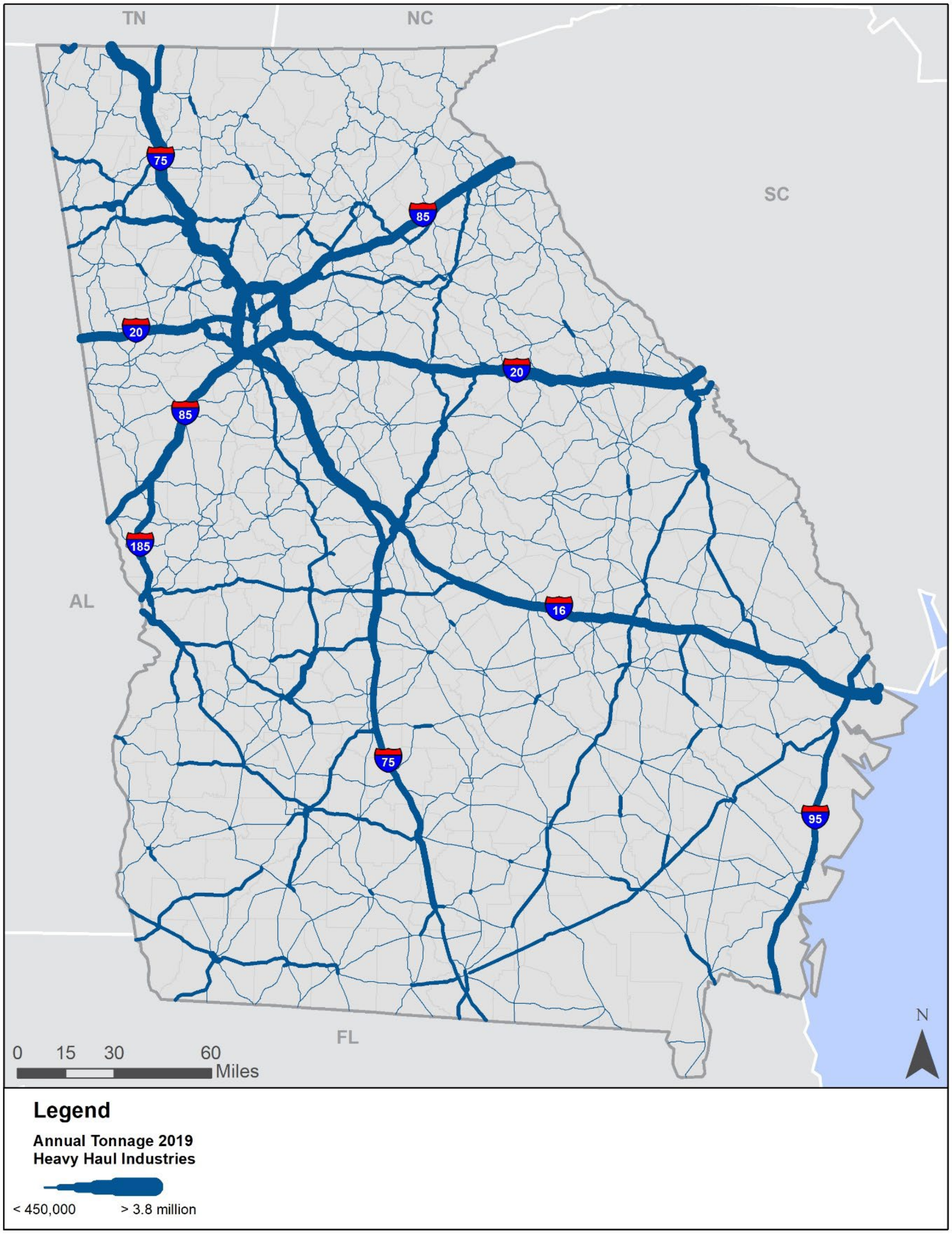
The FAST Act specifically identified the following commodity groups and shipment types to be addressed in the planning process:

- Mining
- Agricultural
- Energy Cargo
- Timber

The heavy haul market in Georgia is largely encompassed by agriculture, forestry, construction commodities and large equipment manufacturing for construction. Maps of heavy haul traffic in 2019 and the forecast for 2050 appear respectively in **Figure 48** and **Figure 49** below, followed by a discussion of each of the commodity groups. The highest volume of heavy haul in 2019 is on the Interstate highways, especially those surrounding the greater Atlanta metro area. The forecast indicates that the Interstates will continue to experience the highest traffic volumes, with the thickness of the lines in the map suggesting that the 2050 volumes will be considerably higher on these routes than they were in 2019.

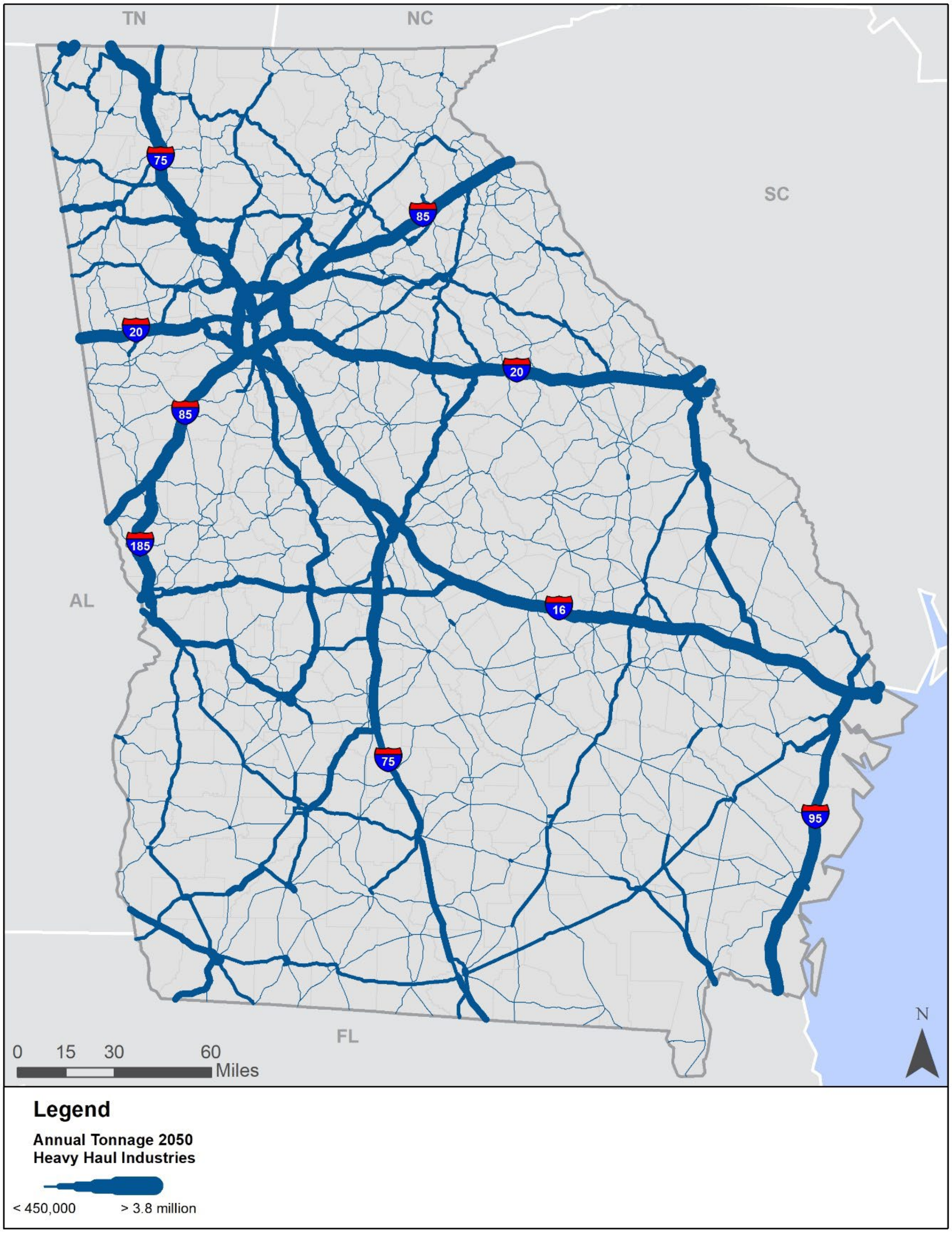
25 Posted and Restricted Bridges - Georgia DOT (ga.gov)

Figure 48. 2019 Heavy Haul Tonnage



Source: Transearch

Figure 49. 2050 Heavy Haul Tonnage



Source: Transearch

Mining

The US Geological Survey reports the value of Georgia's non-fuel mineral production from 2021 as just over two billion dollars ($2,040 million). The state is 12th in the US in this category but represents only 2.25 percent of the total national production. This data includes Portland cement, kaolin clay, sand and gravel for construction and sand and gravel for industrial use as well as crushed stone. Georgia produces significant quantities of titanium and zirconium minerals concentrates but the breakdown of volume is not available as it is considered proprietary information.

Georgia leads in the production of fuller's earth, kaolin, and iron oxide pigments. It is a major producer of barite, dimension stone, and feldspar. The kaolin mining industry has located its processing facilities in the communities near the deposits, primarily in the nine (9) rural counties between Macon and Augusta. Highly technical equipment and processes are employed to transform the crude kaolin into high quality products which are marketed around the world for a wide variety of applications.26 Kaolin clay is widely used in the paper industry and for that reason the associated tonnage was included with lumber and paper in the overall data analysis.

Construction related commodities such as stone and cement are part of this mining category. They have been included in the consideration of construction volumes in the Freight Plan.

Construction Equipment

The off-highway equipment group is defined to include self-propelled work machines used in construction, general purpose industrial, agricultural, forestry and specialized mining industries. Georgia is home to many manufacturers of this type of equipment including companies such as Caterpillar, Kubota, John Deere and Weiler Forestry. This equipment is transported nationally and internationally from their manufacturing facilities in Georgia.

Construction equipment components as well as finished equipment are both imported and exported through Georgia ports. Some of this equipment falls into the OSOW category. Large, finished equipment for export is currently being directed toward Brunswick as facilities are expanded to accommodate this cargo. Efficient movement of this large and heavy equipment is a critical component of the supply chain benefitting this industry group in Georgia.

Agriculture

Georgia is a top producer of agricultural and food products. The market covers a gamut of commodities, but those most associated with heavy haul shipments are grains and fertilizers. Animal feed products are also produced and imported through the network. Confinement

[26] https://www.usgs.gov › centers › mineral-industry-georgia and https://www.usgs.gov/centers/national-minerals-information-center/minerals-yearbook-metals-and-minerals

livestock operations can generate heavy haul shipments on local roads, most notably the slurry wagons used for manure handling.

Maintenance concerns on rural roads can also come from repetitive use from vehicles that do not exceed the legal weight limits but have a volume of traffic that puts a constant stress on the infrastructure. An example of this would be the poultry industry where the continual demand for feed and the seasonal demand for fuel requires 24/7 operations. Tractor trailer vehicles move continuously between farms and provisioning terminals. Poultry is a top commodity in Georgia. Operations frequently cross state lines making weight and roadway maintenance a regional issue.

Georgia Dairy Producers reported just under one million tons of milk produced in 2021. Milk is a commodity that often exceeds weight limits as trucks must fully empty farm tanks when picking up fresh milk for processing. The volume of this cargo is not easy to deduce or forecast. Federal regulations define milk as a non-divisible load and thus certain exemptions exist. Regulations are specifically defined further below.

Large farm equipment, classified as implements of animal husbandry, can also be problematic for infrastructure as the axle loading ratios are different than those for trucks creating different structural design needs particularly for bridges on local roads. Combines would be a specific example of this type of equipment. Local bridge postings can cause farmers to have to move equipment well out of route when moving between fields or to elevator locations, adding cost and time to the process.

Georgia is a major producer of agricultural equipment, most of which is considered small to mid-range in size. Transportation of this locally produced equipment does not pose a challenge to the infrastructure. However, the delivery of various types of large equipment to dealers and farm locations will fall into the OSOW category. Agricultural shipments may also make up some of the “through” traffic in Georgia and should be accounted in the mix when planning for OSOW operations.

Energy

A significant portion of OSOW shipments in most states with a concentration of energy-based cargo comes from coal, oil and gas production or the manufacture and installation of wind equipment.

Georgia is not currently active in any of these markets, and the bulk of energy-derived OSOW shipments in Georgia is associated with project cargo. Project cargo occurs as one-time moves needed for large components for use in facilities such as nuclear and hydroelectric power plants, either for new installations or for maintenance.

Timber

Georgia is the largest timber producer in the southeast and ranks in the top ten in the production of timber related products including pulp and paper. The harvesting and initial movement of logs most often occurs on local roads in the more rural areas of the state. When logging occurs in commercial forests, the road maintenance is shared by the producer. However, when the logging trucks leave those locations, they are moving on local and state roads to reach processing facilities.

As in agriculture, forestry shipments can move regionally, crossing state lines in both directions. They can also fall into the category of repetitive movements that may not necessarily be OSOW but are heavy by nature and create constant demand on the infrastructure. The shipments of harvested logs are more likely to exceed weight and size restrictions. This is less frequently the case with finished products of the industry such as lumber and paper.

2.6.2. Identifying Oversize and Overweight Shipments

Georgia's highways support the movement of regular and OSOW loads in accordance with state and federal statutes. OSOW loads are those whose dimensions and/or weight exceed the legal limits and, with some exceptions, cannot be split into multiple smaller loads (non-divisible). A vehicle that exceeds the legal statutory dimensions usually requires an OSOW permit and must pay associated additional fees to legally travel on designated roadways. An OSOW permit typically includes conditions such as:

- Route specifics
- Dates of load travel
- Times of load travel
- Escort vehicles

The vehicle is routed to avoid permanent or temporary physical constraints of the transportation infrastructure. The laws governing truck size and weight in the State of Georgia are found in Ga. Code Ann. 32-6-20 et seq27.

Summary of State Provisions that Exceed Federal Limits[28]

With respect to trucks operating on the NHS in Georgia, several provisions in State law allow trucks to exceed some elements of Federal limits. The State of Georgia:

1. Allows 20,340 lbs. on a single axle;
2. Allows 40,680 lbs. on a tandem axle on non-Interstate highways;
3. Allows 61,020 lbs. for a tridem axle on non-Interstate highways;
4. Allows vehicles carrying several commodity types to exceed State weight limits on non-Interstate highways up to 23,000 lbs. on any single axle and 46,000 lbs. on any tandem axle; and

[27] available via LexisNexis at http://www.lexisnexis.com/hottopics/gacode/Default.asp
[28] https://ops.fhwa.dot.gov/freight/policy/rpt_congress/truck_sw_laws/app_a.htm#ga

5. Allows an additional 5 percent variance for transportation of specified commodities within a 100-mile radius of the point of origin; poultry waste is allowed the 5 percent variance within a 250-mile radius. Many of these exemptions are limited to transportation from a farm or other point of origin to a processing facility.

Regular Operations

The gross weight of vehicles in regular operations (operating without a special permit) generally follows the Federal limits with a few exceptions. Georgia has adopted the Federal Bridge Formula (FBF) as its State bridge formula. See Exhibit 18 for a summary of Georgia's weight provisions under regular operations (Ga. Code Ann. § 32-6-26).

Table 72. Summary of Georgia Truck Weight Limits for Vehicles in Regular Operations

Single Axle	20,340 lbs. (18,000 lbs. + 13 percent) with low pressure tires 18,080 lbs. (16,000 lbs. + 13 percent) with high pressure, solid rubber, or cushion tires
Tandem Axle	34,000 lbs. 40,680 on non-Interstate highways (if vehicle is less than 55 feet long and GVW is less than 73,280)
Tridem Axle	Per FBF
Gross Weight	80,000 lbs.; subject to FBF if gross weight of vehicle is between 73,280 lbs. and 80,000 lbs.
Other	1,000 lbs. tolerance on axle loads

** Not specified in statute but are derived by calculating 113 percent of 18,000 lbs. and 113 percent of 16,000 lbs., respectively (see §32-6-26[b])*

Exemptions and Special Operations

Commodity Exemptions

State weight limits may be exceeded on any non-Interstate highway[28] without a permit if the load on any single axle does not exceed 23,000 lbs., the load on any tandem axle does not exceed 46,000 lbs., and the total gross weight of the vehicle and load does not exceed 80,000 lbs. for vehicles hauling the following:

- Forest products from the forest where cut to the first point of marketing or processing;
- Live poultry or cotton from a farm to a processing plant;
- Feed from a feed mill to a farm;

- Naturally occurring raw ore or mineral, including either block or sawed granite, from the quarry or stockpile area to a processing plant located in the same or an adjoining county and construction aggregates hauled to any point, unless otherwise prohibited;
- Solid waste or recovered materials from points of generation to a solid waste handling facility or other processing facility;
- Concrete that is in a freshly mixed and in an unhardened State for delivery to a customer; and
- Poultry waste from the point of origin to a farm (Ga. Code Ann. § 32-6-26[g][1])

A vehicle hauling these products or any other agricultural or farm product from a farm to the first point of marketing or processing is permitted a 5 percent variance from State weight limits within a 100-mile radius of the farm or point of origin. In addition and as previously noted, a vehicle hauling poultry waste from the point of origin to a farm is permitted a 5 percent variance from State weight limits within a 250-mile radius of the farm or point of origin (Ga. Code Ann. § 32-6-26[g][2 – 3]).

Emission Reduction/Special Fuel Exemptions

Emission Reduction Equipment: State law has adopted a weight exemption for auxiliary power units or idle reduction technology units similar to the exemption in 23 U.S.C. § 127(a)(12). The exemption, which applies to single axle weight, tandem axle weight, gross vehicle weight, or any group of axles, is up to 400 lbs. or the certifiable weight of the unit, whichever is less (Ga. Code Ann. § 32-6-27[a][3]).

Permits for Overweight Vehicles

The Commissioner of the Georgia Department of Transportation (or the Commissioner's designee) is authorized to issue permits for the transportation of non-divisible loads that exceed State size and weight limits, provided that the vehicle's operation on public roads does not threaten to unduly damage a road or any appurtenance thereto (Ga. Code Ann. § 32-6-28[a][1][A]).

Annual permits are available for vehicles with a GVW of up to 100,000 lbs. and a single axle weight of up to 25,000 lbs. Single- and multi-trip permits may be issued to any vehicle or load allowed by Federal law (Ga. Code Ann. § 32-6-28[b][1]).

An annual commercial wrecker emergency tow permit may be issued for vehicles with a single axle weight of up to 21,000 lbs. or a tandem axle weight of up to 40,000 lbs. (Ga. Code Ann. § 32-6-28[b][3])

The FAST Act identifies the following two conditions that are not mentioned above. The FAST Act amends 23 U.S.C. 127(a) to establish that a vehicle carrying fluid milk products shall be considered a load that cannot be easily dismantled or divided (non-divisible). States may, therefore, issue permits for such vehicles, in accordance with State law, to exceed the gross weight limit of 80,000 pounds or the maximum weight allowed by the Federal Bridge Formula.

[23 U.S.C. 127(a)(13)]. This is a particular concern in the dairy industry where tankers must empty the tanks completely when picking up at a farm location even though the limit may be exceeded.

Additionally, a vehicle operated by an engine fueled primarily by natural gas, may exceed any vehicle weight limit (up to a maximum gross vehicle weight of 82,000 pounds) under 23 U.S.C 127, by an amount that is equal to the difference between: the weight of the vehicle attributable to the natural gas tank and fueling system carried by that vehicle; and the weight of a comparable diesel tank and fueling system.

2.6.3. Permitting Process

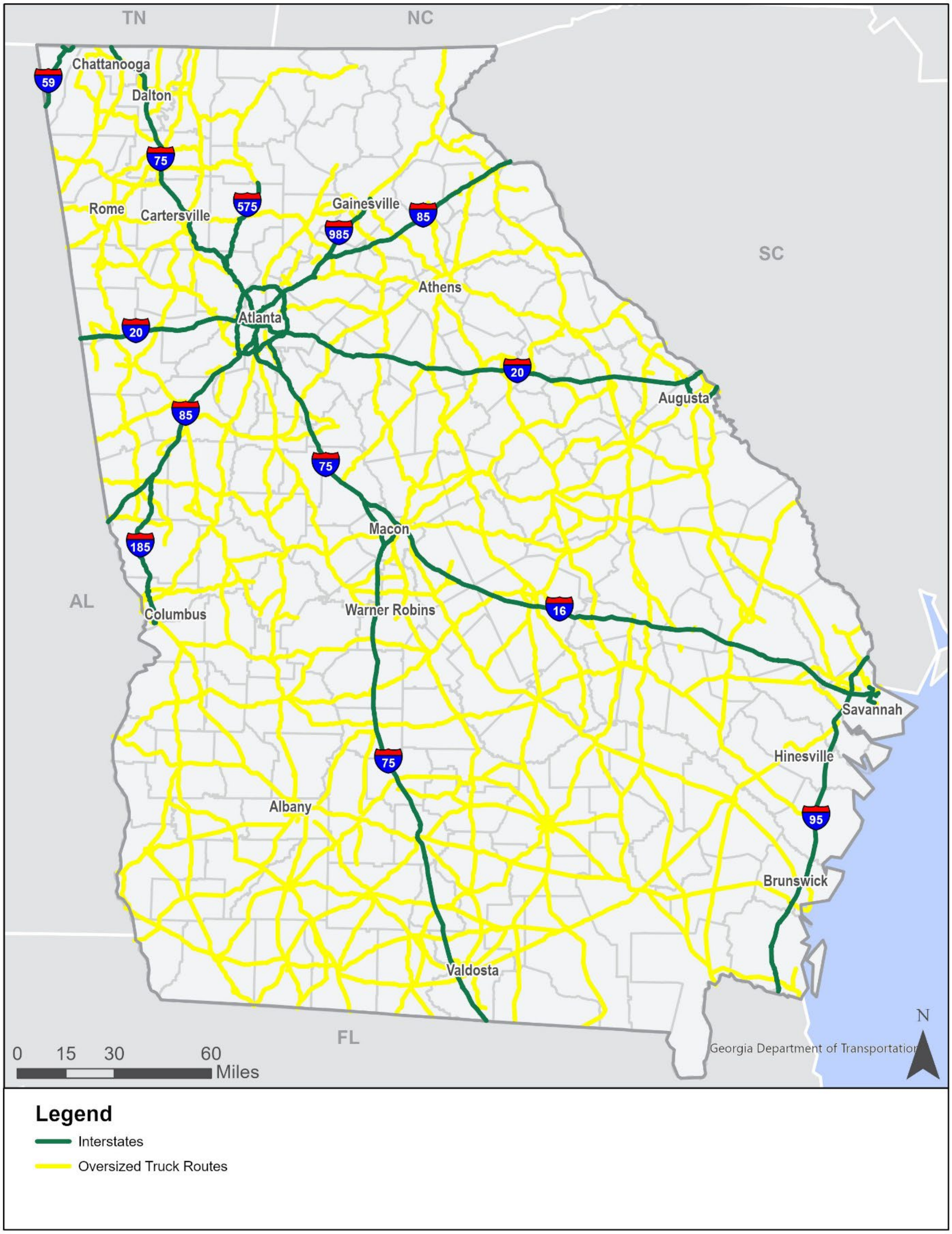
Permits for OSOW shipments are issued for varying time periods. Single use permits allow a one-time transaction for an individual shipment. Annual permits are common for some commodity groups where repeat shipments of the same type are likely. There are other options for validity period of a permit depending on the circumstances.

In addition to the routing considerations, certain shipments have a requirement for escort vehicles. This is determined by the size of the load and the complexity of the travel. The time of day for transport is also determined in the permit process.

Georgia has an automated permitting process, Georgia Pro. The state participated in an FHWA Freight Management and Operations study, Best Practices in Permitting OSOW vehicles. In this report the state indicated that 80 percent of the permit applications were currently managed through the automated system. The Georgia Pro system offers classes, videos and tutorials to educate users on use of the system and the regulatory requirements in the state.

Georgia permits are valid for a 10-day period. Carriers may be unaware If changes in conditions occur within that ten-day period, and this is sometimes a cause of problems with the process.

Figure 50. Georgia Oversize Truck Routes



Source: GDOT

2.6.4. Superloads

The definition of a superload varies by state. It is often related to bridge limits and overhead clearance concerns. In Georgia a superload is defined as loads that are more than 16′ wide, 15′ high, 110′ long and 120,000 lbs. OSOW shippers and carriers may move superloads using rail, but often the dimensions, primarily the width, do not fit the limits for rail transport.

The growth of superloads requiresplanning for current shipments as well as howto accommodate this freight in the future. Water transportation is the most feasible method of moving superloads where there is access. Even when rail and water are available and fit the needs of a superload, trucks often make at least one leg of the trip to origin, destination or linking modes in the route. Infrastructure development projects often create superload situations where large steel beams and preformed concrete structures are required.

Figure 51. Superload Transportation

Source: Freight Insights

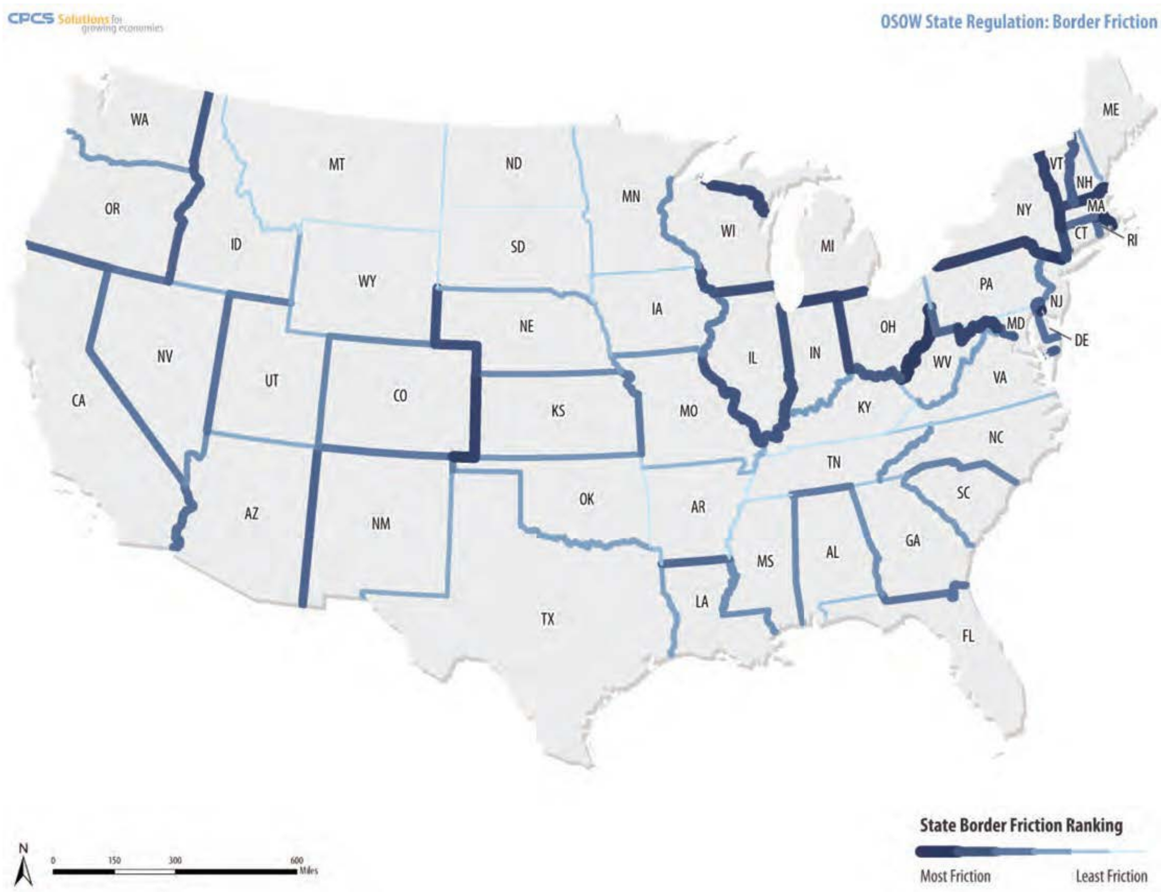
2.6.5. Cross Jurisdictional Transport

The Transportation Research Board's National Cooperative Highway Research Program (NCHRP) Report 830: Multi-State, Multimodal, Oversize/Overweight Transportation, completed in 2016, produced a comprehensive study of OSOW conditions and concerns across the country. This research was directed toward issues in moving OSOW shipments across multiple jurisdictions as is often the case moving cargo from one state to or through another.

The degree to which regulations and permit requirements vary by jurisdiction impacts the operational efficiency of a shipment. The differences in regulations between states can be barriers to transportation. The study identified the degree to which those barriers exist along state lines. The map that depicts those barriers is shown in **Figure 52**.

At the time of this study and unchanged since, the restrictions between Georgia and Tennessee and Georgia and North Carolina were minimal while the barriers between Georgia and Florida, Alabama and South Carolina were more restrictive. Improving the ease of transportation throughout the network connecting Georgia to the rest of the country would allow for better operations for the growing OSOW market segments which are important to some of Georgia's most important commodities.

Figure 52. Border Friction in Regulations Between States



Source: NCHRP Report 830, Multi-State, Multimodal, Oversize/Overweight Transportation

3. Georgia's Freight Transportation Infrastructure

Georgia has a robust inventory of multimodal freight assets that facilitate supply chains and freight movement within and through the state. Highway and rail infrastructure provide access across geographies, and seaports, inland ports, and airports provide strategically placed intermodal linkages for efficient movement of goods and trade. Georgia's supply chains use a portfolio of modes to satisfy logistics requirements and optimize performance. Freight infrastructure in Georgia is both abundant and of high quality, creating a favorable, attractive, and competitive environment for supply chains across industries to conduct business.

Georgia's multimodal transportation system includes 125,508 miles of roadway, 3,288 miles of Class I rail, 1,012 miles of Class III rail, two deepwater ports, two inland ports and one in development, five intermodal rail yards, and nine commercial airports. Each of these components is discussed in the following sections.

3.1. Highways

Georgia's road network is comprised of 17,953 miles of State Routes (including 1,247 miles of Interstates), 86,352 miles of County Roads, and 21,203 miles of City Streets. There are a total of 125,508 centerline miles of roads in Georgia.[29]

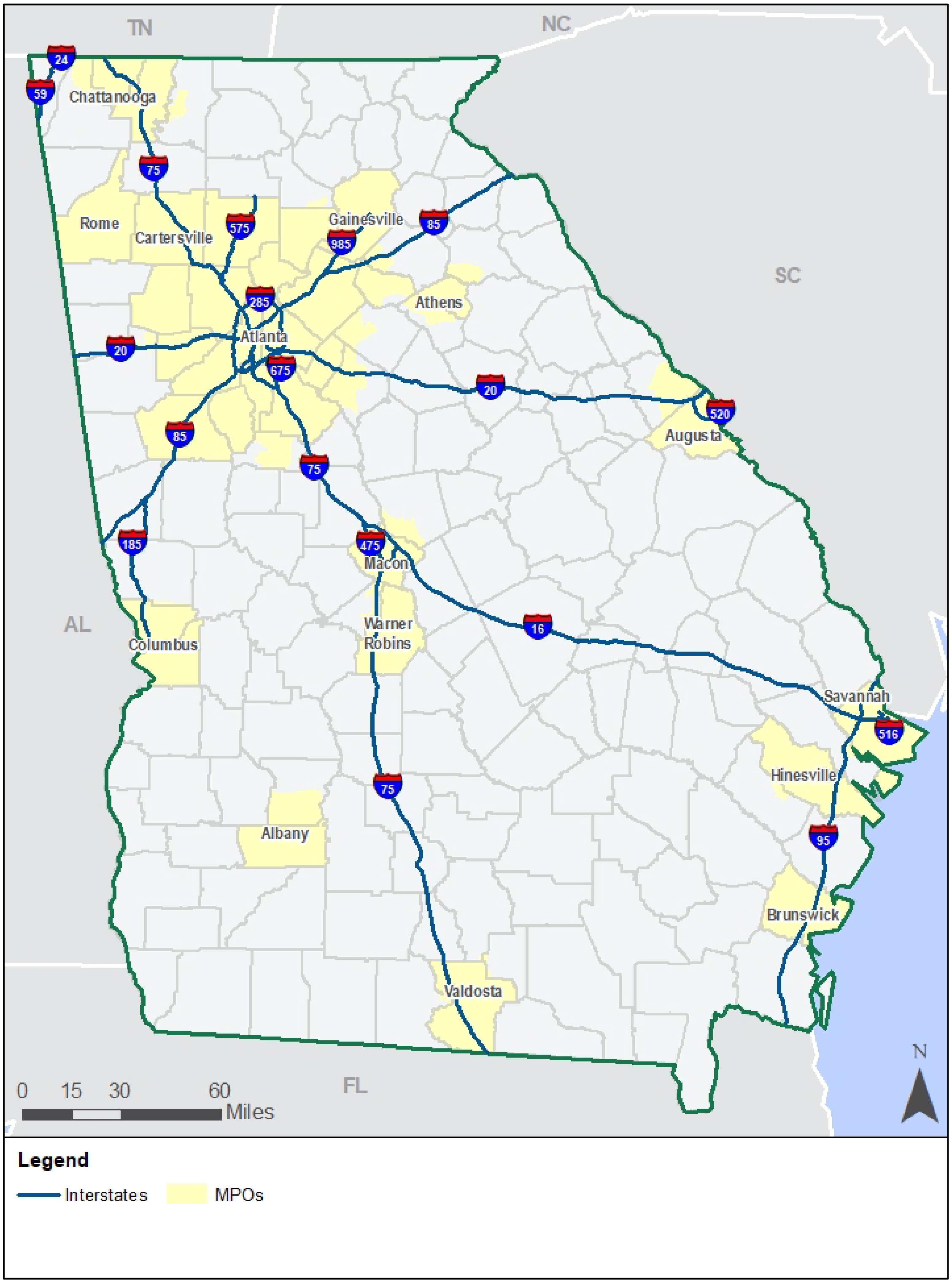
3.1.1. Interstates

There are 1,247 miles of Interstate Highway in Georgia, 1,172 miles of which are within the federally designated Primary Highway Freight System (PHFS).[30] **Figure 53** shows the State's Interstate highway network, its extent across the state, and connections to Tennessee, South Carolina, Florida, and Alabama.

[29] GDOT, OTD, Mileage by Route and Road System Report 445, 2019

[30] GDOT, State Route Prioritization, 2018.

Figure 53. Georgia Interstate Highway Network



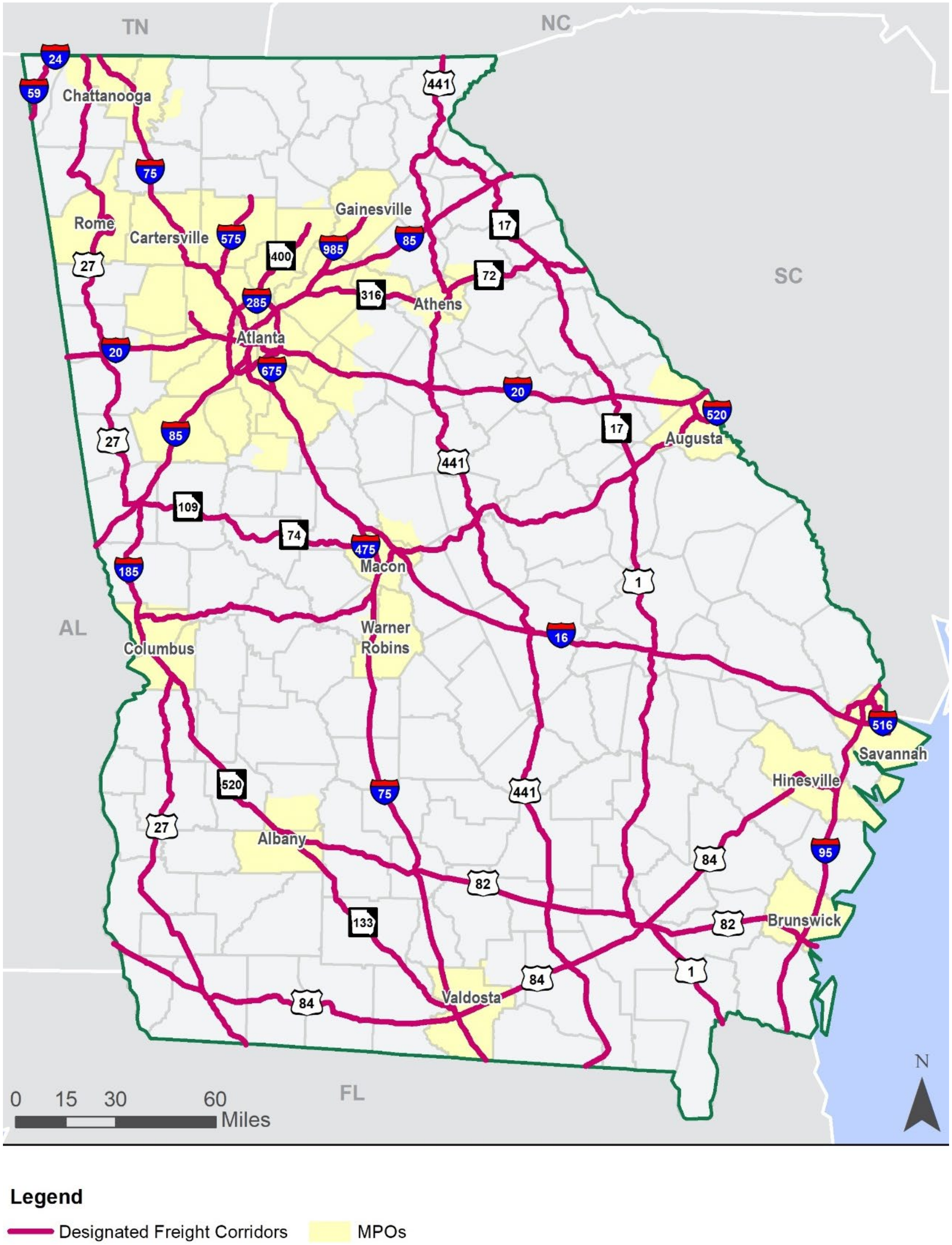
Source: GDOT

3.1.2. State Freight Network

In 2013, House Bill 202 exempted Interstate highways and designated state freight corridors from congressional district balancing, allowing the flexibility to focus funds on projects that can create jobs, reduce traffic, and increase freight flow, rather than solely on geographic location within the state. The State Transportation Board designated freight corridors other than Interstates for inclusion in the State Freight Network, illustrated in **Figure 54** and **Figure 55.**[31] The 4,222-mile network is made up of mostly inter-city roadways and connects to intermodal facilities, airports, and various industrial facilities.

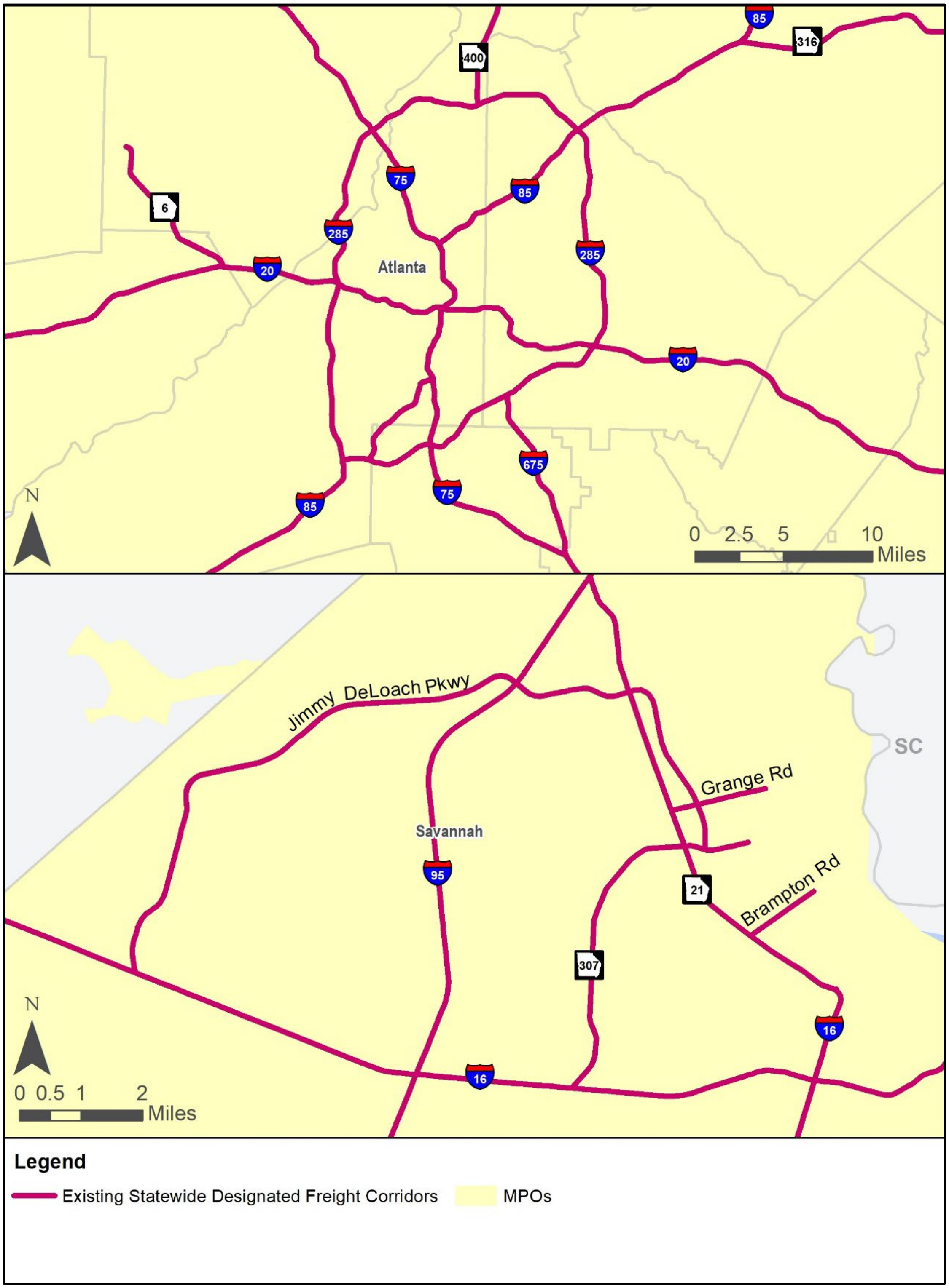
[31] David Pendered, "Georgia's latticework of roads to benefit from GDOT's new freight designation that unties funding rules", Saporta Report, 2013.

Figure 54. Georgia Statewide Designated Freight Corridors



Source: GDOT

Figure 55. Georgia Statewide Designated Freight Corridors in Atlanta and Savannah



Source: GDOT

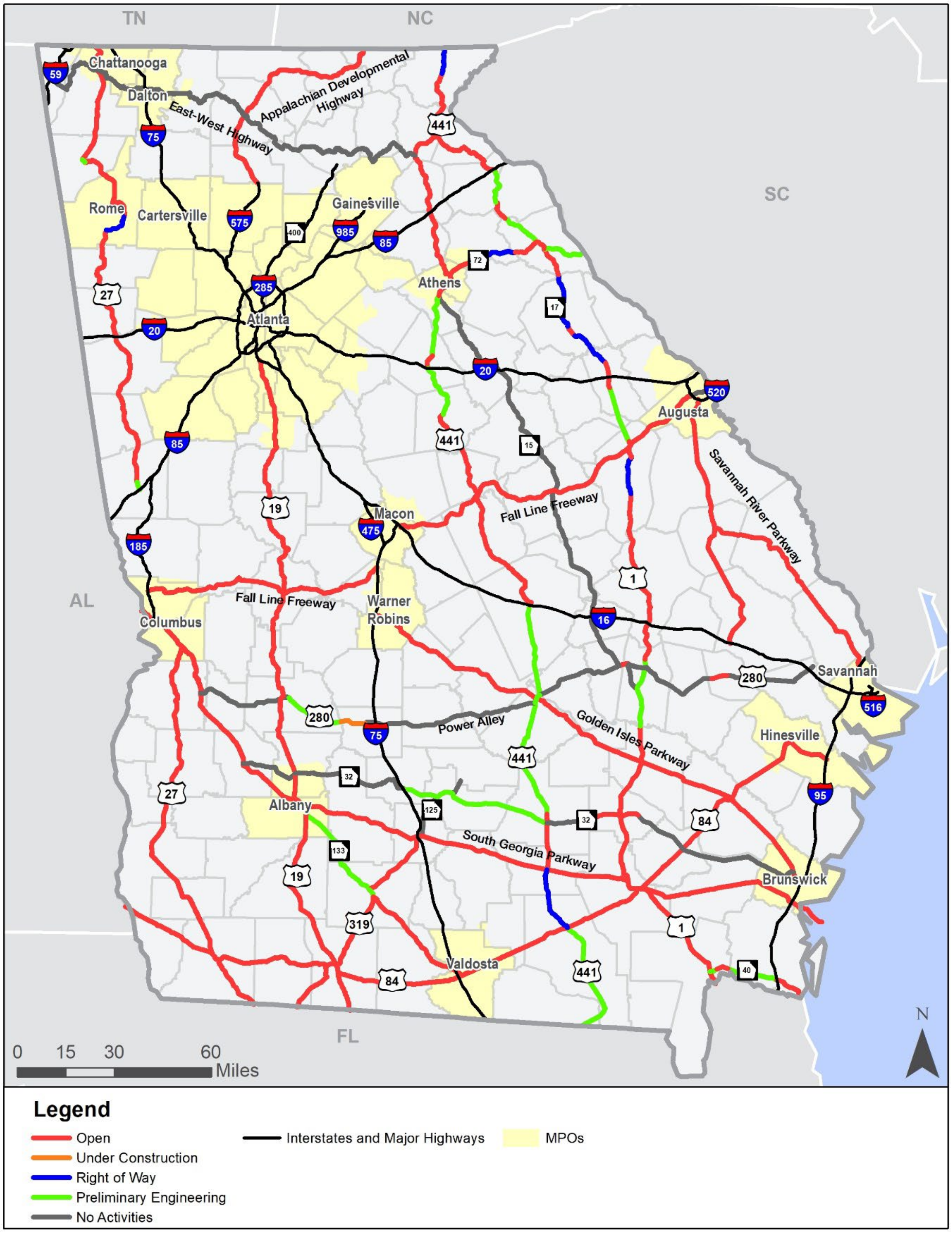
3.1.3. Governor's Road Improvement Program (GRIP)

In 1989, the Georgia General Assembly adopted the Governor's Road Improvement Program (GRIP) as an economic development program to connect most Georgians to the highway system. Once completed, the program will connect 95 percent of Georgia cities with populations of 2,500 or more to the Interstate Highway System, and 98 percent of Georgia's population will live within 20 miles of a four-lane road.[32] GRIP currently includes a total of 3,326 miles of roadway on 19 corridors (including three truck access routes), 2,299 miles of which are complete or under construction. All GRIP corridors are open to trucks.

The original purpose of the GRIP program was to increase connectivity in rural Georgia, provide opportunities for economic growth, provide efficient transportation for a growing population, and reduce crash rates on rural corridors by implementing divided highways.[33] **Figure 56** shows the status of Georgia's GRIP corridors.

[32] Douglas C. Bachtel, Mick Ragsdale, and Kelly Eamon Dowd, "An Analysis of the Governor's Road Improvement Program (GRIP) For the Georgia Department of Transportation.
[33]GDOT, GRIP System Summary Fact Sheet, 2021.

Figure 56. GRIP Corridor Locations and Status as of July 2022



Source: GDOT

3.1.4. National Highway Freight Network

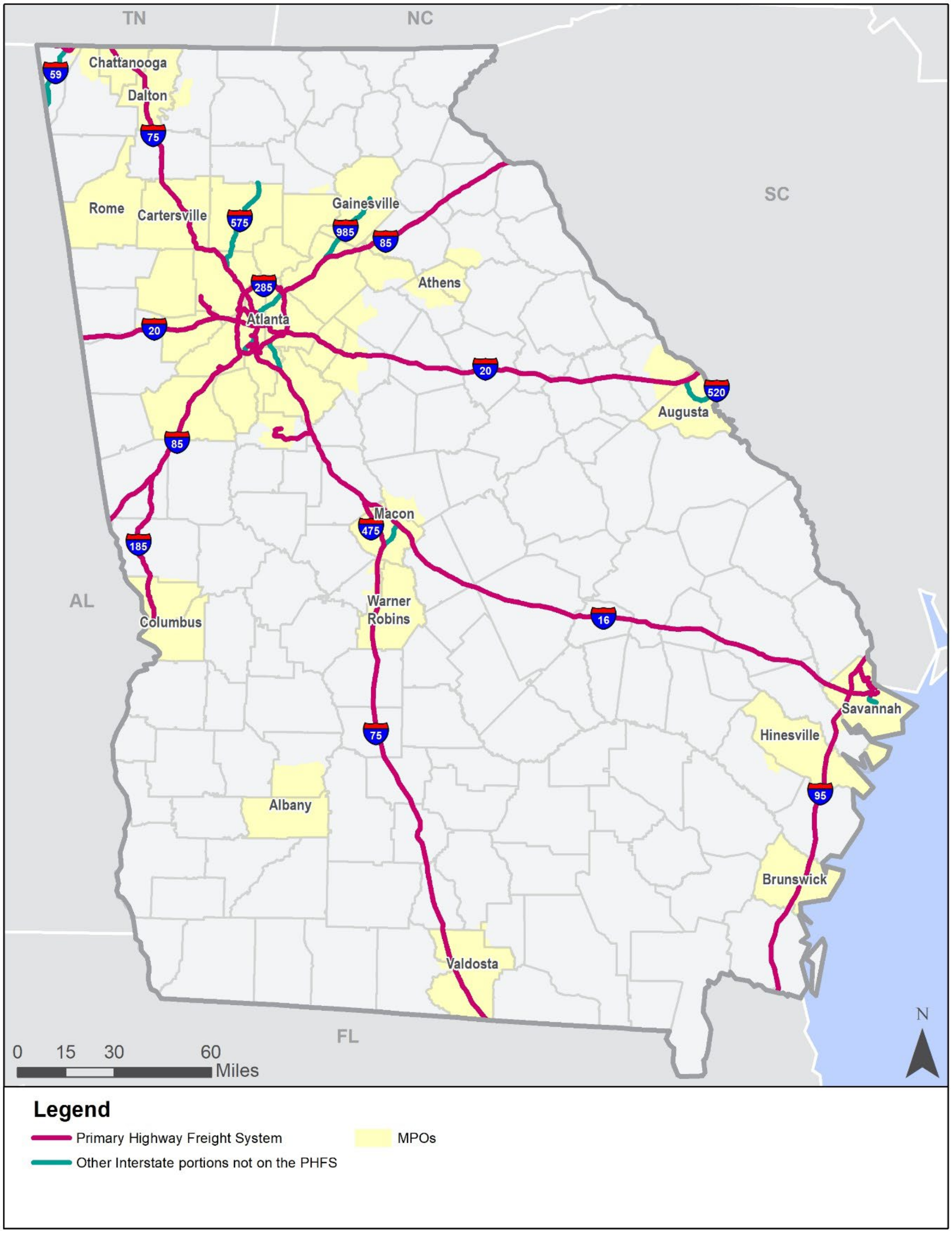
The Fixing America's Surface Transportation Act (FAST Act) directed the FHWA Administrator to establish a National Highway Freight Network (NHFN) to strategically focus Federal resources and policies toward improved performance of highway portions of the U.S. freight transportation system. The NHFN determines where funds from the National Highway Freight Program (NHFP) may be spent, and the eligibility of highway projects for the Nationally Significant Freight and Highway Projects competitive grant program (commonly called INFRA). The Bipartisan Infrastructure Law (BIL) made updates to the NHFN by increasing the miles states may designate as critical urban and rural freight corridors.

The NHFN consists of the following subsystems of roadways:

- **Primary Highway Freight System (PHFS):** This is a 41,799-mile network of highways identified as the most critical highway portions of the U.S. freight transportation system determined by measurable and objective national data. In Georgia, there are 1,172 miles of roadway on the PHFS, including 1,113 Interstate miles. The PHFS must be redesignated every five years by U.S. DOT, at which time up to three percent may be added to the total national mileage.
- **Other Interstate portions not on the PHFS:** These highways consist of the remaining portion of Interstate roads not included in the PHFS. These routes provide important continuity and access to freight transportation facilities. In Georgia, there are 131 miles of Interstate not on the PHFS.
- **Critical Rural Freight Corridors (CRFCs):** These are public roads not in an urbanized area which provide access and connection to the PHFS and the Interstate with other important ports, public transportation facilities, or other intermodal freight facilities. CRFCs are designated by states up to a maximum mileage, equal to 300 miles of highway or 20 percent of the PHFS mileage in the state, whichever is greater. This represents an increase under the BIL from the 150-mile maximum set by the FAST Act. Georgia has not previously designated CRFCs and now is allowed up to 300 miles.
- **Critical Urban Freight Corridors (CUFCs):** These are public roads in urbanized areas which provide access and connection to the PHFS and the Interstate with other ports, public transportation facilities, or other intermodal transportation facilities. CUFCs are designated by states and metropolitan planning organizations (MPOs) up to a maximum mileage, equal to 150 miles of highway or 10 percent of the PHFS mileage in the state, whichever is greater. This represents an increase under the BIL from the 75-mile maximum set by the FAST Act. Georgia has not previously designated CUFCs and now is allowed up to 150 miles.

Figure 57 shows the NHFN in Georgia. NHFP funds in Georgia may be spent on three NHFN components totaling up to 1,622 miles: the PHFS, CRFCs, and CUFCs. The 131 miles of other Interstate portions are excluded. This exclusion does not affect candidacy for INFRA grants, under which the entire 1,753 miles of NHFN in Georgia are eligible.

Figure 57. The NHFN in Georgia



Source: FHWA

3.1.5. Other State and Local Routes

Most of Georgia's road mileage is comprised of roads other than Interstates, though Interstates make up the largest share of annual Vehicle Miles Traveled (VMT). Arterial roads are high-capacity routes that provide a high level of vehicle mobility; within Georgia, these roads make up 12 percent of centerline mileage and 40 percent of VMT (see **Table 73**). Interstates and Arterials, though combined make up less than 15 percent of Georgia's roadways, carry two-thirds of all VMT within the state. In addition, GDOT owns 18 percent of roadway mileage in Georgia, but 59 percent of all VMT is on GDOT-owned roads.

Table 73. Georgia Roadway Mileage and Vehicle Miles Traveled

Functional Classification	Centerline Mileage		VMT	
Interstate	1,247	1%	90,314,515	25%
Freeway	179	<1%	9,699,329	3%
Principal Arterial	4,804	4%	66,474,508	18%
Minor Arterial	9,533	8%	74,806,909	21%
Collector	22,750	18%	44,409,731	12%
Local	86,995	69%	76,715,247	21%
Total	**125,508**		**362,420,239**	

Source: GDOT OTD Mileage by Route and Road System Report 445 for 2019

3.1.6. Truck Parking Facilities

Truck parking shortages are a national concern from which the State of Georgia is not immune. Federal regulations limit the number of hours of service (HOS) for truck drivers based upon commercial activity type. The same regulations also require rest breaks at specific intervals based upon hours of continuous truck operation, most commonly for long haul drivers. Such rest periods are intended to improve highway safety by preventing crashes related to over-exhaustion of truck drivers. These required rest periods are one component of the growing need for additional truck parking along the Georgia freight network.

Another contributor to localized truck parking deficits concerns truck staging near and within industrial areas and other freight intensive land uses. These challenges are caused by drivers appearing before their allotted time so as to ensure on-time arrival time, then finding no, or few options for short-term on-site parking while waiting. The challenge has been exacerbated in Georgia and nationally by the e-commerce boom bringing more and larger freight warehouses, distribution, and fulfillment centers. Other freight intensive land uses such as the Ports of Savannah and Brunswick, several Georgia inland ports, and intermodal centers and military bases across the state also contribute to truck parking needs from both long haul and short term/staging activities.

Existing and anticipated truck parking shortages can have mobility and safety consequences for truck drivers, shippers, the economy and the driving public. Several examples include the following:

- Increased dwell times during staging for pickup and delivery, which reduces productivity and increases shipping and product costs.
- Lost time and wages for truck drivers who may waste time and fuel spending up to an hour daily searching for safe parking. Lost compensation further impedes driver retention and worsens an already challenging labor market.
- Reduced safety for drivers and their cargoes, if they must stop in unsafe areas or parked on facilities which are not meant to service freight vehicles.
- Areas with adequate truck parking may be seen as more desirable by freight related businesses, compared to areas with truck parking deficiencies.

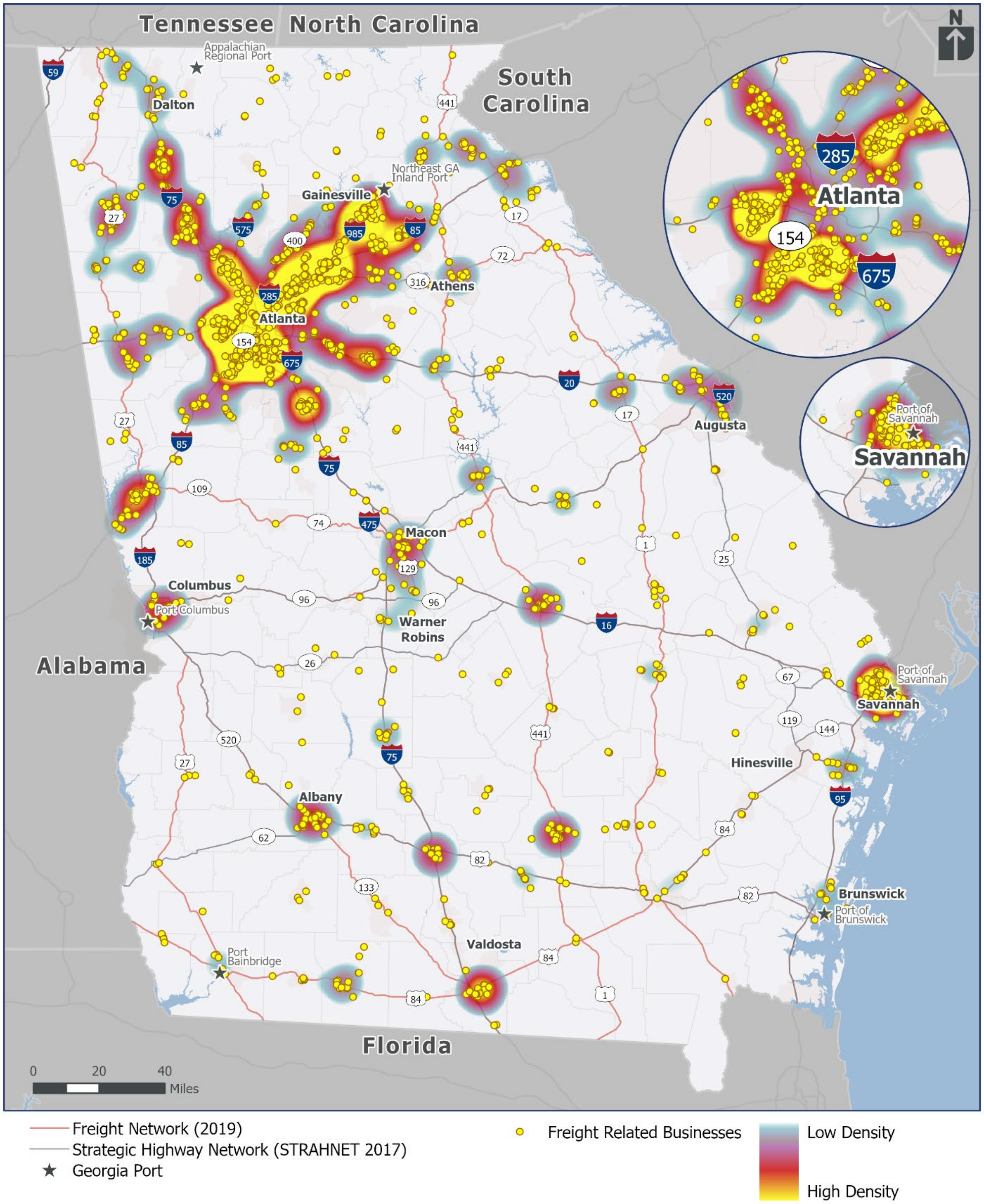
The most significant concentration of freight-related businesses in Georgia is found in the Atlanta region adjacent to the Interstate network, especially along I-75 and I-85 north and south of Atlanta and I-20 west of Atlanta. The Savannah region is home to the next largest concentration of freight-related businesses attributable to the Ports of Savannah and Brunswick. The cities of Augusta, Macon, and Columbus also have significant concentrations of freight businesses but are less intensive than those in the Atlanta and Savannah areas. These freight intensive land uses were mapped[34] using current data and are presented in **Figure 58**.

A mix of public and private truck parking locations are distributed across Georgia with a significant concentration of available locations near or within the metro Atlanta area. Authorized truck parking throughout the state is classified by the following categories:

- Public Truck Parking
  - Parking provided by governmental agencies such as rest areas, weigh stations, welcome centers and some park and ride locations (varies based on the location)
- Private Truck Parking
  - Primary Private Parking
    - Truck parking provided as a service by private industry such as Loves, Pilot, and Flying J truck stops
  - Secondary Private Parking
    - Truck parking provided by industries as a secondary consideration, such as hotel and big box store parking lots.

[34] An analysis of freight intensive land uses was completed in 2021 using information from local development authorities, chambers of commerce, the Georgia Power: Select Georgia tool, and Google Earth.

Figure 58. Existing Freight Intensive Land Uses and Density



Source: Georgia Power, local economic development councils, GA DCA DRI website

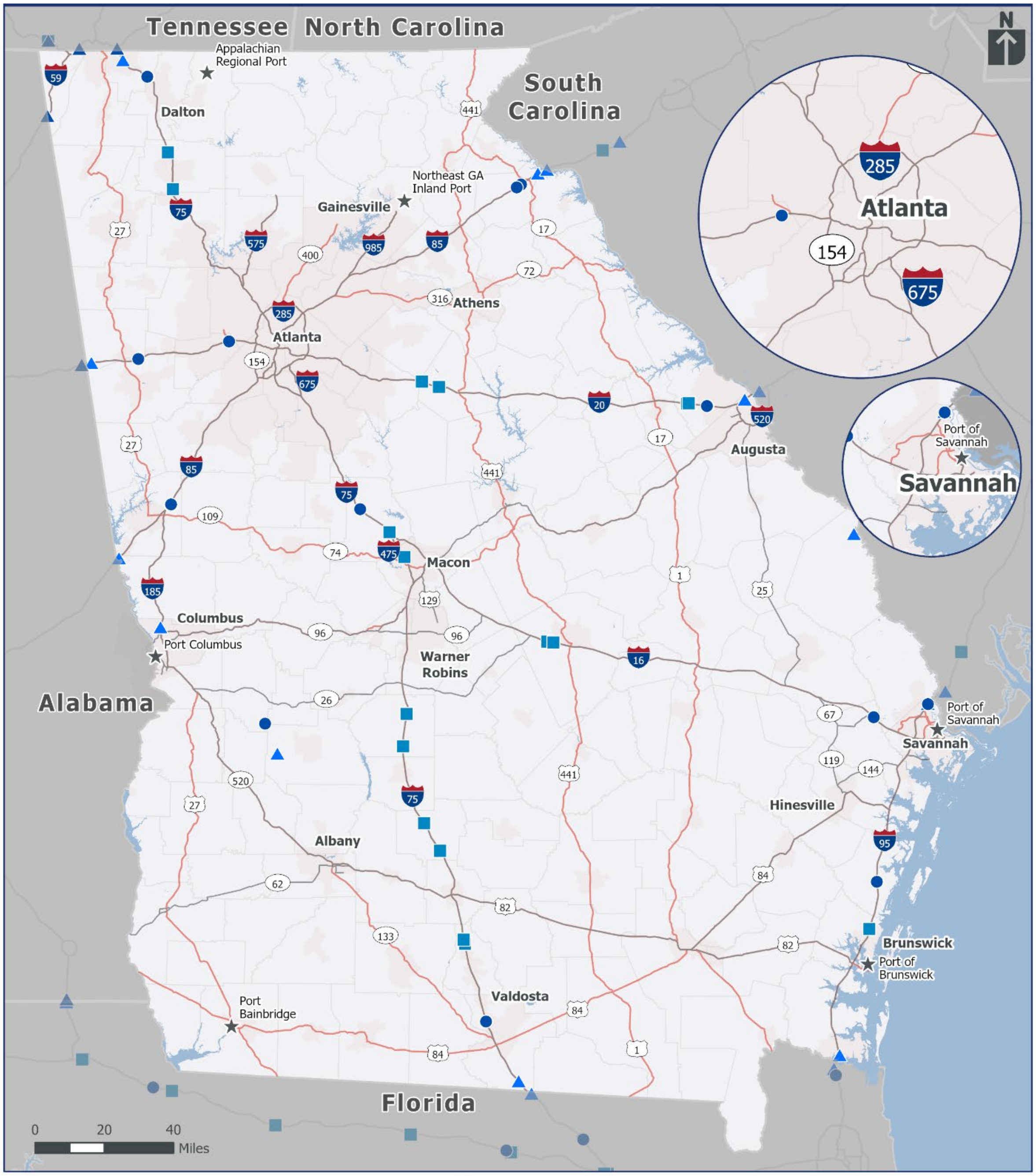
As of March 2022, there are over 27,000 truck parking spaces across Georgia. Of these spaces, 94 percent of the spaces are provided by the private sector and 6 percent provided at public locations. Due to a shortage in available authorized parking, trucks also park within unauthorized areas such as roadway shoulders and Interstate interchange ramps.

Public truck parking in the state is provided by GDOT at rest areas, visitor information centers, and weigh stations. As of 2022, there are 47 publicly owned parking facilities, of which 45 offer designated truck parking facilities comprising of 1,701 truck parking spaces in Georgia. Public truck parking facilities are located along the Interstate corridors as described in **Table 74**.

Table 74. Public Truck Parking Locations Along Interstates

Corridor	Truck Parking Locations	Truck Parking Spaces
I-16	*4*	*106*
I-185	*1*	*9*
I-20	*10*	*390*
I-475	*1*	*38*
I-75	*17*	*664*
I-85	*6*	*269*
I-95	*6*	*225*
Total	***45***	***1,701***

Figure 59. Public Truck Parking Locations (2022)



Freight Network (2019)
Strategic Highway Network (STRAHNET 2017)
Georgia Port
Open Rest Area
Visitor Information Center
Weigh Station
Welcome Center

Source: GDOT, FDOT, SCDOT, NCDOT, TDOT, ALDOT

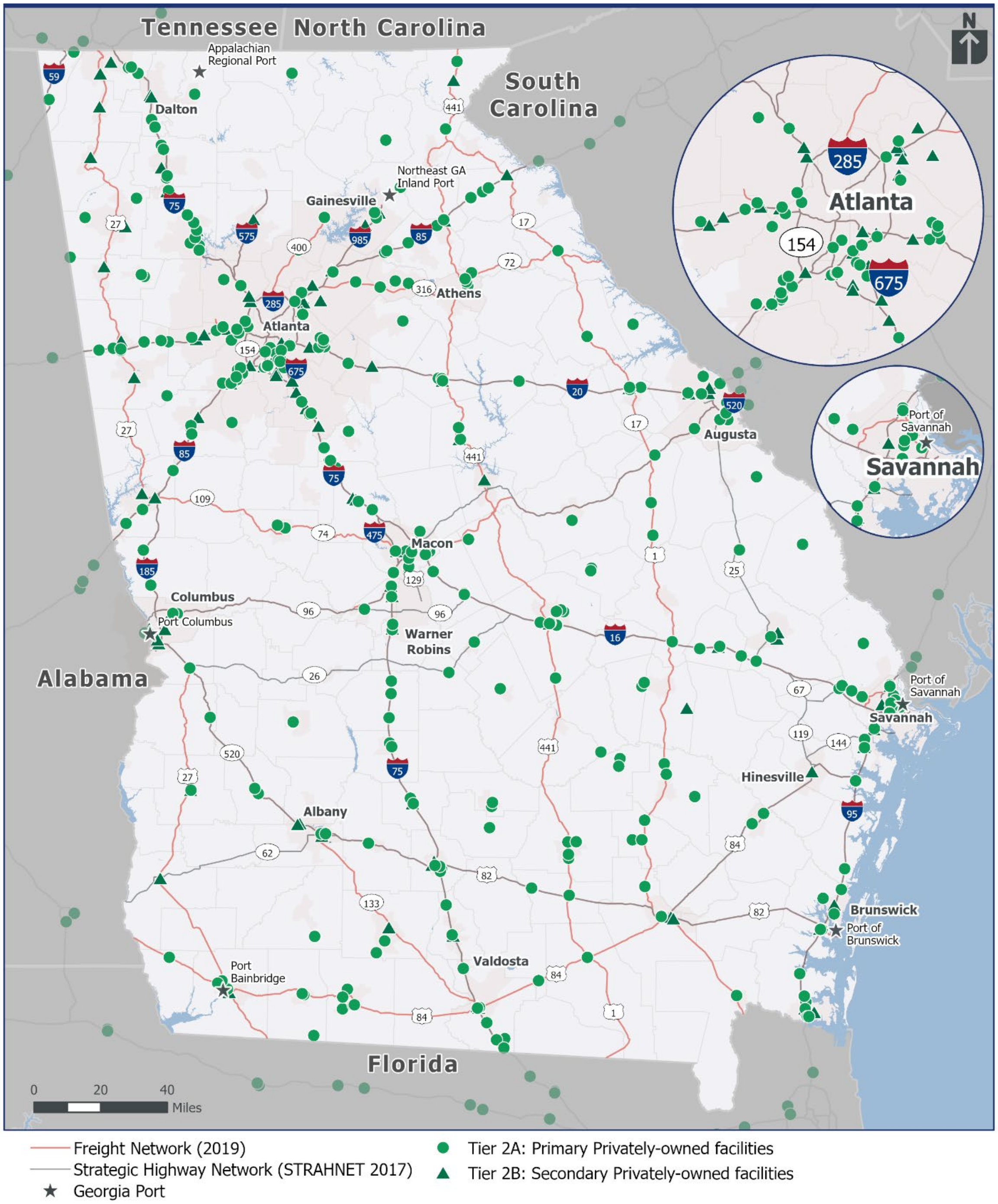
Private truck parking in the state is available at both primary and secondary facilities. Primary facilities are those whose predominant business purpose is providing rest/travel centers, refueling, and truck parking services. Primary facilities are largely developed by three major truck parking providers: Pilot, Flying J's, and Love's. Secondary truck parking facilities are those whose predominant business purpose is not directly associated with truck parking; however, they allow a certain number of truck spaces for patrons.

Examples of secondary private truck parking facilities are hotels, restaurants, and retail establishments. Typically, these businesses have large parking areas which may not be full at all hours and have developed freight-friendly policies to allow truck parking. Big box retailers such as Walmart will often permit extended truck parking in areas of their parking lots; however, many businesses are subject to additional restrictions from the property owners.

The number of private truck parking spaces is an estimate as there is uncertainty regarding the exact number of spaces at secondary facilities, with locations frequently opening and shifting. As of 2022, it is estimated that there are 481 privately-owned truck parking facilities along Georgia's freight network (362 primary and 119 secondary). Overall, these locations provide approximately 25,860 private truck parking spaces (24,883 primary and 977 secondary) throughout Georgia. As shown in **Figure 61**, private facilities are primarily located along Interstate corridors, including I-75, I-95, I-16, and I-20.

Figure 60. Private Truck Parking Data

Figure 61. Private Truck Parking Locations (2022)



Source: GDOT, Trucker-focused Apps, FHWA's Jason's Law Survey, Company websites, Georgia DCA Website

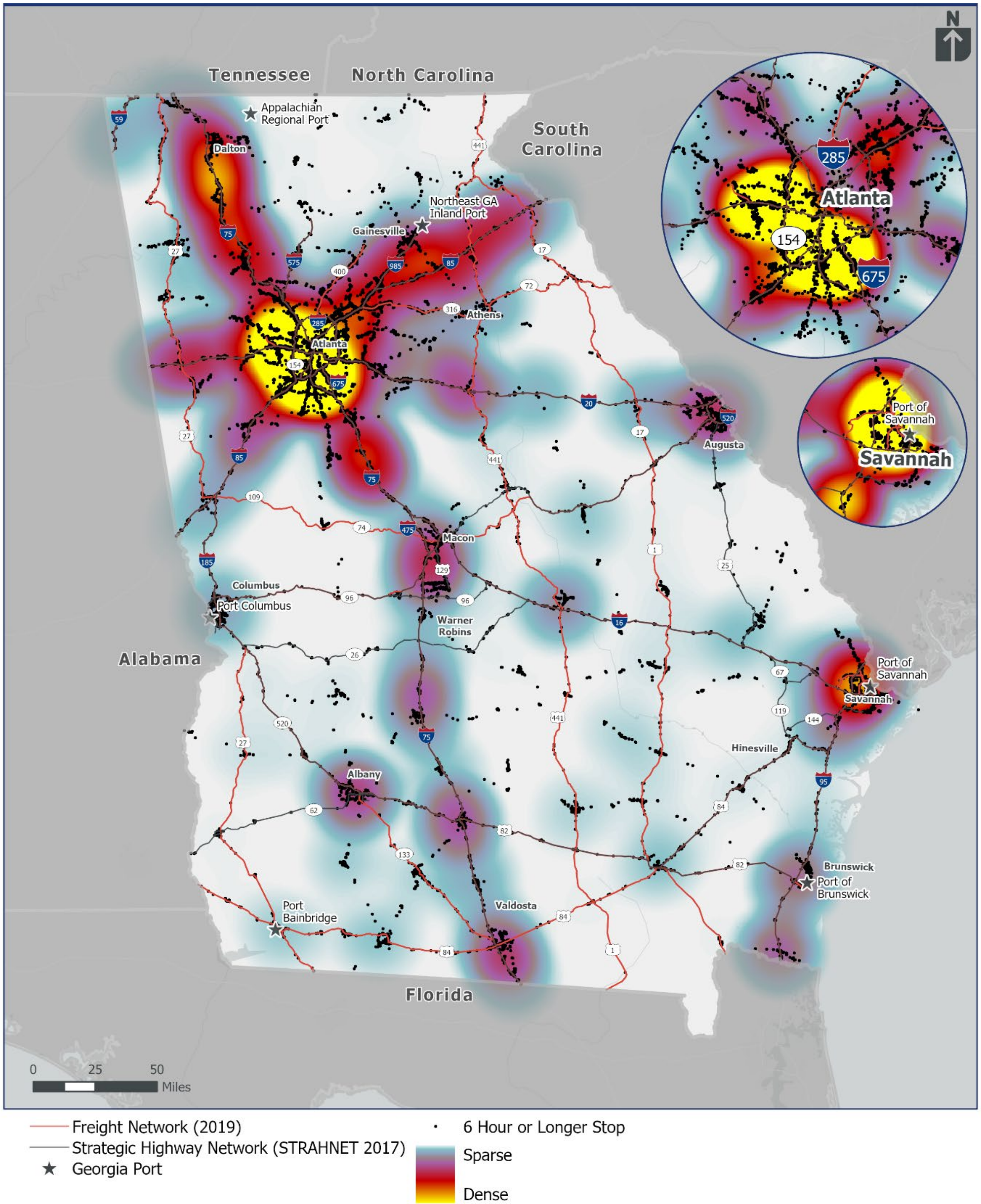
As part of the assessment of existing truck parking, truck movement (GPS) data was obtained from the American Transportation Research Institute (ATRI)[35] for a four-month period (August 2021 through November 2021). The truck movement data was analyzed to determine long term parking trends, defined as trucks parked for six or more hours. The data revealed trucks parked for more than six hours and within 80 feet of the same position (i.e., indicating that the truck has moved little or not at all). Conditions analyzed included the following:

- Long term truck parking across the state
- Long term truck parking on Interstate ramps

Long term truck parking locations across the state were generally clustered around metropolitan areas and along the major Interstate corridors with notable clusters along the Interstates and their border crossings with neighboring states. The Atlanta Metropolitan Area has the most significant clustering of truck parking, representative of a hub and spoke development pattern largely adjacent to the Interstate network (see Figure 62).

[35] Note: This dataset is representative of a sample of trucks within Georgia representative of all trucks

Figure 62. Truck Parking Clusters Across the State (6 Hours or Longer)



Source: ATRI, 2021

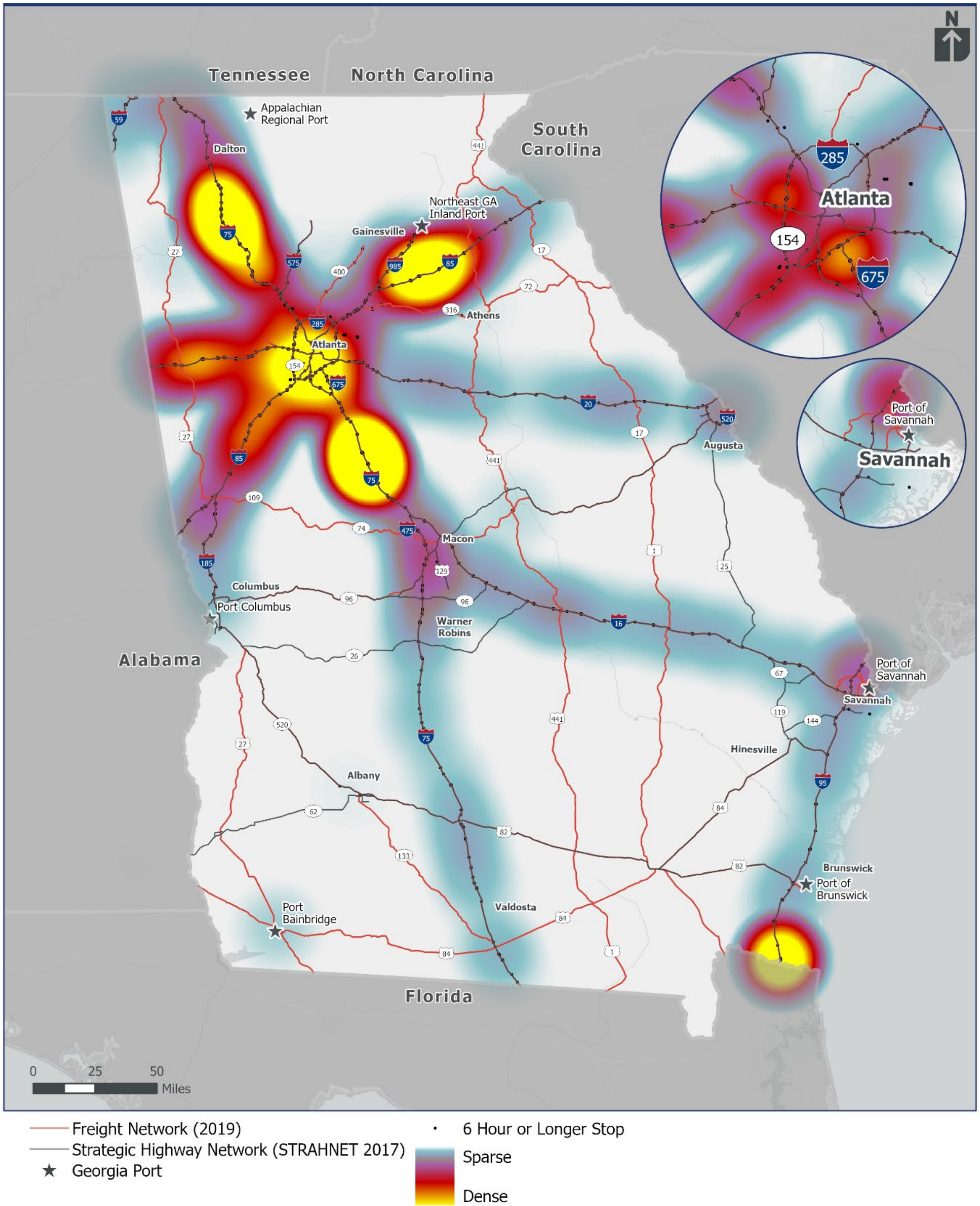
Unauthorized Truck Parking on Interstate Ramps

Due to truck parking shortages, a lack of information on truck parking locations and available parking spots, and challenges due to limited delivery windows and specific rest requirements, many truck drivers are parking in unauthorized locations which can often cause safety concerns for truck drivers and the public. Unauthorized locations include on the shoulder of the road, exit ramps, and vacant lots. The ATRI truck parking data showing parking on Interstate ramps, presented in **Figure 63**, provides an illustration of the unauthorized truck parking issue in the state.

ATRI data was used to determine trucks stopping within 100 ft of Interstate ramps across the state. The use of Interstate ramps is unauthorized and poses safety concerns for both truck drivers and other motorists. Data revealed that areas with significant ramp parking are often located adjacent to authorized truck parking facilities, such as truck stops.

Two assumptions have been made to understand why this situation comes about. The first assumption is that the parking facilities may be at or near capacity, forcing drivers to park nearby or along the ramps in order to access the facilities. The second assumption is that the truckers stop nearby in order to take advantage of the facility amenities but avoid parking fees by using the nearby ramps. However, analysis would be required on a case-by-case basis to determine why truckers are utilizing ramps rather than each parking facility. It is likely that the truckers using the ramps subscribe to either of these scenarios as the conditions at truck parking facilities are very dynamic and can change throughout the day. **Figure 64** depicts the I-75 interchange with SR 36 in Butts County, which has multiple truck parking facilities nearby. As seen in the image, there is significant clustering along the ramps, with a majority located in the northwestern quadrant. **Figure 64** also depicts another example along I-75 N in Gordon County where trucks have been identified along the ramps at the rest area. Given that the parking is free at rest areas, this trend is likely indicative of capacity limitations forcing the trucks to park outside of a designated parking area.

Figure 63. Truck Parking Clusters on Interstate Ramps



Source: ATRI, 2021

Figure 64. Ramp Truck Parking Examples

Source: ATRI, 2021

3.2. Domestic Marine Transportation

As noted by the Georgia Ports Authority, “Georgia's deepwater ports in Savannah and Brunswick, together with inland terminals in Chatsworth, Bainbridge and Columbus, are Georgia's gateways to the world. They are the critical conduits through which raw materials and finished products flow to and from destinations around the globe.” While Georgia’s ports focus primarily on international exports (shipping) and imports (receipts), they also handle significant volumes of domestic freight.

According to US Army Corps of Engineers (Corps) data for calendar year 2020, Georgia as a state handled 46,003,000 short tons of freight, with 58% received and 42% shipped, and with 1,278,000 short tons of domestic freight by water. Of that amount, 1,196,000 tons were received inbound from other states, 47,000 tons were shipped outbound from other states, and 35,000 tons were moved intrastate between two Georgia ports. See **Figure 65**.

Figure 65. CY 2020 Waterborne Tonnage by State (In Units of 1000 Short Tons)

		Shipping		Receiving		
State	**Totals***	**Domestic**	**Foreign**	**Domestic.**	**Foreign**	**Intrastate**
Georgia	46,003	47	19,071	1,196	25,654	35

Source: Waterborne Commerce Statistics Center. https://usace.contentdm.oclc.org/digital/collection/p16021coll2/id/7447

Additionally, the Corps publishes individual port statistics for major ports, including the Port of Savannah and Port of Brunswick. The Port of Savannah includes the Georgia Ports Authority (GPA) Garden City and Ocean terminals along with privately-owned dry bulk and liquid bulk terminals. One of the most important -- Colonial Oil – is located next to GPA's Garden City terminal and handles a variety of plant oils and petroleum products. Further down the Savannah River is Elba Island, one of the first major LNG export terminals in the US. GPA operates three terminals in Brunswick, including Colonels Island, the second largest ro-ro terminal in the US. As shown in **Figure 66**, the Port of Savannah handled 1,136,000 short tons of domestic marine cargo in 2020, while the Port of Brunswick handled 151,000. The total of these two ports is 1,287,000, which is higher than the state total from **Figure 65**, because it counts tons moved between the Ports of Brunswick and Savannah at each port.

Figure 66. CY 2020 Waterborne Tonnage by Port (In Units of 1000 Short Tons)

Port Name	Total	Domestic	Foreign	Imports	Exports
Port of Brunswick, GA	2,559	151	2,407	1,149	1,259
Port of Savannah, GA	43,453	1,136	42,317	24,505	17,812
Grand Total	46,012	1,287	44,725	25,654	19,071

Source: Waterborne Commerce Statistics Center. https://usace.contentdm.oclc.org/digital/collection/p16021coll2/id/7447

In 2020, the leading domestic water commodity at Savannah was, by a wide margin, Petroleum and Petroleum Products, followed by Chemicals and Products and, more distantly, by Food and Farm Products and Manufactured Equipment. Between 2016 and 2020, tonnage varied from a low of 926,459 tons in 2019 to a high of 1,522,040 tons in 2017.

Figure 67. Port of Savannah Domestic Tonnage (Short Tons) by Commodity, Years 2016 to 2020

	All Traffic Directions				
ID	**CY 2020**	**CY 2019**	**CY 2018**	**CY 2017**	**CY 2016**
All Commodities	1,135,777	926,459	1,135,854	1,522,040	1,182,897
1 Coal, Lignite& Coal Coke	0	0	0	0	0
2 Petroleum and Petroleum Products	850,104	649,602	879,811	1,094,976	844,849
3 Chemical and Related Products	209,348	176,762	255,188	269,755	319,683
4 Crude Materials, Inedible Except Fuels	0	0	0	13,079	13,012
5 Primary Manufactured Goods	0	0	0	74,228	1,285
6 Food and Farm Products	72,587	86,893	14,609	59,314	0
7 All Manufacture Equipment, Machinery and Products	3,738	13,202	16,246	10,688	4,068
9 Unknown or Not Elsewhere Classified	0	0	0	0	0

Source: Waterborne Commerce Statistics Center https://ndc.ops.usace.army.mil/wcsc/webpub/#/report-landing/year/2020/region/1/location/776

In 2020, the leading domestic water commodity at Brunswick was, by a wide margin, Chemicals and Related Products, followed distantly by Manufactured Equipment. Between 2016 and 2020, tonnage varied from a low of 68,285 tons in 2017 to a high of 151,145 tons in 2020.

Figure 68: Port of Brunswick Domestic Tonnage (Short Tons) by Commodity, Years 2016 to 2020

ID	All Traffic Directions CY 2020	CY 2019	CY 2018	CY 2017	CY 2016
All Commodities	151,145	85,577	84,380	68,285	112,750
2 Petroleum and Petroleum Products	0	0	0	1,127	0
3 Chemical and Related Products	150,845	79,577	84,105	67,158	112,750
4 Crude Materials, Inedible Except Fuels	0	6,000	275	0	0
5 Primary Manufactured Goods	0	0	0	0	0
6 Food and Farm Products	300	0	0	0	0
7 All Manufacture Equipment, Machinery and Products	0	0	0	0	0
9 Unknown or Not Elsewhere Classified	0	0	0	0	0

https://ndc.ops.usace.army.mil/wcsc/webpub/#/report-landing/year/2020/region/1/location/780

The USDOT Freight Analysis Framework (https://faf.ornl.gov/faf5/dtt_total.aspx) provides estimates of tons and value by trade type and mode, along with forecast projections. However, after consulting FAF data for domestic water mode movements originating or terminating in Georgia, the data was found to be non-aligned with the Corps statistics, so the information was not used and forecasts could not be extracted.

As a final analysis, it is interesting to examine the state level origins and destinations for Georgia domestic waterborne freight. Corps estimates dating from year 2017 show that:

- For waterborne tonnage received in Georgia, 93.9% had a Foreign/Canadian origin, and 6.1% had a domestic origin. The leading domestic origins were Texas, Georgia, and Louisiana, accounting for 79% of domestic origin traffic. See **Figure 69**.
- For waterborne tonnage shipped from Georgia, 99.3% had a Foreign/Canadian destination, and 0.7% had a domestic destination. The leading domestic destination was Georgia itself (72%), followed by New Jersey, North Carolina, and South Carolina.

Figure 69. Origins for Domestic Waterborne Tons Received in Georgia, 2017

Origin	2017 Short Tons Share of Total	Share of Domestic Only
Foreign	91.4%	
Canada	2.5%	
Texas	1.9%	30.4%
Georgia	1.6%	26.1%
Louisiana	1.4%	22.2%
New Jersey	0.6%	10.6%
Florida	0.3%	4.5%

	2017 Short Tons	
Origin	**Share of Total**	**Share of Domestic Only**
Pennsylvania	0.2%	3.4%
Maryland	0.1%	1.5%
Virginia	0.0%	0.8%
Mississippi	0.0%	0.5%
South Carolina	0.0%	0.1%
Grand Total	100.0%	100.0%

Source: Waterborne Commerce of the US https://usace.contentdm.oclc.org/digital/collection/p16021coll2/id/2971/rec/7

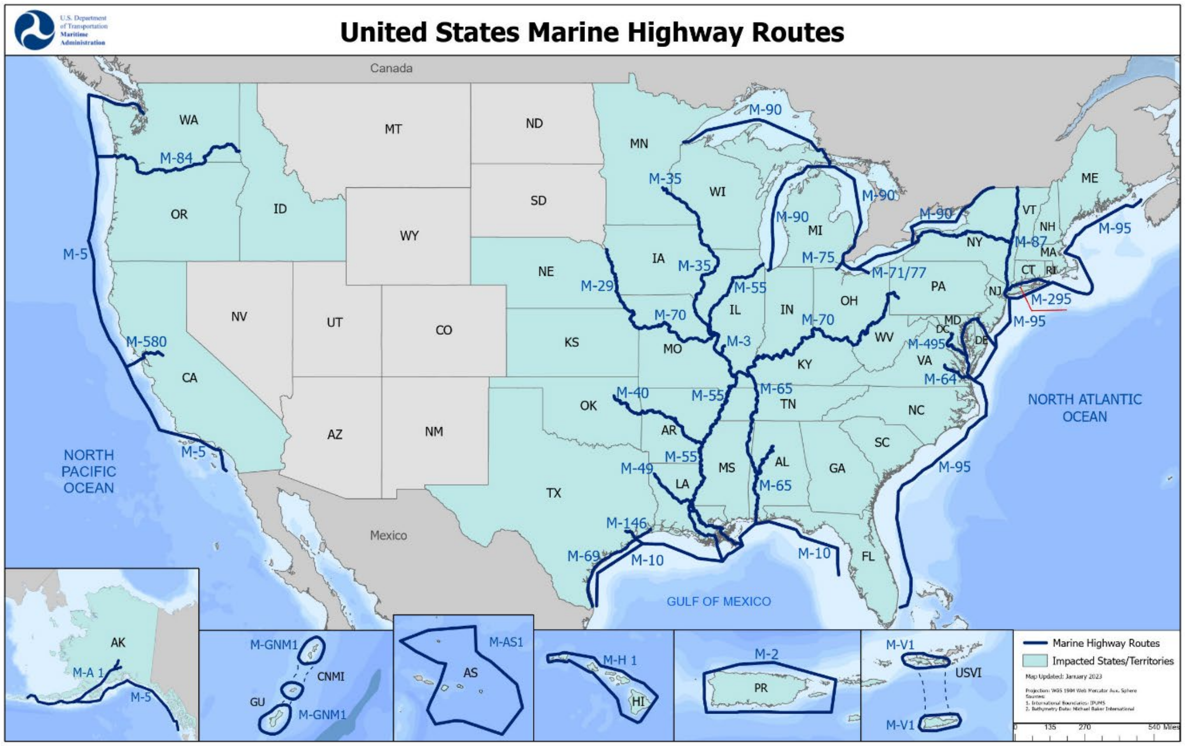
Figure 70. Destinations for Domestic Waterborne Tons Shipped from Georgia, 2017

	2017 Short Tons	
Destination	Share of Total	Share of Domestic
Foreign	97.1%	
Georgia	2.0%	72.1%
New Jersey	0.4%	14.8%
Canada	0.2%	
North Carolina	0.2%	6.0%
South Carolina	0.1%	3.8%
Florida	0.1%	2.7%
Texas	0.0%	0.6%
Grand Total	100.0%	100.0%

Source: Waterborne Commerce of the US https://usace.contentdm.oclc.org/digital/collection/p16021coll2/id/2971/rec/7

Georgia sits on the designated “M-95” United States Marine Highway Route. As all of its domestic waterborne freight to and from other states moves coastally, either north or south from Georgia’s ports, all of it follows and falls within the M-95 service platform. In the future, growth in domestic freight movement is expected to occur consistent with the availability of port facilities and market demand, and is likely to focus on established marine markets such as fuels, chemicals, food/farm products, and machinery.

Figure 71. Designated Marine Highway Routes



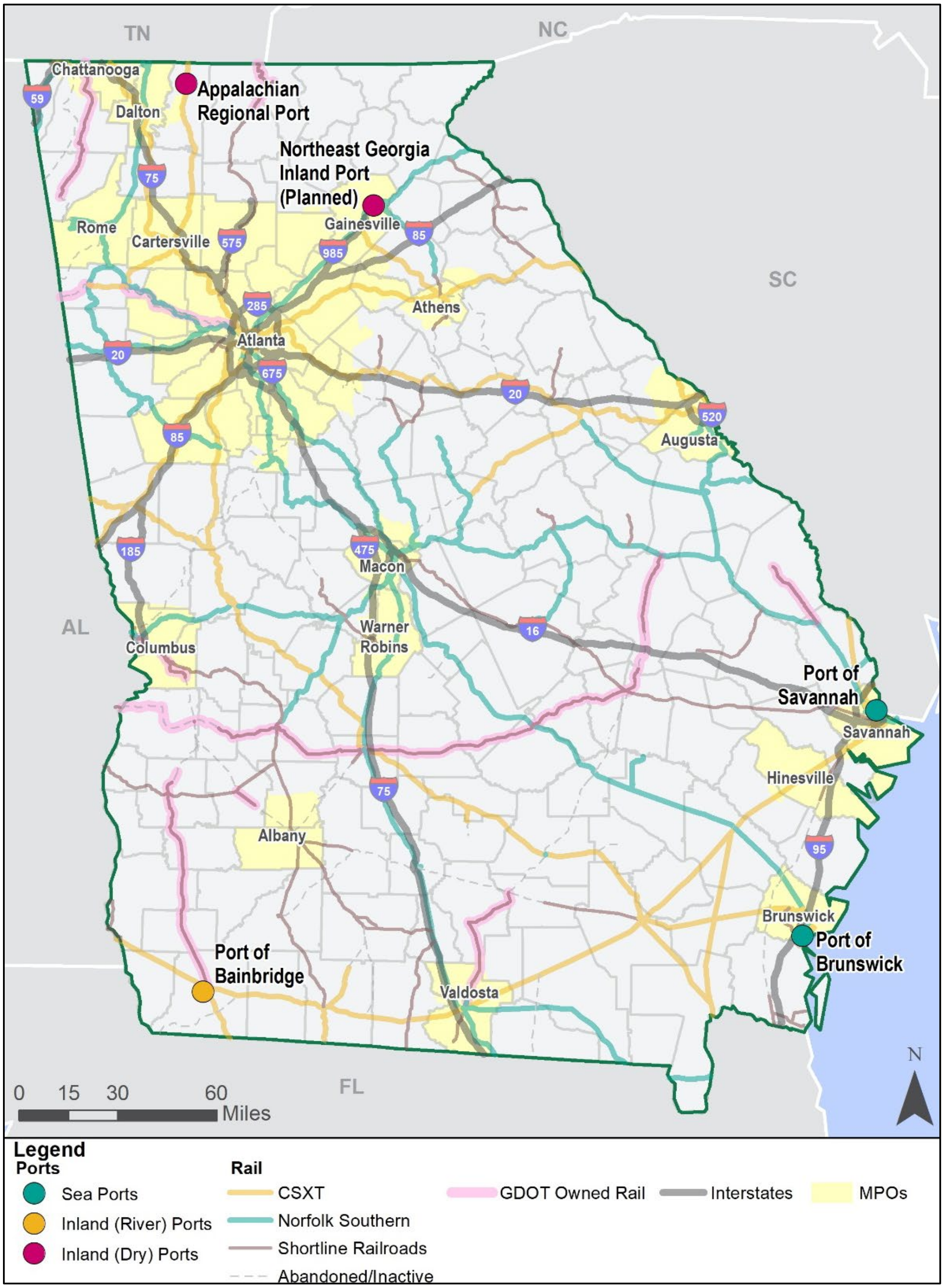
https://www.maritime.dot.gov/grants/marine-highways/marine-highway

3.3. Sea Ports and Inland Ports

Georgia Ports, and the Georgia Ports Authority (GPA), play a major role in both the state's economy and the national and global logistics network. There are two seaports in Georgia: the Port of Savannah and the Port of Brunswick. The Port of Savannah includes Garden City Terminal and Ocean Terminal. The Port of Brunswick includes Colonel's Island Terminal, Mayor's Point, and East River Terminal. Both Class I railroads (CSX and NS) and several short line railroads serve the five seaport terminals.

Inland ports are facilities that complement or partially duplicate seaport functions at inland locations. Inland ports serve two primary functions: they provide capacity relief to seaports and facilitate distribution in the interior of the state. Georgia's inland ports are Appalachian Regional Port in Crandall (a dry port) and Port of Bainbridge (a river port). A new inland port, Northeast Georgia Inland Port in Gainesville, is currently in the planning stages. **Figure 72** shows Georgia's seaports and inland ports.

Figure 72. Georgia Ports



Source: Georgia Ports Authority and GDOT State Rail Plan

3.3.1. Seaports

In 2021, Georgia's two seaports at Savannah and Brunswick moved a combined 5.6 million twenty-foot equivalent container units (TEUs) and nearly 670,000 Roll-On/Roll-Off volumes, primarily consisting of passenger vehicles and heavy machinery.

Port of Savannah

The Port of Savannah is made up of two major terminals: Garden City Terminal and Ocean Terminal. The Garden City Terminal is the largest single terminal in North America and the fourth busiest container port in the United States. Both Class I railroads have facilities on the terminal. The Mason Intermodal Container Transfer Facility serves NS intermodal transport, while the Chatham ICTF serves CSX intermodal traffic.[36]

In 2021, the Port of Savannah moved a record 5.6 million TEUs, an increase from 4.44 million TEUs in 2020 and 4.48 million TEUs in 2019. Compared to 2011, trade through the Port of Savannah has expanded by 90 percent in a single decade.

The GPA continues to increase the Port's capacity through infrastructure projects and container yard expansions. By late 2022, the Port of Savannah will have an additional 1.7 million TEUs of annual container yard capacity, and by 2025 the capacity will increase from 6 million TEUs to 9.5 million TEUs. GPA has also completed the second set of nine new rail tracks for a total of 18 tracks at the Mason Mega Rail Terminal. This expansion increases intermodal capacity by over 30 percent; the terminal is now the largest intermodal port terminal in North America and will support a rail lift capacity of 1 million annual TEUs. Additionally, the project will allow both NS and CSX to build 10,000-foot trains (nearly 2 miles long) by adding 97,000 feet of new rail for a total of 34 miles. Longer trains will enable more frequent and reliable direct service to customers in territory reaching westward to Dallas and Memphis and into the Midwest.[37]

The Port of Savannah is also constructing a new cross-dock facility to be able to transload freight from ocean containers into trailers and intermodal containers. The 325-door facility will be located on a 90-acre parcel and is anticipated to open in 2023.[38]

Garden City Terminal West is also continuing to expand: The Berth 1 project at the Garden City Terminal will increase capacity by 25 percent and allow the dock to simultaneously serve four 16,000-TEU vessels and three additional ships by 2023. Expansion will add approximately 1.5 million TEUs per year of berth capacity.[39] .

Ocean Terminal is a 200-acre breakbulk and Roll On-Roll Off facility that processes wood, steel, automobiles, and farm equipment. It is served directly by NS on terminal, who handles switching to CSX. The Savannah Harbor Expansion Project (SHEP) has completed dredging in 2022. The

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[36] GDOT State Rail Plan, 2021
[37] Georgia Ports Authority, Mason Mega Rail Report: https://gaports.com/rail/megarail/
[38] The Journal of Commerce, "Savannah Port Delves into Transloading to Jolt Development", 2021
[39] Georgia Ports Authority Press Release, "GPA Details Capacity Operations Expansion", 2021

deepening adds five feet in depth and will facilitate vessels carrying over 16,000 TEUs, increasing container through-put. SHEP is anticipated to net over $291 million in annual benefits to the United States. Dredging first began in 2015, and feasibility studies started in 1997.[40].

In addition to its prominence as a freight hub, the Port of Savannah has played an important role in U.S. military mobilization; the Department of Defense has designated 15 seaports in the United State, including the Port of Savannah, as strategic ports. In the case of large-scale military deployment, nearly 95 percent of equipment and supplies would be transported out of these 15 ports. Notably, the Port of Savannah's Ocean Terminal is the primary port for the 3rd Infantry Division's deployment activities.[41] The Port of Savannah has played a key support role in past military activity, including in 1990, when 10 vessels carried 7,764 pieces of military equipment and 1,000 soldiers to Saudi Arabia as part of Operation Desert Shield during the Gulf War.[42]

Port of Brunswick

In 2021, the Port of Brunswick's Roll-On/Roll-Off volumes of vehicles and heavy machinery grew by 11 percent over 2020 and by 6 percent over 2019 to a total of 650,000 units.[43]

The autoport at Colonel's Island in Brunswick serves over a dozen major auto manufacturers, and the site is the second busiest hub in the country for import/export of vehicles and heavy equipment. After a planned expansion is complete, Colonel's Island Terminal will have capacity for 1.4 million vehicles annually.[44] The terminal is directly served by the Golden Isles Terminal Railroad, which provides switching services to both NS and CSX.

Mayor's Point Terminal is a breakbulk facility that primarily handles forest and wood products and has 355,000 square feet of covered storage. The Terminal is served by a shared CSX/NS rail line.

East River Terminal is a breakbulk and liquid and dry bulk facility that is owned by the Georgia Ports Authority and leased to Logistec U.S.A. In FY 2019, Logistec moved 1.2 million tons of bulk cargo, a 20 percent increase over FY2018. The same CSX/NS rail line that serves Mayor's Point Terminal also serves Marine Ports Terminal.

3.3.2. Inland Ports

The Appalachian Regional Port is a 42-acre dry terminal that handles container cargo. The site contains 6,000 feet of rail on three tracks and is served by CSX. The Port has import/export capacity of 1,670 TEUs.

[40] Georgia Ports Authority Press Release, "Port of Savannah Marks Milestone: Harbor Deepening Complete", 2022

[41] Savannah Morning News," GPA's Ocean Terminal Bustling with Activity", 2012

[42] Georgia Ports Blog, "Georgia Ports provided key gateway for Operation Desert Shield", 2019.

[43] Georgia Ports Authority, Annual Report, 2021

[44] GDOT State Rail Plan, 2021

The Port of Bainbridge is a 67-acre river terminal that handles dry bulk cargo. The site has a total of 93,000 square feet of warehouse and transit shed storage space, front end loaders, forklifts with 9,000-pound lift capacity, and a dry bulk unloader.[45]

The new Northeast Georgia Inland Port in Gainesville will benefit major manufacturers in the area and will serve as a new distribution point for the Atlanta market. The Northeast Georgia Inland Port facility is anticipated to be 104-acres and provide a direct link to the Port of Savannah via NS rail. In its initial stage, the terminal will have 9,000 feet of track. At full build out, the terminal will have 18,000 feet of rail and capacity for 150,000 container lifts per year.[46] The U.S. Department of Transportation awarded the Georgia Ports Authority $46.9 million in federal funds; the project was one of 24 selected to receive federal funding out of 157 applications. Port construction is anticipated to take place between 2022 and 2024.[47]

3.4. Rail

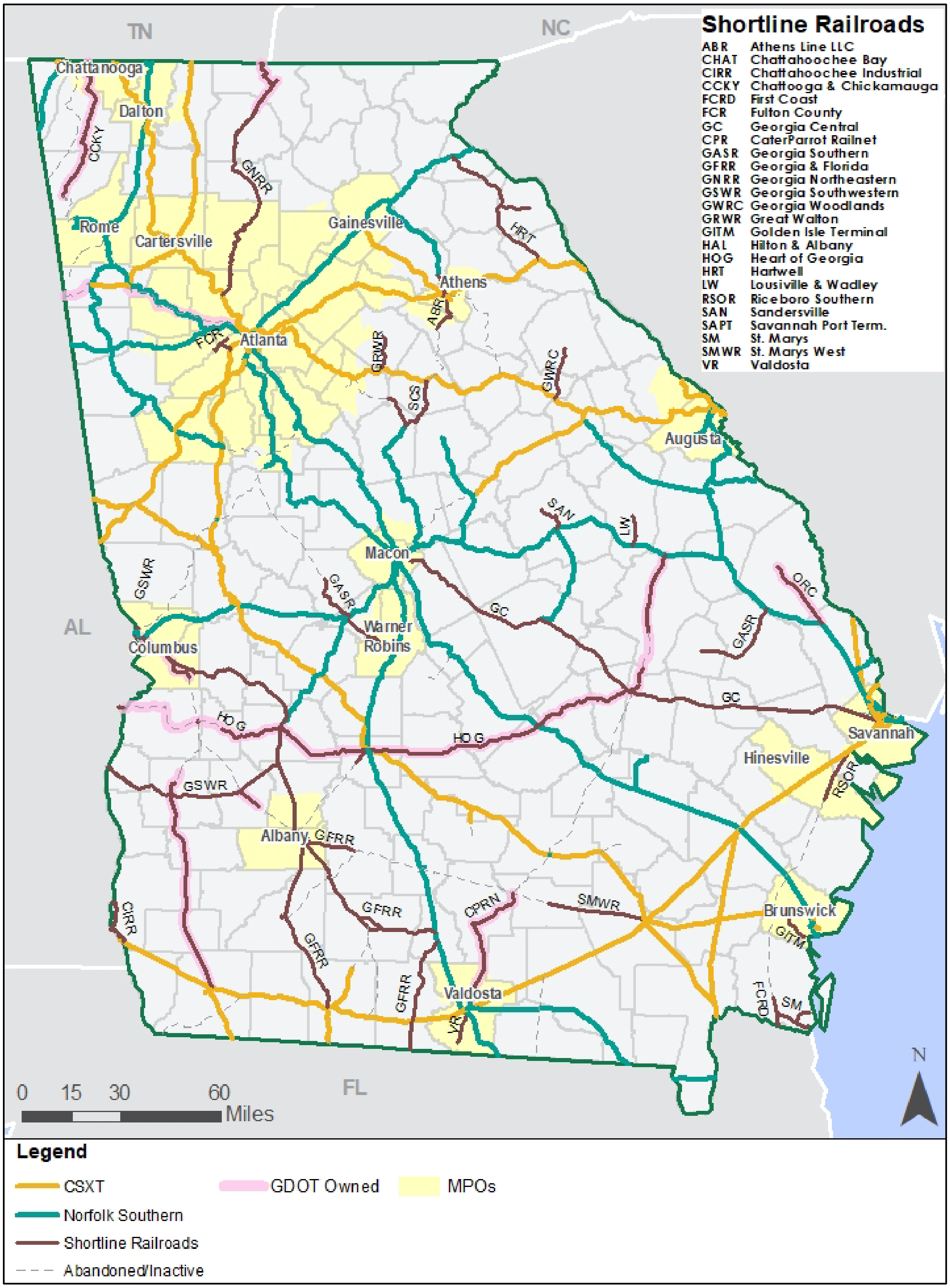
Georgia's existing rail network includes 4,607 miles of track, making it the seventh largest network in the country. Private freight railroads own over 85 percent of railroad miles, GDOT owns nearly 10 percent of miles, the Georgia State Properties Commission owns almost 3 percent, and the Georgia Ports Authority owns 1 percent of railroad miles.[48]

The federal Surface Transportation Board (STB) separates railroad carriers operating in the United States into three classifications based on annual operating revenues. Class I railroads generate at least $447,621,226 in annual operating revenues, Class II railroads generate between $35,809,798 and $447,621,226 in annual operating revenues, and Class III railroads generate $35,809,698 or less in annual operating revenues. Georgia's freight railroads are either large long-haul carriers (Class I) or smaller short line/terminal/switching carriers (Class III). Class I railroads tend to focus on providing long-distance line haul service, connecting Georgia with other parts of the U.S., Canada, and Mexico, as well as with seaports and overseas trade. Short line (Class III) railroads tend to provide first- and last-mile service, connecting Georgia businesses to the long-distance rail network. These connections provide access to raw materials, inland ports, and global markets.

Figure 73 shows Georgia's existing rail network by operator and class of railroad.

[45] Georgia Ports Authority CY2021 Port Guide & Directory
[46] Georgia Ports Authority, Northeast Georgia Inland Port Report: https://gaports.com/facilities/inland-ports/northeast-georgia-inland-port/?1648216002
[47] Michael E. Kanell, Atlanta Journal Constitution: "Feds to give $46.9 million for inland port in Gainesville", 2021
[48] GDOT State Rail Plan, 2021.

Figure 73. Georgia Rail Inventory



Source: Georgia State Rail Plan

3.4.1. Class I Railroads

There are seven Class I Freight Railroads operating in the United States. Two of them, CSX Transportation and Norfolk Southern (NS), operate in the State of Georgia.

Within Georgia, Class I railroads operate over 3,200 miles of railroad, comprising 68 percent of the state's track miles. CSX owns 1,382 miles of railroad and operates 1,501 miles.[49] All CSX trackage is located to the east of the Mississippi River and provides connections to western railroads. Primary commodities transported by CSX are agricultural products, automotive goods, intermodal containers, bioenergy, building materials, chemicals, coal and ore, fertilizers, food products, machinery, manufactured goods, metals, military, minerals, oil, gas and drilling materials, paper and fiber products, and transportation equipment.[50] NS, which recently relocated its headquarters to Atlanta, owns 1,697 miles of railroad and operates 1,706 miles.[51] NS is primarily located east of the Mississippi River and provides connections with western rail carriers. Primary commodities transported by NS are intermodal containers, paper, clay, forest products, metals and construction, agriculture, chemicals, and automotive goods.[52]

3.4.2. Short Line Railroads

According to federal STB classifications, short line railroads include the Class III rail classifications reflecting annual operating revenue less than $40.4 million. 29 short line carriers operate 1,573 miles of railroad in Georgia, representing 32 percent of trackage in the state. The majority of the mileage operated by short line railroads in Georgia is on rail lines leased from either GDOT, Class I carriers, or the Georgia Ports Authority. Short lines provide crucial transportation connections to businesses throughout Georgia, supplying first and last mile links to Class I railroads as well as service for local traffic.

GDOT owns several short lines that are leased to private companies for operation. Private companies operating on these lines are Chattooga & Chickamauga Railway (CCKY), CaterParrot Railnet (CPR), Georgia Northeastern Railroad (GNRR), Georgia Southwestern Railroad (GSWR), Heart of Georgia (HOG), and Ogeechee Railroad Company (ORC).[53]

3.4.3. Intermodal Rail Terminals

Intermodal facilities execute transfers of containerized freight between truck and rail. Intermodal Rail Terminals in Georgia include Austell-Whittaker Yard, Inman Yard, Fairburn Yard, Garden City Terminal, and Savannah Yard. These are shown in **Figure 74**. Conversely, transload facilities execute transfers of non-containerized freight between truck and rail. Transload

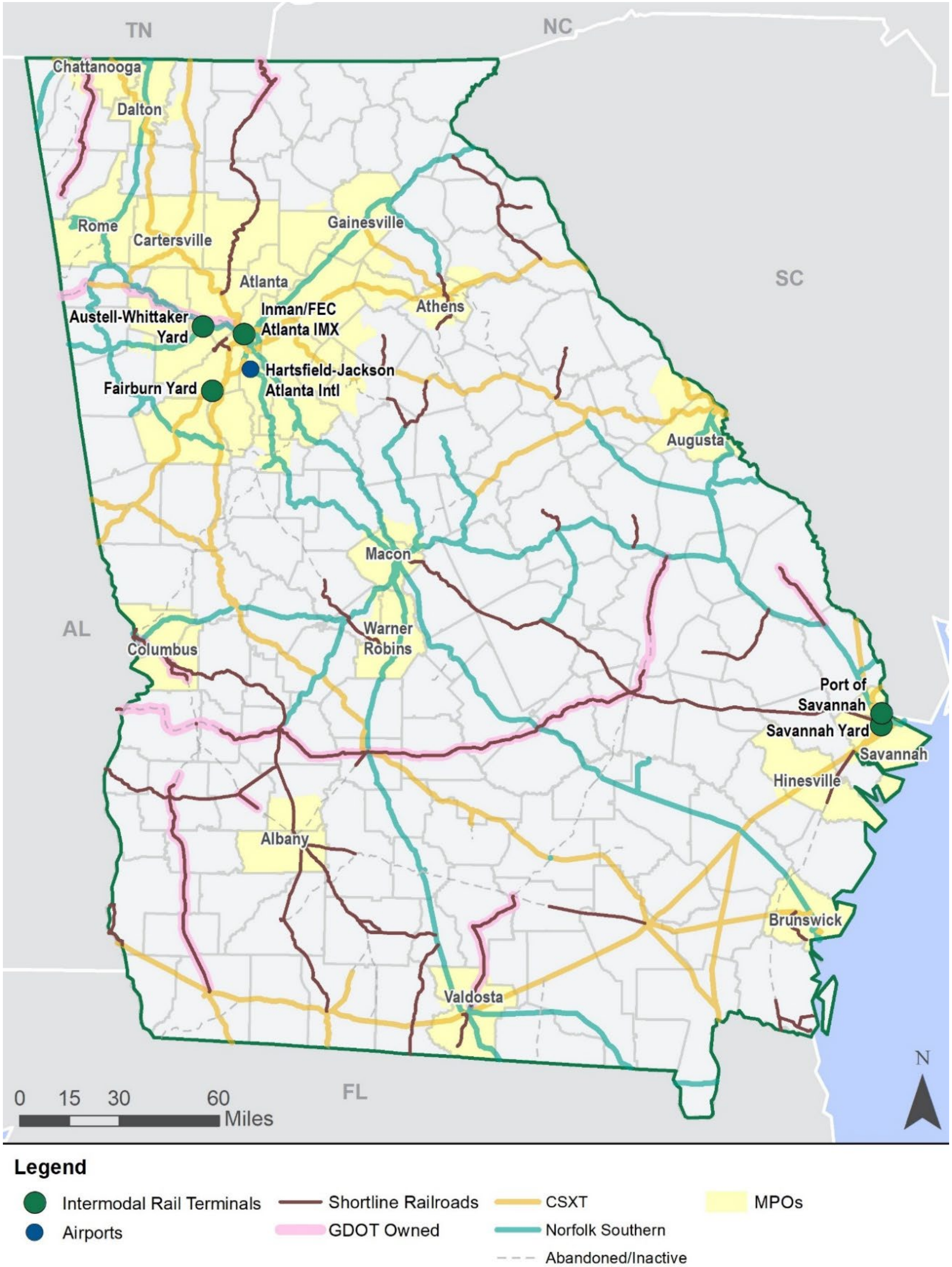
[49] STB Schedule 702 Reports, 2019
[50] CSX website: https://www.csx.com/index.cfm/customers/commodities/
[51] STB Schedule 702 Reports, 2019
[52] NS website: http://www.nscorp.com/content/dam/nscorp/get-to-know-ns/about-ns/state-fact-sheets/ga-state-fact-sheet.pdf
[53] GDOT State Rail Plan, 2021

facilities are located throughout Georgia and include several categories of sites: team tracks allow local shippers to load and unload smaller quantities of products, bulk transload facilities transfer liquid or dry bulk cargo, dimensional transload facilities transfer long products like lumber, steel, and rebar, and warehouse transload facilities transfer breakbulk products from rail directly into a warehouse building.

There are six automotive rail facilities located in Georgia (see **Figure 75**), all of which support auto manufacturing and distribution throughout the state and the southeast region. CSX loads new vehicles from the Kia Motors Manufacturing plant in West Point, which began operation in 2010 and produces 340,000 vehicles annually. NS owns the Poole Creek facility in Hapeville (Atlanta), Georgia, and unloads at a large private Toyota facility in Commerce. CSX, through its subsidiary, Total Distribution Services Inc. (TDSI) operates an unloading facility in Lawrenceville.[54]

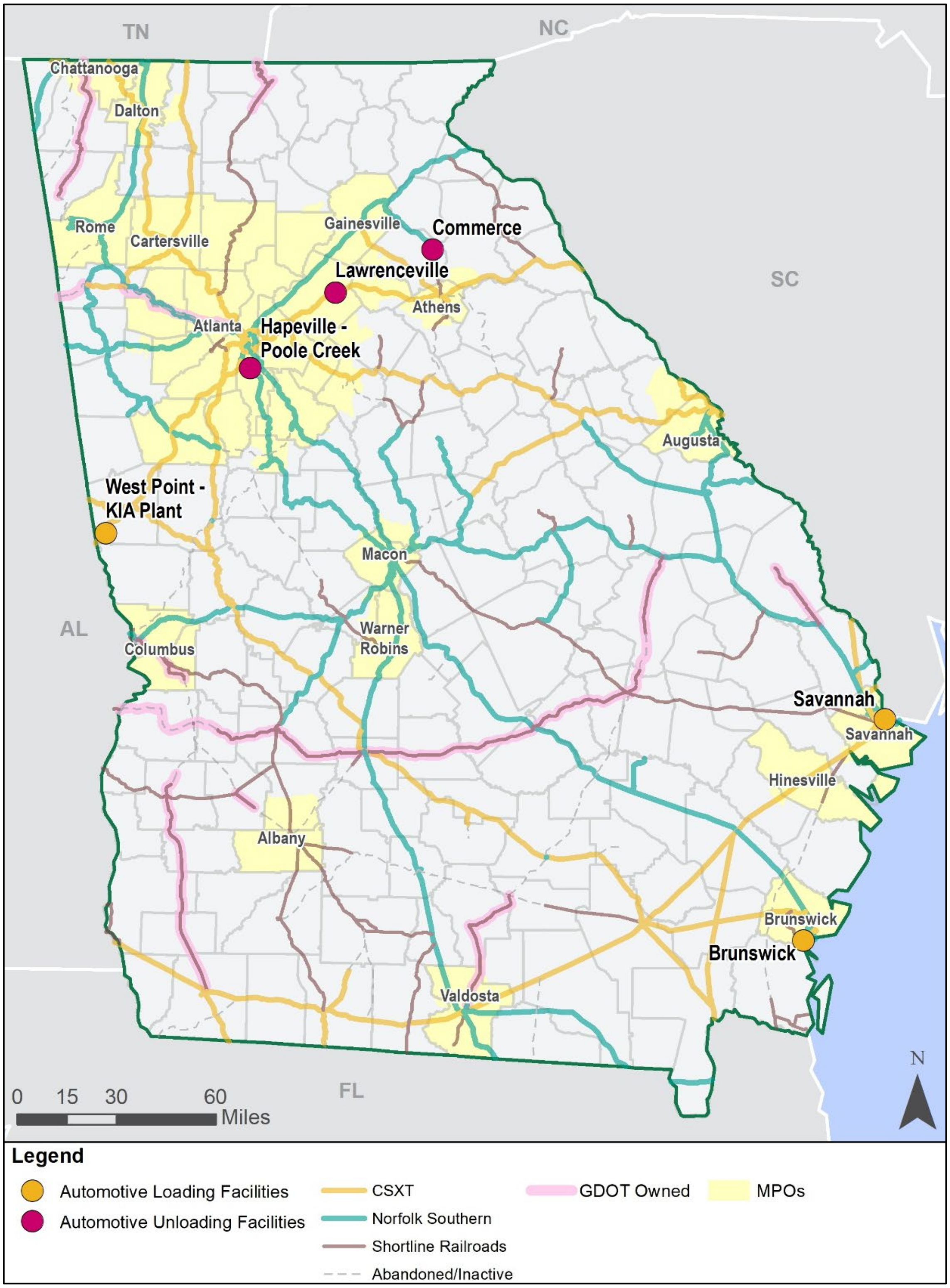
[54]Automotive Facility Guide, Transportation Tech Center Inc.

Figure 74. Intermodal Rail Terminals in Georgia



Source: GDOT State Rail Plan

Figure 75. Automotive Rail Facilities in Georgia



Source: GDOT State Rail Plan

3.4.4. Rail-Highway Crossing Inventory

Within Georgia, there are 5,037 public vehicular highway-rail grade crossings. Nearly half of these crossings are equipped with train-activated warning devices, most of which have gates, as shown in **Table 75**.

Table 75. Georgia Public Grade Highway-Rail Crossings

Primary Warning Device	Count	Percentage
Passive Warning Devices	2,628	52%
Flashers	147	3%
Gates	2,244	45%
Total	**5,019**	**100%**

Source: GDOT State Highway-Rail Grade Crossing Safety Action Plan

3.5. Air

Seven of Georgia's airports transport cargo, and demand for airport freight services increased in 2021 as overall freight demand grew. **Table 76** shows the cargo tonnage transported between December 2020 and December 2021 at Georgia's freight-moving airports; Hartsfield Jackson transported the largest volume by an order of magnitude over the Southwest Georgia Regional, the next highest freight-moving airport.

Table 76. Freight Transportation by Georgia Airports 2021

Airport	Location	2021 Freight/mail (tons)	U.S. Rank
Hartsfield-Jackson Atlanta International (ATL)	Atlanta	4,895,000	16
Southwest Georgia Regional (ABY)	Albany	300,000	99
Savannah/Hilton Head International (SAV)	Savannah	80,000	149
Columbus Airport (CSG)	Columbus	2,030	368
Augusta Regional at Bush Field (AGS)	Augusta	115	535
Athens/Ben Epps (AHN)	Athens	24.3	589
Middle Georgia Regional (MCN)	Macon	13.1	612

Source: USDOT Bureau of Transportation Statistics, TranStats

Much of the freight transported through Georgia's airports is moved by integrators, which are companies that market door-to-door services directly to customers and own the shipping assets: aircraft, trucks and logistics centers. The three primary integrators in Georgia, nationally, and globally are UPS, FedEx, and DHL. Amazon has become a fourth player, using leased aircraft to feed shipments to its delivery trucks. Integrators control most of the domestic air cargo market; they are major players internationally as well, but the overseas market depends on space in the baggage compartments (bellies) of widebody passenger aircraft. Freight forwarders and third-party logistics companies (3PLs) market this capacity to customers and arrange connecting truck service. Connections can be local or long-distance road feeder service.

Figure 76 shows Georgia's airports, located throughout the state, and highlights the three major cargo airports in Atlanta, Albany, and Savannah.

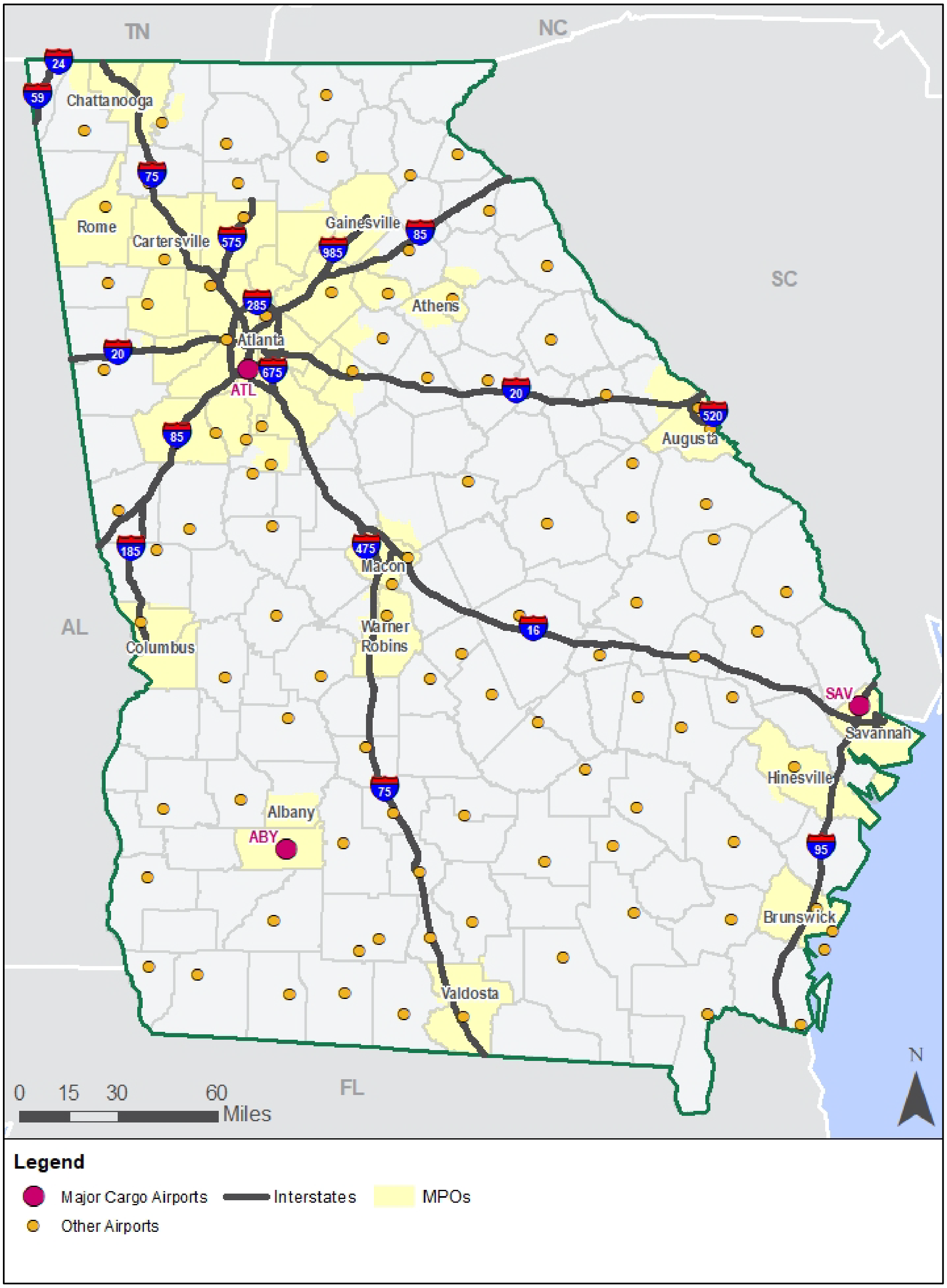
3.5.1. Hartsfield-Jackson Atlanta International Airport

In 2021, the Hartsfield-Jackson Atlanta International Airport (HJAIA) carried the 16th highest freight tonnage of all airports in the country. The integrators operate here, but HJAIA's ranking is due in large part to the high frequency of international passenger flights that fly in and out of Atlanta, supplying ample belly capacity for cargo. Hartsfield-Jackson has three main air cargo areas—North, Midfield, and South—that cover a total area of approximately 6.4 million square feet (147 acres). The Airport plans to expand its cargo building space in an area to the west of the existing South Cargo Area. The site is approximately 40 acres. The Airport also has plans to reconfigure Perry J. Hudson Parkway to allow for expansion of the truck maneuvering space in the North Cargo Area and the North Inner Loop Road.

3.5.2. Other Freight Moving Airports

Within Georgia, Southwest Georgia Regional Airport in Albany and the Savannah/Hilton Head International Airport in Savannah are the second and third most heavily used airports for freight cargo, respectively. While many of the other smaller airports around the state transport freight, they do so to a far lesser extent.

Figure 76. Georgia Airports



Source: USDOT Bureau of Transportation Statistics, TranStats

3.6. Pipelines

Pipelines transport most of the natural gas and nearly two-thirds of all hazardous liquids (including crude and refined petroleum) in the United States. Most of these pipelines are privately owned and operated. There are three major types of pipelines[55]:

1. Natural gas distribution pipelines transport natural gas from transmission pipelines to commercial and residential customers. There are over 1.2 million miles of natural gas distribution lines in the U.S.
2. Natural gas transmission and storage pipelines move natural gas from its sources to the local companies operating the distribution network. There are 324,600 miles of natural gas transmission and storage pipelines are more than 400 storage facilities.
3. Hazardous liquid pipelines and tanks: 177,600 miles of pipeline. Most of these carry crude oil to refineries or refined petroleum products (e.g., gasoline or diesel fuel) to product terminals and airports.

3.6.1. Natural Gas Pipeline Network in Georgia

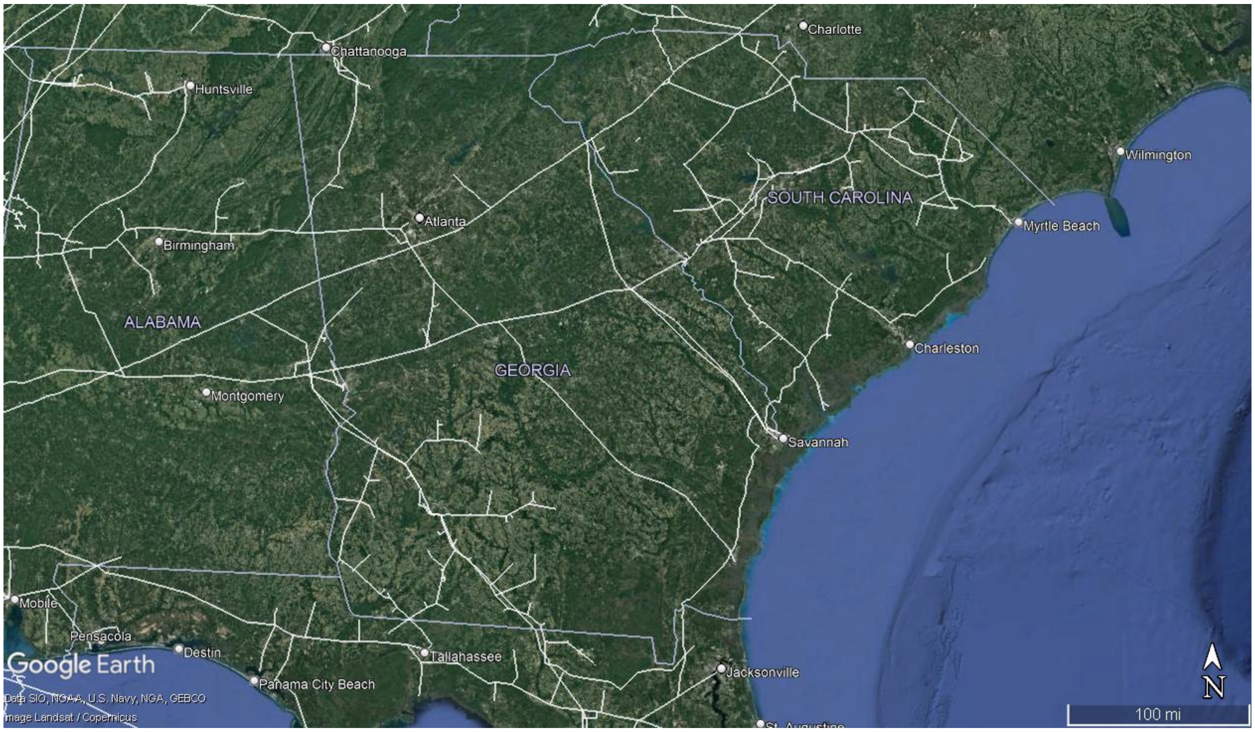
Natural gas customers in Georgia can purchase gas from one of three types of providers: an investor-owned local distribution company, a natural gas marketer, or a municipal gas system. The choice often depends on the customer's location and the service network of the provider[56].

- Some of the key features and companies of the state's pipeline system are noted below[57]:
- 84 municipal gas systems provide natural gas to Georgia residents. Prices for municipal gas service are not subject to Public Service Commission (PSC) regulation.
- Liberty Utilities, Georgia's only local distribution company, is fully regulated by the PSC.
- Atlanta Gas Light Company (AGLC), which opened its territory to competition in 1998, features ten certified natural gas marketers serving customers on AGLC's system. The prices charged by marketers are market-based, but rates for AGLC's distribution service are still regulated by the PSC.

A map showing the major interstate pipelines in Georgia is shown in **Figure 77**:

[55] R. William Johnstone, "Transportation Systems and Security Risk", published 2015 in Protecting Transportation. Retrieved October 6, 2015 at https://www.sciencedirect.com/science/article/pii/B9780124081017000039
[56] State of Georgia Public Service Commission, "Natural Gas", published by Georgia Public Service Commission. Retrieved October 6, 2022 at https://psc.ga.gov/utilities/natural-gas
[57] Ibid.

Figure 77. Major Natural Gas Interstate Pipelines in Georgia



Source: Freight Insights using data from the National Pipeline Mapping System

The four major interstate natural gas pipelines in the state are the Transcontinental Gas pipeline, Southern Natural Gas pipeline, Sabal Trail Transmission pipeline, and South Georgia Gas pipeline. More information on the first three pipelines is provided below:

Transcontinental Gas Pipeline[58]:

- Length: 10,200 miles
- Capacity: 1.1 billion cubic feet per day (design capacity)
- Ownership Interest: Williams Partners L.P.
- Operator: Transcontinental Gas Pipe Line Company, LLC (Transco)

[58] Williams Northeast Supply Enhancement, "Transcontinental Gas Pipeline Company", report published 2013 by The Williams Companies, Inc. Retrieved October 6, 2022 at https://northeastsupplyenhancement.com/wp-content/uploads/2016/11/transco-fact-sheet.pdf

Southern Natural Gas Pipeline[59]:

- Length: 7,600 miles
- Capacity: 3.4 billion cubic feet per day
- Ownership Interest: Kinder Morgan Energy Partners, Southern Company
- Operator: Kinder Morgan Energy Partners

Sabal Trail Transmission Pipeline[60]:

- Length: 517 miles of 36-inch and 24-inch diameter pipeline
- Capacity: 1.03 billion cubic feet per day (Bcf/d) (Estimate)
- Ownership Interest: 50 percent Enbridge Inc, 42.5 percent NextEra Energy, Inc, 7.5 percent Duke Energy Corporation
- Operator: Enbridge Inc

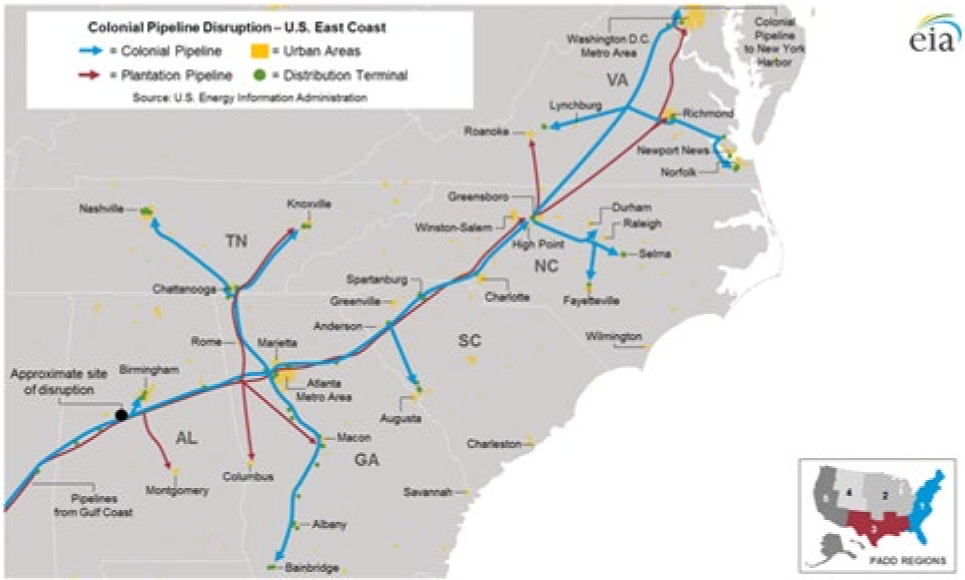
3.6.2. Products Pipeline Network in Georgia

Since there are no refineries between Alabama and Pennsylvania that produce substantial quantities of transportation fuels, the U.S. Southeast is primarily supplied by pipeline flows from refineries along the U.S. Gulf Coast and supplemented by imports via marine shipments. There are two major pipelines that transport refined products, including gasoline, diesel, heating oil and jet fuel, to the state of Georgia. These are the Colonial Pipeline and the Plantation Pipeline, shown in **Figure 78**.

[59] Kinder Morgan, "Southern Company, Kinder Morgan Finalize Southern Natural Gas Pipeline Strategic Venture", Published September 1, 2016 by Kinder Morgan. Retrieved October 6, 2022 at https://ir.kindermorgan.com/news/news-details/2016/Southern-Company-Kinder-Morgan-Finalize-Southern-Natural-Gas-Pipeline-Strategic-Venture/

[60] LINK System, Informational Postings, "Sabal Trail Transmission", published by Enbridge. Retrieved October 6, 2022 at https://infopost.enbridge.com/infopost/STTHome.asp?Pipe=STT

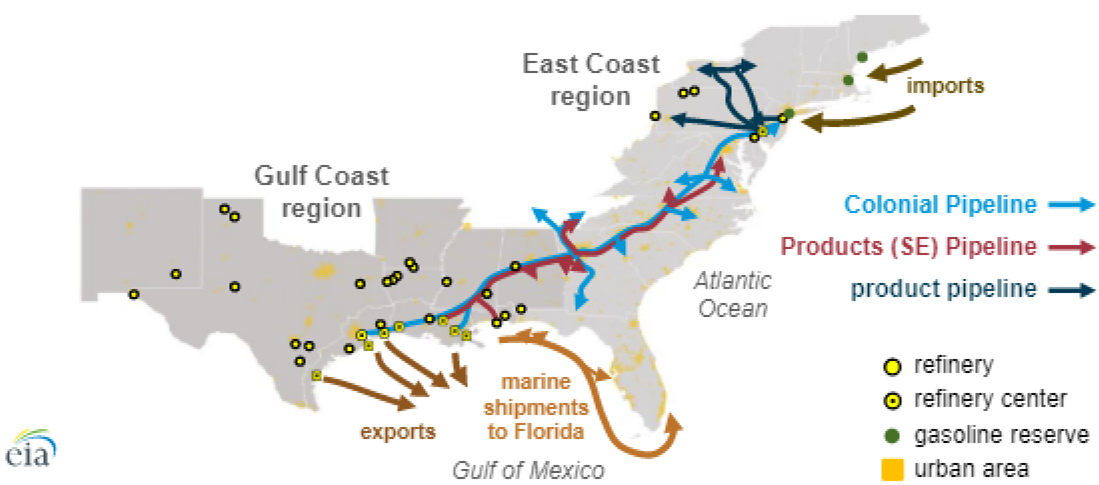
Figure 78. Map of the Colonial Pipeline and Plantation Pipeline



Source: U.S. Energy Information Administration (US EIA). Retrieved October 19, 2022 at https://www.eia.gov/todayinenergy/detail.php?id=28032

The Colonial Pipeline is a 2.5 million barrel per day (b/d) system of approximately 5,500 miles of pipeline connecting 29 refineries and 267 distribution terminals, carrying refined products from as far west as Houston, Texas, to as far north as New York Harbor. **Figure 79** shows the location of the refineries relative to the pipelines.

Figure 79. Petroleum Product Supply in U.S. Southeast Region

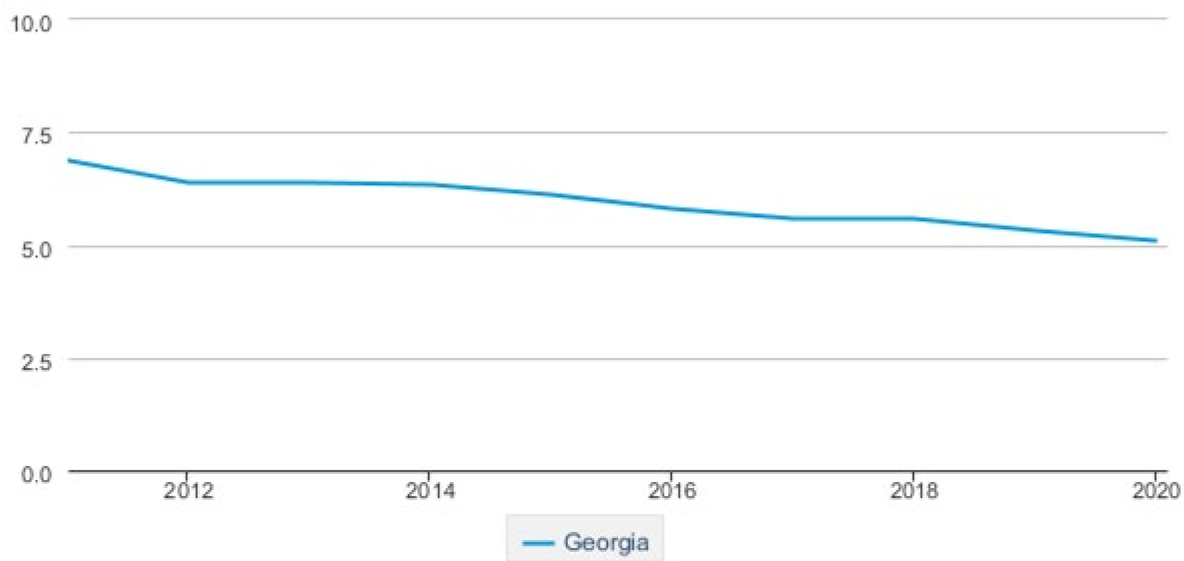


Source: U.S. Energy Information Administration (US EIA)

3.6.3. Energy Statistics for Georgia

Data from the U.S. Energy Information Administration (EIA) shows that annual energy consumption in Georgia declined on a per dollar of gross domestic product basis from 2011 to 2020. It should be noted that the pandemic most certainly impacted energy consumption and demand in 2020, but the decline was evident even before the start of the pandemic.

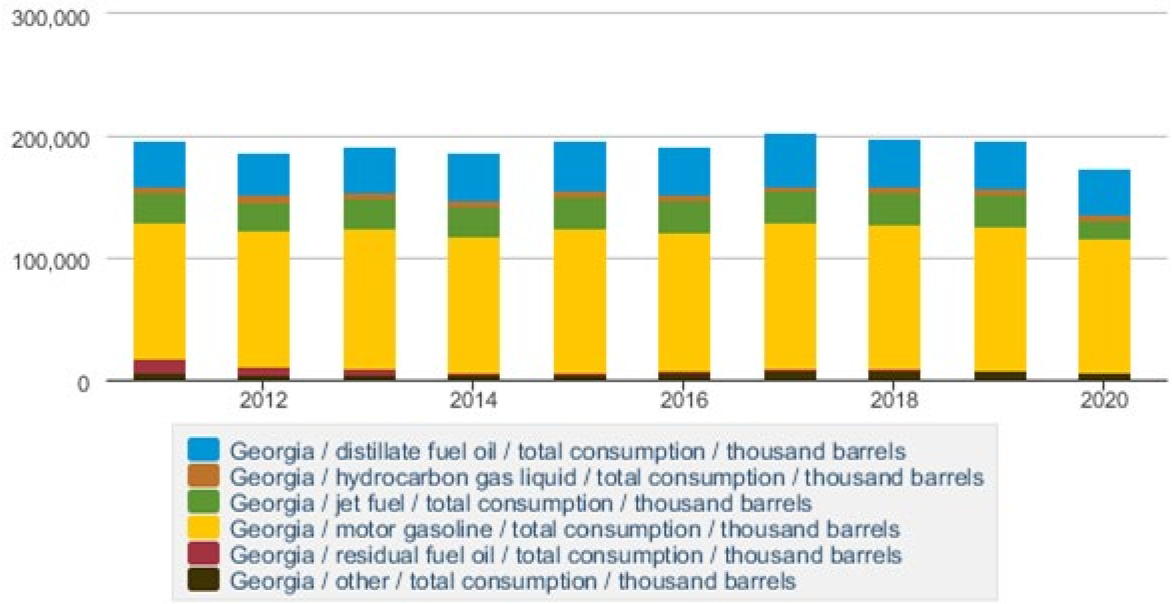
Figure 80. Total Energy Consumption Estimates per Dollar of Gross Domestic Product, Annual (Thousand BTU per 2012 Chained Dollars)



Source: U.S. EIA State Energy Data System (SEDS), retrieved October 11, 2022

Total petroleum consumption fluctuated on an annual basis over the same time period. In 2011, approximately 200M barrels of petroleum was consumed in the state; the number remained fairly consistent through 2019. The mix of fuels consumed has remained steady although the volume of residual fuel oil has declined over the time period.

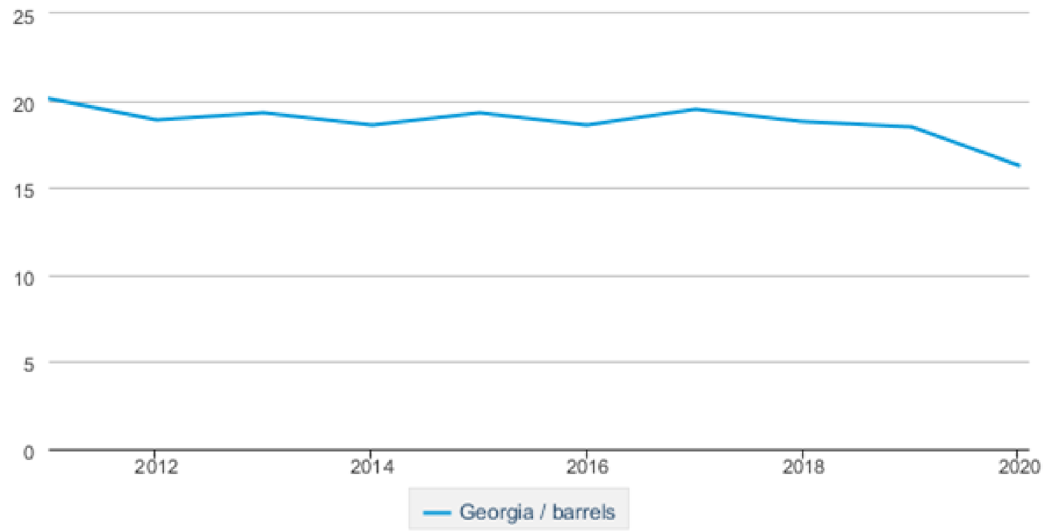
Figure 81. Total Petroleum Consumption Estimates, Annual (Thousand Barrels)



Source: U.S. EIA State Energy Data System (SEDS), retrieved October 11, 2022

On a per capita basis, total petroleum product consumption declined from 2011 to 2019. In 2011, the state had a per capita consumption rate of approximately 20 barrels; by 2019, the number was closer to 18 barrels per capita. During the pandemic year of 2020, the number dropped sharply to nearly 16 barrels per capita.

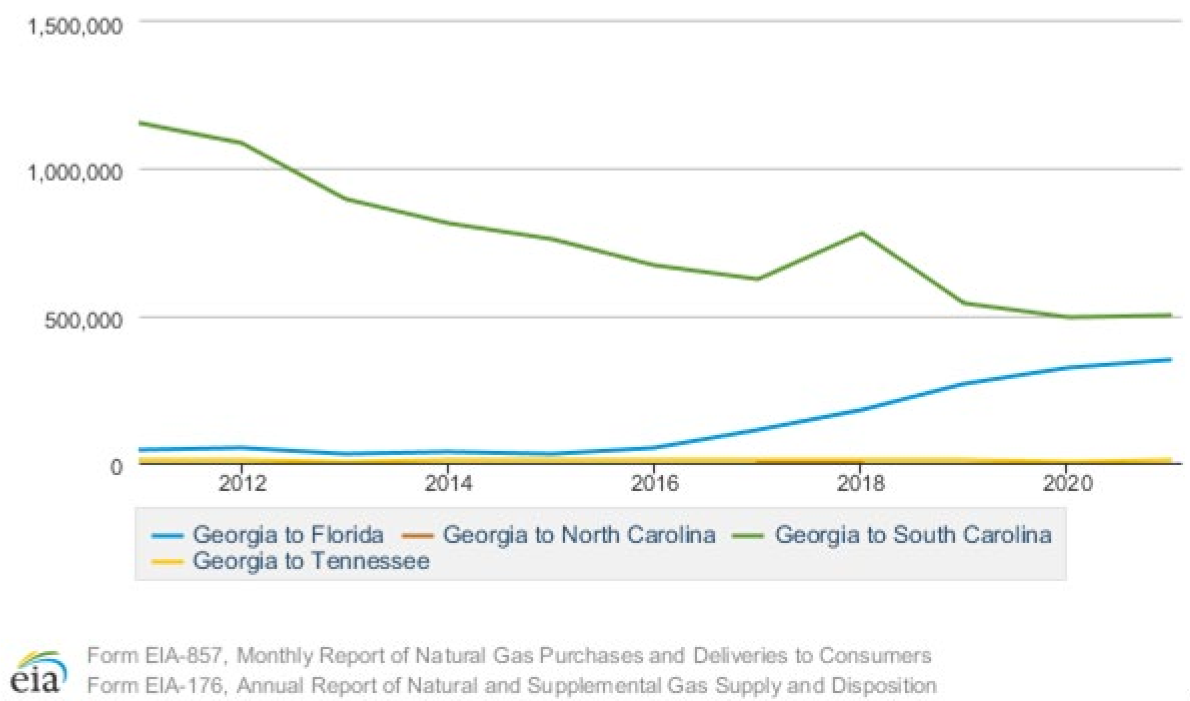
Figure 82. Total Petroleum Products Consumption Estimates per Capita, Annual (Barrels)



Source: U.S. EIA State Energy Data System (SEDS), retrieved October 11, 2022

Interstate natural gas volumes dropped sharply from 2011 to 2020, mainly driven by the drop in volume from Georgia to South Carolina. The natural gas volumes on this trade fell from approximately 1.2 trillion cubic feet to 500 billion cubic feet annually by 2020. From 2015 to 2020, natural gas pipeline volumes from Georgia to Florida grew to 375 billion cubic feet annually.

Figure 83. Interstate Pipeline Deliveries of Natural Gas, Annual (Million Cubic Feet)



Source: U.S. EIA State Energy Data System (SEDS), retrieved October 11, 2022

3.6.4. Pipeline Statistics from FAF Data

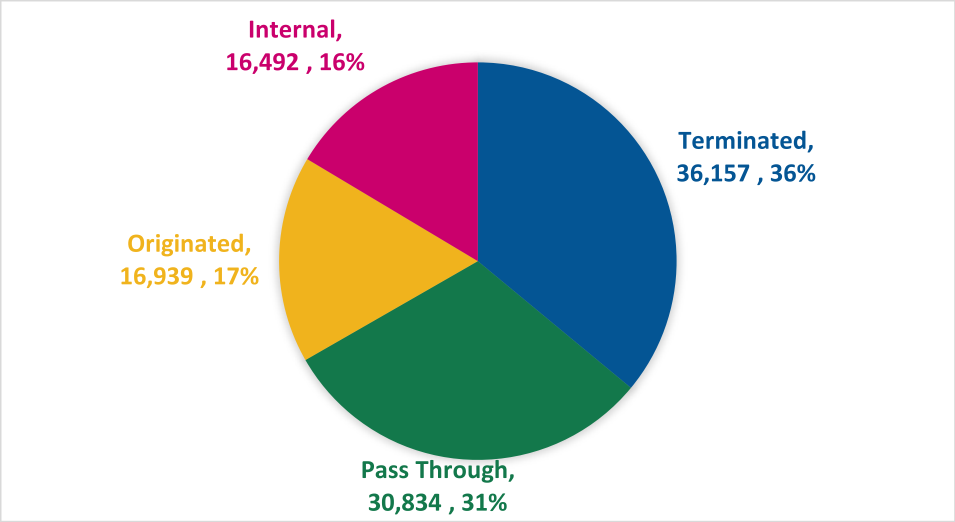
In 2017, over 100,000 tons of commodities moved into, out of, or through pipelines in Georgia. The majority of the traffic terminated in the state (36,147 tons) while another 30,834 tons passed through the state. Only 16,939 tons originated from the state while 16,492 tons of pipeline traffic was internal only.

Table 77. Georgia Pipeline Volume by Flow Direction, 2017 (Tons)

Flow Direction	Tons 2017
Terminated	36,157
Pass Through	30,834
Originated	16,939
Internal	16,492
Grand Total	**100,422**

Source: FAF 5.2

Figure 84. Total Tons by Direction



Source: FAF 5.2

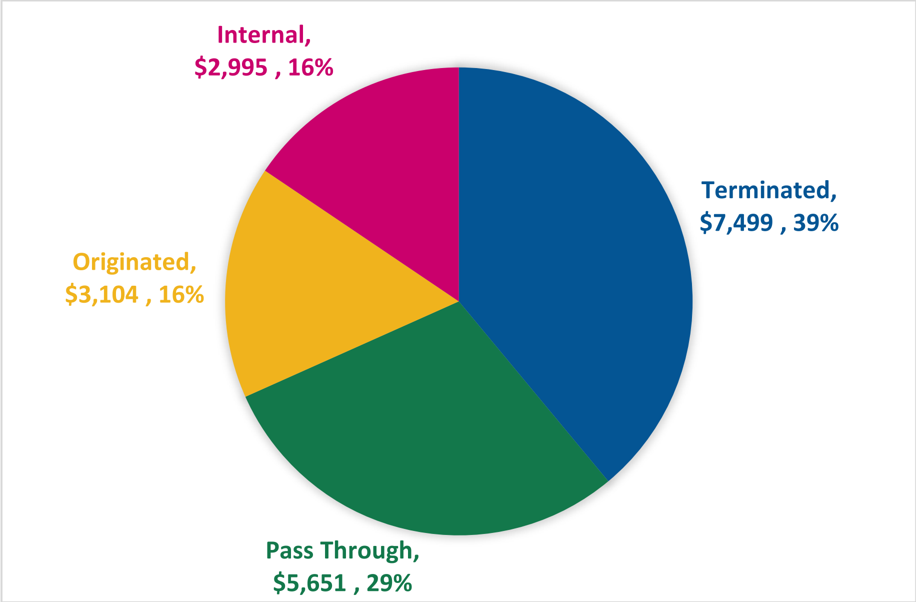
The total value of pipeline commodity traffic in Georgia was estimated at over $19 billion in 2017. The pipeline volume terminating in Georgia accounted for the largest share of value, at $7.5 billion. Pass through volume was the second highest in terms of value at $5.6 billion.

Table 78. Georgia Pipeline Volume by Value, 2017 ($USD Million)

Flow Direction	Value 2017 ($USD Million)
Terminated	$7,499
Pass Through	$5,651
Originated	$3,104
Internal	$2,995
Grand Total	**$19,250**

Source: FAF 5.2

Figure 85. Georgia Pipeline Volume by Value, 2017 ($USD Million)



Source: FAF 5.2

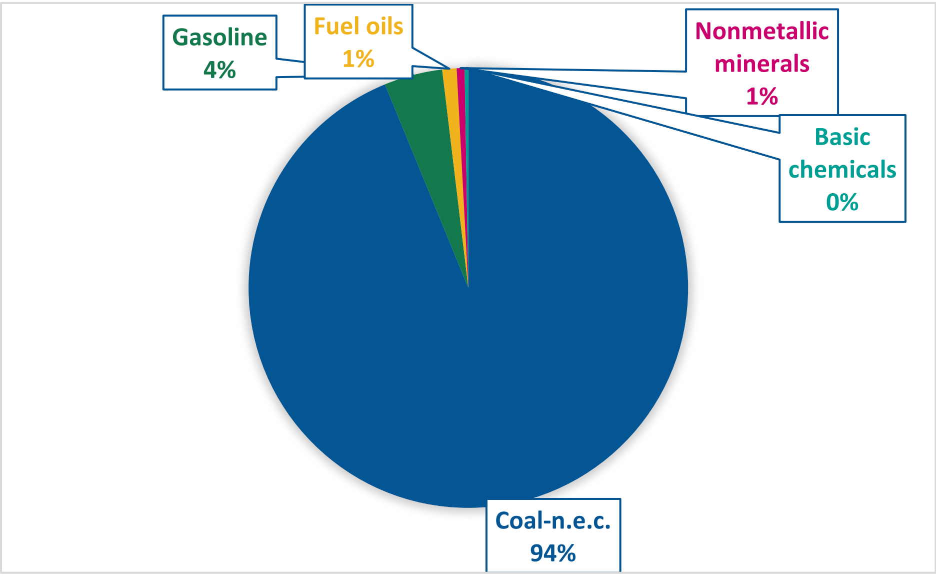
Most of the pipeline volume in Georgia in 2017 was classified as Coal-n.e.c (SCTG 19), a category which includes liquefied and gaseous commodities, including natural gas, natural gas liquids, petroleum, and petroleum-derived products.

Table 79. Georgia Pipeline Volume by Commodity Group, 2017 (Tons)

Commodity Group	Tons 2017
Coal-n.e.c.	94,199
Gasoline	4,314
Fuel oils	1,058
Nonmetallic minerals	580
Basic chemicals	272
Grand Total	**100,422**

Source: FAF 5.2

Figure 86. Georgia Pipeline Volume by Commodity Group, 2017 (%)



Source: FAF 5.2

Georgia has no petroleum refineries. Pipeline originations presumably reflect petroleum products brought into Georgia ports and transferred to pipeline for further transport to destination. The largest destination for Georgia's pipeline tonnage in 2017 was South Carolina (14,089 tons) followed by Florida (2,608 tons). The only other state to register any pipeline volume coming from Georgia was Tennessee (242 tons).

Table 80. Georgia Pipeline Volume by Destination State, 2017 (Tons)

State	Tons 2017
FL	31,917
SC	15,510
TN	242
NC	104

Source: FAF 5.2

Alabama was the largest origination state of pipeline volume for Georgia with 29,620 tons in 2017. Louisiana registered the second most origination volume at 3,215 tons, followed by South Carolina at 2,129 tons.

Table 81. Georgia Pipeline Volume by Tonnage and Origin State, 2017 (Tons

State	Tons 2017
AL	58,758
LA	4,541
SC	2,129
MS	739
TN	560
TX	265

Source: FAF 5.2

3.6.5. Pipeline Impacts on Freight

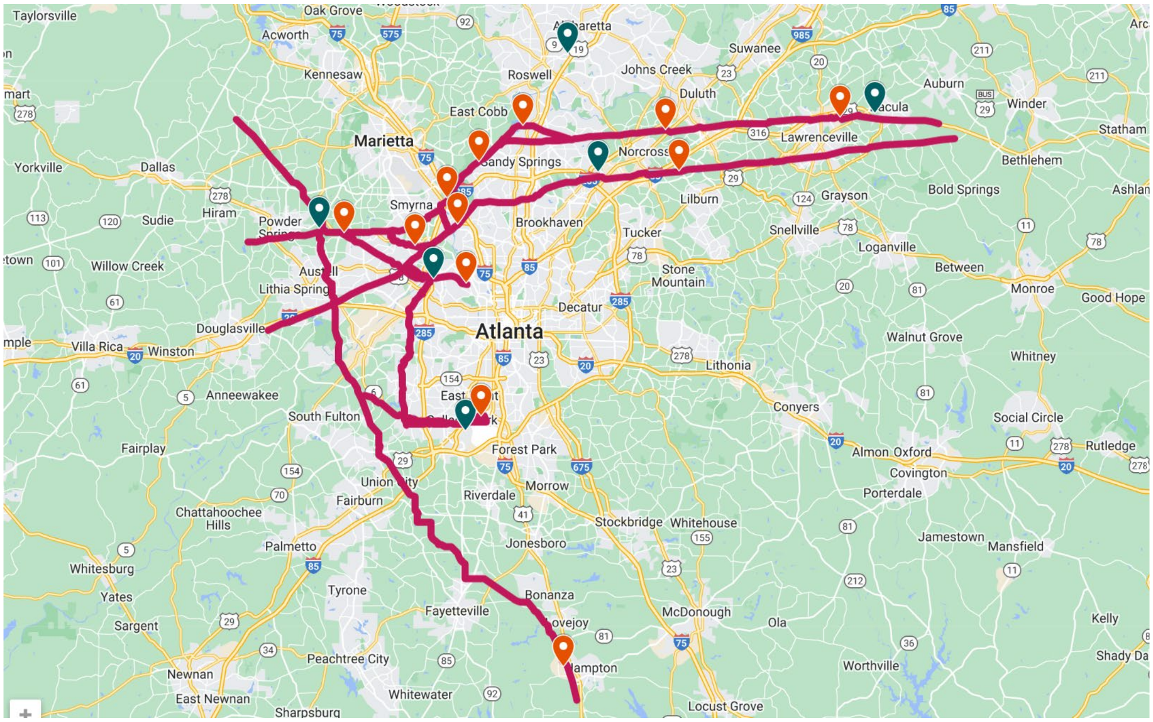
Pipelines are the most cost-effective method of moving large volumes of oil and gas and, as such, they help reduce the cost of a critical input for virtually all other modes of freight transport. Several recent developments have resulted in pipelines having a larger impact on these other freight modes. These developments include disruptions to existing pipelines, the inability to build new pipelines, and new methods of moving oil and gas to the pipelines.

Disruptions to Existing Pipelines

Between May 6 and May 12, 2021, the Colonial Pipeline was shut down. Branches of the Pipeline supply central and eastern Tennessee, southern Georgia, and eastern and western Virginia. The following map shows the Pipeline's network in Fulton, DeKalb, Cobb, Gwinnett and Henry counties. Green flags show major tank stations and orange flags indicate points of interest where the pipelines pass through[61].

[61] The Atlanta Journal-Constitution, "Map: Colonial Pipeline network through metro Atlanta," retrieved October 19, 2022 at https://www.ajc.com/news/colonial-pipeline-atlanta

Figure 87. Colonial Pipeline Network in the Greater Atlanta Metro Area



Source: The Atlanta Journal-Constitution, retrieved October 19, 2022 at https://www.ajc.com/news/colonial-pipeline-atlanta

This pipeline extends from Houston, Texas, along the Gulf of Mexico, and then up the eastern seaboard to the Port of New York and New Jersey. The pipeline carries more than 100 million gallons of fuel a day and serves as a critical link between refiners on the Gulf Coast and consumers on the Atlantic Coast.

The shutdown was identified as a ransomware cyberattack, where the computerized pipeline management controls system was hacked by an unidentified group. The event resulted in five days of pipeline shutdown, a spike in gasoline prices, and panic-buying that resulted in localized fuel shortages[62].

Homes, businesses, and power plants depend on natural gas for heating, cooking, and electricity generation. Similarly, a petroleum product pipeline shutdown would impact the delivery of gasoline to product terminals, and within days most gasoline stations will run out of fuel without pipelines to refill inventory for distribution. These disruptions would ripple through the state and national economies due to limited fuel to individuals, businesses, and reduced GSP and tax revenue from stifled production[63].

[62] Jason Braverman, "What the Colonial Pipeline shutdown means for gas prices in Georgia," published by 11Alive on May 11, 2021. Retrieved October 19, 2022 at https://www.11alive.com/article/news/local/gas-prices-georgia-pipeline-shutdown/85-7313663b-80b7-4ab3-a5aa-5519e48dbbce

[63] Texas Department of Transportation, "Texas Delivers 2050: Texas Freight Mobility Plan", draft study produced by Cambridge Systematics.

Additionally, much of the existing pipeline infrastructure in the U.S. was developed many decades ago and is currently in need of costly maintenance, repair, or replacement. A 2016 report said that more than half of U.S. pipelines are over 46 years old. After 40 or 50 years, problems like corrosion and leaks are likely to increase.

The Colonial pipeline began operating in 1964. In 2011, the pipeline owner spent more than $95 million on an upgrade that allowed it to expand capacity by 200,000 barrels per day. However, existing demand would require it to increase capacity by another 300,000 to 500,000 barrels per day, which would not be possible without building a new pipeline[64].

Any maintenance, repair or replacement of pipelines would cause significant disruption to other freight modes. Pipeline construction can take roads out of service for weeks, if not months, for both logistical and safety reasons. The inability to move oil and gas can also cause prices to spike in the local or regional energy markets. In both cases, operators of vehicles, trains, ships and planes would face much higher input costs.

Inability to Add New Pipelines

New pipeline projects face opposition from landowners, permitting agencies, environmental groups, and a lack of customers willing to commit to long-term offtake deals (a legal contract in which a buyer agrees to purchase some or all of the production). These groups are concerned about safety and the environmental impacts of continued fossil fuel usage. Consequently, they are often able to convince legislators to oppose such projects, despite the potential benefits (including higher jobs wages, revenues, and lower energy prices) that would result from new pipeline construction.

Kinder Morgan Inc. had plans to build the Palmetto pipeline from South Carolina to Jacksonville, Fla., by 2017. The $1 billion pipeline would have run 360 miles, through the counties of Glynn, Camden and McIntosh, carrying 167,000 barrels per day of gasoline, ethanol and diesel. But the Houston-based company shelved the project after its application for a certificate of convenience was denied, which would have allowed it to use eminent domain for property acquisition related to the pipeline[65].

Across the nation, high-profile pipeline projects are being or have been cancelled due to stakeholder opposition. As a result of these cancellations, the supply of oil and gas may be increasingly performed through alternate modes- primarily via truck and rail. Since these modal combinations are less efficient on a per-volume basis than pipelines, their higher operating costs are likely to be passed on to consumers in the form of higher energy prices as well as higher goods prices.

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[64] Alison Slider, "More Than Half of U.S. Pipelines Are at Least 46 Years Old", published November 2, 2016 by the Wall Street Journal. Retrieved October 7, 2022 at https://www.wsj.com/articles/aging-pipelines-raise-concerns-1478128942

[65] Michael Hall, "Palmetto Pipeline denied by state; Kinder Morgan to look for other options to move forward", published May 20, 2015 by The Brunswick News. Retrieved October 7, 2022 at https://thebrunswicknews.com/news/local_news/palmetto-pipeline-denied-by-state-kinder-morgan-to-look-for-other-options-to-move-forward/article_a7c5293f-3ac7-5c1c-8e37-be4ea08f8bf0.html

4. Georgia's Critical Freight Issues, Needs and Trends

Chapter 4 examines the critical issues and challenges facing the multimodal freight system in Georgia and the market trends that shape and drive them. Of the 358 industrial properties listed by the Georgia Department of Economic Development (GDEcD) as new or expanded development in FY 2022, 85 percent were identified as logistics-enabled by GDOT, indicating robust demand[66]. The freight-supported industries that account for 40 percent of Georgia employment[67] and contribute 30 percent of its GDP[68] depend on the five key indicators of freight performance – the KPI measures – introduced in Chapter 1. This chapter begins with those measures and reviews current multimodal performance in Georgia, encompassing assessment of urban and rural highway bottlenecks and their cost to industry, safety analysis, truck parking, and non-highway issues. It then explores nine major trends affecting Georgia's supply chains and freight system and the significance of trends for KPIs. Among them are supply chain shifts, disruption and risks; workforce and demographics; e-commerce; technology and automation; and alternative fuels. The chapter concludes with multimodal freight mobility strategies responsive to trends and performance challenges and describes the KPIs that strategies affect. This sets the stage for Chapter 5, where KPIs are forecast and monetized, and strategies are advanced through programs and investments.

4.1. Understanding Current Transportation and System Performance

Maintaining and enlarging the competitiveness of Georgia and its quality of life will be accomplished through strong performance in the five KPIs: safety, reliability, speed, cost, and risk. Defined in Chapter 1, the five were determined by the Advisory Committee on Supply Chain Competitiveness of the U.S. Department of Commerce, but they are widely acknowledged in the freight industry and were endorsed by the Georgia Freight Advisory Committee.

KPIs are the means through which strategies, programs and investments affect competitiveness and quality of life in Georgia. For instance, modal options by location enable shippers to make more effective decisions based on speed and reliability characteristics. Connectivity creates access for ports, airports and rail to warehouses and customers, influencing the cost, speed, reliability, safety, and risk exposure of shipments end-to-end, and thereby the attractiveness of each mode. Federal, State, and local governments fund the public network, affecting the cost and productivity, redundancy and risk, safety, and the reliability and travel times on the system. KPI improvement results in better outcomes for the general public, from safer roads and cleaner air to lower costs for household goods.

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[66] https://www.georgia.org/center-of-innovation/areas-of-expertise/logistics/resources
[67] US Bureau of Labor Statistics, Quarterly Census of Employment and Wages, accessed October 2022
[68] US Bureau of Economic Analysis, 2021 Annual Gross domestic product (GDP) by state

This section discusses the current transportation system, focusing on highway and non-highway transportation, with a view towards understanding the performance of the system in respect to KPIs. Data in this section is drawn from multiple data sets, notably the National Performance Management Research Data Set (NPMRDS), American Transportation Research Institute (ATRI) and the Georgia Electronic Accident Reporting System (GEARS).

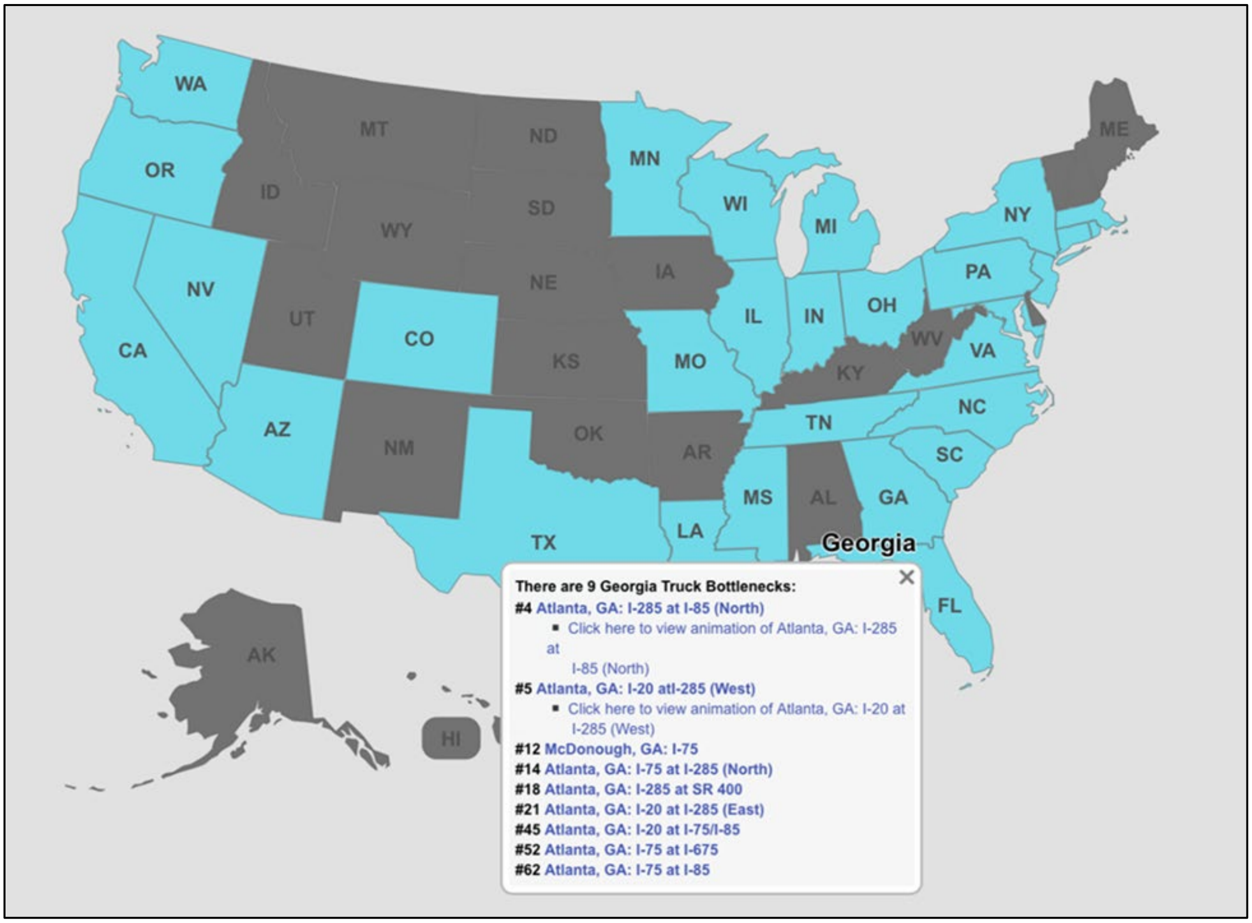
4.1.1. Highway

Central to highway freight performance are speed, reliability, and the cost to freight system users when those two indicators are reduced. Reductions in speed (predictable delay) and reliability (unpredictable delay) equate to congestion, and the cost to users is the cost of congestion. Concentrations of congestion are bottlenecks, which are thus prime generators of elevated costs in Georgia's freight system.

Bottlenecks are identified in different ways by different sources. ATRI publishes an annual Top 100 Bottleneck Report each year which uses GPS data from over one million freight trucks at over 300 major highway points to evaluate congestion on the nation's freight transportation system. In the 2022 edition using 2021 volumes (as shown in Figure 88), ATRI noted that Georgia is home to 2 of the top 5 bottlenecks and 5 of the top 20 overall worst congestion points in the nation. ATRI identifies bottlenecks by subtracting average truck speeds from assumed free flow speeds and multiplying by truck volumes, with adjustments for time of day. FHWA uses NPMRDS data comparing actual truck speeds to calculated free flow over 15-minute intervals, multiplies by reported truck volumes, and produces a national Top 100 list based on hours of delay per mile. Georgia has 5 bottlenecks on its latest list[69] (2020, which was affected by the pandemic). All were in Atlanta, none were in the top 20, and the highest ranking was number 24, the intersection of I-20 with the I-75/I-85 split. FHWA provides a cost of delay by corridor based on operating costs but does not rank individual bottlenecks with this measure. The analysis conducted for this Plan utilizes 2021 NPMRDS data and differs in several ways, most significantly through ranking by cost and accounting for the user cost of unreliability as well as the operating cost of delay. The cost analysis employed in the following pages follows the same method as the cost analysis in Chapter 5, which is focused on forecast rather than current congestion. While Chapter 5 necessarily works within a modeled environment in order to conduct forecasting, its portrayal of current congestion is comparable to the findings shown here.

[69] https://ops.fhwa.dot.gov/freight/freight_analysis/mobility_trends/index.htm

Figure 88. States with ATRI Top Truck Bottlenecks



Source: ATRI.org

The analysis of truck bottlenecks for this Plan used findings from the recently published NCHRP Report 925[70] to estimate the costs that congestion generates for trucking companies and businesses that use trucking services; this represents an improvement over analyses that estimate costs only to trucking companies and ignore broader supply chain impacts. The assessment presented here identifies bottlenecks through a more complete estimation of congestion costs to supply chains and the broader economy, which is critical for prioritizing and right-sizing solutions.

Table 82 lists the steps in the analysis. First, 2021 travel-time data from the National Performance Management Research Data Set (NPMRDS) published by the Federal Highway Administration (FHWA) was combined with hourly truck volume data to calculate the two

[70] Guerrero, S. E., Hirschman, I., Bryan, J., Noland, R., Hsieh, S., Schrank, D., and Guo, S. 2019. NCHRP Research Report 925: Estimating the Value of Truck Travel Time Reliability, Transportation Research Board, National Academies of Science, Engineering and Medicine.

congestion metrics NCHRP Report 925 recommends: Vehicle Hours of Excess Travel (VHET) and Vehicle Hours of Unreliability (VHU). The first metric quantified the impact of recurring congestion – in KPI terms, the reduction in speed - while the later metric quantified non-recurring congestion – in KPI terms, the reduction in reliability. The monetization parameters from NCHRP Report 925 were then used to estimate the user costs incurred by trucks as they face recurring and non-recurring congestion. The sum of the two is the cost KPI, representing the total cost of delay.

Table 82. Bottleneck Identification Overview

Component	Steps
Calculation of Congestion Metrics	Processed National Performance Management Research Data Set
	Approximated hourly truck volumes
	Estimated recurring congestion and non-recurring congestion metrics (KPIs: Speed and Reliability)
	Estimated user costs (KPI:Cost)
Bottleneck Identification	Categorize by Urban Atlanta, Urban Other, and Rural
	Set bottleneck thresholds
	Cluster bottlenecks
Assessment of Causes	Construction work zones

Source: NCHRP Report 925

The estimated user costs were then used to evaluate delay at congested locations, generating high costs to the movement of freight and representing bottlenecks for truck operations. The roadway network was broken up into Urban Atlanta-Region, Urban Other, and Rural categories, so that congested roads are prioritized relative to other roads of the same type. Otherwise bottlenecks in the Atlanta region would dominate the statewide analysis. The thresholds used to identify bottlenecks were set at the 95th percentile user costs per mile (top 5 percent of segments generating congestion costs). Once segments were identified as bottlenecks, they were aggregated into clusters.

Finally, the top bottlenecks were analyzed to determine whether they were caused by roadway construction work zones, which would exclude them from project development considerations. Work zone data was collected by analyzing GDOT records of construction logs for the year 2021.

Identification and Clustering

The thresholds used to identify bottlenecks were set at the top 5 percent of user costs per mile in each bottleneck type (Urban Atlanta, Urban Other, and Rural). Different thresholds for the user cost metric were used to identify bottlenecks in rural areas versus urban areas. Bottlenecks in urban areas typically have different magnitude and characteristics than bottlenecks in rural areas. If the same threshold was used throughout the state, the highly congested roads in metropolitan areas would dominate the results. **Table 83** shows these thresholds. Roads were classified as being Urban Other or Rural based on the distinction made in NPMRDS (originally coming from the U.S. Census Bureau). Urban Atlanta was defined as roads in the territory of the Atlanta Regional Commission (ARC).

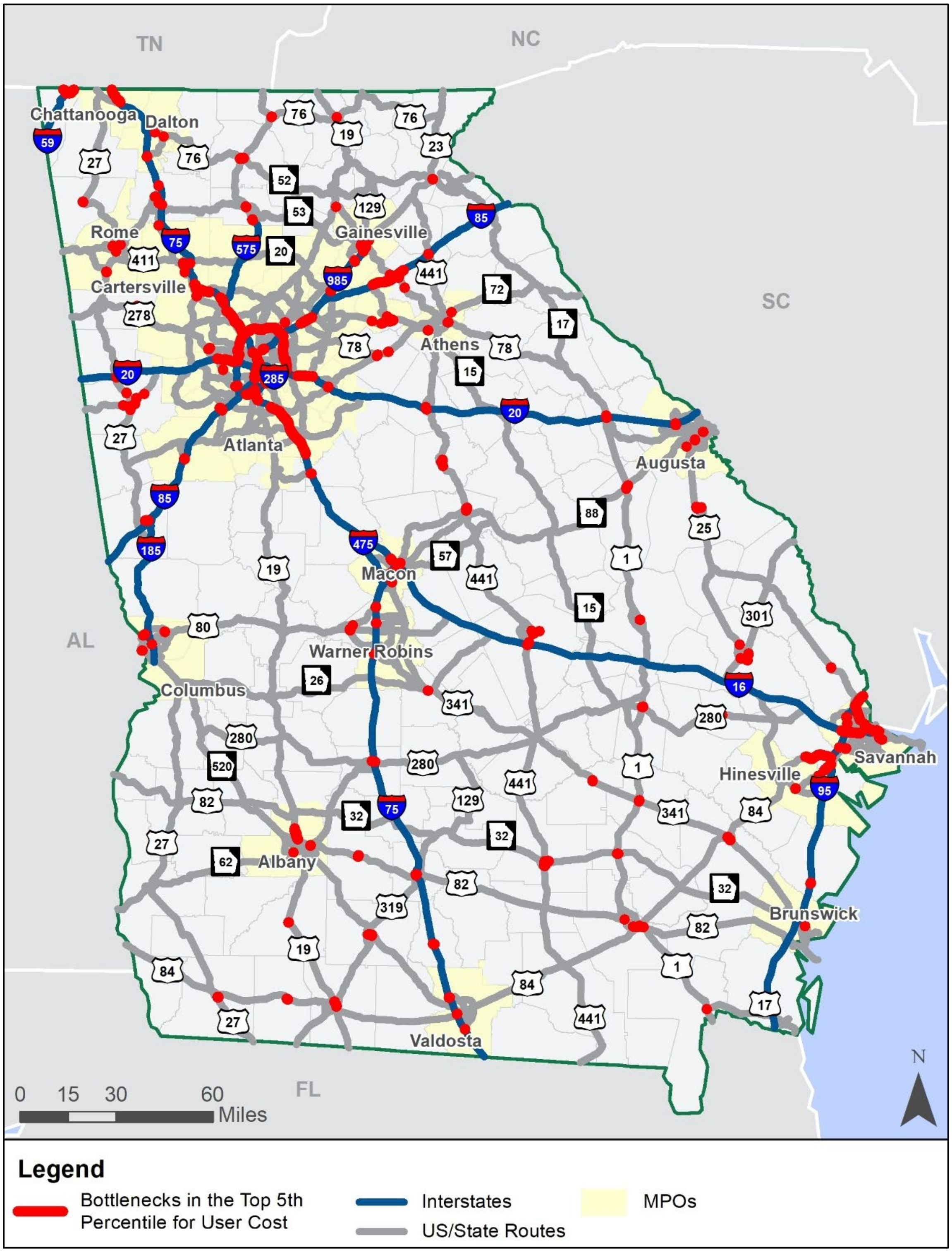
There were 219 roadway segments in Urban Atlanta with user costs higher than the threshold (in NPMRDS each segment is defined by a unique Traffic Message Channel TMC), totaling 111 centerline miles of roadway. In Urban Other, 184 roadway segments were above the threshold, combining for 56 centerline miles of roadway; in Rural, 143 roadway segments were above the threshold, combining for 72 miles of roadway. In total, roughly seventy percent of the bottleneck distance was identified in urban areas and thirty percent in rural areas. **Figure 89** displays a map of the bottlenecks, showing thorough coverage throughout Georgia, but concentrated in urban regions across the state, as highlighted in **Figure 90**.

Table 83. Truck Bottleneck Thresholds and Totals

Bottleneck Type	User Cost Threshold ($/mile-day)	Bottleneck Centerline Roadway Miles	Number of Bottleneck Segments (TMCs)
Urban Atlanta	21,602	111	219
Urban Other	7,089	56	184
Rural	4,077	72	143
Total		**239**	**546**

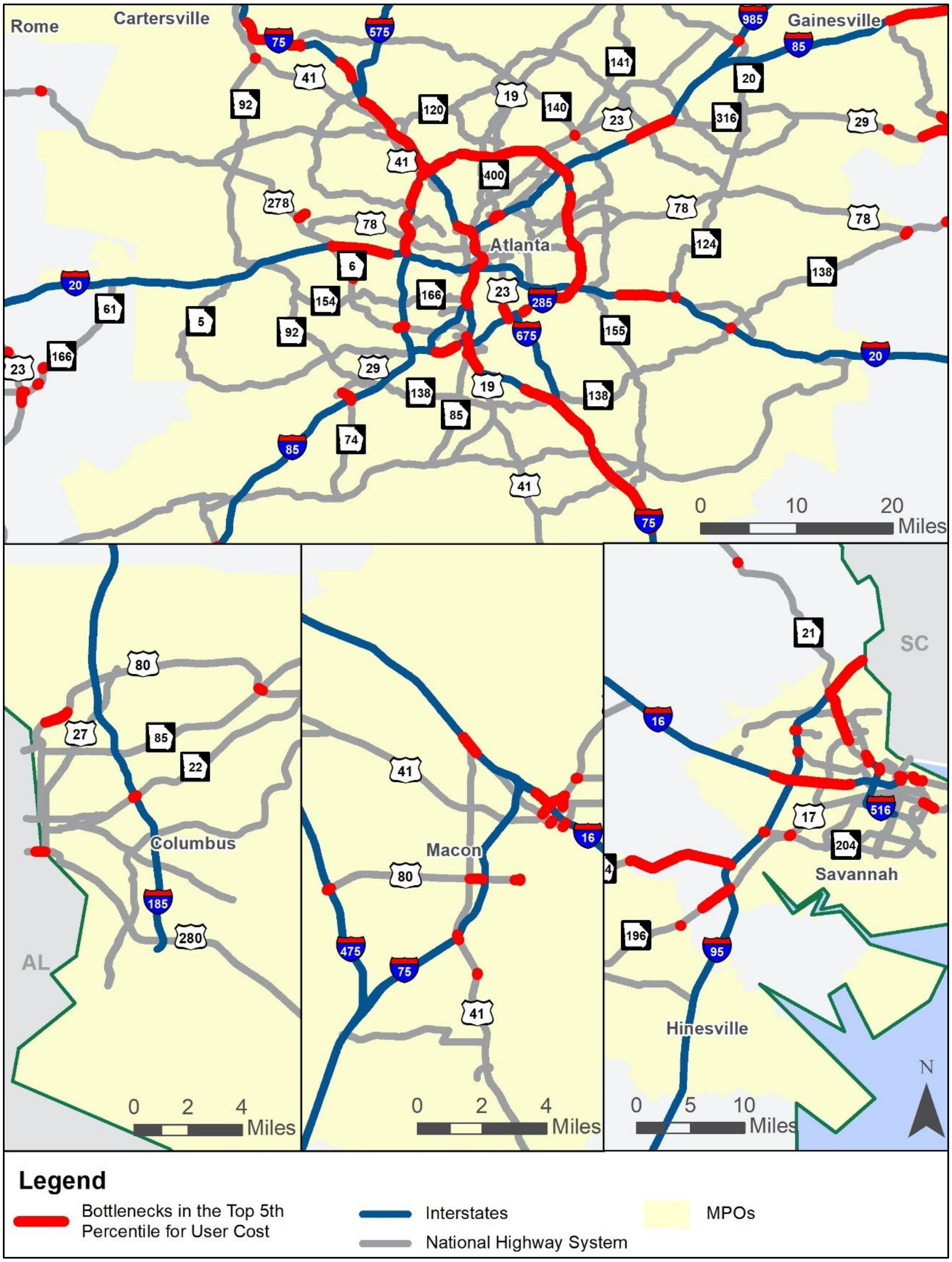
Source: NPMRDS and NCHRP Report 925

Figure 89. Truck Bottleneck Locations - Statewide



Source: NPMRDS and NHCRP Report 925

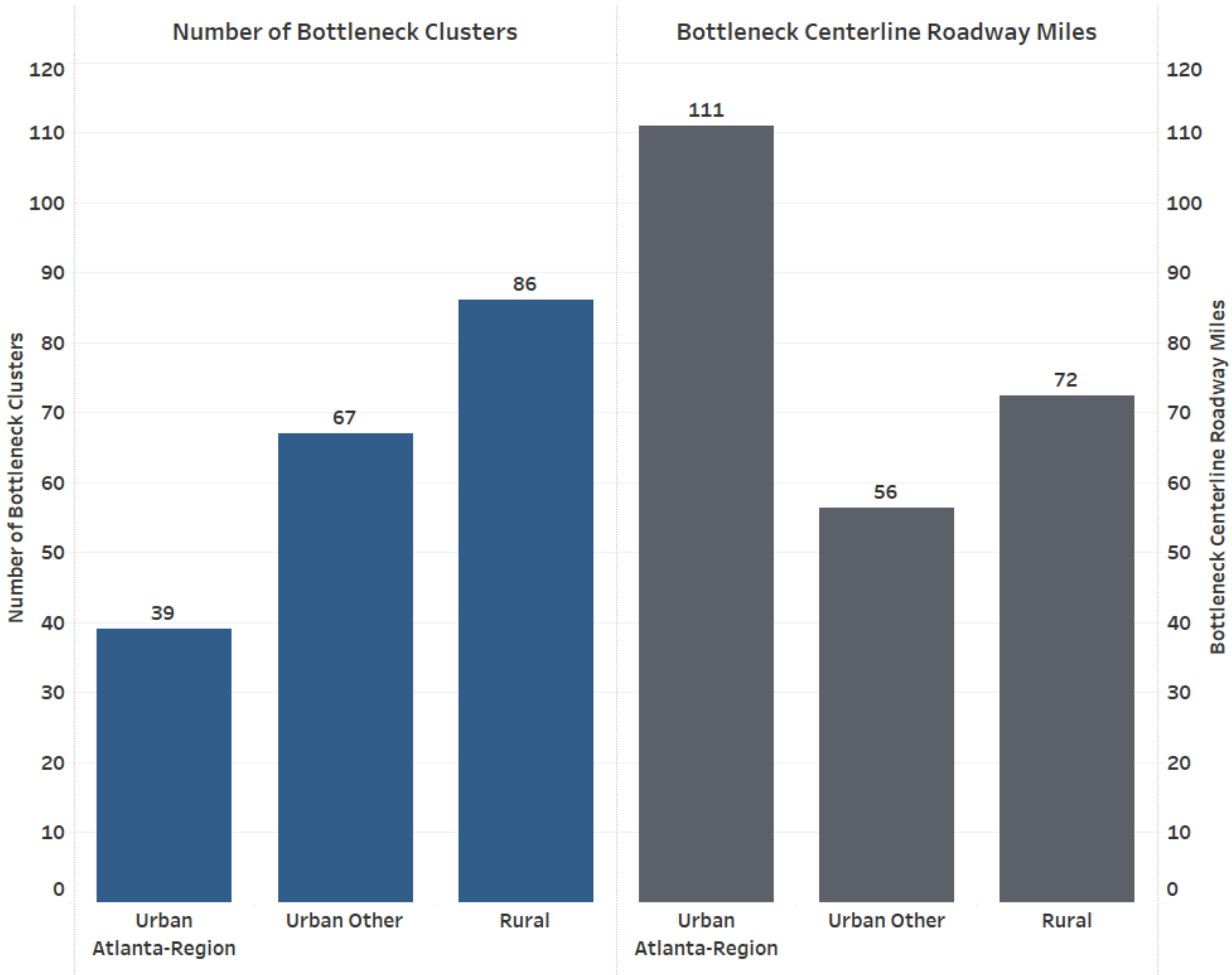
Figure 90. Truck Bottleneck Locations – Highlighted Metropolitan Areas



Source: NPMRDS and NCHRP Report 925

A manual process was conducted to combine consecutive bottlenecks into bottleneck clusters. Especially in urban areas, where the network is segmented more finely, numerous consecutive segments were designated as bottlenecks. For simplicity, and ease of interpreting the results, consecutive and near consecutive segments were combined into bottleneck clusters. In some cases, nearby roads that are not consecutive were combined into the same cluster if the underlying cause of the bottleneck was judged to be the same. As shown in **Figure 91**, this resulted in 86 bottleneck clusters in Rural, 39 in Urban Atlanta, and 67 in Urban Other areas, for a total of 192 bottleneck clusters.

Figure 91. Number of Bottleneck Clusters



Source: NPMRDS and NCHRP Report 925

Top Bottlenecks

This section describes the top 20 bottleneck clusters in Georgia for each of the bottleneck types (Urban-Atlanta, Urban Other, Rural) and the estimated costs they generate.

Urban Atlanta

The top 20 bottleneck clusters in the Atlanta region are listed in **Table 84** and mapped in **Figure 92**. In total, these bottlenecks represent 105 centerline miles of roadway that generate $3.50 million of user costs to trucks and shippers each day. About a third of these user costs accrue to the two top ranked bottleneck clusters on *I-75 NB from Bill Gardner Pkwy to I-675* (ID 92) and *I-75 SB from Hudson Bridge Rd to Mt Zion Blvd* (ID-91), because this is a heavily congested corridor and the longest defined bottlenecks in the study (accruing more congestion costs), and due to the large number of truck terminals in Henry County. As indicated by the northbound and southbound notations in the bottleneck names, the mileage and user costs listed in this table are for specific direction of travel. In a few instances the direction of travel is not mentioned, which implies that both directions of travel are part of the same bottleneck cluster.

The supply chains most impacted by these top 20 urban Atlanta bottlenecks include food and agriculture, construction and distribution (**Table 85**). Through trucks and empty units contribute significantly to congestion at these bottlenecks, accounting for close to half the impact in some cases. All top 20 bottleneck locations are projected to see at least 85 percent growth in truck traffic from 2019 to 2050.

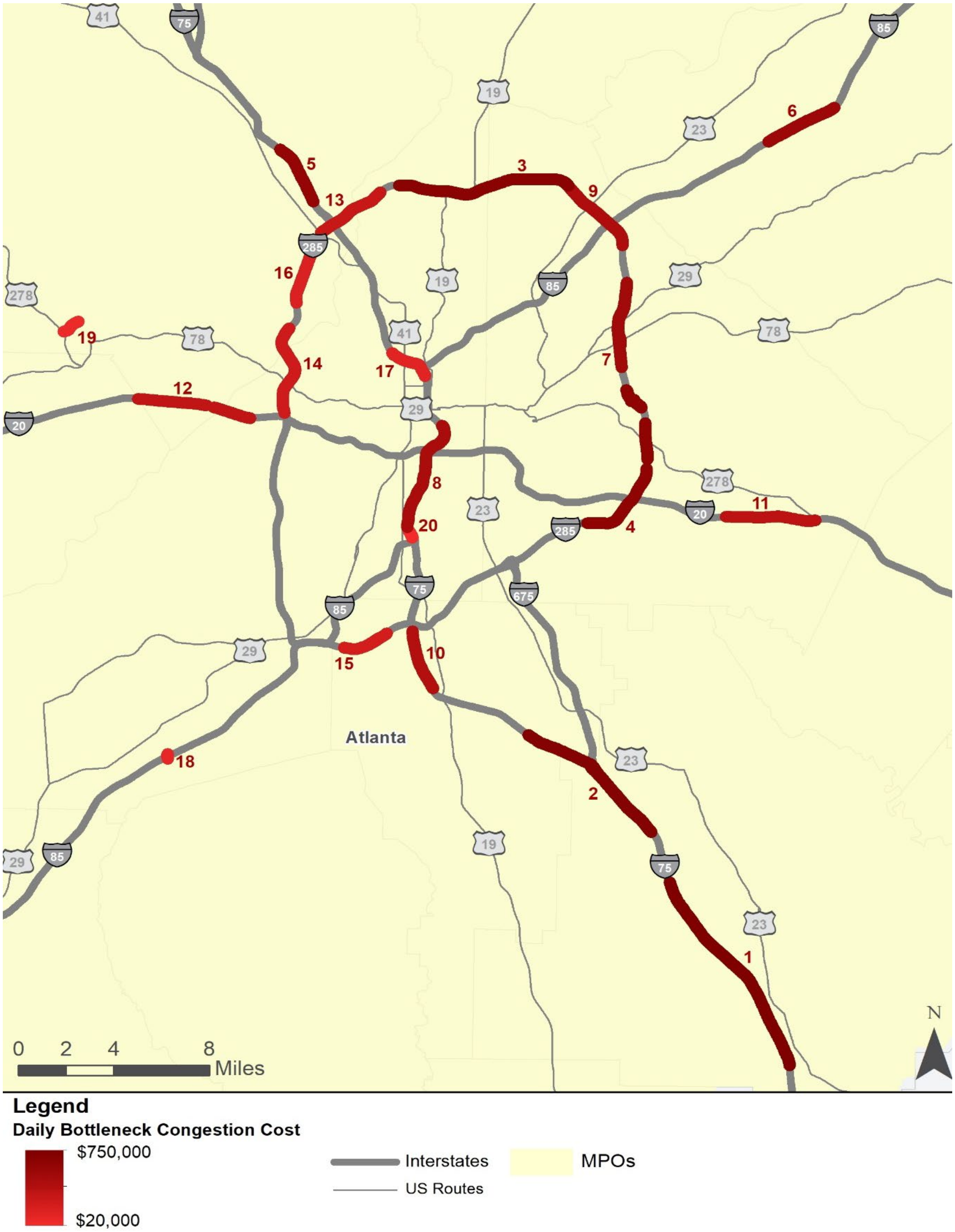
Table 84. Top 20 Bottlenecks in Urban Atlanta-Region

Rank	ID	Bottleneck Name	Total Miles	Average Daily Truck Volume	Congestion Costs in 2019 ($/day)	Growth in Truck Volumes (2019 to 2050)
1	92	I-75 NB from Bill Gardner Pkwy to I-675	18.8	18,132	747,825	98.0%
2	91	I-75 SB from Hudson Bridge Rd to Mt Zion Blvd	10.5	17,595	431,064	103.0%
3	51	I-285 Top End	8.5	21,570	283,500	93.6%
4	54	I-285 from Memorial Dr and I-20 East Interchange	7.7	20,861	233,927	105.4%
5	42	I-75 SB from I-285 North interchange to Roswell St	7.6	13,261	215,306	113.9%
6	46	I-85 SB from Beaver Ruin Rd to GA-316	6.8	13,415	202,133	118.0%
7	53	I-285 from Church St to Lavista Rd	6.5	19,658	196,274	114.5%
8	69	I-75/I-85 NB from I-75/I-85 South Split to John Lewis Freedom Pkwy	4.6	16,401	184,704	156.0%

Rank	ID	Bottleneck Name	Total Miles	Average Daily Truck Volume	Congestion Costs in 2019 ($/day)	Growth in Truck Volumes (2019 to 2050)
9	52	I-285 from I-85 to Peachtree Industrial Blvd	3.8	19,378	143,384	100.5%
10	81	I-75 NB from Tara Blvd to I-285 South Interchange	2.7	18,786	128,096	107.1%
11	73	I-20 WB from Evans Mill Rd to Panola Rd	3.8	12,863	125,801	97.4%
12	72	I-20 EB from Fulton Industrial Blvd to Thornton Rd	4.5	11,494	115,695	101.2%
13	61	I-285 CCW at I-75 North Interchange	3.6	22,206	103,790	91.6%
14	59	I-285 CCW from S Cobb Dr to I-20 West Interchange	4.1	12,256	98,666	92.7%
15	58	I-285 at Riverdale Rd	2.4	37,667	83,451	97.7%
16	60	I-285 CW from Atlanta Rd to Paces Ferry Rd	2.2	23,161	70,113	87.8%
17	67	I-75 SB from I-75//I-85 North Split to Howell Mill Rd	1.4	10,492	45,382	172.0%
18	90	GA-74 from I-85 to Roosevelt Hwy	1.4	4,196	39,191	112.0%
19	63	Dr Luke Glenn Garrett Jr Memorial Hwy	0.8	3,954	32,925	91.5%
20	70	I-85 SB at I-75/I-85 South Split	0.4	16,615	20,511	158.0%
TOTALS			104.8	--	3,501,737	

Source: Transearch and NPMRDS

Figure 92. Top 20 Bottlenecks in Urban Atlanta-Region (number labels represent rank in region)



Source: NPMRDS and NCHRP Report 925

Table 85. Supply Chains affected by Top 20 Bottleneck Clusters in Urban Atlanta-Region (% of Truck Units)

Rank	Bottleneck Name	Automotive	Chemicals & Plastics	Construction	Distribution	Electronics & Electrical	Energy	Food & Agriculture	Furnishings & Clothing	Health	Lumber & Paper	Metals & Machinery	Miscellaneous	Through Trucks	Empty Trucks
1	I-75 NB from Bill Gardner Pkwy to I-675	2.5%	2.3%	9.9%	6.6%	0.5%	1.6%	15.1%	1.7%	0.1%	7.9%	2.3%	3.2%	26.2%	20.1%
2	I-75 SB from Hudson Bridge Rd to Mt Zion Blvd	2.4%	2.3%	11.5%	6.3%	0.5%	1.4%	14.0%	1.6%	0.1%	7.4%	2.3%	3.2%	25.2%	21.7%
3	I-285 Top End	1.4%	2.6%	19.5%	4.2%	0.3%	1.9%	10.3%	0.9%	0.1%	3.5%	1.4%	3.3%	18.1%	32.2%
4	I-285 from Memorial Dr and I-20 East Interchange	1.6%	2.2%	14.4%	4.6%	0.4%	1.2%	8.7%	1.6%	0.1%	3.9%	1.3%	2.8%	31.3%	26.0%
5	I-75 SB from I-285 NIC to Roswell St	1.8%	2.5%	16.3%	4.4%	0.3%	2.6%	10.0%	1.2%	0.1%	4.9%	1.8%	7.4%	14.3%	32.4%
6	I-85 SB from Beaver Ruin Rd to GA-316	1.6%	2.4%	17.3%	5.0%	0.4%	1.6%	7.7%	0.8%	0.1%	2.7%	1.3%	4.1%	22.5%	32.9%
7	I-285 from Church St to Lavista Rd	1.5%	2.2%	16.1%	4.9%	0.4%	4.1%	8.2%	1.1%	0.1%	3.4%	1.2%	3.9%	20.1%	32.8%
8	I-75/I-85 NB from I-75/I-85 South Split to John Lewis Freedom Pkwy	0.4%	1.3%	17.8%	10.3%	0.1%	3.8%	3.8%	0.4%	0.1%	3.1%	0.7%	5.0%		53.0%
9	I-285 from I-85 to Peachtree Industrial Blvd	1.5%	2.6%	18.1%	4.5%	0.4%	2.6%	9.7%	1.0%	0.1%	3.5%	1.4%	3.6%	19.2%	32.0%

Rank	Bottleneck Name	Automotive	Chemicals & Plastics	Construction	Distribution	Electronics & Electrical	Energy	Food & Agriculture	Furnishings & Clothing	Health	Lumber & Paper	Metals & Machinery	Miscellaneous	Through Trucks	Empty Trucks
10	I-75 NB from Tara Blvd to I-285 South Interchange	2.2%	2.4%	14.2%	5.3%	0.5%	1.8%	12.3%	1.4%	0.1%	6.6%	2.0%	3.8%	20.9%	26.6%
11	I-20 WB from Evans Mill Rd to Panola Rd	1.1%	2.8%	13.8%	5.1%	0.2%	0.6%	8.3%	2.2%	0.0%	6.3%	1.1%	4.4%	26.2%	27.9%
12	I-20 EB from Fulton Industrial Blvd to Thornton Rd	1.1%	1.9%	21.0%	3.7%	0.5%	1.1%	7.8%	0.3%	0.1%	2.5%	0.8%	4.0%	23.9%	31.4%
13	I-285 CCW at I-75 North Interchange	1.7%	2.4%	18.1%	4.0%	0.4%	1.6%	10.8%	1.0%	0.1%	4.0%	1.5%	3.2%	22.3%	28.9%
14	I-285 CCW from S Cobb Dr to I-20 West Interchange	2.1%	2.1%	15.0%	3.7%	0.5%	1.0%	11.3%	1.1%	0.1%	5.1%	1.6%	3.4%	29.8%	23.2%
15	I-285 at Riverdale Rd	2.3%	2.3%	11.2%	3.4%	0.5%	0.7%	11.1%	1.9%	0.1%	6.1%	1.9%	3.0%	39.0%	16.6%
16	I-285 CW from Atlanta Rd to Paces Ferry Rd	2.2%	2.1%	14.3%	3.6%	0.5%	0.9%	11.9%	1.2%	0.1%	5.2%	1.7%	3.0%	32.5%	21.0%
17	I-75 SB from I-75//I-85 North Split to Howell Mill Rd	0.7%	2.1%	16.7%	5.3%	0.2%	4.9%	4.0%	0.3%	0.1%	2.5%	1.4%	16.3 %		45.5%
18	GA-74 from I-85 to Roosevelt Hwy	2.1%	2.0%	16.6%	3.5%	0.5%	0.7%	6.2%	1.9%	0.0%	3.6%	1.4%	3.1%	29.6%	28.6%
19	Dr Luke Glenn Garrett Jr Memorial Hwy	1.0%	2.1%	20.8%	2.7%	0.0%	1.3%	10.3%	0.4%	0.0%	4.1%	0.3%	3.7%	5.9%	47.4%
20	I-85 SB at I-75/I-85 South Split	0.4%	1.3%	18.1%	10.2%	0.1%	4.4%	3.8%	0.4%	0.1%	2.8%	0.7%	4.6%		53.2%

Source: Transearch and NPMRDS

Other Urban Bottlenecks

The top 20 bottleneck clusters in the other urban regions of the state are listed in **Table 86** and mapped in **Figure 93**. In total, these bottlenecks constitute 50 centerline miles of roadway in the urban regions around the state (excluding Atlanta), generating $0.6 million of user costs to trucks and shippers each day. About forty percent of these user costs accrue to the two top ranked bottleneck clusters *I-75 NB from Battlefield Pkwy to TN State Line* (ID 2) near Chattanooga and I-16 from Chatham Pkwy to Pooler Pkwy (ID-149). *I-75 NB from Battlefield Pkwy to TN State Line* (ID-2) accrues the highest portion of congestion costs per day within these clusters (22 percent) despite accounting for less than 8 percent of the mileage. Most bottleneck locations are projected to see at least 50 percent growth in truck traffic from 2019 to 2050. However, GA-22 at US-129 (ID-111) is projected to see an approximately 50 percent drop in traffic, due to a projected decrease in non-metallic minerals movement enroute at this location.

The supply chains most impacted by these top 20 other urban bottlenecks include food and agriculture, construction and lumber and paper (**Table 87**). Through trucks and empty units contribute significantly to congestion at these bottlenecks, with share of total congestion costs ranging from 30 percent to 90 percent.

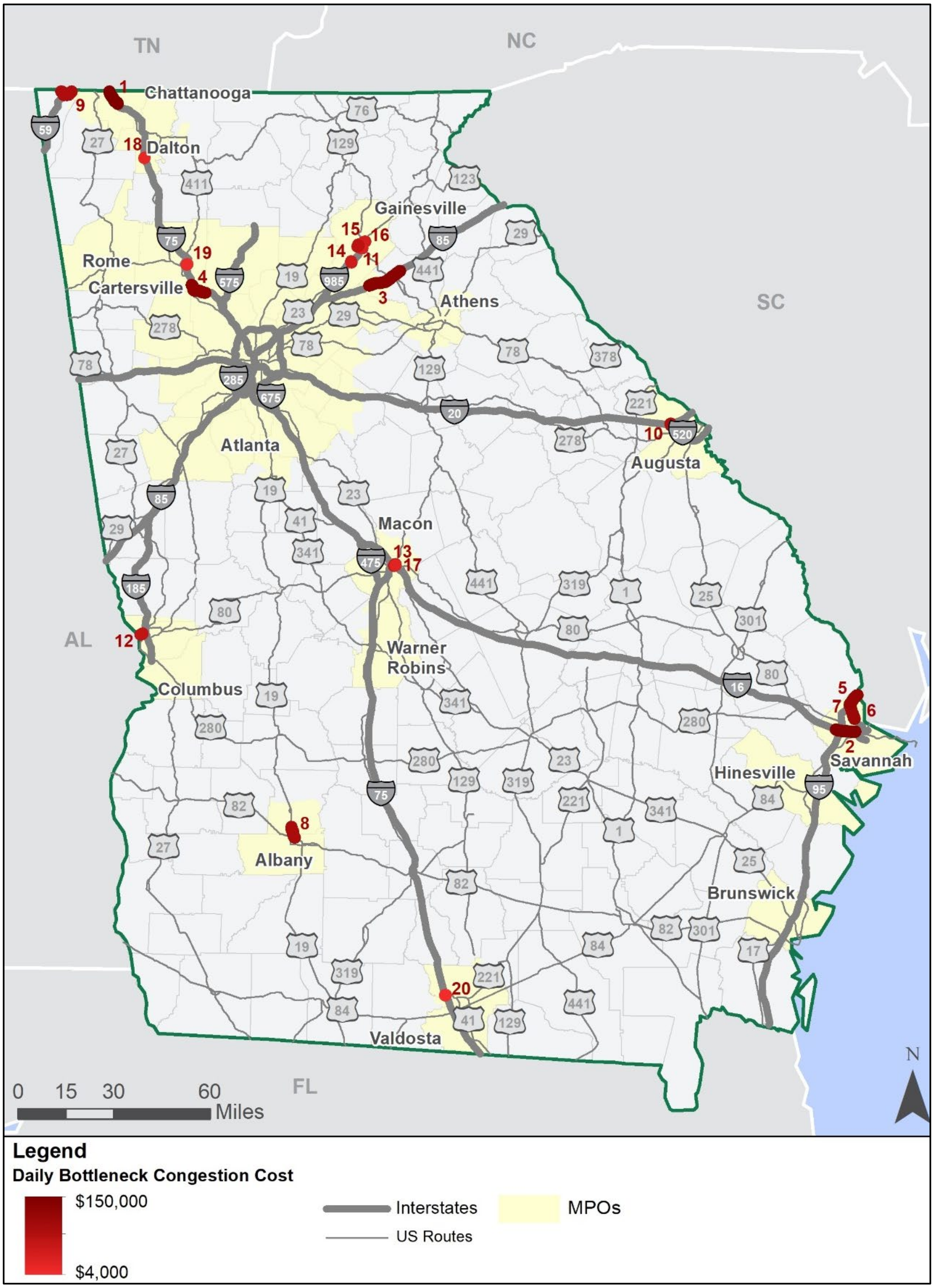
Table 86. Top 20 Urban Other Bottleneck Clusters

Rank	ID	Bottleneck Name	Total Miles	Average Daily Truck Volume	Congestion Costs in 2019 ($/day)	Units Growth (2019 to 2050)
1	2	I-75 NB from Battlefield Pkwy to TN State Line	4.8	18,858	148,003	91.0%
2	149	I-16 from Chatham Pkwy to Pooler Pkwy	8.7	5,659	124,699	85.9%
3	32	I-85 from GA-53 to GA-82	7.2	12,745	57,939	109.3%
4	35	I-75 SB from Cherokee Rd to Old Allatoona Rd	5.7	13,646	45,028	98.3%
5	140	I-95 NB from GA-21 to SC State Line	3.5	11,664	38,143	90.4%
6	142	GA-21 from GA-307 to GA-30	4.1	5,677	35,023	91.1%
7	141	GA-21 from Jimmy Deloach Pkwy to I-95	2.5	4,179	28,757	90.3%
8	161	GA-133 from US-82 to US-19	3.7	1,641	26,535	57.6%
9	1	I-24 EB at I-59	0.6	16,719	17,557	97.1%
10	95	GA-383 at I-20	1.3	2,060	15,293	77.6%
11	19	GA-369 in Gainesville	1	1,477	11,424	72.7%

Rank	ID	Bottleneck Name	Total Miles	Average Daily Truck Volume	Congestion Costs in 2019 ($/day)	Units Growth (2019 to 2050)
12	124	US-80 from Bradley Park Dr to GA-219	1.2	42,115	9,787	90.7%
13	113	US-129 at I-16	0.9	1,847	8,812	35.7%
14	22	GA-53 at I-985	0.8	1,900	8,675	98.2%
15	18	GA-369 at I-985	0.8	1,697	8,257	87.0%
16	20	GA-11 from I-985 to Athens St	1.1	2,355	8,148	72.8%
17	111	GA-22 at US-129	0.4	3,397	7,288	-49.4%
18	7	GA-3 at I-75	0.3	2,311	5,648	93.5%
19	28	GA-20 at I-75	0.5	2,772	5,488	90.0%
20	179	US-41 at I-75 in Valdosta	0.5	3,874	4,822	93.8%
TOTALS			49.6	--	615,326	

Source: Transearch and NPMRDS

Figure 93. Top 20 Urban Other Bottleneck Clusters



Source: NPMRDS and NCHRP Report 925

Table 87. Supply Chains affected by Top 20 Bottleneck Clusters in Urban Other (% of Truck Units)

Rank	Bottleneck Name	Automotive	Chemicals & Plastics	Construction	Distribution	Electronics & Electrical	Energy	Food & Agriculture	Furnishings & Clothing	Health	Lumber & Paper	Metals & Machinery	Miscellaneous	Through Trucks	Empty Trucks
1	I-75 NB from Battlefield Pkwy to TN State Line	2.5%	3.7%	13.0%	4.3%	0.5%	1.1%	17.4%	1.9%	0.1%	5.4%	2.9%	3.5%	20.6%	22.9%
2	I-16 from Chatham Pkwy to Poder Pkwy	3.0%	2.7%	7.2%	3.1%	1.2%	2.5%	14.9%	4.4%	0.3%	10.8%	4.5%	9.0%	1.4%	34.9%
3	I-85 from GA-53 to GA-82	1.6%	3.4%	12.1%	4.6%	0.4%	0.9%	7.9%	1.2%	0.1%	3.2%	1.6%	4.5%	40.2%	18.3%
4	I-75 SB from Cherokee Rd to Old Allatoona Rd	2.4%	3.3%	13.4%	4.8%	0.5%	1.3%	13.5%	1.6%	0.1%	6.1%	2.7%	4.8%	20.3%	25.2%
5	I-95 NB from GA-21 to SC State Line	1.1%	0.4%	1.6%	0.7%	0.1%	0.2%	2.6%	0.4%	0.0%	3.5%	0.3%	0.6%	84.4%	4.0%
6	GA-21 from GA-307 to GA-30	0.1%	0.3%	4.9%	0.1%	0.1%	3.4%	1.5%	0.4%	0.0%	7.1%	0.4%	13.9%		67.8%
7	GA-21 from Jimmy Deloach Pkwy to I-95	0.6%	0.4%	3.6%	0.8%	0.1%	1.8%	2.1%	0.4%	0.0%	5.7%	0.4%	7.1%	41.0%	36.1%
8	GA-133 from US-82 to US-19	1.5%	0.5%	12.4%	2.4%	0.2%	6.2%	16.1%	0.2%	0.0%	9.2%	0.4%	1.6%	6.4%	42.9%
9	I-24 EB at I-59	2.1%	3.0%	5.4%	3.9%	0.4%	0.1%	15.0%	1.6%	0.1%	4.1%	2.5%	2.6%	51.4%	7.9%
10	GA-383 at I-20	1.4%	3.5%	20.6%	6.4%	0.3%	1.5%	8.3%	0.6%	0.1%	8.6%	0.8%	5.6%	3.6%	38.9%

Rank	Bottleneck Name	Automotive	Chemicals & Plastics	Construction	Distribution	Electronics & Electrical	Energy	Food & Agriculture	Furnishings & Clothing	Health	Lumber & Paper	Metals & Machinery	Miscellaneous	Through Trucks	Empty Trucks
11	GA-369 in Gainesville	2.1%	1.9%	15.3%	1.6%	0.2%	2.0%	28.6%	0.4%	0.1%	1.2%	3.1%	2.1%		41.4%
12	US-80 from Bradley Park Dr to GA-219	1.8%	1.9%	15.4%	2.2%	0.7%	1.2%	9.9%	3.0%	0.1%	8.6%	2.3%	3.5%	20.9%	28.7%
13	US-129 at I-16	1.5%	2.3%	18.9%	3.4%	0.1%	1.6%	19.8%	0.3%	0.0%	12.2%	0.8%	4.9%	2.9%	31.2%
14	GA-53 at I-985	1.1%	1.1%	21.4%	3.0%	0.3%	1.1%	14.0%	0.2%	0.1%	1.5%	1.2%	3.1%	1.2%	50.9%
15	GA-369 at I-985	0.8%	0.8%	29.5%	2.7%	0.0%	0.8%	9.5%	0.4%	0.1%	2.4%	1.1%	2.2%	4.2%	45.5%
16	GA-11 from I-985 to Athens St	2.1%	1.9%	15.3%	1.6%	0.2%	2.0%	28.8%	0.4%	0.1%	1.2%	3.1%	2.1%		41.2%
17	GA-22 at US-129	0.3%	0.0%	16.7%	0.5%	0.0%	0.1%	2.7%	0.0%		5.9%	0.1%	30.6%		43.1%
18	GA-3 at I-75	2.7%	4.3%	13.9%	5.0%	0.5%	0.9%	15.1%	1.7%	0.1%	6.1%	3.1%	4.3%	20.5%	21.7%
19	GA-20 at I-75	2.0%	3.0%	17.5%	4.2%	0.4%	1.6%	15.1%	1.0%	0.1%	4.2%	2.4%	4.1%	11.9%	32.4%
20	US-41 at I-75 in Valdosta	0.9%	1.9%	8.5%	3.9%	0.2%	0.2%	7.7%	0.4%	0.0%	3.5%	0.5%	2.4%	57.8%	12.1%

Source: Transearch and NPMRDS

Rural

The top 20 bottleneck clusters in the rural regions in the state are listed in **Table 88** and mapped in **Figure 94**) In total, these bottlenecks constitute 48 centerline miles of roadway in rural regions around the state, generating $0.3 million of user costs to trucks and shippers each day. About thirty percent of these user costs accrue to the two top ranked bottleneck clusters, both of which are roadway sections located near or at interchanges/exits to *I-95 – GA-144 from I-95 to Liberty County Line* (ID 153) and *US-17 from Belfast Keller Rd to I-95* (ID-154).

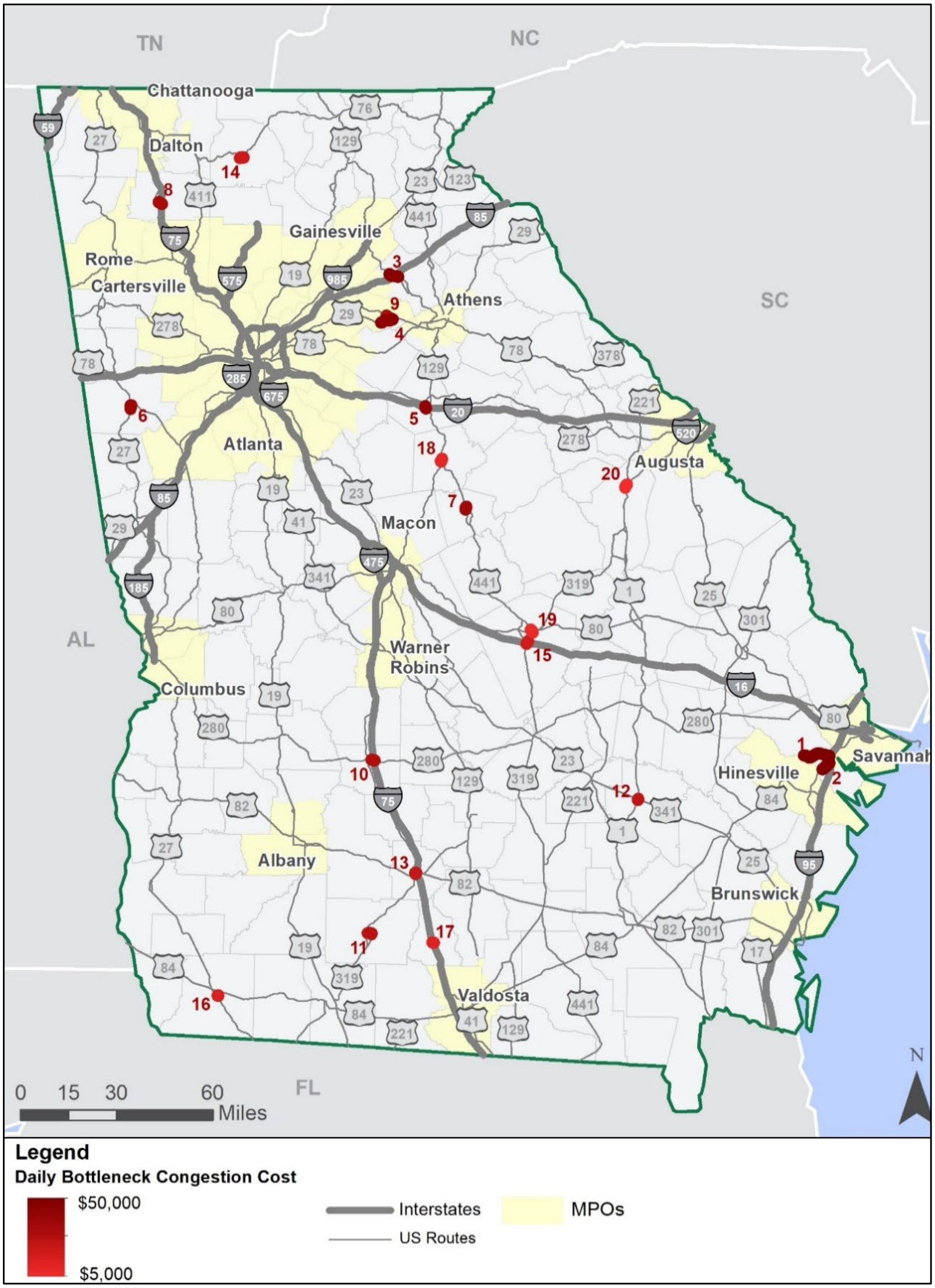
The supply chains most impacted by these top 20 rural bottlenecks include food and agriculture, construction and lumber and paper (Table 89). Through trucks and empty units contribute significantly to congestion at these bottlenecks, with share of total congestion costs ranging from 30 percent to 60 percent.

Table 88. Top 20 Rural Bottleneck Clusters

Rank	ID	Bottleneck Name	Total Miles	Average Daily Truck Volume	Congestion Costs in 2019 ($/day)	Units Growth (2019 to 2050)
1	153	GA-144 from I-95 to Liberty County Line	8.5	485	49,273	70.7%
2	154	US-17 from Belfast Keller Rd to I-95	5.2	2,147	35,212	62.8%
3	33	US-129 at I-85	4.3	2,754	30,652	116.7%
4	48	GA-316 from GA-53 to GA-11	3.9	2,684	22,461	84.5%
5	93	US-129 at I-20	1.6	2,854	15,940	66.8%
6	89	US-27 at GA-166	2.7	1,632	14,766	84.9%
7	104	US-441 in Milledgeville	2.1	1,729	13,499	42.4%
8	13	GA-53 from I-75 to US-41	1.5	1,647	12,699	81.2%
9	47	GA-53 from GA-316 to Atlanta Hwy	2.3	633	11,746	72.5%
10	157	US-280 in Cordele	1.6	2,123	10,200	72.8%
11	177	GA-37 in Moultrie	1.8	1,533	9,756	39.2%
12	159	US-1 in Baxley	0.9	1,758	8,463	62.5%
13	168	US-82/US-319 at I-75	1.5	1,267	7,810	72.3%
14	8	US-76 in Ellijay	1.4	634	6,954	59.7%
15	131	US-441 at I-16	1.2	1,542	6,403	93.8%
16	182	US-27 in Bainbridge	0.5	1,995	6,151	85.3%
17	178	GA-37 at I-75	0.9	2,090	6,030	40.4%
18	100	US-129 BR in Eatonton	1.1	1,527	5,843	53.4%
19	129	US-441 in Dublin	1.2	1,173	5,667	43.0%
20	103	US-1 in Wrens	1.2	2,233	5,626	12.9%
TOTALS			47.5	--	295,552	

Source: Transearch and NPMRDS

Figure 94. Top 20 Rural Bottleneck Clusters



Source: NPMRDS and NCHRP Report 925

Table 89. Supply Chains affected by Top 20 Rural Bottleneck Clusters (% of Truck Units)

Rank	Bottleneck Name	Automotive	Chemicals & Plastics	Construction	Distribution	Electronics & Electrical	Energy	Food & Agriculture	Furnishings & Clothing	Health	Lumber & Paper	Metals & Machinery	Miscellaneous	Through Trucks	Empty Trucks
1	GA-144 from I-95 to Liberty County Line	1.4%	0.9%	6.4%	0.8%	0.1%	2.1%	8.2%	0.5%	0.0%	17.0%	0.9%	1.5%	27.8%	32.4%
2	US-17 from Belfast Keller Rd to I-95	1.0%	2.3%	5.1%	2.2%	0.5%	2.0%	16.2%	0.5%	0.1%	22.3%	1.3%	5.1%	1.8%	39.6%
3	US-129 at I-85	3.1%	2.2%	18.3%	2.4%	0.1%	1.8%	19.8%	0.2%	0.0%	1.8%	1.5%	1.8%	3.0%	43.7%
4	GA-316 from GA-53 to GA-11	0.6%	0.8%	26.7%	4.8%	0.2%	3.2%	9.8%	0.2%	0.0%	2.9%	0.4%	2.4%	2.2%	45.9%
5	US-129 at I-20	1.1%	2.1%	15.2%	3.9%	0.1%	1.4%	11.8%	1.1%	0.0%	6.9%	1.4%	6.0%	11.5%	37.5%
6	US-27 at GA-166	1.6%	1.0%	25.0%	1.4%	0.1%	3.3%	10.3%	0.3%	0.0%	3.5%	0.8%	1.3%	1.0%	50.2%
7	US-441 in Milledgeville	0.4%	0.5%	9.1%	1.9%	0.0%	0.1%	10.4%	0.4%	0.0%	15.8%	0.8%	8.7%		51.9%
8	GA-53 from I-75 to US-41	2.1%	4.8%	13.0%	3.7%	0.3%	2.3%	15.2%	2.2%	0.1%	6.3%	2.6%	3.6%	14.2%	29.6%
9	GA-53 from GA-316 to Atlanta Hwy	1.2%	0.9%	19.7%	4.6%	0.0%	1.3%	8.1%	0.1%	0.0%	3.2%	0.3%	5.9%	0.2%	54.4%
10	US-280 in Cordele	1.1%	1.6%	6.7%	4.2%	0.1%	1.1%	21.1%	0.4%	0.0%	9.0%	0.8%	1.8%	27.1%	24.8%
11	GA-37 in Moultrie	0.5%	0.8%	4.9%	2.1%	0.3%	1.2%	14.5%	0.1%	0.0%	21.9%	1.2%	0.7%	0.8%	50.8%
12	US-1 in Baxley	1.2%	0.3%	9.3%	2.4%	0.1%	0.4%	19.6%	0.5%	0.0%	23.7%	1.4%	2.8%	0.0%	38.3%
13	US-82/US-319 at I-75	3.4%	1.0%	11.0%	4.1%	0.2%	1.7%	16.7%	0.5%	0.0%	10.3%	1.3%	2.8%	13.2%	33.9%

Rank	Bottleneck Name	Automotive	Chemicals & Plastics	Construction	Distribution	Electronics & Electrical	Energy	Food & Agriculture	Furnishings & Clothing	Health	Lumber & Paper	Metals & Machinery	Miscellaneous	Through Trucks	Empty Trucks
14	US-76 in Ellijay	2.7%	2.6%	13.9%	2.3%	0.2%	1.2%	28.9%	4.0%	0.1%	2.9%	3.1%	2.2%	0.3%	35.6%
15	US-441 at I-16	1.3%	0.8%	7.0%	4.6%	0.2%	1.5%	14.8%	2.1%	0.0%	19.7%	1.5%	2.6%	1.3%	42.6%
16	US-27 in Bainbridge	0.4%	0.8%	4.5%	2.3%	0.2%	12.9%	15.6%	0.2%	0.0%	11.6%	0.7%	2.6%	10.9%	37.2%
17	GA-37 at I-75	0.5%	0.8%	6.9%	2.7%	0.1%	0.8%	20.1%	0.2%	0.0%	13.4%	1.0%	1.4%	18.5%	33.7%
18	US-129 BR in Eatonton	1.7%	2.6%	14.9%	4.1%	0.2%	1.2%	22.5%	0.5%	0.1%	13.5%	1.0%	6.8%	3.2%	27.8%
19	US-441 in Dublin	0.4%	0.4%	8.4%	1.4%	0.0%	0.6%	8.4%	0.4%	0.0%	11.8%	0.7%	28.0%		39.5%
20	US-1 in Wrens	0.3%	0.2%	5.3%	0.7%	0.1%	0.6%	9.1%	0.3%	0.0%	14.8%	0.7%	24.0%	0.1%	43.7%

Source: Transearch and NPMRDS

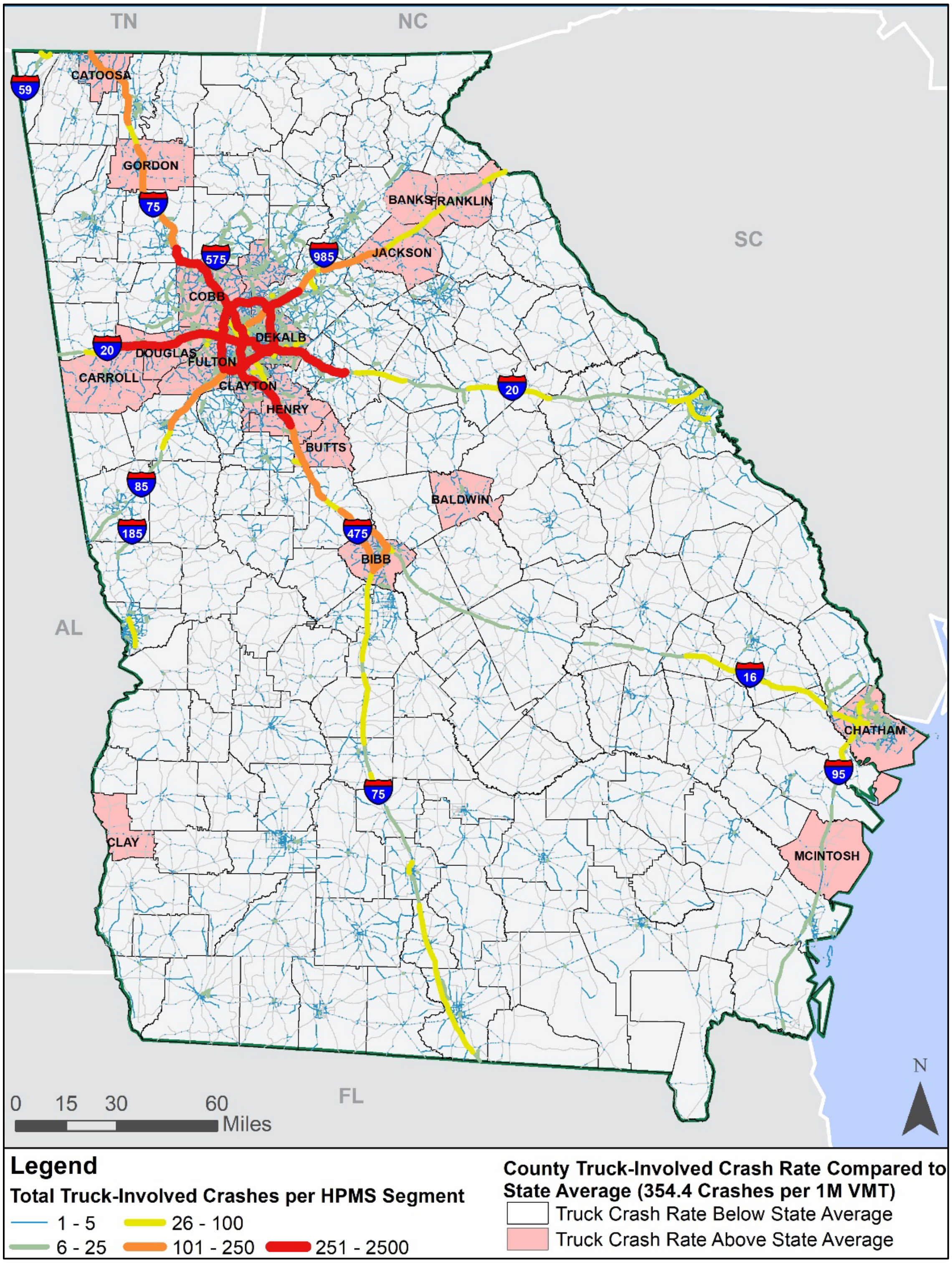
Truck Crash Analysis

An analysis of crashes from 2017-2021 provides insights into specific roadway locations that may be more hazardous to freight and goods movement. Crash data collected from the Georgia Electronic Accident Reporting System (GEARS) shows that the highest volume of truck-involved crashes occurs along Interstates and in metro areas, notably the Atlanta region, and is correlated with higher traffic volumes in **Figure 95**.

Several counties in the Atlanta region exceed the statewide average of approximately 354 truck-involved crashes per one million vehicle miles traveled (VMT) with higher rates of truck-involved crashes along Interstate corridors including I-75, I-475, I-20, and I-985.

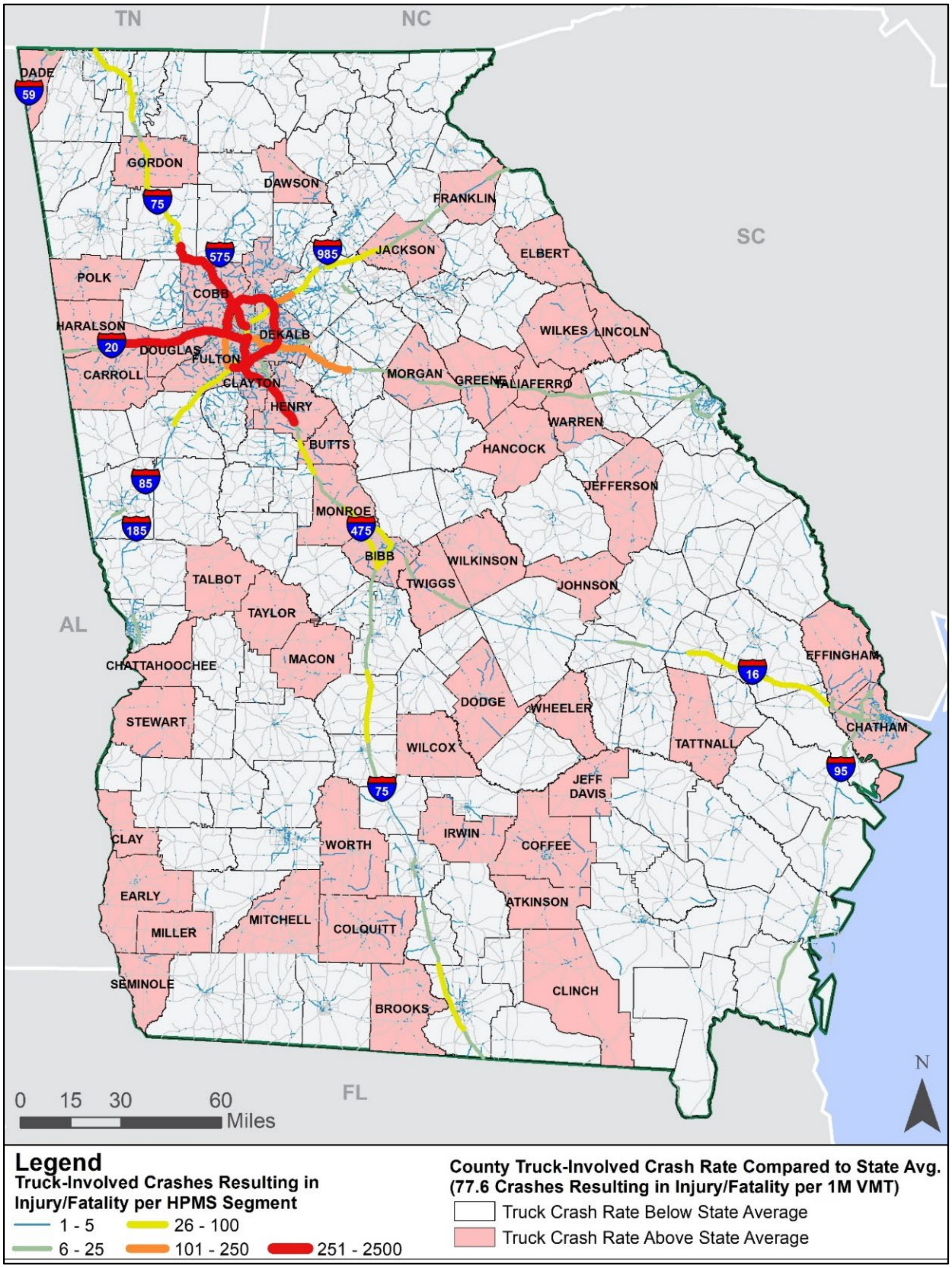
The tables included in this section provide an overview of crash characteristics for all truck-involved crashes, with a detailed breakdown of truck-involved crashes resulting in an injury or fatality in **Figure 96**. Please note that due to gaps in reporting, the tables do not sum to the same number of total crashes.

Figure 95. All Truck-Involved Crashes 2017-2021



Data Source: GEARS data 2017-2021, VMT data GDOT 2019 Form 445, HPMS 2017 road network

Figure 96. Serious* Truck-Involved Crashes 2017-2021



Data Source: Gears data 2017-2021, VMT data GDOT 2019 Form 445, HPMS 2017 road network
**Serious Crashes defined as those resulting in at least one injury or fatality*

Rural areas tend to have higher speed and higher severity crashes, while urban areas typically have a higher volume of less severe crashes. Truck-involved crashes in rural counties across the state are typically more severe.

When analyzing crashes resulting in an injury or fatality (referred to throughout this section as "serious truck-involved crashes," a subset of all truck-involved crashes), several counties in rural areas exceed the statewide average of 77.6 truck-involved crashes per one million VMT, notably Clay County in southwest Georgia and McIntosh County south of Savannah.

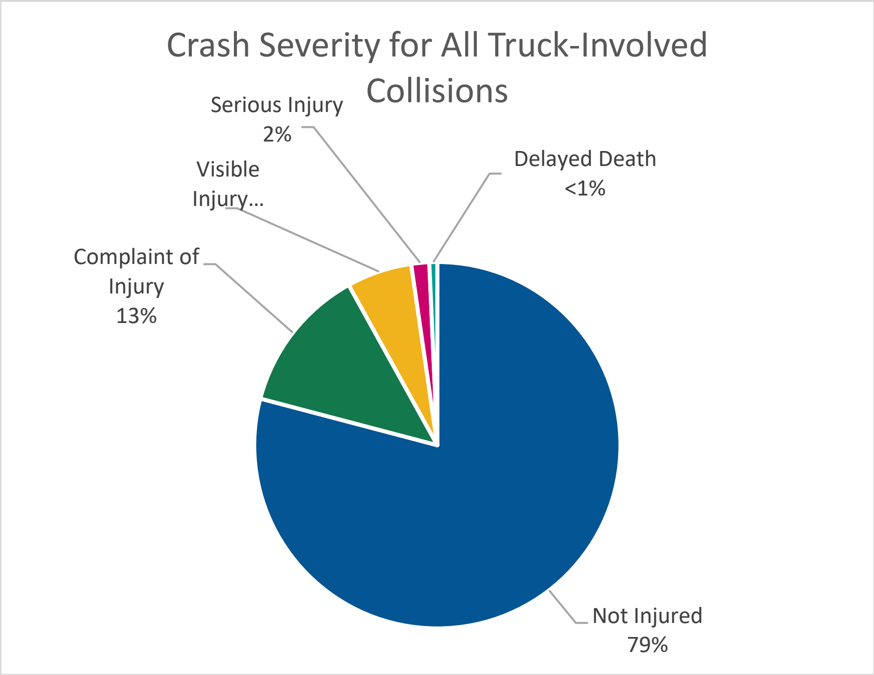
Approximately 130,000 crashes between 2017-2021 involved trucks. Of those, the majority (79 percent, or 101,703 crashes) did not result in an injury or fatality (**Table 90** and **Figure 97**).

Table 90. Truck-Involved Crashes by Severity

Severity	All Truck-Involved Crashes	
Not Injured	101,703	79%
Complaint of Injury	16,533	13%
Visible Injury	7,406	6%
Serious Injury	2,037	2%
Delayed Death	903	<1%
Not Injured	101,703	79%

Source: GEARS Data, 2017-2021

Figure 97. All Truck-Involved Crashes by Severity



Source: GEARS Data 2017-2021

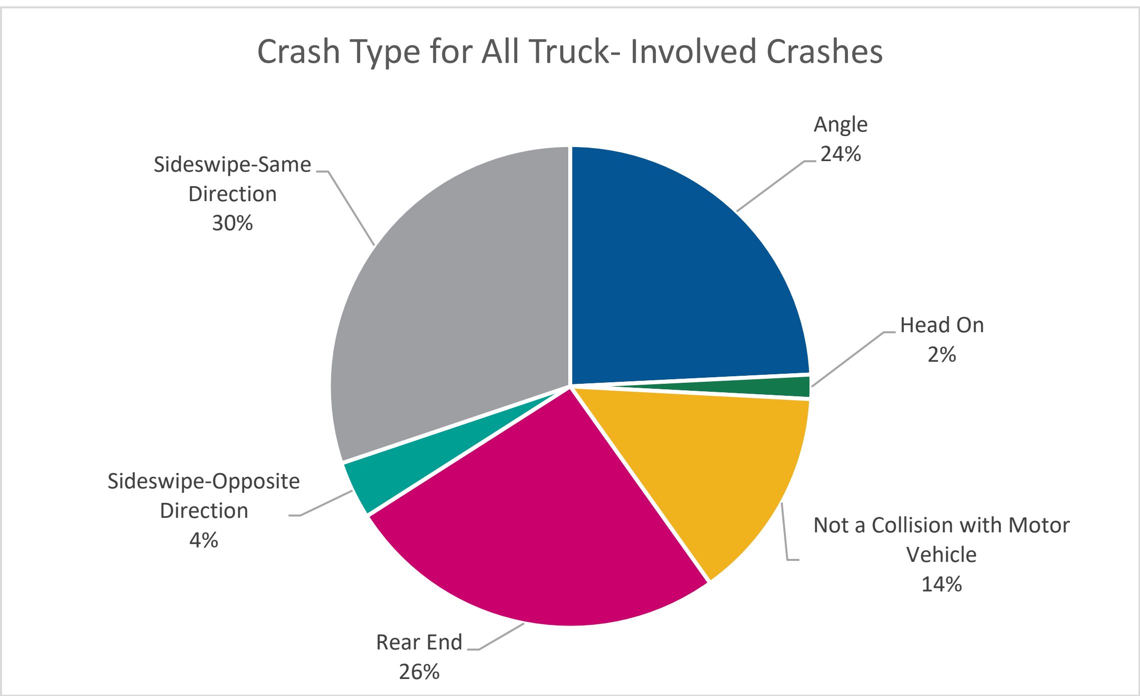
The majority of truck-involved crashes can be classified as either sideswipes (same direction), angle crashes, or rear ends, with rear end and angle crashes making up nearly 65 percent of crashes resulting in an injury or fatality (**Table 91**). While head-on crashes make up a small portion of all truck-involved crashes (2 percent or 2,063), they are typically more severe, with nearly 40 percent (800 crashes) classified as serious (**Figure 98** and **Figure 99**).

Table 91. Truck-Involved Crashes by Type

Crash Type	All Truck-Involved Crashes		Serious Truck-Involved Crashes	
Angle	30,755	24%	7,727	29%
Head On	2,063	2%	800	3%
Not a Crash with Motor Vehicle	18,183	14%	3,251	12%
Rear End	32,773	26%	9,401	35%
Sideswipe-Opposite Direction	4,919	4%	652	2%
Sideswipe-Same Direction	38,305	30%	4,931	18%

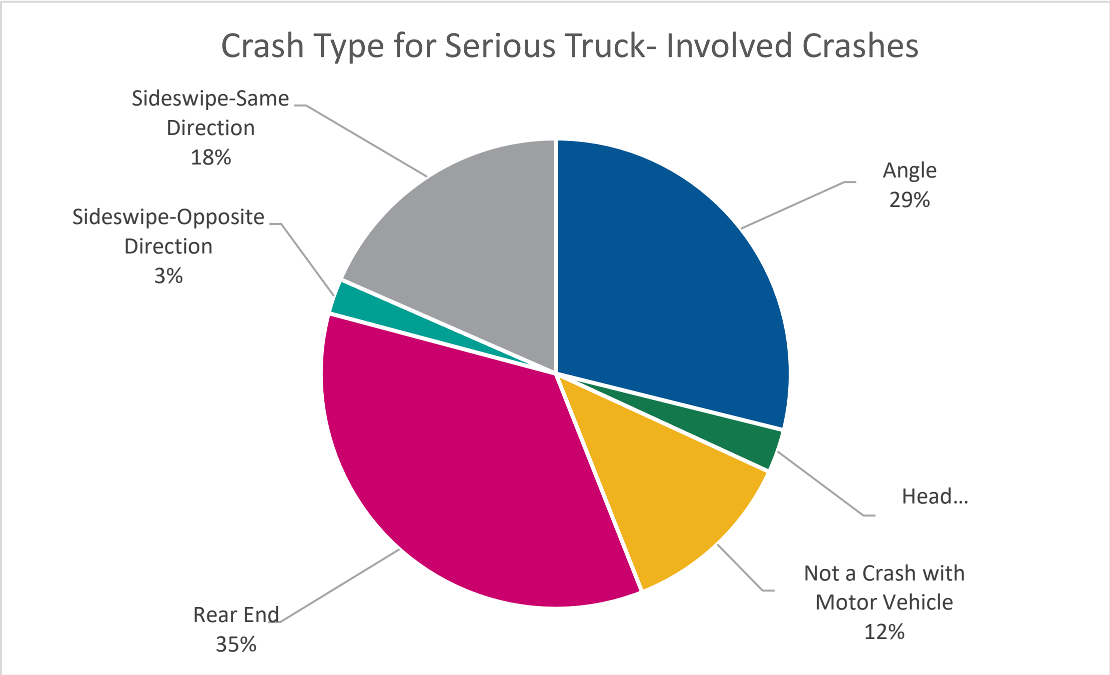
Source: GEARS Data, 2017-2021

Figure 98. All Truck-Involved Crashes by Type and Severity



Source: GEARS Data 2017-2021

Figure 99. Serious Truck-Involved Crashes by Type and Severity



Source: GEARS Data 2017-2021

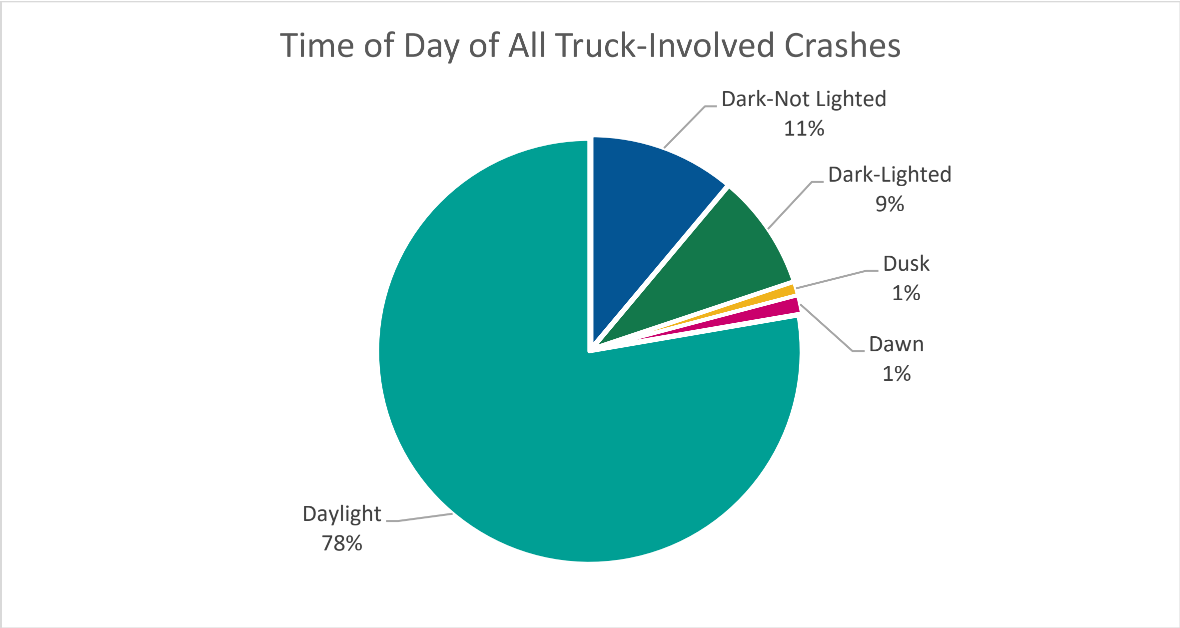
The majority of all truck-involved crashes and serious truck-involved crashes occur in daylight conditions (78 percent). However, unlit dark conditions tend to result in a higher proportion of serious truck-involved crashes, with 15 percent of serious truck-involved crashes taking place in such conditions, compared to 11 percent of all truck-involved crashes (**Table 92**). Approximately 28 percent of all truck-involved crashes (3,953 out of 14,250) taking place in unlit dark conditions resulted in an injury or fatality (**Figure 100** and **Figure 101**).

Table 92. Truck-Involved Crashes by Time of Day and Severity

Time of Day	All Truck-Involved Crashes		Serious Truck-Involved Crashes	
Dark-Not Lighted	14,250	11%	3,953	15%
Dark-Lighted	11,228	9%	2,256	8%
Dusk	1,318	1%	289	1%
Dawn	1,793	1%	403	2%
Daylight	99,617	78%	19,932	74%

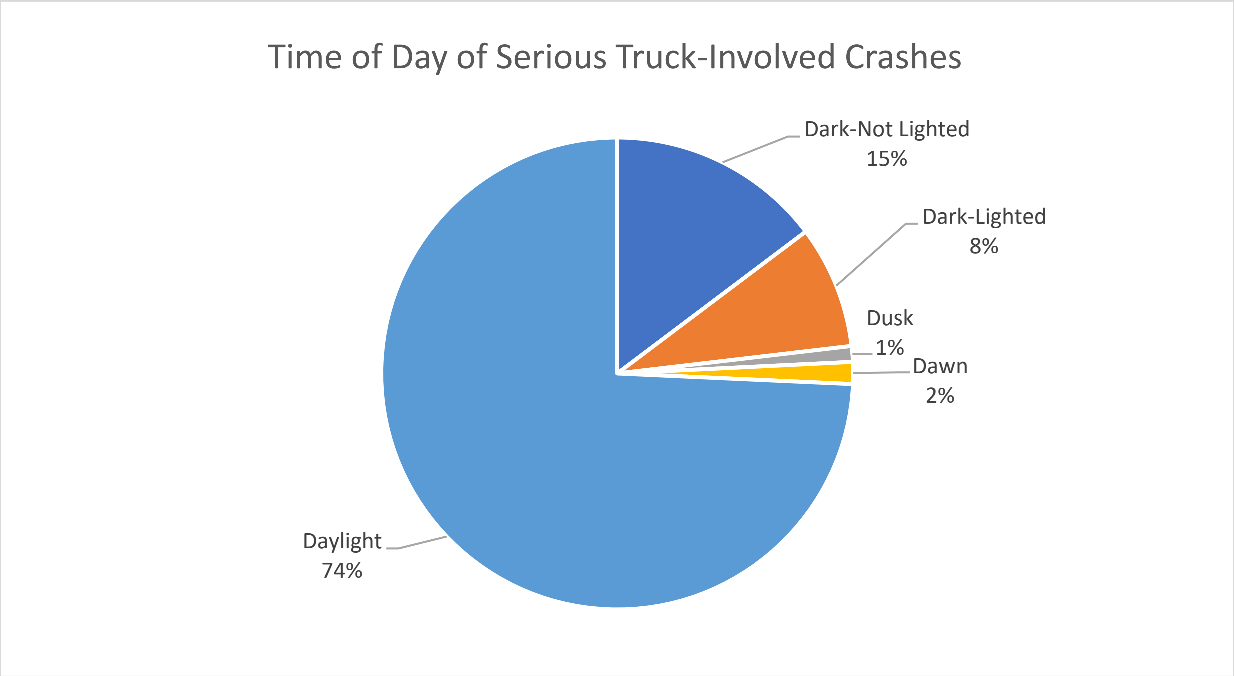
Source: GEARS Data, 2017-2021

Figure 100. All Truck-Involved Crashes by Time of Day and Severity



Source: GEARS Data 2017-2021

Figure 101. Serious Truck-Involved Crashes by Time of Day and Severity



Source: GEARS Data 2017-2021

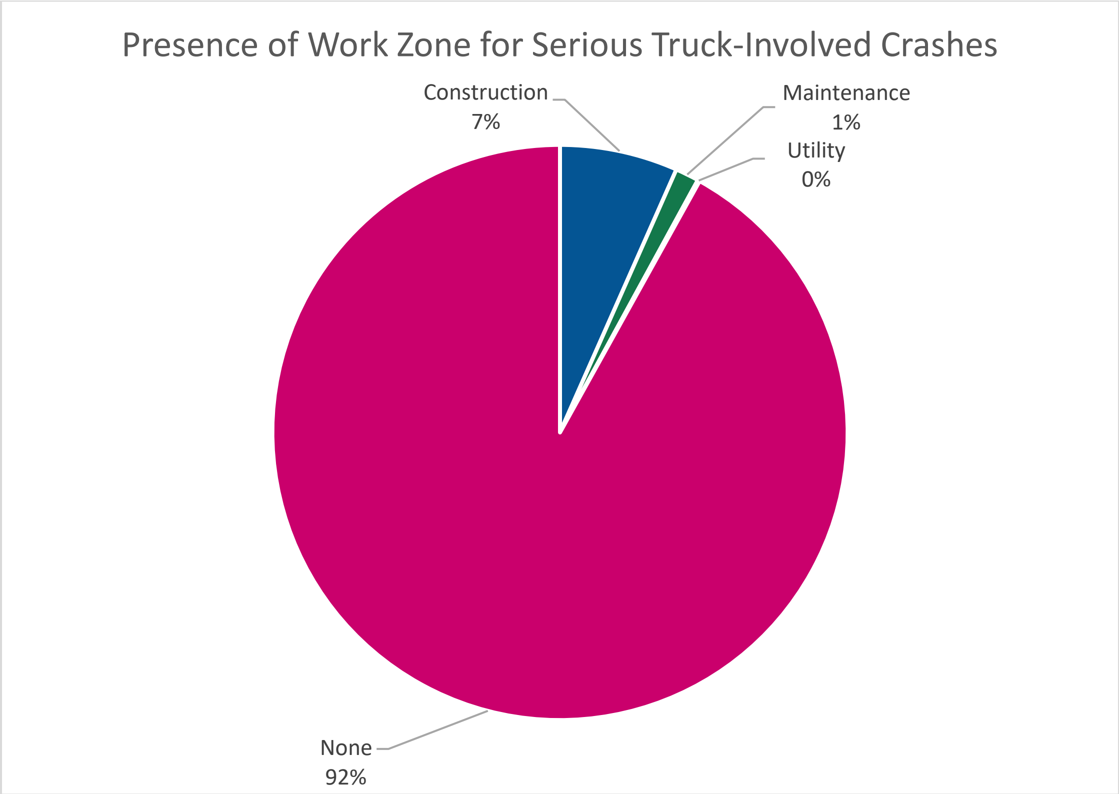
Over 90 percent of all truck-involved crashes occur outside of a work zone (**Table 93**). There is no significant relationship between the presence of a work zone and the severity of crashes (**Figure 102** and **Figure 103**).

Table 93. Truck-Involved Crashes by Presence of Work Zone and Severity

Presence of Work Zone	All Truck-Involved Crashes		Serious Truck-Involved Crashes	
Construction	9,024	7%	1,748	7%
Maintenance	1,588	1%	349	1%
Utility	192	0%	30	0%
None	114,260	92%	24,228	92%

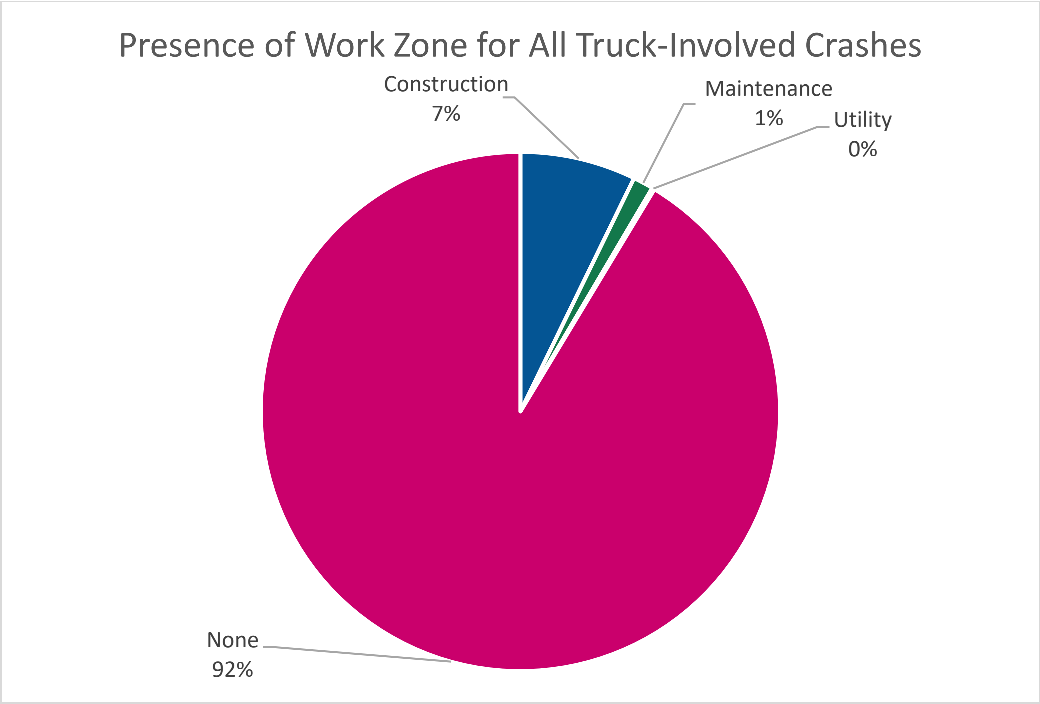
Source: GEARS Data, 2017-2021

Figure 102. Serious Truck-Involved Crashes by Presence of Work Zone



Source: GEARS Data 2017-2021

Figure 103. Serious Truck-Involved Crashes by Presence of Work Zone



Source: GEARS Data 2017-2021

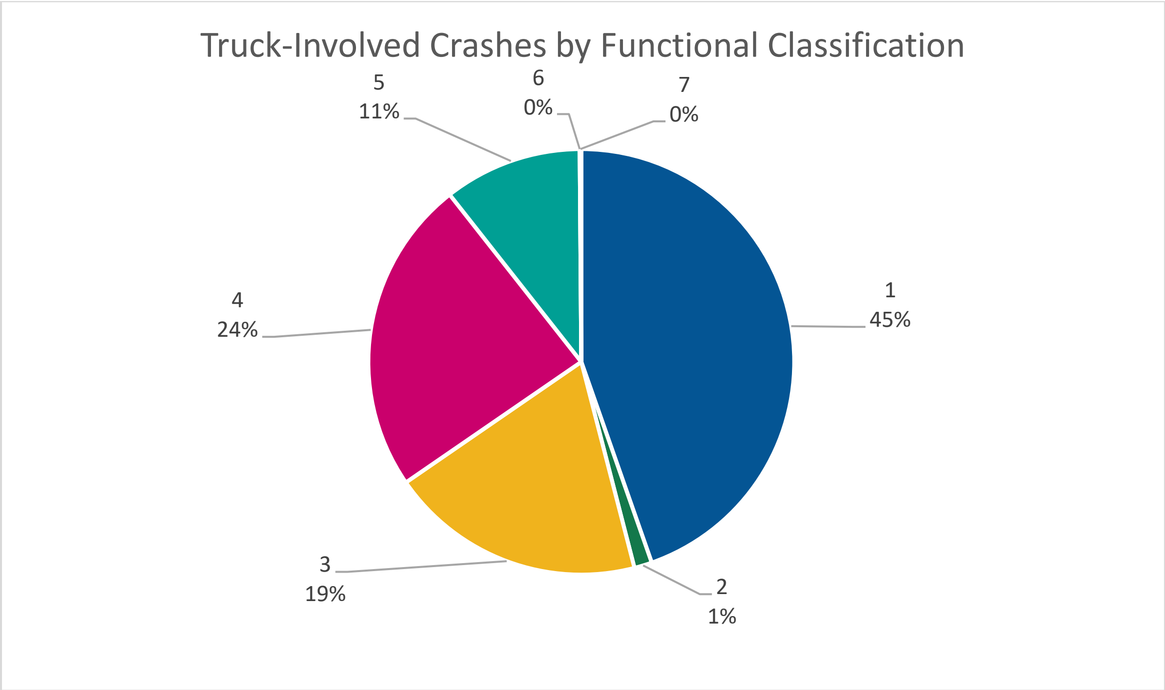
Serious truck-involved crashes make up approximately 25 percent of total truck-involved crashes. A breakdown by functional classification shows that crashes on freeways and expressways are slightly less likely to result in an injury or fatality (261 out of 1,271, or 21 percent), and crashes on major collectors are slightly more likely to result in an injury or fatality (2,661 out of 9,879, or 27 percent). Nearly half (45 percent) of all truck-involved crashes occur on Interstates, reflecting the correlation between traffic volumes and crashes (**Table 94**). The correlation between functional classification and crash severity also reflects the trend of higher severity crashes occurring on rural, less congested roadways (**Figure 104** and **Figure 105**).

Table 94. Truck-Involved Crashes by Functional Classification and Severity

Functional Classification	All Truck-Involved Crashes		Serious Truck-Involved Crashes	
1: Principal Arterial – Interstate	42,041	45%	10,389	44%
2: Principal Arterial – Other Freeway/Expressway	1271	1%	261	1%
3: Principal Arterial – Other	18,297	19%	4,640	20%
4: Minor Arterial	22,593	24%	5,554	24%
5: Major Collector	9,879	10%	2,661	11%
6: Minor Collector	0	0%	0	0%
7: Local	111	0%	24	0%

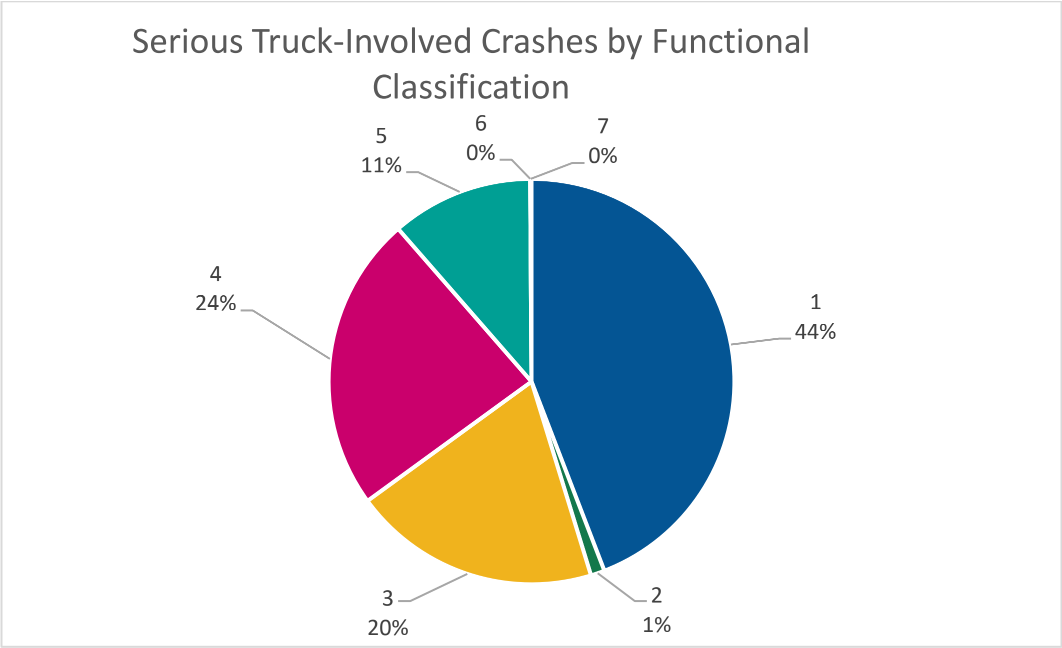
Source: GEARS Data, 2017-2021

Figure 104. All Truck-Involved Crashes by Functional Classification



Source: GEARS Data 2017-2021

Figure 105. Serious Truck-Involved Crashes by Functional Classification and Severity



Source: GEARS Data 2017-2021

4.1.2. Truck Parking

Overview

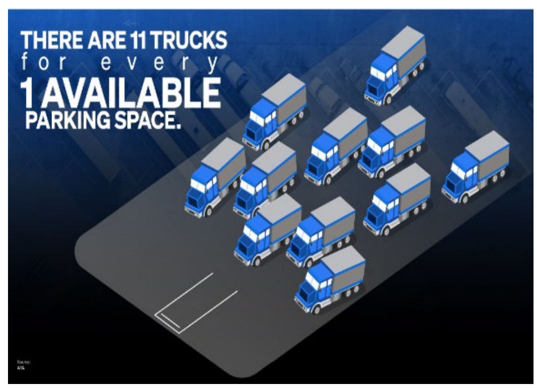
Truck parking remains a national challenge, continuing to impact the United States and Georgia's economy. Even with new truck parking supply, freight demand and corresponding truck volumes continue to expand at faster rates, outstripping new and expanded supply. According to the latest Jason's Law survey (2019), there are about 313,000 truck parking spaces across the nation, including 40,000 at public rest areas and 273,000 at private truck stops, an increase of 6 percent and 11 percent between 2014 and 2019, respectively.

Within Georgia, truck parking supply increased just over 7 percent between 2020-2022, almost exclusively comprised of new private truck parking spaces. Within Georgia, private truck parking, that is parking provided by private facilities, comprises 94 percent of the total supply in the state. The remaining 6% is public truck parking, which includes state-controlled welcome centers, rest areas and weigh stations in Georgia. **Figure 106** shows the private to public truck parking supply within Georgia. Despite these increases, truck parking shortages are still a major problem in every state and region. Major freight corridors and large metro areas, such as within and adjacent to the greater metro Atlanta, have the most acute shortages. Shortages exist at all times of day, week, and year, but mostly overnight and weekdays.

Figure 106. Available Parking Spaces for Trucks

Truck parking remains among the top five (5) challenges reported in the American Transportation Research Institute (ATRI) annual survey of trucking industry concerns. Both ATRI and Jason's Law surveys report nearly all drivers experience regular difficulties finding safe parking. This number increased in dramatically between 2015 and 2019 from 75 percent to 98 percent, respectively. According to the American Trucking Association (ATA), there are 11 drivers competing for each truck parking space with the average driver spending upwards of 56 minutes a day searching for parking. This wasted time amounts to an approximately 12 percent annual pay cut, further impacting the number of truck drivers who choose to remain in the industry. To avoid a route change, late delivery, or trouble with their employer for not resting when they are supposed to, 58 percent of drivers stated they will park illegally at a minimum of three times a week.

As noted previously, Georgia has been successfully increasing its supply of available safe truck parking. According to the 2019 Jason's Law survey, Georgia is ranked in the top tier among states in terms of number of total truck parking spaces per 100 miles of the National Highway System and per 100K Daily Truck Vehicle Miles Traveled, respectively. As of 2019, Georgia remains among the top five states in the nation for total number of public truck parking spaces.



Source: American Trucking Association (ATA)

Despite high national rankings, the state has both qualitive and quantitative data indicating that a truck parking shortage exists. Truck drivers traveling within or through the state report difficulties finding safe, adequate parking. Both public and privately-owned truck parking facilities frequently experience demand at or near capacity. Truck parking utilization counts data obtained at Georgia's visitor centers and rest areas in 2020 indicate that several locations are overcapacity at various times of the day. Private truck parking facilities (who provide the greatest number of truck parking spaces) also indicate frequent shortages. A GDOT study conducted in 2019 identified hundreds of unauthorized parking locations throughout the state (detailed further below). Additionally, areas of unauthorized truck parking locations along ramps have been identified across the state, discussed later in this section.

Contributing Factors

Many varying factors contribute to the truck parking shortage in Georgia, including industrial growth, federal Hours of Service (HOS) regulations, and restrictive delivery and pick-up schedules as shown in **Figure 107**. Additional details on contributing factors were discussed in the Multimodal Assessment Deliverable.

Figure 107. Factors Influencing or Generating Truck Parking Demand

Federal Hours of Service (HOS) Regulations	Warehousing Logistics Inventory Management	Other
Mandatory 10 hours of rest following 14 hours on duty	Staging for pickup/delivery windows at factories and warehouses	Local parking for deliveries to replenish supplies and materials
Required 30-minute breaks at prescribed intervals	Local parking for deliveries to replenish supplies and materials	Unplanned parking due to breakdowns, traffic incidents or weather-related closures

Source: FHWA Truck Parking Handbook (2022)

The factors presented in **Figure 107** can be grouped into five (5) primary reasons for why trucks park, presented as **Figure 108**.

Figure 108. Why Trucks Need to Park

Long-Haul	Staging	30-minute Break	Emergency	Time Off
Long-haul drivers are on the road for days or weeks traveling across the country. They need more amenities than drivers who are home regularly.	Truck drivers picking up and delivering freight at manufacturers, warehouses, and distribution centers need to park nearby to await an appointment, often in busy urban areas.	As part of the Federally mandated 30-minute break, the driver must be off duty, meaning they are no longer working and will not have to move the truck for any reason.	Drivers may be impacted by an incident that has closed or severely congested the roadway. Their original itinerary is disrupted, and parking is needed immediately.	Independent drivers do not have a company facility for off-duty parking. They need a place to park while off-duty, but ordinances may prohibit parking at their home.

Source: FHWA Truck Parking Handbook (2022)

Truck Parking Opportunities

This section focuses on identifying areas along the National Highway Freight Network (NHFN), Strategic Highway Network (STRAHNET), and Georgia Freight Networks where additional truck parking is or is likely to be needed.

To facilitate the identification of needs across the state, a series of maps have been developed which divide Georgia into a grid index network of 400 square mile (20-mile x 20-mile) squares. Each square is given an alphanumeric label that correlates to its position within the state. Alphabet labels are located along the Y-axis and numeric labels are along the X-axis. The grid system and the labels which will be referenced within this section are identified in **Figure 109**.

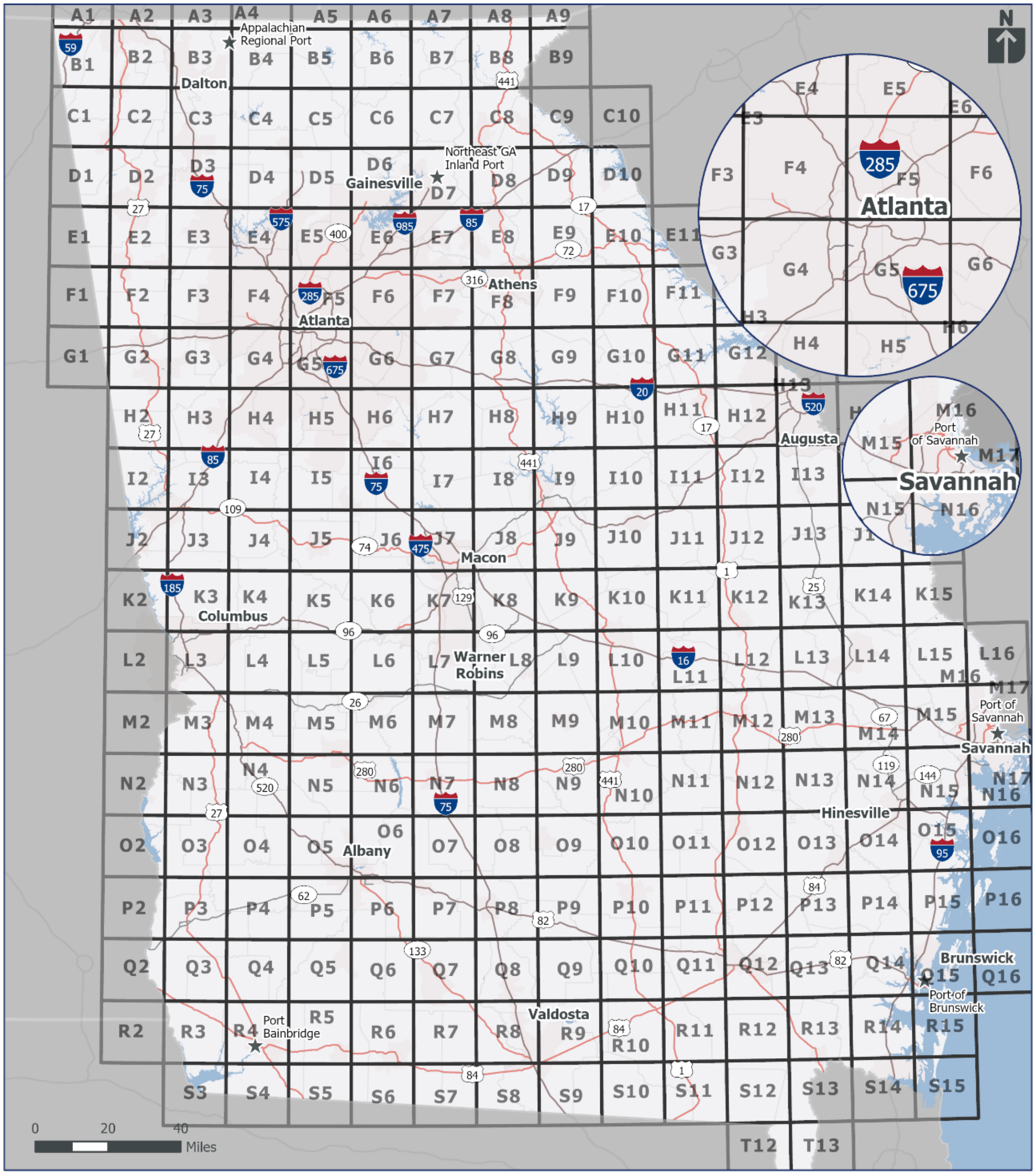
The first piece of the needs assessment involved a review of where trucks are parking across the state as well as where unauthorized parking is occurring. Two separate analyses were conducted. The first used a four-month period of ATRI truck parking data from August through November 2021 to identify both overall truck parking locations and unauthorized truck parking locations. Though not a full count of all trucks parking throughout the state, this data has been utilized to identify trends and in conjunction with additional data to assess truck parking needs across the state.

The ATRI data was filtered using the following methodology:

- All truck parking greater than six hours
    - Truck parking at industry locations, parking areas, and unauthorized parking
- Unauthorized truck parking greater than six hours
    - Unauthorized parking areas were defined as areas within 100 ft of roadway ramps where trucks were parked for more than six hours

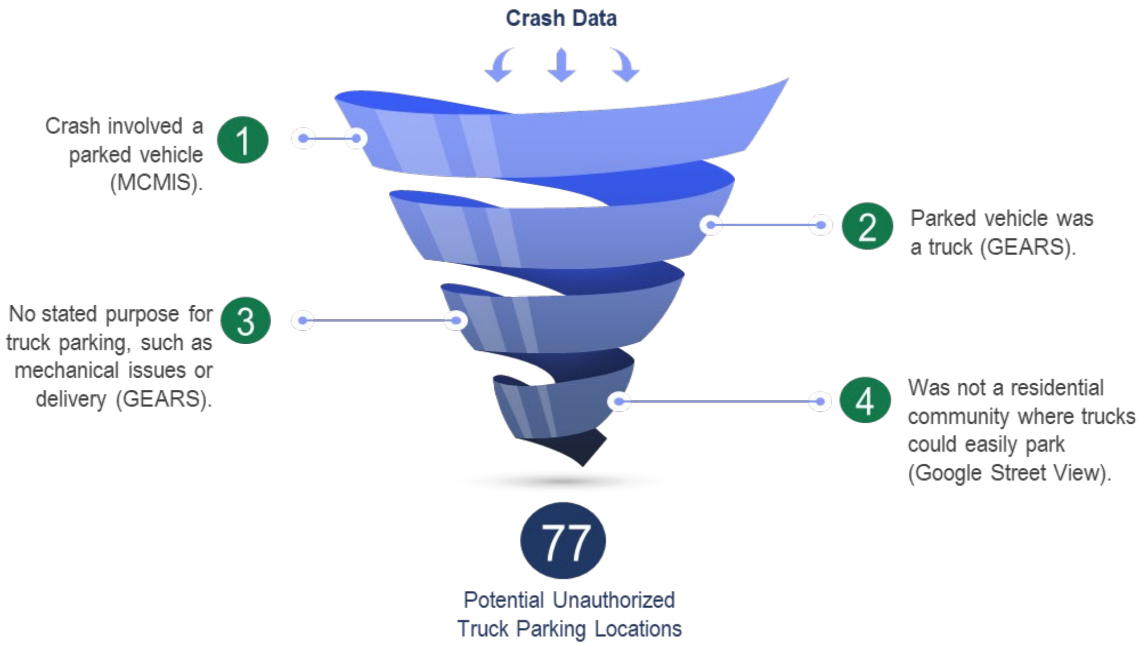
The second analysis involved two steps. First, Motor Carrier Management Information System (MCMIS) 2017-2019 data and Georgia Electronic Accident Reporting System (GEARS) 2017-2019 data was used to determine the location of accidents involving parked trucks across the state (see **Figure 110**). The crash data was reviewed, to only identify truck related crashes related to a parked vehicle, and to also remove emergency/mechanical failures stopping from the analysis. This analysis identified 77 locations in which parked trucks were involved in an accident without known mechanical failure leading to the parking.

Figure 109. Reference Grid Index



Freight Network
Strategic Highway Network
★ Georgia Port
Grid Network (20 x 20 Mi)

Figure 110. Truck Parking Locations Identified Via Crash Data (2017-2019)



Then National Performance Management Research Data Set (NPMRDS) data was used to identify areas where truck speeds were less than 20 mph between 6 PM and 6 AM. That data was overlaid in GIS with data from the GDOT Road Inventory to identify concrete or asphalt shoulders greater than 8 feet in width (see Figure 111). This analysis helped identify areas where unauthorized parking was and could likely occur along the road network. Combined with the 77 original crash related parking data, a total of 403 individual unauthorized parking locations were identified across the state. Of those 403, 199 were located along the Interstate system as identified within Table 95.

Figure 111. Analysis of Unauthorized Truck Parking Locations

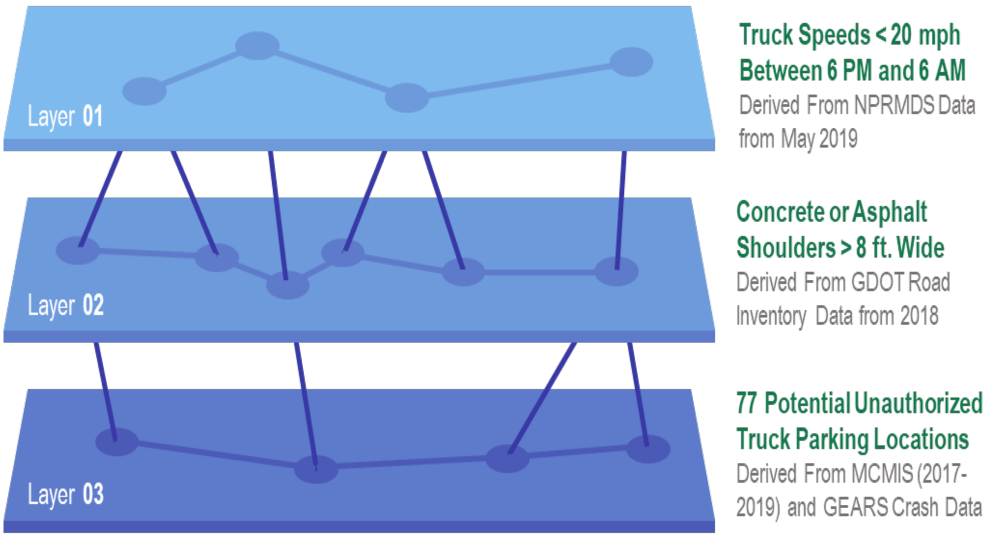


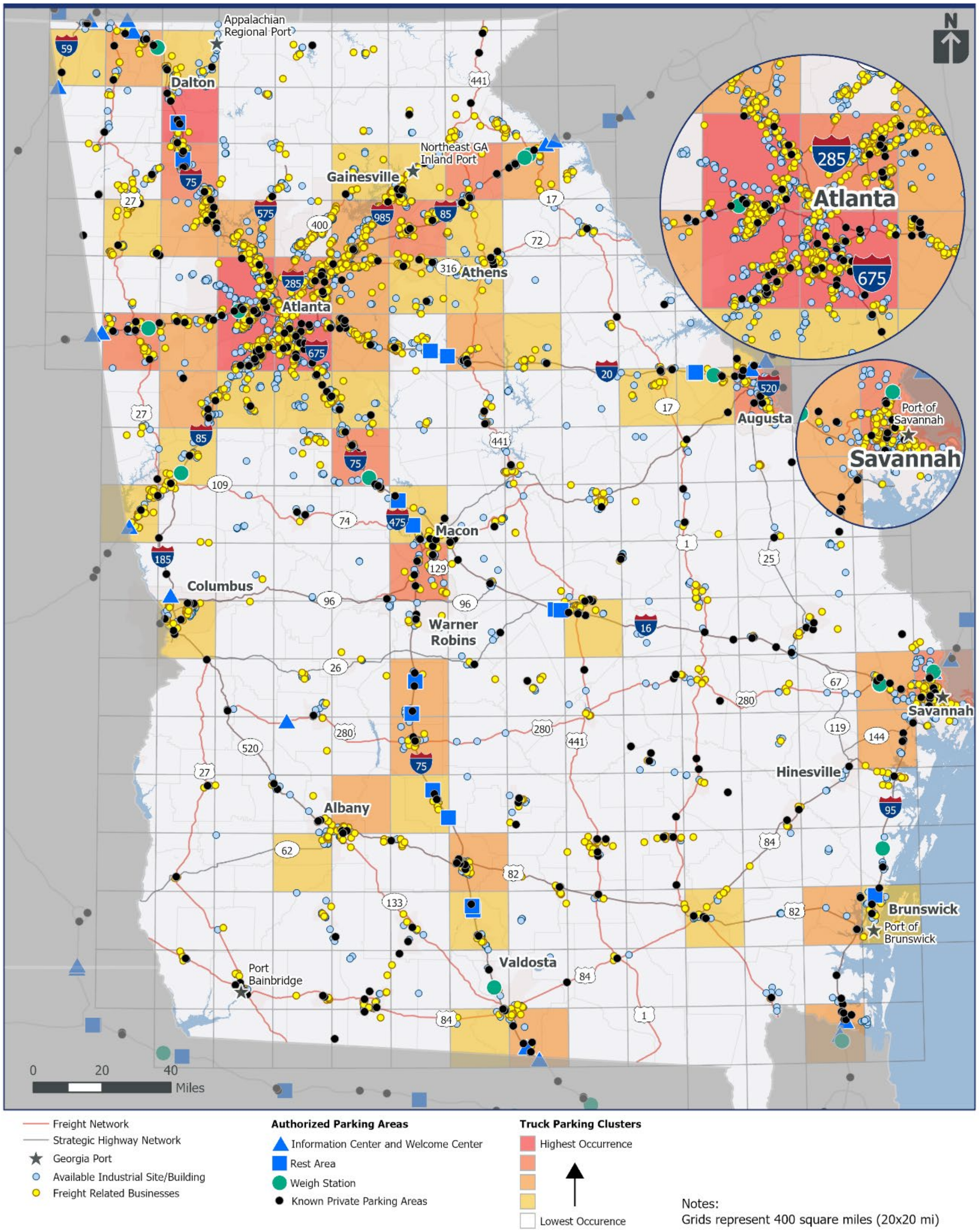
Table 95. Interstate Unauthorized Truck Parking Locations Identified by NPMRDS and Crash Data

Corridor	Unauthorized Parking Locations
I-16	23
I-185	1
I-20	46
I-24	1
I-285	11
I-475	1
I-575	1
I-675	1
I-75	61
I-85	40
I-95	10
I-985	3
Total	**199**

The findings from both analyses were combined to identify all unauthorized parking areas across the state. In total, over 3,000 potential unauthorized truck parking were identified.

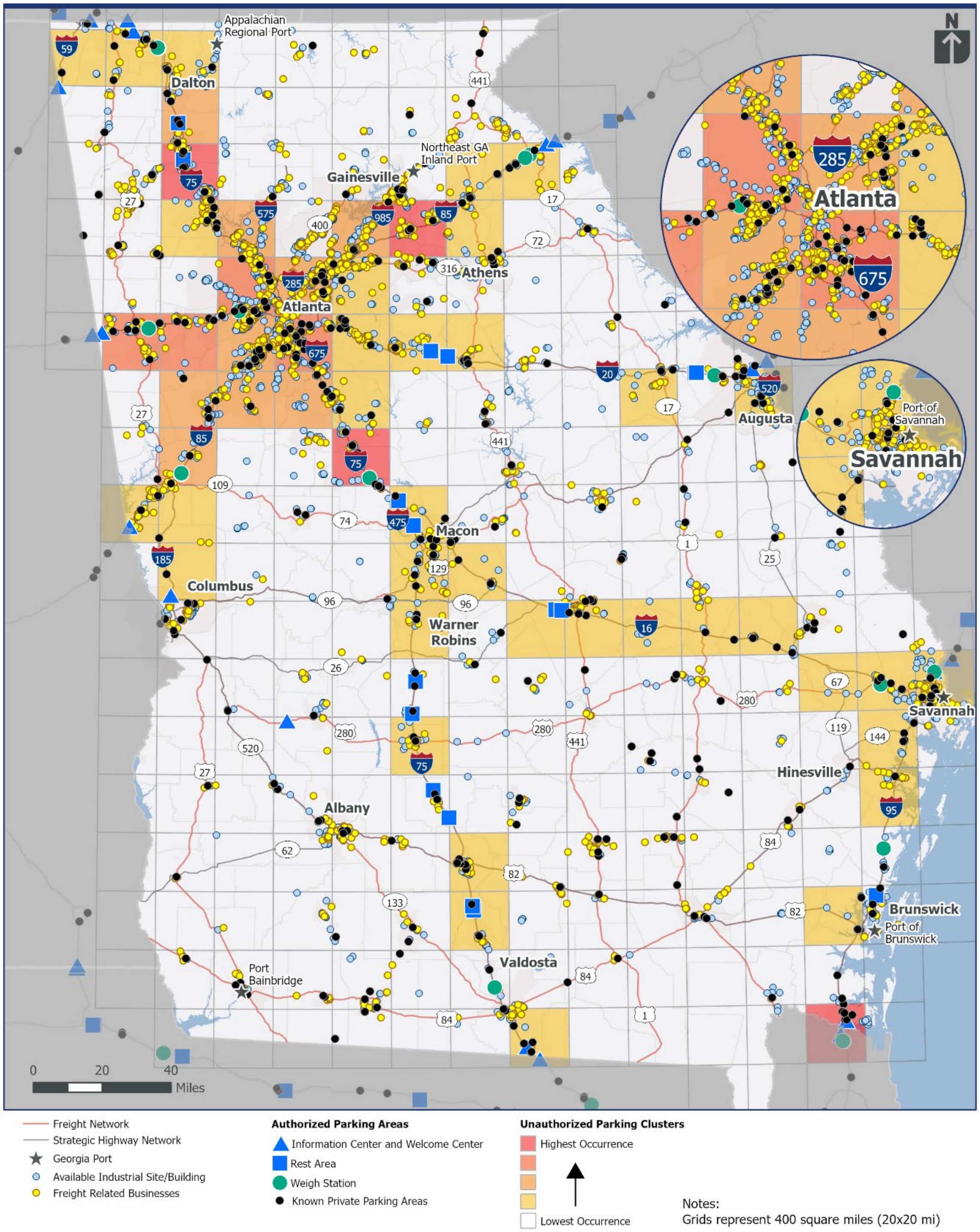
Figure 112 shows overall truck parking trends locations in the state and **Figure 113** shows unauthorized parking locations in the state.

Figure 112. Overall Truck Parking Locations in the State



Source: ATRI (8/21 through 11/21), Georgia Power, local economic development councils, GA DCA DRI website

Figure 113. Unauthorized Truck Parking Locations in the State



Source: ATRI (8/21 through 11/21), GEARS, MCIMS, Georgia Power, local economic development councils, GA DCA DRI website

Overall, truck parking trends align with the Interstate system, with higher densities of truck parking focused in urbanized areas, in proximity to ports, and along state boundaries. The largest (by land area) clustering of the truck parking areas and overall industry locations are located within the Atlanta Metropolitan Area. Outside of the metropolitan area, truck parking is clustered near both Brunswick and Savannah (port cities) and along the freight network, with a primary focus along the Interstate system.

As freight volumes and development continue to increase across the state, it is anticipated that the demand for truck parking in areas with high concentrations of truck parking and high concentrations of unauthorized truck parking will continue to increase. The most prevalent areas of existing truck parking and need are listed below and noted in Table 96 (see **Figure 109** for Grid IDs):

- **Grid ID: F4, G4, G5 -** The Atlanta Metropolitan Area (Clayton, Cobb, DeKalb, Douglas, Fayette, Fulton, Henry, Paulding, and Rockdale Counties)
- **Grid ID: C3 -** I-75 North of Atlanta (Gordon, Murray, Whitfield Counties)

Table 96. Most Prevalent Areas of Overall Truck Parking

Grid ID	Number of GDOT Public Facilities and (Parking Spaces)	Number of Known Private Facilities and (Parking Spaces)
F4; G4; G5	1 (13)	53 (7,543)
C3	1 (50)	5 (519)

The Atlanta Metropolitan Area has the most significant clustering of unauthorized truck parking in addition to the port cities and state borders. The four most prevalent areas where unauthorized truck parking occurs are listed below and noted in Table 97:

- **Grid ID: S14** -The I-95 area at the border with Florida (Camden County)
- **Grid ID: D3** - I-75 North of Atlanta (Bartow, Floyd, and Gordon Counties)
- **Grid ID: I6** - I-75 South of Atlanta (Butts, Lamar, Monroe, and Spalding Counties)
- **Grid ID: E7** - I-85 North of Atlanta (Barrow, Gwinnett, Hall, and Jackson Counties)

Table 97. Most Prevalent Areas of Unauthorized Truck Parking

Grid ID	Number of GDOT Public Facilities and (Parking Spaces)	Number of Known Private Facilities and (Parking Spaces)
S14	1 (29)	8 (666)
D3	1 (51)	12 (1,050)
I6	2 (28)	9 (746)
E7	0 (0) The closest location is within Franklin County	7 (649)

Areas of projected truck parking growth are anticipated to be in locations with significant growth in industry and overall freight volumes. The Atlanta Metropolitan Area is likely to see the greatest influx of freight-related development, however, both Augusta and Savannah are also anticipated to experience significant growth. Though higher densities of freight related growth are anticipated within the major urban areas, development is expected to continue throughout the state.

Freight Volumes & Freight Generating Industries

Another component of the needs assessment was consideration of existing and anticipated freight volumes and existing and anticipated freight generating industries across the state. Existing (2019) and future (2050) freight volumes were derived from Transearch and applied to the current Georgia Statewide Travel Demand Model (GSTDM). These volumes were used to calculate the percent change in freight volumes along roadways throughout Georgia. **Figure 113** shows the segments with the greatest increases in potential freight development and freight volumes.

The segments with the greatest anticipated percent change in freight volumes are primarily within or near indices where new freight generating industries are anticipated (see **Figure 114**). Many of the roadways with projected increases in freight movement over 500 percent are clustered within the Atlanta Metropolitan Area and the areas closest to Savannah and Augusta.

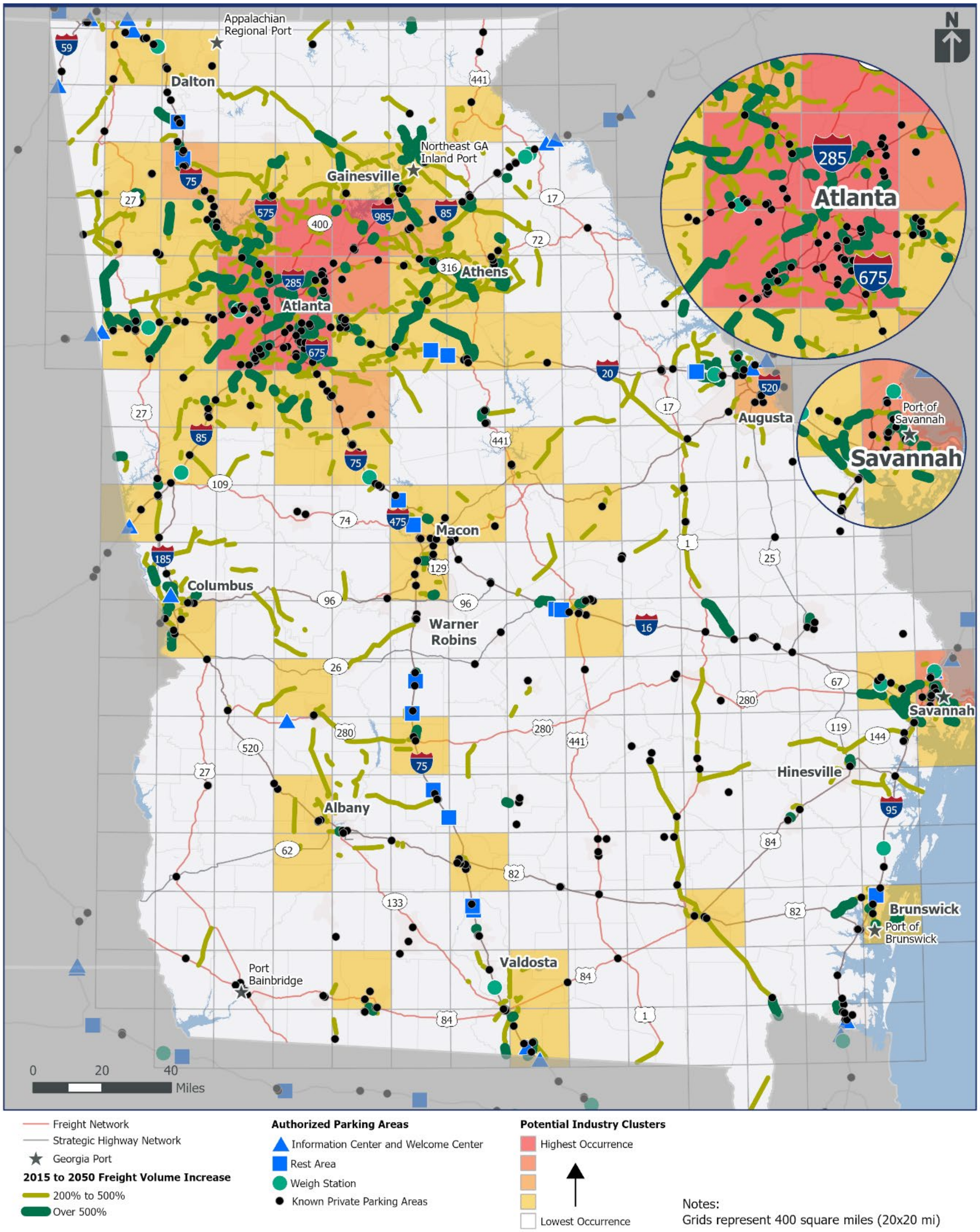
The greatest anticipated need for truck parking due to an increase in development and projected freight traffic volumes is within the Atlanta Metropolitan Area. The six areas with the greatest anticipated freight growth are noted in Table 98 and contain the 13 counties listed below:

- Cherokee
- Clayton
- Cobb
- DeKalb
- Douglas
- Fayette
- Forsyth
- Fulton
- Gwinnett
- Hall
- Henry
- Paulding
- Rockdale

Table 98. Areas with Freight Generating Industries and Significant Increases in Freight Volumes

Grid ID	Number of GDOT Public Facilities and (Parking Spaces)	Number of Known Private Facilities and (Parking Spaces)
F4; F5; G4; G5; E5; E6	1 (13)	66 (7,807)

Figure 114. Freight Intensive Developments and Freight Volumes



Source: GSTDM, Georgia Power, local economic development councils, GA DCA DRI website

Public Facility Parking Utilization

In 2020, a review of 28 GDOT public parking facilities was conducted to estimate truck parking utilization and to understand when the highest demand for truck parking occurred. However, this information was not conducted as a true count of truck parking during this period, as the truck parking stalls were not individually monitored. Assumptions were made based on truck counting stations at the entrance of each facility. This data indicates that there were seven public parking areas where 50 percent or more of the time the number of trucks using the facility exceeded the number of truck parking spaces. The location of these high need facilities is noted in **Table 99**.

Table 99. High Utilization Public Facilities

Grid ID	GDOT Facility Type	Facility Number / Name	Location	Percentage of time interval when truck in-use exceed max truck parking spaces
J7	Open Rest Area	22	I-75, Monroe Co.	99%
Q8	Open Rest Area	5	I-75, Cook Co.	78%
B2	Visitor Information Center	Ringgold	I-75, Catoosa Co.	64%
G1; G2	Visitor Information Center	Tallapoosa	I-20, Haralson Co.	61%
O7; O8	Open Rest Area	9	I-75, Turner Co.	61%
D3	Open Rest Area	34	I-75, Gordon Co.	51%
C3	Open Rest Area	35	I-75, Gordon Co.	50%

Major Port Facilities

The locations of major marine and inland port facilities have also been considered within this analysis. The port facilities are identified within the five Grid IDs depicted in Table 100, (the IDs derive from **Figure 109**). These areas have been specifically identified for their inherent need for truck parking and staging; however, these grids were not identified as having the highest truck parking need as described within the previous sections.

Table 100. Port and Intermodal Facility Locations

Grid ID	Port or Intermodal Facility
B3	Appalachian Regional Port
D7	Northeast Georgia Inland Port
M16	Port of Savannah
Q15	Port of Brunswick
R4	Port Bainbridge

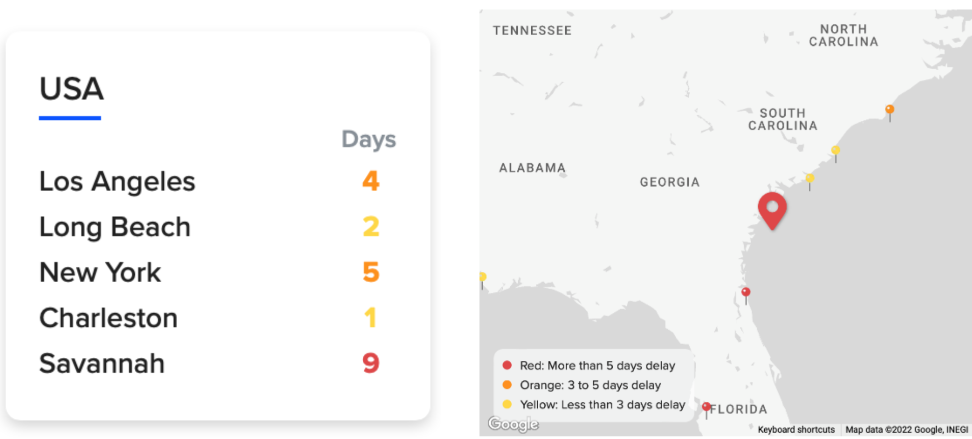
4.1.3. Non-Highway

Ocean shipping, air, rail, and pipeline are the non-highway freight transportation systems in the state of Georgia. This section focuses on system performance for the first three modes.

Port delays are one of the major variables in ocean shipping transit time since vessel sailing times are relatively constant. Port delays are where transit time variability is introduced. Supply chains depend upon reliable delivery. Shippers are highly sensitive to transit time variability and will accept longer transit times for more reliability.

The Port of Savannah is a significant feature of Georgia's freight infrastructure. As the fourth largest container port in the United States, Savannah has experienced both volume growth and increased congestion. A recent snapshot of average delay times, in **Figure 115**, show the Port of Savannah is congested, currently experiencing greater delays than that of other large container ports.

Figure 115. Average Delay Time at Major U.S. Ports, 2022



Source: https://www.gocomet.com/real-time-port-congestion/usa/savannah-ussav

Air system measures are compiled and maintained by the Federal Aviation Administration. The Aviation System Performance Measures[71] (ASPM) system provides detailed aviation performance measures. By its nature, this data is more granular and potentially useful as a planning tool. Performance measures on drayage and long-distance road feeder service routes are not directly tracked and could be as part of regional road performance monitoring.

Rail system performance measures are reported to and made available weekly by the Surface Transportation Board[72]. As with highway and ocean transport, those responsible for planning

[71] Federal Aviation Administration, "Aviation System Performance Metrics" available at https://aspm.faa.gov/aspmhelp/index/Aviation_Performance_Metrics_%28APM%29.html

[72] Surface Transportation Board, "Rail Service Data," available at https://www.stb.gov/reports-data/rail-service-data/#railroads-tab-content-1-7

goods movement are most concerned with transit time reliability. Many of the available measures are higher-level averages and of limited use to supply chain managers.

There are several crossing hotspots throughout the state. According to GDOT's Highway-Rail Grade Crossing Safety Action Plan, between 2017 and 2019, 17 percent of rail crossing crashes in Georgia took place at 21 crossings, representing only 0.4 percent of the state's total number of rail crossings. Crossing hotspots also occur at private rail crossings: nearly a third of private crossing crashes occurred at only three intermodal container yards. These were Garden City in Savannah, Inman Yard in Atlanta, and Whitaker Yard in Austell. GDOT, working in partnership with the Georgia Ports Authority (GPA) and Chatham County, opened a grade separation to address crossing crashes at Garden City in FY2021. The new infrastructure reduces at-grade crossings within the container yard.

4.2. Preparing for Growth

4.2.1. Major Trends Ranked by Importance to FAC Members

The 2050 forecast for Georgia-based freight was presented in the Multimodal Freight Assessment Report. It predicts vigorous growth for every mode. Rail intermodal tonnage is expected to climb 150 percent while truck and total tonnage nearly double. Statewide freight volumes are expected to rise twice as fast as Georgia's already fast-growing population. Container traffic at the Port of Savannah is breaking records and spurring warehouse investment across adjacent territory.

Nine major trends are at work in the supply chain world. The Georgia Freight Advisory Committee (FAC) rank ordered these trends according to importance for the members' operations in the state. The results are shown in **Figure 116**. These trends are assessed in greater detail in the following sub-sections.

What is most remarkable about this list is how different the elements and priorities are from what they would have been just a few years ago – as Georgia FAC members acknowledged. The pandemic accelerated e-commerce demand, disrupted freight operations and exposed risks with a cumulative effect to which supply chains are continuing to adjust.

Figure 116. Trends Identified by the Freight Advisory Committee

Ranked for Importance by Georgia FAC

1. Workforce Capacity
2. Supply Chain Disruption and Risk Management
3. Supply Chain Restructuring
4. Technology and Automation
5. Population and Economic Growth
6. E-Commerce Scale and Penetration
7. Real Time Optimization
8. Electrification and Decarbonization
9. Remote Working and Urban/Rural Location

4.2.2. Workforce Capacity

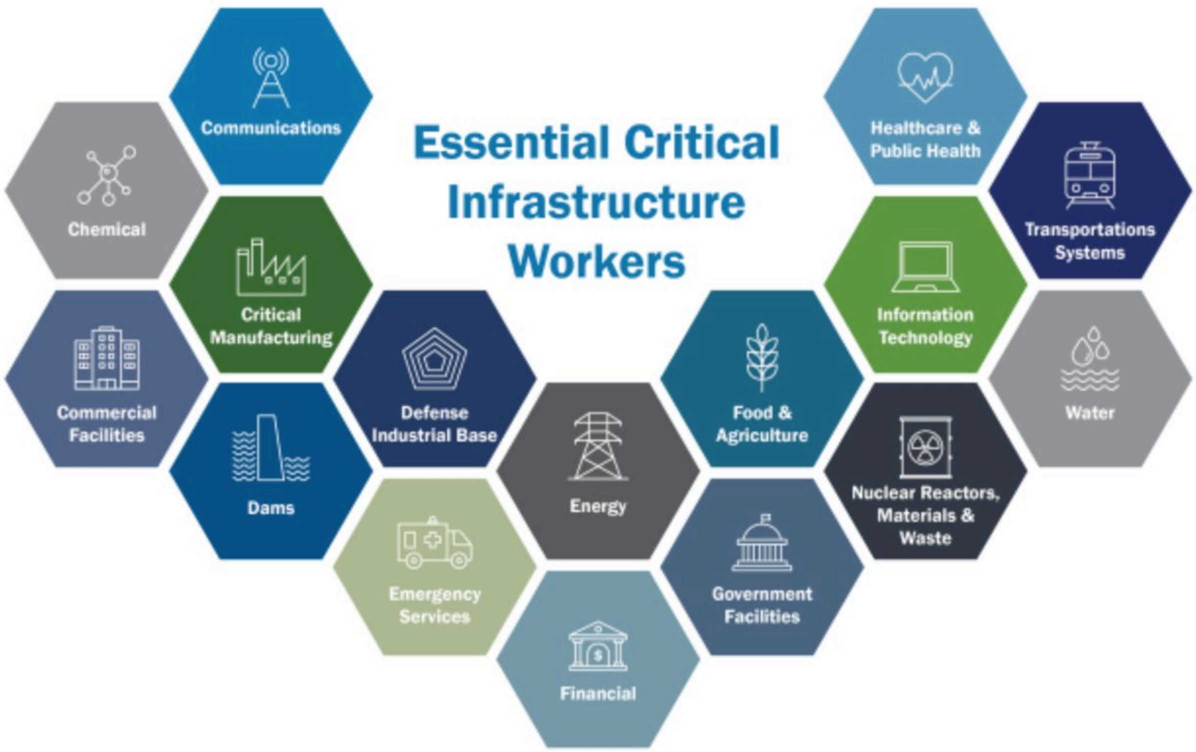
Workforce Capacity issues range from shortages of truck drivers and other carrier personnel to availability of warehouse and factory workers, skill and wage levels, training, location and housing, and transportation access to workplaces. Facility locations that are optimal in terms of an operating efficiency perspective may be impractical in workforce terms. While most of these topics fall outside the direct scope of GDOT responsibilities, they affect KPIs such as cost, safety, and reliability.

The COVID pandemic introduced a new class of labor known as essential workers, those whose work delivers critical "must have" services to society. The definition of essential workers encompasses rail, airline and trucking companies, but also "maintenance, repair and overhaul facilities (MROs), ground handling companies, fixed based operators (FBOs), delivery companies that move freight and cargo out of airports and rail yards."[73] Workers in the transportation system

[73] Fafinski Mark & Johnson, "Is Your Business an Essential Business During Covid-19?" published by fmjlaw.com. Accessed December 22, 2022 at https://www.fmjlaw.com/essential-business-transportation-industry

are considered essential critical infrastructure workers by the Cybersecurity and Infrastructure Security Agency (CISA).

Figure 117. Essential Critical Infrastructure Workers



Source: https://www.cisa.gov/identifying-critical-infrastructure-during-covid-19

According to Bureau of Labor Statistics (BLS) data, 3.9 percent of the national workforce in 2021 were employed in transportation and warehousing jobs. Demand is projected to increase for transportation and warehouse workers over the coming decade at about the same rate as labor demand overall. Many of the current workforce, particularly drivers, are aging out and creating gaps. The nature of these jobs is physically challenging and has been shrinking in number of new entrants into the labor pool due to fertility rates and immigration changes. Thus, attracting and retaining people to perform essential tasks like stocking and picking in warehouses and transporting goods will remain difficult. Industry will continue to face the difficult challenge of maintaining the desired level of employment in supply chain systems work.

Workforce issues impact GDOT and related organizations. The demographic trends of lower birth and immigration rates also mean a shrinking pool of new talent for state transportation departments. A National Academies of Science study revealed the following key findings regarding transportation department workforce needs:[74]

- Departments of transportation are facing many of the same opportunities and challenges as the larger U.S. workforce.
- The primary focus remains on traditional highway/roadway planning and programming, but there is a shift to reflect a more multimodal nature of transportation.
- The skills required in transportation departments today and in the future go beyond the traditional construction, maintenance, and operations missions of agencies.
- There is no standard definition or understanding about workforce development.
- A range of options for funding workforce development exist.

4.2.3. Supply Chain Disruption and Risk Management

Supply Chain Disruption and Risk Management pertains to interference with supply chain operations caused by external events and the efforts to prevent or reduce those effects. The causes can be separated into two broad categories:

Human

- Terrorism, sabotage, cyber-attacks
- Labor strife/strike
- Pandemics
- Congestion and pollution
- Warfare

Environment

- Shifting weather patterns and extreme weather events
- Natural disasters

The following table (**Table 101**) presents an analysis of the above issues, with a view towards understanding the impact on the supply chain and GDOT's role to address these issues and minimize their impact on the supply chain.

[74] National Academies of Sciences, Engineering, and Medicine 2019. Transportation Workforce Planning and Development Strategies. Washington, DC: The National Academies Press. https://doi.org/10.17226/25624.

Table 101. Human and Environmental-Related Supply Chain Disruption and Risk Management Practices

Category	Issue or Event	Description + Example	Impact on Supply Chain
Human	Terrorist / Sabotage / Cyber	Cyber, sabotage, and ransomware attacks are deliberate actions that disrupt and damage functions and/or equipment. A recent attack at a NC power grid substation brought down power to over 30K customers in the state.	Without services such as power and broadband, warehouse operations are impaired; certain transportation systems would be offline; an increase in fuel prices or lack of availability could cause damage to infrastructure, interrupting operations.
Human	Labor Strife / Strikes	Without safety, efficiency, sustainability, and quality of work systems, labor strikes or disputes can arise. As rail, ports, airports, and other modes of freight have the possibility to go on strike for inadequate working standards. In December 2022, railroad workers threatened to strike for sick pay.	Systems gets backed up; goods cannot move; increased congestion at major nodes (ports, terminals, etc.); essential products cannot be moved (i.e. chlorine which is required for water system).
Human	Pandemics	Global COVID-19 pandemic leads to increased consumer demand and global supply chain crisis (i.e. bottlenecks across supply chain, backups at ports, etc.).	Companies involved in production, distribution, and transportation of goods were impacted in the pandemic by labor shortages, disruption in global sourcing and increased demand for domestic production of essential products.
Human	Congestion & Pollution	Rapid population and industrial expansion overload transportation infrastructure causing congestion and in turn, emissions & pollution.	Companies involved with supply chain processes are motivated to make improvements in their environmental practices for both their own corporate governance and due to increasing public pressure.
Human	Conflicts & War	Aspects of conflict create shortages of supply in different parts of the world. For example, the War in Ukraine has caused an increase in fuel prices in the U.S. as well as a global disruption in food supply.	Supply chain impacts vary depending on the location and scale of the conflict. Currently the rising price of fuel in the U.S. due to supply/demand dynamics. There is often a need to change sourcing locations and supply chain routing to provide goods and materials.
Environmental	Extreme weather events	Regional extreme weather events including heat/droughts, tropical and winter storms, landslides, flooding, extreme cold, freezing of roads/ice roads, snowstorms etc.	Disruption of service results in higher costs, delay, and congestion. Normal components of the infrastructure and equipment may not hold up over time. Disruptions occur and there is a need for recovery actions within the supply chain.

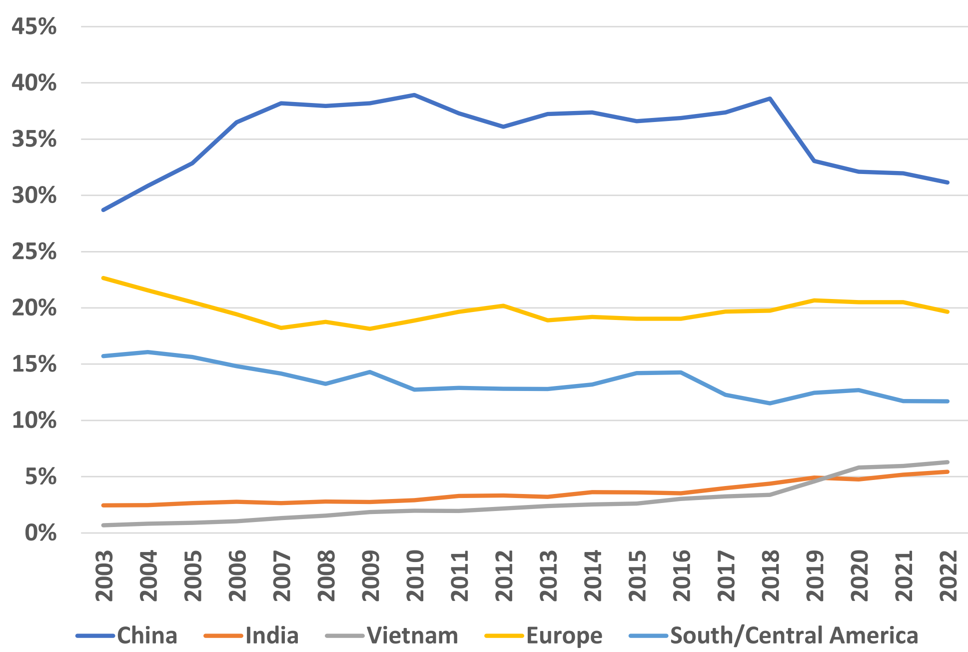
Category	Issue or Event	Description + Example	Impact on Supply Chain
Environmental	Natural disasters	Hurricanes/storms, tropical storms, tornadoes, wildfires, floods, landslides, and power outages.	Disruption of service which results in higher costs and congestion. Increased demand for humanitarian aid and support.

4.2.4. Global Supply Chain Dynamics & Diversification

International trade volumes represent a minority of the freight volumes moving to and through Georgia but are the fastest growing segment, particularly containerized trade. International volumes of containerized freight exported from origins and imported to destinations in Georgia are mostly handled by the Georgia Ports Authority, at its container terminal in Garden City near Savannah. However, other ports also handle containerized volumes moving to/from and through Georgia's road and rail network. These include ports in the Southeast as well as Southern California. These larger US container ports' volumes consist of 50 percent imported goods, 25 percent exported goods, and 25 percent net empty container exports (the US imports a small amount of containers to use for exporting).

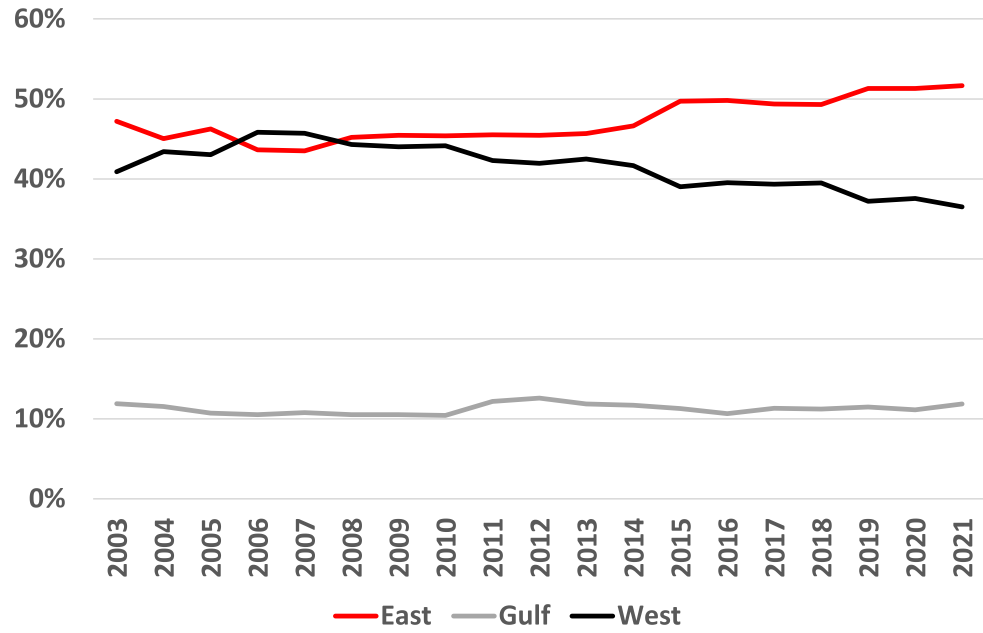
The pattern of international freight flows in the US and in particular Georgia have been continually shifting for decades. Asia has had a dominant share of US containerized trade for decades but the shares of individual Asian country shares have shifted over time. This is shown in the chart below where the shares are estimated using the weight of the commodities in containers. The chart is focused on the dominant freight flow – imports.

Figure 118. Share of U.S. Imports, 2003 to 2022



Source: Analysis of National Ports Data from The Kemmsies Group

Figure 119. Share of U.S. Port Traffic, 2003 to 2021



Source: Analysis of National Ports Data from The Kemmsies Group

The following table shows the connectivity ranking of 22 of the nation's largest container ports as calculated by the United Nations Committee for Trade and Development (UNCTAD). The index is based on five components, collected annually:

1. The number of companies that provide direct services
2. The number of port or country pairs with direct connections
3. The size of the largest container ship
4. The number of services
5. The total deployed carrying capacity

A low rank number means the port is better connected than one with a high rank number. The index shows that the four largest East Coast ports are ranked lower than any other U.S. ports except for the Port of Long Beach. The Port of Savannah has the second lowest ranking of any port in the nation.

An importer that shifts its sourcing location from China to locations west of China, such as India and Vietnam, is mostly going to ship its goods to the US via the Suez Canal. The East Coast ports would be best positioned to benefit from this shift in sourcing location because of their strong connectivity.

Table 102: Port Connectivity Ranking

East Coast Port	Rank	Gulf Coast Port	Rank	West Coast Port	Rank
NT/New Jersey	37	**Houston**	94	**Long Beach**	58
Savannah	45	**New Orleans**	151	**Los Angeles**	61
Norfolk	53	**Mobile**	180	**Oakland**	66
Charleston	59	**Tampa**	196	**Seattle**	114
Baltimore	98	**Gulfport**	417	**Tacoma**	127
Wilmington, NC	123			**San Diego**	608
Miami	138				
Port Everglades	145				
Philadelphia	160				
Boston	200				
Wilmington, DE	415				

Source: UNCTAD

In the last several years a number of other factors have contributed to the East Coast and Georgia's gain of US containerized trade volumes. These include:

- **Trade Policy**. The Trump Administration's policies regarding China have been continued by the Biden Administration. These include tariffs on imports from China, technology export restrictions to China, and subsidies to motivate US companies in national security-sensitive industries to produce the goods they intend to sell in the US in domestic locations (policy-induced reshoring). These industries include information and communication equipment such as chips, pharmaceutical ingredients, advanced medical devices, and other healthcare related commodities.
- **Supply Chain Restructuring.** Various factors that either began or started to be accelerated during the pandemic. These are discussed in the next subsection.

Supply Chain Restructuring

Supply Chain Restructuring alters operating methods, staging sequences, and facility and supplier location in response to disruption risk and market developments. Cost, speed, reliability, and risk are KPIs prominently influenced when changes are made to the network. Connecting facilities to suppliers, resources, and markets, and anticipating capacity and performance requirements are aspects within GDOT's purview.

The COVID-19 pandemic created a challenging situation for global supply chains. The situation was described in the "State of Logistics 2022" report published by the Council of Supply Chain Management Professionals (CSCMP) as follows:[75]

> *As services spending gave way further to the purchase of goods by consumers adjusting to new norms of work and social life, clogged ports and paltry capacity failed to meet surging and often desperate demand. Inventory-to-sales ratios dropped to near-record lows and capacity adds from carriers were in no way near the levels required by shippers.*
>
> *Disruptions in all logistics networks effectively destroyed capacity, as ships loitered at ports; equipment waited to be unloaded; and trucks rushed out half-empty, dashing off to the next high-paying load with little regard for backhauls.*
>
> *Even as companies furiously added capacity in trucking, parcel, air freight and warehousing, it was just as quickly snapped up… United States business logistics costs rose by 22.4 percent and came to represent 8 percent of the nation's entire GDP, a level not seen since GDP.*

These conditions have caused shippers and transportation service providers to rethink their networks and operations in ways that will mitigate the risk from future disruptions of this type. These changes to the shippers' supply chains include these factors:

Replacing Trucking with Intermodal. On both U.S. coasts, rail has been integral to moving containers off congested ports and towards inland hubs and distribution points. Coming off the early 2020 facility closures and the lean operations of precision scheduled railroading (PSR), the railroad industry had to reconfigure its operations to accommodate changed inventory practices along with record cargo volumes. The reconfiguration took time and effort to implement, and rail's importance to the supply chain was evidenced by the container backlogs that occurred while the industry was ramping up capacity.

Intermodal transportation plays a key role in Georgia. As one of five mega intermodal truck-rail hubs across the United States, Atlanta is the Southeastern U.S. distribution hub for both domestic and international intermodal freight. Metro Atlanta is served by two Class I railroads, CSX and Norfolk Southern. With four intermodal terminals and direct service to the Port of Savannah, Atlanta is where shipments transfer between highway and rail. Georgia's short line railroads also play a role in supporting connectivity across the network.

Intermodal rail shipments offer a lower-cost alternative to purely highway transportation services. The trade-off is that intermodal shipments are slower, often adding one to two days to shipment durations. Two factors that make the trade-offs associated with intermodal transportation a winning proposition are 1) workforce capacity and 2) cost, including diesel fuel prices.

As driver shortages persist and worsen, intermodal service offers needed shipping capacity to supply chain managers. One intermodal train can replace as many as 200 trucks. Similarly, the fuel consumption for the typical intermodal shipment is one-half of the highway move. As fuel prices

[75] Kearney, "CSCMP's Annual State of Logistics Report," published in 2022 by CSCMP.

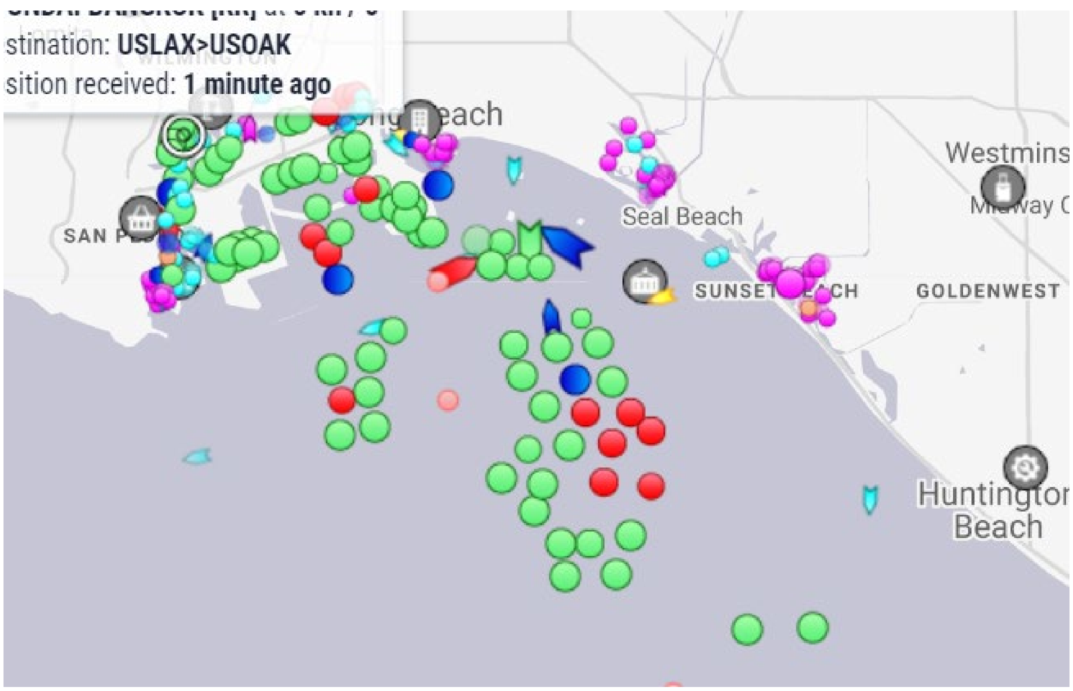
increase, the cost advantages of intermodal shipping increase and it can be effective over a shorter distance.

Holding More Inventory. Prior to 2020, 'just-in-time' (JIT) delivery was a leading phrase in logistics. Rolling shortages of various goods occurred between 2020 through 2022 and businesses started focusing on a 'just-in-case' (JIC) model. JIC is an inventory management strategy used to mitigate risk and uncertainty in the supply chain and/or the anticipation of emergencies or sudden increases in demand. The U.S. shipping industry spent the previous decades perfecting JIT, managing lean inventories based on insights from machine learning, artificial intelligence, and big data. But the COVID-19 pandemic spurred unforeseen surges in demand, compounded by shortages caused by worldwide closures of factories and ports as well as changes to trade policies. Businesses had to pivot to JIC, building up inventories to prepare for potential future shortages of key goods, and ordering well ahead of seasonal demands due to delays across the supply chain.

Import distribution centers have been challenged to pull containers from marine terminals, contributing to significant and widespread port congestion. While container volumes were on the rise before the COVID-19 pandemic, imports across all sectors have since skyrocketed- partially for JIC inventory planning, but mostly because retailers' sales jumped around 20 percent once the stimulus payments were received by households between Q2-2020 and Q1-2021.

Four Corner Port Strategy. Prior to the pandemic the majority of US retail goods importers brought over 90 percent of their goods to the US via US and Canadian West Coast ports, the majority coming through Southern California. The incoming volumes, along with labor shortages due to various factors such as illness, overwhelmed the Southern California ports.

Figure 120. Ships Waiting for A Berth in Southern California December 22, 2020



Source: MarineTraffic.Com

Some retailers learned some time ago to diversify their port gateway entry points to the US in order to minimize risks such as local labor problems, bad weather, etc. This strategy is often referred to as a four or five corner port strategy. A four corner strategy might include using ports in Los Angeles, Seattle, New York, and Savannah. Houston could be a fifth for some.

The news story on the retail sector has had a significant amount of announcements regarding importers using more imports, usually accompanied by investments in new distribution centers in the new ports.

The Southeast was already home to five of the nation's top ten seaports by twenty-foot equivalent units (TEU) handled. Altered consumer buying habits, COVID-19 related closures, labor and chassis shortages, and other factors led to large increases in both container volumes and port congestion. The Port of Savannah saw a 7.5 percent increase in TEUs between 2018 and 2020. and the resulting congestion pushed the port into innovative solutions. In 2021, Georgia Ports Authority opened four additional inland yards, including one in Atlanta, to ease congestion from Savannah.

Table 103. Container Volumes in Savannah for Fiscal Years (July 1 to June 30) 2018 and 2021

	Import	Export	Total
2018	1,291,757	847,814	2,139,571
2021	1,732,824	862,794	2,596,618
Percent (%) Change	34%	2%	21%

Source: Georgia Ports Authority

Since most of the retail goods sold in the US are imported, it is not surprising that warehouse and distribution center vacancy rates fell significantly more in port cities than in the US (those all declined but not as much). In 2022, Savannah's vacancy rate, at 0.1 percent, was the lowest of any real estate market in the US. Savannah has added about 30 million square of distribution center space in the last three years, more than in Atlanta, which has ten times the Savannah population. The real estate industry press has been reporting that Savannah is the fastest growing industrial real estate market in the US.

The supply chain restructuring process is ongoing. Some firms are still researching and planning, while others are already implementing their supply chain changes. Besides adding nodes to their distribution networks (more ports for example), using more intermodal, holding more inventory, etc., another strategic element is reshoring at least some and potentially all of foreign-based production back to the US, or near-shoring some of that to Latin America. These actions would increase domestic freight movement more than international freight movement in Georgia.

Re-shoring. The global management consulting company, AT Kearney (ATK) publishes a Reshoring Index that tracks trends in manufacturing returning to the US from low-cost countries (LCC) in Asia where sourcing, production, and assembly have historically been offshored to. This is a good indicator of the reshoring trends. The index is based on their survey of CEOs of manufacturing companies around the world. Their latest report indicates US companies relied more on manufacturing operations in the LCC in 2021 than they did in 2020, and more in 2020 than in 2019. The report indicates that this is likely caused by the pandemic-driven issues.

The survey of CEOs, conducted in March 2022, indicates that corporate attitudes and strategies are changing. In the 2021 report, 78 percent of the executives answered "maybe" or "yes" when asked about reshoring and in the 2022 report, 92 percent answered maybe or yes.

Yeti tests Port Houston in bid to avoid congestion

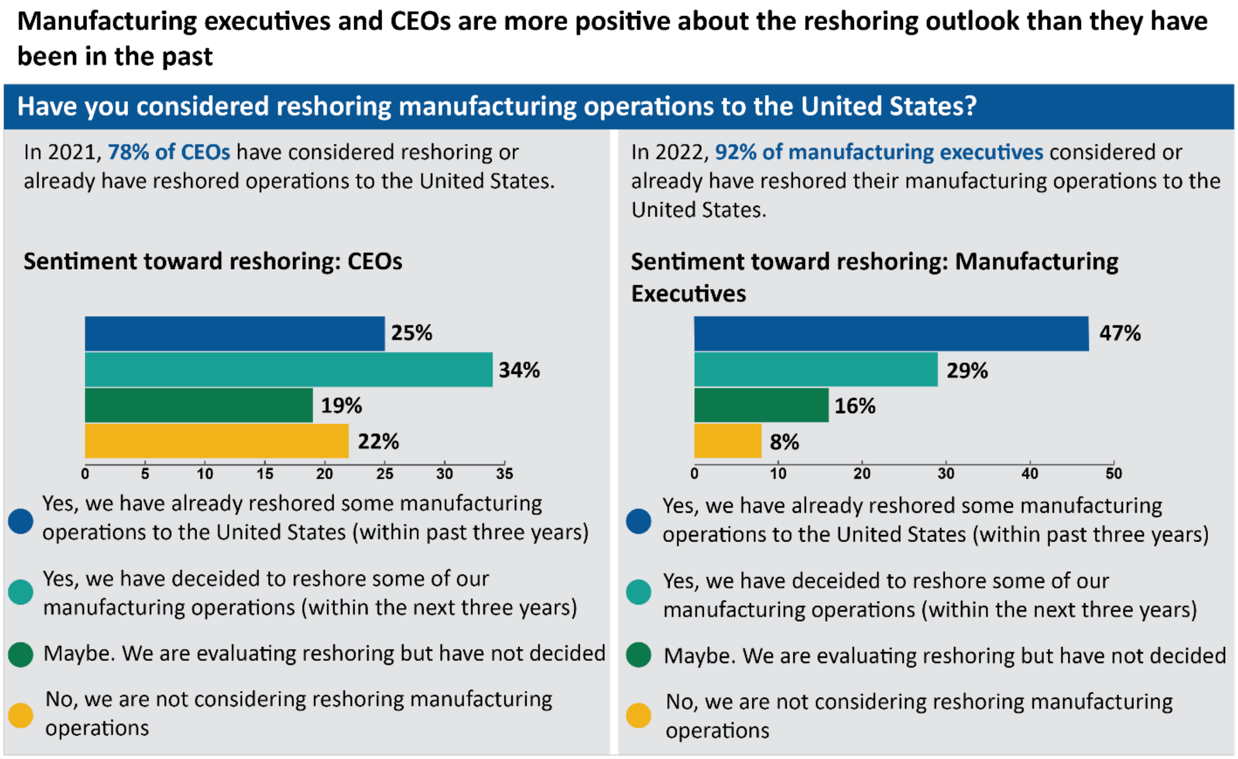
Published March 12, 2021

Yeti has been able to "secure ample capacity" for its ocean shipping needs as some in the industry struggle with accessing containers, but the brand did say it is testing the use of Port Houston to avoid congestion, CFO Paul Carbone said during the Bank of America 2021 Consumer & Retail Technology Conference on Tuesday.

"We're seeing some elongated times coming through the port," Carbone said. Multiple ports have reported congestion issues in recent months — including Los Angeles, Long Beach and New York/New Jersey — but Carbone didn't specify where they're seeing difficulties.

Source: https://www.supplychaindive.com/

Figure 121. Manufacturing Executives and CEOs Attitude about Reshoring Outlook



Source: Kearney analysis

The 2021 Reshoring Index also reveals a positive trend in domestic manufacturing activity: since Q2-2021, quarterly manufacturing gross output levels have been back above pre-pandemic levels. The National Factory Activity index hovered between 58 and 64 in 2021, with any number above 50 meaning expansion.

Five factors underlying the rising interest in reshoring were identified in the report. The report notes that the prioritization of these factors are different depending on the size of the company, as shown in **Figure 122**.

Figure 122. Top Five Factors by Company Size Influencing Reshoring

	Small companies	Medium-size companies	Large companies
1	Quality of goods	Quality of goods	Labor costs
2	Delivery lead times	Labor costs	Logistics costs
3	Logistics costs	Reduced carbon footprint	Labor availability
4	Ease of conducting business	Delivery lead times	Delivery lead times
5	Quality of goods	Logistics costs	Reduced carbon footprint

Factor appears once in top five factors across company sizes
Factor appears twice in top five factors across company sizes
Factor appears three times in top five factors across company sizes

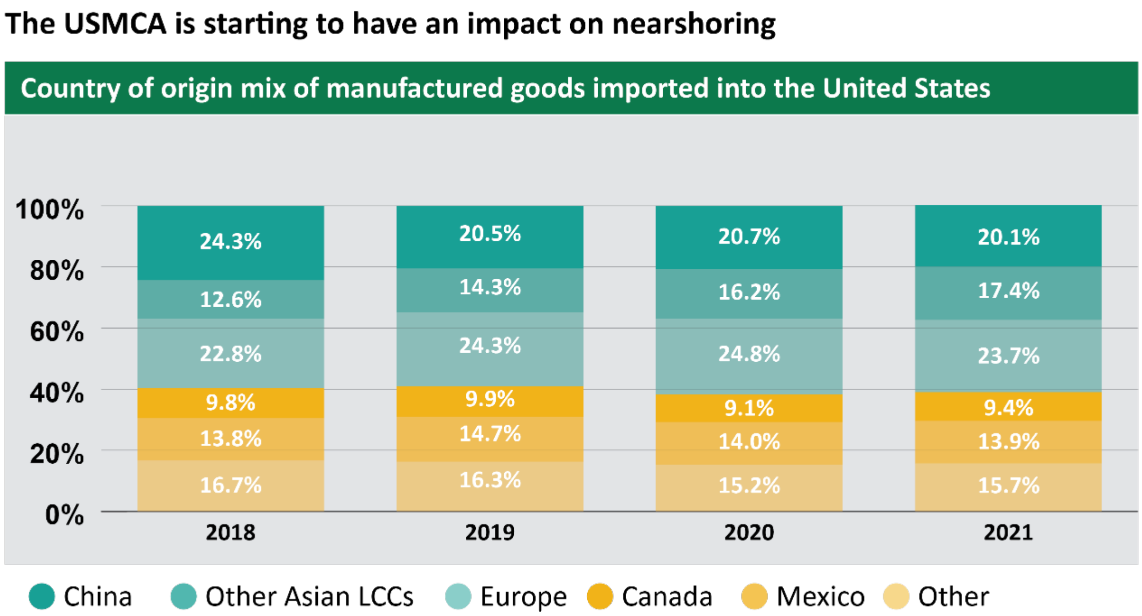
Note: Small= less than $250 million, Medium= $250 million to $5 billion, Large= more than $5billion
Source: Kearney analysis

Besides the factors listed above, the report notes that 45 percent of the CEOs say they have been approached to consider reshoring by their employees, followed by the board of directors (36 percent), industry organizations (31 percent), family and friends (25 percent), and local or state-level officials (18 percent). Seeing other companies reshore their operations has also instigated interest in reshoring among the surveyed executives and CEOs.

The survey states that 79 percent of the manufacturing executives who have operations in China have either already moved some of their operations to the US or plan to do so in the next three years. **Figure 123** shows the shares of the value of US imports from various regions and countries. It is clear that China has lost share.

Imported container data for the US shows that China has been losing share to other Asian countries, corroborating the conclusions of the ATK report. These trends are also true for the port in Savannah, given the incentives that the state and many of its counties and cities offer, it is likely that at least some of the reshoring manufacturing that the ATK reports is likely to end up in Georgia. A good example of such efforts is the siting of electric vehicle and lithium battery manufacturing plants in Georgia.

Figure 123. Value of US Imports from Various Regions



Note: USMCA is the United States-Mexico-Canada Agreement; LCC is low-cost country.
Source: United States International Trade Commission; Kearney analysis

It Is Still About the Gateway of the Future – Savannah

Reshoring production back to the US would have a minimal impact on aggregate freight volumes handled by US ports. To some extent near-shoring to Mexico would a larger negative immediate impact on US port volumes, but in the long run, larger volumes are likely to prompt more short sea shipping to US ports. For now, what matters is that East Coast ports, particularly in Savannah invest to continue to be ahead of the curve.

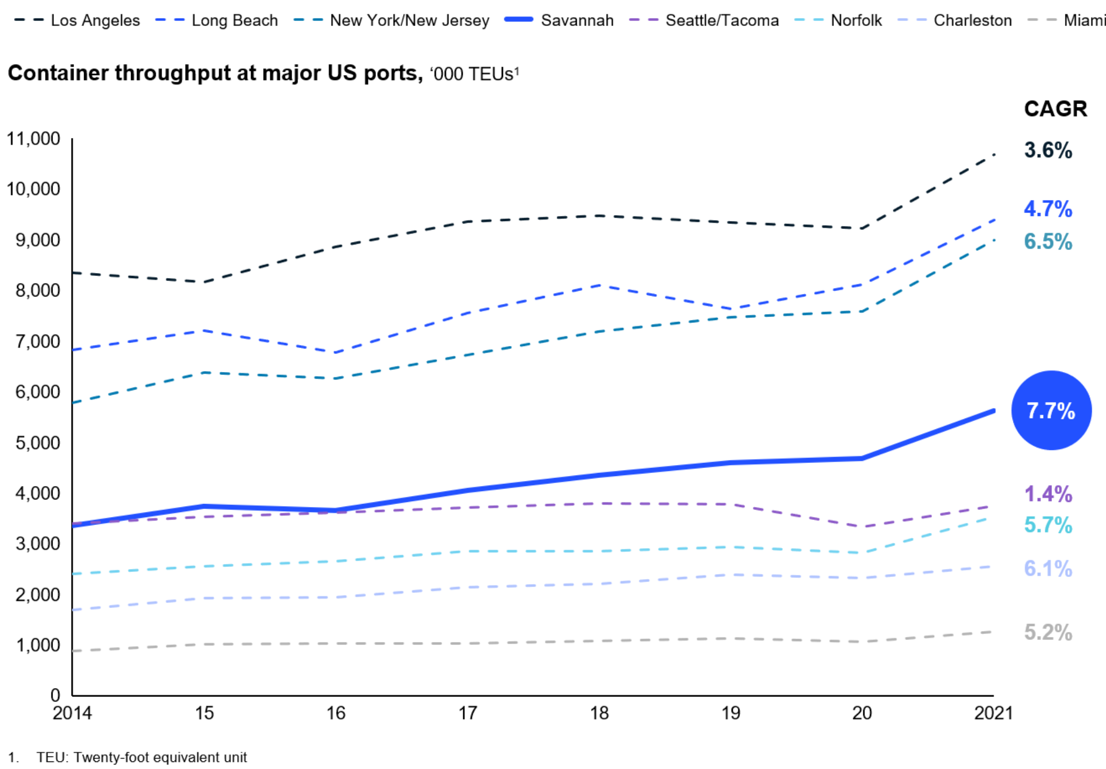
- Port of Savannah has undertaken strategic infrastructure investments to meet short and long term challenges. In progress are:
- Infra-structure upgrades: Investing in berth renovations and new STS cranes that will improve berth capacity and improve productivity
- Capacity expansion: Ongoing Phased capacity expansion to add 1.6 Mn TEU[76] capacity across the terminal

Additionally, Georgia Port Authority (GPA) has made previous strategic investments in port infrastructure which enabled them to keep up with surging demand. and the GPA will now need to continue making broader investments to remain on the growth trajectory and be the premier gateway on the east coast. In the future, Port of Savannah's throughput and hinterland reach will determine future freight flows to meet Georgia's consumption and economic productivity

[76] Source: BTS; CTS; Port Websites; Press Search

opportunities. In short, GPA's investment programs over 25 years have positioned it as the port Gateway of the Future. It is critical for GDOT to invest in a corresponding way alongside GPA.

Figure 124. Port Competitiveness



Source: The Georgia Department of Transportation (The Georgia Advantage); ports websites

Intermodal

Intermodal transportation plays a key role in Georgia. As one of five mega intermodal truck-rail hubs across the United States, Atlanta is the Southeastern U.S. distribution hub for both domestic and international intermodal freight. Metro Atlanta is served by two Class I railroads, CSX and Norfolk Southern. With four intermodal terminals and direct service to the Port of Savannah, Atlanta is where shipments transfer between highway and rail. Georgia's short line railroads also play a role in supporting connectivity across the network.

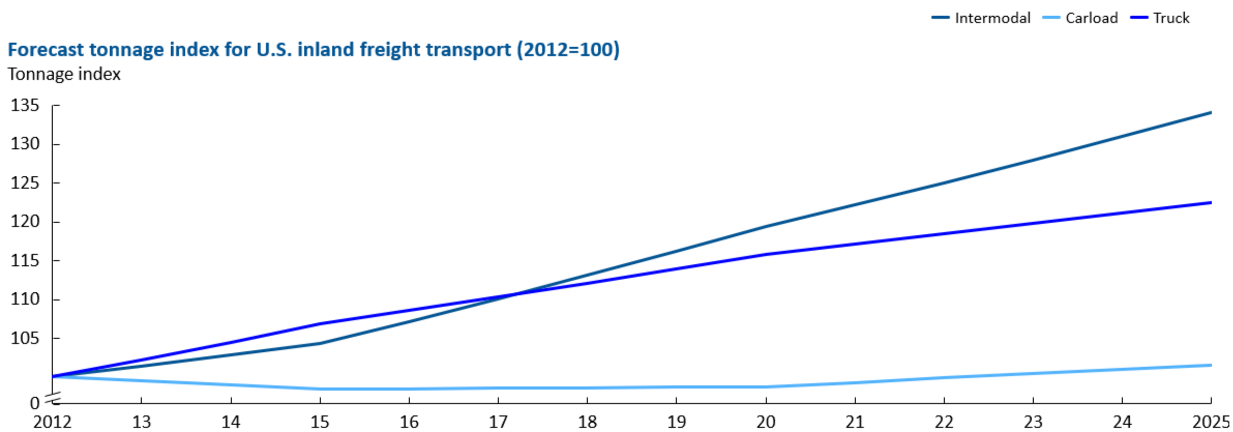
Businesses will continue to make decisions about modal share between intermodal, air, and truck based on a variety of factors. There are four main challenges which will continue affect modal share in the future: business performance, technology, regulation, and structural changes such as emissions reporting requirements.

Rail carries <10 percent[77] of cargo in Georgia, and its share has been decreasing steadily in the past decade within the state and across nation. Rail's modal share loss to truck has been

[77] Source: Freight Analysis Framework; GDOT

consistent for some of the top commodities in Georgia such as cereal grains, basic chemicals, and minerals. One major cause of this share loss and resulting increase in trucking is inconsistent access to rail by key economic engines of Georgia: manufacturing and agricultural.

However, although traditional rail has seen a sharp decline, adoption of intermodal growth is likely to accelerate by 2025. Nationally, intermodal and coal are the largest rail commodity segments, with intermodal showing strong growth while coal has concurrently seen a sharp decline. Intermodal has become a growth engine for the Class I railroads - improvements to infrastructure, transit times, and reliability has made intermodal a viable alternative to long-haul trucking.



Inconsistent access to rail by key economic engines of Georgia have contributed to truck cargo share increase. GA's top manufacturing counties are concentrated around the Atlanta area and have good rail access, but several mid-sized contributors are outside the 60-minute drive time: Clarke County, Habersham County, and Evans County. 3 out of GA's top 10 agriculture producing counties are outside a 60-minute drive from a major railyard or terminal: Franklin County, Early County, and Hart County.

Intermodal rail shipments offer a lower-cost alternative to purely highway transportation services. The trade-off is that intermodal shipments are slower, often adding one to two days to shipment durations. Two factors that make the trade-offs associated with intermodal transportation a winning proposition are 1) workforce capacity and 2) cost, including diesel fuel prices.

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Just-in-Time vs Just-in-Case

Prior to 2020, 'just-in-time' (JIT) delivery was a leading phrase in logistics. Rolling shortages of various goods occurred between 2020 through 2022 and businesses started focusing on a 'just-in-case' (JIC) model. JIC is an inventory management strategy used to mitigate risk and uncertainty in the supply chain and/or the anticipation of emergencies or sudden increases in demand. The U.S. shipping industry spent the previous decades perfecting JIT, managing lean inventories based on insights from machine learning, artificial intelligence, and big data. But the COVID-19 pandemic spurred unforeseen surges in demand, compounded by shortages caused by worldwide closures of factories and ports as well as changes to trade policies. Businesses had to pivot to JIC, building up inventories to prepare for potential future shortages of key goods, and ordering well ahead of seasonal demands due to delays across the supply chain.

Import distribution centers have been challenged to pull containers from marine terminals, contributing to significant and widespread port congestion. While container volumes were on the rise before the COVID-19 pandemic, imports across all sectors have since skyrocketed- partially for JIC inventory planning, but mostly because retailers' sales jumped around 20 percent once the stimulus payments were received by households between Q2-2020 and Q1-2021.

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On both U.S. coasts, rail has been integral to moving containers off congested ports and towards inland hubs and distribution points. Coming off the early 2020 facility closures and the lean operations of precision scheduled railroading (PSR), the railroad industry had to reconfigure its operations to move from JIT to JIC and accommodate the record cargo volumes. The reconfiguration took time and effort to implement, and rail's importance to the supply chain was evidenced by the container backlogs that occurred while the industry was ramping up capacity.

4.2.5. Technology and Automation

Technology and Automation encompasses a range of issues from robotic, optical, and materials handling equipment that reduces labor and increases freight volumes per square foot to alternative fuels and autonomous vehicles that change the methods of transportation.

Technology applied to the infrastructure such as flexible signage also apply as do changes in supply chain operations systems like shipment tracking. Although different aspects of technology affect different KPIs, cost, reliability and safety are leading types, and GDOT interests include capacity, broadband and intelligent transportation systems, air quality, and safety assurance. Technology advancements are creating an emerging transportation infrastructure that is digital in nature and key to the physical infrastructure's performance and reliability. These technologies change both how transportation users engage and operate with the transportation systems in the state and how the Georgia DOT delivers on its mission.

Technology and automation will be discussed in this section from the perspective of both the users of the Georgia transportation network and systems and from the viewpoint of GDOT's role as the provider of state-wide transportation infrastructure. Take the case of new technologies like automated or autonomous driving systems (ADS) and connected driving systems (CDS) that promise improvements in safety, efficiency, and service. Transportation and logistics firms are pursuing, evaluating, and adopting these new technologies. With this deployment of new goods movement methods, transportation infrastructure needs will change.

In the case of ADS/CDS technologies, road markings will remain crucial for all types of guidance systems in the age of mixed-level autonomous driving. Digitizing and sharing roadway geographic information system (GIS) data will be a new service offering using both private and public sector input. Sensor-based and connected technologies will generate large amounts of new and complex data. Public agencies like Georgia's DOT will plan how to leverage and govern emerging data sources to improve the management and operations of transportation infrastructure.

Broadband

Since the Georgia Broadband Deployment Initiative (GBDI) legislation was passed in 2018, the need for broadband services has become an increasingly important asset needed for both existing and unserved businesses and consumers in the State. To preserve Georgia's competitive market and to grow future markets in unserved areas, the following transportation technologies will rely on new or improved broadband infrastructure: real-time travel information, connected vehicle systems, traffic management systems, and signal operations. These technologies assist private-sector industries improve advancements in fleet management, modernized supply chains, and automation at ports and warehouses.

The Georgia Department of Community Affairs (DCA) has supported GBDI in developing the Broadband Ready Community Designation (BRCR) grant program to support broadband expansion. The goal of the grant program is to provide a mechanism to tweak the economics for providers and to encourage them to expand broadband service to unserved areas. Forty-seven local governments, most of which are in rural areas, have committed to facilitating broadband deployment in their communities after receiving the BRCR grant by DCA. This designation signifies that local governments have adopted comprehensive plan language and a model ordinance to promote broadband deployment in their communities.

Additionally, GBDI is working closely with USDA and other federal entities to access all available resources to aid unserved Georgians. USDA's ReConnect Program allocates $600 million in grant and loan funds for rural broadband implementation. GBDI has worked with several active deployment projects to encourage and facilitate USDA funding applications in addition to DCA's BRCR grant program78.

Broadband availability and the need for information has become more important after the recent pandemic because of increases in residents working from home and purchasing household goods online. The federal government in November 2021 enacted the Bipartisan Infrastructure Law (BIL) that allocates $65 billion for broadband improvements. GDOT is supporting the expansion effort by installing broadband along Interstate corridors. The first phase of GDOT's broadband program will install broadband along I-75, I-16 (PI No. 0019550) and I-20, I-75, I-85, I-285, and SR 400 (PI No. 0019551).

GDOT is preparing for emerging technologies and has implemented the installation of equipment to support Vehicle-to Anything (V2X) communications throughout the state. This will allow GDOT to share data such as wrong-way driving information, Signal Phase and Timing (SPaT), work-zone information, freeway speed and road condition. These potential applications can be built upon the high-tech infrastructure and prioritized based on the deployment of broadband.

Emerging Freight Technologies

Given the wide array of technologies and the imprecise definitions inherent in new and evolving work, it is helpful to group like technologies together for analysis and discussion purposes. Various such frameworks for classifying emerging freight technologies exist. One framework example is from a recent academic study[79] by Dong, et al summarizing a systematic literature review of the current and future trends in freight technologies. This study identified nine emerging technologies grouped into three categories:

1. New Automation Systems - 3D Printing, Automated Robots, Autonomous Vehicles, and Drones.
2. New Information Systems - Artificial Intelligence, Big Data Analytics, Internet of Things, and Blockchain.
3. New Energy Systems - Electric Vehicles.

Another framework was developed by the Mid-America Regional Council (MARC) in 2020 to monitor and prepare regional governments in the Midwest for technological change in freight movement practices. That work identified the following eight freight technology categories.

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[78] *"Georgia Broadband Deployment Initiative | The Georgia Broadband Plan." Georgia Broadband Program | Georgia Broadband Program, The Georgia Department of Community Affairs (DCA), 29 May 2019, https://broadband.georgia.gov/.*

[79] Dong, Chuanwen & Akram, Asif & Andersson, Dan & Arnäs, Per Olof & Stefánsson, Gunnar. (2021). The impact of emerging and disruptive technologies on freight transportation in the digital era: current state and future trends. The International Journal of Logistics Management. ahead-of-print. 10.1108/IJLM-01-2020-0043.

Table 105. Major Freight Technology Categories

Freight Technology	Description
Automation	Technologies that allow for greater productivity per labor hour.
Big Data	Information technologies specifically for the processing of large, disparate data sets.
Data, Information, and Communication	Technologies to connect, collect, communicate, and analyze data.
Digital Supply Chain	Information and decision technologies to improve supply chain operations and planning.
Energy	Technologies producing alternative forms of energy to power the transportation of goods.
Enforcement and Inspection	Technologies to improve and enhance equipment inspection and traffic enforcement.
Intermodalism	Technologies that facilitate the linking of transportation modes.
Safety	Technologies that reduce the risk of injury, death and damage to vehicles, occupants, and payload.

Source: Mid-America Regional Council

Finally, a recent study by Comi and Russo focused on a subset of Intelligent Transportation Systems (ITS)[80]. It highlighted the same new information technologies as Dong, et al did. Comi and Russo referred to these technologies as emerging information and communication technologies (e-ICTs): Internet of Things (IoT), Block Chain (BC), Big Bata (BD), and Artificial Intelligence (AI).

Together, these frameworks show both the commonality and disparity in how technologies are viewed, discussed, and thus understood. The three consistent framework categories of information systems, automation, and energy will be used to analyze and discuss freight technology and automation considerations.

Information Systems

Big Data, Artificial Intelligence, Blockchain, and the Internet of Things have been identified as emerging technologies in the field of Information Systems.

- Big Data refers to the ability to capture vast amounts of data regarding a myriad of subjects ranging from traffic counts to road temperatures to engine data. Big Data technologies harvest valuable information from these large datasets and support new models, algorithms, and applications.

[80] Paper - Comi A and Russo F (2022) Emerging Information and Communication Technologies: The Challenges for the Dynamic Freight Management in City Logistics. Front. Future Transp. 3:887307. doi: 10.3389/ffutr.2022.887307N. Sourced at https://www.marc.org/transportation/plans-and-studies/heartland-freight-technology-plan

- Artificial Intelligence (AI) provides a different, machine perspective to both obtain information from and to act on data.
- The Internet of Things (IoT) is a compilation of embedded and connected sensors (like RFID tags, vehicle telematics, and cell phones) that collect, process, and transmit data. IoT creates an interface between data and the actual transportation activities.
- Blockchain, or distributed ledger processing, is a novel approach to create trust among actors sharing data. This is especially important for the transportation sector because freight flows often involve multiple stakeholders from around the globe.

Together, these transportation information systems technologies are being leveraged by both industry and government to improve transportation system performance.

Sound data management is core to all these information technologies and will therefore be a key competency for the effective use of them. Both private and public sector systems can gather and share real-time situational data to improve transportation decisions at vehicle, route, and system levels. In the private sector, data-driven innovations in real-time routing and planning in urban transportation operations like navigation, vehicle routing, and courier delivery scheduling are occurring. Public sector opportunities for more responsive intelligent transportation systems will develop in advanced traveler information and infrastructure and operations management systems.

Automation Systems

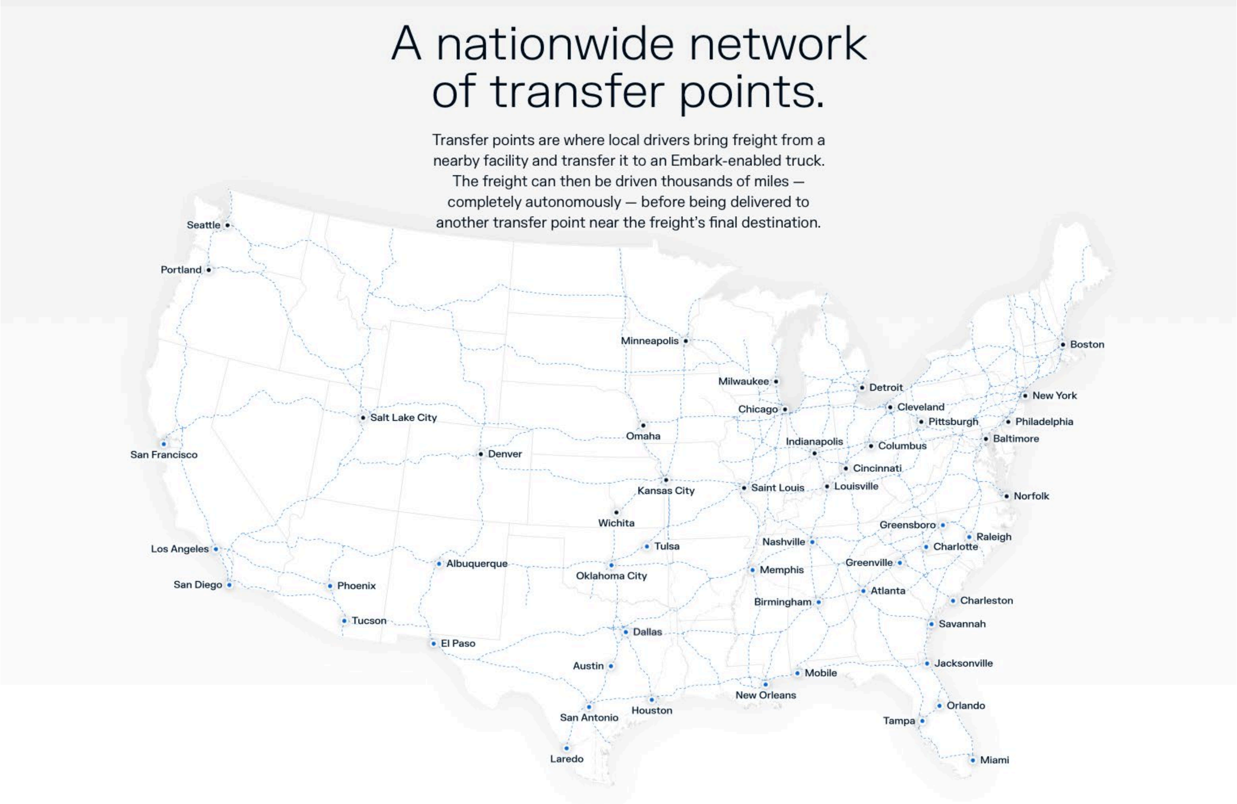
The purpose of all automation technologies is improving or enhancing the efficiency of operations, often by replacing human labor with machinery. Supply chain automation is present within factories and warehouses, automating manufacturing steps and material handling activity. 3D printing and automated robots' impact is mostly inside the factory or warehouse. For example, as land becomes scarcer in desirable warehouse locations, building up occurs. Known as high cube warehouses, they are typically built for a specific use and highly automated. These high cube warehouses often use Automated Storage and Retrieval Systems (ASRS) to maximize storage space availability and to store and pick goods with less labor input.

In transportation, the automation opportunity is the driving task. Given the ever-present shortage of commercial drivers and the accidents caused by human error, there is much interest in and motivation to automate the driving task with autonomous vehicles. It is a more challenging automation task than factory or warehouse automation. It will require both automation and connectivity and rely on the information systems technologies discussed earlier.

Automated driving systems (ADS) can be defined as hardware and software that are collectively capable of performing without any intervention or supervision by a human operator. Connected driving systems (CDS) are hardware and software that enable vehicles to receive and share mobility and safety information with other vehicles and information systems. A short list of ADS/CDS vendors include Kodiak, Embark, TuSimple, Gatik, and Aurora. Leading firms active in Georgia like UPS, Ryder and Walmart are actively testing ADS/CDS technology in their operations.

ADS/CDS technology will be implemented slowly and incrementally in controlled operating conditions, or operational design domains (ODDs), specifically structured to safely leverage the benefits of ADS/CDS technology. A likely first implementation of the technology will involve a hub-and-spoke model where the ADS/CDS power units will do the linehaul between transfer hubs. At the hub, the outbound (pickup) and inbound (delivery) loads will be switched from and to a local delivery power unit with a driver as depicted in this graphic produced by ADS/CDS technology provider, Embark.

Figure 125. Hub Model Diagram

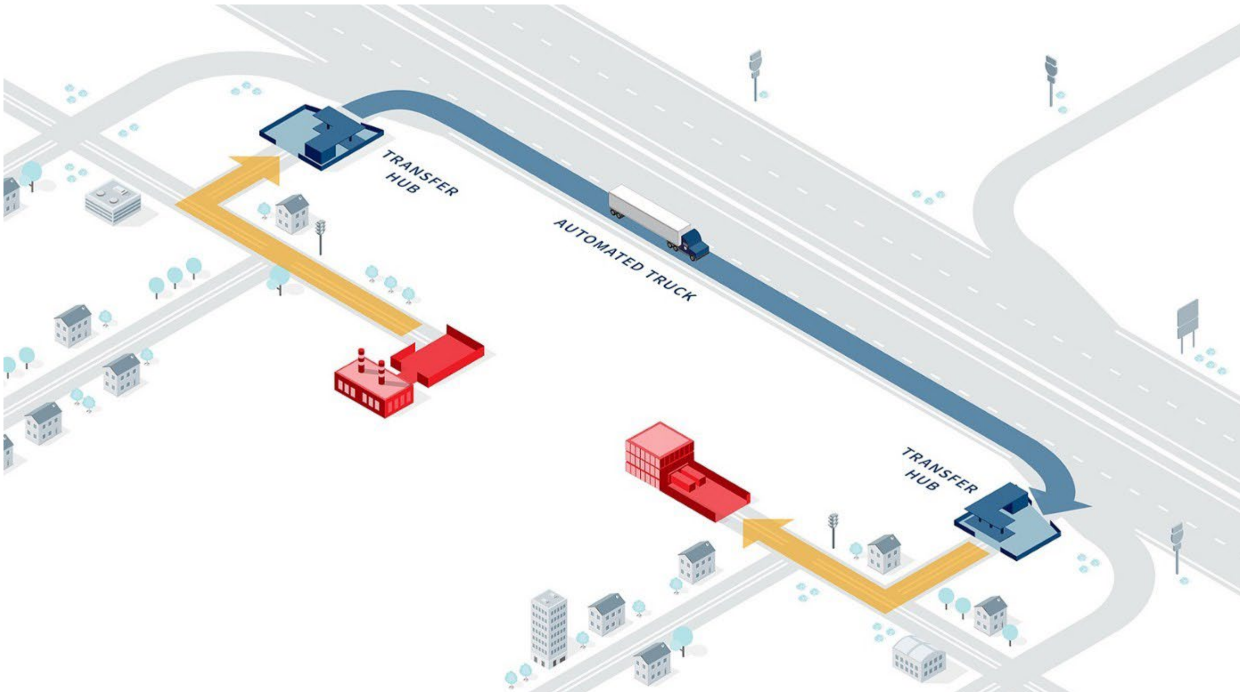


Source: embarktrucks.com

In this hub-and-spoke model use case, the automated driverless truck operates between hubs on the same route. These hub-to-hub linehaul routes will be mapped in detail with repeated test runs to develop and fine tune the algorithms to support the ADS operating the vehicle along each linehaul route. Human drivers will make the initial pickups and final deliveries to customers. This way, the variety and randomness of freight goods movement from one customer location to the next is left to the human driver while the automated driving system always transits a known hub-to-hub route.

The transfer hub operating model leaves the human driver in place to deal directly with customers at shipping and receiving yards and docks while leveraging the ADS/CDS technology to move freight between the transfer hubs with no customer interaction required. The autonomous power units stay in highly controlled ODDs and out of the ever-changing last mile environments. As a primary freight hub, Atlanta will certainly be a major transfer point for automated trucking operations.

Figure 126. Automated Trucking Model



Source: Ike/Medium - https://medium.com/ike-blog/how-automated-trucks-could-create-better-truck-driving-jobs-e817b524c5fd

Embark announced in late 2021 an agreement with Ryder aimed at launching a nationwide network of up to 100 transfer hubs where Ryder will provide yard operations, maintenance, and fleet management to support an autonomous network where freight is moved from driverless long-haul trucks to human-driven driver-enabled trucks for shipment pickup and delivery. Ryder plans to serve as the transfer point operator, managing the logistical operations throughout the yard, performing pre- and post-trip inspections, and providing maintenance services for the vehicles as well as the autonomous hardware.

Platooning is a variation of ADS/CDS technology deployment and will likely be a bridge leading to fully autonomous operation. Locomation, based in Pittsburgh, PA, is an example of a technology provider following this approach. First-generation platooning technology, which keeps an active driver in each vehicle, has been tested and could be deployed more broadly in the mid-term, with a marginal reduction fuel costs and emissions if deployed.

Remotely assisted and/or controlled trucks are another technology that could impact freight operations. The operational design domains most suitable for remote operations have yet to be defined, but it is possible that they might operate within urban areas, along Interstates, or in confined locations, such as ports or even rest areas. Strong, low latency (latency refers to time delay) communication to the vehicle is expected to be needed to enable remote operations, so rural use cases are less likely.

Drones, or unmanned aerial vehicles (UAVs), are more likely to fill a niche in inspection roles or local delivery of certain goods like pharmaceuticals and other medical supplies or to remote areas with few roads. UPS has a new division, Flight Forward, focused on drone delivery solutions. Both Walmart and Amazon also are piloting drone delivery service. Given the drone payload limits (typically 5 to 1,400 pounds), drone deliveries will not significantly impact highway freight transportation volumes.

A final note on automation technology regards the level of public acceptance for sharing the roadways with driverless vehicles. A recent Pew Research Center study found that most Americans have reservations about automating other kinds of transit beyond personal vehicles[81]. Nearly six-in-ten (59 percent) said they opposed the use of technology to operate driverless 18-wheelers. People were somewhat more favorable regarding its use in buses, taxis, ride-sharing and delivery vehicles. In no case were most people in favor of driverless operations. If the traveling public acts on these expressed concerns, the implementation of these automation technologies will certainly be slowed and limited in public spaces.

Energy Systems

Transportation is undergoing two major changes simultaneously – the adoption of ADS/CDS technologies and the electrification of vehicle powertrains. Electric vehicles (EVs) can be defined as vehicles fueled by electricity that can be charged from an off-board electric power source. EVs are often discussed in conjunction with ADS and CDS. According to the Center for Automotive Research[82], “automated, connected, and electric (ACE) automotive technologies can exist as stand-alone advancements, but when combined, this set of advancements may fulfill the loftiest technology expectations. In a few decades, it is likely that people will no longer make the distinction between the three areas and will see ACE technologies as one thing.”

Today, electrification implementations are ahead of higher levels of ADS/CDS technology deployment. According to an article on SAE.org[83], three factors have altered industry’s journey toward full self-driving systems. One factor cited was the COVID pandemic and the resulting “touchless economy” that curtailed at least temporarily the growing enthusiasm for robotaxis and ride sharing. The other two factors were economic constraint across the industry combined with strong regulatory pushes for electrification, particularly in Europe and China. The last point, it was noted, has made electrification a necessary focus for OEMS.

The International Energy Agency’s 2021 Global EV Outlook Report[84] states that around 370 electric car models were available worldwide in 2020, a 40 percent increase from 2019. Battery electric vehicle (BEV) models are offered in most vehicle segments in all regions; plug-in electric hybrid vehicles (PHEVs) are skewed towards larger vehicle segments. Sport utility vehicle (SUV) models account for half of the available electric car models in all markets.

- The report further states that in the commercial vehicle market, electric bus, and electric heavy-duty truck (HDT) registrations increased in 2020 in China, Europe, and North

[81] Nadeem, Reem. “4. Americans Cautious about the Deployment of Driverless Cars.” Pew Research Center: Internet, Science & Tech, Pew Research Center, 18 Mar. 2022, https://www.pewresearch.org/internet/2022/03/17/americans-cautious-about-the-deployment-of-driverless-cars/.

[82] Car Group “Automated, Connected, Electric, and Shared Vehicles: Are Aces Leading to Unprecedented Change?” Center for Automotive Research, 27 Nov. 2017, https://www.cargroup.org/automated-connected-electric-shared-vehicles-aces-leading-unprecedented-change/.

[83] https://www.sae.org/news/2020/12/rise-of-sae-level-2 – Accessed May 19, 2022

[84] IEA (2021), Global EV Outlook 2021, IEA, Paris https://www.iea.org/reports/global-ev-outlook-2021

America. The global electric bus stock was 600,000 in 2020 and the electric HDT stock was 31,000. In the United States, electric bus deployment primarily reflects polices in California, which is the location of most of the current e-bus stock. Global electric HDT registrations were 7,400 in 2020, up 10 percent on the previous year. The global stock of electric HDTs numbers 31,000. China continues to dominate the category, with 6,000 new registrations in 2020, up 10 percent though much lower than the fourfold increase in 2019. Electric HDT registrations in Europe rose 23 percent to about 450 vehicles and in the United States increased to 240 vehicles. Electric trucks are still below 1 percent of sales in Europe and the United States.

While vehicle electrification adoption is leading fully autonomous ADS/CDS implementation, these two technology transformations will certainly converge. One leading automotive manufacturer, General Motors (GM), states that autonomous vehicles[85] should also be electric vehicles for several reasons:

- Environment - All-electric shared autonomous vehicles will be ideal for dense cities that need solutions for congestion and noise pollution.
- Power - The advanced sensing and computing hardware on an autonomous vehicle needs a lot of electric power. Compared to an internal combustion engine, an all-electric battery pack acts as a more stable power source that can enable higher-powered ADS/CDS components.
- Latency - When driving, reaction time matters. Electric propulsion systems have lower latency and more consistent response when accelerating. As a result, when compared to internal combustion counterparts, an all-electric automated and connected vehicle will have a lower delay between the time it decides to make and the time it completes a maneuver.

General Motors (GM) believes electric vehicles allow for simpler integration of the advanced technologies required for the cleanest and safest operation of autonomous vehicles. Other industry players have raised concerns about the ability of current battery technology to satisfy ADS/CDS power needs. A study by Carnegie Mellon researchers Mohan, et al[86] found that ADS/CDS technology energy demand will likely reduce electric vehicle range by 5–10 percent for suburban driving and by 10–15 percent for city driving with negligible impact on battery life. These results suggest that BEVs can provide acceptable range if manufacturers implement energy-efficient computing and aerodynamic sensor stacks for the ADS/CDS technology.

As GM has noted, vehicles that are autonomous, connected, electric, and shared offer many benefits. They can reduce congestion, decrease accidents, ease urban travel, reduce fuel consumption, and lower emissions. Often referred to as shared autonomous electric vehicles (SAEVs), several studies have shown they can dramatically reduce operating costs as well.

For example, a report by Berkeley National Laboratory researchers found that electrification for fleets of automated taxis would reduce GHG emissions by 73 percent and energy consumption by

[85] https://www.gm.com/stories/all-avs-should-be-evs

[86] Mohan, A., Sripad, S., Vaishnav, P. et al. Trade-offs between automation and light vehicle electrification. Nat Energy 5, 543–549 (2020). https://doi.org/10.1038/s41560-020-0644-3

58 percent compared to a fleet using internal combustion engines in Manhattan[87] Operating costs were estimated to range from a low of $0.29 per mile to as much as $0.61 per mile, an order of magnitude lower than traditional taxi operations. A similar study using data from the Capital Metropolitan Transportation Authority's bus fleet in Austin, Texas by Quarles, et al found that adopting both automation and electrification technology simultaneously offers cost savings and other benefits.[88] While the initial cost of adopting both ADS/CDS technology and electrification is higher, over the long term the co-adoption strategy is more economically feasible.

Autonomous and electric vehicle operations share a dependency on connected operations. Both electrification and automation technologies require real-time connectivity with a variety of entities and systems, ranging from central operations centers, roadway infrastructure, or emergency personnel.

A key part of vehicle electrification is charging infrastructure and management. As BEVs replace internal combustion engines, charging station networks will emerge. Fuel gauges will be replaced by battery power monitors, and "smart charging" to maximize battery life and minimize energy cost will be common practice in both passenger and commercial vehicle operations. Connectivity will be needed for EV fleet operators to remotely monitor real-time vehicle conditions, routes, traffic, and weather to inform and predict when each vehicle will need to be recharged and by how much. Passenger vehicles will likely connect to similar systems to optimize their own charging practices.

The synergistic benefits from SAEVs in passenger and transit vehicles are less clear in freight transportation. Like ADS/CDS technology adoption, electric vehicles are in the very initial stages of adoption in trucking. A May 2022 report by the North American Council for Freight Efficiency (NACFE), found that many medium and heavy-duty trucks can be electrified and continue to perform similarly to internal combustion engine (ICE) trucks.[89] Using operational data from California and New York, 65 percent of medium-duty trucks and 49 percent heavy-duty trucks in those regions are considered electrifiable today.

The study also found that electric trucks offer significant greenhouse gas emissions reductions per mile compared with diesel vehicles. Given utility demand charges and high infrastructure costs, fleets will be encouraged to recharge at lower power levels over longer periods of time. Charging at lower power levels outside of peak grid demand times is the best strategy for minimizing both capital and operational expenses related to charging.

One benefit of an automated truck is that it can operate nearly non-stop, but an extended operating day of 20 hours or more leaves no opportunity for recharging an EV truck over longer periods of time as suggested by the NACFE study. This does not mean the linehaul tractors cannot be SAEVs. Carriers will evaluate the cost and benefits of investing in more tractors operating less hours per day that could be electrified versus those of investing in fewer ICE tractors operating more hours each day. Electrification will make more sense for the local pickup and delivery truck

[87] Gordon S. Bauer, Jeffery B. Greenblatt, and Brian F. Gerke, Environmental Science & Technology 2018 52 (8), 4920-4928 DOI: 10.1021/acs.est.7b04732
[88] Quarles N, Kockelman KM, Mohamed M. Costs and Benefits of Electrifying and Automating Bus Transit Fleets. Sustainability. 2020; 12(10):3977. https://doi.org/10.3390/su12103977Que
[89] https://nacfe.org/charting-the-course-for-early-truck-electrification

moves that will be human driven. Transfer hubs will also make ideal charging locations for BEVs, and the emission and noise reductions from BEV operations will benefit urban environments where they matter most.

Automotive vehicles are a durable good. Both passenger and commercial vehicles are being kept in operation longer than before. Fleet average ages are around 12 years old.[90] Fleet replacement strategies will dictate when both automation and electrification technology is adopted. The cost to retrofit a vehicle in the middle or latter stages of its useful life will preclude most retrofits. Only those with compelling business cases and short payback periods are likely to be considered. In addition, the operational cost, and the difficulties of managing the retrofit work make large-scale mid-life vehicle technology adoption unlikely.

Thus, many fleets will only adopt new technologies like ADS/CDS technology and electrification when they replenish their fleet. Since electrification technology is ahead, fleets will likely adopt electrification coupled with the latest proven SAE level of ADS/CDS technology available. Because ADS/CDS technology is supplied by some firms as an OEM-independent kit, mid-life adoption of these technologies is possible if perhaps unlikely.

Key Insights

While the framework used to discuss the emerging freight technologies separated them into distinct and separate groups, it is apparent that the technologies operate in a synergistic and symbiotic manner. Automation requires sensing, sensing requires connectivity, connectivity requires information sharing, electrification enhances automation, and so on. Understanding the component technologies that will drive future transportation systems and how they support and complement each other is vital. Focusing on one component will not provide the perspective or insight needed to plan, design, construct, maintain, and improve Georgia's emerging digital and physical transportation infrastructure. Last, the increasing importance of information in transportation systems means that data management must be part of GDOT's core competencies.

GDOT Opportunities

Georgia's already enhanced management of traffic operations across the state will help to support the vision for Georgia's Freight Plan. Current and future technology deployments will be essential to support Georgia's position as the global gateway of choice, providing reduced time to market, superior supply-chain efficiency, and reliability from destination to end customer. Efficient traffic operations will also be essential to the safe and efficient movement of goods throughout the freight network.

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[90] The Association for the Work Truck Industry. "AGING TRUCKS CREATE MORE SERVICE OPPORTUNITIES." Edited by Dawn Brusseau, Aging Trucks Create More Service Opportunities, Nov. 2019, https://www.ntea.com/NTEA/NTEA/Member_benefits/Industry_leading_news/NTEANewsarticles/Aging_trucks_create_more_service_opportunities.aspx.

4.2.6. Population and Economic Growth

Population and Economic Growth are demographic dynamics underlying the freight system. They affect the demand for goods and labor, and they are affected in turn by the influence of the freight system on business attraction, business retention, cost of living and quality of life.

The size and concentration of demand impacts freight cost, while reliability, speed and safety are subject to the implications of demographic growth on infrastructure requirements and conditions. GDOT has a comprehensive interest in these dynamics.

Population

Georgia's population in 2021 was roughly 10.8 million, an increase of almost 74,000 residents, or about 0.7 percent, over 2020. Only four states (Texas, Florida, Arizona, and North Carolina) grew more than Georgia over the same period. Georgia is the nation's eighth most populous state, just behind Ohio's 11.8 million residents.[91]

The state's median age rose from 37.3 in 2020 to 37.5 in 2021. The fastest-growing age group in Georgia was the 65 and older population, increasing by 3.2 percent over the one-year period from 2020 to 2021.[92] The Census Bureau estimates that more than 20 percent of Georgia's population will be 60 or older by 2030, an increase of almost 34 percent from 2012.[93]

Metro Atlanta added 64,940 new residents in the past year, or 1.3 percent, pushing the region's 11-county population to 5.1 million (nearly 47 percent of the state's population). The concentration of population in the Metro Atlanta area can help businesses be more efficient by serving a larger customer base at lower cost, although it can also result in additional congestion which has implications for transportation system performance (in terms of reducing efficiency and safety) as well as environmental impacts.

The smaller metropolitan areas of Gainesville, Hinesville, Warner Robins, Savannah, and Athens each saw population increases of 1 percent or more over the same period. Albany's population decreased by 644 and Columbus's 1,605 people between 2020 and 2021. The Jefferson metro population increased by about 3,500 residents to reach 80,000 people by 2021.[94]

Population growth through 2050 will likely be concentrated in urban areas, emphasizing the need for urban-rural connectivity. Essentially all population growth will be in urban areas with ~39 percent[95] more Georgians by 2050, while rural Georgia maintains its current population levels. Population growth in urban communities will continue to increase freight flows and congestion

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[91] Dave Williams, "Georgia population growth outstrips most states," published December 21, 2021 by albanyherald.com. Accessed December 6, 2022 at https://www.albanyherald.com/news/georgia-population-growth-outstrips-most-states/article_0b566ef6-6284-11ec-a3ea-53af9a085859.html

[92] Rebecca Grapevine, "New Census Data Shows How Georgia Changed from 2020 to 2021," published July 1, 2022 by GPB.org. Accessed December 6, 2022 at https://www.gpb.org/news/2022/07/01/new-census-data-shows-how-georgia-changed-2020-2021

[93] Department of Human Services, "Demand for professionals in aging field increasing," published April 19, 2021 by dhs.georgia.gov. Accessed December 6, 2022 at https://dhs.georgia.gov/spotlight/2021-04-19/demand-professionals-aging-field-increasing

[94] Ibid.

[95] Source: Georgia Governor's Office Data Series 2020

along routes connecting Georgia's rural production with urban centers of consumption. Urban centers like Atlanta can drive growth across the state, but only with sufficient infrastructure connections to facilitate urban-rural symbiosis.

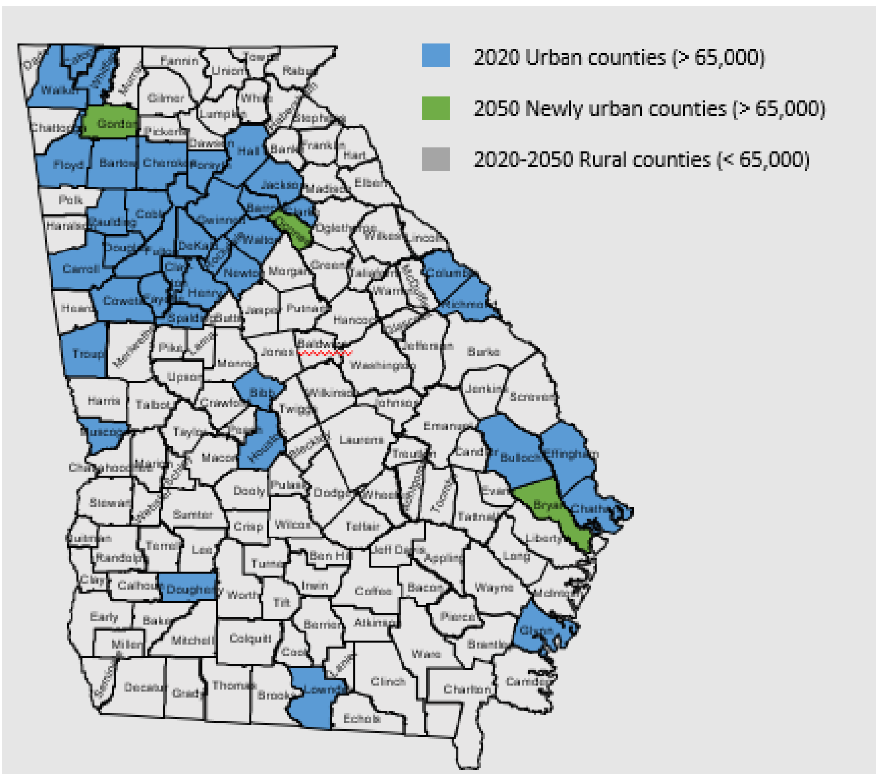
Table 106. Georgia's Population Growth Forecast, 2020 to 2050

Counties	2020 Population	2050 Population	2020-2050 Growth	CAGR
Urban	8,322,027	11,555,567	38.9%	1.1%
Rural	2,385,176	2,388,997	0.2%	0.01%
Total	**10,707,203**	**13,944,564**	**30.2%**	**0.88%**

Source: Georgia Governor's Office Data Series 2020

Georgia's population growth over the next 30 years is projected to be almost exclusively focused in the current 38 urban counties, with the addition 3 new urban counties by 2050.

Figure 127. Projected Change in Urban Counties from 2020-2050



Source: Georgia Governor's Office Data Series 2020

With a large, growing, and diverse population, Georgia offers a strong base of demand for a wide range of industries in addition to a robust and well-trained employment base for the businesses that are serving customers across the nation and world.

Economic Growth

Georgia is home to a diverse range of industries and this economic base has helped the state navigate the economic downturn associated with the COVID-19 pandemic. While other states experienced significant declines in GDP and employment, Georgia's GDP grew by nearly $51 billion. Some of the state's achievements over the past two years include:[96]

- Since 2018, over 1,400 manufacturers, logistics, and agricultural businesses have relocated to the state, with estimated creation of 137,000 new jobs and nearly $50 billion in investments
- Manufacturing employment is near a 20-year high at 289,000 workers, with output of nearly $60 billion in 2021
- Agricultural exports continue to increase on an annual basis, with agribusiness contributing an estimated $74 billion in economic impact each year
- Over 350 film and entertainment productions spent $4.4 billion in the state in FY2021
- Bioscience saw a 147 percent increase in job creation in FY2022 compared to FY2021 thanks to companies such as Boston Scientific and Boehringer Ingelheim
- FinTech projects created $32 million in investment and 1,215 new jobs in FY2022
- Record growth in port traffic, with a 24 percent increase in FY2020, 20 percent increase in FY2021, and an 18.5 percent increase in FY2023 to date

Additionally, the state continues to see a tremendous increase in foreign direct investment, totaling $8 billion in FY2022 with the top five sources of South Korea, Germany, Japan, France, and the Netherlands.[97] Georgia continues to be a leader in workforce development, education and training programs which have facilitated these investments from foreign companies.

4.2.7. E-commerce Scale and Penetration

This section describes the size and scope of the sea change in the retail market and the manner and speed by which goods reach consumers. E-commerce requires three times the warehouse space of traditional retail plus proximity of some facilities to consumers. Cost, speed, and reliability are KPIs substantially affected, as well as safety in neighborhoods. The expectations for level of service from GDOT can rise because freight delivery to homes is personal and visible, and greater coordination of service between GDOT and local agencies may be necessary.

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[96] Chris Clark, "Georgia Is Making the Business Case," published November 3, 2022 by the Georgia Chamber. Accessed December 6, 2022 at https://www.gachamber.com/georgia-is-making-the-business-case/

[97] Andrew Isenhour, Carter Chapman and Marie Gordon, "Georgia Shatters Investment and Job Records in FY22," published August 10, 2022 by Georgia.org. Accessed December 6, 2022 at https://www.georgia.org/press-release/georgia-shatters-investment-and-job-records-fy22

Definition of E-commerce

E-commerce is broadly defined as any commercial transaction involving the internet. The U.S. Census Bureau defines e-commerce to include online manufacturing orders, services, and wholesale business conducted online. This discussion narrows the focus to goods bought and sold online, as in the case where a consumer makes a retail purchase using the internet.

E-commerce has similarities and differences to traditional retail. The primary differences involve how the product is ordered and delivered: for e-commerce, the transaction occurs over the internet and the product is delivered to the customer at their residence, business, a retail location, or another location of their choice; for traditional retail, the product is chosen, purchased, and taken by the customer at the retailer's location.

E-commerce companies use a variety of operational models. Some sell their own products directly, while others pass orders on to a supplier. E-commerce sellers may be "pure players" operating entirely online, or "brick and click" businesses that sell online while maintaining physical stores, where customers can also opt to pick up online orders.

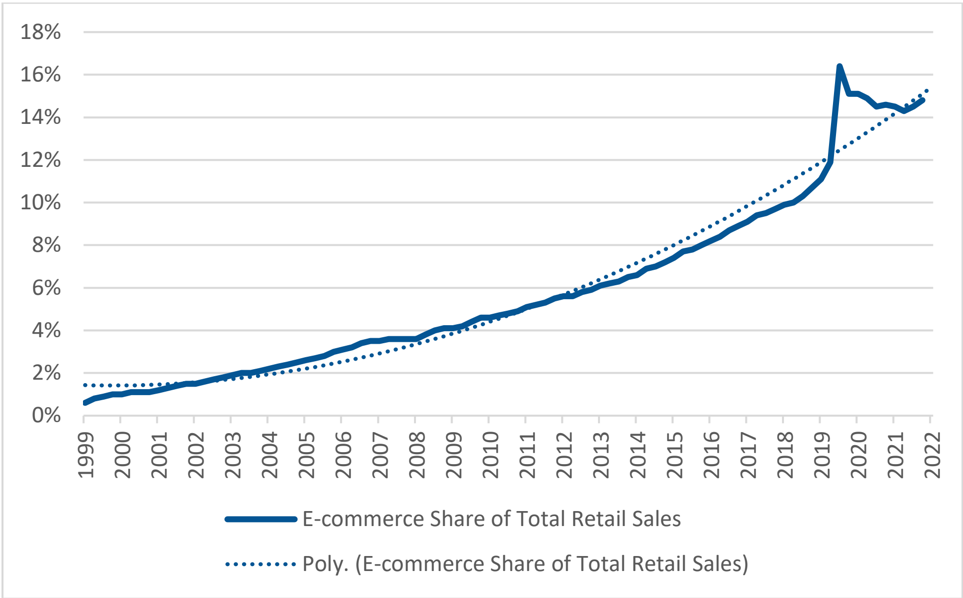
E-commerce has had a significant impact on the transportation sector. It has brought new retailers into the market while traditional retailers have expanded into providing online shopping options for their customers. These retailers have invested in additional warehousing capacity as well as new and additional transportation assets to meet the growing demand for their products.

E-commerce Share of Retail Sales

As shown in **Figure 128**, e-commerce's share of retail sales grew steadily and consistently from 2000 through the first quarter of 2020, then jumped dramatically during the COVID-19 pandemic, from 11.8 percent in the first quarter of 2020 to 16.1 percent in the second quarter, before reverting to trend at 14.3 percent (both seasonally and non-seasonally adjusted) in the second quarter of 2021.

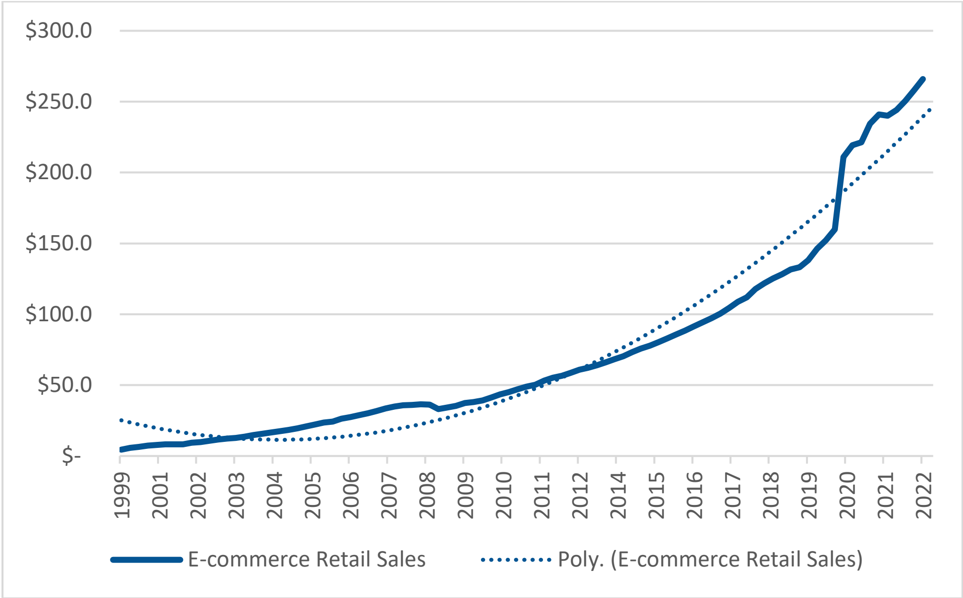
E-commerce share of retail sales has been following a polynomial trend line. In the middle of 2020, e-commerce sales surged because physical stores were closed. In the middle of 2022, as stores reopened, the e-commerce share of retail sales fell. But while e-commerce sales have continued to increase, e-commerce's share of total retail sales has declined because in-store retail sales grew faster than e-commerce sales did. The e-commerce share of retail sales has returned to the trend line.

Figure 128. E-commerce Share of Retail Sales



Source: U.S. Census Bureau, The Kemmsies Group

Figure 129. E-commerce Retail Sales (Billion Dollars)



Source: US Bureau of the Census, The Kemmsies Group

E-commerce share of retail sales is expected to reach 30 percent over the next 10 years. Beyond the early 2030's, the e-commerce share is expected to grow more slowly and could flatten out in the 35 percent to 40percent range. The exact level where it will flatten out depends on too many factors for a credible forecast to be produced.

Trends and Developments in E-commerce

One of the fastest growing segments within e-commerce is online grocery, which tends to be same day/next day delivery and involves perishables. As of Spring 2021, approximately 3 percent of all American groceries were purchased online, a market value of approximately 30 billion dollars. Online grocery shopping services typically offer several options for consumers including curbside pickup or at-home delivery.

The rise in direct-to-consumer (D2C) e-commerce is having significant repercussions for product distribution and delivery, with shipments increasingly going directly to individual residences replacing pick up at brick-and-mortar storefronts. Many retailers are using package delivery companies such as UPS, FedEx, and USPS to handle these deliveries, significantly altering the business model for such companies. Consumers are also purchasing larger items such as furniture and appliances via the internet. This trend is causing larger trucks to move into residential areas to complete these deliveries.

Selling merchandise via e-commerce also requires retailers to use more warehouse space because they are not storing their goods on store shelves or backrooms. Other factors impacting trip generation from e-commerce include returns of wrong-sized or otherwise unwanted merchandise purchased electronically; failed delivery attempts requiring multiple trips; and replacement of damaged, lost, or stolen items.

A similar shift is occurring in the B2B (business to business) space. Companies like Ali Baba are growing by bringing the same quality of delivery service to businesses, most of whom are still ordering from catalogs, that Amazon and other 3PL companies deliver to consumers.

E-commerce Impacts on and Implications for Freight

Retailer Supply Chain Expansion

Amazon is looking to grow its last mile delivery network through regional delivery service partners (essentially transportation franchisees) and its Amazon Lockers program. Walmart, the nation's largest retailer, is also using e-commerce to drive its revenue growth. Both retailers have their own fleet of trucks and are now allowing third party vendors to use their long haul and last mile delivery capacities. Different types and sizes of vehicles are being introduced in this market.

Last-Mile Delivery

North America's last mile delivery market generated revenue of more than $31 billion in 2018 and the market is expected to increase to $51 billion in 2022. The total transportation sector is 3 to 5 percent comprised of last mile delivery. This last mile transportation includes various delivery services which have become familiar sights. The effects are so widespread that they create a significant opportunity for businesses and authorities to have far-reaching influence through improved management of this flow of goods. However, according to a recent meta-analysis of research on the traffic demand for personal shopping, evidence does not overwhelmingly suggest that online shopping will replace the traditional shopping trip.[98]

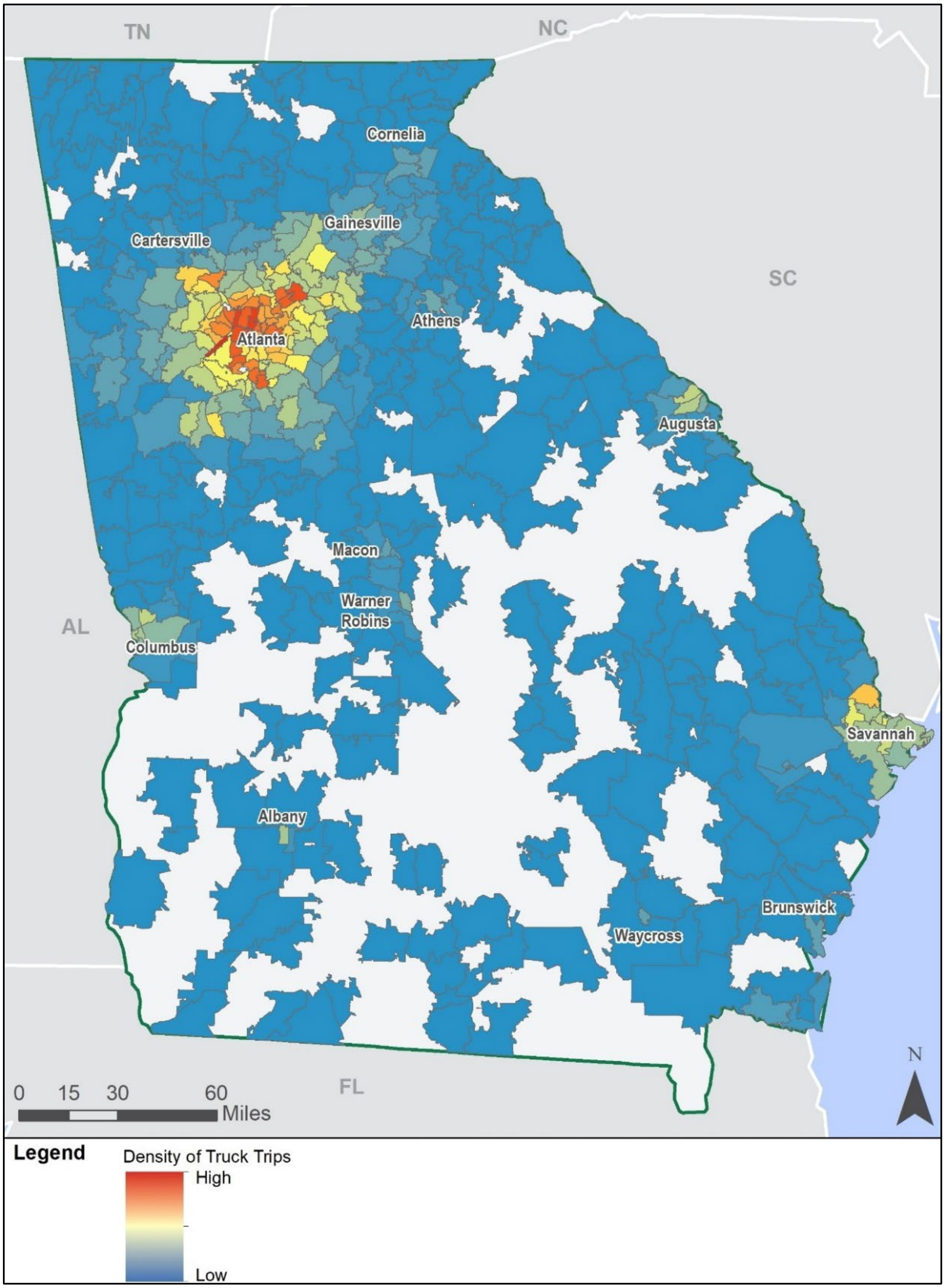
The fastest growing trucking segment is the delivery of goods purchased online. The COVID-19 pandemic accelerated the long-standing trend where Americans spend a growing share of income online. This has significant implications for the logistics system and trucking sector, as these goods must be delivered to people's homes, often within hours of purchase.

The Geotab data, which comes from 4 months in the second half of 2021, was used to better understand the geographic patterns of e-commerce related to trucking. **Figure 130** and **Figure 131** show the destinations of e-commerce related trucking, including courier trucks. These maps show the density of trucking activity per acre, to control for zip codes having a wide range of sizes. As expected, this trucking activity concentrates in urban areas, particularly those with high household incomes.[99]

Nevertheless, the outstanding feature of this map is the pervasiveness of e-commerce around the state, and while the gaps lie in rural areas, there is activity in rural Georgia as well. The absence of e-commerce traffic corresponds well with limitations in broadband service. The implication is that expansion of broadband coverage is likely to bring e-commerce into more parts of the state.

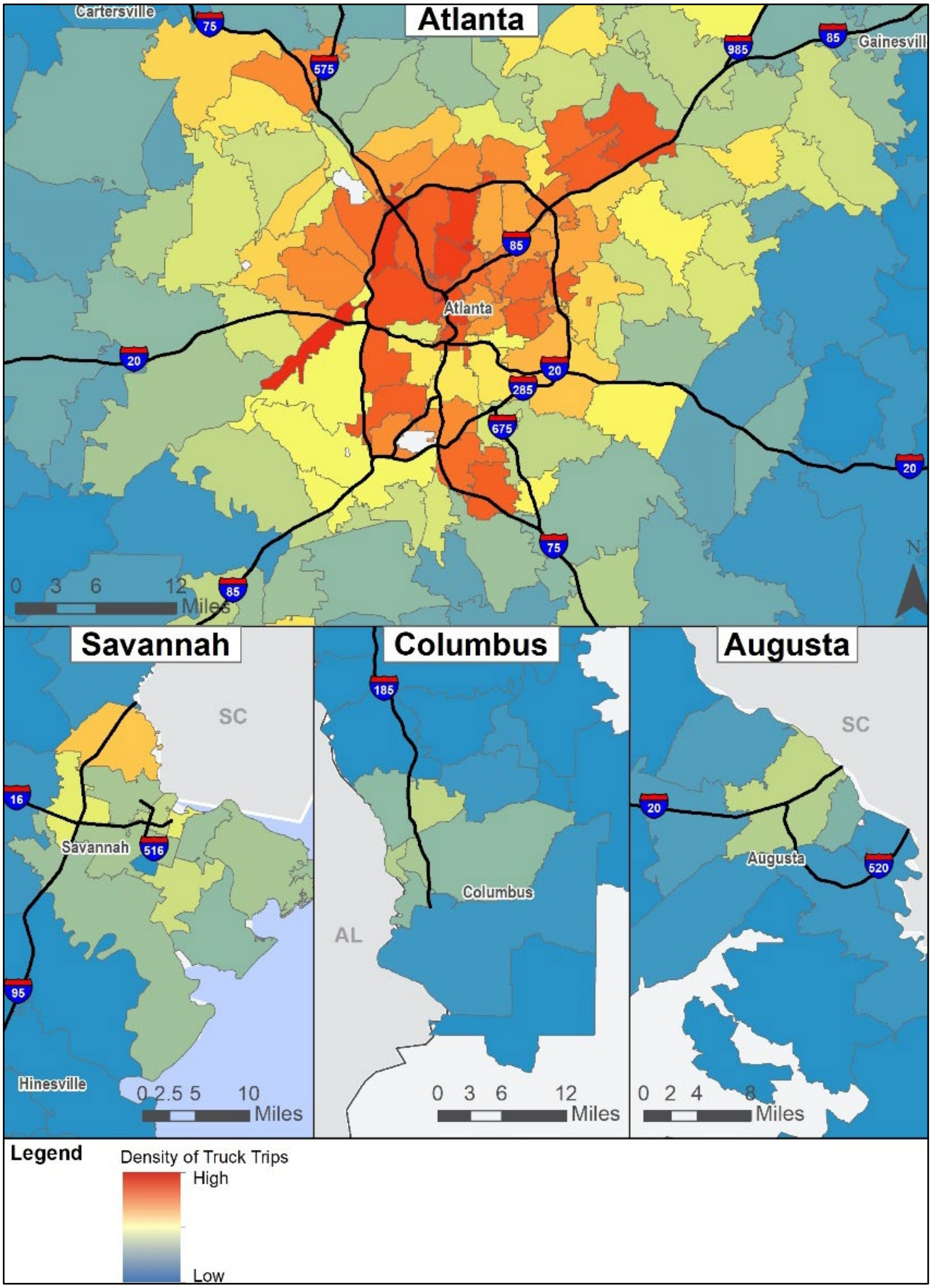
[98] Huyen T. K. Le, Andre L. Carrel & Harsh Shah (2022) Impacts of online shopping on travel demand: a systematic review, Transport Reviews, 42:3, 273-295, DOI: 10.1080/01441647.2021.1961917
[99] 2020 USPS Household Diary

Figure 130. Destinations of Courier and E-commerce related Truck Trips



Source: WSP Analysis of GeoTab Data

Figure 131. Destinations of Courier and E-commerce related Truck Trips in Metro areas



Source: WSP Analysis of Geotab data

Warehouse Expansion

CBRE, a leader in global commercial real estate, estimates that every additional $1 billion of e-commerce requires 1.25 million square feet of new distribution and warehouse space. If the e-commerce sales growth rate slows from growing to three times as fast as overall retail sales to two times as fast over the next 10 years to 2032, its share will increase from 14.3 percent to almost 25 percent. That implies that e-commerce sales will have increased by $437 billion. Given the CBRE estimates, an additional 546 million square feet of distribution and warehouse space will be needed nationally. Georgia is likely to be home to a significant amount of this growth.

E-commerce is steadily changing the Georgia freight distribution network, with a high demand for land for facility expansion. While e-commerce will continue to grow rapidly in the US, physical stores and warehouses remain critical in an omnichannel retail world. Physical retail stores are serving two purposes: as omnichannel storefronts and as warehousing capacity for online orders, given that only 12 percent of purchases across all categories are tied to purchases that are researched and purchased entirely online[100]. Movement away from brick-and-mortar-only retail experiences to omnichannel and online shopping has been spurred by changing consumer expectations and digitization of payments and shopping.

As a result, logistics providers have been moving closer to consumers and increasing the frequency of trips. Until 2019, e-commerce related warehouses under construction had been increasing in frequency but decreasing in size. However, the pandemic accelerated distribution center and warehousing infrastructure, leading to larger warehouse spaces: new warehouses under construction have increased in size by 45.2 percent after COVID[101].

To add to this, reverse logistics is a large and important component of the e-commerce supply chain with unique challenges and complexities for e-tailers and supply chain partners. For example, reverse logistics requires on average up to 20 percent[102] more space. Hence, e-commerce requires 3 times[103] the warehouse space to move the same volume as traditional retail, resulting in additional warehouse and real-estate requirements.

Due to same day and next day delivery commitments, most of the logistics real estate needed is likely to be near population/consumption centers as opposed to traditional remote sites, which creates competition with passenger traffic flow. Local and regional trips increased from 56 percent to 69 percent of all trips, and the proportion of smaller shipments has grown by 5 percent[104], when comparing tonnage by shipment across the same segments. Logistics players are also increasingly

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[100] McKinsey & Company COVID-19 US Consumer Pulse Survey; Forrester consumer spend data

[101] Source: Commodity Flow Survey, American Transportation Research Institute - An Analysis of the Operational Costs of Trucking, CoStar

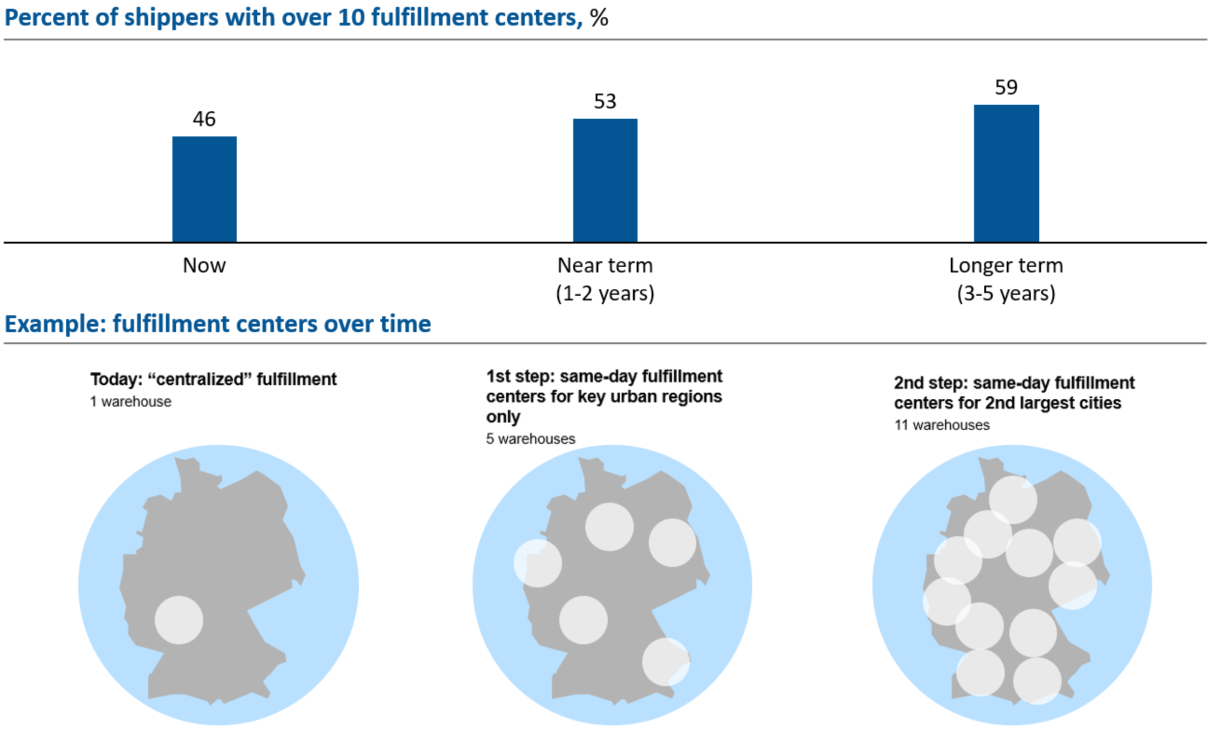
[102] Source: Freight Waves

[103] Source: Department of Commerce; Prologis

[104] Source: Commodity Flow Survey, American Transportation Research Institute - An Analysis of the Operational Costs of Trucking, CoStar

investing in expansion of their fulfilment center networks: 95 percent of shippers expect to increase their number of fulfillment centers within the next 5 years[105].

Figure 132. Fulfillment Center Trends



Source: McKinsey Voice of Shipper Survey – PRELIMINARY – Based on results from 2,331 respondents that sell electronics products in US, Canada and Germany; CNBC

Returns

Returns are an essential component of e-commerce. Part of the industry's growth has been its ability to convince consumers that they could return products without penalty and for any reason within a specified time. This provided assurance to customers that ordering online was essentially the same as buying in stores. By some estimates, 15 percent to 30 percent of e-commerce orders are returned- which is a much higher return rate than for brick-and-mortar sales[106].

In recent years, much of the B2C industry's efforts have been to simplify the reverse logistics process. These efforts have resulted in a variety of options for customers who seek to return products, such as dropping off products at stores, post offices and UPS or FedEx locations, and even at third-party locations (such as a different retailer from where the purchase was made).

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[105] Source: McKinsey Voice of Shipper Survey – PRELIMINARY – Based on results from 2,331 respondents that sell electronics products in US, Canada and Germany; CNBC

[106] Patrick Burnson: "Reverse Logistics Rides High on the Wave of E-Commerce." Published by Logistics Management on March 2, 2020. Accessed November 9, 2020 at https://www.logisticsmgmt.com/article/reverse_logistics_rides_high_on_the_wave_of_e_commerce

However, the process of returning an item to inventory is still complicated because there are several factors for the retailer to consider, including: the condition and nature (including size, weight and expected depreciation) of the product; seller's requirements (if the seller is different from the retailer); and location of purchase and delivery. Although technology such as Artificial Intelligence can help with routing decisions, human intervention is necessary at some point in the reverse logistics chain.

Consequently, several 3PLs have inserted themselves more prominently into the reverse logistics supply chain, offering to use up some of their capacity and manpower to handle the transportation and storage of returned products. Some have established facilities where goods are directly recycled and not returned to the vendor at all. Additionally, large online retailers have been acquiring more Class B warehouse space to prepare for the increased volume of both shipments and returns[107].

Sustainability

Every year, more than two billion tons of waste end up in landfills globally. The enormous volume of waste produced by the e-commerce supply-chain network and its impact on the environment, along with growing consumer interest in and demand for sustainable practices, has forced e-commerce companies to rethink their practices and find solutions.

One of these solutions is eco-friendly packaging. TOMS, for example, an internationally known retailer of footwear, apparel, and other consumer products, uses packaging made from 80 percent recycled waste material and printed with soy ink. Some of TOMS' shoes are made of natural hemp, organic cotton, and recycled polyester[108]. Such practices may not reduce the number of packages being delivered but they could reduce the volume of material being discarded or returned, thereby easing pressure on the reverse logistics supply chain.

Another solution is to consolidate products closer to the actual points of delivery. While this may result in additional trips (and emissions) between large distribution hubs and smaller urban delivery stations, the vehicles transporting products between delivery stations and delivery addresses may be more environmentally friendly than those transporting products between large delivery hubs and delivery addresses. In other words, this movement would theoretically generate fewer truck trips and more van, car, bicycle and even drone trips. These solution ideas are geared toward urban distribution. Deliveries in rural areas over longer distance still rely on traditional service types.

Advancements in transportation and energy also hold promise for the sustainability of e-commerce. In 2019, Amazon placed an order for 100,000 Rivian battery-electric vans to be delivered over the next few years (with the first 10,000 making deliveries by 2022). UPS and FedEx are considering electric battery as well as hydrogen fuel cell technology for their medium to long haul trucks[109]. Any

[107] Ibid.
[108] Byrd: "THE RISE OF SUSTAINABLE ECOMMERCE." Published by Byrd. Accessed November 9, 2020 at https://getbyrd.com/en/blog/rise-of-sustainable-ecommerce
[109] David Ferris: "How the pandemic is delivering the electric truck." Published by E&E News on September 25, 2020. Accessed November 9, 2020 at https://www.eenews.net/stories/1063714673

combination of these technologies will help reduce the emissions impacts associated with e-commerce package delivery.

Figure 133. Walmart Electric Delivery Van

Source: Freight Insights

Ocean shipping remains a major contributor to total e-commerce supply chain emissions; by some estimates, a single large containership can emit as much pollution as 50 million cars[110]. The International Maritime Organization, a United Nations agency, has set ambitious sulfur and Greenhouse Gas emissions targets for 2020 and 2050 for which shipping lines have begun adopting strategies to reach compliance.

4.2.8. Real-Time Optimization

Real-Time Optimization reflects the potential for logistics systems and operating plans – already optimized through software on a daily and longer-term basis – to optimize immediate, on-the-ground route choices, timing and functional sequences using real time information feeds about operating conditions. Cost, reliability, and speed are the KPIs that benefit. GDOT participates through its intelligent transportation systems, 5G broadband availability and coordination with local agencies providing technology services to the freight community.

The focus for the port is supply chain efficiency and optimization. Providing and analyzing data is important for real time information and reporting. Data from various sources allows the freight networks to get a clear picture of the transportation and port networks. These data-sharing

[110] The Guardian: "Health risks of shipping pollution have been 'underestimated." Published by The Guardian on April 9, 2009. Accessed November 9, 2020 at https://www.theguardian.com/environment/2009/apr/09/shipping-pollution

opportunities could produce applications that could track the cargo, the vehicle it's tied to, the route and the delivery time anywhere in the state. They may also provide automatic notifications about any delays and reroutes around the state. The combined data sources can produce real-time dashboards that aid in managing freight. These dashboards can be used by port terminal operators, railroads, truckers, and warehouse operators.

Supply chain managers and freight operators plan and create routes based on the best information available to them. This includes historical information, inputs from different sources, such as the information that GDOT provides to its stakeholders on planned projects and closures. The risk with such plans is that things may not go as expected on the road due to an unplanned event, closure, traffic incident, or other change of conditions.

Real-time data reduces risk by informing freight operators and supply chain managers as they adapt their daily operating plans to the immediate roadway conditions. Coordination of real-time data will support Georgia's Freight Plan objectives by identifying public-sector improvements for broadcasting real-time traffic and operational conditions, and enhancing the resilience of freight infrastructure – whether under routine conditions or during disruptions such as those from extreme weather events. The employment of technology and processes that allow information to be "pushed" out to users rather than requiring a "look up" process is desirable.

Traffic signal optimization improves the flow of traffic and safety through a corridor or network. Traffic signal optimization is also an important traffic engineering strategy for reducing congestion. It minimizes vehicular delays and stops, arrivals on red and bottlenecks. Traffic signal timing needs to conform to the operational and safety goals established by GDOT for each corridor, such as the priority of arterial through traffic progression over local side street traffic delays. Signal retiming projects typically include extensive traffic data collection, data processing, optimization of signal phasing, splits and cycle lengths and computer simulation to develop initial signal timings.

GDOT uses the University of Maryland's Regional Integrated Transportation Information System (RITIS) to identify system bottlenecks, speed, congestion, and travel times, both historically and in real-time. On the arterial network, GDOT uses Automated Traffic Signal Performance Measures (ATSPM) to review split failures, arrivals on green, or arrivals on red. ATSPM metrics, RITIS outputs and field observations are used to fine-tune and adjust signal timing for real world conditions and citizen complaints.

ATSPMs can be used to support other technologies and operational strategies, such as adaptive signal control and emerging connected vehicle applications. It can be used to adjust signal timing to address recurring traffic demands, along with non-recurring incidents, construction, weather conditions, equipment failures and other events. The increase of automation of operations will provide greater data reliability, accuracy, and the level of service on transportation facilities. ATSPMs allow for continuous performance monitoring of the system and proactive identification of problems.

Georgia has multiple deployment Vehicle-to-Everything (V2X) technologies across the state to support the development of connected vehicle environments and related applications to support transportation operations. These deployments include equipment installations on infrastructure such as Interstates, state highways, and intersections across the state.

Trucks and other vehicles have equipment installed in them to share information with the infrastructure. This can help to enable applications to improve safety and operations for all partners. The supporting data is the key when evaluating existing traffic conditions and determining the primary sources of traffic problems, such as high accident rates, recurring congestion, and driveway access/egress for connected or autonomous vehicles. Messages from infrastructure can be used to confirm the position and orientation of the roadway geometry for connected vehicles.

GDOT and the truck/automobile original equipment manufacturers (OEMs) are also exploring ways to leverage emerging vehicle-based telematics-focused data platforms such as Wego and Sibros. Additionally, third party data providers such as Waze, INRIX and Streetlight are expected to continue to be a reliable source of real-time and historical data sets.

Data exchanges between partners are essential to enable operational solutions such as Freight signal priority (FSP), Transit Signal Priority (TSP), Emergency Vehicle Preemption (EVP), work zones, special events and signal timing failures. The MaxTime software and ATSPM are being used statewide. In addition to receiving the information, Georgia also shares data with the RITIS program, as well as with Waze and Streetlight.

GDOT's Road Weather Information System (RWIS) is another tool that provides real-time information to help freight operations. This system includes roadway sensors in 55 locations across the state that improve the ability to predict weather conditions on roads such as ice, temperature, precipitation, and wind. An expanded network of RWIS capabilities will include Georgia airports, and will feature real-time capability to view all surrounding states' weather conditions (AL, TN, NC, SC, North FL, and MS). Paired with the 511 Navigator system, this information can be used to see roadways that have been treated for ice/snow, monitor incidents, and obtain real-time roadway condition information.

Community Systems

Freight Community Systems are cooperative programs to establish a comprehensive foundation for real-time optimization in complex logistical environments with many interdependent players - seaports and airports being prominent examples. They make use of shared software platforms and exchange vital information (such as equipment location and condition) so that all participants have visibility into the factors that affect their decisions. This information may be in private hands, and the challenge is to bring participants to share proprietary data for the common benefit. Community systems exist at Georgia ports and HJAIA, yet the systems are voluntary and lack of participation limits their effectiveness. Following the supply chain breakdowns of 2021, the federal government initiated the Freight Logistics Optimization Works (FLOW) program[111] in 2022 to bring attention to the issue and push for participation from many players across the logistics ecosystem. FLOW is established as a private initiative with public backing, including engagement of the Bureau of Transportation Statistics because of its ability to serve as a confidential steward of data with statutory protections. The program is being designed, negotiated and piloted at a small number of

111 https://www.transportation.gov/briefing-room/dot-supply-chain-companies-collaborate-speed-movement-goods-cut-costs-consumers

seaports to begin with – among them the Port of Savannah – but its ambition is to expand to other multimodal environments, including airports, inland ports and distribution hubs. KPI benefits are in cost, reliability, speed and risk, and with Georgia and Georgia companies involved from the outset, the lessons from the pilot and the opportunities from the program will be known in the state as they evolve. Community systems thus promise to be one way that real time optimization can be promulgated at key locations in Georgia, adding to the state's competitive advantage.

Smart Work Zones

Work zones cause negative roadway conditions for emergency responders, motor carriers, traveling motorists and construction workers.[112] In work zones, bottlenecks and congestion may occur due to lane closures. Studies have shown increased accidents in work zones, which include rear-end collisions and fatal incidents. Work zones also add additional risk for construction workers and motorists as lane volumes increase due to closure. Data-sharing helps with safety and decreases driver frustration by providing real-time information.

Smart work zones utilize real-time information to provide accurate travel time for freight and the traveling public and enable optimal operating plans. The smart work zone could be a part of high-tech infrastructure for connected vehicles. Information can be provided from the Transportation Management Center (TMC), probe data and data warehouse services, and can be a part of high-tech infrastructure for connected vehicles. Safety is GDOT's number one goal and smart work zones increase safety for truck drivers, motorists and construction workers.

Work Zone Data Exchange

Work zone delays can significantly impact travel times and route of truck traffic. These work zones and other roadway closures are often planned weeks, if not months, in advance. High level information is sometimes shared with the public and other partners, but real-time information on openings, closures, and detour/alternate routes is a common challenge for carriers.

To address this challenge, GDOT is working with USDOT and other partners to make reliable and consistent real-time work zone information available for freight and other uses via the Work Zone Data Exchange (WZDx) Specification (https://www.transportation.gov/av/data/wzdx). The objective of the project is to make travel on public roads safer and more efficient through access to data on work zone activity, which can significantly enhance freight operations, both in terms of route planning and real-time decisions. The information made available in the specifications is intended to be embedded in Advanced Drive Assistance Systems (ADAS).

In 2020, USDOT put out a call for demonstration projects with the goal of using these projects to advance the WZDx specification at multiple sites across the U.S. GDOT was awarded one of the WZDx demonstration grants in early 2021. The project will extend the existing lane closure system to include new data capture and exchange capabilities to produce WZDx feeds, which is intended to be used by third party providers, such as freight dispatch units and related applications.

[112] https://ops.fhwa.dot.gov/wz/workshops/accessible/pant_paper.htm

The top causes for fatal work zone crashes are often associated with distraction, driving too fast for conditions and driver impairment. GDOT is also using technology to improve work zones and address these issues in other ways. Work zone safety is important to the freight plan to maintain truck safety as they travel through work zones and top reduce delays due to incidents within work zones.

Freight Priority

The implementation of an additional freight signal priority (FSP) for heavy commercial vehicles allows the vehicles to extend the green light's timing to make it through an intersection without stopping. This will increase safety by allowing intersections to clear and reducing the incentive for trucks to run red lights. The technology could also reduce truck delays and congestion at major freight centers such as ports. With broadband connection and connected commercial vehicles, the trucks can be remotely monitored and progress followed in real time.

The FSP system will help reduce congestion by giving freight vehicles longer green time. It takes trucks more time to startup after stopping at traffic signals which contributes to longer queues and traffic delays. Keeping the trucks moving reduces delay and improves. The system will help with travel time reliability for trucks. The implementation of the system should increase travel time reliability by 10 to 15 percent. GDOT is currently using FSP for railroad crossings near the port, where trains sit on the tracks. The system gives the truck priority at the traffic signals on an alternate route around the track. Priority treatment for freight will incentivize operators to use specific routes.

4.2.9. Electrification and Decarbonization

Electrification and Decarbonization relate to efforts by supply chains to reduce their carbon footprint, and the potential for lower net costs of ownership for freight vehicles not using internal combustion engines. Cost and risks to cost are the principal KPIs affected, with air quality and the availability and capacity of charging networks among GDOT's concerns.

Alternative Fuel Vehicles

Most transportation requires an onboard energy source, making petroleum products (gasoline and diesel fuel) ideal fuel to power transportation vehicles. Petroleum is portable and energy dense. It is no surprise then that the U.S. Energy Information Administration (EIA) reports that petroleum is the main source of energy for transportation. In 2021, petroleum products accounted for about 90 percent of the total U.S. transportation sector energy use[113].

But current social, financial, and environmental concerns are shifting transportation energy fuel choices away from gasoline and diesel to alternative fuels. Recent legislation like the CHIPS and Science Act[114] and the Infrastructure Investment and Jobs Act[115] put the United States on a path to

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[113] U.S. EIA, "Use of Energy Explained," published June 17, 2022 by U.S. Energy Information Administration. Accessed https://www.eia.gov/energyexplained/use-of-energy/transportation.php
[114] https://science.house.gov/chipsandscienceact
[115] https://www.congress.gov/bill/117th-congress/house-bill/3684

a decarbonized economy. Transportation will be transformed in the coming years as fossil fuel use wanes and alternative energy choices emerge. The U.S. Department of Energy identifies the following six categories of alternative transportation fuels making up the remaining 10 percent of transportation energy sources in 2021:

Figure 134. Categories of Alternative Transportation Fuels

Source: U.S Energy Information Administration - https://afdc.energy.gov/fuels/

Biofuels represented about 6 percent of 2021's transportation fuel. Natural gas accounted for about 4 percent, most of which was used in natural gas pipeline compressors. Electricity use by mass transit systems provided less than 1 percent of total transportation sector energy use. Natural gas, both compressed natural gas (CNG) and liquefied natural gas (LNG), are being used by carriers as diesel alternatives today. Renewable fuels like ethanol and biodiesel have limited use and are mostly blended with gasoline or diesel fuel. While each alternative fuel source listed above has a unique set of benefits and drawbacks, electricity is emerging as the most likely dominant transportation energy source.

Electric vehicles are expected to make a significant impact on the trucking industry. Electrification applies to all vehicle types, including light duty vehicles, shuttles and utility carts, delivery trucks and vans, material handling, ground service equipment and terminal tractor, refrigerated trucking, airport and seaports, and delivery trucks and vans. Today, electric vehicle (EV) technology is in the field-testing stage of development and is anticipated to move into adoption within the next five years. Long-standing barriers to widespread adoption are beginning to fall as the market expands and grows.

EVs appeal to motor carriers for a variety of reasons: increasing customer focus on decarbonizing the supply chain, the potential lower total cost of ownership (TCO), and insulation from energy cost volatility. EVs are suited to drayage in port, rail-truck, barge-truck and air-truck operations, making them both an intermodal and energy technology.

Current research indicates the total cost of ownership favors electric vehicles (EVs) as compared to traditional internal combustion engine (ICEs) trucks no later than 2030 for local and regional length-of-haul operations while long-haul (500 mile and greater) operations become less expensive by 2035[116]. The transition to electric vehicles will begin with light and medium duty fleets, then progress to the class 8 heavy duty local (< 75-mile) and regional (< 300-mile) markets.

Battery electric vehicles (BEVs) will dominate the local and regional hauls. Fuel cell electric vehicles (FCEVs) will likely find a place in the long-haul market. Like BEVs, fuel cell electric vehicles (FCEVs) use electricity to power an electric motor. In contrast, rather than drawing electricity from only a battery, FCEVs produce electricity using an onboard fuel cell powered by hydrogen. In the EV market, hydrogen-fueled electric trucks are three to five years behind battery powered trucks (or more specifically, tractors, which is the industry term for the power unit where the driver sits in a combination vehicle pulling a semi-trailer).

The EV vs. ICE TCO tipping point is dependent upon several key items. Government policies supporting EV adoption is one. Regions with such incentives reach parity sooner than those without them. The price of diesel fuel is also a major factor in the TCO calculation. Independent of energy commodity prices, the lower maintenance and repair costs of the EV powertrain is another cost advantage favoring adoption of EVs in freight transportation.

Key to widespread adoption, the EV battery supply chain must expand relatively rapidly. New raw material sources can take up to ten years to develop. While long, this development cycle is within the predicted 2035 timeframe. Transitionary fuels and drivetrains are expected to coexist during the next ten years before BEVs and FCEVs reach TCO parity at scale. These transition or bridge fuel and drivetrain technologies will likely include liquefied/compressed renewable natural gas (renewable LNG/CNG) and biodiesel trucks.[117]

A meta-analysis[118] of EV TCO studies completed by UC-Davis's National Center for Sustainable Transportation in June 2022 states that "while there is a wide range in estimates across studies for specific types of trucks in specific years, all the studies expect the total cost of ownership for battery-electric trucks to reach cost parity with diesel trucks between 2025 and 2035."

Growing EV fleets will require additional electric power distribution infrastructure development and standardization. Charging stations will become the new truck stops, and these new truck stops will become significant electric power consumers. Close coordination with electric utilities is required to determine "behind the meter" updates needed based on estimates of how much electric capacity is required to meet fleet power demand. Electric utilities will need to supply reliable electric power to this new charging infrastructure, and electric grid modifications will be required in many areas. Connected, intelligent charging management services can enable vehicle electrification without negatively impacting the grid while also possibly providing additional benefits like using vehicle

[116] For example, see "Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains" published by Argonne National Laboratory in April 2021. Available at https://publications.anl.gov/anlpubs/2021/05/167399.pdf

[117] MPP, "Making Zero-Emissions Trucking Possible," published July 2022 by Mission Possible Partnership. Accessed December 5, 2022 at https://missionpossiblepartnership.org/wp-content/uploads/2022/11/Making-Zero-Emissions-Trucking-Possible.pdf

[118] Guihua Wang, Lewis Fulton and Marshall Miller, "The Current and Future Performance and Costs of Battery Electric Trucks: Review of Key Studies and A Detailed Comparison of Their Cost Modeling Scope and Coverage," published 2022 by UC Davis NCST. Accessed December 5, 2022 at https://escholarship.org/uc/item/8zj9462h

batteries as off-peak power storage sinks. Utilities like Georgia Power are actively seeking to understand and serve the electric vehicle fleets of the future.

A white paper released in November 2022 – Electric Highways: Accelerating and Optimizing Fast-Charging Deployment for Carbon-Free Transportation- analyzed the impact of highway fast-charging site installations. The study revealed six primary insights to help policy makers, transportation planners, utilities, and charging site operators meet the coming power needs of BEVs[119]:

1. A typical highway charging site will eventually have 20+ fast chargers to meet drivers' needs. Peak power demand at some sites requires charging capacity comparable to that of major power users like large commercial or industrial sites. Delivering this amount of power to a site requires long lead time investments in utility infrastructure.
2. Electric light-duty vehicles (LDVs) will drive load increases in the near term, but medium/heavy duty vehicle (MHDV) electrification will magnify charging needs over the long term. By 2045, over 75 percent of average daily energy need across all sites is expected to come from MHDVs.
3. The need for power at fast-charging highway sites exceeds the distribution system's typical limits. Fortunately, there is overlap between highway rights-of-way and those of the high-voltage transmission system. This coincidence provides an opportunity to facilitate the interconnections required.
4. Proximity to transmission lines should be considered in tandem with expected charger utilization during site selection. Charging developers site charging stations based on factors like traffic, expected utilization, and land availability. Access to electric infrastructure should play an equally critical role. By keeping both in mind, charging sites can be placed in areas that make sense for both EV operations and for the power grid.
5. Build scalable grid infrastructure. For many sites, a transmission interconnection will likely be needed in the next decade to serve LDVs alone. Once a new electric infrastructure upgrade is required, it should be scalable and suitable for long-term needs.
6. Begin preparing now. While charger installation can be completed in a matter of months, larger transmission interconnections and upgrades can take as long as 8 years to complete.

Transportation electrification will require successful collaboration. Addressing the challenges for the local grid infrastructure and vehicle-connected charging accessibility will involve building new work relationships between parties unused to coordinating with each other.

For FCEVs, the deployment of hydrogen production and distribution is a barrier. Hydrogen must be produced and then distributed to the fueling station. In this sense, hydrogen fueling is very similar to diesel fueling. The major difference is there is no developed infrastructure for hydrogen fuel comparable to today's gasoline and diesel fueling networks. Companies like Nikola are working to

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[119] Middlebrooks, George. "Electric Highways: Accelerating and Optimizing Fast-Charging Deployment for Carbon-Free Transportation." Published November 11 2022 by CALSTART. Accessed December 5, 2022 at https://calstart.org/electric-highways-study/.

develop a hydrogen fuel network for FCEVs. Dense freight corridors will see the initial build-out of hydrogen fueling stations served by mobile "tank to truck" fueling sites.

The expansion of EVs will hasten the need for an alternative system to fund roadway maintenance and improvements. As gasoline and diesel fuel use declines per vehicle mile travelled (VMT), gasoline and diesel fuel tax revenue will decline. Collectively, governments will need to identify new methods to assess and collect taxes for transportation infrastructure support. Long a subject of concern[120], reforming the transportation finance system will become more critical as electricity replaces diesel and gasoline as a fuel source for on-road vehicles.

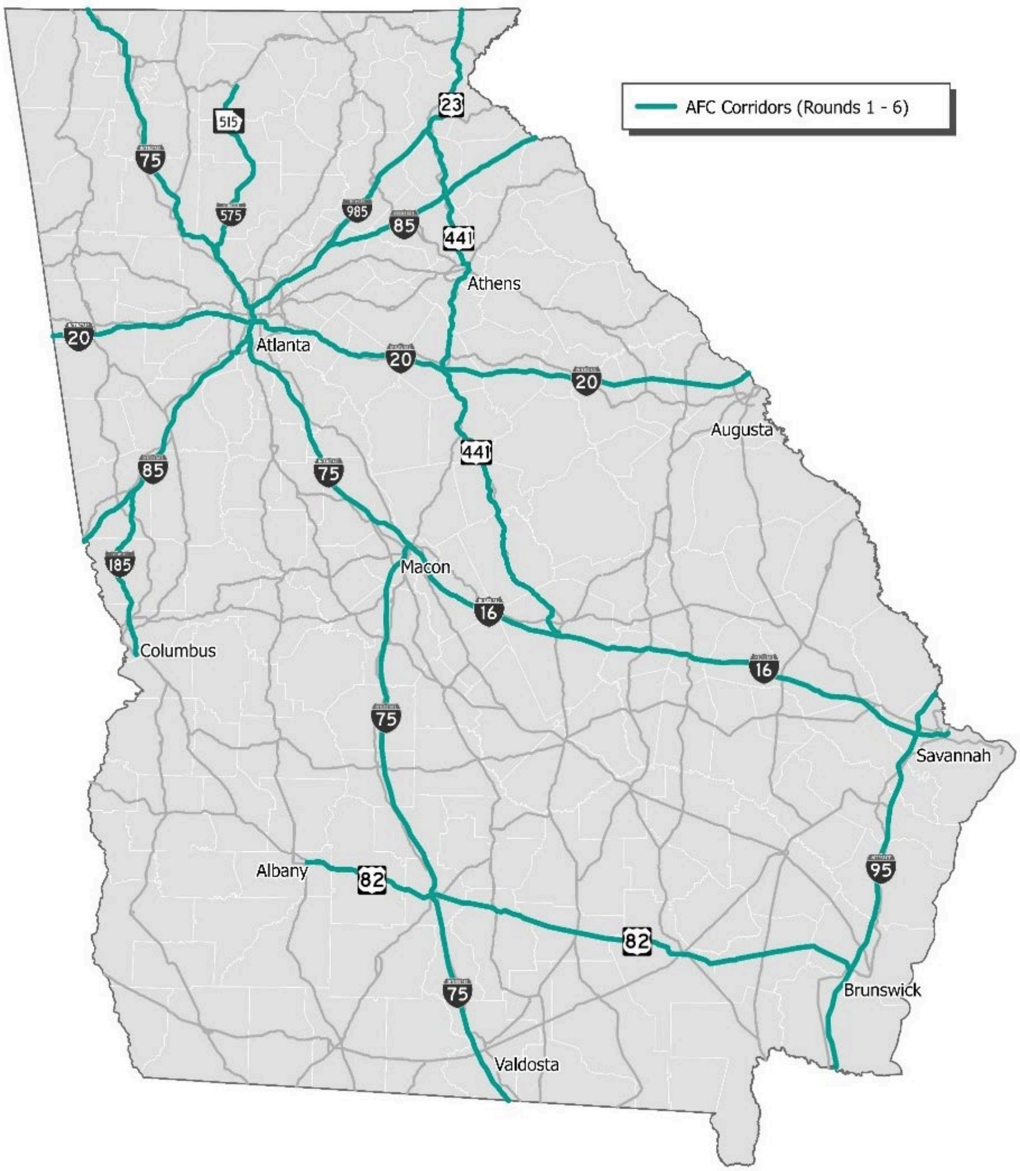
Electric Vehicle Infrastructure

The National Electric Vehicle Infrastructure (NEVI) Formula Program is a $5 billion program established by the Bipartisan Infrastructure Law (BIL) to build a national network of 500,000 electric vehicle (EV) charging stations by 2030 along federally designated Alternative Fuel Corridors (AFC). NEVI will provide funding to states over the next five years to strategically deploy Electric Vehicle Supply Equipment (EVSE) charging station infrastructure and increase access to charging stations for Americans to travel nationwide in EVs. Each state DOT is required to submit a deployment plan to the Federal Highway Administration (FHWA).

Georgia's plan was approved by the FHWA in September 2022. Initial NEVI fund deployment will occur along Georgia's Alternative Fuel Corridors (AFCs) along I-75, I-20, I-85, I-16, US 82, US-441, I-95, I-985/US 23, I-575/GA 515, and I-185. Over the coming years, the NEVI funds must be invested in DC fast charging stations that are compliant with federal guidelines. Among the primary requirements, each station must have at least four ports that can simultaneously charge at 150 kilowatts, be located along every 50 miles of the AFC, less than one mile off the exit, and be accessible to the public 24 hours a day.

[120] Transportation Research Board, "The Fuel Tax and Alternatives for Transportation Funding," published 2006 by TRB. Accessed December 5, 2022 at https://trb.org/publications/sr/sr285.pdf

Figure 135. Alternative Fuel Corridors for EV Charging Stations



The map shows Alternative Fuel Corridors (AFC) where NEVI-funded EV charging stations are required to be installed.

Source: Georgia EV Infrastructure Deployment Plan

4.2.10. Remote Working and Urban/Rural Location

Remote working and household relocations from urban to rural locations arose through the national experiment in working from home during the pandemic. Freed from needing to live in proximity to their workplace, many workers took the opportunity to relocate to a new area completely, often moving from urban areas to higher-amenity areas in more rural areas. This is a societal change with a scope and permanence yet to be understood. Speed, reliability, cost, and safety are KPIs subject to this trend, and there are consequences for the location of demand on GDOT's network and the traffic mix it supports.

According to a brief by the Center on Rural Innovation, if the rate of full-time remote workers settles at 12 percent, twice the pre-pandemic rate, it would mean an additional 9 million remote workers in the U.S. economy. When considering how to incorporate remote work into economic development strategies, the authors recommend an approach that addresses broadband, housing, workforce development, and quality of life.[121] What is not cited as a development factor is transportation. Remote work from more rural or suburban locations is not dependent upon transportation infrastructure. Rather, its impacts on transportation infrastructure may be indirect impacts like urban commuting demand and e-commerce freight activity in outlying areas.

The Minnesota DOT worked with researchers in 2022 to study remote work.[122] The research found that geographic area, life circumstances, and demographic characteristics all made differences in remote work activity. Rural workers were more likely to be back in the office compared to urban workers. Surprisingly, workers without children work remotely more than those with children and older workers work remotely more than younger ones. The study also found that higher education level and higher income workers had more remote work opportunity than less educated and lower wage earners. Racial differences also exist, with white workers having more remote work opportunity than others.

Regarding relocation, only 12 percent of those surveyed said they were highly likely to relocate. Another 15 percent said they were somewhat likely to do so. As intent is not action, an even smaller portion of those able to work remotely are likely to relocate. When asked about relocation destinations, only 14 percent of those likely to relocate would choose a rural Minnesota location. Another 22 percent of them would leave the state entirely. Most would move within the Twin Cities and their suburbs. While it is difficult to say these results would be similar in Georgia, both states have one large metro area and several smaller cities surrounded by large rural regions. It should be noted that some jobs are not open to remote working, especially those in the freight industry such as truck driving and warehouse operations. This leaves the workers in these jobs with few options to experience the benefits of working from home, although some workers may opt to move closer to their place of employment to reduce their commute times. If the trend towards remote

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[121] Mark Rembert, Adenola Osinubi, and Dani Douglas, "The Rise of Remote Work in Rural America," published October 2021 by EDA. Accessed December 6, 2022 at https://ruralinnovation.us/wp-content/uploads/2022/01/Remote-Work_122721.pdf

[122] Minnesota Local Road Research Board, "TELECOMMUTING DURING COVID-19: HOW DOES IT SHAPE THE FUTURE WORKPLACE AND WORKFORCE?", published May 6, 2022. Accessed December 6, 2022 at https://researchprojects.dot.state.mn.us/projectpages/pages/lrrbProjectDetails.jsf?id=24821&type=CONTRACT&jftfdi=&jffi=lrrbProjectDetails%3Fid%3D24821%26type%3DCONTRACT

work continues, it could result in fewer applicants for in-person jobs and a decline workforce available to supply chains.

4.3. Freight Mobility Strategies

This section describes strategies to address the performance of the freight network in the state. These strategies were developed based on the current conditions and anticipated changes as a result of anticipated growth and logistics trends. This section looks at strategies generally by mode and also in relation to workforce and freight generators.

4.3.1. Highway Strategies

Georgia's highway network is a strength for the state and as such attracts heavy freight traffic which results in area bottlenecks, desire for truck parking options and information, potential for commercial vehicle lanes, and overall network improvements for freight mobility.

Bottleneck Relief

As described in Section 4.1.1, the top 20 bottleneck clusters were identified for Urban Atlanta, Urban Other, and Rural portions of Georgia.

Roadway congestion is a major source of unreliability and costs in modern supply chains. For example, the food and agriculture supply chain sees $4.0 million per day in statewide congestion costs, $700,000 of which are directly caused by bottlenecks. Daily statewide congestion costs reach over $15 million per day, over $3 million of which are due to bottleneck locations.[123] In May 2022, FHWA published *Addressing Truck Emissions and Noise at Truck Freight Bottlenecks Final Report*, that documents the issues with idling trucks in congested conditions and potential mitigation strategies to address these issues. Congested conditions, particularly at bottlenecks, cause lower speeds and stop and go conditions that have higher emissions per mile than at cruise speeds.[124]

There are often several potential causes of a bottleneck, such as the proximity of a truck terminal to an interchange of two Interstates. Although these factors often interact, the following provides examples of bottleneck causes independently of one another and provides mitigation strategies that can be combined depending on the combination of bottleneck causes at a particular location.

Bottlenecks in Urban Atlanta-Region

The top 20 bottlenecks in the Atlanta region represent 105 centerline miles of roadway and generate $3.5 million in daily user costs to trucks and shippers. Supply chains most impacted by these top 20 urban Atlanta bottlenecks include food and agriculture, construction, and distribution. All 20 bottleneck locations are projected to see at least 85 percent growth in truck traffic from 2019 to 2050.

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[123] Congestion data and costs derived from NPMRDS and Transearch data as well as NCHRP Report 925

[124] FHWA-HEP-22-026, Addressing Truck Emissions and Noise at Truck Freight Bottlenecks Final Report, May 2022

The most common cause of bottlenecks in the Urban Atlanta region is congestion at interchanges due to merging and diverging. Locations where merge/diverge congestion causes bottlenecks are shown in **Table 107.** Other reasons for bottlenecks at interchanges include geometric conditions such as the loop ramp at I-20 and I-285 west.

Table 107. Atlanta Region Merge/Diverge Bottleneck Locations

Bottleneck Location	County	MPO
I-75 at I-675	Henry County	Atlanta Regional Commission
I-285 at SR 400	Fulton County	Atlanta Regional Commission
I-285 at I-20 East interchange	DeKalb County	Atlanta Regional Commission
I-75 at I-285 North interchange	Cobb County	Atlanta Regional Commission
I-85 at SR 316	Gwinnett County	Atlanta Regional Commission
I-285 at SR 78/Stone Mountain Freeway	DeKalb County	Atlanta Regional Commission
I-285 at SR 29/Lawrenceville Highway	DeKalb County	Atlanta Regional Commission
I-75 at I-85	Fulton County	Atlanta Regional Commission
I-75/85 at I-20	Fulton County	Atlanta Regional Commission
I-85 at I-285 North interchange	DeKalb County	Atlanta Regional Commission
I-285 at Buford Highway	DeKalb County	Atlanta Regional Commission

Through trucks are prohibited on I-75/I-85 inside I-285, therefore truck traffic traveling through Atlanta must bypass downtown. This restriction contributes to bottlenecks at system-to-system interchanges with other Interstates including, I-75, I-85 and I-20. As shown in the listed top 20 bottlenecks, the interchanges with I-285 do create regional bottlenecks.

Bottlenecks can also be caused by temporary conditions. Work zones create recurring congestion for periods of months or years. For example, the Transform 285/400[125] construction has been taking place since 2017 and contributes to congestion along the northern section of I-285. Frequent vehicle crashes can also contribute to recurring congestion, such as the high frequency of crash incidents at I-75/I-85 northbound from I-75/I-85 south split to John Lewis Freedom Parkway and at I-75 southbound from I-75/I-85 north split to Howell Mill Road. Event traffic can also contribute to bottlenecks, such as the recurring congestion at the I-75/I-285 north interchange, which abuts Atlanta's Major League Baseball stadium.

Clusters of truck terminals, freight distribution centers, and warehousing facilities create locations of concentrated demand for truck traffic, contributing to bottleneck formation and affecting non-freight traffic. Within the Atlanta region, this type of bottleneck occurs at I-20 eastbound from Fulton Industrial Boulevard to Thornton Road. Fulton Industrial Boulevard is the largest industrial corridor

[125] https://transform285400-gdot.hub.arcgis.com/

in the eastern United States, containing more than 50 million square feet of industrial space, and accounting for 33 percent of Fulton County's total industrial space.[126]

Some bottlenecks in the Urban Atlanta region are likely caused by the characteristics of the roadway. In some instances, lane drops force trucks and other vehicles to merge, such as on I-85 southbound from Beaver Ruin Road to SR 316 and on I-85 southbound at the I-75/I-85 south split. In other locations, horizontal curves create slower traffic patterns, like at I-75/I-85 northbound from I-75/I-85 south split to John Lewis Freedom Parkway and at I-75 southbound from I-75/I-85 north split to Howell Mill Road. In addition, short on- and off-ramps create vehicle queuing and congestion, like at I-75/I-85 northbound from I-75/I-85 south split to John Lewis Freedom Parkway.

Other Urban Bottlenecks

The top 20 bottlenecks in the other urban regions of the state represent 50 centerline miles of roadway and generate $600,000 in daily user costs to trucks and shippers. Supply chains most impacted by these top 20 urban bottlenecks include food and agriculture, construction, and lumber and paper manufacturing.

Merge/diverge congestion is a contributing factor to many of the other urban bottlenecks in Georgia. Locations where merge/diverge congestion contributes to bottlenecks are shown in **Table 108**.

Table 108. Other Urban Bottleneck Locations

Bottleneck Location	County	MPO
I-75 at SR 146	Catoosa County	Chattanooga-Hamilton County/North Georgia TPO
I-16 at I-95	Chatham County	Coastal Region MPO
I-85 at SR 53	Jackson County	Between ARC and MACORTS
SR 21 at I-95	Chatham County	Coastal Region MPO
SR 133 at US 82	Dougherty County	Dougherty Area Regional Transportation Study
I-24 at I-59	Dade County	Chattanooga-Hamilton County/North Georgia TPO
SR 369 at I-985	Hall County	Gainesville-Hall County MPO
SR 11 at I-985	Hall County	Gainesville-Hall County MPO

Other urban bottlenecks also stem from short-term events such as work zones, like the I-16@ I-95 project[127] contributing to the I-16 bottleneck from Chatham Parkway to Pooler Parkway. Event traffic can also contribute to bottlenecks, like congestion at US 192 at I-16, likely caused by proximity to the Macon Coliseum.

[126] https://boulevardcid.org/portfolio/economic-development/
[127] https://majormobilityga.com/projects/i1695improvements/

Many of the other urban bottlenecks are caused by proximity to truck terminals, port facilities, and freight distribution centers. For example, many of the bottlenecks in and around Savannah, like I-95 northbound from SR 21 to the South Carolina state line, SR 21 from SR 307 to SR 30, and SR 21 from Jimmy Deloach Parkway to I-95, are major entry and exit points to the Port of Savannah, and the Georgia Port Authority. The bottleneck at US 80 from Bradley Park Drive to SR 219 is likely caused by a density of freight and distribution origins/destinations at Bradley Park Drive. Likewise, a density of truck terminals at I-85 at SR 53, I-95 at US 129, and I-85 at SR 82 likely contribute to the bottleneck on I-85 from SR 53 to SR 82.

Many bottlenecks in urban areas throughout Georgia are located on major access roads through a city center (such as SR 369 in Gainesville) or are the major entryway to a large trip generator (such as SR 383 at I-20 where SR 383 is the major access point to Fort Gordon).

Some Urban Other bottlenecks are likely caused by the characteristics of the roadway. The bottleneck at the SR 22 at US 129 intersection may be caused in part by the intersection's irregular alignment. Likewise, the bottleneck at I-95 northbound from SR 21 to the South Carolina state line may be due in part to a drop from three to two lanes at the I-95 bridge over the Savannah River. I-24 eastbound at I-59 may be due to horizontal curves as well as grade changes that make it difficult for trucks to accelerate quickly. Finally, narrow lanes and short on-ramps on I-75 from Battlefield Parkway to the Tennessee state line likely contribute to the bottleneck in that location.

Rural Bottlenecks

The top 20 rural bottlenecks represent 48 centerline miles of roadway and generate $300,000 in daily user costs to trucks and shippers. Supply chains most impacted by these top 20 rural bottlenecks include food and agriculture, construction, and lumber and paper manufacturing.

As is the case with urban bottlenecks, many rural bottlenecks are likely caused by merge/diverge congestion at interchanges. Examples of rural bottlenecks are shown in **Table 109**.

Table 109. Rural Bottleneck Locations

Bottleneck Location	County
SR 144 at I-95	Bryan County
US 17 at I-95	Camden County
US 129 at I-20	Morgan County
SR 53 at US 41	Gordon County
US 82 at I-75	Tift County
US 27 at US-84	Decatur County
US-129 at I-16	Bibbs County
US 441 at I-16	Laurens County

Also similar to urban bottlenecks are rural bottlenecks near work zones. These occur at SR 316 from SR 53 to SR 11 as part of the Transforming SR 316 project[128]. Truck terminals also contribute to rural bottlenecks, as with urban bottlenecks. Examples include freight origins/destinations adjacent to I-95 off SR144 that likely contribute to the bottleneck on SR 144 from I-95 to the Liberty County line, US 76 in Ellijay, and US 1 in Wrens.

Unique to rural bottlenecks are routes that serve as the primary route through a city's commercial district or the primary route running in a particular direction through the city. This is the case for US 441 in Milledgeville, US 280 in Cordele, SR 37 in Moultrie, US 1 in Baxley, US 76 in Ellijay, US 27 in Bainbridge, US 129 in Eatonton, US 441 in Dublin, and US 1 in Wrens.

Bottleneck Mitigation Strategies

Truck bottleneck mitigation strategies are dependent on the cause of the bottleneck. In many cases, GDOT has plans to or is already implementing strategies to lessen bottlenecks and their economic implications. The Major Mobility Investment Program is a key investment to provide additional capacity and operational improvements that target some of these key areas. These projects benefit freight mobility overall and the projects included in the program are shown in **Figure 136**.

As part of the MMIP, GDOT is implementing a managed travel lane solution in the Atlanta Urban area by way of the Express Lane project.[129] The tolled lanes, already in operation on I-75 North, I-575, I-85 North, and I-75 South, are optional priced lanes that run alongside Atlanta's major Interstates. Congestion-based pricing maintains free-flowing travel and aims to reduce bottlenecks on the mainline by allowing automobiles to opt for a less congested route. Although trucks are not permitted in Express Lanes, redistribution of vehicles to the paid lanes is more likely to reduce congestion in the general-purpose lanes, creating better travel conditions for freight vehicles.

[128] https://transformingsr316-gdot.hub.arcgis.com/
[129] http://www.dot.ga.gov/DS/GEL

Figure 136. Major Mobility Investment Program (MMIP) Projects

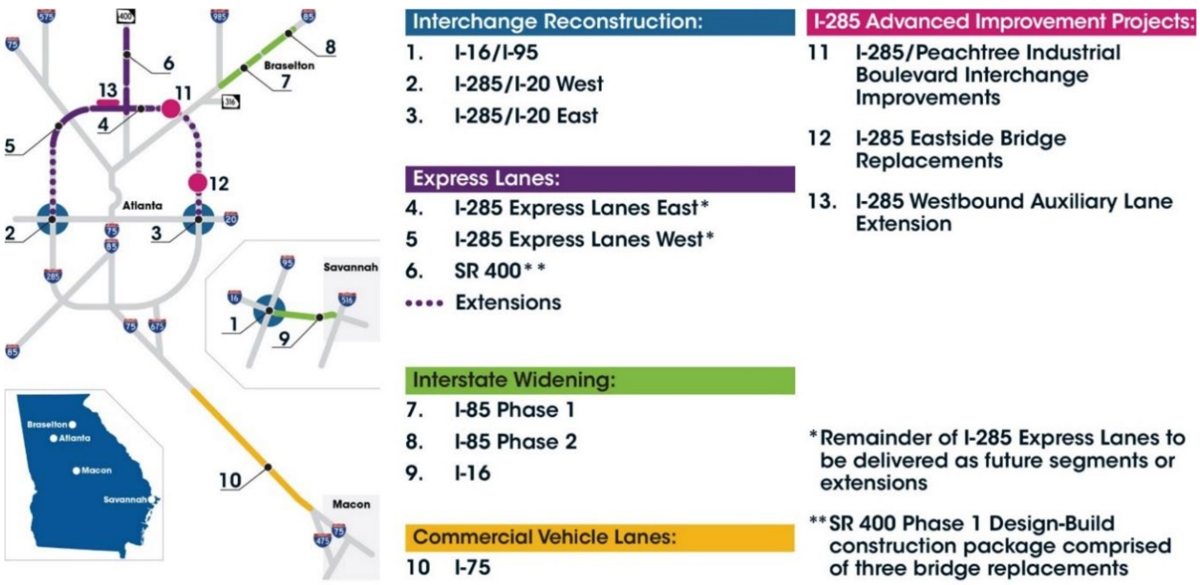


Image source: GDOT

Interchange Improvements

Solutions to bottlenecks that arise at major interchanges, such as where two Interstates meet, can encompass strategies such as roadway expansion, ramp metering, syncing arterial signals to moderate the flow of merging traffic, and managed travel lanes. Two major interchanges in the Atlanta region, I-285 at I-20 west and I-285 at I-20 east are included as system-to-system interchange improvements in the MMIP.

In other urban areas and some rural areas, it may be appropriate to create grade separations at highly congested intersections. The Transforming 316 project proposes several locations along SR 316 where signalized intersections would become unsignalized, grade separated facilities. One proposed location for this type of improvement is SR 316 at SR 11, identified as part of the fourth most severe rural bottleneck in Georgia.

Work Zones

There are several emerging technologies that can reduce congestion and bottlenecks that arise due to work zones.

These may include:

- Advanced closure notification
- Real-time, in-cab alerts to truck drivers prior to reaching the work zone so the truck driver can re-route
- Coordinated traffic control

Frequent Crashes

In highly travelled corridors where crashes are common, there are two types of strategies—those that prevent crashes, and those that clear out crashes so that normal traffic flow can resume.

Strategies to reduce crashes will vary based on the reason for the high crash rate:

- High crash rates due to weather may necessitate real time weather warnings for drivers
- If crashes are due to closely spaced exits and numerous travel lanes, increased signage may help drivers anticipate their movements earlier

GDOT has implemented Highway Emergency Response Operators (HERO) and the Coordinated Highway Assistance & Maintenance Program (CHAMP). HERO and CHAMP vehicles are dispatched after traffic-related incidents occur and clear roads to allow normal traffic flow to resume. HERO serves metro Atlanta and CHAMP serves Interstates outside of metro Atlanta except I-59 and I-24.

Figure 137. Statistics on HERO and CHAMP Services

	HERO	CHAMP
Monitored Routes	30	26
Active Operators	100	80
Miles of Patrol Routes	382	981
Total Assists Performed	88,747	164,529

Source: GDOT https://www.dot.ga.gov/GDOT/Pages/HERO.aspx; https://www.dot.ga.gov/GDOT/Pages/Champ.aspx

Single Access Route

Primarily in rural regions of Georgia, bottlenecks often form when there is only one arterial that runs through a major commercial district or through a city center. In these cases, the city may benefit from an access management study to assess driveway spacings and left-turn locations, median treatments, and intersection alignments. Signal timing assessments may also help the flow of traffic.

Narrow Lanes

In cases where bottlenecks arise because lanes are too narrow to handle existing levels of truck traffic, it may be beneficial to widen lanes or shoulders, create a truck bypass lane or passing lane for non-freight vehicles, or consider implementing redundant, parallel routes.

Commercial Vehicle Lanes

Commercial Vehicle Lanes (CVLs), also known as truck-only lanes, are designations and restrictions which require trucks to travel within specified lanes. The following subsections present an overview of the proposed CVL lanes within Georgia and their impact.

Georgia's I-75 CVL Project

The I-75 CVL project proposes to add two northbound-only commercial-vehicle (CV) only freeway lanes for all truck traffic along approximately 40 miles of I-75 between the I-475 interchange (near Macon) and the SR 155 interchange (near McDonough in Henry County). The project design will physically separate the proposed CVLs from the general-purpose (GP) lanes with a stated purpose to improve safety and travel time along the corridor.

GDOT is leading the development of the I-75 CVL with support of numerous key stakeholders and partners including, but not limited to, the Georgia Ports Authority, freight and logistics representatives, regional commissions, and support of the local governments along the corridor. The support is based upon the understanding of the growing truck volumes and increasing safety incidents between automobiles and commercial vehicles. Much of the support likely stems from the understanding of the rapidly growing freight traffic along the corridor, showing increases in traffic volumes upwards of 44 percent with truck percentages of 33 percent between the 2018 base year and the 2048 future horizon year. [130] The projected benefits of the I-75 CVL project to all Georgians is described below.

The I-75 CVL project will provide an array of benefits from operational, safety to economic to support the successful and growing freight and logistics industry throughout Georgia.

Expected Performance Benefits

The projected operational benefits for the I-75 CVL project show increased traffic capacity with reduced travel times over the no build alternative. The estimated time savings is 3.6[131] days per vehicle over the 20-year design life. The projected safety benefits are even greater showing over the 20-year design life, a reduction of 6 crashes per week, reduction of fatal and injury crashes of 750[132], and reduction of property damage crashes by 5,580[133].

The increase in reliability is directly related to the projected reduction in travel times and crash incidents along the 40-mile corridor, especially due to the separation of trucks in the CVL from the GP lanes. Two crash scenarios were evaluated (high and low) for both the CVL and GP lanes using Planning Time Index (PTI) as a metric:

The results indicate that for the high crash scenario under the no build scenario, travel times would be unreliable with a PTI between 1.30 and 1.43. However, under the build scenario, travel times

[130] I-75 Commercial Vehicle Lane Traffic Report. November 12, 2020.
[131] I-75 Commercial Vehicle Lane Traffic Report. November 12, 2020.
[132] I-75 Commercial Vehicle Lane Traffic Report. November 12, 2020.
[133] I-75 Commercial Vehicle Lane Traffic Report. November 12, 2020.

would be reliable with a PTI for the CVL between 1.03 and 1.05 and for the GP lanes between 1.16 and 1.24.

For the low crash scenario under the no build scenario, travel times would be reliable except in the PM peak period. Both GP and CVL travel times would be reliable in the build with PTI varying between 1.02 and 1.05[134].

Truck Network Improvements

This section considers improvements to the Georgia truck route network from two perspectives:

- The adequacy of the network for serving rural Georgia, especially in respect to truck shipments of food and agriculture.
- The potential for establishing long distance routes that do not pass through the congestion of metropolitan Atlanta.

These considerations are in addition to the bottleneck relief and CVLs presented above. The data employed findings presented here are enlarged upon at the system level in Chapter 5, incorporating projections and analysis from the Georgia Statewide Travel Demand Model (GSTDM) using the Transearch 2050 forecast.

Rural Freight Roadway Network

Annual 2019 truck traffic on the Georgia roadway system is depicted in Figure 138, using data from Transearch and distinguishing four-lane from two- and three-lane facilities. Interstates are shown, but without traffic levels. Several observations of the data:

- The network is extensive and reaches throughout the state. The range of volumes on four-lane facilities seems largely comparable to the two/three-lane facilities, although the highest annual volume on four-lane facilities is around 1 million units greater than the highest annual volume on two/three-lane facilities, which equates to around three thousand more units per day.
- There is a triangular connection with significant truck volume between Columbus, Albany and Warner Robins, described generally as SR 520 from Columbus to Albany, SR 300 from Albany to I-75 near Cordele, I-75 to Warner Robins, and SR 96 between Warner Robins and Columbus. The non-Interstate sections are predominantly four-lane routes except SR 96 from Fort Valley to I-75 in Warner Robins, however from Fort Valley SR 49 is a four-lane route to I-75 in Byron.
- Comparably heavy volumes are on two-lane sections of SR 96 from Warner Robins to I-16, and two-lane US 129 northeast from Macon, connecting to four-lane US 441 near Eatonton and continuing to I-20.

[134] I-75 Commercial Vehicle Lane Traffic Report. November 12, 2020.

- Four-lane US 23 continues with significant volume on the same northeast vector as I-985 and joins to US 441.

The Governor's Road Improvement Program (GRIP) was designed to create a four-lane highway system across the state. Its explicit objective is to connect 95 percent of Georgia cities with populations of 2,500 or more to the Interstate system, and for 98 percent of Georgia's population to live within 20 miles of a four-lane road. The 3,300-mile GRIP is two-thirds built or under development, leaving about 1,000 miles to go. The GRIP network is portrayed in **Figure 139**, distinguishing the four-lane portions built or underway from the two-lane remainder, and indicating the truck volumes. The major unbuilt portions are parts of the east/west SR 32 between Brunswick and Albany, most of the east/west US 280 from Savannah to conjoint SR 520/US 280 below Columbus, the north/south SR 15 from Vidalia to Athens, and a series of routes including SR 52 from west of Dalton to US 441, dubbed the East-West Highway.

Stakeholders near unbuilt facilities underscore the importance of four-lane facilities for faster, safer connection to Interstates, which has an effect on economic development as well. Allowing for these points, the current and projected congestion is around urban centers (Albany, Columbus, Augusta, Athens, Chattanooga, as well as Atlanta and Savannah) and intersections, such as near Waycross and Eatonton. Deteriorating forecast conditions are most notable around Albany, SR 19 south from Atlanta, SR 21 north from Savannah, and SR 441 from Eatonton to Athens.

Figure 138. Freight Flows on Two- and Four-Lane Roadways

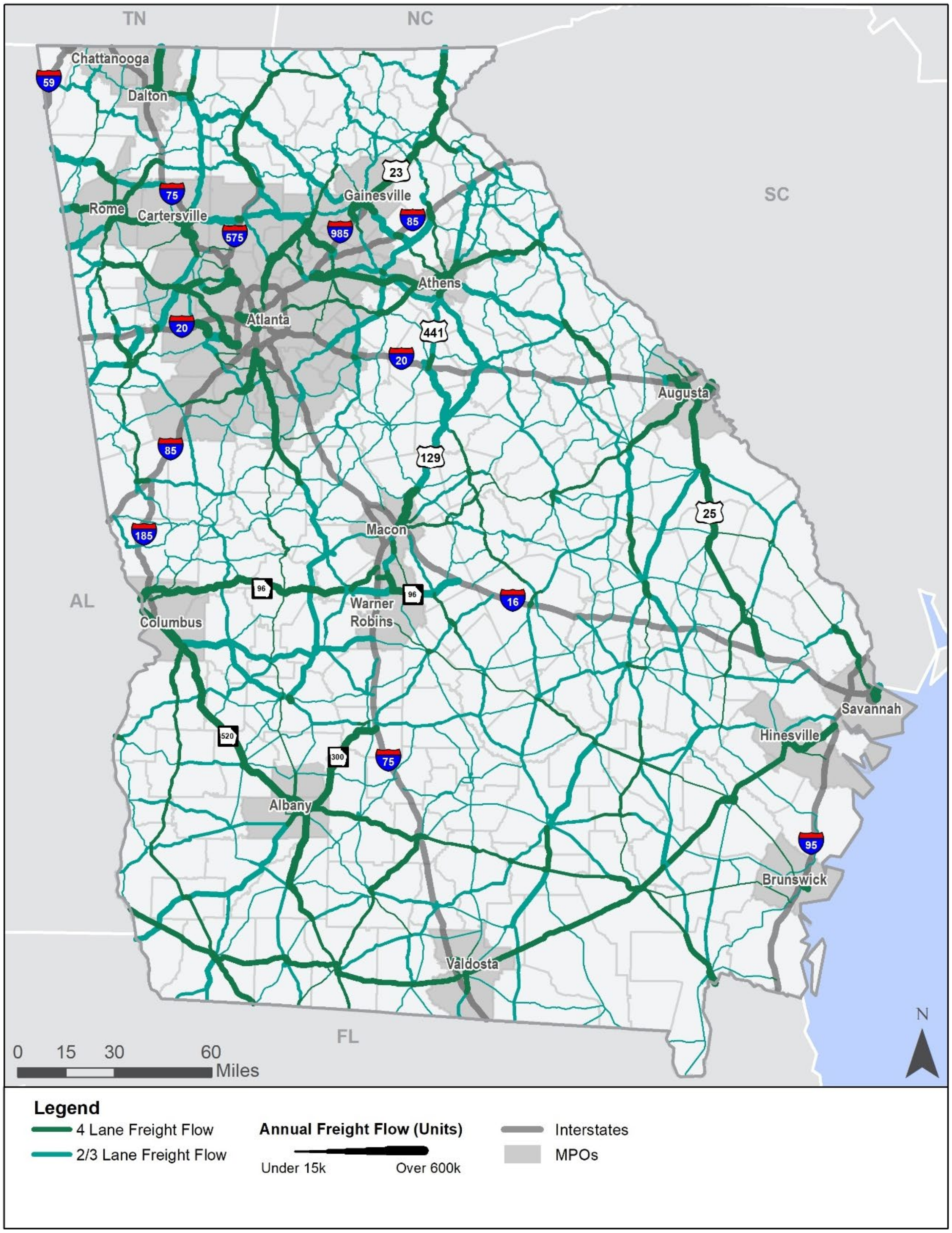
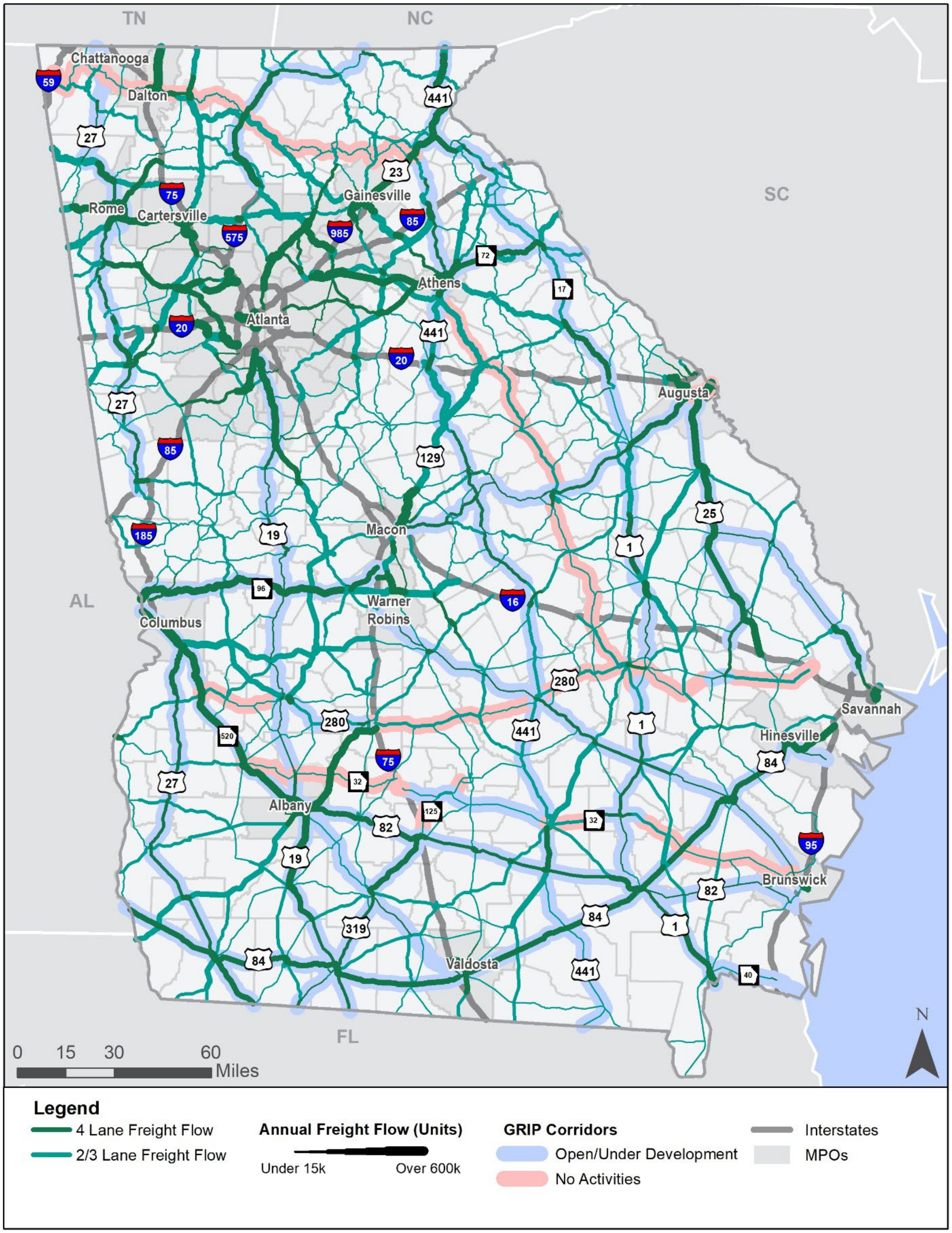


Figure 139. Freight Flows on GRIP Corridors and Other Two- and Four-Lane Roadways

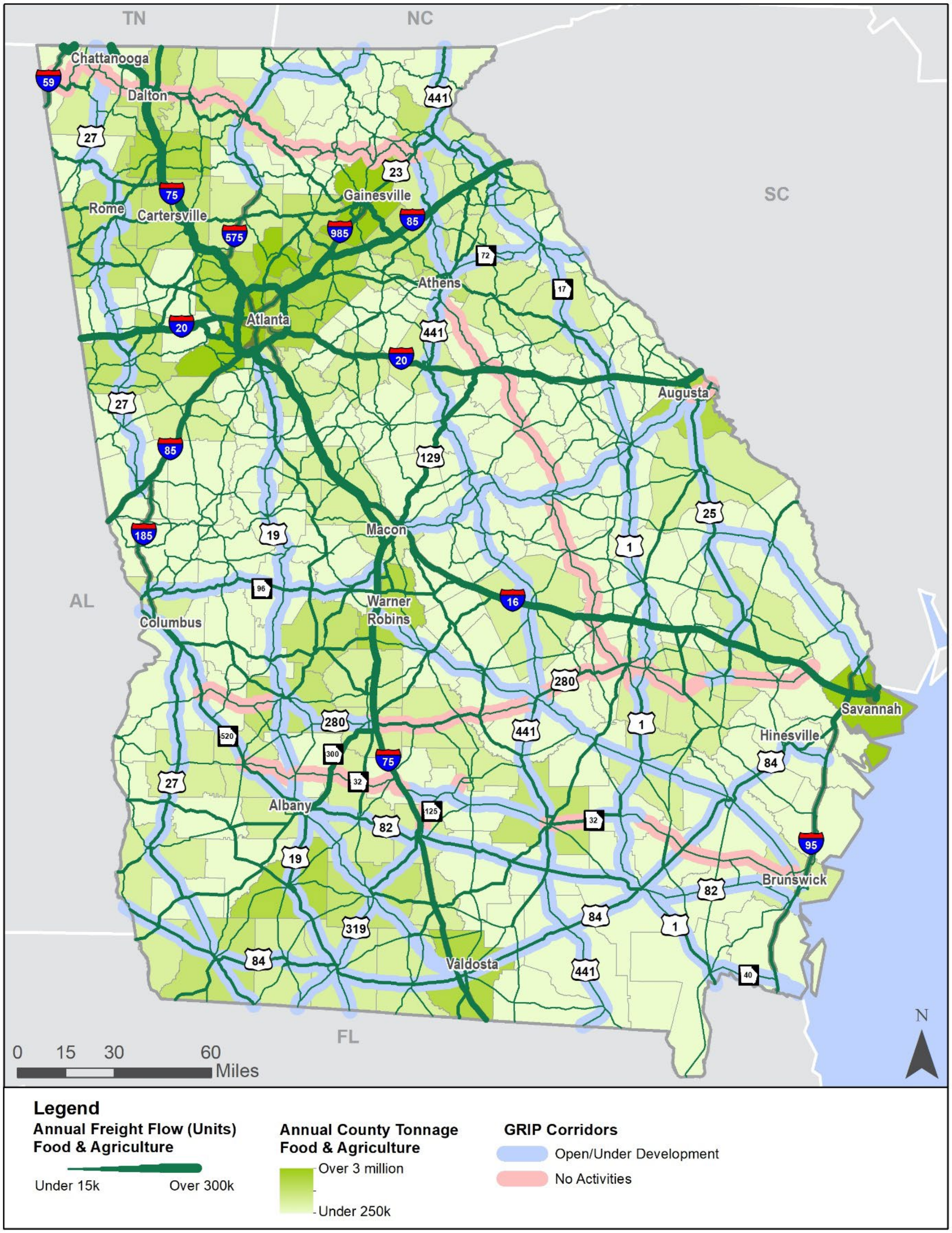


How well does the GRIP system serve rural Georgia, and particularly its prevalent food and agriculture industry? The overall and good linkage between towns in southern Georgia is evident from the analysis. Redundancy (the availability of alternative routes) is one of the strengths of the network, lending it resiliency and mitigating congestion. The system usage by food and agriculture appears in **Figure 140**, displaying the total truck tonnage from the industry by county, and the routes that the traffic travels. The highest volume that is not part of the GRIP network is the previously discussed four-lane SR 300 from Albany to I-75. While light volumes appear on a scattering of two-lane routes in rural territory, the primary conclusion is that the industry is well served: most county locations with substantial freight are connected and the entire network is in use. The most significant facility not yet completed is US 280, which affords a direct east/west connection to Savannah. One aspect of the performance on this system that is not well captured by congestion projections is how well it accommodates volume surges, which occur seasonally in the agriculture sector. Section 4.1.1 identified a number of rural bottlenecks affecting the GRIP, notably north and west of Valdosta toward Albany, which would come under seasonal stress. Once again, the redundancy of the network is an advantage in this respect, and operational solutions can help, such as signal priority and seasonal adjustments to signal timing.

Rural Network Strategy

The preliminary conclusion from this discussion is that the GRIP network – particularly US 280 – should be completed because it meets the intent of the program and builds in redundancy to the freight network, which becomes important at harvest time. The KPIs affected will be speed and cost for access to markets, as well as reliability and safety from higher grade facilities.

Figure 140. Food & Agriculture Industry Freight Flow (2019)



Alternative Route Strategy

Alternative routes to avoid Atlanta and other congested areas were considered as options to provide redundancy in the system and support freight movements that do not serve the Atlanta region but just pass through. One option is four-lane US 27, passing through Rome and the western edge of the Atlanta region to reach Florida through southern Georgia. Another option is to four-lane US 441 to the east. This route would require connection in north Georgia to reach Chattanooga. The main north-south alternatives are four-lane facilities. To be competitive with I-75, the routes would need to have controlled access or be upgraded to Interstate standards. The KPIs involved will be speed and reliability; cost may be lower but must overcome the penalty of circuity.

4.3.2. Truck Parking Strategies

When assessing truck parking needs, numerous factors were considered including truck parking locations, unauthorized truck parking locations, the location of existing and anticipated freight generating industries, existing and anticipated freight volumes, utilization at existing truck parking facilities, and the presence of ports and major intermodal facilities.

These factors were combined to identify the most prominent areas of opportunity for additional truck parking.

Table **110** depicts the location of the areas with the greatest truck parking opportunities as well as the criteria used to identify them. Orange Grid IDs indicate locations where one criterion was met. In total, there are 17 grids meeting one criterion. These grids are clustered along I-75, I-285 and I-85 northeast of Atlanta, I-20 near the Georgia/Alabama line, and near the state ports. Red indices indicate areas where more than one criterion was met. There are five grids meeting more than one criterion. These grids are concentrated in northwest Georgia, primarily within the Atlanta Metropolitan area and north along I-75.

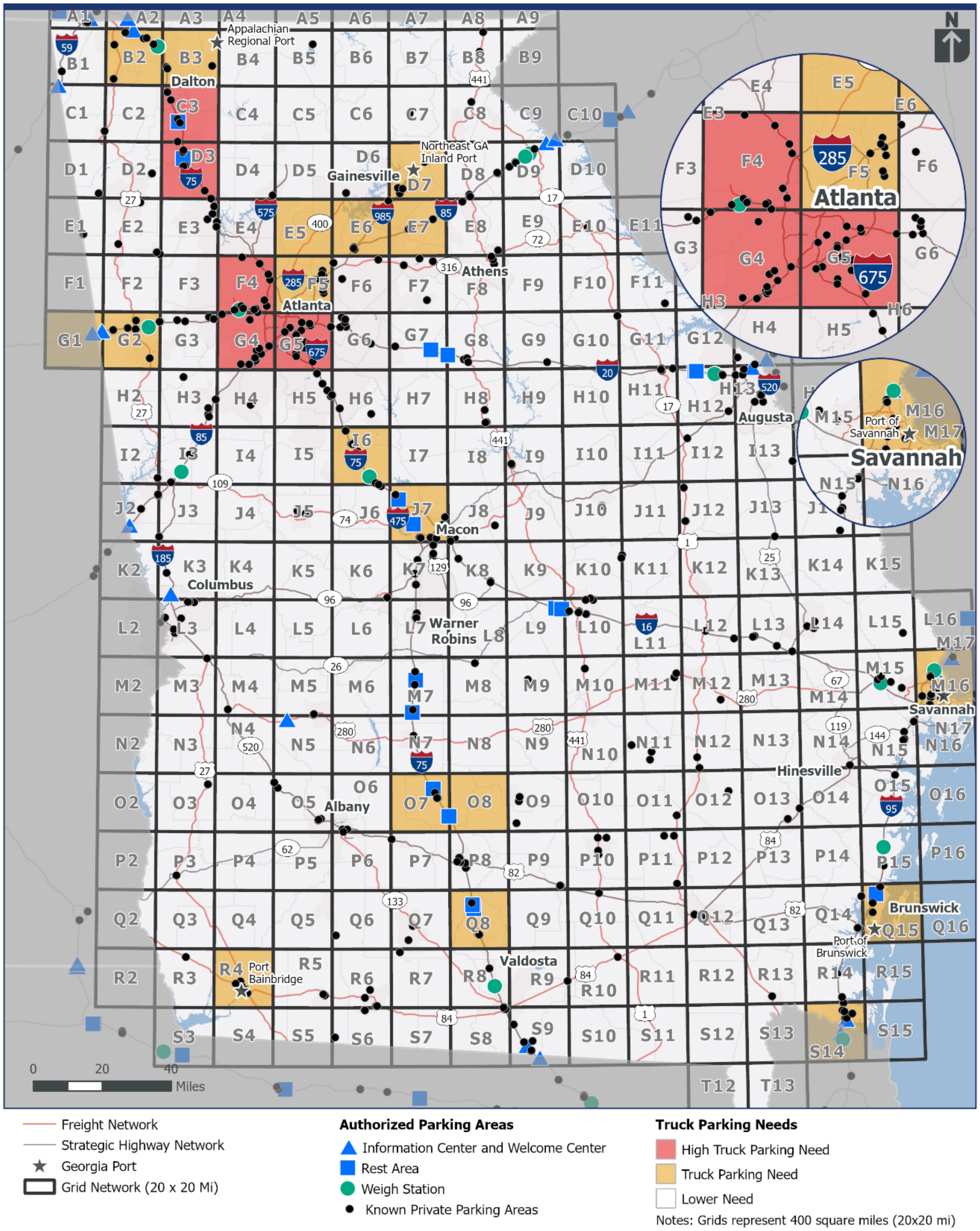
GDOT should update the truck parking needs assessment once data and findings from planned studies and programs are available. The following GDOT studies and programs were planned at the time of this update:

- GDOT Truck Parking Pilot Study (PI 0019350)
- Truck Parking scoping studies (PI 0019106 / 0019107 / 0019108) for Regions 1, 2 and 3

Table 110. Location of Truck Parking Need and Identifying Criteria

Grid ID	Overall Parking Area	Potential Unauthorized Parking	Potential Freight Development and Volume	Exceeding Public Space	Marine or Inland Port
B2	-	-	-	X	-
B3	-	-	-	-	X
C3	X	-	-	X	-
D3	-	X	-	X	-
D7	-	-	-	-	X
E5	-	-	X	-	-
E6	-	-	X	-	-
E7	-	X	-	-	-
F4	X	-	X	-	-
F5	-	-	X	-	-
G1	-	-	-	X	-
G2	-	-	-	X	-
G4	X	-	X	-	-
G5	X	-	X	-	-
I6	-	X	-	-	-
J7	-	-	-	X	-
M16	-	-	-	-	X
O7	-	-	-	X	-
Q8	-	-	-	X	-
Q15	-	-	-	-	X
R4	-	-	-	-	X
S14	-	X	-	-	-

Figure 141. Statewide Truck Parking Need Areas

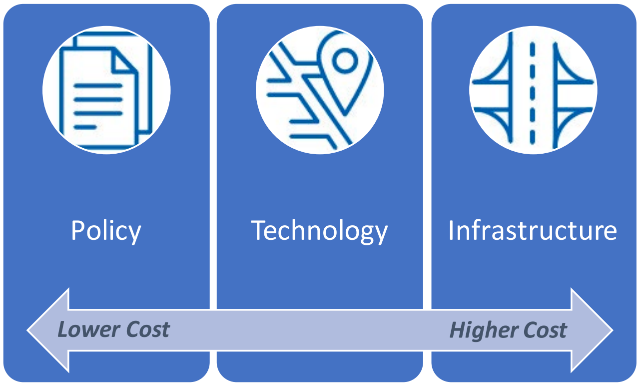


Source: ATRI (8/21 through 11/21), GEARS, MCIMS, Georgia Power, local economic development councils, GA DCA DRI website

Based on the identified needs, the following strategies, split into three (3) categories by policy, technology, and infrastructure, as presented in **Figure 142,** may be considered for implementation.

Policy Strategies

Figure 142. Potential Truck Parking Strategies



Most policy strategies, in comparison to technology and infrastructure strategies, can be implemented relatively quickly for little to no cost. Policy strategies are broader than other types of strategies and include a range of approaches in many categories. These general categories are shown in **Figure 143**. Specific policy recommendations are in Chapter 5.

Figure 143. Policy Strategy Categories

Technology Strategies

There are two main types of truck parking technologies:

A. Onsite parking detection - technologies that collect data on how many truck parking spaces are available.
    - In-ground magnetometer sensors
    - Radar and laser technology
    - Infrared sensor technology
    - Camera vision systems
    - Closed-circuit television cameras
    - License plate recognition systems
    - Inductive loops
    - Blue-band Bluetooth sensors

B. Communication technologies - technologies that communicate parking availability to drivers and other users to make informed decisions regarding their route planning.
    - Truck Parking Information Systems, Advanced Traffic Management Systems and Servers
    - Dynamic Messaging Signs
    - Applications, In-Cab Systems, and Websites

Between these two types of technologies, there are several different strategies available. GDOT's Office of Traffic Operations is currently exploring some of these strategies. GDOT's Office of Traffic Operations has received initial reports that there has been an increase in trucks parking at weigh stations due to the installation of Truck Parking Permitted Signage. The Office plans to confirm these initial reports by conducting intermittent count collections in spaces or at gates across all Georgia's public parking facilities.

Infrastructure Strategies

The majority of truck parking in Georgia is privately owned and operated. Given the limited supply and location of suitable publicly-owned undeveloped land and funding limitations, the private sector is anticipated to continue being the major provider and increase the truck parking supply while GDOT's primarily role will be to encourage construction of truck parking by the private sector. Increases in private truck parking infrastructure will largely be accomplished through implementation of the policy and technology recommendations discussed above.

The private sector also has the ability to take advantage of BIL funding through public-private partnerships (P3s) with the public sector. This provision in the law is new, so there are limited examples or pilot programs available to date. Georgia has an opportunity to become a leader in this area and should consider P3 opportunities further, including conducting interviews with the states that have initiated various levels of truck parking solutions using P3s. Examples include PennDOT and UDOT. Ongoing conversations with FHWA should also be pursued as federal guidance covering P3s and truck parking are released by FHWA.

While public infrastructure improvements will only make a small dent in improving truck parking supply in the state, GDOT recognizes the opportunities that do exist to increase public truck parking. These strategies include:

- Repurposing existing facilities
- Expanding existing facilities
- Building new facilities
- Designating emergency facilities

Trucking Parking Signage at GDOT Weigh Stations

GDOT has expanded existing facilities by removing restrictions preventing trucks from parking at weigh stations. It has also programmed three scoping projects in three regions identified as having the greatest need.

GDOT has also assessed its inventory of existing and abandoned facilities including visitor/ information centers, rest areas, weigh stations as well as other state-owned land and right-of-way that could be used to expand the supply of public truck parking supply.

4.3.3. Port Strategies

The Georgia Port Authority operates sea terminals in Garden City, Savannah and Brunswick, and currently one inland port in Chatsworth, GA. It has also operated pop up container storage yards in other locations such as Statesboro, GA and Charlotte, NC, in order to accommodate the needs of shippers who didn't have enough of their space to be able to do so.

GPA has mentioned a range of expansion plans impacting the sea and inland ports, over a 3-to-10-year timeframe. These plans include:

- Expansion of the Garden City terminal by
  - Straightening out Berths 1-3 (in progress) so that newer and post Panamax (15 thousand TEUs) vessels can be handled simultaneously
  - Development of new property on the west side of the Garden City terminal, with relocation of the transload facility operated on dock by NFI over there, so that more containers can be stored and handled closer to the waterfront
  - Development of 150 acres to the West of the Savannah River and contiguous to the Garden City Terminal, which was acquired in 2019. The additional acreage would allow port users who need a longer dwell time, to do so without creating container yard operation issues for GPA
- GPA also plans to eventually build a new terminal on its property on Hutchison Island, that will be capable of handling the largest container ships in the world
- Ocean terminal capacity and infrastructure is being upgraded to handle growing volumes of containers there

- Brunswick plans are based on expanding automobile roll on-roll off operations in anticipation of the Hyundai plant to be built on I-16
- Future inland ports potentially serving northeast and western Georgia

It is important to note that the port just completed the Mason Mega rail project which will allow CSX and Norfolk Southern to build several unit trains per day that could terminate in Chicago.

The overall capex plan was recently mentioned to be $3.5 billion. To partly fund these plans the port has already issued about $500 billion of bonds.

The current height of the Talmadge Bridge over the Savannah River provides air draft challenges for most of the ships of 18,000 TEU and above carrying capacity. With the Savannah Harbor Expansion Project (SHEP), super-sized freighters will be able to be accommodated in the Savannah River but potentially not by the Talmadge Bridge. GDOT is studying various options to resolve this constraint to allow for larger vessels to reach the Port of Savannah as anticipated to manage the growth in freight traffic and maintain a competitive advantage.

Within 10 years, GPA may be able to handle over 11 million TEUs. Its growth rate has been higher than Los Angeles, Long Beach and New York-New Jersey ports'. It is quite possible that within the next 10 years Savannah could become the second largest container port gateway. If it does, it will be because of the ports' continued investments since 1958 on making sure it offers the best cost, capacity and consistency of service. Mason Mega rail and inland ports are important investments to keep road traffic fluid and allow the port to serve more US geography to take up overflow from other ports that have been able to expand their infrastructure as much. The KPIs affected are cost, reliability speed and risk.

4.3.4. Rail Strategies

Chapter 2 of this plan details freight flow projections by mode and by commodity group. Nationally, the decline of coal is impacting rail traffic. However, in Georgia this trend is offset by a greater increase in intermodal, fueled by growth at Georgia's ports. Inbound rail flows by value are projected to grow at a greater rate than by tonnage, due again to a shift from coal to other commodities, such as mixed freight, vehicles, plastics, and chemicals.

By 2050, the amount of Georgia-based freight is forecasted to nearly double; trucking is anticipated to absorb 86 percent of that change and rail 13 percent if the status quo is maintained, further compounding congestion on key freight corridors. Certain commodities and trip types observed in Georgia present opportunities to shift future growth to rail. Top growth industries that are compatible with rail transportation include: manufacturing, automotive, food and agriculture, and construction.

Rail transportation saves industries an average 23 percent in shipping costs compared to truck. The following presents potential strategies to strengthen the state's rail network and offer competitive options for shippers.

Grant Programs

The BIL presents opportunities for private railroads to participate in federal grant programs on projects that benefit the movement of freight. Select states also offer grant programs to target corridor preservation, economic development, safety, or track upgrade needs. In some situations, state programs take on improvements that serve a public benefit but are not necessarily profitable enough for the private sector. State programs can also be used to incentivize private investment or to leverage additional federal investment. In Georgia, the state has historically only made direct investments in state-owned shortlines, as the state constitution prohibits spending public funds on private projects.

Rail Network Improvements

Strategies to bolster the capacity and resiliency of the state rail network would improve the efficiency of rail from both a time and cost perspective.

Network Connectivity

Completing gaps in the network where rail lines have been disused and are out of repair can provide new access for industries and better resiliency for the overall network. For example, the Heart of Georgia (HOG) railroad between Vidalia and Midville would connect agricultural and manufacturing businesses in Central Georgia to the Class 1 network and the Port of Savannah. Reopening the CSX route from Athens to Union Point would offer an alternate route on the east side of Atlanta. Likewise, the Norfolk Southern (NS) route from Senoia to Griffin and McDonough would complete a western route between Tennessee and Savannah bypassing Atlanta. Additionally, the CSX section between Albany and Oglethorpe would provide better access for industry in Albany and would offer potential Class 1 connections to multiple intersecting shortlines.

Improving network connectivity can also mean opening transfer opportunities between individual railroad owners. For example, the Georgia Central Railroad traverses east-west between Macon and Savannah, roughly parallel to I-16, stopping just short of the Port of Savannah. Accessing CSX tracks for the last mile to the port would open new opportunities for rail customers and may require incentives to make the arrangement viable for both railroads.

Network Capacity

The majority of the rail network in Georgia is single track, with a few exceptions of track within metro Atlanta. Single tracking limits the industry’s growth potential, particularly with longer trains, which is the trend. Double track and siding improvements will benefit high volume corridors that are currently constrained and expected to continue growing. While double tracking may not be cost effective over long-distance routes, longer sidings at regular intervals allow trains to pass one another more efficiently – and with trains now reaching two miles in length, extended sidings are becoming essential. These solutions improve reliability for not only the mainline railroad but other connecting shortlines.

Inland Port and Short-Haul Strategies

Inland ports are truck-rail intermodal facilities that supplement seaport functions at remote locations and collect freight onto rail traveling to the seaport and vice versa. The Georgia Ports Authority (GPA) uses inland ports to improve intermodal rail service between Savannah and inland markets. Inland ports are advantageous to shippers, as they shorten the truck trip between the shipper location and the port. They can also be advantageous to local jurisdictions as they attract new industries, jobs, and warehouse and distribution development and potentially relieve highway congestion.

The Appalachian Regional Port in Murray County opened in 2018 and offers a 388-mile rail route between northwest Georgia near I-75 to the Garden City Terminal. Customers are able to clear customs at the inland port instead of in Savannah and they are able to avoid the risk of congestion on metro Atlanta Interstates. The location is strategically positioned near the epicenter of Georgia's carpet and flooring industry as well as automobile and tire manufacturers. GPA has announced plans to develop the Northeast Georgia inland port in Hall County with direct access to I-985. Rail service times are anticipated to be faster than those between Savannah and the Appalachian Regional port because of shorter mileage between the two. The Northeast Georgia inland port will benefit poultry producers and manufacturers with a new competitive option for shipping and, like its counterpart in Murray County, avoid the risk of truck delays in metro Atlanta.

In order to be successful, new inland port locations should be strategically located to capture an adequate freight volume, balance outbound and inbound containers, and provide adequate highway and rail access. The distance to the seaport should be far enough to warrant a two-day truck roundtrip. Successful inland ports are generally made possible by partnerships among local leaders, port authorities, and private industry. Public investments, like the on-dock rail service at the Port of Savannah, make short-haul intermodal services financially feasible for ports and shippers. As congestion and associated truck costs are anticipated to grow in the future, the minimum viable distance for rail trips may decline, making short-haul rail service and inland ports more attractive.

Shortline Strategy

While shortline railroads generally carry less volume and produce less revenue than the Class 1 railroads, they play a critical first-last mile role and provide an opportunity for Georgia's rural industries and farms to participate in the global marketplace with access to the national network. The following shortline strategies are aimed at improving access and growing small businesses.

Capacity and Speed Upgrades

Improving the condition of track, rails, and bridges to accommodate the industry standard 286,000-lb railcars and 25 mph operating speeds will improve the efficiency of shortline rail travel from both a cost and time perspective. Eliminating weight restrictions makes rail a viable option for more customers that generally move heavier loads and utilize shortlines to connect to Class 1 lines for longer trips.

Business Development

Efforts to attract new rail customers to locate on shortlines could include marketing strategies, industrial park development at the local level, and coordination with the Georgia Department of Economic Development's (GDEcD) GRAD site program to promote the availability of rail access. Sidings and spurs developed in partnership between railroads and local economic development authorities can attract new rail-oriented businesses and offer new options for existing businesses. For example, the Walker County Development Authority, in partnership with the GDEcD and GDOT, was able to attract the $50M Audia Plastics development to the Walker County Industrial Park by subsidizing the construction of a rail spur on the CCKY shortline. Today, Audia is one of CCKY's prime rail customers in Georgia and produces plastics products for building construction, automotive, and consumer products.

4.3.5. Air strategies

The principal air cargo operations in Georgia are at Hartsfield Jackson Atlanta International Airport (HJAIA). The integrated air cargo carriers UPS, FedEx and Amazon Air have their main facilities there, although UPS has a presence in Albany and FedEx in Savannah. However, it is the passenger hub operations of Delta that give HJAIA global significance. International air cargo travels substantially in the bellies of widebody aircraft on overseas routes, whereas domestic air freight largely relies on integrated carriers. With direct flights to Europe, Asia, the Middle East and Latin America, Delta is the main source of overseas capacity. Cargo is trucked in Road Feeder Service (RFS) from as far away as Virginia to take advantage of overseas schedules, and the majority of the international freight reportedly comes from outside Atlanta. RFS connections are common for the top air hubs, with the result that HJAIA competes with Miami, Chicago O'Hare, and JFK in New York. In addition, HJAIA is the hub for Delta's company material - the supplies ranging from food and utensils for onboard services to maintenance parts for technical operations – without which planes cannot fly. These are purchased in bulk and depend on RFS to reach Atlanta.

HJAIA has three main cargo areas, and there are plans for a fourth on a 40-acre site. Autonomous truck operations are being explored for use within the confines of the cargo districts. The HJAIA has a Cargo Community System, which is a way for multiple parties in a logistics operation to improve efficiency and throughput via better visibility into cargo location, arrival times, sequencing and queues. However, the system is voluntary and reportedly undersubscribed, to the extent that urgent shipments may be kept waiting because the less urgent are tying up dock space. Marine ports with multiple terminal operators (unlike Savannah) experience similar problems of coordination. Efficient throughput has clear implications for capacity.

The status of HJAIA for international service is important to Georgia's vision to be the global gateway of choice. However, there is a stakeholder perspective that HJAIA cannot be a global cargo hub without significant international freighter operations. Freighters are dedicated cargo aircraft (familiar from the branded airplanes of the integrated carriers) that fly overseas and bring a substantial boost to carrying capacity: by one estimate, ten freighters carry the cargo equivalent of 150 transpacific passenger flights. Freighters for example are vital to Miami's market position: according to 2020 FAA data, Miami imported by freighter nine times the air cargo volume as HJAIA, largely from Latin America, and is the leading gateway for perishables from that source. Overseas freight can only travel by ship or air and development of freighter service would contribute to Georgia's vision; however, this is not within the direct purview of GDOT.

Unmanned aerial vehicles (UAVs, or drones) are a relatively new entrant in air operations and are not airport-based. Their carrying capacity and range (roughly five pounds and fifteen miles round trip) thus far has limited their utilization, although both are increasing. UPS is working with truck-launched drones as a way to improve delivery efficiency in rural areas: the truck makes delivery at multiple stops along the road in the usual way, then sends the drone to deliver to remote locations such as distant farms. However, heavier cargo craft are coming into play, and are part of the larger development of Urban Air Mobility. This term refers mainly to passenger air taxis with increasing degrees of automation that provide a route around congestion without requiring an airfield. One cargo version being tested is an electric-powered Vertical Takeoff and Landing (VTOL) aircraft with a carrying capacity of 1,400 pounds and a 250-mile range; the VTOL capability enables operation in dense urban areas. UPS has placed a small trial order of these vehicles, pending FAA approval for operation in 2024.

Four strategies emerge from the foregoing discussion:

- **Improve road conditions on RFS routes.** These are chiefly bottlenecks on Interstates leading to HJAIA, and responsibility would fall to GDOT. The KPIs affected are reliability, speed and cost for a mode where time is of the essence.
- **Raise participation in the cargo community system**. Responsibility falls to the City of Atlanta Department of Aviation, with KPI payoffs in terms of cost and reliability. This is not a new investment, although the Department of Aviation may seek methods to further incentivize participation.
- **Develop international freighter service**. Responsibility lies with the marketing arm of the Atlanta Department of Aviation, but it has trade mission overtones with which the State may choose to assist. While there is no immediate investment, the successful attraction of new services may require construction or modification of cargo handling facilities for the carrier, which would catalyze introduction of service. KPIs affected are speed and reliability in the new service lanes.
- **Monitor development of unmanned aerial vehicles**. This is an evolving area with FAA oversight, and operations as well as vehicles are still being created. Monitoring may be undertaken by other parties, but GDOT should do so as well. The forms of investment that may be required are still to be determined but are likely to be categorized as innovation. KPIs also are uncertain but cost and speed would be important motivations.

4.3.6. Technology Strategies

Understanding the emerging freight technologies and their impact to safety, operations, and ultimately the economy of Georgia is key to advancing innovative ideas to support freight. GDOT will need to stay abreast of the latest technological innovations if they are to keep pace with modern supply chain and freight movement needs. It must identify and capture information about emerging technologies and trends and to deliver it in a usable form to decision makers, which is a best practice approach for building institutional knowledge on emerging and potentially disruptive technologies.

Innovation and collaboration go hand in hand and must include both private and public entities, encompassing their perspectives, interests, and input. Public agencies' missions include providing transportation infrastructure, promoting safety, and maximizing the throughput and productivity of the transportation networks. In turn, private sector firms rely on these publicly provided goods and services to increase supply chain efficiency and productivity to deliver their products safely, securely, and on time to demanding customers. This interplay of private and public sector decision making is growing in importance as the world becomes more connected and dependent on standardized, complex technologies.

Programs supporting these technologies fit in the category of innovation. KPIs affected are speed, cost and reliability.

4.3.7. Freight Generators Strategies

Georgia-based freight flows account for the vast majority of total freight flows in volume and in value, both in the present and the future. Additionally, outbound freight flows will grow by 86 percent by tonnage and by 114 percent by value in the next three decades. Thus, it is critical to optimize the transportation performance around freight generators, such as Developments of Regional Impacts (DRIs), Georgia Ready for Accelerated Development (GRAD) Sites, intermodal facilities, seaports, and inland ports across the state. The following list of strategies utilizes readily available tools that were developed in previous studies by the GDOT Office of Planning as well as recommendations for an optimization framework:

a. **Prioritize transportation investment around high-scoring GRAD sites using the Screening Tool**

The GRAD Site Screening Tools offers a multitude of qualitative and quantitative criteria such as geographic location, traffic and infrastructural conditions on adjacent roadways, proximity to primary freight generators (e.g., airports, 4-lane arterials, seaports, and inland ports, etc.), as well as existing and planned projects by GDOT in the area *(see more details in the GRAD Site Analysis Report, GDOT, June 2021*). The Screening Tool was developed in June 2021 and will need continuing maintenance, including regularly updating the GRAD Sites Transportation Database and revising scoring criteria based on current transportation needs and policies. It is recommended that the update and revision be done annually to ensure decision making is based on the most up-to-date data. Focusing investments around high-scoring GRAD sites ensures that the same amount of dollars will be spent on the maximum amount of freight volumes, effectively bringing down the average cost of investment over the next decades.

b. **Regularly update and utilize truck parking technologies and data around freight originators**

Truck parking shortage is a universal challenge in the US. The fast growth of freight flows in Georgia has made it even more urgent to strategize existing and anticipated truck parking. The end goals are (1) to ensure safety and mobility associated with the freight movements, (2) to reduce the average cost from maintenance, wait time and fuel spent in searching for parking, and (3) to boost Georgia's ability to attract and retain businesses. While the existing freight-intensive land uses and density are largely found in the metropolitan areas, most notably in Atlanta and Savannah, there is much potential to expand truck parking availability around freight generators, such as DRIs, GRAD sites, and other industrial sites where the local land uses allow. This expansion must be done with strategies for technology (i.e., onsite parking detection and communication), infrastructure strategies (i.e., parking capacity), and policies for funding, design, and stakeholder partnerships.

c. Periodically Update the designation of the Georgia State Freight Network

The designation of the State Freight Network (SFN) is made by the Director of Planning with the approval of the State Transportation Board. It includes all the Interstates in Georgia and partially overlaps with other defined networks, such as the National Highway Freight Network, the Strategic Highway Network, and the Governor's Road Improvement Program (GRIP) Network. The most recent revision to the SFN was in 2016. Since then, Georgia has experienced significant growth. From 2016 to 2021, the state had a compound annual growth rate in Gross Domestic Product (GDP) of 4.5 percent for all industry totals. In the last quarter of 2021, Georgia's real GDP grew at an annual rate of 7.5 percent, outpacing the national rate at 6.9 percent[135]. Such growth has translated to and has been supported by the growth in freight movements, much of them on the SFN that connects the freight generators across the state.

4.3.8. Strategies by KPI

The following table provides a summary of strategies identified to meet the challenges for freight mobility and areas of opportunities to continue to improve the freight network and conditions for freight services throughout Georgia. The identified strategies provide the framework for the development of programs and investment presented in Chapter 5. The summary below connects the strategies with Key Performance Indicator categories that are used in Chapter 5 with more detail on specific metrics for each KPI.

[135] Bureau of Economic Analysis

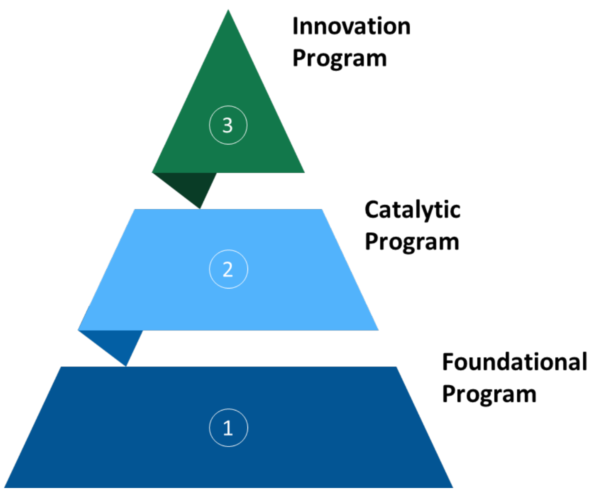
Table 111. Summary of Strategies and Effect on KPIs

Strategy	Key Performance Indicator				
	Reliability	Speed	Cost	Safety	Risk
Interchange improvements	X	X	X	X	
Work zone technology	X		X	X	
Crash prevention			X	X	
Crash clearance	X		X	X	
Access management		X	X		
Roadway capacity		X	X	X	
Truck parking availability information system	X	X	X	X	X
Commercial vehicle lanes	X	X	X	X	
Rural freight roadway network	X	X	X	X	
Atlanta alternative routing	X	X	X		
Improve road conditions on RFS routes	X	X	X		
Raise participation in the cargo community system	X		X		
Develop international freighter service	X		X		
Monitor development of unmanned aerial vehicles		X	X		
Grant programs for rail preservation, development, and upgrades	X	X	X	X	
Rail network connectivity improvements		X	X		
Rail network capacity improvements	X	X	X		
Strategically located inland ports	X	X	X		X
Shortline capacity and speed upgrades	X	X	X		
Freight technological innovation	X		X	X	
Prioritize transportation investment around high-scoring GRAD sites			X		

Strategy	Key Performance Indicator				
	Reliability	Speed	Cost	Safety	Risk
Update and utilize truck parking technologies and data around freight originators			X	X	
Periodically review the Georgia State Freight Network	X	X	X	X	X

5. Georgia's Freight Improvement Program

The GDOT Statewide Strategic Transportation Plan (SSTP), approved in 2021 and looking ahead to 2050, established three components of statewide investment around which transportation strategies were structured. The three components constitute the FCI framework introduced in Chapter 1: Foundational investments to take care of the existing system, Catalytic investments to grow the state economy, and Innovation investments to prepare for the transportation demands of the future. The SSTP does not identify specific projects for investment; instead, it defines strategies to support investment choices as they reach decision. The Georgia Freight Plan is a major step forward in the implementation of the SSTP. It defines specific project investments over the next eight years, applying $427 million of anticipated federal NHFP funds in the fiscally constrained Freight Investment Plan (FIP) presented in this chapter. This plan proposes strategies for meeting freight demand through 2050. Similar to the SSTP, these strategies for improvement are structured around the FCI framework. While specific projects in addition to the Freight Investment Plan are not identified, the strategies for improvement defined in Chapter 4 are organized into programs that will run, grow, and develop the freight system in Georgia for the shippers and carriers that depend on it. The programs consider alternative and multimodal corridors, capitalize on technology, respond to market trends, and seek overall to maintain and strengthen the competitive performance of Georgia.



This chapter opens with the performance measures employed in this Plan to quantify and forecast the critical characteristics of freight service in the state. These measures are the Key Performance Indicators or KPIs introduced in Chapter 1, in alignment with the Governor's objectives for supporting business and commerce and defining performance in the same terms industry uses to manage and ensure freight service for their operations and customers. KPIs are the principal target for the FCI programs of freight improvement, and they lead to safer roads, less air pollution, and lower costs to consumers for critical goods. The method of investment analysis for this Plan is described next, capturing KPIs in a network modeling framework where the effects of project investments can be estimated. Descriptions of the FCI improvement programs follow, leading into plan considerations covering military freight, environmental factors and risks, and resiliency and redundancy in the system. The final sections of the chapter summarize program and policy actions, integration with other state plans, and opportunities for multi-state collaboration.

5.1. Performance Measurement: Key Performance Indicators (KPIs)

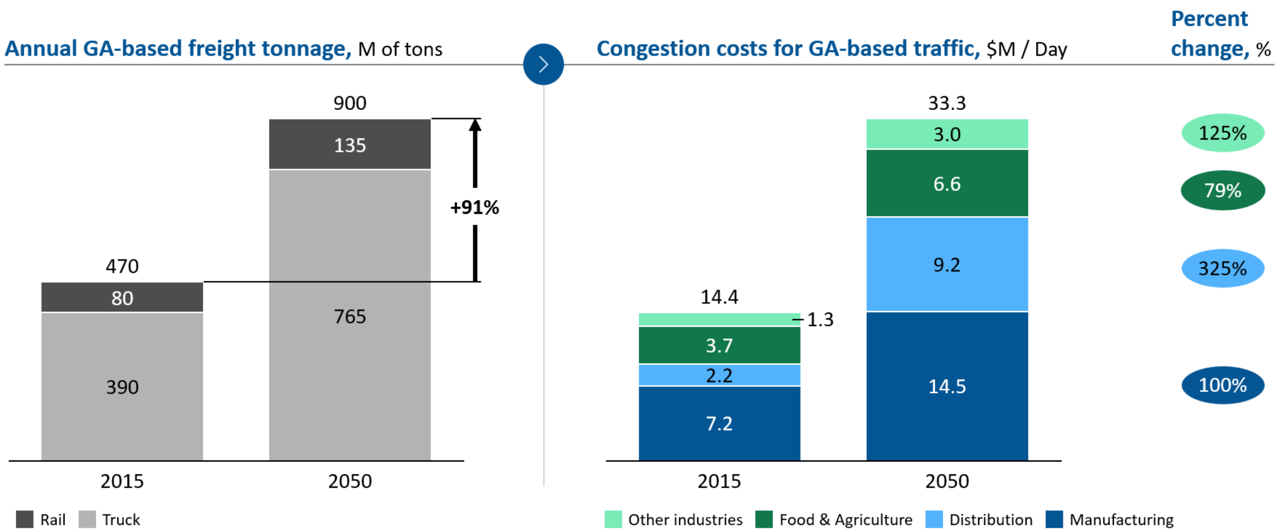
The attraction and retention of freight-supported businesses and the livelihoods they provide depends on Georgia's competitive performance in freight and logistics. The crucial dimensions of performance and the performance measures adopted in this Plan are five business-driven KPIs. Georgia's stature as a leading destination for business and their continued growth requires a carefully planned deployment of limited infrastructure resources. Therefore, GDOT's freight planning effort builds an improvement program for the state based on KPIs most important to business operations and expansion as well as economic development. KPI metrics associated with this effort are safety, reliability, speed, cost, and risk; their correspondence to strategies for performance improvement was presented in Chapter 4.

Figure 144 indicates the near-doubling of Georgia-based freight tonnage, with most of the demand on roadways as well as congestion costs, which more than double. Georgia's manufacturing and food and agriculture sectors bear about two-thirds of the costs in 2050, while costs in the distribution sector climb the fastest and account for most of the remaining third.

TRUCK TRAVEL TIME RELIABILITY INDEX

Like all states, GDOT provides the federal Truck Travel Time Reliability (TTTR) index as its freight movement performance measure in its System Performance Report. The TTTR is the ratio of the 95th percentile truck travel time to the 50th percentile, calculated annually for Interstate highways and indexed through a formula that recognizes times of day and is weighted for distance. The ratio itself is similar to the reliability KPI used in this Plan. Georgia's TTTR was stable from 2017 to 2019 at an index value around 1.44, well below (indicating more reliable than) target values above 1.6. Georgia's TTTR actually improved to 1.37 in 2020 (the latest year released), but 2020 was the pandemic year when automobile traffic fell off and trucks often had the road to themselves.

Figure 144. Forecast Growth in Freight Traffic & Costs



Source: GSTDM, S&P Global Transearch

The situation just described is the No Build scenario[136] used for investment analysis in this chapter. To produce it, the Georgia State Travel Demand Model (GSTDM) was employed and its outputs processed to combine KPIs in safety, reliability, speed and cost with traffic forecasts and industrial segmentation drawn from Transearch.[137] All of this was routed on the state roadway network and dynamic interaction with projected passenger traffic captured. The effect is that the growth, industry composition, and performance issues for freight traffic presented in previous chapters are incorporated, performance is projected into the future, and passenger activity is accounted for. The latter obviously is important because automobiles are the main component of congestion, most freight investment in highways benefits all traffic, and automobiles will divert onto highways upgraded for freight and thereby diminish the performance benefits.

The projects reviewed and those ultimately selected for this Plan have been evaluated within the GSTDM environment. Modeling considerations for the translation of KPIs into plan recommendations are summarized in **Figure 145**.

[136] No Build is defined as maintaining the current network as is along with existing funded projects, with no new additions as part of the freight plan

[137] The base year in GSTDM reflects 2015 Transearch, not the new 2019 Transearch cited elsewhere in the Plan. However, the GSTDM 2050 freight volumes were adjusted to match the new Transearch forecast. Since the key questions for investment concern future conditions and the magnitude of change they entail over three decades, the differences in base year are immaterial.

Figure 145. Definition of Modeling KPIs

KPIs	Business definitions	Infrastructure metrics
A **Reliability**	Meeting a committed delivery/pick-up window	Reduction in hours spent in non-recurring traffic
B **Speed**	Door-to-door travel time	Increases in average truck speed
C **Cost**	Shipping cost / freight spend	Impact on congestion costs
D **Risk**	Potential for interference in operations, cost structure, market, or resource access	Increase availability of alternate routes and shift to rail
E **Safety/ security**	Mitigated harm for people, products, and systems	Social cost of safety as an annual cost and reduction in annual truck crashes

The KPI translation makes it possible to evaluate investment from the business perspective in quantitative terms. Moreover, because congestion costs reflect reliability and speed, and the social costs of safety can be taken as a proxy for business costs (such as insurance, loss and damage, and litigation), the investment benefits for four out of five KPIs (excluding risk) can be quantified in dollars. This enables a freight ratio of KPI benefits to project costs to be estimated across investment alternatives, where the benefits are reductions in KPI costs to business compared to No Build. The KPI metrics were modeled to (1) measure the performance of the statewide transportation system in moving goods and (2) understand their impacts across the state's freight network. Modeling produced a prioritized 8-year project list based on benefit-cost results for Georgia's freight industries. **Figure 145** previously defined the application of these metrics relative to freight network users in the modeled transportation network.

Project selection has been guided by feedback from local and state officials, the business community, and other stakeholders. Beyond impact to KPIs and benefit-cost ratios, projects were considered within the broader context of existing and emerging freight trends in the state, risks and vulnerabilities in the freight network, and the unique needs of critical industries. This allows for the prioritization of projects that may have lower KPI impacts or benefit-cost ratios but do reflect GDOT priorities that are not captured by these measures. Finally, this is a freight plan and it is measuring freight effects. While the benefits of investments for passenger traffic may be large and certainly matter to GDOT, they are beyond the scope of this Plan.

5.2. Application of KPIs

Traditional transportation KPIs were translated into business KPIs to test the impact of various investments on these critical metrics. Georgia's Freight Plan uses these KPIs to understand how they are currently performing across the network, how the performance of those KPIs will change over time as freight on the network continues to grow, and how different investments will impact the KPIs.

5.2.1. Safety

Safety metrics are based on the social cost of crashes, which is calculated in dollars per VMT. Crashes, which result in thousands of lives lost in Georgia each year, impact daily freight movement by introducing delay and unreliability onto normally free-flowing roadways. Non-recurring congestion caused by crashes also produce an increased delay on roadway corridors, resulting in unreliability for businesses that depend on inbound arrival of supply and outbound product shipments. GDOT can develop projects and technologies to evaluate the specific circumstances for crash occurrences at an intersection or along a corridor to mitigate overall crash frequencies, save lives, and improve free-flow operating conditions.

5.2.2. Reliability

Reliability intends to capture the degradation to predictable trips, including non-recurring traffic. This is quantified using the Vehicle Hours of Unreliability, which is defined as the difference between 95th percentile travel times and the average travel times (see bottleneck section for a more detailed definition). The Vehicle Hours of Unreliability represent the additional hours of buffer that shippers and carriers need to build into their delivery plans to ensure 95 percent on time performance. Reliability was modeled as a function of the free flow and congested speeds coming out of the statewide model, using relationships specified in the literature.

5.2.3. Speed

Speed captures the velocity of the freight on average over the journey with metrics that are based on the average speed in miles per hour (MPH). Speed metrics were modeled using state's travel demand model, which outputs the free flow speed and average congested speed throughout the roadway network. The model network has a base of year of 2015, with data on truck movements populated to reflect 2019 conditions and forecast horizon of 2050. The average speed on the modeled network shows where congestion bottlenecks occur so planners can identify projects to reduce bottlenecks and increase average speeds. Similarly, the total volume of truck traffic on a particular roadway can assist planners in determining how important that corridor is to freight transportation. The modeled roadway network measures volume in annual vehicle miles traveled (VMT). The model's annual VMT outputs are converted to daily VMT. To do so, annual VMT is divided by the freight industry's 295 working days in a year. The calculated daily speed and volume measurements help inform GDOT and businesses where roadway networks operate under free flow, congested, and safe traffic conditions.

5.2.4. Cost

Cost metrics were calculated by monetizing recurring congestion and unreliability using factors from NCHRP Research Report 925. These factors consider the average costs of operating trucks during congestion, such as fuel consumption, wages, etc., and the costs of unreliability on the trucking companies and shippers. The monetization factors from the NCHRP report were updated to reflect driver and diesel costs in 2021. The congestion costs accrued on specific roadway links were divided by the length of the links to determine the costs per roadway mile. The total congestion costs statewide were also tracked as a KPI. Transportation planners use cost information to better estimate the benefits a particular project will provide over the costs of implementing those projects. Businesses can compare delay and unreliability costs with traffic congestion impacts to determine their business costs and profitability.

5.2.5. Risk

Risks are of different types and can be difficult to measure uniformly. Operational risk in freight transportation and supply chain logistics is concerned with service assurance, execution and resource supply within short time frames. Operational risks are associated with and measured by the KPIs discussed above: reliability, safety, speed and cost. The larger risks facing supply chains are disruptive, systemic, and of greater scale and duration: failures across tiers of suppliers, political and social issues in regions and countries, regulatory delays, illness and work stoppages affecting labor, rapid market and technology shifts, cyber attacks, and severe weather events are prominent ones. Breakdowns in any of the above can cascade through supply chains, as was seen during the global COVID-19 pandemic; multi, seaport labor disruptions, blockages at global canal passages, etc. Multi-factor metrics to capture this are not available but are being developed in federal programs such as FLOW, cited in Chapter 4.

Risks from weather events have been compiled by federal and other sources, and Georgia's exposure to them in terms of geography and infrastructure is explored later in this chapter. Route and modal redundancy can amplify or mitigate risk and thus are important to measure; analytics to do so also appear later in this chapter. The magnitude of some other risks can be inferred through the responsive strategies. Diversification of location is one example. Georgia does not control this directly yet has benefitted through growth at the Port of Savannah and in domestic manufacturing, and it influences location through competitive KPI outcomes and attractiveness to business. The relevant metrics effectively are about growth and market share in these areas.

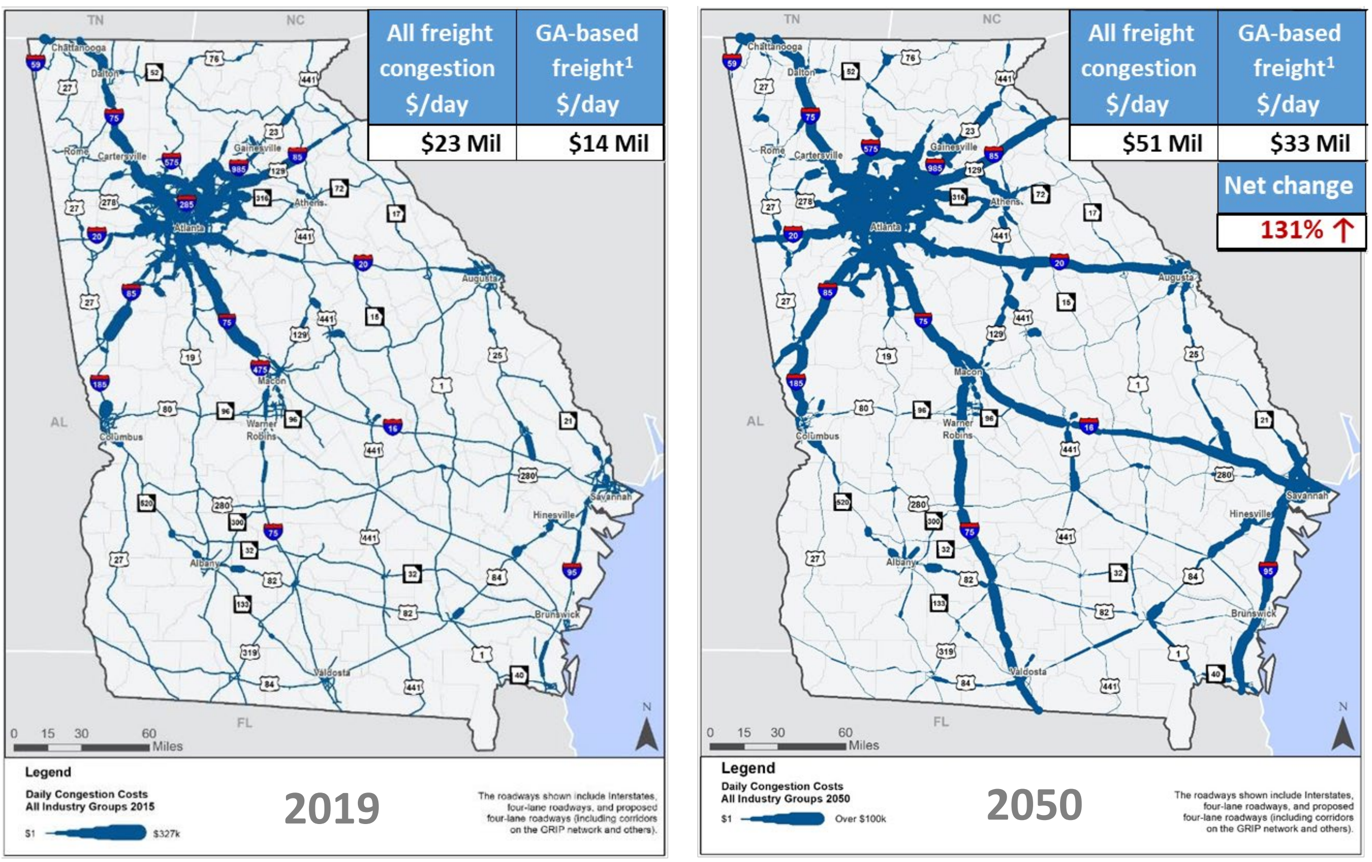
5.2.6. KPI Outputs

To identify potential projects that benefit Georgia's logistics-enabled businesses and make significant impacts on the KPIs for freight movement in the state, a two-step approach was used to evaluate the conditions for freight. This two-step approach uses the Georgia Statewide Travel Demand Model outputs, plus various post-processing formulas to quantify improvements that are unable to be modeled in GSTDM.

In order to start the modeling process. the GSTDM was run with a base-year scenario of the network configuration in 2015 with freight data reflecting 2019 conditions to establish a starting point for comparing model outputs. A second scenario was developed that included the projects already built, constructed, or committed by GDOT to be built to the year 2050. This scenario is called the No Build scenario, as no other improvements beyond those already existing or committed are included in the highway network, yet other input variables are increased to 2050 forecasted levels – such as population, freight demand, passenger vehicle demand, employment, etc. (matching the 2021 Georgia Statewide Strategic Transportation Plan). This No Build scenario establishes the anticipated performance on Georgia roadways for freight and is used to identify target areas for investment.

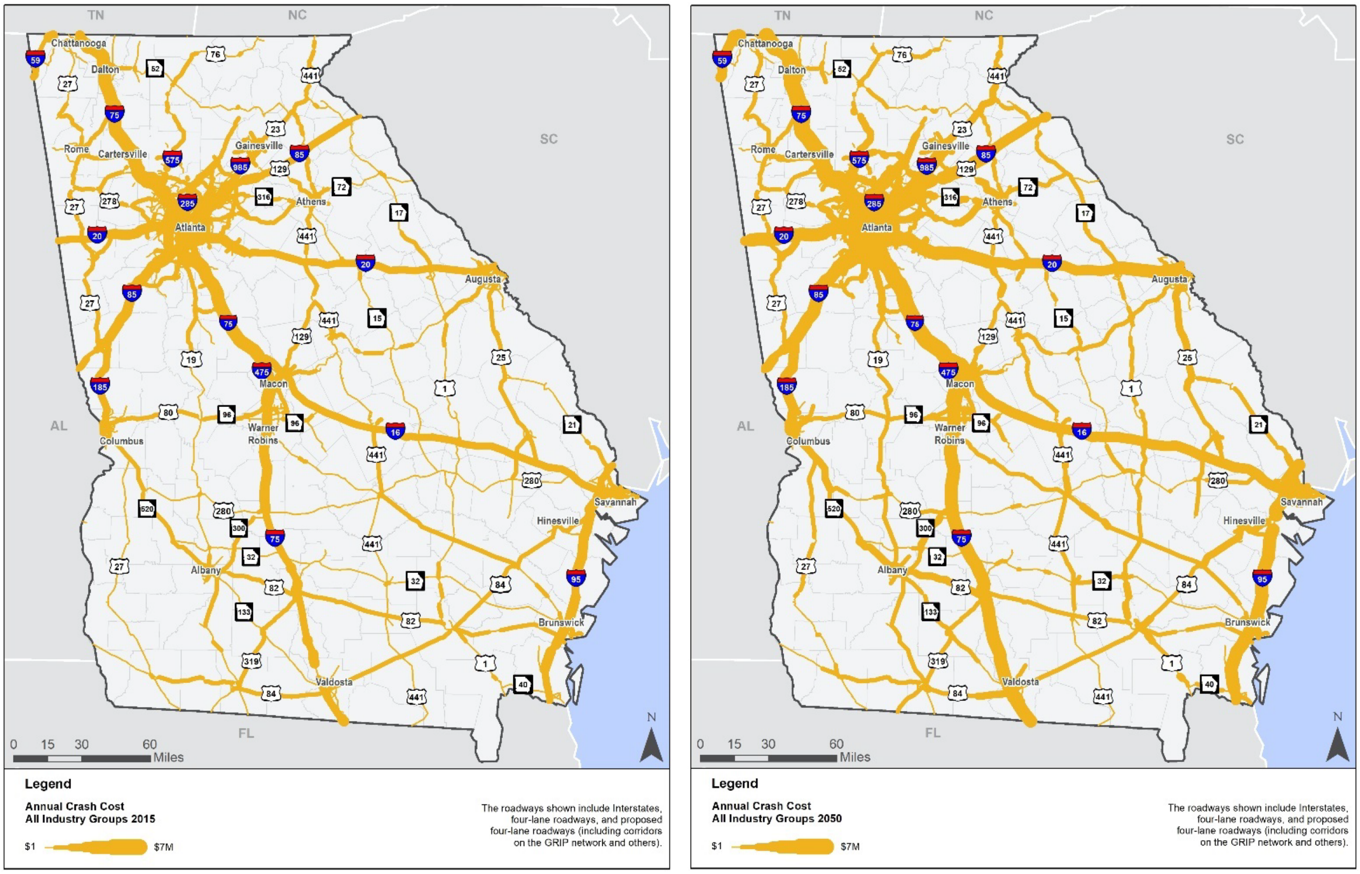
Figure 146 shows the comparison of the daily cost of congestion in the 2015 base year network with 2019 freight data and the 2050 No Build year and which corridors would be most affected. The graphic reveals the anticipated demands falling on the Interstate system and clearly shows the intensity of impact on metro Atlanta facilities. It also demonstrates the impact to reliability and speed, and the cost implications. Georgia based freight, meaning freight that originates in or is destined for Georgia, would have an increase in congestion cost of 131 percent. Based on this analysis, initiatives that reduce congestion, add capacity, or make operational upgrades, interchange modifications and grade separations are the types of improvements desired.

Figure 146. Comparison of 2015 Base Year Network with 2019 Freight Data and 2050 No Build Daily Congestion Costs



Core to GDOT's mission is to provide safe and efficient roadways. Improvements that can minimize safety incidents are beneficial not only to KPIs but to quality of life. **Figure 147** below shows the annual cost of crashes statewide, and similar to the comparison for congestion, this provides insight into locations across the state where action should be taken. The Interstate corridors once more stand out as an opportunity for improvement, but additionally, there are state highways such as US 441 and US 82 where upgrades would be beneficial. From a safety perspective, controlling access and grade separating intersections are important elements for improvement programs.

Figure 147. Comparison of 2015 Base Year with 2019 Freight Data and 2050 Annual Crash Costs



5.3. Freight Investment Plan

The National Highway Freight Program (NHFP) requires a list of priority projects and description of how the funds from this program will be invested in the state. This fiscally-constrained investment plan is limited to initiatives working with NHFP funds over the next eight years. This section presents the projects chosen for this list and the process for selecting these projects. Sections 5.3.4 – 5.3.6 set forth the types of projects for long term consideration through 2050. Consistent with the SSTP/SWTP, future considerations are based on Foundational, Catalytic and Innovative investments.

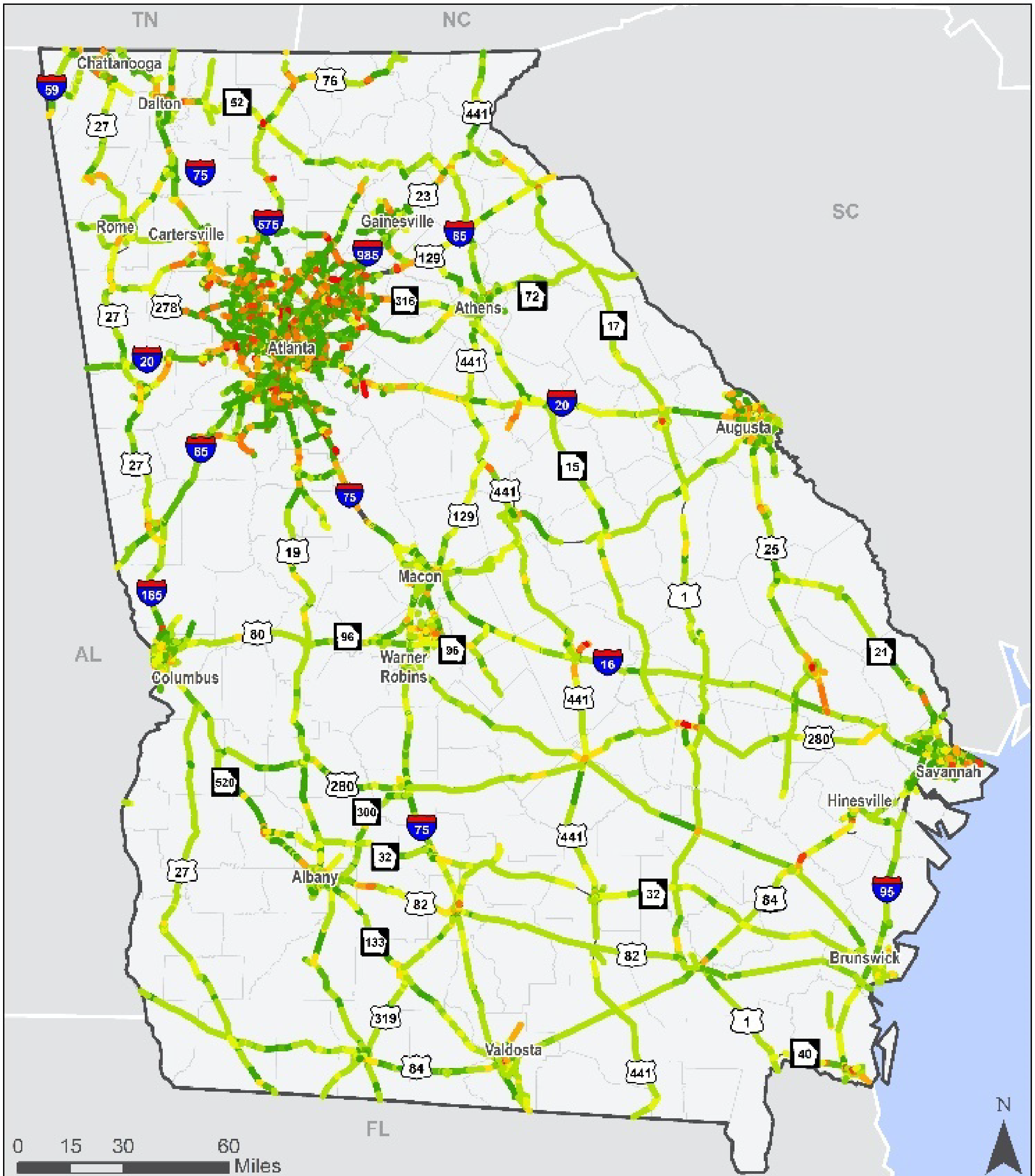
5.3.1. Project Prioritization Process

The process to develop a prioritized set of fiscally-constrained projects started with identification of the measures by which projects would be selected. The following subsections explain these measures and how they were administered.

KPIs Addressed

Projects were assessed based on their ability to improve areas with diminished performance in KPI terms over the forecast horizon. The total monetized KPI projection by roadway appears in **Figure 148,** depicting the change in annual cost per VMT throughout the state from the base year to the 2050 forecast year with no build. The totals are the sum of safety costs plus all delay, the latter capturing speed and reliability changes in terms of user costs. The totals thus reflect four of the five KPIs – safety, speed, reliability and cost; the locations projected to increase in cost per VMT are shown in yellow, orange, and red. Projects that mitigate the increased cost per VMT at these locations were noted for prioritization.

Figure 148. Change in Annual Cost per VMT



Legend

Difference in Annual Cost Per VMT
2050 No Build vs. 2019 Base Year

Decrease in $/VMT — Increase in $/VMT

The cost KPI was calculated by summing the annual delay and crash costs on a roadway segment and dividing this number by the annual freight Vehicle Miles Traveled (VMT) on that segment. The map shows the change in the costs from the 2019 Base Year Scenario to 2050 No Action Scenario.

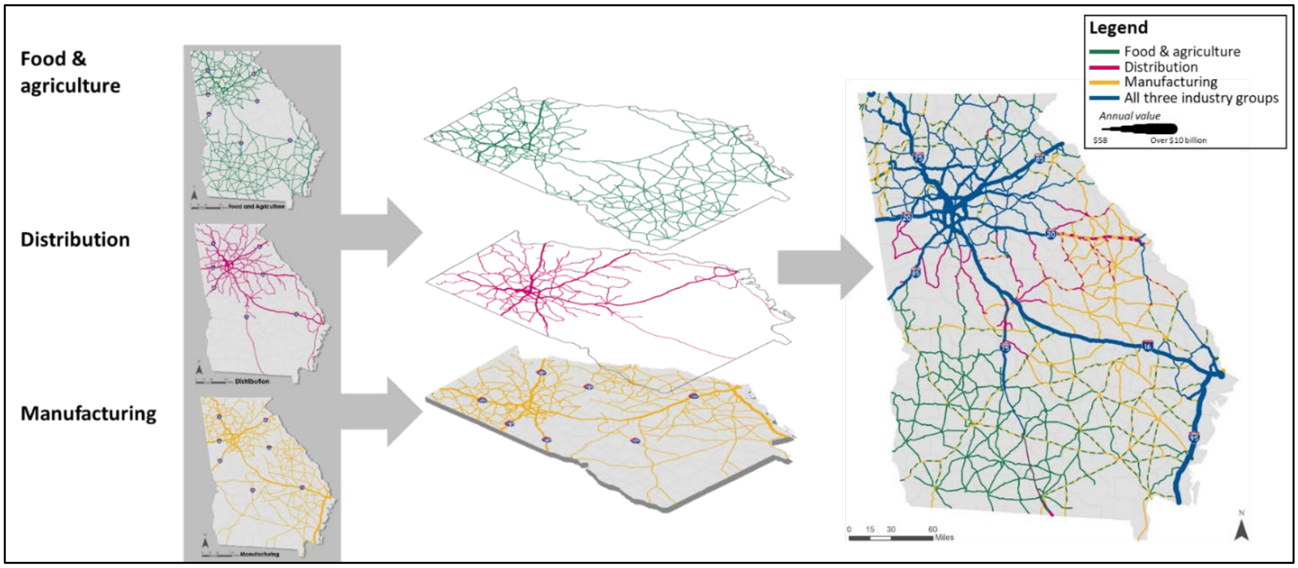
The roadways shown include Interstates, four-lane roadways, and proposed four-lane roadways (including corridors on the GRIP network and others).

Benefits to Key Industries

Three primary industries move freight in Georgia: Food and Agriculture, Distribution, and Manufacturing, together accounting for roughly 60 percent of freight movement in Georgia and around 14 percent of its GDP. **Figure 149** displays the corridors used by trucks traveling between the top 25 Origin-Destination pairs for these three industries by inbound, outbound and intrastate direction. The maps show:

- Manufacturing commodities are concentrated around northwest GA and the ports.
- Distribution traffic moves the third highest annual tonnage in Georgia but has the fastest growth rate through 2050. Freight flows are expected to more than triple from 2019 to 2050. Distribution flows are centralized around Metro Atlanta and along the regional distribution routes where costs are highest.
- Food and agriculture commodity movements are mostly concentrated in Northeast GA, Atlanta metro, and Southwest GA, with the need to move goods between rural areas and into and through metro Atlanta.
- All of these primary industries rely on the Interstate network and northern roadways; Manufacturing and Food and Agriculture rely more heavily on GRIP Corridors in the south and east.

Figure 149. Comparison of Volumes for the Three Primary Industries



Projects that address key issues along these corridors were given elevated priority in the project list.

Heavy Haul Considerations

The prominent heavy haul sectors in Georgia are Food and Agriculture, lumber and paper Manufacturing, heavy machinery in domestic and foreign trade, and OSOW shipping overall. Projects that are located along important current and future heavy haul routes (shown earlier in **Figure 48** and **Figure 49**, respectively) were noted as significant due to the additional requirements for bridge and pavement maintenance and repair caused by heavier vehicles.

Cost Effectiveness

Cost-effectiveness iscomposed as the reduction in total cost to industry produced by a project investment over a 25-year period, compared to the total cost of the project. Projects with higher cost-effectiveness values were viewed more favorably when determining prioritization.

Bottlenecks

Roadway freight bottlenecks in 2019 were presented in Section 4.1.1. Forecast locations of concentrated congestion were developed with GSTDM and generally reveal deteriorating conditions at the same points, although varying in degree because of varying growth rates. Bottleneck locations were another factor considered for project prioritization.

Funding Availability

The prioritization process includes allocation of funds for improving public truck parking at existing rest areas, weigh stations, and visitor welcome centers along Interstate routes, considering these are the predominant long-haul routes where truck are most frequently requiring safe parking for rest breaks. Projects that are currently programmed by GDOT for the years 2023-2031 were then selected to maximize available funding and to deliver projects in the construction phase. Freight traffic analysis in this plan has shown that I-75 is and will remain the primary freight corridor in Georgia; many of the selected projects therefore are along this corridor. Where additional funds were available, additional Interstate projects were prioritized to increase geographic diversity if they rank highly among the evaluation criteria.

5.3.2. Project Prioritization Results

The outcome of this process and the project scoring appears in **Table 112**. The organization of these projects into the investment plan by year with accounting for application of NHFP funds is described next.

Table 112. Prioritized Projects for NHFP Funding

GDOT PI #	Project Name	Safety	Cost/ VMT	Reliability	Speed (V/C)	BCR (25-yr)	Bottleneck	3 Industry	2 Industry
0013915	I-285 @ I-20 - EAST SIDE INTERCHANGE RECONSTRUCTION	X		X		NA	X	X	
0008345	I-20 FROM SR 388 TO CR 573/WHEELER ROAD	X		X		20.66			X
0013157	I-75 @ CR 251/ROUNTREE BR RD & @ CR 253/BARNEYVILLE RD-PH II	X	X	X	X	NA			
0017271	I-95 @ SR 21 INTERCHANGE RECST	X	X	X	X	NA	X	X	
0010298	I-75 @ SR 133 - PHASE II INTERCHANGE RECST		X		X	NA			
0017182	I-75 @ CR 312/BETHLEHEM ROAD	X	X	X		NA			
0012759	I-75 SB CD SYSTEM FROM I-285 TO SR 331	X	X			NA	X	X	
0014203	I-75 FROM I-475 TO SR 155 - COMMERCIAL VEHICLE LANES	X	X	X		2.26	X	X	
311400-	I-75 FROM I-16 TO CR 478/PIERCE AVE - PHASE VI	X	X	X	X	7.27	X	X	
611010-	I-75 FROM SR 151 TO JUST SOUTH OF SR 2	X	X	X		27.22		X	
0013156	I-75 FROM LOWNDES COUNTY LINE TO SR 37 - PHASE II	X	X	X		NA	X		X
0010295	I-75 @ SR 376 - PHASE II	X		X		NA			X
0013918	I-285 @ I-20 WEST SIDE INTERCHANGE RECST	X		X		NA	X	X	
0007841	I-85 @ SR 74/SENOIA RD INTERCHANGE RECST	X	X	X		NA			X
0017411	I-95 FM FL STATE LINE TO S CAROLINA STATE LINE - ITS EXPANSION	X	X		X	NA	X	X	
0013856	I-75 @ SR 33 CONN INTERCHANGE RECST	X	X	X		NA			X
0017518	I-20 FROM SR 47 TO SR 388 - PHASE II	X	X	X		16.99			X
0017110	I-85 @ MCGINNIS FERRY ROAD - NEW INTERCHANGE - PHASE II	X		X		NA		X	

Notes: *projects without BCRs are interchanges*

NA = BCR not available, project not modeled

5.3.3. NHFP Constrained Project List

The fiscal constraint in the Freight Investment Plan is the amount of NHFP funds available to Georgia. The anticipated allocation of NHFP funds to the state is based on federal apportionment data and is assumed to be approximately $427 million for the eight-year period from 2023 through 2031, average about $47 million per year.

Public truck parking improvements will be programmed out of scoping phases that will utilize the lump sum funds for preliminary engineering (PE) and construction (CST) phases at a later date. Projects that are currently programmed by GDOT for the years 2023-2031 where then selected to maximize the remaining available funding and to deliver projects in the construction phase. **Table 113** presents the allocation of funding by year and project.

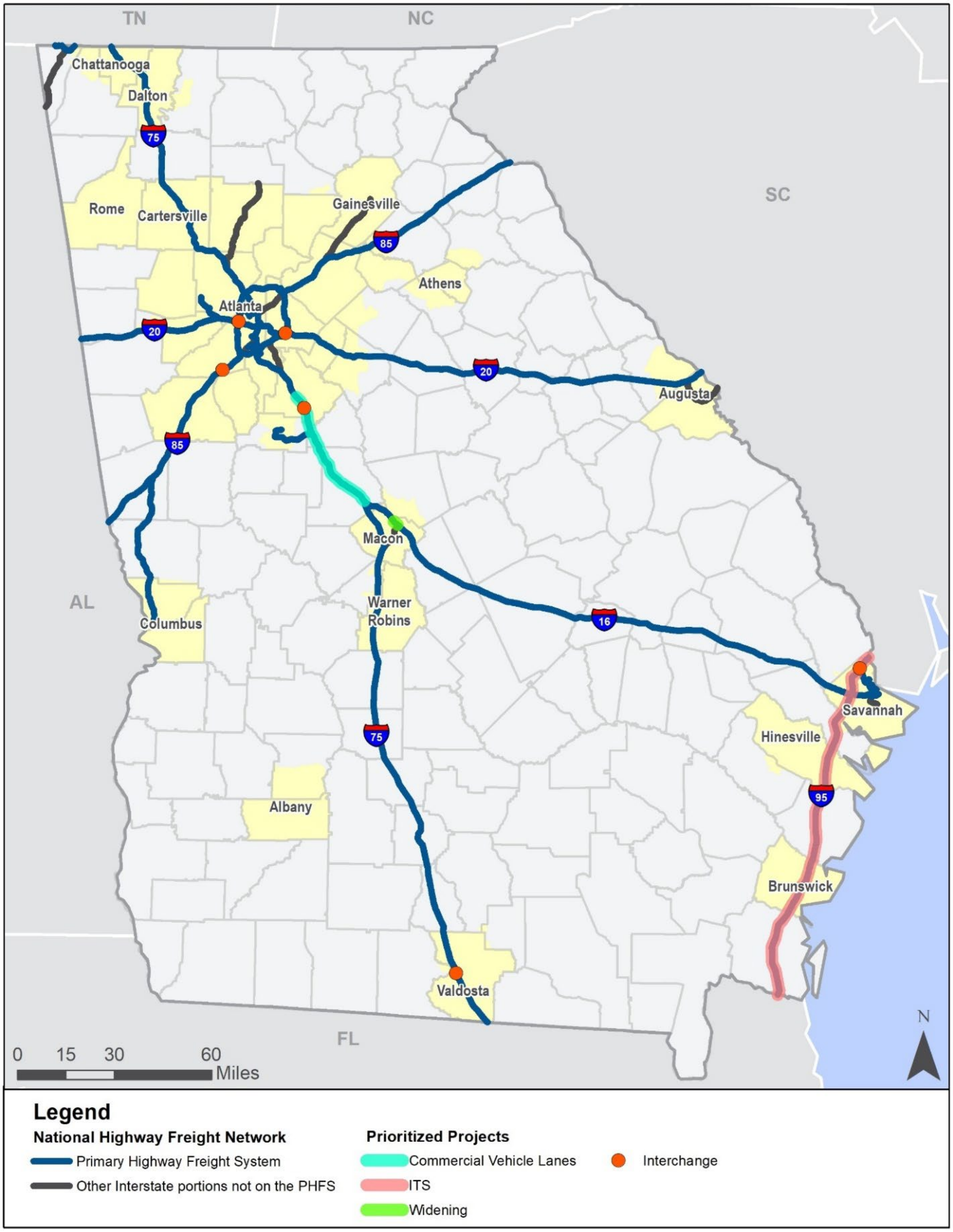
The projects are focused on the Interstate highways, which data shows are the primary corridors for freight travel for multiple industries throughout the state and feature many bottlenecks and areas of heavy congestion that can begin to be mitigated or resolved by implementing these projects. The projects are shown in **Figure 150**.

Table 113. NHFP Allocation by Year and Project

Fiscal Year	PI #	Project Description	Annual NHFP Funds Apportionment*	Federal NHFP Amount	State Funds Match Amount ^	Total NHFP + State Match	Phase
2023	0013915	I-285 @ I-20 - EAST SIDE INTERCHANGE RECONSTRUCTION	$ 44,761,551	$ 32,137,453	$ 8,034,363	$ 40,171,816	CST
	0013918	I-285 @ I-20 WEST SIDE INTERCHANGE RECST		$ 7,050,726	$ 1,762,681	$ 8,813,407	PE
	0014203	I-75 FROM I-475 TO SR 155 - COMMERCIAL VEHICLE LANES		$ 5,573,373	$ 1,393,343	$ 6,966,716	ROW
2024	0013915	I-285 @ I-20 - EAST SIDE INTERCHANGE RECONSTRUCTION	$ 45,656,782	$ 42,296,782	$ 10,574,196	$ 52,870,978	CST
	TBD	Public Truck Parking Lump Sum^^		$ 3,360,000	$ 840,000	$ 4,200,000	
2025	0017182	I-75 @ CR 312/BETHLEHEM RD NEW INTERCHANGE	$ 46,569,918	$ 13,400,000	$ 3,350,000	$ 16,750,000	CST
	0007841	I-85 @ SR 74/SENOIA RD INTERCHANGE RECST		$ 29,809,918	$ 7,452,479	$ 37,262,397	CST
	TBD	Public Truck Parking Lump Sum^^		$ 3,360,000	$ 840,000	$ 4,200,000	
2026	0017411	I-95 FM FL STATE LINE TO S CAROLINA STATE LINE - ITS EXPANSION	$ 47,501,316	$ 16,500,000	$ 4,125,000	$ 20,625,000	CST
	0013915	I-285 @ I-20 - EAST SIDE INTERCHANGE RECONSTRUCTION		$ 21,881,316	$ 5,470,329	$ 27,351,645	CST
	TBD	Public Truck Parking Lump Sum^^		$ 9,120,000	$ 2,280,000	$ 11,400,000	
2027	0014203	I-75 FROM I-475 TO SR 155 - COMMERCIAL VEHICLE LANES	$ 47,501,316	$ 19,190,658	$ 4,797,665	$ 23,988,323	CST
	0013918	I-285 @ I-20 WEST SIDE INTERCHANGE RECST		$ 19,190,658	$ 4,797,665	$ 23,988,323	CST
	TBD	Public Truck Parking Lump Sum^^		$ 9,120,000	$ 2,280,000	$ 11,400,000	
2028	311400-	I-75 FROM I-16 TO CR 478/PIERCE AVE - PHASE VI	$ 47,976,329	$ 27,290,729	$ 6,822,682	$ 34,113,411	CST
	0010298	I-75 @ SR 133 - PHASE II		$ 8,365,600	$ 2,091,400	$ 10,457,000	ROW
	TBD	Truck Parking Lump Sum		$ 12,320,000	$ 3,080,000	$ 15,400,000	
2029	0013915	I-285 @ I-20 - EAST SIDE INTERCHANGE RECONSTRUCTION	$ 48,456,092	$ 48,456,092	$ 12,114,023	$ 60,570,115	CST
2030	0017271	I-95 @ SR 21 INTERCHANGE RECST	$ 48,940,653	$ 24,470,327	$ 6,117,582	$ 30,587,909	ROW
	0010298	I-75 @ SR 133 - PHASE II INTERCHANGE RECST		$ 24,470,326	$ 6,117,582	$ 30,587,908	CST
2031	0013918	I-285 @ I-20 WEST SIDE INTERCHANGE RECST	$ 49,430,060	$ 49,430,060	$ 12,357,515	$ 61,787,575	CST

**Source: FHWA Apportionment Tables and GDOT OFM Estimates*
^Source: GDOT Office of Planning
^^Public Truck Parking Projects will be programmed out of the scoping phases that will utilize the lump sum funds for PE and CST phases (see Table 114)

Figure 150. Prioritized Projects on the NHFP



5.3.4. Foundational

Foundational investments address asset management activities for cost-efficient freight operations. These investments will maintain a state of good repair on the existing statewide freight movement system and maintain and/or improve safety KPIs for the current network as freight volumes increase across Georgia.

The Foundational program focuses on reconstructing, rehabilitating, and improving existing physical assets that support logistics-enabled industries to ensure customer expectations are meet.

The following foundational types of potential improvements reflect a business-as-usual approach to ensure there are efficient and reliable networks statewide:

- Interchange and bridge upgrades
- Increased truck parking and availability systems
- Rail grade crossing safety improvements
- Local assistance programs
- Signalization

Interstate and Highways

A primary mission of GDOT is to plan, maintain, and operate the State's highway system, which includes the critical corridors that enable the efficient and reliable movement of people and freight. GDOT carries out strategic projects to improve reliability of key corridors by focusing project efforts in areas where interchanges and bridges in the state's highway system do not meet current design standards.

Interchanges

As discussed in Chapter 4, truck bottlenecks are a major factor in contributing to reductions in speed and reliability and therefore increases costs. Interchanges are one of the primary locations of truck bottlenecks, especially urban interchanges, and therefore interchange rehabilitation or reconstruction is considered Foundational. Recommendations in this section include grade separations on state highways creating new interchanges that limit access to strategic state routes and therefore improving flow on those corridors. Examples of Foundational interchange improvements already in GDOT's work program include:

- Grade separation projects on SR316/US 29 at six locations
- Major Mobility Investment Program investments for I-285/I-20 east and west
- Multiple interchanges on I-75, I-85 and I-95

Bridges

The bridges on the roadway network are actively managed and inspected through existing programs at GDOT. The GDOT Bridge Maintenance Program and Bridge Structures Maintenance Plan guide the implementation of these efforts. GDOT inspects 8,414 bridges annually to determine where construction and widening projects are needed. In 2019, $509.5 million was invested in construction and widening efforts while $41.9 million were invested in maintenance costs to extend bridge life by 20-25 years. Pending availability of funds, GDOT Office of Intermodal plans to maintain and replace GDOT-owned short line rail bridges and structures to continue meeting industry standards[138].

Bridge conditions that may impact the freight network include, narrow lanes, low clearances, weight limitations, or deterioration. These types of bridge characteristics can contribute to delays to the supply chain. Additionally, heavy truck volumes can also hasten degradation and therefore require more investment to maintain a state of good repair.

Rail Improvements

The Department's Office of Utilities administers a federally funded Section 130 program to evaluate and fund railroad-highway grade crossing safety improvements at public at-grade railroad crossings throughout the state of Georgia. Improvements under this Program include the installation of new or upgraded train activated warning devices (bells, gates, and flashing lights); signing and pavement marking upgrades; elimination of redundant or unnecessary crossings; and other measures to enhance the safety and operational characteristics of Georgia's public railroad-highway at-grade crossings. In 2020, forty-three (43) warning device projects totaling $10.2 million were addressed at 266 crossings[139].

GDOT owns 465 active miles of the approximate 4,600-mile rail network in Georgia, which are partially maintained through grant awards from USDOT's Consolidated Rail Infrastructure and Safety Improvements (CRISI) Program. The CRISI Program funds projects that improve the safety, efficiency and reliability of intercity passenger and freight rail.

Rail grade crossing safety is critical for freight movement for both rail and truck movements. Rail grade crossing initiatives improve safety by reducing the interface between rail and vehicular traffic. Additionally, improving grade crossings may help truck travel and minimize instances of trucks getting caught on railroad tracks where the crossing configuration cannot accommodate long vehicles. These objectives and more are considered when determining which crossings to improve. The recommendations of this plan are to continue to address rail grade crossings at a programmatic level to continue the work being done by the Office of Utilities. Projects may include new gates and warning device and also changeable message signs to divert traffic from blocked crossings.

Truck Parking

As described in Chapter 4, the demand for truck parking is only going to increase over time and is an immediate need throughout the state. Investment in truck parking improves safety by minimizing use of undesignated parking locations and allowing for staging locations as trucks wait for delivery windows. Reliability is also improved because drivers can spend less time navigating for parking or having to divert from their routes to find places to stop, which also helps to lower cost. According to the Owner Operator Independent Drivers Association, an average of one hour per day of truck

138 https://www.dot.ga.gov/GDOT/pages/BridgePrograms.aspx
139 https://www.dot.ga.gov/GDOT/Pages/RailroadSafety.aspx

drivers' time is spent searching for parking. Considering that truck drivers may work up to 14 hours in a day, this one-hour parking search equates to a 7 percent reduction in productivity, affecting wages truck drivers can earn and reducing supply chain efficiencies. **Table 114** shows the locations that are being studied by GDOT as part of three regional scoping projects for Public Truck Parking. The cost of projects that will come out of the scoping being done at these locations appears as Public Truck Parking Lump Sum in the Freight Investment Plan, from which specific projects will be identified for preliminary engineering (PE) and construction (CST).

Table 114. Public Truck Parking Scoping Locations

ID	County	Location
1	Monroe	Rest Area 22 (SB I-75)
2	Cook	Rest Area 5 (NB I-75)
3	Whitfield	Visitors Center Ringgold (I-75)
4	Haralson	Visitors Center Tallapoosa (I-20)
5	Turner	Rest Area 9 (SB I-75)
6	Gordon	Rest Area 34 (NB I-75)
7	Monroe	Weigh Station 6 (NB I-75)
8	Monroe	Weigh Station 6 (SB I-75)
9	Bibb	Rest Area 19 (NB I-475)
10	Turner	Rest Area 10 (NB I-75)
11	Franklin	Weigh Station 2 (SB I-85)
12	Franklin	Visitors Center Lavonia
13	Dooly	Rest Area 14 (SB I-75)
14	Dooly	Rest Area 13 (NB I-75)
15	Dooly	Rest Area 14 (SB I-75)
16	Lowndes	Weigh Station 8 (SB I-75)
17	Richmond	Visitors Center Augusta (I-20)
18	Bryan	Weigh Station 7 (WB I-16)
19	Bryan	Weigh Station 7 (EB I-16)
20	Morgan	Rest Area 52 (EB I-20)
21	Laurens	Rest Area 88 (WB I-16)
22	McIntosh	Weigh Station 9 (NB I-95)
23	Lowndes	Weigh Station 8 (NB I-75)

Signalization

GDOT "operates and maintains over 3,000 traffic signals across the State of Georgia, out of approximately 6,500 on-system signals and over 10,000 total traffic signals in the state. GDOT also manages and operates over 200 Interstate ramp meters in the Metro Atlanta area. Of the on-system signals not maintained and operated by GDOT, the local municipalities and governments rely on GDOT support with much of the equipment and infrastructure required to operate these signals. There are approximately 100 local agencies and municipalities in the State of Georgia that operate and maintain their own traffic signals and systems, relying on the Department for support in these efforts. The programs GDOT offers for support range from detector repair and maintenance all the way to active management of a traffic signal system."140

GDOT developed traffic signal programs to manage the traffic signals throughout the state. These programs support different geographical areas but are intended to address local and regional transportation needs in a consistent manner, leveraging methods and techniques learned from each program. These programs are the Regional Traffic Operations Program (RTOP) within metro Atlanta and Regional Traffic Signal Operations (RTSO) program for areas outside of metro Atlanta. GDOT proactively approaches the maintenance, monitoring, and operations to address signal issues.141

Signals within freight intensive areas, such as freight clusters defined by the Atlanta Regional Commission (ARC), may require modifications in programing to support freight mobility in those areas. Truck signal priority is a strategy that may be employed in areas with high truck volumes to extend the green time at signalized intersections to allow more trucks through without stopping. The benefit of this type of improvement is increased safety by reducing potential for trucks to be caught in a red light cycle thereby reducing both truck idling and opportunities for crashes and increasing supply chain efficiency, especially in key bottlenecks. This Plan identifies freight-based signal programs, such as improvements around the Port of Savannah, within freight clusters, and other freight intensive sites to be coordinated with the Office of Traffic Operations for implementation.

Assistance Programs

Although GDOT has pre-existing programs to finance the improvements of existing Interstate and highway systems, as well as their freight and rail systems, the available funds allocated for these programs are limited when compared to all improvements needed to the entire system. Further consideration should be given to additional assistance programs, which may include:

- Expanded Local Maintenance Improvement Grant (LMIG) program for freight safety
- Local assistance program for Urban Curbside Management policy and projects
- Funding for safety and condition improvements on GDOT freight corridors

[140] Statewide Traffic Operations and Response Management Program, Concept of Operations, April 2019
[141] Statewide Traffic Operations and Response Management Program, Concept of Operations, April 2019

5.3.5. Catalytic

Catalytic investments are meant to build upon the Foundational to support and develop key industries throughout Georgia, as well as to maintain or improve current network performance as freight movement increases. This category of potential investments focuses on strategic infrastructure expansions to aid economic development and increase the customer base for business.

Catalytic investments are looked at in two ways: highway and multi-modal. The highway investments feature initiatives for road building, especially for last-mile freight movement. The multi-modal investments feature advancement-based initiatives that improve modal choice and redundancy, and support highway relief through alternative rail, water, and air networks. Potential Catalytic investments could include:

- Road, rail, and airport capacity projects
- Expanded capacity on Interstate highways
- Access to inland ports and intermodal stations
- Rail grade crossings
- Local assistance programs

Interstate and Highways

GDOT's Major Mobility Investment Program (MMIP) is implementing capacity investments in Georgia's most heavily traveled transportation corridors over the next decade. Completion of MMIP projects will expand capacity, enhance safety, and improve reliability for Georgia's businesses and residents. While not solely designed to improve freight mobility, many MMIP projects will benefit truck movements in key corridors, especially I-285 and I-75. Some MMIP projects are specifically designed to enhance freight mobility, including new commercial vehicle lanes on portions of I-75, capacity additions to I-85 to serve the industrial and distribution hubs in Northeast Georgia, and expansion of the I-16 trade corridor serving Port of Savannah traffic, including an improved interchange with I-95[142].

As demonstrated in Chapter 4, freight traffic is most reliant on the Interstate system in Georgia, therefore an objective of the Catalytic investments are to improve performance through strategic Interstate upgrades and appropriate improvements on state routes that can offer alternative high-performance roadways.

Commercial Vehicle Lanes and Interstate Capacity

As seen through the assessment of truck movement and volumes throughout the state, 20 percent of the truck volumes pass through Georgia, with Georgia as neither the origin nor destination. This type of travel supports development of Commercial Vehicle Lanes (CVL), which are improvements with very limited access serving trucks only. As noted by the FAC, this type of infrastructure brings benefits in safety by removing interaction with regular vehicular traffic, improves reliability with

[142] 2021 Statewide Strategic Transportation Plan: 2050 Statewide Transportation Plan, page 54

designated truck only lanes, and improves cost by reducing delay and congestion. GDOT's I-75 Commercial Vehicle Lanes (CVL) project, as part of the MMIP, is the nations first CVL project. The purpose is to improve mobility and safety for freight operators and passenger vehicles, modernizing freight infrastructure and operations to grow the economy, increase competitiveness, and improve quality of life[143].

Additional Interstate capacity is also warranted where truck volumes are heaviest and where trucks contribute to bottlenecks. In particular, I-75 southward from Macon to Florida and I-20, I-16 and I-95 were identified and primary Interstates for truck movements, both for freight originating in or destined to Georgia, as well as through-truck movements.

Governor's Roadway Improvement Program (GRIP) Corridors

"The Governor's Road Improvement Program (GRIP) is a system of economic development highways that, when complete, will connect 95 percent of Georgia cities with populations of 2,500 or more to the Interstate Highway System. It will also place 98 percent of Georgia's population within 20 miles of a four-lane road."144

This system of over 3,000 miles of roadway provides excellent statewide coverage and supports freight mobility and market access for rural Georgia. This Plan recommends the completion of key corridors in the program such as US 280 as an east west connection and US 441 as a strategic north south corridor serving truck traffic to and from the Port of Savannah. Another form of upgrade is grade separation on strategic corridors. Similar to the projects on SR 316 currently in development and construction phases, this type of initiative would convert signalized intersections to grade separated intersections, with benefits such as increased safety, reliability, and speed.

Options for New Limited Access and Interstate

Interstates are the primary routes for trucks, especially for long haul movements, and therefore an area of focus for much of the Catalytic program, due to the safety and reliability benefits of limited-access configurations. Options include upgrading corridors to limited access Interstate, such as US 280 and US 27, or to constructing new Interstates. Modeling analysis indicates that US 27 could establish an alternate route between Tennessee and Florida, relieving truck traffic in metropolitan Atlanta. Additionally, the Bipartisan Infrastructure Law includes a corridor designation for a new Interstate I-14 covering five states, Texas, Louisiana, Mississippi, Alabama and Georgia. Within Georgia, the corridor designation connects Columbus to Augusta by way of Macon. Before inserting these infrastructure investments in the Department's long-range plans, substantial further evaluation of these corridors is required, including cost-benefit analysis, environmental assessments, and community engagement.

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[143] https://0014203-gdot.hub.arcgis.com/

[144] https://www.dot.ga.gov/GDOT/Pages/GRIP.aspx#:~:text=The%20Governor%27s%20Road%20Improvement%20Program,to%20the%20Interstate%20Highway%20System.

Sea and Inland Port Improvements

Georgia is home to an interconnected network of seaports, inland waterways, private marine terminals, and inland ports. The vast majority of Georgia's marine tonnage moves through terminals owned and operated by the Georgia Ports Authority (GPA). GPA's facilities include the Port of Savannah, which consists of the Garden City Terminal and the Ocean Terminal, North America's busiest single terminal container facility. They also include the Port of Brunswick and its Colonel's Island Terminal, which is the second busiest port in the United States for total roll-on/roll-off cargo. In 2019, over 37.5 million tons of goods moved through these ports[145]. GPA has identified an "inland port" system to serve the Port of Savannah. This system includes locations in Murray County (Appalachian Regional Port) and Decatur County (Bainbridge Terminal). The Northeast Georgia Inland Port is in early stages of planning in Hall County.

Analysis indicates improvements to roadways, railroads, and grade crossings in the vicinity of the port would be Catalytic to logistics-enabled businesses in the state. The Catalytic program encompasses overall improvements to access the existing ports and intermodal facilities and freight flows to and from inland ports, in coordination with the Georgia Ports Authority.

Rail Improvements

At 4,684 miles, Georgia's rail network is the seventh largest in the nation. Most of Georgia's rail network is owned by private freight railroad companies. The following own Georgia's rail network:

- 4,061 miles owned by private freight railroads
- 465 miles are owned by GDOT
- 118 miles are owned by the Georgia State Properties Commission
- 41 miles are owned by the Georgia Ports Authority

Two Class I's operate in the State of Georgia: CSX Transportation and Norfolk Southern (NS). All other railroads operating in Georgia fall into the Class III revenue threshold (short lines). Class I railroads tend to focus on providing long-distance line haul service, connecting Georgia with other parts of the U.S., Canada, and Mexico. Short line (Class III) railroads tend to provide last-mile service, connecting Georgia businesses to the rail transportation network. These connections provide access to raw materials and global markets. Class I's operate the majority of trackage in Georgia (68 percent combined). Short lines operate the remaining 32 percent. GDOT owns 465 active rail miles in the state which is leased to Class I and Short Line operators.[146] Georgia's extensive rail network provides system redundancy and may offer some opportunities to divert more cargo to rail throughout the state, especially through inland port connections. By upgrading rail infrastructure and improving travel time on rail corridors, the mode becomes a more viable choice for businesses if it is competitive with truck service.

[145] Georgia Ports Authority.
[146] Georgia State Rail Plan, https://www.dot.ga.gov/InvestSmart/Rail/StateRailPlan/Georgia%20SRP%20Final%20Draft.pdf

At-grade rail crossings can cause railroad delays when incidents occur and when crossings are blocked. Multimodal Catalytic investments could help eliminate certain grade crossings through the construction of additional grade separations, where warranted. Other multimodal Catalytic investments could include possible reactivation of rail corridors, extension of sidings and improvement to intermodal site access. GDOT will continue further analysis to specify priority locations and viability of various infrastructure solutions.

Airport Capacity Improvements

Georgia is served by a diverse mix of airports ranging in size from small general aviation airports to corporate general aviation reliever airports to Hartsfield-Jackson Atlanta International, the world's busiest commercial airport[147].

In 2018, Hartsfield-Jackson had over 51.8 million enplanements and the other eight commercial service airports had over 1.8 million enplanements combined[148]. Hartsfield-Jackson also is a key air cargo facility, the 13th busiest in the United States, moving over 2.9 billion pounds of cargo in 2018. The other major air cargo airport in Georgia is the Southwest Georgia Regional Airport, located in Albany, which moved over 186 million pounds of cargo in 2018. Georgia's aviation system is a major contributor to the Georgia economy. In 2019, the economic impact of Georgia's airports was over $73.7 billion, supporting more than 450,502 jobs with an annual payroll of $20.2 billion, and $196.5 million in direct aviation-related tax revenues to the State[149].

GDOT's Aviation Program has the responsibility of helping to assure that publicly owned airports in Georgia are safe, adequate, and well maintained. Georgia DOT serves two primary functions in providing airport aid: Airport Development and Aviation Planning. Airport Development provides technical assistance to city, county, and other local airport sponsors as well as private entities on airport and aviation matters including construction, maintenance, and operations of airport facilities, and airport navigational aid facilities. Aviation Planning is charged with planning a safe, comprehensive, accessible, and integrated statewide system of public-use airports[150].

GDOT recently completed an Air Cargo Capacity study and the recommendations of that plan are included here by reference. The types of initiative included are expanded air cargo capacity, apron improvements and road feeder access improvements to airports. Some highlights from the Air Cargo study are:

- Apron rehabilitation at Statesboro and Swainsboro airports
- Air cargo capacity improvements at Savannah/Hilton Head International Airport
- Air cargo capacity at Southwest Regional Airport in Albany
- Airport Distribution Center at Hartsfield Jackson Atlanta International Airport

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[147] Airports Council International Annual World Airport Traffic Report, 2019
[148] Federal Aviation Administration Passenger Boarding Data, 2018
[149] GDOT Statewide Airport Economic Impact Study, 2020
[150] https://www.dot.ga.gov/GDOT/pages/AirportAid.aspx

In addition, roadway improvements are beneficial to air cargo, which is acutely sensitive to reliable transportation service:

- Upgrades in metropolitan Atlanta and in proximity to other Georgia airports improve regional truck pick-up and delivery performance for domestic and international freight.
- Upgrades to the Interstate highway system improve performance for long distance Road Feeder Service, which connects the cargo capacity of international passenger flights at Hartsfield-Jackson to businesses across the Southeast. Reliable road feeder connections also help attract international freighter flights, a market in which Atlanta lags behind Miami.

Truck Parking

As documented earlier when discussing public truck parking locations, freight volumes will continue to increase through 2050 and truck drivers will need safe, accessible locations to park for required periods of rest. In Georgia, private truck parking provides 94 percent of the current supply, so the state's ability to impact the overall availability of spaces is limited. GDOT and other governmental entities can consider some options to support the growth of private truck parking in Georgia:

- Explore Public- Private Development Agreements/ Partnerships (P3) through process already established by GDOT and other state DOTs.
- Increase funding for truck parking through partnerships with local governments and the private sector that would seek federal grant funds.
- Partner with other State agencies to consider truck parking options.

Assistance Programs

Although GDOT has pre-existing programs to finance the improvements of existing Interstate and highway systems, as well as their freight and rail systems, the available funds allocated for these programs are limited when compared to all improvements needed to the entire system. Further consideration can be given to incorporate additional assistance and fund allocations to aid Catalytic investments particularly related to economic development sites and truck parking.

5.3.6. Innovative

Innovative investments focus on developing, piloting, and deploying new and emerging technologies and business practices for freight and logistics. Georgia can improve freight movement throughout the state by leading the effort to develop new technologies for transportation asset management and advanced freight operations. Technology related investments across the state's transportation system will help maintain and improve network performance while continuing to position Georgia as an innovation hub.

Support for new technologies will accelerate industry trends, facilitate growth of emerging technologies, and give existing business industries in Georgia a first-class freight experience. Some examples of innovation categories are:

- Safety Technologies
- Freight Collaboration Systems

- Connected and Autonomous Vehicle (CAV) Implementation

While many of these activities may be driven by the private sector, GDOT can play a role supporting research and pilots, sharing public data, and facilitating roadside technology infrastructure - notably broadband connectivity. With technologies rapidly evolving, specific strategies and opportunities must be identified on an ongoing basis.

Innovative investments are intended to be coupled with Catalytic, due to ways that infrastructure and technology can work together. The value of Innovative improvements is high because for a relatively small investment therefore a positive effect across KPIs. Notably, these technologies improve safety through information and most specifically via CAV, enabling vehicles to communicate with one another and thereby reducing opportunities for crashes. Other systems improve communications about conditions of the facilities in real time, thereby reducing risk and improving operational decision-making about delivery windows, for example, or arrangements for truck parking.

Safety Technologies

Technological advancements change quickly but provide benefits to safety for drivers, the traveling public and more. Some of the types of safety technologies include Advanced Driver-Assistance Systems (ADAS), which are systems of cameras and devices embedded into the vehicle to help drivers detect obstacles and avoid crashes. ADAS elements are a component for implementing CAV as well and are discussed more in Section 4.4.3. Other areas of emerging safety technologies are in artificial intelligence (AI) that can be used to assess large databases of information collected on driver behavior and vehicle performance, to inform fleet and staff management.

Highlights of the plan supporting technological advancement for safety feature such systems as DriveWyze Truck Safety Cab Messaging, which informs electronic logging devices (ELD) and other systems for on-road monitoring of fleets and can sense brake heat or facilitate weigh station bypasses. Another safety technology to consider is Automated Incident Detection (AID), which can be integrated with other ITS investments.

USDOT collaborates with states to provide Work Zone Data Exchange specifications, which allow infrastructure owners to share work zone data for third party use. This data can then be made available through other applications to provide advanced notification of conditions, allow for truckers to plan different routes to avoid work zones, and improve safety outcomes for those working in the work zone and those travelling near it. Although some or much of the investment will be made by the private sector, GDOT can ensure that technology systems and ITS on the roadways can appropriately interface with other applications through embedded technology systems on the roadways and at rail crossings.

Freight Collaboration Systems

Freight collaboration systems involve data and information sharing among supply chain managers, service providers, infrastructure providers, freight vehicles and infrastructure itself. The objective is better decision making and ultimately the optimization of operations in real time. Automation of the process improves speed, precision and cost in many cases; Vehicle-to-Infrastructure data exchange and Internet of Things concepts are two examples of highly automated interactions.

The technology and adoption of these systems will continue to advance over the three-decade horizon of this Plan. They can be expected to have a material effect on delay costs and freight productivity statewide, ranging from Interstate to first and last mile operations and to complex logistical ecosystems like ports, airports and other intermodal centers. While much of the investment will be by the private sector, freight system performance will benefit from their investment, and GDOT will continue to seek options to be a partner in such opportunities. Roadside sensors, communications infrastructure, and the reporting and management of road conditions are ways GDOT is participating today. This will further evolve, and the Foundational and Catalytic investments in this plan produce an upgraded environment in which collaborative systems can function and be supported.

Connected and Autonomous Vehicle (CAV) Implementation

The technology enabling connected and autonomous vehicle operation is continuing to grow in deployments in new trucks and automobiles, notably through advanced driver assistance systems (ADAS). GDOT has been supporting their function in many ways, from lane striping to broadband and vehicle-to-infrastructure systems examples of the latter. Driverless truck operations continue to be researched and developed by the private sector. As the technology continues to improve, affecting the efficiency as well as the safety of trucks and of their interaction with automobiles similarly equipped. Over three decades, the strides in this technology are likely to be substantial and profound.

CAV implementation involving freight and passenger vehicles will improve speeds and reliability especially on Interstate highways, where limited access and truck-friendly designs create favorable conditions. Commercial vehicle lanes in the Catalytic program magnify this advantage while continuing ITS programs undergird it, such that the Innovative program element is mostly directed toward CAV network planning and design.

5.4. Plan Considerations

Previous sections discuss recommendations to meet critical issues to benefit freight mobility in Georgia. This section compiles other considerations in implementation of this Freight Plan including potential studies to advance opportunities from the recommendations and discussion of how the plan meets specific considerations required by the Bipartisan Infrastructure Law and proceeding guidance.

5.4.1. Military Freight

The Strategic Highway Network (STRAHNET) and the Strategic Rail Corridor Network (STRACNET) are designated nationally to prioritize infrastructure and connectivity needs for national defense. In addition, in 2022 the United States Transportation Command (USTRANSCOM), in coordination with FHWA, designated 18 Power Projection Platform (PPP) highway routes connecting vital military installations to seaports and airports. One of those routes is entirely in Georgia and two more traverse the state:

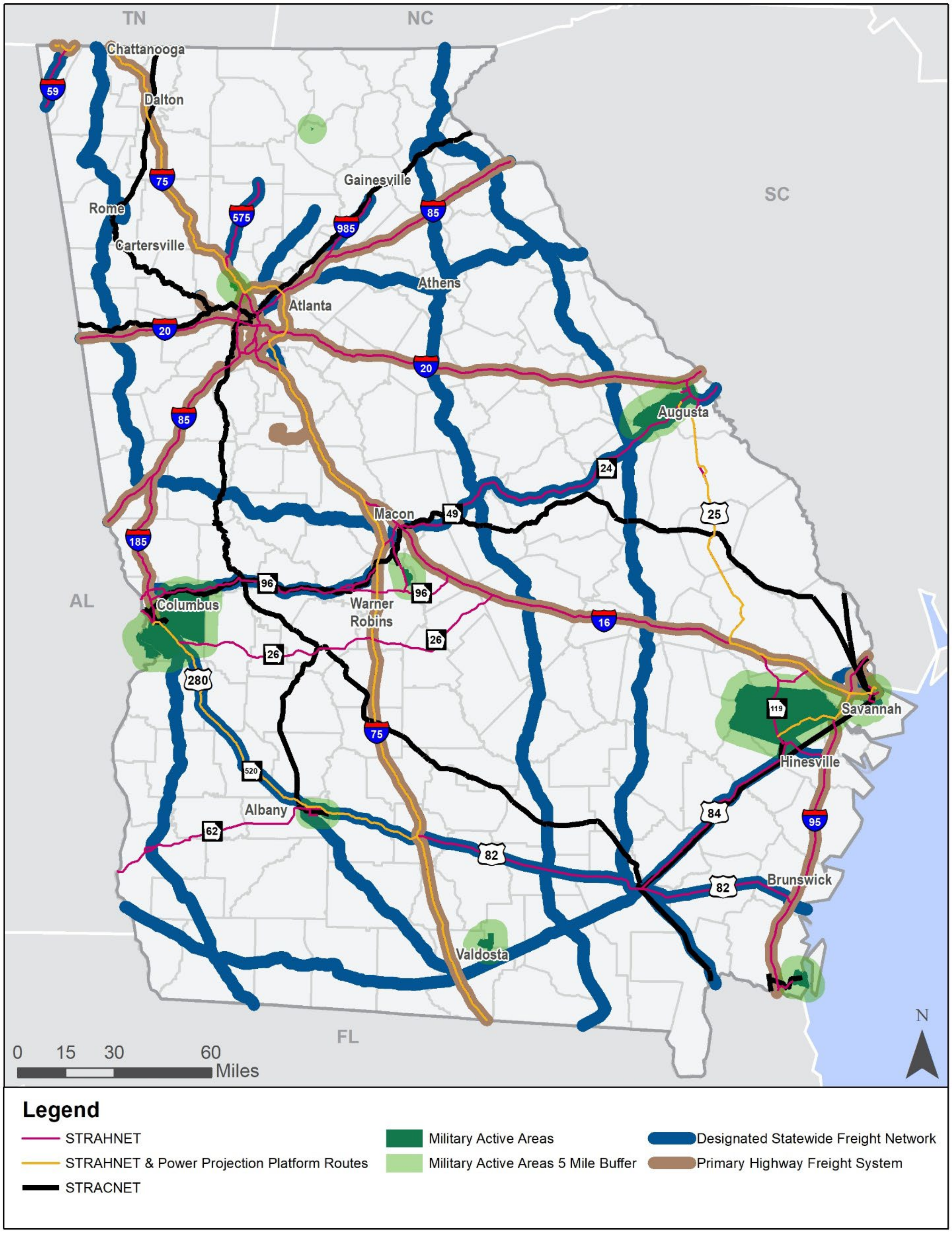
- Fort Gordon, GA (near Augusta) to the Port of Savannah, GA, mainly following US 25 and I-16
- Fort Benning, GA (near Columbus) to the Port of Jacksonville, FL, mainly following US 280, US 82, and I-75 in Georgia
- Fort Campbell, KY to the Port of Jacksonville, FL, mainly following I-75 across Georgia and using I-285 through Atlanta

The PPP routes, STRAHNET, STRACNET, and Georgia's 11 military bases representing the four major armed services - Army, Navy, Marine Corps and Air Force - are depicted in **Figure 151**. The map also shows the Primary Highway Freight System (PHFS), which covers a majority of the PPP and STRAHNET routes in the state. Other STRAHNET routes are along Georgia's State Freight Network (SFN), which is the state's core system for roadway freight. Four projects on the NHFP Constrained Project List (from Section 5.3.3) are located along the PPP route from Fort Campbell to the Port of Jacksonville: the commercial vehicle lanes on I-75 from I-475 to SR 155, a new interchange at I-75 and Bethlehem Road, and reconstructions at the I-75/SR 133 interchange and the I-285/I-20 eastside interchange.

GDOT works in collaboration with the Department of Defense and specifically with USTRANSCOM to support the movement of military equipment and freight. STRAHNET and SFN routes are priority factors in GDOT's allocation of maintenance funds. The forms of funded maintenance encompass traffic signals and devices, bridges and bridge repair, pavement/concrete marking and preservation, guardrails and landscaping, and the installation of sound barriers. The GDOT Major Mobility Investment Program includes widening of I-16 between I-95 and I-516 and reconstruction of the I-16 at I-95 Interchange, a set of improvements beneficial to the Fort Gordon route to the port, and due for completion in 2023. Additional investments identified in this Plan affect all of the PPP facilities, notably on I-75, I-285, I-20 and I-16, including the I-75 northbound Commercial Vehicle Lanes Project between Macon and south Metro Atlanta, which will speed vehicles returning north from Jacksonville for reloading at Fort Campbell.

There are initiatives with indirect benefits as well, such as improvements to Atlanta truck routes that can relieve and improve reliability on I-285. Georgia's ports and access to them by road and rail are a major strategic focus that this Plan identifies; the container operations at Savannah are a key example, while the roll-on/roll-off capabilities at Brunswick serve wheeled equipment and provide redundancy to similar capabilities at Jacksonville just 70 miles away.

Figure 151. Military Freight Network



5.4.2. Environmental Considerations

GDOT strives for excellence in the environmental review process and in addition to policies and procedures committed to ensure compliance with federal regulations. The GDOT Resiliency Committee is made up of management from various important offices, with the goal to:

- Recommend Projects for grant submittal
- Hazard and Risk Assessments
- Determine which projects to build resilience into
- Determine how to capture costs for reimbursements
- Expansion of the resilience program

The Offices of Maintenance, Roadway Design, Traffic Operations, Bridge Design, Environmental Services, Roadway Design, Performance Management and Research, Construction, Planning, Design Policy and Support, and Program Delivery. A goal of the committee is to prepare a statewide Resiliency Plan in 2023.

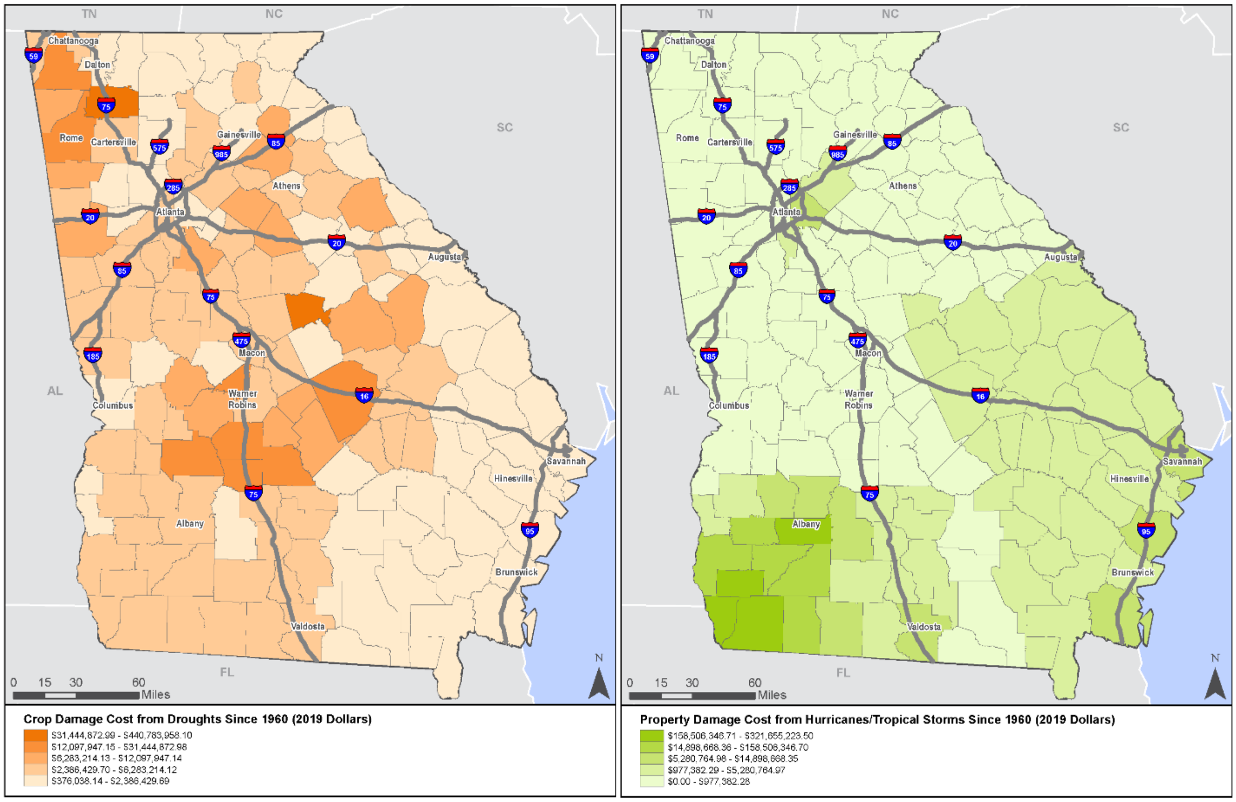
Additionally, GDOT fosters stewardship and improvement of policies and procedures through the Interagency Office of Environmental Quality and the Planning and Environmental Linkages Task Force. These existing groups serve as resources for ensuring that freight projects adhere to the strategies set forth.

Extreme weather and Natural Disasters

GDOT Office of Planning is coordinating with Georgia Tech to document the effects of extreme weather events in Georgia, The resiliency focused project also aims to develop and apply approaches for implementing and improving resilience efficiently across Georgia's transportation system– the organization, its institutions – policies, business processes (i.e., work methods), plans and procedures, and the physical transportation system (including its smart components), supported by decision-making tools and data.

Counties that have been impacted by extreme weather are shown in **Figure 152.** As documented in this Plan, the movement of food and agriculture is a key industry within the state and events that impact crops affect that industry. Georgia benefits from a degree of protection from severe storms because its relatively short coastline lies further west from the Atlantic Ocean than Florida and the Carolinas, and thus has historically been less exposed to wind and water. **Figure 152** displays where weather events have posed a material risk to industry in Georgia, particularly to farmlands in the southern part of the state.

Figure 152. Cost of Extreme Weather Events



Drought can be exacerbated by extreme heat, and high temperatures can be common across the southern United States. Extreme heat may pose risks to Georgia's infrastructure.

Accordingly, GDOT created the position of Manager of Emergency Operations to implement policies and regulations when events occur and coordinate with other state agencies such as the Georgia Emergency Management and Homeland Security Agency. Policies are in place with defined roles and responsibilities and a unified response from necessary state agencies.

Georgia has developed guidebooks for dealing with extreme winter weather and hurricanes. These detail specific recommendations for the public to safely evacuate from areas in danger of hurricanes or tropical storms. GDOT has designated certain roadways as hurricane evacuation routes; I-16 (a key facility for investment in this Plan) becomes a one way "contra-flow" evacuation corridor from Savannah to Dublin in the event of emergencies. GDOT has a Road Weather Information System (RWIS) designed to monitor road conditions during severe winter weather.

A project is being developed to use Unmanned Aerial Vehicles (UAV) to assess damage after severe weather events. These UAVs will be able to assess damage to the state's transportation system in a more efficient manner to assist first responders to rescue and cleanup efforts.

Flooding and Stormwater Runoff

GDOT has policies and procedures in place to address potential flooding and stormwater runoff as a part of the Plan Development Process (PDP)[151]) to ensure standards are met during planning and engineering of projects, including freight projects. GDOT is issued a National Pollutant Discharge Elimination System (NPDES) stormwater permit from the Georgia Environmental Protection Division (EPD), a division of the Georgia Department of Natural Resources (GADNR) approximately every five years with updates as needed based on regulatory changes. This permit authorizes GDOT to discharge stormwater from a municipal separate storm sewer system (MS4) to the waters of the state of Georgia using appropriate stormwater management. Guidance for meeting stormwater management requirements can be found in MS4 Plan Development Process flow chart[152], GDOT's *Drainage Design for Highways Manual* and Georgia Soil and Water Conservation Commission (GSWCC) *Manual for Erosion and Sediment Control in Georgia*.

GDOT evaluates the potential for floodplain impacts in planning and designing projects for applicable projects, in accordance with *Executive Order 11988 Floodplain Management,* and impacts to downstream properties. GDOT Drainage Design for Highways includes technical requirements. GDOT's Office of Bridge Design and Maintenance reviews all hydraulic reports for bridges crossing water. GDOT's Office of Environmental Services (OES) has a *Floodplain Toolkit* for assessing impacts and coordinating with appropriate offices within GDOT to design for minimizing impacts to floodplains and therefore mitigating for flooding in the PDP. These policies and procedures serves as the strategy for minimizing flooding and stormwater runoff that may be associated with freight.

Air Pollution

The Clean Air Act (CAA) 42 U.S.C. §7401 et seq. (1970) is the comprehensive federal law that regulates air emissions from stationary and mobile sources. Among other things, this law authorizes U.S. Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and public welfare and to regulate emissions of hazardous air pollutants. Air quality in Georgia is monitored by the Georgia Environmental Protection Division (EPD). **Table 115** shows the air quality statistics from EPA for the counties that are measured in Georgia and that all measurements are under the thresholds. In October 2015, the EPA changed the threshold for ozone from 0.075 parts per million to 0.070 ppm, and in August 2018 seven metro Atlanta counties (Bartow, Clayton, Cobb, DeKalb, Fulton, Gwinnett and Henry) were designated as nonattainment for the 2015 ozone NAAQS. In October 2022, EPA redesignated the nonattainment area to attainment. As part of the redesignation the Atlanta area is in maintenance and the EPA has approved the State's plan for maintaining attainment.[153]

[151] See PDP Sections 5.13, 6.3.3, and 7.3.4

[152] https://www.dot.ga.gov/PartnerSmart/DesignManuals/PDP/MS4%20Preconstruction%20PDP%20Process.pdf

[153] https://www.govinfo.gov/content/pkg/FR-2022-10-17/pdf/2022-21653.pdf

Table 115. Air Quality Measurements from EPA for Georgia

County	CO 8-hr (ppm)	Pb 3-mo (µg/m³)	NO_2 AM (ppb)	NO_2 1-hr (ppb)	O_3 8-hr (ppm)	PM_{10} 24-hr (µg/m³)	$PM_{2.5}$ Wtd AM (µg/m³)	$PM_{2.5}$ 24-hr (µg/m³)	SO_2 1-hr (ppb)
Bibb County	ND	ND	ND	ND	0.063	ND	9.8	24	3
Chatham County	ND	ND	ND	ND	0.058	ND	10.1	22	50
Chattooga County	ND	ND	ND	ND	0.056	ND	ND	ND	ND
Clarke County	ND	ND	ND	ND	0.06	ND	10.1	25	ND
Clayton County	ND	ND	ND	ND	ND	ND	8.9	19	ND
Cobb County	ND	ND	ND	ND	0.062	ND	8.8	20	ND
Coffee County	ND	ND	ND	ND	ND	ND	6.8	15	ND
Columbia County	ND	ND	ND	ND	0.056	ND	ND	ND	ND
Dawson County	ND	ND	ND	ND	0.061	ND	ND	ND	ND
DeKalb County	1	ND	14	50	0.067	44	9.7	22	2
Dougherty County	ND	ND	ND	ND	ND	ND	10.1	30	ND
Douglas County	ND	ND	ND	ND	0.07	ND	ND	ND	ND
Floyd County	ND	ND	ND	ND	ND	ND	IN	IN	ND
Fulton County	2	ND	17	46	0.066	32	9.7	20	4
Glynn County	ND	ND	ND	ND	0.054	ND	7.7	18	IN
Gwinnett County	ND	ND	ND	ND	0.065	ND	IN	IN	ND
Hall County	ND	ND	ND	ND	ND	ND	9.1	21	ND
Henry County	ND	ND	ND	ND	0.066	ND	ND	ND	ND
Houston County	ND	ND	ND	ND	ND	ND	9.6	26	ND
Lowndes County	ND	ND	ND	ND	ND	ND	8.5	21	ND
Murray County	ND	ND	ND	ND	0.063	ND	ND	ND	ND
Muscogee County	ND	IN	ND	ND	0.061	ND	11.1	35	ND
Paulding County	ND	ND	ND	ND	ND	ND	IN	IN	ND
Pike County	ND	ND	ND	ND	0.061	ND	ND	ND	ND
Richmond County	ND	ND	ND	ND	0.064	58	12.1	38	59
Rockdale County	ND	ND	ND	ND	0.063	ND	ND	ND	ND
Sumter County	ND	ND	ND	ND	0.059	ND	ND	ND	ND
Walker County	ND	ND	ND	ND	ND	ND	IN	IN	ND

Washington County	ND	ND	ND	ND	ND	ND	10.7	26	ND
Wilkinson County	ND	ND	ND	ND	ND	ND	IN	IN	ND

CO - Second maximum non-overlapping 8-hour concentration (applicable NAAQS is 9 ppm)
Pb - Maximum rolling 3 month average (applicable NAAQS is 0.15 µg/m³)
NO_2 (AM) - Arithmetic mean concentration (applicable NAAQS is 53 ppb)
NO_2 (1-hr) - 98th percentile daily maximum 1-hour concentration (applicable NAAQS is 100 ppb)
O_3 - Fourth daily maximum 8-hour concentration (applicable NAAQS is 0.070 ppm)
PM_{10} - Second maximum 24-hour concentration (applicable NAAQS is 150 µg/m³)
$PM_{2.5}$ (Wtd AM) - Weighted annual mean concentration (applicable NAAQS is 12 µg/m³)
$PM_{2.5}$ (24-hr) - 98th percentile 24-hour concentration (applicable NAAQS is 35 µg/m³)
SO_2 - 99th percentile daily maximum 1-hour concentration (applicable NAAQS is 75 ppb)
ND - No Data
IN - Insufficient data to calculate summary statistic
µg/m³ - micrograms per cubic meter
ppm - parts per million
ppb - parts per billion

Additionally, GDOT has completed their National Electric Vehicle Infrastructure (NEVI) Deployment Plan to plan for electric vehicle charging along Alternative Fuel Corridors within the state. As transportation is a source of air pollutants, this supports efforts to positively affect air quality. Additionally, one focus of Plan recommendations is treatment of freight bottlenecks in the state, which improves flow, minimizes idling time and has a net benefit for air quality.

The State's plan for air quality maintenance, investment in zero-emissions infrastructure and projects that reduce freight bottlenecks, serve as the strategy for minimizing impacts to local air pollution that may be associated with freight.

Wildlife Habitat Loss

In certain areas of the state, wildlife habitat can be lost due to road construction and expansion by converting land to roadway use, or by creating fragmentation of wildlife habitat. New roadways may also impact wildlife movement which can contribute to road-related mortality of wildlife. This may also prevent dangers to motorists that come into contact with wildlife on the roadways. Many of the project recommendations in the Plan are along existing roadway corridors. These would be assessed for potential impacts to wildlife and possible consideration of wildlife crossing investments. **Figure 153** below shows the locations of critical habitat in Georgia and areas for conservation that serve as habitat for wildlife.

The Georgia Department of Natural Resources (GDNR) has a State Wildlife Action Plan to conserve populations of species and their habitats. The State Wildlife Action Plan (SWAP) uses the best available data to provide a comprehensive, adaptable assessment of conservation options and the best ways to address them. Within the SWAP, GDNR

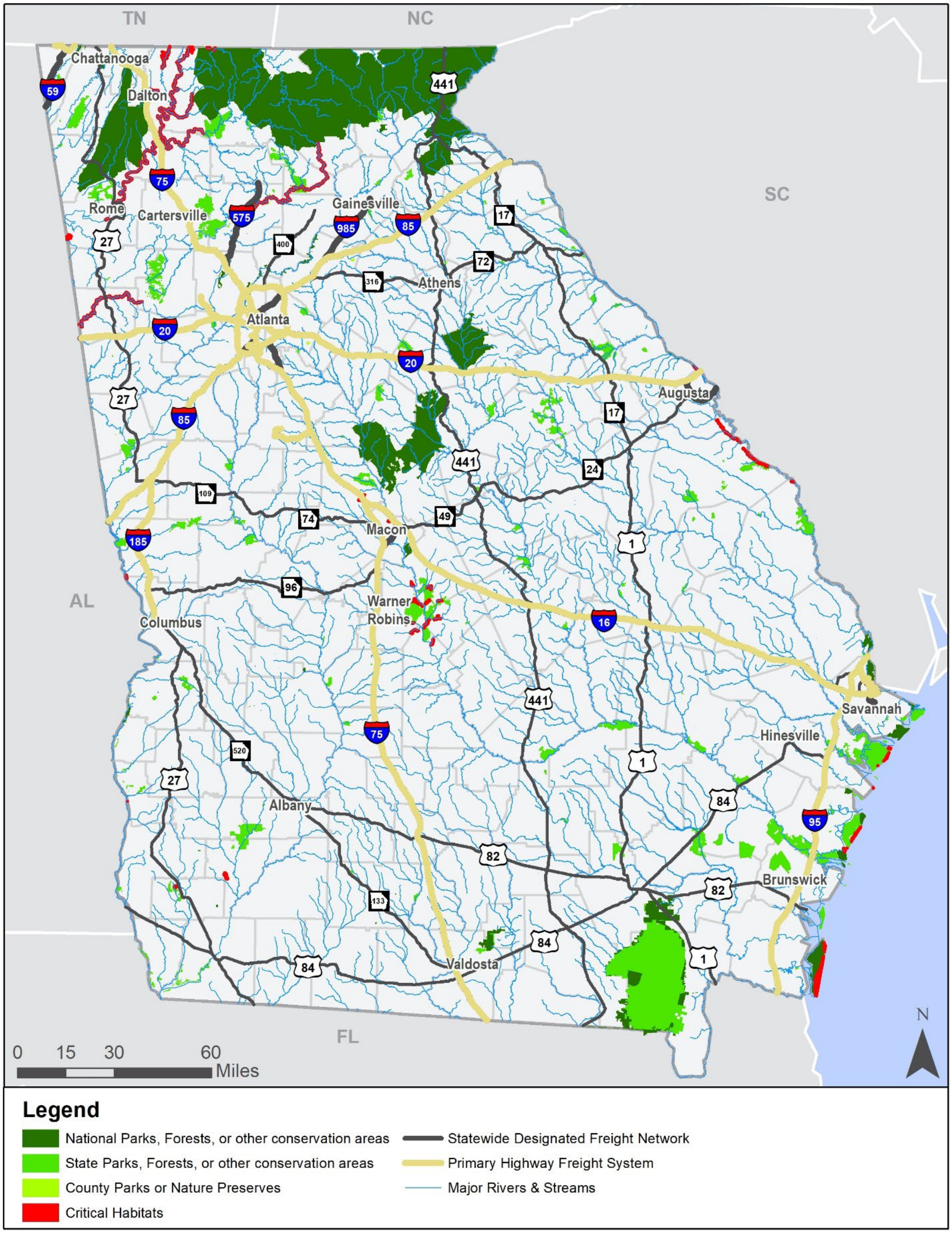
identifies high priority conservation area for wildlife and at-risk species. The SWAP specifically identifies the partnership with GDOT to minimize impacts to high priority species when developing road construction and maintenance projects.

GDOT conducts ecological surveys and impact assessments for transportation investments to minimize or avoid adverse effects to the natural environment. This is managed through the Office of Environmental Services and the procedures are detailed in guidebooks available on GDOT's web site. If it is determined during the ecological surveys that mitigation measures are needed for wildlife and/or protected species, mitigation measures would be recommended to minimize impact. There are a broad spectrum of mitigation measures to limit interaction with wildlife, including but not limited to design features such as wildlife crossing signs to alert drivers, safe passageways for wildlife crossings such as tunnels or overpasses, and minimizing disruption to conservation areas. FHWA provides resources on best practices related to wildlife in the Environmental Review Toolkit[154].

The strategy to address wildlife habitat loss is accomplished through continued coordination with GDNR, conducting project specific ecology reviews and using best practices from FHWA for mitigating wildlife interactions.

[154] https://www.environment.fhwa.dot.gov/env_topics/wildlife.aspx

Figure 153. Critical Habitat



5.4.3. Integration with other State plans

The Georgia Freight Plan was carefully planned to draw from and build on other Georgia state planning efforts, tools, and products, and to (in turn) inform updates to future state planning efforts, tools, and products.

One of the initial work steps was to identify, assemble, and review a comprehensive list of relevant state resources, as listed in **Table 116**. These resources informed the Freight Plan's goals, technical analysis methods, inventory of potential projects, performance measurement approach, and final recommendations.

Table 116. Summary of State Plan Resources Integrated with the Georgia Freight Plan

Document	Source
Georgia Statewide Freight and Logistics Plan 2010-2050	www.dot.ga.gov/freight
Georgia 2050 Statewide Transportation Improvement Plan (SWTP)	https://www.dot.ga.gov/GDOT/Pages/SSTP.aspx
Georgia 2021 Statewide Strategic Transportation Plan (SSTP)	https://www.dot.ga.gov/GDOT/Pages/SSTP.aspx
Georgia State Rail Plan (2021)	https://www.dot.ga.gov/InvestSmart/Rail/StateRailPlan/Georgia%20SRP%20Final%20Draft.pdf
Georgia State Rail Grade Crossing Action Plan (2011) and Update	https://railroads.dot.gov/GARISA
Georgia Statewide Aviation System Plan (2018)	https://www.dot.ga.gov/InvestSmart/Aviation/AirportAid/StatewideAviationSystemPlan.pdf
Georgia Statewide Air Cargo Study (2022)	https://www.dot.ga.gov/InvestSmart/Aviation/Documents/AirCargo/TechnicalReport_AirCargoStudy.pdf
Georgia Ports Authority data and publications	https://gaports.com/publications/
GDOT Traffic Operations data and publications	https://www.dot.ga.gov/GDOT/pages/RoadTrafficData.aspx
GDOT State Route Prioritization/TAM (2018)	https://www.dot.ga.gov/InvestSmart/TAM/GeorgiaStateRoutePrioritization.pdf
GDOT Regional Studies (47 total)	https://www.dot.ga.gov/GDOT/Pages/Studies.aspx

The Freight Plan is designed to implement a statewide vision and corresponding goals and objectives. It utilizes data collected in previous studies, data and modeling tools maintained by GDOT and other state agencies on an ongoing basis, the most current available Federal data, and state-of-the-practice commercial data sources. While it carries forward many of the recommendations identified in previous studies, it also adds many significant new recommendations developed through the Freight Plan analysis. Finally, it places the recommendations firmly within a performance-based framework that quantifies the benefit of project/policy opportunities, looking at all modes through the year 2050. As a result, the Georgia Freight Plan is well-positioned to serve as an effective platform document for future updates to statewide transportation plans, modal system plans, and multi-state planning efforts.

5.4.4. Opportunities for Multi-State Alignment

This Plan presents an opportunity to align investment strategies and planning efforts with states that are positioned up or down stream in key supply chains. Key areas for alignment include: technology, policy and planning, corridor development, and supply chain resiliency.

This Plan recommends strategies to expand truck parking, implement technology to improve truck parking data-sharing, and innovations such as commercial vehicle only lanes. Multi-state groups such as ITTS and ETC can serve as a forum for collaboration among states and ensuring that new innovations are implemented seamlessly across state boundaries. Similarly, the development of policies for usage of commercial vehicle lanes should be coordinated to manage driver expectations on long-haul trips.

Investments on freight corridors, including the Primary Highway Freight System (PHFS), should be coordinated with neighboring states at the planning stage to identify priorities and during project development to coordinate on phasing and construction impacts. For example, Georgia and South Carolina are coordinating a series of I-85 capacity projects underway in each state, with longer range plans to reach the state line. Activities such as construction lane closures and coordinating financing of Interstate bridges will be key to advancing multi-state freight corridor projects.

Supply chain resiliency is a critical issue for today’s freight industry. Coordination amongst state DOTs, Port Authorities, and other key freight stakeholders can help identify opportunities for redundancy in transportation systems and develop coordinated emergency plans. Coordination of Georgia’s inland port strategy with that of neighboring states could result in new strategies to reduce highway congestion and improve the efficiency of seaports.

5.4.5. Summary of Program and Policy Actions

Specific programs are included in Foundational and Catalytic investment categories to support maintenance programs, provide for urban curbside management, support driver training, provide access to economic development sites, and employ information services for truck parking. Recommended policies build on these program recommendations to support freight trends in Georgia and continue to monitor and assess new and changing markets, emerging technologies, and alternative fuels. The following sections describe the three factors and associated policies.

E-commerce

E-commerce and facility expansion is steadily changing the Georgia freight distribution network. Shifts to omnichannel and online shopping has been spurred by changing consumer expectations and digitization of payments and shopping. E-commerce requires three times the warehouse space to move the same volume as traditional retail, resulting in additional warehouse and real-estate needs[155]. To add to this, reverse logistics is a large and important component of the e-commerce supply chain with unique challenges and complexities for e-tailers and supply chain partners; for example, reverse logistics require an average of up to 20 percent more space[156]. The requirement of more space has implications for demand changes affecting the transportation network. The policy is to facilitate more regional and multi-jurisdictional coordination to understand the evolution of e-commerce, and to support economic development objectives with a process for understanding the demands on the transportation network and the necessary first mile/last mile connectivity.

Port of Savannah

The Port of Savannah has become a global gateway-of-the-future. As global geopolitics and pandemic supply chain volatility have risen, shifting trade patterns have led to an increased focus on East Coast ports. Savannah is leading the East Coast port market share growth for containerized import and export volumes as these gateway shifts occur. By creating a significant increase in freight traffic in new routes and directions, the associated volumes also can increase congestion, especially around intermodal terminals and distribution centers, resulting in a need for new surface transportation infrastructure. The Department will aim to prioritize roadway and multimodal projects that enable cargo flow to and from the Port of Savannah to reduce delay and cost to U.S. supply chains.

Advanced Technologies

As discussed in Section 4.4, technology changes and advancements are rapidly occurring. Autonomous driverless operations in controlled environments will be tested in the near term; trucks in point-to-point operations capable of autonomy but retaining drivers for safety are apt to appear in the 2030's. This has the potential for increased efficiency, reliability, and speed; however, the development and ramp up phases could be a hindrance to each of those KPIs. The policy is to continue to remain agile in technology and invest in systems with universal function to facilitate private sector collaboration.

5.5. Conclusion

The Department seeks to support logistics-enabled businesses in Georgia by investing in a portfolio of freight projects that support and enable economic growth in the state. GDOT's metrics-driven approach to freight planning aimes to invest taxpayer funds in a freight network results in tangible benefits for logistics-enabled industries.

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155 Source: Department of Commerce; Prologis
156 Source: Freight Waves

Georgia has steadily grown as a leading destination for business and is projected to maintain a growth rate of 2 to 5 percent in its three key industry groups: distribution, manufacturing, and food and agriculture. To maintain growth and preserve Georgia's status as the premier destination for business, the Department seeks address the effects of a projected increase in freight volume, value, and tonnage through 2050. These critical investments in Georgia's infrastructure are being considered for their strategic importance to these vital industries and their contribution to the state's current and future economic growth.