







2027

Multimodal Freight Plan

NORTH CAROLINA

DRAFT PLAN

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Prepared for
N.C. Department of Transportation

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Executive Summary

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1. Introduction

1.1. Purpose

This 2027 Statewide Multimodal Freight Plan (referred to as "The Plan" in this document) for the State of North Carolina was prepared by the North Carolina Department of Transportation (NCDOT), for two primary purposes:

- To inform and guide NCDOT, its state and regional and local partners, its communities, and its private sector stakeholders, in understanding multimodal freight transportation needs and opportunities, positioning them to take complementary actions to achieve benefits for all parties and the state as a whole; and
- To meet the specifications of **23 U.S.C. § 702**, as enacted by the Fixing America's Surface Transportation (FAST) Act of 2015 and subsequently amended by the Infrastructure Investment and Jobs Act (IIJA) of 2021, which established the National Highway Freight Program (NHFP) and linked receipt of NHFP funds to the creation of State Freight Plans.

The full 2027 Statewide Multimodal Freight Plan consists of this document (the Plan) and two Technical Appendices incorporated with it. A series of technical memoranda used in plan preparation and other supporting material are filed with NCDOT.

1.2. Conformity and Organization

49 U.S.C. § 70202(b)) establishes 17 specific requirements – including both contents and process – that must be addressed by State Freight Plans, as shown in Table 1. This Plan is organized into seven primary sections, and each of the requirements is addressed in one or more sections, as shown in Table 2.

TABLE 1. STATE FREIGHT PLAN REQUIREMENTS

#	Required State Freight Plan Element (49 U.S.C. § 70202(b))
1	An identification of significant freight system trends, needs, and issues with respect to the State.
2	A description of the freight policies, strategies, and performance measures that will guide the freight-related transportation investment decisions of the State
3	When applicable, a listing of multimodal critical rural freight facilities and corridors designated within the State under section 70103 of this title; and critical rural and urban freight corridors designated within the State under section 167 of title 23.
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.
5	A description of how innovative technologies and operational strategies, including freight intelligent transportation systems, that improve the safety and efficiency of freight movement, were considered.
6	In the case of roadways on which travel by heavy vehicles (including mining, agricultural, energy cargo or equipment, and timber vehicles) is projected to substantially deteriorate the condition of the roadways, a description of improvements that may be required to reduce or impede the deterioration.
7	An inventory of facilities with freight mobility issues, such as 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 the freight mobility issues.
8	Consideration of any significant congestion or delay caused by freight movements and any strategies to mitigate that congestion or delay.
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.
10	The most recent commercial motor vehicle parking facilities assessment conducted by the State.
11	The most recent supply chain cargo flows in the State, expressed by mode of transportation.

#	Required State Freight Plan Element (49 U.S.C. § 70202(b))
12	An inventory of commercial ports in the State.
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.
14	The impacts of e-commerce on freight infrastructure in the State.
15	Considerations of military freight.
16	Strategies and goals to decrease: the severity of impacts of extreme weather and natural disasters on freight mobility; the impacts of freight movement on local air pollution; the impacts of freight movement on flooding and stormwater runoff; and the impacts of freight movement on wildlife habitat loss.
17	Consultation with the State freight advisory committee, if applicable.

TABLE 2. PLAN OUTLINE AND REQUIREMENTS ADDRESSED IN EACH PLAN SECTION

#	Plan Outline	Issues Addressed and Relevant Required Elements	Required Elements and Associated Plan Subsections
ES	Executive Summary		
1	Introduction	FAC and stakeholder engagement **[17]**; multistate coordination **[13]**; goals, strategies, and performance measures **[2]**; support for National freight goals [**4]**	**[2]** see 1.5 **[4]** see 1.5 **[13]** see 1.4 **[17]** see 1.3
2	North Carolina's Freight Economy and Commodity Flows	Economic structure; key industries; trade; supply chain commodity flows **[11]**; commodity flow forecasts **[1]**	**[1]** see 2.5 and 2.6 **[11]** see 2.1 through 2.6
3	North Carolina's Freight Transportation Infrastructure	Highways, CUFCs & CRFCs **[3]** and truck parking **[10]**, marine and commercial ports **[12]**; rail, aviation, pipelines, warehousing	**[3]** see 3.1 **[10]** see 3.1 **[12]** see 3.2
4	Current Condition and Performance	Application of performance measures **[2]**; freight bottlenecks and mobility issues **[7]**; congestion and delay **[8];** truck parking utilization **[10]**; multimodal information	**[2]** see 4.1 through 4.3 **[7]** see 4.1 **[8]** see 4.1 **[10]** see 4.1
5	Trends, Scenarios, and Future Performance	General trends **[1]** including technology **[5]**, E-commerce **[14],** and resiliency **[16]**; scenario planning with future congestion and delay **[8],** SWOT analysis	**[1]** see 5.1 **[8]** see 5.2 **[14]** see 5.1 **[16]** see 5.1
6	Plan Recommendations	Policy recommendations addressing state policy **[2];** reliability; resilience (weather and other) **[6];** connectivity; competitiveness Supply chain recommendations addressing economic development and land use, including warehousing and e-commerce **[14]**; technology **[5],** military **[15]**, general resilience [16]; air pollution **[16]**; wildlife habitat loss **[16]** Modal recommendations addressing highways (including truck parking, heavy haul/OSOW trucks **[6]**) and all modes **(**bottleneck elimination **[7]**, congestion mitigation **[8]**)	**[2]** see 6.1 **[5]** see 6.2 **[6]** see 6.1 and 6.2 **[7]** see 6.3 **[8]** see 6.3 **[14]** see 6.2 **[15]** see 6.2 **[16]** see 6.2
7	Freight Investment Plan	Investment Plan **[9]**	**[9]** see 7

The Plan utilizes data from multiple sources and different years. In each case the most recent available data for the applicable data source was utilized. Readers should also be aware that in some cases, tabular data may include rounding effects such that totals may differ slightly from the sums of rows.

1.3. Stakeholder Engagement

The Plan was developed with extensive and structured input from public and private sector partners, including the North Carolina Freight Advisory Committee, the Plan Steering Committee, several rounds of in-person and virtual Regional Workshops, and one-on-one interviews, as summarized in Table 3.

TABLE 3. SUMMARY OF STAKEHOLDER ENGAGEMENT ACTIVITIES

Engagement Type	Types of Representatives and Participants	Outreach Activities
Freight Plan Steering Committee	Subject matter experts from NCDOT, the Federal Highway Administration, metropolitan and rural planning organizations (MPOs and RPOs), and other key partner agencies involved in freight planning across North Carolina.	Three Meetings • Feb. 25, 2026 • May 12, 2026 • Aug. 25, 2026
State Freight Advisory Committee	Public- and private-sector stakeholders, including representatives from advocacy, agricultural, aviation, conservation, economic development, government, freight industry, pipelines, railroads, research, and trucking groups.	Four Meetings • Jan. 20, 2026 • March 26, 2026 • June 30, 2026 • Sept. 29, 2026
Agency Coordination Group	Representatives from state and federal agencies responsible for transportation, commerce (including the NC Office of Science, Technology & Innovation), agriculture, environmental quality, public safety, university and community college, and tribal interests.	Round 1 of Regional Meetings • Raleigh/Durham: March 3, 2026 • Charlotte: March 4, 2026 • Asheville: March 10, 2026 • Wilmington: March 13, 2026 Round 2 of Regional Meetings • Waynesville: July 14, 2026 • Triad: July 15, 2026 • Wilmington: July 16, 2026

Engagement Type	Types of Representatives and Participants	Outreach Activities
Statewide Stakeholder Group	Range of business and special interest organizations, including representatives of state research and development agencies, universities, military bases, hubs of innovation, the North Carolina Chamber, industry sector organizations, and the North Carolina State Ports Authority.	Regional Industry Forums • Raleigh/Cary: April 22, 2026 • Charlotte: April 28, 2026 • Virtual: April 29, 2026 • Wilmington/Virtual: May 4, 2026 One-on-One Interviews Truck Driver Survey
Board of Transportation	The Board of Transportation has the ultimate control over the adoption of the Statewide Multimodal Freight Plan and the implementation of the recommendations therein.	Two Meetings • June 3, 2026 • November 4, 2026
Public Communications	General public	Plan Website Plan Fact Sheet

1.4. Participation in Multi-State Planning

North Carolina is a member of the following multi-state transportation planning coalitions:

- The Eastern Transportation Coalition (TETC), formerly the I-95 Corridor Coalition;
- The Appalachian Regional Commission (ARC);
- The Southeast Corridor Commission;
- The Virginia-North Carolina High Speed Rail Compact; and
- The South Carolina DOT Freight Advisory Committee.

TETC provides access to shared data and policy analysis for its member states, acting as a clearinghouse for information exchange and a facilitator for multi-state planning collaborations addressing passengers and freight, such as the Southeast Rail Operations Study (SEROps). TETC does not develop policy or project recommendations independent of its state members, but it does provide a platform for collaboration and information exchange between neighboring states.

ARC and NCDOT partner strongly in planning for the western portion of North Carolina and have jointly developed a number of analyses addressing freight movement and infrastructure, including improvements to a 12-mile portion of Corridor K between Robbinsville and Stecoah in Graham County. Corridor K extends from I-75 in Cleveland, TN, to Dillsboro, NC. Both North Carolina and Tennessee continue to strive to complete the remaining unimproved sections of this Appalachian Development Highway System (ADHS) route linking Chattanooga, TN and Asheville, NC. US 74 is critically important for freight and the movement of goods. Additionally, the North Carolina Department of Commerce produces a five-year plan for investment of ARC funds (see https://www.arc.gov/wp-content/uploads/2025/12/North-Carolina-ARC-4-YR-Plan-FY-2025-2029.pdf).

The Southeast Corridor Commission was established to develop and implement a common vision for high-performance passenger and freight rail in the region. The commission consists of executive level members of the Departments of Transportation of Florida, Georgia, North Carolina, South Carolina, Tennessee, Virginia, and Washington, D.C. To date, the Southeast Corridor Commission has published the Southeast Regional Rail plan, a report on the Economic Benefits of High-Performance Rail in the Southeast, and the Southeast Corridor Development Strategy. Information related to the Commission can be found at https://www.southeastcorridor-commission.org/. In the Fall of 2026, the Commission will be initiating an analysis of the southeast rail network (Southeast Rail Network Analysis Project) to inform potential future improvements that may influence the fluidity of the Southeast rail network for the benefit of both freight and passenger rail.

The Virginia-North Carolina Interstate High Speed Rail Compact (Compact) was established in 2004, when both the North Carolina General Assembly and the Virginia General Assembly passed state laws creating the Compact (NC General Statutes Chapter 136, Article 18 and Code of Virginia 33.2-1400, Chapter 662). The state laws were passed pursuant to Congressional authorization given to states to create rail compacts in 1997 as part of the Amtrak Reform and Accountability Act (49 USC 24101). The Compact is comprised of two Senators, two representatives and one appointee from the governor from North Carolina and two senators and three delegates from Virginia. The Compact is a legislative entity and can only formally be expanded through changes in each member and potential member states' legislation. Currently, the Compact is limited to only North Carolina and Virginia. The mission of the Compact is to study, develop, and promote a plan for design, construction, financing, and operation of rail on the Southeast Corridor.

NCDOT continues to coordinate projects with our neighboring states, other state agencies, and federal agencies throughout long-range planning to implementation. Examples include the following:

- I-40 Hurricane Helene Repairs – Close collaboration between North Carolina and Tennessee regarding traffic patterns, incidents, and repair schedules.
- Corridor A (US 64/NC 69/GA 515) – Both North Carolina and Georgia have active construction projects underway to improve this ADHS corridor linking Asheville and Atlanta.
- I-26 – NCDOT Division 14 regularly coordinates with SCDOT when implementing detours to accommodate commercial vehicle incidents and/or weather events impact I-26; especially on the Saluda grade.

1.5. Freight Vision, Goals, Objectives, and Performance Measures

The Plan is guided by North Carolina's overall transportation system vision and its supporting goals and objectives, as articulated in the state's most recent Long-Range Transportation Plan, NC Moves 2050. The Plan adapted the NC Moves 2050 framework, incorporated relevant material from four other platform documents (the previous state freight plan, the North Carolina Commerce Strategic Plan, the North Carolina State Rail Plan, and the NCDOT Strategic Plan 2025-2029), and included additional ideas related mostly to new data technologies. This approach produced a vision statement and goals framework consistent with the LRTP, supported by objectives consistent with other relevant policy documents and reflecting current best practice. See Table 5 and Table 6.

TABLE 4. PLAN VISION STATEMENT

The 2027 North Carolina Statewide Multimodal Freight Plan will advance and support the NC Moves 2050 vision to strengthen North Carolina's multimodal transportation system by prioritizing safety, economic vitality, high quality of living and sustainability by integrating technological innovations and demographic shifts.

TABLE 5. PLAN GOALS AND OBJECTIVES

Improve freight cargo and workforce transportation efficiency and reliability

- Improve system efficiency and reliability with strategies that provide the most benefit for the least public cost, emphasizing improvements to existing networks and facilities.
- Promote safe and efficient access between freight industry worker housing and workplace locations.
- Strategically expand system capacity where existing infrastructure cannot be optimized.
- Improve roadway user mobility and productivity by monitoring and addressing recurring and non-recurring truck travel time delay.
- Maintain and improve integration and connectivity across and between freight modes.
- Improve incident management system by partnering with emergency response and law enforcement agencies, facility owners/operators, and carriers across all modes.
- Where possible, schedule road closures for construction and maintenance outside of peak hours and peak seasons.
- Collaborate with MPOs, RPOs, and local governments in improving the “last mile” freight operations and urban area logistics.
- Improve access to information on congestion, incidents, construction activity, and truck parking through messaging infrastructure and web communications.

Foster public-private partnerships and collaboration with freight stakeholders

- Maintain and expand private sector and federal, state, and local agency involvement in freight planning through the state Freight Advisory Committee and other continuous engagement.
- Coordinate with neighboring states through the Eastern Transportation Coalition and/or other multistate transportation collaborations continuous engagement.

Support adoption and deployment of new freight technologies

- Coordinate traffic signals on U.S. and North Carolina routes to improve flow of through traffic.
- Implement adaptive signal control and other Intelligent Transportation System (ITS) solutions for freight transportation corridors, freight facilities, and curbside management in partnership with local agencies.
- Support research and pilot deployment of Connected and Autonomous Vehicle truck corridors and Advanced Air Mobility systems.
- Support research and deployment of advanced fuels and power systems for trucks, ports, airports, and rail facilities, to benefit efficiency, reliability, and community impact.
- Understand and utilize AI and emerging data collection and exchange tools to promote transportation system planning and management.

Enhance freight transportation safety and security

- Reduce death, injury, and crash/incident rates on all modes to improve public health.
- Reduce economic losses due to transportation crashes and incidents.
- Eliminate safety hazards by proactively working with stakeholders and agencies responsible for the freight transportation system.
- Work with public and private stakeholders to monitor truck parking related incidents, reduce the frequency of incidents and undesignated parking, and better match designated parking inventory to demand.
- Develop recommended freight design standards and best practices for multimodal transportation and industrial facility access points for use by state, regional, and local governments.

Enhance economic development opportunities and competitiveness

- Emphasize improvements that benefit industry Key Performance Indicators (KPIs) – such as transportation system reliability, speed, cost, safety, security, and resiliency – to maintain and enhance North Carolina's competitiveness as an industry location and job growth center.

- Emphasize efficient highway access to and from ports, airports, inland ports, rail terminals, industry and logistics hubs, and industrial development mega-sites. Also emphasize other last-mile modal connections such as rail access to industrial sites.
- Enhance the capacity and performance of key domestic and international trade corridors (highway and rail) and gateways (seaports and airports) within the larger multimodal transportation system.
- Partner with the NC Department of Commerce, NC college and university programs, and other partners to support freight industry workforce development and training, emphasizing opportunities for disadvantaged groups and geographies.



Protect and enhance the natural and human environment

- Work to avoid and reduce adverse environmental impacts of freight transportation infrastructure and activity, particularly in disproportionately affected communities and sensitive natural areas.
- Promote modal facility and service options with the least impacts based on location.



Improve resiliency, understand and manage risk, and recover the multimodal transportation system from disruption events

- Strengthen the resilience of the multimodal freight network against extreme weather events.
- Plan for, develop, and maintain alternate access routes and modal redundancy in the system for rapid recovery from weather or other disaster events.
- Identify multimodal transportation improvements which enhance system performance and reliability through natural, technological and man-made hazards.
- Systematically and programmatically address risks to critical multimodal freight infrastructure, considering avoidance, hardening, emergency response, recovery, and reconstruction phases.
- Support regular equipment and fixed infrastructure repair and replacement.
- Organize to recover the transportation network after emergencies.

Improve freight infrastructure conditions and preservation

- Maintain, preserve, and extend the service life of existing and future freight transportation infrastructure serving all modes.

Support good fiscal management and sustainable funding for the state's freight network

- Pursue funding for projects with long-term benefits or high benefit-cost ratios.
- Leverage federal funding in freight projects.
- Maintain high standards in management of public assets and resources.

Performance measurement strategies were considered at an early stage of the planning process. These measures were selected and aligned with goals and objectives to track progress in achieving them and defining them at an early stage helped focus the technical investigations undertaken in this Plan.

TABLE 6. PLAN PERFORMANCE MEASURES

Plan Goal Areas	Associated Quantitative NCDOT Performance Measures (KPIs)
Provide Transportation Access for All	• Share of project and program recommendations with benefit-cost ratios exceeding 1.0 • Percentage of North Carolinians with access to a viable alternative to driving, supporting workplace access options for freight-related employees • Added lane miles by year • National Highway System Reliability Index; Interstate Highway Travel Time Index • Number of intermodal facilities accommodating transfer between modes • Rate of incident clearance within 90 minutes • Share of closure events impacting peak hours • Extent of information distribution by number of physical locations and number of online users
Improve Transportation through Technology	• Extent of coordinated system in lane miles • Extent of ITS deployment in lane miles • Number of advanced technology pilot deployments
Ensure Safety and Security	• Numbers and rates per VMT of roadway fatalities, injuries, and other crashes and incidents • Public (external) and private costs of crashes • Reduction of risk at the most hazardous at-grade rail crossing per NCDOT hazard ratings • Number of truck parking-related crashes; inventory of truck parking spaces; locations and extents of undesignated truck parking
Support a Strong Economy	• Average roadway travel speeds, extent of recurring and non-recurring delays, aggregate costs of recurring and non-recurring delays • Estimated / approximated throughput capacity (in tons or units) for multimodal facilities including seaports; airports; inland ports and rail terminals; key rail corridors; and key highway corridors • Roadway capacity and Volume-Capacity (V/C) ratios on key corridors and access connectors

Plan Goal Areas	Associated Quantitative NCDOT Performance Measures (KPIs)
Maintain a High-Quality System	• Percentage of roads reopened and damaged sites repaired after disruption events • Pavement Condition and Bridge Condition survey scores • Mileage of rail unable to accommodate 286K railcars • Share of programmed/planned projects with committed funding • Number of projects utilizing federal program or grant funding • Delivery rate of projects

The Plan provides strong support for established national freight goals. Each of the National Freight Planning Goals established in **49 U.S.C. §70101(b)** – which incorporates the goals set forth in **23 U.S.C. §167(b)** – is reflected in one of the goal areas defined in this Plan. See Table 7.

TABLE 7. SUPPORT FOR NATIONAL FREIGHT PLANNING GOALS IN 49 U.S.C. §70101(B)

National Freight Planning Goal (49 U.S.C. §70101(b))	What State Freight Plans Should Support	National Goals Addressed in Each Plan Goal Area				
		#1 – Provide Transportation Access for All	#2 – Improve Transportation Through Technology	#3 – Supports Safety and Security	#4 – Support a Strong Economy	#5 – Maintain a High-Quality System
Strengthen U.S. economic competitiveness, reduce congestion and bottlenecks, and increase productivity	Investments and policies that improve freight system performance and economic outcomes.	Yes			Yes	
Improve safety, security, efficiency, and resiliency of multimodal freight transportation	Projects and strategies that reduce risks, improve operations, and strengthen supply chain resilience.	Yes		Yes	Yes	Yes
Achieve and maintain a state of good repair on the National Multimodal Freight Network	Preservation, maintenance, and rehabilitation of freight infrastructure assets.					Yes
Use innovation and advanced technology to improve safety, efficiency, and reliability	Deployment of ITS, freight technology, automation, data analytics, and operational innovations.		Yes			

National Freight Planning Goal (49 U.S.C. §70101(b))	What State Freight Plans Should Support	National Goals Addressed in Each Plan Goal Area				
		#1 – Provide Transportation Access for All	#2 – Improve Transportation Through Technology	#3 – Supports Safety and Security	#4 – Support a Strong Economy	#5 – Maintain a High-Quality System
Improve the economic efficiency and productivity of the National Multimodal Freight Network	Investments that lower freight costs and improve throughput and system performance.	Yes		Yes	Yes	
Improve the reliability of freight transportation	Actions that reduce delays, bottlenecks, and variability in freight movement.	Yes			Yes	Yes
Improve movement of goods across rural areas, between rural and urban areas, and from ports, airports, and gateways to the freight network	Enhanced freight connectivity and first/last-mile access, especially in rural areas.				Yes	
Improve State flexibility to support multi-State corridor planning and multi-State organizations	Regional and corridor-based freight planning and coordination across multiple states.	Yes				
Reduce adverse environmental impacts of freight movement	Emissions reduction, environmental mitigation, and sustainability initiatives.		Yes			Yes

National Freight Planning Goal (49 U.S.C. §70101(b))	What State Freight Plans Should Support	National Goals Addressed in Each Plan Goal Area				
		#1 – Provide Transportation Access for All	#2 – Improve Transportation Through Technology	#3 – Supports Safety and Security	#4 – Support a Strong Economy	#5 – Maintain a High-Quality System
Pursue these goals in a manner that is not burdensome to State and local governments	Efficient, practical implementation approaches that minimize administrative burden.					Yes

1.6. Strategic Transportation Investments Legislation

The Strategic Transportation Investments (STI) legislation establishes the framework for prioritizing transportation capital projects for funding in the State Transportation Improvement Program (STIP). The process is data driven and distributes available funding into three categories: Statewide Mobility (40 percent), Regional Impact (30 percent), and Division Needs (30 percent). The regional and division scoring combines data with local input. Freight is a quantitative measure for highway mobility and highway modernization in all categories making up 25 percent, 10 percent, and 5 percent of the score respectively for statewide, regional and division projects. For both categories the score is based on truck volumes and truck percentage. For P8.0 the contribution of freight to highway modernization has increased to 15 percent for the regional impact score, with 25 percent for statewide and 5 percent for division. Freight is also part of scoring for rail projects, but only Class I freight projects are eligible for statewide mobility.

The Freight Plan provides an evidence-based guide to freight needs, project development, and funding strategies. It does not reflect a separate project selection process or a commitment that projects prioritized within the plan will receive STI funds.

The Freight Plan does provide several opportunities that in collaboration with STI legislation and processes can be used to advance NCDOT's freight goals. For example, the Freight Plan can be used to:

1. **Strengthen the case for freight investments**. The plan identifies bottlenecks and documents freight, safety, congestion, and economic benefits. This information can be used to identify projects to compete through STI.
2. **Build regional and local support**. MPOs, RPOs, and NCDOT divisions can collaboratively use the Plan to translate statewide freight needs into project submissions and to inform local input on regional and division scoring.
3. **Identify complementary funding pathways.** While federal discretionary grants are excluded from the STI formula, offering another potential avenue for funding freight projects, they are still required to have a local match and that match is often covered by the funds allocated to the project through STI. There are other funding sources that can be explored, the most promising being public-private partnerships, especially truck parking projects.

2. North Carolina's Freight Economy and Commodity Flows

The U.S. Department of Transportation (USDOT) has described freight movement as "the economy in motion." Economic forces – production, consumption, trade, and logistics – determine what kinds of freight are moved, between what places, and by what modes. The Plan therefore begins with a baseline assessment of the North Carolina freight economy, addressing five interrelated topics:

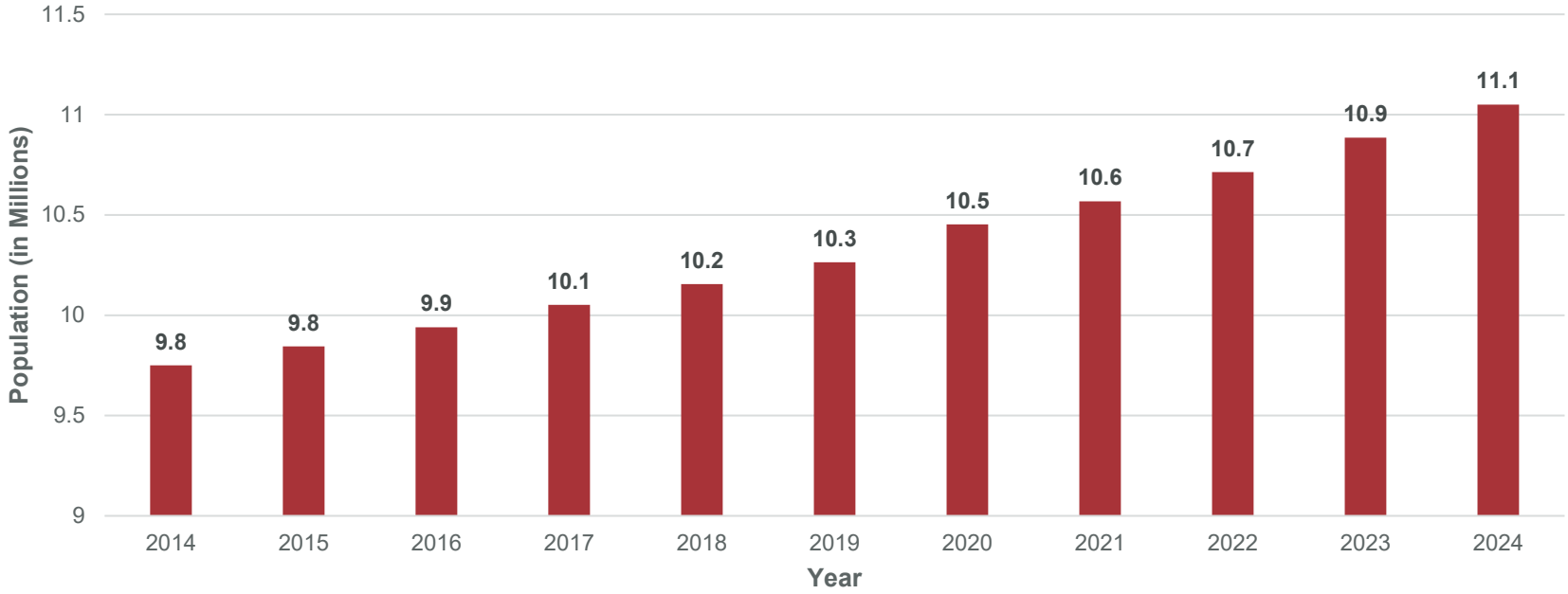
1. State population
2. Employment and Gross State Product (GSP) in freight and non-freight intensive industries
3. Key industries driving supply chain flows of goods
4. North Carolina's role in international trade
5. Supply chain commodity flows generated by population, employment, industry and trade
6. Freight flows over North Carolina's multimodal transportation network

2.1. Population

North Carolina is the ninth most populous state in the United States and holds the fourth largest population gain in the country after Texas, Florida, and California.[1] As of 2024, North Carolina boasts a population of approximately 11.1 million people.[2] As shown in Figure 1, North Carolina's population increased from approximately 8 million in 2000 to an estimated 11.1 million in 2024, representing growth of nearly 39 percent over 24 years. Six counties (Mecklenburg, Wake, Johnston, Brunswick, Durham, and Iredell) accounted for half the population growth (52 percent) between 2023 and 2024.[3]

1 North Carolina Now Home to Over 11 million People | NC OSBM, 2024.
2 U.S. Census Bureau QuickFacts: North Carolina, 2024.
3 North Carolina Counties Bests Trends in the South and Nation | NC OSBM, 2025.

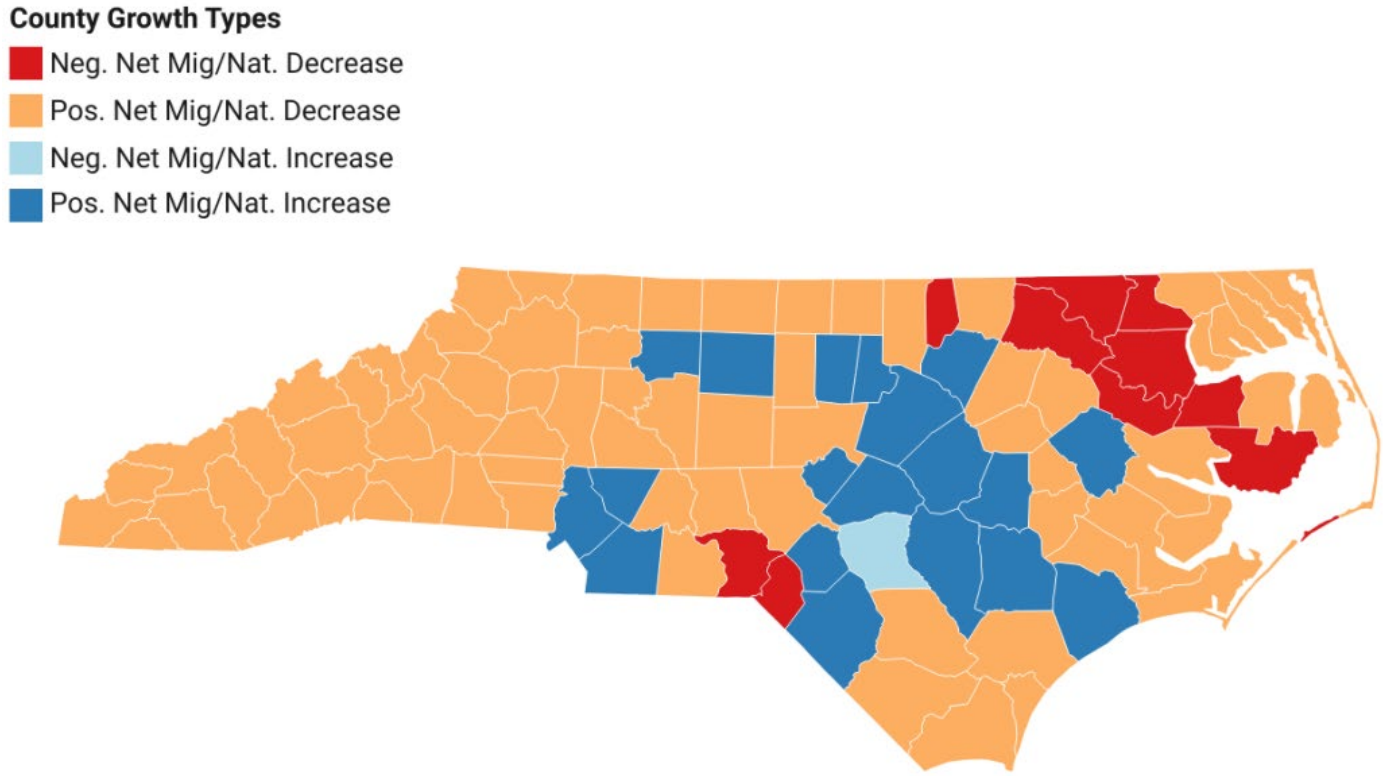
FIGURE 1. HISTORICAL POPULATION CHANGE IN NORTH CAROLINA, 2014-2024



Source: *Certified County Population Estimates* | NC OSBM, 2024

Population growth is strong in future projections with 80 percent of North Carolina counties projected to grow. The state has the unique opportunity to sustain a market driven by demand for goods and supplying a stable, productive labor market for freight, logistics, and manufacturing industries. Figure 2 shows population growth and change among North Carolina's counties. The figure qualifies growth types as negative/positive net migration and natural increase/decrease of population (i.e., change due to births and deaths). Cumberland County was the only county that is expected to undergo a negative net migration with natural increase between 2020 and 2030. Mecklenburg and Wake Counties are projected to observe the highest positive net migration with natural increase in population. Most counties in western North Carolina are expected to show a positive net migration with natural decrease in population.

FIGURE 2. NORTH CAROLINA COUNTIES BY POPULATION GROWTH PATTERNS, 2020-2030



https://datawrapper.dwcdn.net/NiamF/1/

Map: NC Office of State Budget & Management • Source: NCOSBM, Vintage 2024 Population Projections • Created with Datawrapper

Source: *Census Counts & Population Estimates* | NC OSBM, 2025

2.2. Employment and Gross State Product

In 2025, 5.09 million people were employed in North Carolina.[4] Between 2015 and 2025, North Carolina's employment increased by approximately 12 percent, rising from about 4.5 million to over 5 million employed persons.[5] In May 2025, North Carolina had an unemployment rate of 3.7 percent, which was below the national average of 4.2 percent.[6]

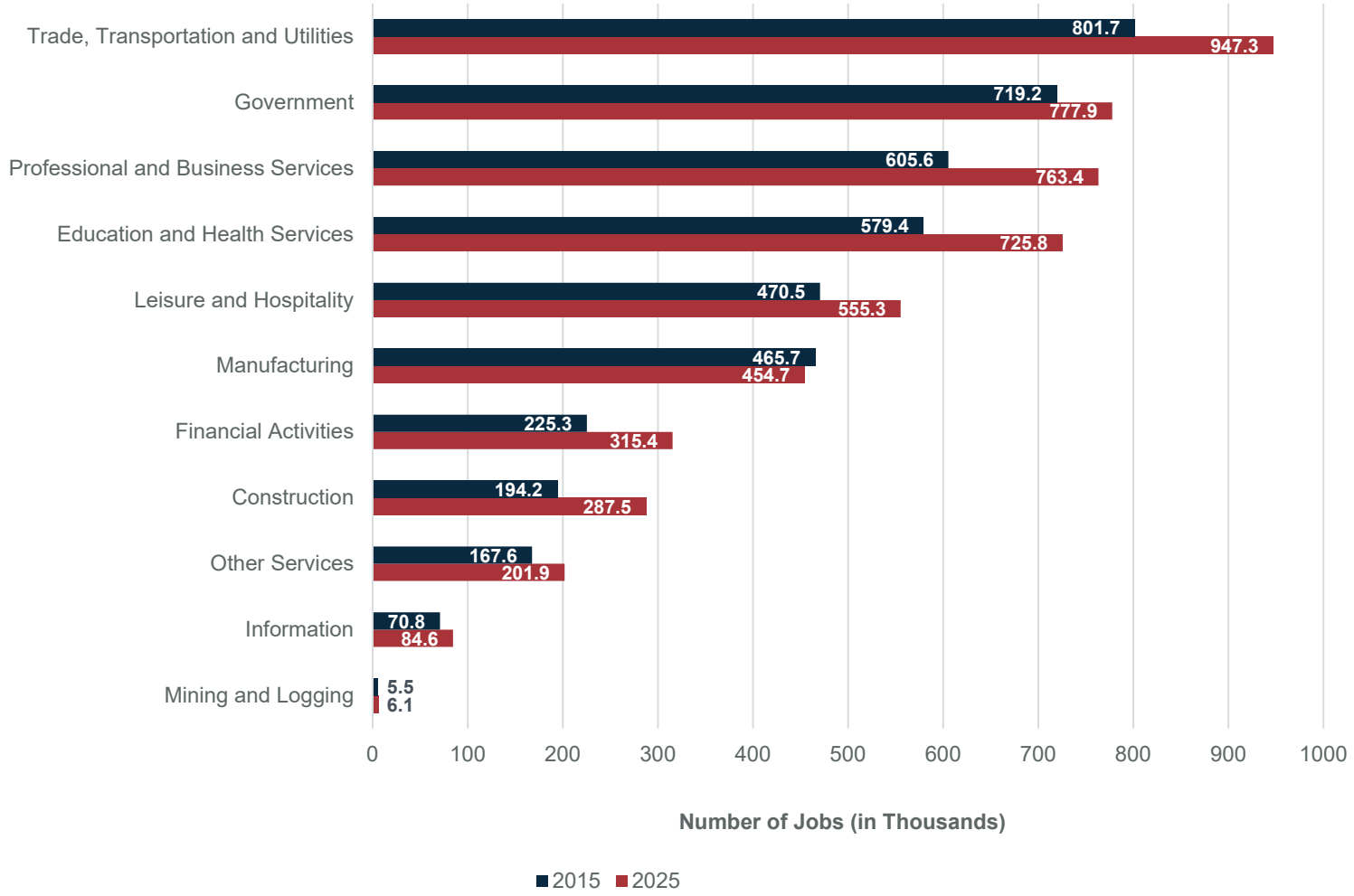
Employment can be generally divided into freight-dependent industry groups (those which are wholly or largely dependent on the movement of goods) and non-freight-dependent industry groups (which may produce or consume some supplies and materials but are not primarily dependent on transported goods). In 2025, freight dependent industries employed **1.7 million** workers (up **15.57** percent since 2015) and non-freight dependent industries employed **3.4 million** workers (up **20.65 percent** since 2015). Figure 3 shows North Carolina employment in freight-dependent and non-freight dependent industries in 2015 and 2025 from Bureau of Labor Statistics data (which does not include agricultural and farm employment).

Looking specifically at freight-dependent industries:

- The trade, transportation, and utilities category had the largest share of employment in North Carolina, responsible for more than 947,000 jobs in 2025 (Figure 3). Between 2015 and 2025, jobs in the trade, transportation, and utilities industries observed a positive percentage change of 18.1 percent.
- Other freight-dependent industries like mining and logging and construction also increased jobs in their industries by 10.9 percent and 48 percent, respectively.
- Manufacturing employed over 454,700 workers; however, between 2015 and 2025, the industry lost about 2.3 percent of its jobs.

[4] North Carolina Economy at a Glance, U.S. Bureau of Labor Statistics, 2026.
[5] Local Area employment Statistics, U.S. Bureau of Labor Statistics Data, 2026.
[6] North Carolina's May Employment Figures Released | NC Commerce, 2025.

FIGURE 3. EMPLOYMENT BY INDUSTRIES, FREIGHT AND NON-FREIGHT DEPENDENT, 2015-2025



Source: *North Carolina Economy at a Glance*, U.S. Bureau of Labor Statistics, 2026

As noted above, the BLS data used in Figure 3 do not include agricultural and farm employment. BLS estimates are built from employer-reported data, mainly the Quarterly Census of Employment and Wages, which covers workers in jobs covered by unemployment insurance. Much of the agricultural workforce falls outside that coverage, including farm operators, family members working on farms, self-employed producers and seasonal laborers. As a result, BLS-based counts substantially understate the number of people working in agriculture.

To fill this gap, the Plan uses the U.S. Department of Agriculture's National Agricultural Statistics Service (USDA NASS) Census of Agriculture, which collects data directly from farms and ranches. The Census of Agriculture is conducted every five years, so the most recent comparison available is 2017 to 2022, rather than the 2015 to 2025 period used for non-farm industries.

North Carolina had approximately 72,500 agricultural producers in 2022, down slightly from about 74,100 in 2017, a decline of roughly 2 percent.[7] This small decline should be read alongside the sector's freight role. Agriculture and food processing remains one of the state's top freight-generating industries (Section 2.3). Food manufacturing, which relies heavily on in-state agricultural inputs, added 4,600 jobs between 2020 and 2025 (Table 8). Because the USDA and BLS figures come from different sources and time periods, agricultural employment is reported separately and is not added to the statewide employment totals above.

Overall, North Carolina freight-dependent employment is growing strongly. The one area that has seen a slight loss – manufacturing, which lost 11,600 jobs between 2015 and 2025 – warrants further discussion. The drop can be attributed to deep workforce reductions that happened during and after the COVID-19 pandemic year 2020. The manufacturing industry made a critical recovery in workforce during 2022 but employment numbers continued to fall past 2022 and into 2025. However, the manufacturing sector is extremely diverse, and it includes several industries that have actually seen net employment increases in the last five years, as shown in Table 8:

- Food Manufacturing (7.9 percent)
- Transportation Equipment (4.6 percent)
- Fabricated Metal Products (4.2 percent)
- Electrical Equipment & Appliances (3.5 percent)
- Beverage & Tobacco Products (18.3 percent)
- Chemicals Manufacturing (10.3 percent)

[7] USDA NASS, 2022 Census of Agriculture, Volume 1, Chapter 1: State Level Data, North Carolina.

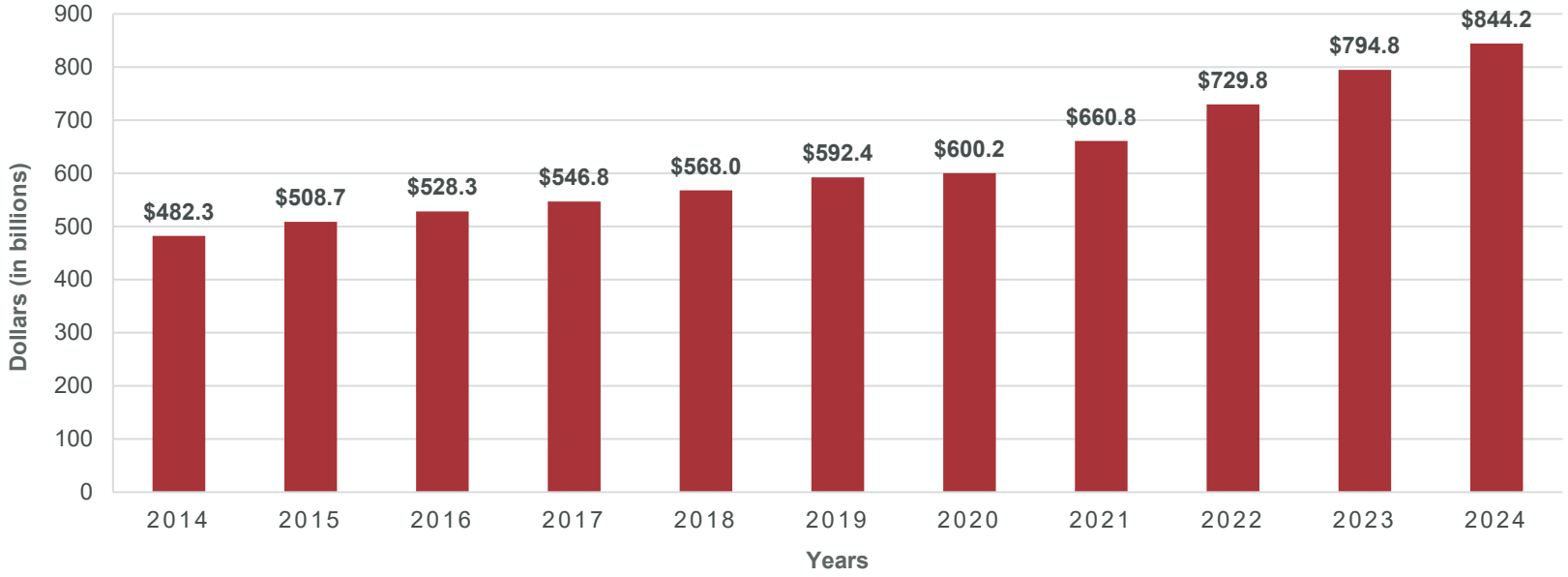
TABLE 8. MANUFACTURING JOBS (IN THOUSANDS) BY INDUSTRY, 2020-2025

Industry	December 2020	December 2025	Change	Percentage Change
Manufacturing	457.5*	452.5**	(5.0)	(1.09)%
Food	58.3	62.9	4.6	7.9%
Chemicals	42.7	47.1	4.4	10.3%
Fabricated Metal Products	35.7	37.2	1.5	4.2%
Machinery	34.5	36.2	1.7	4.9%
Plastics & Rubber Products	34.5	34.4	(0.1)	(0.3)%
Transportation Equipment	32.5***	34****	1.5	4.6%
Furniture & Related Products	33.7	27.2	(6.5)	(19.3)%
Computer & Electronic Products	30.8***	26.4****	(4.4)	(14.3)%
Textile Mills	23.9	20.9	(3.0)	(12.5)%
Electrical Equipment & Appliances	21.5***	22.2*****	0.7	3.5%
Wood Products	17.7	17.8	0.1	0.6%
Beverage & Tobacco Product Manufacturing	12	14.2	2.2	18.3%
Printing & Related Support Activities	11.3	10.4	(0.9)	(7.9)%
Textile Product Mills	5.31	5.09	(0.2)	(4.1)%
Apparel	5.4	3.9	(1.5)	(27.8)%

Source: *All Employees: Manufacturing in North Carolina* | FRED | St. Louis Fed, 2026
* Data is from State and Area Employment, Manufacturing – All Employees, North Carolina, Bureau of Labor Statistics Data
** Data is Nov 2025 and not Dec 2025 from State and Area Employment, Manufacturing – All Employees, North Carolina, Bureau of Labor Statistics Data
*** FRED Data is for the Year 2020 and not Dec 2020
**** Data is from 2025 Annual Evaluation of North Carolina Economic Performance, North Carolina Department of Commerce, 2025, since latest data on FRED was available for the year 2024.
***** Data is for January 2025 from *2025 Annual Evaluation of North Carolina Economic Performance*, North Carolina Department of Commerce, 2025.

Between 2014 and 2024, North Carolina's GSP grew from $482.2 billion to $844.2 billion (see Figure 4), or about a 75.1 percent increase in GSP value. The percentage increase in national Gross Domestic Product (GDP) between 2014 and 2024 was approximately 65.7 percent.[8]

FIGURE 4. NORTH CAROLINA GROSS STATE PRODUCT, 2014-2024



Source: *BEA Interactive Data Application*, U.S. Bureau of Economic Analysis, 2025

Over this time period, GSP in the state's freight-intensive industries grew by **$101.8 billion** and **54.6 percent**, compared to non-freight intensive industries which grew by **$285.4 billion** and **89.12 percent**. Overall, while manufacturing jobs have been facing a dip in numbers, the value produced from the state's goods-producing sectors has continued to steadily increase.

[8] Gross Domestic Product: All Industry Total in the United States (USNGSP) | FRED | St. Louis Fed.

2.3. Key Industries

The top industries utilizing North Carolina's freight network include the following:

1. Pharmaceutical, biologics, and medical products
2. Plastics and chemical manufacturing
3. Transportation equipment and industrial machinery
4. Agriculture and food processing
5. Transportation, distribution, and logistics

Other major industries include electronics, communications, textiles, household goods and furniture, building materials, paper and wood products. A large part of this freight movement is supported by North Carolina's well-maintained and extensive road network supported by rail, airports and seaports. Each of these top five industries are discussed below, along with aerospace and defense (an emerging cluster) and textiles and apparel (an important legacy industry).

2.3.1. Pharmaceutical, Biologics, and Medical Products

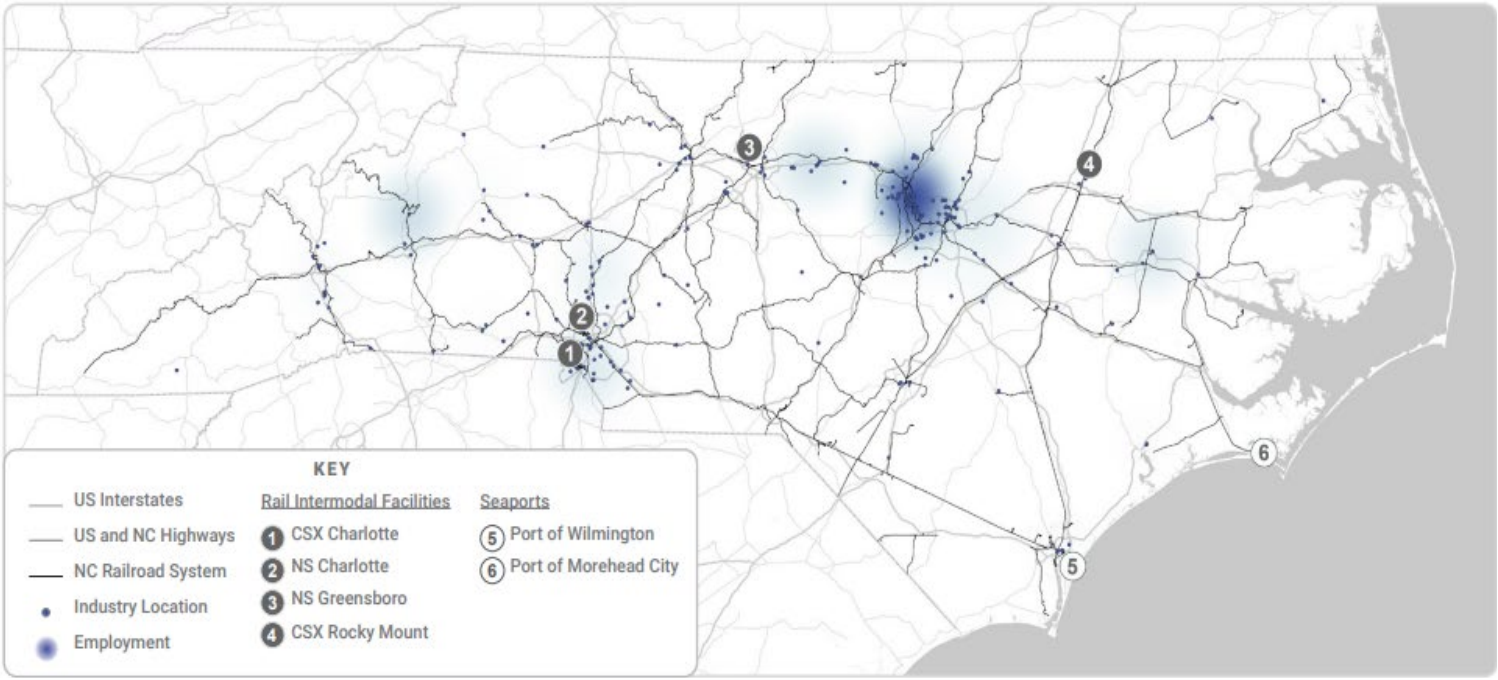
North Carolina's biotechnology and life sciences industry is one of the fastest growing and the most dynamic in the United States. North Carolina ranks seventh nationally in life sciences employment and is recognized as a top-tier, high-growth state alongside Massachusetts and Texas.[9] Since 2019, the life sciences industry in North Carolina has increased its employment base by 20 percent. North Carolina is also one of nine states with a stronghold in all major subsectors in the life sciences industry:

- Drugs and pharmaceuticals (third in the nation)
- Research, testing, and medical labs (fourth in the nation)
- Bioscience-related distribution (eighth in the nation)
- Agricultural feedstock and industrial biosciences (eighth in the nation)
- Medical devices and equipment (19th in the nation)

[9] TEConomy report: NC life sciences growth outpaces nation, passes 100,000 job milestone | North Carolina Biotechnology Center, 2025.

The biotechnology and life sciences industry generates $82.1 billion in total revenue impacts with an output multiplier of 1.6, meaning every $1 in direct output supports an additional $0.59 in the state economy. This translates to over $2.5 billion in state and local tax revenues, consisting of $1.6 billion in state and $0.9 billion in local government revenues. The hot spots are largely near well-connected cities (like Durham, Cary, Chapel Hill, Greenville, Morrisville, High Point, Raleigh, Wilmington, and Winston-Salem) with good transportation facilities. Figure 5 shows the pharmaceutical manufacturing, biologics, and medical products establishment clusters across the state.

FIGURE 5. PHARMACEUTICAL, BIOLOGICS, & MEDICAL PRODUCTS SECTOR HEAT MAP



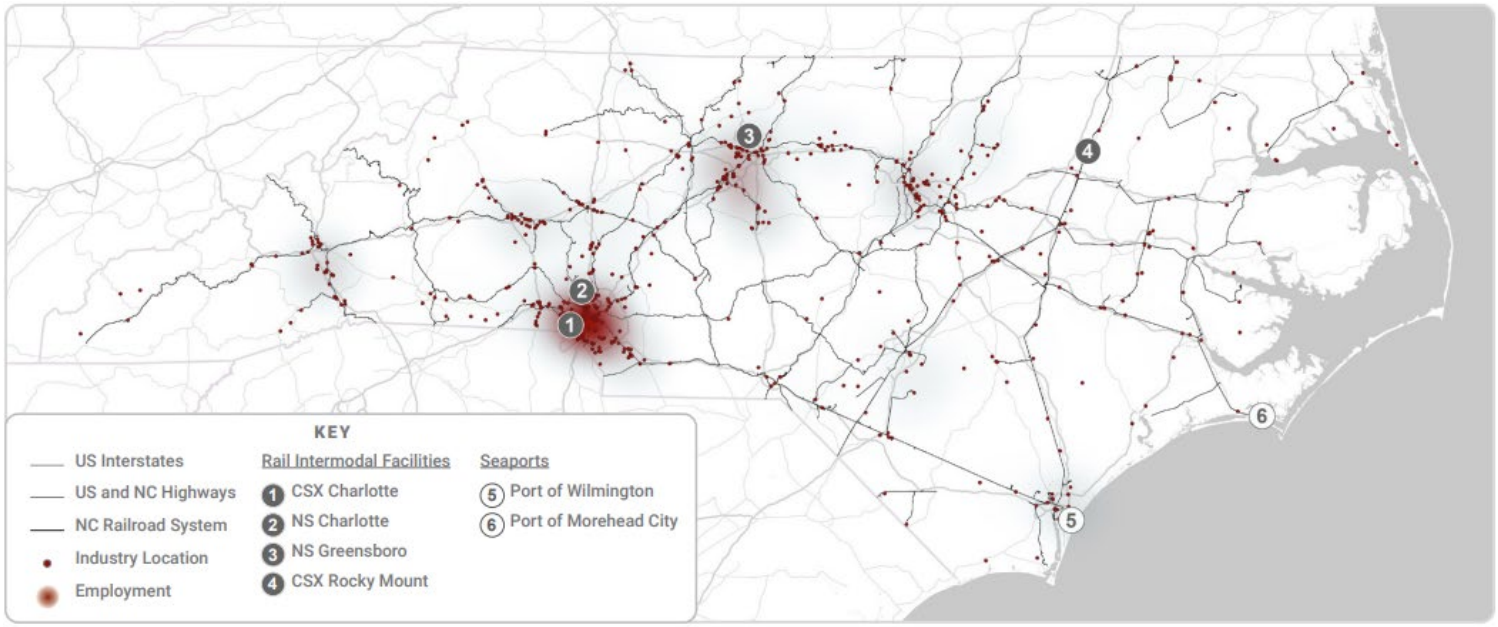
Source: The Economic Contribution of North Carolina's Supply Chain An Analysis of Sectors and Emerging Industries, Institute for Transportation Research & Education, 2024

2.3.2. Plastics and Chemical Manufacturing

North Carolina is one of the leading producers in plastics and chemical manufacturing, hosting the Southeast region's largest and most skilled workforce, and an infrastructure built to support exporting. Since 2018, the industry has grown by over 7 percent, taking advantage of the state's four international airports and two seaports to reach vendors and consumers at all stages of the supply chain.[10] The chemical manufacturing industry in North Carolina provides over 47,300 jobs, which is over 10 percent of North Carolina's overall manufacturing workforce (approximately 460,500 jobs). Plastics and chemical manufacturing together boast of a workforce of over 83,000 employees. In 2022, the industry brought in over $20 billion per year.[11] North Carolina's chemical manufacturing sector operates with above average productivity, output, and wages, and the state has over 2,500 plastic and chemical establishments, distributed as shown in Figure 6.

[10] Plastics & Chemicals Industry in North Carolina | Economic Development Partnership of North Carolina, 2025.
[11] The Economic Contribution of North Carolina's Supply Chain an Analysis of Sectors and Emerging Industries, Institute for Transportation Research & Education, 2024.

FIGURE 6. PLASTICS AND CHEMICAL MANUFACTURING SECTOR HEAT MAP



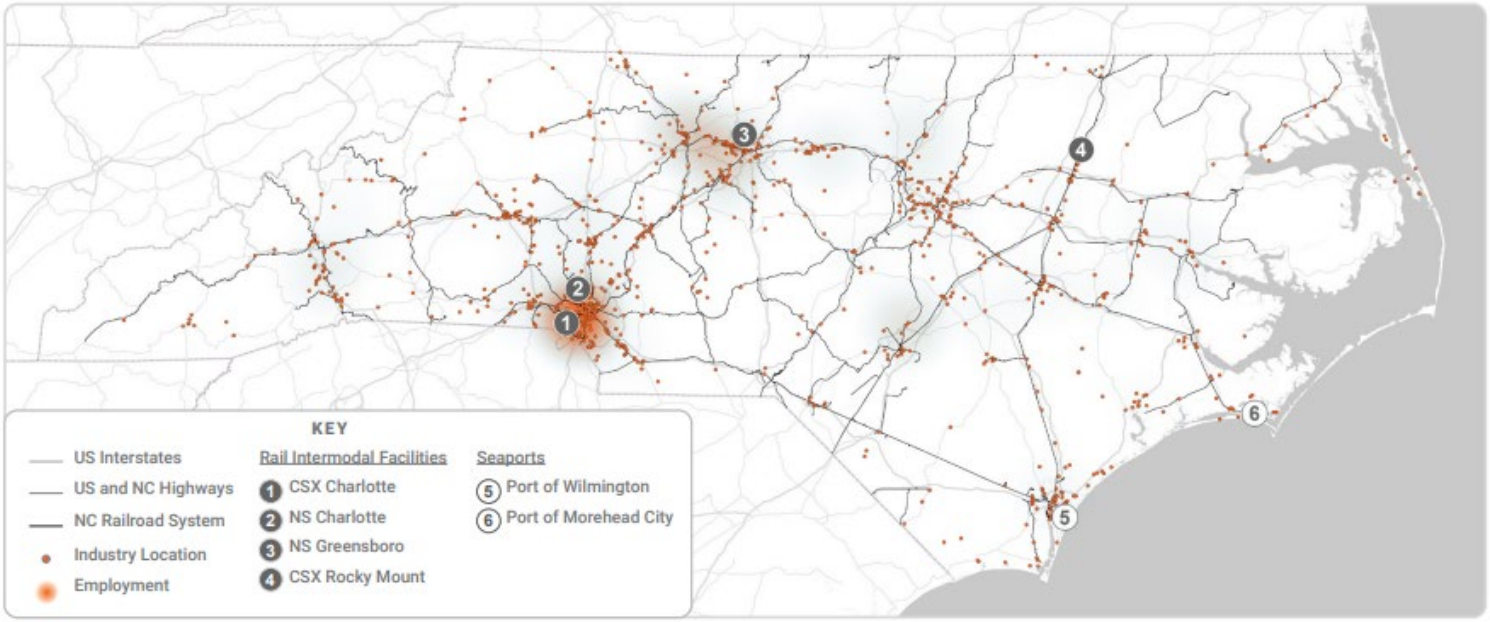
Source: The Economic Contribution of North Carolina's Supply Chain An Analysis of Sectors and Emerging Industries, Institute for Transportation Research & Education, 2024

2.3.3. Transportation Equipment and Industrial Machinery

North Carolina's automotive, truck and heavy equipment industry manufactures a wide variety of items including tires, transmissions, automotive parts, heavy trucks, buses and construction machinery. The industry has shown 30 percent growth since 2011. Multiple factors make North Carolina an attractive state for producing and supplying goods related to the automotive, truck and heavy equipment industry. The southwest region of North Carolina is called the Carolina Tin-Spodumene Belt, home to nearly 80 percent of the nation's lithium ore reserves. Lithium is a vital component to produce

electric vehicle batteries.[12] North Carolina is home to over 250 companies with nearly 300 automotive establishments statewide creating over 240,000 jobs (direct, indirect and induced) across the sector.[13] Figure 7 shows the clustering of establishments manufacturing automotive, truck and heavy equipment. In 2024, the automotive, truck and heavy equipment sector generated over $16.3 billion in total labor income.

FIGURE 7. AUTOMOTIVE, TRUCK AND HEAVY EQUIPMENT SECTOR HEAT MAP



Source: The Economic Contribution of North Carolina's Supply Chain An Analysis of Sectors and Emerging Industries, Institute for Transportation Research & Education, 2024

[12] Sector Spotlight: Driving the Future, Advance NC, 2024.
[13] North Carolina Economic Data | Alliance for Automotive Innovation, 2025.

2.3.4. Agriculture and Food Processing

North Carolina is a leading producer of a variety of agricultural products like tobacco, sweet potatoes, poultry, and eggs, as well as a multitude of livestock products. North Carolina hosts the second-largest animal processing and manufacturing cluster in the United States and is the sixth-fastest growing in confectionary production. A large part of this success is thanks to an extensive supply chain supported by easy access to all major distribution routes across the state.

In 2024, North Carolina was the top producer of sweet potatoes, tobacco, poultry, and eggs, second in Christmas trees, turkeys and trout, third in hogs and cucumbers, fourth in peanuts and broilers, and fifth in cotton. Table 9 shows the volume and value of select agricultural commodities produced in North Carolina in 2024. This massive production happens through nearly 42,100 farms spread over 8.1 million acres of farmland.[14]

TABLE 9. POPULAR AGRICULTURAL COMMODITIES PRODUCED IN NC, 2024

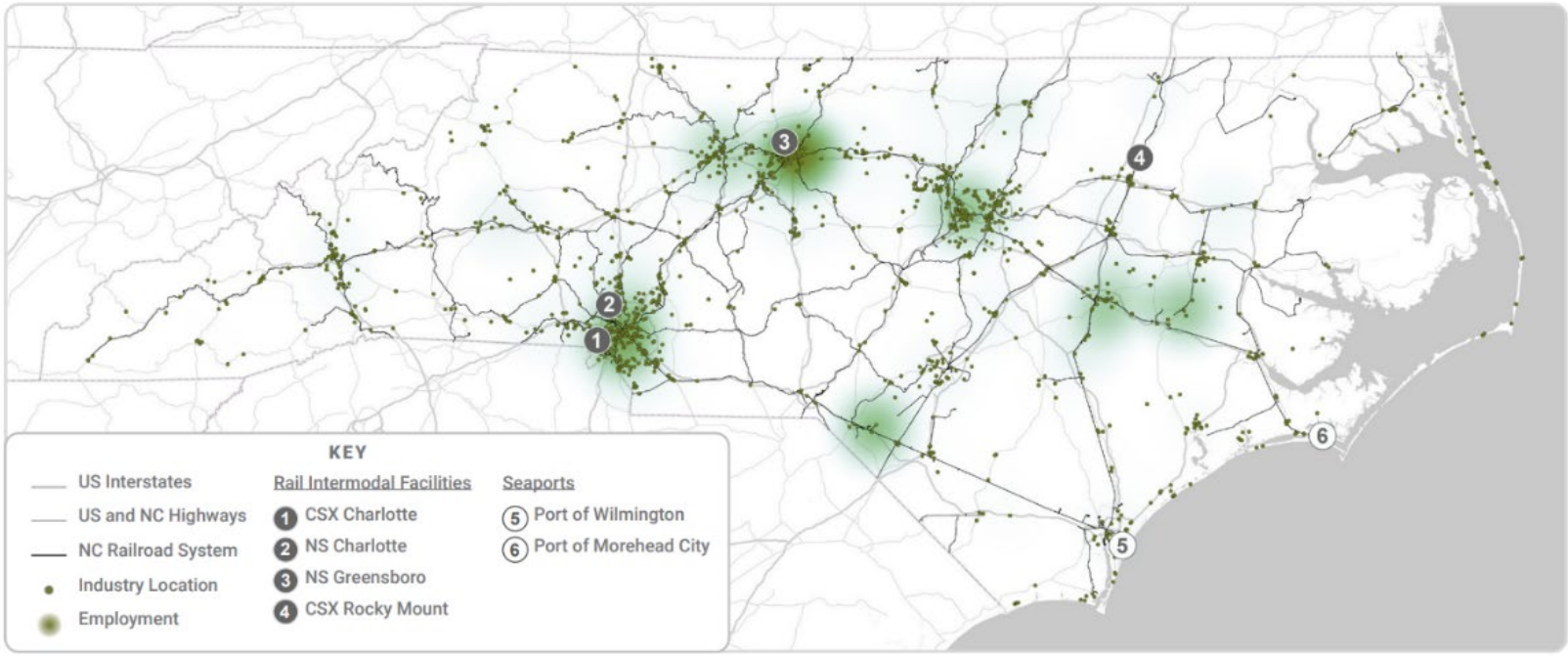
Commodity	Production (in millions)	Value of Production (in millions)
Soybeans	62.4 (bushels)	$634.1
Tobacco	203.4 (lb.)	$469.9
Corn, Silage	0.2 (tons)	$350.9
Sweet Potatoes	12.9 (CWT)*	$254.5
Cotton, Cottonseed	0.2 (tons)	$47.9
Hay	1.3 (tons)	$192.5

Source: USDA/NASS 2024 State Agriculture Overview for North Carolina, U.S. Department of Agriculture, 2026
* 100 pounds = 1 hundredweight

In 2022, North Carolina reported over 72,500 agricultural producers across the state. North Carolina plays host to over 1,275 food and beverage manufacturers and has one of the largest food and beverage industries in the nation.[15] Figure 8 shows the cluster of establishments manufacturing tobacco and foodstuffs in North Carolina.

[14] USDA/NASS 2024 State Agriculture Overview for North Carolina, U.S. Department of Agriculture, 2026.
[15] Food & Beverage Manufacturing in North Carolina | Economic Development Partnership of North Carolina, 2025.

FIGURE 8. TOBACCO AND FOODSTUFFS HEAT MAP



Source: The Economic Contribution of North Carolina's Supply Chain An Analysis of Sectors and Emerging Industries, Institute for Transportation Research & Education, 2024

2.3.5. Aerospace and Defense

In 2024, North Carolina ranked eighth for aerospace manufacturing attractiveness ranking among U.S. states.[16] North Carolina's aerospace manufacturing capabilities are supported by a highly skilled technical workforce, as well as a steady pipeline of military aviation talent entering the civilian workforce. North Carolina ranks fourth in active-duty military

[16] 2024 Aerospace manufacturing attractiveness rankings | PwC, 2024.

personnel,[17] with seven military bases representing four of the six branches of service. The aerospace and defense industry's manufacturing supports aircraft components, engines and turbine airfoils, avionics and electronics, additive manufacturing and advanced materials, defense electronics repair and overhaul.

The aerospace and defense industry supported over 19,500 jobs in North Carolina in 2023.[18] Over 9,255 jobs are direct employment, the remaining 10,252 jobs are integrated into the industry's supply chain. The aerospace and defense industry accounts for 0.9 percent of North Carolina's workforce. Major aerospace manufacturers are based in Wilson, Monroe, Charlotte, Asheville, and parts of western North Carolina. North Carolina has more than 200 aerospace companies and over 400 aerospace suppliers.[19] Different geographic areas have developed concentrations of specialized manufacturing. The Piedmont Triad that includes Greensboro, Winston-Salem, and High Point focuses on aircraft manufacturing and future large-scale production, taking advantage of its proximity to Piedmont Triad International Airport.[20] The industries in Buncombe County specialize in turbine components, advanced materials and ceramic matrix composites, and benefits from the presence of major aerospace companies in the area. Establishments in eastern North Carolina support specialized industrial parks (Global TransPark, Elizabeth City Aviation Research & Development Commerce Park), major military installations, and high-capacity maintenance hubs supporting military branches and commercial fleets alike.

The total economic output of the aerospace and defense industry, in 2023, was over $9.9 billion.[21] The aerospace and defense industry contributed approximately 0.9 percent of the state's total GSP with gross GSP contributions, which amounted to $6.5 billion.

2.3.6. Textiles, Apparel, and Textile Machinery

North Carolina is the leading hub for textiles and nonwovens. It has the second-largest textile and apparel workforce in the nation, its employment concentration is 3.5 times higher than the national average, and it is home to the largest concentration of nonwovens companies in the United States, particularly those that specialize in engineered fabrics.[22]

17 NCMBC Military Presence, Economic Impact, 2022.
18 State Data – North Carolina | Aerospace Industries Association, 2024.
19 Regional Profile | North Carolina's Southeast (NCSE), 2023.
20 Aerospace & Defense | NC Department of Commerce, 2025.
21 State Data – North Carolina | Aerospace Industries Association, 2024.
22 Textile & Nonwoven Industry in North Carolina | Economic Development Partnership of North Carolina, 2025.

North Carolina hosts 13 of the top 40 international nonwoven companies, records more than 40 textile companies overall, and hosts more than 400 textile manufacturing establishments. The textiles, apparel, and textile machinery employs over 33,000 workers directly and indirectly through production in textiles, nonwovens, and apparels. The industry includes a wide range of businesses, from textile mills to clothing manufacturers and retailers.

Major hubs for the textiles, apparel, and textile machinery industry are concentrated around Metrolina, Triad, Triangle, and Asheville regions.[23] These areas form the historical and modern textile belt of North Carolina.

2.3.7. Transportation Distribution and Logistics

North Carolina's transportation, distribution, and logistics sector is a key enabler for almost every industry, manufacturing and otherwise, within the state's economy. The sector includes air, rail, water, truck transport, couriers, and warehousing. It is the catalyst behind two of the country's fastest-growing metropolitan cities (i.e., Raleigh and Charlotte), the eighth busiest airport (Charlotte Douglas Internation Airport) by operations, and over 80,000 miles of state-supported roads, ranking as the second-largest state-maintained highway system in the nation.[24,25,26]

The region also hosts vital interstates like I-95 and I-40, which form a backbone of efficient overland transport. I-95, the East Coast's main north-south corridor, connects the Southeast region directly to major markets up and down the seaboard. I-40, stretching from Wilmington west to California, makes coast-to-coast freight movement feasible. Additionally, upcoming infrastructure improvements – such as the extension of I-295 south of Fayetteville and enhancements to I-74 – are expanding capacity, shortening delivery timelines, and reducing costs for logistics companies and freight forwarders. Other vital interstate corridors include I-85, I-73, I-140, I-795 and the future I-42. Delivery to consumers (i.e., home delivery) was boosted enormously during the COVID-19 pandemic and has become a major component of the transportation, distribution, and logistics sector.

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23 Creating A New Pattern for The Textiles Industry | Economic Development Partnership of North Carolina, 2024.
24 20 Fastest Growing Cities in The US (2025) | Josh Howarth (ExplodingTopics.com), 2025.
25 The United States' 10 Busiest Airports in Operation | Steven Walker (SimplyFlying.com), 2025.
26 State of the System: Highways, NC Moves 2050 | NC Department of Transportation, 2019.

The Port of Wilmington and Port of Morehead City provide North Carolina access to global markets where products are sold and resources are found, making North Carolina ports a key factor in North Carolina's international freight movement. The Port of Wilmington is recognized for its operational efficiency, minimal congestion, and rapid turnaround times. It provides container, bulk, and breakbulk handling services, complemented by on-terminal rail connections and convenient highway access. Businesses benefit from reduced drayage expenses, dependable transit schedules, and a deep-water port that consistently invests in expanding capacity and advancing technology. For companies managing international supply chains, the Port of Wilmington enables faster processing and cost-effective operations. Meanwhile, the Port of Morehead City focuses on bulk and breakbulk cargo, positioning North Carolina's Southeast region as a competitive hub for export-driven industries. North Carolina's ports contribute over $16.1 billion in economic output to the state.[27]

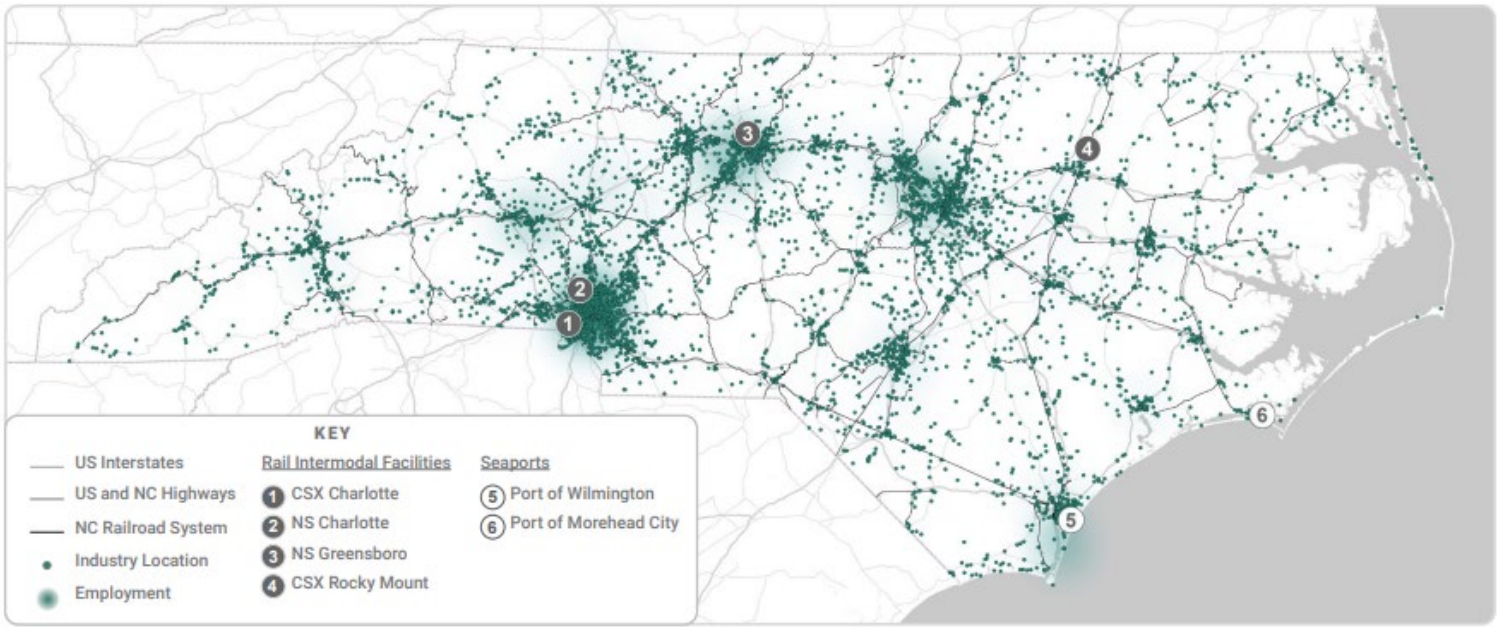
Additionally, North Carolina is served by 17 airports with cargo activity (see list in Section 3.4). North Carolina's Southeast region is served by multiple airports, including Wilmington International Airport and Fayetteville Regional Airport, which provide air freight capabilities alongside passenger services. The North Carolina Global TransPark and Kinston Regional Jetport function as versatile transportation hubs, offering connections to key East Coast and transatlantic markets. Additionally, Raleigh-Durham International Airport and Charlotte Douglas International Airport are close by, which further extends the region's global reach. Businesses that depend on just-in-time delivery or high-value cargo benefit from reliable air logistics integrated into the region's multimodal transportation network.

The state's rail network accommodates a wide range of freight, from bulk commodities to intermodal shipments, providing industries with the flexibility required for growth. Two Class I railroads – CSX and Norfolk Southern – serve the area, offering direct connections to inland markets, seaports, and major distribution centers. As of 2022, with over 116 rail industry businesses in the region and over 860 businesses loading their commodities directly onto rails for transportation, North Carolina's rail systems supported over 80,000 jobs in the state. Additionally, short line railroads delivered tailored freight solutions to local businesses. Over 45 million tons of rail freight terminated in North Carolina and strategically positioned intermodal terminals enhanced efficiency for manufacturers and distributors seeking cost-effective rail transport options. Rails provided over $20 billion in annual statewide output.[28]

[27] Economic Contribution.| North Carolina Ports, 2025.
[28] Economic Contributions of Rail in North Carolina | ITRE, 2022.

Figure 9 shows the cluster of establishments working in the transportation, distribution, and logistics sector in North Carolina.

FIGURE 9. TRANSPORTATION, DISTRIBUTION, & LOGISTICS SECTOR HEAT MAP



Source: The Economic Contribution of North Carolina's Supply Chain An Analysis of Sectors and Emerging Industries, Institute for Transportation Research & Education, 2024

In 2022, the transportation, distribution, and logistics sector (accounting for transportation and warehousing, wholesale trade and retail trade) employed over 925,000 people. North Carolina's industry employment projections predict that the transportation, distribution, and logistics sector will record a 6 percent increase and boast over 980,000 jobs by 2032.[29] Trade and material moving occupations in particular are projected to increase by 11.6 percent with an annualized growth of 1.1 percent.

[29] North Carolina Employment Projection to 2032, NC Department of Commerce, 2022.

2.3.8. Current Conditions and Looking Ahead

Key highlights for North Carolina's freight intensive industries are as follows:

- Growth has been fastest in pharmaceutical, biologics, and medical products manufacturing; chemicals, automotive/electric vehicles (EV), and logistics, while traditional sectors such as textiles and agriculture have modernized and remain globally competitive.
- North Carolina has emerged as a top national exporter of pharmaceuticals, supported by cold-chain infrastructure and air-sea connectivity.
- Life sciences, chemicals, automotive/EV, and logistics are the fastest-growing employment and output drivers.
- Chemicals are one of the state's most globally integrated industries and supply chains for automotive, heavy equipment and EV are rapidly expanding.
- Agriculture, food processing, and distribution contribute to a significant chunk in the state's GSP with strong reliance on reliable rural-to-urban transportation networks, as well as rail networks to source inputs such as feed.
- Transportation, distribution, and logistics is a rapidly growing industry with freight value expected to show 100 percent growth by 2050. North Carolina has the opportunity to prime itself for a higher volume of inbound freight supplying consumer markets, especially in high-growth metros by utilizing the state's access to a strong labor pipeline.

While North Carolina continues to reinforce its freight intensive industries, the industries are still vulnerable to localized, regional and global risks:

- North Carolina is highly dependent on imports to support a significant portion of its existing manufacturing industry. North Carolina imports twice as much in value as it exports. This heavy dependence on out-of-state and international inputs exposes the supply chain to commodity-based volatility.
- Tariffs on inputs and raw materials critical for the manufacturing industries can cause price inflation through supply chains, impacting industrial competitiveness. North Carolina exports pharmaceuticals, vehicles, aerospace products, and chemicals – these industries can be sensitive to retaliatory foreign tariffs and trade barriers. These measures can reduce market access and slow export growth.

- North Carolina's thriving freight intensive manufacturing industries are growing at a fast pace with a majority projected to continue growing in the future. There is a risk of production outpacing the road, rail, and port capacity and straining current freight infrastructure.
- Industrial output is highly reliant on a reliable and resilient transportation system that provides good connectivity between the producers and consumers. Increased targeted transportation investments in North Carolina could help improve supply chain efficiency while lowering production costs.
- North Carolina currently records a warehouse vacancy rate of less than 6 percent. While this is not an issue at present, continued industrial growth might induce pressure on warehousing real estate and create bottlenecks in the future.

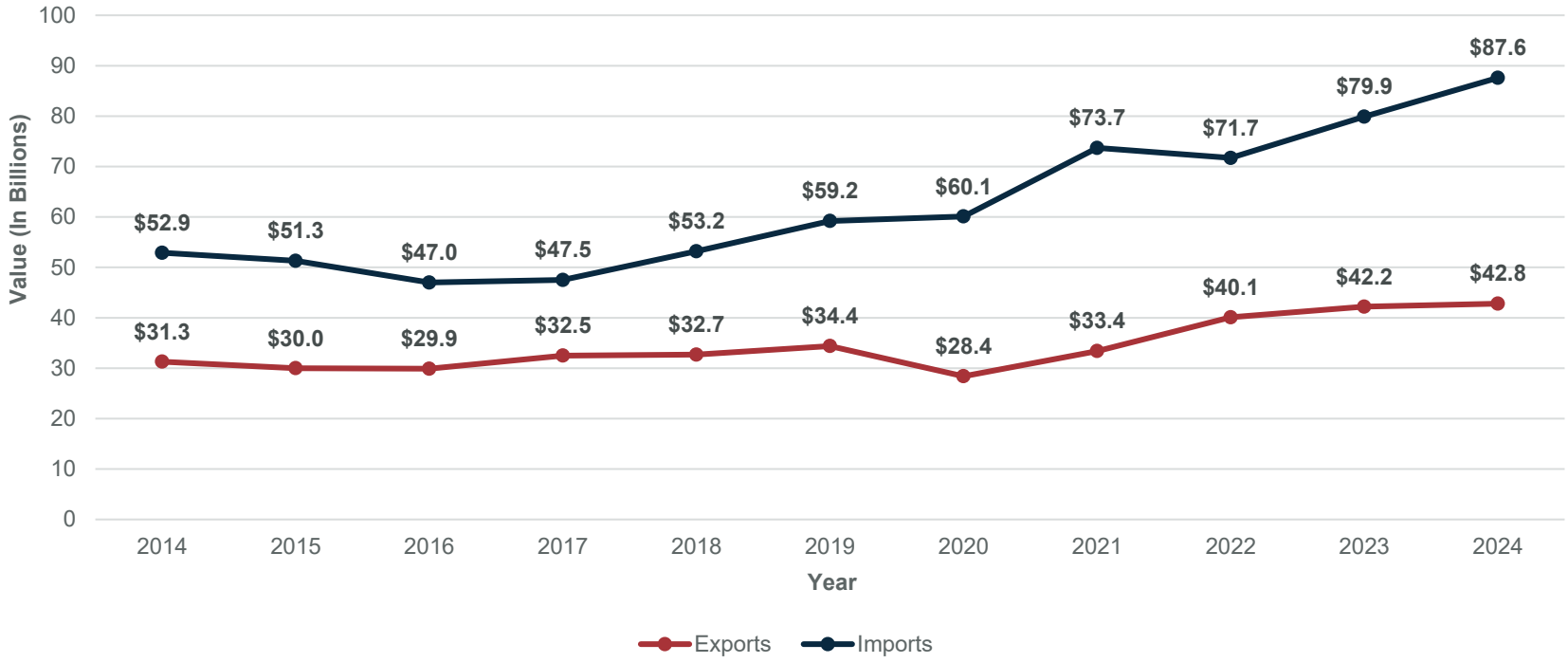
2.4. International Trade

With significant port, rail, and highway connectivity, North Carolina functions as a major gateway for both imports and exports. North Carolina was the 15th largest exporting state with $42.8 billion in exports (2024), surpassing pre-COVID-19 pandemic levels. The Charlotte metropolitan area alone accounts for one-third of North Carolina's exports, driven by advanced manufacturing, machinery, and logistics. Rising demand for imported machinery, chemicals, and components indicates a need for more resilient and diverse supply chains.

As the 15th-largest exporting state in the United States, North Carolina is a critical gateway for international trade. Figure 10 shows North Carolina's exports and imports by value from 2014 to 2024. Although exports declined by 14 percent in 2020 due to COVID-19 pandemic disruptions, trade activity strengthened in subsequent years, with exports exceeding pre-pandemic levels by about 7 percent by 2024 – supporting continued demand for efficient freight and port connectivity.[30] Imports increased by roughly 48 percent between 2019 and 2024, reflecting strong consumer demand and reliance on global supply chains.

[30] How Important is International Trade to North Carolina? | NC Department of Commerce, 2025.

FIGURE 10. NORTH CAROLINA'S STATE EXPORT AND IMPORTS BY VALUE, 2014-2024



Source: Origin of Movement Exports, Origin state-based, U.S. Census Bureau, 2025; State Imports by NAICS Commodities, USA Trade Online, 2025

North Carolina is a net importer of goods, which increases demand for port capacity, highway and rail corridors serving distribution centers, and intermodal terminals and warehousing. In 2024, as shown in Figure 10, North Carolina imported approximately $87.6 billion in goods. The state continues to import more dollar value than export to satiate appetite for low-cost raw materials and input costs, which are critical in keeping companies based in North Carolina competitive in global markets. Pharmaceuticals and medicines represent the largest import value share at 24.2 percent of total imports. Other significant import categories – including computer equipment, motor vehicles, apparel, and basic chemicals – each accounted for roughly 4 to 6 percent of the state's import value.

North Carolina top five import partners (Table 10) accounted for nearly half of the state's total imports. Ireland led with 13.8 percent (mostly from pharmaceuticals). Mexico (13.2 percent), China (8.1 percent), and Germany (7.1 percent) followed, filling North Carolina's strong demand for advanced machinery.

TABLE 10. NORTH CAROLINA'S TOP FIVE IMPORT PARTNERS, 2024

Country	North Carolina Import Value	Share of North Carolina Imports	Top Three Commodities
Ireland	$12.1 billion	13.8%	Pharmaceuticals, Cosmetics, Industrial Machinery
Mexico	$11.6 billion	13.2%	Industrial Machinery, Electric Machinery, Vehicles
China	$7.1 billion	8.1%	Industrial Machinery, Electric Machinery, Plastics
Germany	$6.3 billion	7.1%	Pharmaceuticals, Industrial Machinery, Electric Machinery
Netherlands	$5.1 billion	5.8%	Pharmaceuticals, Organic Chemicals, Inorganic Chemicals
All Others	$45.4 billion	52%	

Source: How Important is International Trade to North Carolina? | NC Department of Commerce, 2025

In 2024, North Carolina exported commodities worth over $42.8 billion (5.4 percent of state GSP) and ranked as the 15th largest state exporter of goods. Pharmaceuticals and medicines were North Carolina's top exports, making up nearly 30 percent of total export value. Other freight-intensive industries – such as aerospace products, engines and turbines, general machinery, and basic chemicals – each contributed between 3 and 5 percent. These industries depend heavily on reliable multimodal freight corridors, international gateways, and port-truck-rail connectivity. In 2024, more than half of North Carolina's exports went to five countries (Table 11): Canada, China, Mexico, France, and Japan.

TABLE 11. NORTH CAROLINA'S TOP FIVE EXPORT PARTNERS, 2024

Country	North Carolina Export Value	Share of North Carolina Exports	Top Three Commodities
Canada	$8.7 billion	20.2%	Industrial Machinery, Pharmaceuticals, Vehicles
China	$5.9 billion	13.8%	Pharmaceuticals, Stone/Lime & Cement, Electric Machinery
Mexico	$5.0 billion	11.7%	Industrial Machinery, Electric Machinery, Chemical Products
France	$1.7 billion	4.7%	Aircraft, Pharmaceuticals, Nickel & Nickel Products
Japan	$1.0 billion	2.8%	Pharmaceuticals, Chemical Products, Aircraft
All Others	$20.5 billion	46.8%	

Source: How Important is International Trade to North Carolina? | NC Department of Commerce, 2025

North Carolina exported $8.7 billion in goods to Canada in 2024, representing 20 percent of the state's total goods exports. Canada was followed by China ($5.9 billion), Mexico ($5 billion), France ($1.7 billion), and Japan ($1 billion).

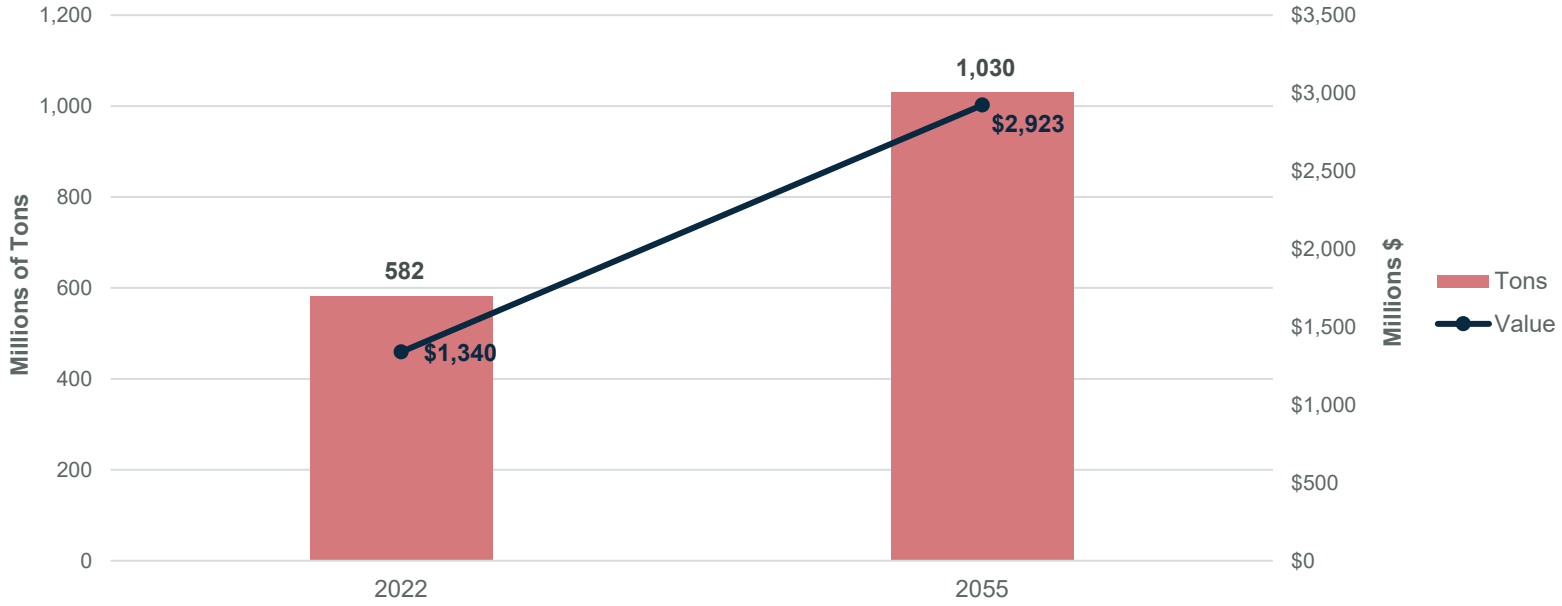
2.5. Supply Chain Commodity Flows

Supply chain commodity flows were estimated using a new NC Commodity Flow Database custom developed for this Plan using a combination of sources: base year 2022 Commodity Flow Survey (CFS) data released in late 2025; the Freight Analysis Framework version 5.7; and enhancements using data from U.S. Census Trade, U.S. Department of Agriculture (USDA), and the Surface Transportation Board (STB) Confidential Waybill.

2.5.1. Multimodal Freight Movement

Over 582 million tons of goods, valued at nearly $1.3 trillion moved across North Carolina's freight network in 2022 through truck, carload rail, intermodal rail, water, pipeline, air, truck, and other modes. By 2055, freight movement is estimated to reach 1 billion tons, valued at $2.9 trillion, a 77 percent increase by tonnage and 118 percent increase by value, as shown in Figure 11.

FIGURE 11. FREIGHT MOVEMENT BY TONNAGE AND VALUE, 2022 AND 2055

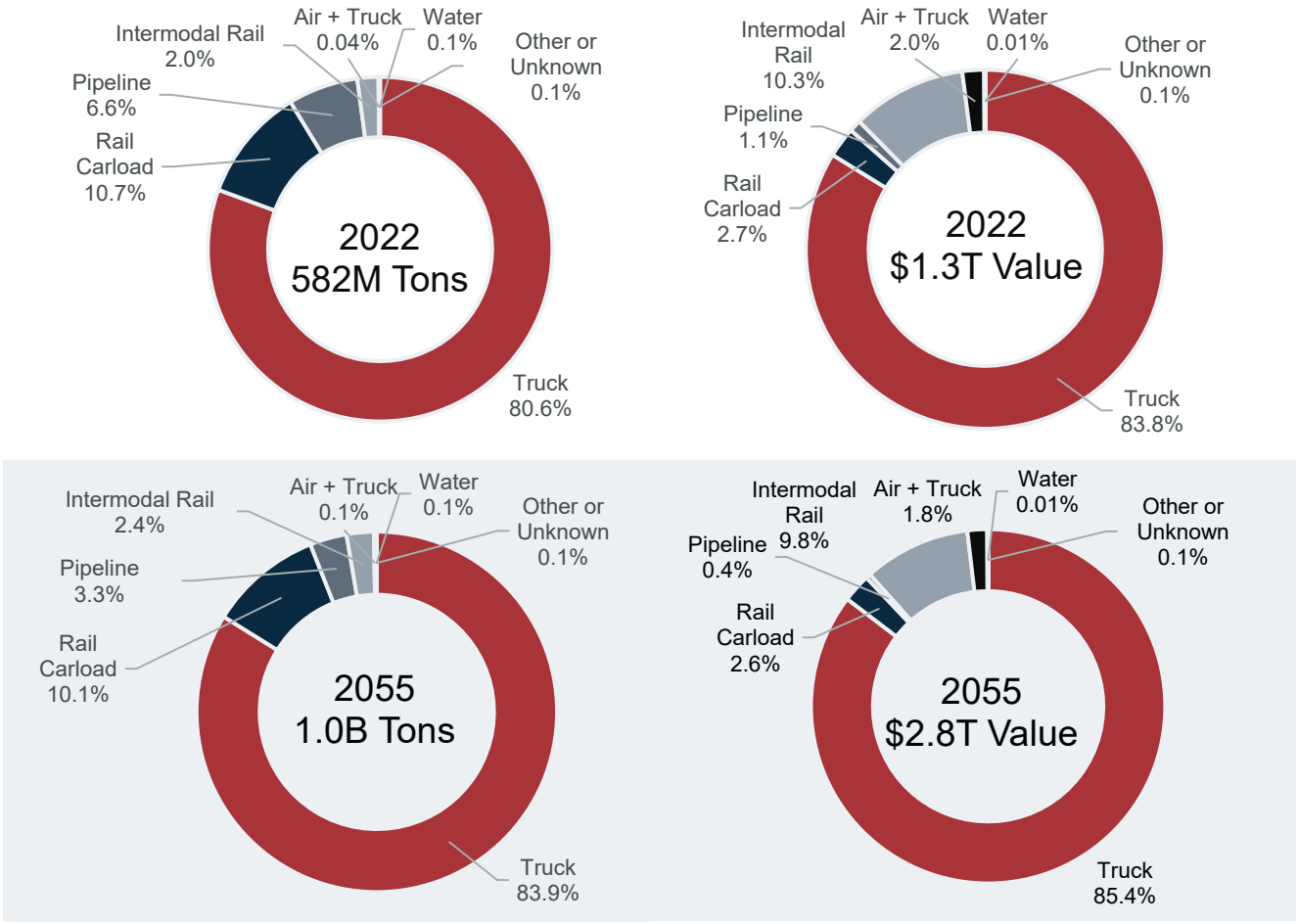


Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

2.5.2. Modal Split

As shown in Figure 12, more than 80 percent of the total tonnage and value in North Carolina moved by truck. By 2055 the proportion of truck movement is projected to slightly increase to over 83 percent in terms of both tonnage and value. Rail is the second leading mode, rail carload and intermodal made up more than 12 percent of total 2022 freight tonnage and of value, and the proportion is estimated to remain relatively stable by 2055. Intermodal rail is commonly used for commodities with higher value per ton, whereas carload rail is dominated by heavier bulk commodities and aggregates, such that coal accounted for the largest tonnage moved by rail carload, while mixed freight represented the largest commodity group moved by intermodal rail.

FIGURE 12. FREIGHT MOVEMENT BY DOMESTIC MODE, 2022 AND 2055

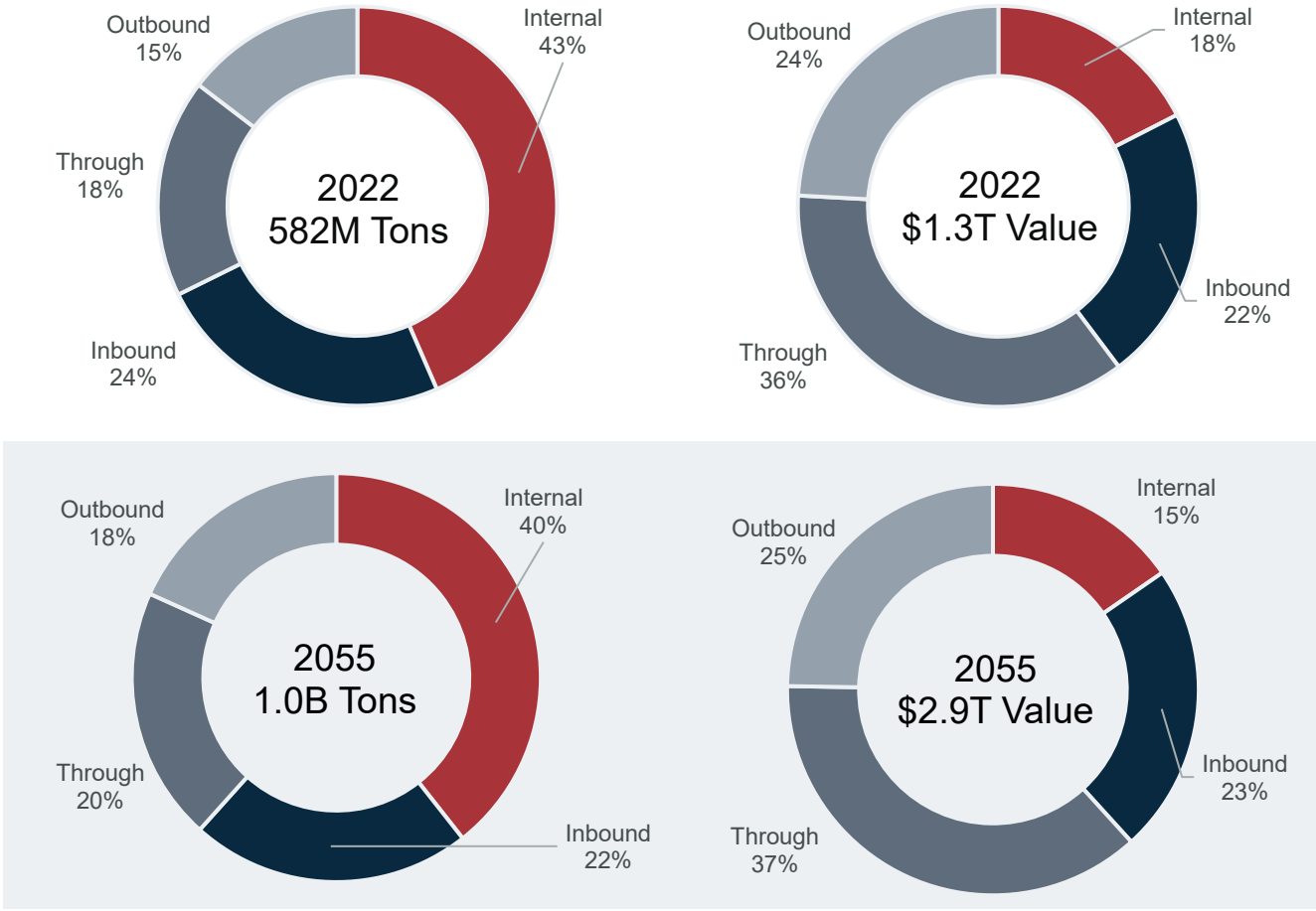


Source: N.C. Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

2.5.3. Directional Split

The directional freight tonnage and value are illustrated in Figure 13. Internal or intrastate freight movement accounted for the largest share of freight tonnage in 2022 with 253 million tons or 43 percent of the total tonnage. By 2055, the share of internal tonnage is projected to slightly decline to 40 percent (406 million tons). Wake, Mecklenburg, and Guilford Counties are the leading internal freight movement origin and destination counties by tonnage. By value, $452 billion through flow accounted for 36 percent of total freight value in 2022, followed by $323 billion in outbound traffic, which accounted for 25 percent. By 2055, the distribution across directions is projected to remain relatively stable, with slight decreases in share for internal flows.

FIGURE 13. FREIGHT MOVEMENT BY DIRECTION, 2022 AND 2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

2.5.4. Top Commodities

A variety of goods are carried by the multimodal freight network in North Carolina. The top commodities by tonnage and value vary. Figure 14 and Figure 15 summarize the top commodity groups by 2022 tonnage and value respectively and their 2055 projections.

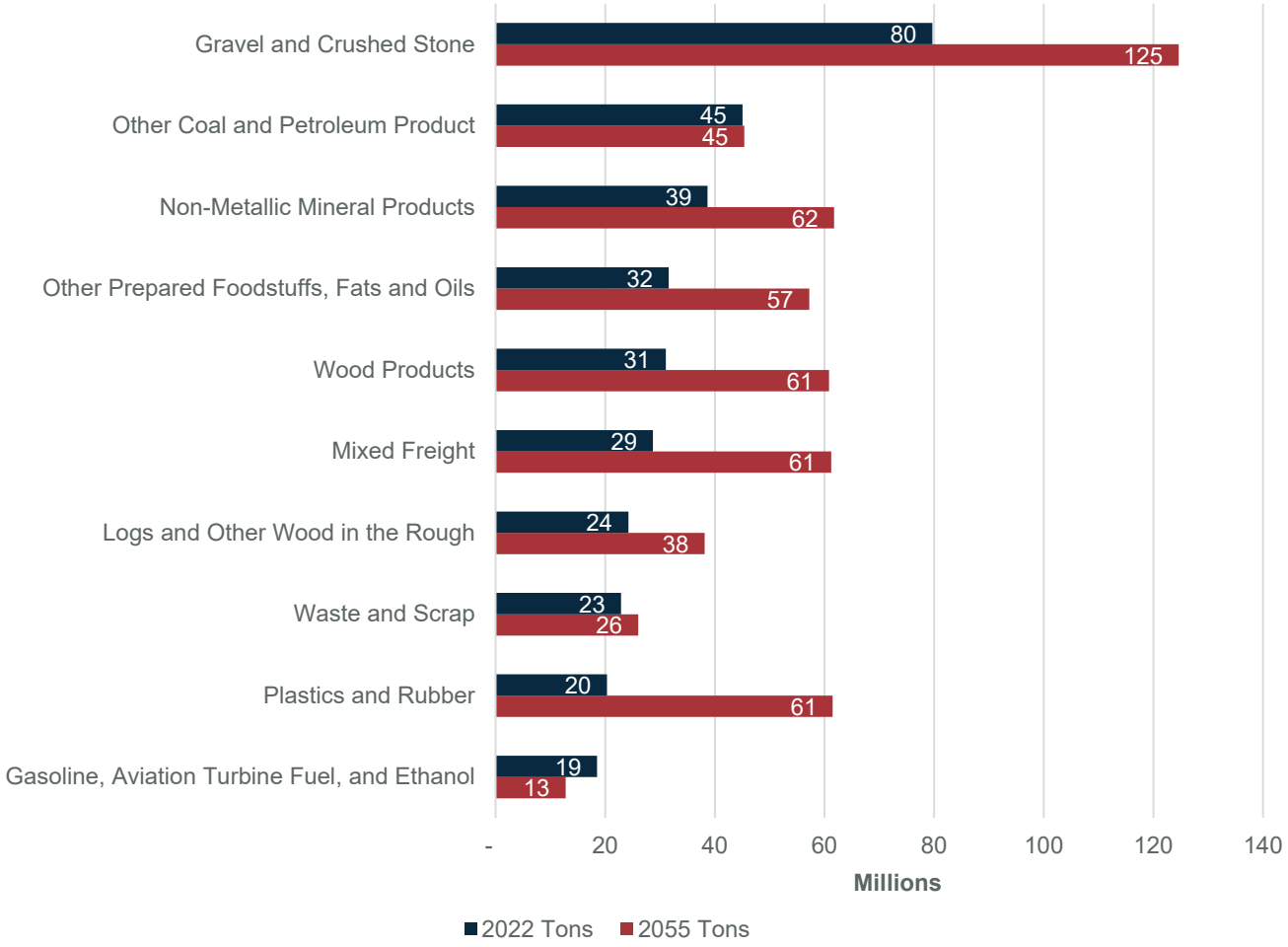
Gravel and crushed stone (largely construction materials) was the top commodity group by tonnage in 2022, making up 14 percent of total freight tonnage or 80 million tons. This commodity was primarily transported by truck (93 percent), and within North Carolina (77 percent), especially internally within Wake County (12 percent of total state internal tonnage). By 2055, gravel and crushed stone tonnage is projected to grow 56 percent to 125 million tons. Other coal and petroleum products, and non-metallic mineral products were the second and third leading commodity groups in 2022, making up 8 percent and seven percent of total tonnage respectively. By 2055, non-metallic mineral products are projected to grow by 60 percent, while other coal and petroleum products tons are projected to remain around 45 million tons, increasing by less than 1 percent. The top 10 commodities by tonnage all together made up nearly 59 percent of total 2022 tonnage, and the same group of commodities are projected to make up 53 percent of total 2055 tonnage. By 2055, waste and scrap (13 percent growth), and gasoline, aviation fuel and ethanol (31 percent decrease) are expected to no longer be in the top 10 commodities by tonnage. Basic chemicals (56 million tons in 2055) and live animals and fish (36 million tons in 2055) are projected to join the top 10 commodities in 2055.

The top 10 commodities in 2022 accounted for 66 percent of total 2022 value, and the same group is expected to account for 71 percent of total 2055 freight value. Mixed freight[31] (16 percent), electronics (8 percent), pharmaceutical products (8 percent), and machinery (8 percent) are the top four commodities by value in 2022, making up 40 percent of total freight value. All of the top 10 commodities are expected to increase in value by 2055, especially the plastic and rubber and miscellaneous manufactured products[32] groups; both are expected to triple.

[31] Mixed Freight includes SCTG 43: grocery, restaurant, hardware and office supplies – thus capturing significant e-commerce activity – and the Freight All Kinds (STCC 4611) category that accounts for most rail intermodal traffic

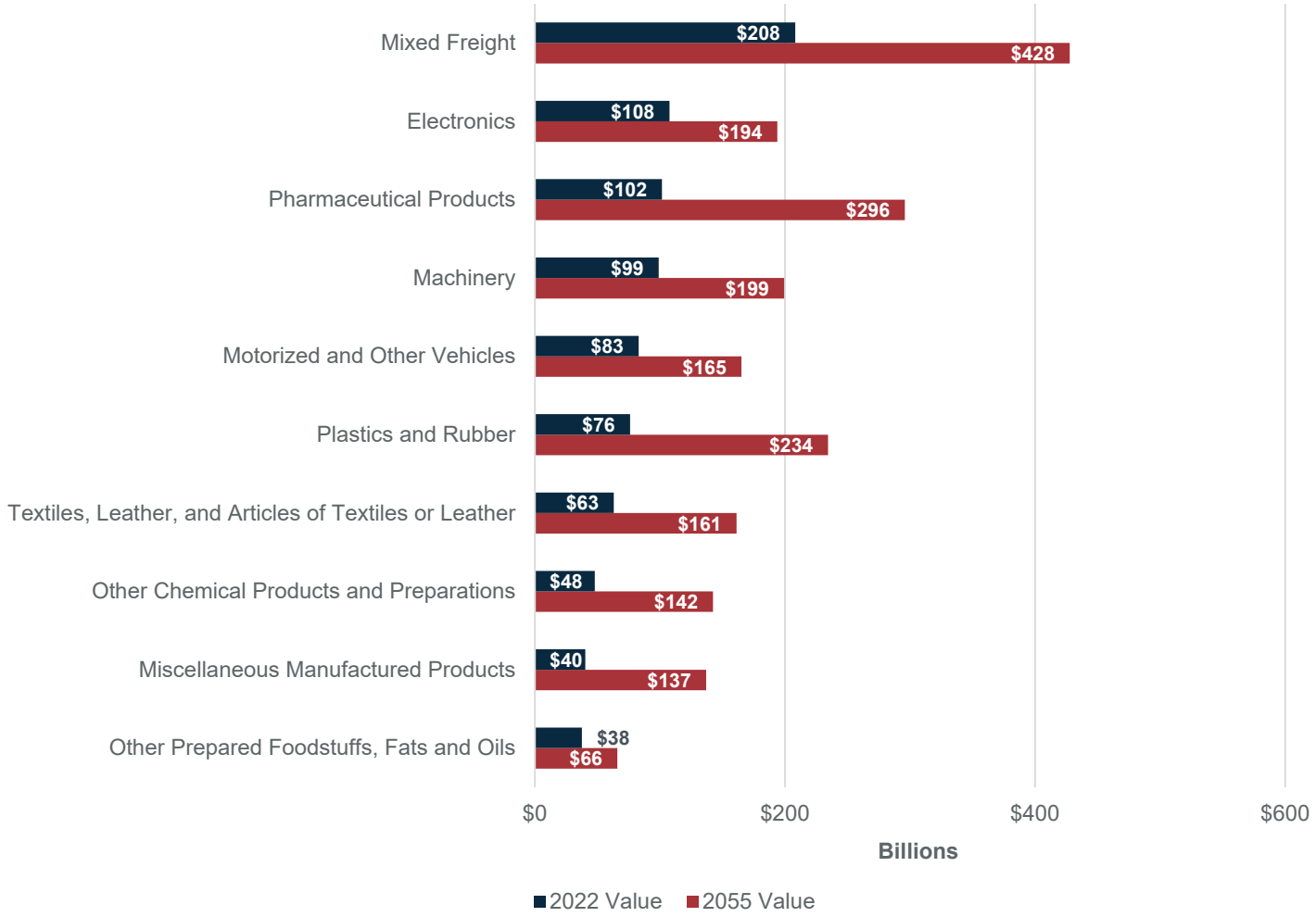
[32] Miscellaneous Manufactured Products (SCTG 40) includes for example toys, sporting goods, arms and ammunition, prefabricated buildings, clocks, musical instruments, precious metals and stones, and costume jewelry

FIGURE 14. TOP COMMODITIES BY TONNAGE, 2022 AND 2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

FIGURE 15. TOP COMMODITIES BY VALUE, 2022 AND 2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

2.5.5. Top Inbound and Outbound Trading Partners

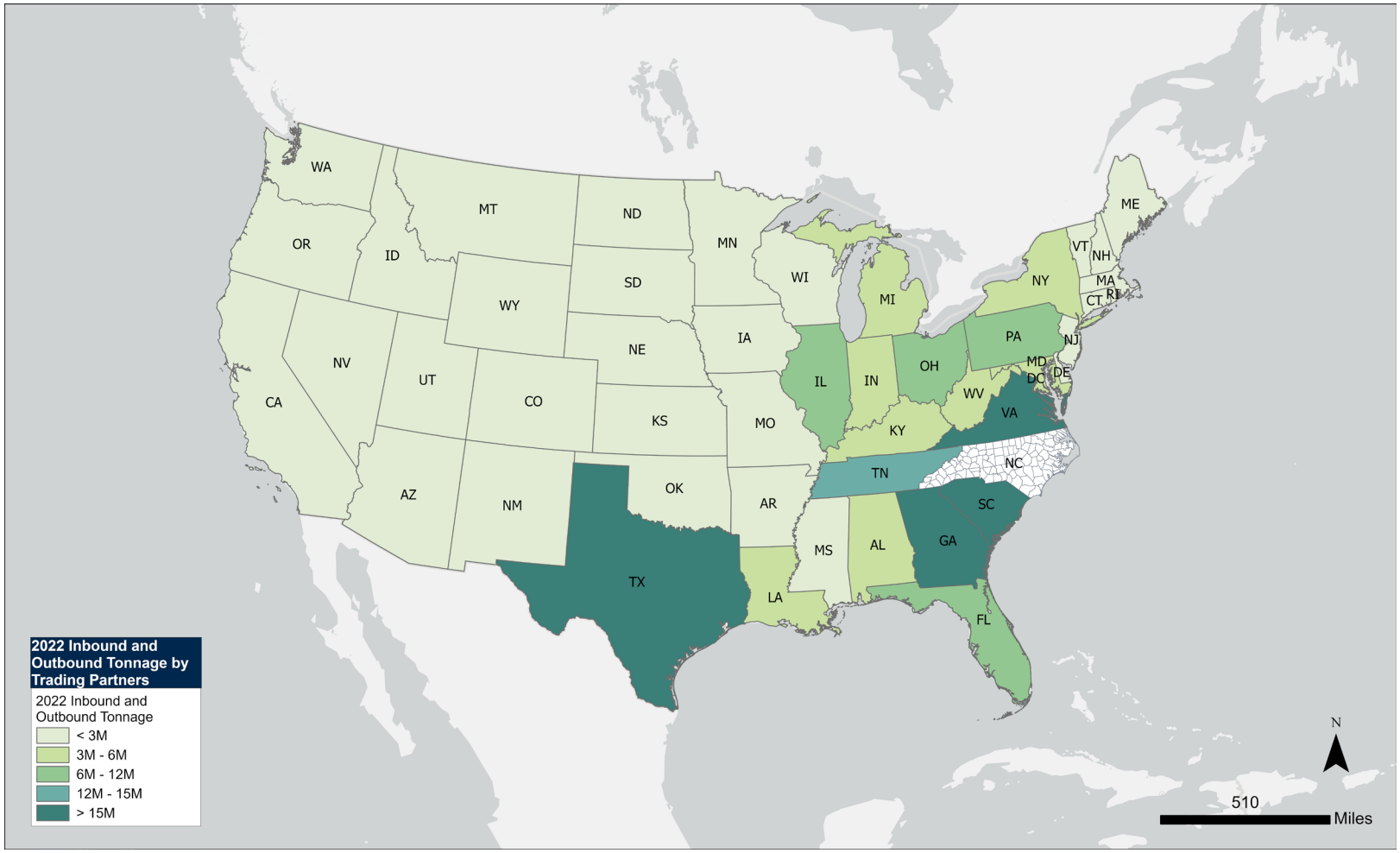
In 2022, 226 million tons of goods, valued at $622 billion, were transported inbound to and outbound from North Carolina to other states or foreign regions. As of 2055, the inbound and outbound total flow is projected to reach 417 million tons, and the value is projected to reach $1.4 trillion, representing an 85 percent growth in tonnage and a 124 percent growth in value from 2022 to 2055.

Virginia, South Carolina, Texas, and Georgia are the top inbound and outbound trading partners in terms of both 2022 tonnage and value, as shown in Figure 16 and Figure 17. Virginia had the highest tonnage of freight trade with North Carolina (42 million tons), and more than 64 percent of the freight movement was inbound flow from Virginia to North Carolina. The *other coal and petroleum product* group accounted for 33 percent of the total inbound and outbound flow tonnage between Virginia and North Carolina.

South Carolina is the leading trading partner by value. More than 12 percent of total inbound and outbound freight value ($75 billion in 2022) occurred between North Carolina and South Carolina. Approximately 52 percent of trade between South Carolina and North Carolina, by value, was an inbound flow from South Carolina. The major commodities moving between these two states included mixed freight, pharmaceutical products, and textile and leather, each accounting for 26 percent, 13 percent, and 12 percent of the total inbound and outbound freight value between South Carolina and North Carolina.

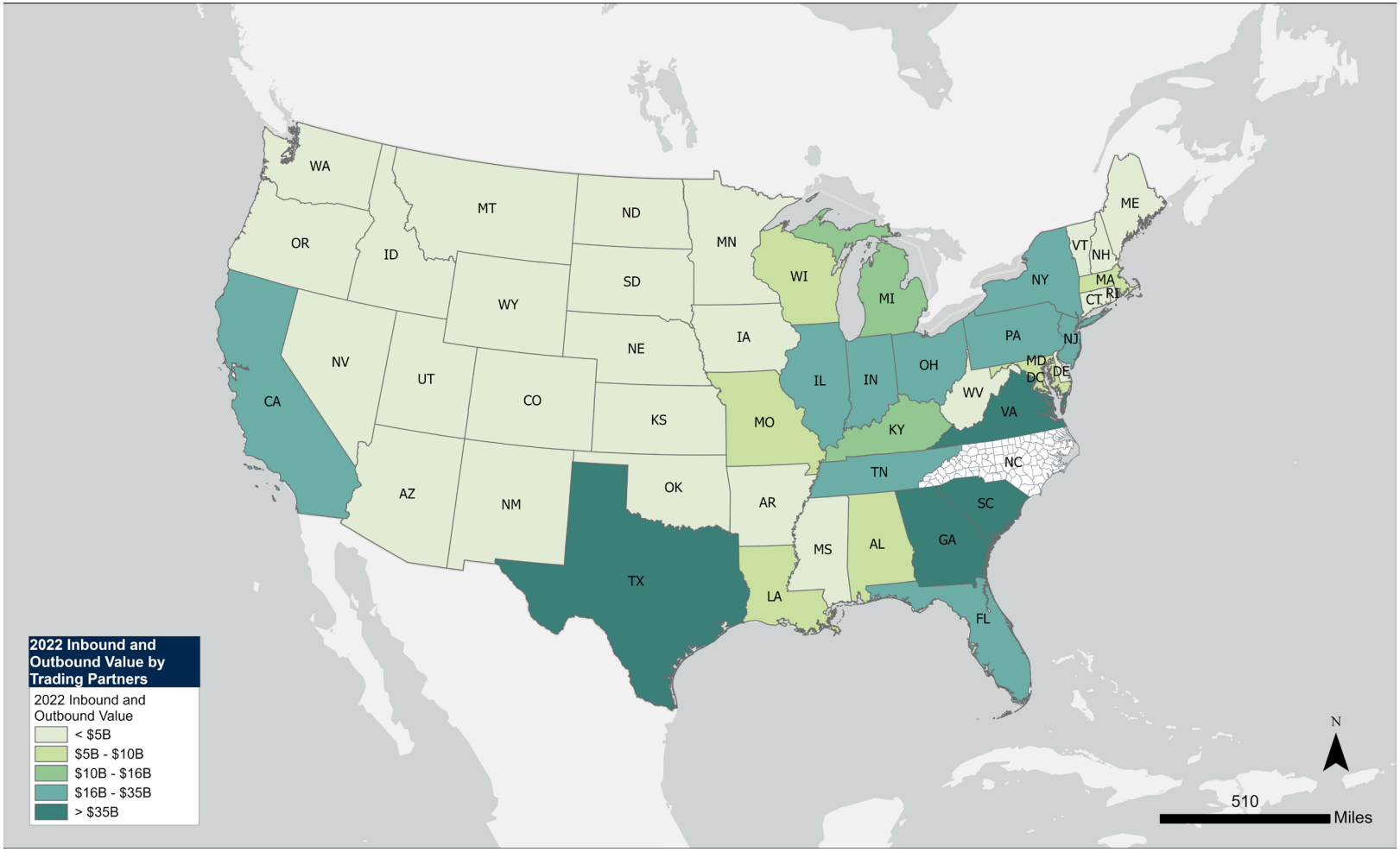
As of 2055, inbound and outbound freight movement between South Carolina and North Carolina increased by 107 percent, reached 86 million tons, and is projected to outperform the trade between Virginia and North Carolina (64 million tons), making South Carolina the top trading partner state in terms of both value and tonnage. The tonnage growth is estimated to be primarily driven by an increase in animal and fish, other coal and petroleum products, and basic chemicals, while the value increase is projected to be driven by an increase in mixed freight, pharmaceutical products, and plastics and rubber goods.

FIGURE 16. INBOUND AND OUTBOUND TRADING PARTNER STATES BY VALUE, 2022



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

FIGURE 17. INBOUND AND OUTBOUND TRADING PARTNER STATES BY TONNAGE, 2022



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

2.5.6. Top Counties by Freight Activities

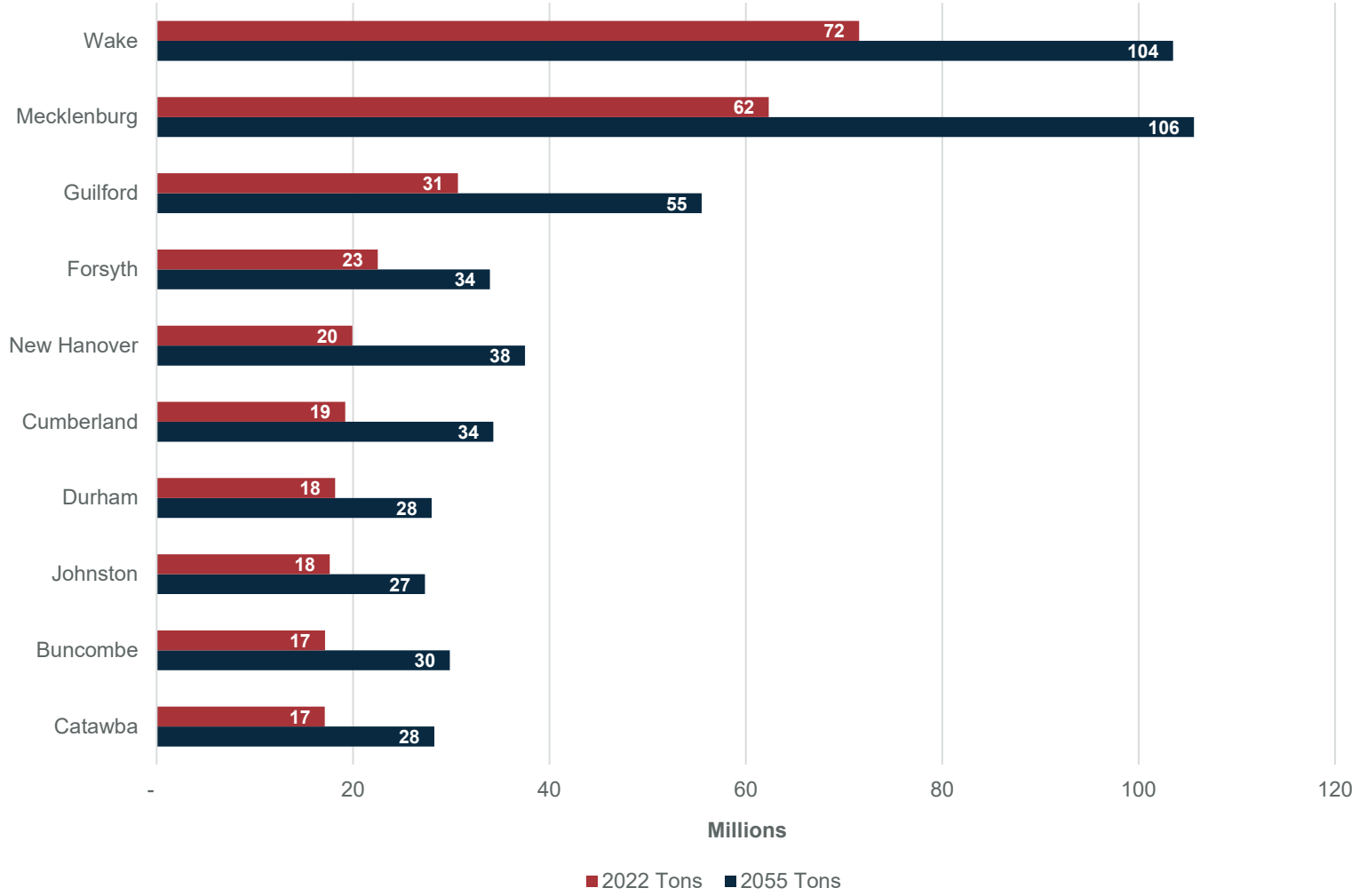
Figure 18 and Figure 19 present the top freight-generating counties by tonnage and value and their 2055 projections. Wake, Mecklenburg, Guilford, Forsyth, and New Hanover Counties accounted for the most freight tonnage and value in 2022. The top counties are also the most populous in North Carolina. Together, these five counties accounted for 196 million tons of goods moving inbound, outbound, or within these counties, valued at $358 billion. This represented nearly 41 percent of North Carolina's total inbound, outbound, and internal freight tonnage and 42 percent of total freight value.

Wake and Mecklenburg Counties are the state's major freight generating counties by tonnage. Wake County generated 72 million tons of goods movement in 2022, valued at $77 billion, and Mecklenburg County generated 62 million tons, valued at $125 billion. By 2055, Mecklenburg County is projected to become the top county by tonnage, reaching approximately 106 million tons valued at $278 billion, followed closely by Wake County at 104 million tons valued at $171 billion.

In 2022, the most common commodities moved into, from, or within Wake County were gravel and crushed stone (24 million tons, $367 million value), other coal and petroleum products (10 million tons, $4 billion value), and natural sands (5 million tons, $127 million value), while Mecklenburg County's leading commodities included other coal or petroleum products (11 million tons, $5 billion value), gravel and crushed stone (6 million tons, $79 million), and gasoline (6 million tons, $4 billion).

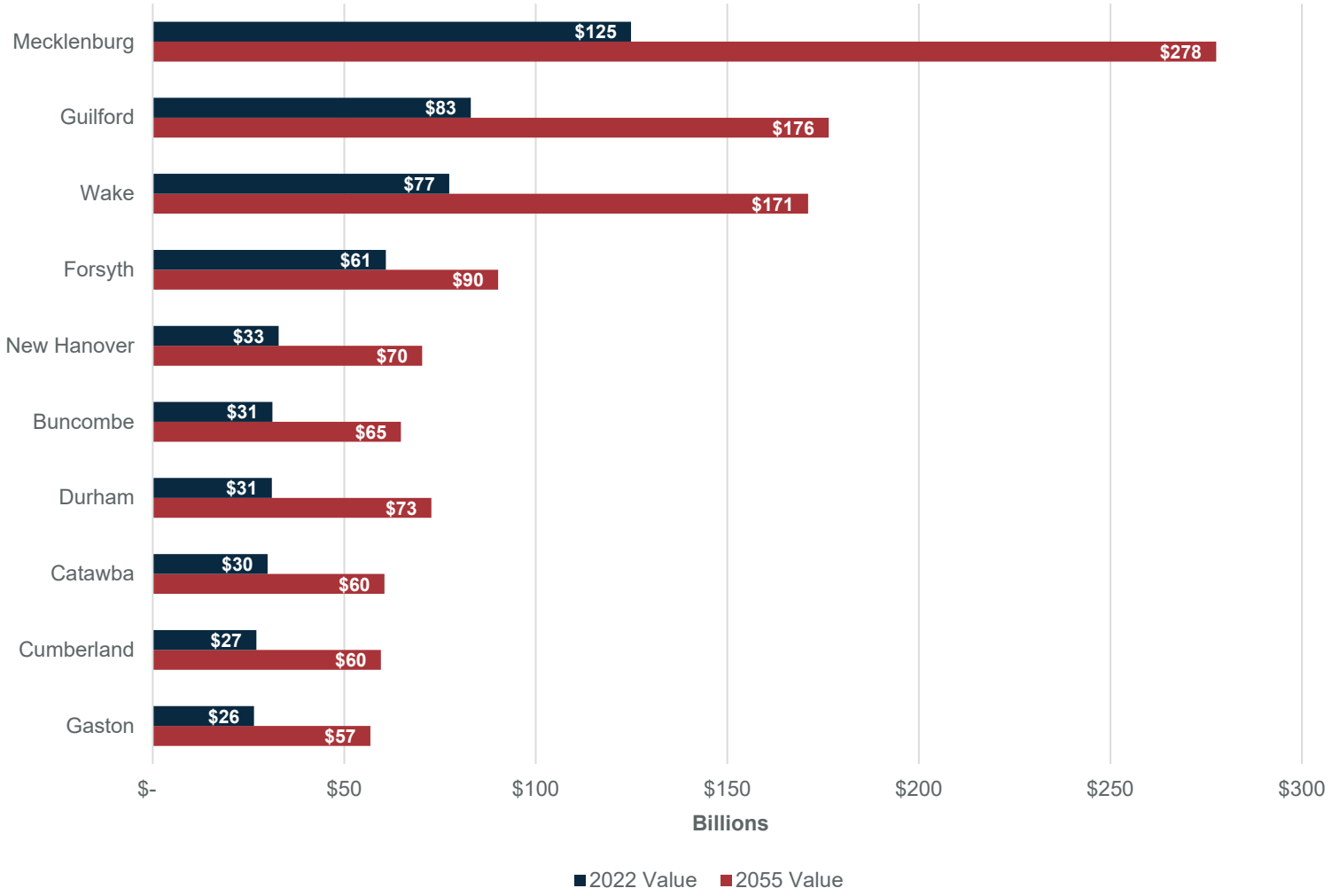
By 2055, although Forsyth is projected to see 51 percent growth in inbound, outbound, and internal tonnage and 48 percent growth in value, it is no longer projected to be among the top five counties. Instead, Cumberland County is projected to become the fifth-leading county, with total freight tonnage increasing from approximately 19 million tons in 2022 to 34 million tons in 2055 (a 79 percent increase), and the value of freight moving through the county is projected to more than double, increasing from approximately $27 billion to nearly $60 billion (a 120 percent increase).

FIGURE 18. TOP COUNTIES BY FREIGHT TONNAGE, 2022 AND 2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

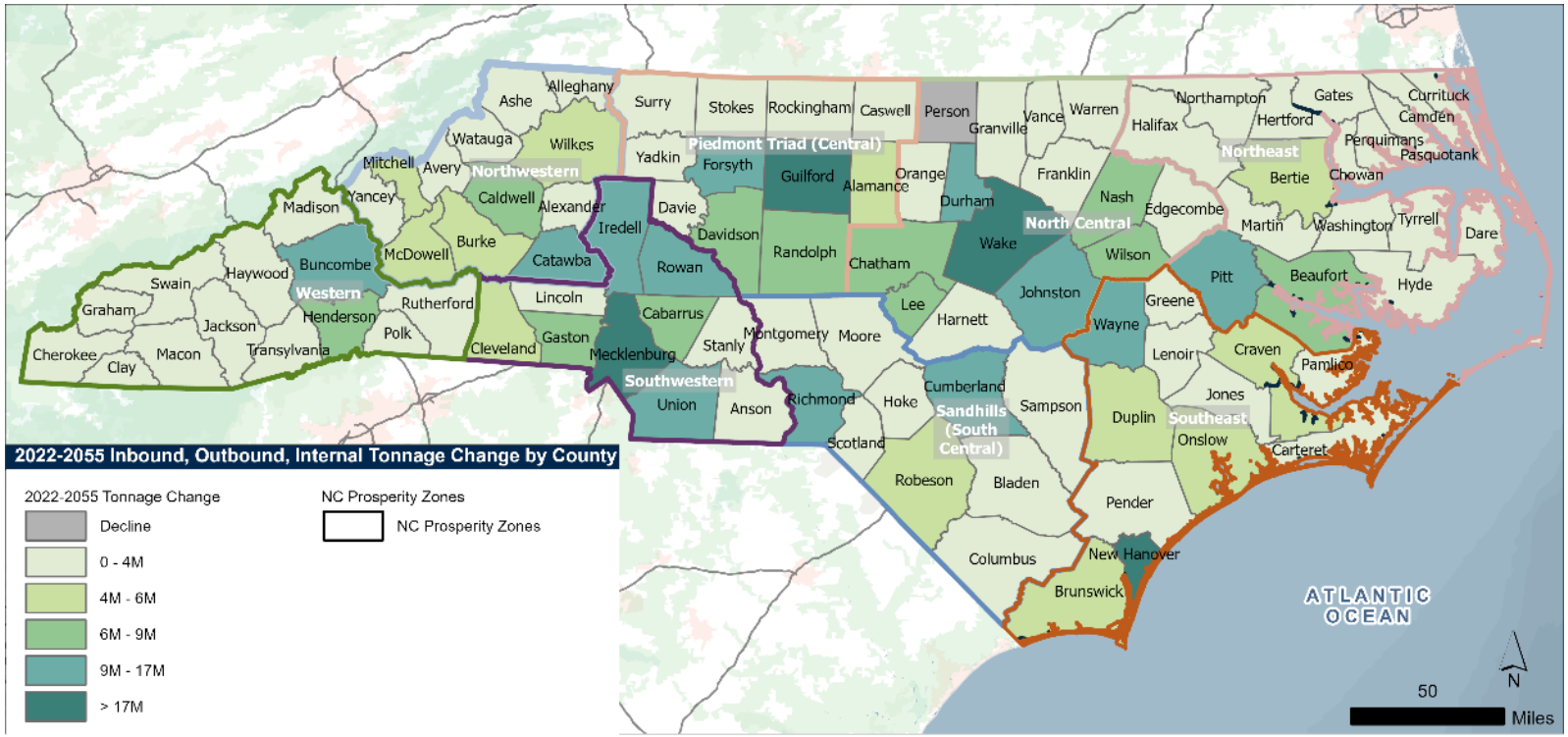
FIGURE 19. TOP COUNTIES BY FREIGHT VALUE, 2022 AND 2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

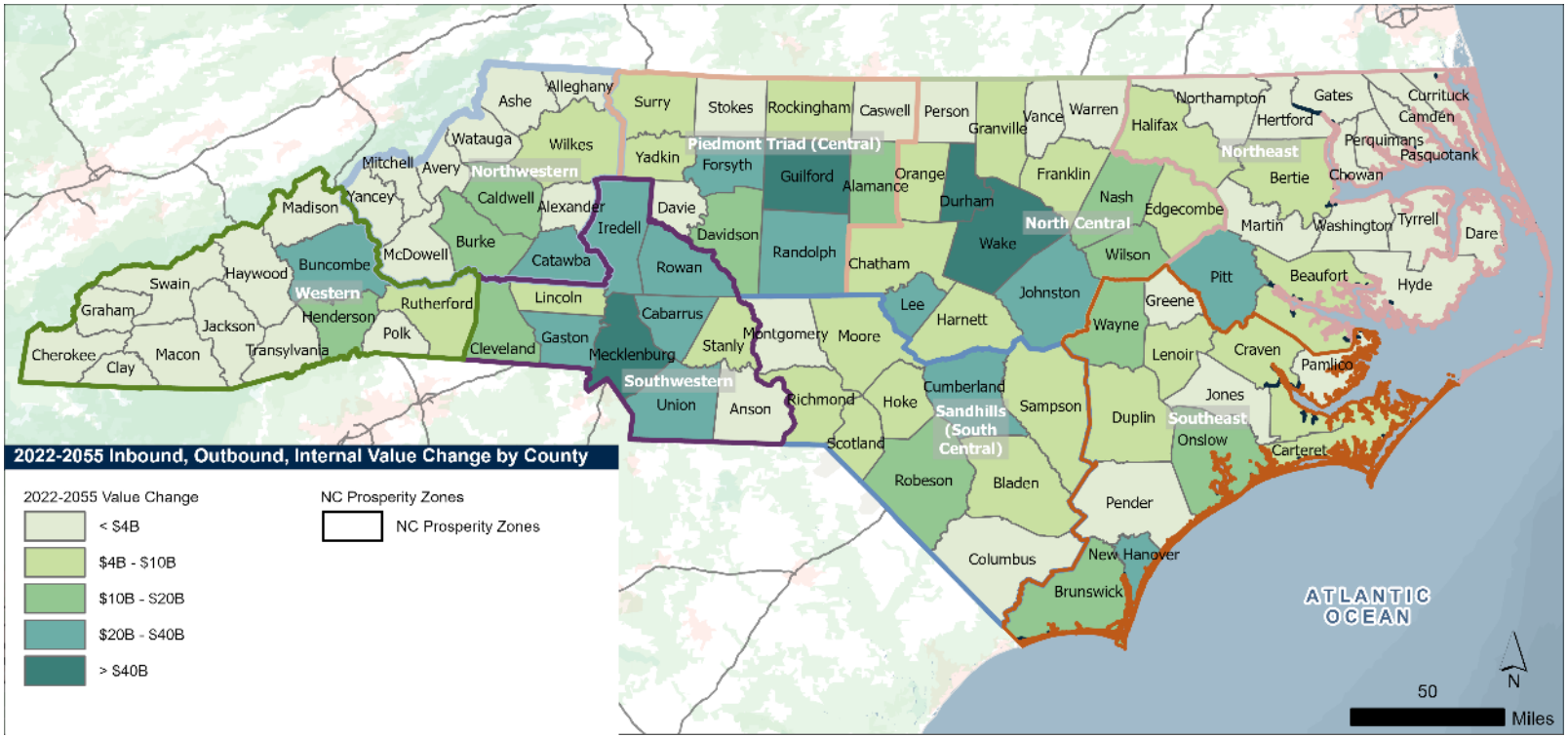
Figure 20 and Figure 21 illustrate the projected absolute growth between 2022 and 2055 in freight tonnage and value by county. As shown in the tonnage growth map, Person County is the only county projected to experience a decline in freight tonnage, with a decrease of approximately 834 thousand tons. This decline is primarily attributable to a projected reduction in coal shipments by rail. In terms of growth, Mecklenburg, Wake, and Guilford Counties are projected to have the largest tonnage and value increases; each county is estimated to see a 25 million to 43 million tonnage increase, while value is projected to increase by $90 billion to $152 billion from 2022 to 2055.

FIGURE 20. FREIGHT TONNAGE CHANGE BY COUNTY, 2022-2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

FIGURE 21. FREIGHT VALUE CHANGE BY COUNTY, 2022-2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

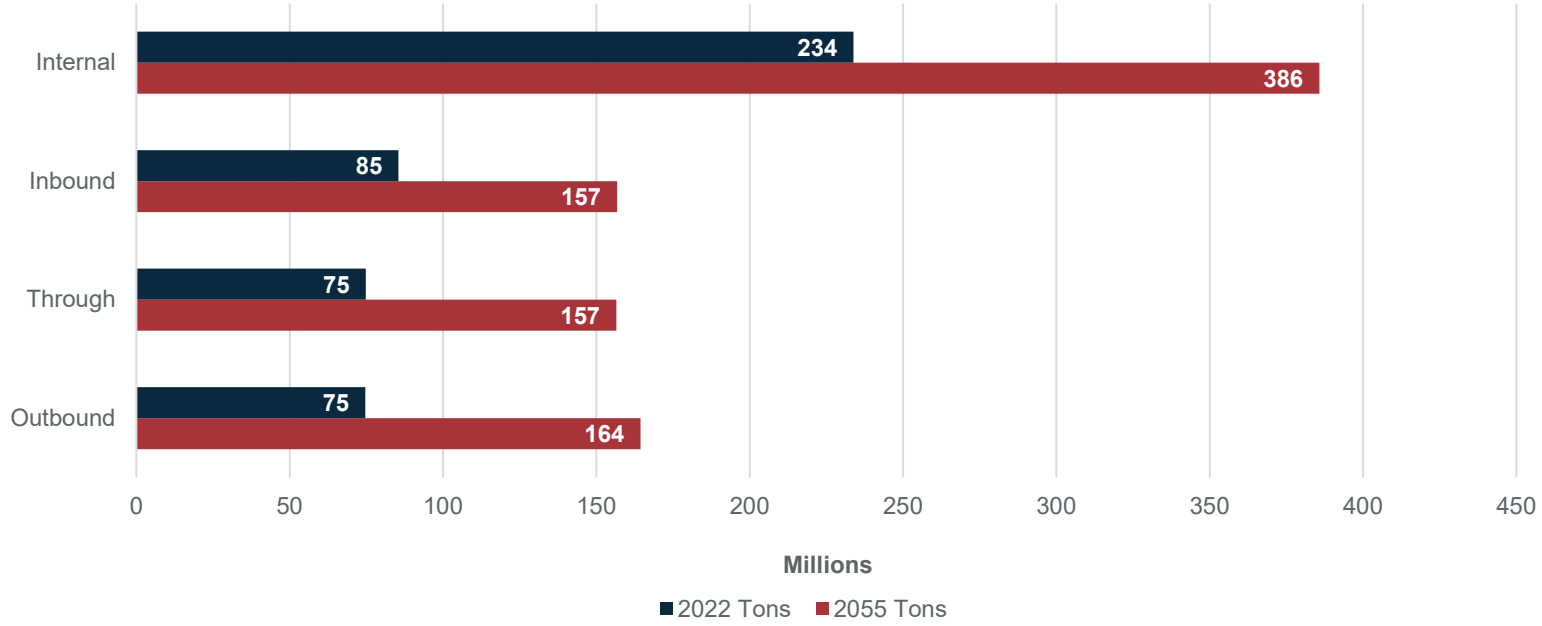
2.6. Multimodal Freight Network

This section looks at commodity tonnages as they appear on different elements of North Carolina's multimodal freight network – its highway, water, air, rail, and pipeline modal networks and facilities.

2.6.1. Freight Highway Movement

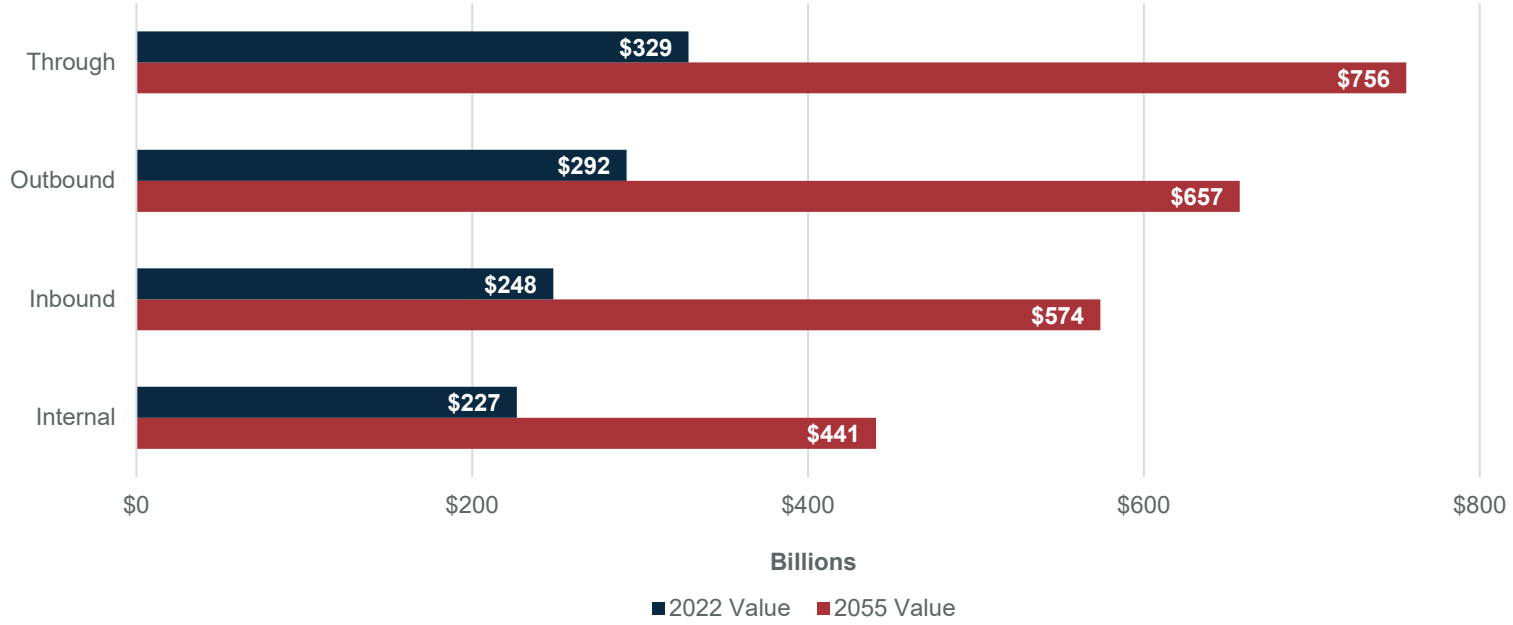
In 2022, nearly 469 million tons of goods, valued at over one trillion dollars, moved on the roadway system in North Carolina, accounting for over 80 percent of total freight flow on the multimodal freight network in the state. Figure 22 and Figure 23 summarize truck freight tonnage and value by direction respectively. Some 234 million tons of internal movement within North Carolina accounted for nearly half of total truck tonnage in 2022 and is projected to reach 386 million tons or 45 percent of total truck tonnage by 2055. In terms of value, $329 billion worth of through flow accounted for more than 30 percent of total truck value in 2022, and is projected to reach $756 billion by 2055, representing 31 percent of estimated total 2055 truck value.

FIGURE 22. TRUCK FREIGHT MOVEMENT DIRECTION BY TONNAGE, 2022 AND 2055



Source: NC Commodity Flow Database 2022, Processed by Cambridge Systematics.

FIGURE 23. TRUCK FREIGHT MOVEMENT DIRECTION BY VALUE, 2022 AND 2055



Source: NC Commodity Flow Database 2022, Processed by Cambridge Systematics.

In 2022, gravel and crushed stone (74 million tons), nonmetallic mineral products (35 million tons), other prepared foodstuffs (29 million tons), and wood products (28 million tons) were the leading commodities transported by truck in North Carolina by tonnage. Together, these commodity groups accounted for approximately 35 percent of the state's total truck tonnage. Demand for these commodities is expected to continue growing through 2055, with each projected to increase by more than 50 percent. Wood products are forecast to experience the most rapid growth, with tonnage increasing by approximately 94 percent over the forecast period.

Automotive and truck manufacturing, heavy machinery, biotechnology, and pharmaceuticals are key industries in North Carolina, including companies such as Caterpillar, John Deere, Novo Nordisk, Merck and FUJIFILM Diosynth.[33] In terms of value, electronics ($101 billion), machinery ($96 billion), and pharmaceutical products ($92 billion) were the top commodities transported by truck and collectively accounted for more than one-quarter of the total value of truck freight in North Carolina. Looking ahead to 2055, plastic and rubber products are projected to experience substantial growth, with their freight value nearly tripling to approximately $211 billion, making them the second-most-valuable commodity group moved by truck.

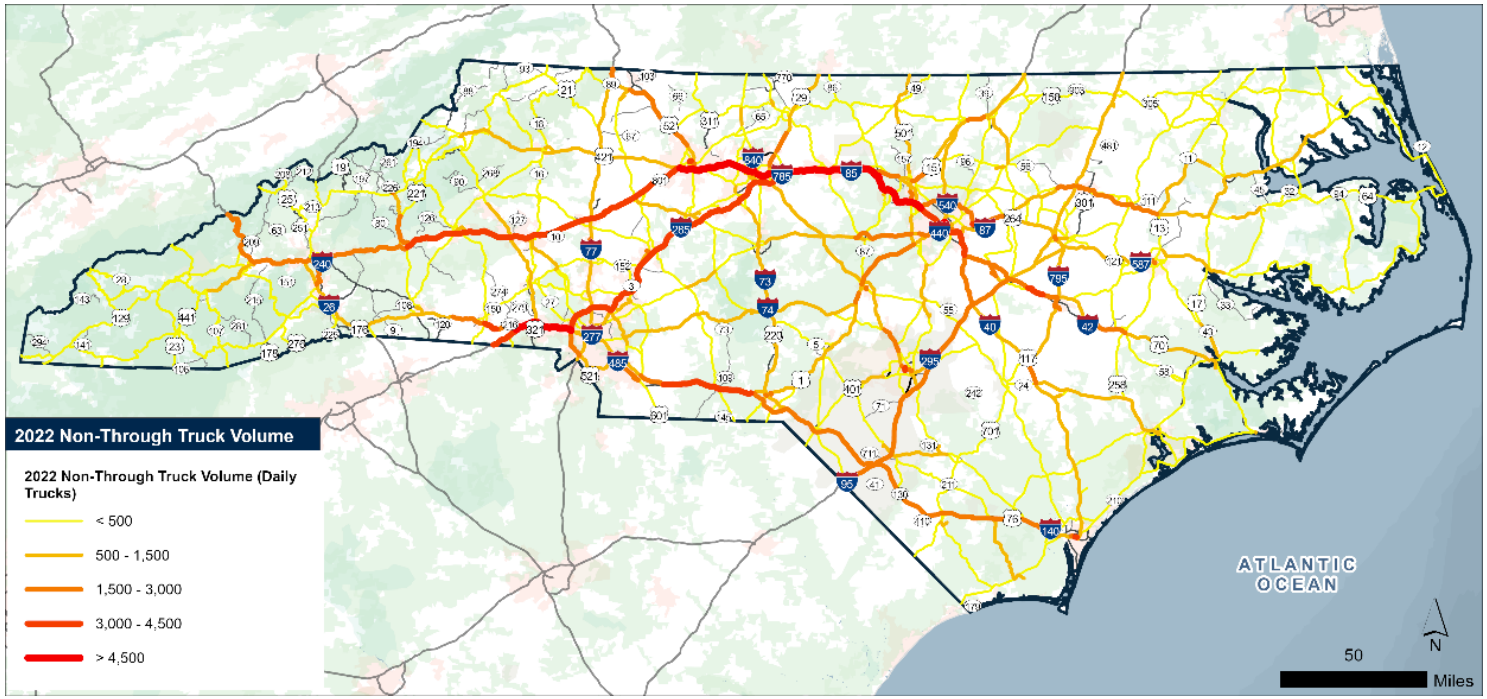
As mentioned previously, internal movement made up nearly 50 percent of total truck tonnage in 2022. More than 5 percent of internal truck movement by tonnage was within Wake County (13 million tons, $6 billion in 2022). More than 7 million tons of goods transported internally within Wake County by truck were gravel and crushed stone. Wake County is home to more than 10 percent of North Carolina's population and had a faster population growth rate of 9 percent from 2020 to 2024 than the state's overall population growth rate of 5 percent[34]. As one of the state's fastest-growing regions, Wake County may have higher demand for construction materials for residential or commercial projects. By 2055, the projected internal movement of gravel and crushed stone within Wake County is estimated at 10 million tons, valued at $137 million.

Trucking is the dominant mode of freight movement in the state and relies on a safe, reliable, and efficient roadway system to transport goods. Routing commodity flow data to the roadway network helps identify roadway corridors that carry the most freight volume and provides valuable insights into the relative importance of roadway assets for freight connectivity supporting key industries and supply chains. As shown in Figure 24, interstates are the major carriers of North Carolina-based freight (i.e., freight with an origin and/or destination in North Carolina and excluding pass-through flows). Especially prominent are I-40, which is the state's primary east-west interstate and runs through Forsyth, Guilford, Alamance, Orange, and Durham Counties; and the I-85 corridor, which links major metropolitan hubs like Charlotte, the Piedmont Triad (Greensboro, Winston-Salem, and High Point), and the Triangle (Raleigh, Durham, and Chapel Hill), carrying more than 4,500 trucks daily. By 2055 (shown in Figure 25), daily truck traffic in the Charlotte-Triad-Triangle corridor is projected to grow to 14 thousand trucks per day on the highest-volume segments. Additionally, various corridors such as US 74 are projected to shift into higher truck-volume categories (more than 4,500 trucks daily), reflecting potential future freight demand growth.

[33] https://www.commerce.nc.gov/business/key-industries-north-carolina
[34] https://www.osbm.nc.gov/facts-figures/population-demographics/state-demographer/county-population-estimates/certified-county-population-estimates

Agricultural-related truck flows are an important component of North Carolina's freight flows in support of the state's economy and businesses. As shown in Figure 26, agricultural and fish-related[35] truck activity is distributed across major highway corridors in eastern and central North Carolina, such as I-40/I-85, US 64, and I-95. These corridors, along with connecting roadways, support the movement of agricultural commodities, including livestock and related products, between farms, processing facilities, and distribution centers.

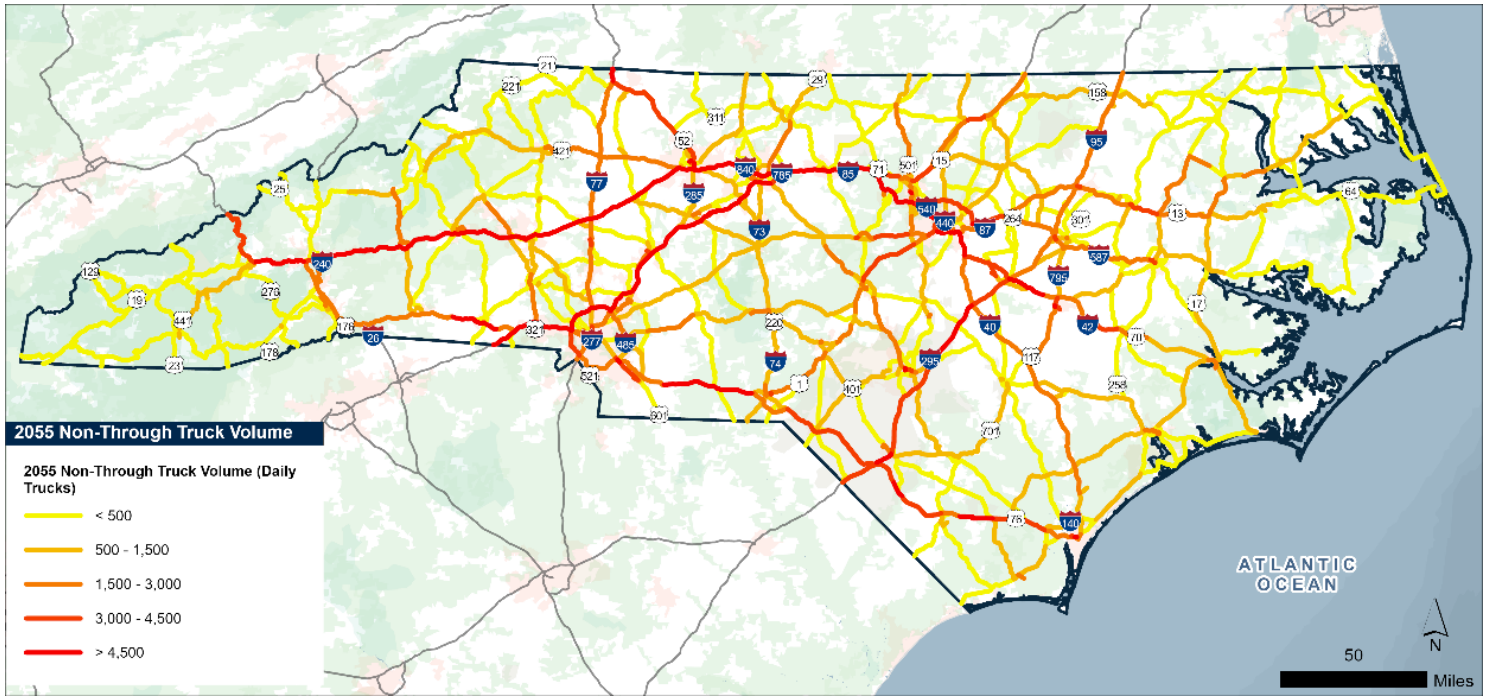
FIGURE 24. ROUTED NC-BASED TRUCK COMMODITY MOVEMENT, 2022



Source: FAF 5.7 Processed by Cambridge Systematics

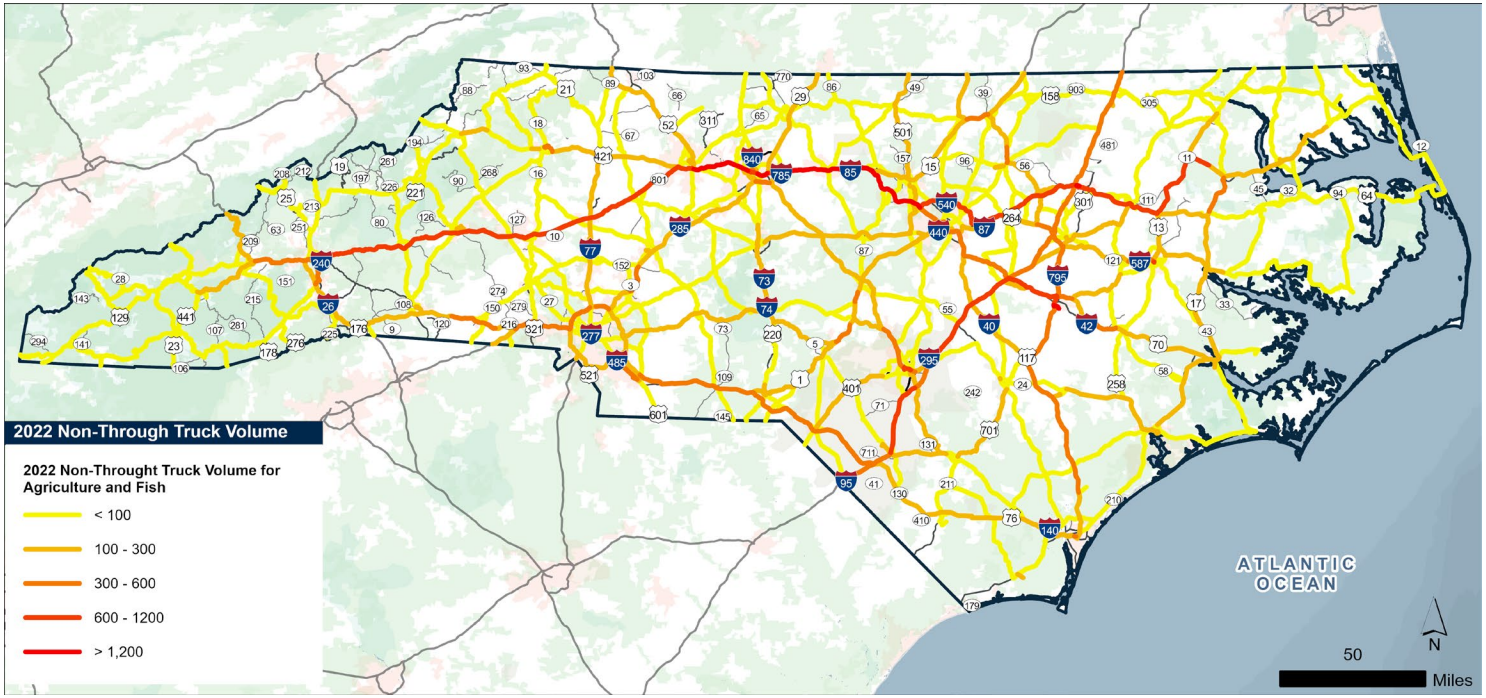
[35] Agriculture and Fish products include SCTG 01– 05: animal and fish (live), cereal grains; agricultural products; animal feed and other product of animal origin; and meat, poultry, fish, and seafood preparations;

FIGURE 25. ROUTED NC-BASED TRUCK COMMODITY MOVEMENT, 2055



Source: FAF 5.7 Processed by Cambridge Systematics

FIGURE 26. ROUTED NC-BASED TRUCK AGRICULTURAL COMMODITY MOVEMENT, 2022

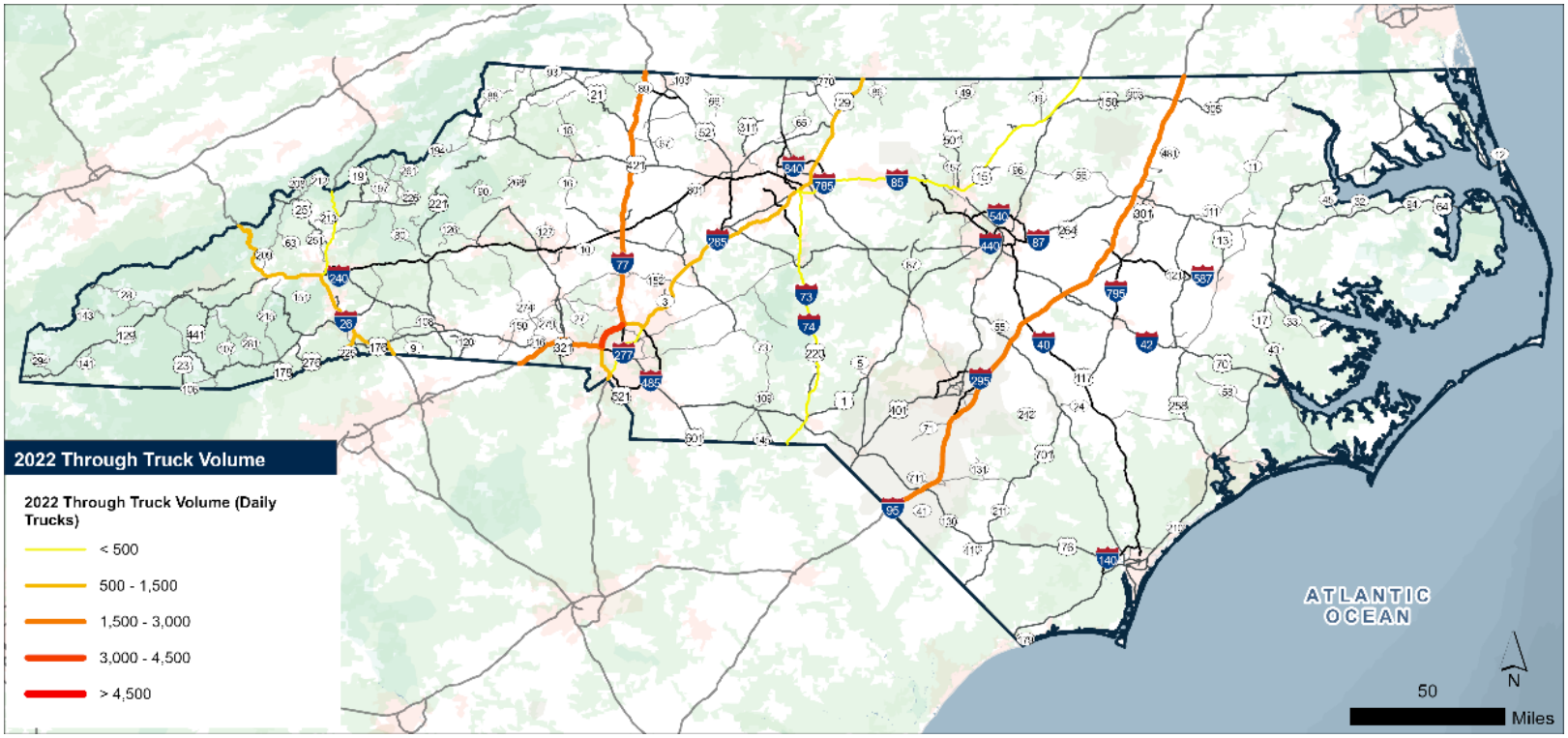


Source: FAF 5.7 Processed by Cambridge Systematics

Inbound, outbound, and internal freight movement provide insights into the state's production and consumption activities and into local economic patterns. The through flows are more likely to imply which roadway corridors are critical to the broader freight network connectivity. Figure 27 shows pass-through truck traffic routed through the roadway network in North Carolina in 2022. As the map shows, most of the through traffic moved north-south (east of the Appalachian Mountains), primarily connecting the major trading partners, Virginia in the north and South Carolina in the south, and primarily via I-77 and I-95. Unlike I-85, these two interstates do not pass through multiple urban centers, and I-77 connects to I-81 roughly 50 miles north of the Virginia border.

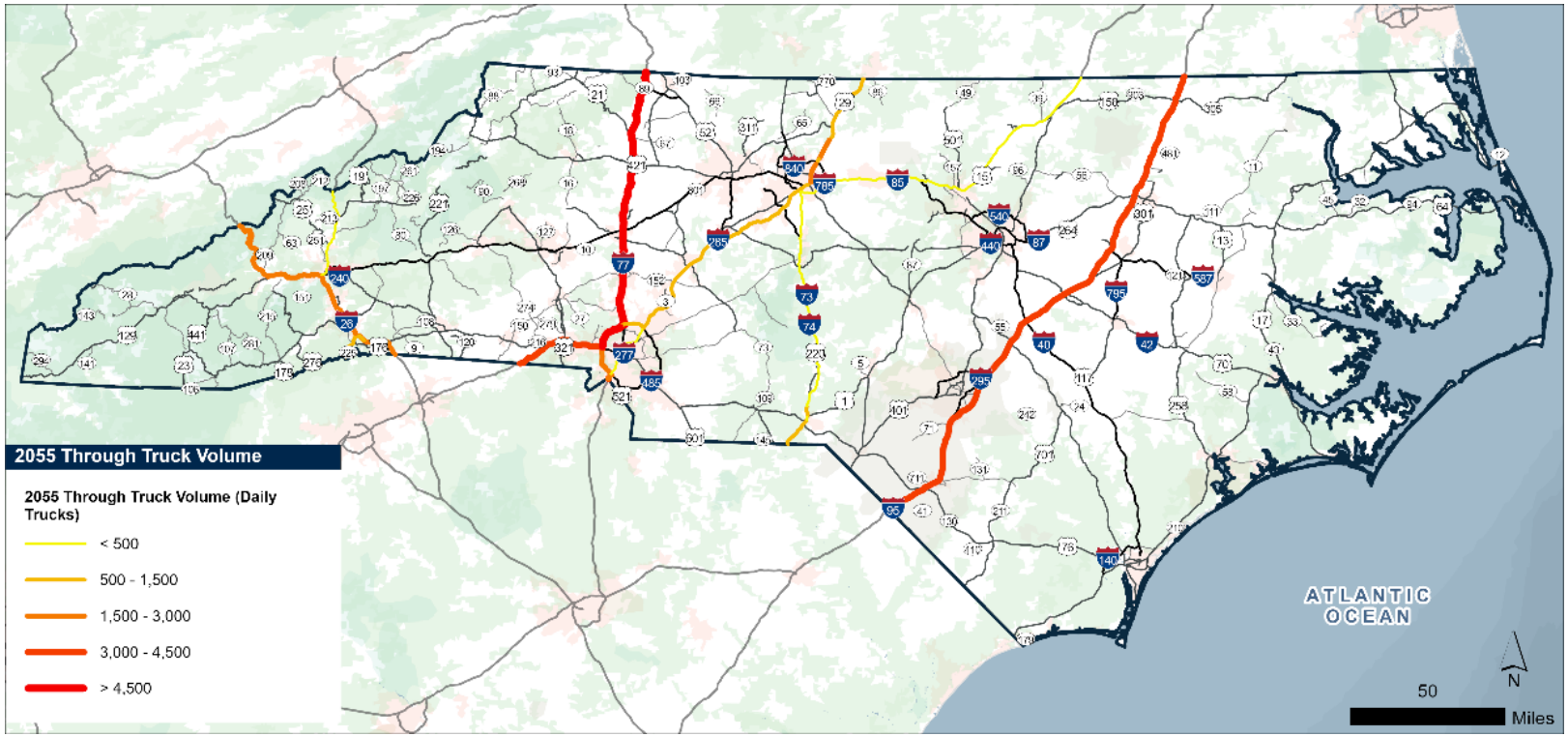
By 2055, the interstate system will continue to carry the most through flow along the I-77 corridor, where nearly the entire corridor within North Carolina is projected to carry more than 4,500 trucks daily (Figure 28).

FIGURE 27. ROUTED THROUGH TRUCK COMMODITY MOVEMENT, 2022



Source: FAF 5.7 Processed by Cambridge Systematics

FIGURE 28. ROUTED THROUGH TRUCK COMMODITY MOVEMENT, 2055



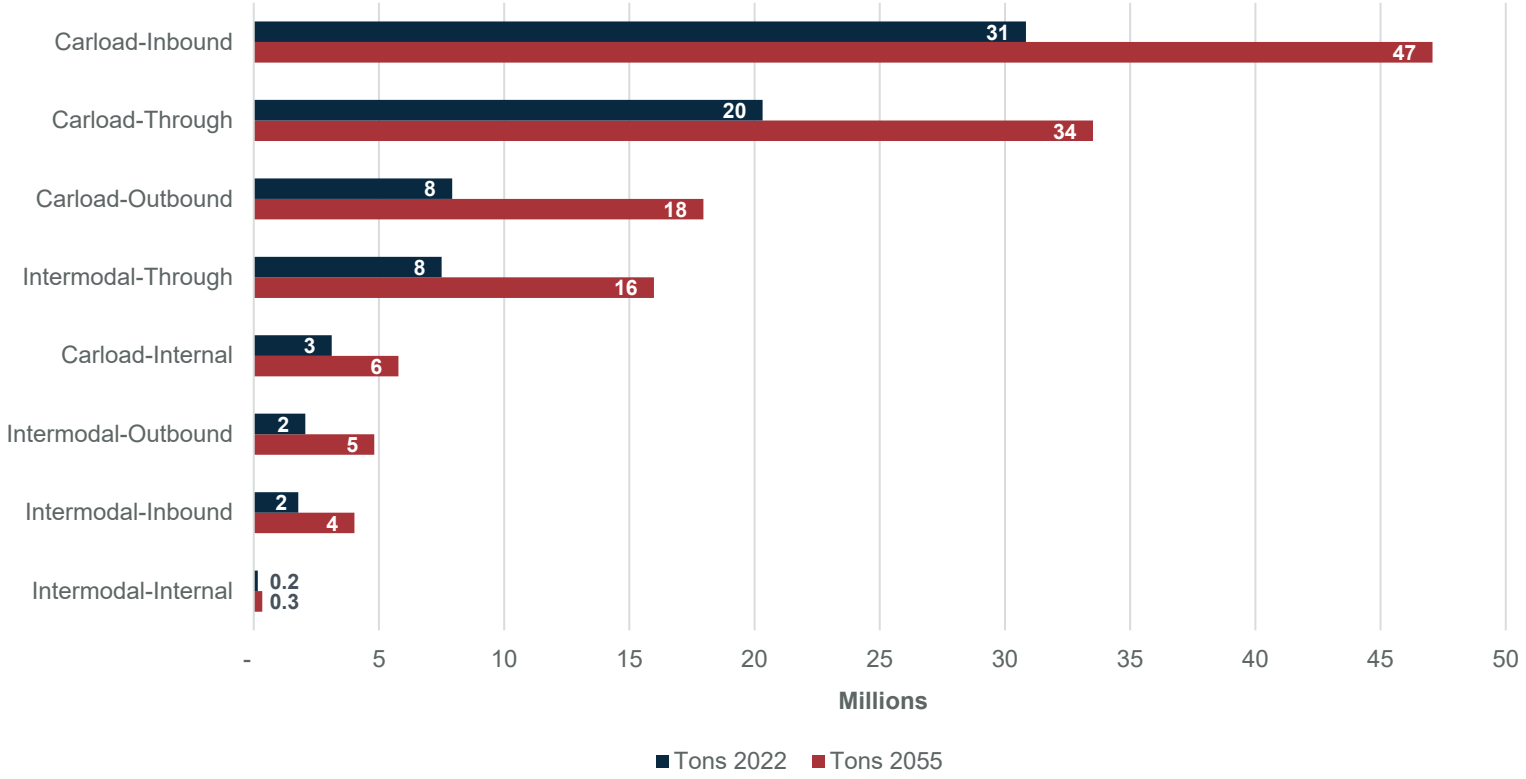
Source: FAF 5.7 Processed by Cambridge Systematics

2.6.2. Freight Rail Movement

In 2022, 62 million tons of goods, valued at $36 billion, were transported by carload rail into, from, within, or through North Carolina, and another 12 million tons, valued at $135 billion, were transported by intermodal rail in North Carolina. By 2055, carload rail movement is projected to reach 104 million tons, valued at $74 billion, and intermodal rail is estimated to reach 25 million tons, valued at $277 billion.

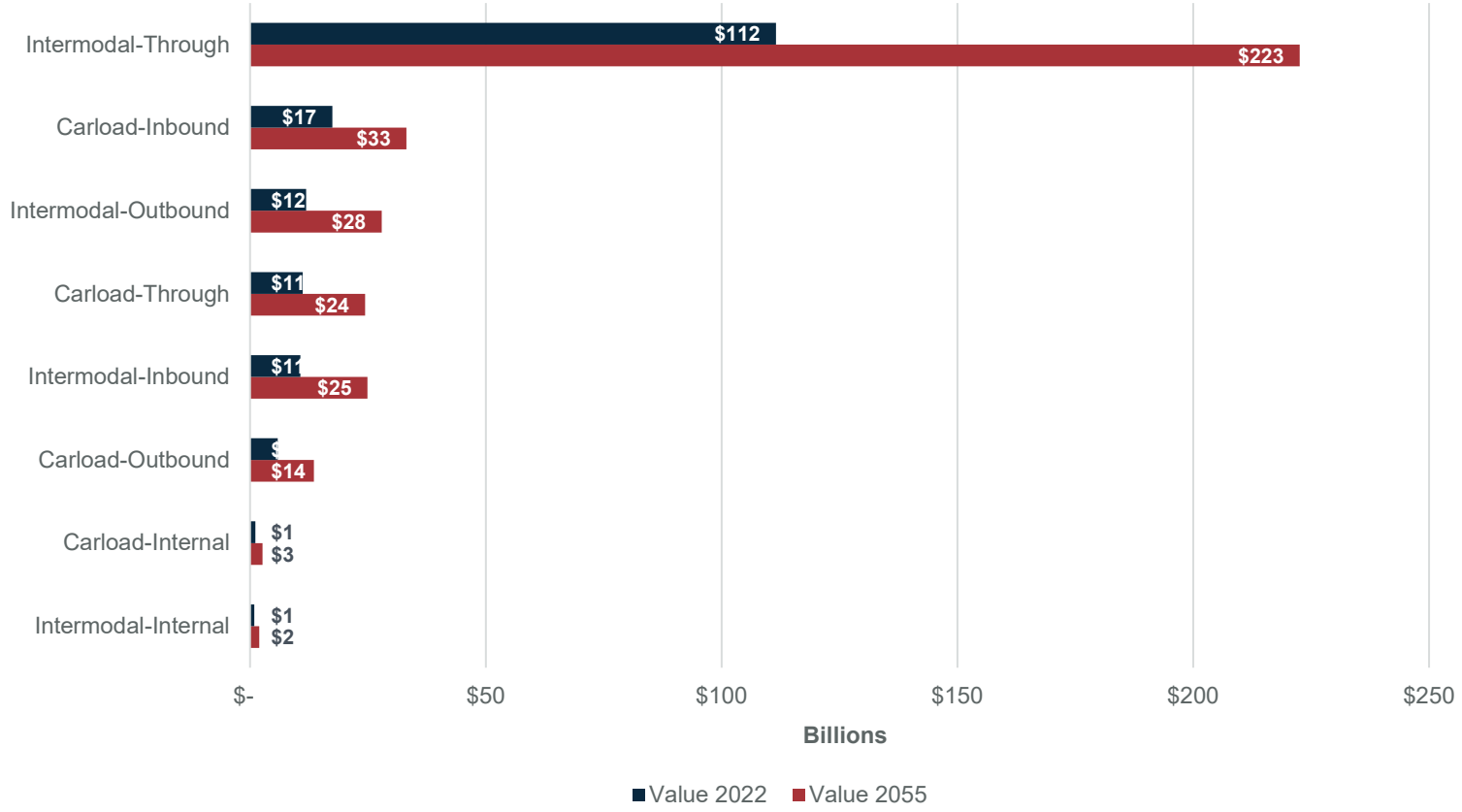
Inbound rail movement (including carload and intermodal) accounts for 44 percent of total rail freight tonnage (33 million tons), as shown in Figure 29. By 2055, inbound rail is projected to reach 51 million tons, a 57 percent increase from 2022; accounting for up to 40 percent of total 2055 rail freight tonnage. In terms of value (Figure 30), through traffic (especially intermodal rail) is the leading rail freight movement by direction. In 2022, $123 billion worth of goods passed through the North Carolina rail network, and the through flow is estimated to reach $247 billion by 2055.

FIGURE 29. RAIL MOVEMENT DIRECTION BY TONNAGE, 2022 AND 2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

FIGURE 30. RAIL FREIGHT MOVEMENT DIRECTION BY VALUE, 2022 AND 2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

Intermodal rail is typically used to transport higher-value and/or more time-dependent commodities, while rail carload service is primarily used for bulk goods. In 2022, the leading **commodities moved by rail carload** were coal (11 million tons), cereal grains (7 million tons), and gravel and crushed stone (6 million tons). By 2055, coal tonnage is projected to decline significantly due to continued national declines in coal production and consumption. Coal movements by rail carload are forecast to decrease from 11 million tons in 2022 to approximately 2 million tons in 2055, representing an 80 percent decline. In contrast, the basic chemicals group, and plastics and rubber group are projected to experience substantial growth and become the dominant commodities moved by rail carload. Basic chemicals are expected to increase from 5 million tons in 2022 to 16 million tons in 2055, while plastics and rubber are projected to grow from 3 million tons to 10 million tons over the same period.

Although **intermodal rail** carried a smaller share of total rail tonnage, it accounted for nearly 80 percent of the total value of rail freight in 2022. This reflects the movement of **higher-value goods** by intermodal service. Mixed freight, which includes consumer goods, dry goods, and freight-forwarded cargo, etc., accounted for 8 million tons and accounted for approximately 89 percent of the total freight value transported by intermodal rail.

North Carolina had nearly 33 million tons of **inbound rail freight** from other states in 2022, valued at $28 billion. The inbound tonnage and value are projected to reach 51 million tons and $58 billion by 2055, respectively, representing a 57 percent increase in tonnage and a 107 percent increase in value. Illinois, Ohio, and Pennsylvania were the top rail freight inbound trading partners by tonnage in 2022, and by 2055, Louisiana is estimated to replace Pennsylvania as a top inbound trading partner of rail freight. The change in rail freight tonnage from Pennsylvania is primarily driven by the continued projected decline of coal products. In terms of inbound value, Illinois, Louisiana, and Tennessee are the top trading partners in 2022 and 2055.

In 2022, 10 million tons of **outbound rail freight**, valued at nearly $18 billion, were moved on North Carolina's rail network via carload or intermodal modes. South Carolina, Illinois, and Georgia were the top outbound trading partners in 2022 by tonnage. These three states received more than 45 percent of total outbound rail tonnage from North Carolina and are projected to remain the top outbound trading partners in 2055. And in terms of outbound value, Illinois, Florida, and Georgia are the top trading partners for both 2022 and 2055 and the top three states are projected to make up nearly 46 percent of total outbound rail freight value in 2055.

2.6.3. Marine Freight Movement

North Carolina is home to two major cargo seaports: the Port of Wilmington and the Port of Morehead City. In terms of **international marine goods movement**, approximately three million tons of goods valued at nearly $5 billion were **imported** through North Carolina ports in 2022,[36] and by 2055 the import flow is projected to reach seven million tons, with a projected value of $8 billion. The major commodities imported through North Carolina ports by tonnage include fertilizer (594 thousand tons, $350 million), other non-metallic minerals (403 thousand tons, $15 million), and basic chemicals (400 thousand tons, $340 million), and by value, the top commodities through North Carolina ports included plastic and rubber (328 thousand tons, $794 million), other chemicals products and preparations (132 thousand tons, $613 million), and machinery (70 thousand tons, $551 million).

The Port of Wilmington is located in New Hanover County, and the Port of Morehead City is located in Carteret County. Both ports serve as critical connections between foreign marine and domestic freight networks. Table 12 compares total county-level truck and rail freight movements (including multiple modes) with marine import and export flows in 2022 and 2055. The table estimates marine flows as international shipments moving through port facilities, while the truck and rail flows capture broader county-level freight activity. In 2022, New Hanover County (Port of Wilmington) handled more than four million tons of imports and exports, while Carteret County (Port of Morehead City) handled about 1.1 million tons. By 2055, marine exports are projected to increase substantially in both counties, reaching about 5.8 million tons in New Hanover County and 1.1 million tons in Carteret County. Combined truck and rail freight movements are also projected to grow, increasing from 19.3 million to 36.7 million tons in New Hanover County and from 4.3 million to 7.8 million tons in Carteret County. These trends highlight growing freight activity at North Carolina's port facilities and the importance of connections between foreign marine and domestic freight networks.

[36] The import includes only shipments with a foreign mode of water whose first point of entry into the United States is in North Carolina.

TABLE 12. MARINE PORT COUNTY FREIGHT FLOW, 2022 AND 2055

County	Freight Mode	2022 Tonnage (Thousand)	2022 Value ($Millon)	2055 Tonnage (Thousand)	2055 Value ($Million)
New Hanover (Port of Wilmington)	Truck + Rail	19,316	$ 31,908	36,678	$ 68,679
	Marine Imports	2,498	$ 3,849	2,307	$ 2,307
	Marine Exports	1,990	$ 3,261	5,843	$ 5,843
Carteret (Port of Morehead City)	Truck + Rail	4,262	$ 5,350	7,843	$ 10,007
	Marine Imports	674	$ 865	1,126	$ 1,286
	Marine Exports	418	$ 588	1,065	$ 853

Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

More than two million tons of goods, valued at less than $4 billion, were **exported** to foreign countries from North Carolina seaports in 2022.[37] This export flow is projected to reach three million tons, valued at less than $7 billion by 2055. The major commodities exported through North Carolina ports by tonnage include pulp, newsprint, paper and paperboard (448 thousand tons, $259 million); wood products, including densified wood products such as wood pellets (445 thousand tons, $127 million); and fertilizer (364 thousand tons, $373 million). By value, the leading commodities included textile or leather (194 thousand tons, $498 million), miscellaneous manufactured products (103 thousand tons, $461 million), and fertilizers. Agricultural and food products[38] also represented a notable export commodity group, totaling approximately 317 thousand tons and $533 million in 2022.

In terms of **domestic waterborne freight**, in 2022, North Carolina ports and terminals handled around 300 thousand tons, valued at approximately $112 million. By 2055, domestic marine freight volumes are projected to increase to 581 thousand tons, with a total value of $154 million, representing a 96 percent increase in tonnage and a 37 percent increase in value. Most of the domestic marine freight movements associated with North Carolina in 2022 were inbound waste and scrap materials.

[37] The export includes only shipments with a foreign mode of water whose last point of exit leaving the United States is in North Carolina.

[38] Agricultural and food products include SCTG 02 – 07: cereal grains; agricultural products; animal feed and other products of animal origin; meat, poultry, fish, and seafood preparations; milled grain and bakery products; and other prepared foodstuffs, fats, and oils.

2.6.4. Air Cargo Movement

Air[39] cargo transportation, which in this case includes shipments moved by air or a combination of truck and air, is commonly used for time-sensitive and high-value products. There are three major commercial cargo airports in North Carolina: Charlotte Douglas International Airport, Piedmont Triad International Airport, and Raleigh-Durham International Airport. North Carolina airports carried 247 thousand tons of domestic (including inbound, outbound, and internal) freight movement, valued at $26 billion in 2022, and by 2055 the figures are projected to reach 597 thousand tons with a value of $51 billion. North Carolina airports also handled 38 thousand tons of international imports, valued at $4 billion, and 13 thousand tons of exports, valued at nearly $1 billion in 2022. Notably, Wilmington International Airport receives several freighter flights a week from a European hub in Ireland, carrying acutely temperature sensitive biotechnology products chartered by an on-airport logistics company. While tonnage would be low, the products have high value.

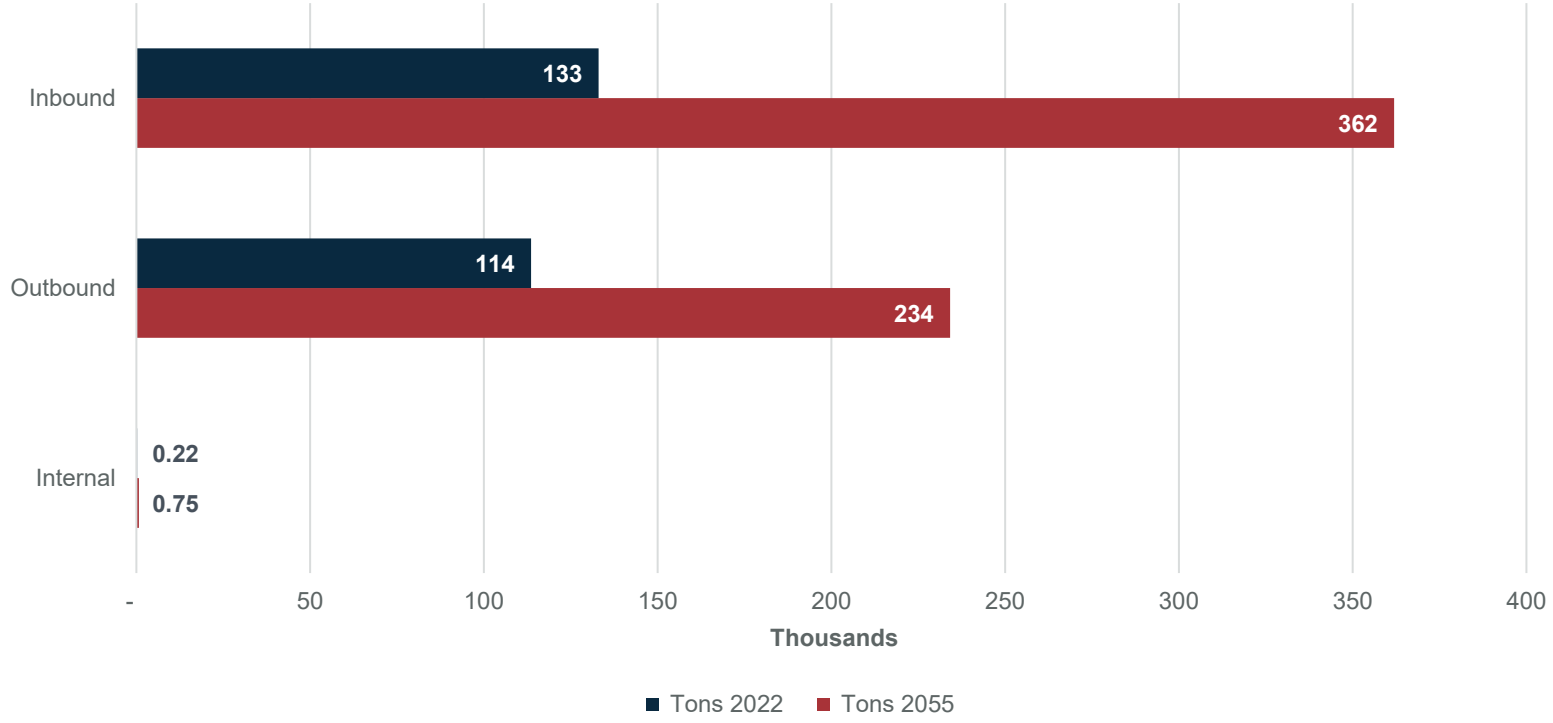
Figure 31 and Figure 32 show the directional split of domestic air freight flow. Inbound and outbound air freight movements were relatively balanced, with 133 thousand and 114 thousand tons, respectively, while internal movements accounted for a negligible share of total freight activity.

Machinery (36 thousand tons), electronics (34 thousand tons), and pharmaceutical products (26 thousand tons) were the leading commodities transported through North Carolina airports in 2022 in terms of domestic tonnage. Together, these commodity groups accounted for more than 39 percent of total domestic air freight tonnage. These commodities are projected to remain the dominant air freight commodities through 2055 and are expected to account for more than 42 percent of total inbound, outbound and internal air freight tonnage.

In terms of domestic air freight value to/from North Carolina, pharmaceutical products, electronics, and machinery were also the highest-value commodities moved by air in 2022 and projected to remain the top commodities by 2055. Pharmaceutical products are projected to increase from $9 billion in 2022 to $13 billion in 2055; electronics are expected to grow from $6 billion to $11 billion; and machinery is forecast to more than double in value, increasing from $3 billion in 2022 to $7 billion by 2055.

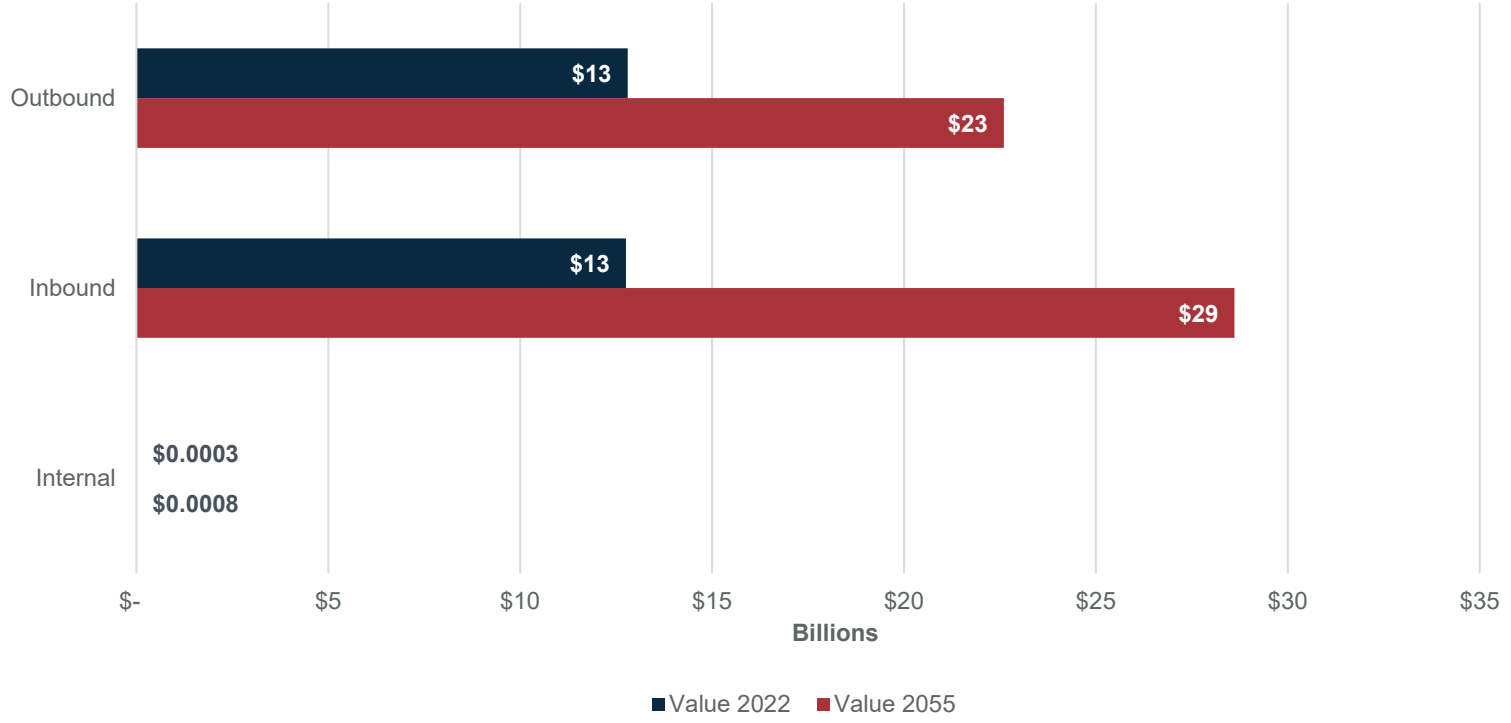
[39] Air (includes truck-air) mode includes shipments moved by air or a combination of truck and air in commercial or private aircraft. Includes air freight and air express. With the exception of through truck-air flows, in the case of imports and exports by air, domestic moves by ground to and from the port of entry or exit are categorized with Truck.

FIGURE 31. DOMESTIC AIR FREIGHT MOVEMENT DIRECTION BY TONNAGE, 2022 AND 2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

FIGURE 32. DOMESTIC AIR FREIGHT MOVEMENT DIRECTION BY VALUE, 2022 AND 2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

Of the 133 thousand tons of **inbound domestic air freight** in 2022, New York accounted for the largest share with 25 thousand tons, followed by Illinois (17 thousand tons) and Kentucky (14 thousand tons). Looking ahead to 2055, inbound air freight from Georgia is projected to grow significantly, from 9 thousand tons in 2022 to 49 thousand tons. This growth is expected to be driven primarily by increased shipments of machinery, electronics, and precision instruments and apparatus.

In terms of domestic air freight value, Kentucky, Georgia, Illinois, and New York were the leading inbound trading partners in 2022, collectively accounting for 43 percent of total inbound air freight value. By 2055, Illinois is projected to lose some of its prominence as an inbound trading partner, largely due to declining values of pharmaceutical products and electronics shipped from the state.

In terms of **domestic outbound tonnage**, Florida, Illinois, and Arkansas were the leading trading partners in 2022, receiving approximately 27 thousand, 17 thousand, and 12 thousand tons of air freight from North Carolina, respectively. Together, these three states accounted for more than 49 percent of total outbound air freight tonnage. By 2055, outbound shipments to Arkansas are projected to decline to less than 8 thousand tons, while shipments to Georgia are expected to grow substantially, increasing from 9 thousand tons in 2022 to 48 thousand tons. This growth is projected to be driven primarily by increased movements of machinery and electronics.

In terms of **domestic outbound value**, Illinois ($3 billion), Florida ($2 billion), and Georgia ($1 billion) were the leading destinations for outbound air freight in 2022. By 2055, however, the value of outbound air freight to Florida is projected to decline by approximately 32 percent, reflecting shifts in commodity demand and trading patterns.

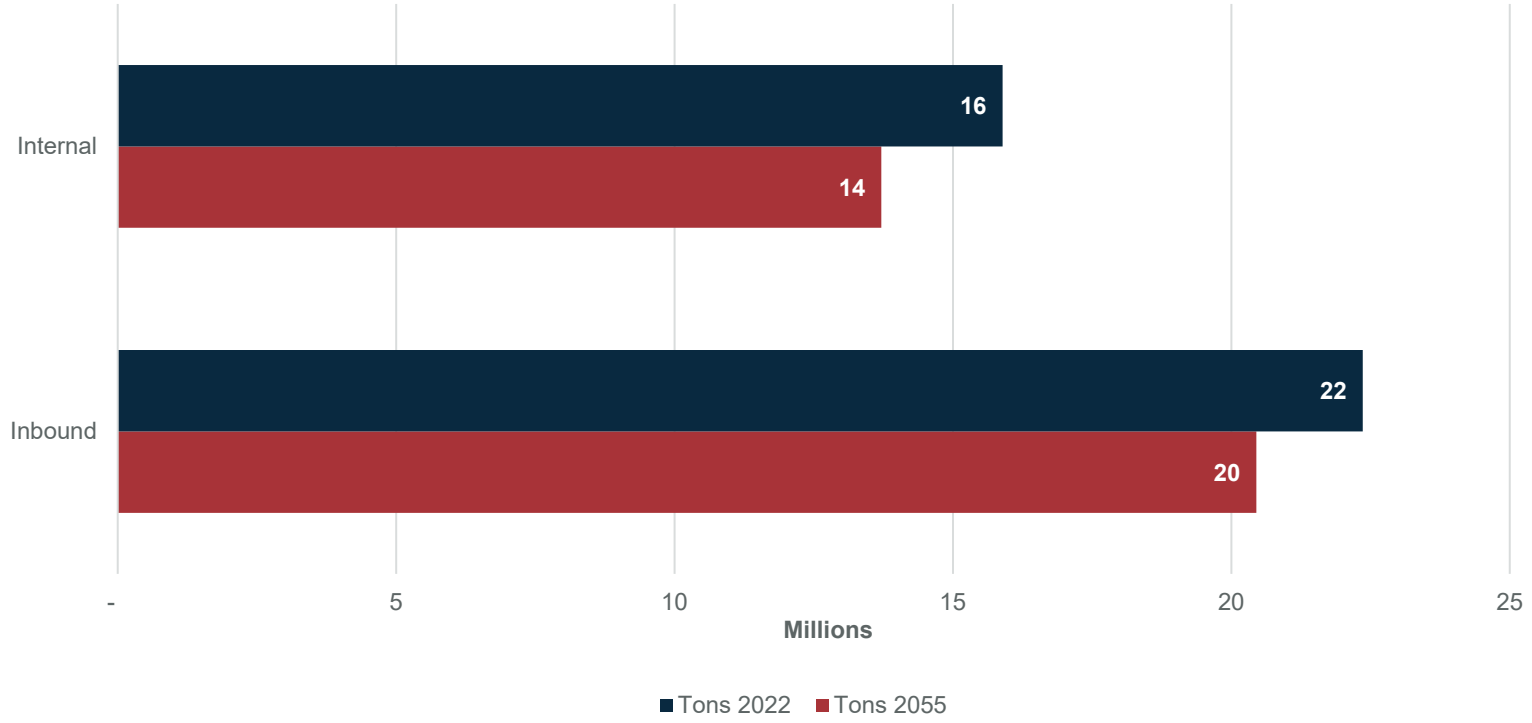
By 2055, the **foreign imports** moving through airports in North Carolina are projected to increase to 142 thousand tons, with an estimated value of $12 billion. Key commodities imported through North Carolina by air include machinery (9,000 tons, $672 million) and electronics (4,000 tons, $371 million). **Foreign export** tonnage is projected to reach 25 thousand tons, with a projected value of $3 billion by 2055. Air exports consist of a diverse mix of commodities, each with relatively small tonnage. In terms of value, the top commodities exported by air from North Carolina are transportation equipment ($280 million, 700 tons) and pharmaceutical products ($132 million, 766 tons).

2.6.5. Pipeline Movement

Pipelines are commonly used to transport liquid or gaseous commodities such as energy products and chemicals. The pipeline network in North Carolina carried more than 38 million tons of freight valued at approximately $14 billion in 2022. By 2055, pipeline shipments are projected to decline modestly to approximately 34 million tons, with a total value of $12 billion. The projected decline is driven by projected shifts in the energy market.

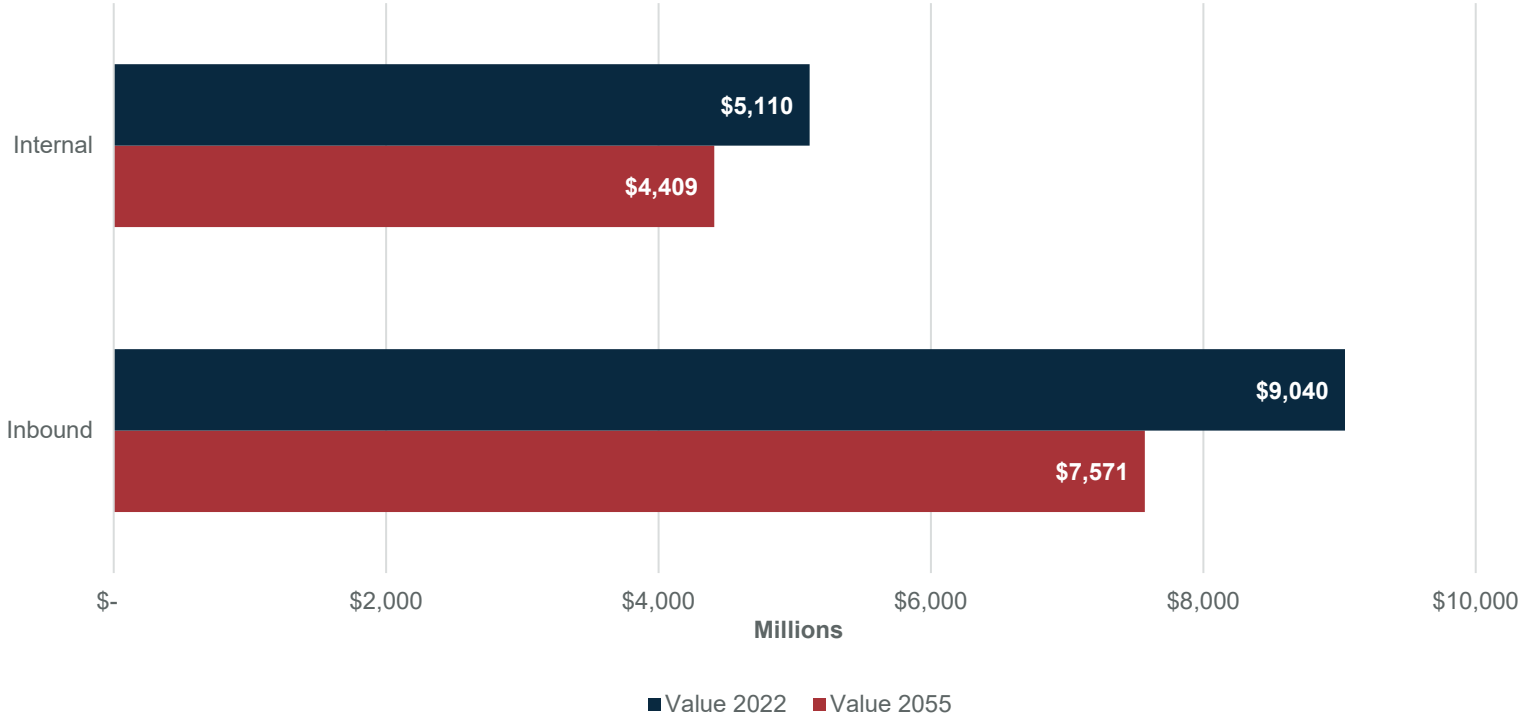
Inbound movements dominate North Carolina's pipeline freight activity, accounting for both tonnage and value. As shown in Figure 33 and Figure 34, approximately 60 percent of total pipeline tonnage and 64 percent of total pipeline value were transported into the state in 2022. Nearly all inbound pipeline shipments originated from Virginia (14 million tons, valued at $5 billion), South Carolina (6 million tons, valued at $2 billion), and Louisiana (2 million tons, valued at $2 billion). These states are expected to remain the primary sources of inbound pipeline freight through 2055.

FIGURE 33. PIPELINE FREIGHT MOVEMENT DIRECTION BY TONNAGE, 2022 AND 2055



Source: NC Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

FIGURE 34. PIPELINE FREIGHT MOVEMENT DIRECTION BY VALUE, 2022 AND 2055



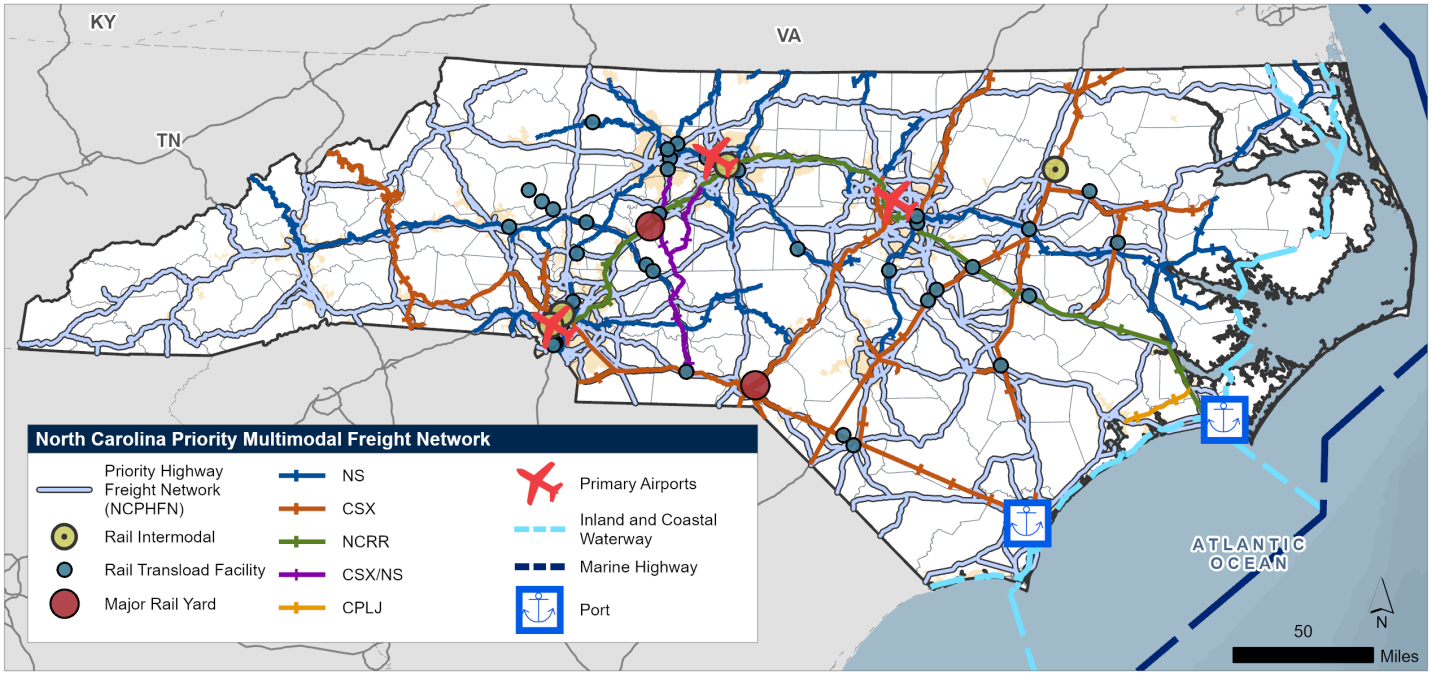
Source: N.C. Commodity Flow Database 2022, STB Waybill 2022, Processed by Cambridge Systematics.

Other coal and petroleum products, which include natural gas, dominated pipeline freight movements in North Carolina, accounting for approximately 36 million tons valued at nearly $12 billion in 2022, representing more than 94 percent of total pipeline tonnage and 87 percent of total value. Gasoline and aviation turbine fuel were the second-leading pipeline commodities, totaling approximately 1.5 million tons and valued at $1.2 billion in 2022, followed by fuel oils, including diesel fuel, at approximately 755 thousand tons and $579 million in value. By 2055, other coal and petroleum products are expected to decline modestly to approximately 33 million tons, while remaining the dominant pipeline commodity.

3. North Carolina's Freight Transportation Infrastructure

Freight in North Carolina is transported using all modes, including trucks, rail, air, water, and pipelines (Figure 35). Freight movement in North Carolina depends heavily on trucks (~81 percent by weight) compared to the share in neighboring states (65 percent – 78 percent). Rail accounts for 6.6 percent, water accounts for 0.1 percent, and pipelines account for 7 percent of all movements. Other modes and mixed modes account for the remaining 5 percent of the trade volume.[40]

FIGURE 35. NORTH CAROLINA MULTIMODAL FREIGHT NETWORK



[40] From table - FAF5.7.1 State Summary by Dmsmode and Trade 2024. "Current_value" tab

3.1. Highways

Highway transport is one of the primary modes of goods movement. It accounts for the largest share of overall tonnage, representing more than 80 percent of total inbound, outbound, internal and through flows for all modes combined in the state of North Carolina.[41]

3.1.1. North Carolina Roadway Network

Based on 2024 data, North Carolina's road network spans 108,827 miles of public roadways, of which the NCDOT maintains 80,593 miles, and other systems (municipal, federal, etc.) maintain the remaining 28,234 miles. The NCDOT-maintained network comprises 1,448 miles of interstates (including business designations), 5,601 miles of U.S. routes, 8,170 miles of North Carolina state routes, and 65,374 miles of other primary and secondary routes, respectively (Table 13).[42] State ownership of approximately three-quarters of the system gives the state a competitive advantage, because a single entity is able to direct investments throughout the state.

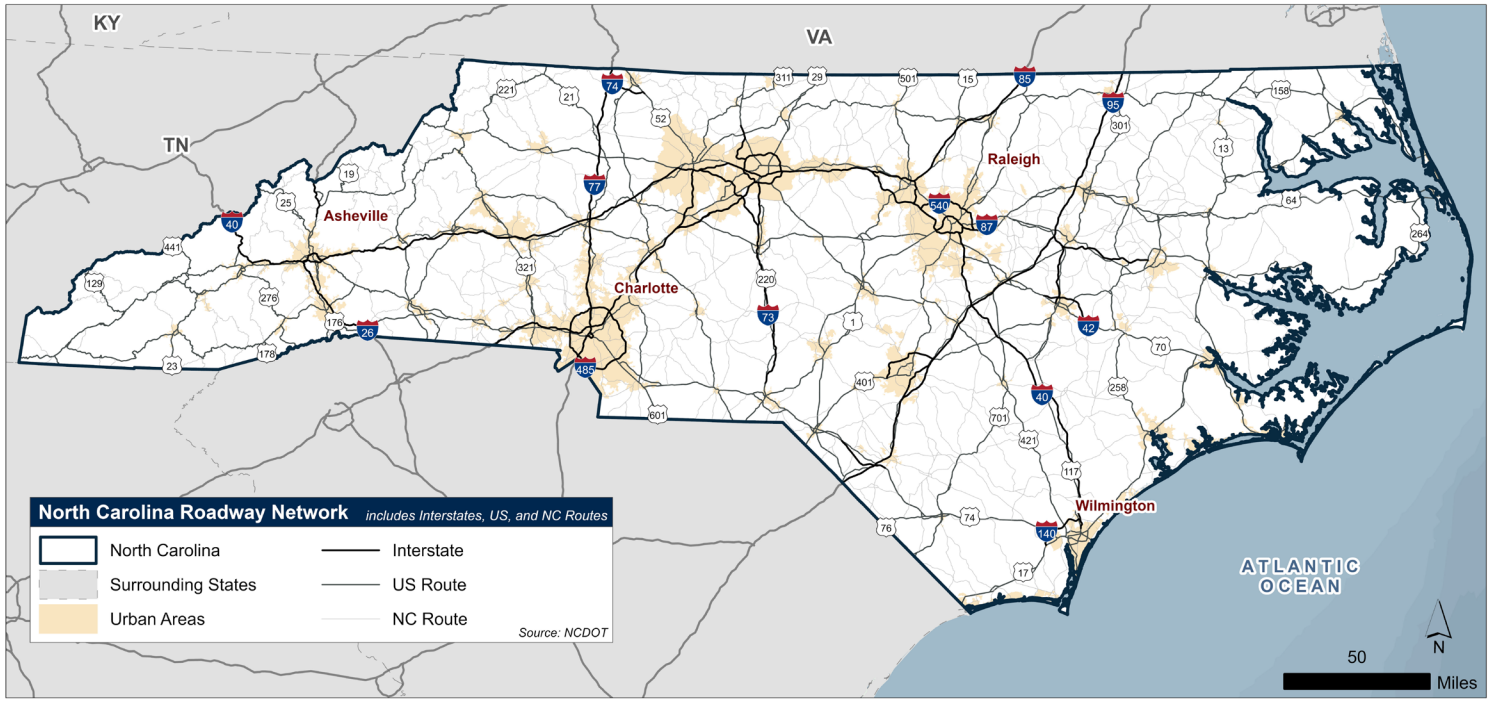
TABLE 13. HIGHWAY DESIGNATIONS IN NORTH CAROLINA BY MILEAGE AND PERCENTAGE OF TOTAL NETWORK (2024)

Roadway Type	Miles	Percentage
Interstates (including. business designations)	1,448	1.3%
U.S. Routes	5,601	5%
North Carolina State Routes	8,170	8%
Secondary and Local Routes	65,374	60%
Total NCDOT Maintained	**80,593**	**74%**
Non-NCDOT Maintained	28,234	26%
Total	**108,827**	**100%**

Figure 36 shows the map of the highway network in North Carolina, focusing on the top three tiers: interstates, U.S. routes, and North Carolina state routes.

41 2022 NC Statewide Freight Plan
42 https://connect.ncdot.gov/resources/State-Mapping/Documents/Official_State_Mileage2024.pdf

FIGURE 36. NORTH CAROLINA ROADWAY NETWORK



3.1.2. National Highway Freight Network

The National Highway Freight Network (NHFN) consists of the following components:

- **Primary Highway Freight System (PHFS):** The PHFS is a network of highways identified as the most critical highway portions of the U.S. freight transportation system designated by FHWA based on eight factors:
    - Origins and destinations of freight movement in the U.S.
    - Total freight tonnage and value of freight moved by highways

- Percentage of annual average daily truck traffic in the annual average daily traffic on principal arterials
- Annual average daily truck traffic on principal arterials
- Access to land and maritime ports of entry
- Access to energy exploration, development, installation, or production areas
- Access to population centers
- Network connectivity

- **Non-PHFS Interstates:** The FAST Act included the entirety of the interstate system – including interstate facilities not located on the PHFS – in the NHFN. The FHWA is to update the maps and tables on a periodic basis, incorporating any interstate system routes that are missing, as well as roads added to the interstate system.

  North Carolina has 1,033 miles on the PHFS and 185 miles on the non-PHFS interstate networks. In "high mileage" states like North Carolina, which have more than 2 percent of the national PHFS mileage, the FAST Act prohibits the use of NHFP funds on non-PHFS interstates.

  In addition, as part of the FAST Act, the USDOT allocated additional miles to each state, based on its PHFS mileage, to designate to the NHFN. These miles are eligible for NHFP funds and are referred to as:

  - **Critical Urban Freight Corridors (CUFC):** These are public roads in an urbanized area which provide access and connection to the PHFS and non-PHFS Interstates with other important ports, public transportation facilities, or other intermodal freight facilities.
  - **Critical Rural Freight Corridors (CRFC):** These are public roads not in an urbanized area which provide access and connection to the PHFS and non-PHFS Interstates with other important ports, public transportation facilities, or intermodal freight facilities.

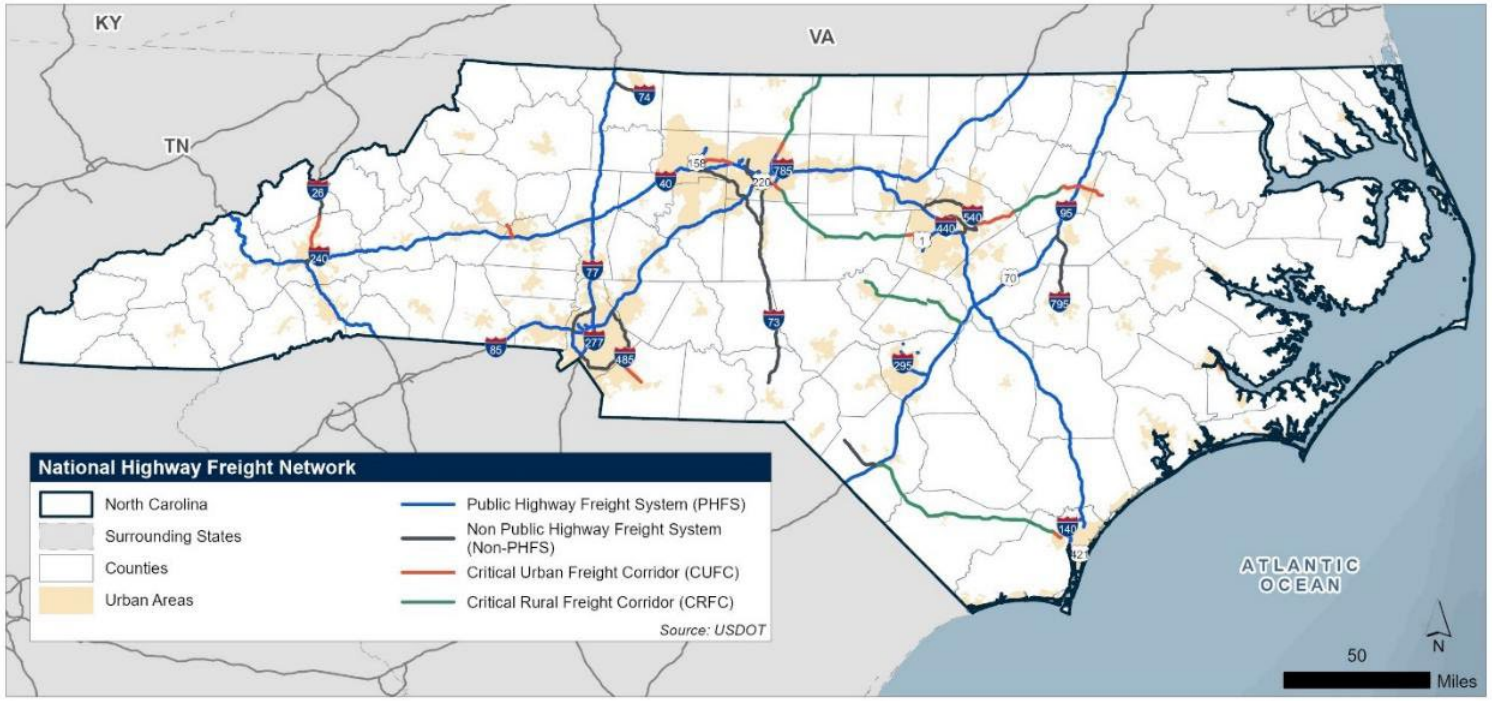
According to the IIJA, the maximum mileage limits of highways have increased from the FAST Act. North Carolina may designate a maximum of 150 miles as CUFCs and may designate a maximum of 300 miles as CRFCs. Prior to this plan update, North Carolina had 102 miles of CUFCs and 206 miles of CRFCs.[43]

[43] Table of National Highway Freight Network Mileage by State, Federal Highway Administration.

Reflecting national defense needs, USDOT also included the Strategic Highway Network (STRAHNET) in the NHFN. The STRAHNET network consists of highways that are important to the U.S. strategic defense policy and which provide defense access, continuity and emergency capabilities for such purposes.

Figure 37 shows the current NHFN in North Carolina.

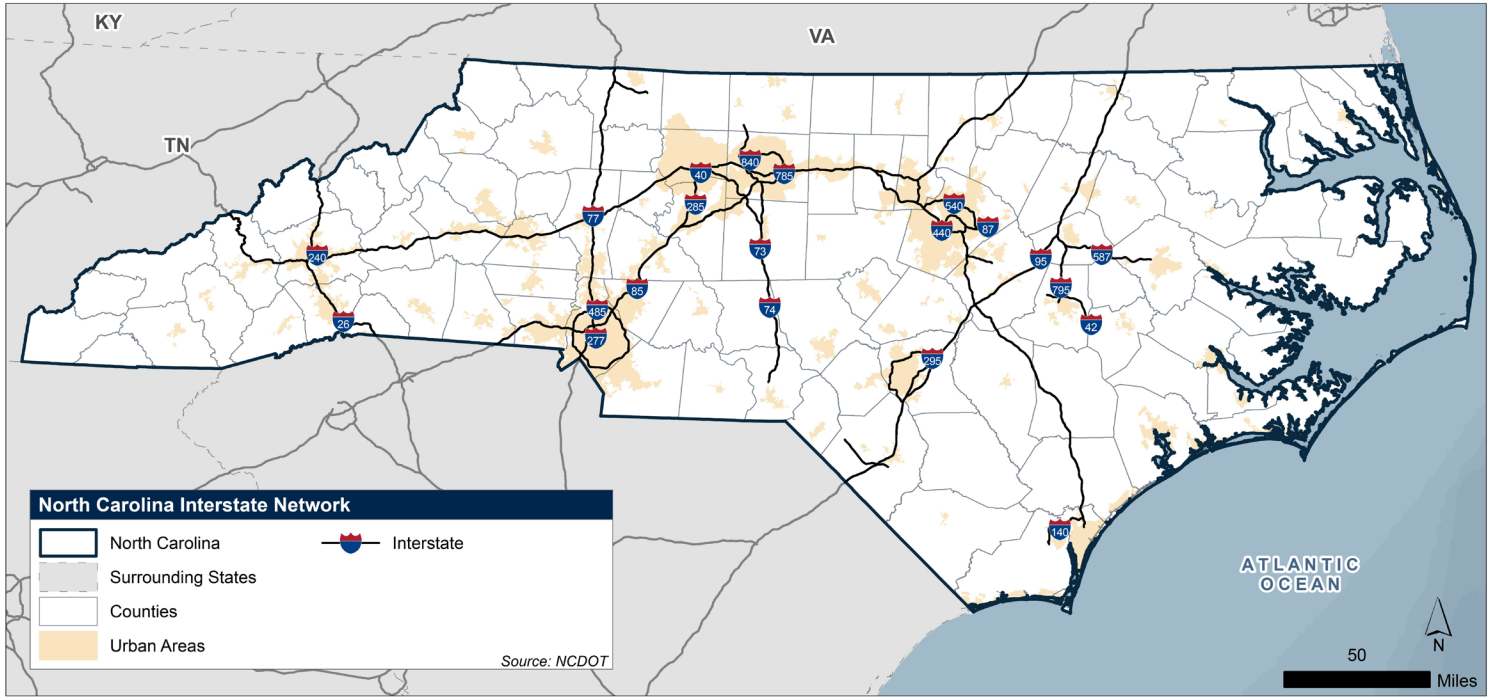
FIGURE 37. NATIONAL HIGHWAY FREIGHT NETWORK (NHFN) IN NORTH CAROLINA



There are 1,433 miles of interstates and 15 miles of Interstate Business Routes (auxiliary routes that connect main interstate highways to commercial districts and towns otherwise bypassed) in North Carolina. Three interstates (I-40, I-85, and I-95)

form the backbone of the interstate network in the state, with various connectors and loops in urban areas. These interstates have a total of 7,054 lane-miles of roadway. Figure 38 shows the state's interstate highway network and its extent across the state and connections to and from the neighboring states.

FIGURE 38. NORTH CAROLINA INTERSTATE NETWORK



North Carolina's National Highway Freight Network mileages are listed in Table 14 below and mapped in Figure 37.

TABLE 14. NORTH CAROLINA CUFCS AND CRFCS

PHFS	Non-PHFS Interstate	CRFC as of 8/1/2025	CUFC as of 8/1/2025	NHFN Total	CRFC Maximum Limit	CUFC Maximum Limit
1033.5	185.31	206.35	102.09	1527.10	300	150

Source: FHWA

3.1.3. Truck Parking Facilities

An inventory of truck parking facilities was developed to quantify the supply and distribution of truck parking across North Carolina. Because truck parking facilities may open, close, expand, or modify operations over time, the inventory was developed using multiple public and private data sources and independently reviewed by the project team to improve accuracy.

The inventory developed for the North Carolina Truck Parking Study Phase II (2020) served as the starting point for this effort. The 2020 inventory identified 5,839 truck parking spaces across 48 public and 94 private facilities and was used to confirm existing facilities and identify potential changes in parking supply.

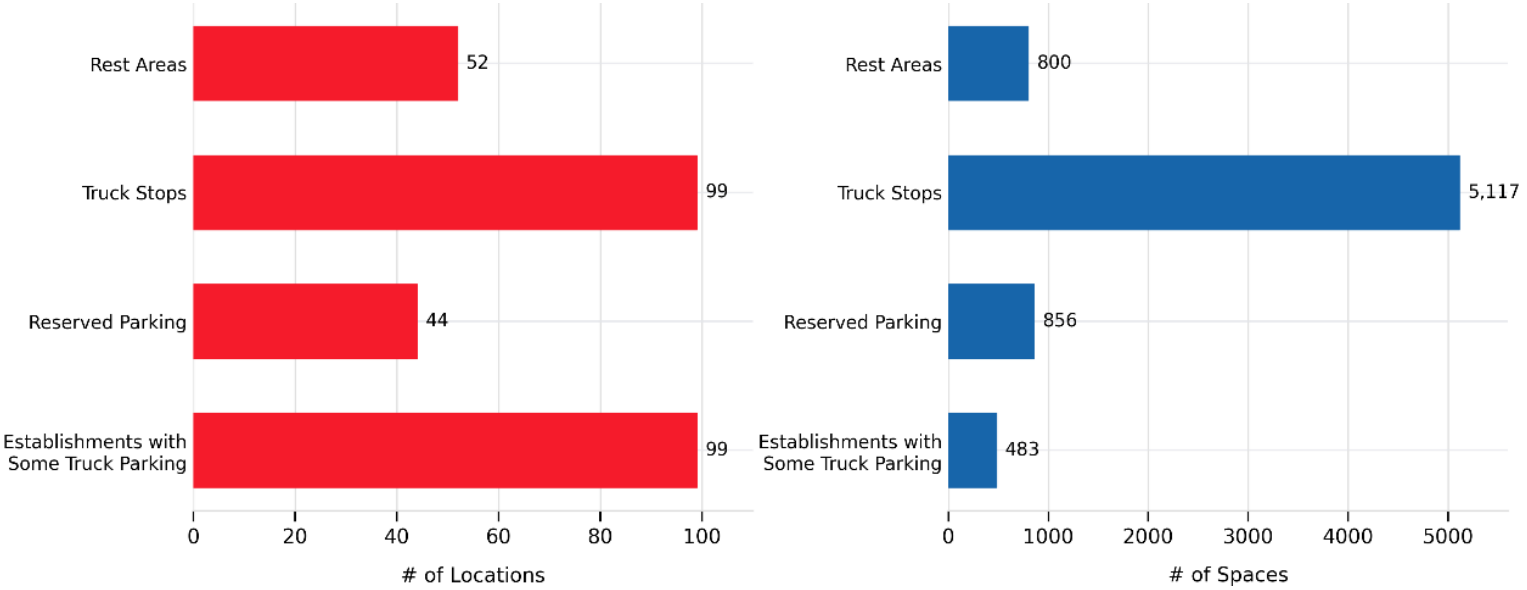
- **TruckerPath:** Crowdsourced mobile application drawing on input from more than one million drivers. The platform provided information on parking locations, amenities, and user-reported operating conditions. For this study, data on facility locations, amenities, and reported operating characteristics were used.
- **Truckstopsandservices.com:** A web and mobile directory of truck stops, rest areas, truck service facilities, and associated amenities. Data from this platform supported the identification of facilities and the verification of available services.
- **Trucker Lab:** A data platform synthesizing driver feedback, third-party datasets, operator information, and independent validations. Trucker Lab provided additional insight into facility amenities, ownership (public/private), and estimates of parking supply, and helped corroborate conflicting or incomplete information.
- **Private Truck Stop Operator Websites:** Publicly available information from truck stop and travel center operators was reviewed to verify facility locations, parking availability, amenities, and operating characteristics.

Information from these sources was compared and reconciled to improve inventory accuracy and identify facilities that may not have been included in previous inventories. To better distinguish facilities specifically designed to serve truck drivers from locations where truck parking is provided as an ancillary service, facilities were categorized as:

- **Rest Areas:** Public roadside facilities that provide truck parking as part of a broader traveler services function.
- **Truck Stops:** Travel centers, truck stops, and large fuel stations that actively cater to commercial truck drivers and provide dedicated truck parking.
- **Reserved Parking:** Facilities where truck drivers reserve parking spaces in advance, including Truck Parking Club locations and other reservation-based parking providers.
- **Establishments with Some Truck Parking**: Restaurants, convenience stores, fuel stations, and other businesses where truck parking is available but is not the primary function of the site. Many of these locations provide only a small number of spaces or informal parking areas.

Figure 39 shows the distribution of truck parking spaces by facility type. A total of 294 facilities providing 7,256 truck parking spaces were identified in North Carolina. Truck stops account for the largest share of statewide capacity, providing 5,117 spaces (71 percent of total supply). Reserved parking facilities provide 856 spaces (12 percent), while rest areas provide 800 spaces (11 percent). Establishments with some truck parking provide an additional 483 spaces (7 percent).

FIGURE 39. DISTRIBUTION OF TRUCK PARKING SPACES BY FACILITY TYPE



The private-sector providers have an important role in meeting truck parking demand. Private facilities, including truck stops, reserved parking facilities, and establishments with some truck parking, account for 242 facilities (82 percent of all inventoried locations) and provide 6,456 spaces, representing 89 percent of statewide truck parking capacity. In comparison, 52 public facilities were identified statewide, all of which are rest areas, providing 800 spaces, or 11 percent of total capacity.

As shown in Figure 40 and Figure 41, truck parking facilities are distributed throughout North Carolina. truck stops, reserved parking facilities, and rest areas are concentrated along the interstate system, while establishments with some truck parking are more broadly distributed across rural areas and secondary highway corridors. The largest concentrations of truck parking capacity are located along major freight corridors and near metropolitan areas.

FIGURE 40. TRUCK PARKING INVENTORY BY FACILITY TYPE

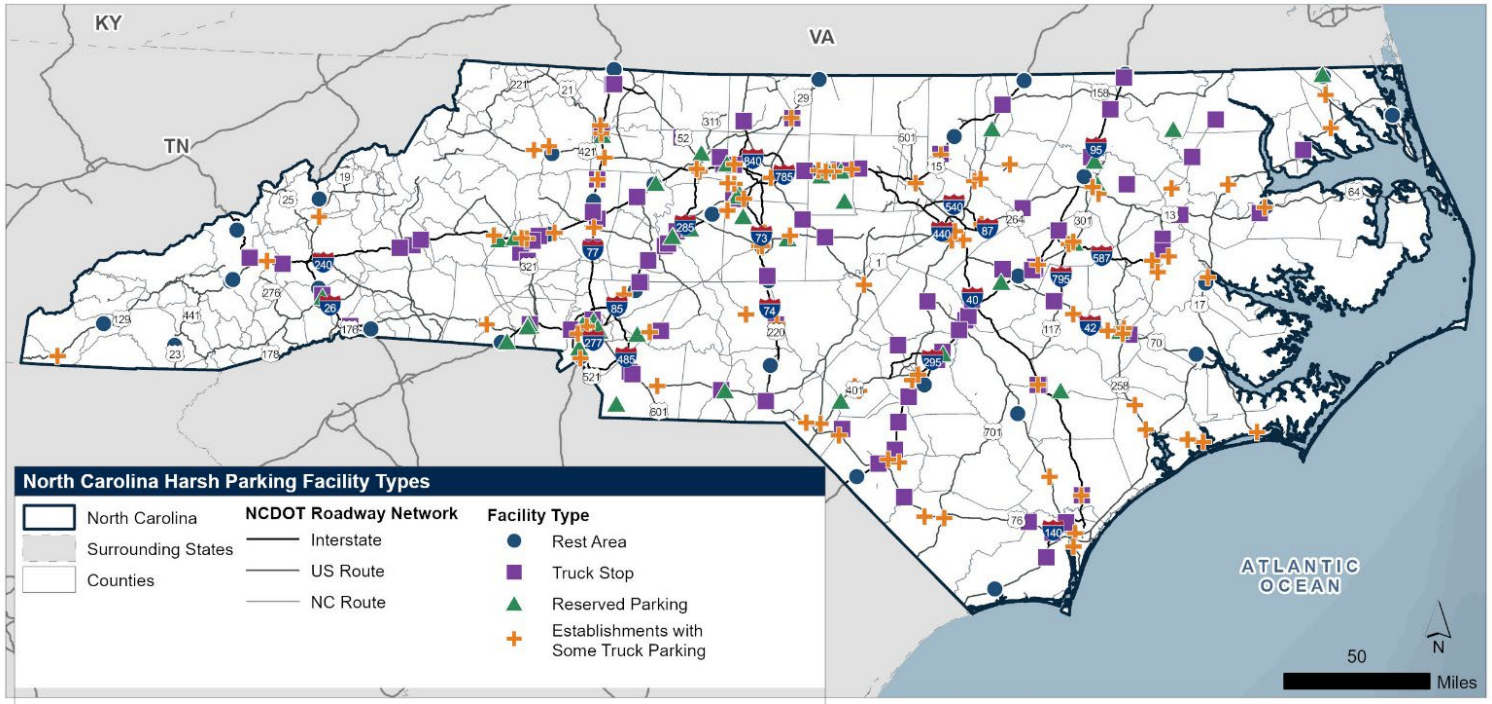
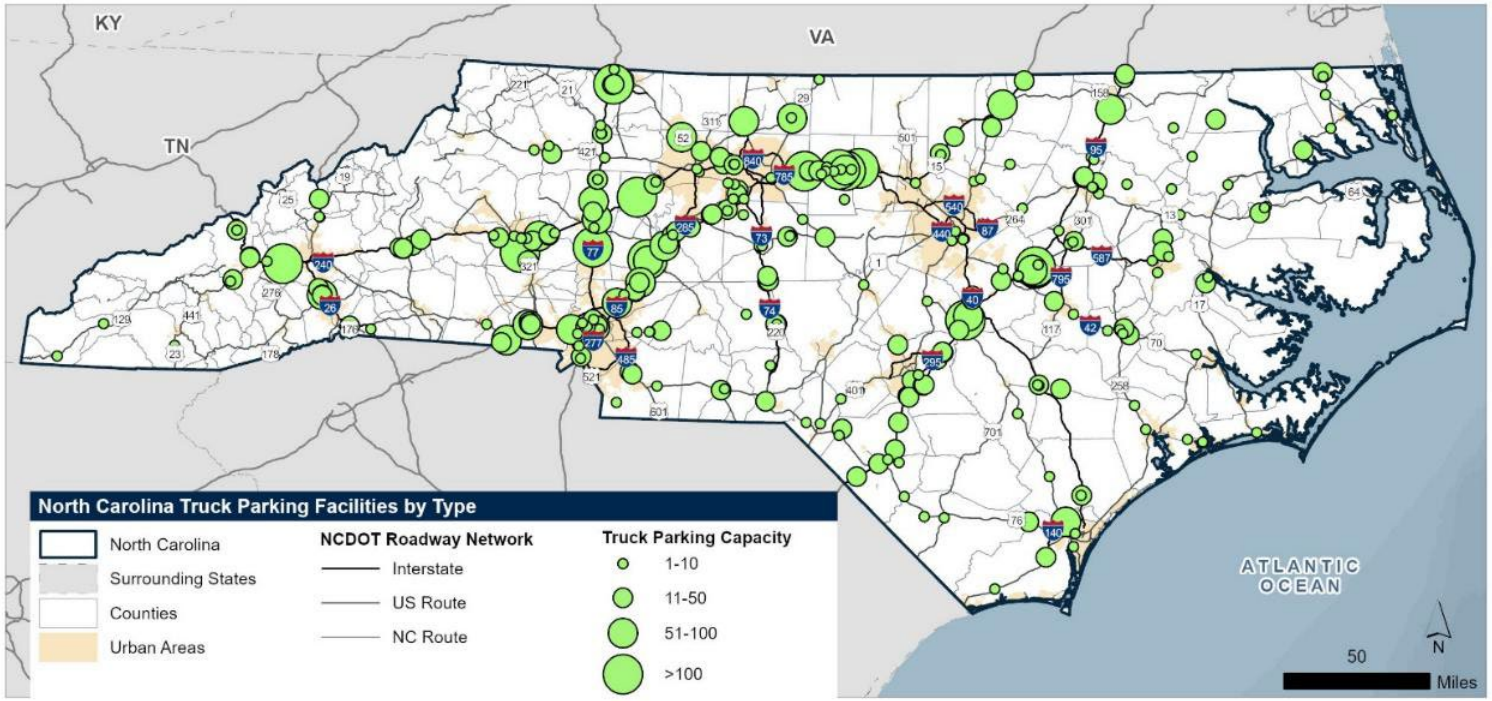


FIGURE 41. TRUCK PARKING INVENTORY BY CAPACITY



Compared to the 2020 inventory, the updated inventory identified approximately 1,400 additional truck parking spaces and more than 150 additional facilities. Much of this increase reflects a broader inventory approach that captured additional reserved parking facilities and establishments with some truck parking, as well as improvements in the availability and verification of truck parking inventory data.

3.2. Marine Transportation

3.2.1. NC Ports Facilities

North Carolina freight producers and consumers are served by marine cargo terminal facilities in Wilmington and Morehead City, an inland port in Charlotte, the Carolina Connector in Rocky Mount, private marine terminals within North Carolina, and through truck and rail connections to water and inland ports in Virginia, South Carolina and Georgia. The North Carolina State Ports Authority owns the Port of Wilmington, the Port of Morehead City, and the Charlotte Inland Port. The Port of Wilmington the Port of Morehead City are two of 18 Strategic Seaports as designated by the U.S. Department of Defense, and as such must maintain the capability and capacity to meet the national security needs of the nation. This role is critical to Army and Marine Corps Power Projection Platforms (PPPs), which facilitate the rapid, strategic deployment of troops and equipment to assist in various domestic or global crises.

Wilmington

Wilmington is a port city in New Hanover County in coastal southeastern North Carolina. The Port of Wilmington is located on the Cape Fear River approximately 2 miles south of the downtown area. It has nine berths with approximately 6,800 linear feet of wharf. The Port of Wilmington's operations encompass approximately 352 developed acres along the Cape Fear River.

CSX Transportation provides daily service for container, boxcar, tanker, and general cargo services via a short line, Wilmington Terminal Railroad (WTR). CSX now owns and operates the largest intermodal rail network in the eastern United States. The Port of Wilmington is designated as a Foreign Trade Zone 214, along with Wilmington International Airport (ILM). Primary Highway Freight System (PHFS) routes, North Carolina Priority Highway Freight Network (NCPHFN) routes, Critical Rural Freight Corridors (CRFCs), Critical Urban Freight Corridors (CUFCs), and local truck routes are all found adjacent to the Port of Wilmington and are heavily utilized by freight traffic.

Adjacent to the port, US 421 is the main access road north and south. For trips to Raleigh and points north, trucks can use US 421 to I-40 (around 20 miles from the Port). For trips to Charlotte and the I-85 corridor, trucks can use US 421 to US 74, accessing the I-77 and I-85 corridors at Charlotte. For trips to all Eastern Seaboard locations and east-west interstates (particularly I-20) reachable via I-95, trucks can use US 421/NC 87 to US 74 (81 miles) to reach I-95. US 117 provides alternate access to I-40, but port trucks generally look to avoid this route due to congestion.

The container terminal has intermodal rail service by the Wilmington Terminal Railroad (WTR) and exchanges traffic with CSX, which provides access to the full CSX network including the Charlotte Intermodal Terminal/Charlotte Inland Port as well as the Carolina Connector Intermodal Rail Terminal in Rocky Mount. The general cargo terminal has daily train service.

The container terminal offers capacity for 600,000 TEUs per year and is supported by seven container cranes and more than 1,500 refrigerated container plugs. It offers high productivity, with ship-to-shore cranes typically handling 40 or more container moves per hour and average truck turnaround times of 18 minutes for a single move (drop-off or pick-up) or 32 minutes for a double move (drop-off and pick-up).[44]

The general cargo terminal handles a full range of non-containerized cargo types including bulk, breakbulk, project and roll-on/roll-off (ro-ro). Leading commodities include grains, wood products, chemicals, fertilizers, furniture, apparel, and automotive parts. Much of this cargo is stored in transit sheds, warehouses, and cargo shelters (i.e., covered storage).

Morehead City

Morehead City is a port town located on the eastern coast of North Carolina with a population of 9,560 (2020 Census). The Port of Morehead City operates under Foreign Trade Zone 214, attracting businesses involved in international trade such as Nutrien.

The Port of Morehead City is also the port of embarkation and debarkation for U.S. Marine Corps at Camp Lejeune and Cherry Point. Visiting Navy ships also use the Port's deep-water berths and the state-owned ramps at the terminal for loading amphibious ships. Vessels operated by or chartered to the Military Sealift Command berth at the Aviation Fuel Terminal on Radio Island.

The Port of Morehead City terminal is accessible via water, rail, and truck. I-95 and I-40 are easily accessed via US 70 and US 17. The Atlantic Intracoastal Waterway connecting Aurora to Morehead City is part of designated M-95, a marine alternative to I-95 as part of America's Marine Highway Program, an initiative to move more cargo on the water rather than on

[44] https://ncports.com/port-facilities/port-of-wilmington/

crowded highways. The strategic advantage of the Port is further amplified by its proximity to the Coastal Carolina Regional Airport (EWN), a full-service commercial airport spanning over 785 acres.

Morehead City specializes in bulk and breakbulk cargo, while also handling project cargo and ro-ro cargo. It offers nine berths with a 124-metric ton capacity gantry crane, 30 acres of paved open storage, and over 1 million square feet of covered storage. Leading commodities include rubber, paper, steel, lumber, wood chips, phosphate, fertilizer, grain, and aircraft parts.

Charlotte Inland Port

The Charlotte Inland Port is a facility for handling inbound and outbound container trucks, located just over 1 mile from the CSX Charlotte Intermodal Rail Terminal. It consists of 10 developed acres accommodating 2,000 grounded/wheeled containers, with 10 additional acres available for future expansion. It offers an off-port extension of marine container yard operations to ocean carriers, providing value-added staging and storage before and after transfer to rail. The Charlotte Inland Port is supported by the CSX Queen City Express, a direct service to/from the Port of Wilmington. The Inland Port allows freight shippers and receivers to benefit from Port of Wilmington services without driving further east than Charlotte.

3.2.2. Private Facilities

Marine Terminals

North Carolina's waterways support a substantial ecosystem of private port facilities, which handle mostly bulk commodities such as fuels, chemicals, paper, metals, and aggregates. According to the U.S. Army Corps of Engineers Waterborne Facilities database, 31 unique private terminals are in North Carolina. Of these, 11 are within Wilmington Harbor, three are within Morehead City Harbor, and 17 are on other navigable waters. See Table 15.

TABLE 15. PRIVATE MARINE CARGO TERMINALS IN NORTH CAROLINA

Terminal Name	City	Waterway
Apex Oil Co Wilmington Terminal Wharf	Wilmington	Wilmington Harbor, NC
Archer Daniels Midland Southport NC	Southport	Wilmington Harbor, NC
Buckeye Terminals, LLC - Wilmington Terminal	Wilmington	Wilmington Harbor, NC
Carolina Marine Terminal	Wilmington	Wilmington Harbor, NC
Colonial Oil Wilmington Terminal Wharves	Wilmington	Wilmington Harbor, NC
Invista Terminal Wilmington NC	Wilmington	Wilmington Harbor, NC
Kinder Morgan Wilmington River Road Terminal	Wilmington	Wilmington Harbor, NC
Kinder Morgan Wilmington Woodbine Street Terminal	Wilmington	Wilmington Harbor, NC
Midstream Wilmington NC	Oak Island	Wilmington Harbor, NC
National Gypsum Co Wilmington Plant Wharf	Wilmington	Wilmington Harbor, NC
Southport Municipal Dock	Oak Island	Wilmington Harbor, NC
Aviation Fuel Terminals, Beaufort Terminal	Morehead City	Morehead City Harbor, NC
Lucky International Seafood, Morehead City East Wharf	Morehead City	Morehead City Harbor, NC
Radio Island Terminal, Beaufort Terminal	Beaufort	Morehead City Harbor, NC
J.W. Jones Chip Mill Inc. (bulkhead)	Shiloh	Atlantic Intracoastal Waterway
International Paper Company	Riegelwood	Cape Fear River above Wilmington, NC
Nucor Steel Hertford	Cofield	Chowan River, NC
MI Tek Industries, Inc.	Edenton	Edenton Harbor, NC
Vulcan Materials Kitty Hawk Bay, NC	Kitty Hawk	Kitty Hawk, NC
Etheridge Wharf	Manteo	Manteo (Shallowbag) Bay, NC
The Texas Company Wharf	New Bern	Neuse River, NC
Cemex Wilmington Terminal Wharf	Wilmington	Northeast (Cape Fear) River, NC
Invista Plant	Wilmington	Northeast (Cape Fear) River, NC
Kinder Morgan Wilmington Terminal Wharf	Wilmington	Northeast (Cape Fear) River, NC
Koch Sulfur Products Co Wilmington Pier	Wilmington	Northeast (Cape Fear) River, NC
PCS Nitrogen Wilmington Plant Wharf	Wilmington	Northeast (Cape Fear) River, NC
Nutrien Aurora Phosphate	Washington	Pamlico and Tar Rivers, NC

Terminal Name	City	Waterway
Perdue Agribusiness Belhaven Grain Elevator	Belhaven	Pantego Creek, NC
Standard and Sinclair Oil Company	Windsor	Roanoke River, NC
Wells Oates Lumber Company	Williamston	Roanoke River, NC
Weyerhaeuser Company	Windsor	Roanoke River, NC

Source: WSP analysis of U.S. Army Corps of Engineers Data

Carolina Connector (CCX) Intermodal Terminal

The Carolina Connector is a private CSX rail facility in Rocky Mount that integrates access to and from the ports of Wilmington, Hampton Roads, Charleston, and Savannah. It opened as a 330-acre facility in 2021 with a lift capacity of 110,000 containers per year and sits within a 5,000-acre developable footprint. It provides North Carolina ports with improved access to out-of-state markets and North Carolina freight shippers and receivers with improved access to out-of-state port capacity.[45]

3.2.3. Truck Ferry Terminals

The North Carolina ferry system includes seven routes accommodating vehicles up to 65 feet long without special permits:

- Aurora to Bayview
- Cedar Island to Ocracoke
- Cherry Branch to Minnesott Beach
- Currituck to Knotts Island
- Fort Fisher to Southport
- Hatteras to Ocracoke
- Swan Quarter to Ocracoke

[45] https://econdev.org/carolina-connector-intermodal-terminal/

While these are not port facilities, per se, they do represent critical marine transportation links within the multimodal system, providing access to communities and trade lanes that would not otherwise be reachable via truck freight.

3.3. Rail

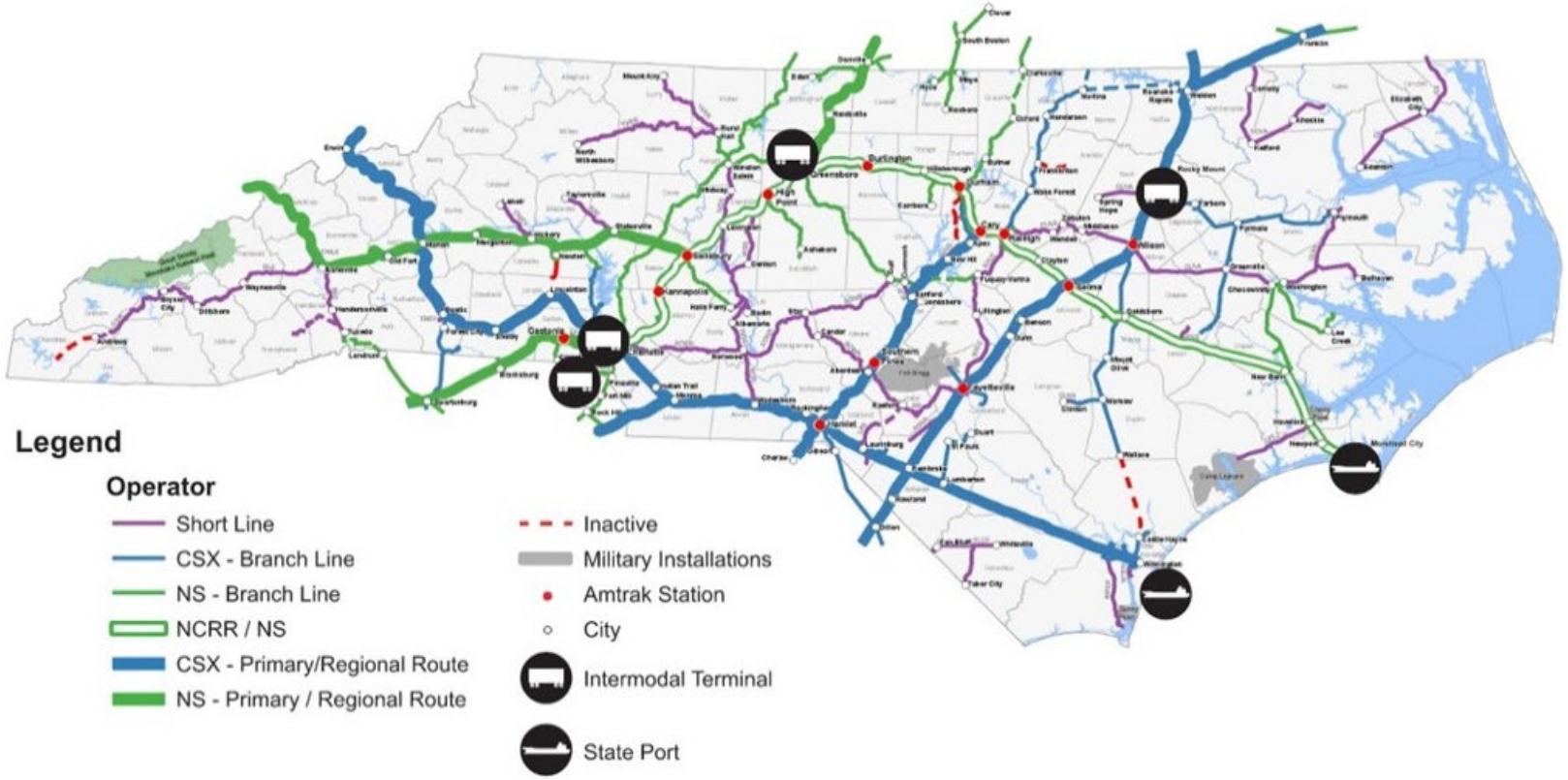
3.3.1. Overview

North Carolina's rail network is a 3,263-mile system comprising private- and state-owned infrastructure. Two Class I railroads,[46] CSX and Norfolk Southern, operate approximately 67 percent of the track mileage in North Carolina. The North Carolina Railroad, a private corporation with the State of North Carolina as the exclusive shareholder, owns 324 miles, which connects Morehead City, Raleigh, Greensboro, and Charlotte. Norfolk Southern (NS) is responsible for operating and maintaining the North Carolina Railroad corridor between Raleigh and Charlotte, which forms a critical link in the 19,500-mile NS network. Of the entire North Carolina rail network, 33 percent is operated by 27 unique short line railroads that range in length from 4 to 168 miles.

Figure 42 illustrates the North Carolina rail network, distribution of operators and key cities, nodes, terminals, and ports. Not shown on this map are the 24 Class I yard facilities located in North Carolina, which range in size and type from smaller, flat-switching facilities to large classification yards capable of processing thousands of individual carloads per day.

[46] A class I railroad as defined by the Surface Transportation Board is a railroad that generates more than $1,074,600,816 in operating revenues.

FIGURE 42. NORTH CAROLINA RAIL NETWORK



Source: 2026 Draft North Carolina State Rail Plan

3.3.2. Ports Served by Rail

The Port of Morehead City connects to Norfolk Southern. Switching within the port is provided by the Carolina Coastal Railway (CLNA). The port primarily handles non-containerized freight such as bulk, breakbulk, and roll-on/roll-off cargo, and offers on-dock rail and storage. It is located within 700 miles of 70 percent of the U.S. industrial base, is part of FTZ 214, and has a 45-foot channel depth.

The Port of Wilmington, also within 700 miles of 70 percent of the U.S. industrial base, is connected to the rail network via CSX. Switching operations at the port is provided by the Wilmington Terminal Railroad (WTRY). It handles containerized and non-containerized freight, including reefer cargo, and offers inland transport and cold storage. The port is part of FTZ 214, has a 42-foot channel depth, nine berths with on-dock rail, and a capacity of 600,000 TEUs annually.

CSX provides intermodal service through the Queen City Express between Wilmington and Charlotte, and the Wilmington Midwest Express connecting to Chicago, St. Louis, and northwest Ohio via the Carolina Connector in Rocky Mount.

3.3.3. Intermodal Rail Terminals

North Carolina hosts four intermodal terminals across the state. Intermodal terminals facilitate the movement of containerized freight between rail and truck, providing rail service access for shippers at sites or in markets that otherwise would be unreachable with direct rail service. The intermodal business model leverages trucking, commonly known as “drayage,” to bridge between rail service and shipper origin and destination points. These terminals serve different markets, with some focusing on 53 foot “domestic” containers used within North America, while others focus on international trade with 20, 40, 45 “ISO” containers that are used in overseas shipping, while others serve both. Figure 42 shows the locations of the four North Carolina intermodal terminals, details of which are summarized in Table 16.

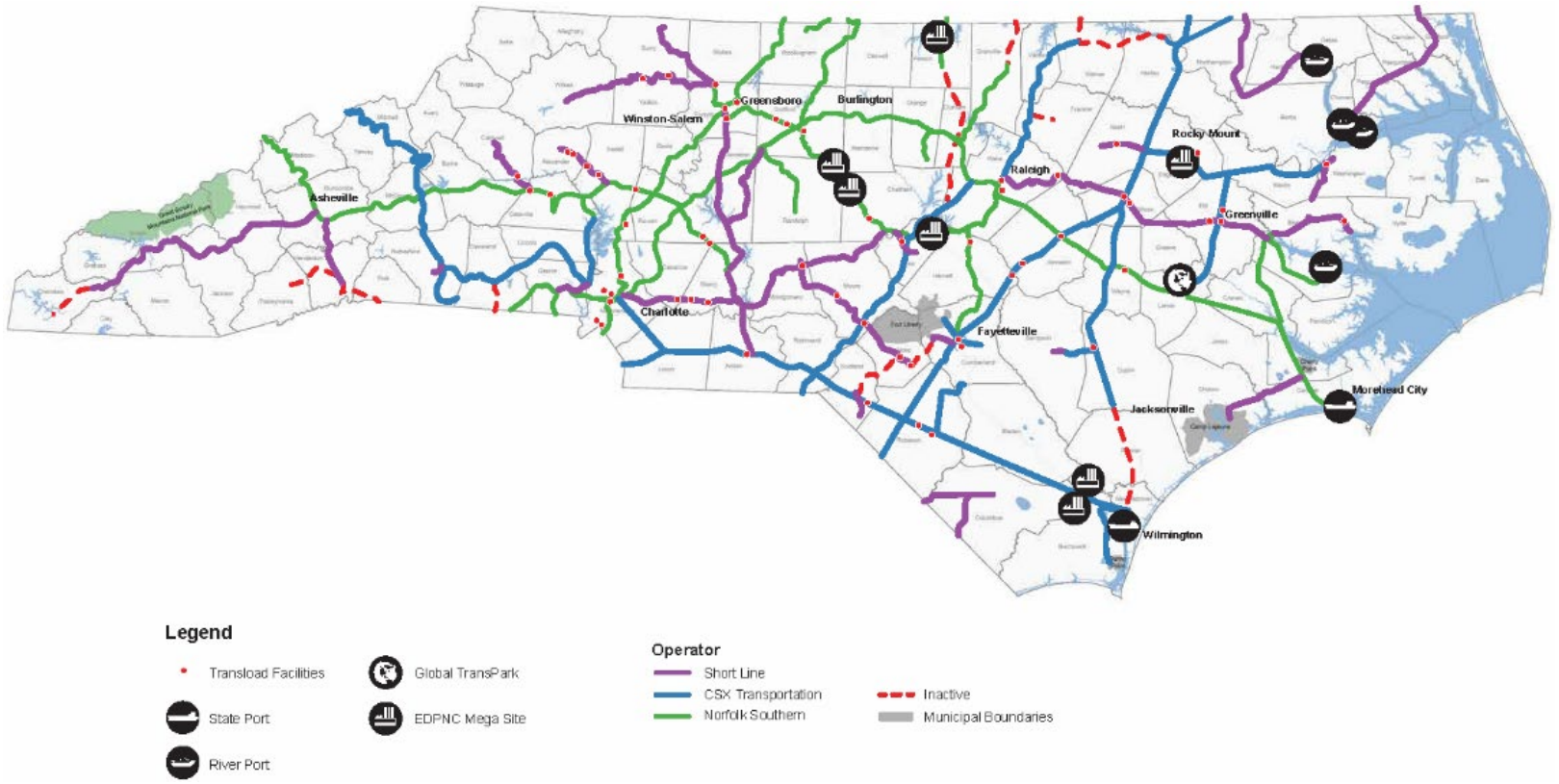
TABLE 16. NORTH CAROLINA INTERMODAL TERMINALS

Intermodal Terminal	Railroads Served	Location	Market Service
Charlotte Intermodal Terminal (NS)	Norfolk Southern	Charlotte International Airport, Charlotte, NC	Domestic/international
Greensboro Intermodal Terminal	Norfolk Southern	Greensboro, NC	Domestic
Carolina Connector (CCX)	CSX	Rocky Mount, NC	Domestic/international
Charlotte Intermodal Terminal (CSX) / Inland Port	CSX	Charlotte, NC	International

3.3.4. Transload Facilities

Transload facilities enable shippers that do not have direct access to rail services at their site locations to take advantage of rail service by transferring freight between rail and other modes, most frequently truck. Using transload services and locations, shippers can leverage rail to move long distances and then rely on trucks to complete the first and last miles between the railhead (transload) and the end destination or origin. Transload facilities handle freight commodities that are bulk or non-containerized freight. North Carolina hosts approximately 70 unique transload facilities across the state. Figure 43 displays the transload facilities and serving railroads in North Carolina.

FIGURE 43. RAIL FREIGHT TRANSLOAD FACILITIES



Source: 2026 North Carolina Draft State Rail Plan

Both CSX and NS own transload facilities in North Carolina as do many of the short lines. Transload facilities provide railroads with flexibility to pursue traffic opportunities and more readily compete against trucks in the logistics marketplace. In addition, non-railroad owned transload sites play a similar role and can coordinate with short line and Class I railroads to meet shipper requirements.

3.3.5. Rail-Served Development Sites

The Economic Development Partnership of North Carolina has designated five mega sites within the state that have been positioned to leverage convenient multimodal transportation, skilled workers, and supplier access. Table 17 lists the five NC mega sites and their nearest Class I railroad.

In addition to the mega sites, there are numerous rail-served sites in North Carolina that have been developed by Class I and short line railroads. Both Class I railroads have site development programs (i.e., NS Redi Sites and CSX Select Sites) and each program has designated sites in North Carolina. Short line railroads across the state are also developing rail-served sites along the corridors they serve.

TABLE 17. NORTH CAROLINA MEGA SITES AND RAIL ACCESS

Mega Site	Rail Access
Chatham – Siler City	Norfolk Southern
International Logistics Park - Leland	No current rail access
Kingsboro CSX Select Site - Rocky Mount	CSX
Mid-Atlantic Industrial Rail Park - Brunswick County	CSX
Great Meadows - Morganton	Norfolk Southern (no current access)

Source: Economic Development Partnership of North Carolina; WSP analysis

The North Carolina Global TransPark in Kinston provides more than 900 acres of shovel-ready land for industrial development. Features include an on-site airport with an 11,500-foot runway, dedicated fiber communications, and proximity to I-95 and I-40. In addition, the Global TransPark has an existing rail access spur that ties into the North Carolina Railroad / NS.

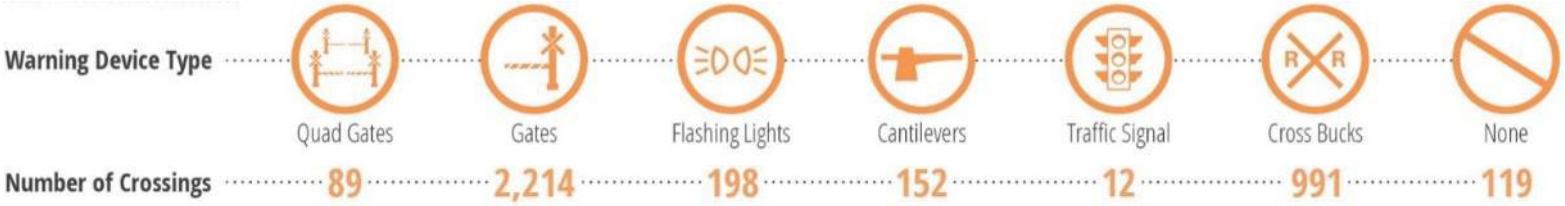
3.3.6. Grade Crossings

North Carolina has 6,557 grade crossings throughout the state:

- 3,726 (56 percent) are public grade crossings, which includes roadway and pedestrian crossings at the same elevation as the railroad.
- 2,831 (43 percent) are private crossings whereby a road is privately owned or connects across the railroad to private property.

Figure 44 illustrates the different types of signals in place across North Carolina's public grade crossings. Similarly, Figure 45 provides the same illustration for private grade crossings.

FIGURE 44. NORTH CAROLINA PUBLIC GRADE CROSSING WARNING DEVICES



Source: NC 2026 Draft State Rail Plan

FIGURE 45. NORTH CAROLINA PRIVATE GRADE CROSSING WARNING DEVICES



Source: 2026 North Carolina Draft State Rail Plan

North Carolina prioritizes grade crossing safety and infrastructure investment through the NCDOT BeRailSafe program and investments in grade crossing infrastructure that include grade separations. Annual grade crossing crashes in North Carolina have decreased from 203 to 47 (76 percent) between 1981 and 2020.

3.3.7. Freight and Passenger Rail Coexistence

Freight and passenger rail use portions of the same network in North Carolina. This coexistence can be both complementary and conflicting. For instance, freight trains tend to be longer and operate at slower speeds than passenger trains. In contrast, passenger trains are shorter and operate in North Carolina at speeds up to 79 mph. These dual uses and traffic types require sufficient extra capacity to accommodate the needs of operators and their customers. At the same time, passenger trains connect North Carolinians to jobs and economic hubs within the state, making North Carolina more attractive to business and economic development, which can translate to more freight moving on the railroad. In addition, investments in infrastructure that benefit passenger trains frequently benefit freight operations. For example, double-track installments on the North Carolina Railroad will benefit both NS and Amtrak operators and their respective customers with more capacity to support reliability, resiliency, and consistent service.

3.3.8. Rail and the Military in North Carolina

Given the importance of the military in North Carolina, the state's STRACNET is a significant consideration within the state. Certain railroad corridors that are not federally-owned are designated as part of the Strategic Rail Corridor Network (STRACNET) system. These identified corridors in combination with federally-owned corridors serve military facilities and installations across the country and must remain ready to serve the nation's defense operation at all times. Improvements and investments made to the STRACNET system help strengthen the country's defense network and provide increased resilience to the statewide railroad network.

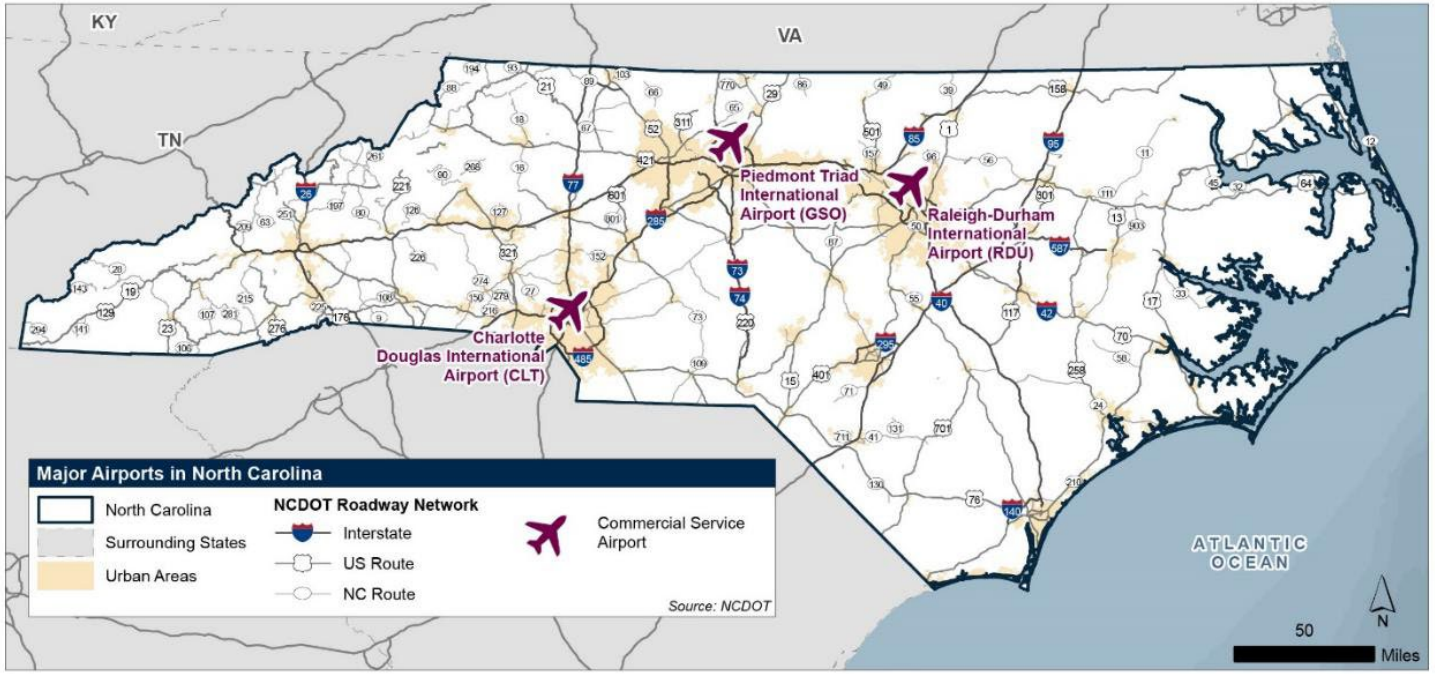
3.4. Aviation

3.4.1. Commercial Service Airports

Air cargo operations are vital in supporting the state's economic growth and activity. Most air freight in, from, and to North Carolina is transported either by air cargo carriers such as DHL, FedEx, and United Parcel Service (UPS), or belly cargo shipped in the hold of passenger aircraft.

Charlotte Douglas International (CLT), Raleigh-Durham International (RDU), and Piedmont Triad International (GSO) are the three main commercial service airports in North Carolina (Figure 46).

FIGURE 46. MAIN COMMERCIAL SERVICE AIRPORTS IN NORTH CAROLINA



Air freight processed at other airports may fly as belly cargo or be carried by smaller freighters also known as feeders. For instance, Mountain Air Cargo has a base at Kinston Regional Jetport (ISO) from where Cessna 408 SkyCourier aircraft operates for FedEx. Freight service similarly can include part for Maintenance, Repair and Overhaul (MRO) functions at general aviation airports. Also, air cargo solutions are developed to address the supply chain needs of the local industry. For instance, logistics integrator Frontier Scientific Solutions and air freighter operator ATSG are commissioning in 2026 a cold storage facility at Wilmington International Airport (ILM) to support global shipment by the North Carolinian life sciences sector.

Because they are home for major hubs of integrated air cargo carriers (FedEx, UPS, DHL, and Amazon Air), the top four domestic air cargo destinations for North Carolina airports are:

- Memphis International (MEM)
- Louisville Muhammad Ali International (SDF)
- Cincinnati/Northern Kentucky International (CVG)
- Indianapolis International (IND)

Charlotte Douglas International Airport (CLT)

CLT is positioned between I-85 and I-485, with convenient connections to I-77, providing travelers and cargo operators with efficient routes to and from the airport to the greater Charlotte area. All air cargo headed to CLT passes through the Air Cargo Center, which consists of several buildings totaling 585,000 square feet and features 2.2 million square feet of aircraft ramp space (Charlotte Douglas Airport Authority, 2016).

CLT manages large volumes of air cargo operations with the following three parallel runways providing an hourly capacity of 89 arrivals and 76 departures:

- Runway 18R-36L (9,000 feet x 150 feet)
- Runway 18C-36C (10,000 feet x 150 feet)
- Runway 18L-36R (8,676 feet x 150 feet)

A fourth parallel runway is under construction, and the existing crosswind runway is being removed.

Raleigh-Durham International Airport (RDU)

RDU is next to I-40 and I-540, which connects the airport to Raleigh, Durham, and Chapel Hill. The airport is adjacent to Research Triangle Park. Cargo passing through RDU is processed at one of two designated facilities.

- North Cargo Building (985,530 square feet), which houses cargo carrier facilities (UPS, FedEx, DHL)
- South Cargo building (161,468 square feet), which houses freight shipped through commercial airliners (belly cargo)

Airside access to these facilities is through the North and South Cargo Ramp, totaling almost 1.2 million square feet of dedicated cargo ramp space (Raleigh-Durham Airport Authority, 2017).

RDU is well-equipped to adequately handle all aircraft capacity needs through 2040 because it has three runways:

- Runway 05L-23R (10,000 feet x 150 feet). This 40 year-old runway is being replaced with a new, 10,639 feet runway, expected to open in 2029.
- Runway 05R-23L (7,500 feet x 150 feet)
- Runway 14-32 (3,550 feet x 100 feet)

Piedmont Triad International Airport (GSO)

GSO borders I-73 and I-840, located east of the airport, and I-40 on the south side, which also connects to I-85. For cargo transportation, Cargo Road is a two-lane roadway that provides smooth access to the cargo facilities. (North Carolina Department of Transportation [NCDOT] 2023).

The FedEx Mid-Atlantic Hub facility at GSO occupies roughly 495,000 square feet for package sorting as well as loading/unloading. In addition to this main facility, additional structures support the hub operations including an Administration Building, Vehicle Maintenance Building, Generator Building, and World Service Center and Security Building. Other freight forwarders, logistics companies, and air cargo operators with facilities at GSO include Delta Cargo, DHL Express, Forward Air

Freight, United Cargo (United Airlines), UPS, and Worldwide Flight Services (WFS). In addition, the manufacture of new models of aircraft planned by JetZero and others is expected to bring traffic in aircraft components to GSO.

Overall, air cargo facilities consist of approximately 495,517 square feet with an associated apron area of over 2 million square feet (Piedmont Triad Airport Authority, 2024).

Piedmont utilizes a three-runway system:

- Runway 5R-23L (10,001 feet x 150 feet)
- Runway 5L-23R (9,000 feet x 150 feet)
- Runway 14-32 (6,380 feet x 150 feet)

Existing airfield capacity is more than adequate through 2040 and beyond. GSO does not offer passenger international flights.

3.5. Pipelines

North Carolina imports all of its conventional fuel (petroleum, natural gas, biofuels, etc.) whether used for heating and cooling, transportation, or other industrial and household purposes. Pipelines form a key mode of transport for these fuels. At the time of this report, the U.S. Energy Information Administration website was under maintenance, and an official current pipeline shapefile was unavailable. The data in this section has been collected from various sources, primarily USDOT Pipeline and Hazardous Materials Safety Administration (PHMSA) website, NC Energy Security Plan (NCDEQ, 2025) and the previous statewide freight plan (NCDOT, 2022).

The fuel transportation network in the state consists of:

- 4,883 miles of pipeline for the movement of gas, petroleum products, and other liquids: (Source: PHMSA)
- 3,722 miles – gas transmission
- 1,068 miles – refined petroleum products
- 89 miles – highly volatile liquids, flammable, and toxic liquids

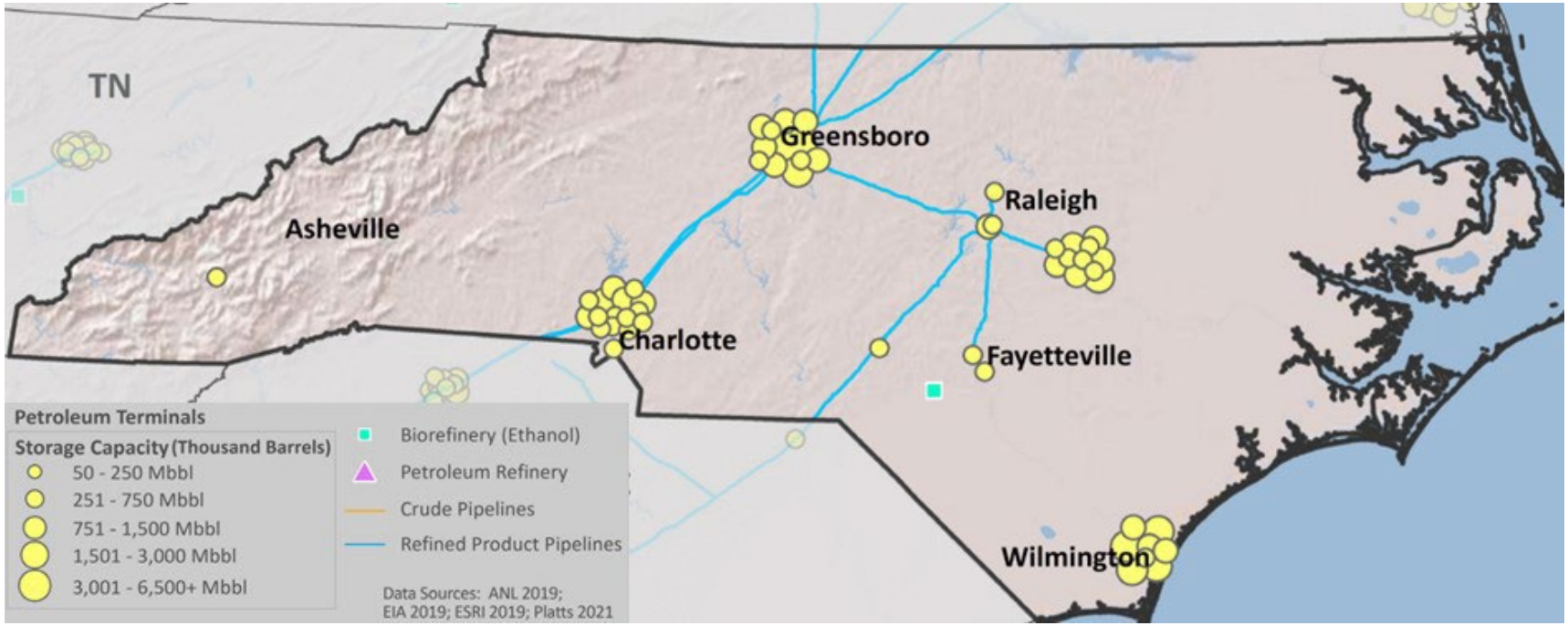
- 4 miles – biofuel
- 38 inland motor fuel terminals
- 12 aviation fuel terminals
- Two propane terminals, in Sylva and Apex
- Two transload facilities, in Star and Midland
- Six marine petroleum terminals – receive ships and barges through the Port of Wilmington
- Six biofuel production facilities
- Numerous truck tank trailer fleets and support services to enable the transport and local delivery of all fuels but natural gas

The state receives refined petroleum products from three major pipelines and through the Port of Wilmington. The Colonial and Plantation pipelines deliver refined petroleum products to North Carolina enroute to their termini in the Northeast. The Dixie pipeline transports propane from the Gulf region to North Carolina before terminating in Apex.

The liquid fuels storage facility in Greensboro is the state's largest. As the endpoint of the Colonial Pipeline's mainlines from Houston and a major distribution hub for gasoline, diesel, and jet fuel, the Greensboro fuel storage facility supports the state's high petroleum demand. Its size surpasses smaller terminals like those in Charlotte or Selma, making it a critical asset in the state's fuel supply chain.

Figure 47 shows the refined product and crude pipeline infrastructure, biorefinery and petroleum refineries, along with the petroleum storage terminals.

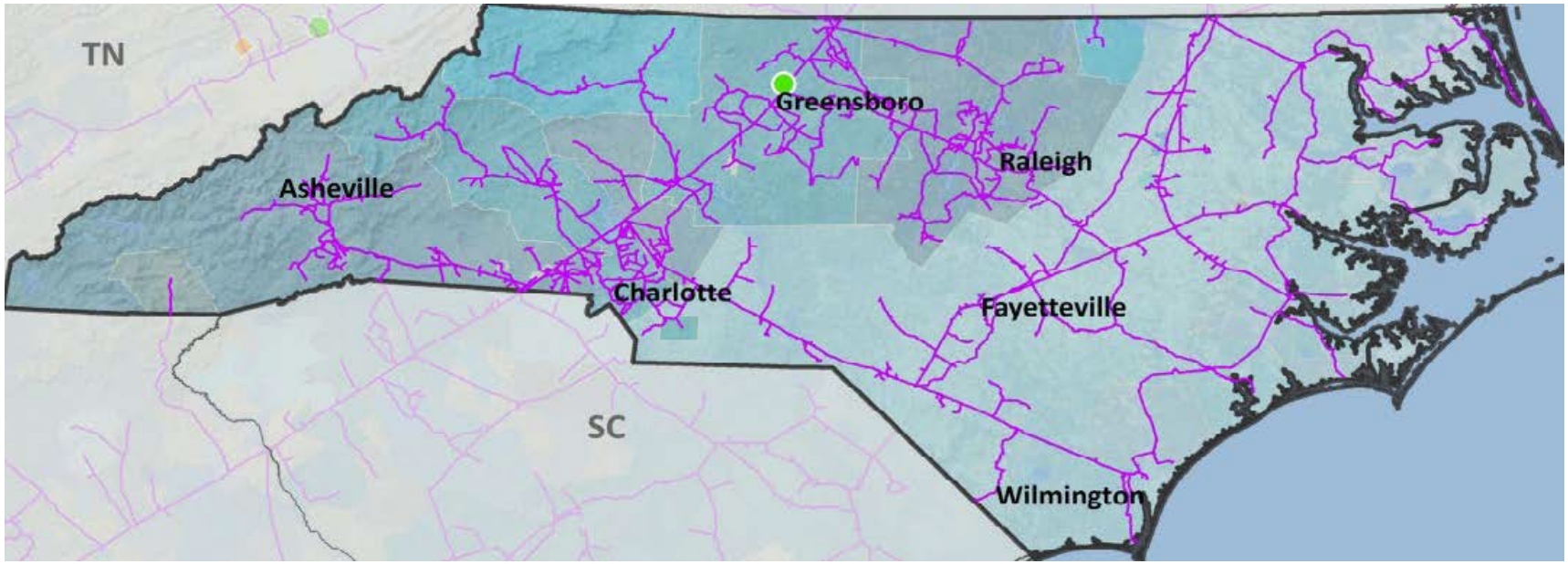
FIGURE 47. LIQUID FUEL PIPELINES, STORAGE, AND REFINERIES IN NORTH CAROLINA



Source: Department of Energy

Natural gas is imported to North Carolina primarily through the Transcontinental (Transco) pipelines running through Virginia, South Carolina, and Georgia. As of 2018, North Carolina had about 4,188 miles of transmission pipelines and 31,801 miles of distribution pipelines (NC Energy Risk Profile, 2021). In addition to Transco, a small segment of the East Tennessee pipeline also connects to North Carolina, by transporting gas from Tennessee to Rockingham County where it then intersects with the Transco pipeline. Figure 48 shows the natural gas pipeline infrastructure and natural gas storage and processing plants within North Carolina as of 2019.

FIGURE 48. NATURAL GAS PIPELINE INFRASTRUCTURE, STORAGE, AND PROCESSING PLANTS IN NORTH CAROLINA



In addition to pipeline supply, North Carolina has six liquid natural gas (LNG) storage facilities, each serving a specific purpose for the state's energy needs (Table 18).

TABLE 18. NATURAL GAS INTERSTATE PIPELINES AND STORAGE FACILITIES IN NORTH CAROLINA

Facility Name	Facility Type	Description
Cardinal Pipeline	Intrastate pipeline	Transports natural gas in the North-Central region of the state.
East Tennessee Pipeline	Interstate pipeline	Transports natural gas via Virginia to northern North Carolina.
Columbia Gas Transmission	Interstate pipeline	Transports natural gas via Virginia to northern North Carolina.
Transco	Interstate pipeline	Connects North Carolina to natural gas reserves in the Gulf and Northeast regions.
Pine Needle Liquid Natural Gas (LNG) Storage	LNG storage	Williams-operated storage facility with a capacity of 2 billion cubic feet (BCF).
Greenville LNG Plant	LNG storage	Municipally owned 300,000-gallon storage facility.
Bentonville LNG	LNG storage	Serves the Raleigh-Durham area.
Robeson LNG facility	LNG storage	1 BCF LNG storage facility owned and operated by Piedmont Natural Gas.
Huntersville LNG Facility	LNG Storage	Provides capacity for the Charlotte region.
Moriah Energy Center	LNG storage	Proposed LNG storage facility in Person County, anticipated to be in service in 2027.

3.6. Warehousing

Warehouses form an important part of the freight network and typically work as an interchange point between two modes or two legs of a journey in the same mode. They are generators and consumers of freight in the intermediate stages of supply chains and are subject to time performance and throughput requirements. While warehouse usage and location reflect overarching supply chain strategies, site selection is largely driven by local market forces and zoning codes. Warehouses typically are not under the direct purview of NCDOT, yet they need to be served by reliable and safe road and/or rail access and are part of a larger economic process, which is why it is important to understand the concentration, growth, and types of warehouses.

As of 2025, there were 2,276 active storage facilities[47] in North Carolina with a total rentable area of approximately 468 million square feet:

[47] Only facilities above 75,000 square feet of rentable building area are considered in this inventory. Source: CoStar data.

- **Warehouses:** 284 million square feet
- **Distribution Centers:** 176 million square feet
- **Cold Storage:** 4.7 million square feet
- **Truck Terminals:** 2.7 million square feet

As of December 2025, 50 million square feet (10 percent) of storage facilities were vacant and available for rent.

In addition to the existing storage facilities, there were 31 facilities (11.4 million square feet) under construction and 118 facilities (34 million square feet) proposed or in planning stage. Cold storage facilities near Wilmington have been one source of recent growth, accommodating import/export traffic in pharmaceuticals and life sciences especially. Figure 49 shows the facility type by building status for all storage facilities in North Carolina, including those proposed or planned.

FIGURE 49. WAREHOUSE TYPES BY STATUS IN NORTH CAROLINA (MILLION RENTABLE SQUARE FEET)

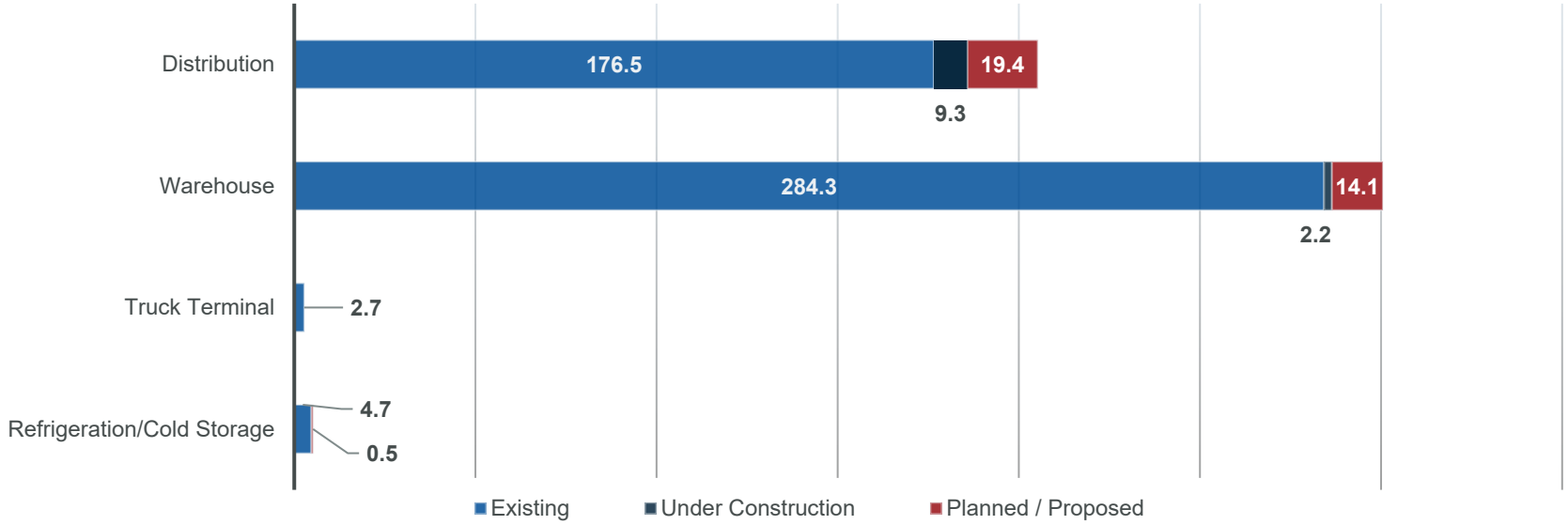
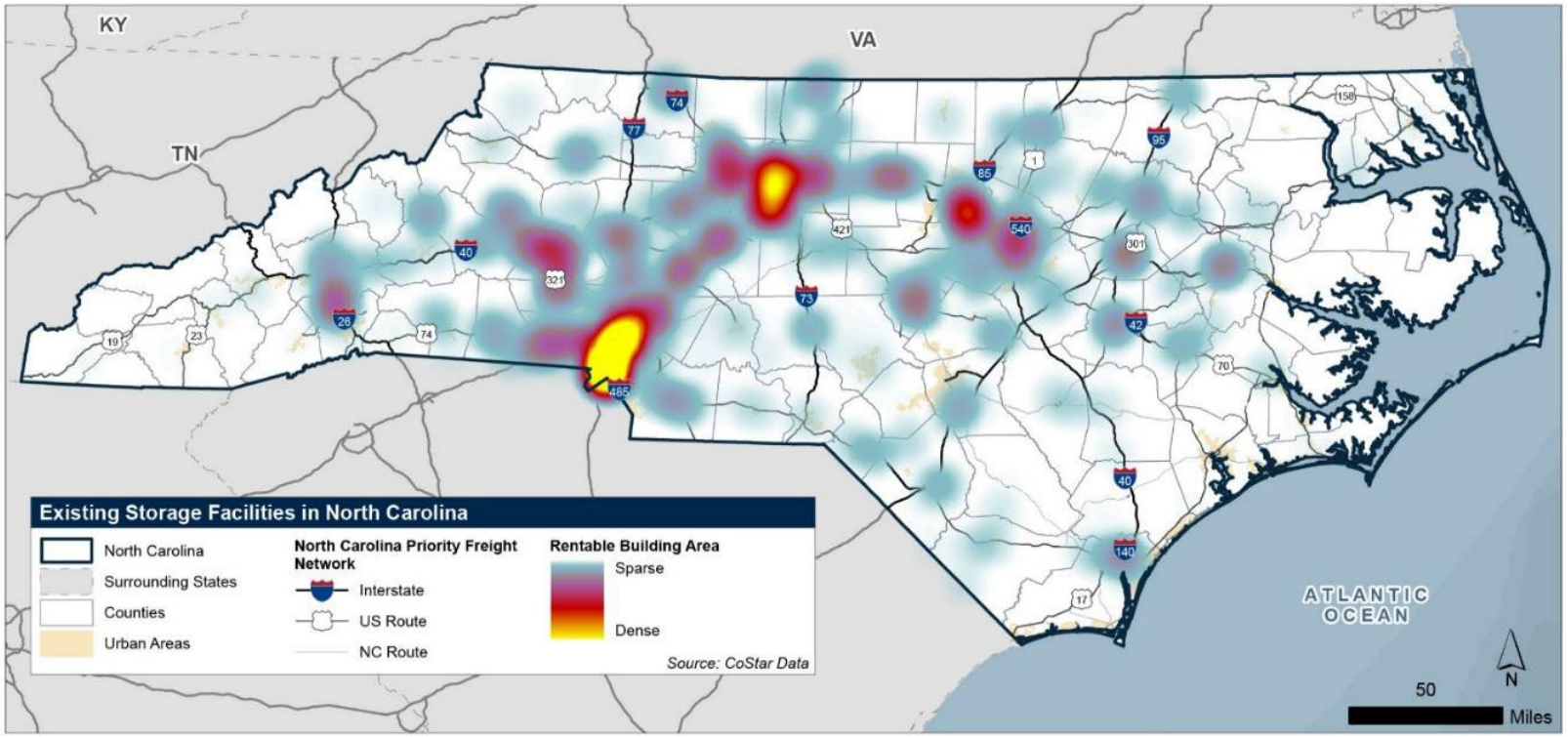


Figure 50 shows a heat map of the location of storage facilities (weighted by square footage) in the state. The highest concentration is along the I-85 corridor between Charlotte and the Triad region, with a few other hotspots in the Triangle region and Wilmington.

FIGURE 50. EXISTING STORAGE FACILITIES BY RENTABLE BUILDING AREA (HEAT MAP)



3.7. North Carolina Priority Freight Network (NCPFN)

As part of the Plan, NCDOT updated the North Caroliina Priority Freight Network (NCPFN) to include the elements of the state's multimodal network that are most critical to freight transportation. The NCPFN is composed of the highway, rail, port, and airport

facilities responsible for moving most of the freight in North Carolina and serving the state's key businesses. In general, the methodology presented in this report is similar to the methodology used to designate the NCPFN in previous versions of the North Carolina Statewide Multimodal Freight Plan.
The motivation for designating the NCPFN is twofold:

- Designation of a subsystem that is responsible for carrying the majority of freight moving in North Carolina allows NCDOT to focus limited resources on the portion of the system that impacts the greatest number of users and the majority of the total freight moved. In turn, this will maximize the statewide return on NCDOT's investments. The designated network becomes a freight transportation and economic development asset for the state.
- The NCPFN can be used as a factor to designate Critical Rural and Urban Freight Corridors, which allow for National Highway Freight Program funds to be spent on these roads.

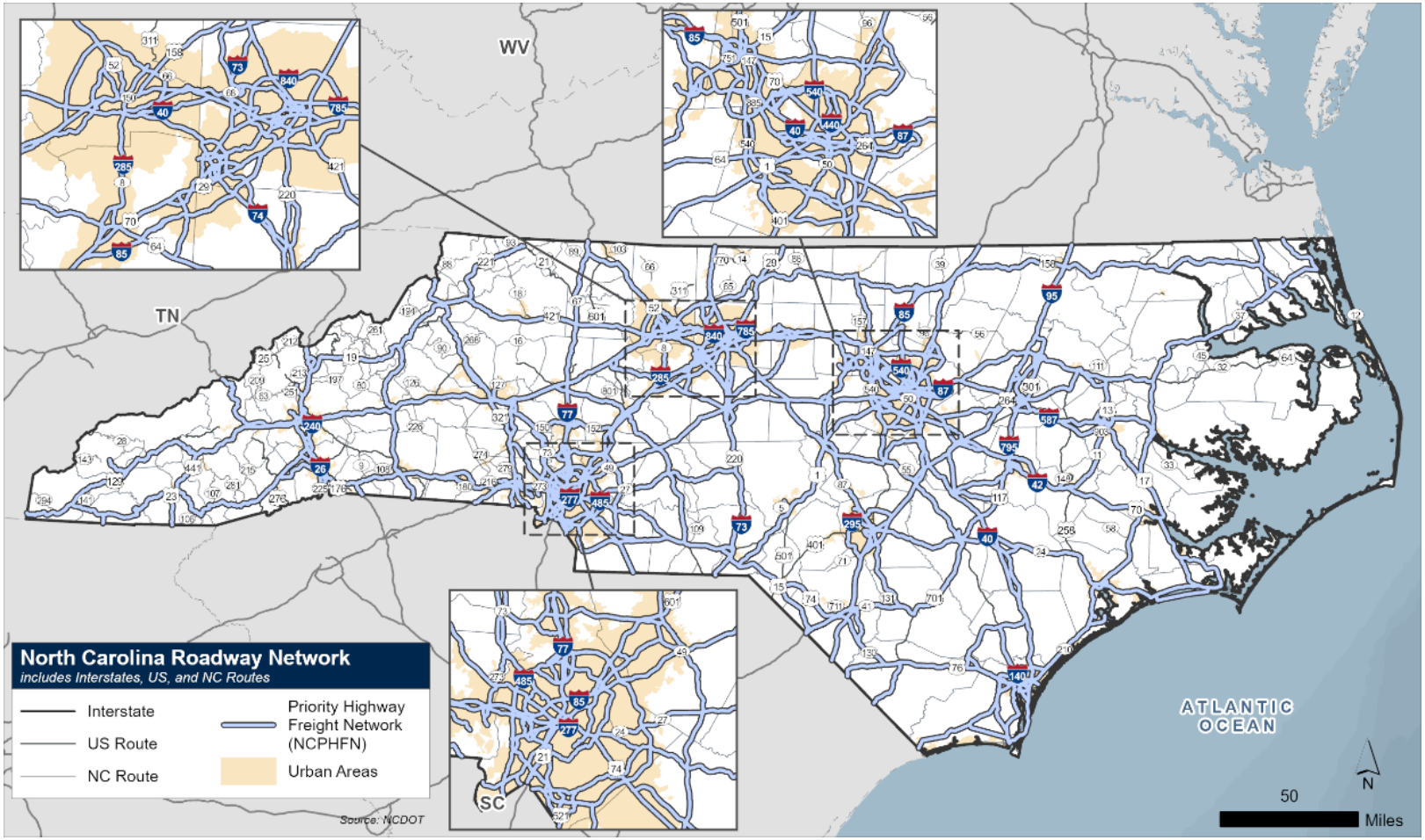
3.7.1. Priority Highway Freight Assets

To assess freight importance and inform the designation of the NCPFN, each highway segment was scored based on criteria that measure the role of the highway system in supporting:

- Economic competitiveness
- Goods movement
- Strategic supply chains
- Market access and connectivity

The recommended highway elements of the NCPFN are shown in Figure 51.

FIGURE 51. RECOMMENDED NCPFN HIGHWAY ELEMENTS



Source: Consultant Analysis

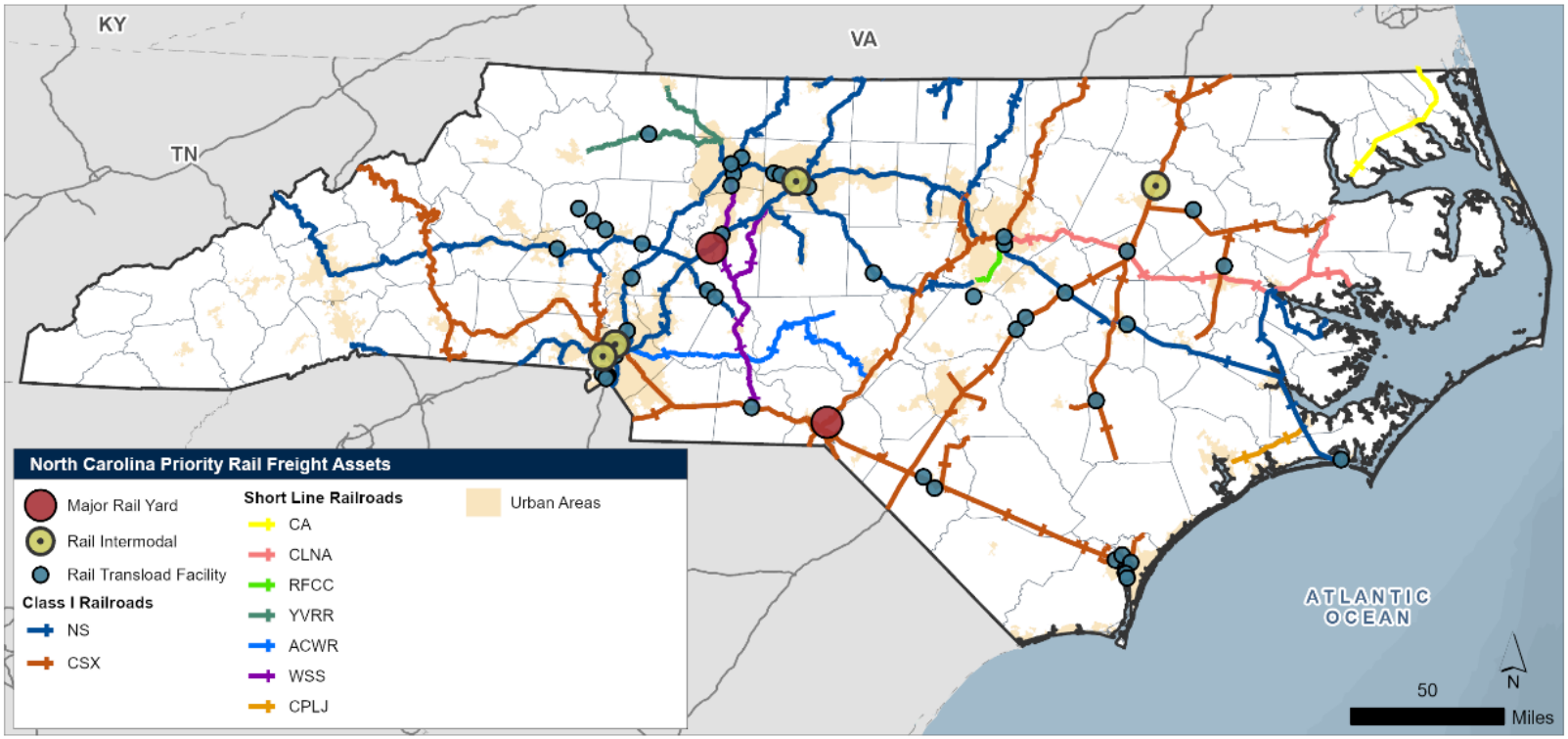
3.7.2. Priority Rail Freight Assets

Rail is a key component of freight movement in North Carolina. The National Multimodal Freight Network (NMFN) includes all Class I railroads and their major terminals. Consistent with the NMFN, rail facilities in North Carolina, including intermodal terminals, major classification yards, and transload facilities, were considered for inclusion as part of the NCPFN.

Figure 52 and Table 19 shows the priority rail freight assets in North Carolina included in the NCPFN, which consists of the following:

- The entirety of two Class I railroads, CSX and Norfolk Southern (NS), totaling approximately 2,300 route miles, including shared-use segments that are jointly owned under trackage rights arrangements. This includes the North Carolina Railroad (NCRR), a state-owned rail corridor operated by NS and short line railroads that serve military bases, such as Camp Lejeune Railroad Company (CPLJ).
- Two major classification yards (CSX Hamlet Yard and NS Salisbury Yard).
- Four intermodal terminals (CSX Southern Piedmont Freight Intermodal Center, NS Greensboro Terminal, NS Intermodal Facility at Charlotte Douglas International Airport, and CSX Carolina Connector (CCX) Terminal).
- Some 55 transload facilities on the Class I railroad system.

FIGURE 52. NORTH CAROLINA PRIORITY RAIL FREIGHT ASSETS



Source: Consultant Analysis

TABLE 19. PRIORITY RAIL FREIGHT FACILITY BY LOCATION

MPO/RPO	Facility Type	Railroad - Facility Name	Location	County
Cabarrus-Rowan MPO	Transload	NS - Carolina Plum, Inc.	Gold Hill	Rowan
Cabarrus-Rowan MPO	Transload	NS - Trexler Trucking, Inc.	Gold Hill	Rowan
Capital Area MPO	Transload	NS - Harnett Transload Intermodal, LLC	South of the Town of Fuquay-Varina	Harnett
Capital Area MPO	Transload	NS - Security Bonded Warehouse	City of Raleigh	Wake
Capital Area MPO	Transload	CSX - TRANSFLO Raleigh Terminal	City of Raleigh	Wake
Central Pines RPO	Transload	NS - Asheboro Tie Yards, Inc.	Bear Creek	Chatham
Charlotte Regional TPO	Intermodal	CSX - South Piedmont Freight Intermodal Center	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Intermodal	NS - Charlotte Regional Intermodal Facility at Charlotte Douglas International Airport	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	NS - Bestway South	Stony Point	Iredell
Charlotte Regional TPO	Transload	NS - Chem-Way Corp.	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	NS - Distribution Technology, Inc.	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	NS - Kelly Pipe Company, LLC	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	NS - Thoroughbred Bulk Transfer Terminal - Charlotte	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	NS - PAX Industries, Inc.	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	NS - Shaver Wood Products	City of Statesville	Iredell
Charlotte Regional TPO	Transload	NS - West Logistics	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	NS - Wheat Flour Mill	Town of Mooresville	Iredell
Charlotte Regional TPO	Transload	CSX - Cenco, Inc	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	NS - Nordic Cold Storage - Charlotte Distribution Center	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	CSX - TRANSFLO Charlotte - FG (West) Terminal	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	CSX -TRANSFLO Charlotte - GP (East) Terminal	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	CSX - Charlotte Terminal	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	NS - Millard Refrigerated Services	City of Statesville	Iredell
Charlotte Regional TPO	Transload	CSX - Total Distribution, Inc.	City of Charlotte	Mecklenburg
Charlotte Regional TPO	Transload	CSX - BlueLinx Corp.	City of Charlotte	Mecklenburg
Down East RPO	Transload	NS - Industrial Marine Service	Town of Morehead City	Carteret

MPO/RPO	Facility Type	Railroad - Facility Name	Location	County
Eastern Carolina RPO	Transload	CSX -United States Cold Storage, Inc. - Warsaw	Town of Warsaw	Duplin
Goldsboro Urban Area MPO	Transload	NS - Nordic Cold Storage - Goldsboro Distribution Center	City of Goldsboro	Wayne
Greater Hickory MPO	Transload	NS - Liberty Reload Services	Town of Taylorsville	Alexander
Greater Hickory MPO	Transload	NS - Luckey Trucking	City of Conover	Catawba
Greensboro Urban Area MPO	Intermodal	NS - Greensboro Terminal	City of Greensboro	Guilford
Greensboro Urban Area MPO	Transload	NS - Lewis Storage Company	City of Greensboro	Guilford
Greensboro Urban Area MPO	Transload	NS - Triad Wholesale Lumber, Inc.	City of Greensboro	Guilford
Greensboro Urban Area MPO	Transload	NS - Triangle Warehouse	City of Greensboro	Guilford
Greensboro Urban Area MPO	Transload	NS - Triangle Warehouse	City of Greensboro	Guilford
Greenville Urban Area MPO	Transload	CSX - TES Logistics, Inc.	City of Greenville	Pitt
High Point Urban Area MPO	Rail Yard	NS - Linwood Yard (Salisbury)	Northeast of the City of Salisbury	Davidson
High Point Urban Area MPO	Transload	NS - RWBT, Inc.	City of Lexington	Davidson
Lumber River RPO	Rail Yard	CSX - Hamlet Yard	City of Hamlet	Richmond
Lumber River RPO	Transload	CSX - Nordic - Lumberton Distribution Center	City of Lumberton	Robeson
Lumber River RPO	Transload	CSX - United States Cold Storage, Inc. - Lumberton	City of Lumberton	Robeson
Mid-Carolina RPO	Transload	CSX - Nordic Cold Storage - Benson Distribution Center	Southwest of the Town of Benson	Harnett
Northwest Piedmont RPO	Transload	NS - A&M Freight Consultants, LLC	North of the Town of Boonville	Surry
Rocky Mount Urban Area MPO	Intermodal	CSX - Carolina Connector Intermodal Terminal	City of Rocky Mount	Edgecombe
Rocky River RPO	Transload	CSX - Carolinas Reload	Town of Wadesboro	Anson
Upper Coastal Plain RPO	Transload	NS - NSEW Corp. (Bailey Feed Mill)	Town of Selma	Johnston
Upper Coastal Plain RPO	Transload	NS - Paxton Bonded Storage, Inc.	City of Wilson	Wilson
Upper Coastal Plain RPO	Transload	CSX - Cloverleaf Cold Storage - Benson	Town of Benson	Johnston
Upper Coastal Plain RPO	Transload	CSX - Kanban Logistics	Town of Tarboro	Edgecombe

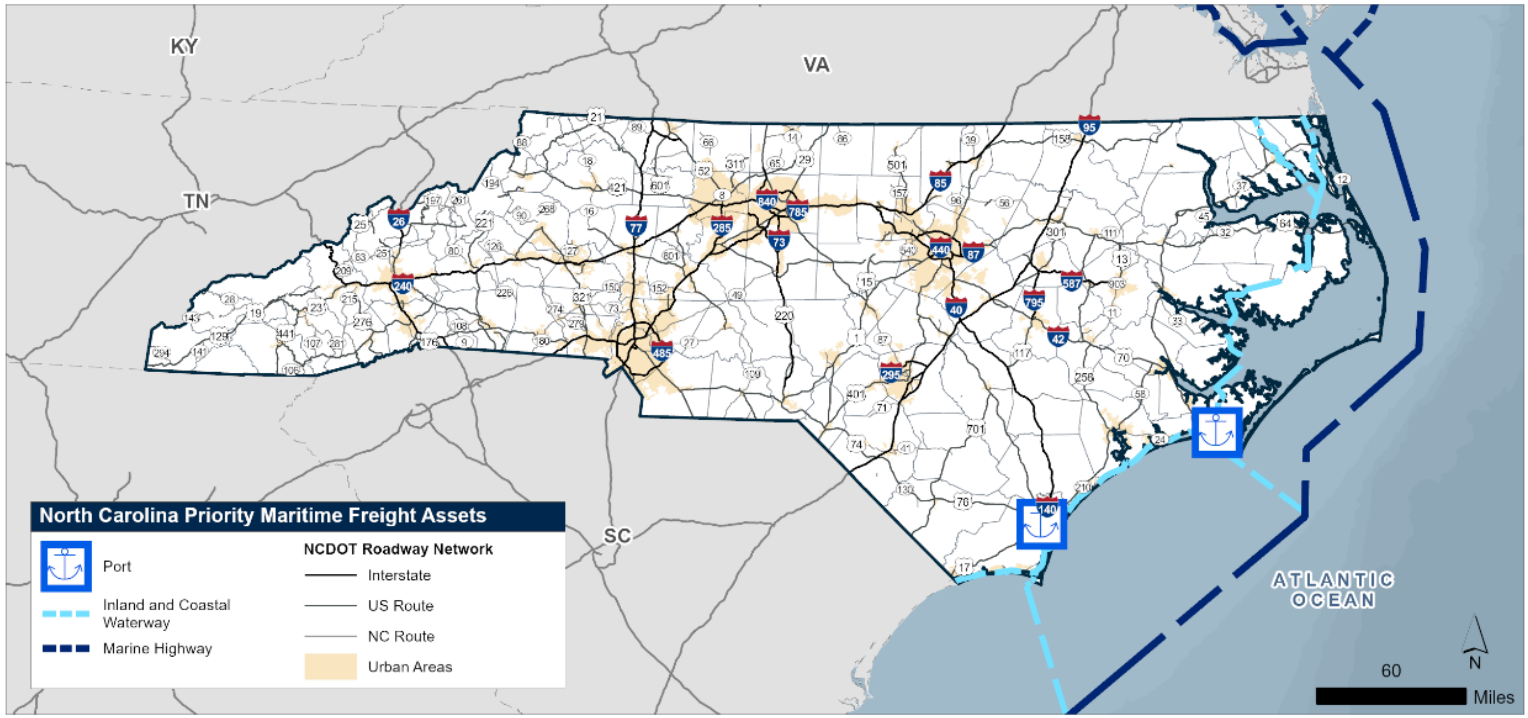
MPO/RPO	Facility Type	Railroad - Facility Name	Location	County
Wilmington Urban Area MPO	Transload	CSX - TRANSFLO Wilmington Terminal	Town of Navassa	Brunswick
Wilmington Urban Area MPO	Transload	CSX - Colonial Terminals	City of Wilmington	New Hanover
Wilmington Urban Area MPO	Transload	CSX - Transport Service Co.	Northwest of the City of Wilmington	New Hanover
Wilmington Urban Area MPO	Transload	CSX - Port of Wilmington	City of Wilmington	New Hanover
Wilmington Urban Area MPO	Transload	CSX - MCO Distribution & Logistics	City of Wilmington	New Hanover
Wilmington Urban Area MPO	Transload	CSX - North Carolina State Port Authority	City of Wilmington	New Hanover
Wilmington Urban Area MPO	Transload	CSX - Cape Fear Bonded	City of Wilmington	New Hanover
Winston-Salem Area TPO	Transload	NS - Carolina Public Warehouse	City of Winston-Salem	Forsyth
Winston-Salem Area TPO	Transload	NS - Thoroughbred Bulk Transfer Terminal - Winston-Salem	City of Winston-Salem	Forsyth
Winston-Salem Area TPO	Transload	NS - Winston-Salem Auto Distribution	Town of Walkertown	Forsyth
Winston-Salem Area TPO	Transload	NS - B & M Storage and Distribution Company	City of Winston-Salem	Forsyth
Winston-Salem Area TPO	Transload	CSX - TRANSFLO Winston-Salem Terminal	City of Winston-Salem	Forsyth

3.7.3. Priority Maritime Freight Assets

North Carolina's ports and waterways play a key role in the efficient movement of freight and are important drivers of the state's economy. The NMFN, designated under the FAST Act, was used to identify priority maritime freight assets within the state. Figure 53 shows these assets, which currently include the following:

- Port of Wilmington
- Port of Morehead City
- The M-95 Marine Highway Corridor
- Inland and coastal waterway routes, including Atlantic Intracoastal Waterway, Pasquotank River, and Great Dismal Swamp Canal

FIGURE 53. NORTH CAROLINA PRIORITY MARITIME FREIGHT ASSETS



Source: Consultant Analysis

3.7.4. Priority Air Cargo Assets

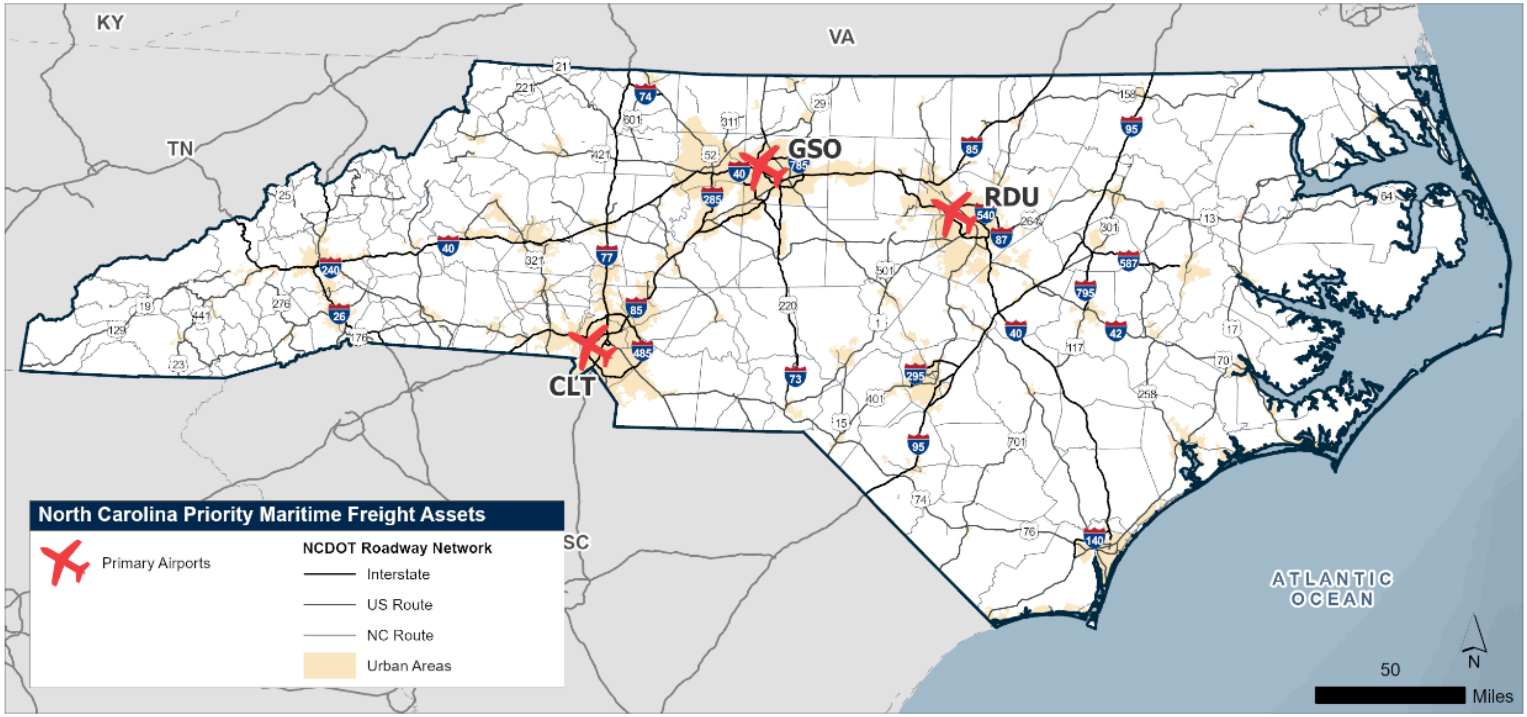
North Carolina is home to three of the top 50 cargo airports in the United States based on landed weight in 2024.[48] These air cargo gateways are near the largest metropolitan areas in the state, which provide strong connectivity to other freight infrastructure and support industries that rely on fast shipment of high-value and time-sensitive goods. The three airports are:

[48] Final Calendar Year 2024 All-Cargo Landed Weight, Federal Aviation Administration (FAA)

- Charlotte/Douglas International Airport (CLT)
- Piedmont Triad International Airport (GSO)
- Raleigh-Durham International Airport (RDU)

All three airports are included in the NMFN and therefore are also included in the NCPFN. Figure 54 shows the locations of these airports.

FIGURE 54. NORTH CAROLINA PRIORITY AIR CARGO ASSETS



Source: Consultant Analysis

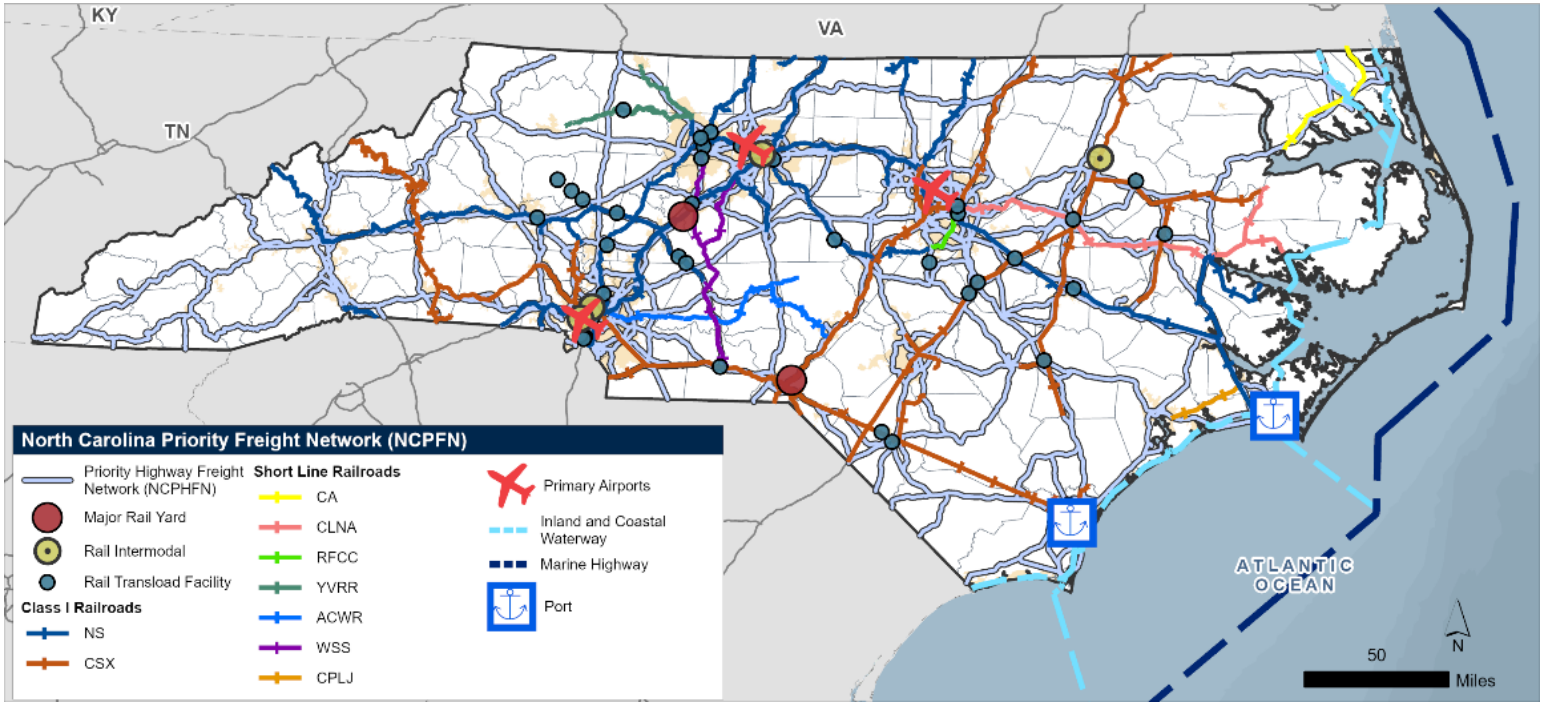
3.7.5. Recommended Multimodal NCPFN

The recommended NCPFN comprises the following highway, rail, maritime, and air cargo facilities that move most freight in North Carolina and serve the state's key businesses:

- 6,942 highway miles
- Two Class I railroads totaling 2,300 route miles
- All short line railroads that operate on Class I-owned tracks, as well as short line railroads that serve military bases
- Two seaports: Port of Wilmington and Port of Morehead City
- Three airports: Charlotte/Douglas International Airport (CLT), Piedmont Triad International Airport (GSO), Raleigh-Durham International Airport (RDU)
- Four intermodal terminals: CSX Southern Piedmont Freight Intermodal Center, NS Greensboro Terminal, NS Intermodal Facility at Charlotte Douglas International Airport, and CSX Carolina Connector (CCX) Terminal
- Two major rail yards: CSX Hamlet Yard and NS Salisbury Yard
- Some 55 rail transload facilities on the Class I railroad system (see Table 19 for details).

Figure 55 presents the recommended multimodal NCPFN.

FIGURE 55. NORTH CAROLINA PRIORITY FREIGHT NETWORK



Source: Consultant Analysis

4. Current Condition and Performance

This section addresses:

- A wide range of highway metrics including pavement condition, bridge condition, vehicle miles of travel and mode share, bottlenecks (based on speed, delay, and user cost), crashes, harsh braking events, incident recovery, and truck parking utilization;
- A sampling of key performance metrics addressing ports, rail, aviation, and pipeline modes; and
- A resiliency analysis addressing the multimodal system and its component elements. Resilience can be measured, and analysis of multimodal transportation system performance based on resiliency measures can identify deficiencies as well as opportunities.

4.1. Highway Metrics

4.1.1. Pavement Condition

The NCDOT uses a Pavement Condition Rating (PCR) to measure the physical state of state-maintained roads. This rating is a composite index ranging from 0 to 100, where 100 represents a perfect roadway and 0 indicates a completely failed surface.[49] The PCR displays a composite score that has been determined using a pavement condition survey that has been performed annually for interstate routes and every two years for primary and secondary routes. PCR scores correspond to the following pavement condition assessments:

- Good: PCR greater than or equal to 80
- Fair: PCR greater than or equal to 60, but less than 80
- Poor: PCR less than 60

[49] NCDOT Pavement Conditions Map - https://arcg.is/1j4u491

NCDOT aims to maintain more than 62 percent of interstate lane-miles and more than 31percent of non-interstate lane-miles in good condition, and limit interstate and non-interstate lane-miles in poor condition to below 1.5 percent and 3 percent, respectively.[50]

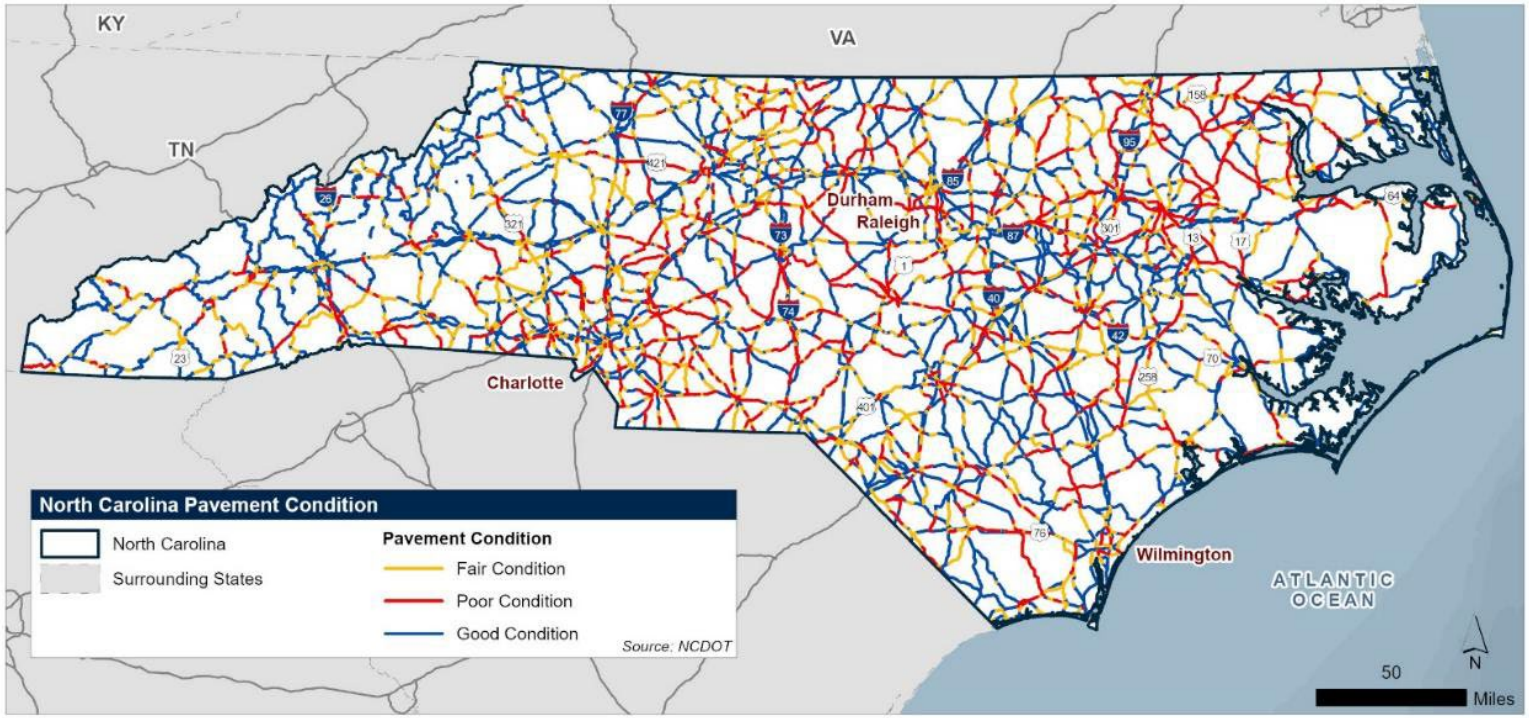
Most of the 80,000 miles of state-maintained roads are in Good (67 percent) or Fair (25 percent) pavement condition. Table 20 shows the pavement condition by percentage of route-miles. Interstates have the highest route mileage in good condition at 91 percent. Primary routes, which mostly comprise U.S. and North Carolina state routes, have 59 percent of the pavement in good condition and 22 percent in fair condition. Secondary roads, which comprise local, collector and minor arterial roads, have 68 percent of the pavement in good condition.

TABLE 20. PERCENT OF PAVEMENT IN EACH CONDITION BY ROADWAY TYPE (2024)

Condition	Interstate	Primary	Secondary	Overall
Good	91%	59%	68%	**67%**
Fair	7%	22%	27%	**25%**
Poor	2%	18%	5%	**8%**

[50] NCDOT Transportation Asset Management Plan – 2022 Update

FIGURE 56. NORTH CAROLINA PAVEMENT CONDITION (2024)



Urban areas comprise 18,200 miles of state-maintained roads (about 23 percent). The urban interstates are in slightly better condition than the interstates overall. The primary routes in urban areas have the same pavement conditions as those in the state overall. However, secondary routes in the urban areas are in a marginally worse condition than the state overall (see Table 21).

TABLE 21. URBAN PAVEMENT CONDITION BY ROADWAY TYPE

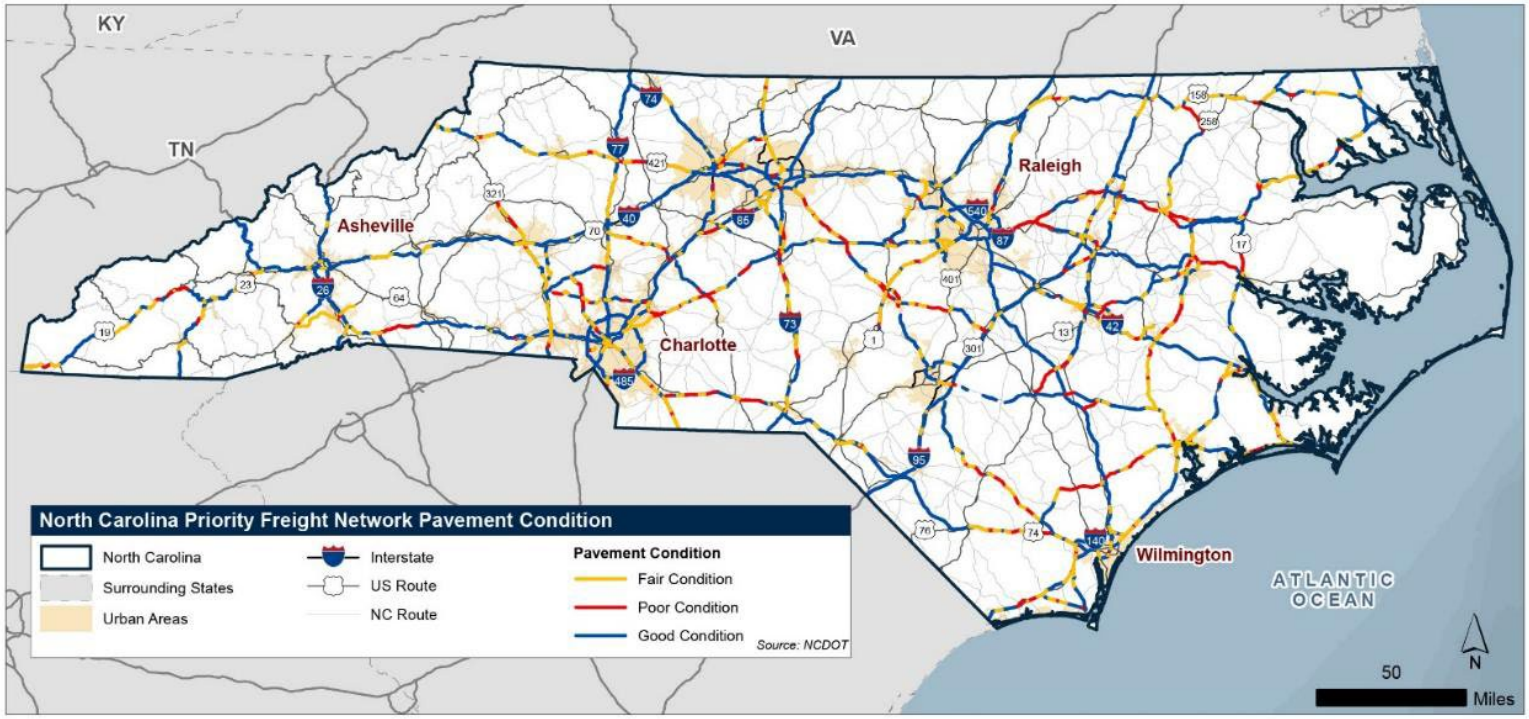
Condition	Interstate	Primary	Secondary	Overall
Good	95%	58%	60%	**62%**
Fair	4%	25%	30%	**27%**
Poor	1%	16%	9%	**10%**

Within the PFN, 91 percent of interstates and 61 percent of primary roads are in good condition; 7 percent and 20 percent, respectively, in fair condition; and 2 percent and 19 percent, respectively, in poor condition (see Table 22). Overall, the pavement condition of the SHPFN is similar to the state-maintained roads.

TABLE 22. NC STATE HIGHWAY PRIORITY FREIGHT NETWORK PAVEMENT CONDITION BY ROADWAY TYPE

Condition	Interstate	Primary	Secondary	SHPFN Overall
Good	91%	61%	58%	**72%**
Fair	7%	20%	32%	**16%**
Poor	2%	19%	10%	**12%**

FIGURE 57. NORTH CAROLINA PRIORITY FREIGHT NETWORK PAVEMENT CONDITION



NCDOT's goal of maintaining at least 62 percent of interstates and 31 percent of non-interstates is met across all roadway classifications and network subsets (urban and PFN). However, the goal of limiting interstate and non-interstate lane-miles in poor condition to below 1.5 percent and 3 percent was not met by any roadway classification or network subset except urban interstates.

4.1.2. Bridge Condition

NCDOT maintains approximately 13,800 bridges and 4,900 culverts that fit the federal definition of a bridge. NCDOT scores the bridge conditions using the Bridge Health Index, which indicates whether the bridge condition is "Good," "Fair," or "Poor." The state has a target of keeping at least 70 percent of bridges in good condition, which means that the bridge can safely carry the typical-sized commercial or passenger vehicles for that route. Poor condition bridges are safe; however, they have components that are deteriorating and require significant maintenance to remain in service and might require limits on vehicle weights.

Approximately 2,350 (19 percent) of the bridges were in poor condition according to the online map,[51] whereas the NCDOT bridge information website[52] indicates 1,350 (7.5 percent) of the state's bridges were in poor condition as of January 2025. NCDOT Divisions 11 (northwest North Carolina around Wilkesboro) and 14 (southwest North Carolina around Waynesville) have the lowest percentage of bridges in good condition, at 71.5 percent and 72.5 percent, respectively.[53] In all these cases, the state's bridge condition targets have been achieved.

Figure 58 shows the locations of North Carolina bridges in poor condition. Western North Carolina contains a higher proportion of bridges in poor condition, followed by the Outer Banks and urban areas in central North Carolina. Southern and eastern North Carolina have a lower proportion of bridges in poor condition than the state average.

[51] NCDOT Bridges Map - https://www.arcgis.com/apps/mapviewer/index.html?layerId=0&layers=627485648d4a40f688192fe907c4a407. Accessed January 2026.
[52] NCDOT Bridges Webpage - https://www.ncdot.gov/initiatives-policies/Transportation/bridges/Pages/default.aspx
[53] NCDOT Annual Performance Report - https://www.ncdot.gov/about-us/our-mission/Documents/2024-interactive-annual-report.pdf

FIGURE 58. NORTH CAROLINA BRIDGES IN "POOR" CONDITION (2023)

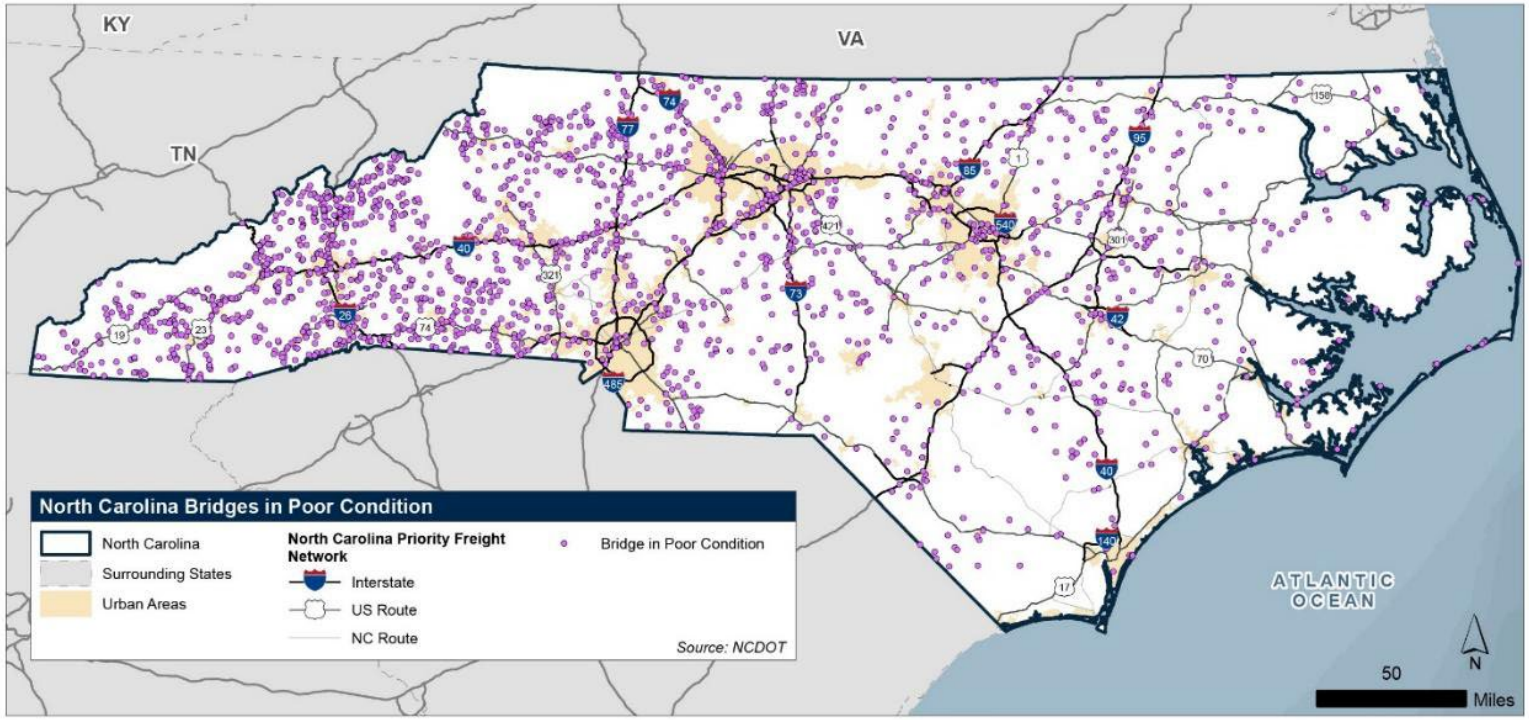
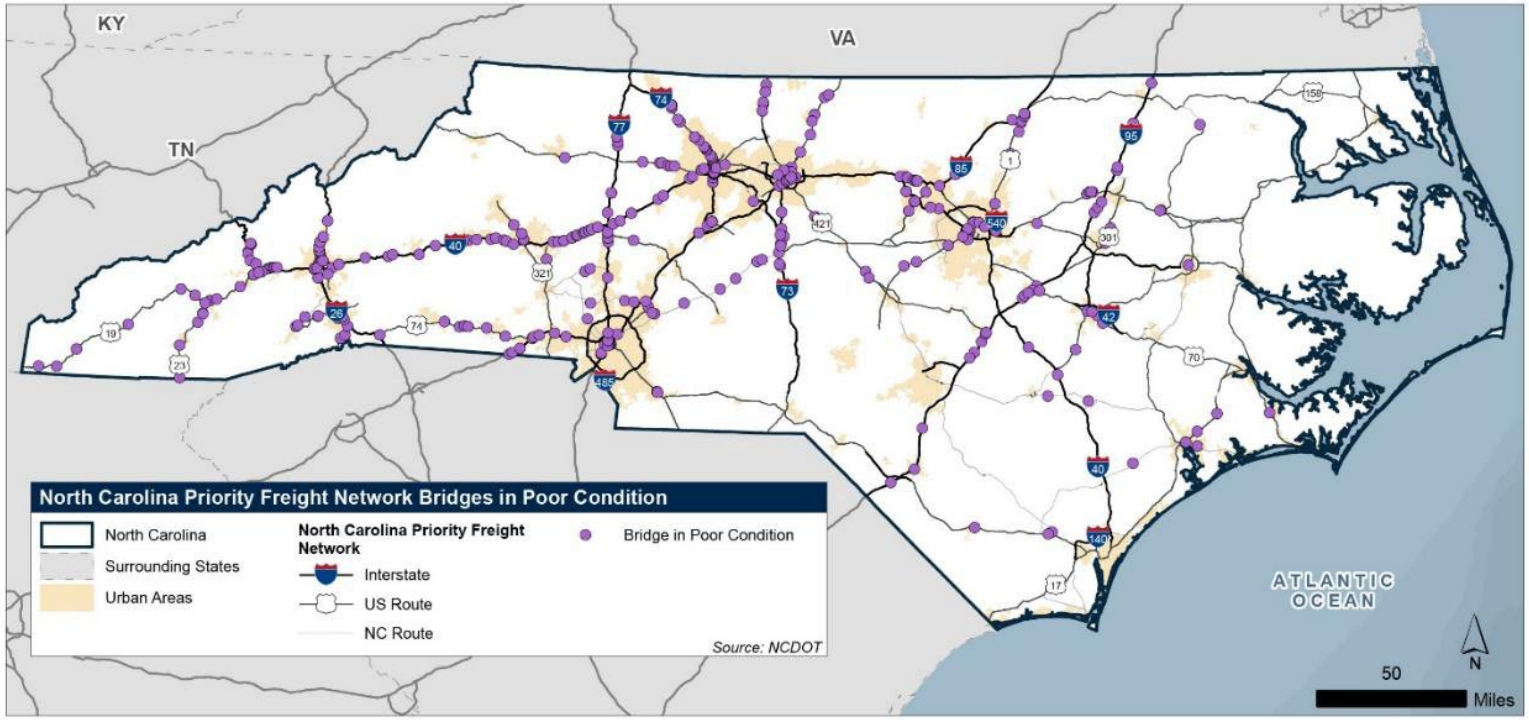


Figure 59 highlights the bridges in poor conditions specifically on the SHPFN. This map brings to light the highways in the western part of the state (I-40, I-26, US 23 and US 74 in particular) that have a high concentration of bridges in poor condition. Some of this damage can be attributed to Hurricane Helene, which significantly damaged the transportation infrastructure of western North Carolina.

FIGURE 59. BRIDGES ON THE STATE HIGHWAY PRIORITY FREIGHT NETWORK IN "POOR" CONDITION



4.1.3. Truck VMT and Mode Share

This section pertains to the overall performance of the highway network regarding truck traffic. Truck vehicle miles traveled (VMT) is a key factor to determine the intensity of truck traffic on different classes of roads. NCDOT does not directly report truck VMT. Interim internal data that included estimated truck VMT was obtained from NCDOT for this purpose. This data included truck VMT for 2022 for seven roadway functional classes, which are different from the four route classes introduced in the previous section. The Highway Performance Monitoring System (HPMS) developed for federal reporting purposes was used to obtain the state-maintained highway and lane-mile length by functional class for 2024. The route length changes

between 2022 and 2024 were within 1 percent of the overall network length. Table 23 shows the relationship between the length, lane-miles, and truck VMT on each functional class.

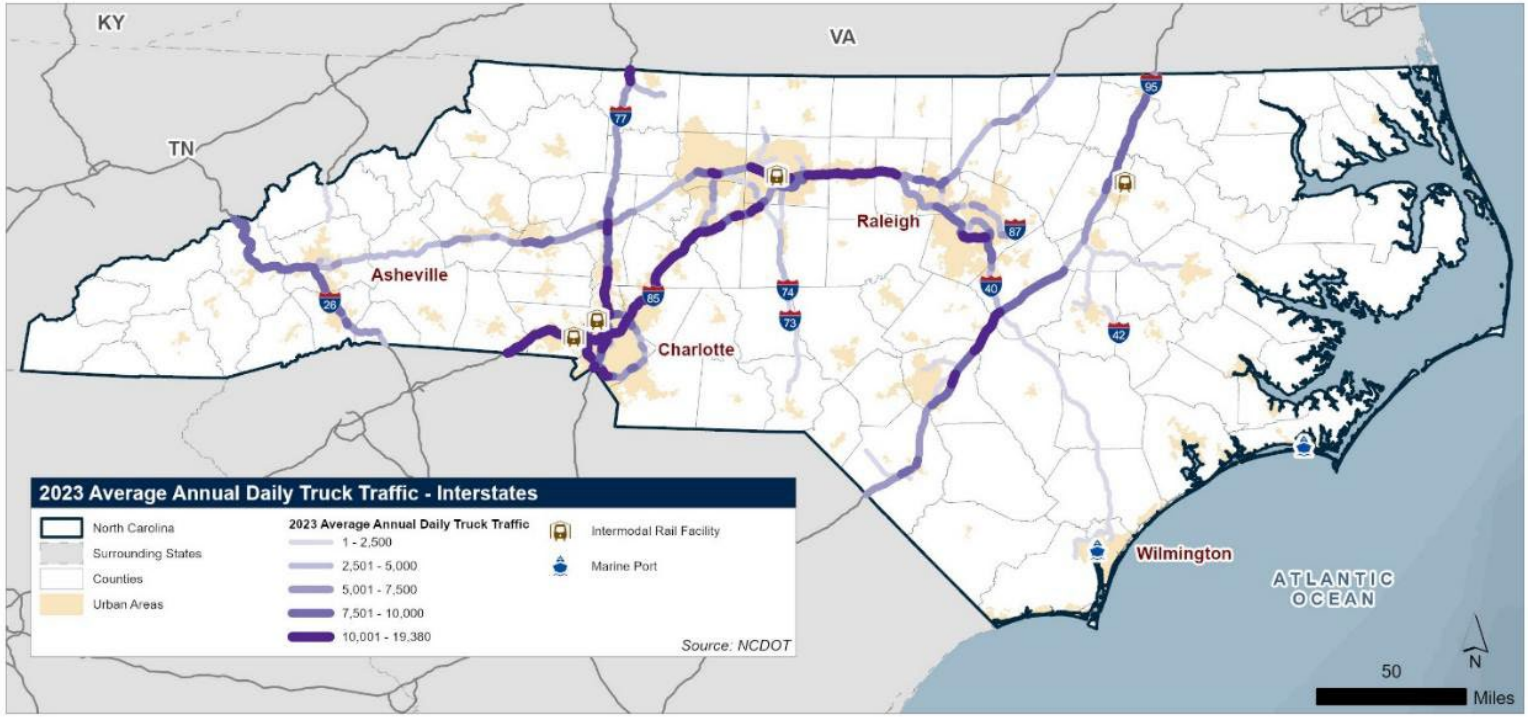
TABLE 23. LENGTH AND TRUCK VEHICLE MILES TRAVELED COMPARISONS ACROSS FACILITY TYPES

Year	2024			2022		
Functional Class	**Length (miles)**	**Length share (%)**	**Lane-miles (miles)**	**Lane-mile share (%)**	**Annual VMT Truck ('000 m)**	**Annual VMT share %**
1 - Interstate	1,432	2%	6,991	4%	2,819,429	34%
2 - PA - Other Freeways and Expressways	850	1%	3,556	2%	681,348	8%
3 - PA - Other	3,604	4%	12,420	7%	1,283,847	15%
4 - Minor Arterial	5,905	7%	13,934	8%	992,134	12%
5 - Major Collector	10,346	13%	21,135	12%	856,306	10%
6 - Minor Collector	6,435	8%	12,877	7%	234,708	3%
7 - Local	52,020	65%	104,040	59%	1,532,005	18%
Total	**80,593**		**174,955**		**8,399,777**	

Note: data in rows reflects rounding and may not sum exactly to the totals shown.

Interstates account for a high proportion of truck flows in North Carolina, accounting for one-third of the truck VMT on just 4 percent of the lane-miles. This is especially pronounced throughout the entire I-95 corridor, portions of I-40 between Raleigh and Asheville, I-85 west of Durham, and I-77 north of Charlotte. The highest truck volumes are on I-85 west of Charlotte (about 18,000 average annual daily truck traffic [AADTT]), which is approximately 15 percent of the total volume on that segment (Figure 60).

FIGURE 60. AVERAGE ANNUAL DAILY TRUCK TRAFFIC ON THE INTERSTATES IN NORTH CAROLINA (2023)

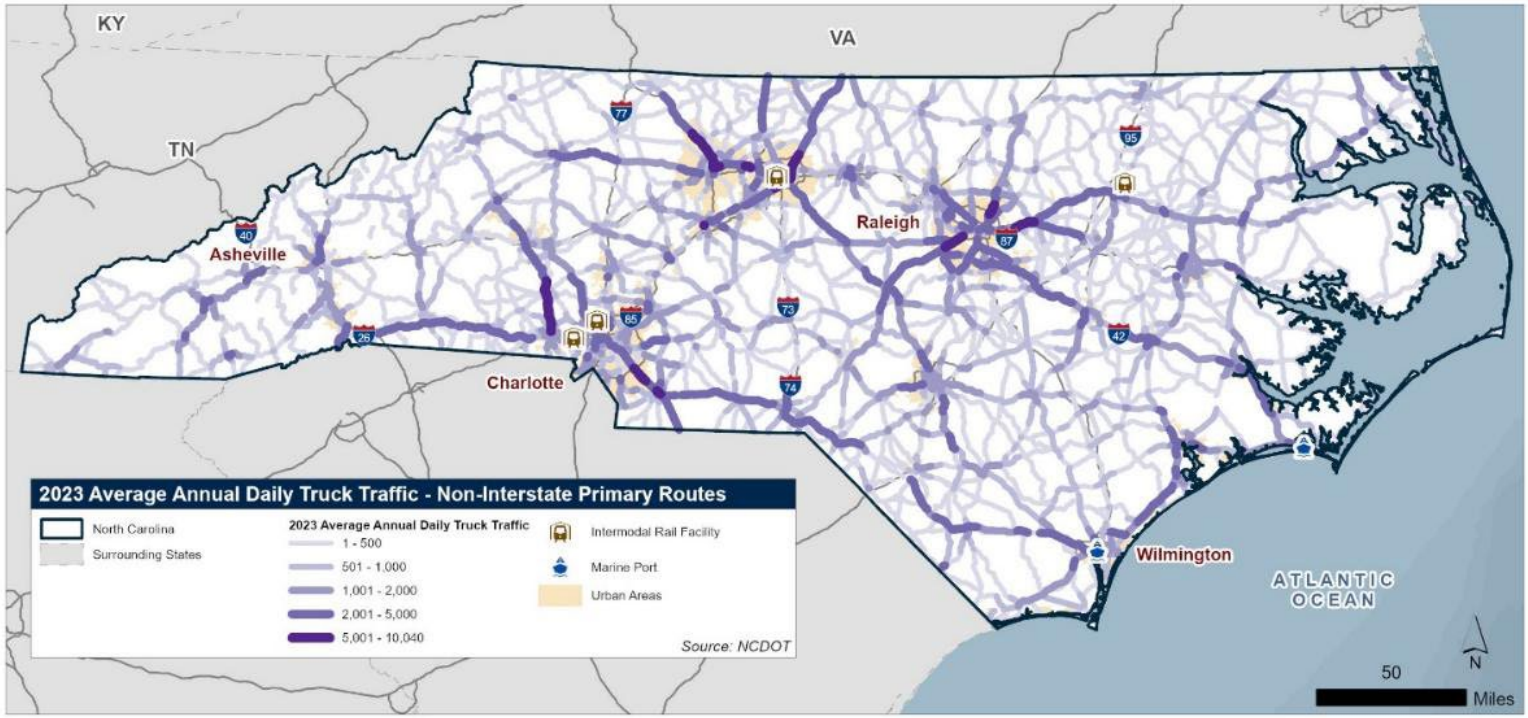


All key intermodal freight facilities in North Carolina that are listed in the National Freight Network are within proximity of the interstates. I-40 serves the Port of Wilmington. The Port of Morehead City is the only key intermodal terminal that is not accessible by an interstate, but it is accessible by US 70, which is a non-interstate primary route.

The non-interstate primary routes carry a combined 49 percent of the truck VMT. These include U.S. routes and North Carolina routes, which have a much denser network in North Carolina. Figure 61 shows the truck volumes in 2023. The corridors with the highest truck traffic (>5,000 AADTT) are as follows:

- US 321 between Gastonia and Lincolnton, west of Charlotte
- US 74 between Matthews and Monroe, southeast of Charlotte
- US 52 north of Winston-Salem
- US 1 southwest of Raleigh
- US 64 and US 1 northeast of Raleigh

FIGURE 61. AVERAGE ANNUAL DAILY TRUCK TRAFFIC FOR NON-INTERSTATE ROUTES (2023)



Note: The legend scale is smaller than the map in Figure 60 and should not be compared visually with the interstate AADTT map.

4.1.4. Highway Freight Bottlenecks Based on Speed, Delay, and User Cost

A comprehensive, data-driven approach was used to identify truck bottlenecks in North Carolina. The first step was to obtain 2024 travel-time data for the National Highway System (NHS) in North Carolina from the National Performance Management Research Data Set (NPMRDS) and extract the average and congested (95th percentile) speeds on the highway network. The maps in Figure 62 and Figure 63 show the average and congested travel speeds on all NHS segments in North Carolina. As expected, speeds are higher on interstates compared to other roadways on the NHS, while speeds in urban areas are lower, particularly in congested periods of the day. Overall, Charlotte-area roadways see the lowest average and congested speeds within their functional class. One caveat to keep in mind when interpreting Figure 62 and Figure 63 is the significant influence of Hurricane Helene and its aftermath on North Carolina roadways and mobility overall in 2024. The collapse of a section of I-40 in the western part of the state, multiple road closures and associated detours all influenced travel time and driver behavior for the remainder of the year after Helene made landfall in September 2024. As such, calculations of average speeds and particularly congested speeds are significantly impacted by this 1-in-1,000-year event. Figure 63 shows multiple large stretches of the NHS in western North Carolina (including interstates) with congested speeds below 25 mph. Other locations with low speeds due to congestion include:

- Large stretches of US 158 and US 301
- US 264 around Greenville
- Most non-interstate segments in Fayetteville
- Most non-interstate segments in the Triangle, and almost all non-interstate segments around Greensboro
- Entire stretch of NC 12 along the Outer Banks
- US 17, US 421, and other non-interstate segments around Wilmington

FIGURE 62. AVERAGE TRAVEL SPEEDS ON NATIONAL HIGHWAY SYSTEM IN NORTH CAROLINA (2024)

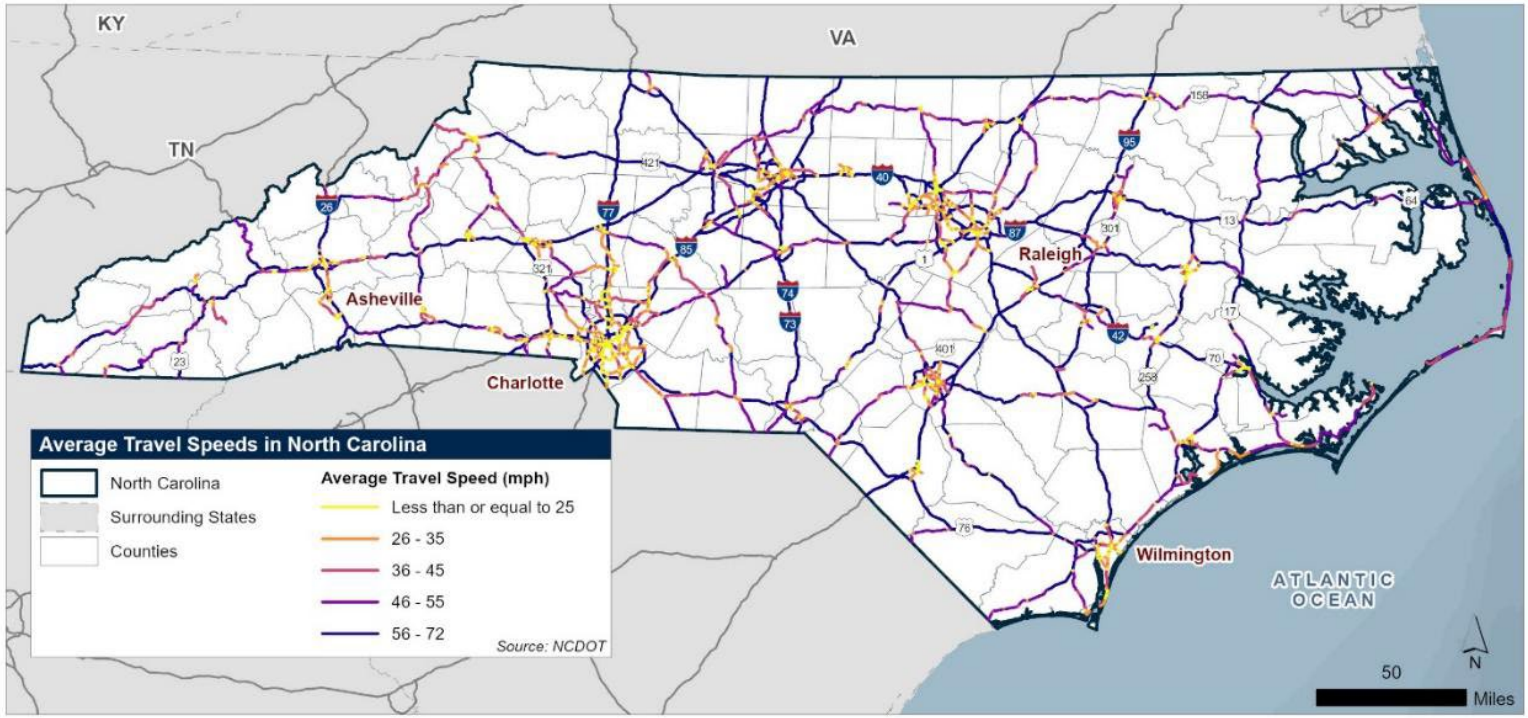
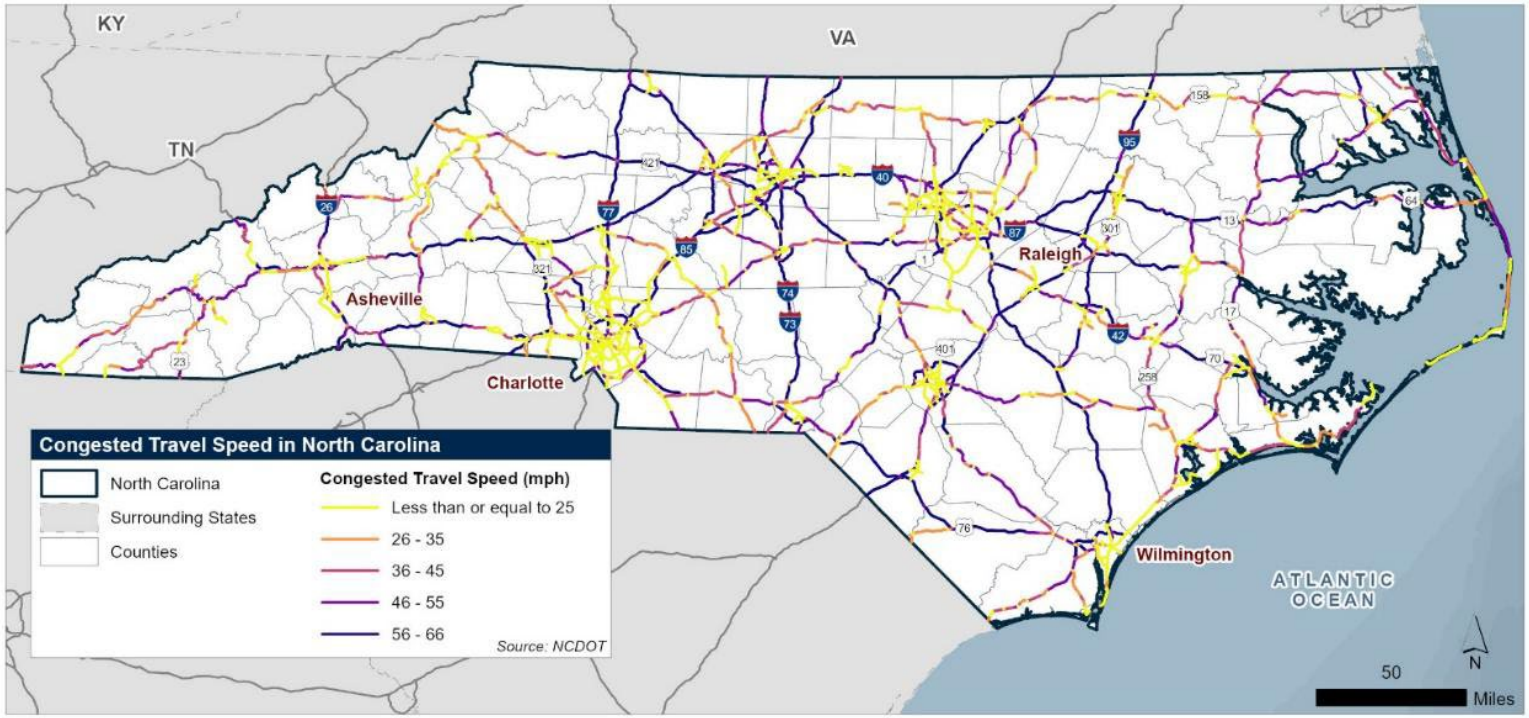


FIGURE 63. CONGESTED TRAVEL SPEEDS ON NATIONAL HIGHWAY SYSTEM IN NORTH CAROLINA (2024)



For the next step in the analysis, NHS travel-time data from NPMRDS was combined with hourly truck volume data to calculate two truck congestion metrics described in *NCHRP Report 925, Estimating the Value of Truck Travel Time Reliability*:

- Vehicle Hours of Excess Travel (VHET) quantifies recurring congestion (slowdowns that happen regularly).
- Vehicle Hours of Unreliability (VHU) measures non-recurring congestion (unexpected delays).

Monetization parameters from NCHRP Report 925 were then applied to estimate the costs of congestion to the trucking industry in North Carolina and the supply chains the trucking industry serves. Congestion costs were used to identify bottlenecks, highlighting locations where freight movement is facing the greatest costs from congestion.

The roadway network was segmented into the following categories so that congested roads were prioritized relative to other roads of the same type, otherwise, bottlenecks in the Charlotte urban area would dominate the statewide analysis:

- Urban Charlotte
- Urban Raleigh-Durham
- Urban Other
- Rural

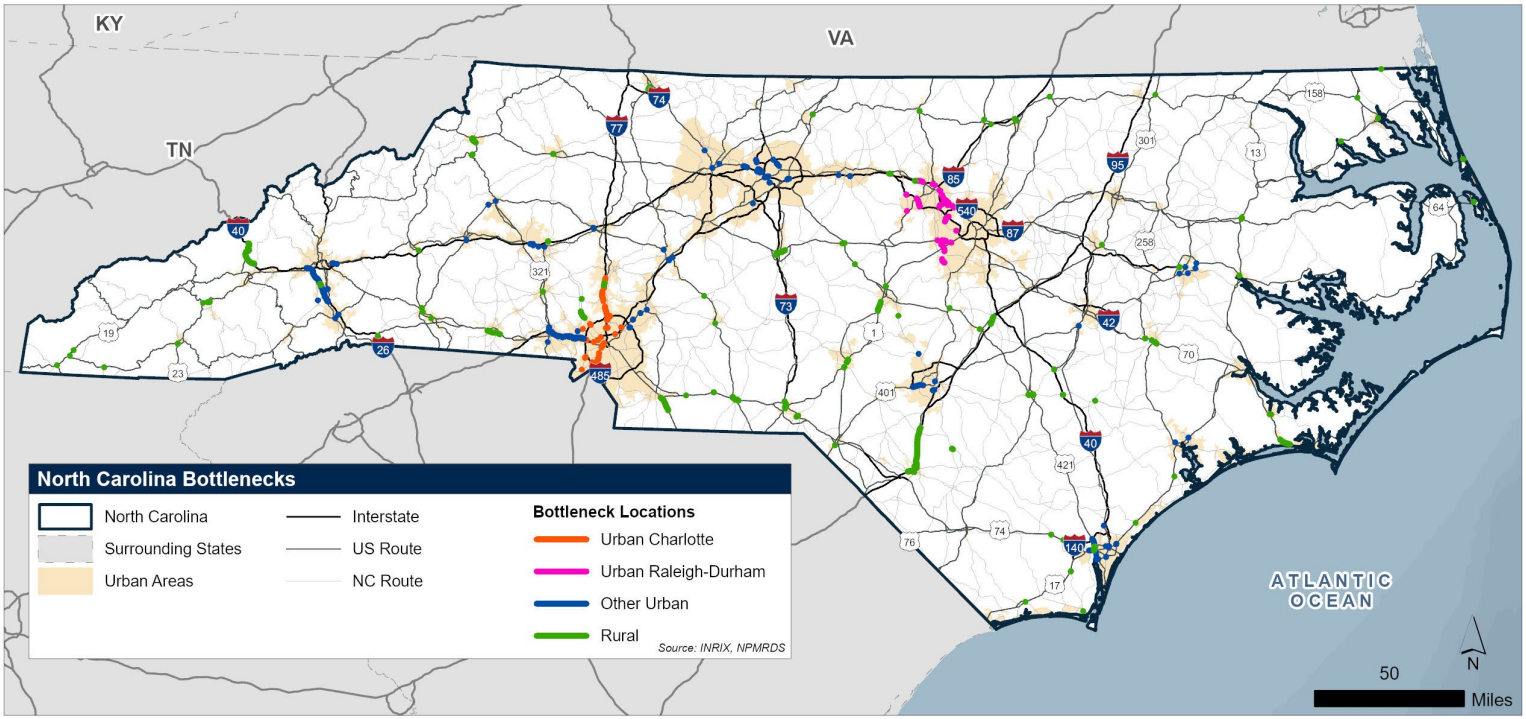
The thresholds used to identify bottlenecks were set at the 95th percentile of user costs per mile (the top 5 percent of segments generating congestion costs), focusing on the segments responsible for the highest congestion costs. These segments were then grouped into clusters for further analysis (see Table 24).

TABLE 24. TRUCK BOTTLENECK IDENTIFICATION APPROACH OVERVIEW

Objective	Steps
Calculation of Congestion Metrics	Processed National Performance Management Research Data Set data; approximated hourly truck volumes; estimated recurring and non-recurring congestion metrics; estimated user costs
Bottleneck Identification	Categorized by “Urban” and “Rural”; set bottleneck thresholds; clustered bottlenecks

In North Carolina, 460 roadway segments were classified as freight bottlenecks across the state, representing 170 centerline miles of roadway. These bottlenecks had combined congestion costs of $3.45 million per day, representing 14 percent of total congestion costs across the state across all roadways, despite accounting for less than 1.5 percent of total roadway mileage in the state (see Figure 64).

FIGURE 64. NORTH CAROLINA BOTTLENECK LOCATIONS



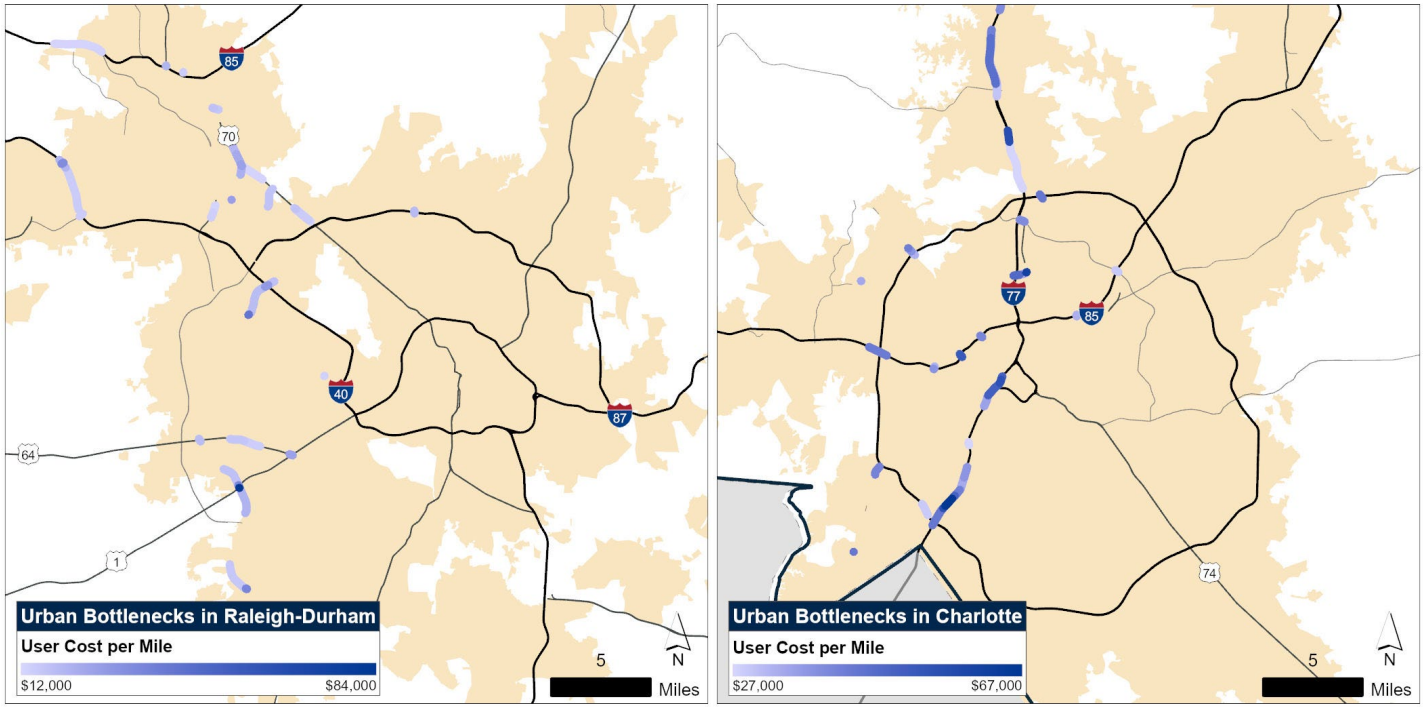
Segments were classified as bottlenecks in the urban Charlotte area only if their congestion costs per mile exceeded $26,491 per day. It is likely that roadways in the Charlotte urban area would have dominated statewide results if they were not initially segmented by urban and geographical considerations, as the bottleneck thresholds for the other categories (such as Urban Raleigh-Durham, Urban Other and Rural) are significantly lower. In fact, urban Charlotte bottlenecks account for almost 4 percent of statewide daily congestion costs, while accounting for only 0.2 percent of the centerline mileage. When compared to other identified bottlenecks, urban Charlotte bottlenecks contribute over 20 precent of daily bottleneck costs, despite representing only 11 percent of the total bottleneck mileage. See Table 25 and Figure 65.

TABLE 25. BOTTLENECK TYPES BY MILEAGE AND CONGESTION COST

Bottleneck Type	Number of Traffic Message Channel Segments	Total Centerline Miles	Share of Bottleneck Mileage	Bottleneck Threshold (User Cost per mile per day)	Congestion Costs in 2024 ($/day)	Share of Congestion Costs
Urban Charlotte	55	25	11.3%	27,959	1,043,584	20.7%
Urban Raleigh-Durham	59	21	9.6%	15,069	408,468	8.1%
Urban Other	173	60	27.1%	12,430	1,534,618	30.4%
Rural	210	114	52.0%	7,607	2,057,373	40.8%
Total	**497**	**219**	**100.0%**		**5,044,035**	**100.0%**

Source: NPMRDS (2024)
Note: data in rows reflects rounding and may not sum exactly to the totals shown.

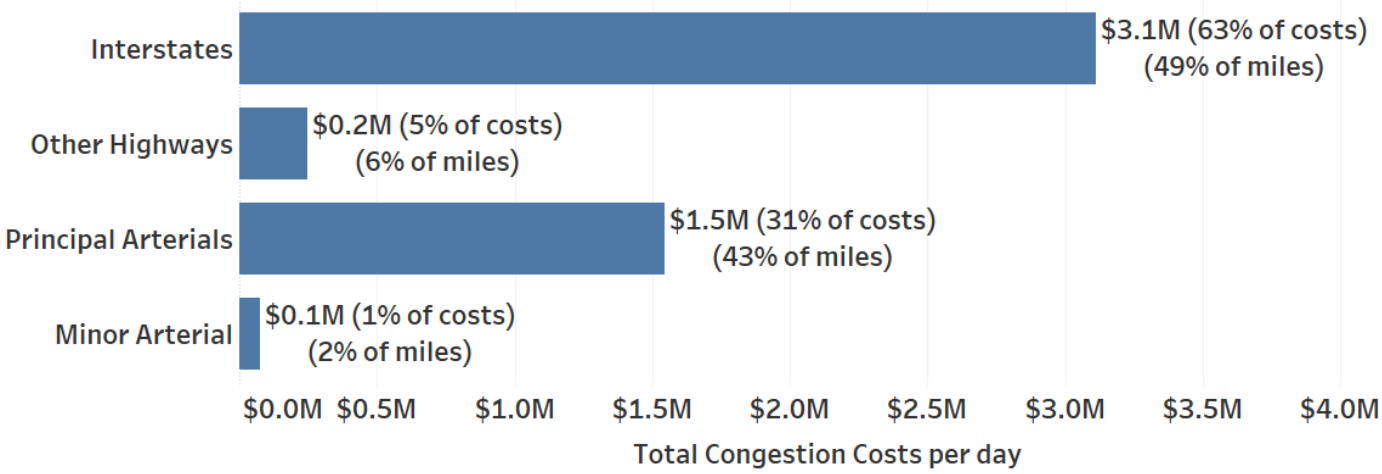
FIGURE 65. URBAN BOTTLENECKS IN THE CHARLOTTE AND RALEIGH-DURHAM AREAS



Source: NPMRDS and NCHRP Report 925

Interstates were found to contribute to almost 45 percent of all bottleneck congestion costs, even though they account for approximately 26 percent of the total bottleneck mileage. Other freeways and arterials (excluding interstates) account for 71 percent of total mileage and 52 percent of the total bottleneck congestion costs. See Figure 66.

FIGURE 66. BOTTLENECK CONGESTION COSTS (MILLION US$) PER DAY BY ROADWAY TYPE



Source: NPMRDS and NCHRP Report 925

Table 26 lists the top 20 bottleneck clusters in North Carolina after removal of locations impacted by work zone closures. In total, these bottlenecks represent 67 centerline miles of roadway that impose $1.04 million of user costs on trucks and supply chains each day, which accounts for over half of identified bottleneck costs and over one-tenth of entire total congestion costs throughout the state. Over 35 percent of these user costs derive from the two top-ranked bottleneck clusters along I-85 in Gaston and Mecklenburg Counties, which was impacted by flooding over the Pigeon River Gorge near the Tennessee border during Hurricane Helene in September 2024. As indicated by the northbound and southbound notations in the bottleneck names, the mileage and user costs listed in Table 26 are for specific travel directions. In a few instances, the travel direction is not mentioned, which implies that both travel directions are part of the same bottleneck. I-77 in Charlotte and US 74 in Cleveland and Gaston Counties are other key bottleneck locations.

TABLE 26. TOP 20 BOTTLENECKS IN NORTH CAROLINA

Rank	Bottleneck Cluster	Bottleneck Type	County	Road Name	Length (miles)	Average Daily Truck Volume	2024 User Costs per Mile	Congestion Costs in 2024 ($/day)
1	I-85 N from US 321/Exit 17 to NC 273/Exit 27	Urban Other	Gaston	I-85 N	9.34	6,971	42,631	398,215
2	I-85 S from NC 7/Exit 23 to I-485/Exit 30	Urban Other	Gaston / Mecklenburg	I-85 S	7.61	7,344	42,593	323,948
3	I-77 N from Tyvola Rd/Exit 5 to I-485/J G Martin Fwy/Exit 2	Urban Charlotte	Mecklenburg	I-77 N	3.5	3,570	44,911	157,264
4	I-77 S from US 21/Exit 33 to Griffith St/Exit 30	Urban Charlotte	Iredell / Mecklenburg	I-77 S	3.47	4,845	37,299	129,588
5	US 601 N from US 74/E Roosevelt Blvd to Carl Funderburk Rd/Claude Austin Rd	Rural	Union	US 601 N	5.06	2,006	22,841	115,483
6	I-77 N from US 21/Exit 28 to NC 73/Exit 25	Urban Charlotte	Mecklenburg	I-77 N	3.44	4,790	33,219	114,383
7	I-77 S from US 21/Exit 28 to NC 73/Exit 25	Urban Charlotte	Mecklenburg	I-77 S	2.38	4,820	45,911	109,412
8	I-77 N from I-77/Gilead Rd Exit 23 to I-77/I-485 Exit 19	Urban Charlotte	Mecklenburg	I-77 N	3.07	4,609	32,808	100,850
9	I-77 S from US 29/NC 27/Morehead St/Exit 10 to Remount Rd/Exit 8	Urban Charlotte	Mecklenburg	I-77 S	1.83	3,979	45,819	83,632
10	US 74 BYP from NC 18 to US 74 BR/E Marion St	Rural	Cleveland	US-74 W	3.78	1,771	15,649	59,224
11	US 74 BYP from Mark Dr to US 74 BR/E Marion St	Rural	Gaston	US-74 E	2.71	1,831	20,024	54,281
12	US 401 N from Raeford Rd to US 401 BR/US 401 BYP/Skibo Rd	Urban Other	Cumberland	US-401 N	2.77	981	18,729	51,942

Rank	Bottleneck Cluster	Bottleneck Type	County	Road Name	Length (miles)	Average Daily Truck Volume	2024 User Costs per Mile	Congestion Costs in 2024 ($/day)
13	NC 55 W from Salem St to E Williams St	Urban Raleigh / Durham	Wake	NC-55 W	2.68	1,355	17,596	47,080
14	US 29 S at I-40/I-85 BR/US 421	Urban Other	Guilford	US-29 S	0.51	3,303	88,689	45,654
15	I-40 W from US 15/US 501/Exit 270 to NC 54/Exit 273	Urban Raleigh / Durham	Durham	I-40 W	2.76	2,587	15,355	42,370
16	US 321 SB from I-74 Exit 17 to Grier Beam Blvd	Urban Other	Gaston	US-321 S	1.69	2,480	23,909	40,407
17	Airport Blvd S from NC 54/Chapel Hill Rd to Aviation Pkwy	Urban Raleigh / Durham	Wake	Airport Blvd S	2.3	1,426	17,289	39,803
18	US 421 S from I-140 to US 74	Urban Other	New Hanover	US-421 S	3.29	1,310	11,550	38,014
19	Airport Blvd N from NC 54/Chapel Hill Rd to Aviation Pkwy	Urban Raleigh / Durham	Wake	Airport Blvd N	1.9	1,581	19,270	36,528
20	US 1 N from US 15/US 501/White Hill Rd to Phillips Dr	Rural	Lee	US-1 N	3.41	1,325	10,665	36,319
Total					**67.5**			**2,024,397**

4.1.5. Crashes

This section highlights the truck travel safety statistics in North Carolina. NCDOT categorizes the severity of a crash on a KABCO scale (see Table 27) based on the severity of an injury caused by the crash.

TABLE 27. KABCO SCALE

Crash Severity Scale	Injury Grade	Definition
K	Killed/Fatal Injury	Results in death within 30 days of the crash
A	Suspected Serious Injury	Incapacitating injury, such as broken limbs, severe lacerations, or unconsciousness
B	Suspected Minor Injury	Evident injury, such as lumps, abrasions, or bruises
C	Possible Injury	No visible injury, but complaint of pain or momentary unconsciousness
O	No Injury	No injury reported or evident; property damage only

The analysis in this section combines the scales into three categories:

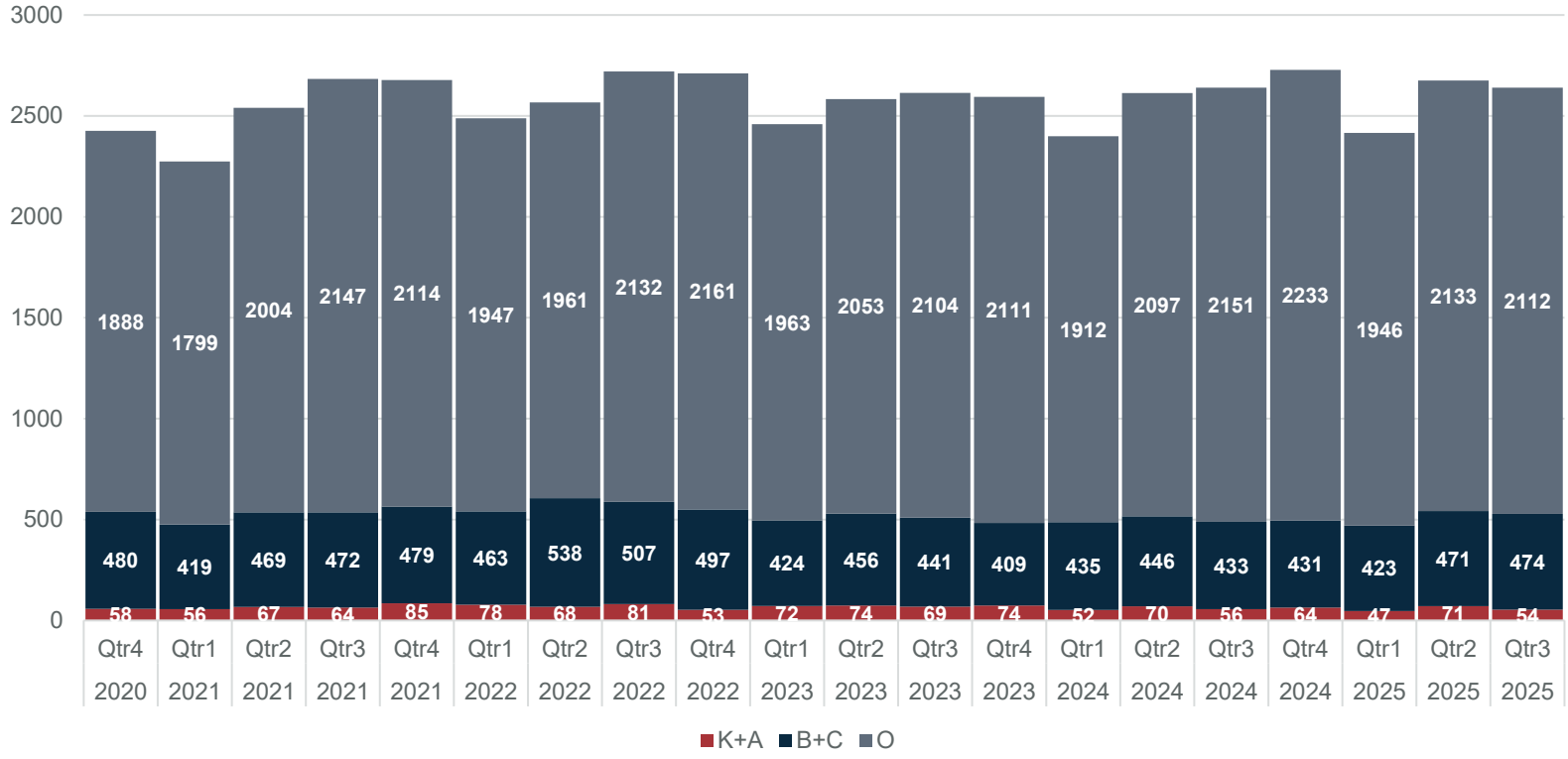
- Killed or Major Injury (K+A)
- Minor or Possible Injury (B+C)
- No Injury (O)

From October 2020 to September 2025, 51,500 crashes involved trucks, which roughly amounted to 860 crashes every month (see Table 28). (Note that crashes involving trucks do not equate to crashes caused by trucks). Approximately 3 percent of these crashes were in the K+A category, 18 percentwere B+C category and the remaining 79 percent were of the O category. Trendline analysis shows that the number of crashes has remained mostly flat in the past five years (see Figure 67).

TABLE 28. TRUCK-RELATED INJURIES BY FACILITY TYPE AND INJURY (OCTOBER 2020-SEPTEMBER 2025)

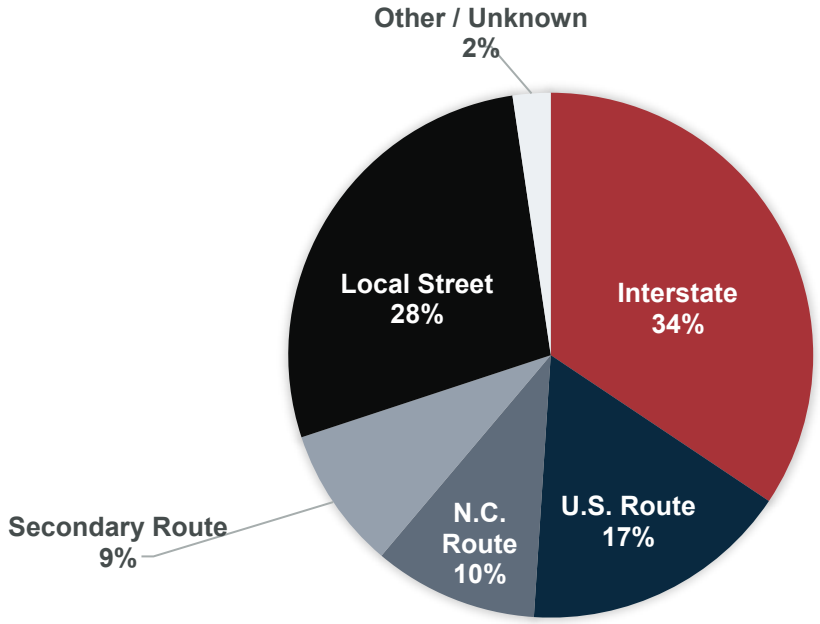
Facility Type	K+A	B+C	O	Total by Facility Type
Interstates	417	3,288	13,983	17,688
U.S. Routes	358	1,819	6,386	8,563
North Carolina State Routes	268	1,111	3,835	5,214
Secondary Routes	160	764	3,591	4,515
Local Streets	99	2,051	12,117	14,267
Other / Unknown	11	134	1056	1,201
Total by Severity	**1,313**	**9,167**	**40,968**	**51,448**

FIGURE 67. TRUCK CRASHES BY QUARTER (OCTOBER 2020–SEPTEMBER 2025)



Most truck crashes in the past five years (October 2020-September 2025) were on the interstates (34 percent) followed by local streets (28 percent). U.S. routes and North Carolina state routes comprised 17 percent and 10 percent of truck crashes, respectively, followed by secondary routes at 9 percent (see Figure 68).

FIGURE 68. SHARE OF TRUCK CRASHES BY FACILITY TYPE (OCTOBER 2020-SEPTEMBER 2025)



Interstates have the highest number of truck crashes, but that could be the case because more truck-miles are traveled on the interstate. Comparing the crash rates across facility types will highlight the number of crashes per 100 million truck VMT on a given facility. NCDOT does not publish truck VMT in their annual VMT report. Truck VMT data presented here is from the same source as that in the Network Performance section. Interstates and local roads are the only two functional classes that matched the truck crash dataset provided by NCDOT. The other functional and route classes had to be combined to form the non-interstate group of roadways.

This crash rate analysis suggests that, on average, North Carolina roads experienced 126 crashes for every 100 million truck VMT, 3.2 of which were fatal or serious injury (Type A). Overall crash rate is highest among local roads, but they have a lower

rate of fatal and serious injury (Type A) crashes. Interstates experienced 125 crashes for every 100 million truck VMT. Non-interstate roads had the highest rate of serious or fatal crashes, but lowest overall rate. Table 29 shows crashes per 100 million Truck VMT (September 2020-October 2025) distributed by facility and severity types.

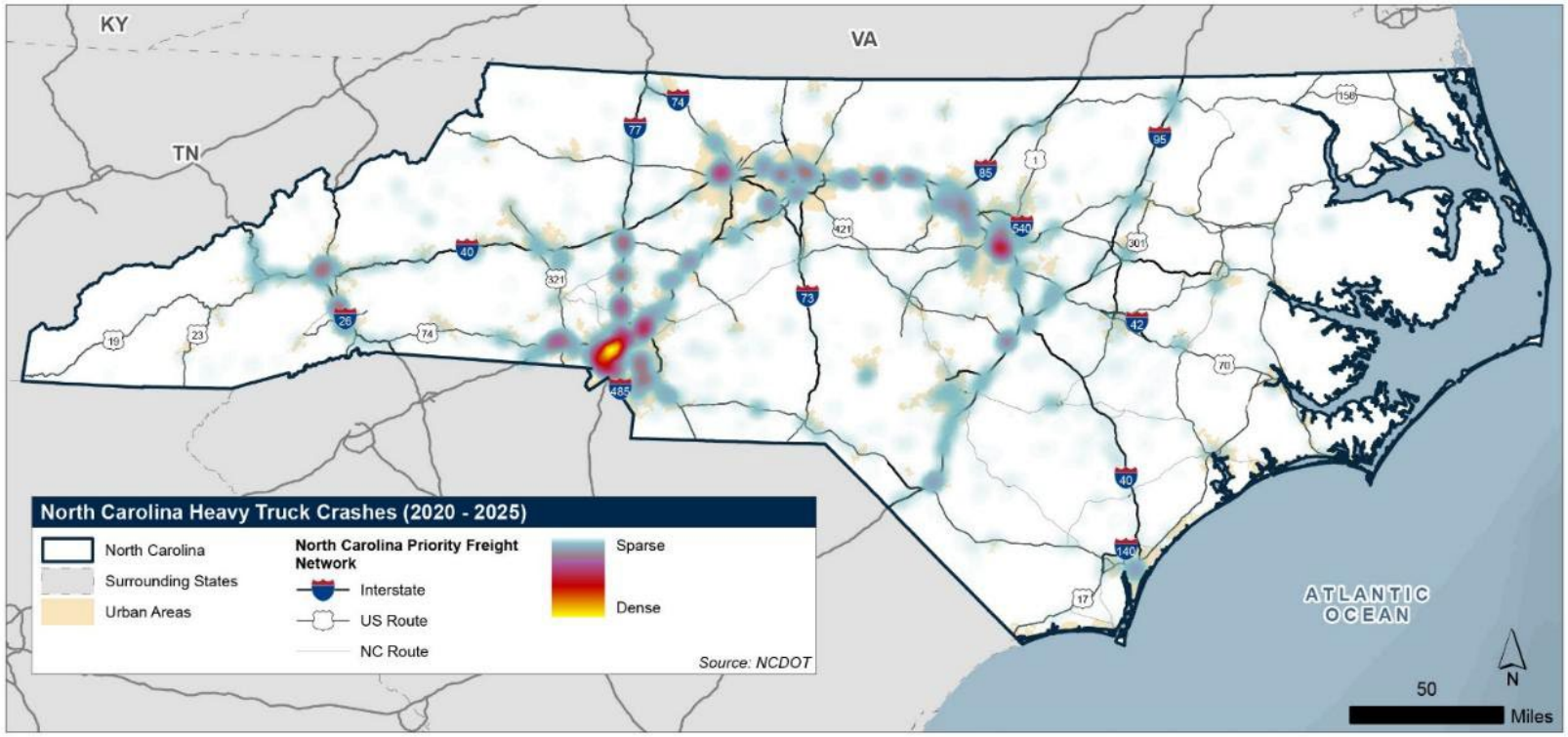
TABLE 29. TOTAL CRASHES AND CRASH RATES BY SEVERITY TYPES FOR GROUPED FUNCTIONAL CLASSIFICATION (OCTOBER 2020-SEPTEMBER 2025)

Func Class	Total Crashes			Truck VMT (5 years)	Crashes per 100 million Truck VMT				
Scale	K+A	B+C	O	Total	x100 million miles	K+A	B+C	O	Total
Interstate	417	3,288	13,983	17,688	141	3	23	99	125
Non-interstate	797	3,828	14,868	19,493	202	3.9	19	73	96
Local	99	2051	12117	14,267	64	1.5	32	189	222
Total	**1,313**	**9,167**	**40,968**	**51,448**	**408**	**3.2**	**22**	**101**	**126**

Figure 69 shows the heatmap of truck crashes in the past five years on all primary routes (interstates, U.S. routes and North Carolina state routes) with the following key hotspots:

- I-40 between US 29 and I-85 in Greensboro
- I-85 between Catawba River and University City Boulevard in Charlotte
- North Chester Street Exit in Gastonia
- I-77 between I-40 and US 70 in Statesville
- Gilead Rd Exit in Huntersville
- I-95 south of I-40
- I-26 south of Asheville

FIGURE 69. NORTH CAROLINA HEAVY-TRUCK CRASHES (OCTOBER 2020-SEPTEMBER 2025)



Source: NCDOT

Fatalities, injuries and property damage arising from truck-related incidents all impose societal costs to roadway users as well as the general public in North Carolina. Applying the latest monetization factors available from USDOT to the incident data presented in Table 30, crash costs associated with truck-related incidents are estimated to average about $1.88 billion annually. On average, crashes involving fatalities account for almost $1.25 billion annually, representing two-thirds of overall crash costs, even though they only account for 1 percent of crashes. Crashes with serious injuries account for 12 percent of total crash costs despite only comprising 2 percent of total truck-related crashes.

TABLE 30. TOTAL CRASHES AND MONETIZED CRASH COSTS BY SEVERITY TYPES (OCTOBER 2020-SEPTEMBER 2025)

Crash Severity Scale	Injury Grade	5-yr Aggregate Truck-Related Incidents	Monetized Value (2024$)	5-yr Costs	Average Annual Crash Costs	Percentage of Total Annual Crash Costs
K	Killed/Fatal Injury	456	$13,700,000	$6,247,200,000	**$1,249,440,000**	67%
A	Suspected Serious Injury	857	$1,302,300	$1,116,071,100	**$223,214,220**	12%
B	Suspected Minor Injury	3,366	$256,300	$862,705,800	**$172,541,160**	9%
C	Possible Injury	5,801	$122,400	$710,042,400	**$142,008,480**	8%
O	No Injury	39,996	$5,500	$219,978,000	**$43,995,600**	2%
U	Unknown	972	$238,500	$231,822,000	**$46,364,400**	2%
Total		**51,448**		**$9,387,819,300**	**$1,877,563,860**	**100%**

4.1.6. Harsh Driving Events

The objective of this analysis is to identify roadway segments that exhibit elevated rates of harsh driving behavior. Harsh driving events provide insights into driving behavior by detecting sudden changes in vehicle movement. Derived from Geotab observations of truck driver activity, these events serve as a proxy for unsafe or unstable driving conditions and complement traditional crash-based analyses.

While crash data captures confirmed safety outcomes, harsh events identify near-miss conditions and underlying behavioral patterns that may indicate elevated risk before a crash occurs. They provide a proactive measure of safety that supports earlier identification of high-risk roadway segments.

For this analysis, harsh events are categorized into three types based on vehicle dynamics:[54]

- **Harsh acceleration** events are detected when a vehicle accelerates more quickly than usual.
- **Harsh braking** events are detected when a vehicle decelerates abruptly, often indicating a stop.
- **Harsh cornering** events are detected when a vehicle takes a turn too sharply, potentially losing steering control or stability.

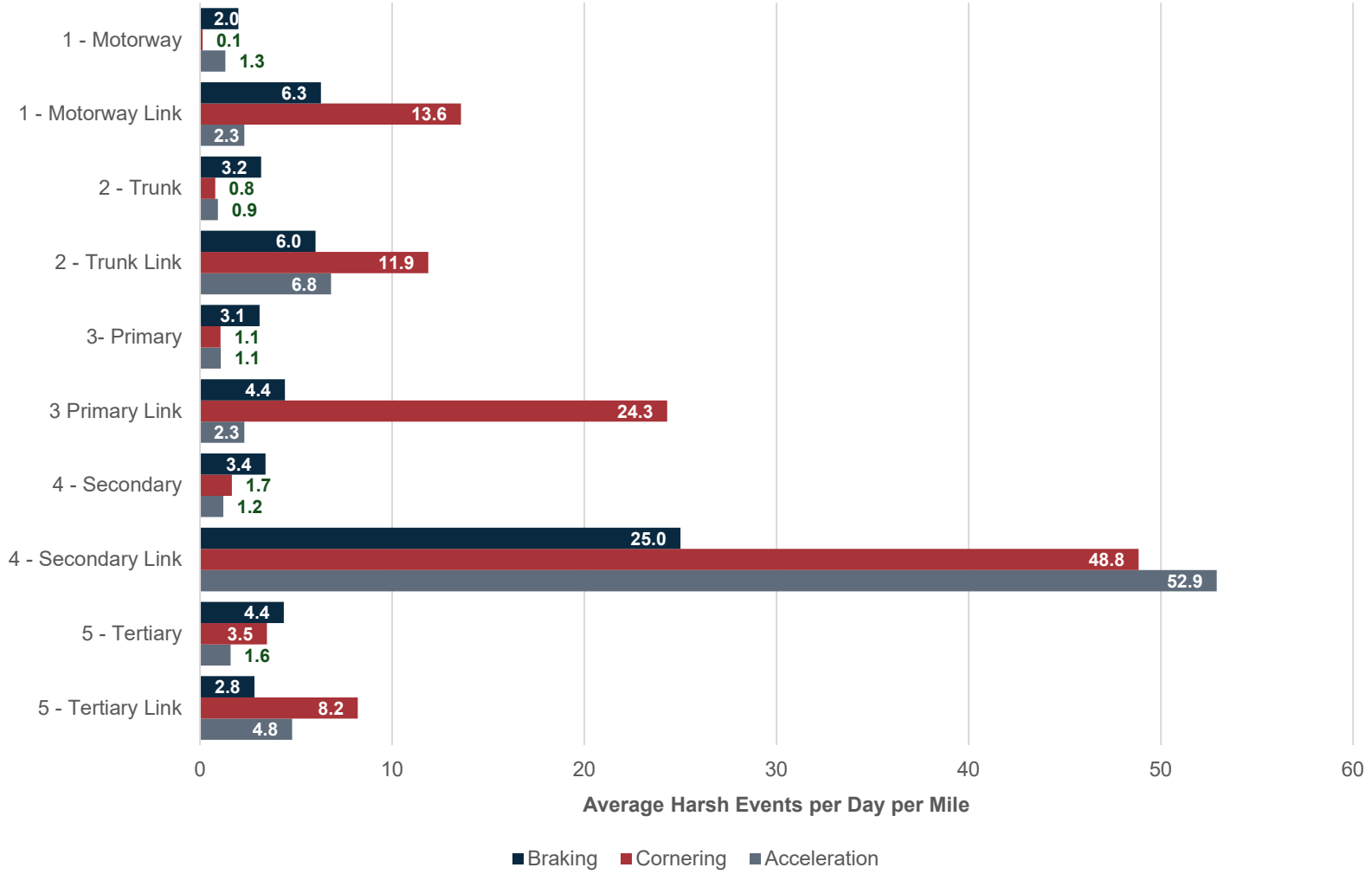
The analysis period includes data from June through August 2024. During this time, approximately 1.7 million harsh braking events, 0.6 million harsh acceleration events, and 1.2 million harsh cornering events were recorded across the statewide North Carolina network.

As shown in Figure 70, secondary roads exhibit the highest rates of harsh driving events, followed by trunk and primary facilities. This pattern is consistent with roadway types characterized by higher access density, more frequent intersections, and greater geometric variability, all of which can contribute to abrupt changes in vehicle movement.

A substantial share of harsh events also occur on slip roads and ramps. These facilities serve as transition points within the network, where merging, diverging, and speed adjustments are required over short distances. As a result, drivers are more likely to perform sudden acceleration, braking, or turning maneuvers in these locations.

[54] https://altitude.geotab.com/news-and-releases/highway-safety-harsh-events/

FIGURE 70. AVERAGE HARSH EVENTS PER DAY PER MILE FROM JUNE TO AUGUST 2024



Source: WSP Analysis of Geotab Telematics Data

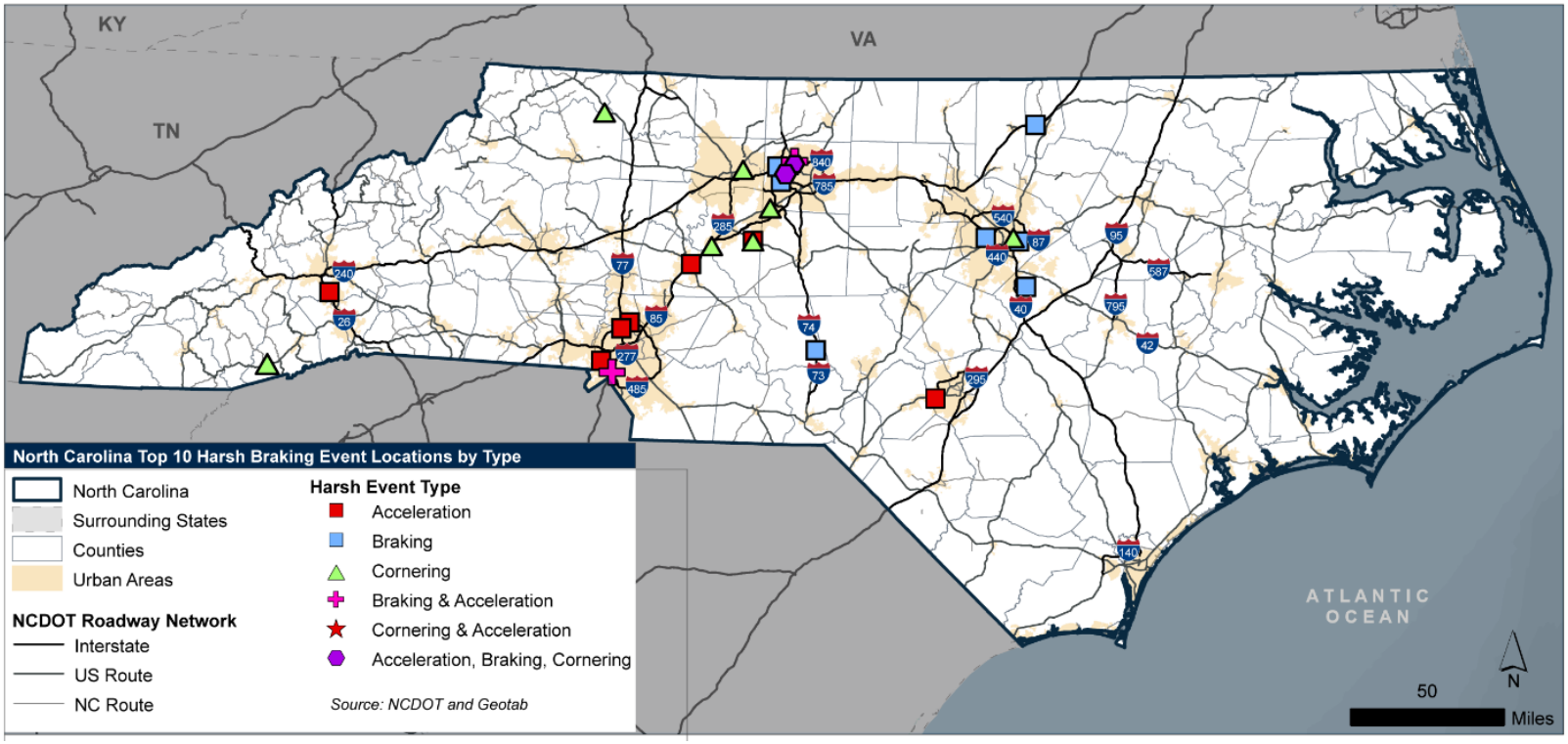
Building on statewide patterns, Figure 71 shows the top ten harsh acceleration, cornering, and braking locations within North Carolina. These locations are intended to identify candidate sites for further review rather than to draw conclusions about the safety performance of any specific facility type or design treatment. Individual locations may reflect localized operational conditions, site geometry, or short-term context that cannot be generalized.

Across these top-ranked segments, several recurring site characteristics were observed:

- Harsh cornering locations frequently include tight curvature and constrained geometry, which can require increased lateral maneuvering.
- Harsh braking locations commonly include signalized intersections, where traffic control and queueing introduce stopping and speed transitions.
- Harsh acceleration locations also appear at signalized intersections and underpasses, where vehicles often accelerate to recover speed following stops or yield conditions.

Note that in some locations, particularly along routes near freight origin-destination pairs, drivers may be highly familiar with roadway conditions. This familiarity can influence driving behavior, including higher travel speeds or more consistent maneuvering patterns, which may contribute to the observed frequency of harsh events.

FIGURE 71. TOP 10 HARSH ACCELERATION, CORNERING, AND BRAKING EVENTS



Source: WSP Analysis of Geotab Telematics Data

Within the top ten, one location, the W Friendly Avenue Underpass at I-73 in Greensboro, appears across all three harsh event categories. This site is a signalized underpass intersection with complex channelization and multiple driver decision points. The combination of vertical separation, traffic control, and lane guidance transitions likely contributes to frequent braking, acceleration, and turning maneuvers within a short distance.

FIGURE 72. AERIAL AND STREET VIEW OF W FRIENDLY AVE UNDERPASS AT I-73 – GREENSBORO, NC

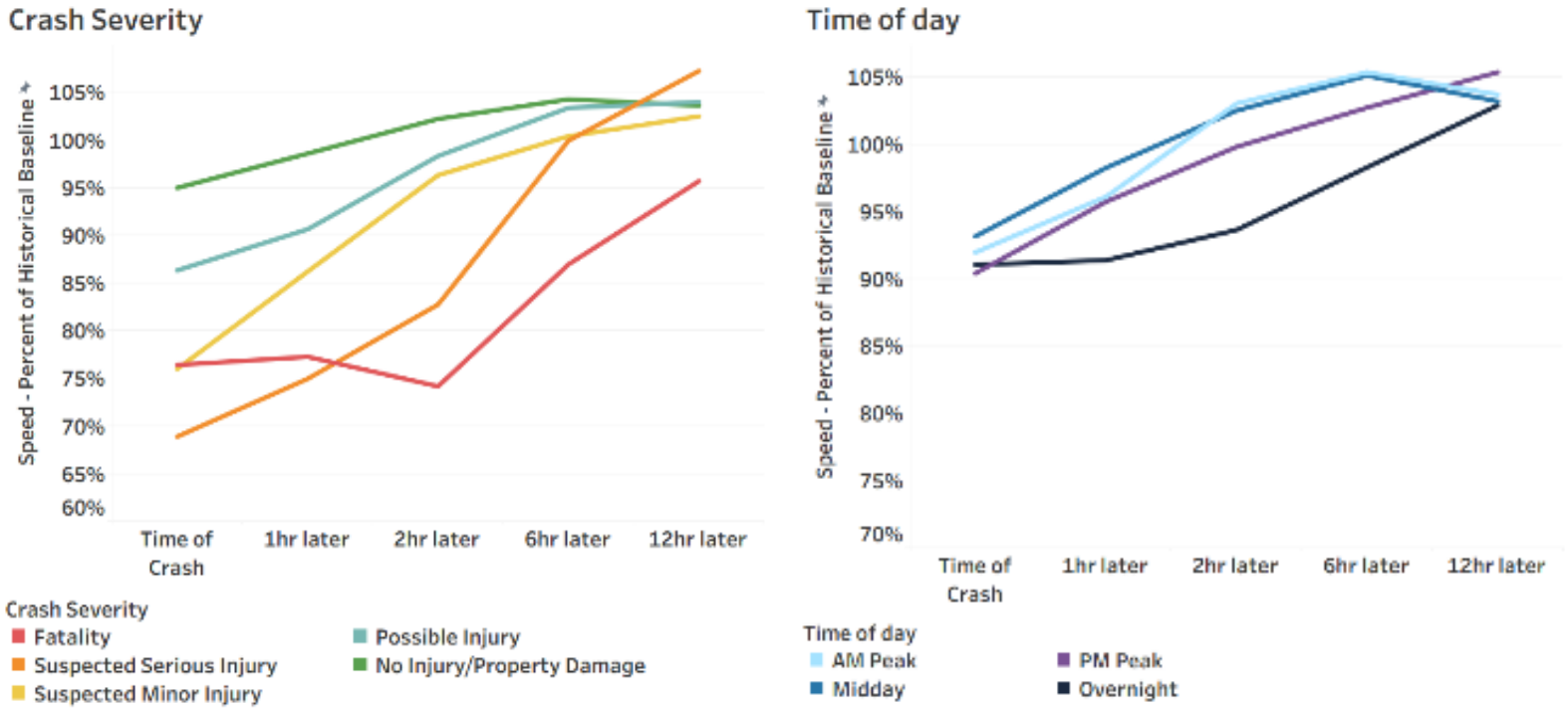


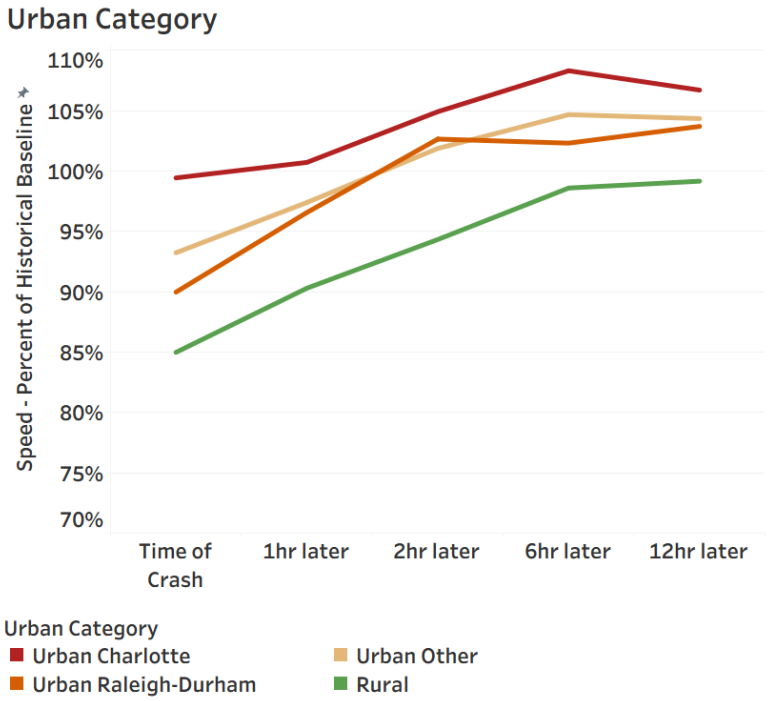
4.1.7. Incident Recovery

In addition to directly impacting those involved in the crash, truck-involved crashes on roadways also contribute to delays and congestion while traffic operations and incident management respond to the incident on the roadway. Incident recovery time refers to the period required for traffic operations on the affected roadway segment to return to normal following an incident. It reflects the combined effect of detection, response, scene management, clearance, and the time required for congestion to dissipate under prevailing demand. Longer incident recovery implies extended delays, greater reliability impacts, and increased risk of secondary crashes.

Incident recovery times were evaluated by linking heavy-truck crashes to NPMRDS segments and then tracking segment speeds at the time of the crash and at later time offsets. Speeds were normalized to historical baselines for the same segment and the same time of day, and as such represent deviations from typical conditions at that time. Figure 73 summarizes how quickly speeds approach normal conditions (100 percent of baseline speeds) over the first several hours after the crash.

FIGURE 73. INCIDENT RECOVERY TIMES BY CRASH SEVERITY, TIME OF DAY AND URBAN CATEGORY





Source: WSP Analysis of NCDOT Crash Data and NPMRDS

The results show clear and intuitive incident recovery trends. Higher-severity crashes take longer to recover. Fatal crashes start at a lower percentage of baseline and remain further below baseline for longer than less severe crashes. Traffic operations recover fastest and have the least impact from property-damage-only crashes, while injury crashes recover more slowly and fatal crashes recover slowest. This pattern is consistent with the expectation that more severe crashes require more complex responses and longer on-scene activity, which prolongs disruption.

Incident recovery also varies by time of day. Overnight and PM peak crashes exhibit slower incident recovery than midday and AM peak crashes. Overnight time periods may be impacted by longer response times and longer lane closures, while the PM peak effect is consistent with higher traffic volumes and tighter operating conditions, where even a short-duration disruption can cause lower speeds for longer.

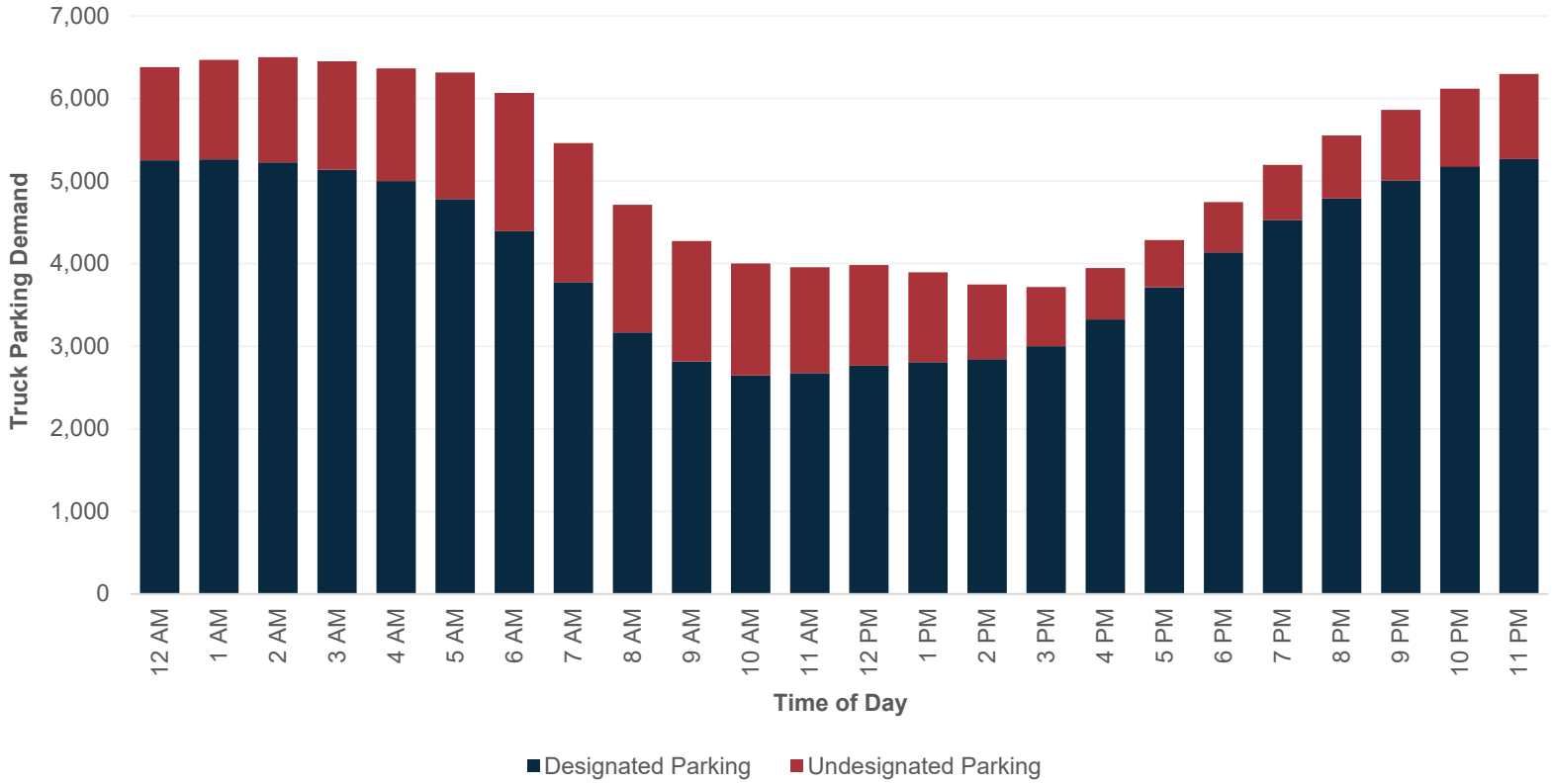
Incident recovery is also impacted by where the crash is occurring. Rural segments take the longest to recover. This is likely caused by limited route redundancy in the system, fewer viable detours, and longer response travel times in more remote areas. Urban segments recover more quickly on average, with the large metro areas such as Charlotte and Raleigh-Durham showing faster return toward baseline than rural segments.

4.1.8. Truck Parking Utilization

Geotab data was used to estimate hourly truck parking demand across North Carolina. Weekday observations from January through August 2024 were expanded using Geotab-provided expansion factors to develop an average weekday demand profile. Demand includes trucks identified in designated parking spaces and undesignated locations.

As shown in Figure 74, statewide truck parking demand follows a V-shaped daily profile. Demand is highest during the overnight period, peaking at approximately 6,500 parked trucks at 2 a.m. The number of parked trucks decreases during the morning and early afternoon, reaching a low of approximately 3,700 trucks at 3 p.m. Demand then increases through the evening and returns to overnight levels. The higher demand observed during the evening and overnight periods is consistent with drivers stopping for required rest periods.

FIGURE 74. STATEWIDE AVERAGE WEEKDAY TRUCK PARKING DEMAND BY HOUR AND PARKING TYPE

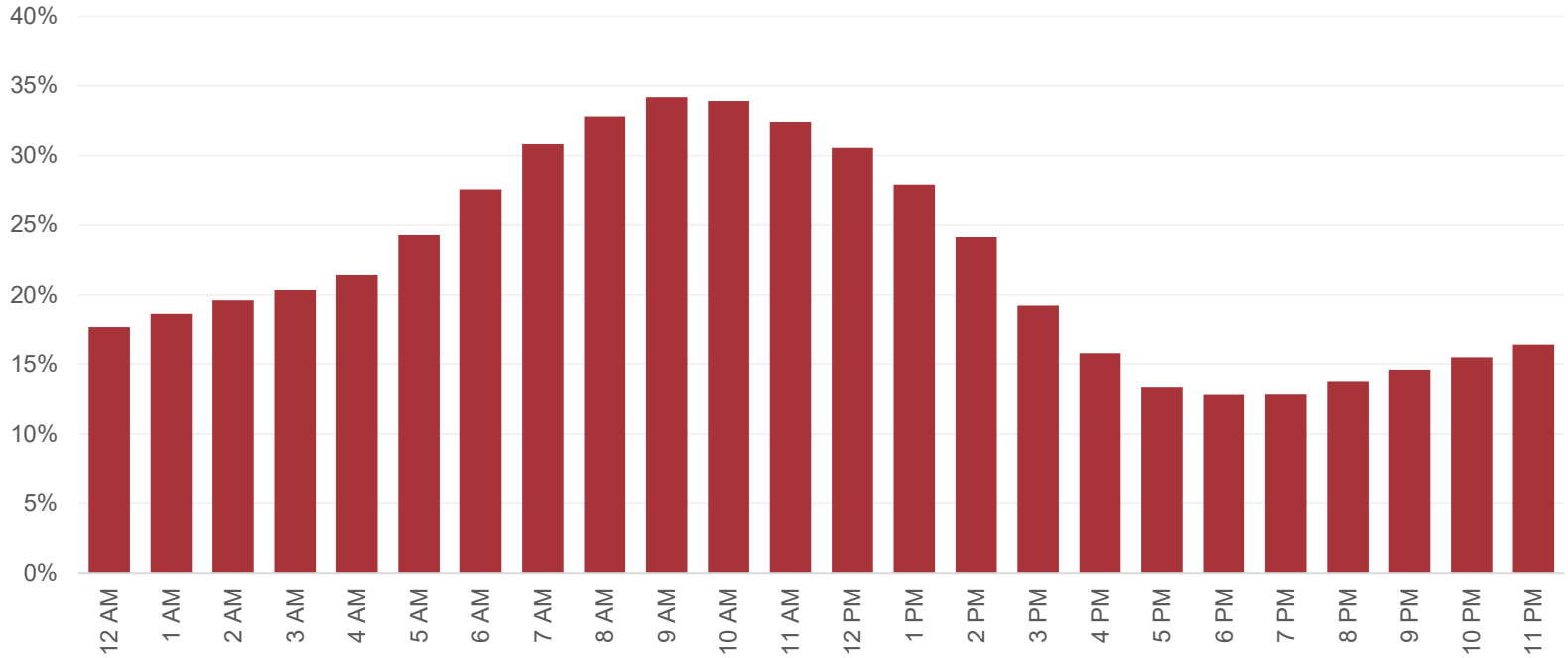


Source: WSP Analysis of Geotab Data

Undesignated parking occurs throughout the day but follows a different hourly pattern. The number of trucks parked in undesignated locations increases during the early morning and peaks at approximately 1,700 trucks at 7 a.m. Undesignated parking then decreases through the afternoon before increasing during the evening.

The share of demand occurring in undesignated locations is highest during the morning. As shown in Figure 75, undesignated parking accounts for 34 percent of total observed demand between 9 a.m. and 10 a.m. The share remains above 20 percent through 2 p.m. and declines during the late afternoon and evening. Potential contributing factors include staging near delivery locations, waiting for scheduled appointment windows, taking shorter rest breaks, or limited access to designated parking – although the latter is a lesser factor, because use of designated parking has dropped off by 8 a.m., whereas use of undesignated locations remains high through noon. Location-specific evaluation would be required to determine the conditions associated with individual locations.

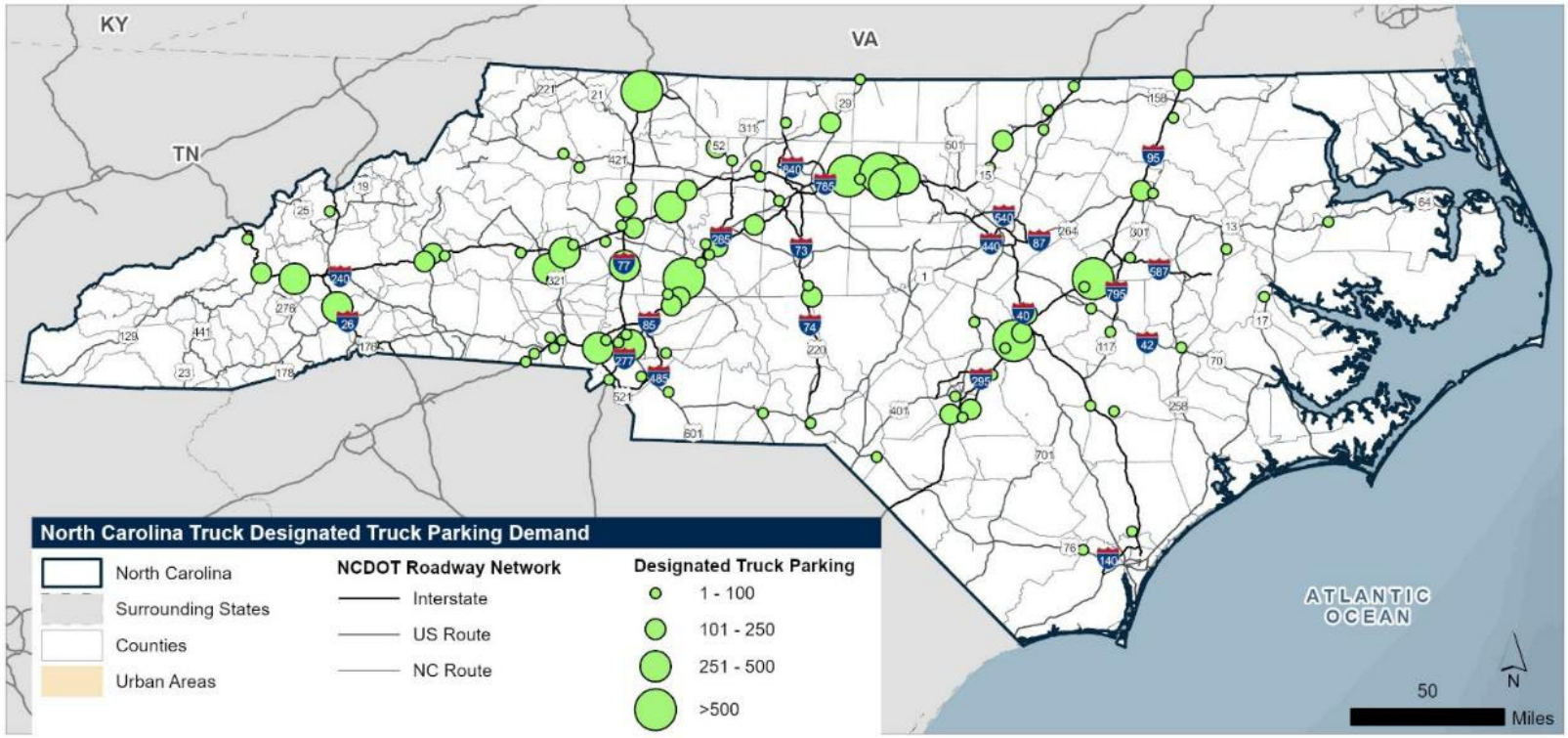
FIGURE 75. UNDESIGNATED PARKING AS A PERCENTAGE OF AVERAGE WEEKDAY TRUCK PARKING DEMAND



Source: WSP Analysis of Geotab Data

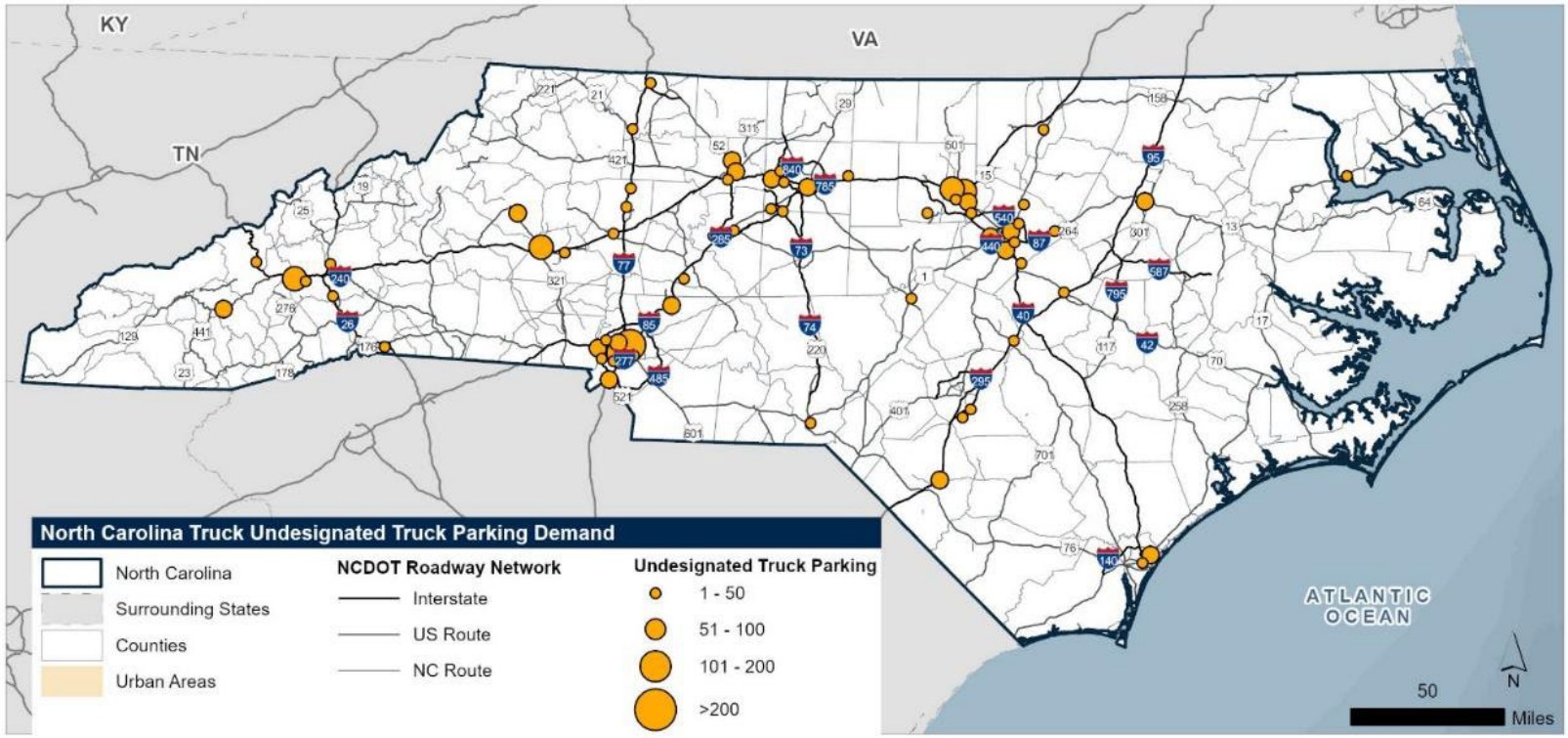
The geographic distribution of designated and undesignated parking demand is shown in Figure 76 and Figure 77. Designated demand is concentrated at public and private truck parking facilities along the interstate system. The highest-demand locations are near Charlotte, the Triad, and Raleigh-Durham and along I-40, I-85, I-95, and I-77. Demand at several facilities exceeds 200 trucks, representing substantial parking activity at major truck stops, travel centers, and public parking facilities.

FIGURE 76. AVERAGE WEEKDAY DESIGNATED TRUCK PARKING DEMAND



Source: WSP Analysis of Geotab Data

FIGURE 77. AVERAGE WEEKDAY UNDESIGNATED TRUCK PARKING



Undesignated parking occurs throughout North Carolina. As shown in Figure 77, screening areas with more than 50 trucks observed in undesignated locations are concentrated near Charlotte, the Triad, Raleigh-Durham, Asheville, and Wilmington, as well as along the interstate freight corridors and roadways serving freight activity centers.

Of the 67 screening areas shown in Figure 76, 53, or approximately 79 percent, contain fewer than 30 designated truck parking spaces. These locations may warrant additional facility- and corridor-level evaluation to better understand local parking conditions and potential improvement opportunities.

4.2. Non-Highway Performance Indicators

4.2.1. Ports

One key performance indicator for ports is their number of vessel calls. In 2023, according to U.S. Army Corps of Engineers data (Table 31):

- There were 1,740 cargo vessel trips inbound to and outbound from Wilmington Harbor. The majority (1,129) were self-propelled dry vessels, followed by liquid bulk tankers (263), towboats (262) and liquid bulk barges (86).
- There were 1,286 cargo vessel trips inbound to and outbound from Morehead City Harbor. The majority (463) were towboats, followed by dry bulk barges (296), self-propelled dry vessels (275), liquid bulk barges (232) and tankers (20).
- There were just 18 cargo vessel trips reported for other waterways.

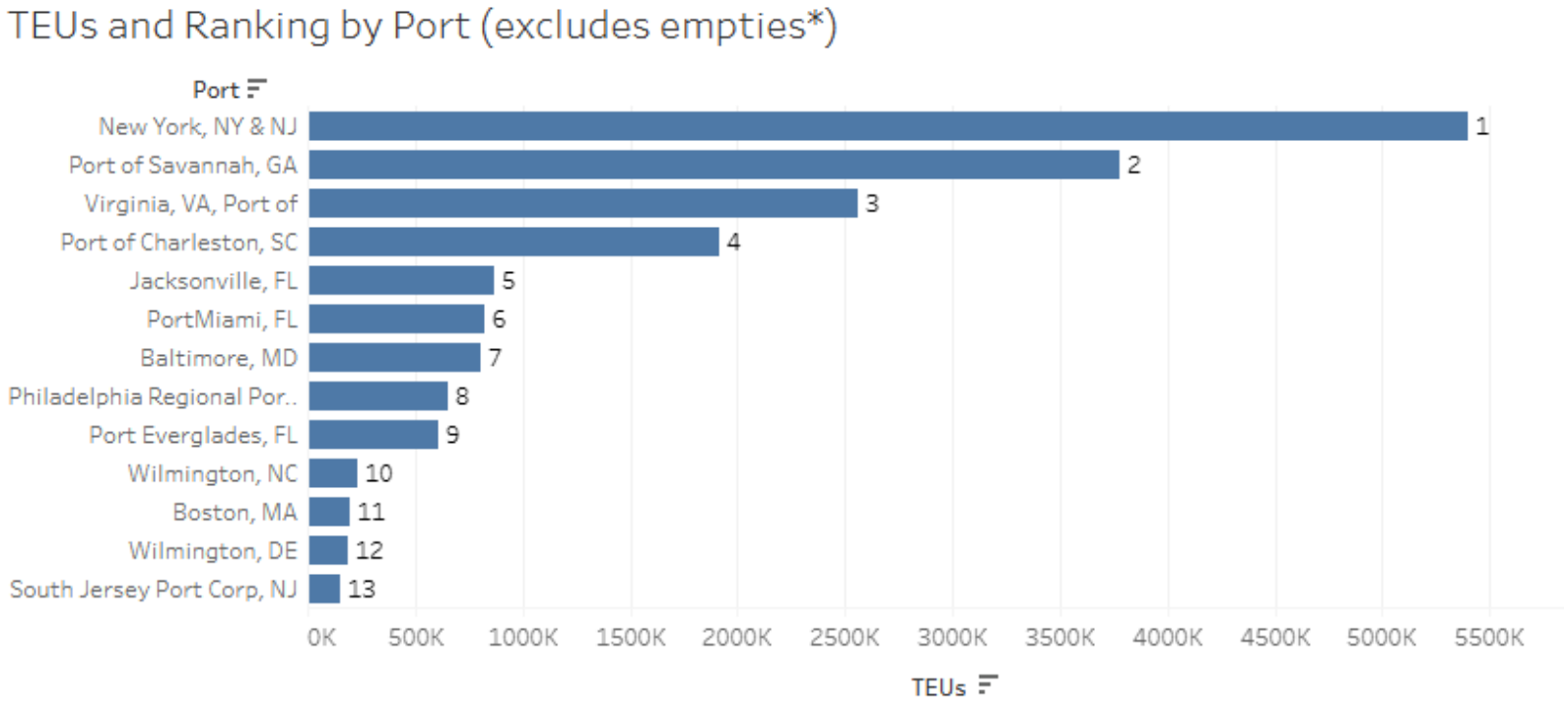
TABLE 31. CARGO VESSEL CALLS AT NORTH CAROLINA MARINE CARGO TERMINALS, 2023

Terminal	Vessel Type	Inbound Receiving	Outbound Shipping	Total
Wilmington Harbor	Dry Barge	0	0	**0**
	Liquid Bulk Barge	51	35	**86**
	Self-Propelled Dry	567	562	**1,129**
	Liquid Barge Tanker	132	131	**263**
	Towboat	132	130	**262**
	Total	**882**	**858**	**1,740**
Morehead City Harbor	Dry Barge	148	148	**296**
	Liquid Bulk Barge	113	119	**232**
	Self-Propelled Dry	137	138	**275**
	Liquid Barge Tanker	10	10	**20**
	Towboat	232	231	**463**
	Total	**640**	**646**	**1,286**

Source: https://ndclibrary.sec.usace.army.mil/searchResults?series=WCUS-TripsData

Another key indicator for container ports is the number of twenty-foot equivalent container units (TEUs). The USDOT Bureau of Transportation Statistics reports 232,014 loaded TEUs for the Port of Wilmington in year 2023. This places the port in the top ten of all East Coast container ports. Note that the Ports of Savannah, Norfolk, and Charleston – all of which are within a one-day drive of North Carolina freight shippers and receivers – rank second, third, and fourth, respectively (Figure 78). Reporting in 2023 suggested a total TEU figure of 330,000 for the Port of Wilmington, including both loads and empties.

FIGURE 78. ATLANTIC COAST PORTS RANKED BY LOADED TEUS, 2023



Source: https://data.bts.gov/stories/s/Container-TEU/x3fb-aeda/

Considering all cargo types, containerized and non-containerized, North Carolina's public and private ports handled an estimated 11.5 million short tons of cargo. On average, a road-legal TEU will weigh between 7.5 and 12.5 tons, and using an estimate of 10 tons per TEU, loaded containers probably accounted for around 2.3 million tons of the state's marine cargo tonnage. Overseas imports represented more than 4.3 million tons of cargo while overseas exports represented more than 4.2 million tons of cargo – a nearly perfect balance of import and export trade tonnage. Another 1.6 million tons moved internally to distribute freight within North Carolina's harbors; almost 720 thousand tons moved domestically as coastwise traffic; and almost 686 thousand tons were imported from Canada.[55]

Table 32 summarizes tonnages and trade directions for the top 20 commodities handled. It should be noted these totals include both public and private marine terminals. Starting with the statewide total of 11.5 million tons, then subtracting 2.3 million tons for containers and 4.6 million tons for NC Ports general cargo,[56] the private share of port tonnage can be estimated at 4.6 million tons.

TABLE 32. NORTH CAROLINA MARINE CARGO TONNAGE BY COMMODITY AND TRADE DIRECTION, 2023

Rank	Commodity	Total	Cumulative Share	% Import	% Export	% Domestic
1	Fuel Wood	1,479,893	13%	0%	100%	0%
2	Inorganic Chemicals	812,473	20%	2%	29%	69%
3	Nitrogenous Fertilizers	746,360	26%	96%	0%	4%
4	Alcohols	714,747	33%	57%	0%	42%
5	Pig Iron	709,602	39%	43%	0%	57%
6	Pulp & Waste Paper	425,129	42%	10%	90%	0%
7	Iron & Steel Scrap	412,994	46%	0%	0%	100%
8	Potassic Fertilizers	372,333	49%	18%	82%	0%
9	Textile Products	340,993	52%	45%	55%	0%
10	Cement & Concrete	306,246	55%	100%	0%	0%
11	Gypsum	305,402	57%	100%	0%	0%
12	Lumber	297,647	60%	86%	11%	3%

[55] https://ndclibrary.sec.usace.army.mil/searchResults?series=WCUS%20-%20Manuscript%20Cargo%20Files
[56] https://ncports.com/wp-content/uploads/2023/11/NC-Ports-Annual-Report-Digital.pdf

Rank	Commodity	Total	Cumulative Share	% Import	% Export	% Domestic
13	Wood Chips	291,643	63%	0%	100%	0%
14	Meat, Fresh, Frozen	282,631	65%	1%	99%	0%
15	Unknown or Not Elsewhere Classified	217,674	67%	1%	99%	0%
16	Manufactured Products NEC	205,545	69%	71%	26%	3%
17	Limestone	191,573	70%	100%	0%	0%
18	Plastics	184,230	72%	60%	40%	0%
19	Sodium Hydroxide	156,649	73%	40%	0%	59%
20	Fabricated Metal Products	156,068	75%	73%	8%	19%
	All Other	2,929,291	100%			
	Grand Total	**11,539,123**				

Source: https://ndclibrary.sec.usace.army.mil/searchResults?series=WCUS%20-%20Manuscript%20Cargo%20Files

4.2.2. Rail

Based on the Surface Transportation Board (STB) Waybill Sample, originating and terminating North Carolina rail freight volumes in 2023 are below 2017 volumes but slightly above 2021 volumes.

The top three rail freight commodities originating in North Carolina in 2023 were stone, sand and gravel, chemicals, and intermodal, while chemicals, nonmetallic minerals, and coal were the top products by tonnage terminating in North Carolina shown in the first three rows of Table 33.

TABLE 33. NORTH CAROLINA RAIL FREIGHT TONS BY COMMODITY (MILLIONS)

Commodity Type	2017		2021		2023	
	Originating in NC	Terminating in NC	Originating in NC	Terminating in NC	Originating in NC	Terminating in NC
Waste and Scrap	4.4	-	0.8	-	0.9	-
Stone, Sand & Gravel	3.9	-	-	-	3.1	-
Chemicals	2.5	6.3	3.3	6.3	3.1	6.7
Intermodal	1.6	-	2.6	-	2.6	-
Lumber/Wood Products	0.9	-	1.1	-	1.2	-
Coal	-	13.9	-	7.9	-	5.8
Nonmetallic Minerals	-	5.1	2.5	3.6	-	3.8
Farm Product/Grain	-	4.8	-	6.2	-	6.4
Food Products	-	3.4	-	3.4	-	3.9
Other	2.7	11.8	2.2	10	3.6	11.3
Total	**16**	**46.4**	**12.7**	**37.5**	**14.5**	**37.8**

Source: 2026 North Carolina Draft State Rail Plan; STB Waybill Sample

To carry this freight in the safest manner possible, the North Carolina State Rail Plan identifies several proposed freight rail improvements:

Freight Rail Access and Capacity

- Class III or short line railroads in North Carolina mostly operate low density rail lines. Revenues from these rail lines do not always entirely support long-term maintenance, particularly because many of the lines were in poor condition with years of deferred maintenance when originally acquired. Many of North Carolina's short line railroads operate at FRA Track Class 1 conditions, meaning that, due to the condition of these rail lines, rail service is limited to no more than 10 miles per hour. Operating at slow speeds over antiquated infrastructure can reduce the efficiency of short line operations. Some sections of railroad operate over FRA Excepted track, meaning that the railroad obtained a waiver from the FRA to not be required to maintain and inspect trackage at FRA Track Class 1 conditions. Most rail lines in North Carolina are able to accommodate industry standard 286,000-lb railcars.

- Business conditions constantly change, and new rail-served industrial sites are often needed. Building rail access to their premises is costly for rail customers. Adding industrial rail access provides public benefits by moving freight off of highways and supports economic development, so the State of North Carolina provides funding for the FRRCSI Rail Industrial Access Program.
- Some rail-served sites can serve as strategic nodes within the rail network, such as mega-sites and multi-modal industrial complexes such as Global TransPark (GTP). A major rail initiative is to add access from GTP to the CSX AA-line, adding a second rail access point beyond the current NS service.
- Truck/rail multimodal facilities enable customers not directly served by rail to benefit from rail service and to benefit from the flexibility of truck while also the low costs of freight rail transportation. North Carolina is studying improvements to the Triad Area Rail Intermodal Freight Facility. North Carolina is also looking for opportunities to support transload facilities, which are non-containerized facilities where freight is transferred between truck and rail.
- North Carolina is investigating improvements to rail access at the Ports of Wilmington and Morehead City. Rail access at both ports is capacity constrained, and the State Rail Plan includes projects to improve on-dock rail access.

Safety

- Incidents and fatalities continue to occur on North Carolina's rail network. The state will continue to improve safety at highway-rail grade crossings through the federal funded Section 130 and through state-funded initiatives. The safest highway/rail grade crossing is one that does not exist, either eliminated through a grade separation or closure. Grade separations are effective, but they are costly. North Carolina prioritizes grade separations for corridors that carry high volumes of trains and/or highway traffic along with the number and severity of incidents at a location.
- One of the largest causes of rail-related fatalities is unauthorized persons on railroad rights-of-way that are struck by trains. Some are suicides, and some are accidents. North Carolina is investigating ways to reduce the incidence of trespasser strikes.

Resiliency

- North Carolina continues to experience frequent, severe weather events, and there is a need for resiliency in the rail network. Adding redundancy can assist resiliency, and two initiatives can add redundancy: restore the 27-mile segment between Wallace and Castle Hayne to provide a second rail route to/from the Port of Wilmington, and restore

the S-Line between Raleigh and north to Virginia, to provide a redundant corridor to the CSX A-Line. Resiliency is particularly important in North Carolina, given the importance of the rail network to military installations in the state.

Rail Corridor Preservation

- Once rail corridors pass through the abandonment process with the U.S. Surface Transportation Board, the rights-of-way are often no longer contiguous, and they are lost as transportation corridors. Once lost, these corridors would be very difficult to reconstruct. North Carolina has a program to preserve rail corridors and permit interim compatible uses of these corridors.

4.2.3. Aviation

The combined traffic of Charlotte Douglas International (CLT), Raleigh-Durham International (RDU), and Piedmont Triad International (GSO) combined traffic accounts for 99 percent of the state's air freight activity (North Carolina Department of Transportation [NCDOT] 2023).

TABLE 34. TOTAL AIR CARGO ACTIVITY IN NORTH CAROLINA (2024)

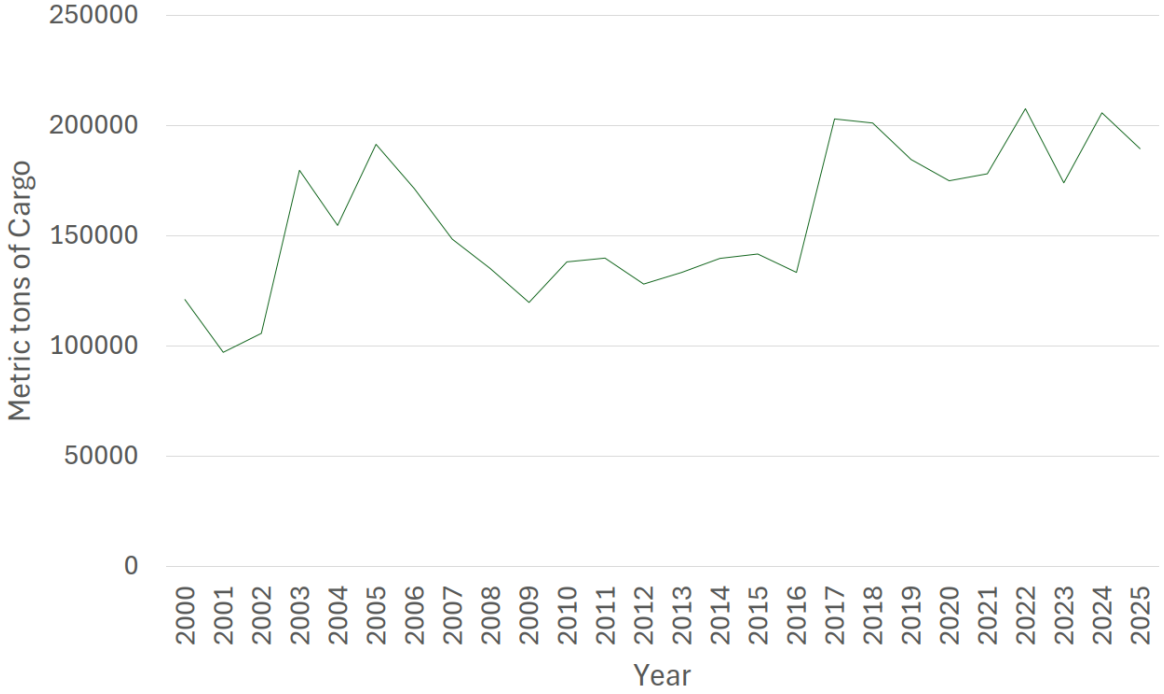
Airport Name	Total Tonnage	% of Total
Charlotte Douglas International (CLT)	209,098	51%
Raleigh-Durham International (RDU)	105,456	26%
Piedmont Triad International (GSO)	87,933	22%
Others	3,549	1%

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, 2024

CLT was the seventh-ranked busiest U.S. commercial airport in 2024 (USDOT, ACI-NA, 2025). CLT offered 188 passenger destinations across the globe with seven major carriers and 15 regional and three non-US air carriers in 2025. CLT acts as a regional hub for FedEx, UPS, and Amazon. In 2024, the airport handled 205,700 metric tons of cargo and in the same seven-month span in 2025, tonnage increased by 14 percent from 2024. Air cargo volumes at CLT have mirrored broader industry

trends, with fluctuations driven by economic cycles, e-commerce growth, and COVID-19 pandemic-related disruptions between 2000 and 2025 (Figure 79).

FIGURE 79. CHARLOTTE DOUGLAS INTERNATIONAL AIRPORT (CLT) AIR CARGO VOLUME (2000-2025) (METRIC TONS)

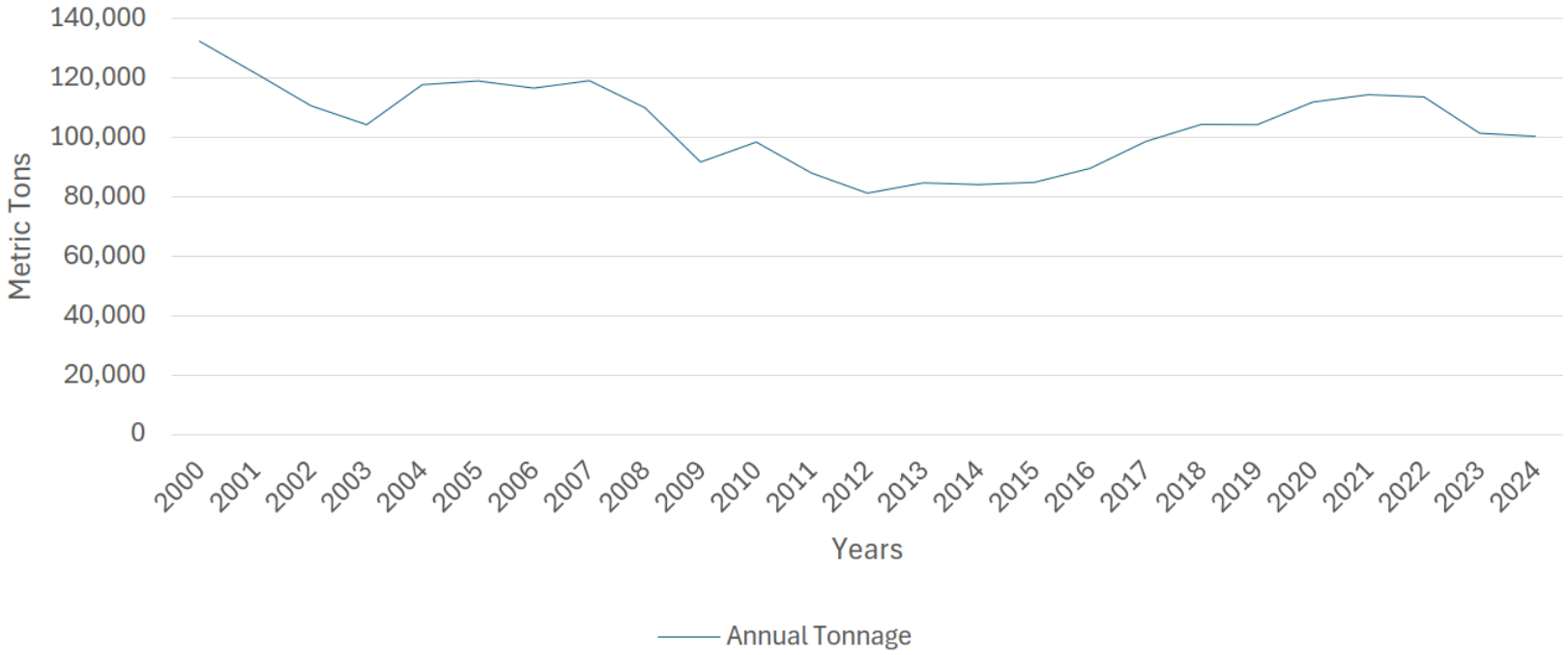


Source: Bureau of Transportation Statistics, 2025.

On average, more than 278 tons of cargo are transported through RDU daily, primarily by cargo carriers, FedEx and UPS and 19 other airlines (belly cargo). RDU is the third-largest air cargo operator in the state with 101,000 tons of cargo processed in 2024. The volume of the peak cargo occurred in 2000, then experienced a 29 percent decline, indicative of the 2009

economic recession. From 2019 to 2024, air cargo tonnage decreased by 4 percent. But from an overall perspective, RDU's air cargo volume has remained relatively flat (Figure 80).

FIGURE 80. RALEIGH-DURHAM INTERNATIONAL AIRPORT (RDU) AIR CARGO VOLUME (2000-2024) (METRIC TONS)

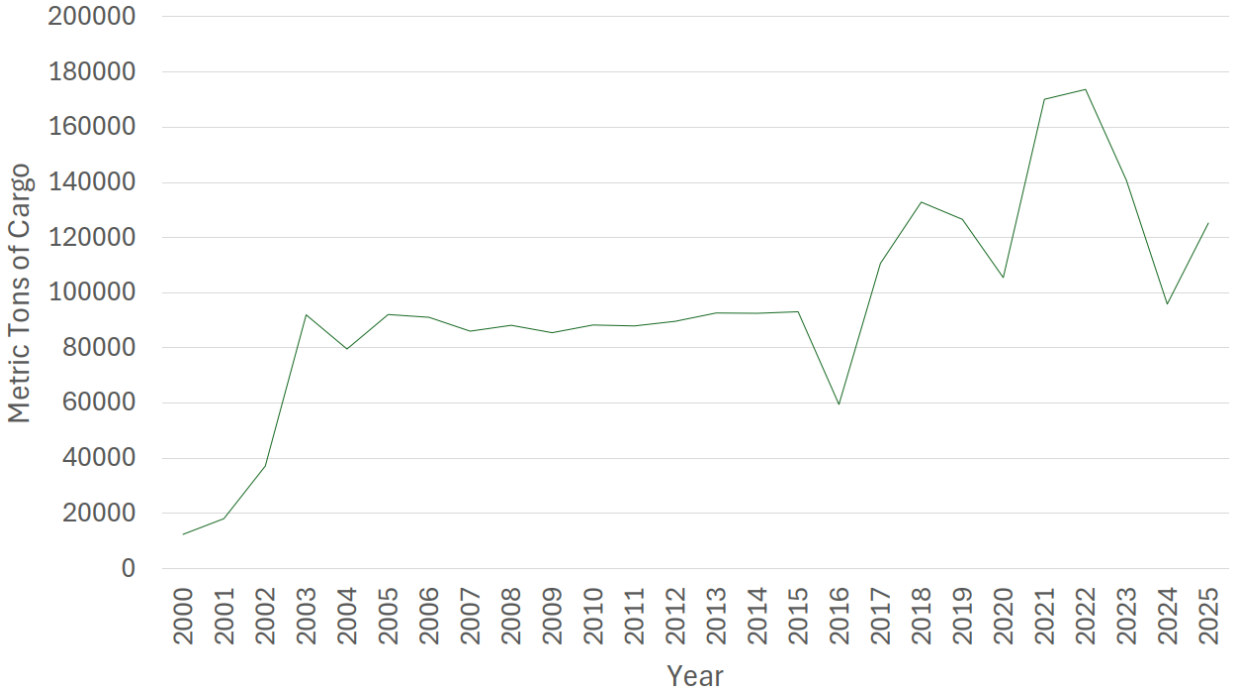


Source: Bureau of Transportation Statistics, 2024.

The second largest air cargo airport in traffic in Norh Carolina is GSO, which acts as FedEx's Mid-Atlantic hub. The air cargo service providers at GSO include FedEx, Mountain Air, DHL Express, TradeWinds, UPS, and belly cargo for passenger airlines. From 2000 to 2025, air cargo at GSO fluctuated significantly. In 2000, overall tonnage was just over 12,000 tons and peaked in 2022 with just over 175,000 tons (Figure 81). The significant increase observed in the early 2000s and the

subsequent annual traffic of about 90,000 tons sustained over the next 12 years or so was driven by the creation of the FedEx Mid-Atlantic Hub at GSO. The 2020-2024 volatility can be explained by the COVID-19 pandemic with an initial collapse of air traffic followed by an intense air freight activity around the boom of e-commerce and the shipment of medical supplies and pharmaceutical products by air.

FIGURE 81. PIEDMONT TRIAD INTERNATIONAL AIRPORT (GSO) AIR CARGO VOLUME (2000 TO 2025) (METRIC TONS)

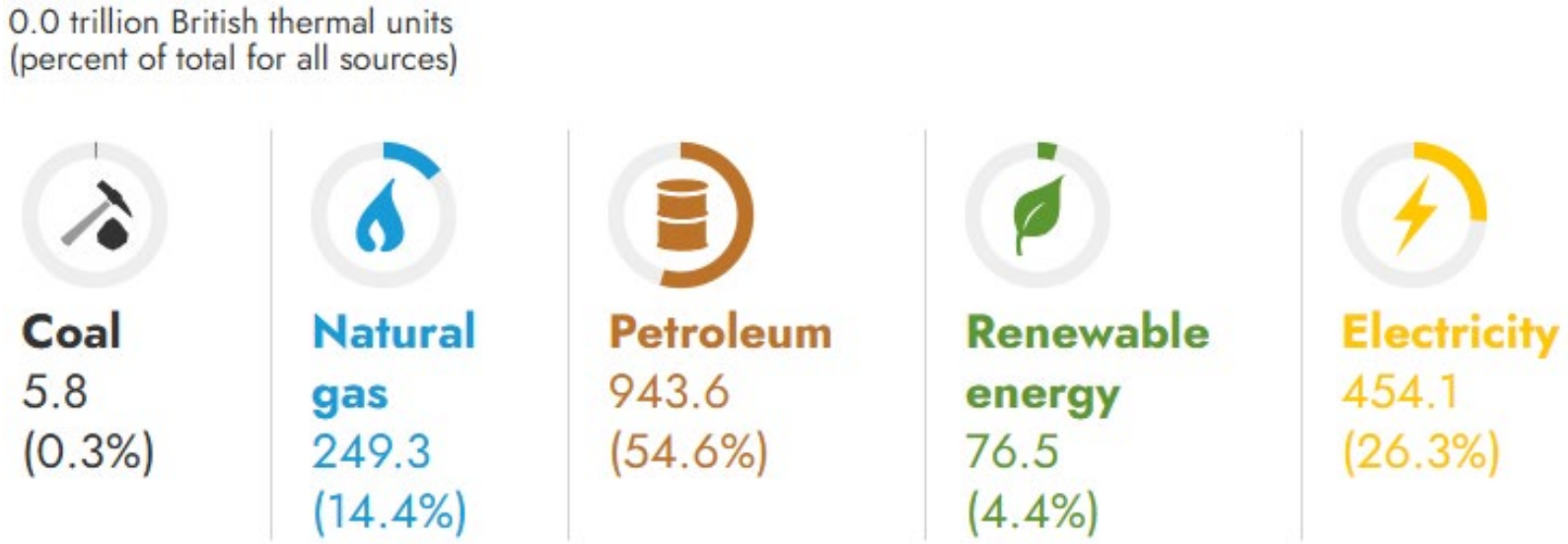


Source: Bureau of Transportation Statistics, 2025

4.2.4. Pipeline Condition and Performance

North Carolina's annual energy consumption of 1.73 quadrillion Btu (quads) in 2023 depended heavily on petroleum (approximately 55 percent), followed by electricity (approximately 26 percent), natural gas (approximately 14 percent), and other sources (Figure 82).

FIGURE 82. NORTH CAROLINA ANNUAL ENERGY CONSUMPTION (2023)

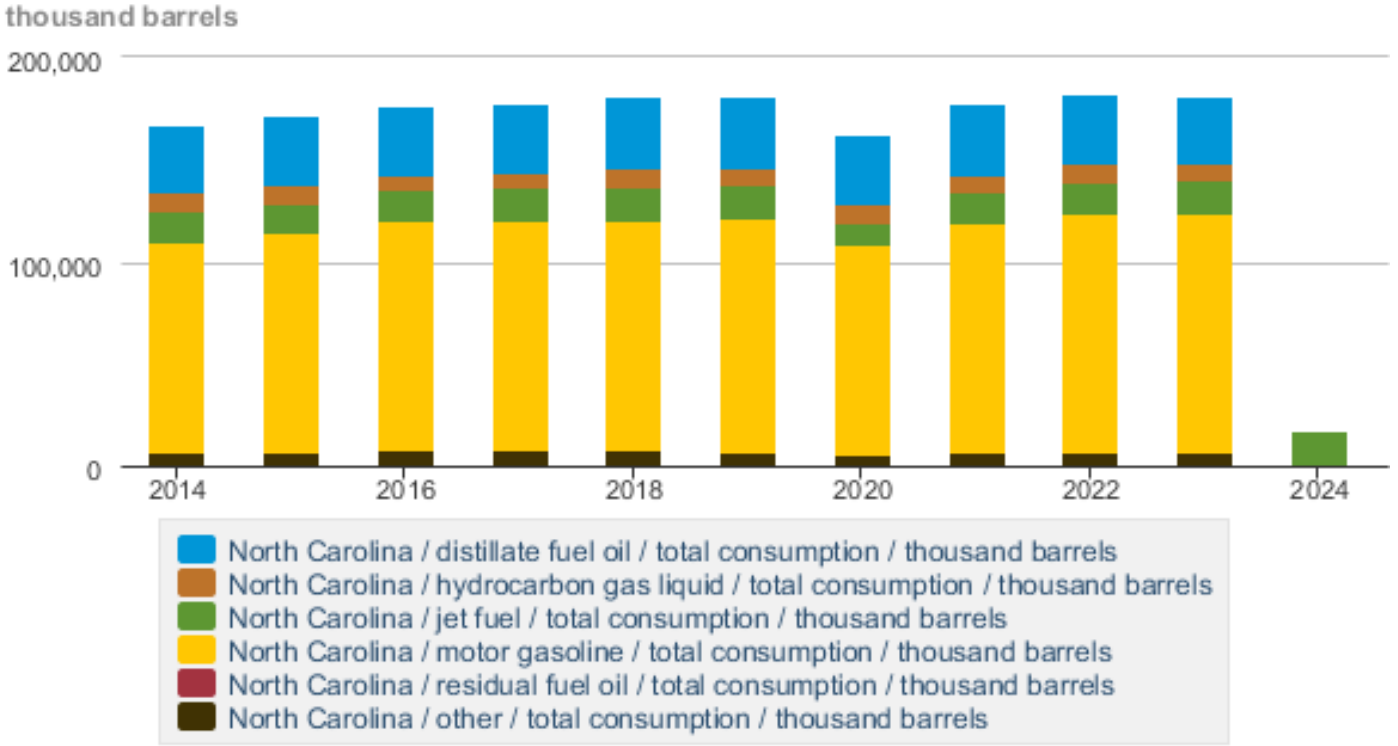


Source: U.S. Energy Information Administration

The 943 trillion Btu of petroleum consumed translates to approximately 185 million barrels of petroleum products annually, which has remained relatively constant since the past decade, except the dip in 2020 caused by the COVID-19 pandemic (Figure 83). However, there has been a steady increase in natural gas consumption in the state which has increased from 500,000 million cubic feet (mmcf) in 2014 to approximately 750,000 mmcf in 2024.[57]

[57] Form EIA-176 Annual report of Natural and Supplemental Gas Supply and Disposition

FIGURE 83. TOTAL ANNUAL PETROLEUM CONSUMPTION ESTIMATES IN NORTH CAROLINA (2014-2024)



Source: U.S. Energy Information Administration, State energy Data System

4.3. Resilience

4.3.1. Overview

Resilience is the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions. From a freight transportation perspective, it translates into a system that "is responsive, able to provide reliable services when it encounters small disruptions and return to service quickly after large disruptions. Disruptions to the transportation system often require the coordinated activities of the public and private sectors to ensure freight transportation flows, both for emergency response and economic recovery. The availability of alternative routes and modes allows shippers to develop contingency plans enhancing their flexibility."[58]

Freight resilience is critical because the freight system underpins economic activity, public safety, and critical routine operations, yet it is highly vulnerable to disruptions that can propagate quickly across regions and modes. Freight networks are complex, interdependent, and increasingly optimized for efficiency rather than redundancy, meaning even localized disruptions can cascade into widespread supply chain impacts. When freight systems lack resilience, disruptions lead to delayed deliveries, increased transportation costs, inventory shortages, lost export competitiveness, and heightened risks to critical goods such as food, fuel, medical supplies, and emergency equipment.

The USDOT Guidance on Multimodal State Freight Plans and State Freight Advisory Committees provides detailed guidance on the contents of a state freight plan. This federal guidance suggests that recommendations associated with supply chain resilience and resilience performance measures should be included as additional considerations in a state freight plan. The USDOT also strongly recommends that states include elements of the resilience improvement plan in their state freight plans. The guidance emphasizes the need to strengthen resilience for critical single points of failure and routes supporting critical goods or areas of proper federal interest.

[58] State of the Practice Scan: Freight Resilience Planning in the Face of Climate-Related Disruption, USDOT, 2022

A more comprehensive take on resilience is encapsulated in the USDOT 2020 National Freight Strategic Plan goals.[59] The NFSP lays out three strategic goals to improve resilience within the freight transportation system. The goals act as a guide to inform and support decision making in freight planning and investments.

- **Safety**: This is USDOT's top strategic goal, aimed at protecting the freight system from natural and human caused disasters and to expedite response and recovery to quickly reestablish the safe movement of people, goods, and services. A subcomponent of this goal addresses the need to protect the freight system from natural and human-caused disasters and improve system resilience and recovery speed.
- **Infrastructure**: This goal acknowledges that targeted transportation investments are needed to improve the efficiency and connectivity of the freight system. The various objectives under this goal focus on ensuring that investments keep pace with growing freight needs, and with freight bottlenecks and chokepoints across our multimodal transportation system.
- **Innovation**: This goal targets achievement of efficiency in freight movement through the development and adoption of innovative freight technologies and innovative business practices.

4.3.2. Challenges

North Carolina's natural geography and climate creates significant challenges for the state's transportation system. North Carolina is regularly affected by the following hazards:

- Hurricanes and coastal storms
- Flooding
- Geotechnical events (landslide, rockslide, rockfall, and embankment failure)
- Winter weather
- Rising sea Levels and coastal erosion
- Heatwaves and drought

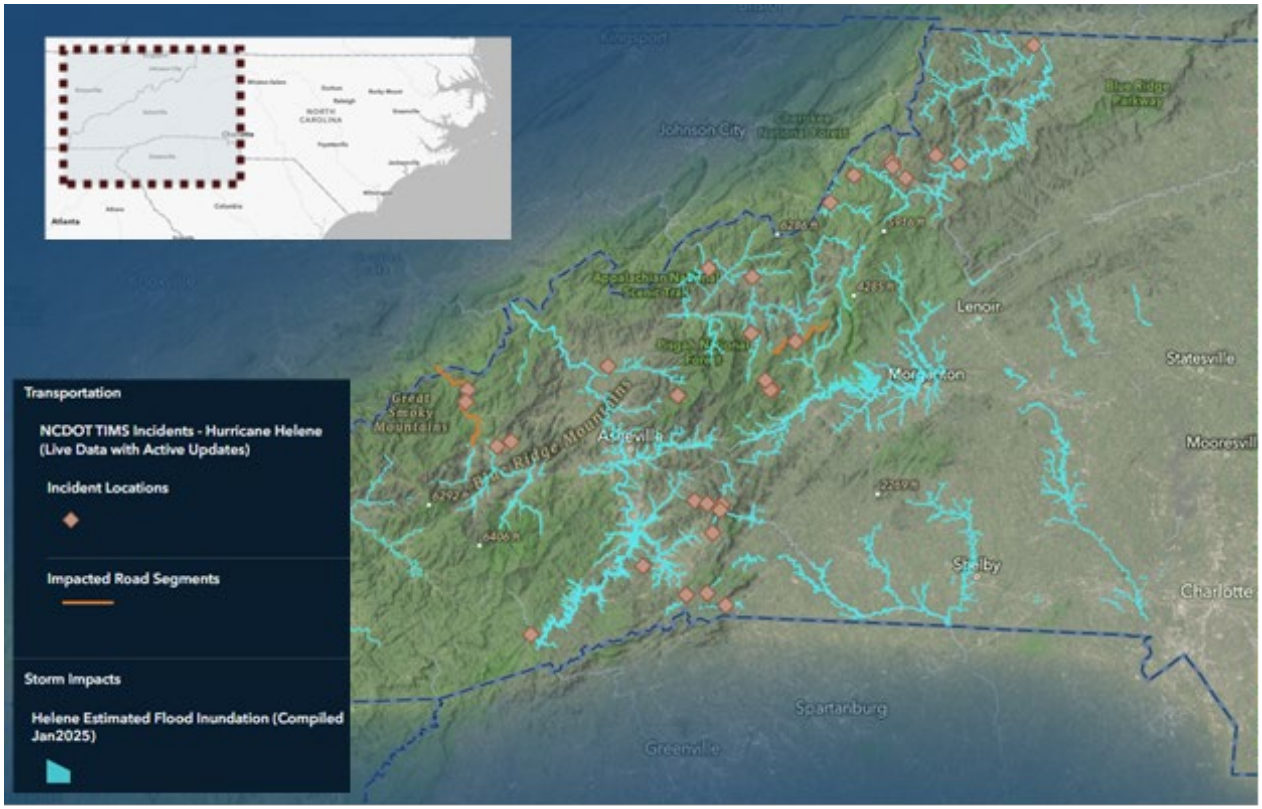
[59] National Freight Strategic Plan (NFSP) | US Department of Transportation

North Carolina has suffered multiple catastrophic events such as flooding from tropical storms and hurricanes including Hurricanes Floyd (1999), Irene (2011), Matthew (2016), Florence (2018), and Helene (2024) that disrupted freight infrastructure by damaging roads and bridges, flooding key corridors, interrupting port and rail operations, and reducing system reliability. North Carolina has also experienced multiple winter storms and coastal snowfall that led to road closures and power disruptions due to ice and freezing rain.[60] [61] Between 2021 and 2025, North Carolina observed drought conditions leading to rainfall deficits, agricultural stress and increased wildfire risk.[62] [63]

Hurricane Helene was the deadliest and costliest natural disaster in North Carolina's recorded history. It produced historic rainfall, catastrophic flooding, and widespread landslides, especially across western and mountainous regions of the state. Hurricane Helene caused 108 fatalities in North Carolina, primarily due to flash flooding and landslides in western counties.[64] Millions of residents experienced prolonged loss of power, water, sewer, and telecommunications services.[65] The storm damaged nearly 9,400 transportation sites, including over 800 bridges and with hundreds of culverts damaged or destroyed. About 1,400 state-maintained roads underwent closure during the disaster event. [66] Some of the most heavily damaged routes included portions of I-40 along the Pigeon River Gorge, US 19 West, US 64/74 near Chimney Rock, NC 197 near Pensacola, and US 64 and 74A. Landslides and slope failures severed critical highway and rail access, limiting freight mobility and delaying emergency response and recovery logistics.[67] The total estimated damage and recovery needs in North Carolina exceed $59.6 billion, including $44.4 billion of direct damage, $9.4 billion of indirect or induced damage, and $5.8 billion of potential investments for strengthening and mitigation. Transportation, utilities, housing, and agriculture accounted for nearly 90 percent of the damages.

60 Significant Weather & Climate Event Archive for Southeast NC & Northeast SC, 2026.
61 A look back at storm impacts for NC in 2025, Spectrum News 1, 2025.
62 2021-2022 NC Drought Management Advisory Council Annual Report, NC Department of Environmental Quality, 2022.
63 North Carolina's Weather Rollercoaster: From Drought to Record Floods – The Carolinian Newspaper, 2025.
64 One Year After Helene, New Perspectives on Our Worst Storms | North Carolina State Climate Office, 2025.
65 Hurricane Helene Damage and Needs Assessment, Office of State Budget and Management (OSBM), 2024.
66 TRIP Report Examines Hurricane Helene Impact on Western North Carolina Roads, Bridges, and Rail - Construction, 2025.
67 Study, Columbia Climate School, 2025.

FIGURE 84. NORTH CAROLINA STATE EMERGENCY RESPONSE TEAM (SERT) MAP SHOWING HURRICANE HELENE INCIDENT LOCATIONS AND ESTIMATED FLOOD INUNDATIONS



Source: Helene Retrospective, SERT, 2026

Freight is a critical backbone for North Carolina's economy. Disruptions to the freight network result in economic losses, supply-chain failures, public safety issues, and community impacts. Resiliency of the freight transportation network ensures that goods can continue to move before, during, and after disruptions caused by weather, infrastructure failure, labor shocks,

or geopolitical and market stresses. Resilient networks ensure that freight industries can switch from impacted routes, shift modes, or operate with partial capacity without experiencing complete system failure during disruptions. Additionally, resilience means that no one mode becomes a single point of failure, and that disruptions in one mode do not create cascading impacts across the freight network. The RIP is critical in identifying the current and future climate adaptation initiatives in North Carolina's transportation sector, underpinned by climate resilience planning that builds on earlier vulnerability and risk assessments to enable informed, data-driven investment decisions.

North Carolina is both a mountainous and coastal state furnishing global trade, military bases, major freight terminals, agricultural and natural resources of significant value, which will greatly benefit by embracing and employing resiliency. Measures aimed at ensuring resilience are critical in protecting public safety, reducing life cycle expenditures and aligning with state and federal goals and strategies. Accounting for disruptors beyond the traditional weather-based events is especially critical today.

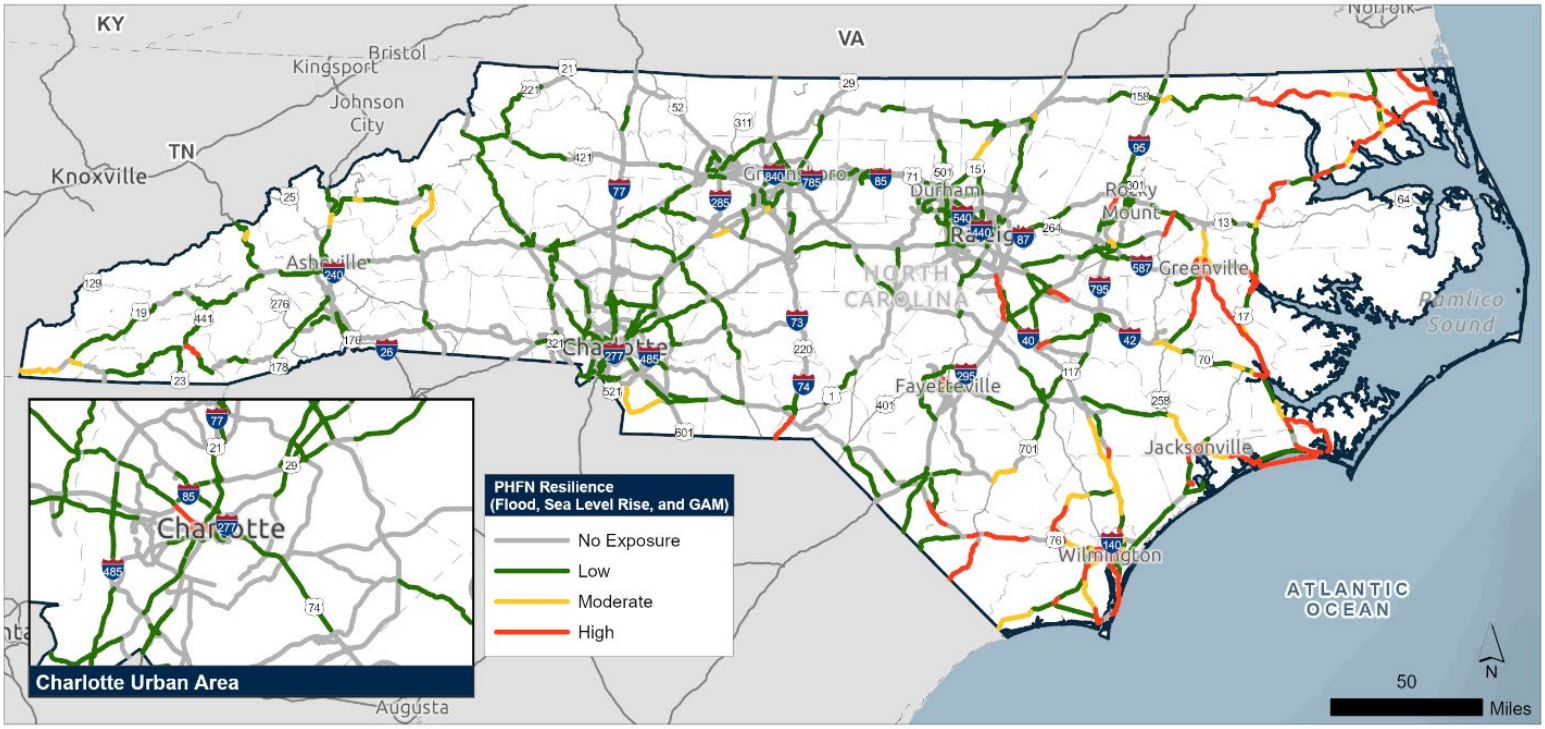
4.3.3. Resiliency Analysis

Process Steps

This analysis utilizes NCDOT's 2024 Resiliency Improvement Plan (RIP) parameters and results to characterize the resilience priority of freight assets from the North Carolina Priority Highway Freight Network (PHFN).

Figure 85 maps the exposure levels of the PHFN to various hazards that make up the exposure index. These segments are predominantly in the eastern parts of the state, driven by exposure to sea level change and coastal flooding. In addition, there are small key segments in the western mountainous parts of the state, exposed to landslides. Finally, there are smaller segments in and around Charlotte.

FIGURE 85. PRIORITY HIGHWAY FREIGHT NETWORK'S EXPOSURE



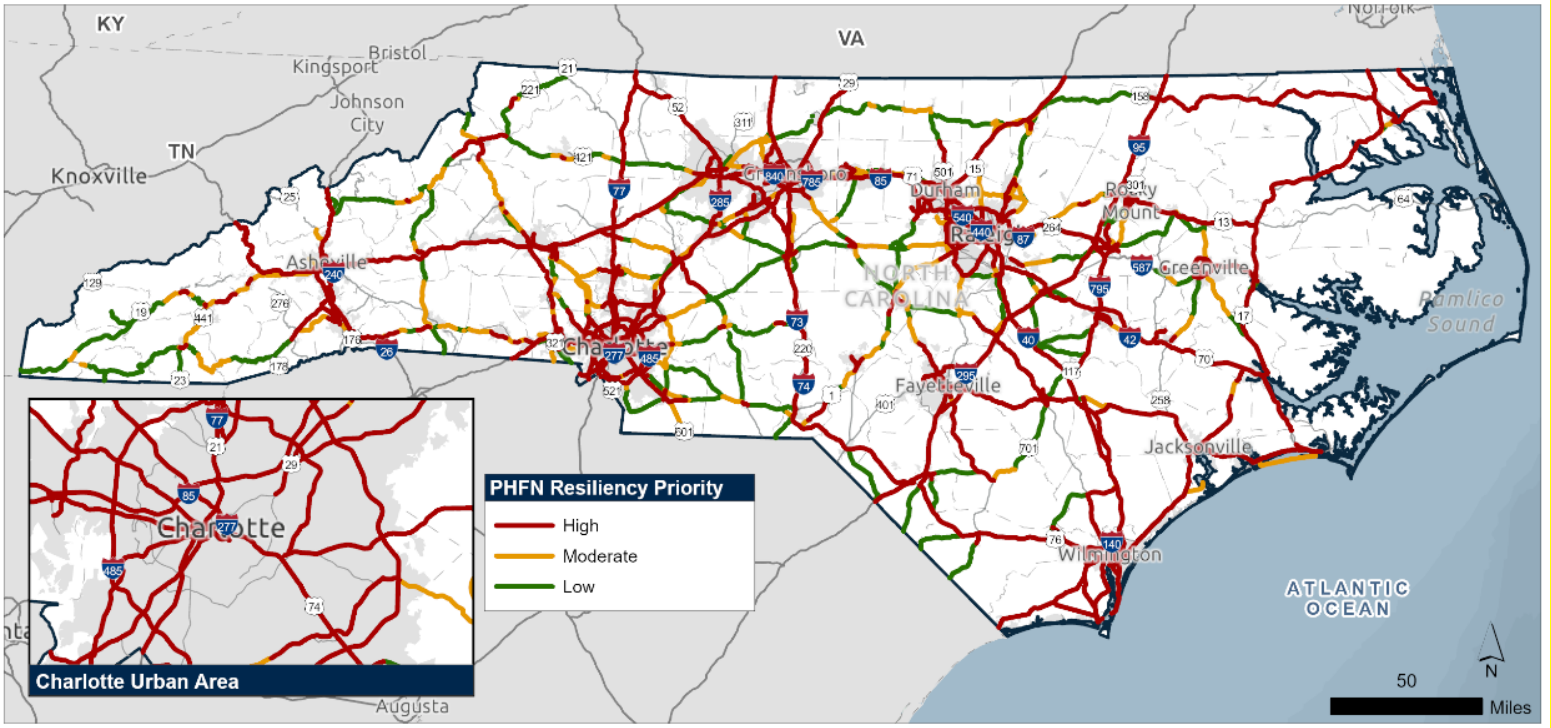
Source: Developed by Cambridge Systematics based on NCDOT Resiliency Improvement Plan

Table 35 and Figure 86 classify the PHFN by various criticality levels. These high criticality segments include most of the state's interstate network. It is spread across the state, concentrating around major urban and freight centers. A third, or 33 percent of the network, is either low or not critical. These sections are still part of the PHFN as they are within a two-hour travel shed of a major freight terminal.

TABLE 35. CRITICALITY OF THE PRIORITY HIGHWAY FREIGHT NETWORK

Criticality Level	Length (miles)	Percent
High	3,693	53.2%
Moderate	953	13.7%
Low	1,391	20.0%
NA	906	13.1%

FIGURE 86. CRITICALITY OF THE PRIORITY HIGHWAY FREIGHT NETWORK



Source: Developed by Cambridge Systematics based on NCDOT Resiliency Improvement Plan

Combining these metrics provides an overall resilience score ranging from 3 to 11. As seen in Table 36, a large part of the network, over 70 percent, has low or no resilience priority index, i.e., a lower resilience risk. However, about 29 percent, or 2,030 miles, are at moderate or high priority, or higher risk of loss or damage. This covers 338 high and moderate-risk bridges as well.

TABLE 36. RESILIENCE NEEDS (RISK) OF THE PRIORITY HIGHWAY FREIGHT NETWORK

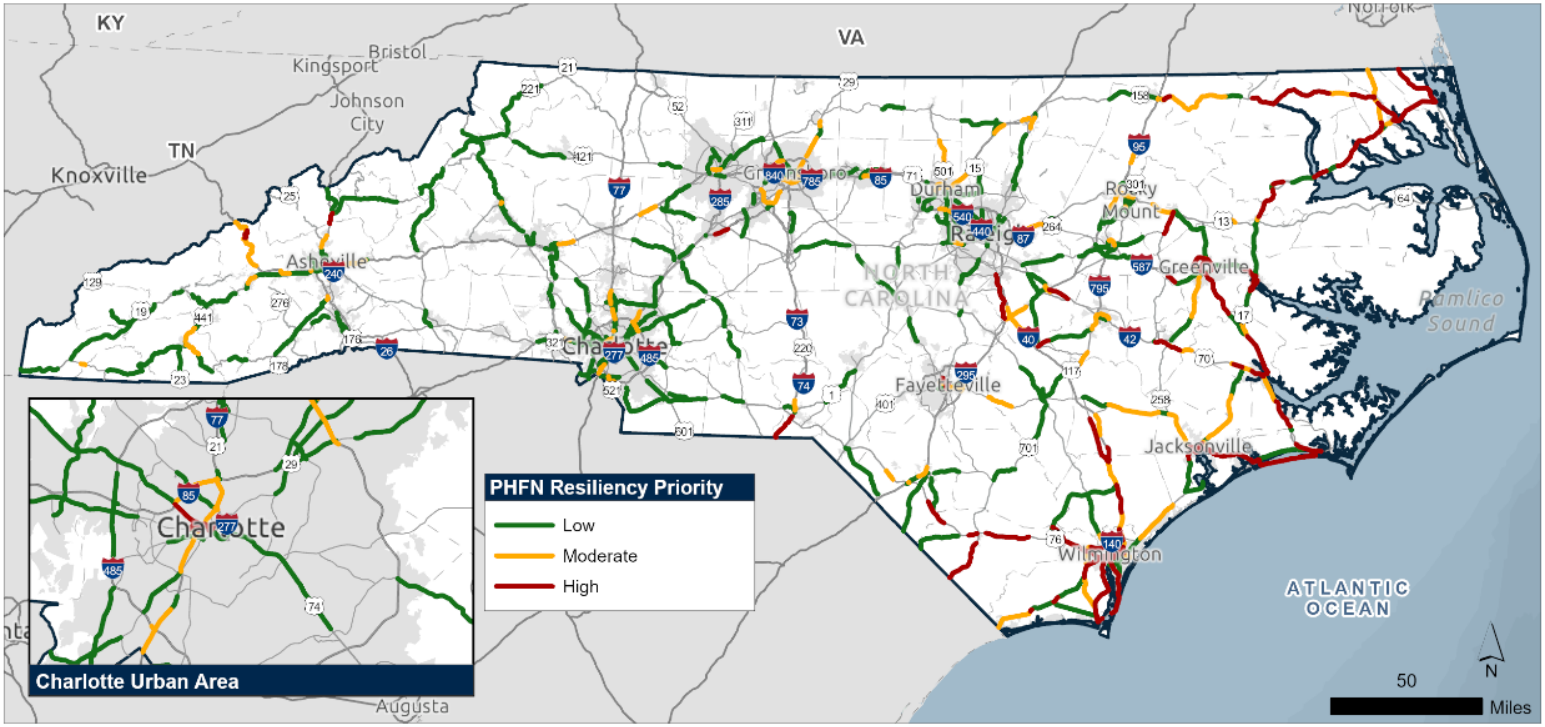
Resilience Priority	Length	Share of PHFN length	No. of Bridges
High (priority index of 7 - 11)	533	7.7%	209
Moderate (priority index of 5 - 6)	1,497	21.5%	129
Low (priority index of 3 - 4)	881	12.7%	29
Other	4,031	58.1%	

Table 37 and Figure 87 show where high and moderate-risk segments are located across the state. The highest risk scoring segments are east of I-95 along the coast, driven by risk of coastal flooding and sea level change. This region is discussed in detail in the next section (Critical Corridors). Segments in the central and western parts of the state are driven by their significance to the freight system. The RIP was published in April 2024, before Hurricane Helene hit western North Carolina in September. Additionally, the RIP does not measure drought or heatwave exposure risk, which were observed especially in the west in 2025-2026. While these are also high-risk segments, utilizing the RIP, they are smaller in number and coverage relative to those along the coast and should not be compared to each other In the Piedmont region, the highest risk segments are on I-85, specifically between High Point and Greensboro and north of Raleigh. In the western mountains, the high-risk segments are concentrated along I-26 and I-40.

TABLE 37. HIGH RESILIENCY RISK PRIORITY SEGMENTS WEST OF I-95

Rank	County	Route	Miles
1	Johnston	NC 27	15.8
2	Richmond	US 1	9.5
3	Granville	I-85	7.4
4	Haywood	I-40	7.0
5	Madison	I-26	6.5
6	Nash	I-95	6.4
7	Davidson	I-85	4.3
8	Mecklenburg	U. 29	3.3
9	Cumberland	NC 210	3.0
10	Cumberland	US 401 BUS	3.0
11	Mecklenburg	NC 27	2.9

FIGURE 87. RESILIENCE IMPROVEMENT PLAN ANALYSIS OF THE PRIORITY HIGHWAY FREIGHT NETWORK



Source: Developed by Cambridge Systematics based on NCDOT Resiliency Improvement Plan data.

Breaking down the same by highway type, it is seen that of the 533 miles of the high-resilience risk routes, 362 miles are U.S. highways while only 38 miles are interstates. This pattern may reflect, in part, the higher design standards typically associated with interstates, while also suggesting that coastal U.S. highways can be more exposed to extreme weather impacts. See Table 38.

TABLE 38. PHFN RESILIENCE IMPROVEMENT PLAN PRIORITY BY HIGHWAY ROUTE TYPE

	Interstates	Off-Interstate Business Marker	U.S. Highways	State Routes	Others	Total
High	38 *(7%)*	0 *(0%)*	362 *(68%)*	131 *(25%)*	2 *(0%)*	**533** ***(100%)***
Moderate	271 *(18%)*	7 *(0%)*	845 *(57%)*	339 *(23%)*	36 *(2%)*	**1,497** ***(100%)***
Low	0 *(0%)*	0 *(0%)*	674 *(77%)*	194 *(22%)*	13 *(1%)*	**881** ***(100%)***

Summary of Results

- In terms of **criticality** (e.g., importance to have available), **53.2 percent of PHFN mileage is considered high**, 13.7 percent moderate, and 33 percent low or not critical but still important for freight facility connections.
- PHFN **exposure risk** is concentrated in two areas: **eastern/coastal North Carolina** (driven by coastal flooding and sea level rise), and **western North Carolina** (with smaller but important segments exposed to landslides and geotechnic risk).
- Approximately **8 percent** of the 6,942-mile PHFN is considered at **high priority for resilience improvements** including 209 high-risk bridges. U.S. highways make up 68 percent of this high-resilience risk mileage. Most resilience impacts are corridor-scale: high-risk segments consolidate into a small set of high-priority corridors, including longer coastal corridors (US 74, US 17, NC 24, eastern I-40) and shorter western and central corridors.
- Coastal rail corridors (CSX and Norfolk Southern) east of I-95 also show elevated risk; this is concerning because rail is a potential alternative when roads are closed.

Other Risks to the Freight Network

- Human-caused risks can disrupt freight without physically damaging infrastructure by reducing **capacity, reliability, safety/security, and decision-making effectiveness**, often with cascading, multi-modal impacts.

- **Government shutdowns** can create clearance and regulatory bottlenecks (e.g., reduced staffing for secondary cargo reviews), increasing dwell times and risking spoilage for time-sensitive goods such as perishables and pharmaceuticals.
- **Artificial intelligence** may improve logistics efficiency but introduces operational risks (design/sensor/software failures, reduced situational awareness, biased decision-making, and brittleness in over-optimized systems) that can affect freight reliability and safety.
- **Cybersecurity** is now a core freight resilience issue: ransomware, cargo theft/fraud, third-party exposure, and vulnerabilities in connected/Internet of Things (IoT) systems can directly disrupt physical freight movement and prolong recovery.
- **Labor strikes** can quickly reduce throughput at ports/terminals and create backlogs that persist after operations resume; even short disruptions can affect statewide supply chains and disaster response logistics.
- **Energy blackouts** can halt port, intermodal, and warehousing operations; disrupt fuel pumping/payment and terminal equipment; and cause cascading delays and spoilage risks – highlighting the importance of backup power and continuity planning for critical freight nodes.
- **Pandemics** can constrain freight through workforce shortages and health protocols across modes, shifting congestion patterns and stressing capacity even when infrastructure remains intact.
- **International trade shifts** can redistribute freight flows faster than infrastructure and labor systems can adapt, complicating investment assumptions and increasing vulnerability to volatility.

Table 39 lists the disruptors and their impact on the freight industry.

TABLE 39. SUMMARY OF NON-TRADITIONAL DISRUPTORS AND THEIR IMPACTS ON THE FREIGHT INDUSTRY

Disruption Type	Impact Characterization
Government shutdowns	✓ Reduced federal staffing affects port inspections, customs clearance, permitting, and freight funding approvals. ✓ Increased border dwell times and uncertainty for import/export flows.
Artificial Intelligence (AI)	✓ Operational risks from algorithmic errors or biased decision-making in routing, pricing, or demand forecasting. ✓ Overdependence on automation reduces human override capacity to assess operational risks. ✓ Workforce disruption due to skills displacement. ✓ Data quality issues affecting supply chain decisions.
Cybersecurity Threats	✓ Disruptions to terminal operations, rail signaling, trucking dispatch, and supply chain IT systems. ✓ Risk of data breaches, ransomware, and operational shutdowns. ✓ Cascading impacts across intermodal networks due to system interconnectivity.
Labor Union Strikes	✓ Temporary shutdown of ports, rail lines, warehouses, or trucking operations. ✓ Congestion and backlog leading to ripple effects across supply chains. ✓ Increased costs and transit time variability.
Energy Blackouts	✓ Interruptions for port cranes, warehouse operations, fueling systems, and traffic management systems. ✓ Disruptions to fuel supply and electrified freight systems. ✓ Network-wide slowdowns due to loss of ITS and communications infrastructure.
International Trade Shifts (Tariffs, Geopolitics)	✓ Changes in trade flows, port volumes, and commodity demand. ✓ Supply chain reconfiguration (reshoring, nearshoring) causing network imbalances. ✓ Increased volatility in shipping costs and routing patterns.

These risks tend to reduce system capacity, safety, security, reliability, and decision-making effectiveness over extended periods, complicating recovery and resilience planning.

5. Trends, Scenarios, and Future Performance

This section of the plan bridges from current conditions to change drivers and potential futures, and includes an overall assessment of:

- General / system-wide freight trends
- Results from a formal Scenario Planning exercise to identify potential future conditions and associated changes in economic and transportation performance
- A stakeholder-driven Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis that considers current and future conditions at the regional level

Together, these analyses provide a foundation for the recommendations presented in Section 6.

5.1. General Freight Trends

5.1.1. Supply Chain Disruption and Risk Management

Across the United States, communities depend on the reliable delivery of goods to support manufacturing industries, as well as household necessities like food and medicine. Supply chains rely on “just-in-time” strategies to deliver goods right as they’re needed, and while this approach helps businesses reduce costs by improving efficiency and minimizing inventory needs, it also makes the supply vulnerable to disruptions that can ripple through the system, creating delays and shortages.

Supply chain disruptions can generally be categorized in two ways: localized disruptions, such as severe weather events that cause closures, and global disruptions, including international trade policies or public health crises such as the COVID-19 pandemic that have far-reaching and often longer-lasting impacts on goods movement patterns. For example, the pandemic created massive labor reductions at factories, ports, and warehouses, the effects of which rippled through the global and national supply chain, creating shortages, right when demand for direct-to-consumer deliveries was spiking.
Uncertain or changing global trade policies, wars, or other long-term disruptions can cause companies to change where materials are sourced, where manufacturing or assembly occurs, and thus, from where and by what modes and routes the

products that North Carolina's economy and consumers need are transported to them. They can also affect the reliability of the supply chain to deliver goods just-in-time.

North Carolina's economy has deep ties in global trade, and imports and exports are key facets of the state's manufacturing sector in particular. North Carolina exported $42.8 billion worth of goods in 2024, with agricultural and pharmaceutical products at the top of the list in value, followed by aerospace products, engines and turbines, general machinery, and basic chemicals. North Carolina also relies heavily on imports, to the tune of $87.6 billion worth of goods in 2024. The largest share of those imports represented inputs to the pharmaceutical and medicines industry in North Carolina.[68]

Further, North Carolina is no stranger to disruptions associated with severe weather events. Hurricanes have impacted coastal and western regions of the state in recent years; and winter storms, nor'easters, and other events can impact and disrupt the movement of goods on a temporary basis.

To address these impacts, many companies are investing in building redundancy into their supply chains, such as by tapping multiple materials or production locations, in some cases by making efforts to manufacture more products domestically, and by expanding their capacity to hold inventory in the event of shorter-term disruptions. Red Bull, for example, is investing $1.5 billion to open a bottling plant near Charlotte to improve its domestic supply chain and expand its U.S. production capacity.[69] Similarly, Johnson & Johnson pharmaceuticals is expanding its presence in the City of Wilson with $2 billion investment in manufacturing over the next 10 years.[70] These actions could lead to increased demand for manufacturing, warehousing, and distribution facilities.

5.1.2. Global Supply Chain Dynamics

North Carolina has deep ties in global trade and relies heavily on exports and imports that generate far-reaching economic benefits. The state's key industries like agriculture, mining, construction and manufacturing are vulnerable to national trade policy and tariffs, and as such rising costs and changing policies can introduce volatility into the state's economy.

68 NC Department of Commerce (accessed February 2026)
69 NC has more miles of state-supported roads, except for Texas | wcnc.com (accessed February 2026)
70 Governor Stein Announces Johnson & Johnson Second Major Facility | NC Governor (accessed February 2026)

North Carolina is one of the largest exporters of tobacco, pork, and broiler meat and a significant player in the cotton, soybean, tobacco, and corn industry in the United States and as such, trade shifts create significant impacts in the state.[71] Consequences for farmers are expensive; trade shifts mean farmers lose orders and end up with overflowing reserves.[72]

Up until 2023, most of North Carolina's trade activity was recovering gradually from COVID-19 pandemic disruptions and was exhibiting solid overall growth. Yet volatile trade policy since 2025, including tariffs between U.S. trading partners, has mitigated this growth. Sectors such as pharmaceuticals, transportation equipment, electronics, and machinery are especially exposed due to their reliance on global supply chains. Major manufacturers based in North Carolina like Toyota, Caterpillar and Bridgestone face rising input costs from tariffs, potentially disrupting the supply chains for their respective industries.[73] Tariffs also threaten North Carolina's massive pharmaceutical industries that have invested heavily in the state and catalyze various supply chains based on direct manufacturing needs and distribution networks. [74] For consumers, the tariffs have resulted in rising prices on nearly everything from heavy machinery to household products.[75]

Tariffs from partner countries have particularly affected North Carolina's agricultural markets. In 2018, the United States levied 25 percent tariffs on Chinese imports. China retaliated by imposing 25 percent tariffs on American soybeans as well as corn, wheat, poultry, and beef. [76] This retaliation resulted in a drop in U.S. soybean exports to China. In 2018, U.S. soybean exports to China fell to 8.2 million metric tons, roughly 22 million metric tons less than the prior four-year average.[77] North Carolina was deeply affected not only due to its large soybean producing industry but also due to the ripple effects of the tariffs into the integrated supply chain of the soy-fed pork and poultry industry. Chinese tariffs on American pork had lasting impacts across the supply chain, which affected processors, truckers, and feed suppliers. U.S. pork exports to China fell from 172,550 metric tons in 2017 to 151,900 metric tons in 2018 (i.e., 12 percent drop in volume).[78] Hog inventory for 2018 amounted to 74.6 million heads (up 2 percent from 2017) and the largest inventory since 1943.[79] North Carolina recorded a 3 percent drop in

71 State Agricultural Trade Data - Annual State Agricultural Exports | Economic Research Service, 2025.
72 How tariffs once again threaten North Carolina farmers, *Center for Food, Power, and Life, John Locke Foundation*, 2025.
73 Steel tariffs rattle North Carolina's auto sector, The Carolina Journal, 2025
74 North Carolina booked over $10 billion in life sciences investments in 2024 | North Carolina Biotechnology Center, NC Biotechnology Center, 2025
75 How Tariffs Are Affecting Prices in 2025 | St. Louis Fed, 2025
76 How Has China Responded to the Tariffs it Placed on American Soybeans? | Yeutter Institute | Nebraska, 2019
77 Reshuffling in Soybean Markets following Chinese Tariffs, Federal Reserve Bank of Kansas City, 2020
78 Livestock and Meat International Trade Data | Economic Research Service,2025
79 The effects of tariff rates on the U.S. economy: what the Producer Price Index tells us: Beyond the Numbers: U.S. Bureau of Labor Statistics

pork exports to China, dropping from 33,840 metric tons in 2017 to 32,785 metric tons in 2018.[80] China was North Carolina's top market for the state's flue-cured tobacco; tobacco leaf exports dropped from $162 million in 2017 to $4 million in 2018.[81] The tariffs have also caused major supply chain impacts and revenue losses for other agricultural products like cotton, corn, wheat, sorghum, and meat poultry, all of which North Carolina produces.

Tariffs have raised costs, disrupted supply chains, and weakened export competitiveness for many of North Carolina's manufacturers. The imposition of tariffs by and upon the U.S. has continued through 2025 and since, with changeable charges and court rulings affecting a wide variety of products and creating an unstable environment for business and economic planning. As the state moves forward, policymakers and planners need to prepare to handle uncertainty amidst policy pivots that impact trade and supply chains.

5.1.3. Severe Weather Disruptions and Impact on Freight

Severe weather uncertainties are a common denominator for damage to infrastructure and disruptions to freight movement and operations. Being a coastal state, North Carolina is vulnerable to coastal flooding and tropical hurricanes, as well as to droughts. Coastal infrastructure is particularly vulnerable, as increased frequency of flooding deeply impacts the condition and life span of the infrastructure. North Carolina's seaports and nearby waterways are especially vulnerable to sea-level rise, storm surge and saltwater intrusions. These events cause damage to docks, terminals, and access roads and affect the reliability of maritime freight operations.[82] Future expansion projects to support the increased needs of the various supply chains that are using the multimodal freight network can exacerbate the impacts of these events as well.

An increase in the frequency and intensity of precipitation can lead to inland flooding affecting railways, highways, and secondary freight corridors. Precipitation generated from hurricanes (Dorian, Florence, Matthew, Michael, and Helene), from nor'easters (strong coastal storms with winds from the northeast), or from other weather systems like thunderstorms can trigger flash floods, landslides and washouts, which can result in widespread closure of key roadways and rail lines.[83] In 2018, Hurricane Florence produced the heaviest rainfall in North Carolina history. It was the wettest year in 125 years of recordkeeping. The coastal and inland storm events that followed the hurricane necessitated detours that bypassed entire

[80] USA Trade Online, State Exports by HS Commodities for 0203 Meat of Swine(pork), Fresh, Chilled or Frozen, 2017 – 2025.
[81] The Impact of Tariffs on North Carolina's Economy | NCFP, 2025.
[82] Impacts Of Climate Change and Stormwater on Freight Planning – Draft | NC Department Of Transportation, 2022.
[83] Once-in-a-generation floods hit North Carolina mountain railroads | Chase Gunnoe (Trains), 2024.

regions, stressing highways not originally designed for sustained diverted freight traffic. In 2024, Hurricane Helene brought 10 to 14 inches of rain to western North Carolina, which led to traffic disruptions on I-40, I-26, and US 64. Record rainfall led to flooding and landslides that damaged mountain-region rail lines and roads and washed out bridges, prompting service suspension, debris cleanup, structural inspections, which rerouted and delayed shipments and increased operational risk by rail and highway. A portion of I-40 near the Tennessee line was swept away and is still being rehabilitated today. Hurricane damage so far inland was atypical and points to future uncertainty in extreme weather risks.

Droughts and extremely dry spells can accelerate pavement deterioration. Dry conditions cause soil shrinkage under roads, which lead to cracks and uneven surfaces. Prolonged droughts can increase wildfire risk in forested areas. Western North Carolina is especially vulnerable to wildfire risks, which can close highways and rail lines, force detours, and raise freight costs. In mid-2024, drought affected 99 of North Carolina's 100 counties. Droughts can also trigger water restrictions in municipalities, leading to deep agricultural losses for producers. The 2025 spring corn season showed hundreds-of-millions of dollars in yield losses due to dry, sandy soils that drain moisture quickly.[84] Poor pastures and hay production caused by droughts affected livestock producers and resulted in losses throughout the supply chain.[85,86,87] The large water requirements of data centers are another concern, potentially leading to disputes over limited resources.

5.1.4. Technology and Automation

Among the many technological advancements and deployments that may impact goods movement in the years and decades to come, warehouse automation and autonomous vehicle technologies could have significant impacts on the siting, sizing, design, and operations of facilities that generate or handle freight.

Warehouse Automation

Warehouse automation refers to a combination of technologies and processes that facilitate the movement of products into, within, and out of warehouses and distribution facilities with minimal human assistance. Autonomous robots and sensors are key elements of these technologies. While these technologies require a significant upfront investment, the companies that

84 Farmers issue warning as deepening crisis threatens crops: 'There is increasing concern', Salette Cambra (thecooldown.com), 2025.
85 Drought and Cattle: Implications for Ranchers, Federal Reserve Bank of Kansas City, 2023.
86 Livestock, Dairy, and Poultry Outlook: March 2023, USDA Economic Research Service, 2023.
87 U.S. beef cow inventory settling at progressively lower levels, drought contributing to most recent declines | USDA Economic Research Service, 2023.

operate the facilities benefit from longer-term cost savings, both in reduced human labor costs and increased facility efficiency, including:

- Facility layout efficiency: Product can be stacked higher, aisles can be narrower, and more product can be stored and processed in a smaller physical footprint compared to traditional facilities; and
- Faster and safer material processing or order fulfillment with fewer errors.

The increased throughput and efficiency associated with warehouse automation can lead to greater freight volumes being generated per square foot, and/or a potential for the market to produce smaller buildings to handle projected volumes of goods. The effect can be warehouses located closer to population centers with higher intensity of truck activity.

Employment associated with warehousing and distribution may be reduced. As more functions inside an industrial building are automated and the need for human labor is reduced, fewer jobs will be generated in this sector. This would diminish one of the benefits developers and community leaders cite when trying to gain the support of elected officials, planning and zoning boards, and the public. Reducing this benefit could make community acceptance of these facilities more difficult to achieve.

Automation of warehousing and distribution centers has been happening in North Carolina over several years. In 2020 Amazon opened a fulfillment center in Garner that has the capacity to process 600,000 packages daily with the assistance of 4,300 employees and robots that are used to stow and retrieve items.[88] At the Macy's fulfillment center in China Grove, robots are used to pick products from storage shelves and automated conveyor and sortation systems are used to move parcels to the appropriate processing areas within the facility.[89]

Alternative (and Autonomous) Delivery Methods

Last-mile deliveries represent as much as 50 percent of the total end-to-end logistics cost for e-commerce shipments, and a substantial cost for other types of goods movement. Factors such as metropolitan area congestion, remote customer

[88] Gordon, B. (2025). "At Amazon's massive Triangle warehouse, metrics drive workers and robots alike," The News & Observer. (August 3). https://www.newsobserver.com/news/business/article309086680.html (accessed February 11, 2026).

[89] Warehouse Automation AI. (n.d.), "Inside Macy's New Highly Automated Fulfillment Center," https://www.warehouseautomation.ca/news/macys-new-automation-facility-tdhma-zknnj (accessed February 11, 2026).

locations in rural areas, fuel, labor, unsuccessful delivery attempts, and difficulty finding parking and loading zones contribute to the high cost of making deliveries to business and residential customers.

The industry continues to develop solutions to address these factors and the associated costs through the use of artificial intelligence (AI)-supported real-time routing, incentivizing in-store pickups or consolidated deliveries (e.g., Amazon offers small rewards in exchange for selecting delivery options that result in fewer delivery trips and reduced packaging), and other strategies. In addition, the use of alternative delivery methods, such as cargo bicycles, aerial drones, and autonomous robots are in various stages of testing and deployment in parts of the country.

North Carolina passed legislation enabling the use of robots, like the ones pictured in Figure 88, to deliver personal packages around the state in 2020. Since then, several pilot deployments have taken place, including a short-lived delivery robot service in Charlotte (2022-2023) and on-campus delivery robot services operated by Starship Technologies at North Carolina Agricultural and Technical State University, University of North Carolina (UNC) Charlotte, East Carolina University, and UNC Wilmington. In 2025, DoorDash partnered with drone delivery company Wing to begin delivering food orders by aerial drone in a small area of Charlotte.[90] Using these alternative delivery methods requires investments in equipment and management systems but can save fuel and labor costs.

[90] Evans. S. (2025), "DoorDash Expands Wing Drone Delivery to Charlotte, North Carolina," IOT World Today. (May 16). https://www.iotworldtoday.com/transportation-logistics/doordash-expands-wing-drone-delivery-to-charlotte-north-carolina (accessed February 11, 2026).

FIGURE 88. FOOD DELIVERY ROBOTS IN JERSEY CITY, NJ (LEFT) AND CHICAGO, IL (RIGHT)



The land use implications of alternative delivery methods are that some of them need support facilities. For example, New York City plans to transform a former marine terminal in Brooklyn into an intermodal facility that will receive inbound shipments of parcels by barge, which will be transferred to cargo bicycles for delivery in nearby neighborhoods. Parcel consolidation facilities and curbside or neighborhood-level "microhubs" can be part of a strategy to facilitate the transfer of packages from trucks to aerial drones or sidewalk robots as well.

Adoption of Advanced Technologies

The adoption of new and innovative technology into the operation and maintenance of freight infrastructure and networks brings cost-effective and efficient opportunities to offload pressures from North Carolina's current multimodal freight network. These opportunities include the following:

- Intelligent transportation systems (ITS)
- Automated freight handling systems
- Adoption of safety and compliance technology
- Adoption of predictive maintenance systems
- Alternative fuel vehicles

Various state level documents recommend the adoption of smart infrastructure by elevating ITS, digital twins, and truck parking technology. [91,92,93] North Carolina is deploying real-time traffic monitoring, dynamic message signs, and freight-specific routing tools are being deployed along strategic corridors (e.g., I-85, I-40, I-95).[94] The US 74 resiliency study also tested digital twins to simulate climate impacts and optimize freight flow under extreme conditions.[95] Future improvements in truck parking technology will support smart parking systems and apps to help drivers locate safe, legal parking near freight hubs.

Port of Wilmington is planning to adopt automated freight handling systems that include rail-mounted cranes, yard management systems, digital scheduling, and gate automation for container and pallet movement.[96] These will be supplemented by automated gate systems, RFID container tracking, and expanded capacity for cold-chain logistics.[97,98] The inland terminals at Charlotte are also planning to integrate digital scheduling to streamline container transfers and provide foundational support for yard automation.

Freight vehicles will become safer with the adoption of safety and compliance technology.[99] Heavy-duty fleets in North Carolina will soon have automatic emergency braking as per federal requirements.[100] The adoption of innovative technologies in freight fleets, infrastructure, and operations will have a multitude of effects, ranging from lower vehicular emissions,

91 NCDOT: Intelligent Transportation System.
92 North Carolina's Statewide Multimodal Freight Plan, 2023.
93 North Carolina Statewide Freight Plan – Truck Parking Study, 2017.
94 NCDOT: Traffic Management & Information Devices.
95 U.S. – 74 Resiliency Study, 2024 .
96 Navis N4 TOS Selected to Enhance Terminal Operations at North Carolina Ports, NC Ports, 2019.
97 Container Gate Complex, NC Ports, 2022.
98 Wilmington's Cold Chain Summit showcases North Carolina's global logistics leadership | WHQR, 2025.
99 Safer Vehicles | US Department of Transportation, 2025.
100 Heavy Vehicle Automatic Emergency Braking; AEB Test Devices, Federal Register, 2023.

improved air quality near freight hubs, reduced margin of error due to automation of operations and data systems, as well as reduced dwell times at ports and terminals, faster turnarounds, and optimized routing. Adoption of predictive maintenance systems like sensors on bridges, pavements, and rail tracks will help in the early detection of costly emergency repairs, and integration of demand forecasting will minimize empty miles and improve load planning.[101,102]

This technological adoption can be in tandem with the new developments among the existing manufacturers and suppliers in the state. Since 2021, EV and battery component manufacturers like VinFast and Toyota have announced plans to grow in North Carolina, investing nearly $21 billion.[103] North Carolina also has a range of EV companies that contribute to each step in the EV supply chain, these range from lithium mining production, carbide semiconductor manufacturing, vehicle parts manufacturing, and battery recycling. This supports ongoing efforts to adopt zero-emission trucks as well as pilot explorations for hydrogen fueling for heavy-duty trucks and renewable natural gas for fleets. The business case for transition to diverse sources of fuel is that it contributes to a more sustainable freight industry that is strengthened against energy supply risks.

5.1.5. Growth and Land Use

As North Carolina's population grows, demand for housing, institutional, and other freight-receiving land uses will also increase. Population growth will continue to catalyze economic growth by expanding the workforce and consumer spending.

As North Carolina's economy also grows, demand for freight-generating and freight-handling land use will increase with it. For example, manufacturers will need manufacturing buildings and warehouses. More distribution centers will be needed to meet the needs of increased consumer spending. Transportation infrastructure for handling freight may need to be expanded or enhanced.

How land is used and developed for freight-generating or freight-handling purposes will certainly be influenced by broader development patterns across the state. While the locations of some freight-generating land uses (such as mining or crop agriculture) are determined by where natural resources or ideal soil conditions are found, many manufacturing, warehousing,

[101] Fixing America's Bridges: AI Revolution in Infrastructure, Bentley, 2025.
[102] Data to Drive Decisions | National Operations Center of Excellence, 2023.
[103] Emerging Automotive Technology in North Carolina | Economic Development Partnership of North Carolina, 2024.

and distribution facilities are where there is good access to transportation infrastructure, to customers and/or suppliers, and to a population that can supply workforce. Locations along or near North Carolina's major interstate highways and in or near its metropolitan areas, therefore, are often most desired for the development of industrial properties. And, as highways are upgraded, new development tends to follow.

5.1.6. E-commerce

For more than a decade, U.S. consumer behavior has been increasingly shifting toward e-commerce, outpacing traditional brick-and-mortar retail. E-commerce reached an all-time high during the onset of the COVID-19 pandemic. Today, it accounts for just over 16 percent of total U.S. retail sales, nearly returning to those peak levels. This trend has been accompanied by a surge in parcel shipments across the country, dominated by four parcel carriers – UPS, FedEx, the United States Postal Service (USPS), and Amazon Logistics – which together delivered nearly 22 billion parcels in the U.S. in 2024.[104] More recently, UPS and FedEx have been demarketing consumer home delivery due to low profit margins, ceding much of the market to USPS, Amazon, and local carriers cultivated by Amazon and other e-commerce merchants.[105]

To support the rise in demand for quick home delivery of online orders, an increasingly decentralized and high-frequency delivery network is necessary, creating pressures on local infrastructure and increasing traffic nationwide. To satisfy these demands, communities across the state may face pressures to develop more e-commerce fulfillment and distribution facilities. In North Carolina, e-commerce giant Amazon operates 13 fulfillment and sortation centers across the state, with five more planned or under construction as of late 2025.[106]

In order to provide quick fulfillment and delivery of customer orders, sites for e-commerce fulfillment centers are often sought within or very close to major population centers. While urban industrial sites were often passed up in favor of cheaper greenfield sites in exurban areas, e-commerce is changing the economic calculations of industrial developers and retail company facility owners/tenants in some urban markets. The higher costs of land acquisition and parcel assembly, demolition of obsolete older industrial buildings, brownfields remediation, and other costs are becoming worthwhile for some e-

[104] Pitney Bowes. (2025). Parcel Shipping Index. (accessed January 28, 2026).
[105] "Parcel Carriers Face Industry-wide Stagnation", CSCMP, January 20, 2026.
[106] Amazon to open five new delivery stations across North Carolina - (February 2026). (accessed March 25, 2026).

commerce retailers in some metropolitan areas. This means that as development of all kinds makes available land in North Carolina's metropolitan areas more scarce – and likely more expensive – the redevelopment of brownfields and, potentially, multi-story facilities with more freight generation per acre could be a solution that the market pursues, if and where local land use and development regulations allow.

In addition, retail stores are playing bigger roles in e-commerce. Some retailers are adapting their brick-and-mortar stores to accommodate online order pickups and returns and parcel storage/holding. In other instances, vacant storefronts are being repurposed as e-commerce delivery centers, as Figure 89 shows. In many communities, however, this use change may be prohibited by local zoning laws.

Industrial real estate development to support e-commerce demand could generate additional trips by large trucks delivering products to fulfillment facilities and transporting large quantities of customer orders through the logistics chain. There are also increased volumes of smaller vehicles used to deliver packages from the last Amazon facility in the chain for "the last-mile" to consumers. Growth in warehousing and distribution center development necessitates coordination between transportation and land use planning functions at the local and regional levels. It is important to plan for the transportation system impact of fulfillment centers with regard to truck trip generation, times of day, etc., on local and state highways.

FIGURE 89. FORMER SAM'S CLUB OUTLET IN LUMBERTON, NC (212)CONVERTED TO SAM'S CLUB E-COMMERCE FULFILMENT CENTER (2019)



Source: Google Maps, Street View from 2012 (left) and 2019 (right). The Next Phase of the Retail Apocalypse: Stores Reborn as E-Commerce Warehouses - WSJ (accessed March, 2026)

5.1.7. Trucking Regulations

Trucking is the dominant freight mode in North Carolina, accounting for over 80 percent of freight tonnage and moving goods valued at more than $700 billion annually. Nearly every major industry cluster – life sciences, agriculture, chemicals, automotive, retail – as well as most multimodal transport depends on trucking for first- and last-mile connectivity. As a result, regulations, and particularly regulatory changes, have wide economic ripple effects across the state's freight ecosystem. These regulations and regulatory changes include the following:

- Minimum driver training standards and license requirements
- Hours of Service (HOS) regulations
- Limitations on vehicle weight, axle load and dimensions
- Emission standards

North Carolina enforces federal trucking regulations alongside state-level compliance and inspection regimes, making regulatory impacts particularly visible for carriers and freight-intensive industries. The following federal and state agencies regulate truck driver training in North Carolina:

- Federal Motor Carrier Safety Administration (FMCSA) sets nationwide minimum training standards, including Entry-Level Driver Training.[107]
- North Carolina Division of Motor Vehicles administers commercial driver licenses (CDL) licensing, testing, and enforces compliance with federal rules at the state level.[108]

Since Feb. 7, 2022, the Class A CDL and Class B CDL applicants must complete FMCSA Entry-Level Driver Training before taking the CDL skills or endorsement tests:

- Commercial Class A: required for any combination of vehicles with a gross vehicle weight rating of 26,001 pounds or more (provided the gross vehicle weight rating of the vehicle or vehicles being towed is more than 10,000 pounds).
- Commercial Class B: required for any single vehicle with a gross vehicle weight rating of 26,001 pounds or more, and any such vehicle towing a vehicle with a gross vehicle weight rating not more than 10,000 pounds.

Recent tightening of federal motor carrier safety enforcement has targeted use of non-domiciled CDLs, English language proficiency, and the quality of electronic log equipment and driver training schools. Such steps should improve driver skill consistency and safety overall as well as reduce accident risk in high-value freight sectors (e.g., pharmaceuticals, chemicals, hazardous materials). It may, however, also slow the entry of new drivers into the labor market, cause some current drivers to exit the market, and induce higher training costs for small carriers and owner-operators. For freight-dependent industries, especially agriculture and time-sensitive manufacturing, this can result in fewer trucks available to shippers, higher

[107] Entry-Level Driver Training (ELDT) | FMCSA.
[108] Official NCDMV: Commercial Driver License.

transportation costs, and longer lead times, particularly in rural regions with limited driver pools.[109] Even so, the withdrawal of national fleets with well-established driver safety programs from consumer home delivery raises questions about the programs of local operators seeking to replace them.

North Carolina follows the HOS regulations established by FMCSA, which impose limits on driving time and mandatory rest periods.[110] HOS regulations are strongly enforced and penalties can be high. North Carolina State Highway Patrol (Motor Carrier Enforcement) enforces HOS rules during roadside inspections, audits, and weigh-station checks. The rules prioritize fatigue prevention, safety, and consistent national standards, but they also significantly shape freight costs, capacity, and logistics design across the state.

These regulations reduce schedule flexibility for long-haul and regional carriers and increase the need for relay driving or team drivers. To avoid steep fines, drivers are constantly under pressure to find parking to avoid violating HOS regulations while trying to make pickup/deliveries as efficiently as possible. For North Carolina industries that rely on just-in-time logistics, such as automotive and biopharmaceutical manufacturing, HOS rules have increased the importance of logistics planning, warehousing buffers, and intermodal rail substitution.

Federal and state limits exist for vehicle weight, axle loads, and dimensions. Truck size and weight limits in North Carolina are governed by the following:[111,112]

- North Carolina General Statutes 20-116 and 20-118[113]
- North Carolina Department of Transportation (NCDOT)
- North Carolina State Highway Patrol (NCSHP)
- Federal Bridge Formula (for interstate highways)

These rules apply to interstates, U.S. routes, and state highways, with additional restrictions on posted roads and bridges. These regulations help protect road infrastructure and support safer movement of heavy industrial and chemical cargo.

[109] Rural Freight Transport Needs, Institute for Transportation Research & Education North Carolina State University, 201
[110] Summary of Hours-of-Service Regulations | FMCSA.
[111] Weight of vehicles and load | G.S. 20-118, 2018.
[112] Axle Grouping Weight Charts | North Carolina State Highway Patrol.
[113] Size of vehicles and loads | G.S. 20-116.

However, this also imposes constraints on bulk agricultural hauling efficiency and increases operating costs for low-margin commodity producers.

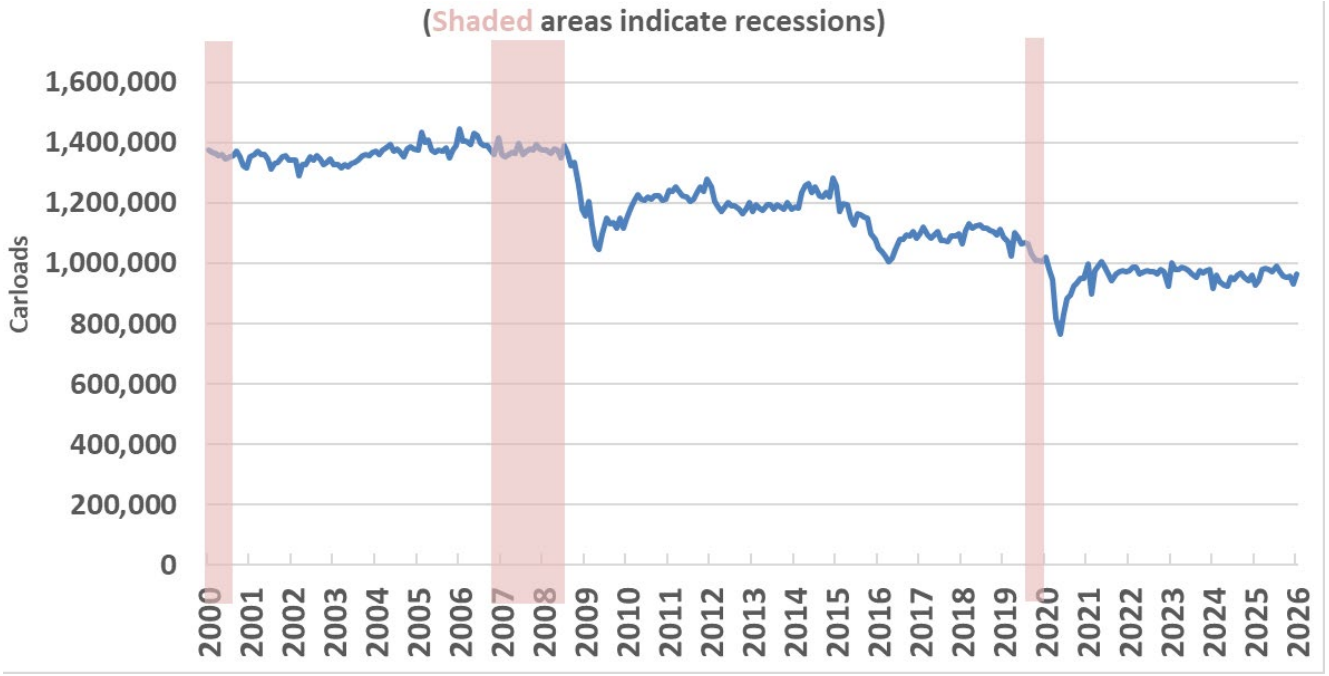
Federal- and state-level emission standards have existed for trucking and terminal operations. These standards have supported the larger sustainability goals of big manufacturers and are critical to improving air quality around ports and urban logistics hubs. These standards are also an incentive for fleet modernization. However, these regulations also mean higher capital costs and thus slower adoption by small and rural carriers. The federal regulatory framework may also change.

5.1.8. Freight Rail Market Share

The Bureau of Transportation Statistics tracks monthly carloadings using data from the Association of American Railroads. Figure 90 illustrates the long-term declining trend in monthly carload traffic across the industry over the last 25 years. The areas in gray on the graph are recessions, namely the Dot-Com Recession of 2002, the Great Recession of 2008, and the COVID-19 pandemic in 2020. While railroads are showing growth in some areas such as intermodal, the net carload movement of the entire franchise is in decline.

The realization of benefits of rail compared to highway transportation is dependent on the relative growth rates of rail and trucking.

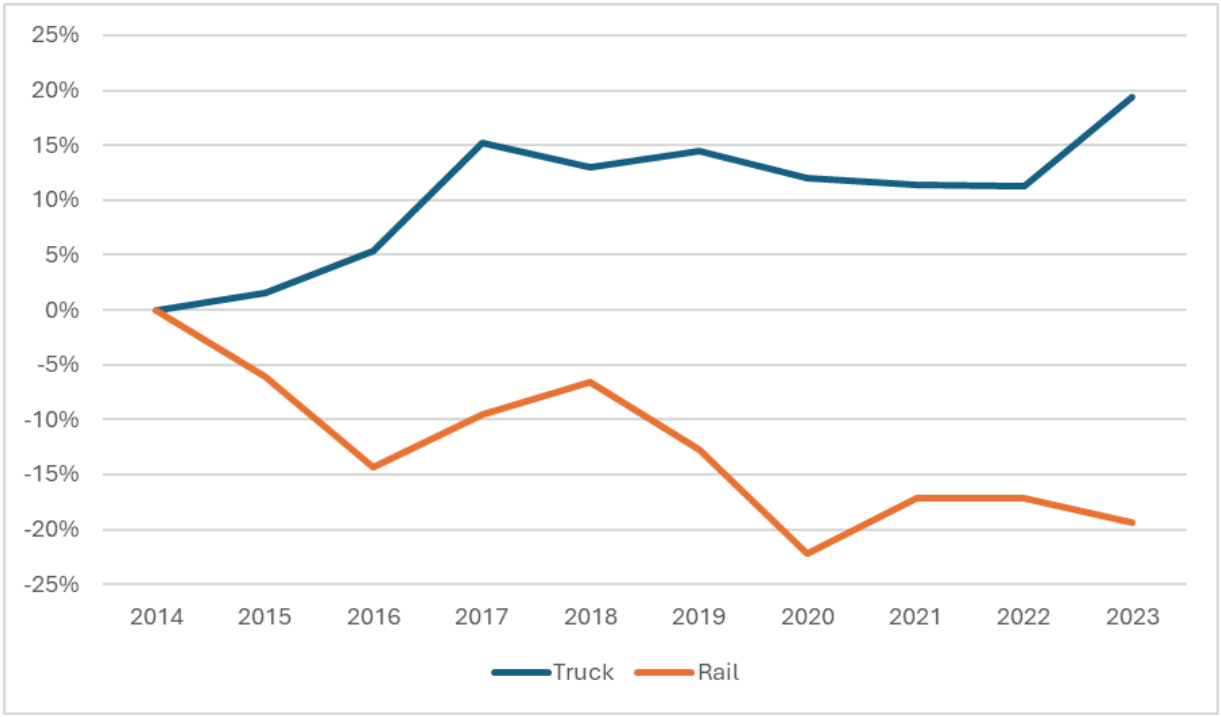
FIGURE 90. RAIL FREIGHT CARLOADS (2000-2026)



Source: U.S. Bureau of Transportation Statistics via FRED

As shown in Figure 91, between 2014 and 2023, rail volumes fell around 20 percent while truck volumes have increased by roughly the same percentage. Volumes here are measured as ton-miles (each ton-mile is one ton of freight moved 1 mile). These trends suggest a shift of freight from rail to truck.

FIGURE 91. PERCENTAGE CHANGE IN U.S. TRUCK AND RAIL TON-MILES (2014-2023)



Source: Bureau of Transportation Statistics

One of the reasons for the decline is the dramatic reduction in the use of coal in electricity generation. Over the past 25 years, coal-fired power plants have been decommissioned or converted to natural gas combustion, particularly as the price of natural gas per Btu became cheaper than coal due to the expansion of fracking operations across the United States. For example, in 2008, Norfolk Southern realized 30 percent of its revenue from coal.[114] In 2025, revenue from coal was 12 percent.[115]

[114] Norfolk Southern
[115] Ibid.

In large part as a result of shareholder pressure over the last decade, most of the leading Class I railroads have prioritized delivering lower operating ratios (a financial measure of total operating expenses divided by total revenues) over franchise growth, an operational practice frequently referred to as Precision Scheduled Railroading (PSR). Although specifics vary by railroad, a PSR strategy generally involves reducing staff, running longer trains, and combining train types. For example, intermodal trains might be combined with manifest (mixed-carload) services. Often, longer trains are operated with distributed power, where locomotives are in the front, middle, and end of a train. Elimination of assets deemed surplus reduces cost and requires less labor to maintain and operate the property. Railroads implementing PSR also try to simplify networks by eliminating handling yards that classify individual cars and blocks of cars enroute to destinations. In addition, railroads try to de-market less profitable business and focus on increasing rates for remaining customers.

In simple terms, the result has been that the railroad industry is moving less freight by foregoing less profitable freight while realizing higher rates from the remaining customers. In a study published in March 2023, the four leading U.S. Class I railroads (BNSF, UP, CSX, NS) increased revenue per train mile from $91 to $195 between 2006 and 2021 (Oliver Wyman 2023). Over the same time period, revenue ton-miles and total train-miles decreased 15 percent and 24 percent, respectively.

5.1.9. Railroad Class I Consolidation and Mergers

On July 29, 2025, Union Pacific Railroad announced it entered into an agreement to acquire NS in a combined stock and cash transaction to form the first quad-coastal (East, West, Gulf, Great Lakes) railroad in the United States. The proposed transaction is subject to approval by the STB, which also takes into account input from other stakeholders, including but not limited to the Department of Justice, other federal agencies, state DOTs, shippers, other railroads, MPOs, trade associations, and passenger operators. If approved by the STB, the proposed system would cover 50,000 route-miles, 43 states, and more than 100 ports.

Union Pacific submitted its formal merger application to the STB on Dec. 19, 2025. Subsequently, the STB rejected the application as incomplete on Jan. 16, 2026, providing feedback should Union Pacific decide to submit a revised application, which it did on April 30, 2026. The STB accepted the revision, requested additional information, and currently has the application under review.

North Carolina will want to fully understand how the proposed acquisition of Norfolk Southern by Union Pacific will affect the state's diverse commercial, economic, and civilian constituencies.

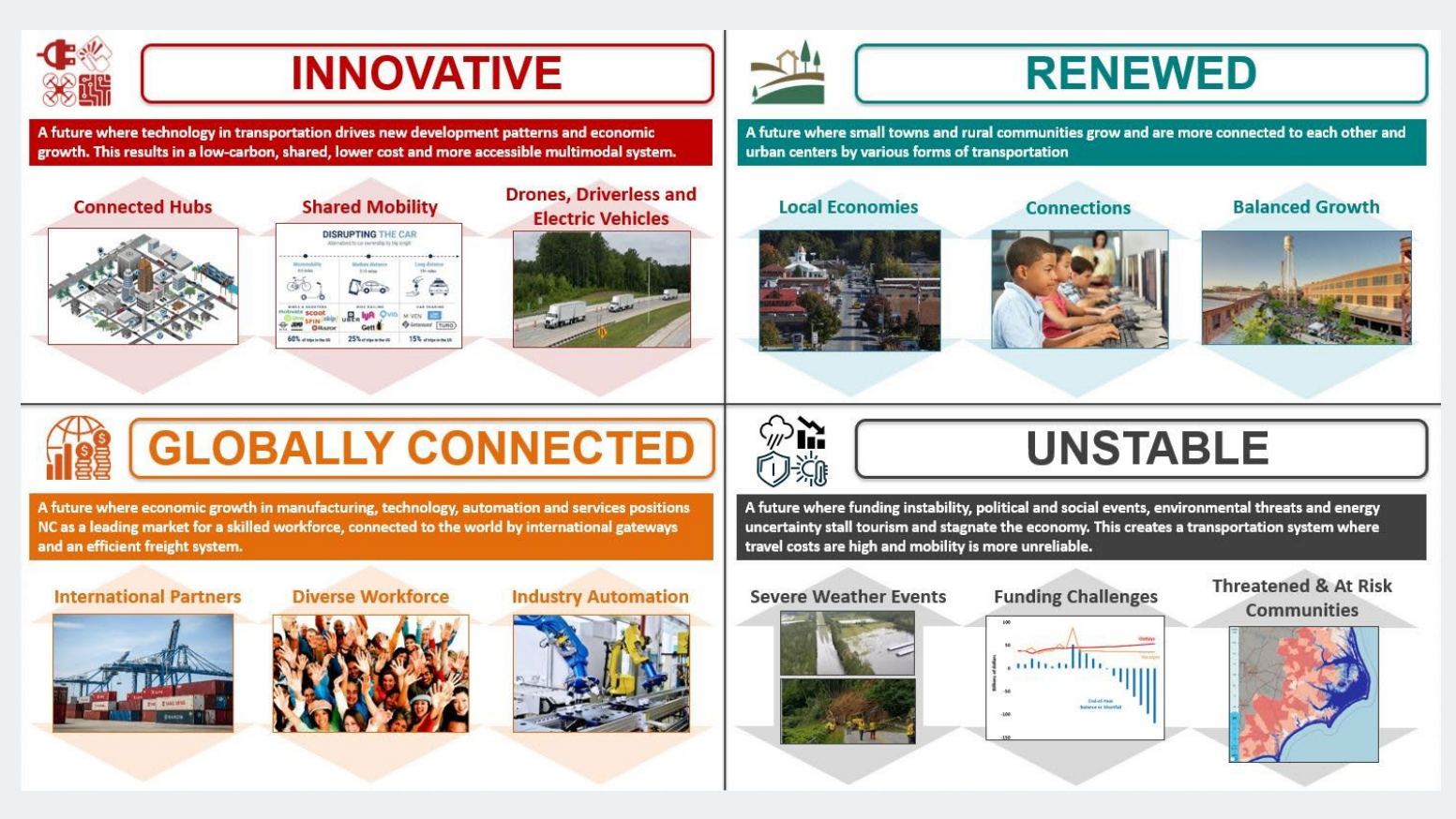
5.2. Freight Scenario Planning and Performance Outputs

5.2.1. NC Moves 2050

North Carolina's population and economy growth, the locations of that growth, and how that growth spreads (i.e., centralized in its major cities and metropolitan areas or with suburban development expanding farther into existing rural fringe areas) can influence where the users of freight-generating land will want to be located as well. NC Moves 2050, the Long-Range Transportation Plan for North Carolina, considered four scenarios for North Carolina's future.[116] The four scenarios are not predictions, but illustrate potential outcomes based on combinations of assumed factors and trends. The four scenarios are summarized in Figure 92.

[116] North Carolina Department of Transportation, NC Moves 2050: Connecting Your Community, Your Voice, and Your Future, (accessed January 29, 2026).

FIGURE 92. NC MOVES 2050 SCENARIOS



Source: NC Moves 2050 Plan, https://www.ncdot.gov/initiatives-policies/Transportation/nc-2050-plan/Pages/default.aspx

Table 40 describes the potential freight land use implications of each scenario.

TABLE 40. NC MOVES 2050 FUTURE SCENARIOS, WITH CONSIDERATIONS OF FREIGHT LAND USE IMPLICATIONS ADDED

Scenario Name	Scenario Description	Possible Freight Land Use Implications
Innovative	A future where technology drives new development patterns and economic growth, resulting in a low-carbon, low-cost, shared, and more accessible multimodal system.	In this scenario, the widespread use of innovative technologies could facilitate the delivery of goods by aerial drones and other autonomous vehicles and robots. Warehouse automation could make warehouses and distribution centers more efficient. North Carolina could see the development of fewer and/or smaller warehousing and distribution facilities as a result of these efficiencies, and terminals for parcel transfer from trucks to last-mile autonomous vehicles may be needed.
Renewed	A future where small towns and rural communities grow and are more connected to each other and urban centers by a variety of transportation modes.	In this scenario, where the economies of small towns and cities are reinvigorated, we may have more manufacturing and distribution in and near our urban core communities. Brownfields and vacant industrial sites could be redeveloped. Relatively small “delivery station” buildings and microhubs could be used in many communities to dispatch last-mile deliveries by cargo bicycle and/or autonomous modes.
Globally Connected	A future where economic growth in manufacturing, technology, automation, and services positions North Carolina as a leading market for a skilled workforce, connected to the world by international gateways and an efficient freight system.	In this scenario, North Carolina’s manufacturing sector produces greater volumes of goods, and the state is connected to the world through its international trade gateways. This scenario could result in the development or expansion of manufacturing facilities across the state and the development of large distribution centers to handle goods being imported or exported through ports in NC and neighboring states. These developments would likely be concentrated on or near highway or rail corridors that provide access to these international trade gateways in Eastern NC, including future segments of I-74 to Wilmington, I-42 to Morehead City, and I-87 to the Port of Virginia.
Unstable	A future where funding instability, political and social events, environmental threats, and energy uncertainty stall tourism and stagnate the economy, creating a transportation system where travel costs are high and mobility is unreliable.	In this scenario, speculative industrial real estate development could slow, as developers would want to avoid risk. This could contribute to decreased vacancy rates and increased rental rates.

Source: NC Moves 2050, with additions by Cambridge Systematics.

5.2.2. Freight Plan Enhancement

Building on this framework, the Plan evaluated potential impacts on freight movement and transportation system performance. The scenario analysis is structured to answer three related questions.

- First, how could the highway system and the supply chains that depend on it look in 2055 under each scenario, including changes in commodity flows, truck volumes, corridor-level congestion, and the role of intermodal connections?
- Second, what benefits accrue from investing in freight infrastructure at a pace that keeps up with growth?
- Third, which specific projects, policies, and strategies most effectively enhance resilience, understood both as the network's capacity to withstand and recover from disruption and as its flexibility to perform acceptably across multiple divergent futures?

The intent is to give NCDOT and its partners a defensible basis for prioritizing strategies, policies, and investments that remain resilient across a range of possible outcomes.

Methodology

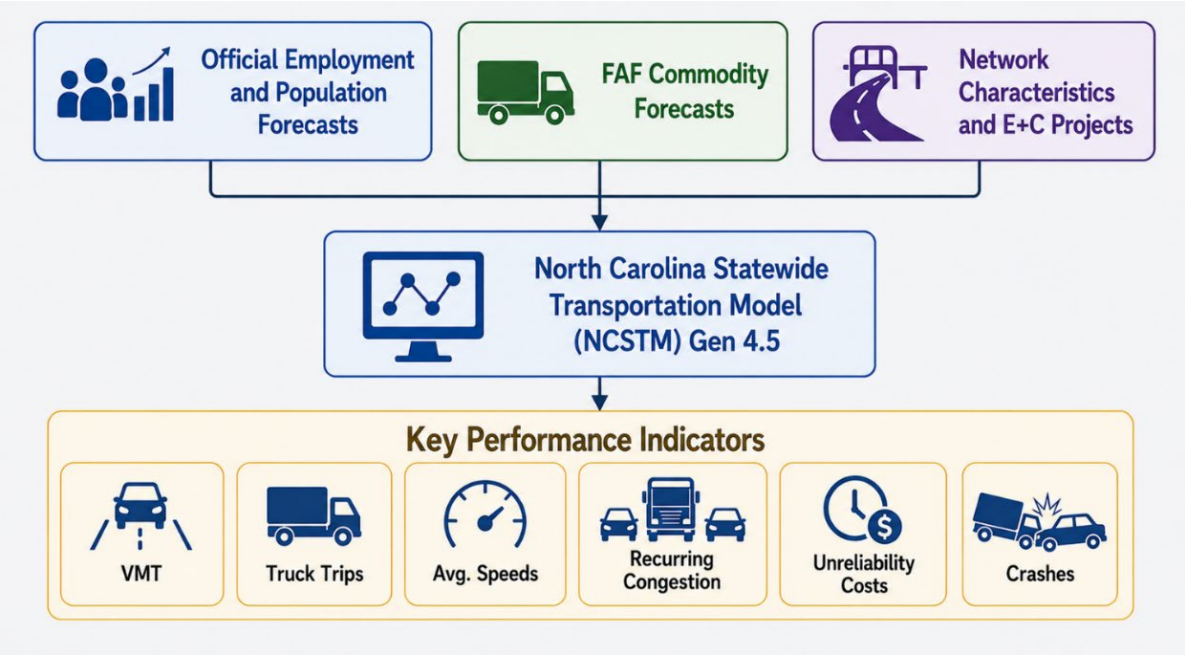
The scenario analysis used the North Carolina Statewide Transportation Model, Generation 4.5, to evaluate how the different economic, development, freight, and technology assumptions could affect the state's roadway and freight system in 2055. Population and employment forecasts, commodity-flow forecasts, truck-trip patterns, and transportation-network characteristics were adjusted to represent the Innovative, Globally Connected, Renewed, and Unstable scenarios described previously. These inputs were then processed through the statewide model to estimate travel demand and network performance. Modeling of all four scenarios included existing and committed projects, while the Innovative scenario included targeted increases in coded capacity and free-flow speeds on Interstates and U.S. highways to represent the operational effects of emerging transportation technologies.

A fifth scenario – 2055 Trend – represents the business-as-usual reference condition against which the four NC Moves 2050 alternative scenarios were evaluated. Trend assumes that current economic and travel-growth patterns continue and that projects already included in the existing and committed network are constructed. It is not a no-build scenario, but it does not include additional transportation investments beyond those already committed. Comparing the 2055 Trend with the 2017

Base establishes how projected growth could affect freight demand and system performance if transportation capacity does not expand at a comparable pace. The alternative scenarios were then compared with Trend to isolate the effects of changes in economic growth, development patterns, freight activity, technology, and system conditions.

Performance was evaluated using a set of key performance indicators generated directly by the model or through post-processing of model outputs. These KPIs included total and truck vehicle miles traveled, short- and long-haul truck trips, vehicle hours traveled, average roadway speed, recurring congestion, travel-time unreliability costs, and truck crash costs. Recurring congestion was measured as Vehicle Excess Hours of Travel, representing the additional time trucks spend traveling relative to free-flow conditions. Unreliability costs monetized unexpected truck delays based on the difference between 95th-percentile and average travel times, while future truck crash costs were estimated by scaling observed truck-involved crashes in proportion to projected truck VMT. Together, these measures show how each scenario affects freight demand, mobility, congestion, reliability, and safety at both statewide and regional levels (Figure 93).

FIGURE 93. MODELING PROCESS AND KEY PERFORMANCE INDICATORS



Key Findings

The key findings of the scenario analysis are as follows, beginning with the Trend scenario that models the effects of projected growth on a system with today's planned projects:

- **Existing and committed (funded) projects are not sufficient to keep pace with projected growth through 2055.** Under the 2055 Trend scenario (business-as-usual scenario for 2055 against which all other scenarios are compared), total employment increases by 69 percent and freight-related employment by 51 percent, leading total VMT to increase by 47 percent and truck VMT by 41 percent. In comparison, roadway centerline miles and lane miles increase by only 2 percent. This imbalance between demand and available capacity results in a 373 percent increase in recurring congestion delay, a 202 percent increase in unreliability costs, and a 37 percent decline in average

speeds. These results demonstrate the need for additional transportation funding and investment beyond currently committed projects, particularly investments targeted toward freight bottlenecks, major freight corridors, and first- and last-mile connections that support continued economic growth.

- **All of the modeled 2055 scenarios remain substantially more congested than in the 2017 base year, even when technology improves operations or economic growth is significantly reduced.** The Innovative scenario provides meaningful benefits relative to the 2055 Trend, but applying those improvements to the Trend results still leaves recurring congestion at approximately 195,000 hours per day, more than four times the 2017 level, while unreliability costs remain approximately $67 million per day compared with $26 million in 2017. Even the Unstable scenario, which assumes a 22 percent reduction in employment relative to the 2055 Trend and substantially lower travel demand, results in approximately 129,000 hours of recurring congestion per day and $54 million in daily unreliability costs. Average speeds under the Unstable scenario also remain approximately 20 percent below 2017 levels. These results reinforce that technology, changes in development patterns, or slower growth can mitigate future congestion, but none eliminates the need for continued investment in roadway capacity and freight system performance.
- **Technology and changes in the geographic distribution of growth can mitigate congestion, but they do so in different ways.** The Innovative scenario demonstrates the potential benefits of technology and operational improvements: despite modest increases in employment, trips, and VMT, recurring congestion decreases by 12.1 percent, and unreliability costs decrease by 15.5 percent relative to the 2055 Trend. The Renewed scenario produces smaller statewide reductions in recurring congestion and unreliability, but its effects vary by geography. As population and employment shift toward rural and suburban areas, unreliability improves in Metrolina and the Triangle by 7 percent and in the Triad by 4 percent, while increasing in several smaller and more rural regions, including Jacksonville, Goldsboro, Asheville, and Rocky Mount. Together, these scenarios show that both transportation technology and the location of future development can materially affect where and how severely congestion occurs.
- **The lower congestion projected under the Unstable scenario is the result of significant reductions in economic activity and employment.** Relative to the 2055 Trend, total employment and freight-related employment each decline by 22 percent, substantially reducing passenger and freight travel demand. This results in lower congestion across the state, including a 41.7 percent reduction in recurring congestion and a 32.6 percent reduction in unreliability costs relative to the Trend. These results should therefore be interpreted as the effect of fewer jobs, less economic activity, and lower travel demand placing less pressure on the roadway network, rather than as an

improvement in transportation system performance. Moreover, despite these substantial reductions in economic growth, congestion under the Unstable scenario remains considerably worse than in 2017, reinforcing the need for continued transportation investment even under a lower-growth future.

Table 41 summarizes the projected changes in Key Performance Indicators between the 2017 Base and 2055 Trend conditions.

TABLE 41. SCENARIO MODELING – 2055 TREND VS. 2017 BASE

Type of KPI	Measures	2017 Base	2055 Trend	% Change 2017 to 2055
Employment	Total Employment	5,997,949	10,144,811	69%
	Total Freight-Related Employment	2,496,765	3,777,619	51%
Network	Centerline Miles (mi)	33,560	34,225	2%
	Lane Miles (mi)	73,177	74,676	2%
Trips and VMT	Long Haul Truck Trips (NC-based)	112,025	213,188	90%
	Short Haul Truck Trips (NC-based)	996,783	1,344,814	35%
	Total VMT (passenger + truck)	283,841,950	418,083,186	47%
	Total Truck VMT	20,523,034	28,967,751	41%
Performance and Congestion	Total VHT	6,989,579	16,285,844	133%
	Avg. Speed (MPH)	40.61	25.67	-37%
	Vehicle Hours of Travel (VEHT) (hours/day)	46,958	221,886	373%
	Unreliability Costs ($/day)	26,339,674	79,744,465	202%
Safety	Truck Crash Costs ($/day)	4,804,771	6,781,815	41%

Source: North Carolina Statewide Transportation Model (NCSTM) Gen 4.5

The scenario results, summarized in Table 42, illustrate how different assumptions about economic growth, development patterns, and technology can substantially change future freight system performance. The Globally Connected scenario produces the highest levels of employment and freight activity and, as a result, also generates the greatest congestion impacts, with higher vehicle hours traveled, recurring congestion, and unreliability than the 2055 Trend. In contrast, the Innovative scenario demonstrates the potential for technology and operational improvements to offset some of the effects of continued growth: despite modest increases in employment, trips, and VMT, average speeds improve and both recurring congestion and unreliability decline relative to the Trend. However, these improvements should be viewed in the context of the much larger deterioration projected between 2017 and 2055; without major additional capacity investments, technology alone does not return the system to existing-year performance. The Renewed scenario shows a different effect, with greater growth shifted toward rural and suburban areas, redistributing travel away from some of the state's already-congested urban areas; this yields modest reductions in statewide congestion and unreliability measures yet worse performance where the growth occurs – and where today's planned projects do not focus. Finally, the substantially lower congestion levels in the Unstable scenario are driven primarily by the scenario's large decline in employment and associated reductions in travel demand, rather than by improvements to the transportation system. Overall, the results demonstrate that congestion outcomes are closely tied to the amount and geographic distribution of future growth, while technology and investment can help determine how effectively the transportation network accommodates that growth.

TABLE 42. KPI MODELING RESULTS – PERCENT CHANGE OF FOUR ALTERNATIVE SCENARIOS RELATIVE TO 2055 TREND

Type of Measure	Measures	2055 Globally Connected	2055 Innovative	2055 Renewed	2055 Unstable
Employment	Total Employment	4%	1%	0%	-22%
	Total Freight Employment	6%	1%	0%	-22%
Trips and VMT	Long Haul Truck Trips (NC-based)	8%	2%	6%	-22%
	Short Haul Truck Trips (NC-based)	3%	1%	2%	-14%
	Total VMT (passenger + truck)	1.0%	1.9%	-0.4%	-12.7%
	Total Truck VMT	1.8%	2.3%	-0.3%	-6.5%

Type of Measure	Measures	2055 Globally Connected	2055 Innovative	2055 Renewed	2055 Unstable
Performance and Congestion	Total VHT	2.8%	-0.9%	1.2%	-30.7%
	Avg. Speed (MPH)	-1.8%	2.8%	-0.8%	25.8%
	VEHT (hours/day)	6.1%	-12.1%	-2.6%	-41.7%
	Unreliability Costs ($/day)	4.8%	-15.5%	-4.2%	-32.6%
Safety	Truck Crash Costs ($/day)	1.80%	-18.13%	-0.3%	-6.5%

Source: North Carolina Statewide Transportation Model (NCSTM) Gen 4.5

The regional results in Figure 94 and Table 43 show that the effects of each scenario are distributed differently across North Carolina. Under the Globally Connected scenario, congestion and unreliability worsen throughout the state, with some of the largest increases occurring in eastern and coastal regions, reflecting the stronger growth in international trade and freight activity associated with the state's ports and related supply chains. The Innovative scenario produces congestion and reliability benefits across most regions, particularly in the major urban areas, demonstrating the potential for technology and operational improvements to improve system performance even as travel demand continues to grow. The Renewed scenario produces a different geographic pattern: as population and economic activity shift away from the state's largest urban centers, congestion and unreliability improve in Metrolina, the Triangle, and the Triad, while worsening in many smaller, rural, and coastal regions that absorb a greater share of future growth. Finally, the Unstable scenario reduces congestion in every region because of the substantial decline in employment and travel demand. However, these reductions are relative to the already-congested 2055 Trend condition; even under the Unstable scenario, overall congestion remains substantially higher than in 2017, reinforcing the point that reduced growth alone does not eliminate the need for continued transportation investment beyond currently committed projects.

FIGURE 94. SCENARIO CHANGE IN UNRELIABILITY COSTS RELATIVE TO 2055 TREND BY PROSPERITY ZONE

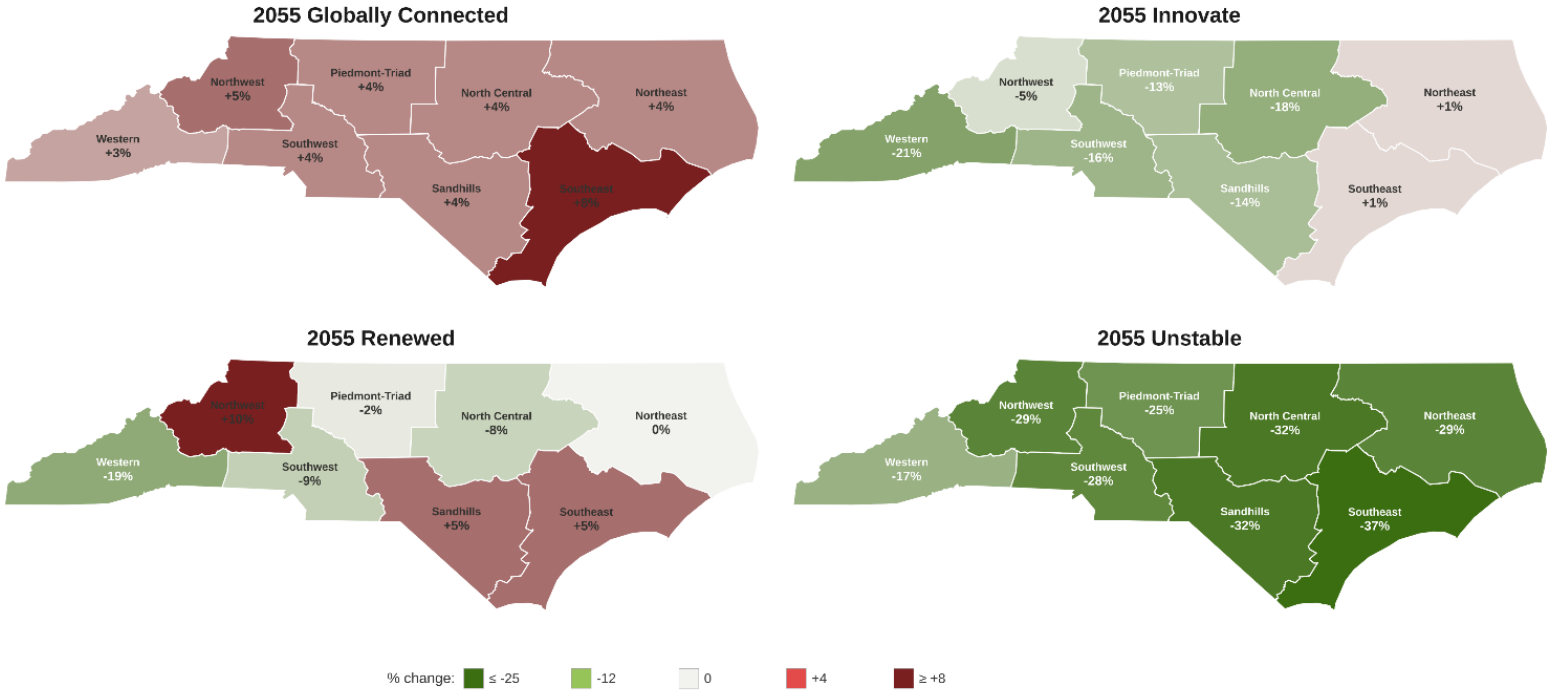


TABLE 43. SCENARIO CHANGE IN UNRELIABILITY COSTS RELATIVE TO 2055 TREND BY REGION

Regions	2055 Globally Connected	2055 Innovative	2055 Renewed	2055 Unstable
Other	4%	-9%	1%	-29%
Asheville	6%	-18%	14%	-35%
Fayetteville	8%	-5%	2%	-45%
Goldsboro	10%	3%	15%	-30%
Greenville	4%	1%	1%	-37%
Hickory	7%	-27%	5%	-42%
Jacksonville	14%	3%	17%	-40%
Metrolina	4%	-17%	-7%	-30%
Rocky Mount	5%	-10%	12%	-32%
Triad	5%	-21%	-4%	-39%
Triangle	5%	-16%	-7%	-34%
Wilmington	6%	0%	0%	-40%

Source: North Carolina Statewide Transportation Model (NCSTM) Gen 4.5

5.3. SWOT Analysis

As a final look at critical change drivers, SWOT evaluations were performed in a joint meeting of the NCDOT Freight Advisory Committee with state leadership of the NC Chamber of Commerce, and again with public and private sector stakeholders in four regions – Asheville, Charlotte, Triangle, and Wilmington – focusing on a set of key themes in terms of current expectations and future conditions:

- Freight network capacity and condition
- Routing, redundancy and reliability

- Multimodal access and connectivity
- Land use, development, and physical constraints
- Policy, funding, and coordination
- Community impacts and public acceptance
- Workforce, operations, and supporting infrastructure
- Technology, data and innovation

Key results from the regional meetings are summarized in Table 44 following. The table is organized around the key themes, and the prefixes in the region columns denote strength [S], weakness [W], opportunity [O], and threat [T].

TABLE 44. SWOT ANALYSIS SUMMARY

Themes/ Region	Asheville	Charlotte	Triangle	Wilmington
Freight Network Capacity & Condition	[S] Upgrades to major roads (when construction eventually stops). [S] Lack of bottlenecks.	[W] Delays for through-freight in CRTPO area. [W/T] Congestion costs. [W] Engineering design. [W] Bridge conditions and maintenance. [T] Safety mitigation.	[S] Low congestion. [S] Safety [S] Extensive safety features across majority of network. [S] Aggressive upgrades to roadway facilities to interstate standards. [O] Signage on freight network. [T] Diminished capacity for infrastructure improvements.	[S] Balanced import/export freight market [W] Infrastructure maintenance.
Routing, Redundancy & Reliability	[W] Existing infrastructure for alternate routes. [W] Lack of alternate routes or redundancy. [W] Lack of resilience. [T] Redundant routes identification.	[W] Lack of suitable secondary routes for last-mile connections.	[S] Resilience and adaptability. [W] Incident clearance. [T] Climate change.	

Themes/ Region	Asheville	Charlotte	Triangle	Wilmington
Multimodal Access & Connectivity	[W] Distance from interstates.	[S] Connection to NC Inland Port/ CLT. [S] East-west connectivity. [S] Extensive effort to capitalize on various freight modes. [W] Needed improvements at freight rail intersections and corridors. [O] Work with airport cargo logistics and rail access.	[S] Burgeoning aviation port. [W] Supporting port growth.	[S] Access to NC Ports. [S] Alternate transportation mode accessibility. [W] Rail and roadway access to Port of Wilmington. [W] Single Class One Rail served.
Land Use, Development & Physical Constraints	[S/W] Location. [W] Topographical limitations on developable land. [T] Future growth creates need while also triggering additional restrictions.	[S] Geographic position and regional market access. [S] Well-located airport. [S] Easy access to freight generators along East Coast. [S] Access to industrial parks. [W] Loss of farmland and impact on economy. [W] Suitable land analysis. [T] Bad land-use planning. [T] Rapid growth outpacing implementation.	[S] Great market for new industries and businesses. [S] Economic ecosystems (more value add before movement to final destinations). [W] Coordination with land-use planning.	[T] Inability to deepen Cape Fear River.
Policy, Funding & Coordination	[W] Lack of Region G funding for US and NC routes in region. [W] Difficulty competing with larger metros for funds. [W] Increased construction costs due to topography and constraints. [O] Highway maintenance funding for improved	[S] Proactiveness. [S] Well-developed research and analysis. [W/T] Funding availability for maintenance and modernization. [O] Leadership and change management in policy, design, and coordination. [O] Improved coordination.	[S] Innovative funding mechanisms. [S] More public-private partnerships allowed. [S] Collaborative planning. [W] Proactiveness. [W] Collaboration with industry.	[W] Balance needed outside of Triangle. [W] Funding to deliver needed capital investments and repair critical needs. [W] Construction costs for roads and bridges. [W] Limited revenue sources.

Themes/ Region	Asheville	Charlotte	Triangle	Wilmington
	shoulder stabilization and long-life paint and reflectors. [T] Inflation [T] State competition vs. state cooperation	[O] Facilitate conversations with rail companies during planning efforts. [O] Invest in public-private partnerships. [T] Climate resilience treated as taboo topic. [T] Construction costs.	[W] Ensuring CDLs are comprehensive and enforced. [W] Potential missing synergy with other states with similar challenges. [W] Local areas considering their needs over what is good for entire system. [W] Predatory towing. [W] Policy and planning. [O] Regulation to reflect technology development. [O] Obtain direct feedback from MPO and RPO boards. [O] Interstate compact freight corridors with Tennessee, Virginia and South Carolina. [O] Increased funding for improvement and maintenance. [O] More education to local elected officials. [O] Regional coordination and aligned assets. [T] Funding. [T] Inflation [T] Construction and engineering costs. [T] Defense community infrastructure investment by other states. [T] Increasing gas prices.	[W] Need to factor in state government and military into overall Freight Plan. [T] $300,000 cap on state funds for GA airfield projects.

Themes/ Region	Asheville	Charlotte	Triangle	Wilmington
			[T] Low ROI with ports. [T] Freight companies merging. [T] Prioritization of funding in less-served areas. [T] Involvement of rail freight in policy work.	
Community Impacts & Public Acceptance	[S] Scenery. [W] NIMBY pressures.	[O] Public education to help explain impacts of freight. [T] Public outreach and education.	[W] Public awareness of freight network. [W] Impact to public health. [O] More community meetings to discuss impacts and opportunities. [T] Public resistance to new funding models.	[W] Citizen opposition to dredging for better ports access. [W] Anti-growth mentality in local citizenry. [T] Prioritization of community needs and support of that prioritization.
Workforce, Operations & Supporting Infrastructure	[S] Opportunity for workforce. [W] Accommodations (e.g., parking and first/last-mile infrastructure).	[W] Truck parking. [W] First/last-mile infrastructure.	[W/O] Truck parking facilities. [O] Educate truck drivers on new technology for parking.	[T] Infrastructure security.
Technology, Data & Innovation	[T] Fear of future Technologies.		[W/O] ITS/TSMO deployment for freight-specific operations (e.g., parking, incident clearing, dynamic detours). [W] Technology and utility readiness gap. [O] Driverless vehicles and drone delivery. [T] Potential security/safety risks with Autonomous Air Mobility.	

5.3.1. Cross-Region Summary

The open-ended SWOT activity comments provided through a live polling platform reveal a freight system that is broadly strong in assets, but constrained by the ability to coordinate, fund, and operate these assets effectively under growing economic, environmental, and public pressure. While many issues surface statewide, the way they are framed and experienced varies meaningfully between the Asheville, Charlotte, Triangle, and Wilmington areas.

Strengths: Assets Are Strong but the Capacity to Leverage Them Varies

Across all four regions, stakeholders consistently point to the **presence of major freight assets** as a core strength. Ports, inland ports, aviation facilities, rail connections, and highway corridors form a solid multimodal foundation statewide. Charlotte and Wilmington emphasize their connectivity to national and global markets through inland port access, East Coast freight generators, and balanced import and export activity. The Triangle region highlights safety, system design, and ongoing roadway upgrades as distinguishing advantages.

Beyond physical assets, several regions pointed to **institutional and planning strengths**. Charlotte and the Triangle frequently reference proactive problem-solving, collaborative planning, strong analytical capacity, and innovative funding or partnership mechanisms. These comments suggest that in some regions, the ability to plan, coordinate, and adapt is viewed as equally important as infrastructure itself.

Asheville's strengths are framed more through **place-based qualities**, including location, scenery, and recent roadway improvements, underscoring how physical context shapes freight discussions in more topographically constrained areas.

Overall, the additional insights on the strengths of the NC Freight Network underscore its potential. The freight system features strong infrastructure and resources, and in several regions, growing confidence in the tools and partnerships needed to capitalize on it.

Weaknesses: Institutional and Operational Gaps Dominate

While assets are widely acknowledged, weaknesses consistently point to gaps in execution, coordination, and supporting infrastructure. Funding constraints, rising construction costs, and challenges maintaining and modernizing existing

infrastructure appear in every region, suggesting that affordability and delivery capacity are systemic issues rather than localized problems.

Operational challenges, especially **truck parking, first- and last-mile connections, and congestion-related delays**, are widespread. Charlotte's comments are heavily shaped by congestion, bridge condition, and delay costs, reflecting the region's scale and intensity of activity. The Triangle similarly raises truck parking, ITS deployment, and coordination challenges, but frames them more as governance and policy shortcomings as opposed to physical deficiencies.

Asheville's weaknesses are strongly influenced by **geography and network structure**, with repeated references to limited alternate routes, lack of redundancy, and resilience concerns tied to terrain and distance from interstates. Wilmington's weaknesses, by contrast, center on **modal dependence and access**, including rail limitations, port access constraints, and narrow funding options.

Across regions, **land use** emerges as a recurring weakness, in terms of both availability and alignment. Participants cited poor coordination between transportation planning and land use decisions, loss of farmland, and local priorities overriding broader system needs.

Opportunities: Coordination and Technology are Clear Paths Forward

Opportunities are the most consistently aligned across regions. Participants overwhelmingly pointed to **better coordination** as a catalyst for improving freight conditions. Ideas such as interstate freight compacts with Virginia, Tennessee, and South Carolina; stronger engagement with MPO and RPO boards; and facilitated conversations with rail partners reflect a belief that governance and stakeholder engagement improvements could unlock significant value without requiring entirely new infrastructure.

Technology also appears prominently as an opportunity. Freight-specific TSMO strategies, ITS deployment, dynamic detours, improved signage, and smarter truck parking systems were repeatedly cited as practical, near-term improvements. The Triangle, in particular, articulates a vision of technology-enabled operations as both an efficiency and safety strategy.

Education and engagement round out the discussion around opportunities. Across regions, participants saw value in better educating elected officials, increasing community dialogue, and improving public understanding of freight's role and impacts. This suggests that public and stakeholder buy-ins are viewed as prerequisites to long-term success.

Threats: External Pressures and Competitive Dynamics Loom Large

Feedback on threats is dominated by **external, largely uncontrollable forces**. Inflation, rising construction and fuel costs, and uncertainty around funding were cited repeatedly and across regions. These pressures amplify existing funding challenges and threaten the ability to deliver even well-supported projects.

Interstate competition also emerges as a significant concern. Several comments point to other states' investments – particularly in ports, defense-related infrastructure, and rail as a risk to North Carolina's competitiveness. Rail consolidations, including major mergers, are seen as potentially reducing leverage and participation in policy efforts.

Climate change and resilience surface more selectively but meaningfully, especially where flooding, route redundancy, or long-term system reliability are already concerns. Meanwhile, **emerging technologies** such as autonomous air mobility are viewed as both opportunities and threats due to unresolved safety, security, and regulatory questions.

Public resistance represents a quieter but persistent threat. Opposition to new funding models, dredging, growth, or freight investment more broadly suggests that even well-designed strategies may face implementation hurdles without sustained engagement.

6. Plan Recommendations

The Plan recommendations cover a broad range of issues including federally required elements as well as specific topics of critical interest to North Carolina. The recommendations and supporting discussions of context are broadly divided into three areas:

- Policy Recommendations
- Supply Chain Recommendations
- Modal Recommendations

A summary table of recommendations by area appears in Appendix A.

6.1. Policy Recommendations

North Carolina's freight transportation infrastructure and services are one of the state's greatest strengths, in the consensus view of public and private sector stakeholders engaged in development of this plan. The physical system is multimodal and the services it supports enable North Carolina's supply chains to function. Supply chains are the logistical dimension of the state economy, generating jobs by providing products for regional and global markets and the necessities of life for every person in the state.

Industrial diversity is a major advantage of the North Carolina economy, attracting and retaining business across a broad spectrum and protecting economic output in the same way that diversity of investment protects returns in a financial portfolio. The accompanying map in Figure 95 depicts industrial diversity in geographic terms across the state's Prosperity Zones, which are administrative regions defined by the North Carolina Department of Commerce. The pie charts capture supply chain activity through the value of originated freight for a dozen industry commodity groups, with the sizes of pies and the shades of zones reflecting total value. What stands out is that the industry groups are present essentially everywhere. The three largest groups accounting for 55 percent of statewide production – chemicals, pharmaceuticals and plastics; machinery and electronics; and mixed freight[117] – are active in every zone and are prominent in many of them. The implication is that the industrial ecosystems of North Carolina supply chains crisscross the state, and connections between them and the zones in which they operate are vital to their function.

[117] Mixed freight includes miscellaneous manufactured products, furniture and lighting, most intermodal container freight, and a blend of business and home supplies significant in e-commerce.

FIGURE 95. INDUSTRIAL DIVERSITY ACROSS NC PROSPERITY ZONES, 2022

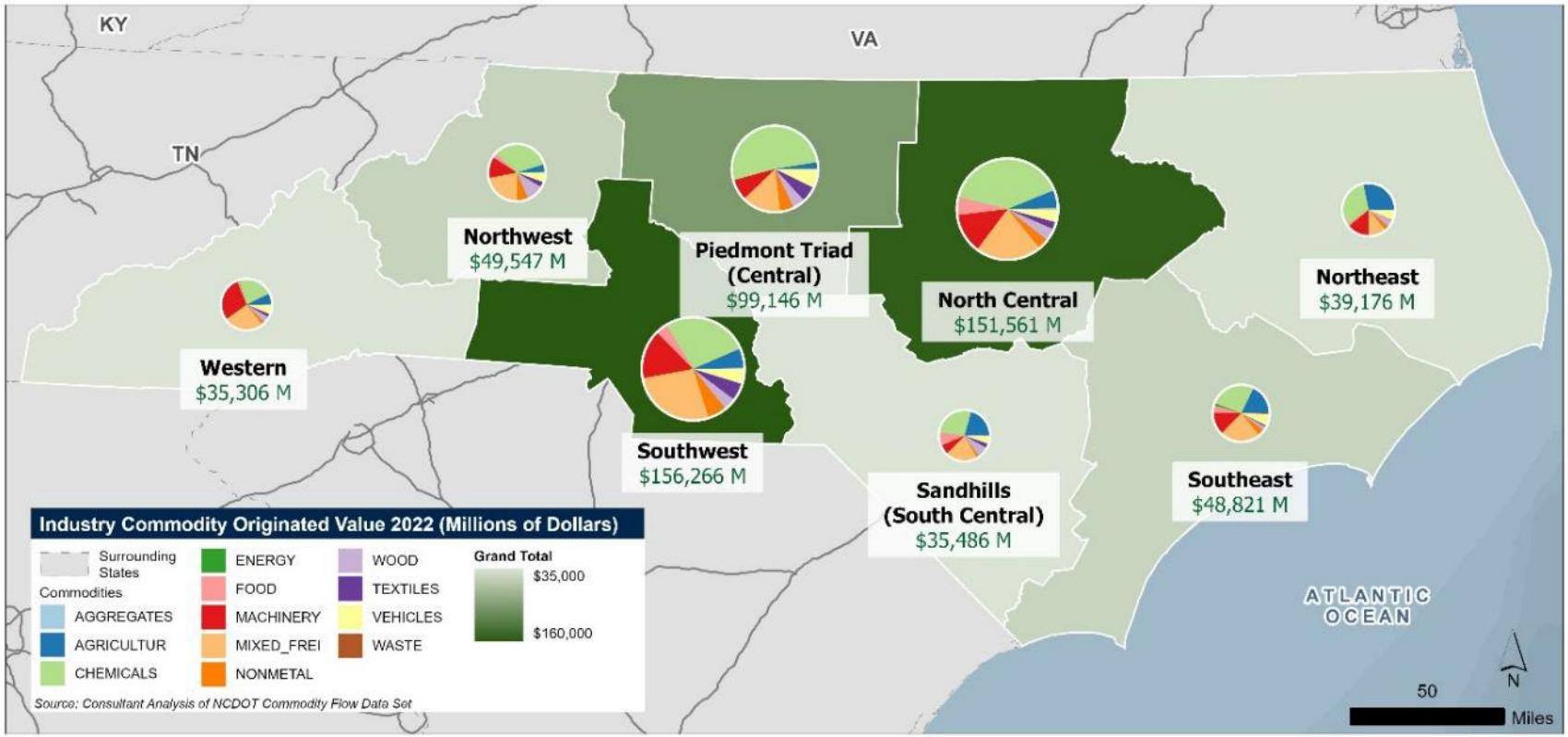


FIGURE 96. FREIGHT PRIORITIES FROM NC STAKEHOLDERS



What do the supply chains of North Carolina require from freight transportation? North Carolina stakeholders identified four priorities, shown in Figure 96. The four are interrelated:

- **Reliability** is the number one performance requirement[118] in freight transportation because delivery of cargo intact and on schedule is the primary thing shippers and receivers are buying from carriers. A common minimum metric is 95 percent on-time delivery. Reliability is an important driver of transportation cost, because carriers who cannot be sure of meeting this metric due to unpredictable congestion or other performance risks in a region will adapt by adding buffer time to their schedules. With longer schedules, more assets (equipment, labor, facilities) are required to deliver the same volume of freight, which drives up costs in the market. Higher costs then affect the competitiveness of the region for attracting and retaining industry.
- **Resilience** is the ability to maintain or recover freight service in the face of severe weather events, cyber attacks, labor outages, or other disruptions. It is an acute concern in North Carolina in the aftermath of Hurricane Helene in 2024. Preparation for and recovery from disruptions add to costs, and resilience risk in vulnerable areas affects business location decisions.

[118] Determined by the Committee on Supply Chain Competitiveness of the U.S. Department of Commerce in 2014, although it is widely accepted in the industry.

- **Connectivity** is the ability of a multimodal transportation network to support efficient end-to-end service through links between freight origins and destinations and between the modes that serve them – some of whose important facilities are out of state. Efficiency reflects time and distance and thus the availability, circuity, and capacity of routes, and the cost of using them. The quality of connecting routes affects their reliability and effectiveness in joining together the elements of supply chain ecosystems and of intermodal service. Connectivity influences resilience through the presence or absence of alternative and relief routes, and it affects the competitive viability of regions for economic development.
- **Competitiveness** is the ability of a region to attract and retain industry in comparison to other regions, and to support the productivity of its industry against rivals worldwide. It is shaped by the contribution of a region to the logistical outcomes from whole supply chains, combining local performance with that of connected regions in the ecosystem, including the locations of suppliers, distributers, gateways and multimodal networks. Competitiveness is where reliability, resiliency, connectivity and cost come together to influence economic vitality and the prosperity of the state.

The competitiveness of North Carolina is evident from its ranking as the top state for business in three of the past five years[119] – yet rankings must be merited to be maintained, through policy and investment in the years ahead. An important characteristic of the four freight priorities under discussion is that they operate at the statewide level and at the local level. Both must be addressed because supply chain performance is achieved end to end; weak links compromise the whole chain. Connectivity is a case in point; it pertains to cross-town travel as much as to travel between regions, and local travel in fact can have an outsized influence. Recent research finds that half of supply chain transportation and logistics are incurred in the last mile[120], indicating that freight performance in the cities and towns of North Carolina is crucial to state outcomes, and that integration of state corridors with community networks and of rail, marine, air and pipeline modes with roads that reach businesses and homes is a fundamental need in the freight system.

Strategy recommendations in this chapter are organized under the four freight priorities. Each one is a component in a statewide whole. As described above, the components are interrelated, making the whole more than the sum of its parts and each part less effective without the others.

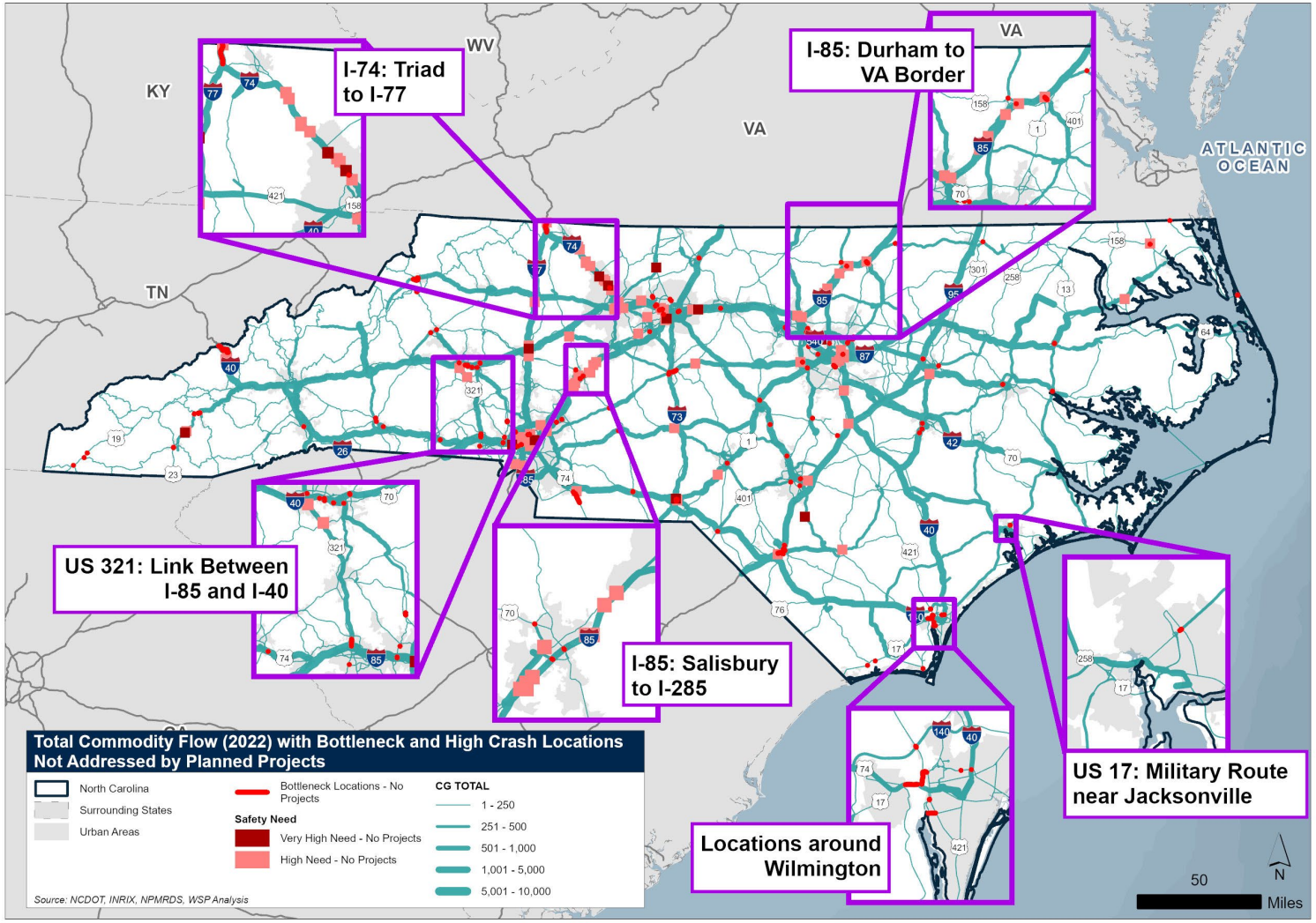
[119] Ranking by CNBC, https://www.cnbc.com/2026/07/09/ohio-no-1-americas-top-states-for-business-rankings.html. NC ranked first in 2022, 2023, and 2025; second in 2024 and 2026.
[120] "5+ SCM Trends Shaping the Now and Future of Logistics", Dr. Terry Esper, The Ohio State University, Fisher College of Business, presentation to Ohio Conference on Freight, 8/26/26. The reported figure is 53%.

6.1.1. Reliability

Operational pain points in the freight system are among North Carolina's greatest weaknesses in the consensus view of public and private sector stakeholders from the SWOT analysis cited in the previous chapter. Reliability needs are focused on pain points because they are the weak links in supply chains. For freight transportation purposes, they equate to congestion bottlenecks and to high crash locations, the latter because crash incidents delay delivery, harm people and cargo, and elevate costs.

- **Recommendation P-1:** Support reliability and safety on interstate highways and state routes in the NC Priority Highway Freight Network (NCPHFN) that are not covered by ongoing and planned projects.
    - Figure 97 depicts industry freight flows on the NCPHFN as they encounter freight bottlenecks and high crash locations not currently slated for improvements. While a broader set of performance deficiencies and project needs appear later in this chapter, six prominent locations for potential improvements are highlighted in the map.

FIGURE 97. INDUSTRY FREIGHT FLOWS (TONNAGE) AND PERFORMANCE DEFICIENCIES, WITH POTENTIAL PROJECT HIGHLIGHTS



- **Recommendation P-2:** Support investment in secondary roads, local freight connectors, and last-mile infrastructure.
    - These routes provide connectivity to the freight network, and the reliability of such connecting routes matters to overall performance. When designed for freight use, they can offer alternative and redundant routes to ensure mobility and resilience. Moreover, many of them are the means of access to multimodal facilities (ports, inland ports, airports, rail intermodal terminals, pipeline terminals) and affect the quality of their service.

- **Recommendation P-3:** Balance the needs for freight reliability investment across the state.
    - North Carolina urban and rural areas are united in their importance to supply chain ecosystems. Rank the top bottlenecks identified in this plan separately so reliability needs in all regions of the state receive attention.

- **Recommendation P-4:** Incorporate low-cost "quick win" initiatives in reliability programs to improve performance sooner.
    - Provision in real time of advance information on incidents and optional truck routes helps protect reliability and driver productivity. Technologies already deployed in North Carolina would benefit from real-time data feeds and greater accuracy.
    - Truck parking improvements through various means reduces lost driving time under hours-of-service regulations and leaves more time to meet delivery windows.

Scenario analysis of the Renewed future revealed that economic growth driven by the small towns of North Carolina yielded reduced congestion and higher reliability in urban centers. While these areas of the state certainly face reliability challenges, they are fewer and perhaps less costly to address than elsewhere. This suggests that investment chiefly focused on correcting deficiencies may overlook investment in the opportunities for growth in areas that already offer better reliability. Growth inevitably will degrade performance – as the scenario analysis also revealed – yet the purpose of opportunity investment is to anticipate and prepare for such developments.

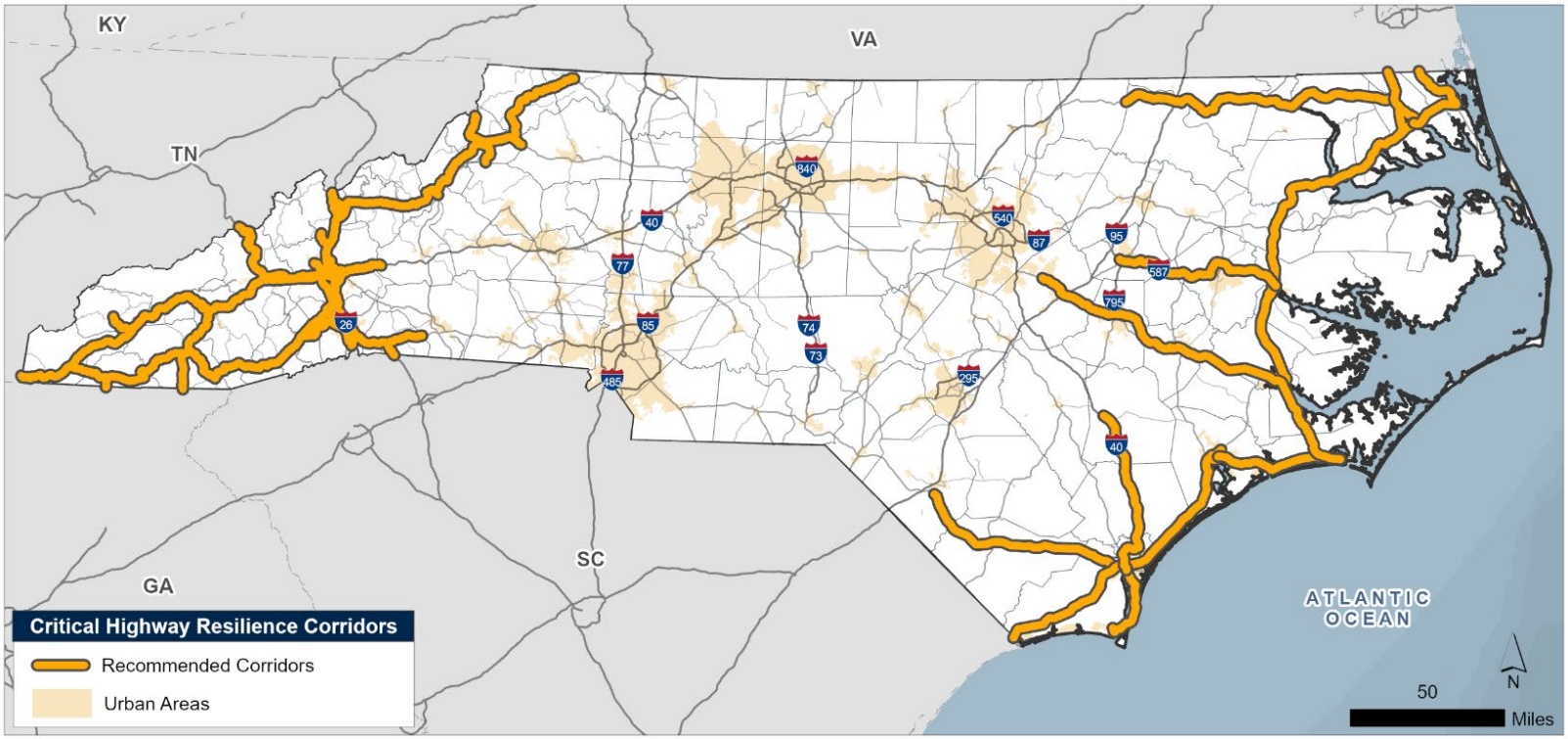
- **Recommendation P-5:** Include investment in growth opportunities in the smaller communities of the state among the programs to improve reliability.

6.1.2. Resilience

Severe weather can devastate communities, crop land, facilities, and transportation routes – I-40 in western North Carolina is still undergoing reconstruction two years after Hurricane Helene. The effect of that storm on the mines in Spruce Pine, NC shows how supply chain vulnerabilities and repercussions can become global. These mines produce the majority of the world's high-purity quartz, which is used in silicon refining for semiconductors, smartphones, and a variety of other products. Hurricane Helene cut road and rail access to the mines for shipping and for workers, causing a temporary shutdown of production and lingering difficulties in transport.

- **Recommendation P-6:** Adopt Priority Highway Resilience Corridors (PHRCs, displayed in Figure 97) as factors in prioritizing projects for investment.
    - The corridors capture at-risk portions of the NCPHFN in low-lying areas of eastern North Carolina and elevated portions in the west, totaling almost 1,500 miles.

FIGURE 98. PRIORITY HIGHWAY RESILIENCE CORRIDORS



- **Recommendation P-7:** Include portions of STRAHNET with resilience risks in developing Primary Highway Resilience Corridors (PHRC) factors for investment priority.
    - PHRCs overlap STRAHNET critical military routes in eastern and western North Carolina; examples include US 17, US 70, I-40 and US 23. STRACNET rail routes in the same territory warrant similar protection. Both STRAHNET and STRACNET are portrayed in the Military section below (Figure 108 and Figure 109).

- **Recommendation P-8:** Consider roadway and bridge designs appropriate for freight transportation in pursuing route redundancy in at-risk areas.
    - Alternative routes can keep freight moving during disruptions, for communities, businesses, ports, airports, and other multimodal facilities. They may serve as relief routes for evacuation and supply routes during recovery, but to be effective, they must be designed for the weight and dimensions of freight vehicles on roadways and bridges. Similar purposes apply to rail, which requires adequate track weight and clearances and access to rail lines.

- **Recommendation P-9:** Prepare for network disruption threats from many sources.
    - Continual monitoring of risks beyond severe weather is necessary for NCDOT and its planning partners in state government and regional jurisdictions. The potential sources are many and can result from global events. Cyber security is especially significant today because of the potential for artificial intelligence to breach defenses, with consequences ranging from cargo theft to network-wide breakdowns of management and operating systems.

6.1.3. Connectivity

Connectivity enables reliability and resiliency, it is vital to multimodal freight services, and it is essential to the performance of supply chain ecosystems at the statewide and local levels. The three industry groups that accounted for more than half of statewide production in 2022 are forecast to drive nearly three-quarters of the incremental value of North Carolina production in 2055. Their projected networks on the NCPHFN in 2055 are displayed in the following maps: Figure 99 for chemicals, pharmaceuticals and plastics; Figure 100 for machinery and electronics; and Figure 101 for mixed freight. A fourth map (Figure 102) displays network flows of agricultural goods.

FIGURE 99. INDUSTRY NETWORK FLOWS IN 2055: CHEMICALS, PHARMACEUTICALS & PLASTICS (TONNAGE)

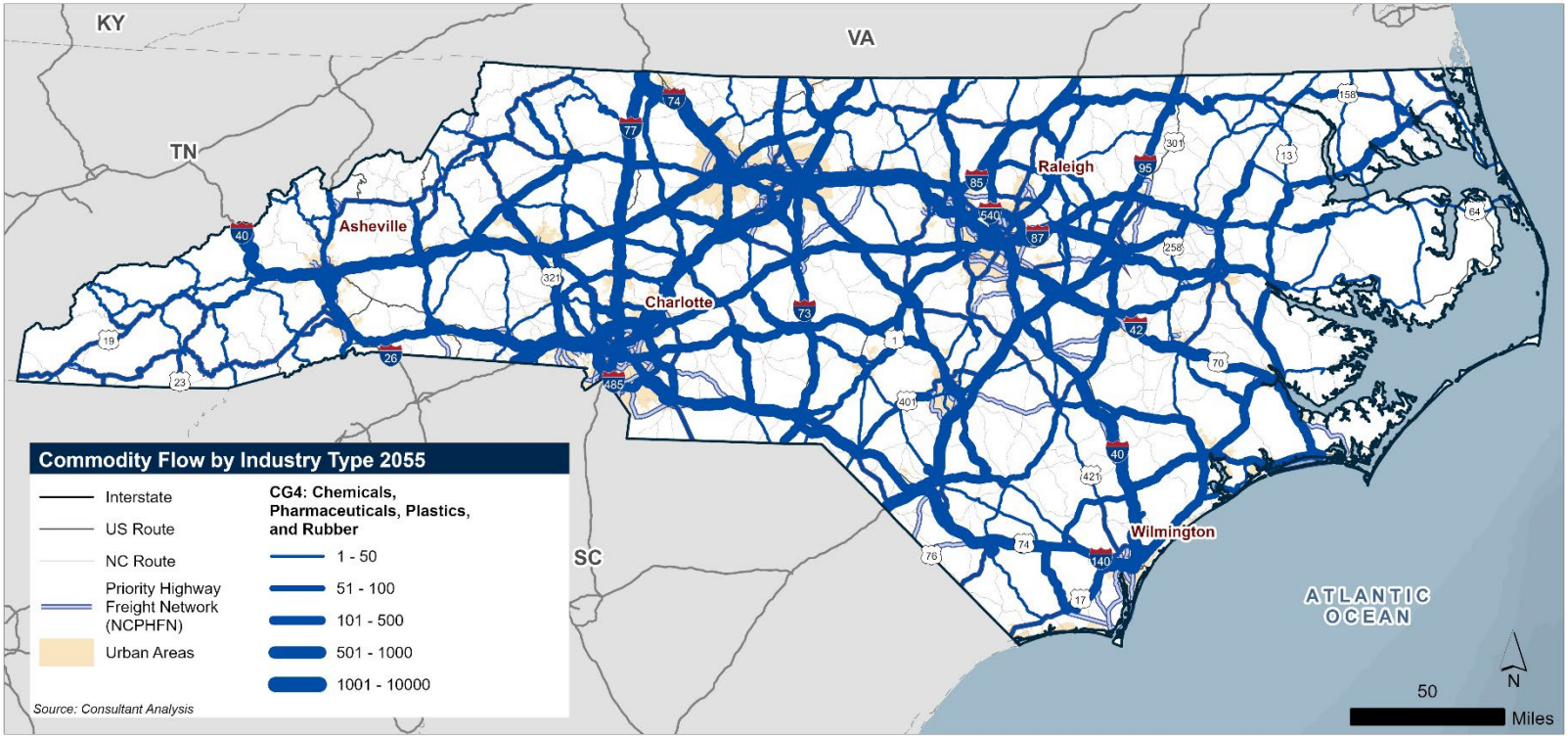


FIGURE 100. INDUSTRY NETWORK FLOWS IN 2055: MACHINERY & ELECTRONICS (TONNAGE)

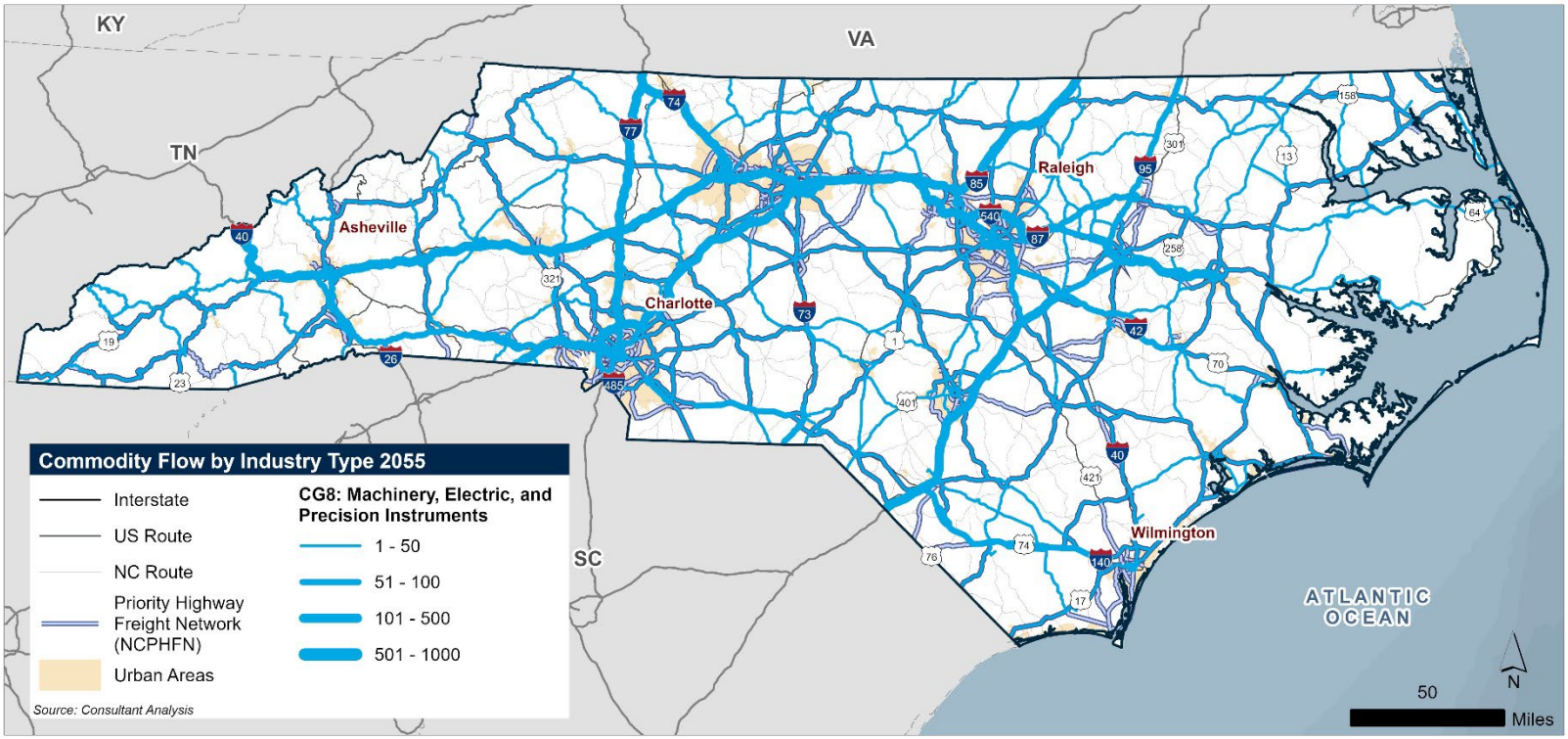


FIGURE 101. INDUSTRY NETWORK FLOWS IN 2055: MIXED FREIGHT (TONNAGE)

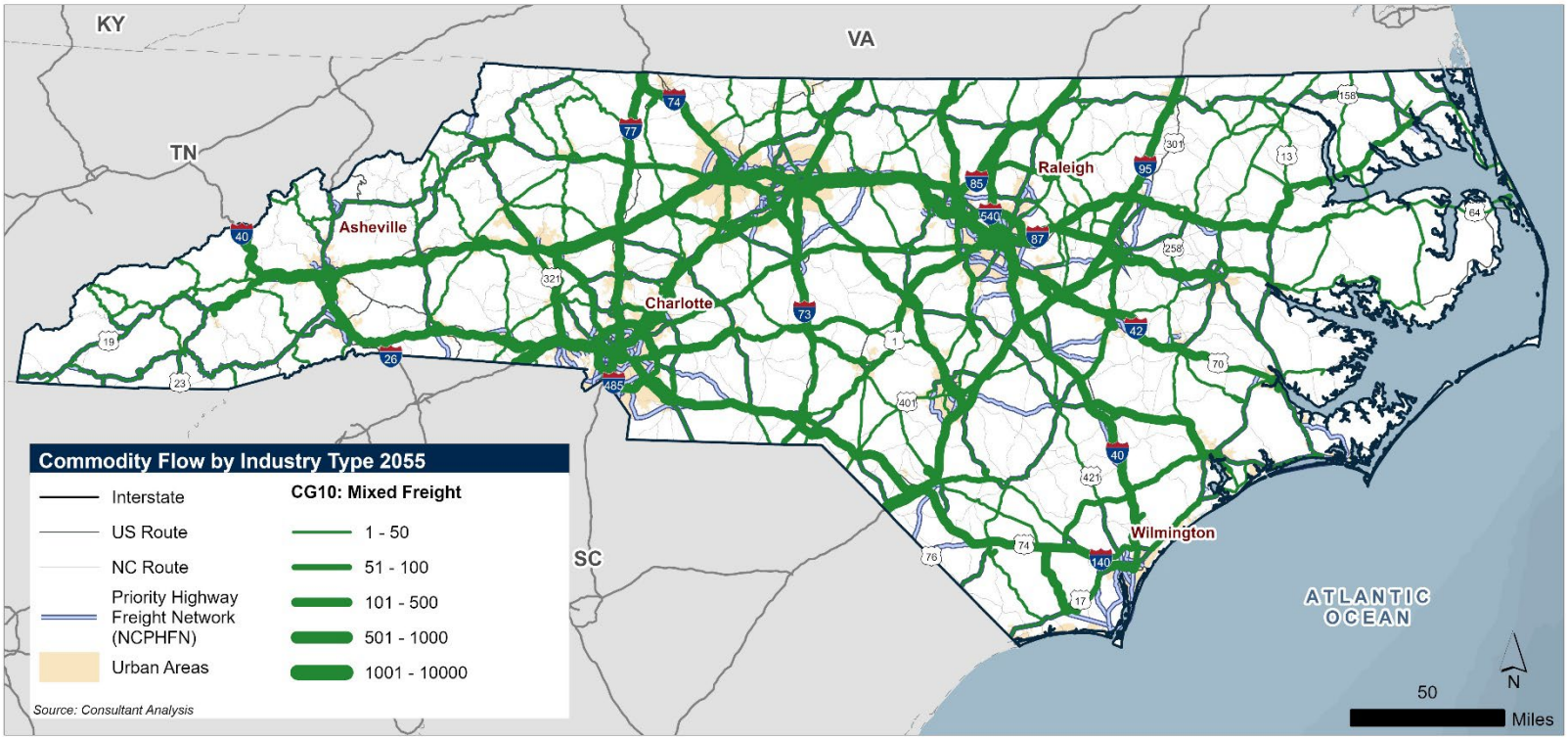
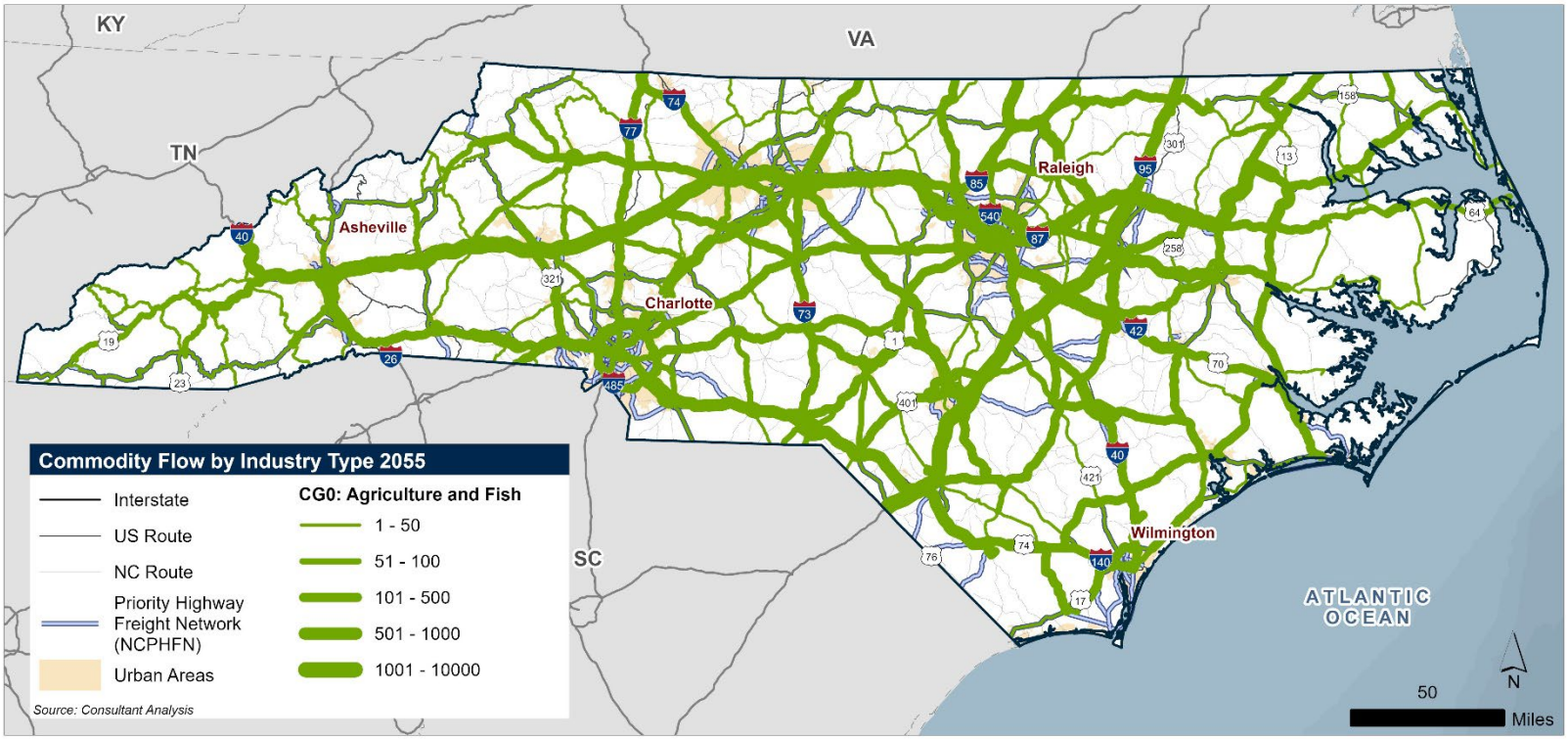


FIGURE 102. INDUSTRY NETWORK FLOWS IN 2055: AGRICULTURAL GOODS (TONNAGE)



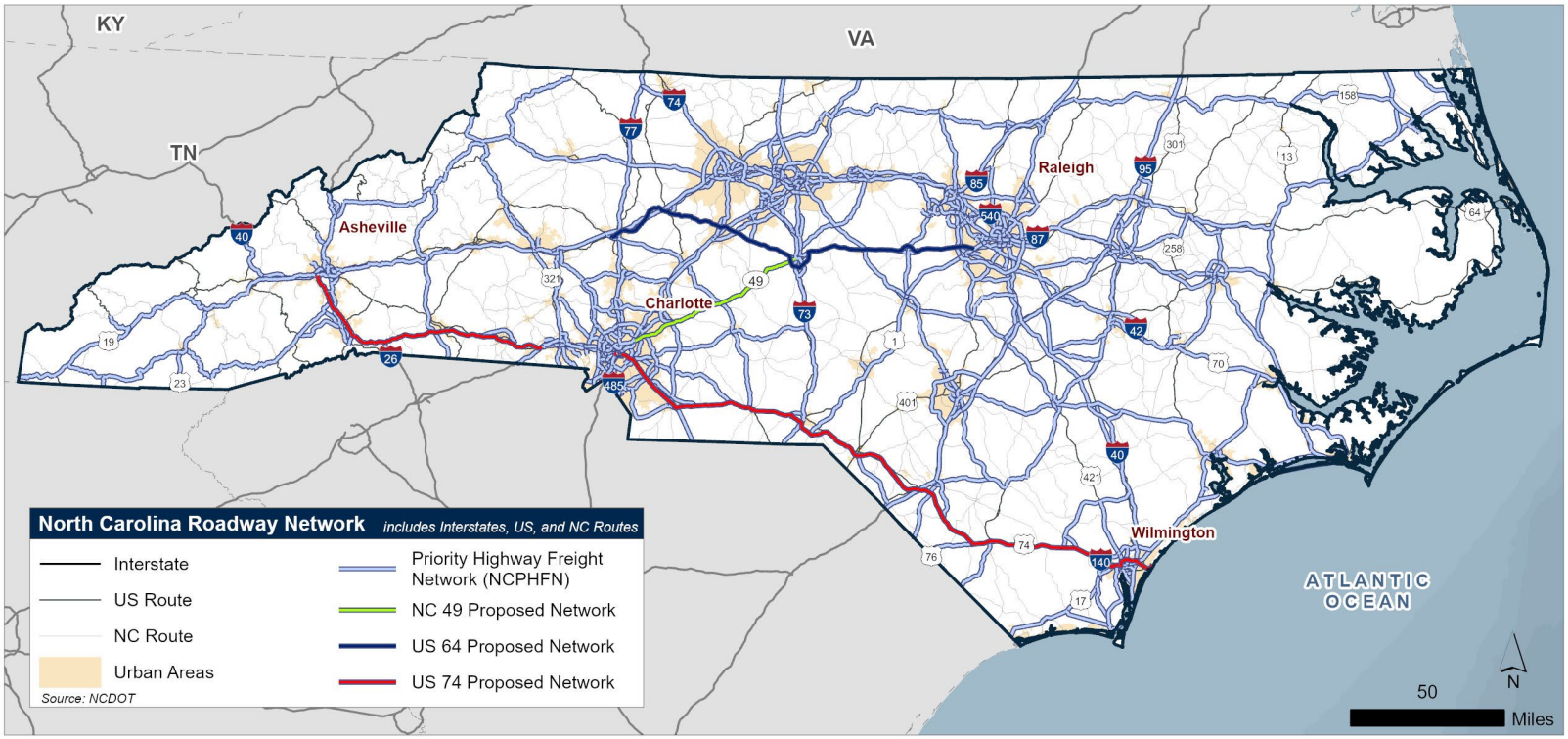
All four maps show industry networks spanning the state, requiring connections across North Carolina and across the local networks in cities and towns as well. Not depicted in the maps but evident by their location is use of ports, airports, inland ports, and rail intermodal terminals. Three of the four industries are significant users of rail carload services, and the fourth (mixed freight) utilizes intermodal rail. Some of the multimodal services involve facilities in other states, using rail and interstate highways such as I-85 and I-95: container ports and inland ports in Virginia, South Carolina and Georgia; and international cargo airports in Virgina and Georgia. The Globally Connected scenario produced the best results for freight growth and jobs; yet it also produced declining KPIs without further investment. Finally, and related, while the freight forecast

for North Carolina industry is robust, forecasts must be earned. Investment in the connecting and multimodal networks over which supply chain logistics operate is a powerful way through which a favorable future can be brought to pass.

- **Recommendation P-10:** Prioritization project submittal decisions affecting corridors and corridor-related local input point assignments should consider interstate freight flows, regional economic relationships, and strong connections to neighboring states.
    - The importance of regional economic relationships is visible in the maps. All of these industries also have suppliers and markets outside the state, and they reach global suppliers and markets through North Carolina and neighboring gateways.

- **Recommendation P-11:** Evaluate East-West system connectivity.
    - North Carolina measures 400-plus miles from the mountains to the sea, yet most interstates run North/South, not East/West: I-26, I-77, I-85, I-74/73, I-95, and the southeast portion of I-40. The single East/West interstate is I-40 (including part of I-85) west of Raleigh, connecting to three East/West routes east of Raleigh, which are largely access-controlled: US 64, US 264, and US 70. US 70 in addition is being developed as I-42 from the Triangle region to the coast.
    - Improving East/West routes offers the mobility advantages of a grid system with viable alternative routes, added redundancy, and greater resilience.
    - NCDOT should explore this concept. Three options to consider for upgrade on the NCPHFN are shown in Figure 103 and described below. There may well be more alternatives, and all options should be evaluated.
        - US 64 between Cary and Statesville is not access controlled except for a short section joined to I-40. It has several points of performance deficiency. The section from Cary to NC 49 is a Strategic Transportation Corridor.
        - NC 49 West from I-74 adds a diagonal connection to Charlotte, it is a Strategic Transportation Corridor, and it could serve as an alternate route to I-85.
        - US 74 between Wilmington and I-26 south of Asheville skirts the South Carolina border and passes through Charlotte. It is a Strategic Transportation Corridor, portions are becoming I-74, and much is access-controlled, but gaps remain.

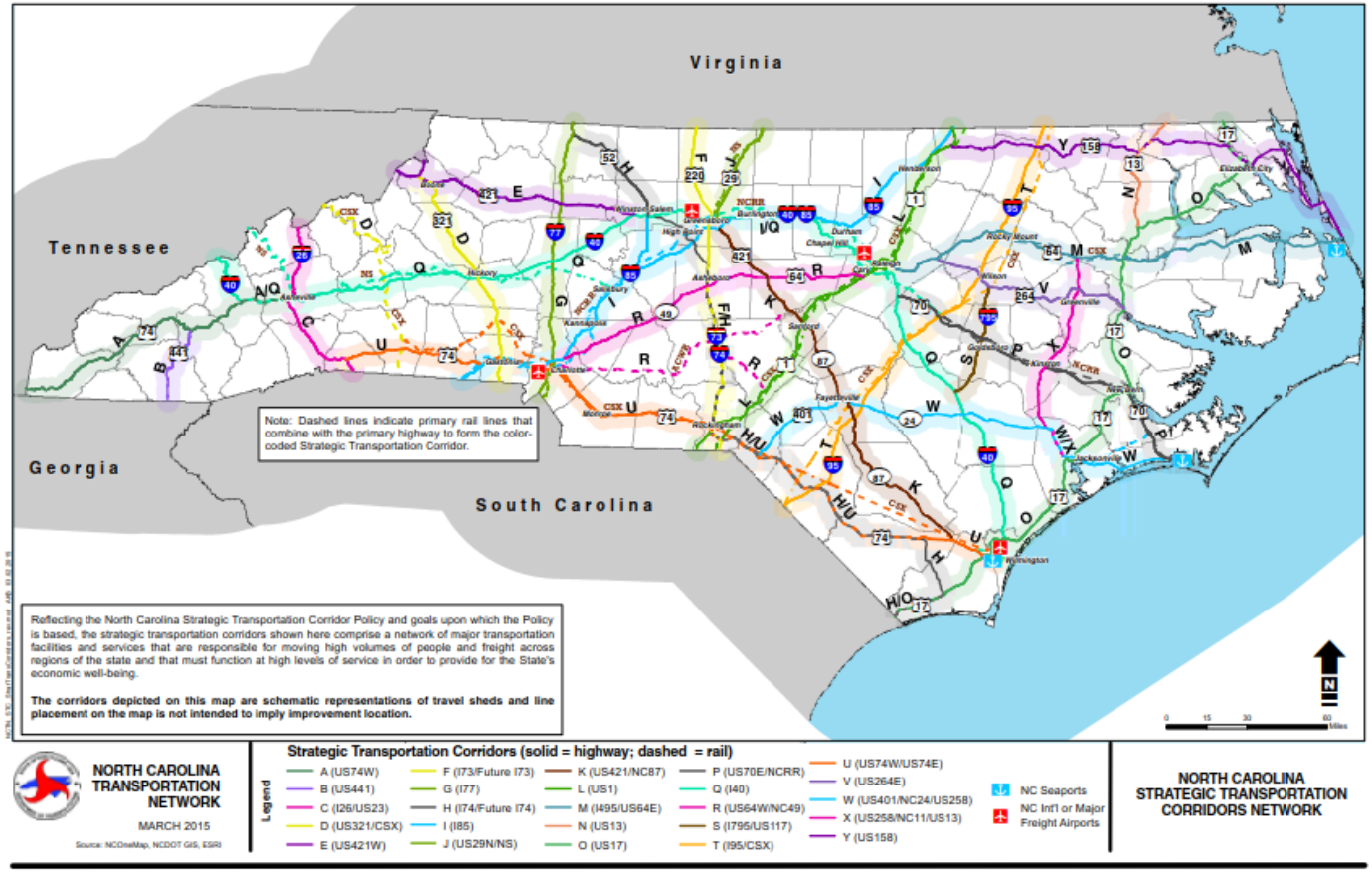
FIGURE 103. THREE EAST-WEST UPGRADE OPTIONS



- **Recommendation P-12:** Advance transportation corridors to support supply chain ecosystems statewide.
    - Supply chain connectivity into mid-size and smaller communities is important. The PHFN accomplishes some of this, although volumes in other locations may fall below its thresholds. Strategic Transportation Corridors (STCs, portrayed in Figure 104) form a core network of multimodal routes to serve passenger and freight traffic and can complement the PHFN. They are intended to support reliability and economic development, and while they include interstate highways, they are mainly state routes. As such, STCs reach mid-size and smaller communities throughout North Carolina, providing connections between regions able to support supply chain

systems. Many STC corridors are important to North Carolina military installations, as detailed later in this chapter. STCs are intended to be developed with regional planning partners and thus offer a platform from which to explore interregional service through a supply chain lens, and to connect that to local plans for the final miles.

FIGURE 104. NC STRATEGIC TRANSPORTATION CORRIDORS



- **Recommendation P-13:** Equip regional planning partners to integrate freight into local processes, joining state initiatives to local programs in support of end-to-end service for supply chain systems.
    - This plan has prepared a Framework for Incorporating Freight into Transportation Planning to help local planners consistently integrate freight into Comprehensive Transportation Plan (CTP) and Metropolitan Transportation Plan (MTP) processes. The Framework is grounded in a review of current practice and identified gaps, giving guidance for each step of CTP development with links to NC Freight Plan data resources and recommendations. Needs vary by region, and the Framework allows for that. The Framework with full detail appears in the Appendix B.
    - The Framework together with the STC platform creates a mechanism to bring connectivity from the statewide to the local level in a coordinated process. Cross-town freight performance needs are comparable to inter-regional needs at a smaller scale and with greater complexity. The local scale is where the highest costs are incurred, with clear consequences for the competitiveness of the state and the success of its industries. Local communities are home to the multimodal and military facilities of North Carolina, providing them access to national and global networks and the markets and nations they reach.

- **Recommendation P-14:** Support Advanced Air Mobility (AAM) as an additional avenue of connectivity.
    - AAM requires minimal launch facilities, giving it the potential to be sited almost anywhere and to connect almost anywhere within its range. Operating ranges are limited to a couple hundred nautical miles, and cargo payloads are less than one ton, giving it less capacity than an aircraft and more than a drone. Flexibility is its greatest asset. It is suited to applications in low density markets, to emergency services, and to recovery from disasters and disruptions where access is compromised and urgency is high. As with any new technology today, capabilities will evolve and integration of AI can be expected.

6.1.4. Competitiveness

Uncertainty is a principal threat facing North Carolina in the view of private and public stakeholders. It comes from multiple sources – geopolitics, technology, weather and financial markets, among others. It affects investment and risk premiums, and it demands that North Carolina plan for uncertainty. Scenario analysis was conducted for this plan for that purpose. The

Unstable scenario itself showed ample reason for caution, while the Trend scenario demonstrated serious deterioration across KPIs and regions without serious investment in improvements beyond those currently planned.

The disparity between the transportation needs of North Carolina – for freight and any purpose – and the money available to tackle them is clear to all stakeholders. Funding uncertainty is therefore a leading concern. The implications for competitiveness are stark, and indeed, rivalry for raising and winning funds is an aspect of competition. Leadership in the North Carolina legislature has voiced the view that every form and mechanism for funding must be on the table. Reauthorization of federal transportation legislation and grant opportunities that may emerge should be of assistance, but North Carolina must find solutions for itself.

Private sector stakeholders view leveraging of policy and partnerships as a major strategic opportunity. Public sector stakeholders emphasize regional and corridor development. The two perspectives intersect on the question of funding investment to meet supply chain needs. When that happens, the prospects for competitiveness brighten, because the issues in reliability, resilience and connectivity start to be addressed.

- **Recommendation P-15:** Develop partnerships at the state and local level between public and private sector players to establish which forms and mechanisms for raising funds could acquire consensus and attract political support.
    - Solutions may differ around the state and mechanisms may be specific to the application, such as a special purpose local option sales tax. The role of NCDOT could be limited to that of a convener, or it may be called upon for more.
    - Opportunities to encourage economic development could be one focus for finding funds, using proactive freight planning, tax incentive financing, cultivation of trade skills, zoning policies, trade initiatives aimed at foreign direct investment, or through other means. A workgroup centered on freight and economic development could be established for this purpose, drawing from NCDOT divisions involved in these topics and potentially other partners.

- **Recommendation P-16:** Capitalize on technology as a lower cost and faster route to freight performance improvement, while advancing new technology carefully.

- There are many avenues available for technology, and possible applications of AI continue to alter the outlook. One productive category is technology supporting what supply chain managers call visibility, which is the ability to know where every unit of owned and expected inventory is at all times in real time, and the operating conditions it faces in concluding its movement to market. Visibility enables optimization, AI accelerates and reconfigures optimization, and both reduce costs and support market share. The public role is in communicating and managing operating conditions, and in ensuring that communications can take place. NCDOT's DriveNC program and participation in Drivewyze are examples of the former.
- The Innovative scenario found major gains in freight KPIs from the introduction of connected and autonomous vehicles in 24/7 operation. This plainly matters to competitiveness and the possibility of other Southeastern states moving well beyond North Carolina is a factor – nor is freight autonomy limited to trucks. Public acceptance of autonomous technology for trucks in the North Carolina environment may be another matter nevertheless, although military installations are using it and advised in one workshop for this plan that "unmanned vehicles are upon us." The promise of technology can exceed its performance in early days, suggesting for public right-of-way that a careful approach using pilots, partnerships, and/or phased deployment is wise.

- **Recommendation P-17:** Adopt regional, coordinated approaches to freight initiatives.
  - Freight does not conform to jurisdictional boundaries, nor is it uncommon for one region to bear the burden of heavy freight traffic while another region enjoys the benefits. In addition, the elimination of pain points in one part of a network can cause them to erupt in others. Especially given the slim access to funds, the need to generate them, and the inter-regional, interdependent nature of supply chain ecosystems, purposeful coordination of freight initiatives can promise better outcomes.

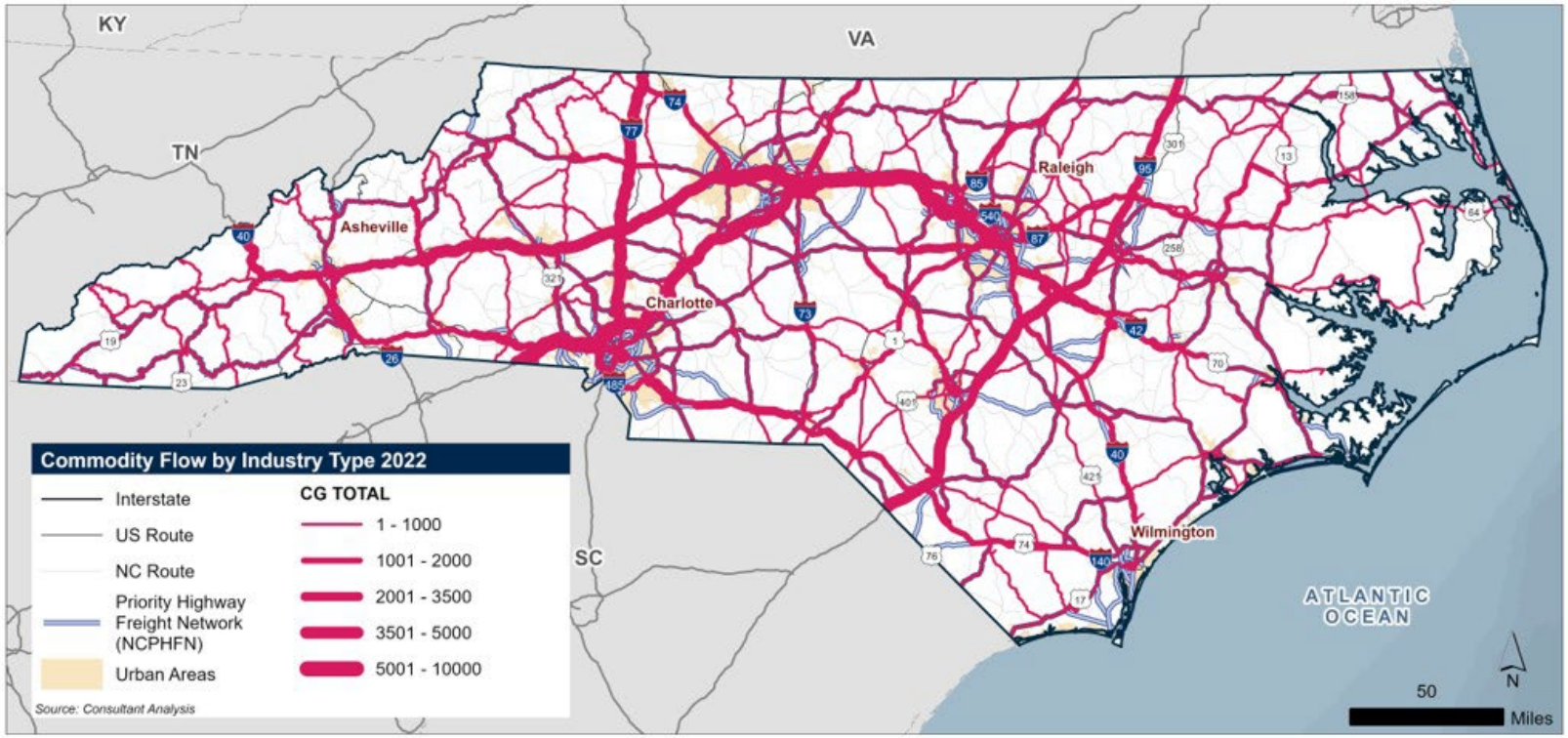
6.2. Supply Chain Recommendations

6.2.1. Economic Development and Land Use

The economic importance of freight corridors is evident from the reliance placed on them by the supply chains of North Carolina. Figure 105 depicts the total supply chain use of the NCPHFN through industry commodity groups (CGs) in 2022.

The state is blanketed, every region is involved, and almost every element[121] of the network is in use, providing access to multimodal facilities as well as to industrial sites. Comparably pervasive reliance on the NCPHFN can be seen from maps of individual industry supply chains displayed in the Policy discussion above.

FIGURE 105. TOTAL SUPPLY CHAIN ACTIVITY ON THE NCPHFN, 2022 (TONNAGE)



[121] Routing of commodity flows starts from county-level geography. This can understate use of some routes; the process used to update the NCPHFN for this plan makes it likely that few if any NCPHFN facilities are unused.

Freight activity results from economic activity. For supply chains, this is expressed in the logistics of sourcing, production and distribution in the state's trade and industrial system, with its connections across the state, nation and world. In 2024, North Carolina exported $42.8 billion in goods and imported $87.6 billion, underscoring how deeply economic performance depends on reliable freight infrastructure. Pharmaceuticals and medicines alone accounted for about 30 percent of total exports and 24 percent of import value. Other major freight-reliant sectors included chemicals, machinery, agriculture, and mining. These industries depend on reliable access to ports, highways, rail corridors, and intermodal terminals for both inbound supply chains and outbound market access. Reliable freight corridors that link production centers to gateways and markets help North Carolina manufacturers keep raw materials, parts, and finished goods moving efficiently and remain globally competitive. The resilience of this infrastructure and the freight operations it enables is a matter of economic continuity and vitality.

Central North Carolina

Most of the major industries of North Carolina have a strong presence in the Piedmont region at the center of the state, as Figure 95 demonstrates. Freight-generating industrial buildings, warehousing and distribution facilities, rail terminals, and intermodal assets are concentrated in the economic centers of Charlotte, Greensboro, and Raleigh and the corridors that serve them. Reliable multimodal access is essential to production, processing, and storage in the region, as well as to the supply of everyday goods to the large populations that inhabit it, and to the businesses and residents in the rest of the state that interact with and depend on Piedmont industry. As is common in urban areas, the region is rife with bottlenecks that can be costly. If its freight facilities cannot perform reliably in the years ahead, and if they cannot remain functional during and after disruptive events, the consequences extend beyond transportation performance to supply chain impacts, export competitiveness, and long-term statewide growth.

- **Recommendation SC-1:** Work closely with the local agencies, such as Metropolitan and Rural Planning Organizations and regional industry associations, to help identify specific projects to improve freight performance in Central North Carolina.

Eastern North Carolina

The land use and freight system connection in eastern North Carolina is especially strong in the agriculture, food-processing, and cold-storage sectors. Its most freight-relevant land uses are geographically concentrated east of I-95 and across the

coastal plain; the seaports of North Carolina are there as well. The state is the nation's third-largest hog producer, with Sampson and Duplin Counties alone accounting for about 46 percent of the state's 8.2 million hogs in 2024. Both counties are served by I-40, parts of which are classified as high-resiliency priority segments. Cold storage facilities are clustered near livestock and poultry production areas along I-95 and in locations linked to the Port of Wilmington. These patterns reflect a tightly connected freight system in which agricultural land, processing activity, cold storage, and export-oriented logistics come together in one supply chain that depends on freight infrastructure at high risk for resilience and facing top-ranked bottlenecks on access routes to the ports. Interruptions to major corridors here threaten livestock movement, food processing, and the ability of agricultural producers to reach domestic and international markets. Protecting this network is essential to preserving the economic productivity of eastern North Carolina and the industries that rely on it.

- **Recommendation SC-2:** Consider connections to PHRCs as a factor in investment prioritization, in areas where port-dependent logistics and dispersed agricultural activity rely on high-risk coastal and inland corridors serving fixed, location-dependent freight land uses.

Western North Carolina

In western North Carolina, the most strategically significant freight land uses are often dependent on natural resources, specialized, fixed to location, and served by a smaller set of transportation links where capacity and alternatives are constrained by terrain. Mining land uses are a function of geology, whether for low value but high-volume construction aggregates or high value and lower volume resources like the specialty quartz in Spruce Pine. That quartz is a crucial component of semiconductors for computer chip-enabled devices. Similar factors apply to selected forestry activities such as the Christmas tree industry, which thrives in the terrain and is seasonal for harvesting, but requires cultivation at other times of year. Drought and flooding can impact harvest or mining conditions and their connections to the freight network. Hurricane Helene (2024) and its heavy rains shut down Spruce Pine and caused more than $100 million in losses for the Christmas tree industry.[122] Conversely, in times of heavy activity, these industries contend with the same network, where incidents and bottlenecks are harder to clear and options are few due to the mountainous terrain.

[122] https://www.cbsnews.com/video/north-carolinas-christmas-trees-devastated-by-hurricane-helene/

- **Recommendation SC-3:** Consider regional natural resources, their conditions and seasonal needs, as well as their connections to the priority freight network in identifying the critical role of small network segments in freight planning and investment in this region, not just mileage and corridor classification.

Warehousing Land Use and E-Commerce

Industrial buildings used to manufacture, store, or distribute goods typically generate significant volumes of inbound and outbound freight shipments. The evolution of e-commerce, particularly since the pandemic, has changed the deployment of warehouses in the retail sector, introducing more specialization and stages and placing more facilities near end-markets. In addition, the third-party logistics (3PL) sector has enlarged the quantity of warehouses on offer, combining ownership of facilities with others available from partners. This has allowed industry clientele to rely on short-term leases for "flex space," rather than needing to own facilities with surge capacity. The major types of industrial facilities are:

- **Manufacturing** buildings are receiving inbound shipments of raw materials or input parts or components and are generating outbound shipments of finished manufactured goods. Manufacturing includes food processing and food product manufacturing, pharmaceuticals manufacturing, and the industrial manufacturing of durable and non-durable goods for consumers and other businesses.
- **Warehousing and distribution** buildings are places where products are stored, staged, consolidated, and prepared for delivery to retail stores or customer locations. Table 45 provides definitions of common terms used to describe different types of warehousing and distribution buildings. Various combinations of these facilities may be used in any company or product supply chain, depending upon the specific characteristics of where the products are manufactured, consumed, handling requirements, etc.

TABLE 45. DESCRIPTIONS OF COMMON WAREHOUSING AND DISTRIBUTION BUILDING TYPES

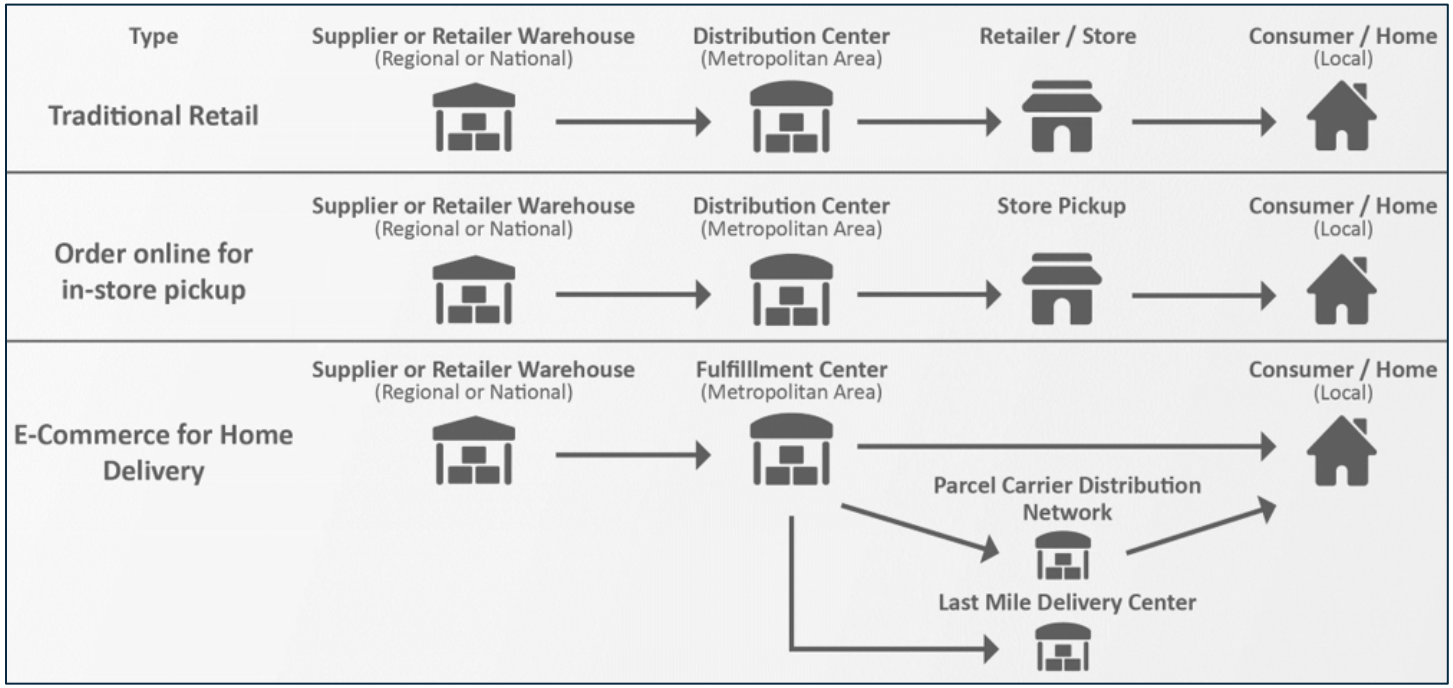
Building Type	Description
Warehouse	Buildings or portions of buildings where product inventory is stored. A warehouse may hold supplies or materials used in manufacturing processes or finished products that are awaiting distribution to retail stores, and/or may hold reserves of product that have not yet been ordered.

Building Type	Description
Distribution Center (DC)	A type of warehouse that is oriented to resupplying retail stores. DCs may be supplied from other warehouses or with shipments arriving from ports of entry. Outbound shipments are assembled and loaded for delivery to retail stores, often as a full truckload destined for a single store or several stores on a route/tour. Depending upon the size of the company that the DC supplies, and the number of stores in its service area, a DC could range in size from tens of thousands of square feet to over one million square feet. Some large manufacturers, particularly in consumer-packaged goods, have their own distribution centers.
Fulfillment Center	A type of warehouse that specializes in the fulfillment of e-commerce orders. Fulfillment centers have product inventory in stock, and customer orders of one or more products are gathered and packaged for outbound shipment.
Delivery Center or Station	A type of distribution center that facilitates quick-turnaround e-commerce orders. Delivery centers may include fulfillment activities and/or sort parcels for loading onto the vehicles that will perform the last-mile delivery.

Source: National Cooperative Highway Research Program Web-Only Document 373: Integrating Freight Movement into 21st Century Communities' Land Use, Design, and Transportation Systems, 2023

The three primary ways a retailer might use warehousing and distribution facilities in its supply chain – using traditional retail operations, online order/in-store pickup, and e-commerce home delivery – are shown in Figure 106.

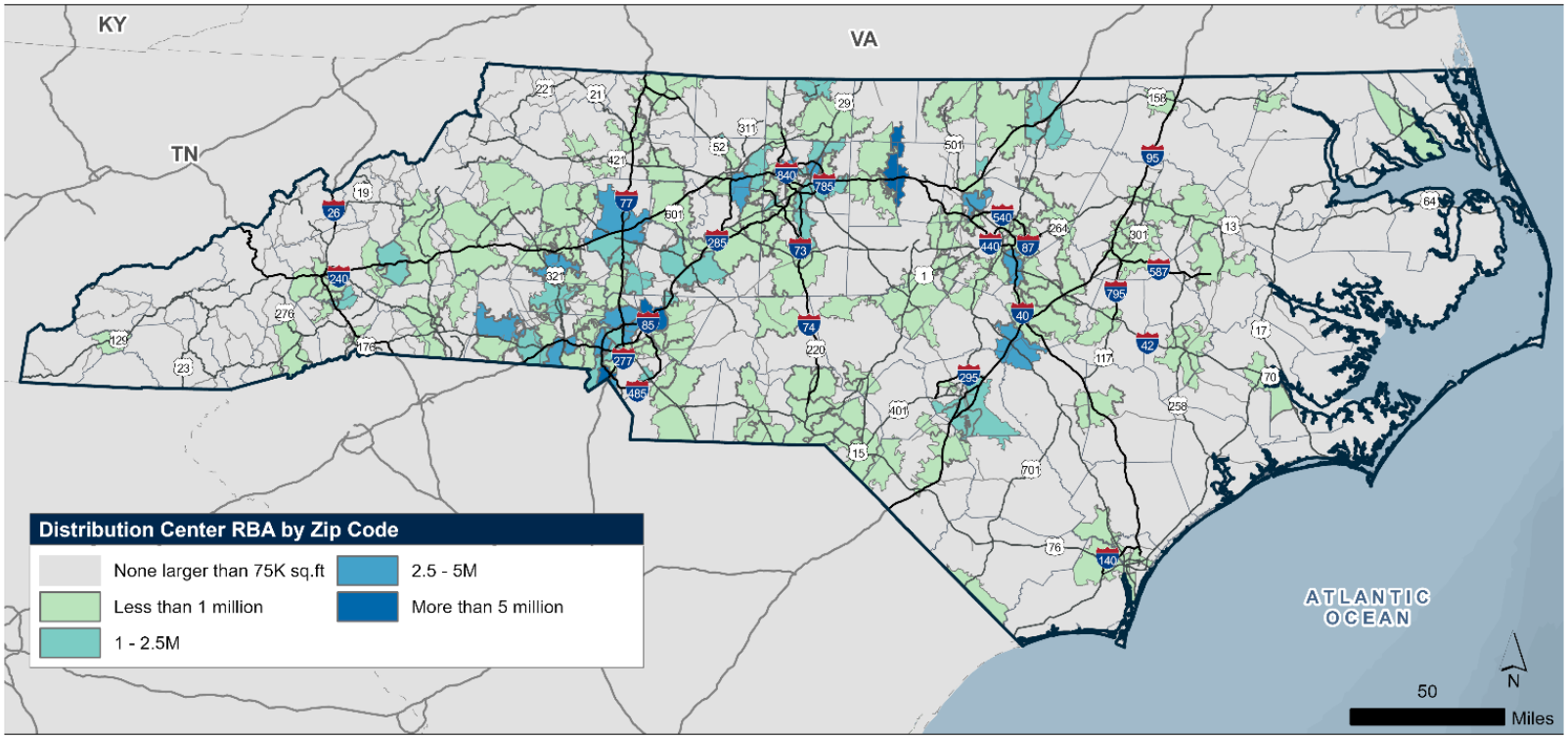
FIGURE 106. LOGISTICS MODELS FOR RETAILERS FULFILLING IN-STORE AND DIRECT-TO-CONSUMER ORDERS



Source: NCHRP Integrating Freight Movement into 21st Century Communities' Land Use, Design, and Transportation Systems Toolkit

Nationally, distribution centers are most often found in the suburban areas outside of major cities, with good access to highways. Figure 107 shows that distribution centers in North Carolina are sited in the same pattern. Most of the facilities are concentrated in ZIP codes that are in suburban areas surrounding Charlotte, Greensboro, and the Raleigh-Durham region. There are also a few notable pockets along I-95 north and south of Fayetteville.

FIGURE 107. DISTRIBUTION CENTER RENTABLE BUILDING AREA BY ZIP CODE, 2025



Source: CoStar Industrial Real Estate Data, 2025, buildings with RBA>75,000 sq. ft. aggregated by WSP and analyzed by Cambridge Systematics.

Two important recommendations emerge from this:

- **Recommendation SC-4:** Protect local and longer-distance access routes from warehouses to communities.
  - Freight commonly passes through distribution facilities enroute to end markets, and e-commerce heavily depends on them. Much of the flow of distribution freight appears under the Mixed Freight category depicted in Figure 100, which has a statewide pattern. Distribution centers are in many parts of North Carolina, but

Figure 106 shows they are not statewide. For everything from industrial goods to household items, the availability and quality of connecting routes affects much of the state economy.

- **Recommendation SC-5:** Prepare for continuing pressure on last mile service quality.
  - A primary differentiator between the e-commerce giant Amazon and its competitors is speed of delivery, which necessitates reliability. Amazon has gained direct control over much of its delivery service for this reason, and to develop a commanding position in last mile density and thereby cost. Competitive pressure on cross-town networks is unlikely to abate and constituent interest in rapid service should grow with its availability.

- **Recommendation SC-6:** Ensure access to intermodal facilities.
  - Not all of the freight inbound to warehouses and distribution centers arrives by truck. Within North Carolina are important multimodal hubs, where rail intermodal terminals supply concentrated areas of warehouses and distribution centers. Projects to ensure the reliability of these connections should be prioritized.

6.2.2. Technology Supporting Freight Operations

The application of technology to freight service and supply chain logistics has been growing steadily and may accelerate with the integration of artificial intelligence. It shapes private and public sector operations and, as noted above, it offers ways to improve freight performance with less investment and greater speed. Applications for passenger transportation frequently benefit freight and the reverse can be true as well. Technology encompasses new forms of freight vehicles and motive power. The following section reviews technology for freight operations in North Carolina and appropriate steps to take in this fast-moving area.

Technology is already an important component of freight operations in North Carolina. NCDOT uses a combination of traveler-information systems, corridor-management systems, commercial-vehicle technologies, incident-management tools, traffic monitoring, and data systems to improve the operation of the highway network. Some applications are deployed statewide, while others are corridor-specific deployments or pilots that could support broader implementation.

NCDOT Systems

Real-Time Traveler Information and DriveNC:

NCDOT distributes real-time roadway information through both public traveler-information services and freight-specific in-cab alerts. DriveNC was substantially upgraded in May 2026. The system provides information on crashes, lane and road closures, maintenance, construction, and weather-related disruptions. New capabilities include customizable email and text alerts for selected routes or areas, messages currently displayed on dynamic highway signs, live video from approximately 1,100 highway traffic cameras, and a DriveNC mobile application. In 2025, more than 34,000 incidents and closures were entered into DriveNC, and approximately 1.4 million people generated 2.2 million website visits. Information from the system also continues to feed commercial navigation providers including Google Maps, Apple Maps, and Waze[123]

Since 2021, NCDOT has also provided real-time Fleetworthy (formerly Drivewyze) in-cab slowdown and congestion alerts to participating commercial vehicle drivers. The system combines traffic-speed information from INRIX with Fleetworthy's in-cab communications platform to deliver alerts through compatible electronic logging devices. Alerts notify commercial drivers of sudden slowdowns, congestion, work zones, and other urgent roadway conditions before they reach the affected location. Unlike roadside dynamic message signs, in-cab alerts can reach participating truck drivers where roadside signs are not available, may reach them with more lead time, and do not require drivers to search a website or call a traveler-information service.[124] The initial pilot covered I-95 and rural portions of I-40. Subsequent implementation expanded coverage from approximately 500 rural interstate miles during the first year to North Carolina freeways during the second year, and the service was renewed for an additional four years. The program delivered more than 120,000 alerts during its early implementation period and has reached nearly 700,000 in-cab alerts as the program has continued. An evaluation conducted at an I-95 southbound work zone near Fayetteville found that approximately 70 percent of alerted drivers slowed before reaching a sudden slowdown.

Together, DriveNC and Fleetworthy provide complementary services. DriveNC provides broad public access to network conditions, maps, cameras, alerts, and archived incident information, while Fleetworthy delivers selected safety and congestion warnings directly to participating commercial drivers in the cab. This combination gives North Carolina both a statewide traveler-information platform and a freight-specific method of communicating time-sensitive roadway conditions

[123] NCDOT's Popular Traveler Information Website Getting Major Overhaul
[124] North Carolina DOT - Alerting Commercial Motor Vehicles - NOCoE Case Study.pdf

directly to trucks. NCDOT currently is exploring how to distribute route restriction information to trucks, as well as the addition of truck routes to DriveNC.

Integrated Corridor Management on I-85:

One of North Carolina's most developed examples of technology being used to increase the performance of existing roadway capacity is Integrated Corridor Management (ICM) on I-85 near Charlotte. NCDOT deployed ICM over approximately 22 miles of I-85 between mile markers 10 and 32, focusing on incident-related congestion on I-85 and its parallel US 74 arterial. The deployment combines dynamic-message-sign traveler information, incident-activated detour trailblazer signs, and incident-specific signal timing along detour routes. Bluetooth and Wi-Fi monitoring were also used to evaluate traffic patterns on the primary and alternate routes.[125] NCDOT-sponsored research found that the ICM deployment produced substantial benefits, particularly for higher-severity incidents and during peak periods. Evaluation of the program also indicated favorable estimated benefit-cost performance over both five- and ten-year periods.[126] ICM therefore demonstrates an important technology application for freight: rather than adding physical highway capacity, the system uses information, alternate routing, signs and coordinated signal operations to make better use of the available corridor network when an incident reduces interstate capacity. The initial deployment project is complete but work in this vein continues.

Commercial Vehicle Electronic Screening:

North Carolina has a mature freight-specific application in NCPass, NCDOT's electronic commercial-vehicle screening program. Implemented in 2007, this voluntary program allows qualifying motor carriers with current credentials and acceptable compliance and safety records to bypass North Carolina weigh stations. A roadside reader detects a participating vehicle's transponder as it approaches a weigh station and communicates whether the truck is authorized to bypass the facility.[127] NCDOT identifies benefits including reduced weigh-station backups, more efficient truck travel times, improved motor-carrier compliance oversight, highway-safety benefits, and reduced fuel consumption and emissions.

[125] Project Details
[126] RP2022-23 Final Report.pdf
[127] NCDOT: Freight & NCPass

Vehicle-in-Motion and Freight Data:
NCDOT has been developing its Weigh-in-Motion (WIM) capabilities. NCDOT-sponsored research completed in 2023 evaluated use of WIM as a statewide freight monitoring system, particularly for truck-weight distributions. Potential uses identified by the research include pavement and bridge design, asset management, load rating, commercial-vehicle weight enforcement, freight planning, and logistics. This work has progressed beyond research alone. In 2024, NCDOT advertised work for a Weigh-in-Motion ITS and traffic-data-collection system at the northbound and southbound I-95 weigh stations in Halifax County, providing an example of physical deployment of this type of technology in a major freight corridor. [128] WIM creates freight information while vehicles remain in motion, speeding the process and supporting both commercial-vehicle oversight and better understanding of how heavy vehicles use and affect roadway infrastructure.

Technology Strategy Recommendations

North Carolina should build on its existing technology deployments by integrating proven systems, expanding applications with demonstrated freight benefits, and testing emerging technologies through phased implementation. Technology should complement investments in infrastructure, maintenance, resiliency, and operations by improving the safety, reliability, productivity, and effective capacity of the multimodal freight system.

- **Recommendation SC-7:** Continue Developing Connected Freight Corridors
  - NCDOT should build on the technology systems already supporting freight operations in North Carolina and pursue greater coordination where doing so would improve the usefulness, timeliness, or reach of freight information. Statewide systems such as DriveNC and Fleetworthy should continue providing roadway-condition information to travelers and commercial vehicle operators, while corridor-specific technologies should be applied where operational needs and expected benefits justify investment.

- **Recommendation SC-8:** Continue improving the delivery of timely, actionable information to commercial vehicle operators.

[128] Project Details

- DriveNC and Fleetworthy provide complementary capabilities. DriveNC provides statewide information on incidents, closures, construction, weather, cameras, and dynamic message signs, while Fleetworthy delivers selected warnings directly to participating commercial drivers through compatible in-cab devices.
- Future enhancements should integrate freight-relevant information such as bridge clearances, vehicle-weight restrictions, designated truck routes, work-zone conditions, emergency detours, and truck parking availability. Information should be distributed through multiple channels, including DriveNC, commercial navigation systems, fleet-management platforms, and in-cab applications. Data should also be available in documented, machine-readable formats where appropriate so that public and private applications can distribute consistent information.

- **Recommendation SC-9:** Closely coordinate traveler information with incident detection, response, and clearance activities.
  - Timely and accurate information on lane closures, sudden slowdowns, crashes, work zones, severe weather, and alternate routes can help drivers adjust before reaching a disruption and can support more effective traffic management during an incident. NCDOT should continue improving the speed, accuracy, consistency, and geographic coverage of traveler information, including its distribution through roadside signs, DriveNC, in-cab systems, navigation applications, and other available channels. Performance should be monitored using data currently collected to capture measures such as the time required to detect and verify an incident, the time required to issue or update an alert, alert accuracy, geographic coverage, and the time required for traffic operations to recover. Recognition of disruptions as they happen and prevention of human-in-the-loop errors can be the greatest hindrance to action; AI may help address these constraints by automatically reviewing camera feeds, detecting disruptions, and checking alerts for potential errors or inaccuracies.
  - Managing the time required for response and clearance mitigates the delay from incidents. NCDOT utilizes dedicated tow contracts in work zones to help reduce response and incident clearance times. NCDOT now is working to expand the use of tow contracts to non-work zones, focusing on heavy/commercial vehicles, with the goal of improving the safety, efficiency, and reliability of incident management along the target corridors. The first implementation of this expanded heavy tow program is planned for I-95 and should be continued.

- **Recommendation SC-10:** Further deploy electronic screening and Weigh-in-Motion to reduce unnecessary stops and processing delays for compliant commercial vehicles while strengthening weight-enforcement and compliance activities.
    - The data produced by these systems can also support pavement and bridge design, load-rating analysis, asset management, freight planning, and evaluation of truck-volume and weight patterns. Coordinated use of screening and monitoring technologies can improve freight mobility while providing NCDOT with more complete information about commercial vehicle activity and its effects on infrastructure.

- **Recommendation SC-11:** Encourage use of freight signal priority to reduce truck delay on signalized freight routes.
    - Extending green time for approaching trucks under defined operating conditions can improve the fluidity of freight operations. Reducing unnecessary stops can be particularly beneficial on routes serving ports, intermodal terminals, airports, industrial areas, distribution facilities, and military installations. Potential benefits include shorter and more reliable truck travel times, reduced queueing, fewer acceleration and braking cycles, and improved intersection safety, particularly on high-speed, uphill, or downhill approaches. Signal timing, signal sequencing, and other operational improvements along key freight corridors can improve travel-time reliability, reduce delay, improve fuel efficiency, and increase the effective capacity of existing roadway infrastructure. Because traffic patterns, freight activity, and development conditions change over time, signal timing plans require regular monitoring and periodic review to maintain their effectiveness.

- **Recommendation SC-12**: Facilitate dissemination of truck parking information to reduce uncertainty for drivers searching for safe and legal parking.
    - Reliable information about parking locations and space availability can help drivers make parking decisions before reaching a facility, reduce unnecessary circulation and parking-search time, and support compliance with hours-of-service requirements. Potential data sources include monitoring devices in parking locations and on-line apps. Parking information may be delivered through roadside signs, traveler-information platforms, in-cab systems, fleet-management tools, and commercial truck parking and navigation applications. Truck parking information should complement physical capacity improvements because information cannot resolve locations where parking demand consistently exceeds available supply.

- **Recommendation SC-13:** Continue implementation of connected-vehicle technologies.
    - Continued implementation of interoperable connected vehicle technologies to improve the exchange of time-sensitive information among commercial vehicles, roadside infrastructure, transportation agencies, and third-party applications. Applications may include warnings about sudden slowdowns, lane closures, work zones, severe weather, roadway restrictions, available truck parking, traffic-signal conditions, red light violations, and the presence of or potential conflicts with pedestrians, bicyclists, or other vulnerable road users as well as applications such as signal priority. Direct communication with vehicles can extend the reach of traveler information beyond locations served by roadside signs and provide warnings closer to the time and location at which drivers need to act. Implementation should emphasize compatibility across vehicle platforms, communications systems, geographic areas, and jurisdictional boundaries. Systems must be able to communicate with one another; this can be accomplished through common standards, cybersecurity, privacy protection, and reliable data exchange.

Automated and Driverless Freight Technologies

Automated and driverless freight technologies are moving from controlled pilot programs toward early-stage commercial deployment in the United States. Potential benefits include increased equipment utilization, extended operating hours, greater operational consistency, and improved freight movement where labor availability, safety conditions, or access constraints limit conventional operations. However, deployment has advanced more rapidly in western states, where newer interstate infrastructure and more favorable weather conditions may provide a less complex operating environment. Eastern states face different conditions, including older infrastructure, higher population density, and greater weather variability, which may affect the pace, location, and operating requirements of these deployments. Nevertheless, the U.S. military in North Carolina is working with driverless vehicles today, although the needs of warfighting and the changing nature of war entail quite different objectives than civilian applications.

- **Recommendation SC-14**: Prepare for deployment of automated freight technologies.
    - Successful deployment of automated freight technologies will depend on infrastructure readiness, regulatory considerations, institutional responsibilities, safety oversight, enforcement, emergency response, cybersecurity, and data-sharing requirements. Particular importance will be placed on the exchange of timely, accurate information among transportation agencies, freight carriers, automated vehicle developers, and third-party data

providers, including information related to work zones, roadway restrictions, bridge clearances, routing, weather, and other operating conditions.

- **Recommendation SC-15:** Monitor developments in automated freight technologies.
  - As deployment expands beyond early pilot corridors, questions related to workforce impacts, reporting requirements, institutional responsibilities, and operational readiness will become increasingly important. North Carolina's mix of urban, rural, and mountainous environments presents operating conditions that differ from many of the locations where automated freight technologies are currently being tested and deployed. Continued monitoring of technology developments, operating experience, regulatory frameworks, and deployment trends will help inform future planning and investment decisions.

Alternative-Fuel Freight Vehicles

The freight industry has a long history of evaluating alternative fuels and propulsion technologies as carriers seek to reduce operating costs, improve reliability, and respond to changing market conditions. Fuel represents one of the largest components of trucking operating costs, creating a strong incentive for fleets to adopt technologies that offer economic advantages. Over time, freight operators have tested and deployed a range of alternatives, including natural gas, hydrogen, renewable fuels, and battery-electric vehicles. While no single technology has emerged as the universal solution for all freight movements of the future, the industry has consistently demonstrated a willingness to adopt new technologies when they provide operational, financial, or resilience benefits.

Battery-electric trucks are among the most visible recent developments. Manufacturers such as Tesla and Volvo are introducing electric Class 8 trucks with increasing range and improved performance characteristics, while fleets continue to evaluate their suitability for different freight applications. Particular attention has been given to the Tesla Semi, which combines extended range (reportedly up to 500 miles) with a growing charging network and has attracted significant interest from fleet operators. While battery-electric trucks are unlikely to replace diesel vehicles across all applications in the near term, they demonstrate how quickly freight technologies can evolve when carriers identify potential operational and economic advantages.

- **Recommendation SC-16:** NCDOT should remain technology-neutral while closely monitoring developments in alternative-fuel freight vehicles and the supporting infrastructure they require.
    - Rather than reacting to changes after they occur, NCDOT should actively track industry adoption trends, vehicle capabilities, fueling and charging infrastructure needs, and emerging freight operating patterns. This monitoring should be integrated into ongoing freight planning, corridor planning, resiliency, asset management, and economic development efforts so that future infrastructure investments reflect changing freight needs and technology trends. A proactive understanding of industry direction will help the Department anticipate future infrastructure and operational needs, support informed investment decisions, and avoid a purely reactive response to changing freight technologies as carriers adopt the solutions that best meet their operational and economic needs.

6.2.3. Military

This section with its sub-components describes freight and cargo movements associated with seven North Carolina military installations as well as the North Carolina National Guard. Military facilities and activities in North Carolina consist of U.S. Department of War (DoW) operations and the North Carolina National Guard. The military sector generates freight and cargo movements involving personnel, supplies, and equipment throughout North Carolina, across the United States, and worldwide. The U.S. Army, Navy and Marine Corps, Air Force, and Coast Guard maintain a presence in North Carolina; there are currently no Space Force bases in the state.

Military installations function much like small communities. They include housing, workplaces, medical services, schools, restaurants, utilities, warehouses, maintenance areas, and their own internal road networks. Supporting these daily operations requires regular deliveries of food, fuel, equipment, construction materials, mail, and other supplies, along with the movement of personnel, service vehicles, and waste. Because of this, military installations create regular freight and transportation needs in addition to the specialized movements tied to training, deployment, and national defense.

North Carolina's seven DoW installations have strong working relationships with local, regional, and state transportation agencies. Many of the installations have grown significantly over the last decade and are positioned for additional growth.

Their geographic locations, coordination with state officials, and access to a well-maintained transportation network support military operations. Table 46 provides a summary of the installations and their primary activities.

TABLE 46. U.S. MILITARY INSTALLATIONS IN NORTH CAROLINA

Military Base	Location	Military Branch	Primary Activities
Fort Bragg	Fayetteville	U.S. Army	Special Operations Command, Forces Command, Army Reserve Command, Womack Army Medical Center, and Pope and Simmons Airfields
Military Ocean Terminal Sunny Point	Southport	U.S. Army	Import and export of weapons, ammunition, explosives, and military equipment; operated by the 596th Transportation Brigade
Camp Lejeune	Jacksonville	U.S. Navy and U.S. Marines	Training, expeditionary forces, special operations, engineering and infantry schools, medical facilities, and maritime training
MCAS Cherry Point	Havelock	U.S. Marine Corps	2nd Marine Aircraft Wing, aircraft groups, communications, logistics, and fleet readiness
MCAS New River	Jacksonville	U.S. Marine Corps	Marine aircraft groups, aviation technical training, wing support, air control, and training squadrons
Seymour Johnson AFB	Goldsboro	U.S. Air Force	4th Fighter Wing, 916th Air Refueling Wing, and 414th Fighter Group
Coast Guard Air Station Elizabeth City	Elizabeth City	U.S. Coast Guard	Aviation Technical Training Center, Aviation Logistics Center, and Station Elizabeth City

Source: North Carolina Department of Military and Veterans Affairs and military installation websites.

Strategic Transportation Networks

The Strategic Highway Network (STRAHNET) seen in Figure 108 for North Carolina is a national system of public highways that are a key part of the deployment of the United States Armed Forces. It provides defense access, continuity, and emergency capabilities for movements of personnel and equipment in both peace time and war. These are bolstered by STRAHNET Connectors, which are additional highway routes linking important military installations and ports to the STRAHNET. More than 2,100 miles of state roadways are included in the STRAHNET.

The Strategic Rail Corridor Network (STRACNET) seen in Figure 109 for North Carolina consists of the civilian rail lines identified as most important to national defense, along with connector lines that provide direct access to military installations, ports, and other key transportation facilities. The network supports the movement of military personnel, equipment,

ammunition, fuel, and other supplies during routine operations, training exercises, mobilizations, and emergency deployments. By linking installations to the national rail system and designated ports, STRACNET provides an alternative to highway transport for moving large, heavy, or oversized military equipment over long distances. More than 1,000 miles of North Carolina railroads are included in the STRACNET. Federally-owned rail infrastructure is also important, such as the rail line to Military Ocean Terminal Sunny Point.

NCDOT policy identifies essential connections to national transportation networks that support interstate commerce and national defense as a core corridor goal. This aligns the state network with the DoW Strategic Highway Network. The investments that NCDOT is planning as part of its priority freight network are also geared towards supporting the military operations and installations.

FIGURE 108. NC STRATEGIC HIGHWAY NETWORK (STRAHNET) OVERLAID WITH NC MILITARY INSTALLATIONS

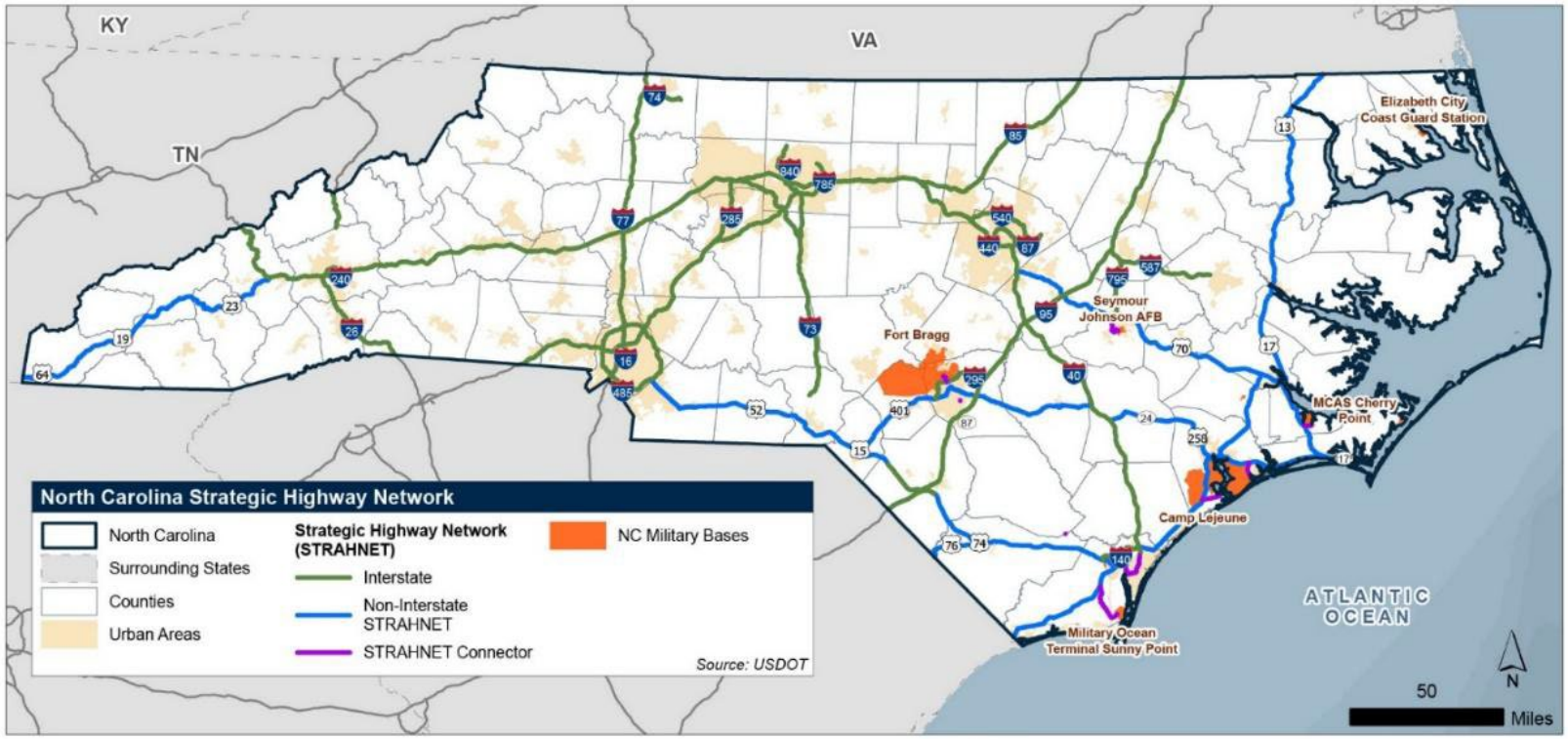
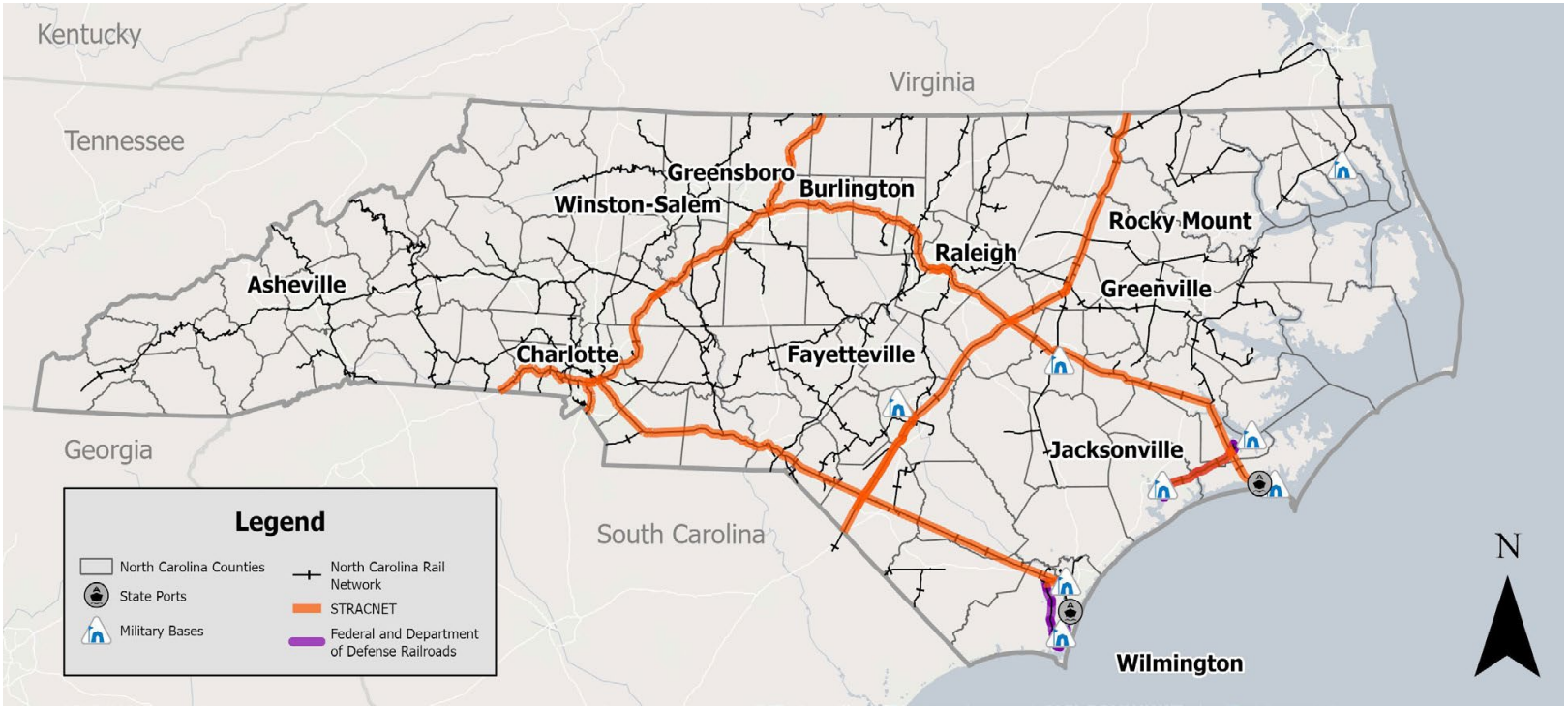


FIGURE 109. NC STRATEGIC RAIL CORRIDOR NETWORK (STRACNET) OVERLAID WITH NC MILITARY INSTALLATIONS



North Carolina Military Goods Movement

Military supplies and equipment move among bases, across North Carolina and the United States, and worldwide by truck, rail, barge, ship, and air. Fort Bragg is adjacent to I-95 and the CSX Railroad, while Seymour Johnson AFB is close to I-95 and Norfolk Southern rail connections. The coastal installations benefit from access to rail and ports but are generally farther from the interstate network. These varying transportation connections influence how each installation receives supplies,

deploys personnel and equipment, and supports military readiness. The following subsections summarize the freight transportation assets, intermodal connections, and cargo movements associated with each military installation.

Fort Bragg

Fort Bragg, located in Fayetteville, supports more than 51,000 active-duty personnel. Five federal agencies move cargo into and out of the installation by truck, air, and rail. The base has three locomotives connecting its internal rail operation to CSX in Fayetteville, two airfields supporting global airlift and special operations, 17 truck staging areas, a general receiving warehouse, and a separate ammunition entrance and storage facility. As a designated Power Projection Platform (discussed further below), Fort Bragg is connected to the Port of Wilmington through a dedicated deployment corridor that supports the rapid movement of personnel and equipment to maritime transportation assets. Fort Bragg also supplies cargo to North Carolina's other six military installations. The Pope Army Airfield, situated at Fort Bragg, serves as a hub for global power projection.

Fort Bragg is well positioned for north-south truck and rail movements along I-95 and the CSX railroad, which is designated Corridor T. I-40 (Corridor Q) and NC 24 (Corridor W) provide east-west access. Continued mission growth is expected to increase cargo demand. The I-295 extension to US 401 west of Fayetteville and a truck-only entrance have reduced congestion and improved safety. Table 47 and the two tables following report truck and rail freight activity for Fiscal Year 2025 at Fort Bragg, in the form that the service provided it:

TABLE 47. FORT BRAGG SURFACE MOVEMENT CENTER (FY 2025)

Activity	Amount
Shipments	19,382
LTL Loads	3,017

Source: Military Installation Responses from the DOT Statewide Multimodal Freight Plan Update RFI on 5/22/26.

TABLE 48. FORT BRAGG AIRFIELD CONTROL GROUP (FY 2025)

Activity	Amount
Outbound Trips	3,693
Inbound Trips	54

Pieces (Inspected)	1,780

Source: Military Installation Responses from the DOT Statewide Multimodal Freight Plan Update RFI on 5/22/26.

TABLE 49. FORT BRAGG RAIL OPERATIONS GROUP (FY 2025)

Activity	Amount
Outbound Rail Cars	996
Inbound Rail Cars	897

Source: Military Installation Responses from the DOT Statewide Multimodal Freight Plan Update RFI on 5/22/26.

Military Terminal at Sunny Point

Military Ocean Terminal Sunny Point is one of the world's largest military terminals and the Department of War's key Atlantic Coast ammunition shipping point. It transfers weapons, ammunition, explosives, and military equipment among rail, trucks, and chartered commercial ships. Approximately 40 ships call annually, and the terminal can handle six ships at once. The facility includes major cargo cranes and 62 miles of internal railroad track. FY 2022 freight movement data are reported as more recent data was not provided.

TABLE 50. MILITARY OCEAN TERMINAL SUNNY POINT SHIPMENTS (FY 2022 YTD)

Period	Direction	Tons	Containers
FY 2022 YTD	Outbound	139,600	3,975
FY 2022 YTD	Inbound	153,300	3,778

Source: North Carolina Department of Military and Veterans Affairs (DMVA)

CSX connects to the military-owned Cape Fear Railway for the final 17 miles between Leland and Southport. NC 74 (Corridor H/U) is the primary highway approach, with US 17 (Corridor O) and NC 87 (Corridor K) also supporting truck traffic. Existing highway, rail, river, and ocean access were reported sufficient for operations at the time.

Camp Lejeune

Camp Lejeune, located in Jacksonville, is one of the largest U.S. military training facilities, with approximately 37,500 personnel, and is headquarters for the 2nd Marine Expeditionary Force. Its 14 miles of beaches support amphibious assault training, while its location between the deep-water ports of Wilmington and Morehead City supports rapid deployment. Supplies normally move primarily by truck with a smaller rail component.

FY 2025 shipment data show that Camp Lejeune and MCAS New River rely heavily on trucks for freight movement as seen in Table 51. The installations recorded 2,406 small shipments within the continental United States, 280 overseas small shipments, 1,300 outbound LTL shipments, and 138 arms, ammunition, and explosives truck movements. Truckload activity included 1,414 outbound and 2,017 inbound loads, while no inbound or outbound railcars were reported. As seen in Table 52, Camp Lejeune also received 1,224,023 gallons of fuel by truck, with Jet A accounting for the largest share at 502,983 gallons, followed by unleaded fuel at 343,164 gallons and diesel at 276,585 gallons.

TABLE 51. FREIGHT SHIPMENTS CAMP LEJEUNE AND MCAS NEW RIVER (FY 2025)

Shipment Category	Amount
Small Shipments CONUS	2,406
Small Shipments OCONUS	280
LTL outbound	1,300
AA&E trucks	138
Truckloads outbound	1,414
Truckload inbound	2,017

Source: Military Installation Responses from the DOT Statewide Multimodal Freight Plan Update RFI on 6/24/26.

TABLE 52. MCB CAMP LEJEUNE FUEL SHIPMENTS (FY 2025)

Truck	Capacity	Gallons/Year
Bio Diesel	8,000	7,470
Diesel	8,000	276,585
E-85	8,000	93,821
Jet A	8,000	502,983
Unleaded (MUR)	8,000	343,164

Source: Military Installation Responses from the DOT Statewide Multimodal Freight Plan Update RFI on 6/24/26.

MCAS Cherry Point

MCAS Cherry Point in Havelock is a major deployment point for 2nd Marine Aircraft Wing overseas missions, a training facility, and an aircraft maintenance center. Cargo, including munitions from military suppliers around the country, moves by truck, air, and multimodal routes. Most truck trips use US 70, with additional access through NC 24. Some bottlenecks occur in Havelock, although existing infrastructure meets current needs. The Havelock Bypass (part of future I-42 on US 70) officially opened to drivers on Dec. 19, 2025. It was built to reduce through traffic and improve travel times.

TABLE 53. MCAS CHERRY POINT FUEL SHIPMENTS (FY 2025)

Mode	Fuel Activity	Trips/Cars	Capacity	Gallons
Truck	Jet Fuel to Base	260	8,000	2,060,864
Truck	Fuel Service Stations	49	8,000	351,916
Rail	Jet Fuel to Base	258	30,000	7,782,445

Source: Military Installation Responses from the DOT Statewide Multimodal Freight Plan Update RFI on 6/24/26.

Table 53 shows that MCAS Cherry Point received 10,195,225 gallons of fuel through truck and rail shipments. Rail accounted for the largest share, with 258 railcars delivering 7,782,445 gallons of jet fuel. Truck deliveries included 260 trips carrying 2,060,864 gallons of jet fuel to the base and 49 trips carrying 351,916 gallons to fuel service stations.

MCAS New River

MCAS New River in Jacksonville is home to Marine helicopter and tilt-rotor operations. Because the installation lacks rail access, it relies entirely on truck deliveries for jet fuel. In FY 2025, approximately 6.9 million gallons of jet fuel were delivered to the base through 864 truck trips using 8,000-gallon tankers as shown in Table 54.

MCAS New River is also relatively isolated from the interstate system. Its primary highway connections are US 70 (Corridor P) and NC 24 (Corridor W), with most truck movements using US 70. (The lettered corridor identifiers here and below refer to the STC network depicted in Figure 104). The installation reports few highway deficiencies beyond limited access to the interstate network.

TABLE 54. MCAS NEW RIVER FUEL STATIONS (FY 2025)

Truck	Trips/Yearly	Capacity	Gallons/Year
Jet Fuel to Base	864	8,000	6,922,315

Source: Military Installation Responses from the DOT Statewide Multimodal Freight Plan Update RFI on 6/24/26.

Seymour Johnson AFB

The Seymour Johnson Air Force Base, located in Goldsboro, is home to the 4th Fighter Wing, 916th Air Refueling Wing Air Force Reserve Command and the 414th Fighter Group. There are nearly 12,000 personnel on the base, approximately half of which are on active duty. The 4th Fighter Wing accomplishes its training and operational missions with 93 F-15E Strike Eagles, assigned to four different squadrons. The 916th Air Refueling Wing supports routine refueling missions with 12 KC-46A for other Air Force, Navy, Marine Corps and allied aircraft. To support the base, the Defense Logistics Agency supplies common use logistics, including aircraft, construction equipment and food. The Transportation Officer oversees shipments of parts, and the Responsible Officer oversees shipments of fuel through truck and rail movements to the base. Table 55 provides a summary of the Seymour Johnson AFB fuel totals. Norfolk Southern Railway (NS) transports 300,000 gallons of fuel one day/week to the Miller Siding, where fuel is transported via pipeline to the five storage tanks. Another 240,000 gallons three days/week are transported from Selma, NC by tanker trucks. Additional shipments of unleaded gas and diesel fuel are transported to the base as needed at 8,000 gallons each.

TABLE 55. SEYMOUR JOHNSON AFB FUEL (FY 2025)

Fuel Type and Mode	Gallons
Jet Fuel Rail	11,083,000
Jet Fuel Truck	20,544,000
Unleaded Gas Truck	61,000
Diesel Fuel Truck	82,000
Ethanol-85 Truck	16,000
Total Fuel	**31,786,000**

Source: Military Installation Responses from the DOT Statewide Multimodal Freight Plan Update RFI on 5/22/26.

The base is well connected to rail and highway networks through NS, I-95, US 70 (Corridor P), and I-795 (Corridor S). Although highway access is adequate, the rail connection and supporting infrastructure could be upgraded. Because rail carries approximately one-third of the base's fuel, strengthening this connection could improve the reliability of future deliveries.

U.S. Coast Guard Air Station at Elizabeth City

The U.S. Coast Guard Base Elizabeth City is located in the heart of Northeastern North Carolina and provides regional mission support activities within the 5th Coast Guard District. The Base Elizabeth City complex houses the Aviation Technical Training Center, Aviation Logistics Center, Air Station Elizabeth City, Station Elizabeth City, and the Aviation Projects Acquisition Center.

Currently, Coast Guard Air Station Elizabeth City maintains and operates five HC-130J Hercules aircraft and three MH-60T Jayhawk helicopters. The Aviation Logistics Center serves as the Coast Guard's sole Aviation Inventory Control Point supporting the readiness and sustainment of 13 product lines/divisions and 26 CG Air Stations. The United States Coast Guard repairs or maintains 10 Class 60 and 22 Class 65 rotary wing aircraft, four C-130 and four C-144 fixed wing aircraft each year or a total of 40 aircraft at the facility.

To supply the operation, approximately 13 tractor-trailers transport aircraft parts to and from Norfolk, VA each day, where Crowley Logistics, TForce, and FedEx operate hubs. These are primarily LTL trips. In addition, FedEx and UPS make a combined seven trips daily. US 17 (Corridor O) is the primary route to Norfolk, while US 158 (Corridor Y) provides access toward I-95. Both routes have adequate capacity, with significant delays generally limited to inclement weather. The FY 2025 totals are shown in Table 56.

TABLE 56. USCG ELIZABETH CITY SHIPMENTS (FY 2025)

Deliveries	Trips/Day	Trips/Year	Route
LTL Trucks	13	4,745	To and from Norfolk, VA
FedEx Trucks	4	1,460	FedEx Hub, Norfolk, VA
UPS Trucks	3	1,095	UPS Hub, Norfolk, VA

Source: Military Installation Responses from the DOT Statewide Multimodal Freight Plan Update RFI on 5/22/26.

North Carolina National Guard

The North Carolina National Guard deploys soldiers, supplies, and equipment throughout North Carolina, the United States, and overseas for operational and training missions. Led by the governor, it includes seven major subordinate commands.

TABLE 57. MAJOR NC NATIONAL GUARD UNITS

National Guard Unit	Location
60th Troop Command	Raleigh
449th Combat Aviation Brigade	Morrisville (RDU)
30th Armored Brigade Combat Team	Clinton
113th Sustainment Brigade	McLeansville
139th Regional Training Institute Regiment	Fort Bragg/Fayetteville
130th Maneuver Enhancement Brigade	Charlotte
145th Airlift Wing	Charlotte (CLT)

Source: North Carolina National Guard, "Major Subordinate Commands," https://ng.nc.gov/about-us/major-subordinate-commands.

Around 11,000 soldiers and airmen serve in the units depicted in Table 57. Personnel and cargo regularly travel to and from the National Training Center in California. Although the Guard maintains 79 facilities statewide, most heavy equipment – including tanks, armored personnel carriers, Bradley fighting vehicles, and howitzers – is concentrated at the Maintenance and Training Equipment Site at Fort Bragg.

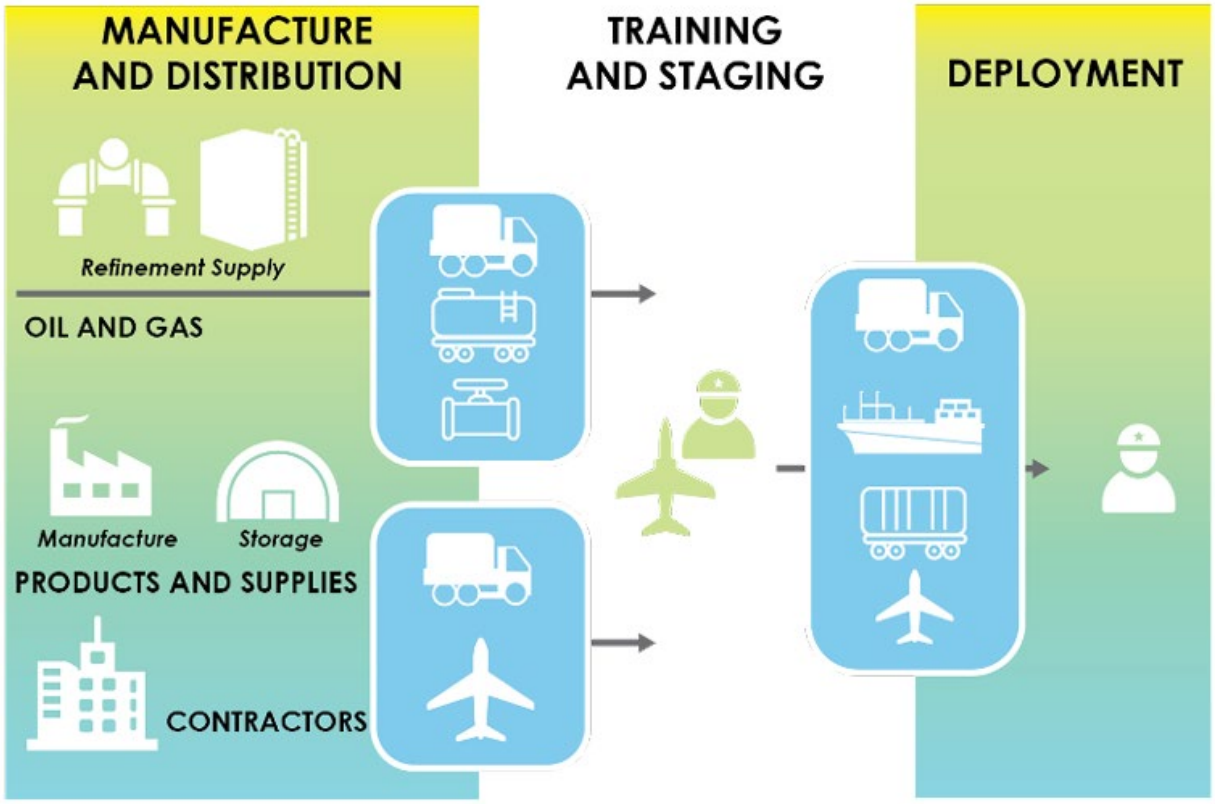
The Defense Movement Coordinator and North Carolina Movement Control Center approve Department of War convoys originating in the state and coordinate movements for training, mobilization, exercises, and emergency response. They work with other state and territorial movement-control centers on special hauling permits and interstate convoy monitoring and coordinate closely with NCDOT to protect public safety on the highway network.

Supply Chain Functions

North Carolina's military freight system functions as an interconnected supply chain linking commercial suppliers, distribution networks, military installations, training areas, ports, and airfields. As illustrated in Figure 110, military freight moves through three related functions – manufacturing and distribution, training and staging, and deployment. These functions are not

discrete steps: routine deliveries sustain installation operations and readiness, training generates recurring movements of fuel, equipment, and supplies; and deployment depends on the same highway, rail, port, and air connections used throughout the supply chain.

FIGURE 110. MAIN STAGES IN THE MILITARY SUPPLY CHAIN



All of the military facilities cited freight transportation assets as a contributing factor in base expansion and realignments. Some of the key challenges and bottlenecks identified are:

- Limited ability to use Port of Wilmington due to insufficient staging area for convoys; insufficient dockside access; and transit time up and down the Cape Fear River.
- Limited rail cargo opportunities for most of the military bases due to lack of access and requirements for minimum loads, particularly in the case of heavy equipment.
- Bridge conditions can restrict movements of some of the large equipment, resulting in the need to make the moves by rail, which significantly increases the cost.

Power Projection Platforms

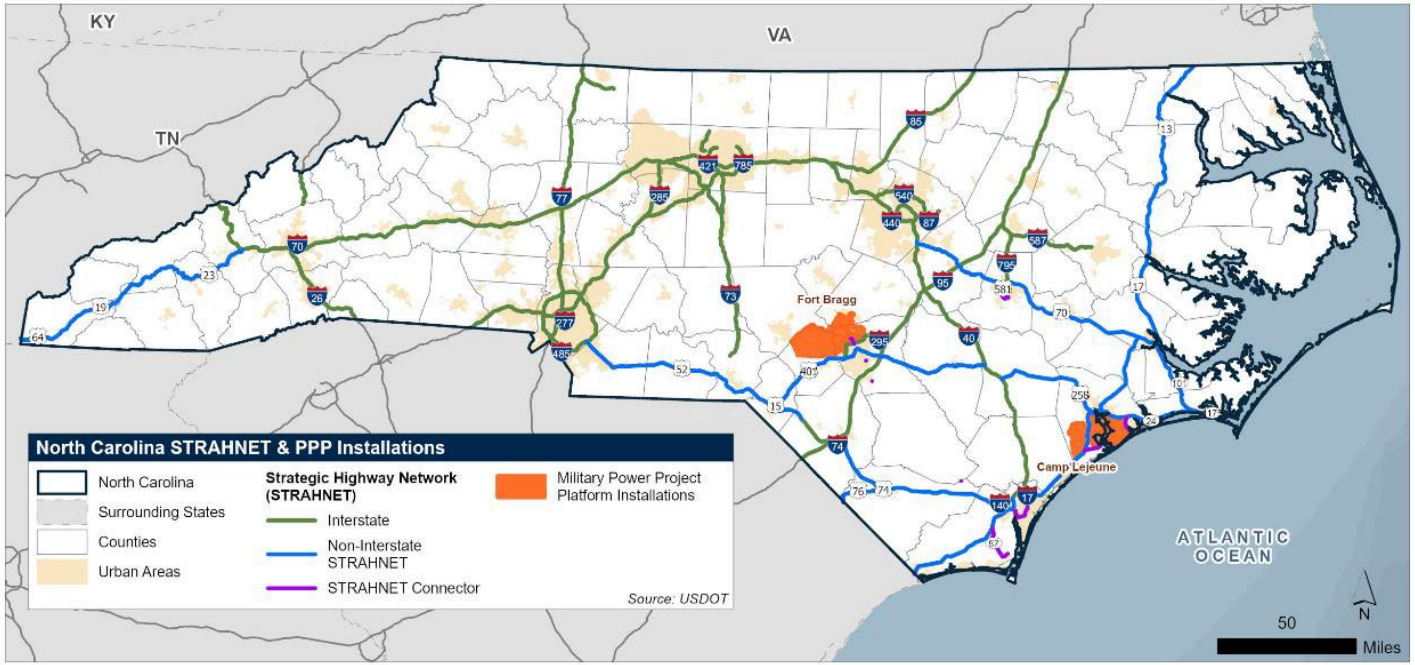
Deployment is the final stage and ultimate purpose of the military supply chain. North Carolina plays an important role in the nation's military deployment network shown in Figure 111, with Fort Bragg and Camp Lejeune designated as Power Projection Platforms (PPPs). These installations rely on strong multimodal connections between military bases, ports, airfields, and the Strategic Highway Network (STRAHNET) to support the rapid movement of personnel and military equipment. As seen in Table 58, Fort Bragg is assigned to the Port of Wilmington for its Seaport of Embarkation (SPOE), and Pope Army Airfield as its Aerial Port of Embarkation (APOE). Camp Lejeune is linked to the Port of Morehead City as its SPOE, and MCAS Cherry Point as its APOE.

TABLE 58. NC POWER PROJECTION PLATFORMS WITH DESIGNATED SPOE AND APOE

PPP Installation	Designated SPOE	Designated APOE
Fort Bragg	Port of Wilmington	Pope Army Airfield
Camp Lejeune	Port of Morehead City	MCAS Cherry Point

Source: United States Department of Transportation - Federal Highway Administration

FIGURE 111. POWER PROJECTION PLATFORMS AND STRAHNET



Innovation and Recommendations

Beyond traditional rail, roadway, port, and air transportation systems, emerging mobility technologies are beginning to play a larger role in military operations and logistics (Figure 112). Military stakeholders reported that autonomous vehicles and unmanned aircraft systems are already being utilized at installations across North Carolina, they are changing the character of combat on overseas battlegrounds today, and they are expected to become increasingly important in the movement of personnel, equipment, and supplies. As adoption expands, these technologies may create new demands related to transportation infrastructure, communications networks, cybersecurity, airspace management, and operational safety. Their continued development presents opportunities for collaboration between the military and NCDOT, allowing both organizations to better understand transportation implications and prepare for the integration of advanced mobility technologies into state, regional, and military transportation systems.

FIGURE 112. MARINES TESTING UNMANNED GROUND VEHICLE AT CAMP LEJEUNE



- **Recommendation SC-17:** Pursue solutions to needs identified by U.S. Military in North Carolina.
  - Three sets of needs are described above: limited ability to use Port of Wilmington due to insufficient staging areas and dockside access, as well as transit time on Cape Fear River; limited rail cargo opportunities due to lack of access and minimum load requirements, particularly for heavy equipment; and bridge restrictions for large equipment in some locations. The military would also benefit from redundancy. As one example, the

Military Ocean Terminal Sunny Point could benefit from a second route inland by restoring the out of service segment on the CSX corridor between Wallace and Castle Hayne.

- **Recommendation SC-18:** Continue to prioritize freight facility investments where military routes are involved.
  - Military use should remain a factor in acquiring and applying funds for these facilities.

- **Recommendation SC-19:** Direct resilience initiatives toward military regions.
  - Many NC military installations and freight routes that serve them are on the coastal plain, where they are exposed particularly to severe weather hazards.

- **Recommendation SC-20:** Coordinate technology implementation with military partners.
  - While military and civilian objectives may differ, the function and utility of advanced technology may align. Compatibility of systems will be important, and joint investment in development may be possible in some cases.

6.2.4. Resilience

The NCDOT resilience policy, formalized in 2021,[129] communicates NCDOT's vision of a resilient North Carolina as "a state where our communities, economies and ecosystems are better able to rebound positively, adapt to and thrive amid changing conditions and challenges, including disasters and climate change. Where we maintain and improve quality of life, healthy growth, and durable systems, while conserving resources for present and future generations." To implement and achieve this vision, NCDOT developed the Resilience Improvement Plan (RIP) which was released in April 2024, before the devastating landfall of Hurricane Helene in late September 2024.[130]

Preparation of this North Carolina Freight Plan undertook further analysis to interpret the RIP in a freight context, and to consider the aftermath of Helene. Its findings are presented in the previous chapter of this plan; they included the Priority Highway Resilience Corridors depicted in Figure 98 as well as considerations for non-highway modes. The following

[129] NCDOT Resilience Improvement Plan, NCDOT, 2024.
[130] Tropical Storm Helene: September 26-27, 2024, National Weather Service, 2024.

recommendations result from those findings and are presented in four categories: Prioritization, Asset Management, Planning and Performance, and Operations. Collectively, they support NCDOT's freight goals to strengthen resilience against extreme weather events, build modal redundancy and alternate access, systematically address risk through avoidance and hardening, and improve emergency response, recovery, and reconstruction performance. Investment in resilience improvements is larger than infrastructure preservation. It is a matter of protecting the economic performance of North Carolina and its supply lines – some of them crucial – to national and global industry. Among the examples are bags of sterile intravenous fluids and high-purity Spruce Pine quartz, both shipped from the western part of the state, and the North Carolina pork shipped from the coast. Investments in resilience improvements should therefore focus on facilities that are essential to maintaining the industrial, agricultural, and trade functions that define the state's long-term competitiveness.

Resilience is entwined with environmental needs and in some ways is their major concern. This discussion of Resilience includes at its end two subsections on topics connected to environmental themes: air quality and wildlife habitat loss.

Planning and Performance Recommendations

- **Recommendation SC-21:** Define measurable freight resilience performance measures.
  - Develop a concise set of performance measures to enable transparent tracking of progress toward NCDOT freight resilience goals.
  - Include outcome-oriented measures such as time to reopen freight-critical corridors after disruptions, percent of PHFN mileage/assets brought to a defined resilience standard, and redundancy/alternate route availability for high-consequence nodes and port connectors.
  - Use performance reporting to support prioritization updates, demonstrate risk reduction benefits, and inform investment decisions.
  - Develop a resilient freight corridors program where risk and resilience are looked at holistically to minimize supply chain disruptions and improve reliability end-to-end.

- **Recommendation SC-22:** Align resilience planning with emerging conditions.
  - Expand resilience considerations to include additional stressors identified for future planning (e.g., elevation, drought, and wildfires). Maintain and periodically refresh hazard and exposure factors used for freight resilience screening.

Where feasible, integrate resilience considerations earlier in planning and design to reduce lifecycle costs and avoid repeated damage and reconstruction.

Prioritization Recommendations

- **Recommendation SC-23:** Consider integrating freight resilience into project prioritization.
  - Institutionalize a process for absorption of RIP data and available performance measures from SC-21 into the freight network attributes.
  - Use corridor-level findings to help prioritize limited resources.
  - Translate resilience need into delivery decisions by defining a list of work types for standard scoping on projects.
  - Where NCDOT's Strategic Prioritization Process (SPOT) and related programming processes are applicable, incorporate resilience considerations as a transparent factor or modifier.
  - Starting with the next State Transportation Improvement Program, identify the portfolio of projects – funded and unfunded – that can improve resilience on the PHFN.

- **Recommendation SC-24:** Prioritize corridors on high-risk routes.
  - Add mountainous terrain to the critical highway resilience corridors.
  - Study and explore ways to include resilience metrics within SPOT that could result in corridor packages (not isolated fixes) because disruptions manifest operationally at the corridor level.
  - Select appropriate capital and operational actions based on a context-based evaluation of appropriate resilience improvement strategies.
  - Where feasible, improve route and modal redundancy by preparing for suitable alternate highway routes coordinated with parallel rail and maritime options.

Asset Management Recommendations

- **Recommendation SC-25:** Strengthen multimodal redundancy, especially for rail and ports.
  - Pursue improvements to coastal rail corridors where hazard risk is elevated and where rail can serve as an alternative mode when highways are disrupted.

- Coordinate with railroads and rail stakeholders to advance resilience-supportive investments such as grade separations, capacity enhancements, and hardening.
- Treat access to the Ports of Wilmington and Morehead City as an integrated, multimodal system by prioritizing investments that strengthen key highway connectors, rail corridors, terminal access points, and supporting infrastructure as a unified network rather than as discrete assets.
- Incorporate continuity planning with NC Ports and key private and public sector partners to address disruption scenarios affecting port throughput, and to define coordination protocols for rapid restoration.

- **Recommendation SC-26:** Protect access to freight nodes.
  - Identify and periodically update a short list of high-consequence freight nodes where a localized failure can generate outsized supply-chain impacts.
  - Draw from the Hurricane Helene experience in western North Carolina: where terrain and network limit alternate routes, investment should emphasize access preservation, rapid repair, and restoration sequencing on the small set of links that connect high-consequence nodes to the broader freight system.
  - For high-consequence nodes, define minimum viable access standards and pre-disaster restoration priorities to support continuity of operations.

Operations Recommendations

- **Recommendation SC-27:** Build operational resilience to all disruptions, including non-traditional disruptions.
  - Adopt TSMO resilience strategies using the best available technologies, including real-time monitoring; emergency traffic management; dynamically managed detours; portable ITS; signal timing for evacuation and recovery routes; priority freight-route restoration; cross-jurisdictional data sharing; and communications redundancy.
  - Strengthen continuity of operations and coordination protocols for disruptions that threaten freight systems without damaging infrastructure – such as government shutdowns, labor disruptions, blackouts, and disease vectors – and include backup for essential telecommunications.
  - Incorporate cybersecurity readiness into freight resilience planning for transportation operations and freight-adjacent systems.

- Coordinate with emergency management and relevant state agencies to strengthen freight-specific recovery operations and protect supply chain functions.
- For port and intermodal operations, incorporate energy resilience considerations (such as backup power and operational workarounds) to reduce throughput losses and recovery time.

6.2.5. Air Quality and Wildlife Habitat Loss

Air Quality

Freight transportation affects air quality through emissions from trucks, trains, cargo-handling equipment, aircraft, and ships. Important air pollutants include nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$ and PM_{10}), ozone, and carbon monoxide (CO), as well as sulfur dioxide (SO_2), HAP (Hazardous Air Pollutants) and TAP (Toxic Air Pollutants). Diesel engines power most freight vehicles and equipment, and they are a leading source of NO_2 and fine particles. In 2014, on-road heavy-duty diesel vehicles produced about 23 percent of North Carolina's mobile-source nitrous oxide emissions, and nonroad diesel equipment produced another 11 percent; NO_2 emissions have declined since then. Freight activity is concentrated along major corridors and at ports, rail yards, and distribution centers. As a result, nearby communities can face higher exposure even when regional air quality is good.

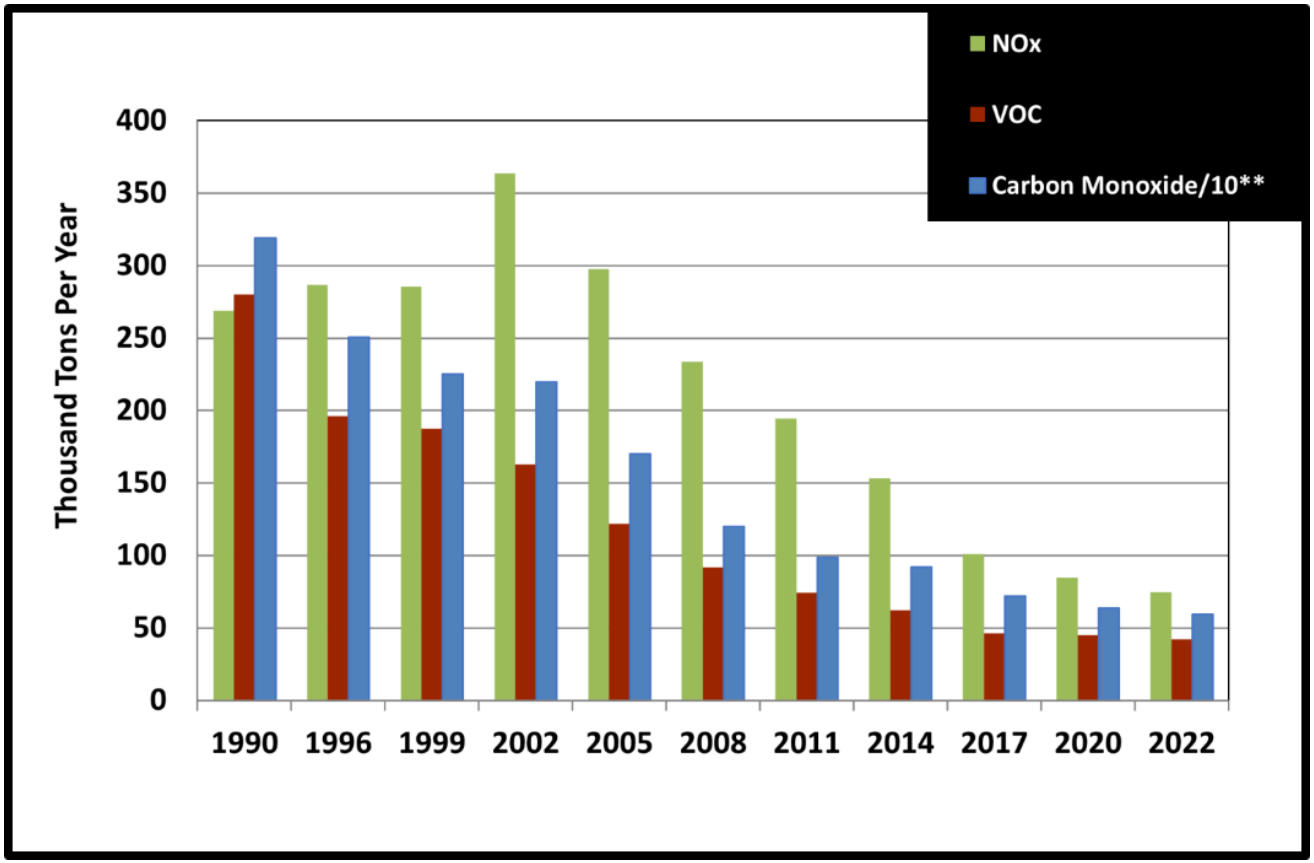
Under the federal Clean Air Act, the U.S. Environmental Protection Agency establishes National Ambient Air Quality Standards for ozone, particulate matter, carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead. Areas that do not meet a standard are designated as being in nonattainment and must implement additional measures to attain it. The last year any county in North Carolina was in nonattainment was 2014[131].

North Carolina's statewide air quality was generally favorable over the 2015–2025 period. The trends in improvement and its achievements are displayed in Figure 113 and Figure 114. Statewide air quality is the best it has been in decades – from 1990 to 2022, on-road vehicle emissions fell 72 percent for NOx, 85 percent for VOCs, and 81 percent for CO – although the

[131] EPA. (n.d.). *North Carolina Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants*. USEPA. https://www3.epa.gov/airquality/greenbook/anayo_nc.html

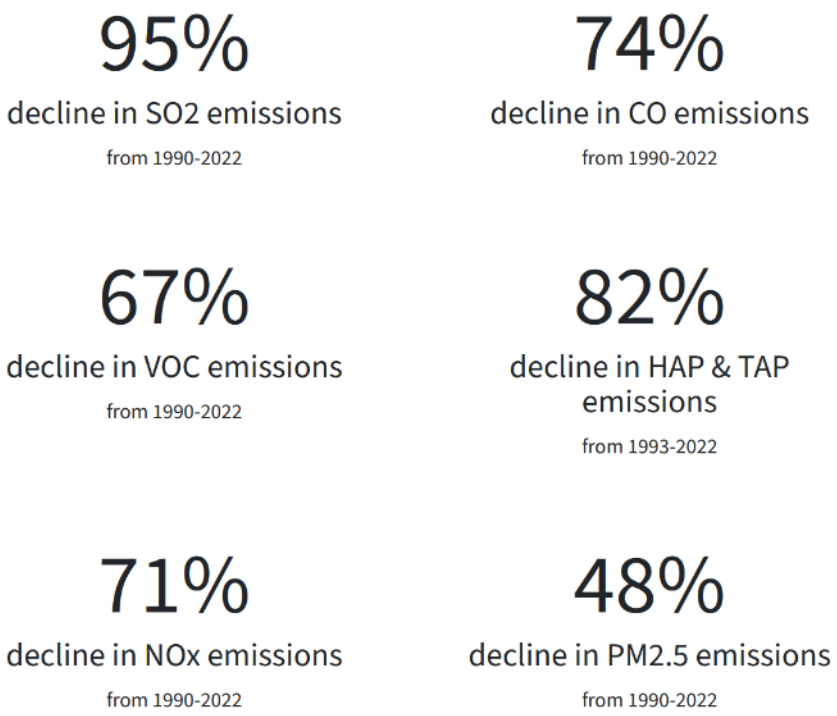
majority of the substantial air pollution reductions occurred in the 2000s or early 2010s[132]. Since this period, air pollution has declined more slowly. Localized exposure may also remain elevated near high-volume highways or freight terminals.

FIGURE 113. TRENDS IN NC AIR EMISSIONS



[132] NC DEQ. (n.d.). *Air Quality Trends in North Carolina*. https://www.deq.nc.gov/about/divisions/air-quality/about-air-quality/air-quality-trends-north-carolina.

FIGURE 114. ACHIEVEMENTS IN NC AIR QUALITY IMPROVEMENT



The North Carolina Department of Environmental Quality attributes this mostly to a shift away from the use of coal for power generation; however, tighter standards on emissions from cars and trucks have also been a major driver of the improvements[133]. Cleaner vehicles, such as electric vehicles and gas vehicles with advanced catalytic converters, have more than offset much of the emissions effect of increased travel.

[133] NC DEQ. (2025, December 19). *NC air quality has vastly improved since '90s, DEQ report shows*. https://www.deq.nc.gov/news/press-releases/2025/12/19/nc-air-quality-has-vastly-improved-90s-deq-report-shows.

The NC Moves 2050 plan supports new technologies, policies, and partnerships in order to reduce air pollution as part of the state's long-range transportation strategy[134]. The plan's system performance report incorporates the federal Congestion Mitigation and Air Quality Improvement Program and related system-performance measures[135]. State actions include: NCDOT Transportation Planning coordinates with local governments, metropolitan planning organizations, the state Division of Air Quality, FHWA, and FTA to ensure that plans, programs, and projects comply with current air-quality standards[136]. NCDOT also works with local governments and NCDOT business units to oversee the CMAQ program.

NCDOT administers the state's CMAQ program and distributes funding as follows: 45 percent to statewide or systemwide improvements, 5 percent to regional projects that span more than one air quality region, and 55 percent to county- or MPO-level projects. Diesel idle-reduction projects are among the eligible uses.

- **Recommendation SC-28:** Continue the state's successful path in managing air emissions associated with freight.
    - Initiatives recommended elsewhere in this plan related to freight reliability improvements and alternative sources and technology for motive power have direct benefits for air quality. Fuel efficiency is a critical focus for the freight industry, its effect on air emissions is straightforward, and industry efforts to improve it reach into areas like telematics monitoring of driving behavior and better identification of truck parking locations.

Wildlife Habitat Loss

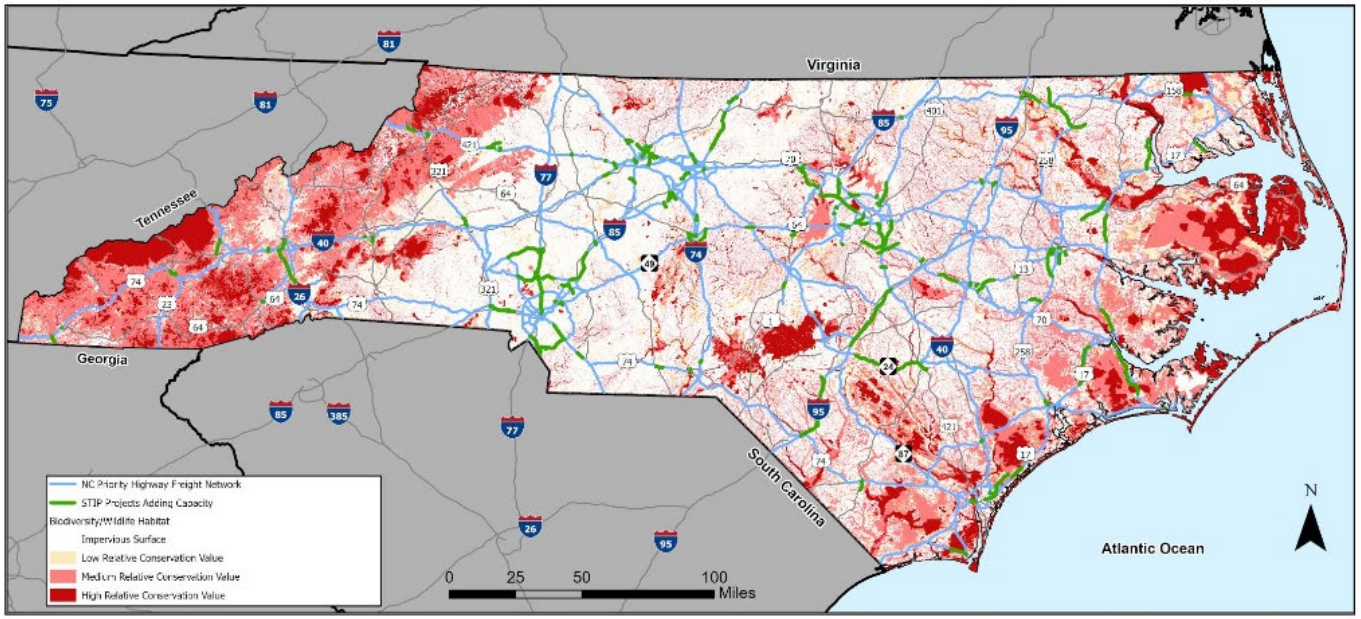
Wildlife conservation is highly relevant to freight planning because transportation infrastructure can both affect ecological systems and create direct safety and operational risks for drivers and other users. Roads, rail lines, ports, and other freight infrastructure fragment habitats, restrict animal movement, increase mortality, and introduce noise, light, vibration, runoff, and invasive species. Conversely, healthy forests, wetlands, streams, and floodplains support wildlife while also providing services important to transportation, including floodwater storage and erosion control along corridors. North Carolina is an especially

[134] NC DOT. (2021). *NC MOVES 2050 PLAN*. https://www.ncdot.gov/initiatives-policies/Transportation/nc-2050-plan/Documents/nc-moves-final-plan.pdf.
[135] https://connect.ncdot.gov/projects/planning/nc-moves-2050-plan/Documents/NC%20Moves%202050_System%20Performance%20Report_Final%20%281%29.pdf.
[136] Connect NCDOT. (n.d.). *Transportation Planning Program and Services*. https://connect.ncdot.gov/projects/planning/Pages/Transportation-Planning-Program-and-Services.aspx.

significant environment because its geography spans from the Appalachians to the Atlantic Coast, meaning its habitats are unusually diverse.

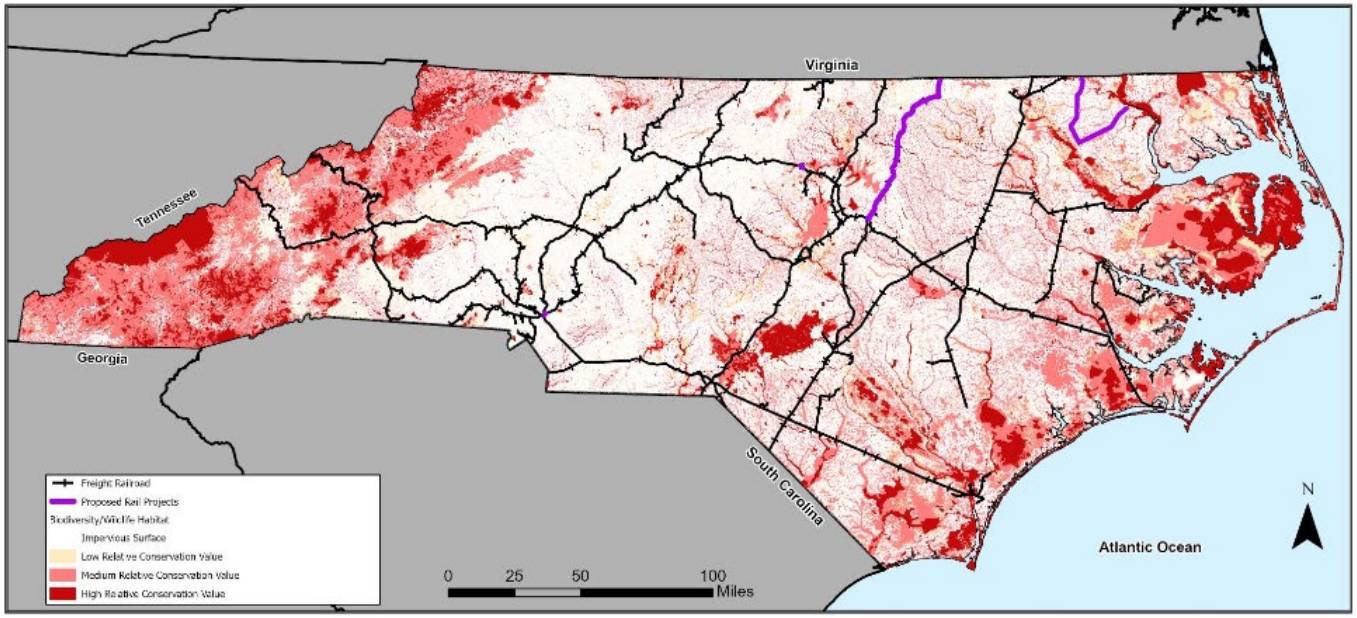
The 2023 North Carolina DOT Freight Wildlife Habitat Assessment reported 18,607 animal-related crashes in the state in 2020 and more than $160 million in damages from wildlife crashes during the 2018-2020 period[137]. Its screening analysis identified approximately 180 capacity-adding projects on the Priority Highway Freight Network with potential impacts on habitats. Figure 115 depicts wildlife habitats in the context of the NCPHFN in 2020, and Figure 116 does the same for the rail system.

FIGURE 115. WILDLIFE HABITATS, BIODIVERSITY, AND THE NCPHFN (2020)



[137] North Carolina Department of Transportation. (2023). *NCDOT FREIGHT WILDLIFE HABITAT ASSESSMENT - FINAL* (NC Statewide Multimodal Freight Plan). https://connect.ncdot.gov/projects/planning/Statewide-Freight-Plan/Documents/NCDOT%20SMFP_Freight%20Improvement%20Habitat%20Loss_2023-01-11.pdf

FIGURE 116. WILDLIFE HABITATS, BIODIVERSITY AND THE NC RAIL SYSTEM (2020)



More recently updated data shows that the conflict between freight traffic and wildlife has not diminished. Reported animal-related crashes increased from 24,174 in 2022 to 25,931 in 2023, remained high at 25,540 in 2024, and reached 26,143 in 2025[138]. The 2023-2025 total was 65,470 crashes. Approximately 90 percent of reported animal crashes involve deer. The true number of crashes is unknown, but NCDOT guidance based on academic studies indicates that it could be between five and nine times greater than the reported number of crashes[139]. Most crashes occur during the dawn or dusk hours, and the winter months see more crashes than the summer.

[138] Albee, M. (2026). *North Carolina Animal Related Crashes* (2023–2025 County Rankings and Crash Data). https://connect.ncdot.gov/resources/safety/Documents/Crash%20Data%20and%20Information/2025%20Animal%20Crash%20Data.pdf

[139] North Carolina Department of Transportation & North Carolina Wildlife Resources Commission. (2024). *Wildlife Passage Guidance*. https://connect.ncdot.gov/resources/Environmental/EPU/Policy/Documents/NCWRC-NCDOT_Wildlife_Passage_Guidance.pdf

Since the 2023 Freight Plan, North Carolina has made notable institutional and project-level progress, but the underlying pressures on wildlife are continuing. The 2025 North Carolina State Wildlife Action Plan identifies rapid population growth, land-use change, habitat connectivity, and uncertainty about future conditions as major conservation considerations[140]. The share of developed land in the state is increasing while wetlands and cropland are decreasing. Transportation-related pressures are highly likely to grow as population, development, freight movement, and roadway demand expand; this makes habitat fragmentation all the more likely.

However, North Carolina has advanced several significant actions since the previous freight plan:

- In March 2023, NCDOT and the NC Wildlife Resources Commission entered a Wildlife Stewardship Memorandum of Understanding covering project planning, habitat connectivity, biological studies, vehicle impacts, invasive species, education, and conflict resolution[141]. This was intended to ensure smooth cooperative planning at the state level and serves to give NCDOT access to wildlife expertise and data while embedding transportation considerations in conservation planning.
- An August 2024 Wildlife Passage Guidance published within the framework of the NCDOT/NC Wildlife Resources Commission MOU provides meaningful recommendations for integrating dry passage, floodplain benches, natural substrates, appropriate culvert geometry, reduced riprap barriers, fencing, and maintenance into bridge and roadway projects. It notes that many of the state's approximately 18,000 bridges and culverts already provide some passage opportunity, making routine replacement projects a practical way to improve connectivity. Reported examples indicate that crossing-and-fencing treatments have reduced animal-vehicle collisions by roughly 50 to 75 percent on certain North Carolina highway corridors, although results depend on site conditions and fence maintenance.
- Planning is currently underway for a series of wildlife crossings on US 64 in Dare County, a major freight, travel, and hurricane-evacuation corridor[142]. The project's cost is estimated at $31.25 million, $25 million of which will be provided

[140] N.C. Wildlife Resources Commission. (2026). *State Wildlife Action Plan*. https://www.ncwildlife.gov/state-wildlife-action-plan
[141] NCWRC and NCDOT. (2023). *MEMORANDUM OF UNDERSTANDING BETWEEN THE NORTH CAROLINA WILDLIFE RESOURCES COMMISSION AND THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION*. https://connect.ncdot.gov/resources/Environmental/EPU/Policy/Documents/MOU_NCDOT-NCWRC_Wildlife_Stewardship_2023.pdf

[142] *U.S. 64 Wildlife Crossings*. (n.d.). N.C. Department of Transportation. https://www.ncdot.gov/projects/us-64-wildlife/Pages/default.aspx

by a grant from the federal Wildlife Crossings Pilot Program. Construction is scheduled to begin in 2028 and end in 2031, and animals protected include black bears, white-tailed deer, and red wolves.

- **Recommendation SC-29:** North Carolina should continue its efforts to reduce freight vehicle wildlife crashes.

6.3. Modal Recommendations

6.3.1. Highways

This section presents highway recommendations in four areas: project costs and funding responsive to needs; safety and harsh driving events; truck parking; and oversize/overweight trucks.

N.C. Highway Project Costs and Funding

Many locations with significant freight safety and bottleneck needs have corresponding projects identified in the Statewide Transportation Improvement Plan (STIP) or in Metropolitan Transportation Plans (MTPs) developed by Metropolitan Planning Organizations (MPOs). Projects that do address freight needs clearly need to move ahead. However, several high-need locations remain unaddressed. This section identifies planned projects that may address these needs and presents a methodology for developing planning-level cost estimates for locations without programmed improvements. The analysis addresses two key questions:

- Which projects in the STIP and MTPs may address the identified high crash and bottleneck locations?
- What planning-level cost and funding information is available for improvements addressing identified freight needs?

Because these estimates are intended for statewide planning purposes, they rely on broad assumptions and should be considered approximate. To provide a consistent basis for comparison, costs for both safety and bottleneck improvements were estimated using a standard improvement scenario: adding one lane in each direction along the full length of each

roadway segment with an identified unaddressed need. Actual projects will be developed through future planning and design processes, and the improvements ultimately implemented may differ substantially from this planning-level assumption.

Planned Projects That May Address the Identified Needs

A review of the latest STIP identified 195 projects that geographically coincide with locations exhibiting safety or bottleneck needs. Each project was screened to determine whether the proposed improvement had the potential to address the identified deficiency. Projects whose scope was unlikely to improve safety or operational performance, such as pavement resurfacing and bridge replacement projects, were excluded from further consideration. This screening process removed 66 projects, resulting in a final set of 129 STIP projects considered relevant to the identified needs.

The resulting project set represents a range of improvement strategies. Of the 129 projects, 41 are intersection-focused improvements, 47 involve roadway widening, and the remainder consist of other project types, including interchange modifications, access management treatments, and operational improvements. The complete list of relevant STIP projects is provided in Table 59.

In addition to the STIP, the most recent MTPs from 19 MPOs were reviewed to identify planned projects located within the identified need areas. The consolidated MTP project inventory contained 422 projects, including 62 point-based projects (such as intersection improvements) and 360 linear projects (such as roadway widening and corridor improvements). Unlike the STIP review, the MTP project list was not screened to determine whether individual projects would fully or partially address the identified safety or bottleneck needs. Instead, the inventory was used to document the extent of planned improvements within identified need locations across the state.

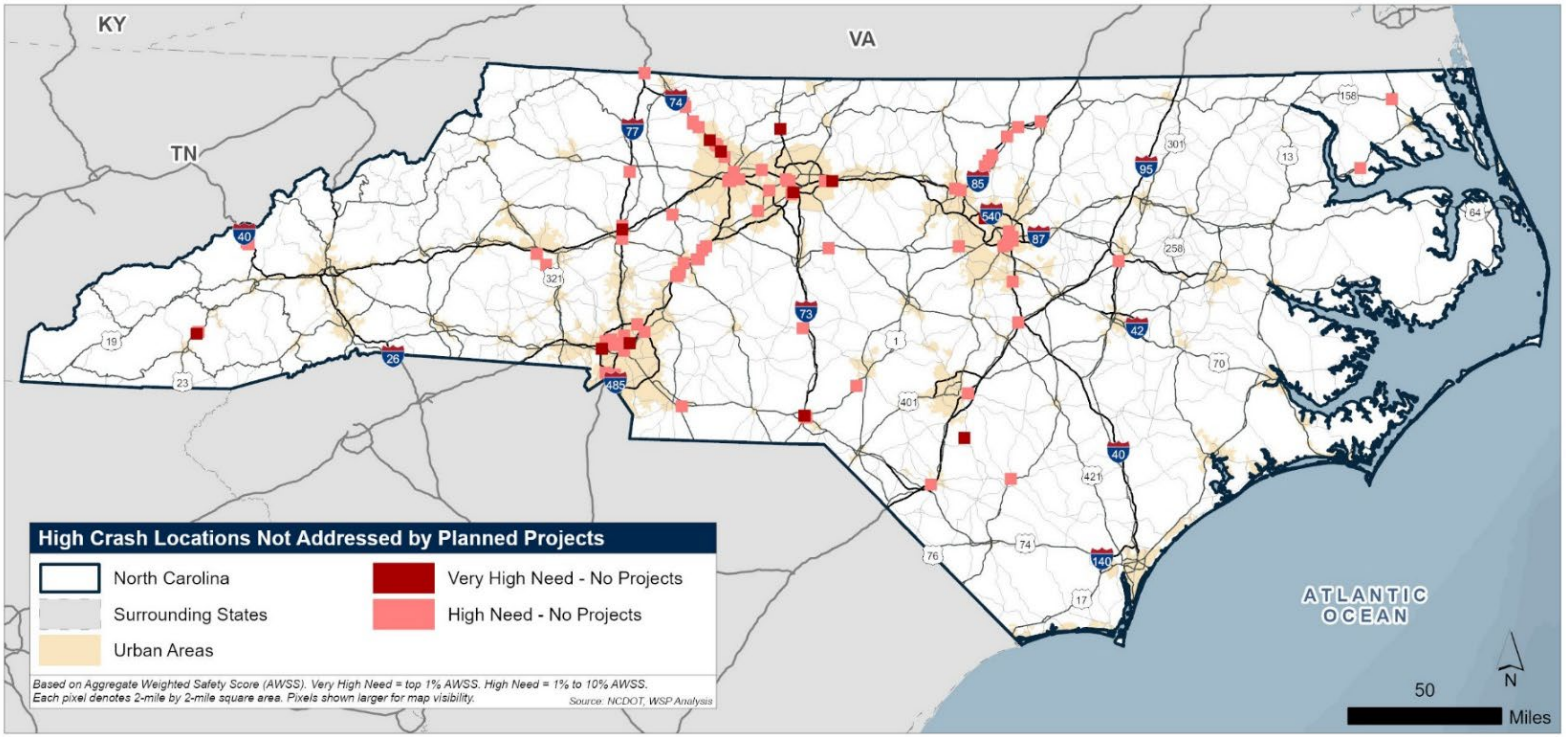
Determining the Extents of the Unaddressed Needs

The extent of unaddressed needs was quantified to support the development of planning-level cost estimates. Because the safety and bottleneck analyses identify needs in different ways, separate methodologies were used to determine the length of improvements associated with each need category.

High Truck Crash Locations

High crash locations were identified using a grid-based analysis. This analysis aimed to identify locations with more than five crashes involving trucks between October 2020 and September 2025, scaled using their relative wights on KABCO scale. Each cell in the grid was given a score based on the aggregated relative weights of the crashes within that cell. The cells with top 1 percent of the score were determined to be locations with ‘very high safety need’ and those between 1 percent and 10 percent of the score were determined to be locations with ‘high safety need’. Locations classified as high or very high need that did not overlap with any planned STIP or MTP project were considered unaddressed. This analysis assumed that the design of the STIP projects will take into account safety aspects and will potentially aid in reducing crashes, and a project-by-project analysis was not carried out at this stage. As shown in Figure 117, this included 13 very high-need cells and 84 high-need cells. Prominent concentrations of unmet needs are on the arc of I-85/I-40 from Charlotte through the Triad to the Triangle, on I-85 northeast from Durham, and on I-74 from the Triad to I-77.

FIGURE 117. HIGH NEED SAFETY LOCATIONS NOT ADDRESSED BY PLANNED PROJECTS



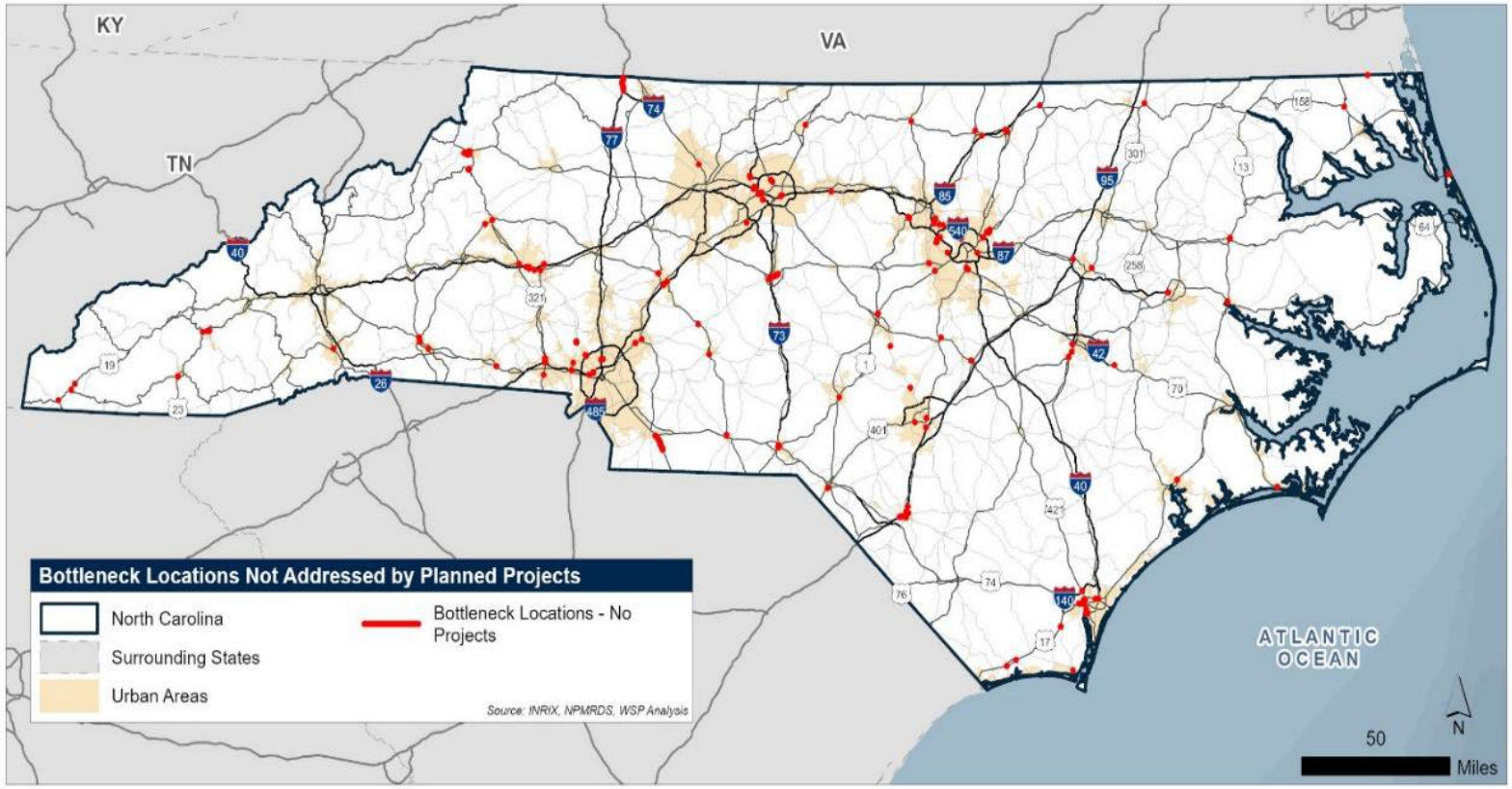
Each safety need cell represents a 2-mile by 2-mile analysis grid. For planning-level cost estimation purposes, a standardized improvement length of 2 miles per cell was assumed. Applying this assumption resulted in an estimated 194 miles of unaddressed safety improvements.

Bottleneck Needs

Bottleneck needs were identified as linear roadway segments. Figure 118 illustrates the bottleneck locations that do not overlap with planned roadway improvement projects identified in the STIP or MTPs. There are prominent clusters in Charlotte,

the Triad and the Triangle, in Wilmington surrounding the port, in Fayetteville near Fort Bragg, on I-40 near Hickory, in multiple locations along US 74/I-74, and in other points in the state. As discussed under Policy in this chapter, the absence of bottlenecks does not denote the absence of investment need. In the smaller communities of North Carolina, in the mountainous regions to the west, and elsewhere in the state, economic growth and growth in the freight traffic that goes with it requires routes that can reliably and safely attract and support it.

FIGURE 118. HIGH NEED BOTTLENECK LOCATIONS NOT ADDRESSED BY PLANNED PROJECTS



Because these needs are represented as roadway segments rather than grid cells, the improvement length was calculated by summing the lengths of all unaddressed bottleneck locations. The combined length of these segments was approximately 68 miles.

Total Improvement Length and Cost

Combining the estimated lengths of unaddressed safety and bottleneck improvements resulted in a total of approximately 262 miles of roadway requiring improvement. This total length formed the basis for the subsequent planning-level cost estimates. Planning-level cost estimates were developed using roadway widening projects identified in the STIP as a representative basis for estimating improvement costs. Analysis of these projects found a median widening cost of approximately $28 million per mile. Recognizing that project costs vary considerably based on factors such as right-of-way requirements, environmental constraints, utility relocations, and differences between rural and urban settings, a range of unit costs was applied for this analysis.

For estimating purposes, $28 million per mile was used as the lower-bound cost assumption, while $50 million per mile was used as the upper-bound cost assumption. These values establish a reasonable planning-level range for evaluating the potential costs of addressing identified needs statewide.

Applying these unit costs to the estimated 262 miles of unaddressed safety and bottleneck improvements results in a total potential investment need ranging from approximately **$7.3 billion to $13.1 billion**. These estimates are intended solely for long-range planning and screening purposes and should not be interpreted as project-level cost estimates. Actual implementation costs will depend on project-specific conditions, including the scope of improvements, right-of-way acquisition requirements, environmental mitigation measures, construction market conditions, material costs, and inflation at the time of project delivery.

- **Recommendation M-1:** Pursue feasibility studies for high truck crash locations and freight bottlenecks not currently addressed by programmed projects.
    - Many identified needs for improvement are in population centers where systematic solutions to freight performance deficiencies require coordination and partnership between NCDOT and local agencies.

- Evaluation of technology and operational strategies should be part of feasibility studies for unaddressed high-crash locations and freight bottlenecks. (Examples of such strategies appear under Supply Chain Recommendations.)

- **Recommendation M-2:** Continue to pursue projects that address currently unaddressed high truck crash locations and freight bottlenecks.
  - Relevant projects from the current STIP appear in Table 59.

TABLE 59. STIP PROJECTS THAT ADDRESS IDENTIFIED FREIGHT NEEDS

TIP	Roadway	Description	Resolution of identified needs	Project Cost '000
HE-0001	I-26	Construct new interchange	May address congestion	4859
HE-0019	NC 61	NC 61 road widening, turn lanes and installation of two signals	May address safety	500
HP-0022	NC 49	Relocate on new alignment	Addresses safety	6600
HS-2003F	US 17	Revise traffic signal and install traffic signs	Addresses congestion	271
HS-2003N	NC 24 Bus.	Revise traffic signal	Addresses congestion	252
HS-2003O	US 74 / US 76	Install traffic signals	Addresses safety	533
HS-2013O	SR 3075	Construct sidewalk and upgrade bridge rail	May address safety	395
HS-2014H	US 23 Bus.	Install rectangular rapid flashing beacon and upgrade curb ramps	Addresses safety	107
HS-2405J	US 70 / US 401	Upgrade ramp traffic signals	Addresses safety	360
I-0305B	I-85	Construct interchange improvements	Addresses safety	164500
I-2513C	I-26	Construct interchange improvements	Addresses safety	284001
I-4400BA	I-26	Construct interchange improvements	Addresses safety	106950
I-5703	I-40	Reconstruct interchange	Addresses safety	398494

TIP	Roadway	Description	Resolution of identified needs	Project Cost '000
I-5712	I-40 / US 421	Improve interchange	Addresses safety	42600
I-5964	I-40 / Bus 85	Improve interchange	Addresses safety	1532
I-6004	I-40 / I-85	Upgrade interchange	Addresses safety	29900
I-6009	I-40 / I-85	Construct additional left turn lane	May address safety	2940
I-6012	I-85	Construct interchange improvements	Addresses safety	52100
I-6013	I-85	Construct interchange improvements	Addresses both	23980
I-6015	I-485	Construct interchange improvements	Addresses safety	15560
I-6016	I-85	Construct interchange improvements	Addresses both	44370
I-6016A	I-85	Improve interchange	Addresses both	200
I-6020	I-85	Construct interchange improvements	Addresses both	132100
I-6053	I-85	Construct interchange improvements	Addresses both	51928
I-6059	I-40 / I-85	Upgrade interchange	Addresses safety	39980
I-6061	I-95	Improve interchange	Addresses safety	30300
R-2561C	NC 87	Widen to multi-lanes	May address safety	116798
R-5869B	US 17	Upgrade at-grade intersection to interchange	Addresses congestion	60081
U-2509AB	US 74	Construct interchanges	May address safety	122400
U-2567	US 74	Construct interchange	May address congestion	70899
U-5716	NC 24	Upgrade at-grade intersection to an interchange	Addresses congestion	105972
U-5729SW	US 421	Construct intersection improvements	May address congestion	13420
U-5731	US 74	Construct a fly-over and free flow ramp at interchange	May address both	55390
U-5792	US 117 / NC 132	Upgrade roadway	May address congestion	291499

TIP	Roadway	Description	Resolution of identified needs	Project Cost '000
U-5929	US 74	Construct intersection improvements	May address congestion	22500
U-6115A	NC 54	Construct intersection improvements	Addresses safety	7720
U-6115B	NC 54	Upgrade ramp intersections	Addresses safety	12180
U-6118	NC 55	Construct third southbound lane, upgrade ramps, and include bike-ped facilities	Addresses safety	7550
U-6131	NC 54	Install dual left turn lanes	May address safety	20200
U-6134	NC 16 Bypass	Upgrade to interchange	Addresses safety	47400
W-5807B	SR 1301	Pedestrian signals, curb ramps, and revise pavement markings	Addresses safety	76
I-5718	I-77	Widen	Addresses both	4313315
I-5719	I-85	Widen	Addresses both	1500000
I-5719A	I-85	Widen	Addresses both	587705
U-5518	US 70	Access Management	Addresses both	399600
U-6044	SR 2200	Widen	Addresses both	65300
U-3125A	US 117	Upgrade to Interstate	Addresses both	227900
U-5307A	US 1	Upgrade to Freeway	Addresses both	480550
U-5307B	US 1	Upgrade to Freeway	Addresses both	319450
U-5307C	US 1	Upgrade to Freeway	Addresses both	211350
I-2513B	I-26 / I-40	Widen	Addresses bottleneck	1401988
I-5719B	I-85	Widen	Addresses bottleneck	547805
R-5721A	NC 73	Widen	Addresses bottleneck	268800
U-2801AA	US 25A	Widen	Addresses bottleneck	185491
U-2901B	NC 55	Widen	Addresses bottleneck	54900
U-3431	NC 101 / SR 1763	Widen	Addresses bottleneck	126100
U-5702B	NC 132	Access Management	Addresses bottleneck	96000

TIP	Roadway	Description	Resolution of identified needs	Project Cost '000
U-5732	US 17	Intersection	Addresses bottleneck	90300
U-5734	US 421	Widen	Addresses bottleneck	76500
U-5737	US 64	Access Management	Addresses bottleneck	54500
HP-0009	US 401 / US 70 Bus.	Intersection	Addresses safety	7500
I-6055	US 74 / Future I-74	Upgrade to Interstate	Addresses safety	275600
R-5713	US 74	Access Management	Addresses safety and congestion	3200
R-5795	US 70	Access Management	Addresses safety	23400
R-5798	US 74	Access Management	Addresses safety	89100
R-5829B	US 70	Upgrade to Freeway	Addresses safety	132300
U-5726	US 301 / NC 39 / NC 96	Access Management	Addresses safety	47300
U-5815A	US 1	Access Management	Addresses safety	20600
U-6100	US 29 / US 70 / US 220	Access Management	Addresses safety	36300
U-6122	NC 68	Intersection	Addresses safety	38300
U-6152	US 401	Access Management	Addresses safety	62000
HL-0049	Brenner Avenue	Access Management	Addresses safety	3881
HS-2004W	US 70	Intersection	Addresses safety	800
HS-2006R	I-95	Access Management	Addresses safety	816
HS-2014I	US 25 Bus.	Safety	Addresses safety	349
HS-2010L	SR 5901	Safety	Addresses safety	960
HS-2007K	I-40	Safety	Addresses safety	325
HS-2003AH	US 117	Safety	Addresses safety	507
U-2509	US 74	Upgrade to Freeway	Addresses safety	Not Determined in STIP
U-5911	NC 48	Intersection	Addresses safety	4290
U-6086	NC 51	Access Management	Addresses safety	7553
U-6203	NC 210	Intersection	Addresses safety	88400

TIP	Roadway	Description	Resolution of identified needs	Project Cost '000
HP-0004	I-85	Interchange	May address both	47800
I-5966	I-40	Widen	May address both	74330
U-5955	NC 16	Widen	May address both	Not Determined in STIP
U-5955B	NC 16	Interchange	May address both	17345
U-5811	SR 1002	Widen	May address both	61205
I-6065	I-77	Peak period shoulder use lanes	May address bottleneck	47000
U-5301	US 64	Corridor Upgrade and improvements	May address bottleneck	304500
U-5729REG	US 421	Upgrade	May address bottleneck	53680
HP-0001	US 74	Widen	May address safety	116000
HP-0026	I 40	Interchange	May address safety	3800
HP-0027	US 52	Upgrade to Interstate	May address safety	377700
I-4400A	I-26	Widen	May address safety	116900
I-5719FA	I-85	ITS	May address safety	4100
I-5968	I-540	Widen	May address safety	40420
I-5981A	I-40	Widen	May address safety	109901
I-5981B	I-40	Widen	May address safety	44800
I-5981C	I-40	Widen	May address safety	116600
R-5706BA	NC 73	Widen	May address safety	171500
R-5706BB	NC 73	Widen	May address safety	75200
U-2509D	US 74	Widen	May address safety	304804
U-5764	US 74	Widen	May address safety	141946
U-5772	NC 115	Widen	May address safety	119700
U-5844	NC 62	Widen	May address safety	36095
U-6009	US 70	Widen	May address safety	27905
U-6103	US 74	Widen	May address safety	268600
HL-0140	SR 5220	Widen	May address safety	9600

TIP	Roadway	Description	Resolution of identified needs	Project Cost '000
HO-0014	NC 72	Complete Streets	May address safety	11000
I-0305A	I-85	Widen	May address safety	139998
I-5111REG	I-40	Widen	May address safety	27274
I-5111SW	I-40	Widen	May address safety	144224
R-3410	NC 42	Widen	May address safety	229295
R-5709B	NC 211	Widen	May address safety	114200
U-2523B	NC 279	Widen	May address safety	60900
U-3415A	SR 1394	Widen	May address safety	63200
U-5304F	US 15 / US 501	Widen	May address safety	83600
U-5767	US 21	Widen	May address safety	135500
U-5845	SR 1009	Widen	May address safety	77400
U-5864	SR 1595 / SR 4053	Widen	May address safety	79500
U-5934	I-885	Widen	May address safety	142610
U-6045	SR 1850	Widen	May address safety	49790
HO-0002D	US 74	Resilience upgrades	May address safety	2200
HP-0002	I-485	Widen	May Address Safety	271500
R-2561C	NC 87	Widen	May Address Safety	116798
R-0211	I-485	Widen	May Address Safety	Not Determined in STIP
U-5816	SR 1305	Widen	May address safety	81705
I-5701	I-40 / US 64	Widen	May address safety	165400
HL-0057	NC 24	Safety	May address safety	1532

Safety and Harsh Driving Events

The analysis of harsh driving events from truck telematics data presented in Chapter 4 of this plan offers a different lens through which to see truck safety and suggests different preparations and interventions for roadway management beyond the capital projects put forward in the previous section, although those may apply. These events encompass harsh acceleration, cornering and braking, which are actions taken by truck drivers responding to operating conditions. The value of recognizing such events includes their ability to serve warning of developing hot spots for safety, especially on roads where freight volumes are growing.

Key patterns from the analysis indicate that higher event rates are commonly associated with constrained geometry, signalized or stop-controlled intersections, and transition areas such as ramps and underpasses, where drivers must adjust speed or direction over short distances. For roadway design and management, these findings can be instructive. At the segment level, patterns reflect recurring operational conditions such as tight turning radii, traffic control, and complex channelization, with deficiencies in signage a contributing factor.

- **Recommendation M-3:** Public agencies should consider using truck telematics data as a monitoring mechanism to help ensure safety around freight vehicle movements.
    - Especially revealing at a local level, telematics can assist evaluation of interventions such as enhanced signage, signal timing adjustments, and geometric modifications..

Truck Parking

The inventory and demand analyses set forth in Chapter 4 of this plan indicate that truck parking needs vary across North Carolina and are concentrated in specific freight corridors, metropolitan areas, and freight activity centers. While the updated inventory identified more than 7,200 truck parking spaces statewide, 89 percent of those spaces are provided by private facilities, and undesignated parking activity was observed throughout the state. Elevated undesignated parking activity was identified in several locations with relatively limited designated parking supply, suggesting that parking availability is not evenly distributed across the state. Addressing these needs will require a combination of targeted planning, strategic capacity investments, coordination with private-sector partners, deployment of technology solutions, and continued pursuit of implementation funding.

- **Recommendation M-4:** Conduct corridor- and site-level evaluations of truck parking.
  - Statewide analysis identified concentrations of undesignated parking activity near Charlotte, the Triad, Raleigh-Durham, Asheville, Wilmington, and along major interstate freight corridors including I-40, I-85, I-95, and I-77. Additional corridor- and site-level evaluations should be conducted to better understand local parking conditions, facility utilization, operational constraints, and opportunities for improvement in collaboration with private sector providers. Particular attention should be given to the 53 locations where elevated undesignated parking activity coincides with fewer than 30 designated truck parking spaces.

- **Recommendation M-5:** Expand truck parking capacity at strategic locations.
  - Parking needs are not evenly distributed across the state. Future investments, whether public or private, should prioritize locations where elevated parking demand, undesignated parking activity, and limited parking supply occur in close proximity. Potential opportunities may include expansion of capacity at existing public and private facilities, and development of new parking locations.

- **Recommendation M-6:** Strengthen coordination with private sector partners in truck parking.
  - Private truck stops and travel centers account for most of North Carolina's truck parking supply. Continued coordination with truck stop operators, travel centers, freight generators, and local governments can help identify opportunities to expand parking capacity, improve access to existing facilities, and align future investments with freight activity patterns and industry needs.

- **Recommendation M-7:** Advance truck parking information systems.
  - Technology solutions can improve the utilization of existing parking resources. Real-time truck parking information systems provide drivers with information on parking availability and can reduce uncertainty and productivity losses associated with locating available parking. NCDOT should continue evaluating opportunities to deploy truck parking information systems at public facilities and incorporate lessons from the proposed I-77 North Welcome Center in Surry County pilot deployments, as well as successful applications in other states.

- **Recommendation M-8:** Pursue implementation funding for truck parking improvements.
    - Successful implementation of truck parking improvements will depend on the availability of commercial and public funding. NCDOT should continue advancing truck parking projects and planning activities that identify opportunities, improve project readiness and position the state to attract private development and compete for federal discretionary grant opportunities, some of which can allow for public-private collaboration. Recent federal programs have increased the availability of funding for truck parking infrastructure and technology improvements, additional federal funds are proposed under transportation reauthorization, and these developments may provide opportunities to accelerate implementation of priority projects.

Oversize/Overweight and Heavy Trucks

North Carolina issued 658,912 oversize/overweight (OS/OW) permits between June 2023 and June 2026, or about 220,000 a year. Single-trip permits account for 81 percent of records, annual permits 14 percent, and superloads 6 percent. This section examines patterns from these permits, but there are two limitations to the data:

- North Carolina permits are for travel within the state. North Carolina inbound trips from outside the state and outbound trips that leave the state can be analyzed only within state boundaries.
- Approximately 30 percent of OS/OW flows begin and end at a state line location. These are probably pass-through trips, and they have been excluded from facility-level analysis.

Principal Dynamics

Construction equipment accounts for just over 250,000 permit – 38 percent of the total, and more than the next two categories combined. General loads follow at 14 percent, manufactured and modular housing units at 11 percent, and sealed shipping containers at 9 percent. OS/OW activity thus supports construction infrastructure projects, homebuilding, and port trade; and as a result, road capacity for OS/OW travel is a concern for these industries and their contribution to the state economy.

Oversize/overweight freight in North Carolina is a short-haul, metro-anchored system built on construction equipment. The average trip is 36 miles, three-quarters stay under 75 miles, and the Triangle, Charlotte and Triad regions together account for about three-fifths of all origins and destinations. Its defining constraint is access capacity, not corridor capacity. Six in ten trips

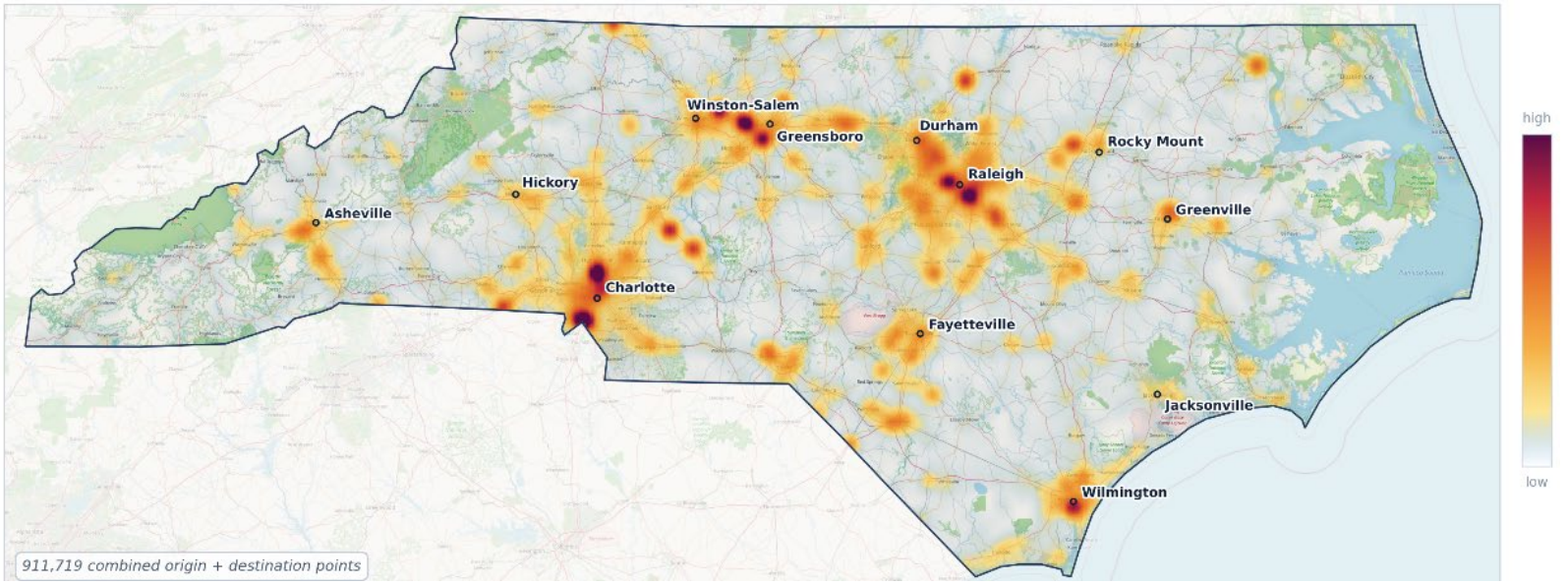
have both first and last miles on county secondary roads – the roads least engineered for oversize vehicles, and largely outside the NCPHFN.

Demand is increasing where it is most costly to serve. Superload permits grew 40 percent over three years while total permits grew 5 percent, most recently reaching nearly 7 percent of the total. Stakeholders report several influences: modular construction replacing on-site construction, which reduces labor costs but requires transport of large units, such as HVAC equipment; transformers growing larger so that power companies can build one large station rather than multiple substations; companies seeking to load more product in a single shipment to save cost; and growth in data center construction. Truck parking is also most difficult for the largest loads, because shipments can be restricted as to the times of day they are allowed to move, and because parking facilities may not be designed for heavy vehicles carrying dimensional freight.

Regions and Networks

OS/OW activity is concentrated in a broad arc along I-85 and I-40 that connects Charlotte, the Triad and the Triangle (Figure 119). Fayetteville and the Wilmington area form smaller clusters outside that arc. Raleigh accounts for 16 percent of origins or destinations (trip ends) within a 25-mile radius, while Charlotte and Durham account for 13 and 11 percent, respectively. Notably, the densest individual cluster in the state sits between metros near Mooresville and Statesville rather than in any city center – a signature of highway-adjacent industrial and equipment yards.

FIGURE 119. PERMIT CONCENTRATIONS BY REGION



Source: WSP Analysis of NCDOT data, 6/23-6/26

A small number of sites drive a large share of movement (Table 60). The largest generators are Carolina CAT's Caterpillar dealership in Charlotte (9,869 trip ends), the Deere-Hitachi excavator plant at Kernersville (8,088), Clayton Homes' modular plant at Rockwell (7,693), Guy M Turner's crane and rigging base in Greensboro (7,058) and the Port of Wilmington (5,469). The four industries that dominate this category include modular housing plants, construction-equipment dealers and rental yards, heavy-haul carriers, and ports.

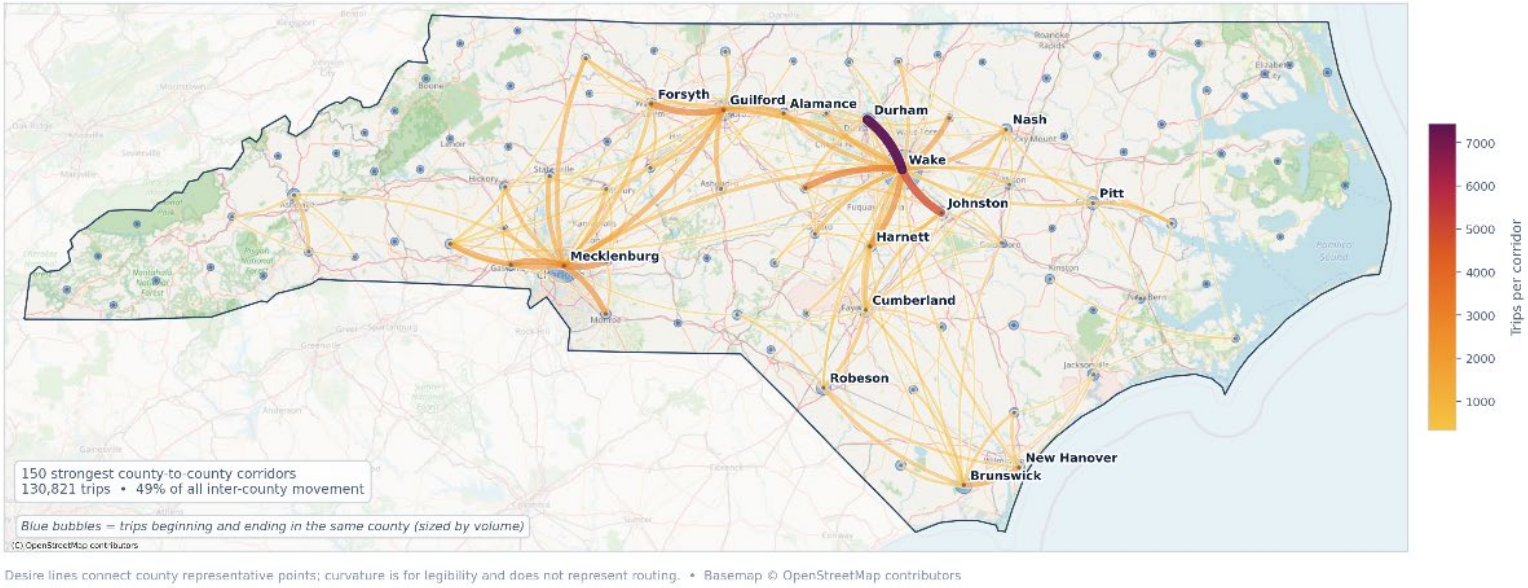
TABLE 60. TOP INDUSTRIAL SITES GENERATING OS/OW PERMITS

Rank	Freight Generators	Location	Trip Ends	Main Commodity
1	Carolina CAT – Caterpillar dealer	Charlotte	9,869	Construction equipment
2	Deere-Hitachi excavator plant	Kernersville	8,088	Construction equipment
3	Clayton Homes / Schult	Rockwell	7,693	Modular units
4	Guy M Turner – crane & rigging	Greensboro	7,058	Special mobile
5	Modular home plant	Richfield	6,161	Modular units
6	Port of Wilmington	Wilmington	5,469	Sealed containers

Source: WSP Analysis of NCDOT data, 6/23-6/26

Grouping permits into counties (Figure 120) reveals two independent hub-and-spoke-like flow systems rather than one integrated statewide network. Durham to Wake County is the heaviest corridor at 7,446 trips, followed by Johnston to Wake (4,930) and Chatham to Wake (3,404). Wake and Mecklenburg Counties freight corridor footprints tend to wane with distance, indicating the presence of industry clusters.

FIGURE 120. COUNTY FLOWS FROM OS/OW PERMITS



Source: WSP Analysis of NCDOT data, 6/23-6/26

As noted above, 61 percent of first and last mile portions of OS/OW routes are county secondary roads. U.S. highways account for a further 19 percent of first miles and 18 percent of last miles, N.C. highways 14 percent, and interstates only 5 percent. County secondary roads can be the least likely to have been engineered for oversize vehicles. They have narrower lanes, tighter turning radii, lower bridge postings, and more utility conflicts. This analysis identifies potential constraints at the network-level by facility type rather than corridor-level bottleneck analysis, which considers additional highway infrastructure data not included as part of the study dataset.

- **Recommendation M-9:** Support improvements to secondary roads prominent in OS/OW permitting.
  - Usage of secondary roads can be repetitive. Identifying data is available from NCDOT, although it requires processing.

- **Recommendation M-10:** Recognize OS/OW needs in truck parking initiatives.
  - Permitting data and the concentrations it reveals allow this to be focused on areas of greatest need.

- **Recommendation M-11:** Incorporate OS/OW requirements in network planning and design.
  - Length, width, height and weight are all factors. Roundabouts – especially several in sequence – can be hard for OS/OW trucks to navigate, even with steerable axles. Overhead traffic signals on poles with the rigid bars are difficult to remove when tall loads need to pass.

- **Recommendation M-12:** Prepare for growth in OS/OW freight.
  - The trend is upward, it enables cost savings to important industries, and it goes beyond data centers. Local coordination is important, both for viable through routes and for consistent policy on operating matters such as time windows.

6.3.2. Ports

NC Ports has completed a new 2025 Container Cargo Master Plan and a new 2031 Strategic Plan. These plans include forecasts and recommended actions and strategies to respond to and capture growth opportunities.

For general cargo, growth forecasts and investment strategies have been developed as part of the General Cargo Master Plan Report (Aug. 8, 2025) and can be summarized as follows:

Combined, the Port of Wilmington and the Port of Morehead City are projected to handle between 5.8 and 7.0 million tons of general cargo annually by the year 2035, representing an increase between 41 percent and 71 percent as compared to 2025 volumes of 4.11 million tons.[143] By 2045, this is projected to increase to between 7.1 and 9.1 million tons of cargo annually.

Key trends and disruptors that impact planning for North Carolina ports in the context of this freight plan include:

- Changes in port demand related to changes in the North Carolina economy and preference for North Carolina ports
- Changes in capacity or operability of North Carolina's multimodal freight network
- Changes in underlying economic conditions, domestically and globally
- Effects of national and global trade policy
- Climate and weather-related disruptions and risks
- Changing logistics practices
- Deployment of advanced technologies and AI systems

Multi-State Port Connections

A core strength North Carolina offers its freight shippers and receivers is access not only to the full-service NC Ports facilities by truck and rail, but also easy and cost-effective access to the ports of Hampton Roads in Virginia, Charleston in South Carolina, and Savannah and Brunswick in Georgia. Different ports accommodate different ocean services and carriers, and access to port choices is a huge advantage for the freight community. Access to multiple ports is also critical to enhance the resiliency and reliability of essential port services.

As shown in Table 61, freight customers throughout North Carolina – in Asheville, Greensboro, Charlotte, and Raleigh – are all within a one-day (450-mile) truck dray of multiple port and inland port options. Conversely, freight customers in neighboring states enjoy the same access to NC Ports. The roads and railroad lines providing these multi-state port connections are essential elements and extensions of the port system serving North Carolina.

[143] Note that 2025 volumes are lower than the 2023 volumes, so the forecast is starting from a more conservative baseline.

TABLE 61. COMPARATIVE DRIVE DISTANCES (IN MILES) TO SELECTED PORTS AND INLAND PORTS

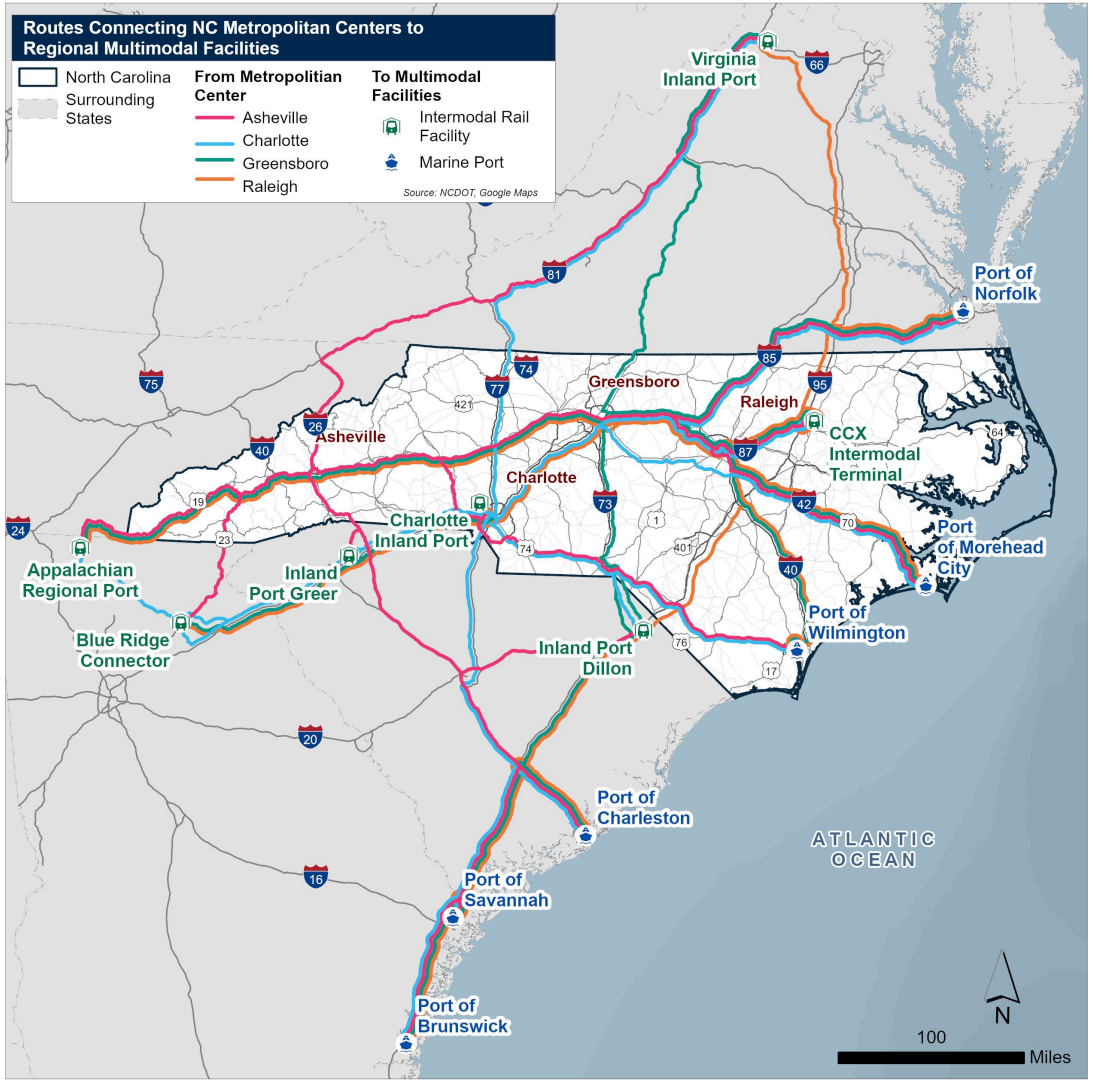
Port	Asheville	Greensboro	Charlotte	Raleigh
Port of Wilmington	362	212	200	136
Port of Morehead City	399	226	312	152
Charlotte Inland Port	128	95	7	168
CCX Intermodal Terminal	304	134	225	60
Port of Norfolk, VA	407	237	325	181
Virginia Inland Port (Front Royal, VA)	405	250	358	294
Port of Charleston, SC	268	286	209	280
Inland Port Greer	63	177	90	251
Inland Port Dillon	262	143	124	120
Port of Savannah, GA	310	328	252	323
Port of Brunswick, GA	387	404	328	398
Appalachian Regional Port (Crandall, GA)	177	346	292	421
Blue Ridge Connector (Gainesville, GA)	144	293	205	366

Source: WSP analysis and Google Maps. Green = 200 miles or less; Yellow = 400 miles or less; Orange = over 400 miles.

Additionally, different parts of North Carolina are likely to prefer different facilities. For the Raleigh area, facilities in North Carolina are the most attractive based on distance, but the Port of Norfolk is almost as attractive. For the Charlotte area, the Charlotte Inland Port is extremely attractive, along with the two Inland Ports in South Carolina; and the ports of Wilmington, Charleston, and Savannah are all well-located to serve it. For the Greensboro area, the Charlotte Inland Port, CCX Intermodal Terminal, Inland Port Greer, and Inland Port Dillon are all attractive, and the ports of Wilmington, Morehead City, and Norfolk are best positioned to serve it. For Asheville, the Charlotte Inland Port, Inland Port Greer, and the two Georgia Inland Ports offer strong advantages, and the ports of Charleston and Savannah offer the shortest travel distances. Distance affects cost, reliability affects cost and ability to meet schedules, and the services and connections on offer at any of these points greatly affect their utility. The key advantage to North Carolina is that so many facilities, services and connections are within practical reach.

Maintaining that reach and the reliability of a one-day truck dray requires competitive performance on the connecting routes. The map in Figure 121 depicts connections between the four North Carolina metro centers and the ports and inland facilities in Table 61. The map captures the confluence of routes providing connecting service to multiple metro centers; prominent are I-85 and I-40, including continuation from I-40 onto I-42 and US 64 in the east and US 19 in the west. I-95, I-73, and I-77 all show significance, and US 74 is the link for Charlotte and Asheville to the Port of Wilmington. The relative isolation of Asheville also is visible, as it relies uniquely on several routes leading out of the state.

FIGURE 121. CONNECTING ROUTES FOR SELECTED PORTS AND INLAND PORTS



It is challenging to estimate the amount of North Carolina cargo that is using ports in other states, but the USDOT Freight Analysis Framework version 6 (FAF-6) offers some insights based on 2022 data. Analysis of FAF estimates suggests that imported waterborne cargo destined for North Carolina and exported waterborne cargo originating in North Carolina is moving through ports in five key states. North Carolina ports handle the largest share of its North Carolina origin-destination waterborne trade tonnage (28 percent) and are particularly important for export tonnage (39 percent). Virginia ports rank second with 24 percent of North Carolina waterborne trade tonnage, followed by South Carolina ports at 19 percent, Georgia ports at 10 percent, and Florida ports at 8 percent. (See Table 62).

TABLE 62. SHARE OF NORTH CAROLINA WATERBORNE IMPORTS AND EXPORTS MOVING THROUGH PORTS IN DIFFERENT STATES, 2022

State	Share of NC Waterborne Trade Tons	Exports	Imports
North Carolina	**28%**	39%	28%
Virginia	**24%**	25%	24%
South Carolina	**19%**	15%	19%
Georgia	**10%**	9%	10%
Florida	**8%**	8%	8%
All Other	**10%**	5%	10%
Total	**100%**	**100%**	**100%**

Source: WSP Analysis of FAF-6 Model

Virginia performs strongly based on its diverse range of container and non-container handling facilities and its proximity advantages for the Triangle and Triad regions; South Carolina ports are similarly well-positioned to serve the Charlotte area. Georgia offers strong connectivity for container and automobile trades, while Florida offers unique services to the Caribbean, Gulf, Central America, and South America. These clear findings strongly highlight the importance of efficient multi-modal connections and multi-state corridors linking North Carolina shippers and receivers with ports in North Carolina and other southeastern U.S. states.

Industry Mode Preferences

Certain industries have higher affinities for water transportation for different reasons. Looking at domestic cargo, modal preferences tend to be based on the balance between cost, speed and reliability; heavier, bulkier, less time sensitive, and/or less expensive (per unit) goods prefer the economies of scale offered by water to the added speed or reliability offered by truck. This is why we see fuel, chemicals, and metals moving domestically on water in North Carolina and coal, fertilizers, and grains moving domestically in large quantities elsewhere.

Looking at international cargo, the issue becomes less about modal performance, because except for trade with Canada and Mexico there are only two options – air and water. Air is very expensive and has limited size and weight capacity, so it specializes in smaller, lighter, time-sensitive, and/or high-value goods. Everything else that would normally get to choose between water, rail, truck and pipeline ends up on water by default. North Carolina freight shippers and logistics providers utilizing overseas imports and exports will make modal choices between air and water based on performance requirements for cost, speed, reliability, and other metrics.

From this perspective, almost any North Carolina industry that utilizes imported materials or products or sells to overseas markets is de facto dependent on ocean shipping. Unless they can source or sell by air, this is their only choice if they wish to benefit from participation in the global economy. The importance of their dependence on water, and of the need for public and private sectors to jointly provide the necessary facilities and services, is difficult to overstate.

- **Recommendation M-13:** Enhance multi-state and multi-port connectivity.
    - This includes providing North Carolina freight shippers and receivers with excellent truck and rail service options to reach ports in North Carolina and nearby states, and to allow shippers and receivers in other states equivalent access to North Carolina ports. Bridge condition, pavement condition, congestion reduction, bottleneck mitigation, and safety improvements on key port access routes should be prioritized. Promotion of Inland Ports and innovative rail connector services should continue and expand, and opportunities to expand rail carrier service choices for freight customers should be explored.

- **Recommendation M-14:** Ensure port facility State of Good Repair.

    - The condition of port facilities can be evaluated on a number of dimensions, including but not limited to the ability to operate at capacity; the amount of facility or equipment downtime; the costs for routine maintenance and upkeep; and the anticipated life-cycle costs for major refurbishment or reconstruction. Typically, condition analysis considers different elements of ports, including:

        - Wharf and dock
        - Terminal operating area
        - Structures
        - Equipment
        - On-port and off-port rail
        - On-port and off-port road
        - Utilities (electrical & stormwater)
        - Information systems
        - Security systems
        - Vessel navigation channel
        - Truck gates, scales & services

      The 2025 General Cargo Master Plan report provides an 86-page conditions analysis addressing general cargo facilities at Wilmington and Morehead City. Results of this analysis can be summarized as follows:

      "The existing general cargo assets for both terminals were evaluated and each requires certain improvements within the 10-year horizon. Approximately $88 million in core capital and maintenance projects were identified for the general cargo assets with 60 percent being at the Port of Wilmington. Some assets require immediate improvements, others can be planned, and some should be phased out earlier in the 10-year period. The existing assets were categorized to include waterfront berths, transit sheds and warehousing, bulk facilities (without long-term leases), rail assets (on-terminal and excluding yards), and pavement … These costs are estimated based on 2025 dollars and exclude future cost escalations."

- **Recommendation M-15**: Maintain focus on bulk cargo opportunities.
    - NC Ports and its peer ports have invested to ensure they are ready to handle the coming "next wave" of international container growth and larger vessels, positioning themselves for performance and growth over the coming decades. NC Ports is now giving renewed attention to its non-containerized commodities. While they often receive less attention than containers, these commodities are critical to state and regional freight

industries and consumers and can be strong revenue generators for Ports. The NC Ports 10-Year General Cargo Master Plan identifies almost $500 million in upgrade projects.

"The 10-Year General Cargo Master Plan recommends sixteen (16) projects at the Port of Wilmington and eight (8) projects at the Port of Morehead City totaling approximately $497 million in expansion capital expenditure. These projects will provide a total capacity to exceed the forecasted 2035 high volumes for the commodities analyzed and plan for future growth opportunities. Depending on the commodity, it is possible that some of these projects could be funded by private operators."

As a first step in exploring public-private partnership interest, in November 2025 NC Ports released a Request for Expressions of Interest to develop a new Integrated Bulk Cement Terminal at the Port of Wilmington. In January 2026, Silvi Cement announced it was expanding its cement terminal capacity at Morehead City by 500 percent.

6.3.3. Rail

The 2026 North Carolina Draft State Rail Plan is a current document with specific recommendations for investment, which this North Carolina Freight Plan supports.

Rail Investment Program Recommendations

The 2026 North Carolina State Rail Plan organizes projects into three timeframes:

- Committed: 2025–2030
- Next Steps: 2031–2035
- Vision: 2036 and Beyond

Funding needs for all three timeframes in North Carolina are $12.6 billion, of which $1 billion has been funded and $11.5 billion remains unfunded. Table 63 summarizes the funded and unfunded needs across the three timeframe categories. Figure 122 and the two figures following illustrate the location of projects in the committed, horizon, and 2036 and beyond

timeframes. Investments across all phases encompass projects that benefit passengers, freight, Class I railroads, and short lines.

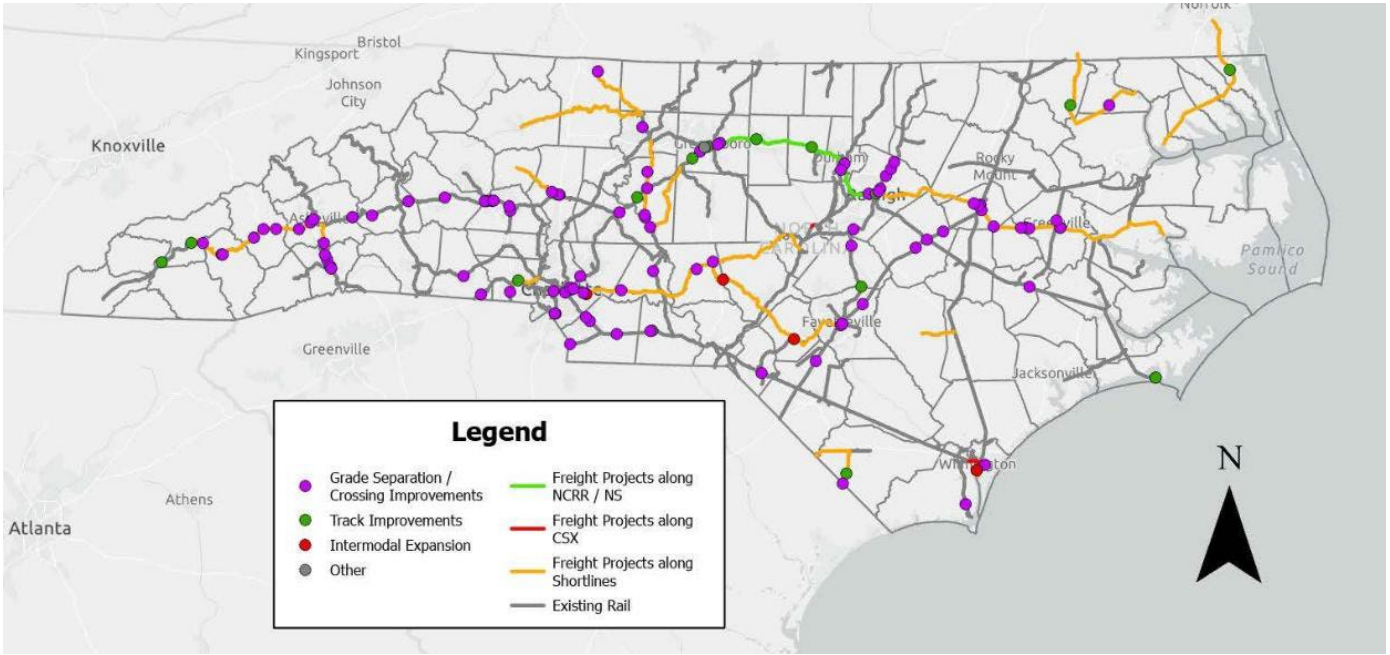
TABLE 63. NORTH CAROLINA FREIGHT RAIL FUNDING INVESTMENT PROGRAM AND NEEDS

	Need ($millions)	Funded ($millions)	Unfunded ($millions)
Committed	$2,442	$912	$1,531
Horizon	$751	$88	$663
2036 and Beyond	$9,430	$33	$9,397
Total	**$12,623**	**$1,033**	**$11,591**

Source: 2026 North Carolina Draft State Rail Plan, Chapter 5

Figure 122 depicts North Carolina's focus on grade crossing improvements and separations, which are committed projects throughout the state. Many of these grade separations projects will benefit not only freight, but passenger operations as well. For example, in 2026 North Carolina will initiate a $47.8 million project to grade separate SR 1121 (Cornwallis Road) benefiting both Amtrak and Norfolk Southern (STIP # P-5717).

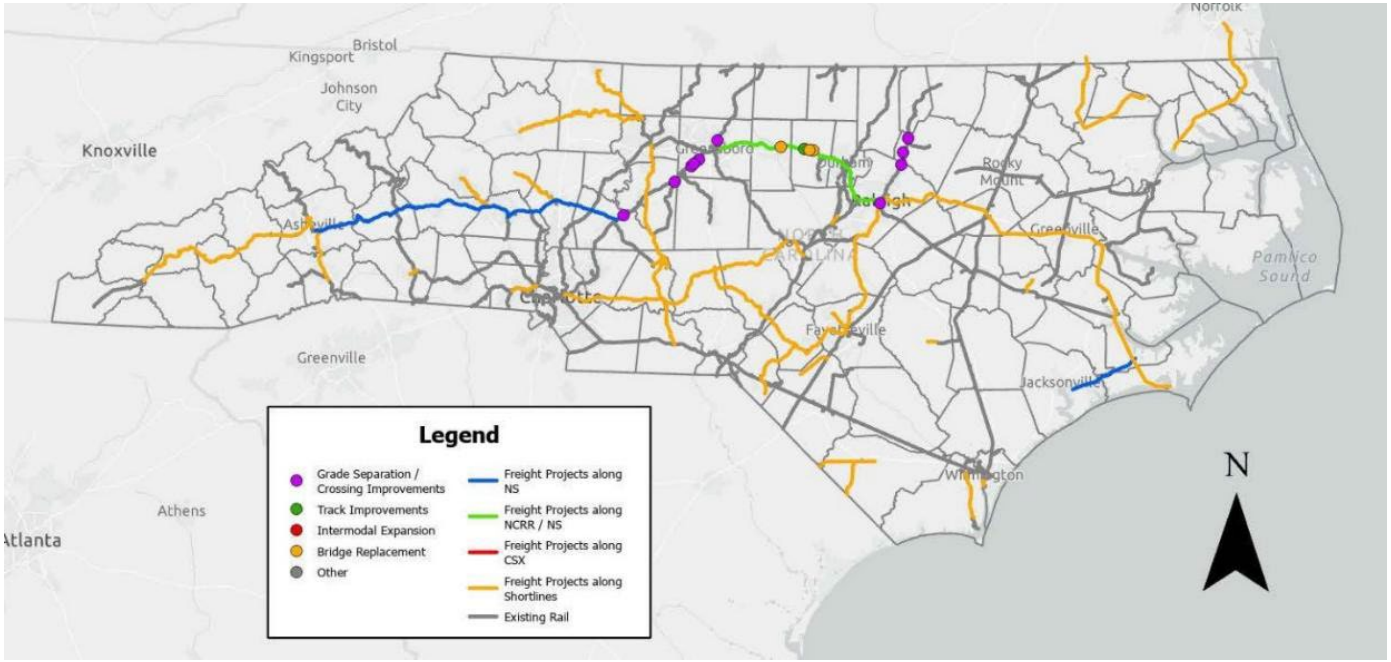
FIGURE 122. FREIGHT RAIL PROGRAM PROJECTS: COMMITTED (2025-2030)



Source: 2026 North Carolina Draft State Rail Plan

Similarly, grade separation emphasis continues into the “Horizon” phase, where additional projects focus on the North Carolina Railroad corridor (Figure 123). The Horizon phase also includes key capacity projects such as $100 million for second main track near Cary, and $65 million for a second track out of the East Durham yard, both which will benefit passengers as well as freight rail users.

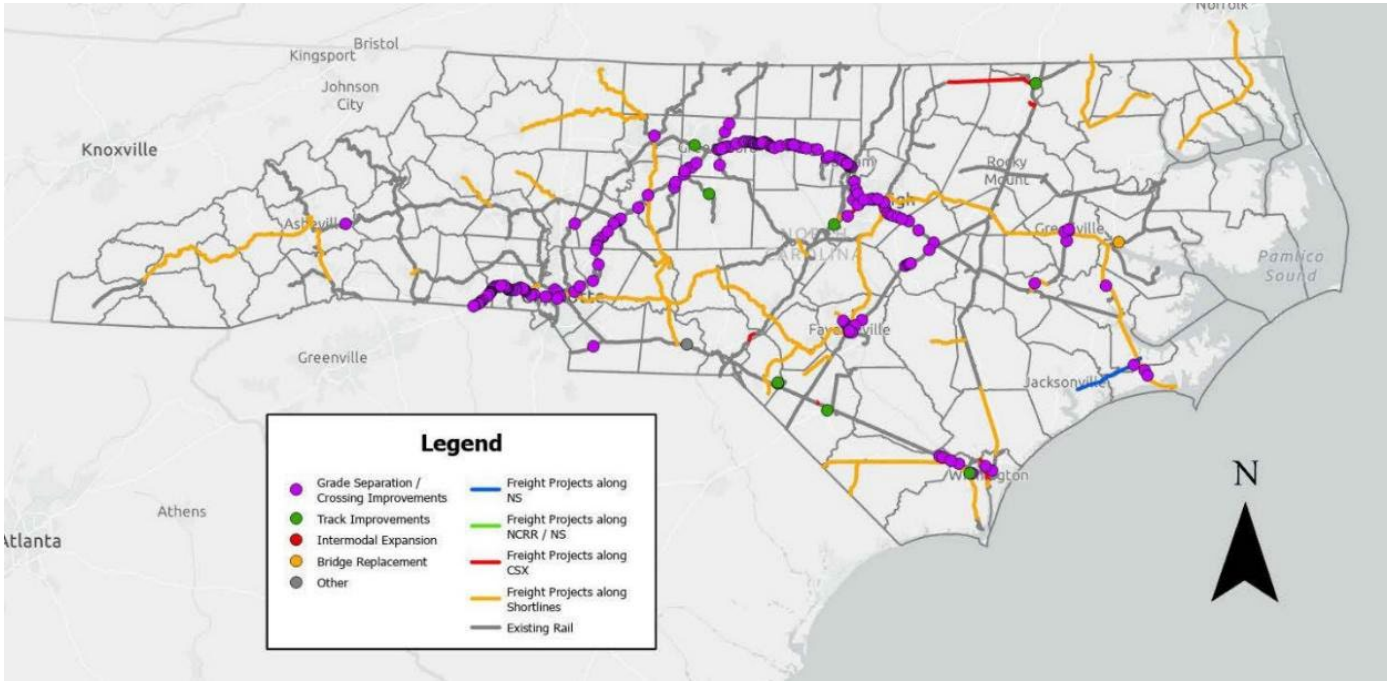
FIGURE 123. FREIGHT RAIL PROGRAM PROJECTS: HORIZON (2031-2035)



Source: 2026 North Carolina Draft State Rail Plan

In the long term (Figure 124), North Carolina will continue to focus on grade separations along the North Carolina Railroad corridor and at key locations approaching the Ports of Wilmington and Morehead City. Long-term rail investments encompass an extensive vision with a funding need of over $9.4 billion, yet only $33 million has been identified to support these projects.

FIGURE 124. FREIGHT RAIL PROGRAM PROJECTS (2036 AND BEYOND)



Source: NC 2026 Draft State Rail Plan

6.3.4. Aviation

North Carolina's Division of Aviation and its principal cargo airports have plans for capacity and new forms of aircraft with direct or indirect value for air freight. They are described below, and continuing support for these initiatives is the recommendation of this North Carolina Freight Plan. In addition, Wilmington International Airport is now hosting dedicated trans-Atlantic freighter services chartered for the biotechnology market. This opens a niche in cold chain cargo valuable to a supply chain important to North Carolina. Reliable access routes supporting time and security sensitive distribution from Wilmington align with the highway recommendations of this plan.

Charlotte Douglas International Airport (CLT)

CLT's master plan proposes two new runways:

- Runway 17C-35C
- Runway 1L-19R

Each one will accommodate wide-body aircraft to handle long-term demand. Construction on the fourth parallel runway started in June 2023 and is scheduled for completion in 2027. Wide-body aircraft typically is used for international passenger travel and its larger size creates belly space for air cargo. Runway expansion thus facilitates growth in international trade once passenger services are introduced.

Piedmont Triad International Airport (GSO)

Boom Supersonic is an aircraft manufacturer that has selected GSO as the manufacturing site of its supersonic aircraft, Overture. The Boom Supersonic production facility was completed in 2024 and occupies 65 acres on the airport (with the initial building comprising 188,000 square feet) with the potential for a second production facility as production lines increase. The facility is on the south side of I-73 adjacent to runway 5L-23R (Boom n.d.).

JetZero has also selected GSO as the manufacturing site for the Z4 aircraft; the facility will cost $4.7 billion for a total of 3 million square feet. Construction will begin in early 2026 and is estimated to be completed sometime in 2030 (Piedmont Triad Airport Authority 2025).

The addition of Boom Supersonic and JetZero manufacturing facilities at GSO will potentially increase industrial activity on airport property. These manufacturing facilities will impact land availability and could potentially constrain future cargo expansion areas. Increased aircraft manufacturing could also drive demand for high-value express freight (e.g., parts and tools) and perhaps specialized freight (e.g., oversized components) as well, which may require additional cargo handling capacity.

Raleigh-Durham International Airport (RDU)

RDU began replacing its primary commercial Runway 5L-23R in October 2023. The 10,639-foot runway is expected to be completed in 2029 (Raleigh-Durham Airport Authority, n.d.) Replacing Runway 5L-23R will ensure long-term operational

reliability and will support future growth in both passenger and cargo operations. The upgraded runway will provide added capacity for heavier aircraft and will indirectly benefit cargo carriers by improving flexibility for wide-body freighters. While the runway replacement will not directly create new cargo facilities, it will form a critical component of RDU's broader modernization strategy.

Advanced Air Mobility

Cargo applications for advanced air mobility (AAM) and unmanned aircraft system (UAS) are anticipated to precede passenger operations as AAM and UAS technologies are deployed, in the view of NCDOT Division of Aviation (DOA). This sequencing reflects current technological and regulatory constraints related to payload, range, and certification requirements. In the near term, the movement of medical supplies, semiconductors, and other critical or high-value goods are identified as the most viable use cases for AAM cargo operations in North Carolina, given the low weight and time-sensitive nature of these commodities. Limited operational activity underway in the state includes Google Wing's last-mile delivery operations in the Charlotte area, conducted under current Federal Aviation Administration operational frameworks. AAM "airfield" requirements are comparable to heliports, giving them considerable flexibility and moderate costs for operating locations.

The current DOA work program focuses on testing, regulatory readiness, and demonstration projects rather than routine commercial freight service. While freight mobility remains a long-term objective, near-term efforts are centered on establishing the technical and regulatory foundations needed to support expanded operations.

In addition to testing and regulatory initiatives, AAM and UAS initiatives have a role in enhancing disaster response and supply chain resilience. These technologies are being evaluated for their potential to support emergency logistics and access to remote or isolated communities, particularly in coastal areas such as Ocracoke and the Outer Banks, where conventional transportation links can be vulnerable during extreme weather events.

Interoperability for cargo between AAM and drones is feasible, in DOA's view, although any such services lie in the future and their market value is untested. Payloads would be light and potential market share low for that reason, although AI-enabled drone technology is evolving rapidly in the military sphere and some capabilities may cross over into civilian use.

7. Freight Investment Plan

This final chapter presents North Carolina's planned investment of its apportioned National Highway Freight Program (NHFP) funds. Several factors affect how the plan is composed:

- The usual five-year cycle for reauthorization of federal transportation legislation is at its end. As of October 2026, the governing legislation remains the Infrastructure Investment and Jobs Act (IIJA) of 2021. How the governing legislation may be modified in the reauthorization process is uncertain, including the size and apportionment of NHFP funds. Therefore, certain assumptions must be made for the future years of the Investment Plan.
- The current federal fiscal year (FFY) is 2027. North Carolina's Investment Plan looks ahead for four years, covering FFY 2028, 2029, 2030, and 2031. The four-year horizon mirrors the four-year cycle for state freight plans set forth in the IIJA. In view of the uncertainty attending reauthorization, a more distant horizon such as eight years seems speculative. North Carolina stands ready to extend the period of its investment plan beyond FFY 2031 in the next scheduled update of its state freight plan, or to amend this update of its freight plan as reauthorization or federal funding may warrant.
- North Carolina estimates its NHFP apportionment over the four years of its Investment Plan will total $164.49 million in gradually escalating amounts. This estimate assumes North Carolina's FFY 2026 NHFP apportionment of $39.15 million will have risen to $39.91 million for FFY 2028 and would climb annually and modestly thereafter, as has been past federal practice.
- States are permitted to transfer up to half of NHFP funds to different program accounts. North Carolina's Investment Plan does so, transferring 50 percent of assumed NHFP funds to the National Highway Performance Program in each year of the plan, leaving an estimated total of $82.2 million to be invested in infrastructure eligible for application of NHFP dollars.
- The North Carolina Freight Investment Plan appears below in Table 64. For each of the four fiscal years of this plan, the projects to receive investment and their locations are identified, the total programmed project cost for each is cited along with the total federal share, the contribution of NHFP funds to the federal share is specified, and the investment match by North Carolina from its State Highway Trust Fund is shown.
- In sum over four years, $219.78 million is planned for investment, for which the federal contribution is $176.3 million including $82.2 million from the NHFP, and the North Carolina match is $43.5 million.
- The investments are planned for Asset Management and Utilization improvements on identified sections of interstate highways I-40, I-73, I-77, I-87, I-95, I-485, and I-540. These facilities are part of the federal Primary Highway Freight System

in North Carolina, including designated Critical Urban and Critical Rural Freight Corridors. They also are part of North Carolina's Primary Highway Freight Network.

TABLE 64. NORTH CAROLINA FREIGHT INVESTMENT PLAN

Project Name	TIP / Project Number	County	Programmed Project Cost ($M)	Total Federal Share ** ($M)	NHFP ($M)	Match ($M)	Source of Match
2028			**$46.70**	**$37.36**	**$39.91**	**$9.34**	
Asset Management and Utilization			**$46.70**	**$37.36**	**$39.91**	**$9.34**	
I-40: Johnston County Line to the Duplin County Line. Pavement Rehabilitation.	HI-0011	Sampson	$22.40	$17.92	$11.96	$4.48	State Highway Trust Fund
I-77: Mile Marker 58.4 to Yadkin County Line. Pavement Rehabilitation.	I-5920	Iredell	$24.30	$19.44	$8.00	$4.86	State Highway Trust Fund
Transfer to National Highway Performance Program (NHPP)					$19.95		
Mobility and Reliability			**$0.00**	**$0.00**	**$0.00**	**$0.00**	
2029			**$32.48**	**$26.47**	**$40.71**	**$6.01**	
Asset Management and Utilization			**$32.48**	**$26.47**	**$40.71**	**$6.01**	
I-95: Robeson County Line to NC 53 / 210. Pavement Rehabilitation.	HI-0021	Cumberland	$8.00	$6.88	$4.80	$1.12	State Highway Trust Fund
I-73: Old US Highway 311 to Guilford County Line. Pavement Rehabilitation.	HI-0003	Randolph	$8.12	$6.50	$4.50	$1.62	State Highway Trust Fund
I-485: I-77 to NC 48. Rehabilitate Pavement	I-5828	Mecklenburg	$16.36	$13.09	$11.06	$3.27	State Highway Trust Fund
Transfer to National Highway Performance Program (NHPP)					$20.35		
Mobility and Reliability			**$0.00**	**$0.00**	**$0.00**	**$0.00**	

Project Name	TIP / Project Number	County	Programmed Project Cost ($M)	Total Federal Share ** ($M)	NHFP ($M)	Match ($M)	Source of Match
2030			**$84.10**	**$67.28**	**$41.52**	**$16.82**	
Asset Management and Utilization			**$84.10**	**$67.28**	**$41.52**	**$16.82**	
I-40: Sampson County Line to the Pender County Line. Pavement Rehabilitation.	HI-0012	Duplin	$31.10	$24.88	$10.00	$6.22	State Highway Trust Fund
I-40: Old Mocksville Road to Davie County Line. Pavement Rehabilitation.	I-5805	Iredell	$53.00	$42.40	$10.76	$10.60	State Highway Trust Fund
Transfer to National Highway Performance Program (NHPP)					$20.76		
Mobility and Reliability			$0.00	$0.00	$0.00	$0.00	
2031			**$56.50**	**$45.20**	**$42.35**	**$11.30**	
Asset Management and Utilization			**$56.50**	**$45.20**	**$42.35**	**$11.30**	
I-87: I-440 to Rolesville Road. Pavement Rehabilitation.	I-5944	Wake	$28.60	$22.88	$10.68	$5.72	State Highway Trust Fund
I-540: Triangle Towne Center Boulevard to I-495. Pavement Rehabilitation.	I-5945	Wake	$27.90	$22.32	$10.50	$5.58	State Highway Trust Fund
Transfer to National Highway Performance Program (NHPP)					$21.17		
Mobility and Reliability			**$0.00**	**$0.00**	**$0.00**	**$0.00**	

** Total Federal Share includes NHFP as well as any other federal funding source.
See STIP for detailed breakout of other federal sources.

Appendix A: Freight Plan Recommendations

Type	Category	#	Recommendation
Policy	Reliability	P-1	Support reliability and safety improvements on interstate highways and state routes in the NC Priority Highway Freight Network (NCPHFN) that are not covered by ongoing and planned projects.
Policy	Reliability	P-2	Support investment in secondary roads, local freight connectors, and last-mile infrastructure.
Policy	Reliability	P-3	Balance the needs for freight reliability investment across the state.
Policy	Reliability	P-4	Incorporate low-cost “quick win” initiatives in reliability programs to improve performance sooner.
Policy	Reliability	P-5	Include investment in growth opportunities in the smaller communities of the state among the programs to improve reliability.
Policy	Resilience	P-6	Adopt Priority Highway Resilience Corridors (PHRCs) as factors in prioritizing projects for investment.
Policy	Resilience	P-7	Include portions of STRAHNET with resilience risks in developing Primary Highway Resilience Corridors (PHRC) factors for investment priority.
Policy	Resilience	P-8	Consider roadway and bridge designs appropriate for freight transportation in pursuing route redundancy in at-risk areas.
Policy	Resilience	P-9	Prepare for network disruption threats from many sources.
Policy	Connectivity	P-10	Prioritization project submittal decisions affecting corridors and corridor-related local input point assignments should consider interstate freight flows, regional economic relationships, and strong connections to neighboring states.
Policy	Connectivity	P-11	Evaluate East-West system connectivity.
Policy	Connectivity	P-12	Advance transportation corridors to support supply chain ecosystems statewide.
Policy	Connectivity	P-13	Equip regional planning partners to integrate freight into local processes, joining state initiatives to local programs in support of end-to-end service for supply chain systems.
Policy	Connectivity	P-14	Support Advanced Air Mobility (AAM) as an additional avenue of connectivity.
Policy	Competitiveness	P-15	Develop partnerships at the state and local level between public and private sector players to establish which forms and mechanisms for raising funds could acquire consensus and attract political support.
Policy	Competitiveness	P-16	Capitalize on technology as a lower cost and faster route to freight performance improvement, while advancing new technology carefully.
Policy	Competitiveness	P-17	Adopt regional, coordinated approaches to freight initiatives.

Type	Category	#	Recommendation
Supply Chain	Economic Development and Land Use	SC-1	Work closely with the local agencies, such as Metropolitan and Rural Planning Organizations and regional industry associations, to help identify specific projects to improve freight performance in Central North Carolina.
Supply Chain	Economic Development and Land Use	SC-2	Consider connections to PHRCs as a factor in investment prioritization, in areas where port-dependent logistics and dispersed agricultural activity rely on high-risk coastal and inland corridors serving fixed, location-dependent freight land uses.
Supply Chain	Economic Development and Land Use	SC-3	Consider regional natural resources, their conditions and seasonal needs, as well as their connections to the priority freight network in identifying the critical role of small network segments in freight planning and investment in this region, not just mileage and corridor classification.
Supply Chain	Economic Development and Land Use	SC-4	Protect local and longer-distance access routes from warehouses to communities.
Supply Chain	Economic Development and Land Use	SC-5	Prepare for continuing pressure on last mile service quality.
Supply Chain	Economic Development and Land Use	SC-6	Ensure access to intermodal facilities
Supply Chain	Technology Supporting Freight Operations	SC-7	Continue developing Connected Freight Corridors.
Supply Chain	Technology Supporting Freight Operations	SC-8	Continue improving the delivery of timely, actionable information to commercial vehicle operators.
Supply Chain	Technology Supporting Freight Operations	SC-9	Closely coordinate traveler information with incident detection, response, and clearance activities.
Supply Chain	Technology Supporting Freight Operations	SC-10	Further deploy electronic screening and Weigh-in-Motion to reduce unnecessary stops and processing delays for compliant commercial vehicles while strengthening weight-enforcement and compliance activities.
Supply Chain	Technology Supporting Freight Operations	SC-11	Encourage use of freight signal priority to reduce truck delay on signalized freight routes.
Supply Chain	Technology Supporting Freight Operations	SC-12	Facilitate dissemination of truck parking information to reduce uncertainty for drivers searching for safe and legal parking.
Supply Chain	Technology Supporting Freight Operations	SC-13	Continue implementation of connected-vehicle technologies.
Supply Chain	Technology Supporting Freight Operations	SC-14	Prepare for deployment of automated freight technologies.

Type	Category	#	Recommendation
Supply Chain	Technology Supporting Freight Operations	SC-15	Monitor developments in automated freight technologies.
Supply Chain	Technology Supporting Freight Operations	SC-16	NCDOT should remain technology-neutral while closely monitoring developments in alternative-fuel freight vehicles and the supporting infrastructure they require.
Supply Chain	Military	SC-17	Pursue solutions to needs identified by U.S. Military in North Carolina.
Supply Chain	Military	SC-18	Continue to prioritize freight facility investments where military routes are involved.
Supply Chain	Military	SC-19	Direct resilience initiatives toward military regions.
Supply Chain	Military	SC-20	Coordinate technology implementation with military partners.
Supply Chain	Resilience	SC-21	Define measurable freight resilience performance measures.
Supply Chain	Resilience	SC-22	Align resilience planning with emerging conditions.
Supply Chain	Resilience	SC-23	Consider integrating freight resilience into project prioritization.
Supply Chain	Resilience	SC-24	Prioritize corridors on high-risk routes.
Supply Chain	Resilience	SC-25	Strengthen multimodal redundancy, especially for rail and ports.
Supply Chain	Resilience	SC-26	Protect access to freight nodes.
Supply Chain	Resilience	SC-27	Build operational resilience to all disruptions, including non-traditional disruptions.
Supply Chain	Air Quality and Wildlife Habitat Loss	SC-28	Continue the state's successful path in managing air emissions associated with freight.
Supply Chain	Air Quality and Wildlife Habitat Loss	SC-29	North Carolina should continue its efforts to reduce freight vehicle wildlife crashes.
Modal	Highways	M-1	Pursue feasibility studies for high truck crash locations and freight bottlenecks not currently addressed by programmed projects.
Modal	Highways	M-2	Continue to pursue projects that address currently unaddressed high truck crash locations and freight bottlenecks.
Modal	Highways	M-3	Public agencies should consider using truck telematics data as a monitoring mechanism to help ensure safety around freight vehicle movements.
Modal	Highways	M-4	Conduct corridor- and site-level evaluations of truck parking.
Modal	Highways	M-5	Expand truck parking capacity at strategic locations.
Modal	Highways	M-6	Strengthen coordination with private sector partners in truck parking.
Modal	Highways	M-7	Advance truck parking information systems.
Modal	Highways	M-8	Pursue implementation funding for truck parking improvements.
Modal	Highways	M-9	Support improvements to secondary roads prominent in OS/OW permitting.
Modal	Highways	M-10	Recognize OS/OW needs in truck parking initiatives.

Type	Category	#	Recommendation
Modal	Highways	M-11	Incorporate OS/OW requirements in network planning and design.
Modal	Highways	M-12	Prepare for growth in OS/OW freight.
Modal	Ports	M-13	Enhance multi-state and multi-port connectivity.
Modal	Ports	M-14	Ensure port facility State of Good Repair.
Modal	Ports	M-15	Maintain focus on bulk cargo opportunities.

Appendix B: Framework for Integrating Freight into the Transportation Planning Process

Framework Overview
Including freight in the transportation planning process is important because freight movement is essential to the economy and affects how well the overall transportation system works. Key reasons for including freight in your transportation planning process and long-range plan include:

- Freight movement supports economic growth and supplies the households of North Carolina.
- Freight planning improves system efficiency and safety.
- Understanding freight movement helps inform infrastructure investment.
- Freight planning helps identify congestion, aging infrastructure and disruption risks that could negatively impact the movement of goods and the competitiveness of the state for business.
- A planning process that includes freight can lead to better coordination and improvement of first mile/last mile connections between truck, rail, port, air, and pipeline.
- The consideration of freight during the evaluation of travel demand provides a more complete picture of needs and potential strategies.

This transportation planning framework provides actionable steps and strategies that NCDOT, MPO and RPO planners can use to better incorporate freight into their transportation planning process. The framework is broken down into the high-level steps of the transportation planning process: initiate process and collect data, identify needs, evaluate alternatives, and recommend solutions. To facilitate implementation within the CTP process, each step is aligned with the existing CTP process. In addition to being grouped by steps in the planning process, the actionable steps and strategies are also grouped by categories for data, engagement, and analysis. The data category captures data that can be used to support the integration of freight into the planning process. Data is connected to the analysis step by either providing data that supports separate analysis, or by using the data directly in an analytical way to inform various steps of the planning process. Engagement focuses on who to engage at what steps of the process. Analysis covers ways to better analyze freight needs.

The user can pick and choose the strategies that work best with their goals for freight integration and available resources for process improvement.

Framework for Integrating Freight into the Transportation Planning Process					
Steps in the Process	**Detailed description of the activities covered in this step**	**How the steps align with the existing CTP process**	**Data: What data can be used to support the integration of freight into the process?**	**Engagement: Who and when should we engage?**	**Analysis: How do we better analyze freight needs?**
Initiate Process and Collect Data	This step captures all the initial plan activities including all the things that are needed to set up the project, identify roles & responsibilities, create a public engagement plan, and initial data collection. This step also covers the visioning process and development of the goals, objectives and performance measures necessary to evaluate alternative strategies against goal attainment.	**CTP 1a, 1c, 1d-1h** • Determine the level of freight analysis that will be included in the plan. • Include appropriate stakeholders for freight planning. • Embed freight mobility, reliability, and economic competitiveness into goals. • Define required freight data/tools during the "*Agreement on Tools and Data Needs* " step.	**Develop a Freight GIS Inventory** Layers should include all freight-related infrastructure, facilities, and constraints, including: • Freight corridors and designated truck routes, including areas with truck parking. • Intermodal facilities (rail terminals, ports, inland ports, airports). • Industrial and logistics clusters, warehouses, and distribution centers. • First-/last-mile freight access routes. • Known truck bottlenecks, clearance constraints, and weight-restricted facilities. **Refer to Data Resources for additional details.**	**Integrate Freight Partners Directly Into Governance Structures** • Establish freight representation on the Steering Committee to ensure freight considerations are embedded in all major planning decisions. • Designate at least one freight-focused representative on committees who has strong connections to the freight industry. The committees selected may be unique to each MPO or RPO. • Additional commitment to freight engagement could include the development of a Regional Freight Advisory Committee. • Freight representatives on committees or included in outreach efforts could include representatives from local airports, inland ports, rail operators, major industrial employers, manufacturers, warehouse/ distribution centers, trucking carriers, and parcel/delivery service providers.	**Enhance Freight Content in the Community Understanding Report (CUR)** • Include a standard subsection that documents key freight generators, Freight Priority Network corridors or facilities, and known freight or truck issues within the study area. • Develop guiding questions for staff and stakeholders (e.g., key truck routes, last-mile challenges, delivery constraints, rail access, and industrial growth areas).
			Create a Standardized Freight Data Package • Compile truck AADT and percent truck data on key corridors. Extract truck volumes and truck share for all freight-priority corridors and major connectors. • Map travel time reliability metrics. Produce reliability indicators and flag segments with recurring delay, peak-period instability, or seasonal variability. • Pull truck-involved crash records, including severity, crash types, contributing factors, and spatial clusters. Identify safety hotspots and freight-specific risk patterns. • Map major freight generators and multimodal connectors. Attribute each location with employment, commodity relevance, and access constraints. • Define policy-relevant freight performance measures aligned with the plan's goals. • Use this package to support mapping, needs assessment, alternatives evaluation, and plan documentation. Document methodologies to ensure reproducibility.	**Embed Freight Partnership Explicitly in the Plan's Vision and Goals** • Include freight goals, objectives, and measures of effectiveness (MOEs) to ensure collaboration with freight partners is stipulated as an agency priority. The Statewide Multimodal Freight Plan should be the starting point to ensure alignment with the statewide plan. • Vision and Goals should explicitly commit to improving freight mobility, reliability, safety, and economic vitality. • Example MOEs that quantify progress include truck travel time reliability, first-/last-mile access quality, industrial land accessibility, and freight-related safety metrics.	**Prepare for Future Technologies** • Use statewide guidance to create a data profile related to automation, connected freight corridors, and multimodal freight opportunities. • Document emerging freight trends such as automated trucking, connected infrastructure, and last-mile delivery. • Map potential military deployment areas, including key corridors, industrial areas, and logistics hubs.
					Address Rail Freight Passenger Conflicts • NCDOT Rail Division can support MPOs and RPOs as they navigate complex rail operations and grade-separation needs. • Inventory at-grade crossings, shared-use corridors, and key freight/passenger interfaces using GIS and available rail data.
					Clarify Freight's Role in MTPs/CTPs • Provide checklists, examples, and performance measures to standardize freight integration across the state. • Define key steps for planners to follow, including data collection, stakeholder engagement, needs assessment, and project identification. • Recommend metrics such as travel time reliability, truck travel time index, bottleneck delay, last-mile connectivity, and access to intermodal facilities. • Identify preferred datasets and analytical approaches to ensure consistency across MPOs and RPOs.
					Integrate Freight into Alternatives Evaluation Criteria • Define freight-specific evaluation measures such as travel time reliability, truck delay, bottlenecks, and last-mile connectivity.

Steps in the Process	Detailed description of the activities covered in this step	How the steps align with the existing CTP process	Data: What data can be used to support the integration of freight into the process?	Engagement: Who and when should we engage?	Analysis: How do we better analyze freight needs?
Identify Needs	**This step covers needs assessment, including existing conditions and likely future problems. At this step we develop an understanding of where we are now and where we want to go with respect to vision, goals and performance measures. Technical and planning analysis is used to develop an understanding of how the system is performing now and how it is expected to perform in the future as measured against the goals through the lens of performance measures. This gap informs the development of strategies to address those identified needs.**	**CTP 2b-2j** • Include truck volume and reliability analysis. • Identify freight bottlenecks and substandard industrial access. • Evaluate weight-restricted bridges and intermodal connectivity gaps. • Integrate industrial land use and freight-intensive activity data.	**Require Freight Analysis in the Needs Assessment** Generate maps of the following freight data to assess current and future conditions: • Truck volumes and truck percentages on key corridors. • Travel time reliability for freight-priority routes. • Freight bottlenecks and congestion hotspots. • Industrial and intermodal access conditions. • First- and last-mile connectivity gaps. • Heavy-vehicle crash and safety hotspots. • Truck parking. **This data supports analysis to:** • Clearly identify freight system deficiencies. • Understand conflicts between freight movement and other transportation goals. • Anticipate how future growth and land use changes may affect freight demand.	**Employ Context-Specific Engagement Tools to Complement Data Analysis** • Assess freight transportation planning needs and current/future conditions via surveys, focus groups, interviews, pop-up events, or digital newsletters. • Select the appropriate engagement tool through careful consideration of the audience (e.g., if opportunities exist to engage at industry focused meetings this may provide richer detail than other methods). • Use engagement to validate and refine data findings. Compare stakeholder input with freight data outputs and document areas of alignment, divergence, or new issues raised through engagement. • Consider deploying such engagement strategies at regular intervals outside of the planning cycle to maintain stakeholder relationships and demonstrate the consistent prioritization of freight needs. A great example of this is the creation of a Regional Freight Advisory Committee.	**Use the Freight Flow Tool to Generate a Comprehensive Regional Freight Movement Profile** • Visualize truck and commodity flows within, into, and out of the region. • Identify high-volume freight corridors and key origin-destination pairs. • Understand dominant commodity types and industries shaping regional freight demand. • Translate tool outputs into actionable planning insights. For each output, document implications for system performance, safety, land use, and the local economy. **Clarify Freight's Role in MTPs and CTPs** • Ensure freight is explicitly reflected in MTP and CTP goal areas. **Integrate Freight into Vision, Goals, Objectives and Performance Measures** • Include a freight component in your vision statement. • Include freight specific goals or capture freight in goals. • Include performance measures that directly measure freight to support the evaluation of freight related alternatives. **Integrate Freight into Alternatives Evaluation Criteria** • Include qualitative considerations where data is limited, such as operational efficiency and delivery access. **Address Rail Freight Passenger Conflicts** • Evaluate delay, safety, and reliability issues for both rail and roadway users, including blocked crossings and emergency access.

Steps in the Process	Detailed description of the activities covered in this step	How the steps align with the existing CTP process	Data: What data can be used to support the integration of freight into the process?	Engagement: Who and when should we engage?	Analysis: How do we better analyze freight needs?
Evaluate Alternatives	**The results from the previous step are used to inform the development of strategies that address the identified needs to achieve the goals and vision. Both qualitative and quantitative tools and processes are used to evaluate the alternative strategies to identify projects for the final transportation plan. This is an iterative process and performance measures, stakeholder engagement and storytelling with data play an important role.**	**CTP 3b-3d** • Evaluate alternatives using freight-specific MOEs. • Test corridor cross-sections for truck accommodation. • Incorporate industrial access improvements into scenario testing. • Ensure freight access supporting certified, mega, and select sites.	**Use Freight Data and Maps When Defining, Screening, and Refining Alternatives** • Identify strategies that directly address documented freight needs. • Consider a range of solution types spanning infrastructure, operational, policy, and multimodal solutions. Ensure freight is not limited to "roadway only" concepts. • Integrate freight considerations during the evaluation of other modes. • Prioritize concepts that improve performance for freight corridors, bottlenecks, and generators when defining and refining alternatives.	**Leverage the Diversity of the Freight Stakeholder Contact list** • Ensure draft strategies are comprehensive of differing needs. • Alternative strategies should be informed by engagement efforts that reach a variety of sub-fields (e.g., agriculture vs pharmaceuticals), employee types (e.g., truck drivers vs. supply chain managers), and settings (e.g., in the warehouse vs at a driver rest stop). • Test each alternative against the needs and constraints of sectors with different supply chain characteristics, time sensitivities, and modal dependencies. • Identify engagement results that recur over the course of multiple, regular survey efforts to assist in the prioritization of alternatives.	**Integrate Freight into Alternatives Evaluation Criteria** • Add freight performance measures to ensure freight influences scenario testing. • Incorporate freight metrics into alternatives evaluation frameworks. • Weight freight measures alongside other criteria to reflect their importance in decision-making. **Address Rail Freight Passenger Conflicts** • Consider grade separations, crossing closures/consolidations, signal upgrades, and corridor-level strategies. • Incorporate rail-related improvements into the CTP and MTP prioritization framework using criteria such as safety, mobility, freight reliability, and community impact.
			Evaluate Alternatives Using Freight-related Performance Measures • Measure truck travel time and reliability impacts. Identify whether the alternative improves, maintains, or degrades reliability. • Assess reduction in freight bottlenecks. Evaluate how each alternative addresses known bottlenecks, queueing locations, and recurring slowdowns. • Determine how an alternative affects access to industrial clusters, distribution centers, ports, rail terminals, and airports. • Analyze freight-related safety outcomes. Estimate the alternative's impact on truck-involved crash risk, severity, and exposure. Identify whether the concept mitigates known safety hotspots or introduces new conflicts.	**Use Stakeholder Expertise to Refine Prioritization and Tradeoffs** • Convene freight leaders in a forum or focus group format to evaluate alternatives based on the real constraints that current leaders are knowledgeable about managing. • Encourage stakeholders to evaluate alternatives based on the operational constraints they manage daily. • Elevate strategies that stakeholders identify as high-impact or operationally feasible.	**Clarify Freight's Role in MTPs/CTPs** • Ensure freight elements are consistent with statewide freight plans, federal planning factors, and funding program requirements.

Steps in the Process	Detailed description of the activities covered in this step	How the steps align with the existing CTP process	Data: What data can be used to support the integration of freight into the process?	Engagement: Who and when should we engage?	Analysis: How do we better analyze freight needs?
Recommend Solutions	**In this final step, plan recommendations are presented to the public, stakeholders and decision makers. This step is iterative with the prior step as the community moves towards a final transportation plan that reflects a package of strategies that address the community needs and support the community vision and goals.**	**CTP 4a-4c, 5b** • Designate key freight corridors on CTP maps. • Include intermodal connectors and industrial access routes. • Introduce short- and medium-term freight priority windows. • Develop a freight recommendation tracking mechanism. • Develop recommendations for changes to land use or zoning that will support freight plan recommendations.	**N/A**	**Bring the Draft Plan to the Freight Advisory Committee** • The final plan should be reviewed and approved by freight leadership identified during the Initiation stage of the planning process. • If included at the outset, treat Regional FAC review and approval as a required governance step prior to plan adoption. • Ensure freight leadership approval is visible in the final plan.	**Create a Freight Recommendation Tracking System** • Develop a freight recommendation tracking system that follows freight-related projects from CTP/MTP identification through prioritization, programming (TIP/STIP), and implementation. • Assign consistent freight identifiers and standardized project information (e.g., project type, freight benefits, status, cost, and funding eligibility) to support tracking and reporting. • Ensure compatibility with MPO and RPO databases, NCDOT systems, and prioritization processes to streamline updates and avoid duplication. • Regularly update the tracking system to monitor project status, refine costs, communicate progress, and support funding and prioritization decisions. **Clarify Freight's Role in MTPs/CTPs** • Share case studies and sample plan language illustrating how freight considerations have been successfully integrated into MTPs/CTPs. • Clearly describe how freight needs informed project prioritization and investment decisions within the MTP/CTP. **Prepare for Future Technologies** • Identify where technologies could address congestion, safety, and delivery challenges. • Coordinate with NCDOT and local partners on pilots, policies, and planned investments. • Flag projects that support adaptable, technology-ready infrastructure. • Maintain and update a list of technology-supportive corridors and projects.

Data Element	Location	Analysis Component	Plan Component	Deliverable
Freight Truck Flow Tool	**TBD**			*
Commodity Flow Analysis and Forecast	Final report			*
Priority Freight Network	**TBD**			*
Highway Profile	Final report			*
Supply Chain and Logistics	Final report			*
Profile Truck Parking	Final report			*
Bottlenecks	Final report	*		
Harsh braking	Final report	*		
Safety	Final report	*		
Access route conditions to airports, ocean ports, inland ports, rail and warehouses	Final report	*		
Scenarios	Final report	*		
Funding alternatives	Final report	*		
Goals and objectives	Final report		*	
Key performance indicators	Final report		*	
Stakeholder input	Final report		*	
Resilience analysis	Final report		*	
Primary commodities	Final report		*	
NC Primary freight corridors	Final report		*	
Critical urban freight corridors	Final report		*	
Critical rural freight corridors	Final report		*	
Economic competitiveness analysis	Final report		*	
Goods movement analysis	Final report		*	
Market access and connectivity analysis	Final report		*	
Industry type heat maps	Final report		*	

Map	Data Layers	Data Sources	Data Link
Figure 1. Multimodal Freight Network in North Carolina	NC Military Bases Roadway Network Rail Network Commercial Service Airports Rail Facilities Marine Port	NCDOT NCDOT NCDOT NCDOT NCDOT NCDOT	https://www.arcgis.com/apps/mapviewer/index.html?url=https%3A%2F%2Fgis11.services.ncdot.gov%2Farcgis%2Frest%2Fservices%2FNCDOT_Military_Commuting%2FMapServer&source=sd https://www.nconemap.gov/datasets/NCDOT::ncdot-road-characteristics/about https://www.nconemap.gov/datasets/NCDOT::ncdot-north-carolina-rail-system/explore?layer=2&location=35.223450%2C-80.108350%2C7 https://www.arcgis.com/home/item.html?id=0ed5baea11d24b8394bec96dfb45f4c5#overview https://www.nconemap.gov/datasets/NCDOT::ncdot-north-carolina-rail-system/explore?layer=0&location=34.242444%2C-78.055280%2C11 https://www.arcgis.com/apps/mapviewer/index.html?url=https%3A%2F%2Fgis11.services.ncdot.gov%2Farcgis%2Frest%2Fservices%2FNCDOT_Military_Commuting%2FMapServer&source=sd
Figure 2. North Carolina Roadway Network	Roadway Network	NCDOT	https://www.nconemap.gov/datasets/NCDOT::ncdot-road-characteristics/about
Figure 3. North Carolina Interstate Network	Interstate	NCDOT	https://www.nconemap.gov/datasets/NCDOT::ncdot-road-characteristics/about
Figure 4. National Highway Freight Network in North Carolina	National Highway Freight Corridor	FHWA	https://www.arcgis.com/home/item.html?id=6fdc9274b0934d98b61a7a716a85d0a1#overview
Figure 5. State Highway Priority Freight Network	Roadway Network NC Priority Freight Network	NCDOT Cambridge	https://www.nconemap.gov/datasets/NCDOT::ncdot-road-characteristics/about Developed by CS for the 2026 NC Freight Plan
Figure 6. North Carolina Pavement Conditions (2024)	Pavement Condition	NCDOT	https://www.arcgis.com/home/item.html?id=fd72c3ba0be144e5928a5b36931c1d61#overview
Figure 7. State Highway Priority Freight Network Pavement Condition	Roadway Network Pavement Condition North Carolina Priority Freight Network	NCDOT NCDOT Cambridge	https://www.nconemap.gov/datasets/NCDOT::ncdot-road-characteristics/about https://www.arcgis.com/home/item.html?id=fd72c3ba0be144e5928a5b36931c1d61#overview Developed by CS for the 2026 NC Freight Plan
Figure 8. North Carolina Bridges in “Poor” Condition (2023)	Bridge Conditions	NCDOT	https://www.arcgis.com/home/item.html?id=627485648d4a40f688192fe907c4a407#overview
Figure 9. Bridges on the State Highway Priority Freight Network in “Poor” Condition	Bridge Conditions	NCDOT	https://www.arcgis.com/home/item.html?id=627485648d4a40f688192fe907c4a407#overview
Figure 10. Average Annual Daily Truck Traffic on the Interstates in North Carolina (2023)	2023 AADT Rail Facilities Marine Port	NCDOT NCDOT NCDOT	https://www.nconemap.gov/datasets/NCDOT::ncdot-road-characteristics/about https://www.nconemap.gov/datasets/NCDOT::ncdot-north-carolina-rail-system/explore?layer=0&location=34.242444%2C-78.055280%2C11 https://www.arcgis.com/apps/mapviewer/index.html?url=https%3A%2F%2Fgis11.services.ncdot.gov%2Farcgis%2Frest%2Fservices%2FNCDOT_Military_Commuting%2FMapServer&source=sd
Figure 11. Average Annual Daily Truck Traffic for Non-Interstate Routes (2023)	2023 AADT Rail Facilities Marine Port	NCDOT NCDOT NCDOT	https://www.nconemap.gov/datasets/NCDOT::ncdot-road-characteristics/about https://www.nconemap.gov/datasets/NCDOT::ncdot-north-carolina-rail-system/explore?layer=0&location=34.242444%2C-78.055280%2C11 https://www.arcgis.com/apps/mapviewer/index.html?url=https%3A%2F%2Fgis11.services.ncdot.gov%2Farcgis%2Frest%2Fservices%2FNCDOT_Military_Commuting%2FMapServer&source=sd
Figure 12. Average Travel Speeds on National Highway System in North Carolina (2024)	Avg. Travel Speed (mph)	INRIX, NPRMRDS	https://auth.ritis.org/npmrds
Figure 13. Congested Travel Speeds on National Highway System in North Carolina (2024)	Congested Travel Speed (mph)	INRIX, NPRMRDS	https://auth.ritis.org/npmrds
Figure 14. North Carolina Bottleneck Locations	Bottleneck Locations	INRIX, NPRMRDS	https://auth.ritis.org/npmrds
Figure 15. Urban Bottlenecks in the Charlotte and Raleigh-Durham Areas	Bottleneck Locations	INRIX, NPRMRDS	https://auth.ritis.org/npmrds
Figure 19. North Carolina Heavy-Truck Crashes (October 2020–September 2025)	NC Priority Freight Network Heavy Truck Crashes	Cambridge NCDOT	Developed by CS for the 2026 NC Freight Plan Received from NCDOT on special reuest
Figure 21. Truck Parking Facilities and Number of Spaces in North Carolina	Truck Parking Facility Types	NCDOT	https://connect.ncdot.gov/projects/planning/Statewide-Freight-Plan/Documents/NCDOT_TruckParkingStudy_PhaseII_Concepts_of_Operations_2020.pd
Figure 44. Commercial Service Airports in North Carolina	Roadway Network Commerical Service Airports	NCDOT NCDOT	https://www.nconemap.gov/datasets/NCDOT::ncdot-road-characteristics/about https://www.arcgis.com/home/item.html?id=0ed5baea11d24b8394bec96dfb45f4c5#overview
Figure 61. Existing Storage Facilities by Rentable Building Area (Heat Map)	NC Priority Freight Network Rentable Building Area	Cambridge CoStar Data	Developed by CS for the 2026 NC Freight Plan Account Required
Figure 62. Existing Storage Facilities in Charlotte by Rentable Building Area (Heat Map)	NC Priority Freight Network Rentable Building Area	Cambridge CoStar Data	Developed by CS for the 2026 NC Freight Plan Account Required

Map	Data Layers	Data Sources	Data Link
Figure 67. Strategic Highway Network (STRAHNET) in North Carolina	STRAHNET NC Military Bases	USDOT BTS NCDOT	https://geodata.bts.gov/datasets/usdot::national-highway-system-nhs/about https://www.arcgis.com/apps/mapviewer/index.html?url=https%3A%2F%2Fgis11.services.ncdot.gov%2Farcgis%2Frest%2Fservices%2FNCDOT_Military_Commuting%2FMapServer&source=sd

Figure	Data Sources	Data Link
Figure 16. Bottleneck Congestion Costs (million US$) per Day by Roadway Type	NPMRDS	
	NCHRP Report 925	https://www.nationalacademies.org/publications/25655
Figure 17. Truck Crashes by Quarter (October 2020 – September 2025)	NCDOT	Truck crash location data obtained from NCDOT on special request
Figure 18. Share of Truck Crashes by Facility Type (October 2020–September 2025)	NCDOT	Truck crash location data obtained from NCDOT on special request
Figure 20. Incident Recovery Times by Crash Severity, Time Of Day and Urban Category	WSP Analysis of NCDOT Crash Data, NPMRDS	
Figure 22. North Carolina Rail Network	2026 Draft NC Rail Plan	https://www.ncdot.gov/divisions/rail/Pages/rail-plan.aspx
Figure 23. Charlotte Inland Port	North Carolina Ports	https://ncports.com/port-facilities/charlotte-inland-port/
Figure 24. Rail Freight Transload Facilities	2026 Draft NC Rail Plan	https://www.ncdot.gov/divisions/rail/Pages/rail-plan.aspx
Figure 25. North Carolina Public Grade Crossing Warning Devices	2026 Draft NC Rail Plan	https://www.ncdot.gov/divisions/rail/Pages/rail-plan.aspx
Figure 26. North Carolina Private Grade Crossing Warning Devices	2026 Draft NC Rail Plan	https://www.ncdot.gov/divisions/rail/Pages/rail-plan.aspx
Figure 27. STRACNET in North Carolina	2026 Draft NC Rail Plan	https://www.ncdot.gov/divisions/rail/Pages/rail-plan.aspx
Figure 28. Freight Rail Program Projects: Committed (2025-2030)	2026 Draft NC Rail Plan	https://www.ncdot.gov/divisions/rail/Pages/rail-plan.aspx
Figure 29. Freight Rail Program Projects: Horizon (2031-2035)	2026 Draft NC Rail Plan	https://www.ncdot.gov/divisions/rail/Pages/rail-plan.aspx
Figure 30. Freight Rail Program Projects (2036 and Beyond)	2026 Draft NC Rail Plan	https://www.ncdot.gov/divisions/rail/Pages/rail-plan.aspx
Figure 31. Rail Freight Carloads (2000 - 2025)	USDOT BTS via FRED	
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Figure 33. Port of Wilmington Aerial View	Google Earth	
Figure 34. Port of Wilmington Regional Roadway Access	Google Earth	
Figure 35. Port of Wilmington Fact Sheet	North Carolina Ports	https://ncports.com/wp-content/uploads/2022/02/Port-of-Wilmington-Fact-Sheet.pdf
Figure 36. Port of Morehead City Aerial View	Google Earth	
Figure 37. Port of Morehead City Regional Roadway Access	Google Earth	
Figure 38. Port of Morehead City Fact Sheet	North Carolina Ports	https://ncports.com/wp-content/uploads/2022/02/Port-of-Morehead-City-Fact-Sheet.pdf
Figure 39. Charlotte Inland Port and CSX Charlotte Intermodal Terminal Aerial View	Google Earth	
Figure 40. Charlotte Inland Port and Queen City Express Fact Sheet	North Carolina Ports	https://ncports.com/wp-content/uploads/2019/09/Queen-City-Express-CIP-Flyer.pdf
Figure 41. Carolina Connector Intermodal Terminal Aerial View	Google Earth	
Figure 42. CCX Intermodal Terminal, Charlotte Intermodal Terminal and Inland Port, and CSX Network	North Carolina Ports	https://ncports.com/rail-connectivity/queen-city-express/
Figure 43. Atlantic Coast Ports Ranked by Loaded TEUs, 2023	USDOT BTS	https://data.bts.gov/stories/s/Container-TEU/x3fb-aeda/
Figure 45. Charlotte Douglas International Airport (CLT) Air Cargo Volume (2000 to 2025) (metric tons)	USDOT BTS	
Figure 46. Raleigh-Durham International Airport (RDU) Air Cargo Volume (2000 to 2024) (metric tons)	USDOT BTS	
Figure 47. Piedmont Triad International Airport (GSO) Air Cargo Volume (2000 to 2025) (metric tons)	USDOT BTS	

Figure	Data Sources	Data Link
Figure 48. Raleigh-Durham International Airport (RDU) Air Cargo Layout	Raleigh-Durham International Airport	
Figure 49. Piedmont Triad International Airport (GSO) FedEx Main Sorting Facility	Piedmont Triad Airport Authority	
Figure 50. Piedmont Triad International Airport (GSO) Boom Supersonic and JetZero Facilities	Piedmont Triad Airport Authority	
Figure 51. Raleigh-Durham International Airport (RDU) Runway 5L/23R and Taxiway B Replacement	RDU Vision 2040	https://www.rdu.com/vision2040/
Figure 52. Liquid Fuel Pipelines, Storage, and Refineries in North Carolina	Department of Energy	
Figure 53. Natural Gas Pipeline Infrastructure, Storage, and Processing Plants in North Carolina	NC Energy Security Plan	https://www.deq.nc.gov/state-energy-office/2025-nc-energy-security-plan-final/open
Figure 54. Transcontinental Gas Pipeline Southeast Supply Enhancement Project	Williams	https://www.williams.com/expansion-project/southeast-supply-enhancement/?tab=maptab-1
Figure 55. Mountain Valley Pipeline Southgate Proposed Route	MVP Southgate	https://www.mvpsouthgate.com/map
Figure 56. Mountain Valley Pipeline Southgate Extension Route (T-15)	WUNC News	https://www.wunc.org/environment/2025-09-12/mvp-southgate-natural-gas-pipeline-mountain-valley-pipeline
Figure 57. North Carolina Annual Energy Consumption (2023)	US EIA	https://www.eia.gov/states/NC/overview
Figure 58. Total Annual Petroleum Consumption Estimates in North Carolina (2014–2024)	US EIA	https://www.eia.gov/states/NC/data/dashboard/crude-oil-petroleum
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Figure 65. Storage Facilities by Decade (million square feet)	WSP analysis of Costar Data	
Figure 66. Logistics Real Estate under Construction, U.S.	CBRE, Cushman & Wakefield, JLL, Colliers, Prologis Research	

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Table 1. Highway Designations in North Carolina by Mileage and Percentage of Total Network (2024)	NCDOT	https://connect.ncdot.gov/resources/State-Mapping/Documents/Official_State_Mileage2024.pdf
Table 2. Pavement Condition by Roadway Type (2024)	NCDOT	https://www.arcgis.com/home/item.html?id=fd72c3ba0be144e5928a5b36931c1d61#overview
Table 3. Urban Pavement Condition by Roadway Type	NCDOT	https://www.arcgis.com/home/item.html?id=fd72c3ba0be144e5928a5b36931c1d61#overview
Table 4. North Carolina Priority Freight Network Pavement Condition by Roadway Type	NCDOT	https://www.arcgis.com/home/item.html?id=fd72c3ba0be144e5928a5b36931c1d61#overview
Table 5. Length and Truck Vehicle-Miles Traveled Comparisons across Facility Types	NCDOT	https://www.nconemap.gov/datasets/NCDOT::ncdot-road-characteristics/about
Table 6. Truck Bottleneck Identification Approach Overview	N/A	N/A
Table 7. Bottleneck Types by Mileage and Congestion Cost	NPMRDS	https://auth.ritis.org/npmrds
Table 8. Top 20 Bottlenecks in North Carolina	N/A	N/A
Table 9. KABCO Scale	NCDOT	Truck crash location data obtained from NCDOT on special request
Table 10. Truck Related Injuries by Facility Type and Injury (October 2020–September 2025)	NCDOT	Truck crash location data obtained from NCDOT on special request
Table 11. Total Crashes and Crash Rates by Severity Types for Grouped Functional Classification (October 2020–September 2025)	NCDOT	Truck crash location and Truck VMT by Functional Class data obtained from NCDOT on special request
Table 12. Total Crashes and Monetized Crash Costs by Severity Types (October 2020-September 2025)	NCDOT	Truck crash location data obtained from NCDOT on special request
Table 13. Key Performance Indicators	N/A	N/A
Table 14. Queen City Express CSX Train Schedules	North Carolina Ports	https://ncports.com/port-facilities/charlotte-inland-port/
Table 15. North Carolina Intermodal Terminals	North Carolina Ports	
Table 16. North Carolina Freight Volumes by Commodity Group (2021)	2026 Draft NC Rail Plan STB Waybill Sample	https://www.ncdot.gov/divisions/rail/Pages/rail-plan.aspx
Table 17. North Carolina Freight Rail Funding Investment Program and Needs	2026 Draft NC Rail Plan	https://www.ncdot.gov/divisions/rail/Pages/rail-plan.aspx

Table	Data Sources	Data Link
Table 18. North Carolina Mega Sites and Rail Access	Economic Development Partnership of North Carolina and WSP analysis	
Table 19. Private Marine Cargo Terminals in North Carolina	WSP analysis of US Army Corps of Engineers Data	
Table 20. Cargo Vessel Calls at North Carolina Marine Cargo Terminals, 2023	US Army Corps of Engineers	https://ndclibrary.sec.usace.army.mil/searchResults?series=WCUS-TripsData
Table 21. North Carolina Marine Cargo Tonnage by Commodity and Trade Direction, 2023	US Army Corps of Engineers	https://ndclibrary.sec.usace.army.mil/searchResults?series=WCUS%20-%20Manuscript%20Cargo%20Files
Table 22. Comparative Drive Distances (in Miles) to Selected Ports and Inland Ports	WSP analysis and Google Maps	
Table 23. Share of North Carolina Waterborne Imports and Exports Moving Through Ports in Different States, 2019	WSP analysis of FAF-5 Model	
Table 24. Total Air Cargo Activity in North Carolina (2024)	USDOT BTS	
Table 25. Natural Gas Interstate Pipelines and Storage Facilities in North Carolina	N/A	N/A