



**NORTH CAROLINA
STATEWIDE
MULTIMODAL
FREIGHT PLAN**
Planning for the Future of Freight Movement

RAIL PROFILE - FINAL



North Carolina Statewide Multimodal Freight Plan

Rail Cargo Profile

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ACRONYMS

AAPA	American Association of Port Authorities
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ABS	Automatic Block Signaling
ACE	Automated Commercial Environment
ACWR	Aberdeen Carolina and Western Railway
AR	Aberdeen & Rockfish Railroad
ARRA	American Recovery and Reinvestment Act
ATA	American Trucking Association
ATW	Atlantic & Western Railway
BIL	Bipartisan Infrastructure Law
BLS	Bureau of Labor Statistics
BTS	Bureau of Transportation Statistics
CAGR	Compound Annual Growth Rate
CATS	Charlotte Area Transit System
CBP	Customs Border Protection
CCX	Carolina Connector Intermodal Rail Terminal
CDL	Commercial Driver's License
CFR	Code of Federal Regulations
CFS	Commodity Flow Survey
CIP	Charlotte Inland Port

CLNA	Coastal Carolina Railroad
CMAQ	Congestion Mitigation Air Quality Act
CMV	Commercial Motor Vehicle
CSX	CSX Transportation
CTA	ORNL's Center for Transportation Analysis
CTC	Centralized Traffic Control
CTI	Commuter Train Interference
CTPAT	Customs Trade Partnership Against Terrorism
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial Vehicle Operations
DBS	Debris Delays
DCS	Signal Delays
DOD	U.S. Department of Defense
DSR	Slow Order Delays
EMS	Emergency Medical Services
FAF	Freight Analysis Framework
FAST	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
FPD	Freight Railroad Administration
FRA	Federal Rail Administration
FRRCSI	Freight Rail and Rail Crossing Safety Improvement
FTA	Federal Transit Administration
FTI	Freight Train Interference
FY	Fiscal Year
GIS	Geographic Information Systems
GPS	Global Positioning System
NCGTP	North Carolina Global TransPark
HazMat	Hazardous Materials
HERS	Highway Economic Requirements System
HPMS	Highway Performance Monitoring System
I-###	Interstate ###
IIJA	Infrastructure Investment and Jobs Act
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
LEHD	Longitudinal Employer-Household Dynamics
LOS	Level of Service
MAS	Multi-Agent System
MPG	Miles Per Gallon
MPO	Municipal Planning Organization
MUTCD	Manual on Uniform Traffic Control Devices
NAFTA	North American Free Trade Agreement
N.E.C.	Not Elsewhere Classified
N/S	No Signal

NC	North Carolina
NCDOT	North Carolina Department of Transportation
NCRR	North Carolina Railroad
NCSPA	North Carolina State Ports Authority
NCSRP	North Carolina Statewide Rail Plan
NCVA	North Carolina & Virginia Railroad
NHS	National Highway System
NMFN	National Multimodal Freight Network
NS	Norfolk Southern Railway
NVOCC	Non-Vessel Operating Common Carrier
OD	Origin-Destination
ORNL	Oak Ridge National Laboratory
OTP	On-Time Performance
P&D	Pick Up and Delivery
POD	Proof of Delivery
POE	Port of Entry
PTI	Passenger Train Interference
Q	Quarter, as in for a fiscal year
QCEW	Quarterly Census of Employment and Wages
RMG	Rail Mounted Gantry
RPO	Rural Planning Organization
RR	Railroad
RSIA	Rail Safety Improvement Act
SCAC	Standard Carrier Alpha Code
SED	Shipper's Export Declaration
SEROps	Southeast Rail Operations Study
SLSC	Shipper Load, Driver Count
SSO	State Safety Oversight Program
STB	Surface Transportation Board
STC	Strategic Transportation Corridor
STCC	Standard Transportation Commodity Code
STCG	Standard Classification of Transported Goods
STI	Strategic Transportation Investment Program
STIP	State Transportation Improvement Plan
STRACNET	Strategic Rail Corridor Network
STS	Ship-to-Shore
TEUS	Twenty-foot Equivalent Units
TN	Tennessee
TransCAD	Transportation Computer Assisted Design
TWC	Track Warrant Control
UFC	Uniform Freight Classification
U.S.C.	United States Code
URCS	Uniform Rail Costing System

U.S.	United States
USD	United States Dollars
USDOT	United States Department of Transportation
V/C	Volume-to-Capacity Ratio
VA	Virginia
VMT	Vehicle Miles Traveled
WTRY	Wilmington Terminal Railroad

1.0 OVERVIEW

Used as a singular mode or as part of a multi-modal network, rail transport is one of the five modes of freight transportation. For North Carolina, the rail system allows the state access to national and international trade destinations. Provided within this profile is a facility overview, the latest modal trends, and future flow projections of North Carolina's rail freight movements. Furthermore, an outline of data analysis, stakeholder perspectives, and key references is provided to produce an up-to-date and accurate analysis of North Carolina's rail and related freight programs.

1.1 Data Sources and Methodology

This modal profile is designed to support the 2022 North Carolina Multimodal Freight Plan and update key data metrics found in the 2017 Plan. Datasets used in the analysis for this profile include:

U.S. Bureau of Labor Statistics (BLS)¹

As part of the broad range of employment analysis provided by the U.S. Bureau of Labor Statistics (BLS), the Quarterly Census of Employment and Wages (QCEW) program publishes quarterly employment and wage data reported by employers covering 95% of U.S. jobs. BLS data was used to evaluate how North Carolina's employment rates compare to the rest of the U.S. in top, high-level industries.

Surface Transportation Board – Carload Waybill Sample & Uniform Rail Costing System (URCS)²

The Surface Transportation Board (STB) is an independent federal agency charged with the economic regulation of various modes, with a primary focus on freight rail. Various data resources from STB were used to develop this profile. The Carload Waybill Sample is a stratified sample of carload waybill data for all categories of U.S. rail traffic. A confidentiality agreement is required to access North Carolina's sample as it contains sensitive shipping and revenue information. Updated data on current flows and levels of service was acquired for intermodal and carload rail services. Intermodal services include a wide variety of goods ranging from automotive parts, to bottled water, to toys or various other commodities typically transported in containers or trailers. Carload rail services consist mostly of bulk commodities such as coal, agricultural products, and nonmetallic minerals and products. These bulk commodities are transported in boxcars, tankers, and hopper cars. Additionally, the Uniform Rail Costing System (URCS) was used to calculate the empty return ratios for intermodal and carload rail services for the two Class I railroads. Class I railroads are typically used for long-haul transportation of commodities and have operating revenues reaching or exceeding \$500 million annually that run through North Carolina.

¹ [U.S. Bureau of Labor Statistics \(BLS\) https://www.bls.gov/cew/](https://www.bls.gov/cew/)

² [Surface Transportation Board \(STB\) https://www.stb.gov/reports-data/](https://www.stb.gov/reports-data/)

Freight Analysis Framework (FAF)³

The Freight Analysis Framework (FAF) is produced through a partnership between the Bureau of Transportation Statistics (BTS) and the Federal Highway Administration (FHWA). FAF integrates data from various sources to create a comprehensive picture of freight commodity movement among states and major metropolitan areas by all modes of transportation. The 2017 Commodity Flow Survey and international data from the U.S. Census Bureau serve as the backbone of FAF and are integrated with supplementary data sources that capture goods movement in various sectors. The current version of FAF (5.2) provides estimates for tonnage (unit: thousand tons) and value (unit: million USD) by origin-destination pairs of FAF regions, commodity type, and mode for the base year (2017) and the forecast years (2020-2050). This framework was used to analyze current and projected flows (outbound, inbound, and intrastate) for the state of North Carolina.

Federal Railroad Administration (FRA) Office of Safety Analysis⁴

The Federal Railroad Administration (FRA) is one of the agencies within the U.S. Department of Transportation (DOT) concerned with intermodal transportation. The Office of Safety Analysis provides railroad safety information including accidents and incidents, inventory, and highway-rail crossing data that is made available to the public. This database was used to analyze rail safety trends for the past ten years.

NCDOT Rail Division

Priorities for the state's rail system were identified in coordination with the North Carolina Department of Transportation (NCDOT) Rail Division across a 30-year horizon. Goals and objectives that reflect NCDOT Rail Division priorities include:

- Addressing rail system safety concerns,
- Growing freight rail access and capacity,
- Addressing risks to system resiliency,
- Integrating freight and passenger rail into the multimodal transportation network, and
- Advancing a corridor-level approach to rail planning and investment.

1.2 Profile Organization

The rail modal profile is organized as follows:

Section 2 describes the existing state of the rail system in North Carolina in terms of infrastructure and capacity and how the rail network and major facilities connect to the overall multimodal transportation system.

Section 3 details freight rail demand in North Carolina, highlighting industries and markets served, level of service, system deficiencies, and safety.

³ [Freight Analysis Framework \(FAF\) https://faf.ornl.gov/faf5/Default.aspx](https://faf.ornl.gov/faf5/Default.aspx)

⁴ [FRA Office of Safety Analysis https://safetydata.fra.dot.gov/OfficeofSafety/default.aspx](https://safetydata.fra.dot.gov/OfficeofSafety/default.aspx)

Section 4 identifies future performance and long-term trends that shape future freight rail opportunities and articulates the current rail needs of North Carolina's statewide freight network.

Section 5 provides a needs assessment that identifies needs and opportunities specific to the State's rail system and intermodal services.

2.0 STATE RAIL SYSTEM

North Carolina's intermodal rail system is comprised of the interconnected rail network and the major intermodal rail terminals and facilities where freight is loaded, unloaded, or transferred. North Carolina's rail system is a major economic driver that supports the state's economy by stimulating growth, providing jobs, connecting urban and rural regions, and serving as a critical link to other state, regional, and national economic marketplaces.

2.1 Rail Network

The state rail network consists of the rail lines, owners, operators, and grade crossings where tracks intersect with roadways.

Rail Lines

North Carolina has approximately 3,200-miles of railroad track. Within this widespread network are two Class I railroads, including Norfolk Southern (NS) and CSX Transportation (CSX), as well as 24 freight short line railroads that connect businesses and industries to domestic and global markets. NCDOT owns several rail lines which are preserved for future use and are not currently in use. These lines are not part of the current freight rail network in North Carolina. Around 70% of the rail system is operated and managed by NS and CSX, while the remainder is managed by short line owners. Included in this network is a 317-mile corridor, owned and managed by the North Carolina Railroad Company (NCR). NCR is an independent and private business corporation with 100% of stock owned by the state of North Carolina. This 317-mile corridor stretches from Charlotte to the Port of Morehead City. Through a long-standing agreement, NS leases and operates these tracks, while CSX also uses a portion of the corridor. The state's rail network connects North Carolina's two deep water ports, the Port of Wilmington and the Port of Morehead City, four existing inland intermodal terminals, 21 rail yards, and more than 70 transload facilities across the state. Figure 2.1 identifies railroad owners and operators in North Carolina and Table 2.1 shows the breakdown of the route mileage.

FIGURE 2.1 TRACK OWNERSHIP AND RAILROAD OPERATORS IN NORTH CAROLINA



Source: NCDOT Rail Division (4th quarter 2021 Shapefile)

TABLE 2.1 RAILROAD MILEAGE IN NORTH CAROLINA

Rail Operator	Length (miles)	Percent of NC Rail Network
<i>Class I Operators</i>	2,282.0	71.38%
CSXT	1,104.0	34.53%
Norfolk Southern (NS)	1,178.0	36.85%
<i>Short Line Operators</i>	888.0	27.78%
Aberdeen & Rockfish Railroad	47.0	1.47%
Aberdeen Carolina & Western Railway	140.0	4.38%
Alexander Railroad	19.0	0.59%
Atlantic & Western Railway	10.0	0.31%
Blue Ridge Southern Railroad	92.0	2.88%
Caldwell County Railroad	17.0	0.53%
Cape Fear Railways	1.0	0.03%
Carolina Coastal Railway	168.0	5.25%
Chesapeake & Albemarle Railroad	52.0	1.63%
Clinton Terminal Railroad	3.0	0.09%
Craggy Mountain Railroad	3.0	0.09%
Great Smoky Mountain Railroad	52.0	1.63%
Kinston Railroad	6.0	0.19%
Laurinburg & Southern Company	31.0	0.97%
Military Ocean Terminal Sunny Point	18.0	0.56%
North Carolina & Virginia Railroad	55.0	1.72%
New Hope Valley Railroad	4.0	0.13%
Charlotte Western Railroad	13.0	0.40%
RJ Corman Railroad Co- Carolina Lines	36.0	1.13%
Red Springs & Northern Railroad	21.0	0.66%
Thermal Belt Railway	3.0	0.09%
Wilmington Terminal Railroad	4.0	0.13%
Winston-Salem Southbound Railway	120.0	3.75%
Yadkin Valley Railroad	93.0	2.91%
<i>Non-Class I, Non-Short Line Operators</i>	27.0	0.84%
Camp Lejeune Railroad (Federal) (NS)	27.0	0.84%
Total North Carolina Mileage	3,197	100.00%

Source: NCDOT Rail Division (4th Quarter, 2021 Shapefile)

Roadway/Rail Crossings

Railroad crossings where tracks intersect with public or private roadways are a major component of the rail network with operations and safety impacts to both rail and roadway traffic. Crossings can be characterized as *at grade*, *above grade*, or *below grade* depending on how the rail and roadway networks intersect. There are a total of 4,985 public railroad crossings and 3,084 private railroad crossings across North Carolina. The public rail crossings include 3,746 *at grade*, 421 *above grade*, and 728 *below grade* crossings. According to data provided by the NCDOT Rail Division, approximately 74.5% (3,656) of the *at grade* crossings have warning devices including flashing lights, gates, quad gates, cantilevers, traffic signals, and cross bucks, while only 119 (2.4%) public crossings have no warning devices.

North Carolina currently has ten Quiet Zones, which restrict trains from sounding their horn when approaching a public *at grade* crossing. NS has five Quiet Zones located in Asheville, Salisbury, Kannapolis, China Grove, and Gastonia. Two Quiet Zones are on the CSX network in Apex and Four Oaks. The remaining three Quiet Zones in North Carolina are pre-rule, meaning the horn restrictions have existed prior to the establishment of Quiet Zones. These zones are located on NS in New Bern and two on CSX in Rocky Mount.⁵

2.2 Major Rail Facilities

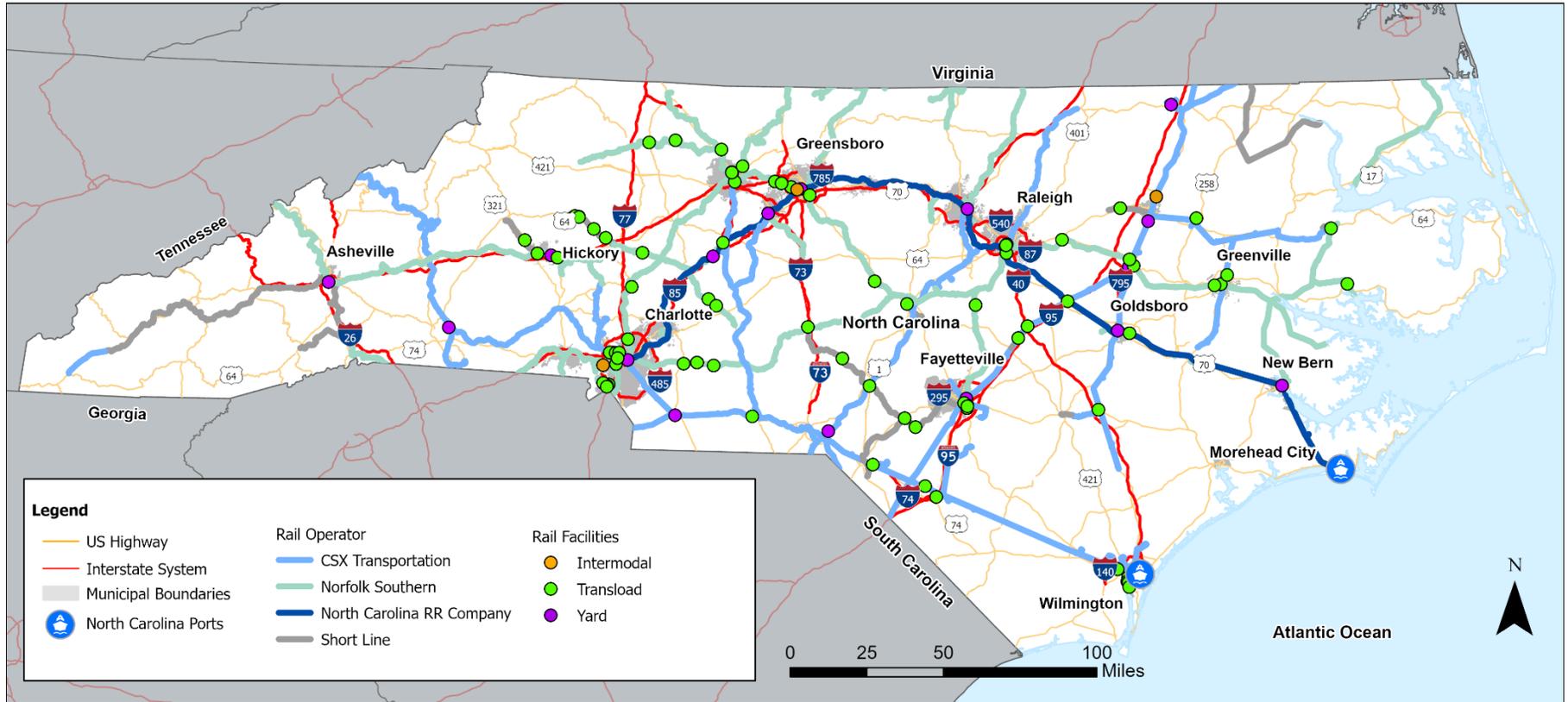
North Carolina's rail facilities are comprised of four Class I intermodal terminals (CSX Charlotte Intermodal Terminal, NS Charlotte Intermodal Terminal, NS Greensboro Intermodal Terminal, and Carolina Connector (CCX) in Rocky Mount), two deep-water ports (Port of Wilmington and Port of Morehead City), 21 rail yards, and 79 transload facilities⁶. Figure 2.2. displays the location of these facilities with respect to the rail network.

In addition to the major rail facilities outlined above, there are numerous rail-served businesses and sites located throughout the state that include industrial facilities and third-party for-hire terminals. Movement of freight into and out of these facilities is directly affected by the efficiency of connections and switching operations at state ports, barge and ocean terminals, transload facilities, and short line railroads.

⁵ [Federal Railroad Administration, *Quiet Zone Locations by City and State*, April 14, 2022](#)

⁶ [NCDOT Rail Division Shapfile Data, First Quarter 2022](#)

FIGURE 2.2 MAJOR RAIL FACILITIES ACROSS NORTH CAROLINA



Source: NCDOT Rail Division (4th Quarter 2021 Shapefile), BTS Open Data Catalogue (October 2021 Shapefile), NC OneMap (September 2021 Shapefile)

Major Rail Yards

CSX has ten rail yards in North Carolina. The primary classification rail yard organizes railcars by destination and is located in Hamlet near the intersection of the Charlotte to Wilmington and Hamlet to Raleigh corridors on the S-Line. Other CSX rail yards include the Pinoca Yard serving the Charlotte area, the Raleigh Yard serving Hamlet to Norlina, the Bostic Yard, the Monroe Yard, the Fayetteville Yard and Rocky Mount Yard along the A-Line, the Roanoke Rapids Yard, the Wilson Yard, and the Wilmington Yard. NS has 11 rail yards located throughout North Carolina. The Linwood Yard is the hub for Norfolk Southern's operations in North Carolina, with additional rail yards in Charlotte, Durham, Goldsboro, Greensboro, Hickory, High Point, New Bern, Raleigh, Salisbury, and Wilmington.

Intermodal Facilities and Multi-modal Terminals

Intermodal rail terminals facilitate freight movement using multiple modes of transportation, most commonly via highway or water to transfer large quantities of freight, generally in shipping containers. There are a total of four intermodal facilities in North Carolina. Two facilities are operated by NS, one in Greensboro and one located on the Charlotte-Douglas International Airport property. CSX operates one terminal in Charlotte and one in Rocky Mount. The Carolina Connector (CCX) near Rocky Mount opened in November 2021 and is located on the north-south A-Line. CCX is a 330-acre state-of-the-art intermodal terminal with three fully automated, zero-emission electric Rail Mounted Gantry (RMG) cranes and gate system. This terminal provides daily freight rail services including domestic service to the Midwest and international services from the Port of Wilmington via the branded Wilmington Midwest Express.⁷ In addition, CSX will partner with another regional port for expanded international services.

The North Carolina State Ports Authority (NCSPA) operates the Charlotte Inland Port (CIP), which can accommodate 2,000 grounded/wheeled containers and serve as a staging area for empty and loaded containers with maintenance and repair services offered onsite. The inland port serves I-85 and I-77 corridors, located north of the Charlotte Douglas International Airport and eight miles from the NS Charlotte Intermodal Terminal. CIP is less than two miles from the CSX Charlotte Intermodal Terminal, which provides the Queen City Express (QCE) service.

The Queen City Express (QCE) provides intermodal rail service between the Wilmington Port Terminal and CSX Charlotte Intermodal Terminal. QCE is advantageous because it offers intermodal express rail service that shortens first and last mile truck transit to the Charlotte region. QCE provides shippers with competitive rates potentially lowering transportation costs for businesses. This service offers reduced dwell times at the Port of Wilmington and provides access to Charlotte Inland Port (CIP). QCE directly reduces the number of trucks on North Carolina's roadways, reducing emissions and environmental impacts.

Ports/Marine

North Carolina State Ports Authority operates two international seaports in Morehead City and Wilmington. A brief description of the port terminal rail services is provided in this section. For additional details, refer to the North Carolina Statewide Multimodal Freight Plan Maritime Profile. The Port of Morehead City is served by NS along the NCRR-owned corridor, with Carolina Coastal Railway (CLNA) operating the terminal switching. The Port of Wilmington is served by CSX and Wilmington Terminal Railroad (WTRY) provides the switching services. Both

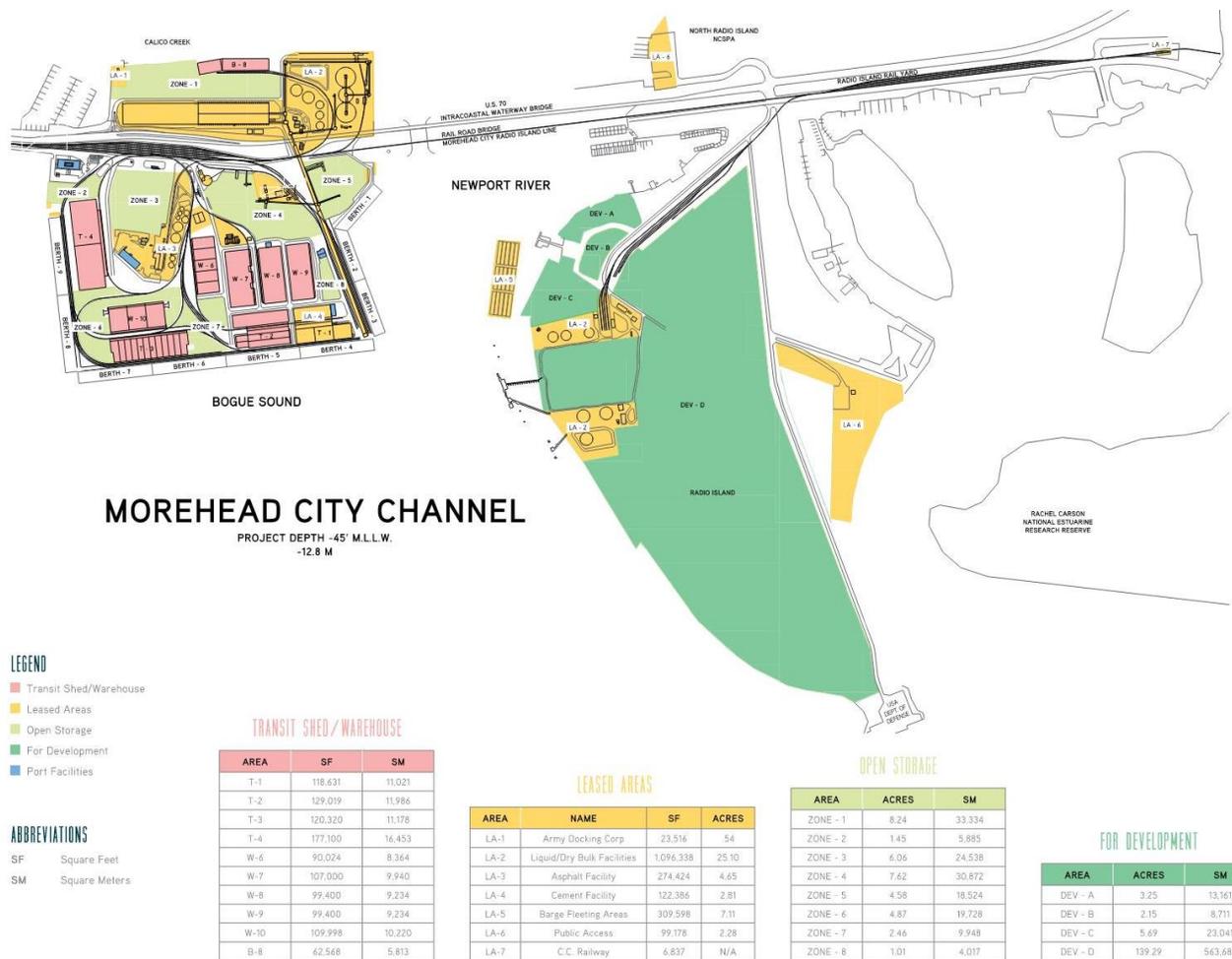
⁷ [CSX Resource Center, Carolina Connector Terminal. Accessed: April 18, 2022](#)

ports are equipped to handle bulk and breakbulk freight, as well as on-dock rail, but only Wilmington provides intermodal services.

Port of Morehead City Rail:

The Port of Morehead City primary rail services include heavy lift cargo, breakbulk, and bulk cargos. The port has on-dock rail directly serving its 9 berths with more than 5,000 feet of dock space. The port has rail service to Radio Island Terminal which lies across the Newport River. The port has a certified railroad scale and substantial storage tracks and spurs available to support rail activity. Figure 2.3 depicts a Facilities Map of the Port of Morehead City showing facility track infrastructure using darker, black lines. The Port of Morehead City has one gantry crane that focuses on bulk, breakbulk, and project freight.

FIGURE 2.3 PORT OF MOREHEAD CITY FACILITIES USE MAP



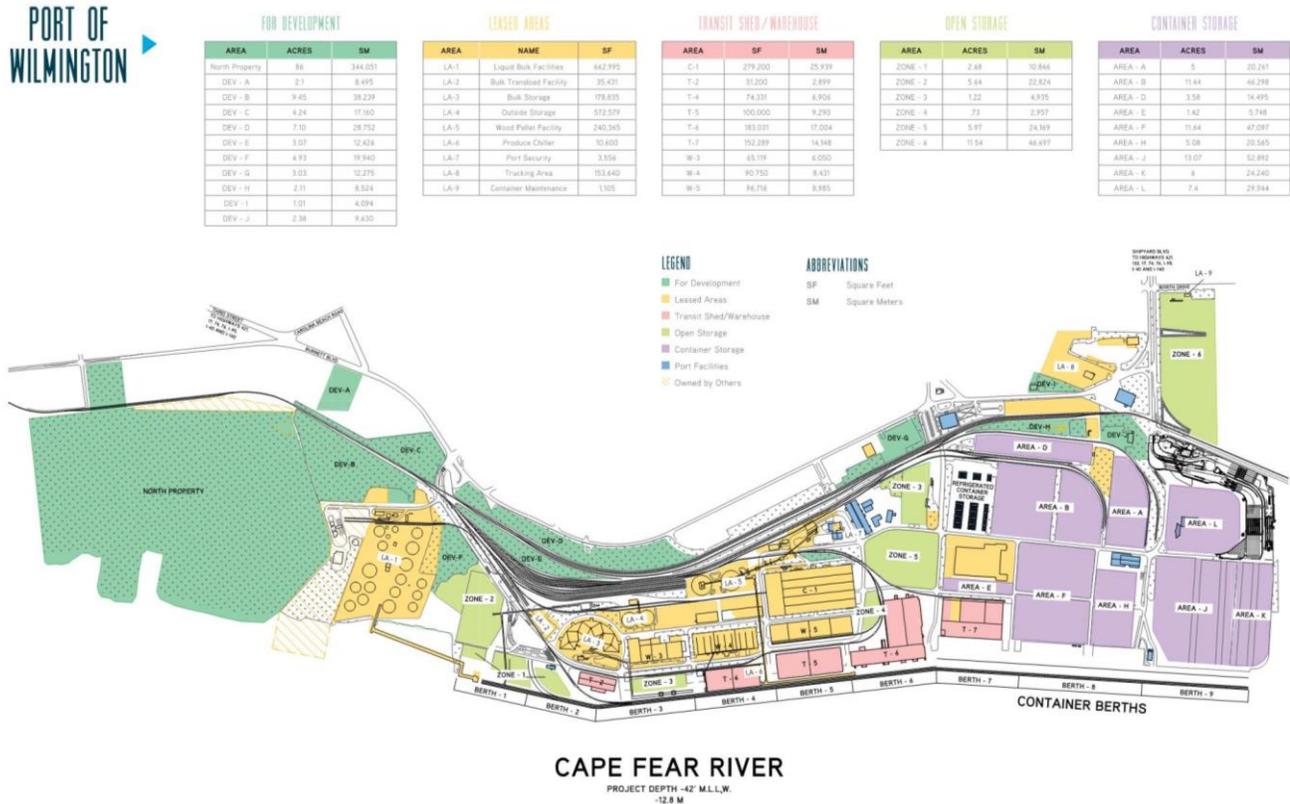
Source: North Carolina Ports Facilities Guide October 2021 – Accessed online 2022 https://ncports.com/wp-content/uploads/2021/10/Facilities_Guide_5.0_Oct.2021.pdf

Port of Wilmington Rail:

The Port of Wilmington primarily focuses on container, bulk, breakbulk, and project freight with rail access to berths, transit sheds, warehouses, and open storage. The port has nearly 7,000 feet of berth frontage with on-dock rail

access. Figure 2.4 depicts a Facilities Map of the Port of Wilmington showing facility track infrastructure with darker, black lines.

FIGURE 2.4 PORT OF WILMINGTON FACILITIES USE MAP



Source: North Carolina Ports Facilities Guide October 2021 – Accessed online 2022 https://ncports.com/wp-content/uploads/2021/10/Facilities_Guide_5.0_Oct.2021.pdf

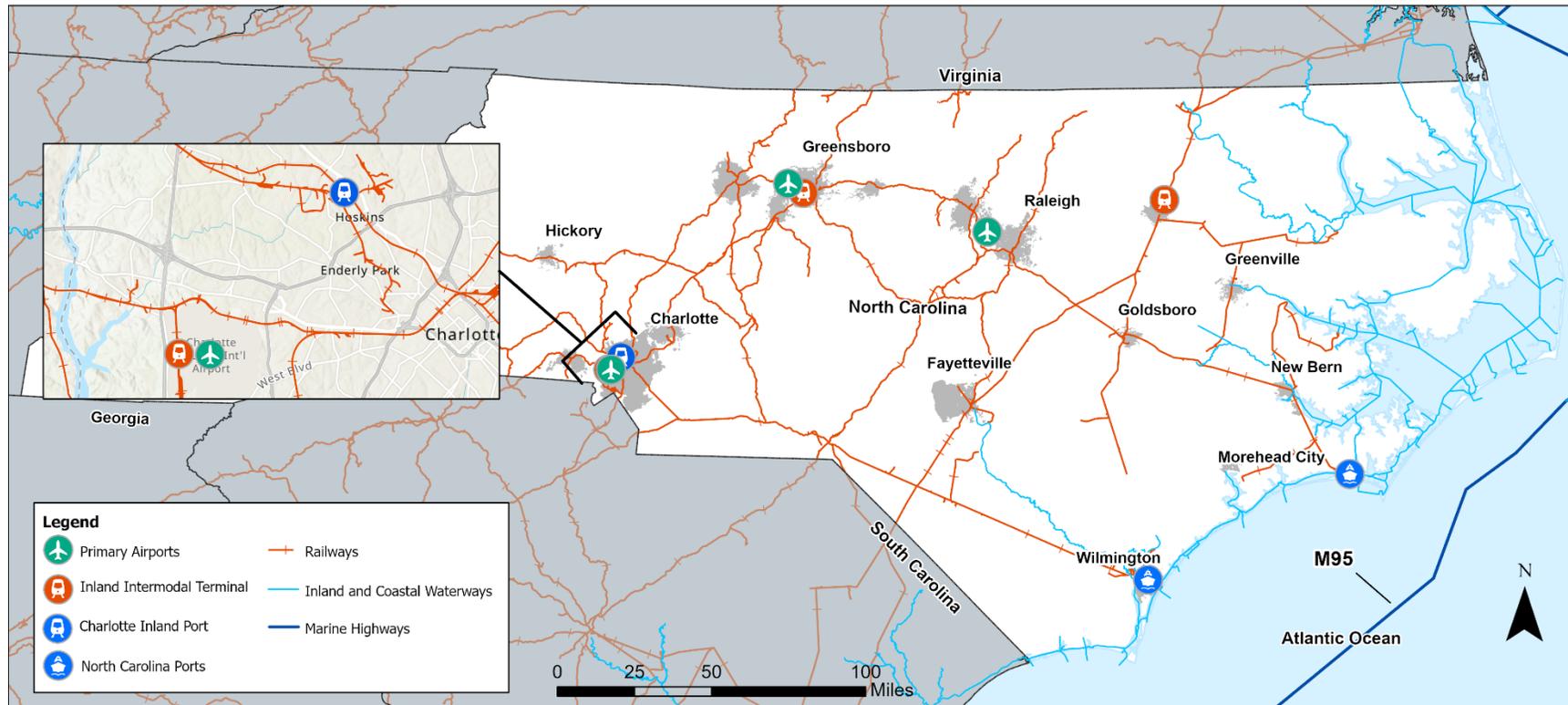
The Port of Wilmington intermodal rail services are growing by improving container throughput. At the beginning of 2020, the Port worked with Duke Energy to increase air draft (water surface to the lowest restricted point) by raising power lines that crossed the channel from 164 ft to 212 ft. The turning basin was widened to 1,524 feet accommodating post-Panamax vessels that can transport 14,000 twenty-foot equivalent units (TEUS). The port has seven container cranes in total, three Neo-Panamax ship-to shore (STS) cranes that reach 203 feet or 22 containers across, four Post-Panamax STS cranes that reach 165 feet or 18 containers across, and a multi-purpose bulk/intermodal crane with a 150-ton lift capacity. These waterside and terminal container improvements increase the need for intermodal rail services to move containers off the port.

The Wilmington Midwest Express provides CSX access to the Carolina Connector terminal (CCX) in Rocky Mount with reliable access to Midwest markets connecting the Port of Wilmington to Chicago.

This direct route delivered by the port provides efficient commerce with the fastest ship-to-rail service on the East Coast. The Queen City Express (QCE) provides intermodal rail service in the existing CSX Class I network between the Port of Wilmington and CSX Charlotte Intermodal Terminal and Charlotte Inland Port (CIP).⁸

Figure 2.3 shows the marine ports in North Carolina and their relationship to intermodal facilities and the freight rail network.

FIGURE 2.5 NORTH CAROLINA MARINE PORTS, INTERMODAL FACILITIES, AND FREIGHT RAILROAD



Source: NCDOT Rail Division (4th Quarter 2021 Shapefile), BTS Open Data Catalogue (October 2021 Shapefile), NC OneMap (September 2021 Shapefile)

⁸ [North Carolina Ports, Facilities. Accessed: April 21, 2022](#)

2.3 Freight Significant Corridors

National Multimodal Freight Network

Section 70103 of Title 49 United States Code (U.S.C.), which was established in Section 8001 of the 2015 Fixing America's Surface Transportation (FAST) Act, directs the Under Secretary of Transportation for Policy (Under Secretary) to establish a National Multimodal Freight Network (NMFN) to:

- Assist states in strategically directing resources toward improved system performance for the efficient movement of freight on the NMFN.
- Inform freight transportation planning.
- Assist in the prioritization of federal investment.
- Assess and support federal investments to achieve the national multimodal freight policy goals.

As specified in the FAST Act, the interim NMFN contains the freight rail systems of the Class I railroads as designated by the STB, totaling 104,926 corridor miles. In addition to the Class I railroad miles, the NMFN includes intermodal facilities and freight rail lines of Class II and Class III railroads critical to interstate commerce. Routes that were also critical to national defense, designated by the U.S. Department of Defense's (DOD) Strategic Rail Corridor Network (STRACNET), were included in the total mileage of the rail system. The total freight rail system includes the 95,200 route miles of Class I railroads and 9,096 route miles of Class II and III railroad.

The 2021 Bipartisan Infrastructure Law (BIL) requires the U.S. Secretary of Transportation to report to relevant congressional committees on the continued implementation of the final NMFN. The finalized NMFN will be established with the goals of improving network and intermodal connectivity using measurable data as part of the assessment of the significance of freight movement. Points of origin, destinations, and linking components of domestic and international supply chains will be considered in the assessment. In designating the route miles and facilities on the final NMFN, the Under Secretary of Transportation for Policy shall have considered the following factors:

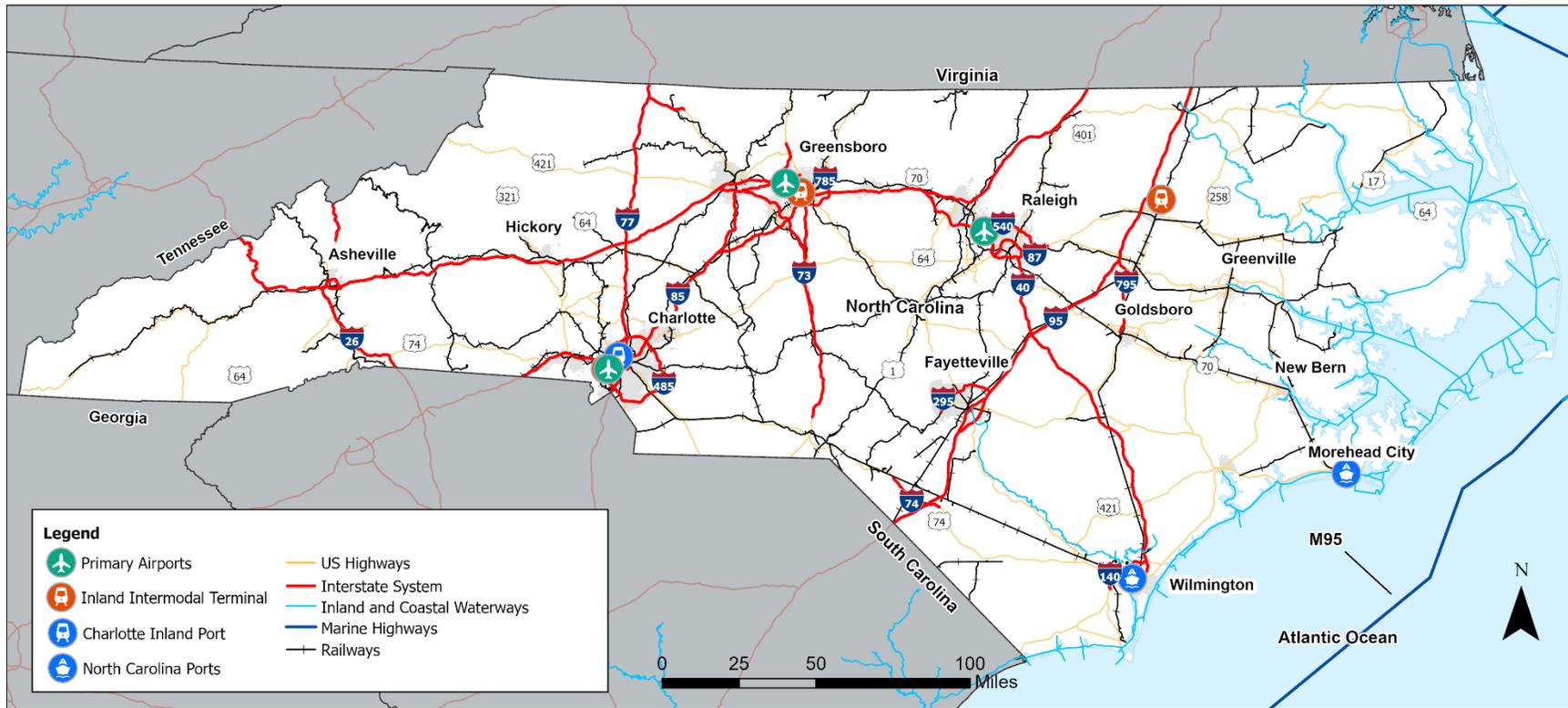
- Origins and destinations of freight movement within, to, and from the United States
- Volume, value, tonnage, and the strategic importance of freight
- Access to border crossings, airports, seaports, and pipelines
- Economic factors, including balance of trade
- Access to major areas for manufacturing, agriculture, or natural resources
- Access to energy exploration, development, installation, and production areas
- Intermodal links and intersections that promote connectivity

- Freight choke points and other impediments contributing to significant measurable congestion, delay in freight movement, or inefficient modal connections
- Impacts on all freight transportation modes and modes that share significant freight infrastructure
- Facilities and transportation corridors identified by a multi-state coalition, a state, a state freight advisory committee, or a metropolitan planning organization (MPO), using national or local data as having critical freight importance to the region
- Major distribution centers, inland intermodal facilities, and first- and last-mile facilities
- The significance of goods movement, including consideration of global and domestic supply chains⁹

The rail portion of the interim NMFN in North Carolina consists of 2,341 miles of multimodal rail freight network routes and four primary highway freight system intermodal connectors. Figure 2.6 depicts the interim NMFN for North Carolina.

⁹ [Establishment of Interim National Multimodal Freight Network, 2016-13261. Accessed April 24, 2022](#)

FIGURE 2.6 INTERIM NATIONAL MULTIMODAL FREIGHT NETWORK



Source: NCDOT Rail Division (4th Quarter 2021 Shapefile), BTS Open Data Catalogue (October 2021 Shapefile), NC OneMap (September 2021 Shapefile)

Intermodal Corridors

There are two major rail corridors that cross North Carolina connecting raw material and manufacturing markets to major East Coast, Gulf Coast, Midwest cities, and international ports. These corridors have received multimillion dollar investments from railroads and federal grants to improve the efficiency, reliability, and competitive advantage of intermodal rail traffic and provide more direct routes and high-capacity intermodal rail connections.

Crescent Corridor

The Crescent Corridor is a 2,500-mile corridor operated by NS that includes two primary rail lines operating across 11 states from Louisiana and Tennessee to the Northeast in New Jersey and New York. Shown in Figure 2.5, the rail lines run parallel to I-85 through North Carolina and I-40/I-81 in eastern Tennessee. The \$2.5 billion investment in partnership with NS, USDOT, and state and local governments improves rail freight capacity with the addition of new intermodal terminals, new rail track, route enhancements, and speed improvements.¹⁰

FIGURE 2.7 THE CRESCENT CORRIDOR



Source: NSCorp

¹⁰ [Norfolk Southern, Crescent Corridor, April 21, 2022](#)

National Gateway Corridor

The National Gateway Corridor is a public-private partnership between CSX, USDOT, and various state DOTs that operates across six states (Ohio, Pennsylvania, West Virginia, Maryland, Virginia, and North Carolina) and the District of Columbia as shown in Figure 2.6. The project was initiated to alleviate highway congestion along three major corridors: I-95/I-81 in North Carolina, Virginia, and Maryland; I-70/I-76/I-80 between Washington D.C. and Northwest Ohio; and I-40 in North Carolina between Charlotte and Wilmington.

FIGURE 2.8 THE NATIONAL GATEWAY CORRIDOR



Source:

CSX Transportation Intermodal Core Network, November 2021

NCDOT Strategic Transportation Corridor Policy¹¹

In 2015, NCDOT adopted the Strategic Transportation Corridor (STC) Policy to guide transportation planning and project development efforts along a network of multimodal, high-priority strategic transportation corridors statewide. The STC identifies a network of critical multimodal (including highway and rail) transportation corridors considered the backbone of the state's transportation system. The 25 established rail corridors handle the majority of rail borne freight and passenger traffic. These rail corridors link critical centers of economic activity to international airports and seaports and are critically important to interstate commerce. NCDOT is in the process of creating individual master plans that include project recommendations for each corridor to collectively develop a consistent vision for the corridor based on data analysis, stakeholder outreach, and strategic planning. Figure 2.7 represents the established STC map.

STC corridors that facilitate rail and intermodal freight transport include:

Corridor D – provides connectivity to the CSX rail line that operates from the northern North Carolina mountains to the coal fields in the Appalachians. This rail line is a primary coal route for delivery of Appalachian coal to North Carolina electric generation plants.

Corridor I – serves the state's Piedmont Crescent, carrying high volumes of freight along the NCRRT trackage between Charlotte and Durham major metropolitan areas.

Corridor J – provides STRACNET connectivity through the NS Crescent Corridor. The NS mainline located along this corridor connects Greensboro to Danville, Virginia.

Corridor L – is a regional connector that runs along the U.S. 1 corridor from the South Carolina state line to I-85 near Henderson, providing mostly regional and interregional passenger rail service along the CSX rail line. Much of the freight rail has been shifted to the CSX A-Line that parallels the I-95 corridor.

Corridor M – parallels a secondary CSX railroad line carrying relatively lower volumes of freight, but provides needed access to manufacturing and natural resource markets in eastern North Carolina.

Corridor P – includes the NCRRT mainline connecting the Port of Morehead City to Raleigh, where it connects to CSX in Johnston County.

Corridor Q – connects the NCRRT trackage and the secondary NS line from Salisbury through Asheville to Tennessee. This corridor is the state's most essential cross-state corridor, linking each of the state's three geographic areas and serving a high percentage of the state's population including three of the four international airports, major universities, and major tourist areas. Corridor Q carries high volumes of truck and passengers through the core of the state.

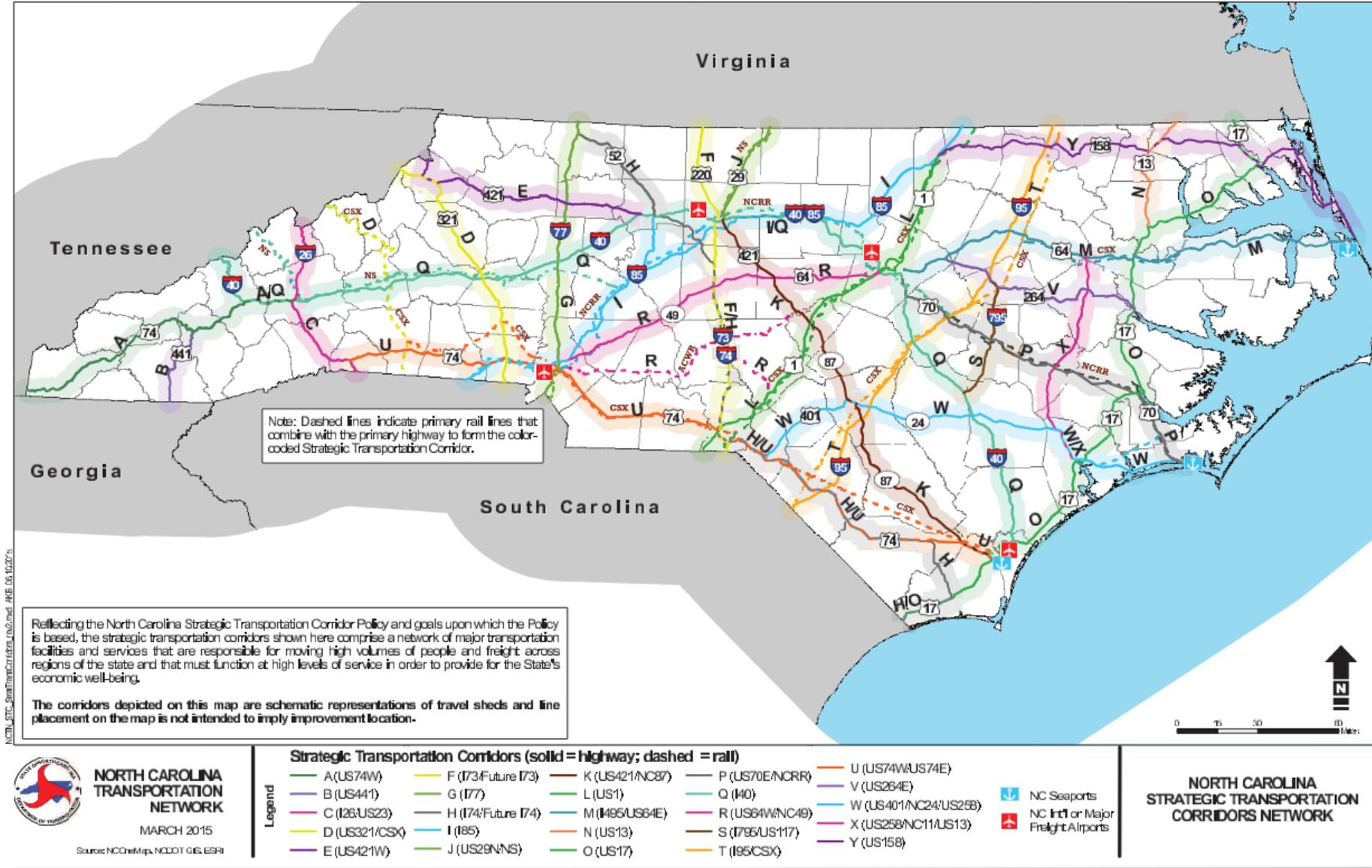
Corridor R – includes the Aberdeen Carolina and Western Railway ACWR, a secondary freight railroad connecting Mecklenburg County to Sanford and Lee County.

Corridor T – includes the CSX rail line that runs parallel to the I-95 corridor, providing major rail access in North Carolina by connecting major regional employment centers in the Coastal Plains region between the South Carolina and Virginia state lines. The CCX intermodal terminal near Rocky Mount is located on this corridor. The CCX has three all electric cranes that provide advanced container mobility between trucks and rail.

Corridor U – is served by the CSX rail line between Charlotte and Wilmington via the Queen City Express (QCE), providing freight rail access to the Port of Wilmington.



FIGURE 2.9 NORTH CAROLINA STRATEGIC TRANSPORTATION CORRIDORS



Source: NCDOT, North Carolina Transportation Network and Strategic Corridors Framework, August 2015.

3.0 NETWORK USAGE AND PERFORMANCE

The following section analyzes the industries and markets served by the North Carolina rail network and considers system deficiencies and safety issues that pose a potential impact on the freight rail system's ability to manage current and future freight demand.

3.1 Industries Served

Examining key industries in North Carolina served by the rail system allows NCDOT and respective partners a clearer understanding of the impacts specific rail improvements and strategies have on certain portions of the state and the national economy. Key industries include energy machinery production, electronics, pharmaceuticals, agriculture, furniture, plastics and chemicals, and textiles, all of which use rail as the primary mode to transport freight and goods.

Employment

A comparison of industry sector employment using BLS data for North Carolina and the U.S. is provided in Table 3.1. North Carolina has similar employment percentages when compared to the national levels for industries that are rail-served and are highlighted in the table, such as trade/transportation/utilities, manufacturing, leisure and hospitality, construction, and forestry and logging.

TABLE 3.1 NORTH CAROLINA AND US INDUSTRY SECTOR COMPARISON

Industry Sector	Percent of Total NC Employment	Percent of Total U.S. Employment
Education and Health Services	22.30%	23.90%
Trade, Transportation, and Utilities*	20.40%	19.90%
Public Administration (Government)	5.50%	5.20%
Manufacturing*	10.30%	8.60%
Leisure and Hospitality*	10.30%	10.10%
Professional and Business Services	14.90%	14.90%
Construction*	5.30%	5.30%
Financial Activities	6.00%	5.90%
Information	1.70%	2.00%
Natural Resources & Mining*	0.60%	1.30%
Forestry & Logging *	0.10%	0.04%
Other Services	2.60%	2.90%

*Typically rail-served industry

Source: Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2021

Notes: Mining & Logging are represented with two different NAICS codes, therefore different rows were created for each

Manufacturing industries depend largely on rail transportation. Within North Carolina, manufacturing employers are responsible for producing top commodities by weight including energy machinery production, electronics, pharmaceuticals, agriculture, furniture, plastics and chemicals, and textiles.¹² Freight rail typically ships a number of these commodities or their product inputs, particularly chemicals, machinery, and agricultural products.¹³

The auto manufacturing industry in North Carolina has grown 25% over the last five years now encompassing nearly 300 manufacturing establishments employing 26,000 industry employees.¹² Railroads are involved in all stages of auto manufacturing from transporting raw materials, to delivering semi-finished goods to manufacturing plants, to moving auto parts and fully assembled vehicles. In a typical year, freight railroads carry 1.8 million carloads of motor vehicles and parts.¹³ The state's freight rail system gives auto manufacturing companies the advantage of easy access to major seaports and manufacturing hubs in the southeast.

North Carolina is home to Duke Energy, which uses traditional sources of energy such as coal, ethanol, crude oil, and alternative renewable energy. Duke is the largest electric power holding company in the U.S. and ranks second in turbine manufacturing, third in fossil fuel power generation, and fifth in semiconductor manufacturing. North Carolina currently has a large and growing energy workforce with more than 39,000 employees in key industries that manufacture and distribute energy-efficiency equipment. Additionally, North Carolina has the potential to become the second-highest offshore wind net producer in the U.S. and is well positioned to participate in this rapidly growing global industry.¹² The shift to more renewable sources of energy has impacted bulk rail movements in North Carolina as consumption of traditional rail transported fuels have declined. Freight rail has refined its approach to meet customer needs and continue moving energy products safely and efficiently. Coal is a major commodity that has been declining as energy providers invest heavily in renewable and sustainable sources such as wind. Much of the car capacity has been re-captured with higher value modes such as intermodal.

North Carolina participates in all phases of the agricultural and food industry supply chain from sourcing and processing to manufacturing and distribution. North Carolina is home to food vendors such as Tyson, Campbell's, and Smithfield making it the second largest state in the U.S. for animal processing and manufacturing. These businesses, along with many others, employ more than 62,500 workers in the food and beverage manufacturing industry in North Carolina.¹² Agricultural products are one of the top commodities transported by freight rail, with approximately 1.6 million carloads of food products and 1.6 million carloads of grain and other farm products in annually.¹³

Since 2010, plastic and chemical industries have grown 50% more in North Carolina than the national average, culminating in more than 75,000 industry jobs.¹² Chemicals consist of various products including plastics, synthetic fibers, drugs, and soaps. Chemical products are used by farmers, automotive manufacturers, paper manufacturers, and numerous other intermediaries and end users. In 2020, Class I railroads in the U.S. moved 2.1 million carloads of chemicals.¹³

Intermodal freight has been the fastest growing rail traffic segment for the past 25 years. Around half of rail intermodal consists of imports and exports, reflecting the vital role intermodal rail plays in international trade. Benefits of intermodal rail include reductions in highway congestion and reduced cost of moving goods to market.

¹² [NC Department of Commerce. Key Industries in North Carolina. Accessed: 26 April 2022](#)

¹³ [Association of American Railroads. Industries Freight Rail Supports. Accessed: 26 April 2022.](#)

In 2020, U.S. rail intermodal volume was 13.5 million units and accounted for 25% of the revenue for major U.S. railroads, exceeding every other single commodity group.¹³

Goods Movement Demand

This subsection provides an overview of North Carolina rail traffic totals by weight and value, further grouped by direction and rail type (intermodal and carloads) in Table 3.2, Table 3.3, and Table 3.4.

Analysis of the total rail traffic for North Carolina was completed using 2019 Waybill data. Table 3.2 provides a summary of rail traffic tons and units. The majority of tonnage is inbound at 40.9 million tons or 50.4% of the total 81 million tons. Outbound rail is about 13.7% of the total moving 11 million tons and through traffic is 25.5 million tons and 31.4% of total rail tonnage moved in North Carolina. Waybill data does not supply the value of the commodity moved; therefore, the ratio of dollar-to-ton for each movement in 2014 (Waybill data year used in previous Rail Profile) was applied to the 2019 tonnages and an 8% inflation rate was factored into the ratio. By this analysis, 2019 total value were at \$146.7 million U.S. dollar value of goods moved by rail in North Carolina, with \$67.6 million moving though, \$37.6 million inbound, and \$40.6 million outbound originating in North Carolina and railed out of the state.

TABLE 3.2 SUMMARY OF NORTH CAROLINA RAIL TRAFFIC TOTALS, 2019

Direction	Tons	% Tons	Units	% Units	USD	% Values
	(thousands)		(thousands)		(millions)	
Local	3,629	4.5	41	2.8	1,040	0.7
Through	25,499	31.4	575	39.7	67,566	46.0
Inbound	40,924	50.4	556	38.4	37,576	25.6
Outbound	11,084	13.7	277	19.1	40,588	27.7
Total	81,136		1,449		146,770	

Source: 2019 Waybill Sample for North Carolina and analysis by HNTB

Intermodal traffic accounts for only 10% of total tonnage, but accounts for 80% of the total value as shown in Table 3.3. The percent of intermodal traffic compared to total traffic was calculated from the 2014 Waybill Sample and applied to the 2019 data for tonnages, units, and value, with an 8% inflation rate factored into the data.

TABLE 3.3 SUMMARY OF NORTH CAROLINA INTERMODAL TRAFFIC TOTALS, 2019

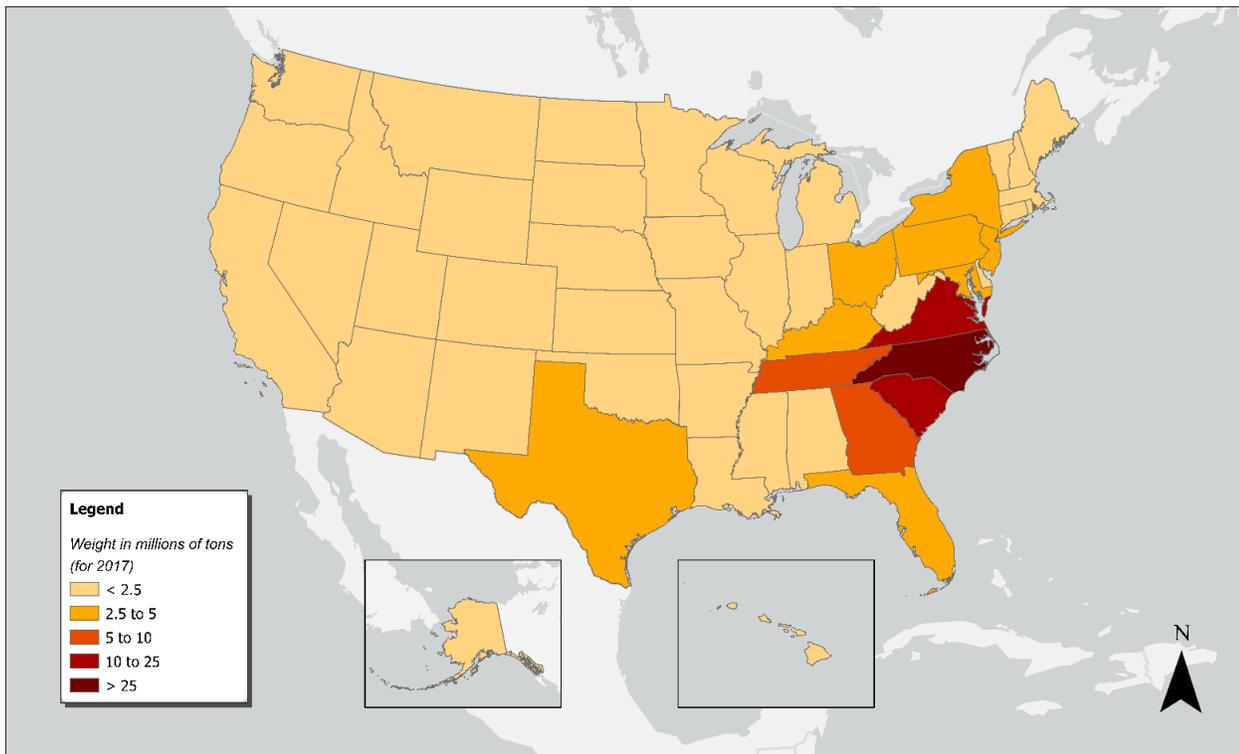
Direction	Tons	% Tons	Units	% Units	USD	% Values
	(thousands)		(thousands)		(millions)	
Through	4,340	51.7	341	50.0	57,550	49.0
Inbound	1,681	20.0	156	22.9	23,915	20.4
Outbound	2,370	28.2	185	27.1	35,882	30.6
Total	8,391		683		117,346	

Source: 2019 Waybill Sample for North Carolina and analysis by HNTB

Trading Partners

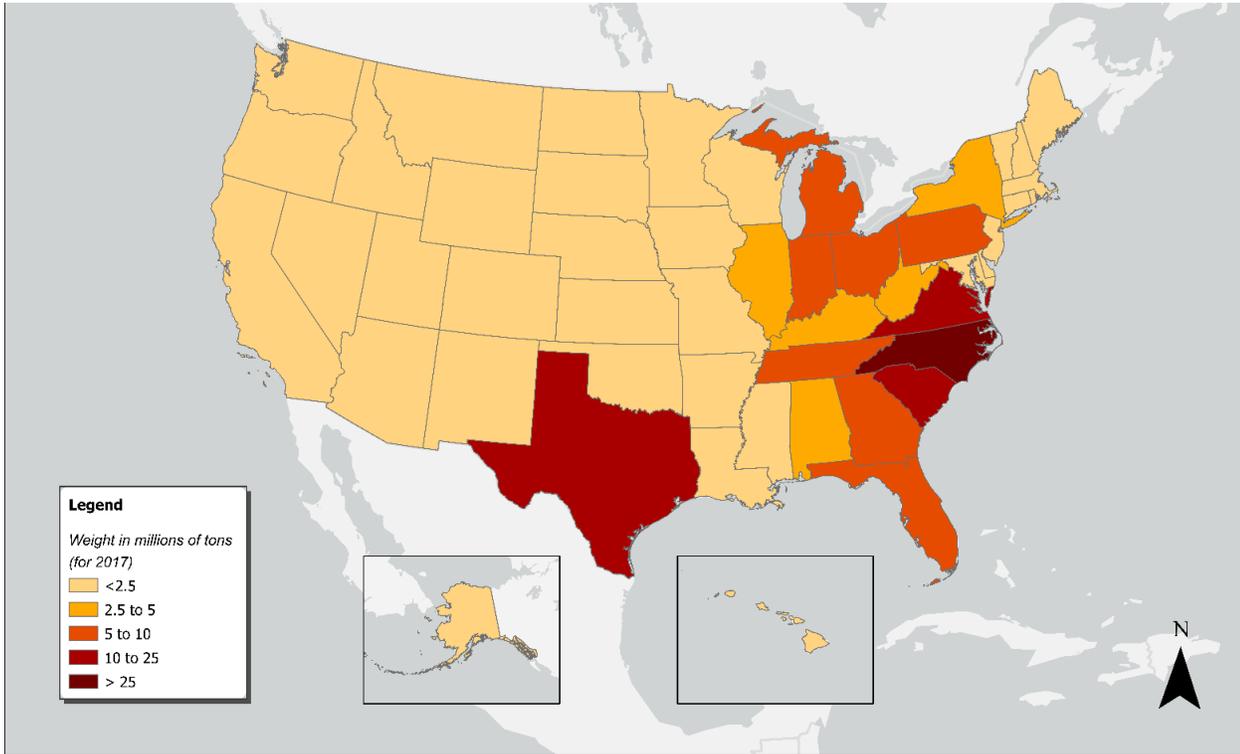
The figures below represent trading partners of commodities entering and leaving North Carolina by weight (in million tons) and by value (in billion dollars) for 2017. The data represents all commodity flows from all modes. Figure 3.1 and Figure 3.2 show that the top trading partners for goods originating and ending in the state are from the eastern U.S. with an emphasis on the southeast and Texas as the highest. For all modes, by weight and value, North Carolina remained with the highest volume – in other words, within-state trading. Figures 3.3 and 3.4 represent the top trading partners by value, with the southeast remaining dominant with goods originating in North Carolina in addition to Texas and California. For goods ending in North Carolina, the neighboring states in the southeast remain dominant.

FIGURE 3.1 TOP TRADING PARTNERS – TRADE FROM NORTH CAROLINA, BY WEIGHT



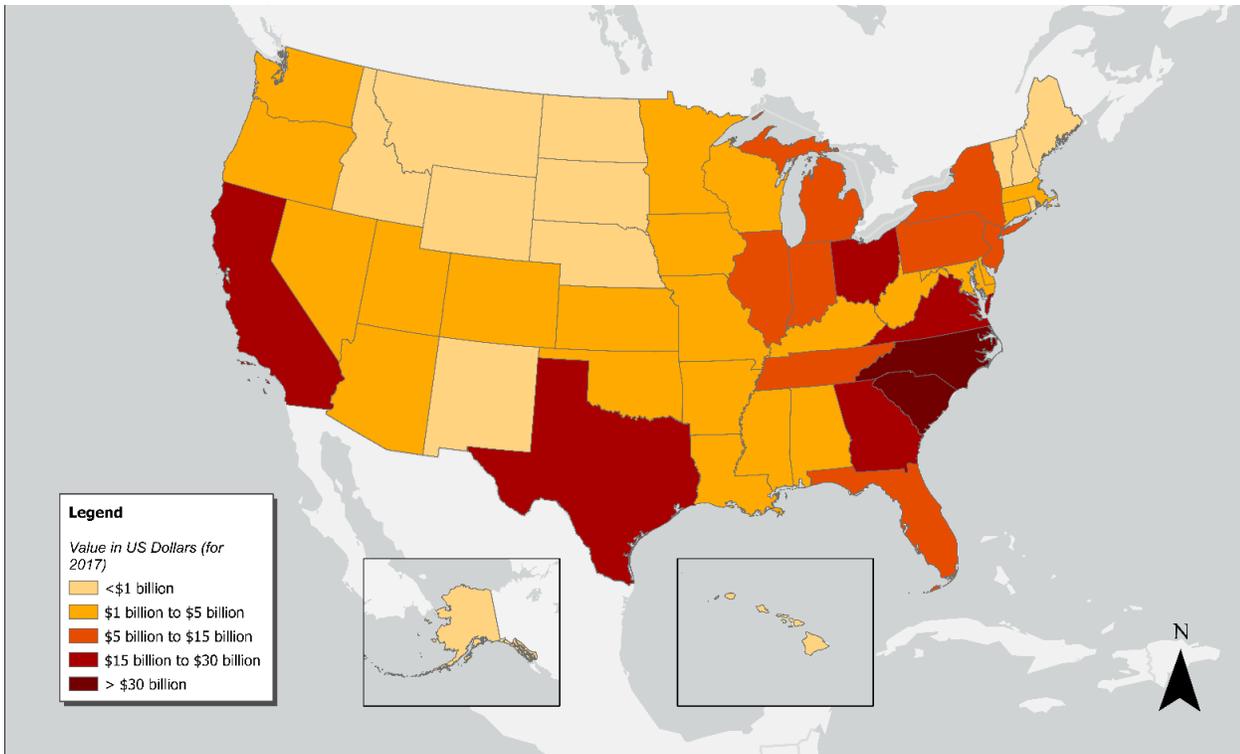
Source: Freight Analysis Framework 5 (FAF5.2)

FIGURE 3.2 TOP TRADING PARTNERS – TRADE TO NORTH CAROLINA, BY WEIGHT



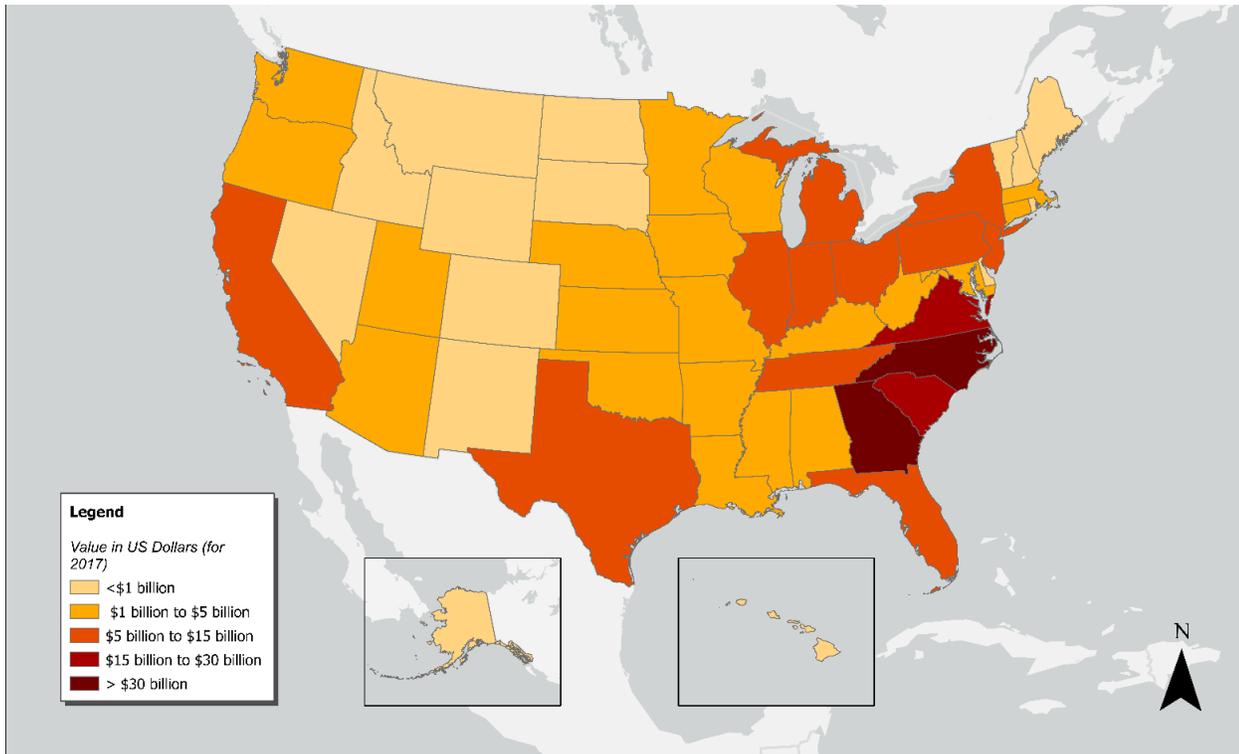
Source: Freight Analysis Framework 5 (FAF5.2)

FIGURE 3.3 TOP TRADING PARTNERS – TRADE FROM NORTH CAROLINA, BY VALUE



Source: Freight Analysis Framework 5 (FAF5.2)

FIGURE 3.4 TOP TRADING PARTNERS – TRADE TO NORTH CAROLINA, BY VALUE



Source: Freight Analysis Framework 5 (FAF5.2)

Rail Traffic Generators

To understand how the rail system has shaped North Carolina's economy, it is imperative to analyze railroad development in the state dating back as early as the 1800s. Many of North Carolina's modern-day large cities such as Durham, High Point, Charlotte, Greensboro, Winston-Salem, Wilmington, Raleigh, and Asheville experienced economic growth and developed into manufacturing cities as a result of the railroad network's success.^{14,15} Combining the two Class I railroads and short line railroad corridors, the network traverses 86 of the state's 100 counties.¹⁶ The railroad system has influenced decisions on land use in proximity to the state's major cities when adapting to the production and trading of cotton, timber, and other easily shipped commodities for markets and manufacturers.¹⁷

¹⁴ [City of Durham. History at a Glance. Accessed: 24 April 2022](#)

¹⁵ [High Point Museum. High Point and Furniture. Accessed: 24 April 2022.](#)

¹⁶ [Analysis on municipality and railroad data from North Carolina Department of Transportation GIS.](#)

¹⁷ [Association of American Railroads. A Short History of U.S. Freight Railroads. Accessed: 24 April 2022](#)

3.2 System Deficiencies

Deficiencies found in the railroad network or operations are due to time delays often caused by bottlenecks or physical constraints. These are issues that typically require substantial changes to infrastructure, policy, or other factors and affect all rail movements along a route.

Bottlenecks and Constraints

As provided by NCDOT Rail Division, various occurrences happen in the rail network that cause system deficiencies; however, congestion was identified as the most common constraint, primarily due to the shared use of rail corridors for freight and passenger services. Other examples of bottlenecks include sidings for passing requirements with stacked trains on a single-track lines, broken traffic signals, inadequate numbers of container cranes to service a train, or an insufficient number or length of sidings. There is a combination of growing demand for passenger rail (intercity and commuter) as well as capacity limits along existing freight rail lines that may cause congestion to increase. Physical constraints include narrow tunnels, utility lines, and bridges, which restrict the ability for double stacking and oversized loads, or track sections not being able to handle railcar weights. To alleviate such challenges, the following needs were identified in collaboration with the 2020-2029 State Transportation Improvement Program (STIP), and the NCDOT Rail Division's proposed freight rail improvements, and stakeholder interviews:

2020-2029 State Transportation Improvement Program (STIP)¹⁸

- Tie and rail rehabilitation improvements to highway grade crossings and upgrade of switch operations
- Upgrade existing track and construct new track on CSX S-Line from Raleigh to Virginia state line and CSX SA-Line from Raleigh to Weldon
- Construct rail spur for industrial access, spine track and turnouts, and rehabilitate existing track sections in Scotland County CSX facility
- Construct siding extension in Anson and Union County on the CSX SF-Line

NCDOT Rail Division Prioritized Needs and Proposed Improvements

- Provide access and additional capacity for freight rail users by bridging logistic gaps with short line rail access and expanding and improving capacity and capabilities at port terminals
- Enhance the resiliency of rail infrastructure by looking for opportunities to close, improve or convert at-grade railroad crossings to increase efficiency in operations, enhance highway safety, reduce risk, and enhance freight reliability; reestablish redundant rail corridors to mitigate interruptions due to hurricanes, flooding, or maintenance

¹⁸ [NCDOT 2020-2029 Current STIP \(April 2022\) Accessed: 25 April 2022](#)

- CSX Queen City Express to include upgraded track components and at-grade rail crossing infrastructure to improve safety and intermodal access to North Carolina's ports with initial sidings in Laurinburg, Bladenboro, and East Arcadia.
- CSX has been awarded funding from the CRISI grant program (PAIRS) to further improve the corridor for future rail traffic in Corridor U.

Stakeholders

- Short line access to Class I network for short line support as more customers rely on these entities to move their goods
- Improve freight rail access to Ports of Wilmington and Morehead City to address need for greater access and fluidity on existing rail network between ports, logistics centers, and railroad facilities through continued coordination and progress with CSX and NS on current improvements to rail service at each port
- Supporting resiliency projects as short line operators lack financial capacity to continuously upgrade rail infrastructure
- Expanding utilization of statewide intermodal and transload facilities to smaller logistic partners by providing educational and informative programs to help promote access

3.3 Safety

The Engineering Coordination and Safety Branch of NCDOT Rail Division oversees and coordinates safety efforts and initiatives that include crossing safety programs, inspecting and overseeing infrastructure, and promoting rail safety through public awareness, and education. In addition to state oversight, the FRA holds rail safety authority at a national level. A detailed explanation of the safety efforts at a national, state, and public level is provided below.

National Railroad Safety Oversight

The FRA promotes and regulates safety throughout the nation's railroad industry through the Office of Railroad Safety. The FRA partners with NCDOT to inspect rail infrastructure in five technical disciplines focusing on compliance and enforcement in hazardous materials, motive power and equipment, operating practices, signal and train control, and track.¹⁹

One of the many divisions of FRA's Office of Railroad Safety is State Rail Safety Participation, where the participating state and the FRA enter a multi-year agreement for the exercise of specific authority. NCDOT takes part in this safety program, allowing the FRA to delegate investigative and surveillance authority regarding federal railroad safety laws.¹⁹ As part of this program, FRA helps NCDOT develop rail safety programs and enables qualified state inspectors to maintain technical proficiency.

- The NCDOT's safety programs conform to rules and regulations implemented by FRA including 49 Code of Federal Regulations (CFR) Part 234, Grade Crossing Safety, Including Signal Systems, State Action Plans,

¹⁹ [Federal Railroad Administration \(FRA\). Railroad Safety. Accessed: 6 April 2022](#)

and Emergency Notification Systems and 49 CFR Part 212 State Safety Participation Regulations. In 2008, Congress passed the Rail Safety Improvement Act (RSIA), the first authorization of FRA's safety programs since 1994. The RSIA directs FRA to issue safety regulations for different areas related to railroad safety such as hours of service requirements for railroad workers, positive train control implementation, standards for track inspections, certification of locomotive conductors, and safety at highway-rail grade crossings.²⁰ In order to preserve the structural integrity of the bridges, the FRA released a Bridge Safety Standards Final Rule in 2010 requiring all railroad track owners to implement bridge management programs, including annual inspections of railroad bridges and auditing programs.²¹

Crossing Safety

NCDOT's Rail Division is responsible for maintaining a crossing inventory and analyzing data to determine which crossings are eligible for safety improvements through the Crossing Hazard Elimination Program. An investigative index is derived based on factors such as train volume, train speed, average daily vehicle traffic, school bus passenger loads, existing warning devices, number of main-line tracks and sidetracks in use, and the crossing's most recent 10-year accident history (made available from FRA Office of Safety Analysis).²² Based on the index value, updated annually, approximately 100 crossings with the highest indices are selected as candidates for improvement. Each crossing is taken into consideration, and based on engineers' recommendations and available funding, NCDOT selects as many crossings as possible and assigns priorities for improvements. After the selected crossings have been added to the Crossing Hazard Elimination Program, the new projects are submitted to the North Carolina Board of Transportation for approval as additions to the State Transportation Improvement Program.²³

Through continued implementation of educational programs, rail safety initiatives, and safety programs, North Carolina continues to make significant headway to hold rail safety as one of the NCDOT's top priorities. These educational programs and crossing improvements are believed to have contributed to the decline in train-related incidents. The Piedmont Improvement Program is an example of project prioritization aimed to improve freight and passenger rail service and add passenger frequencies between Charlotte and Raleigh. The project was granted \$520 million from the American Recovery and Reinvestment Act (ARRA), and more than 40 projects were completed between 2009 and 2017. Some safety and enhanced infrastructure improvements include building 13 bridges to carry roadways over or under railroad tracks to separate traffic from trains, closing more than 40 railroad crossings to eliminate the potential for train and vehicle collisions, improving railroad curves to permit consistent and higher operating speeds, and adding 27 miles of parallel, or secondary track, on the heavily traveled corridor between Greensboro and Charlotte.²⁴

NCDOT uses funds from the Freight Rail and Rail Crossing Safety Improvement (FRRCSI) program to implement safety improvements on eligible rail/highway safety projects that are not funded by other programs. The Rail

²⁰ [Federal Railroad Administration. "Rail Safety Improvement Act of 2008 \(RSIA\)." Accessed: 24 April 2022.](#)

²¹ [United States Department of Transportation. "Federal Railroad Administration Railroad Bridge Safety Fact Sheet." Accessed: 24 April 2022.](#)

²² [Federal Railroad Administration Office of Safety Analysis. Accessed: 24 April 2022.](#)

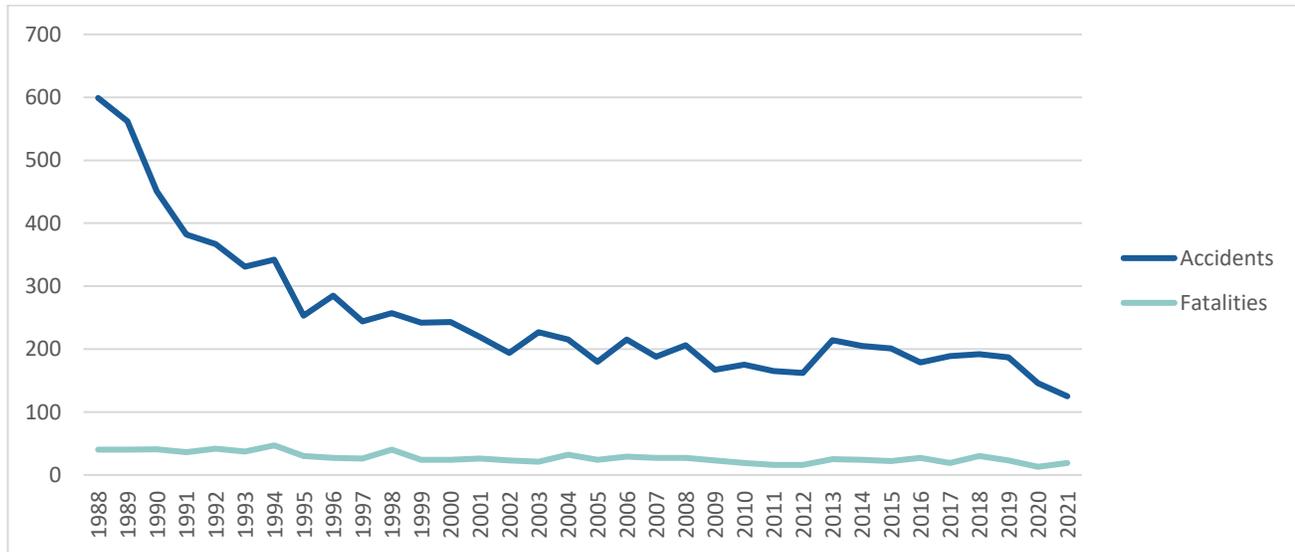
²³ [North Carolina Department of Transportation Rail Division. Train Crossing Program. Accessed: 24 April 2022](#)

²⁴ [North Carolina Department of Transportation. Piedmont Improvement Program. Accessed 24 April 2022](#)

Division uses quantitative analysis to determine funding and prioritization of projects. The FRRCSI program includes \$26.4 million allocated for fiscal years 2020-2022 for more than 40 projects statewide. As of December 2021, the program has resulted in the improvement of more than 1,000 crossings, modernization of 72 bridges, and upgrade of 107 miles of short line road.²⁵

Active warning devices and closures of at-grade crossings enhance safety and resiliency throughout the state rail system. From 2014 to 2019, North Carolina has completed 65 closure and grade separation projects. Such projects can increase public awareness and deter or prevent train-related incidents. The number of annual accidents has decreased 79.1% from 599 in 1988 to 125 in 2021 (Figure 3.5), despite the state population increasing 59% from 1988 (6.6 million people) to the last census in 2020 (10.4 million people). Train related fatalities have fluctuated over the past 33 years with a decreasing trend. The past two decades remained relatively constant until recently, when fatalities fell, breaking a 30-year low in 2012.

FIGURE 3.5 NORTH CAROLINA HIGHWAY-RAIL INCIDENTS AND FATALITIES (1988-2021)



Source: FRA Office of Safety Analysis

Inspection and Oversight

Apart from prioritizing railroad-highway crossing safety, the Rail Division’s Railroad Safety Enforcement Program partners with the FRA to inspect and oversee more than 3,300 miles of track, signal systems, and thousands of rail cars and locomotives. Additionally, in partnership with the Federal Transit Administration (FTA) and local transit agencies, NCDOT Rail Division coordinates existing and proposed local rail projects under the State Safety Oversight Program (SSO). The SSO oversees safety of rail transit systems and ensures all rail projects meet safety standards.²⁶

²⁶ Federal Transit Administration. State Safety Oversight (SSO) Program. Accessed: 24 April 2022

Public Awareness and Education

North Carolina's BeRailSafe program provides educational programs on rail safety, augmenting physical improvement programs such as the Sealed Corridor Program, which works with communities along the Raleigh-Charlotte corridor to eliminate or improve rail-highway crossings, or the FHWA HSIP Rail-Highway Safety Section 130 Program, or the FRRCSI Program. The BeRailSafe program offers training and educational courses for schools, public and private transportation agencies, and public safety entities such as fire, police, and Emergency Medical Services (EMS). The BeRailSafe educational material stresses the message that railroads are not a shortcut, a trail, or a resting place.²⁷

In conjunction with the NCDOT BeRailSafe program, there are also various national groups with the same mission to prevent collisions, injuries, and fatalities on and around railroad tracks and crossings like Operation Lifesaver. Operation Lifesaver is an organization that provides materials, videos, and trainings about education, enforcement, and engineering and publishes statistics about rail trespassing and crossing collisions to promote rail safety.²⁸

North Carolina Rail Accident Statistics

The following section provides a statistical review of rail safety in North Carolina over the last ten years. The tables and figures provided address the rail accident/incident trends and provide details as to the type of rail accidents/incidents, the affected entities, and causes. As defined in the Code of Federal Regulations (CFR) Title 49, Part 234, an accident/incident signifies "any impact between railroad on-track equipment and a highway user at a highway-rail grade crossing or pathway grade crossing. The term 'highway user' includes automobiles, buses, trucks, motorcycles, bicycles, farm vehicles, pedestrians, and all other modes of surface transportations motorized and unmotorized."

Table 3.6 shows statistics for the total number of rail accidents/incidents in North Carolina as well as the number of those that resulted in an injury or fatality. From 2012 to 2019 there has been an increase in events with a fluctuation of fatalities and gradual decline of injuries. From 2019 to 2021, there has been a 28.4% reduction of total events, however, it is unknown how the reduction of flows due to the COVID-19 pandemic has influenced these statistics.

TABLE 3.4 TOTAL RAIL ACCIDENTS AND INCIDENTS IN NORTH CAROLINA

Total Rail Accidents/Incidents	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Total Events	162	214	202	194	179	189	192	187	145	116	1,780
Fatalities	16	25	24	22	27	19	30	23	13	18	217
Injuries	32	53	43	46	49	38	30	35	44	28	398

Source: FRA Office of Safety Analysis

²⁷ North Carolina Department of Transportation. BeRailSafe. Accessed 24 April 2022. <http://www.berailsafe.org/>

²⁸ Operation Lifesaver. Operation Lifesaver – About Us. Accessed 24 April 2022. <http://oli.org/about-us>

Train Accidents in North Carolina

Train accidents include train derailments, collisions with other trains, and other events involving on-track rail equipment that result in fatalities, injuries, or monetary damage above a threshold set by FRA. Train accidents over the past ten years have remained consistent with peak accidents occurring in 2014 and 2018. No fatalities have been recorded and injuries have improved since 2017 as shown in (Table 3.7).

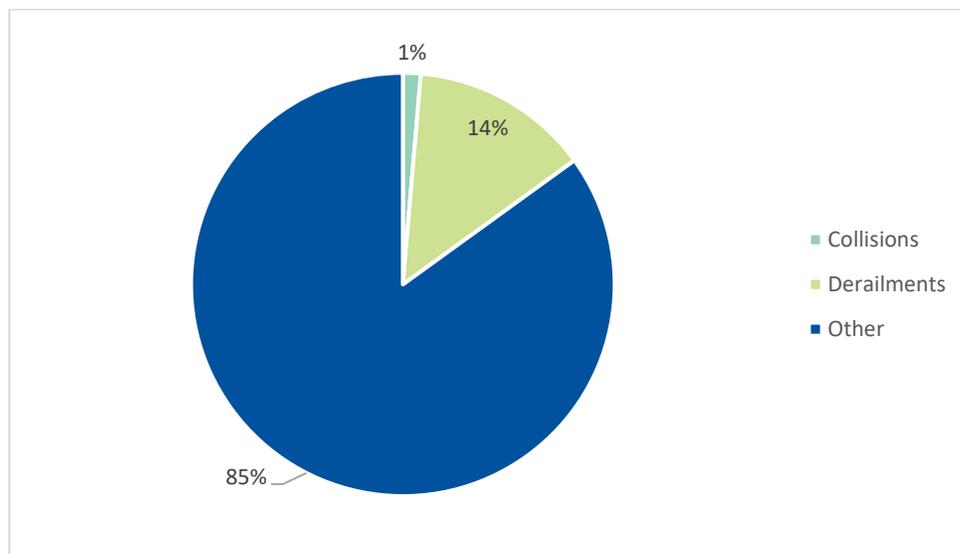
TABLE 3.5 TRAIN ACCIDENTS IN NORTH CAROLINA

Train Accidents	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Total Accidents	21	20	30	23	20	23	35	26	24	16	238
Fatalities	0	0	0	0	0	0	0	0	0	0	0
Injuries	0	1	0	0	0	1	3	1	2	0	8

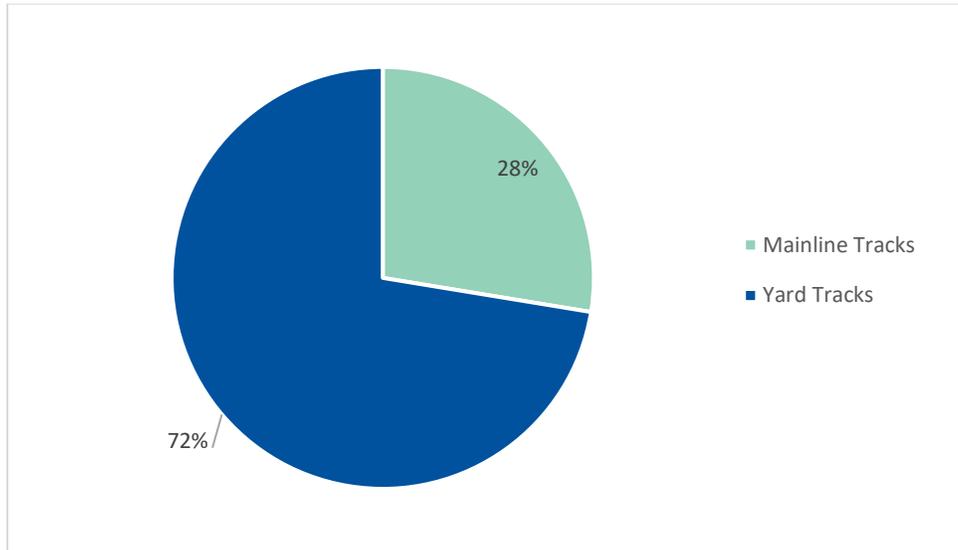
Source: FRA Office of Safety Analysis

The most common train accidents have been labeled as “other,” which are events other than train accidents or crossing incidents that have caused physical harm to persons as shown in Figure 3.6. More than half of the train accidents have occurred on yard tracks as opposed to main line tracks as shown in Figure 3.7. Human error (38%) and track defects (30%) were the leading causes of train accidents over the past ten years and have remained consistent as such since 2006 as seen in Figure 3.8.

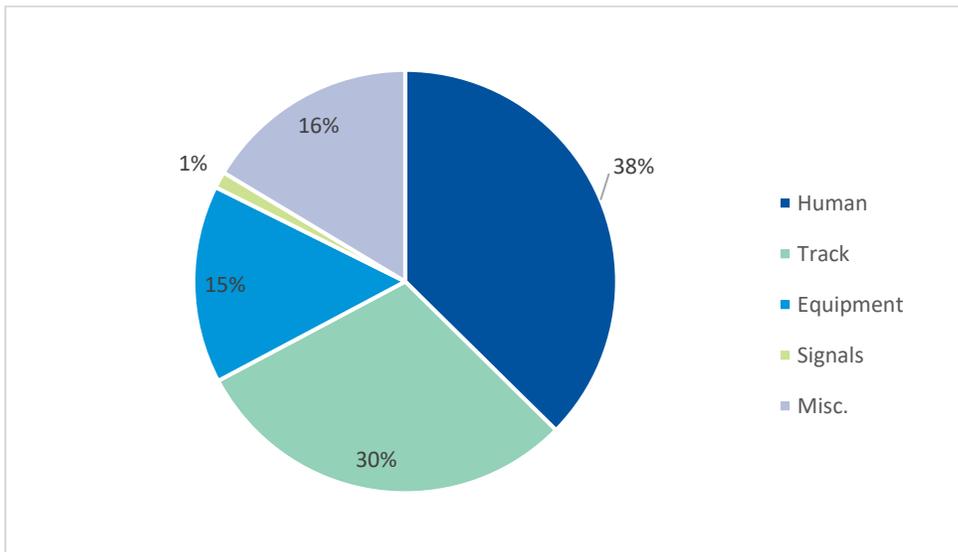
FIGURE 3.6 NORTH CAROLINA TRAIN ACCIDENTS, BY TYPE (2012-2021)



Source: FRA Office of Safety Analysis

FIGURE 3.7 NORTH CAROLINA TRAIN ACCIDENTS, BY LOCATION (2012-2021)

Source: FRA Office of Safety Analysis

FIGURE 3.8 NORTH CAROLINA TRAIN ACCIDENTS, BY CAUSE (2012-2021)

Source: FRA Office of Safety Analysis

Other Rail Accidents or Incidents in North Carolina

As mentioned previously, “other” rail accidents or incidents are events other than train accidents or crossing incidents that have caused physical harm to persons. Events that fall under this category can lead to injury or fatality and include getting on or off equipment, doing maintenance work, setting handbrakes or trespassing. Since 2012, there has been a 32.3% improvement of total accidents and 39.3% improvement of reported injuries. Statistics for this category are shown in Table 3.8.

TABLE 3.6 OTHER RAIL ACCIDENTS OR INCIDENTS IN NORTH CAROLINA

Other Accidents/ Incidents	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Total Accidents	96	138	120	104	120	123	101	108	79	65	1,054
Fatalities	14	18	19	14	23	14	18	18	12	15	165
Injuries	84	120	101	92	100	114	83	90	68	51	903

Source: FRA Office of Safety Analysis

Almost all rail-related fatalities in North Carolina, not including highway/rail incidents, are caused from trespassers on railroad property struck by trains or other equipment. Trespass related fatalities accounted for 99% of total fatalities over the past ten years. Injuries were reported due to rail accidents or incidents not at highway/rail crossings from employees/workers on and off duty, non-trespassers on railroad property, and contractors.

At-grade Roadway/Rail Crossing Incidents in North Carolina

From 2012 to 2021, there has been a 22% improvement of total highway-rail grade crossing incidents. There has been a substantial improvement of 80.9% of total injuries in the past ten years. Table 3.9 show a slight decrease in numbers of total incidents and deaths compared to the last decade (2006-2012) as there have been about ten deaths less per year between 2012 to 2021.

TABLE 3.7 HIGHWAY-RAIL INCIDENTS IN NORTH CAROLINA

Highway-Rail Incidents	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Total Accidents	45	56	52	67	39	43	56	53	42	35	488
Fatalities	2	7	5	8	4	5	12	5	1	3	52
Injuries	42	29	28	99	19	18	26	6	10	8	285

Source: FRA Office of Safety Analysis

Rail Incidents Involving Hazardous Materials in North Carolina

Most rail incidents involving hazardous (hazmat) materials have been related to railcars designated to carry hazmat materials but did not result in damaged or a derailed railcar. These incidents have been on the decline since 2018, with 98 incidents down to 22 in 2021 as shown in Table 3.8. Hazmat railcars that were damaged or derailed during an incident reported fewer incidents in that period with the highest number of incidents during the past 10 years involving 20 hazmat railcars in 2019. In most years incidents where railcars were damaged or derailed were much lower with only two in 2020 and zero in 2021. Table 3.8 also illustrates that cars releasing hazmat has only occurred five total times during the past 10 years with two in 2018 and three railcars in 2019 and apart from those two years, no incident caused hazmat to be released in North Carolina.

TABLE 3.8 RAIL INCIDENTS INVOLVING HAZARDOUS MATERIALS IN NORTH CAROLINA

Rail HazMat Incidents	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Incidents Involving HazMat Releases	0	0	0	0	0	0	1	2	0	0	3
Cars Carrying HazMat	5	70	51	33	150	39	98	80	54	22	602
HazMat Cars Damaged or Derailed	0	11	5	1	7	2	4	20	2	0	52
Cars Releasing HazMat	0	0	0	0	0	0	2	3	0	0	5

Source: FRA Office of Safety Analysis

4.0 FUTURE PERFORMANCE AND TRENDS

4.1 Future Activity/Demand

Explained in this subsection are the current and forecasted rail freight flows broken down by direction (local, inbound, and outbound). Data from the 2019 North Carolina Waybill Sample was used for the year 2019 and FAF 5.1 was used for the forecasted values of 2020-2050. The compound annual growth rate (CAGR) was calculated for each direction of total rail flows. Table 4.1 displays the inbound and outbound tonnages of rail movements in North Carolina. Through state movements were not derived at this time due to a lack of throughput data available in the FAF 5.1 data resource. The NCDOT Rail Division is working on the State Rail Plan update, which will provide additional details to rail flow forecast.

TABLE 4.1 NORTH CAROLINA RAIL FLOW FORECAST BY WEIGHT (THOUSAND TONS)

Direction	2019	2020	2025	2030	2035	2040	2045	2050
Local	3,629	4,938	5,378	5,765	6,258	6,757	7,376	8,066
Inbound	40,924	21,503	22,278	22,933	24,138	25,527	27,281	30,004
Outbound	11,084	3,839	4,402	4,774	5,219	5,728	6,392	7,035
Total	55,637	30,279	32,058	33,471	35,615	38,011	41,049	45,105

Source: 2019 Waybill Sample for North Carolina and FAF 5.1

TABLE 4.2 NORTH CAROLINA RAIL FLOW COMPOUND ANNUAL GROWTH RATE FORECAST

CAGR 2020 -2050	By Weight	By Value
Local	1.6%	1.3%
Inbound	1.1%	2.3%
Outbound	2.0%	2.3%
Total	1.3%	2.2%

Source: 2019 Waybill Sample for North Carolina and FAF 5.1

4.2 Trends and Implication of Growth

Demographic, Economic, and Land Use Pattern Trends

North Carolina is experiencing population growth across the state, especially in urban and suburban areas. Between 2010 and 2020, the population has increased 9.5% from 9.5 million to 10.4 million. Counties surrounding cities such as Charlotte and Raleigh see the highest concentration of population in the state.²⁹ The state population is expected to increase an additional 32% by 2050 with an estimated 13.8 million people residing in North Carolina. The concentration of population is expected to remain the same in major urban counties like Wake and Mecklenburg. Rural counties are projected to experience a decrease in population, as many people will continue to move to more metropolitan areas.³⁰

North Carolina's aggregate production of goods and services (GPD) increased at an annual rate of 4.5% in 2021, a higher rate than the national average of 3.8%. As of the third quarter of 2021, the state's economy is 3% larger than its pre-COVID-19 pandemic level. There has been an addition of 143,500 jobs, primarily in the leisure/hospitality, professional services, manufacturing, and construction industries.³¹

As population growth is predicted to be concentrated in urban areas, railroad infrastructure needs and redevelopment will play an important role in shaping future land use patterns. As major metropolitan areas grow, more people will move into city centers and investors will target suburban areas for new operations. As announced at the end of 2021, Toyota will construct a multibillion-dollar factory in Randolph County to produce electric batteries for vehicles.³¹ Additionally, the electric vehicle manufacturer VinFast will locate a manufacturing plant in Chatham County, attracting more than 7,500 jobs and \$4 billion in investment to the community.³² Strategic expansion of rail infrastructure with access to industrial zoned properties, marine terminals, or raw material sources can lure developers and investors to a region or locality.

Freight Trends

Freight railroads provide efficient and reliable transportation service for various commodities in the state including agriculture and food products, chemical and chemically derived products, forest and wood pulp products, electronics, and communication components, as well as large machinery, scrap materials and intermodal containers. The railroad system has the ability and established network to connect to North Carolina's deep-water ports and to inland domestic and international markets.

North Carolina's trading market extends beyond U.S. borders to partners overseas. In 2018, the state was the 15th largest exporter of goods totaling a value of \$32.8 billion from all modes. The top international trade partners

²⁹ [U.S. Census. North Carolina: 2020 Census. Accessed: 25 April 2022](#)

³⁰ [The University of North Carolina at Chapel Hill. Carolina Demography. Accessed: 25 April 2022](#)

³¹ [NC State University. 2022 Economic Outlook: Moving Toward the Next, New North Carolina. Accessed: 25 April 2022.](#)

³² <https://www.chathamcdc.org/vinfast-chatham-county/>

included Canada, Mexico, and China, with top exports including manufactured parts, chemicals, tobacco, and other agricultural products.³³

Within the U.S., core commodities supplied by North Carolina include pharmaceuticals, farm products, forest products, and electronic components. Based on 2017 North Carolina Waybill data, the top commodity groups moved by rail in units of tons include coal (24%), chemicals (20%), farm and food (18%), raw materials and instruments (14%), and forest, wood, and furniture (10%).

When comparing historical and forecasted freight flows, a downward trend is observed in total freight movements, mostly due to the reduction in the volume of coal moved. By 2050, coal volume is expected to decline to 1.3 million tons from the original 30 million tons North Carolina moved in 2015. This decline is due to the emergence of alternative energy solutions. Other commodity groups are expected to increase, such as intermodal shipments. Some shippers are seeing a growth in intermodal business because containers offer a safe, secure means of transporting finished goods. Freight movements in the U.S. are expected to grow 50% by 2050.³⁴ Along with overall freight, intermodal volumes are expected to increase almost 50% from 2020 to 2050 and are the top growing mode since the 2007-2009 recession.³⁵ Increased usage of intermodal containers supports investments and funding towards projects that develop, upgrade, or expand intermodal railroad networks. These networks connect raw materials, manufacturing, ports, and intermodal distribution centers, while achieving a sustainable transportation system and reducing total truck miles in the state.

Highway Congestion and Freight Rail

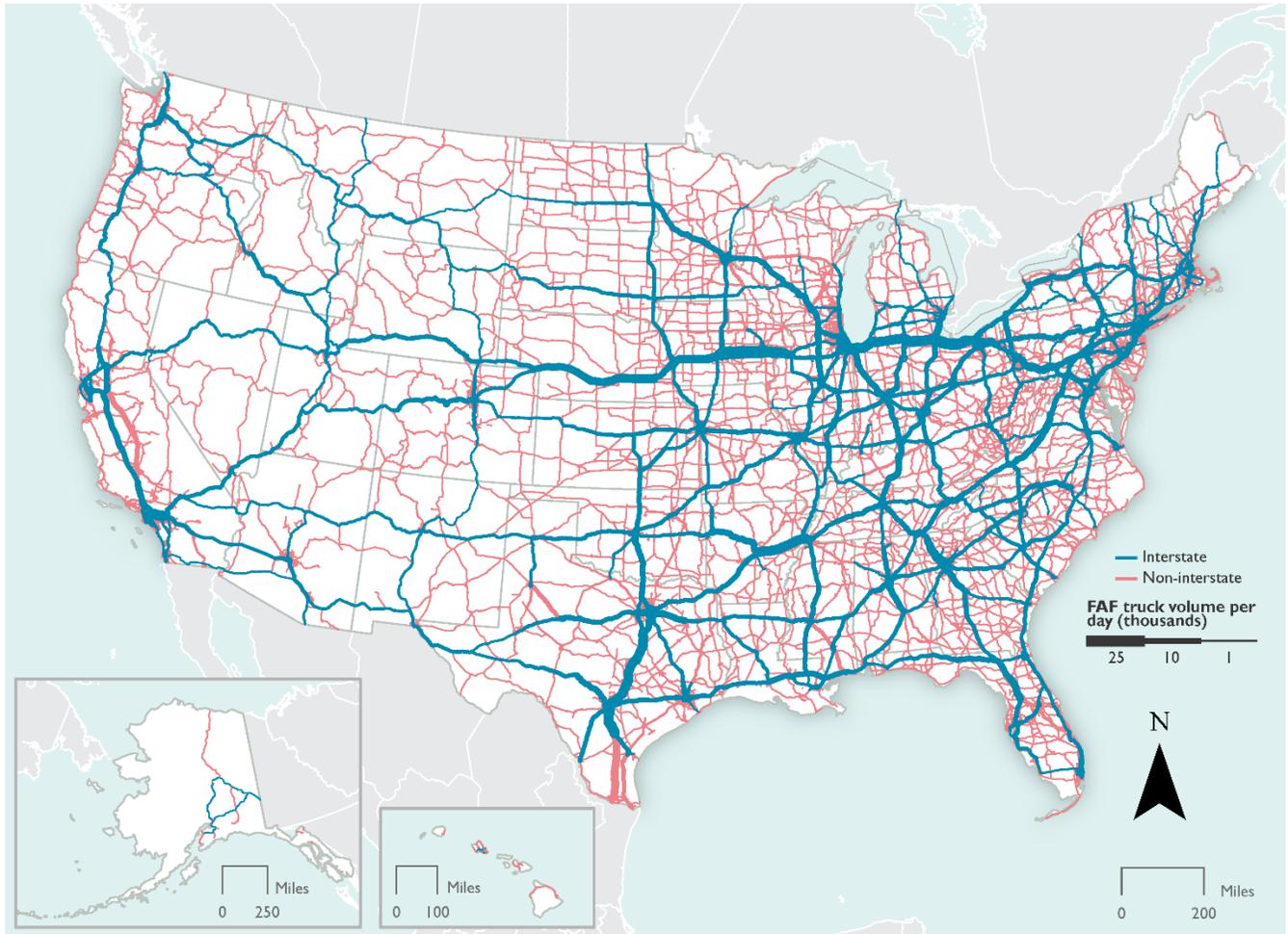
Modal shift has been a theory to reduce congestion, ease constrained highway corridors, reduce carbon emissions, and provide competitive transportation costs. The need for freight movement rises as a result of continued population growth. Limited highway capacity may demand relief as congestion increases, shifting commodities to rail could provide needed system growth. Figure 4.1 and Figure 4.2 show interstate freight truck volumes in 2015 and those projected for 2045, respectively. The projected truck volume increases in 2045 are in the same corridors as in 2012, which include I-40/I-85 in the Piedmont Crescent, I-40 in western North Carolina, I-77, and I-95. Figure 4.3 presents 2045 volume-to-capacity ratios on major highway corridors. Most of North Carolina's interstates are projected to be highly congested, high-volume systems, specifically I-40 and I-95 in the Triangle and eastern North Carolina areas. These highly congested areas will negatively affect the intermodal system. Consideration should also be given to the state's access to intermodal facilities, as the four intermodal terminals are in Charlotte, Greensboro, and Rocky Mount. Drayage to the intermodal facilities can move on rail lines that run parallel to the busy interstates and other primary roads and reduce long-haul truck trips to shorter drays. Additionally, focusing on improvements to primary roads within 25-75 miles of intermodal facilities can help enhance the overall intermodal network.

³³ [Office of the U.S. Trade Representative. State Benefits of Trade: North Carolina. Accessed: 25 April 2022](#)

³⁴ Freight Activity in the U.S Expected to Grow Fifty Percent by 2050, located online 11/22/2021 from, <https://www.bts.gov/newsroom/freight-activity-us-expected-grow-fifty-percent-2050>

³⁵ Rail Intermodal was Top Growing Mode since Recession, located online 11/28/2018 from, <https://www.bts.gov/newsroom/rail-intermodal-was-top-growing-mode-recession>

FIGURE 4.1 AVERAGE DAILY LONG HAUL INTERSTATE FREIGHT TRUCK TRAFFIC (2015)

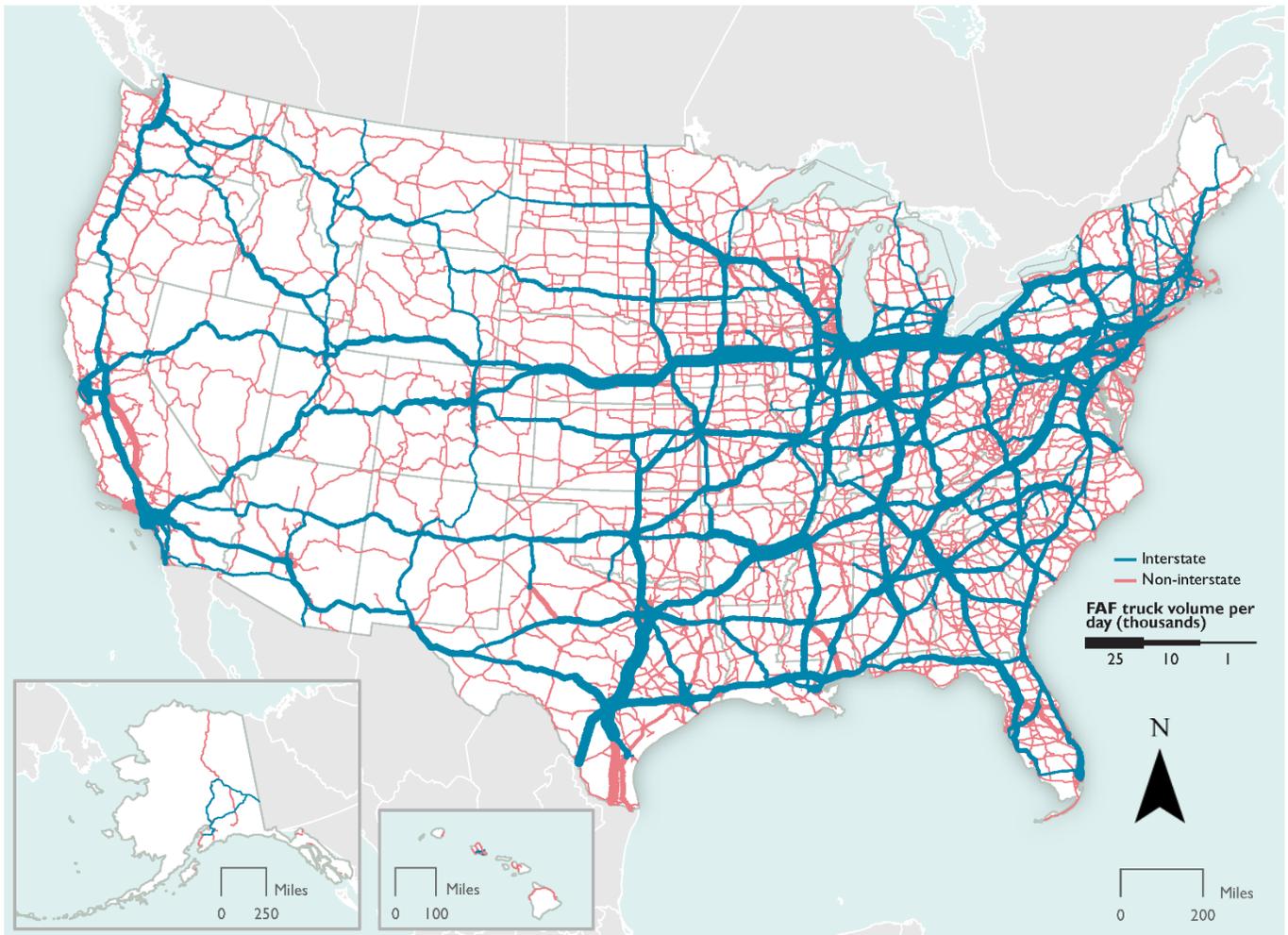


Source: USDOT Freight Facts and Figures, 2019 FAF4.5

Note: The Freight Analysis Framework (FAF) is based in large part on the results from the Commodity Flow Survey (CFS) last administered in 2012. Long-haul freight trucks typically serve locations at least 50 miles apart, excluding trucks that are used in movements by multiple modes and mail³⁶.

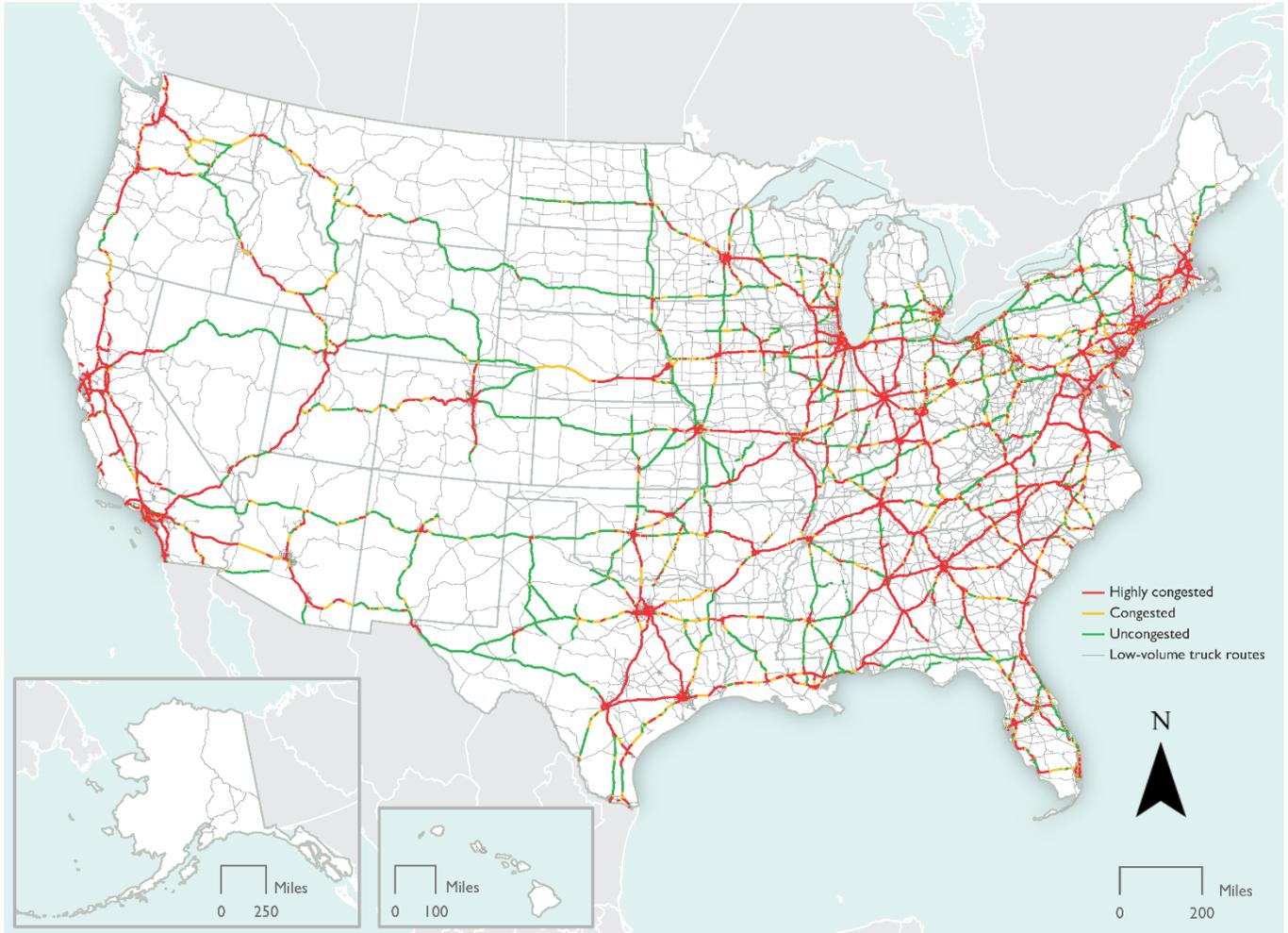
³⁶ <https://data.bts.gov/stories/s/Freight-Transportation-System-Extent-Use/r3vy-npqd#freight-flows>

FIGURE 4.2 PROJECTED AVERAGE DAILY LONG-HAUL INTERSTATE FREIGHT TRUCK TRAFFIC (2045)



Source: USDOT Freight Facts and Figures, 2019 FAF4.5

FIGURE 4.3 PEAK PERIOD CONGESTION ON HIGH-VOLUME TRUCK PORTIONS OF THE NATIONAL HIGHWAY SYSTEM (2045)



Source: USDOT Freight Facts and Figures, 2019

Transferring goods from truck to rail has several benefits to the highway system. This transfer will result in a reduction in truck volume, congestion, maintenance costs, fuel, and emissions. Using rail can also reduce the investment needed in capacity and maintenance highway projects by not having to construct additional lane-miles or the rehabilitation of roads due to truck damage. Ultimately, these reductions will improve the highway system.

Passenger Train Delays

There are six intercity passenger routes within North Carolina (including state-supported Piedmont and Carolinian services) with stops in 16 cities or towns. These services provide access to major east coast urban centers between New York and Miami. Amtrak's Piedmont and Carolinian provide access to communities between Charlotte and Raleigh.

The Carolinian travels from Charlotte to New York along the CSX A-Line and NCRP corridor, which is part of NS's Crescent Corridor (Greensboro to Charlotte). The Piedmont operates from Charlotte to Raleigh and is also on the

NCRR corridor. Performance data are collected and published each quarter by Amtrak for its passenger services. For the purposes of this rail profile, the data were analyzed to identify areas where passenger and freight trains conflict and result in time delays that can lead to congestion issues. Table 4.3 summarizes the top causes of host railroad delays and the primary owner or operator that has effective operating control over a segment of trackage from 2016 to 2021.

TABLE 4.3 SUMMARY OF TOP TWO HOST RAILROAD-RESPONSIBLE DELAYS FOR PASSENGER SERVICES BY QUARTER (Q3 FY 2016 THROUGH Q3 2021)

Delay Type		Carolinian (CSXT)	Carolinian (NS)	Piedmont (NS)
Commuter Train Interference (CTI)	Average Delay (mins)	0	0	0
	Count	0	0	0
Signal Delays (DCS)	Average Delay (mins)	306	203	162
	Count	1	2	6
Slow Order Delays (DSR)	Average Delay (mins)	332	273	290
	Count	2	15	15
Debris (DBS)	Average Delay (mins)	0	0	0
	Count	0	0	0
Freight Train Interference (FTI)	Average Delay (mins)	479	242	362
	Count	20	13	20
Passenger Train Interference (PTI)	Average Delay (mins)	393	296	315
	Count	18	12	2

Source: Amtrak Rail Service Metrics and Performance Reports

Table 4.3 lists various types of delays including and defined below as:

- **Commuter Train Interference (CTI)** delays for meeting or following commuter trains
- **Signal Delays (DCS)** Signal failure or other signal delays, wayside defect-detector false alarms, defective road crossing protection, efficiency tests, drawbridge stuck open
- **Slow Order Delays (DSR)** temporary slow orders, except heat or cold orders
- **Debris (DBS)** Debris strikes of the train or infrastructure
- **Freight Train Interference (FTI)** Delays from freight trains
- **Passenger Train Interference (PTI)**. Delays for meeting or following other passenger trains (not commuter trains)

The table indicates that Freight Train Interference (FTI) is responsible for the greatest number of interferences and longest average delays in minutes for the top two host railroads.

Mentioned in Section 3, one of the most heavily trafficked corridors as established by NCDOT is the one that connects to the NCRR rail corridor and NS secondary line.

5.0 NEEDS ASSESSMENT

Needs and opportunities in freight rail arise from two factors: goods movement affected by supply chain demand, and infrastructure conditions that affect time efficiency. Many of the top commodities transported throughout the nation rely on rail for at least one step of the resource-to-consumption production cycle. North Carolina is equipped with two deep-water ports, two Class I railroads, multiple regional and short line railroads, as well as an established highway and interstate system, and can accommodate changes in freight flows whether expanding to different or emerging industries or increasing overall capacity in the freight rail mode.

5.1 Freight Rail Needs and Opportunities

With the emergence of new industries and the projected growth of the state's population, demand for the movement of goods will continue to rise. If North Carolina is to remain a strong competitor for international trade and imports and exports of commodities, certain needs and opportunities must be identified in order to enhance the overall reliability of the state's rail system. Network upgrades on existing facility infrastructure, expansion of new tracks that can connect to more markets and destinations, and safety improvements will allow for a safe and efficient delivery of goods.

According to the NCDOT Rail Division, freight rail needs and opportunities are summarized below.

- Provide access for freight rail users
- Continue the partnership between Class I railroads to identify projects that enhance the connectivity to ports, industries, and overall fluidity on the rail network within the state
- Identify and develop transload and other rail industrial access projects that provide access to the rail system to enhance economic development and/or help divert truck-miles to rail
- Support local access to and promote the utilization of transload and intermodal facilities
- Improve the safety of the transportation system
- Identify and mitigate high hazard highway-railroad crossings through Section 130 program, FRRCSI program, or the STI funding prioritization process
- Financially support and pursue grade separations where appropriate on busy freight corridors that will also eliminate conflicts that cause time delays and reduce the reliability of the network
- Improvement examples: highway grade separations, crossing improvements, upgrading ballast deck bridges

- Enhance the resiliency of rail infrastructure
- Continue the support of state of good repair programs and the development of redundant transportation corridors
- Improvement examples: S-Line and SA-Line acquisition, restoration of the Wallace to Castle Hayne rail corridor, restoration of prior active lines in southeast NC, Wilmington Rail Realignment Project
- Integrate freight and passenger rail into the Multimodal Transportation Network
- Continue to use programs such as FRRCSI to help preserve strategic freight corridors, develop rail industrial access, and help finance short line infrastructure projects
- Advance a corridor-level approach to rail planning and investment
- Continue to identify projects that can provide additional capacity for freight and passenger movements and provide opportunities to develop local freight and associated economic development
- Use a holistic approach to rail planning that incorporates the present and future needs of both freight and passenger rail operators