North Carolina Statewide Multimodal Freight Plan

Final Report

prepared for

North Carolina
Department of Transportation

prepared by

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with
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November 2017

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

CAMBRIDGE SYSTEMATICS

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Think Forward

North Carolina State Freight Plan Compliance with Fixing America's Surface Transportation (FAST) Act

FAST ACT—REQUIREMENT	FREIGHT PLAN REFERENCE(S)
Plan Contents—A State freight plan shall include, at a minimum:	
Identification of significant statewide freight **trends, needs, and issues**	Chapters 3, 5, and 6
Description of **freight policies, strategies, and performance measures** that will guide freight-related transportation investment decisions	Chapters 6, 7, and 8
Critical multimodal **rural freight facilities and rural and urban freight corridors**	Chapter 4
Link to **national multimodal freight policy and highway freight program goals**	Chapter 2
Description of how **innovative technologies and operational strategies** (including ITS) that improve the safety and efficiency of freight movements were considered	Chapters 6, 7, and 8
Description of improvements to **reduce roadway deterioration by heavy vehicles** (including mining, agricultural, energy cargo or equipment, and timber vehicles)	Chapters 6, 7, and 8
Inventory of facilities with **freight mobility issues** and a description of the strategies the State is employing to address the freight mobility issues	Chapters 3, 6, 7, and 8
Description of **significant congestion or delay caused by freight movements** and any mitigation strategies	Chapters 3, 6, 7, and 8
Freight investment plan that includes a list of **priority projects** and describes **investment and matching funds**	Chapter 8
Consultation with the State **freight advisory committee**	Ongoing throughout plan development. Seven specific meetings (see Chapter 1)

LIST OF ACRONYMS

3D	Three Dimensional
AADTT	Average Annual Daily Truck Traffic
AFB	Air Force Base
ATCMTD	Advanced Transportation and Congestion Management Technologies Deployment
BOT	Board of Transportation
BTI	Buffer Time Index
BTS	Bureau of Transportation Statistics
CAMPO	Capital Area Metropolitan Planning Organization
CCX	Carolina Connector Intermodal Rail Terminal
CLT	Charlotte Douglas International Airport
CRFC	Critical Rural Freight Corridor
CRTPO	Charlotte Regional Transportation Planning Organization
CTP	Comprehensive Transportation Planning
CUFC	Critical Urban Freight Corridor
DoD	Department of Defense
DMS	Dynamic Message Signs
DOT	Department of Transportation
ED&IR	Economic Development and Intergovernmental Relations
EHS	Extremely Hazardous Substance
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FAC	Freight Advisory Committee
FAF	Freight Analysis Framework
FAST Act	Fixing America's Surface Transportation Act
FDI	Foreign Direct Investment
FHWA	Federal Highway Administration
FRRCSI	Freight Rail and Rail Crossing Safety Improvement
FSD	Freight System Designation
GHG	Greenhouse Gas
GPS	Global Positioning System
GSO	Piedmont Triad International Airport
HazMat	Hazardous Material
INFRA	Infrastructure For Rebuilding America
ISO	Kinston Regional Jetport
ITRE	Institute for Transportation Research and Education
ITS	Intelligent Transportation Systems
LEPC	Local Emergency Planning Committee
LOS	Level of Service
LTL	Less-than-load
MAP-21	Moving Ahead for Progress in the 21st Century
MCAS	Marine Corps Air Station
MOTSU	Military Ocean Terminal Sunny Point
MOVES	MOtor Vehicle Emission Simulator
MPO	Metropolitan Planning Organization
NCAMPO	North Carolina Association of Metropolitan Planning Organizations
NCARPO	North Carolina Association of Rural Planning Organizations
NCDOT	North Carolina Department of Transportation
NCPFN	North Carolina Priority Freight Network
NCPHFN	North Carolina Priority Highway Freight Network
NCRR	North Carolina Railroad Company
NCSPA	North Carolina State Ports Authority
NHFN	National Highway Freight Network
NHFP	National Highway Freight Program
NHS	National Highway System
NS	Norfolk Southern Railway
PHFN	Priority Highway Freight Network
PHFS	Primary Highway Freight System
RDU	Raleigh-Durham International Airport
Ro/Ro	Roll-on/roll-off
RPO	Rural Planning Organization
STB	Surface Transportation Board
STC	Strategic Transportation Corridors
STI	Strategic Transportation Investments
STIP	North Carolina's State Transportation Improvement Program
STS	Ship-to-Shore
TEU	Twenty-foot equivalent unit
THMT	Truck Highway Miles Traveled
TNC	Transportation Network Company
TTTR	Truck Travel Time Reliability
USACE	U.S. Army Corps of Engineers
USAF	United States Air Force
USCG	United States Coast Guard
V/C	Volume-to-Capacity Ratio
VIUS	Vehicle Inventory and Use Survey
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
WACF	World Air Cargo Forecast
WIM	Weigh in Motion
WTRY	Wilmington Terminal Railroad

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THE NORTH CAROLINA STATEWIDE MULTIMODAL FREIGHT PLAN

This plan represents the State's first statewide multimodal freight plan. The North Carolina Department of transportation recognizes the need to have a plan that:

- Sets specific multimodal transportation goals, strategies, and actions that will contribute to North Carolina job growth, improved economic competitiveness, and enhanced quality of life;
- Provides clear, compelling freight-specific recommendations that support the 25-year vision and addresses the criteria in the Strategic Transportation Investments (STI) prioritization process;
- Offers strategies for helping elected officials and the general public better understand the value of freight transportation investments and their economic benefits; and
- Positions North Carolina to capitalize on the creation of the National Highway Freight Program developed as part of the Fixing America's Surface Transportation (FAST) Act, which requires states to develop State Freight Plans.

This first section introduces North Carolina's State Freight Plan. **Chapter 1** discusses the approach, methods and data sources, and demonstrates how the North Carolina Statewide Multimodal Freight Plan meets Federal requirements. **Chapter 2** describes North Carolina's freight vision, goals, and objectives, and demonstrates how this Plan supports the National Goals, the 25 Year Vision for North Carolina, the 2040 Plan, and other planning efforts in the State.

1 NORTH CAROLINA'S FIRST STATEWIDE MULTIMODAL FREIGHT PLAN

North Carolina's freight system plays a critical role every day for every resident and business. Delivering goods to the State's businesses and residents, keeping the manufacturing plants operating, the store shelves stocked, the medicine flowing at area medical facilities, and food on the table.

The State's freight infrastructure faces continually changing demands due to changing freight trends and developments, including:

- Significant population growth in the State's urban areas;
- Adoption of new technologies such as autonomous and connected trucks;
- Concentration of manufacturing facilities along major trade corridors; and
- Increasing demand for same-day and next day deliveries, which will continue to stress the capacity and operations of the State's highways, rail, and port facilities.

As North Carolina adapts to these changing conditions in an era of constrained resources, NCDOT must continue to balance freight mobility needs with passenger needs, environmental, social, and financial concerns while addressing rapidly rising maintenance costs on aging infrastructure.

NCDOT has recognized the link between the statewide transportation system, job creation, and economic expansion in its 25-Year Vision and development of strategic corridors.

The approach to developing this Plan, links together various analyses – freight system, commodity flow, trade/economic, industry supply chain, and institutional (e.g., regulations and public policies) – in a way that identifies the most critical infrastructure, operational, institutional, and market-related issues and chokepoints impacting the State's freight transportation system. The Plan addresses both current and future needs and opportunities. It combines the traditional planning approach with scenario planning to allow North Carolina to consider investments under a variety of plausible futures that ensures the most robust and effective recommendations move forward.

Federal Legislation

The Fixing America's Surface Transportation Act (FAST Act) of 2015 is a five-year, $305 billion transportation bill providing funding for the nation's transportation planning and infrastructure investments. The FAST Act includes several provisions specifically geared to improving the performance of the national freight network and supporting investment in freight-related surface transportation projects. At the national level, this includes the development of a National Multimodal Freight Policy, National Freight Strategic Plan, and designation of a National Multimodal Freight Network. On the funding side, it also includes $6.3 billion in formula funding for freight projects on the National Highway Freight Network (NHFN) and a $4.5 billion discretionary, freight-focused grant program for states, metropolitan planning organizations (MPOs), local governments, and other entities.

The North Carolina Statewide Multimodal Freight Plan was developed in compliance with FAST Act requirements for state freight plans to ensure the State has access to Federal funding opportunities and competitive grant opportunities. A table summarizing this plan's compliance with the FAST Act requirements is included as cover page.

Freight Plan Methods and Data Overview

Completing a comprehensive multimodal state freight plan requires transforming data from a myriad of sources into information that is reliable and meaningful to accomplishing the goals of the Plan. Key sources of data used in the plan included stakeholder input, previous studies, and numerous statistical and modeling datasets and tools.

Stakeholder Outreach

Outreach to industry and key stakeholders was a critical component in developing North Carolina Statewide Multimodal Freight Plan. In order to better understand the needs and issues faced by producers, shippers/receivers, and carriers, as well as the regional planning organizations and economic development organizations throughout North Carolina, thoughtful stakeholder outreach and engagement was structured to receive targeted feedback through the development of the Plan. There are five critical elements of this outreach: the State Freight Advisory Committee, Metropolitan Planning Organizations (MPOs) and Rural Planning Organizations (RPOs), Board of Transportation Economic Development and Intergovernmental Relations committee, freight and industry stakeholder interviews, and the Secretary of Transportation briefings.

NCDOT convened the North Carolina Freight Advisory Committee (FAC) to advise on freight-related priorities, issues, projects, and funding needs; act as forum for discussion of transportation decisions affecting freight mobility; communicate and coordinate regional priorities with other organizations; and promote sharing of information between

sectors. The FAC members are reflective of the diverse range of stakeholders that own, operate, plan, maintain, and conduct business utilizing North Carolina's freight infrastructure. Its members include both the public and private sectors.

The project team interviewed over forty freight and industry stakeholders that helped inform the freight system profile and needs assessment. These stakeholders included: freight shippers and receivers, carriers, freight terminal/facility operators, industry associations, government agencies such as the Department of Agriculture and the Department of Commerce, regional and statewide economic development organizations, and NCDOT Divisions. In addition, industry roundtables with North Carolina Trucking Association and regional freight advisory committees were conducted.

The project team engaged all of the North Carolina Metropolitan Planning Organizations and Rural Planning Organizations by conducting interviews, webinars, workshops and attending NCARPO and NCAMPO quarterly meetings to communicate updates on the Plan development and collect input on freight system profile, needs assessment, freight system designation, freight performance measures, and project identification and screening. Additionally, the project team presented to the BOT ED&IR committee and briefed the Secretary of Transportation on the Freight Plan progress and key analysis results.

Data and Previous Studies

The North Carolina Statewide Multimodal Freight Plan draws from a variety of proprietary and publicly-available data sources to analyze freight demand, commodity flows, business climate, freight transportation network performance, assets and infrastructure, and demographic and socioeconomic statistics. This final plan document is compiled from a series of detailed technical reports available at www.NCDOT.gov.

STAKEHOLDER ENGAGEMENT TO INFORM THE PLAN

North Carolina Freight Advisory Committee Meetings

- Formally met 7 times during the Freight Plan development

Metropolitan Planning Organizations (MPOs) and Rural Planning Organizations (RPOs) Outreach

- Interviews, workshops, webinars, and presentations in quarterly NCARPO and NCAMPO meetings

Board of Transportation Economic Development and Intergovernmental Relations Committee Presentations

- Presented at the ED&IR committee meetings 5 times

Secretary of Transportation Briefings

- Briefed the Secretary on the Plan progress 4 times

Freight and Industry Stakeholder Interviews

- Shippers and Receivers
- Carriers
- Ports and Airports
- Railroads
- North Carolina Railroad Company
- Industry Associations (e.g., North Carolina Trucking Association, and Farm Bureau)
- NCDOT (e.g., Rail Division, Safety and Mobility, Division Engineers)
- Department of Agriculture, Department of Commerce, North Carolina Chamber of Commerce, Regional Economic Development Organizations
- Military Bases

NORTH CAROLINA FREIGHT ADVISORY COMMITTEE

DATA SOURCES USED IN NORTH CAROLINA STATEWIDE MULTIMODAL FREIGHT PLAN

Category	Data Source	Data Type
Freight System Demand and Commodity Flows	FHWA Freight Analysis Framework Version 4	Origin-Destination commodity flows
	U.S. Bureau of Trade Statistics	Imports and exports statistics
	U.S. Energy Information Administration	Petroleum products stocks and shipments
	U.S. Department of Defense	Military shipments sample
	North Carolina Department of Transportation	Truck counts
	North Carolina State Ports Authority	Port traffic and forecast
	Surface Transportation Board (STB) Confidential Carload Waybill Sample	Rail freight origin-destination commodity flows
	Bureau of Transportation Statistics (BTS) TranStats Database	Air cargo by airport
	Boeing World Air Cargo Forecast (WACF)	Air cargo demand forecast
	North Carolina Department of Public Safety Emergency Management	Hazardous Material flows
Establishment Data	InfoUSA	Business establishments employment, area, and location
Transportation Cost	TranzAct Freight Waybills	Freight billing data
Network Performance	National Performance Management Research Data Set	Truck travel times
	NCDOT Statewide Model	Truck demand and LOS (existing and forecast)
Safety	North Carolina Department of Transportation	Truck-involved crashes
	Federal Railroad Administration Office of Safety Analysis	At-grade crossings inventory, accidents and incidents
Assets and Infrastructure	FHWA Office of Planning, Environment, and Realty	Freight intermodal connectors
	North Carolina Department of Transportation	Highway network, rail network, weigh stations, at-grade rail crossings, bridges, tunnels, work zones, truck size, and weight
	U.S. Pipeline and Hazardous Materials Administration	Pipeline network
	U.S. Energy Information Administration	Hazardous material terminals
	North Carolina State Ports Authority	Port infrastructure characteristics
	Oak Ridge National Laboratory	Rail network
	National Transportation Atlas Database	Transportation facilities
Demographic and Socioeconomic Data	U.S. Census Bureau	Population, Longitudinal Employer-Household Dynamics
	U.S. Bureau of Labor Statistics	Industry employment and wages
	U.S. Bureau of Economic Analysis	Gross Domestic Product
	U.S. Energy Information Administration	State energy prices and expenditures
	Moody's Analytics	Cost of doing business review
	North Carolina Office of Management and Budget	Population projections

Past planning efforts that contributed to the development of this Plan include:

- 25 Year Vision for North Carolina: Mapping Our Future
- 2011 Governor's Logistics Task Force: Final Report
- 2012 North Carolina Maritime Strategy
- 2012 North Carolina Statewide Transportation Plan – 2040 Plan
- 2013 North Carolina Jobs Plan: Recommended Strategies for Economic Growth 2014-2024
- 2014 Economic Contribution of the North Carolina Ports study by the Institute for Transportation Research and Education (ITRE)
- 2015 North Carolina Transportation Network and Strategic Transportation Corridors Framework
- 2015 Strategic Plan of the North Carolina State Ports Authority
- 2015 Comprehensive State Rail Plan
- 2015 Eastern Infrastructure Improvement Study: A Report to the North Carolina General Assembly
- 2016 Greater Charlotte Regional Freight Mobility Plan
- 2016 North Carolina's Supply Chain: Conduit for Commerce and Economic Development
- 2016 Evaluation of a Proposed Intermodal Terminal (CCX) in Rocky Mount

2 OUR FREIGHT TRANSPORTATION VISION

North Carolina's multimodal freight transportation network is meeting the growing needs of the State to compete globally for quality jobs, provide safe and efficient people and goods mobility, and build quality communities for today and the future.

NCDOT developed a freight vision, and goals and objectives to meet that vision which drives performance measures and freight investment decision-making. These vision, goals, and objectives are informed by:

- The Freight Advisory Committee (FAC);
- The 25-year Vision for North Carolina;
- The NCDOT's 2040 Plan and the Strategic Transportation Corridors; and
- National freight policy goals defined in the 2012 Moving Ahead for Progress in the 21st Century Act (MAP-21) and the 2015 Fixing America's Surface Transportation Act (FAST Act).

To achieve this vision, goals and objective were defined. The goals primarily focus on enabling economic growth and competitiveness, with a significant focus on trade and access to markets and population centers. Another focus is on system performance goals from the perspective of passengers, shippers, carriers, and stakeholders who are impacted by the operational performance, reliability, and resilience of the freight system. In addition, the plan goals and objectives ensure environmental stewardship through minimization of freight-induced negative impacts on natural, cultural and environmental resources, and promote deployment of advanced technologies, and fostering public-private partnerships.

North Carolina Department of Transportation (NCDOT) and the Freight Advisory Committee (FAC) agreed on eight strategic goals for North Carolina's freight transportation system. These strategic goals are intended to guide current and ongoing freight-related transportation planning efforts and serve as a touchstone by which to gauge the success of these efforts. In addition to articulating goals for the State's freight transportation system, a number of objectives are identified for each goal. Accomplishment of these objectives will make concrete, measurable progress toward the attainment of the freight transportation system goals and ultimate realization of the North Carolina freight transportation system vision.

SUPPORT OF NATIONAL GOALS AND PREVIOUS STATE PLANNING EFFORTS

NC Freight Plan	Economic Competitiveness	Mobility and Reliability	Safety and Security	Innovative Technology	Asset Management	Environmental Sustainability and Livability	Collaboration and Partnership	Sustainable Funding
MAP-21 and FAST Act	Economic Competitiveness	Innovation and Advanced Technology			State of Good Repair	Environmental	Multistate Connectivity	
	Economic Efficiency and Productivity	Reliability	Safety, Security, Efficiency, Resiliency					
NC 25 Vision	Economic Competitiveness	Mobility and Reliability	Safety and Security	Innovative Technology	Asset Management	Environmental Sustainability and Livability	Collaboration and Partnership	Sustainable Funding
NC 2040 Plan	Economic Opportunity	Mobility and Reliability	Safety and Security	Advanced Technology	Asset Management	Environmental Stewardship	Collaboration and Partnership	Sustainable Investments and Financial Stewardship
NC STC	Economic Development and Prosperity	Mobility, Reliability, and Connectivity						

NORTH CAROLINA FREIGHT GOALS AND OBJECTIVES

Economic Competitiveness

Enhance economic development opportunities and competitiveness

- Support the State's freight economy sectors to attract quality growth and high paying jobs
- Improve the ports and the airports to increase exports to key trading partners and to fully participate in the global markets
- Leverage state-owned logistical assets such as the maritime ports to form cooperative alliance and accommodate increased cargo flow from the introduction of mega-container vessels and the opening of the expanded Panama Canal
- Improve access to freight-related industries, and potential industrial or mega development sites
- Improve mobility and access to intermodal operations and facilities
- Expand access to competitive multimodal transportation options
- Develop strategic highway and rail connections with regional trading partners
- Collaborate with local government in improving the "last mile" freight operations and urban area logistics

Mobility and Reliability

Improve freight system efficiency, reliability, and resiliency

- Enhance integration and connectivity across and between freight modes
- Strategically expand system capacity where existing infrastructure can longer be optimized
- Improve mobility and travel time reliability by managing traffic congestion
- Improve system productivity by lowering transportation costs
- Improve incident management system by partnering with Emergency Response and Law Enforcement agencies
- Reduce road closures during peak season and peak hours for construction and maintenance
- Coordinate traffic signals on U.S. and North Carolina routes to improve flow of through traffic
- Monitor and evaluate system performance to assess truck travel time reliability, operational conditions and effectiveness of congestion management strategies
- Expand multimodal access to ports, airports and other intermodal and logistics hubs
- Maintain alternate access routes and redundancy in the system for rapid recovery from weather or other disaster events

Safety and Security

Enhance freight transportation safety and security

- Reduce fatality, 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
- Improve system security to protect people, cargo and critical infrastructure assets

Innovative Technology

Support adoption and deployment of new freight technologies

- Promote the adoption of safety, fuel efficiency, telematics, alternative fuel, electronic logging device, and other technologies for the trucking industry
- Implement adaptive signal control and other ITS safety solutions on key freight transportation corridors and freight facilities
- Foster safe future use of autonomous vehicles and drones in freight transportation
- Foster the adoption of Mobility-as-a-Service or similar last mile freight delivery operations through freight-focused planning and projects

Asset Management

Improve freight infrastructure conditions and preservation

- Maintain, preserve, and extend the service life of existing and future freight transportation infrastructure serving all modes
- Monitor infrastructure conditions and prepare an annual freight state-of-the-system report covering all modes

Environmental Sustainability and Livability

Protect and enhance the natural environment

- Reduce freight-induced negative impacts on natural, cultural and environmental resources
- Reduce mobile source emissions, GHG, and energy consumption
- Reduce noise, vibration and other freight-induced negative impacts on residential communities
- Improve quality of life for those communities most impacted by freight operations

Collaboration and Partnership

Foster public-private partnerships and collaboration with freight stakeholders

- Develop and nurture partnerships with private industries with significant role in the State's economy
- Provide a forum for public agencies, industry groups, U.S. military, and local business chambers to coordinate and integrate freight movements
- Provide a forum for participation by freight shippers and carriers in the State
- Improve access to data and information such as traffic speed, incidents, and construction management information
- Expand external communication through social media and mobile apps

Sustainable Funding

Ensure good fiscal management and sustainable funding for the State's freight network

- Secure funding for projects with long-term benefits or high benefit-cost ratio
- Leverage Federal funding in freight projects
- Maintain high standards in management of public assets and resources

FUELING NORTH CAROLINA'S ECONOMY

In North Carolina, a multimodal freight transportation network which includes truck, rail, air, water, and pipeline transportation, provides shipping alternatives for all types of commodities produced or consumed in the State. North Carolina also is home to a large manufacturing industry. Efficient transportation services are necessary in order to keep these companies competitive in regional, national, and global economies. A large consumer market is present in big metropolitan areas, which drives the demand for goods shipped from other states and countries.

Chapter 3 takes stock of North Carolina's freight assets and identifies the most pressing needs and issues facing that system. **Chapter 4** focuses on priority assets by identifying the North Carolina Priority Multimodal Freight Network, which is the part of the transportation systems that is most important to moving freight in the State. **Chapter 5** discusses how freight transportation drives the North Carolina's economy, supports supply chains of key industries, and responds to national and statewide economic trends impacting how and where freight moves.

3 TAKING STOCK OF OUR EXTENSIVE FREIGHT RESOURCES

The movement of goods is a major contributor to the North Carolina economy. North Carolina's freight assets are the backbone of the State's economic vitality, enabling the movement of millions of tons of freight each year. The State's freight transportation system is an important component of business retention and attraction. According to the Area Development 30th Annual Corporate Survey, an annual questionnaire to identify the key factors influencing site location decisions, several site selection factors identified in the survey were related to transportation.[1]

Ranking of transportation factors influencing site location decisions:

- 2 Highway accessibility*
- 8 Proximity to major markets and suppliers
- 19 Inbound/outbound shipping costs
- 20 Proximity to suppliers
- 21 Accessibility to major airports
- 22 Water accessibility
- 27 Railroad service
- 24 Waterway or ocean port accessibility

* Highway accessibility ranked first or second for each of the 30 years the study has been conducted.

An inventory of the State's freight assets and an assessment of the role those assets play in supporting statewide freight transportation is the foundation of conducting the needs assessment and developing the most effective freight investment plans.

[1] Area Development Online. 30th Annual Corporate Survey. Q1/2016. Available at https://issuu.com/areadevelopment/docs/survey-q1_2016issue. Accessed August 11, 2017

HIGHWAY FREIGHT ASSETS

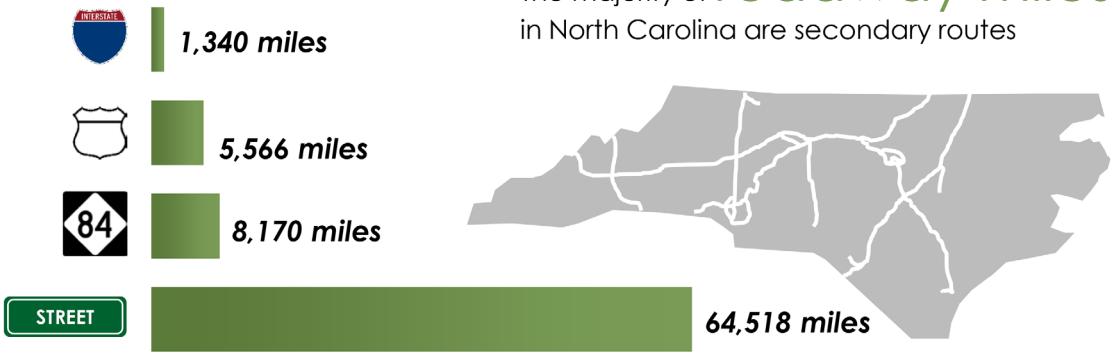
Highway transport is the primary mode of goods movement. By far, it accounts for the largest share of overall tonnage by mode representing more than 80 percent of total inbound, outbound, internal, and pass-through flows for all modes combined in North Carolina. The highway system is a critical element of the multimodal freight system as the majority of goods transported in the State utilize the highways for at least one leg of their trips.

Inventory

North Carolina maintains approximately 79,600 miles of roadway. Secondary Roads account for the largest share of the state-maintained system, over 80 percent of all roads. State roads (i.e., North Carolina Routes) are a distant second, comprising about 10 percent of the system. U.S. routes and interstate highways comprise the remainder of the state-maintained system at 7 percent and 2 percent, respectively.

Demand

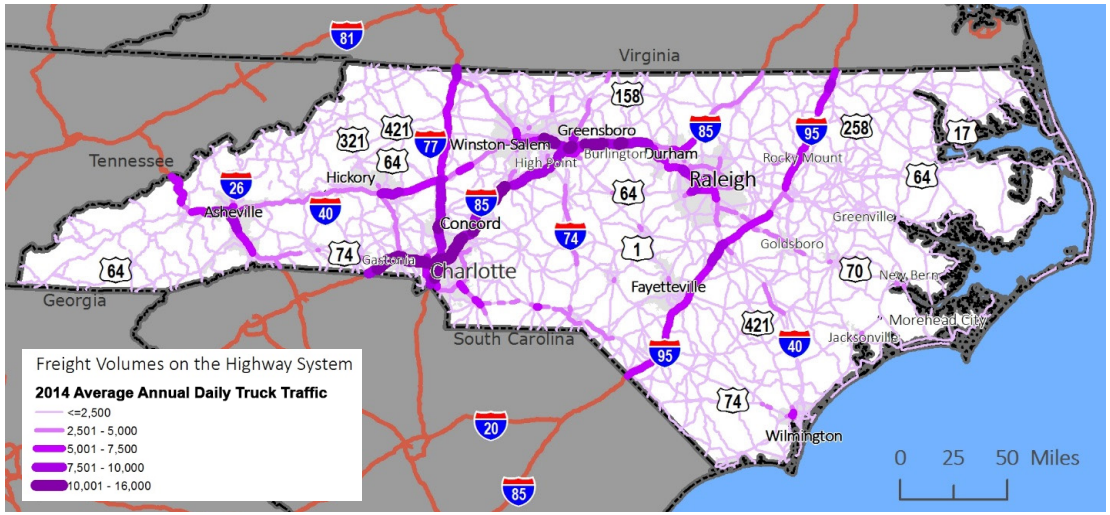
Most of North Carolina's truck flows occur on the interstate highway system. In general, I-40/I-85 is the heaviest utilized freight corridor in North Carolina based on truck volumes. Truck volumes on I-40/I-85 range from 10,000 to 16,000 trucks per day. In particular, the highest truck volumes occur on I-40/I-85 between Greensboro and Durham – nearly 16,000 trucks per day utilize this corridor.



The majority of roadway miles in North Carolina are secondary routes

As large numbers of freight-intensive industries are located along this corridor, I-85 is important to freight movements in which the State has a potential economic interest as local shippers are likely heavy users of the highway. Other interstate highways with particularly high truck volumes include I-77, I-40, I-26, and I-95, with portions carrying between 8,000 to 11,000 trucks daily.

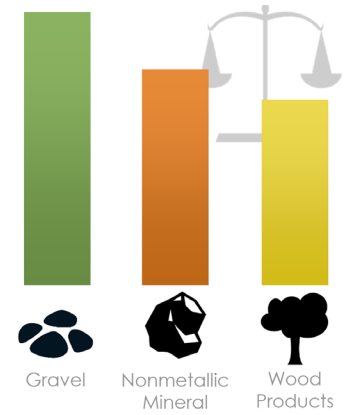
There also are noninterstate highways that are important freight corridors as indicated by daily truck volumes. Some of these highways achieve daily truck volumes that are comparable to those experienced by the interstate highway system. Among the largest noninterstate highway freight corridors are U.S. 74 and U.S. 70. Portions of U.S. 74 transports nearly 5,000 trucks per day. U.S. 70 carries nearly 3,000 trucks daily on its busiest segments.



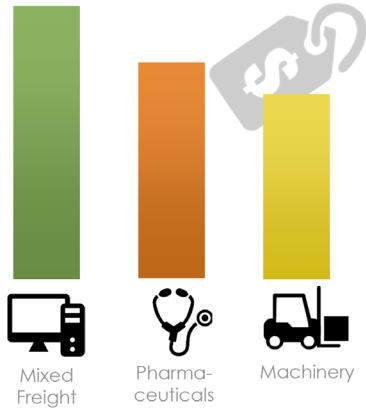
In 2015, nearly 430 million tons of cargo worth $765 billion were transported over North Carolina's highways. Nearly 49 percent of total truck tons began and ended within North Carolina. Truck flows inbound to North Carolina and outbound from the State had nearly equal shares of total truck flows, which allows carriers to provide more competitive truck rates for the region's shippers since they have more opportunities to reduce empty hauls. Through truck flows, those traveling through North Carolina without stopping to make a pick-up or delivery, comprised about 18 percent.

The top commodities, by weight, traveling on North Carolina's highways are bulk goods such as gravel, non-metallic mineral products, and wood products. However, the highest-value goods transported include mixed freight (i.e., consumer products and other miscellaneous products), pharmaceuticals, and machinery.

Demand for highway freight is expected to increase to over 614 million tons of cargo by 2045. This represents an increase of nearly 43 percent over 2015 flows. The majority of truck flows, about 43 percent, are expected to continue to be internal to North Carolina, although internal truck tonnage is expected to have moderate growth (27 percent) over the next 30 years. Inbound (17 percent) and outbound (21 percent) flows are expected to maintain somewhat balanced shares of truck flows.



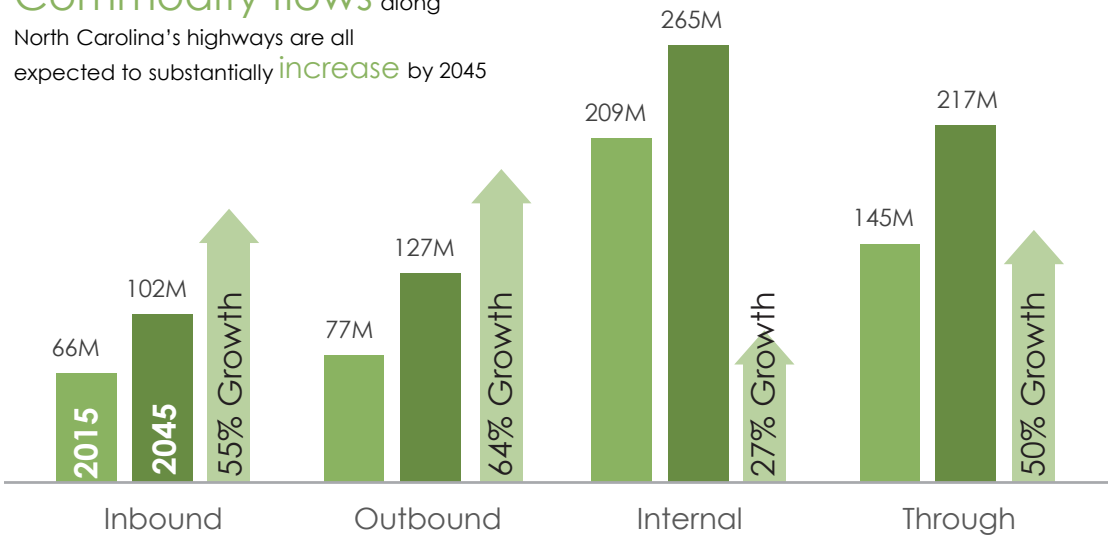
are highway's
Top 3 Commodities
by total tons



are highway's
Top 3 Commodities
by total value

A 43 percent increase in total tonnage over the next thirty years, especially in bulk commodity groups, will place significant pressure on North Carolina's highway system. It is expected that many of the truck trips associated with the highway commodity flows will travel on non-interstate roadways for some portion of the trip. In the absence of a modal shift, motor carriers will be forced to accommodate demand with heavier and more frequent trucks. This will contribute to congestion in the State's urban areas as heavy trucks compete with commuters for highway capacity. It will also further strain pavements and bridges.

Commodity flows along North Carolina's highways are all expected to substantially **increase** by 2045



Conditions and Performance

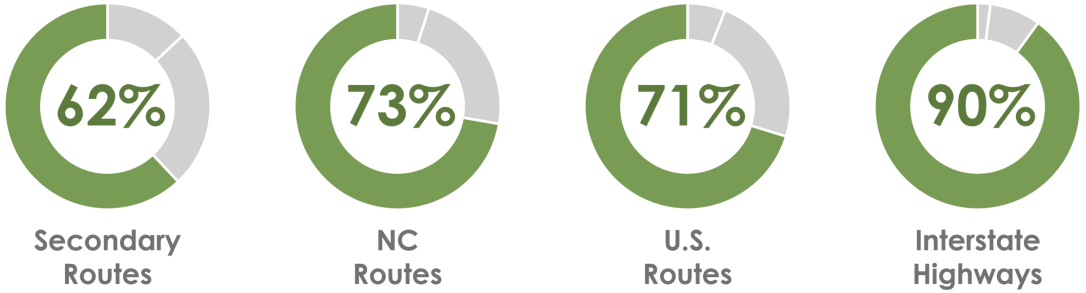
Overall, pavements are in good condition across the State. Interstates have the highest percentage of route mileage in "Good" condition with 90 percent, and secondary routes have the highest percentage of route mileage in "Poor" condition with 13 percent.

Poor to Fair pavement conditions are observed on several high truck volume routes. For instance, the U.S. 64, U.S. 264, and U.S. 70 corridors, which connect Eastern Carolina to the Triangle Region, all have stretches in Fair or Poor condition. This directly affects the performance of truck trips to the Port of Morehead City and will impact future truck trips to the planned CSX rail intermodal

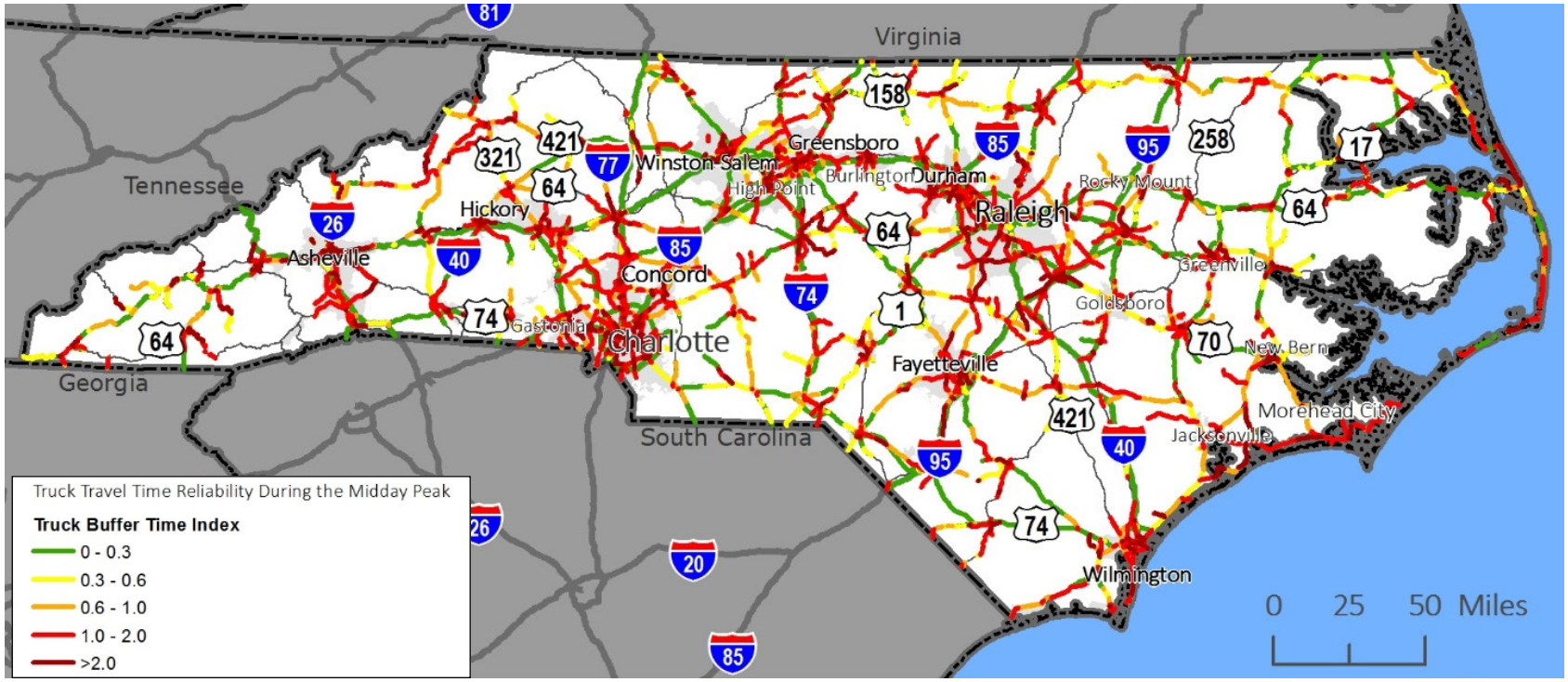
facility in Rocky Mount should conditions worsen. U.S. 74, which links the Port of Wilmington to the Charlotte Region, has mostly Good pavement conditions though conditions worsen as it approaches the City of Charlotte.

For the most part, truck congestion is limited to the State's largest metropolitan areas – the Triangle Region, the Triad, and the Charlotte metropolitan area. These urban areas also have the least reliable truck travel time. These areas all have significant commuter activity on the interstate highway system, which competes with truck traffic.

The percentage of pavement in good condition in North Carolina varies by roadway type



Buffer Time Index (BTI) is the ratio of the difference between the 95th percentile truck travel time and average travel time to the average travel time. Thus, the BTI represents the extra time (i.e., buffer) that must be factored into scheduling to ensure an on-time arrival for 95 percent of truck trips. For example, a BTI equal to 0.5 indicates that a trip that on average takes 30 minutes would need 50 percent more time or an extra 15 minutes (for a total scheduled travel time of 45 minutes) to reach its destination on time with confidence.



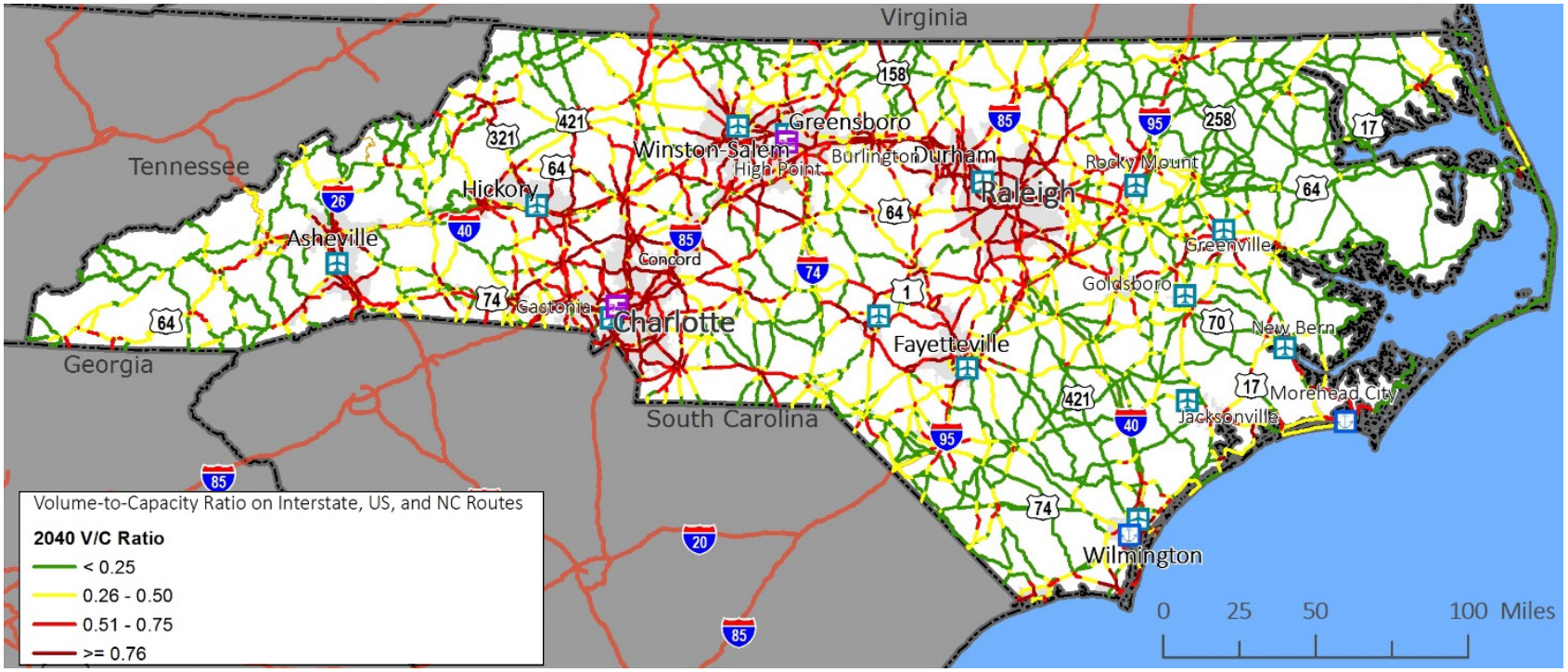
- **Triangle Region:** truck congestion is most pronounced near Raleigh, along the I-40 and I-440 corridors. There also is significant congestion along I-540 near its interchange with I-40.
- **Charlotte Region:** truck congestion is heaviest along I-77 through the core of the region and north of the I-485 perimeter. The southwest portion of I-485 (between U.S. 74 and I-85) also exhibits heavy truck congestion.
- **Triad Region:** truck congestion is most pronounced along the future I-285 corridor and the portion of I-40 bounded by U.S. 421 in Winston-Salem.

Like truck congestion, truck travel time is least reliable in these same urban areas.

- **Triangle Region:** poor travel time reliability is most pronounced along I-40 and I-440 through the City of Raleigh. Along the I-40 corridor, poor reliability also extends west from Raleigh to Durham and south towards the I-40/U.S. 70 interchange. Poor reliability is also exhibited along I-540 near its interchange with I-40.
- **Charlotte Region:** truck travel time reliability is poorest along I-77 through the core of the region and north of the I-485 perimeter. The southwest portion of I-485 (between U.S. 74 and I-85) and the northern portion of I-85 (from the I-485 perimeter to its interchange with U.S. 52 in Salisbury) also exhibit poor reliability.
- **Triad Region:** travel time reliability is poorest along the future I-285 corridor and the portion of I-40 bounded by U.S. 421 in Winston-Salem.

Truck-involved crashes also are a major concern to North Carolina. Between 2011 and 2015, over 49,000 truck-involved crashes occurred in the State, with the total number of crashes increasing in each year. Ten counties accounted for nearly half of all truck crashes in the State, all of which are located within one of the State's major metropolitan regions: Charlotte, Triangle, Triad, Asheville, and Fayetteville regions.

Volume-to-Capacity Ratio (V/C) is a measure that reflects mobility and quality of travel of a facility or a section of a facility. V/C is a conventional level-of-service measure for roadways, calculated by dividing the total volume of traffic on a roadway by its capacity. V/C ratio is generally reported as a decimal, for example, a V/C of 1.00 indicates the roadway facility is operating at its capacity and a V/C of 0.5 indicates the roadway facility is operating at 50 percent of its capacity. The 2040 V/C ratio shows the projected mobility conditions and congestion on the roadways by 2040.

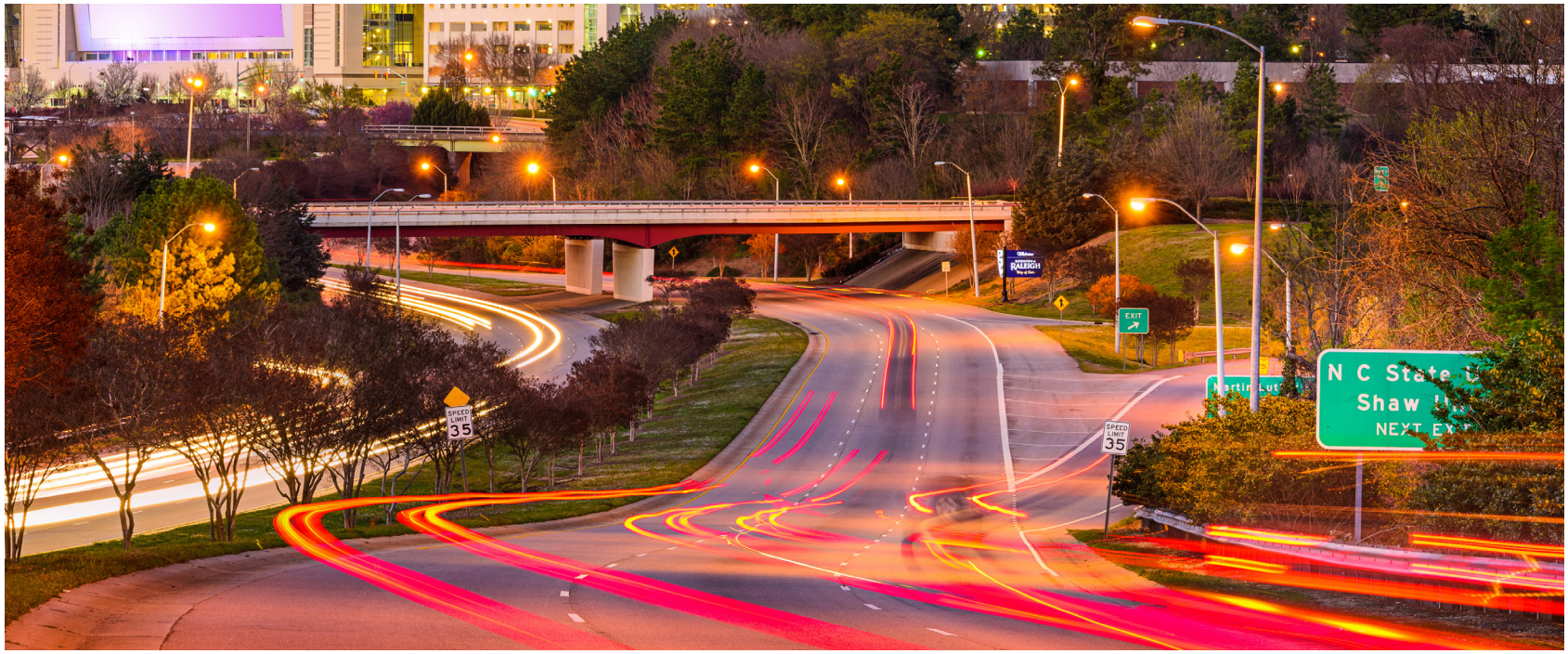


Though most of the State system provides for uncongested and reliable truck travel, there are portions of the system where performance is challenged, particularly major metropolitan areas. Traffic volumes on North Carolina highways are predicted to grow by a substantial amount, which will result in capacity-constrained conditions on several corridors that are important to freight mobility. Furthermore, the highway system will remain the predominant mode by which freight is moved through and within the State. Mitigating the effects of growth, especially on corridors with existing challenges, is important for moving forward.

Corridors that may be exacerbated by growth include: in the Triangle Region, I-40, I-440, and I-540 near its interchange with I-40; in the Charlotte Region, I-77 through the core of the region and north of the I-485 perimeter, and I-485 (between U.S. 74 and I-85); and in the Triad Region, Future I-285, and I-40 corridors.

Over the past 5 years, over
1,100 severe truck crashes
have occurred in North Carolina

Over the past 5 years,
severe truck crashes
in North Carolina have slowly
increased



FREIGHT RAIL ASSETS

Rail transport is one of the most cost effective means of moving freight and it is vital to many of North Carolina's key exporting industries.

Inventory

In North Carolina, there are over 3,200 miles of railroad serving 86 of the State's 100 counties. The State's network features two Class I railroads, Norfolk Southern Railway (NS) and CSX Transportation (CSX), and 20 short line railroads that connect businesses and industries to the Class I network. CSX and NS operate approximately 70 percent of the State's rail system. Twenty short lines and switching companies operate the remainder of the system. Some short lines are managed by railroad holding companies like Genesee and Wyoming, Watco, and RJ Corman. In addition, the North Carolina Railroad (NCRR) Company owns and manages a 317-mile corridor extending from the Port of Morehead City to Charlotte. NS operates along the corridor through an exclusive operating and maintenance agreement.

North Carolina's rail network includes two major classification yards, three intermodal terminals, one future intermodal terminal, two deep water ports, and numerous transload facilities. The rail-served sites include proprietary industrial facilities and third-party for-hire terminals that may have waterfront facilities or more concentrated operations at inland locations. Railroad freight movements are directly affected by the ease of connections and switching operations at state ports, barge and ocean terminals, and transload facilities, as well as connections with short lines and their industrial customers.

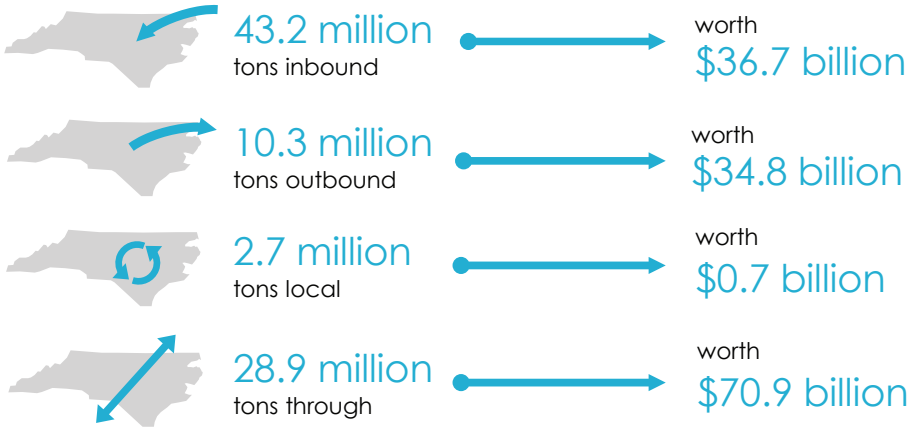
The freight rail network in North Carolina provides services to ports, power plants, mines, military installations, and industries including agriculture, forestry, plastics, furniture, food products, and chemicals.

Demand

Over 85 million tons of cargo worth $143 billion was transported on North Carolina's rail network in 2014. Of that tonnage, 10 percent was intermodal. Over half of rail flows traveled inbound to North Carolina, while just 12 percent traveled outbound from the State. This leads to an imbalance in rail flows and potentially higher costs for rail services.

Through-traffic makes up about one-third of total rail traffic tonnage, and more than half of the intermodal container traffic. Through-traffic is primarily on the north-south NS Crescent Corridor and CSX A Line. Generally, lower volume east-west Class I branch lines and short lines help connect North Carolina industries to the primary north-south Class I network. These branch lines-to-Class I-connections provide important national and international economic and transportation linkages for industries located in rural and small urban areas.

The top commodities moved by rail carload are coal, hazardous materials and chemicals.



coal

hazardous materials

chemicals

are rail's

Top 3 Carload Commodities

by total tons

freight-all-kinds

apparel

food products

are rail's

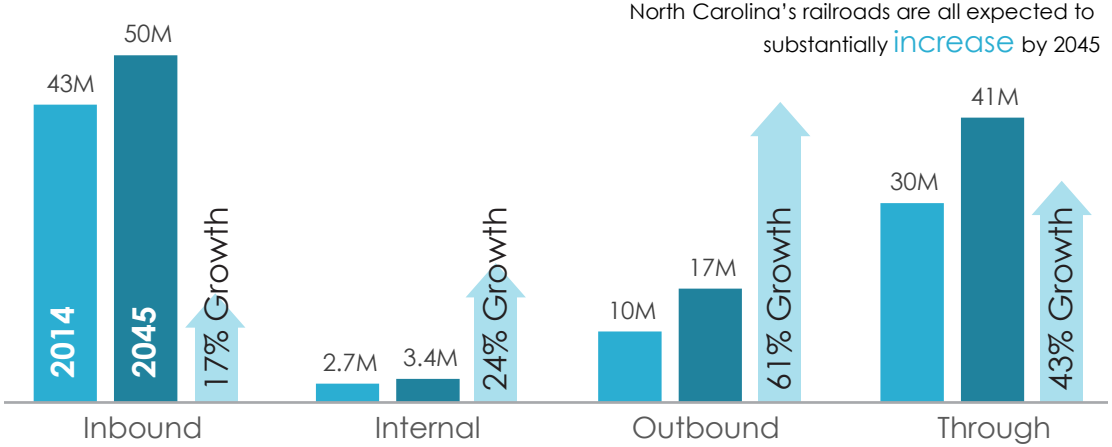
Top 3 Intermodal Commodities

by total tons

Intermodal commodities, such as consumer goods, can be difficult to tease apart and are referred to as FAK or Freight All Kinds. FAK is a mix of commodities being shipped together and are by far the largest category. Often FAK shipments are intended for a particular retailer (e.g., Lowe's or Wal-Mart). Beyond this general intermodal category, apparel and food products are top commodities. Pharmaceuticals are a major outbound commodity by value, now and through 2045. Growth for inbound freight flows includes textile goods, missile or space vehicle parts, and liquor.

Most of North Carolina's rail carload trade is inbound, mainly due to coal from West Virginia, Pennsylvania and Kentucky, though Illinois and Ohio are also notable trading partners. The rail intermodal trade is more balanced with outbound flows accounting for 55 percent. The top trading partners for intermodal rail include Illinois, Florida, Tennessee, Texas, California, and Georgia. Evaluating trading partners by weight shipped is an important metric since trade by weight can be translated into truckloads and used to identify corridors where truck-to-rail diversion might be studied to relieve highway congestion.

Commodity flows along North Carolina's railroads are all expected to substantially increase by 2045



By 2045, rail freight flows are expected to increase in North Carolina from 85.1 million tons in 2014 to 111.6 million tons in 2045, or on average 0.9 percent per year with the dollar value increasing at a faster rate of 1.9 percent per year. Intermodal rail flows are expected to grow from 8.9 million tons in 2014 to 15.4 million tons in 2045 – an average rate of 1.8 percent per year which matches the forecasted growth in value per year.

Outbound traffic is expected to grow much faster than inbound non-container traffic over the next 30 years. This is due to substantial amounts of heavy-weight coal moved in 2014 to North Carolina, which is forecasted to decline significantly by 2045.

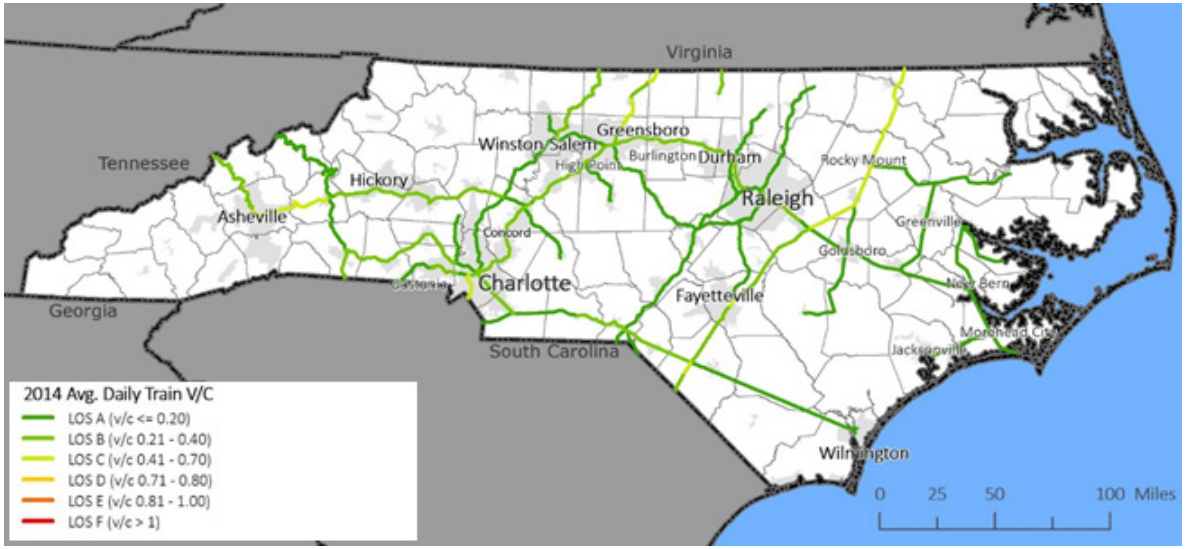
In response to the expected decline of coal traffic, the rail operators are moving to capture more intermodal business. Reduction in coal shipments passing through and terminating in North Carolina provides network capacity to accommodate growth in other commodities.

Through-traffic will grow at about 1.2 percent and 1.6 percent annually in terms of tons and value respectively. As NS and CSX invest more money into the Crescent Corridor and National Gateway Corridor, respectively, with rehabilitation of rail tracks to achieve faster delivery times, improve capacity, and run more efficient trains, North Carolina will experience growth in intermodal traffic.

Conditions and Performance

The Class I rail mainline network in the State is operating below capacity – which allows for the system to be able to accommodate maintenance work and recover quickly from incidents such as weather delays, equipment failures, and minor accidents.

Rail mainline segments projected to be near capacity (LOS grade of D) or higher by 2045 include Norfolk Southern's (NS) "R-line" between Charlotte, North Carolina – Pineville, North Carolina. In addition, rail mainline segments just below near capacity (with LOS grade C) need to be monitored over time, including: CSX's "A-line" between Pleasant Hill, North Carolina and Pembroke, North Carolina, and NS' "H-line" between Raleigh, North Carolina and Greensboro, North Carolina and between Greensboro, North Carolina and Danville, Virginia. These segments will also be affected by increases in Amtrak (passenger rail) services.



In addition, CSX' new Carolina Connector Intermodal Rail Terminal (CCX) near Rocky Mount will bring a high capacity facility to the I-95 corridor in the eastern part of the State, and will be able to support local shippers as well as the Port of Wilmington. This yard is expected to handle 260,000 container lifts by the 5th year of operation, resulting in potentially 65,000 additional rail cars on the "A-line."

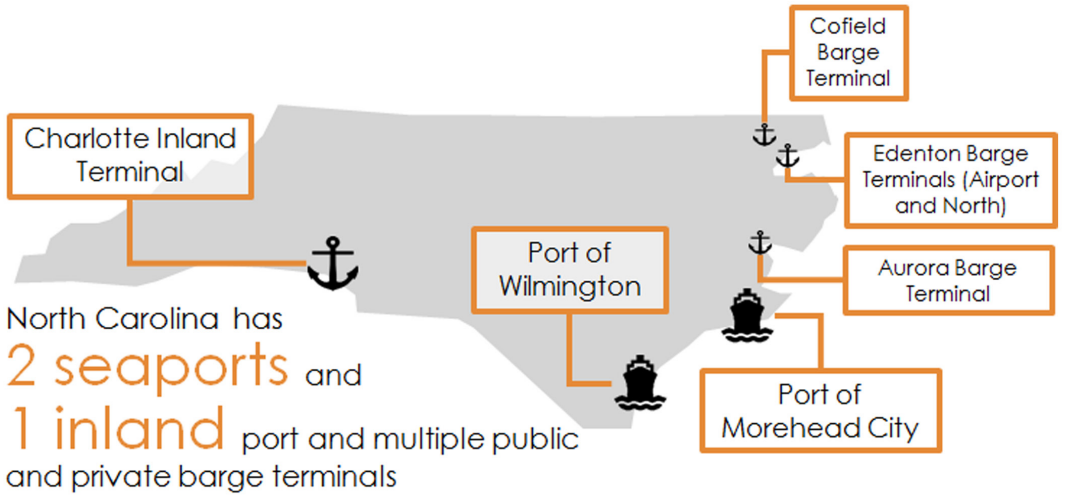
Currently, CSX's "A-line" between Pleasant Hill, North Carolina and Pembroke, North Carolina has several breaks in double-track sections, and in some cases there are differences in maximum speeds on second tracks. Also, CSX's "SE-line" between Pembroke, North Carolina and Hamlet, North Carolina has a low rail capacity due to single track operated without a signal. The siding on the "SE-line" is also not long enough to accommodate local trains, causing conflicts on the mainline. Freight trains from/to the CCX Carolina Connector Intermodal Rail Terminal will increase volume to capacity ratios on these lines.

Active plans to increase passenger service will also impact freight capacity. This includes the Piedmont Corridor service expansion presently underway, as well as the Southeast High Speed Rail initiative that envisions vastly increased service between Washington D.C., Richmond, and North Carolina, on a combination of dedicated and joint use rail lines.

NCDOT's Rail Division safety efforts include planning and implementing crossing safety programs, inspecting and overseeing infrastructure, and promoting rail safety through public awareness and education. Total rail accidents/incidents have remained fairly steady in the past decade, from 215 in 2006 to 194 in 2015, averaging 189 events per year. On average, 12 percent of these events resulted in a fatality.

MARINE FREIGHT ASSETS

North Carolina's marine freight network comprises more than its marine terminals and extends well beyond the State's coastal counties. State infrastructure supporting maritime trade includes its ports, waterways, highways, rail network, as well as inland production, logistics, and distribution centers that serve maritime and other freight modes.



Inventory

There are two deep-water ports in North Carolina, the Port of Wilmington and the Port of Morehead City, which are operated by the North Carolina State Ports Authority (NCSPA). The NCSPA handles containers, dry bulk, and breakbulk goods at the Port of Wilmington, which is 26 miles upriver on the Cape Fear River. The "S" curve shape of the Cape Fear River at the ocean entrance requires careful piloting for larger vessels, but has been proven to handle post-Panamax ships. The Port of Morehead City handles bulk and breakbulk goods and is located approximately four miles from the Atlantic Ocean. North Carolina also has an inland port, the Charlotte Inland Terminal (CIT).

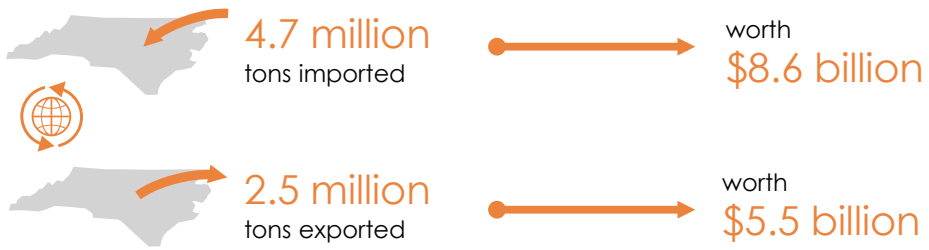
In addition to the two deep-water ports, there are four inland "wet" ports in North Carolina, all accessible via the Intracoastal Waterway. An inland wet port is a port not served by deep-water vessels, but instead by barge.

North Carolina's deep-water ports rank the closest and farthest among the regional peers in terms of distance to the ocean. Morehead City has a highly advantageous location that is closest to the ocean and nearly the best water depth – only Norfolk is currently deeper. Wilmington, by contrast, is the most distant from the ocean. In terms of water depth, it ranks at the bottom among its peers, tied with Savannah.

In terms of physical capacity, Wilmington currently has space for 600,000 TEUs, which is substantially less than neighboring ports of Norfolk, Charleston, and Savannah. The two North Carolina ports combined also have less breakbulk capacity than any of the neighbor ports. However, the North Carolina ports top all regional ports in bulk cargo capacities, each at well over 2 million short tons. Finally, although North Carolina ports have the capabilities and can move roll-on/roll-off (Ro/Ro) cargo, this is a lesser focus than for the neighbor ports that presently serve automobile manufacturers as well as other heavy vehicle manufacturers.

Demand

Over 7 million tons of cargo worth $14 billion were imported and exported by North Carolina ports in 2015. Of that tonnage, 65 percent was imports. The two North Carolina Ports, located at Wilmington and Morehead City, offer services for a variety of commodity types. Whether it is containers, bulk, break-bulk, or Ro/Ro, one of the ports can handle all goods.



fertilizers | ores & minerals | rubber

are Morehead City's

Top 3 Commodities

by total tons

forest products | chemicals | fertilizers

are Wilmington's

Top 3 Commodities

by total tons

The Port of Morehead City sees a ship approximately once every three days and a barge daily. Top imports include sulfur, rubber, metal products, scrap metal, and ores and minerals. On the exports side, phosphate, woodchips, metal products, and military material are the top commodities. Total tonnage through the Port of Morehead City has remained relatively steady ranging from 1.5 million to 2.4 million tons from 2002-2016. Over the past five years, the total tonnage has hovered around 1.8 million tons, having not reached 2 million since 2012. The tonnage is all bulk and breakbulk, as containers are not handled at Morehead City.

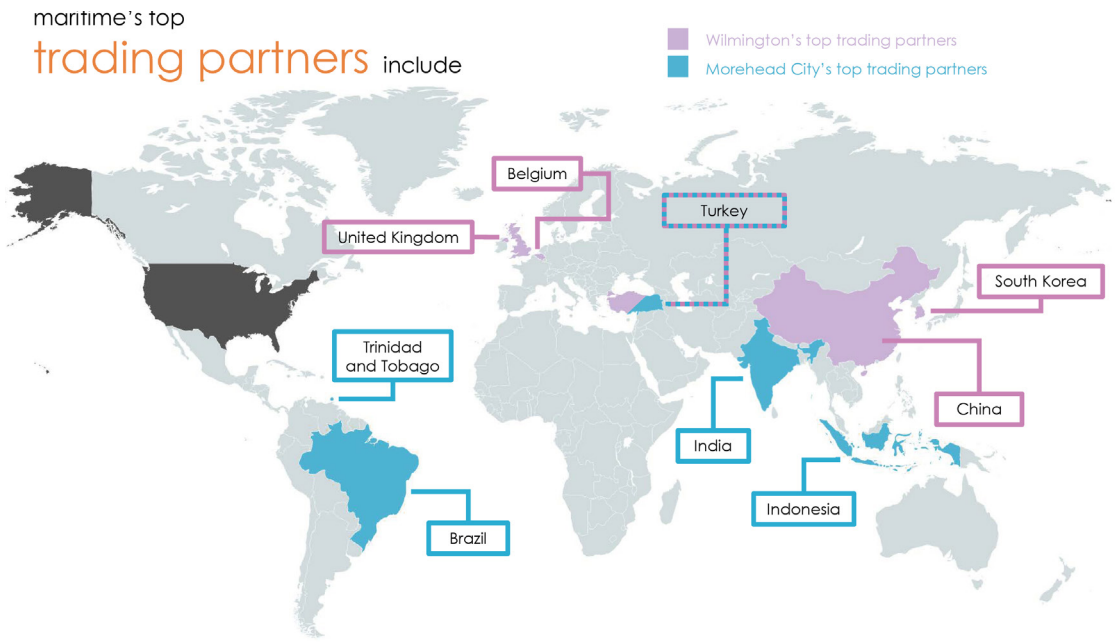
The Port of Wilmington sees an average of one ship per day, while barges are infrequent at about two every month. Imports include chemicals, grains, fertilizers, cement, and chemicals. The top exports are forest products, woodchips, wood pulp, food, and general merchandise. Total tonnage through the Port of Wilmington has more than doubled from 2 million tons in 2002 to 4.4 million tons in 2016. In 2013, tonnage hit a record high of 5.3 million. Most of the tonnage is accounted for in containers (52 percent in 2016). While the number of TEUs serviced at the Port of Wilmington has been historically small compared to neighbor ports, the volumes have grown and are projected to continue to grow due to a significant increase in container ship calls, the recently inaugurated intermodal service Queen City Express (short term), and the future opening of the CCX intermodal terminal in Rocky Mount (mid term).

North Carolina's trading partners are geographically diverse. Major export regions include Eastern Asia, Europe, Canada, and a variety of Asian and Latin American destinations. The mix is similarly diverse on the import side, led again by Eastern Asia and Europe. This diversity is favorable as it shields the State from an economic downturn in a particular region of the world economy.

On the import side, three import partners top the two lists, albeit in different orders – Eastern Asia, Europe and the Rest of Americas. On the export side, Eastern Asia fills the top spot with Europe, and Southwestern and Central Asia filling in second and third. This suggests that North Carolina shippers choose to use an out-of-state port to reach some of their leading trade partners due to the availability of ship calls, storage/equipment availability, or other factors.

maritime's top

trading partners include



Conditions and Performance

The operation and level-of-service, or efficiency possible within the current state of each port, depends on a number of moving pieces. The activities at each port rely on physical constraints of facilities, policy decisions on commodities served and operating hours, worker and equipment productivity, weather, and numerous other factors that may or may not be controllable. A truck turn is basically the amount of time (in minutes) it takes for a truck to enter, conduct business, and leave a port facility. Turn times are partially contingent upon the size of the terminal facility and how far the truck must be driven – so a smaller port like Wilmington is likely to have shorter turn times than a larger port, unless that larger port sets up gates for each terminal to reduce on-port distances and hence times. Port of Wilmington has faster average truck turn times of 18 and 30 minutes for single and dual turns, respectively, than the neighboring ports in the region.

AVERAGE TRUCK TURNS BY PORT

Port	Single Truck Turn	Import/Export Truck Turn
Wilmington	18 minutes	30 minutes
Charleston	23 minutes	< 60 minutes
Savannah (Garden City Terminal)	30 minutes	< 60 minutes
Norfolk	50 minutes (single and dual combined)	

Sources: http://savannahnow.com/exchange/2015-05-16/savannahs-port-positioned-perfect-storm-growth, http://www.scspa.com/cargo/, http://www.portofvirginia.com/pdfs/Weekly%20Metrics.pdf, NCSPA interview.

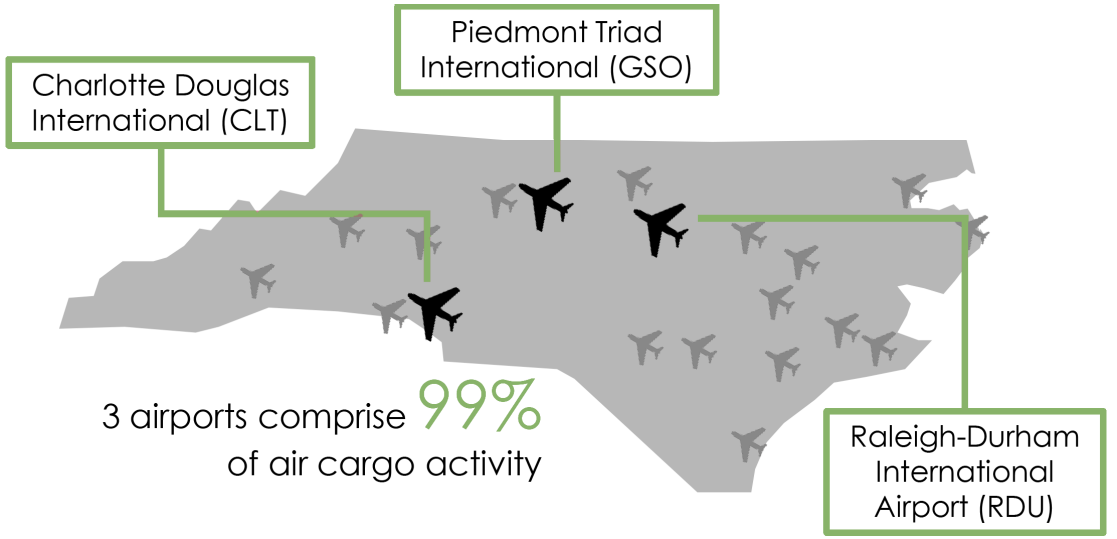
At Morehead City, a bottleneck to the movement of goods from inland to the port is the rail line through town. It is a built-up corridor requiring slow train speeds for miles. A concern for community relations, but not a strong operational bottleneck for the rail freight is the flip-side of this issue. The rail line divides downtown Morehead City in two, and though trains are infrequent, they block a number of at-grade crossings when moving through town. This is of particular concern during the summer, as tourism at the Crystal Coast is an important industry, and bad traffic may convince some visitors to not return. At Wilmington, 30 at-grade crossings throughout the city and at the Port of Wilmington's south entrance cause traffic backups, especially during rail switching activities. It is not uncommon to see a number of trucks bound to/from the port lined up on access roads as they wait for trains to move over the crossings.

Safety concerns at the ports seem to stem from the need for improved infrastructure rather than security threats. The Port of Wilmington would like to review the possibility of relocating pedestrian and cyclist activity from the Front Street and Memorial Bridge projects as that corridor has three "at-grade" rail crossings for port traffic. The intent would be that the added traffic could create an unsafe environment for the pedestrians and cyclists. The Port of Morehead City has recognized a need for a crane replacement plan. The original two cranes were built in the 1960s, one was dismantled, and the other will need to be replaced over the next few years. It will cost $1.5 million to refurbish. Portable cranes would be a desirable addition, but they are heavy and the port surface may not be able to sustain their weight. Also, having overhead powerlines creates a safety hazard and limits use of a portable crane.

Traditionally, attacks on marine vessels have included piracy, boarding, theft, and/or destruction. In addition, there is great need to upgrade security measures to counter the cyber-attacks that can be waged. The implication of these attacks includes the disruption of business transactions, navigation, cargo-related functions, and financial losses. Maritime vessels are under significant threat of cyber-attack because many are carrying outdated software and were not designed with cyber security in mind. This has an impact on the North Carolina ports and those providing cargo operations throughout the country. Through the updating of security systems, training, and ongoing technology improvements, the maritime security infrastructure at the ports at Morehead City and Wilmington can be successful in meeting future security threats.

AIR CARGO ASSETS

North Carolina has 74 publicly-owned airports and nearly 300 privately-owned airports throughout the State, though just 20 airports handle air cargo, including both dedicated all-cargo operations and commercial passenger belly cargo. However, three airports comprise over 99 percent of air cargo activity in North Carolina: Charlotte Douglas International Airport (CLT), Piedmont Triad International Airport (GSO), and Raleigh Durham International Airport (RDU).



Inventory

CLT, GSO, and RDU each has critical air cargo processing infrastructure, as well as connections to highway, rail, and maritime modes.

- CLT's Air Cargo Center has a total of 570,000 square feet of available space and roughly 2.2 million square feet of aircraft ramp space. The Air Cargo Center is able to link freight between air, rail, water, and truck modes. Rail connection is available to Norfolk Southern Railway (NS) which operates an intermodal container facility on the southwest side of CLT. CSX has an intermodal terminal and bulk transfer terminal in Charlotte, east of CLT, but does not connect directly to CLT.
- GSO's multimodal cargo facility connects to major trucking lines operating terminals near the airport. It hosts FedEx Express' Mid-Atlantic Air Hub, which is a 1 million square foot facility able to sort up to 24,000 packages per hour for freight destined for various East Coast locations.

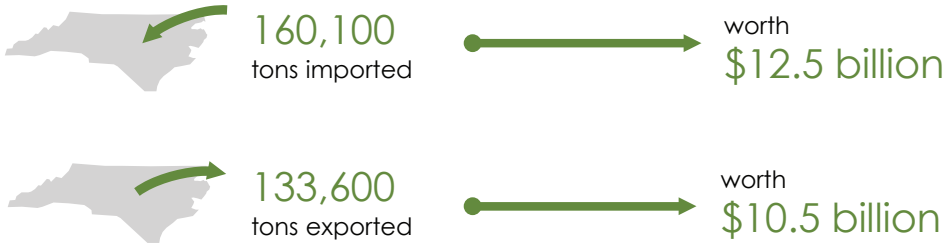
There are four apron areas at GSO dedicated to air cargo services, totaling nearly 227,000 square feet of air cargo apron space. UPS operates both express overnight cargo and ground cargo out of the airport in two separate facilities. An NS track runs along the south of the perimeter of GSO, along W. Market Street, but does not connect directly with the airport.

- RDU's North Cargo and South Cargo areas of the airport have over 672,000 square feet of cargo space. The North Cargo facilities house RDU's two all-cargo carriers, FedEx and UPS. The South Cargo facilities, reserved for cargo shipped via commercial airlines, are located near Aviation Pkwy. Although there is no direct rail connection to either CSX or NS at RDU, both rail lines pass through Raleigh and near to RDU.

Demand

In 2015, North Carolina airports handled nearly 294,000 tons of cargo worth $23 billion. Inbound cargo totaled over 160,000 tons worth $12.5 billion, while outbound traffic totaled nearly 134,000 tons worth $10.5 billion.

Compared to other modes, air cargo is a relatively small amount of the State's overall freight activity. However, it has a substantially higher value per ton at over $78,000 per ton compared to $1,300 per ton (highway), $1,700 per ton (rail) and $1,200 per ton (water).



Electronics | Machinery | Textiles + Leather

are air cargo's

Top 3 Commodities

by total tons

Electronics | Pharma-ceuticals | Machinery

are air cargo's

Top 3 Commodities

by total value

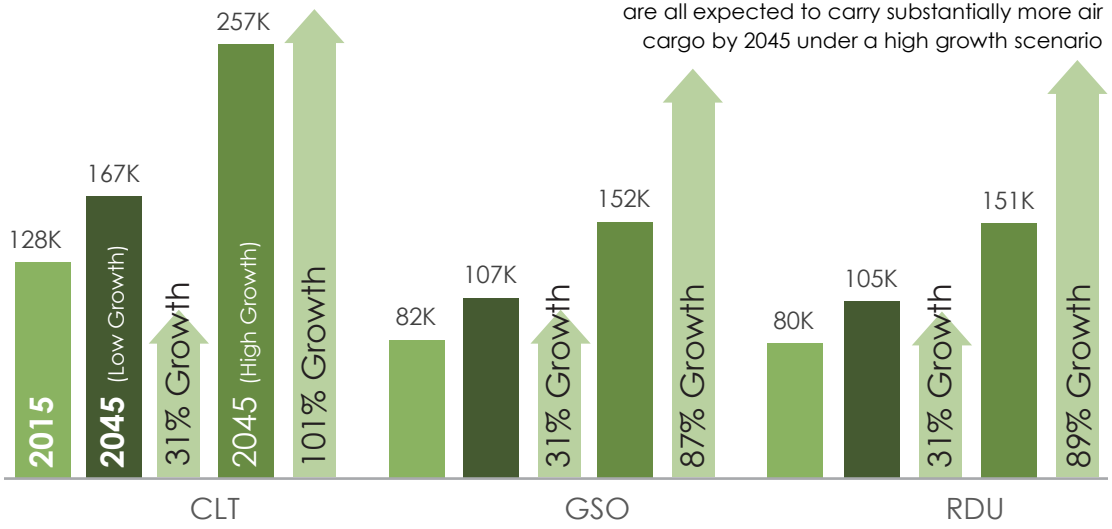
North Carolina traded air cargo with over 200 airports in the U.S. and across the world, including 47 international airports in 2015. Memphis, Louisville and Indianapolis international airports are North Carolina's top air trade partners, together these comprise 69 percent of the State's air cargo. Both FedEx and UPS have hubs in more than one of these cities.

Air freight modes tend to transport the highest proportion of high-value, low-weight commodities due to the high cost of air transport when compared to surface modes. In 2015, the top transported commodity by air at North Carolina airports was electronics, comprising 21 percent of total tonnage ($5.1 billion). Machinery was the second-most transported commodity, comprising 14 percent of total tonnage ($3.5 billion).

To better understand the potential growth in air cargo activity at North Carolina airports through 2045, both a low growth scenario and a high growth scenario were developed. Although the low-growth scenario is more realistic in predicting future demand for air cargo in North Carolina, the potential growth under the high growth scenario is substantial and mostly driven by growth in international markets, and could result in intense pressure on the State's air cargo network and supporting multimodal infrastructure.

North Carolina's 3 major airports

are all expected to carry substantially more air cargo by 2045 under a high growth scenario



Conditions and Performance

Although capacity exists at airports in North Carolina, it will be important to expand access to reach more parts of the State and provide service for highly time-sensitive commodities produced in North Carolina. These products are well suited for air cargo transport, and could take advantage of increased air cargo access to grow its manufacturing and distribution base within North Carolina and across the U.S.

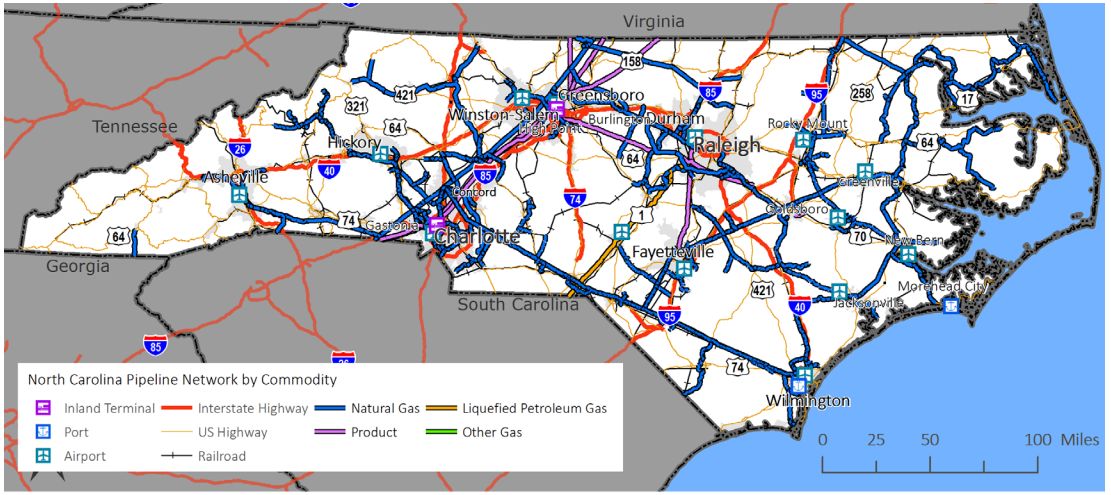
Air cargo carriers are experiencing price competition from other freight modes such as trucks, container ships, and railroads, while demand for expedited services (i.e., UPS and FedEx) has exploded in recent years with the latest e-commerce trends. In North Carolina, FedEx and UPS have consistently been the top air cargo carriers, and domestic belly cargo has remained relatively flat over the last decade.

Air cargo access is critical to economic vitality, particularly for high-value commodities. Consumer markets tied to e-commerce have increased the demand for express package services, which have been traditionally fulfilled by air cargo jets. However, because advances in ground logistics have made trucks a viable option for express service, North Carolina airports must ensure seamless access to air cargo facilities via the roadway network to stay competitive with other freight modes.

HAZARDOUS MATERIALS AND PIPELINE ASSETS

Hazardous Material (HazMat) freight movement has an enormous impact on North Carolina's transportation infrastructure. With communities growing, land-use increasingly congested and development costly, and the demands on all parts of the aging infrastructure increasing, it is important that the State consider critical investments in the transportation infrastructure that will support the safe and timely delivery of HazMat freight to local markets and to destinations outside of North Carolina.

HazMat includes any chemical, in any form, that has one or more hazardous properties and that is in transportation. HazMat, in some form, is in transportation everywhere in the State all of the time, as it is essential to the State's economy. Almost everything we drink, grow, wear, or drive, the roads we drive on, and what we use to build our homes is transported at some point as HazMat freight. HazMat is routinely transported in commerce in all modes of transportation, including ship or barge, pipeline, rail, and truck.



Inventory

North Carolina imports all of its petroleum based fuel and natural gas, as well as, significant quantities of bio-fuels, such as ethanol. The transportation network used for transportation of fuel consists of:

- 5,490 miles of pipeline for the movement of petroleum fuel, non-fuel products, propane, and natural gas
- 38 inland motor fuel terminals
- 12 aviation fuel terminals
- Two propane terminals – Sylva in western North Carolina and Apex in east central North Carolina
- Two Transload Facilities – Star, North Carolina and Midland, North Carolina
- Six marine petroleum terminals – receive ships and barges through the Port of Wilmington
- Truck tank trailer fleets and support services to enable the transport and local delivery of all fuels but natural gas
- Six bio-fuel production facilities

North Carolina is the 7th highest Value producer and shipper of chemicals in the United States with a value of over $2.3 billion shipped in 2012 by the chemical manufacturing industry

Demand

Fuel

In 2015, the State generated nearly 2 million shipments of fuel, with 458 million barrels of fuel delivered to the State by ship, pipeline, and rail, and distributed to local markets within the State by pipeline, rail, and truck. The demand for motor fuel is projected to reduce by 23 percent by 2045, reducing to 352 million barrels annually in North Carolina. Furthermore, the demand for refined petroleum fuel is expected to decrease by 26 percent from 2012 to 2045. A total of 27 million tons of fuel is expected to be transported into North Carolina in 2045.[2]

Selected Extremely Hazardous Substances and non-Extremely Hazardous Substances

Extremely Hazardous Substances (EHS) and Non-EHS HazMat chemicals are present on nearly every major highway, all of the interstate highway system, the entire length of both Class I railroads, and many of the short line railroads in significant volumes. Volumes of over a billion pounds per year or more are represented on some parts of the transportation system. Charlotte, Winston-Salem, Raleigh, and Wilmington are major HazMat hubs.

Conditions and Performance

Following are the key performance challenges for HazMat and fuel transportation in North Carolina:

- **Fuel Pipeline System Capacity.** The pipelines are operating at or near peak capacity creating a vulnerability for disruption. While there appears to be some additional capacity to import fuel via the marine terminals at the Port of Wilmington, this would only be sufficient for emergency needs and surge capacity as there would be a higher cost to transport fuel to markets around the State. Consequently, the State is highly dependent on the pipelines.
- **Fuel Terminal Access and Multimodal Connectivity.** Connections to local road networks from fuel terminals need to be improved to allow for safe integration of trucks into traffic. All of the inland and marine fuel terminals are only supported with two lane roads to connect to main arterial roads, highways, and the interstate system, which creates opportunities for a serious incident and HazMat event as these trucks turn or merge into traffic.
- **Field Fuel Blending.** Both butane and ethanol are primarily shipped into the State in rail tank cars but only 3 of the inland terminals have rail access to receive them. The ones that do not have rail facilities have to pay for ethanol and butane delivery or meet in the middle somewhere and blend directly into the tanker trucks before they deliver fuel to the gas stations. Often this field blending is done in back lots, without adequate safety processes and systems, and no community awareness. Rail connections need to be established with all fuel terminals in the State that distribute gasoline.
- **The navigation channel into Morehead City adjacent to Radio Island** at the mouth of the Newport River is filling with sediment and deposition of sand and is a bottleneck to the transport of HazMat by ship in that area. This is causing PCS Phosphate to only partially load ships to prevent grounding and other safety concerns. They suggest the Corps of Engineers enhance the channel that nature seems to favor, rather than continuing to dredge in an area of ongoing deposition.
- **The concurrent use of the two Class I railroad mainlines for passenger, freight, and HazMat service** is a deficiency. These trains have different maximum allowable speeds over the same track and have different infrastructure needs that are not compatible with each other.
- All parties to work through the Local Emergency Planning Committee in their county to develop land-use planning policies that **prevent incompatible land-uses relative to HazMat** storage, use, or transportation.
- Railroads should consider **not using sidings within city limits to store HazMat rail cars.**

2 IEM analysis using data from www.eia.gov/forecasts/aeo/data/browser.

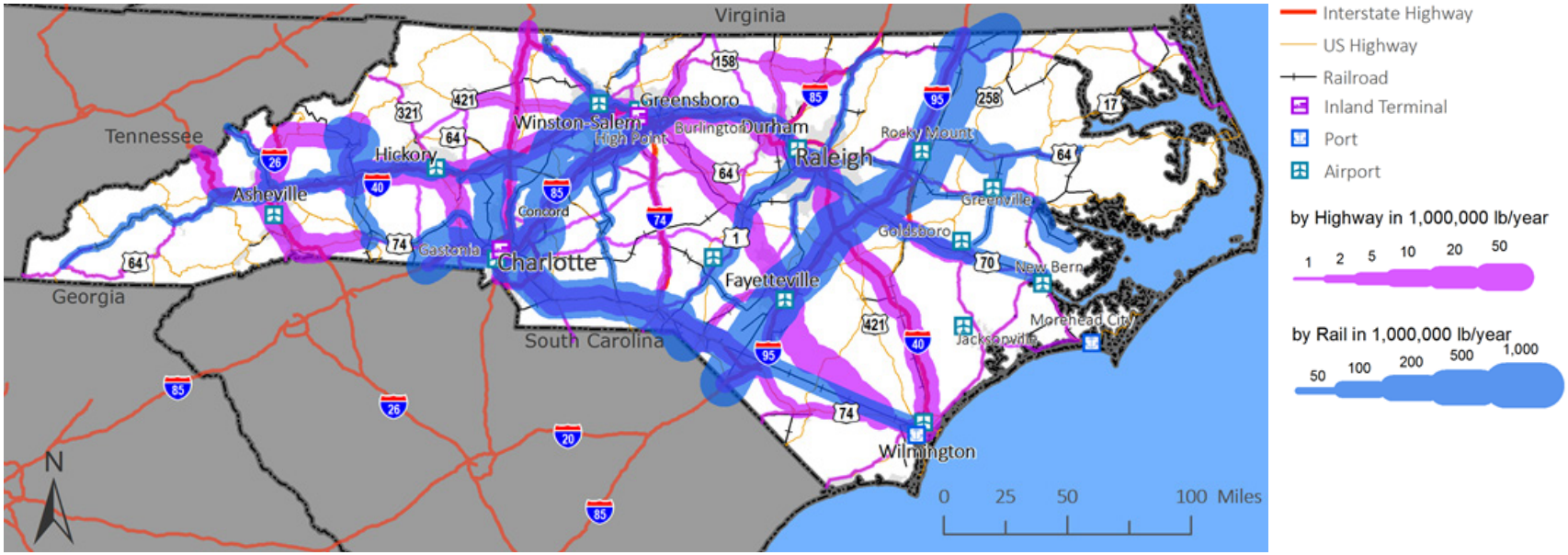
Non-EHS Chemicals

- Phosphoric Acid
- Toluene Diisocyanate
- Butane
- Toluene

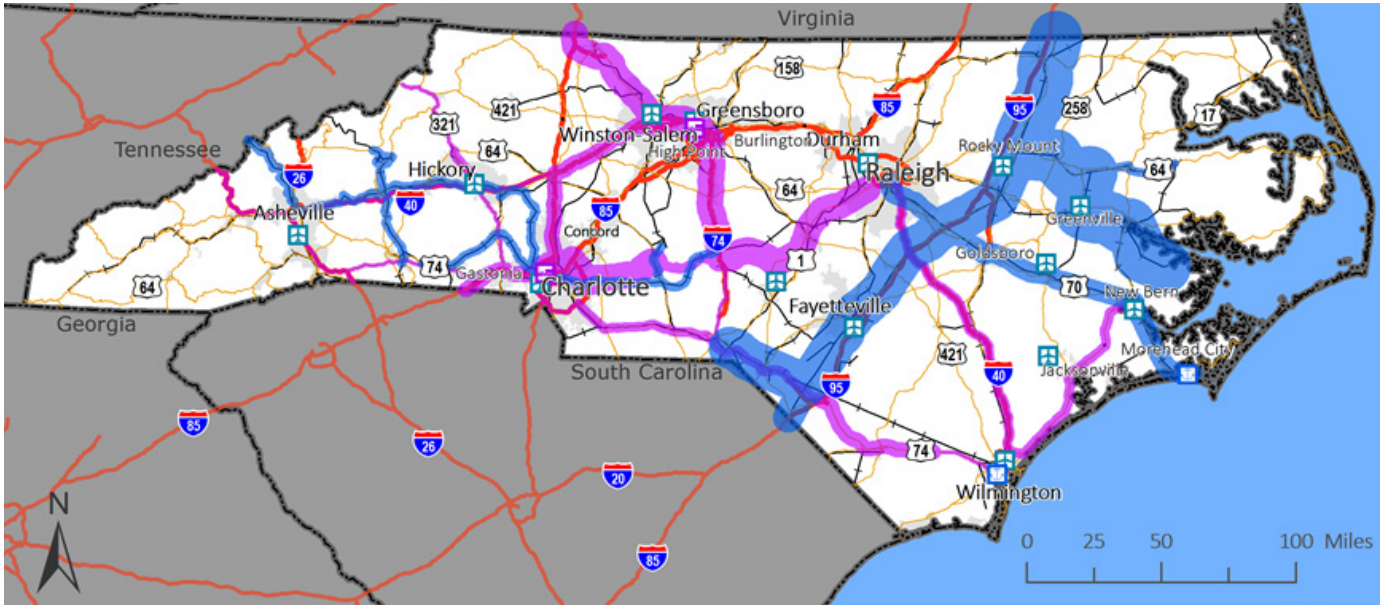
EHS Chemicals

- Anhydrous Ammonia
- Chlorine
- Formaldehyde
- Hydrogen Fluoride
- Hydrogen Chloride
- Sulfuric Acid
- Sulfur Dioxide
- Bromomethane
- Hydrogen Peroxide
- Cycloheylamine
- Vinyl Acetate Monomer
- Phenol
- Ethylene Oxide

SAMPLED EXTREME HAZARDOUS SUBSTANCE CHEMICAL SHIPMENT IN NORTH CAROLINA



SAMPLED NON-EXTREME HAZARDOUS SUBSTANCE CHEMICAL SHIPMENT IN NORTH CAROLINA



4 FOCUSING ON PRIORITY FREIGHT ASSETS

Purpose and Role

North Carolina has extensive multimodal freight transportation assets including highways, rail lines, waterways, airports and pipelines, as well as interchange points between the modes, such as airport terminals, seaports, rail terminals, pipeline terminals and warehouse/distribution centers.

The motivation for designating the North Carolina Priority Freight Network (NCPFN) is twofold:

- Designation of a subsystem that is responsible for carrying the majority of freight moving in the State 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 tonnage being 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 Fixing America's Surface Transportation (FAST) Act established the National Highway Freight Network which is to be supplemented by the designation of additional critical freight corridors by each of the states and large Metropolitan Planning Organizations (those having populations greater than 500,000).

North Carolina Priority Highway Freight Network

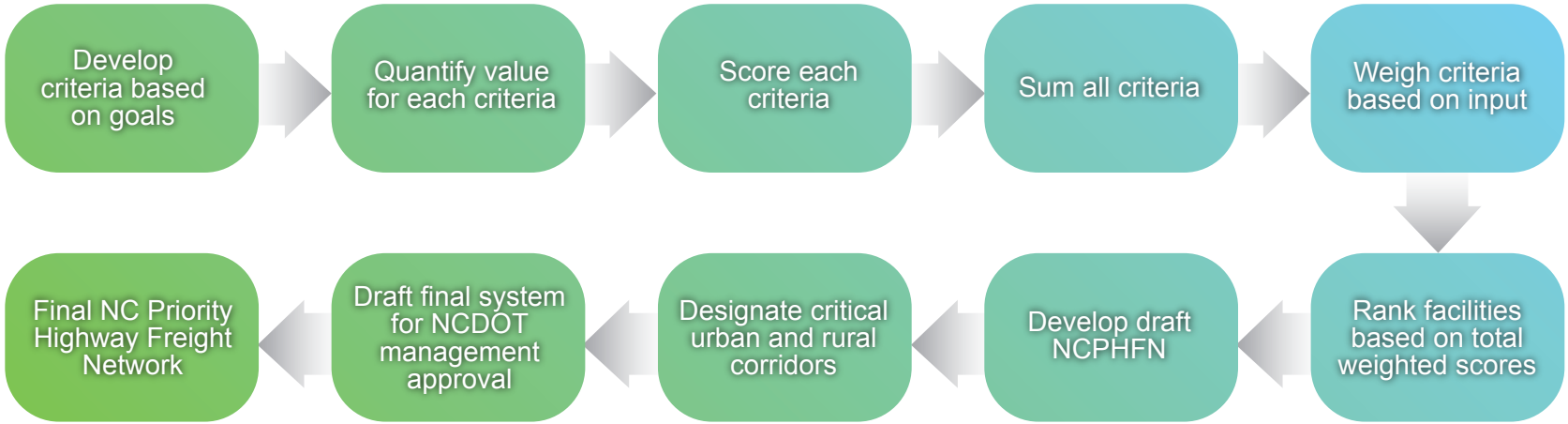
Priority Highway Freight Assets

The North Carolina Priority Highway Freight Network (NCPHFN), or the State's highway network that is most critical to freight transportation, was designated using metrics that measure economic activity, goods movement, market access and connectivity, and support to key industries' supply chains.

The evaluation process scored every highway segment based on criteria measuring the role of the highway in supporting:

- **Economic competitiveness** (10% of total score) measures economic activities that interact with transportation investments with the goal of supporting economic growth, such as support of freight intensive employment and supporting facilities such as military bases.
- **Goods movement** (30% of total score) measures the role of the facilities in the physical movement of goods using criteria such as tonnage, value, truck volume, and percentage and projected truck freight growth.
- **Strategic supply chains** (25% of total score) examines how highway facilities support key freight intensive businesses and their global supply chains. Twelve target supply chain industry sectors were identified as key freight-intensive export industries in the State and metrics such as the number of supply chains served, the number and size of businesses in key supply chains served and the volume of commodities associated with these industries carried.
- **Market access and connectivity** (35% of total score) evaluates intermodal connectivity and connectivity to trading partners and international gateways.

NCPHFN EVALUATION AND DESIGNATION PROCESS



After scoring the measures within each of the four analysis categories, the scores were totaled, resulting in the total Freight System Designation (FSD) score. Based on stakeholder input, the scores were weighted so that the economic factors represent 10 percent of the total score, the goods movement factors 30 percent, supply chain 25 percent, and market access and connectivity 35 percent.

The National Highway Freight Network (NHFN), is the starting point for the designation of the North Carolina Priority Highway Freight Network (NCPHFN). The National Highway Freight Network (NHFN), defined by United States Department of Transportation, includes:

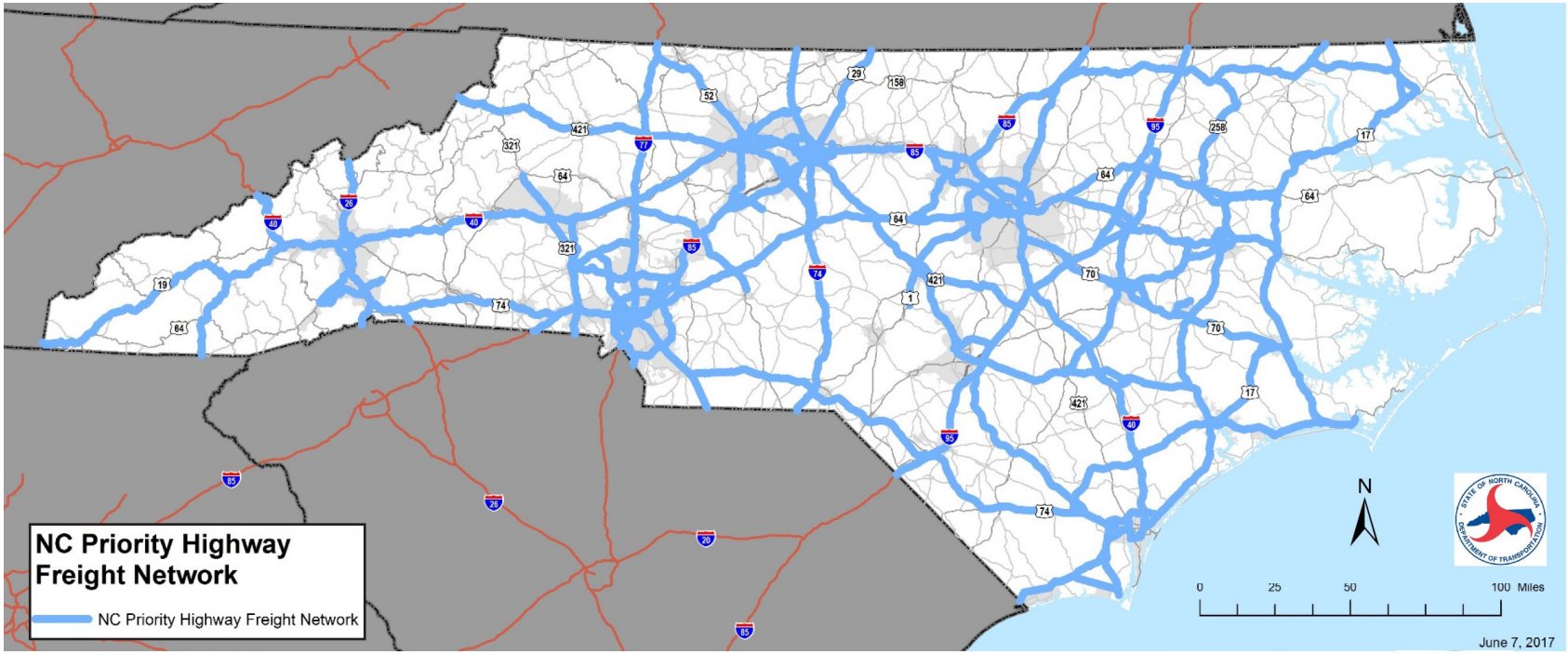
- **Primary Highway Freight System (PHFS) –** The PHFS was designated by the Federal Highway Administration (FHWA) based on eight factors, including freight tonnage and value, truck traffic, access factors, and network connectivity. North Carolina's portion of the National Primary Highway Freight System totals 1,011.06 miles.
- **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 FAST Act restricts National Highway Freight Program (NHFP) funding on Non-PHFS Interstates in states deemed high mileage states, defined as containing more than two percent of the National PHFS. North Carolina is classified as a high mileage state and thus, cannot use NHFP funding on Non-PHFS Interstate.

Next, the highway facilities that scored above average in terms of their role in supporting statewide freight movement as measured by the FSD score were added. Input from NCDOT, the State Freight Advisory Committee (FAC), and the MPOs and RPOs was reviewed and helped shape the final NCPHFN.

The role of the NCPHFN is to:

- **Drive policy and investment of statewide funds; and**
- **Serve as the foundation from which the Critical Urban Freight Corridors and Critical Rural Freight Corridors are designated.**

NORTH CAROLINA PRIORITY HIGHWAY FREIGHT NETWORK



Critical Rural and Critical Urban Freight Corridors

As part of the FAST Act, U.S. DOT allocated additional miles to each state, based on its Primary Highway Freight System (PHFS) mileage, to designate to the NHFN. These miles are eligible for National Highway Freight Program (NHFP) funds and are referred to as:

- **Critical Urban Freight Corridors (CUFCs)** are defined as freight highways located within urbanized areas. They are part of the NHFN and are eligible for the National Highway Freight Program (NHFP) funding. In an urbanized area with a population of 500,000 or more individuals, the MPO, in consultation with the State, may designate a CUFC. According to Federal Highway guidance, North Carolina may designate a maximum of **103.43 miles** as CUFCs. Charlotte Regional Transportation Planning Organization (CRTPO) and Capital Area Metropolitan Planning Organization (CAMPO) led approval on designation within their respective Census-defined urbanized areas – NCDOT led the designation process for all other urbanized areas.
- **Critical Rural Freight Corridors (CRFCs)** are defined as freight highways located outside of urbanized areas. They are part of the NHFN and are eligible for the National Highway Freight Program (NHFP) funding. According to Federal Highway guidance, North Carolina may designate a maximum of **206.86 miles** as CRFCs.

The North Carolina Priority Highway Freight Network (NCPHFN) is the foundation from which the CUFC and CRFC are designated. North Carolina's NHFP formula funds are usable on CUFCs, CRFCs, and along the 1,034 miles of National Primary Highway Freight System.

For the designation of the CUFCs and CRFCs, NCDOT used the scores from the NCPHFN as the starting point to rank corridors that provided connectivity to the NHFN and met the FAST Act requirements. Additionally, the projects that were on the latest State Transportation Improvement Program (STIP) were used to determine which corridors could potentially use funds from the NHFP. CAMPO and CRTPO approved the CUFCs in the Raleigh and Charlotte urbanized areas respectively. The CUFCs, CRFCs, and the NCPHFN will be reviewed and updated a minimum of once every five years.

FAST ACT REQUIREMENTS FOR DESIGNATING CRITICAL URBAN AND RURAL FREIGHT CORRIDORS

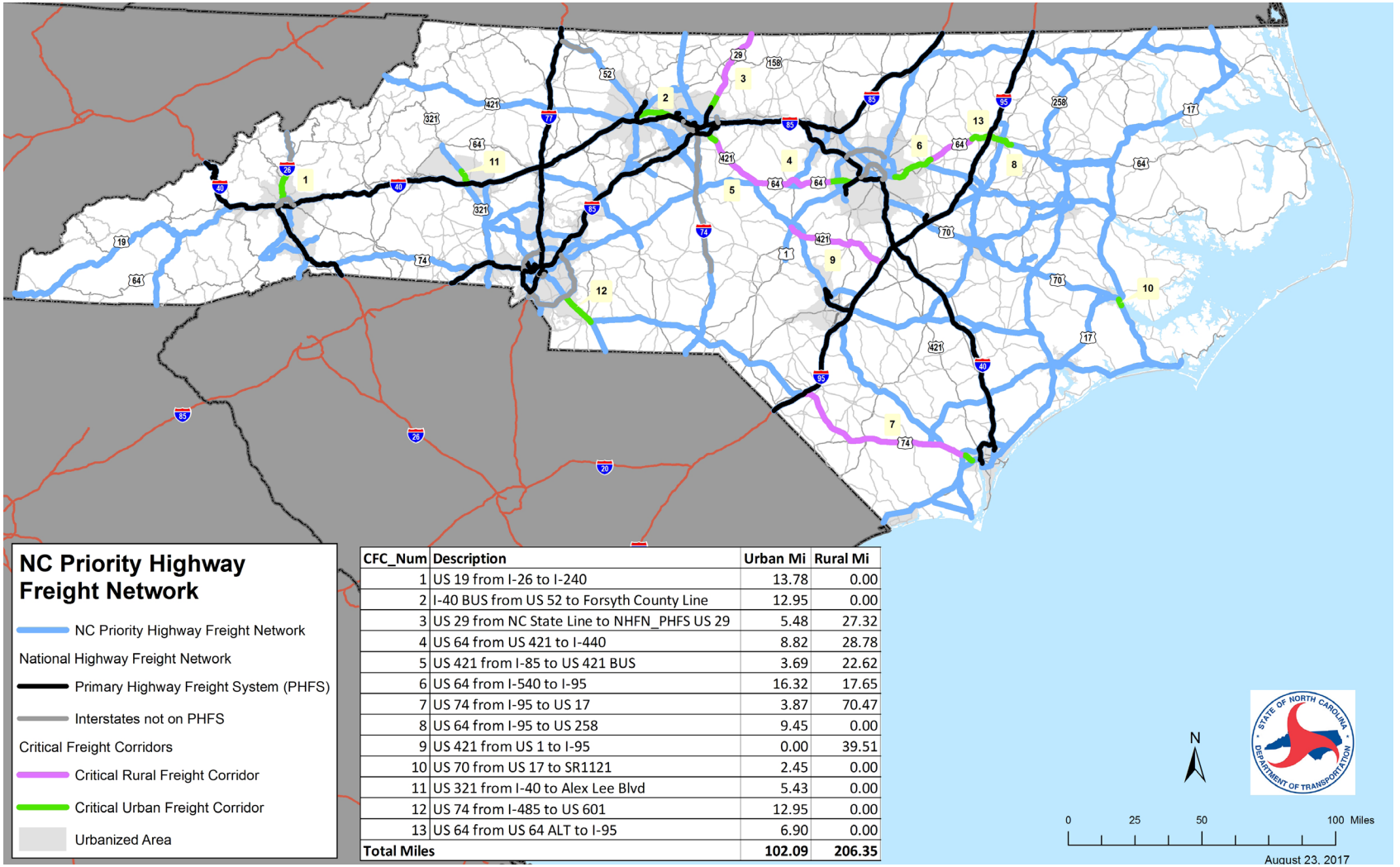
A CUFC must meet one or more of the following four criteria:

1. Connects an intermodal facility to the PHFS, the Interstate System, or an intermodal freight facility.
2. Located within a corridor of a route on the PHFS and provides an alternative highway option important to goods movement.
3. Serves a major freight generator, logistic center, or manufacturing and warehouse industrial land.
4. Is important to the movement of freight within the region, as determined by the MPO or the State.

A CRFC must meet one or more of the following seven criteria:

1. Rural principal arterial roadway with a minimum of 25 percent of the annual average daily traffic of the road measured in passenger vehicle equivalent units from trucks.
2. Provides access to energy exploration, development, installation, or production areas.
3. Connects the PHFS or the Interstate System to facilities that handle more than: 50,000 20-foot equivalent units per year; or 500,000 tons per year of bulk commodities.
4. Provides access to a grain elevator, an agricultural facility, a mining facility, a forestry facility, or an intermodal facility.
5. Connect to an international port of entry.
6. Provides access to significant air, rail, water, or other freight facilities.
7. Is vital to improving the efficient movement of freight of importance to the economy of the State.

NORTH CAROLINA'S CRITICAL FREIGHT CORRIDORS



CFC_Num	Description	Urban Mi	Rural Mi
1	US 19 from I-26 to I-240	13.78	0.00
2	I-40 BUS from US 52 to Forsyth County Line	12.95	0.00
3	US 29 from NC State Line to NHFN_PHFS US 29	5.48	27.32
4	US 64 from US 421 to I-440	8.82	28.78
5	US 421 from I-85 to US 421 BUS	3.69	22.62
6	US 64 from I-540 to I-95	16.32	17.65
7	US 74 from I-95 to US 17	3.87	70.47
8	US 64 from I-95 to US 258	9.45	0.00
9	US 421 from US 1 to I-95	0.00	39.51
10	US 70 from US 17 to SR1121	2.45	0.00
11	US 321 from I-40 to Alex Lee Blvd	5.43	0.00
12	US 74 from I-485 to US 601	12.95	0.00
13	US 64 from US 64 ALT to I-95	6.90	0.00
Total Miles		**102.09**	**206.35**

Priority Rail Freight Assets

Rail is a key component of freight movement in North Carolina and the network is expanding. The National Multimodal Freight Network includes all Class I railroads and their major terminals. The rail network that is served by the Class I railroads, including intermodal terminals, major classification yards, and transload facilities are part of the NCPFN. North Carolina's rail system includes two Class I railroads, CSX and Norfolk Southern; two major classification yards; three intermodal terminal and one future intermodal terminal and rail hub; and numerous transload facilities. All of these facilities are included on the North Carolina Priority Freight Network.

Priority Maritime Freight Assets

North Carolina ports and waterways play a key role in the efficient movement of freight and are important drivers of the North Carolina economy. The National Multimodal Freight Network, designated as part of the FAST Act, was used to designate the priority maritime freight assets in North Carolina, which include: the Port of Wilmington, the Port of Morehead City, the M-95 marine highway corridor, and inland and coastal waterway routes Atlantic Intracoastal Waterway, Pasquotank River and Great Dismal Swamp Canal.

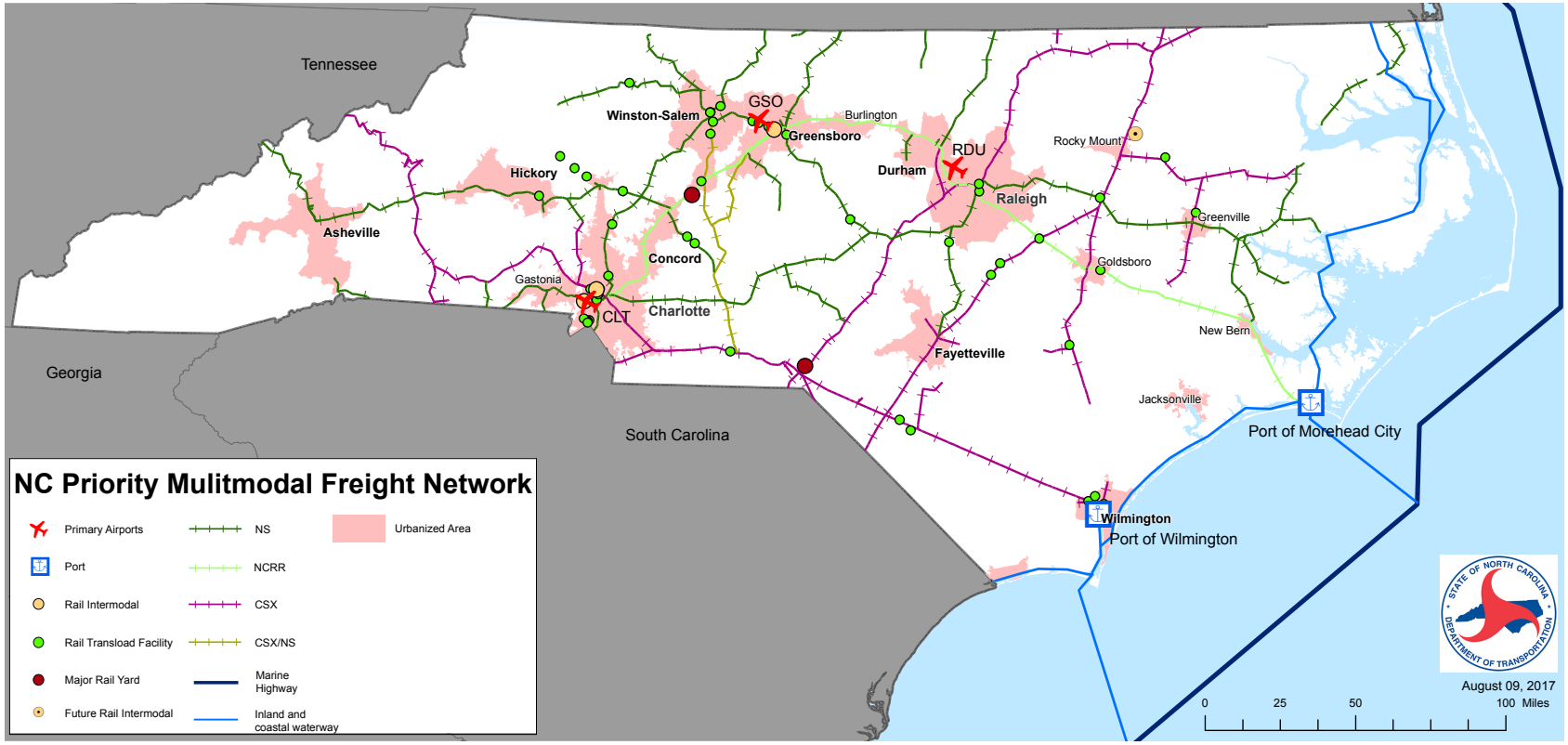
Priority Air Cargo Assets

North Carolina is home to three of the top 50 cargo airports in the U.S. in terms of landed weight in 2016.[3] These air gateways are located near the largest metropolitan areas in the State, which provide better connections to other freight infrastructure, and the industries that require fast shipment of high-value/time-sensitive products. The three airports – Charlotte/Douglas International, Raleigh-Durham International and Piedmont Triad International – are on the National Multimodal Freight Network and the NCPFN.

[3] Federal Aviation Administration, 2016.

NORTH CAROLINA PRIORITY FREIGHT NETWORK

MULTIMODAL

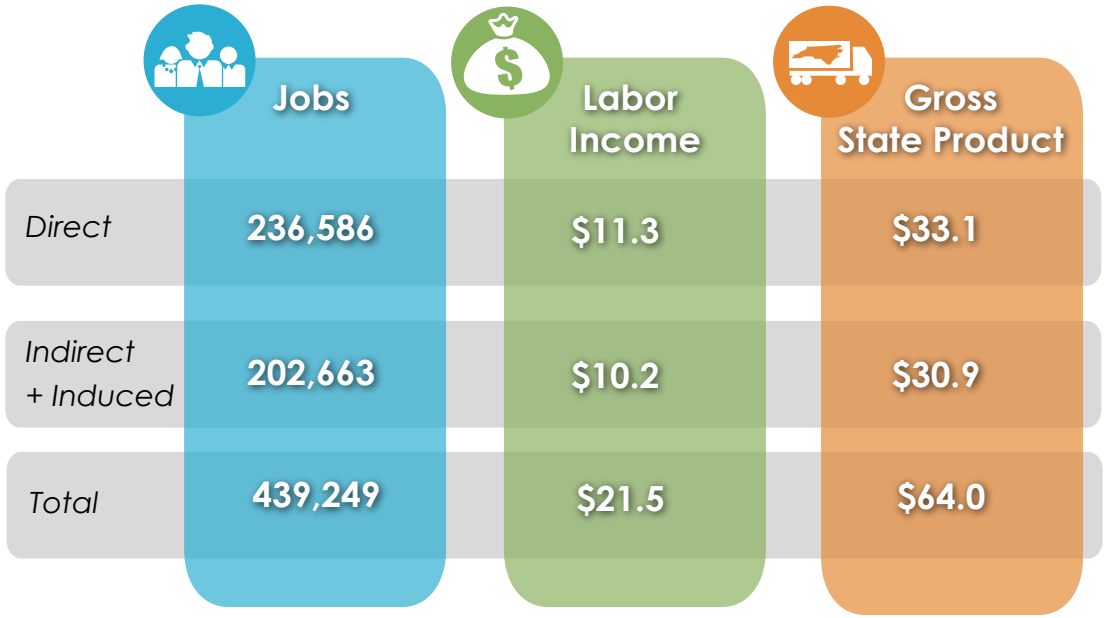


5 DRIVING THE NORTH CAROLINA ECONOMY WITH FREIGHT

Economic Contributions of Freight Transportation

All goods consumed or manufactured in North Carolina are, at some stage in the supply chain, considered freight, needing to be transported and stored several times from production to consumption. Freight transportation, therefore, is vital to a region's economy. It plays an important role by allowing businesses to stay competitive, by connecting regions to domestic and international trading partners, and by supporting thousands of jobs and driving economic activity.

There are approximately 236,600 persons in freight-related jobs in North Carolina, ranging from truck drivers to couriers to wholesale workers. Most of these employees are related to the truck transportation sector, with 119,000 jobs, or 50 percent of the total freight related jobs. Warehousing and storage provides the second largest number of jobs, amounting to approximately 70,800 or 30 percent of the total freight-related jobs. Using the broad definition of the transportation sector, the sector supports a grand total of 457,000 jobs, including direct, indirect, and induced jobs. The sector also adds nearly $64 billion to North Carolina's economy annually.



Note: Dollar values in 2015 billions.

Supporting the State's Strategic Export Industries

North Carolina is home to a vibrant economy built in part on the effective movement of goods both to consumers as well as between businesses. This transportation of freight is organized into supply chains that combine gateways such as ports and airports, corridors, including highways and rail, transfer and distribution centers used to link modes and consolidate goods and first and last mile connectors to facilitate pick-ups and deliveries.

The reliability of the freight transportation network is critical when planning raw material sources and the distribution of finished products. Unexpected delays can result in slowing or halted manufacturing processes and decreasing productivity, which increases manufacturing costs and prices for the end consumer. To enhance future economic growth, North Carolina must invest and implement strategies to support the increasing demand for a safe and reliable multimodal transportation infrastructure.

Eleven strategic supply chains were identified as key freight-intensive export industries in the State. In 2015, these industries combined for over 452 million tons and over $682 billion worth of freight moving into, out of and within North Carolina. Energy, and the Agriculture, Food Processing and Distribution sectors had the highest tonnage, while the Automotive, Truck and Heavy Equipment, and Aerospace and Aviation sectors had the highest value.

FREIGHT INTENSIVE INDUSTRIES CRITICAL TO NORTH CAROLINA'S ECONOMY

- Aerospace and Aviation
- Agriculture, Food Processing and Distribution
- Automotive, Truck, and Heavy Equipment
- Biotechnology, Pharmaceuticals, and Life Sciences
- Chemicals, Plastics, and Rubber
- Distribution/Logistics for Consumer Goods
- Energy/ Green Energy
- Forestry and Wood Products
- Furniture
- Military/ Defense
- Textiles, Apparel, and Textile Machinery

Understanding the concept of a supply chain provides a better grasp of freight transportation's impact on the North Carolina economy. A supply chain is a network between a company and its suppliers to produce and distribute a specific product, and the supply chain represents the steps it takes to get the product or service to the customer. Typical nodes in a supply chain include the following:

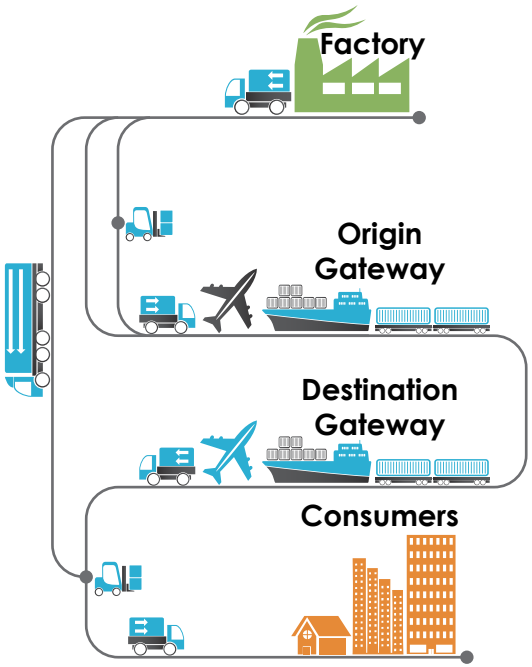
TOTAL TONNAGE AND VALUE FOR ALL INDUSTRIES

INBOUND, OUTBOUND, AND INTRASTATE FLOWS 2015

Industry	2015 Tonnage	% of Total	2015 Value ($M)	% of Total
Aerospace and Aviation	13,393,384	3%	$140,167	21%
Agriculture, Food Processing and Distribution	68,713,925	15%	$74,685	11%
Automotive, Truck and Heavy Equipment	17,795,251	4%	$156,572	23%
Biotechnology, Pharmaceuticals and Life Sciences	14,251,981	3%	$80,343	12%
Chemicals, Plastics, and Rubber	42,970,732	10%	$88,612	13%
Distribution and Logistics for Consumer Goods	22,906,920	5%	$121,784	18%
Energy/Green Energy	99,625,900	22%	$133,179	20%
Forestry and Wood Products	46,736,922	10%	$11,624	2%
Furniture	3,859,851	1%	$21,042	3%
Military/Defense	5,521,600	1%	$36,622	5%
Textiles, Apparel and Textile Machinery	6,426,416	1%	$44,987	7%
Total Commodity Flow	**451,884,525**	**100%**	**$682,088**	**100%**

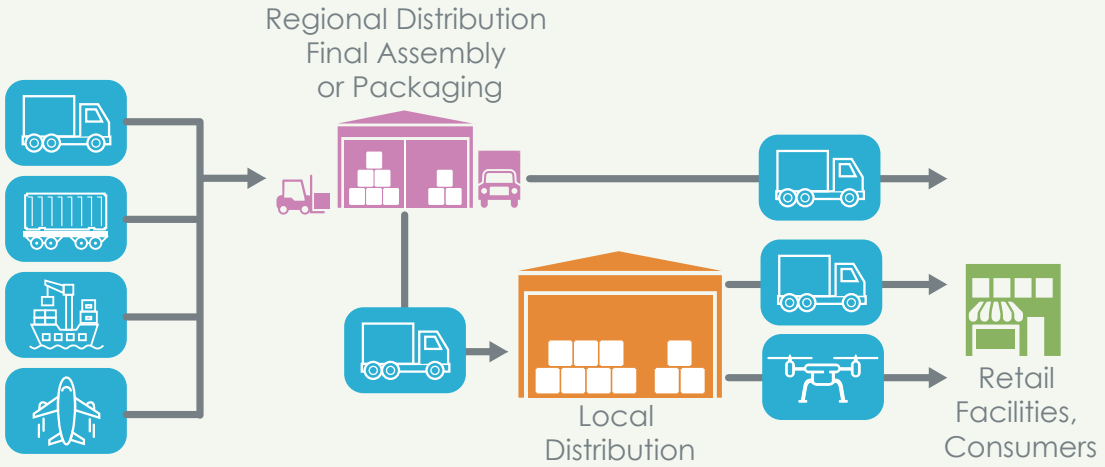
Note: Due to some commodities overlapping in industries and not all commodities being included in an industry, the Total Commodity Flow is not the sum of all industries but rather the sum of all commodities.

- **Gateways** include rail terminals, seaports, commercial border ports of entry and airports. These facilities handle large volumes between North Carolina, the nation, and the world.
- **Corridors** include highways and rail lines that serve both long- and short-haul freight traffic.
- **Distribution and En-Route** facilities include warehouses and distribution centers, transload facilities where cargo can move efficiently between railroads and trucks or from truck to truck. These facilities are often concentrated in and around large population centers and gateways.
- **First and Last Mile** is an industry term for the facilities used to move cargo from distribution centers to consumers in the urban and suburban core and from manufacturers to gateways.



Supply Chain Focus
Consumer Goods Trade and Distribution

Goods desired and needed by North Carolina households and businesses enter the North Carolina trade, distribution, and logistics supply chain after being produced domestically or abroad. Imported goods enter the State through land, sea, or air ports of entry. Bulk shipments of goods are delivered from these points of origin to large distribution centers closer to or more strategic to the final market than the product's origin. In some cases, final assembly or packaging may also occur at these distribution centers. From regional distribution centers, goods may be delivered to retailers and consumers, or they may pass through an additional local distribution center before delivery. Final deliveries are predominantly made by truck to retail outlets or increasingly to the consumer's front door. However, emerging technologies in autonomous deliveries may change how the last mile transportation is accomplished, particularly in dense, urban areas.



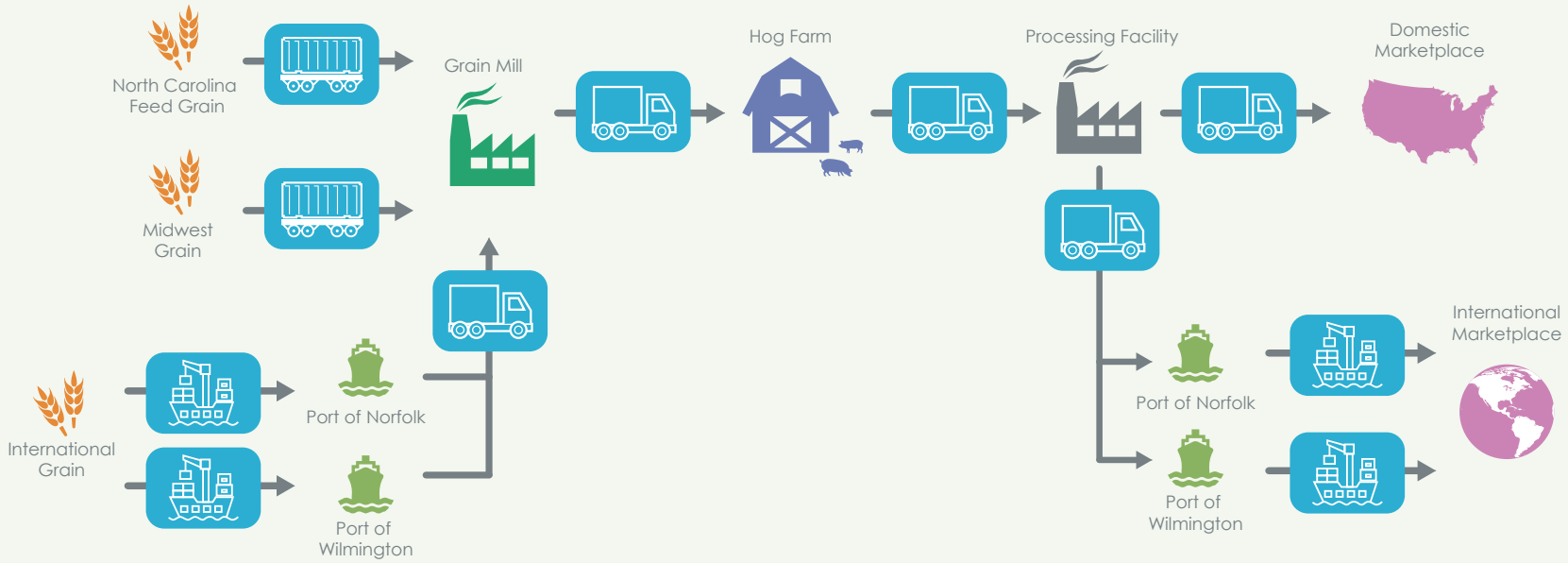
Supply Chain Focus
Agriculture, Food Processing, and Distribution

The agriculture sector comprises crop production and livestock and poultry breeding. The crop production industry includes establishments that grow crops at farms, orchards, nurseries, and greenhouses for human or animal consumption. The food processing and manufacturing sector transforms livestock and agricultural products into products for intermediate or final consumption. The industry groups are distinguished by the raw materials (generally of animal or vegetable origin) processed into food products. The food products manufactured in these industries are typically sold to wholesalers or retailers for distribution to consumers.

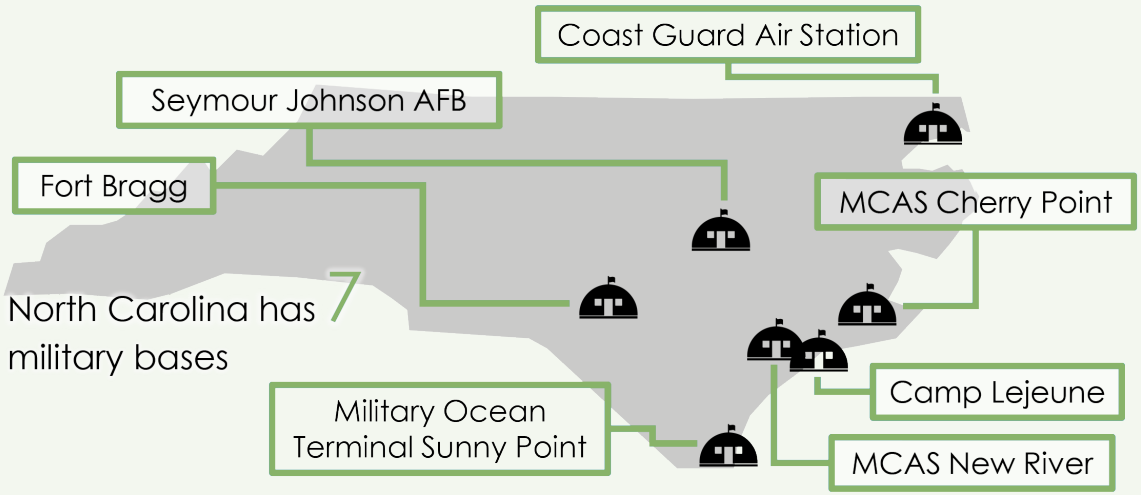
In addition to being one of the largest industries in North Carolina, Agriculture, Food Processing, and Distribution establishments are found throughout the State, with concentrations in eastern North Carolina. Food manufacturing enjoys a legacy in North Carolina – including companies like Pepsi in New Bern, Winston-Salem-based Krispy Kreme Donuts, Snyder's-Lance snack and chip giant headquartered in Charlotte, poultry and meat processing companies such as Butterball, Smithfield, Tyson, and Sanderson Farms, as well as Mt. Olive Pickles Company, Campbell's Soup Company, Bimbo Bakeries, Sierra Nevada Brewing Company, and numerous others.

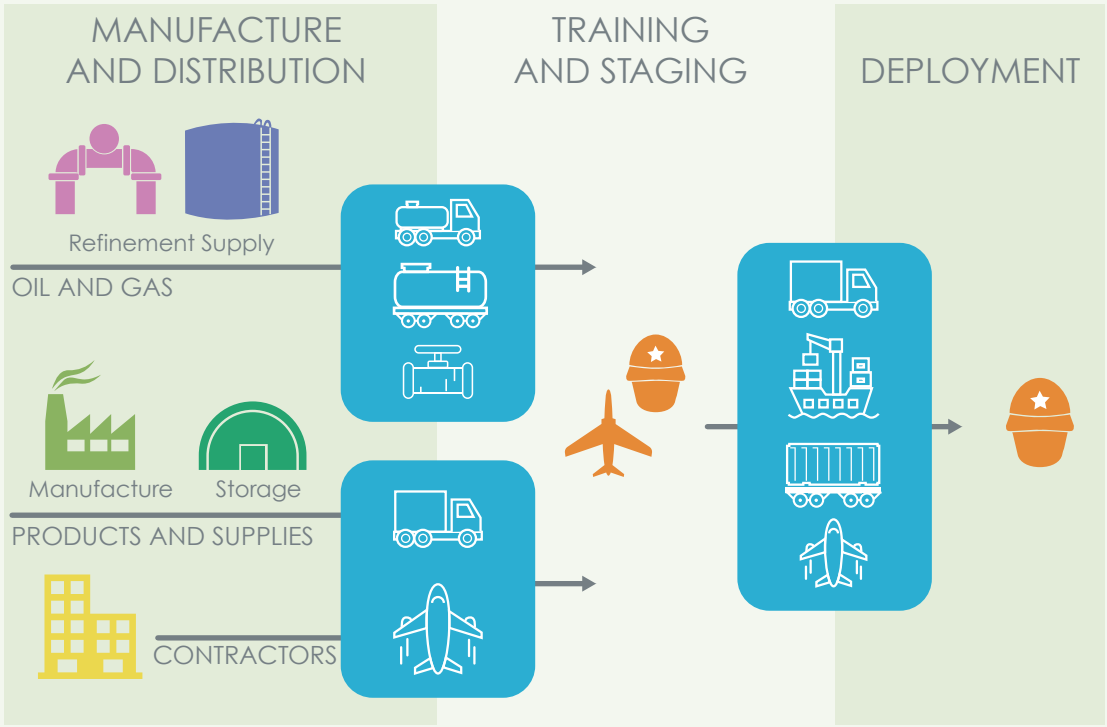
The industries within the agriculture and food processing sector require a wide range of transportation and logistics services to move raw agricultural commodities (e.g., grains, vegetables, fruits, livestock), agricultural inputs (e.g., fertilizer, pesticides), and foods products for intermediate or final consumption. Some products such as grain are bulky and low-value commodities that are mostly transported at lower unit costs by water and rail modes. Other commodities, such as fresh fruits, vegetables, and meats, are highly perishable and high-value items and therefore, rely on refrigerated trucks and railcars, refrigerated cargo ships as well as air cargo to protect the integrity of the shipments. Cold chain logistics has transformed the farming industry by providing facilities with several storage areas with different temperature settings to handle regular grocery goods at ambient temperature, produce, dairy, meat, and frozen products, where significant amount of perishable food products can be received, stored, sorted, and assembled into loads bound for respective grocery stores.

The most common crops and livestock in North Carolina are tobacco, soybeans, sweet potatoes, peanuts, and various kinds of corn, hay, cotton, cut Christmas trees, broilers, and chickens, turkeys, and hogs.



Supply Chain Focus
Military Freight





Annually, eastern North Carolina supports an overall military-related economic impact of $48 billion, including 540,000 military-related jobs.

Source: NCDOT 25-Year Vision for North Carolina: Mapping Our Future.

The military is a critical economic driver for the State of North Carolina. It also is a driver of freight and cargo movements, especially in the eastern portion of the State. This includes the movement of military personnel, supplies and equipment around North Carolina, the United States, and throughout the world. In North Carolina, military facilities and activities consist of U.S. Department of Defense (DoD) operations and the North Carolina National Guard, with every branch of the U.S. Military represented, including the U.S. Army, Navy/Marines, Air Force, and Coast Guard. These bases range from training facilities to military terminals and are primarily located on the eastern side of the State, along the coastline.

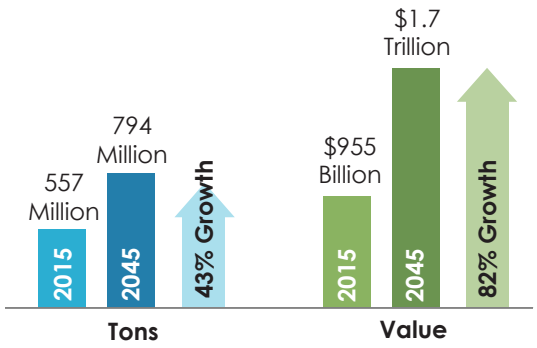
All of the military facilities cited freight transportation assets as a contributing factor in base expansion and realignments. Some of the key challenges and bottlenecks identified are:

- 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.

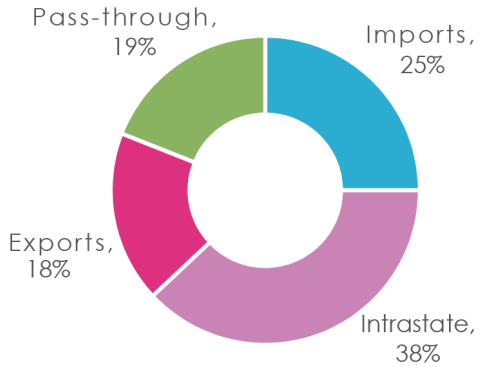
Tracking Economic and Freight Demand and Growth Forecasts

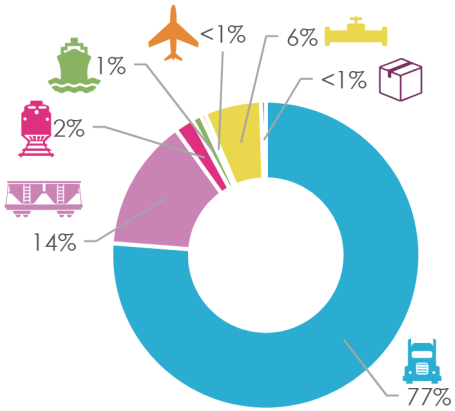
The statewide commodity flows summarize the total freight flows moving to, from, within, and through North Carolina currently and in the future. It provides insight into modal dependence, route choice, and equipment and service required to meet the needs of the State's businesses and residents.

In 2015, 557 million tons of freight valued at $955 billion moved over North Carolina's transportation system. By 2045, North Carolina's transportation system is projected to carry more than 794 million tons of freight valued at $1.7 trillion annually, an increase of 43 percent by tonnage and 82 percent by value. The weight of shipped commodities is important to understanding how freight vehicles use the transportation system. This understanding is critical when addressing factors such as bridge stress, pavement consumption, and congestion. Shipment weights for different commodity types are also crucial when assessing the impacts of certain commodities and industries (including consumer goods, coal, and non-metallic minerals) on the transportation system. However, it also is important to consider the value of the products being transported. It is particularly important in understanding the impacts of value-added manufacturing and service-related

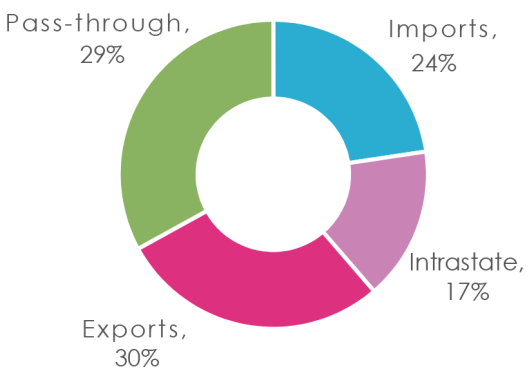


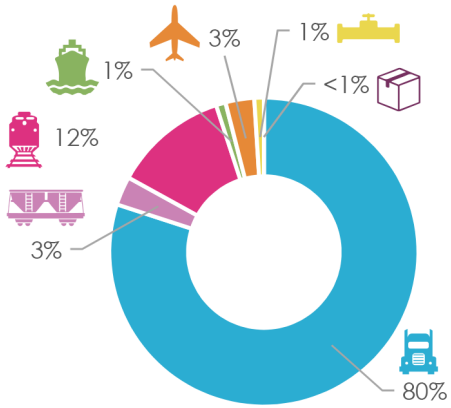
2015 Total Tons: 557 Million





2015 Total Value: $955 Billion





Truck | Rail Carload | Rail Intermodal | Water | Air | Pipeline | Other

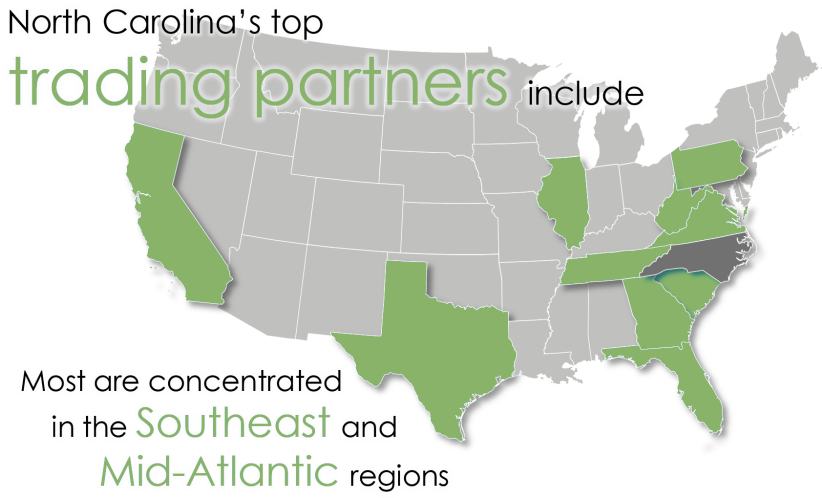
industries. These industries tend to generate and ship lower-weight, higher-value commodities.

Every freight shipment can be categorized as moving in one of four directions- imports, exports, intrastate, or pass-through. By volume, the largest component of the State's freight movements is intrastate, accounting for 38 percent of the 557 million tons moved in 2015. Most of these flows constitute movement of heavy bulk commodities (e.g., gravel, non-metallic mineral products, gasoline, logs and wood products) associated with construction, and forestry and wood products industries. By value the largest component of total statewide freight is exports originating in the State and being shipped outside the State (30 percent). North Carolina's import and export freight flows are fairly even, allowing for balanced trade lanes. This is important because it allows carriers a better opportunity to reduce empty hauls which leads to more competitive transportation rates for the region's shippers.

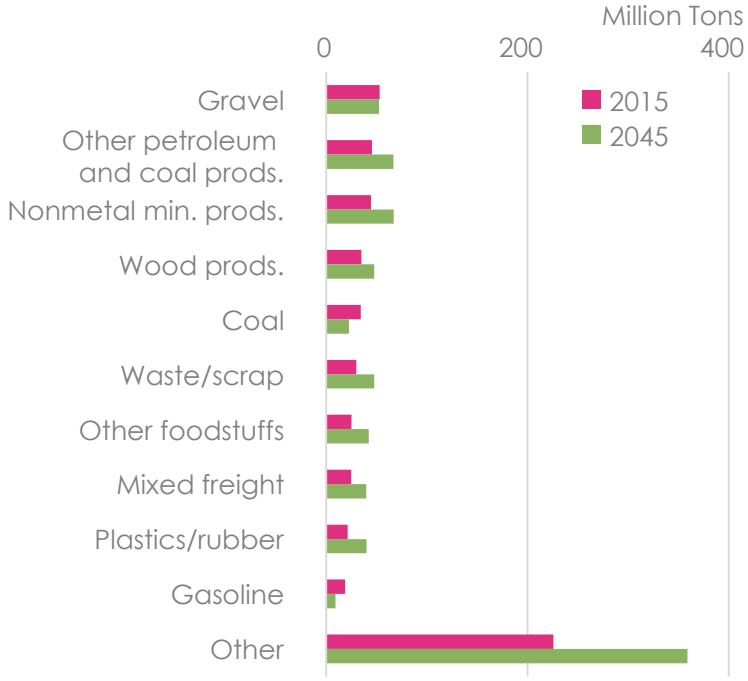
Trucks are the dominant mode utilized for carrying these goods, transporting 77 percent of the total volume and just over 80 percent of the total value of goods in 2015. Rail moved the second highest

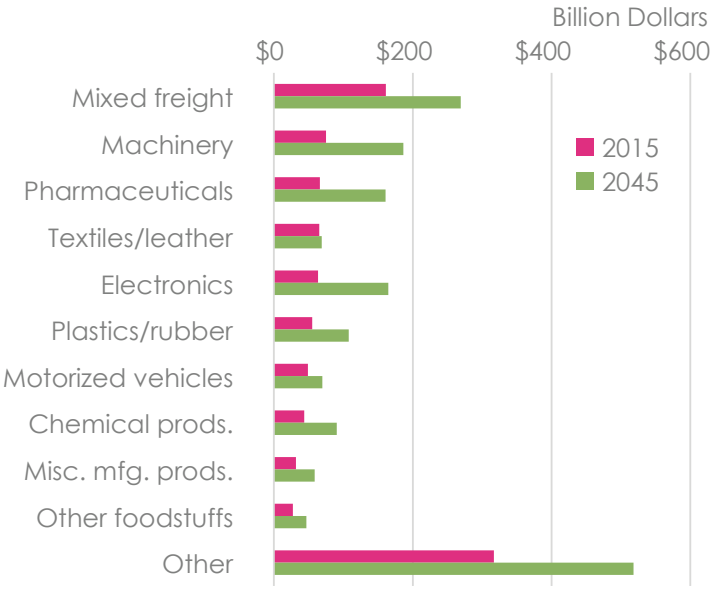
volume of freight, carrying 16 percent of the State's freight volumes with 14 percent in full carloads and 2 percent by intermodal cars. It also represented the second highest modal share measured by value, with 12 percent by intermodal cars. The heavy reliance on trucks to move freight has cascading impacts on infrastructure (i.e., roads and bridges), air quality, and the cost to businesses and consumers.

Most of North Carolina's top trading partners are concentrated in the Southeast and Mid-Atlantic regions. It is not surprising that North Carolina relies heavily on trucks for moving its goods, when its largest trading partners are accessible by truck within a day of travel – extending from north Florida to eastern Pennsylvania along the Eastern Seaboard, as far west as Nashville in the Southeast, and as far north as Cleveland in the Midwest. This footprint also contains several freight assets outside of North Carolina that are valuable to the State's shippers, such as the Ports of Jacksonville, Savannah, Charleston, and Norfolk. Other important trading partners that are not within a day of travel are key rail lanes for intermodal shipments connecting to terminals in Illinois, Florida, Texas, California, and some nearby in Georgia and Tennessee.



COMMODITY FLOW FORECASTS OVER THE NEXT 30 YEARS



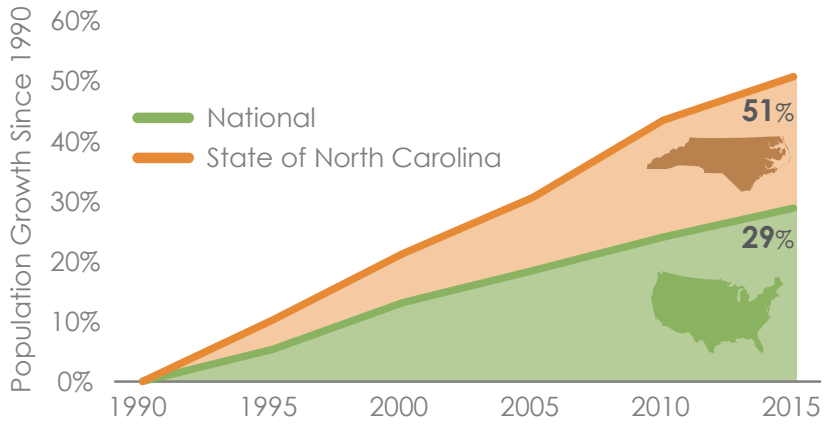


Trends Shaping Our Future

There are a number of global, national, and statewide trends that will continue to drive the demand for and performance of North Carolina's freight transportation system. Leading trends impacting future freight flows include continued statewide population growth, technology innovations in transportation such as the advent of autonomous vehicles, new business and consumer practices such as the emergence of e-commerce fulfillment centers, containerization and intermodal growth, and global shifts in manufacturing.

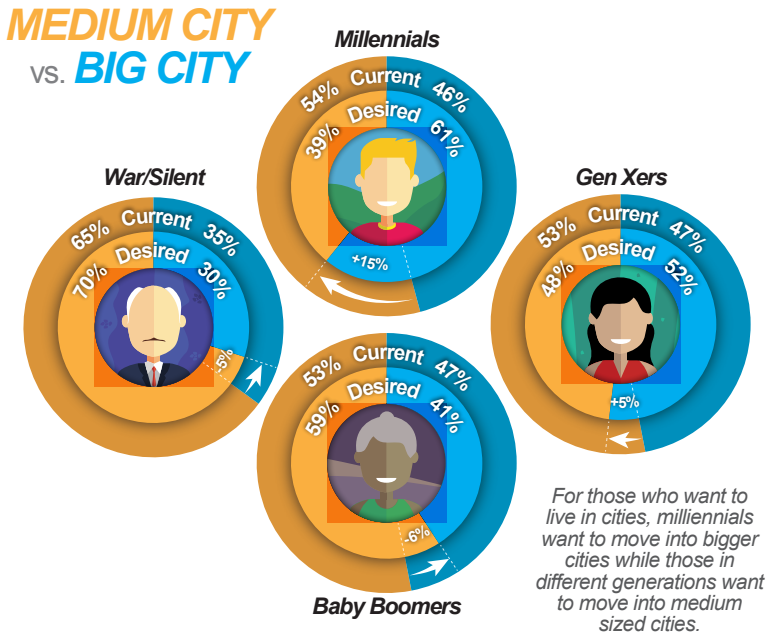
Population and Urbanization on The Rise

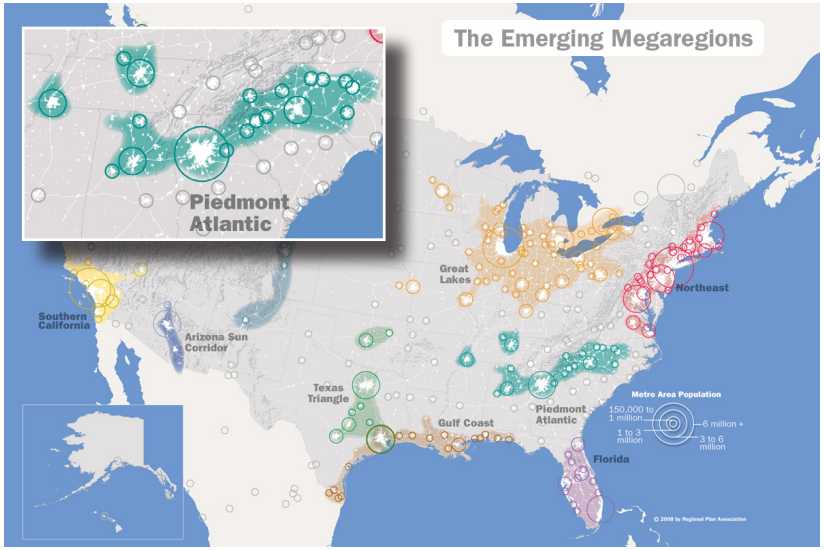
North Carolina's demographics are changing. The population of North Carolina has grown from 6.7 million people in 1990 to 10 million people in 2015, a total growth rate of 51 percent. Over the same time period, the population of the U.S. has increased by 29 percent. Population change is a key contributor to economic growth and transportation demand, as increases in population create demand for goods and services. In conjunction with the expanding demand for goods and services, population impacts the number of passenger and freight trips through the North Carolina transportation system. As the number of passenger vehicles and trucks continues to multiply, competition will rise for the increasingly scarce capacity remaining on the highway system, straining existing roadway capacity and resulting in more severe congestion. As highway congestion increases, freight rail will be an increasingly in demand to meet the needs of those industries that are particularly reliant on freight.



U.S. Census data indicates that a significant share of the Nation's population is shifting from Northeastern and Midwestern states to Southeastern states such as North Carolina. Much of this growth will be centered in North Carolina's, and other states', major metropolitan areas. The urbanization, or concentration of the nation's population in metropolitan areas, will lead to the emergence of megaregions which will influence the movements of goods, people and capital. These regions will act as semi-unified entities as their economies become increasingly linked. This linking of economies necessitates a corresponding linking of freight and other infrastructure assets to support economic and population growth. For the Piedmont Atlantic megaregion (which includes North Carolina), much of the impact of an emergent megaregion will be concentrated along the I-85 corridor.

The rate of urbanization will be influenced by the generational composition of the State's population as millennials have a higher desire for big city living relative to Baby Boomers and older generations. As growth in North Carolina's metropolitan areas increases and as metropolitan economies across the Southeast are increasingly linked via megaregions, there will be greater demand for resources in these communities. Effective freight planning will need to address goods movement within the mega-region and to neighboring mega-regions, and how the future freight network will serve the State's rural communities and connect them to the mega-region. This heightens the importance of addressing connectivity between rural and urban areas.





Source: Regional Plan Association. America 2050. http://www.america2050.org/piedmont_atlantic.html.

Since trucking is currently, and predicted to remain, the predominant freight mode much of the corresponding increase in freight activity will occur on North Carolina's highways. The I-85 corridor will become even more important as it forms the backbone of the Piedmont Atlantic megaregion.

Technology – Changing the Way Freight Moves

Technology innovations have the potential to optimize and improve the transportation network. These innovations include the freight portion of the broader trends in autonomous and connected vehicles. Researchers have predicted that when the majority of the fleet is both connected and automated, there will be significant decreases in crashes, resulting in significant increases in safety and reliability. It will also lead to significant decreases in non-recurring congestion (i.e., incidents, work zones, weather, and special events), which accounts for about 50 percent of total congestion.[4] Decreased congestion provides the opportunity to get more capacity out of the existing system, lessening the need for expensive, time consuming capacity expansion solutions.

Commercial vehicles will likely be the earliest adopters of connected and automated vehicle technology given the intense pressures faced by the transportation industry. These include a shortage of commercial vehicle drivers that is likely to worsen over time,[5] pressure from shippers to reduce costs and increase reliability, and increasing demand that is expected to continue well into the future as the tonnage of freight moved on the multimodal freight system steadily grows.[6]

Regulatory issues that would allow for widespread use of relevant technologies could be realized in the next decade. Meanwhile, alternate delivery systems such as drones and freight shuttles have the potential for overhauling "last mile" approaches, and pilot programs both in the U.S. and Europe are testing such deliveries. Another source of technology is the potential evolution of transportation network companies (TNC) to expand into freight delivery beyond some of

4 FHWA. Office of Operations. http://ops.fhwa.dot.gov/program_areas/reduce-non-cong.htm.

5 American Trucking Association. Truck Driver Shortage Analysis, 2015. http://www.trucking.org/ATA%20Docs/News%20and%20Information/Reports%20Trends%20and%20Statistics/10%206%2015%20ATAs%20Driver%20Shortage%20Report%202015.pdf.

6 Bureau of Transportation Statistics. "Table 2-1 Weight of Shipments by Transportation Mode: 2007, 2013, and 2040." Freight Facts and Figures, 2015.

the current last-mile systems such as meal delivery. A more expansive TNC approach could have implications for costs (and thus driver earnings and retention), congestion reduction, and modal shift.

Business and Consumer Practices

Evolving business and consumer practices include changes in sourcing, advances in manufacturing and e-commerce. Manufacturing advances have increased the amount of heavy-haul transport in sectors such as energy, as more complex pieces are manufactured and shipped whole as opposed to assembled on site. Conversely, 3D printing innovations may reduce the size and distance of shipments and enable production closer to assembly or retail. As same-day and next-day delivery has become the norm for e-commerce transactions, retailers have begun to reposition regional distribution centers and smaller distribution centers closer to urban areas – the centers of demand. Delivery on such a short timeframe is expensive, though it has become necessary, as customers have come to expect this level of service. Strategically placed fulfillment centers allow firms to deliver the level of shipping service that consumers demand while maintaining relatively affordable costs.

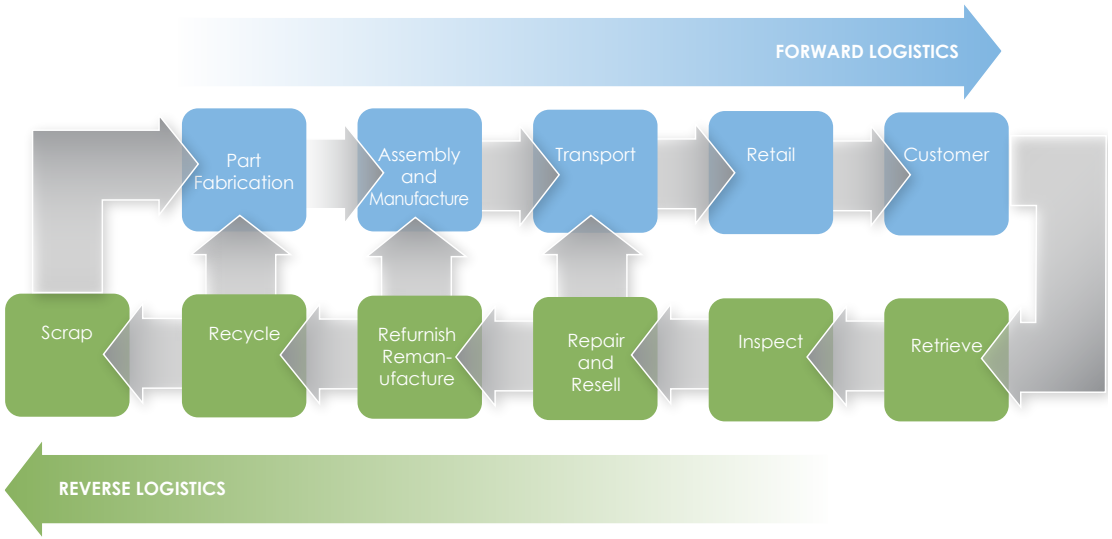
E-commerce continues to grow and evolve, including changes in "omni-channel" marketing, home delivery and alternate centralized parcel facilities, and private fleets of delivery vehicles and coordination with TNCs. The impact of the emergence of e-commerce and its supporting infrastructure on the North Carolina freight system is likely to be an increased importance on freight system reliability and more frequent truck trips in urban regions that utilize smaller vehicles and alternative delivery methods.

The portion of the highway network serving rail intermodal facilities, such as those in Charlotte, Greensboro and the proposed facility in Rocky Mount, will also be impacted as many e-commerce shipments with longer delivery times utilize rail intermodal service. To support the coordination of intermodal facilities with e-commerce fulfillment centers, the highway network linking these freight terminals must provide reliable performance if shippers are to develop schedules based on the level of service provided by these highway links. Reliability directly affects shipping costs and the ability of retailers to meet consumer demand.

Reverse Logistics

Reverse logistics involves all supply chain activities – returns, recalls, withdrawals, recycling, refurbishment, and disposal – connected with products after the point of sale. When a product cannot move forward in the supply chain or requires backward motion, reverse logistics practices works to recover lost value and determine the product's final destination. According to CBRE, returns during 2015 in the U.S. and Canada equaled $290 billion of retail sales and returned goods cost retailers about 4.4 percent of total annual revenue due to shipping and handling costs and significant markdowns to remove returned goods from inventory. As a result, reverse logistics has stimulated demand for facilities to handle the reverse flow of goods, especially near major population centers as these represent both the point of consumption and the logical point of return.

Reverse logistics will directly impact the North Carolina highway system as many of the support facilities will be located in major metropolitan areas and will be often co-located with other freight



assets, such as rail intermodal terminals. These support facilities include return, recycling, and refurbishment centers where returned goods will be further processed. Highways connecting into these facilities may experience growth in truck traffic that exceeds levels predicted in travel demand models as these models typically cannot account for such a micro level of detail in their estimates. In addition, as mentioned in the discussion of the impacts of e-commerce and fulfillment centers, rail intermodal service will likely play an important role in the forward logistics of e-commerce shipments with longer delivery times. Likewise, intermodal terminals will likely be important in the reverse logistics supply chain as returned goods are shipped to support facilities.

Containerization and Intermodal Shipments

The use of shipping containers was initiated in the late 1950s, but it was not until the 1980s that fully functional container terminals began to take hold. The use of containers to import and export goods was a true revolution in freight handling. Containers offered security of transport and logistical efficiencies that had not previously existed.

The efficiency of intermodal – ship to rail – container cargo is even more dramatic, cutting dwell times in the port by 50 percent or more. Due to efficiency of handling, the use of containers has expanded beyond use for consumer goods.

The role for intermodal terminals continues to grow as more products are shipped via container, including agricultural products and other materials previously shipped in bulk. Bulk products may be loaded and unloaded at customer facilities or with dedicated purpose built connections for transloading. Coal, petroleum, chemicals, plastics and paper, pulp, and paper products each fall into this category of freight products. Intermodal commodities are typically reported as a mix of commodities being shipped together and are often intended for a particular retailer (e.g., Lowe's or Wal-Mart).

Intermodal growth in North Carolina will be impacted by the CCX terminal construction in Rocky Mount. CCX will primarily serve Raleigh and the Eastern North Carolina freight market as well as act as a hub for the railroad's southeast and mid-Atlantic intermodal operations. It will provide the Port of Wilmington with rail intermodal service. The facility is expected to consolidate shipments and shipping lanes to serve the growing demand both in the region and nationally. The facility would also expect to divert long-haul truck traffic to rail, with most being through-traffic.

Reshoring of Domestic Manufacturing

The combination of a growing wages in China and Southeast Asia and higher transportation costs has led to a number of firms shifting manufacturing back to the United States, a trend known as reshoring. In addition to increasing labor costs, locating production closer to U.S. consumers carries other advantages, such as allowing supply chains to be more responsive to changing consumer tastes and the ability to better manage disruptions. As a result, the U.S., and the Southeast in particular, has become a more attractive location for high-value manufacturing. Not only has this spurred U.S. companies to bring back certain manufacturing activities, it has also increased the attractiveness of the U.S. for foreign direct investment from international firms.

U.S. Manufacturing Jobs/Year 2016
The Tide Has Turned

	2000-2003 Annual Average	2016	~% Change
New Offshoring	~240,000*	~50,000*	-80%
New Reshoring and FDI	12,000*	77,000**	+500%
Net Jobs Gained	~ -220,000	~ +25,000	N/A

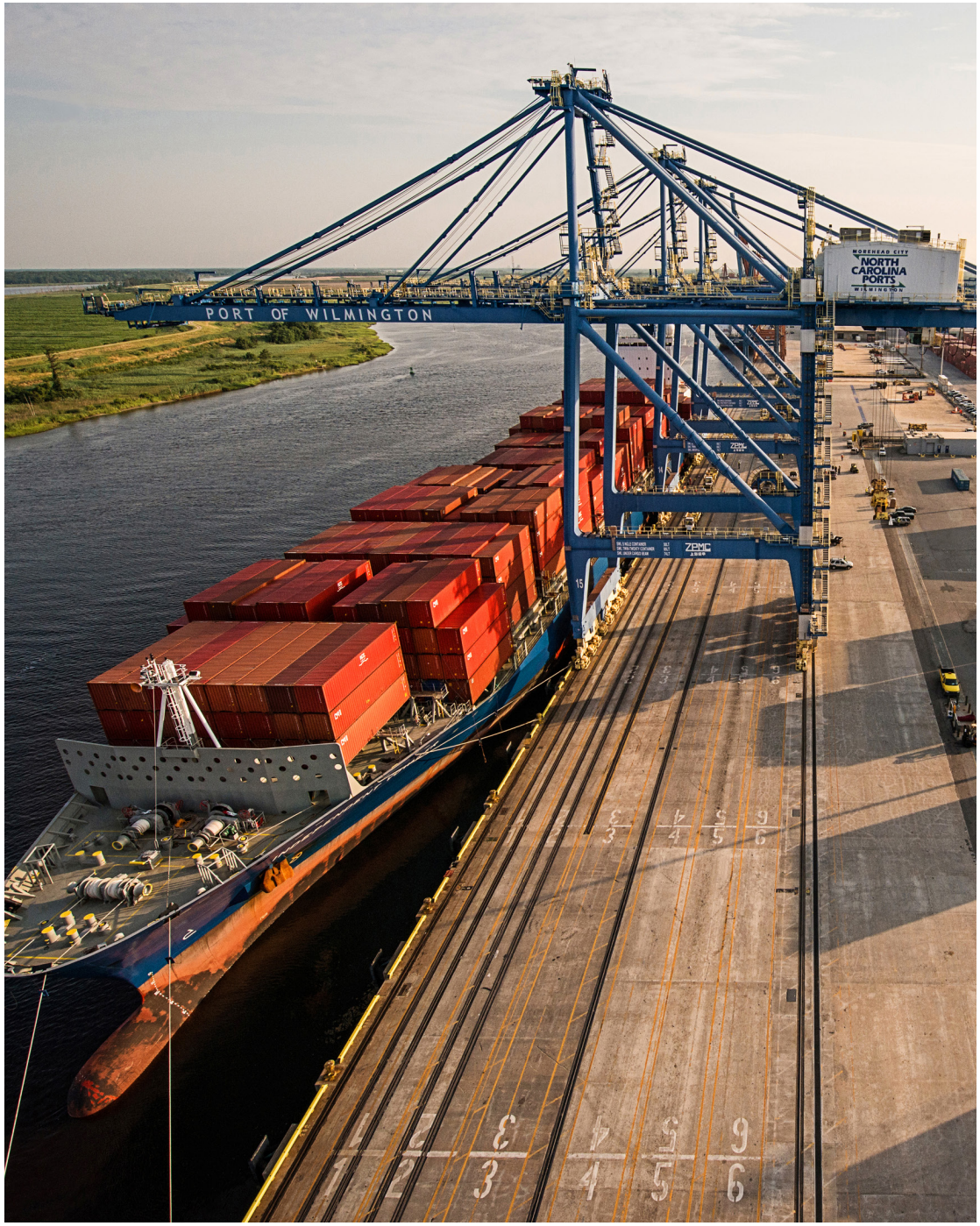
Source: Reshorenow.org.

*Estimated.

** Calculated – Reshoring Library through December 31, 2016.

Between 2010-2016 North Carolina was 5th in the Nation attracting over 18,000 reshoring manufacturing jobs in 109 companies.

The trend of reshoring along with foreign direct investment has created an opportunity for North Carolina to leverage its freight assets to improve its competitiveness in high-value manufacturing. The expansion of the State's interstate highway system along with improved rail service and connectivity to the Port of Wilmington could make North Carolina more desirable to these types of investments. According to the Reshoring Initiative, North Carolina is fourth (behind South Carolina, Tennessee, and Georgia) in the cumulative number of manufacturing jobs that result from reshoring or foreign direct investment.[7] With the planned increased investments in the highway system, especially the interstate system and roadways that provide access to major freight terminals (e.g., the Port of Wilmington, the CSX terminal at Rocky Mount, Charlotte-Douglas International Airport, etc.); North Carolina could surpass its southeast competitors.

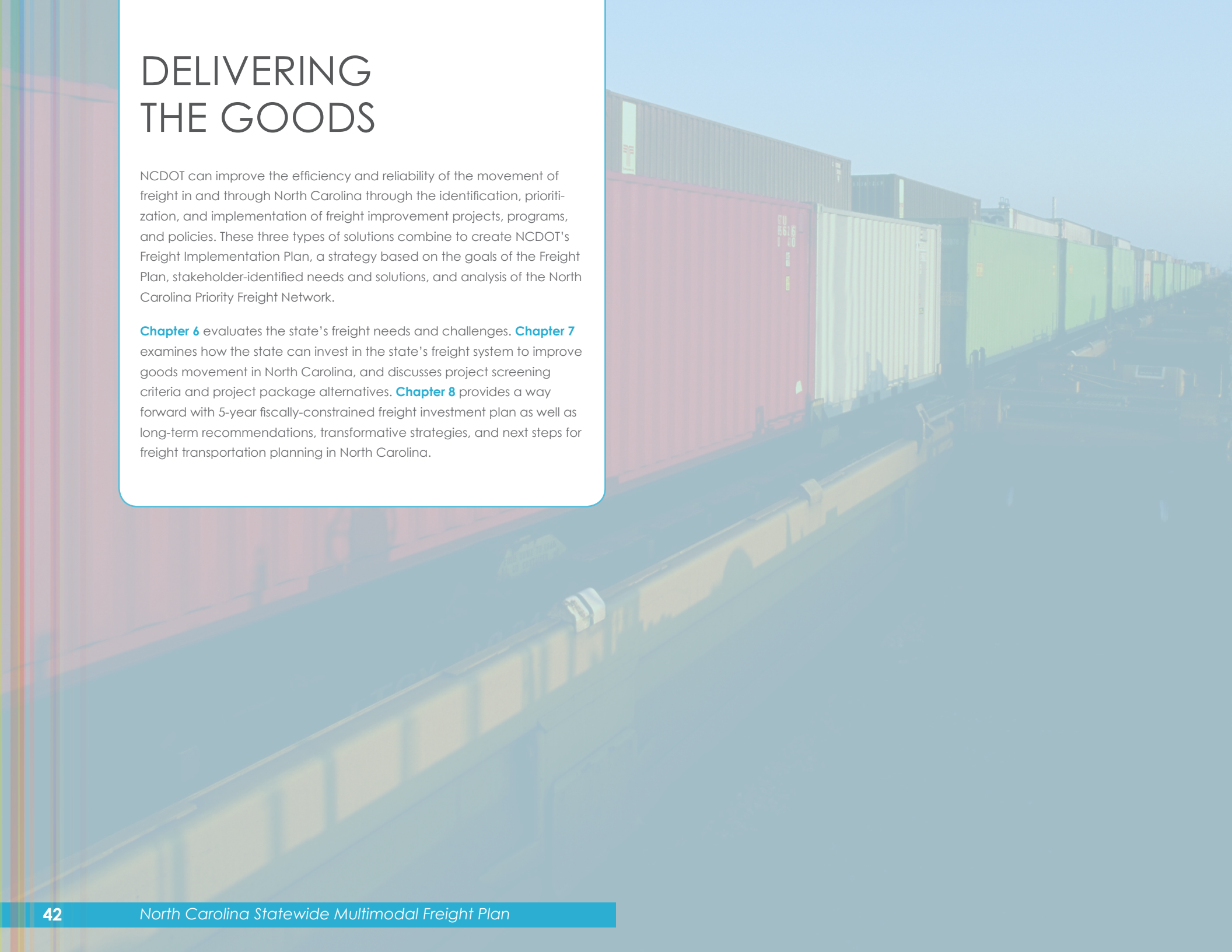


7 Reshoring Initiative. Reshoring Initiative Data Report, 2015. http://reshorenow.org/content/pdf/2015_Data_Summary.pdf.

DELIVERING THE GOODS

NCDOT can improve the efficiency and reliability of the movement of freight in and through North Carolina through the identification, prioritization, and implementation of freight improvement projects, programs, and policies. These three types of solutions combine to create NCDOT's Freight Implementation Plan, a strategy based on the goals of the Freight Plan, stakeholder-identified needs and solutions, and analysis of the North Carolina Priority Freight Network.

Chapter 6 evaluates the state's freight needs and challenges. **Chapter 7** examines how the state can invest in the state's freight system to improve goods movement in North Carolina, and discusses project screening criteria and project package alternatives. **Chapter 8** provides a way forward with 5-year fiscally-constrained freight investment plan as well as long-term recommendations, transformative strategies, and next steps for freight transportation planning in North Carolina.



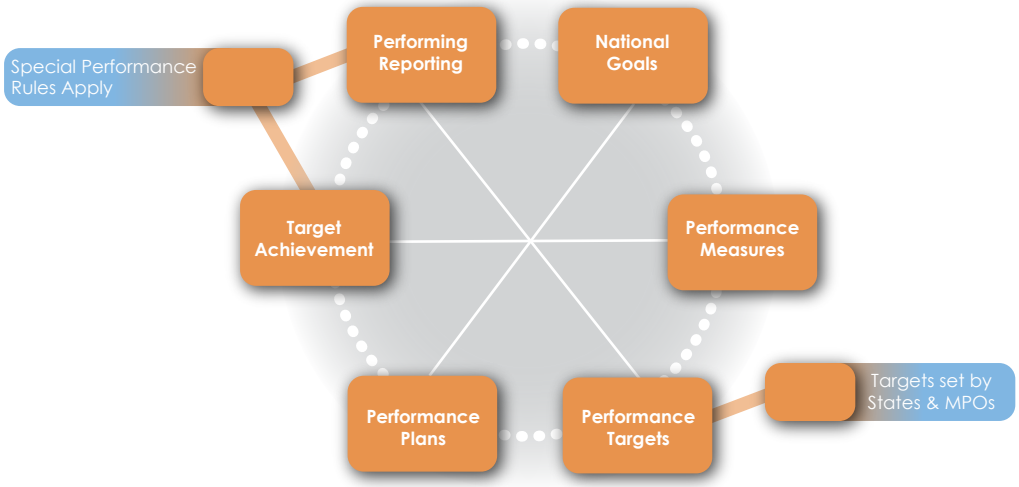
6 EVALUATING OUR FREIGHT NEEDS AND CHALLENGES

Assessing Performance

Performance measures are intended to track the State's freight system performance against the Statewide Multimodal Freight Plan goals of: Economic Competitiveness, Mobility and Reliability, Asset Management, Safety and Security, Environmental Sustainability and Livability, Innovative Technology, Sustainable Funding, and Collaboration and Partnership.

State and Federal transportation agencies have long used asset and performance management techniques to assess, measure, and gauge infrastructural and operational capabilities of their systems. Each state tends to have individual interpretations as to how, if, and which performance measures should be incorporated into their planning and programming processes, but while approaches differ, agencies tend to measure the same basic physical and operational elements. In an effort to incorporate uniformity in these measures and emphasize a performance-based approach in applying the Federal Highway Program, the U.S. DOT, by way of MAP-21 and FAST Act legislation, has proposed several performance measures across key management areas, including safety, pavements, bridges, freight, emissions, performance, and congestion. This approach will incorporate performance management into Federal and state transportation programs, unify high-level national transportation goals, and link key measures to state and local funding opportunities.

FEDERAL GUIDANCE FOR TRANSPORTATION PERFORMANCE MANAGEMENT



Source: FHWA Transportation Performance Management.

Freight Performance Measures Based Upon FHWA Final Rulemaking

Freight performance measures were identified by starting with the FHWA final rulemaking on national freight performance measures that took effect in May of 2017 and adding performance measures that are related to the Freight Plan goals.

The FHWA final rulemaking on freight requires state DOTs to calculate freight travel time reliability on the Interstate highway system using the Truck Travel Time Reliability (TTTR) index. High TTTR values indicate unreliable truck travel times while low TTTR values indicate more reliable travel times. For example, a TTTR value equal to 2 indicates that truck travel times may be twice as long as average travel times for a given time period.

The TTTR index measures the variability of travel times on the highway network. Highly variable, or inconsistent, truck travel times result in unreliable service over the highway network. Unreliability is a direct cost to motor carriers as they must hedge against unreliable travel times by budgeting additional time into their schedules. This translates into higher transportation costs that may be passed on to shippers. Wasted time also reduces available hours of service for the truck drivers.

Performance Measures Based Upon Freight Plan Analysis

In addition to FHWA final rulemaking, the North Carolina Statewide Multimodal Freight Plan includes additional performance measures to support its goals and objectives.

Input for consideration for target setting is provided for measures with adequate trend data. NCDOT will be undertaking a department wide target setting exercise for all performance measures in 2018.

PERFORMANCE MEASURES BASED UPON FREIGHT PLAN ANALYSIS

Performance Measure	Current Condition	Trend	Analysis	Target Setting Consideration
Economic Competitiveness				
North Carolina's employment growth relative to national growth in freight-related defined target supply chains	***Freight employment growth 2014-2015:*** • North Carolina: 3.45 percent (1.39 million/1.34 million) • U.S.: 2.57 percent (44.91 million/ 43.79 million) • 3.45 percent – 2.57 percent = 0.88 percent	***2014:*** 0.81 percent ***2013:*** 0.34 percent ***2012:*** 1.03 percent ***2011:*** 0.01 percent ***2010:*** 1.21 percent	***Positive trend:*** From 2014 to 2015, the State of North Carolina's freight employment growth was 0.88 percent higher than the national freight employment growth and is trending in a positive direction. The gap between North Carolina and national freight related growth gradually shrank between 2010 and 2014. In 2015, North Carolina's employment growth exceeded national growth.	Maintain growth equal to or exceeding national average
Cargo volume through State seaports	***By cargo tonnage in 2015:*** • North Carolina: 6,545,267	***2013:*** 7,678,423 ***2014:*** 6,944,167	***Negative trend:*** In recent years, North Carolina's cargo tonnage has dropped slightly.	Maintain or increase year-over-year cargo tonnage
Percent import vs. export commodities by weight and value	***Mode by weight in 2015:*** • Truck: 7.9 percent • Rail (carload): -67.3 percent • Water: -78.7 percent • Air: 1.2 percent • Rail (intermodal): 10.7 percent • Pipeline: -27.5 percent • Other: -79.3 percent • Total: -15.6 percent ***Mode by value in 2015:*** • Truck: 16.0 percent • Rail (carload): -53.5 percent • Water: -35.4 percent • Air: -7.7 percent • Rail (intermodal): 13.8 percent • Pipeline: -11.0 percent • Other: 33.0 percent • Total: 11.1 percent	***Mode by weight in 2012:*** • Truck: 7 percent • Rail (carload): 71 percent • Water: 80 percent • Air: 7 percent • Rail (intermodal): 8 percent • Pipeline: 25 percent • Other: 75 percent • Total: 18 percent ***Mode by value in 2012:*** • Truck: 15 percent • Rail (carload): -54 percent • Water: -61 percent • Air: 1 percent • Rail (intermodal): 16 percent • Pipeline: -9 percent • Other: -69 percent • Total: 11 percent	***Positive trend:*** A positive number indicates North Carolina exports far more than it imports. By weight, North Carolina imports more than it exports, but the imbalance is shrinking. By value, North Carolina has a stable positive trade imbalance.	Maintain or reduce trade imbalance
Rail modal share from ports	0.0 percent	***Percent rail mode projected:*** 8 percent, 10 percent, and 12 percent predicted over the next three years when intermodal service to Charlotte begins.	***Positive trend:*** Rail mode share is expected to increase now that the rail intermodal service Queen City Express has begun.	Increase to 8% by 2020 and 10% by 2022

Performance Measure	Current Condition	Trend	Analysis	Target Setting Consideration
Mobility and Reliability				
Travel time reliability	***Truck buffer index on the NCPHFN:*** • AM – 47 percent • Midday – 46 percent • PM – 50 percent	Not available	There are significant fluctuations in travel time at all periods of the day. This makes it difficult for truck operators to predict arrival times.	TTTRI – Meet national targets on Interstates 2018 – 50% on remaining NCPHFN 2022- 45% on remaining PHFN
Incident clearance times	***Minutes in 2017:*** • 75.0	***2015:*** 69.2 minutes ***2014:*** 64.9 minutes ***2013:*** 61.8 minutes	***Negative trend:*** As of 2017, incident clearance times are 75 minutes in North Carolina. This is a negative trend, up from 61.8 minutes in 2013.	2018 – 70 minutes 2022 – 60 minutes
Number of congested directional-miles	***Congested directional miles on the NCPHFN:*** • AM – 2,409 (30 percent) • Midday – 2,367 (30 percent) • PM – 2,607 (33 percent)	Not available	Roughly one-third of all directional miles on the freight highway network experience some level of congestion and delay throughout the day.	NCPHFN congested miles 30%
Percent of short line rail network with 286K capacity	***Rail Network Mileage in 2017:*** • With capacity: 395 • Entire rail network: 722 • Percent with capacity: 54.7 percent	Not available	More than half of the entire rail network has the capacity to accommodate trains that are more than 268,000 pounds. The remaining rail network has been determined to have insufficient infrastructure to handle more than 268,000 pounds.	Class I – 100% Shortlines – maintain or increase
Number of at-grade crossings within 85 percent of volume threshold for grade separation eligibility	***At-grade crossings in 2016:*** • Rural: 188 • Urban: 149 • Total: 337	Not available	There are 337 at-grade crossings within 85 percent of volume threshold for grade separation eligibility. The majority of these at-grade crossings are rural.	Maintain or decrease number
Average travel time from port gate to freeway	***Average travel time in 2016:*** *Morehead City to I-795 (106 miles):* • AM – 181 minutes • PM – 187 minutes *Wilmington to I-40 (8.8 miles):* • AM – 26 minutes • PM – 30 minutes	Not available	Travel times from Morehead City to I-795 indicated reasonable travel conditions with little delay. Travel times from Wilmington to I-40 indicate significant delay.	Maintain Morehead City Wilmington – 25 minutes

Performance Measure	Current Condition	Trend	Analysis	Target Setting Consideration
North Carolina airports' vs. all U.S. airports' air cargo total tonnage	***Enplaned air freight and mail in 2016:*** • North Carolina: 276,825 • U.S.: 17,322,680 • Percent: 1.6 percent	***2015:*** • North Carolina: 293,929 • U.S.: 18,710,162 • Percent: 1.57 percent ***2014:*** • North Carolina: 293,929 • U.S.: 18,710,162 • Percent: 1.57 percent ***2013:*** • North Carolina: 279,602 • U.S.: 17,520,843 • Percent: 1.6 percent ***2012:*** • North Carolina: 268,459 • U.S.: 17,387,528 • Percent: 1.54 percent	***Stable trend:*** North Carolina's share of national airport cargo tonnage has remained stable over the last 5 years. North Carolina's three airports are ranked 39th, 50th, and 60th among the 135 U.S. airports ranked in 2015. In 2016, North Carolina enplaned air freight and mail make up 1.6 percent of total U.S. air tonnage.	Maintain or increase share
Safety and Security				
Percent of fatal motor-vehicle crashes involving trucks from total fatal motor-vehicle crashes	***Fatal truck-involved motor vehicle crashes in 2015:*** • Truck Involved: 74 • All Motor Vehicle Crashes: 1,380 • Percent: 5.4 percent ***2011-2015 Total:*** 293 ***5-year rolling average:*** 59	***2014:*** • Truck Involved: 62 • All Motor Vehicle Crashes: 1,277 • Percent: 4.9 percent ***2013:*** • Truck Involved: 48 • All Motor Vehicle Crashes: 1,260 • Percent: 3.8 percent ***2012:*** • Truck Involved: 61 • All Motor Vehicle Crashes: 1,262 • Percent: 4.8 percent ***2011:*** • Truck Involved: 48 • All Motor Vehicle Crashes: 1,208 • Percent: 4 percent	***Stable trend:*** While total highway fatalities in North Carolina have been trending upwards, truck-involved motor vehicle crash fatalities have remained relatively constant until a slight increase in 2015.	Toward 0 with declining trend

Performance Measure	Current Condition	Trend	Analysis	Target Setting Consideration
Percent of fatal crashes involving trucks at at-grade rail crossings from total fatal crashes at at-grade rail crossings	***Fatal crashes at at-grade rail crossings in 2015:*** • Truck-involved: 0 • Total: 9	***2014:*** • Truck Involved: 0 • Total: 4 ***2013:*** • Truck Involved:: 0 • All Motor Vehicle Crashes: 7 ***2012:*** • Truck Involved: 0 • All Motor Vehicle Crashes: 2 ***2011:*** • Truck Involved: 0 • All Motor Vehicle Crashes: 3	***Positive trend:*** There have been zero truck involved fatal crashes at at-grade rail crossings from 2011 to 2015, compared to only a handful of motor-vehicle fatal crashes at at-grade rail crossings.	Maintain 0
Percent of crashes involving trucks	***Truck-involved motor vehicle crashes 2015:*** • Truck Involved: 6,871 • All Motor Vehicle Crashes: 251,638 • Percent: 2.7 percent 2011-2015 Total: 28,574 5-year rolling average: 5,715	***2014:*** • Truck Involved: 6,116 All Motor Vehicle Crashes: 226,552 • Percent: 2.7 percent ***2013:*** • Truck Involved: 5,081 • All Motor Vehicle Crashes: 220,271 • Percent: 2.3 percent ***2012:*** • Truck Involved: 5,330 • All Motor Vehicle Crashes: 213,605 • Percent: 2.5 percent ***2011:*** • Truck Involved: 5,176 • All Motor Vehicle Crashes: 208,471 • Percent: 2.5 percent	***Stable trend:*** The share of truck-involved crashes has remained somewhat stable over the last five years. Both total and truck involved crashes have been increasing from 2011 to 2015; the percentage of truck involved crashes has risen marginally.	2.5% or lower
Percent of rail crossings with no active warning devices	***Number of rail crossings with no active warning in 2016:*** • Crossings with no active warning devices: 981 • All crossings: 3,575 • Percent of all crossings: 27.4 percent	***2011:*** • Crossings with no active warning devices: 1,051 • All crossings: 3,629 • Percent of all crossings: 29 percent	***Positive trend:*** There are fewer crossings without active warning devices in 2016 compared to 2011, both in absolute and relative terms.	Reduce number annually

Performance Measure	Current Condition	Trend	Analysis	Target Setting Consideration
Asset Management				
Percent of lane miles on the NCPHFN in fair or better condition	***Percentage of NCPHFN Roadways in fair or better condition in 2015:*** • 93 percent	***2014:*** 95 percent ***2013:*** 94 percent ***2012:*** 90 percent ***2010:*** 85 percent ***2008:*** 86 percent ***2006:*** 86 percent	***Positive trend:*** More of the NCPHFN is in fair or better condition today than 10 years ago.	95%
Percentage of NCDOT state-maintained bridges on the NCPHFN that are structurally deficient or functionally obsolete	***Functionally Obsolete Bridges on NCPHFN:*** • 26/391 = 7 percent ***Structurally Deficient Bridges on NCPHFN:*** • 22/170 = 13 percent	***2016:*** 9 percent ***2015:*** 10 percent ***2014:*** 10.5 percent ***2013:*** 11 percent	***Positive trend:*** The percentage of deficient structures is steadily declining on an annual basis.	5%
Innovative Technology				
Percent of NCPHFN with ITS infrastructure	***PHFN Roadways with ITS infrastructure in 2017:*** • Roadway miles with ITS: 573 • Total NCPHFN miles 3813 • 15 percent with ITS	Not available	On the NCPHFN 15 percent of roadways are equipped with ITS infrastructure as of 2017.	Move toward 100% of interstate system
Percent of weigh stations on NCPHFN with Weigh in Motion (WIM)	***Weigh Stations with WIM in 2017:*** • Weigh stations with WIM: 7 • Total weigh stations: 19 • 37 percent with Weigh in Motion (WIM)	***2016:*** 37 percent ***2015:*** 32 percent ***2014:*** 26 percent ***2013:*** 21 percent	***Positive trend:*** Out of the 19 weigh stations in the NCPHFN, 7 have WIM technology. The percentage of stations with WIM is higher today than in 2013. However, WIM technology has been slow to be implemented and these numbers are only expected to change as new stations come online.	Move toward 100%
Environmental Sustainability and Livability				
Emissions from truck delay	***2014 Truck VMT and delay emissions annual tons:*** • CO_2 – 1,231,650 • NO_x – 6,126 • VOC – 561 • $PM_{2.5}$ – 288	Not available	Emissions data for heavy duty vehicles taken from the EPA National Emissions Inventory (2014), and truck VMT and delay data calculations developed through the North Carolina statewide transportation model.	Reduce annually based on truck delay target and Federal heavy-duty vehicle emission standards

Performance Measure	Current Condition	Trend	Analysis	Target Setting Consideration
Freight rail modal share (excluding pass-through)	***2015 rail modal share by weight:*** • 15.3 percent (85,082 thousand tons) ***2015 rail modal share by value:*** • 15 percent ($143,188 million)	***2012 rail modal share by weight:*** • 16.6 percent (84,296 thousand tons) ***2012 rail modal share by value:*** • 17 percent ($155,331 million)	***Positive trend:*** Although the primary means of goods transport to, from, and within North Carolina is by truck, the planned CCX intermodal terminal and new intermodal service to Port of Wilmington present an opportunity to encourage and accommodate increased use of freight rail.	2022 – 20%
Sustainable Funding				
Percent spent of Freight Program Funding	Future performance measure	Not available	The expectation is that all freight program funds will be spent.	100%
Percent STI Funding on NCPHFN	Future performance measure	Not available	This performance measure can be calculated for the next round of STI.	Increasing share

Highway Needs Assessment

Identification of highway freight needs are focused on the North Carolina Priority Highway Freight Network (NCPHFN) as these facilities have been recognized as most important for the movement of freight throughout the State. Freight-related highway needs were identified by evaluating the conditions and performance of the NCPHFN based on the goals of the Plan (see Chapter 2) and through the stakeholder engagement process. The highway needs were grouped into five major categories: safety; mobility and reliability; rural; asset management and utilization; and technology and operational improvements. The analysis factors included in each of these categories are described next, along with maps depicting the factors that went into the calculations of the roadway needs.

Safety Needs

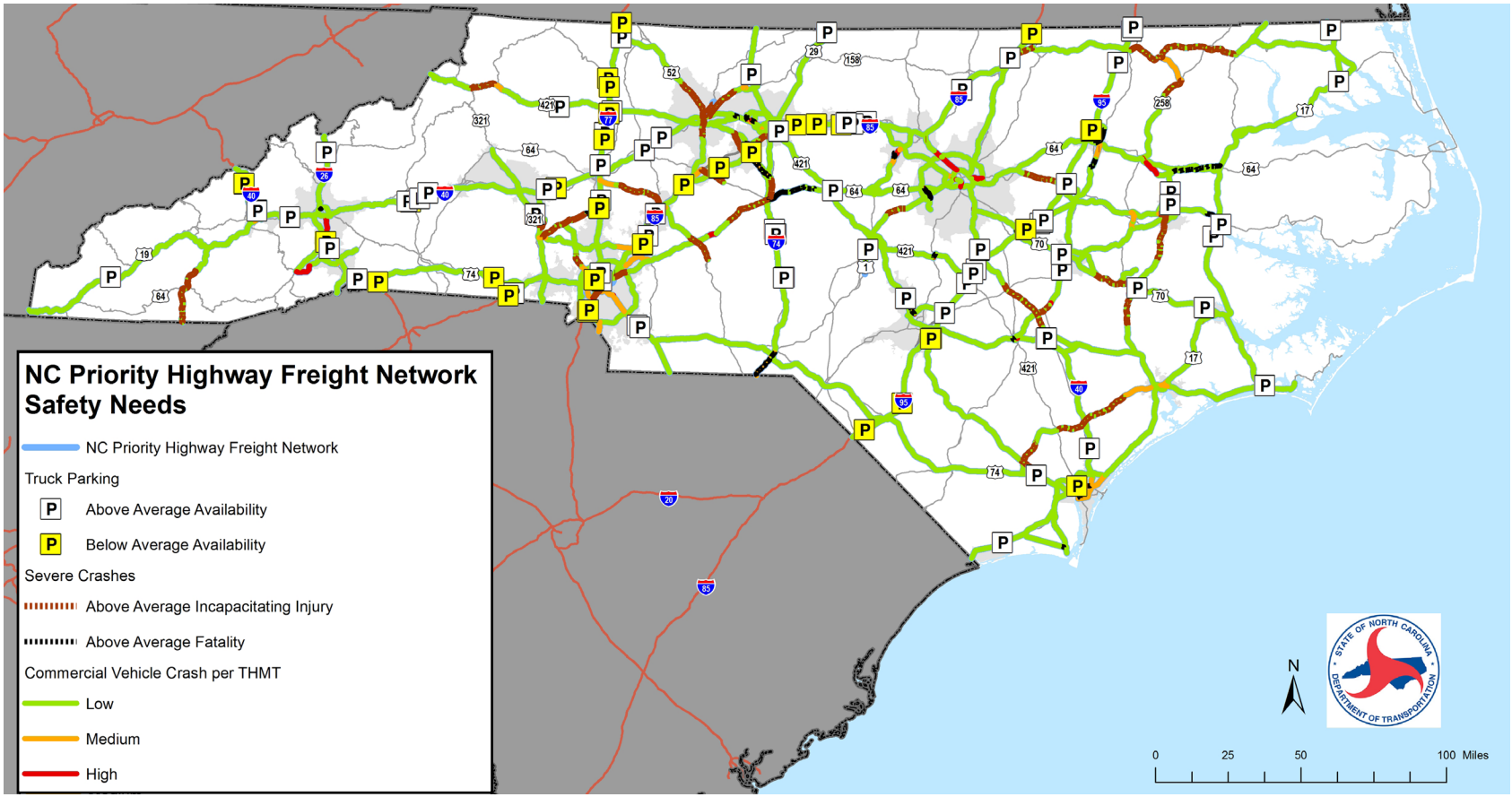
To measure highway freight transportation safety, and identify facilities on the network that could benefit from safety improvement projects, the following factors were utilized in the safety needs assessment:

- **Commercial Truck Crash Rates:** measured the number of commercial motor vehicle crashes over a five year time frame (2011-2015) on segments of the NCPHFN. These values were normalized by Thousand Truck Highway Miles Traveled (THMT) on each segment.
- **Truck Involved Severe Injuries or Fatalities:** Identified NCPHFN segments that had higher than average number of crashes resulting in incapacitating injuries and/or fatalities. These values were normalized across the freight network by THMT.
- **Truck Parking Availability:** Measured the availability of truck parking as a ratio of truck parking spaces to truck traffic volumes.

SAFETY NEEDS FACTORS

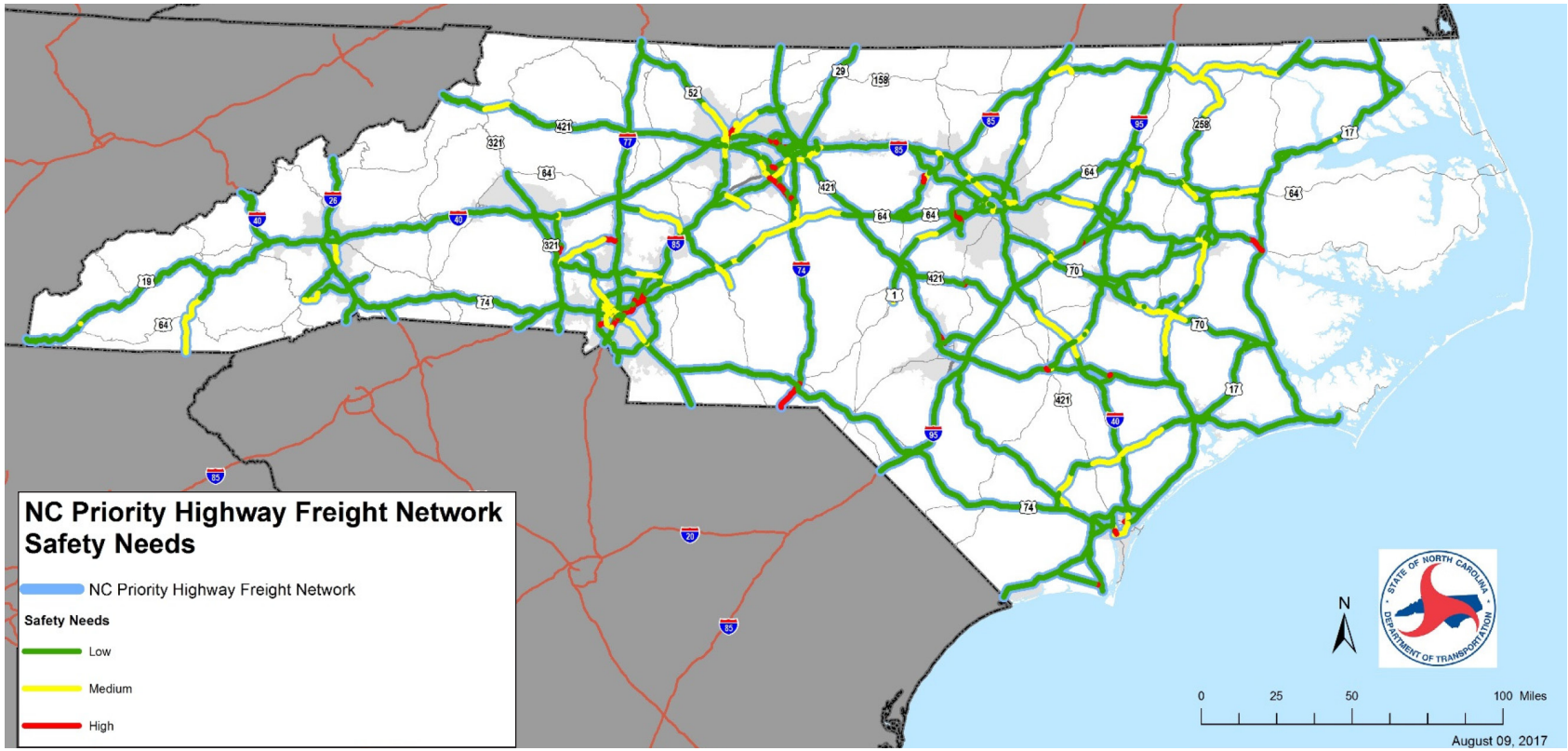
TRUCK-INVOLVED CRASHES AND TRUCK PARKING AVAILABILITY

Higher than average severe truck-involved crashes are found throughout the State, from high population areas such as Charlotte, Triangle, Triad and Asheville, to more rural roadways. Specific locations include: NC 53, U.S. 1 between Rockingham and South Carolina, U.S. 64 around Asheboro, U.S. 23 in western North Carolina, U.S. 64 between Bethel and Williamston, U.S. 301 in Rocky Mount and Sharpsburg, and U.S. 264 between Latham and Washington. Higher than average truck crash rates are found typically around the largest populated areas. Truck parking, is found along the interstate system, with the lowest availability along I-77 and I-85 and highest along I-95, I-40 (west of Winston-Salem) and I-74.



SAFETY NEEDS ASSESSMENT

The overall highway freight needs, as it relates to safety, are primarily in high populous locations, such as the Charlotte, Triad, and Triangle regions. Other needs are highlighted in the eastern portion of the state, especially in U.S. routes connecting to the interstate network and in U.S. 1 south of Rockingham.



Mobility and Reliability

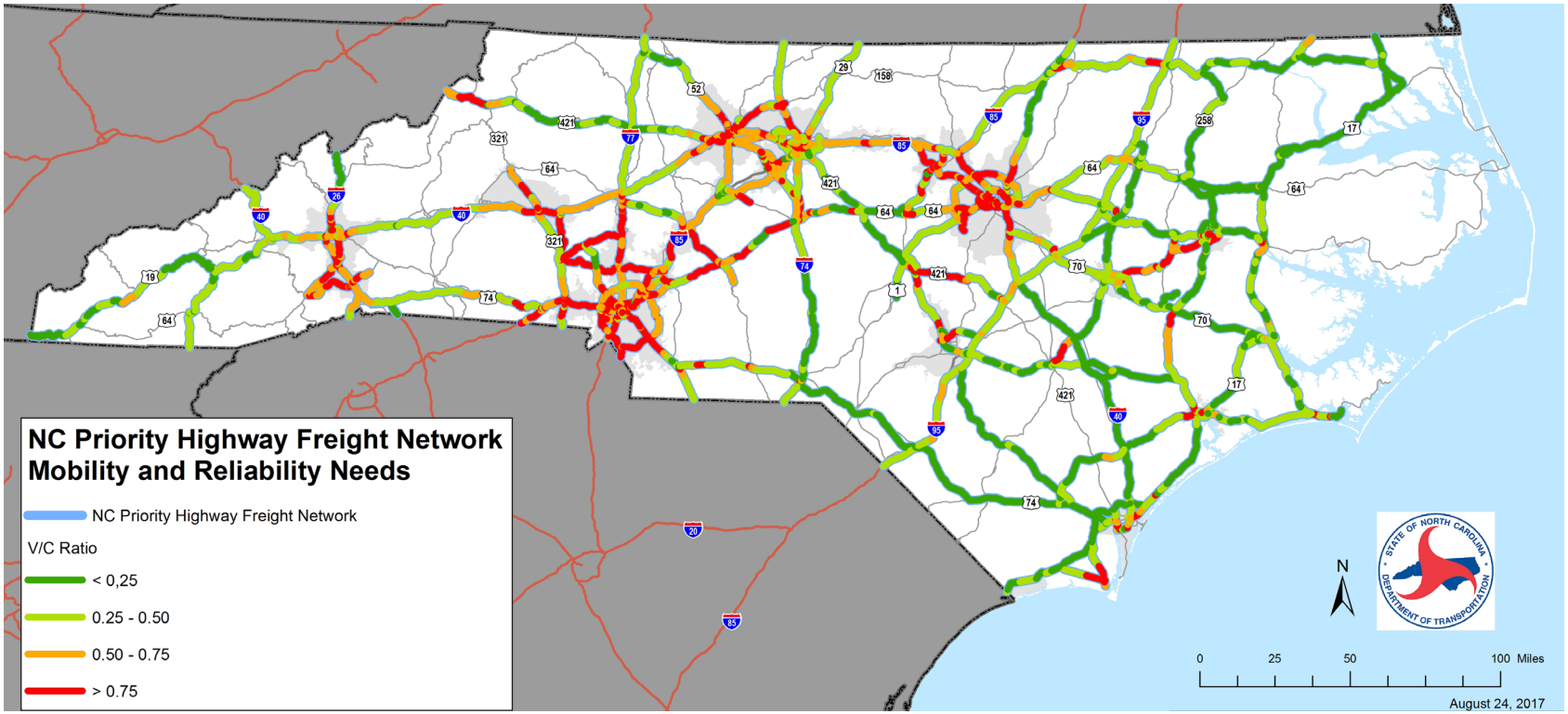
Efficient highway freight movements require reliable and predicable travel times. The following factors were evaluated to identify portions of the PHFN that would benefit the most from mobility and reliability projects.

- **Volume-to-Capacity (V/C) Ratio:** Measured capacity constraints, focusing on roadways with a V/C ratio of 0.5 or higher. V/C ratios are calculated by dividing to the total volume of traffic on a roadway by its capacity. In this manner, V/C ratios indicate the severity of congestion on a given roadway.
- **Truck Travel Time Reliability:** PHFN roadways were evaluated for reliable travel times using the Truck Buffer Time Index (BTI). The BTI represents the extra time (i.e., buffer) that must be factored into scheduling to ensure an on-time arrival for 95 percent of truck trips. A lower buffer time index indicates that expected travel delays are minimal and additional time may not be required to travel through that corridor. A higher BTI indicates the opposite, that extra travel time is needed to traverse a corridor.
- **Connectivity to Strategic Supply Chain Industries:** Additional weight was given to PHFN segments with high V/C ratios, by applying factors from the Freight System Designation (FSD) process of the PHFN that measured connectivity to significant economic generators.
- **Connectivity to Intermodal Terminals and Gateways:** Additional weight was given to the PHFN with high V/C ratios, by utilizing FSD measures for connectivity to key freight generators.
- **At-Grade Railroad Crossings:** Measured the impact of delay due to at-grade crossing of the PHFN by active railroad main lines. There were 62 at-grade railroad crossings on the highway freight network.

MOBILITY AND RELIABILITY NEEDS FACTORS

VOLUME-TO-CAPACITY RATIO

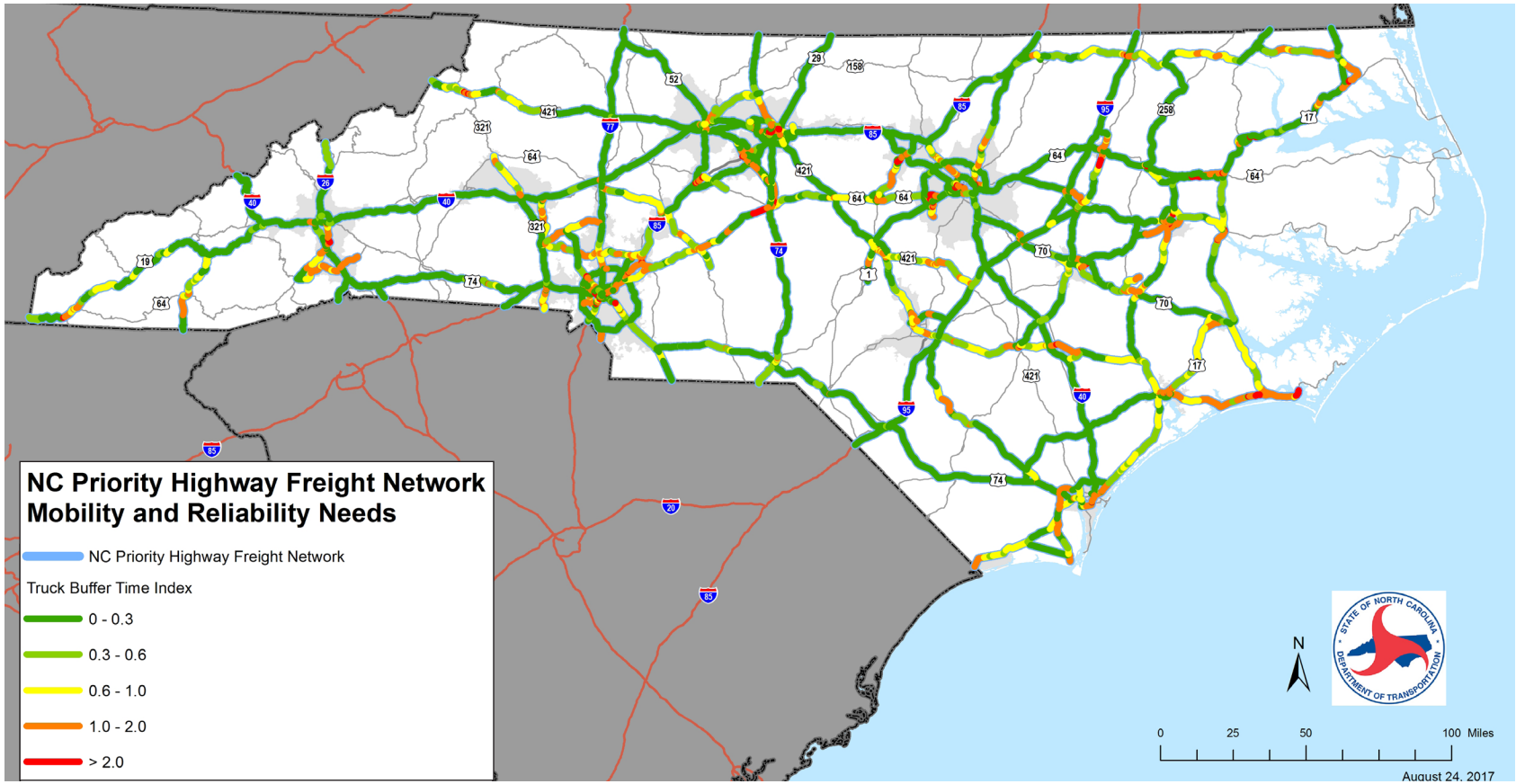
Capacity constrained conditions are found within metropolitan areas, such as Charlotte, Triad, Triangle, and Asheville. A few other key routes, such as U.S. 421, U.S. 13, and NC 49 also show heavy congestion.



MOBILITY AND RELIABILITY NEEDS FACTORS

TRUCK BUFFER TIME INDEX

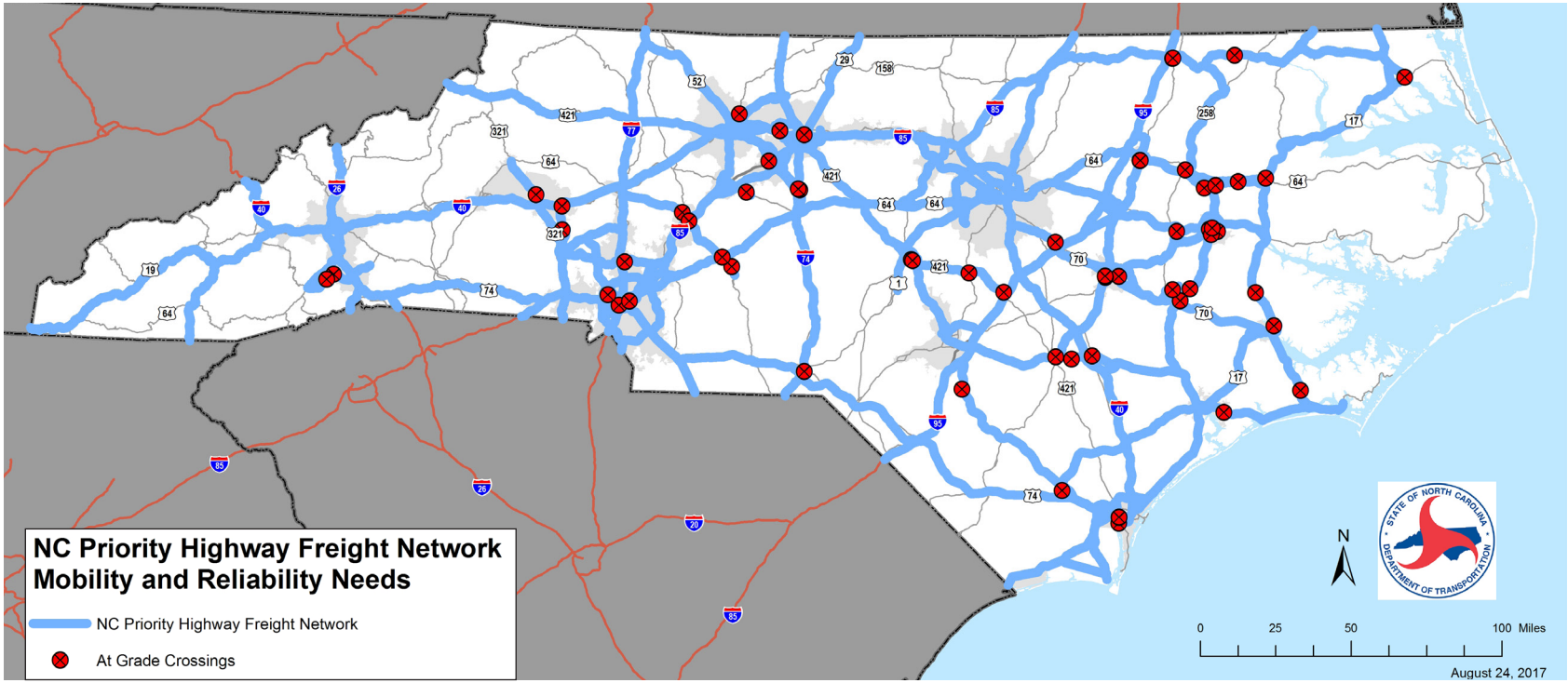
Like truck congestion, truck travel time is least reliable in the State's largest metropolitan areas: the Triangle, Charlotte, and Triad regions. Additional roadways with poor reliability include NC 24 and U.S. 70 to Morehead City, and U.S. 158.



MOBILITY AND RELIABILITY NEEDS FACTORS

AT-GRADE CROSSINGS

At-grade crossings on the PHFN are found throughout North Carolina but are generally located in the eastern portion of the State and around Charlotte and the Triad region.



North Carolina Department of Transportation (NCDOT) is currently transitioning to using benefit-cost evaluations within its existing prioritization methodology as part of an agency-wide effort.

STEP 1

Measure cost of highway-rail grade crossing crash. This includes primary effect costs (fatality and injury costs, property damage) and secondary effect costs (including vehicle delays, rerouting, logistics costs).

STEP 2

Use crash costs to screen for high-risk crossings. This includes total crash costs (crash probability x (primary effect cost + secondary effect cost)) and the hazard index, which considers crash risks, not relative crash outcomes.

STEP 3

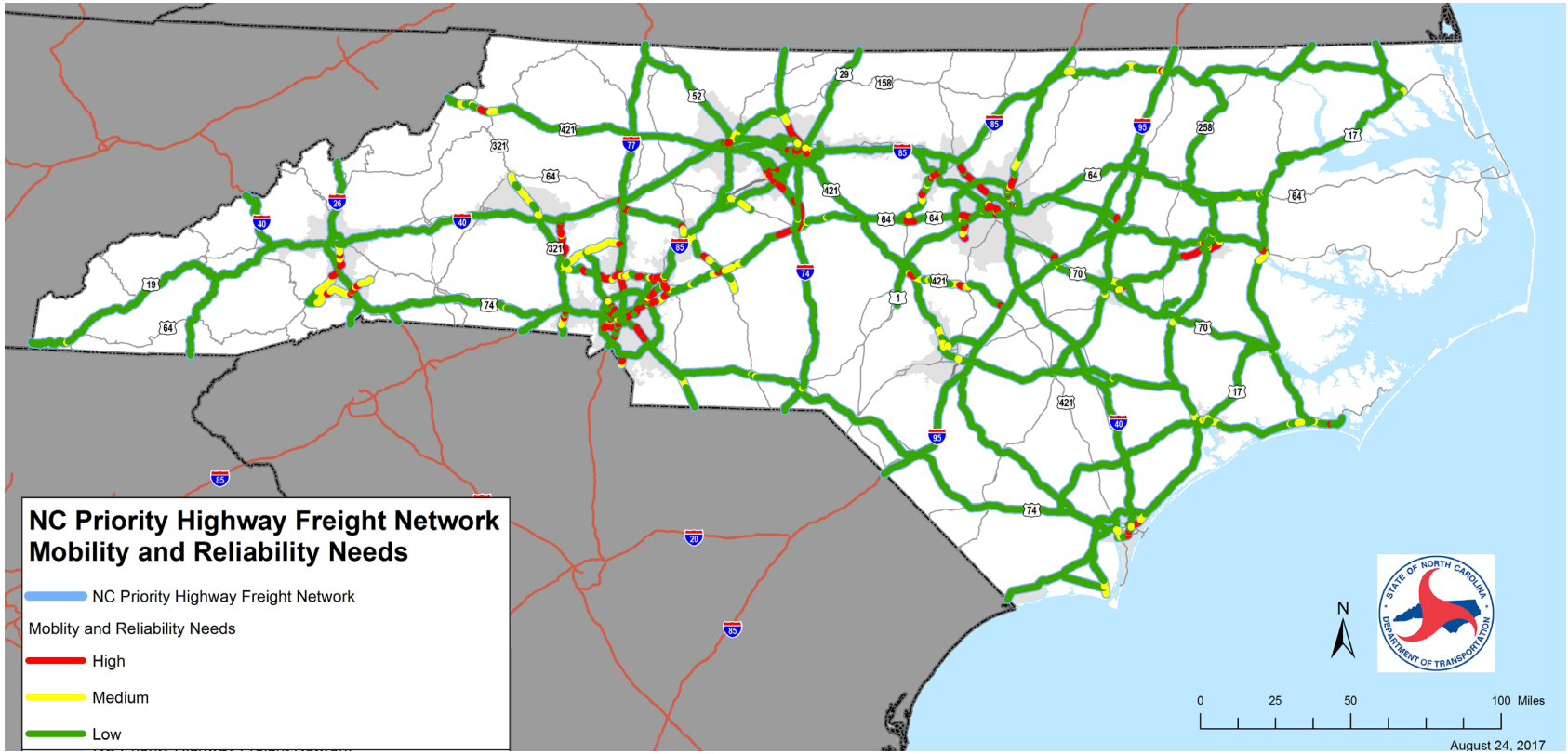
Perform benefit cost analysis for each project. This includes incorporating broader secondary effects and considering safety effects primarily.

STEP 4

Prioritize safety improvements with highest benefit cost analysis scores under resource constraints.

MOBILITY AND RELIABILITY NEEDS ASSESSMENT

The complete mobility and connectivity needs of North Carolina's highway freight network are high surrounding major metropolitan regions, such as Charlotte, Triangle, Triad, and Asheville, and to a lesser extent Greenville and Wilmington.



Rural Highway Needs

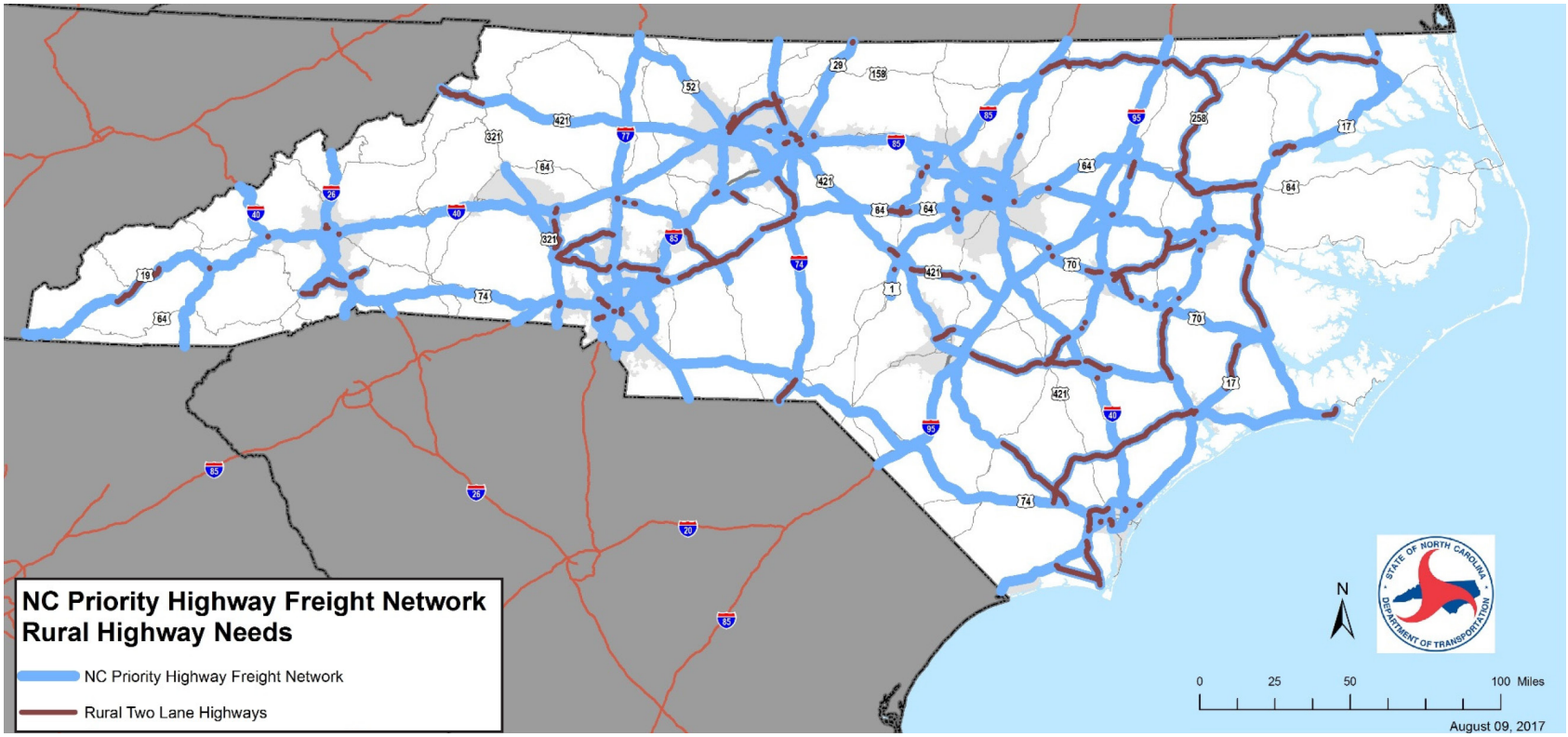
Twenty percent of the PHFN consists of rural two lane highways (i.e., outside of an urbanized area). These roadways are important to the movement of freight throughout the State and play a key role in providing access to freight generating industries.

There are a range of projects that can be identified to improve rural two lane highways to better accommodate the movement of freight. The rural highway freight needs were measured by evaluating the average annual daily truck traffic (AADTT) utilizing these roadways.

RURAL NEEDS FACTORS

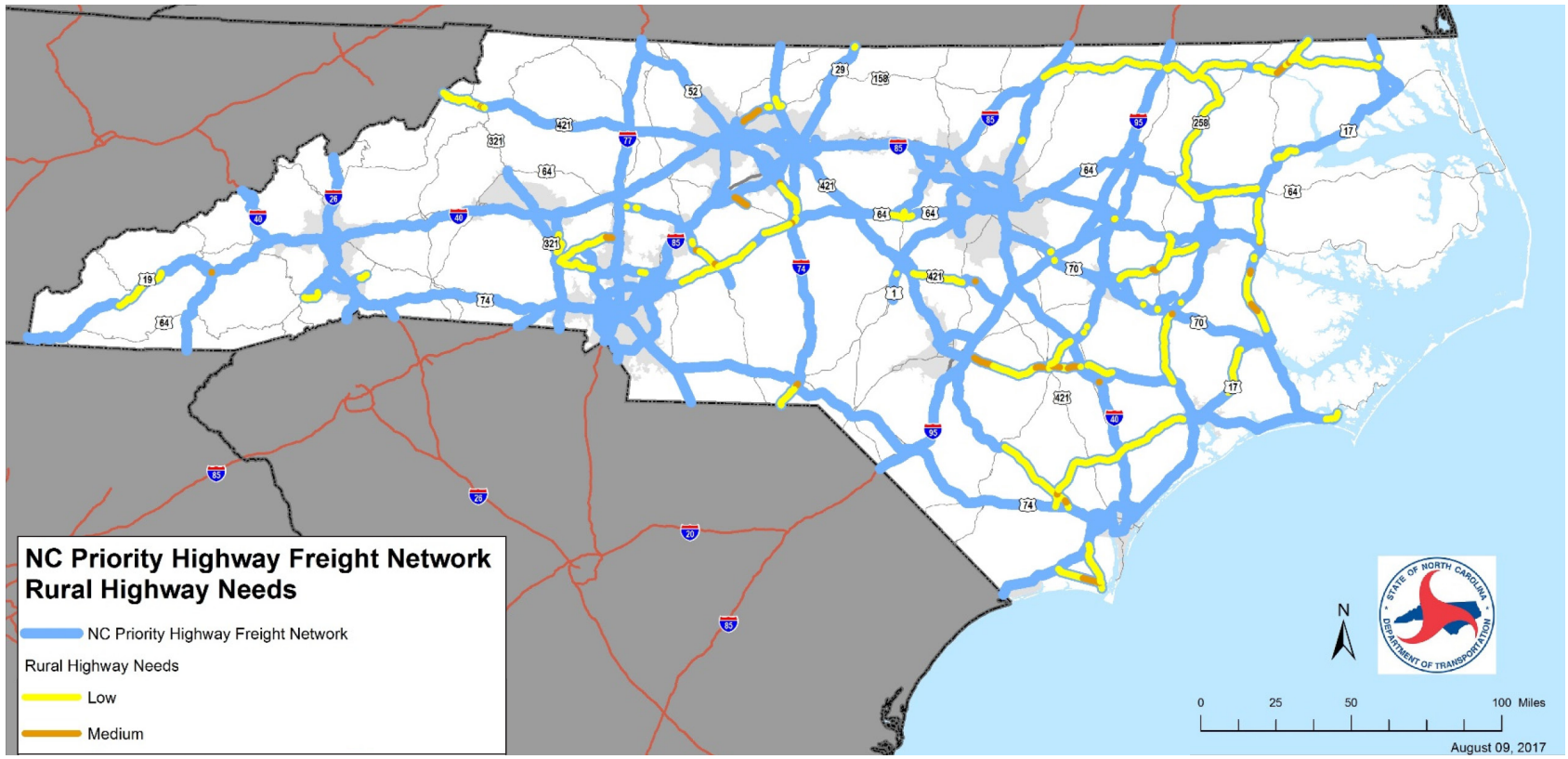
RURAL TWO LANE HIGHWAYS

Rural two lane highways are primarily found in the eastern portion of North Carolina, especially roadways such as U.S. 158, U.S. 17, and U.S. 258, which have long stretches of two lane highways. There are also key routes leading into the Charlotte and the Triad regions that are two-lane highways.



RURAL HIGHWAY NEEDS ASSESSMENT

Roadways with the most rural highway needs for North Carolina's freight network are primarily in the eastern portion of the State, especially along NC 24, U.S. 17, and NC 211 leading into Southport. A few other locations surrounding metropolitan areas, such as U.S. 158, U.S. 150, and NC 49 also have noted rural highway needs.



Asset Management and Utilization

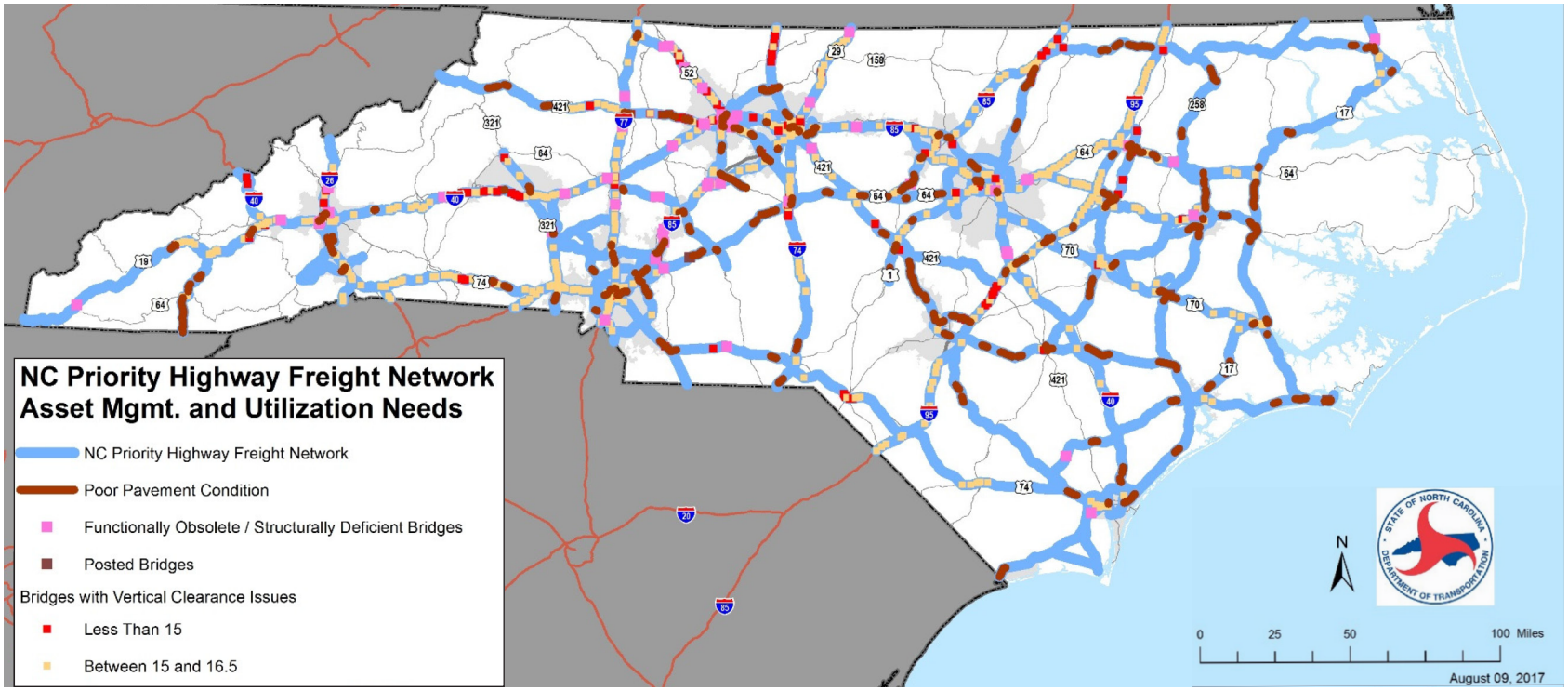
The condition of the roadways and infrastructure that make up the PHFN plays an important role in facilitating the movement of freight. In addition to pavement condition, several factors related to vertical clearance, load restrictions and structural condition were evaluated to locate facilities on the network that have a need for asset management related projects. These factors were:

- **Bridge and Tunnel – Vertical Clearance:** impacts the ability to accommodate trucks of certain heights. On the PHFN 262 bridges and tunnels were identified with a vertical clearance less than 15 feet.
- **Bridge – Load Restricted:** impacts ability to accommodate trucks of certain weights. On the PHFN 73 bridges were identified with weight restrictions.
- **Bridge – Condition Issues:** High truck traffic accelerates the deterioration of bridges. On the PHFN 56 bridges were identified as being Functionally Obsolete or Structurally Deficient.
- **Roadway – Pavement Condition:** PHFN roadways having poor pavement condition were identified and weighted based on the AADTT. Approximately 10 percent of the freight network has poor pavement condition.

ASSET MANAGEMENT AND UTILIZATION NEEDS FACTORS

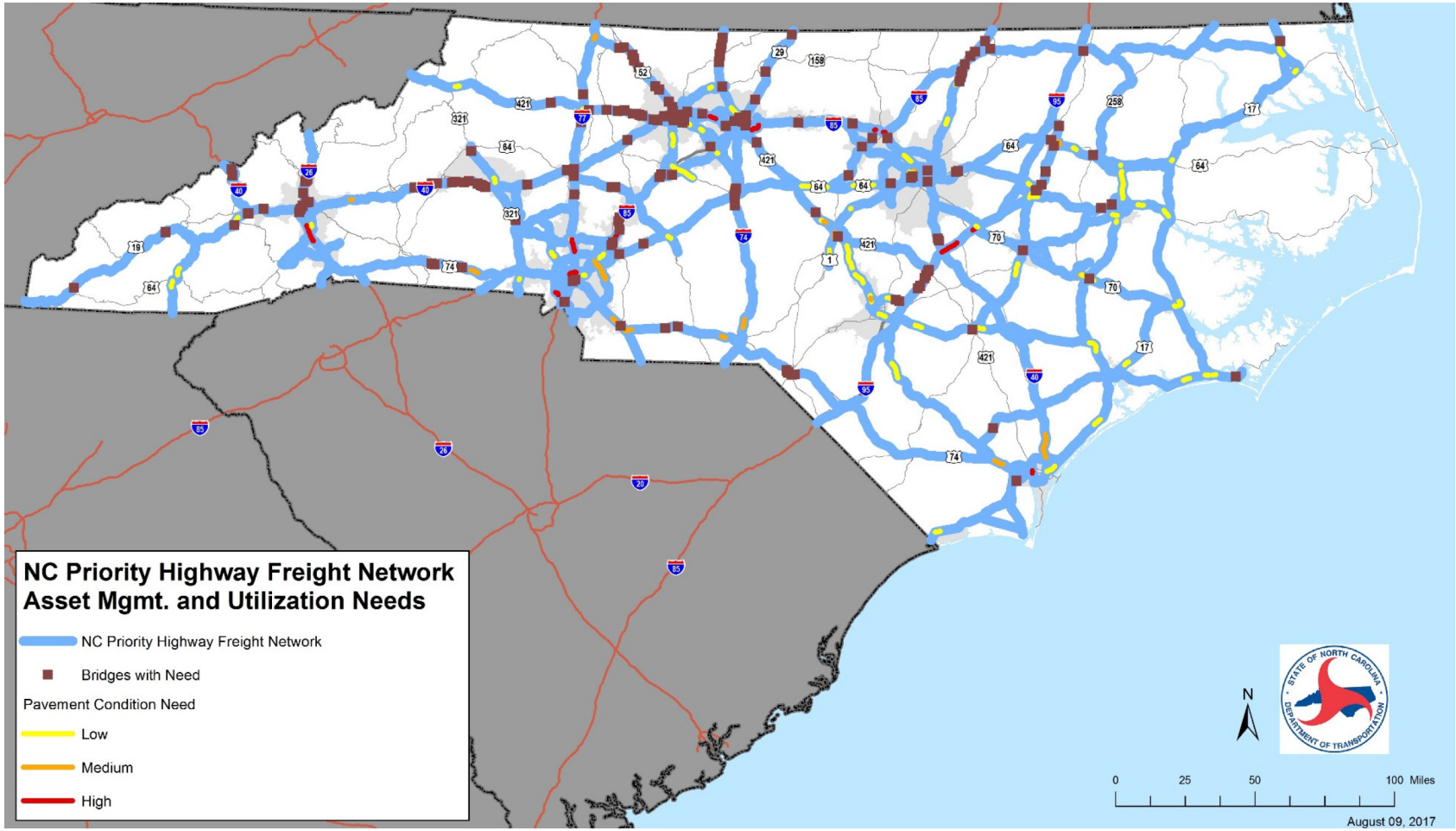
PAVEMENT AND BRIDGE CONDITIONS

Segments of North Carolina's PHFN with poor pavement conditions are scattered throughout the State, with the longest stretches along U.S. 158, NC 87, U.S. 23, and other routes. Bridges with vertical clearance issues are also throughout North Carolina, with a large concentration along the interstates. Bridges that are functionally obsolete/structurally deficient also are scattered throughout the State but are primarily along the routes surrounding and connecting the Charlotte and Triad regions. There are four posted bridges on the State's PHFN: two in Cabarrus County (U.S. 29 and NC 49), one on U.S. 70 Neuse River in Lenoir County, and one on U.S. 70 Beaufort Channel in Carteret County.



ASSET MANAGEMENT AND UTILIZATION NEEDS ASSESSMENT

Segments of North Carolina's PHFN with asset management and utilization needs are found throughout the State, in both rural and urban locations. Bridge needs are concentrated in the Triad area and along certain highway segments such as I-85/U.S. 1 leading into Virginia and I-26 close to Asheville. Roadways with highlighted pavement needs are primarily along segments leading in and out of major metropolitan areas, such as Charlotte, Asheville, Greensboro, Fayetteville, and Wilmington.



Technology and Operational Improvements

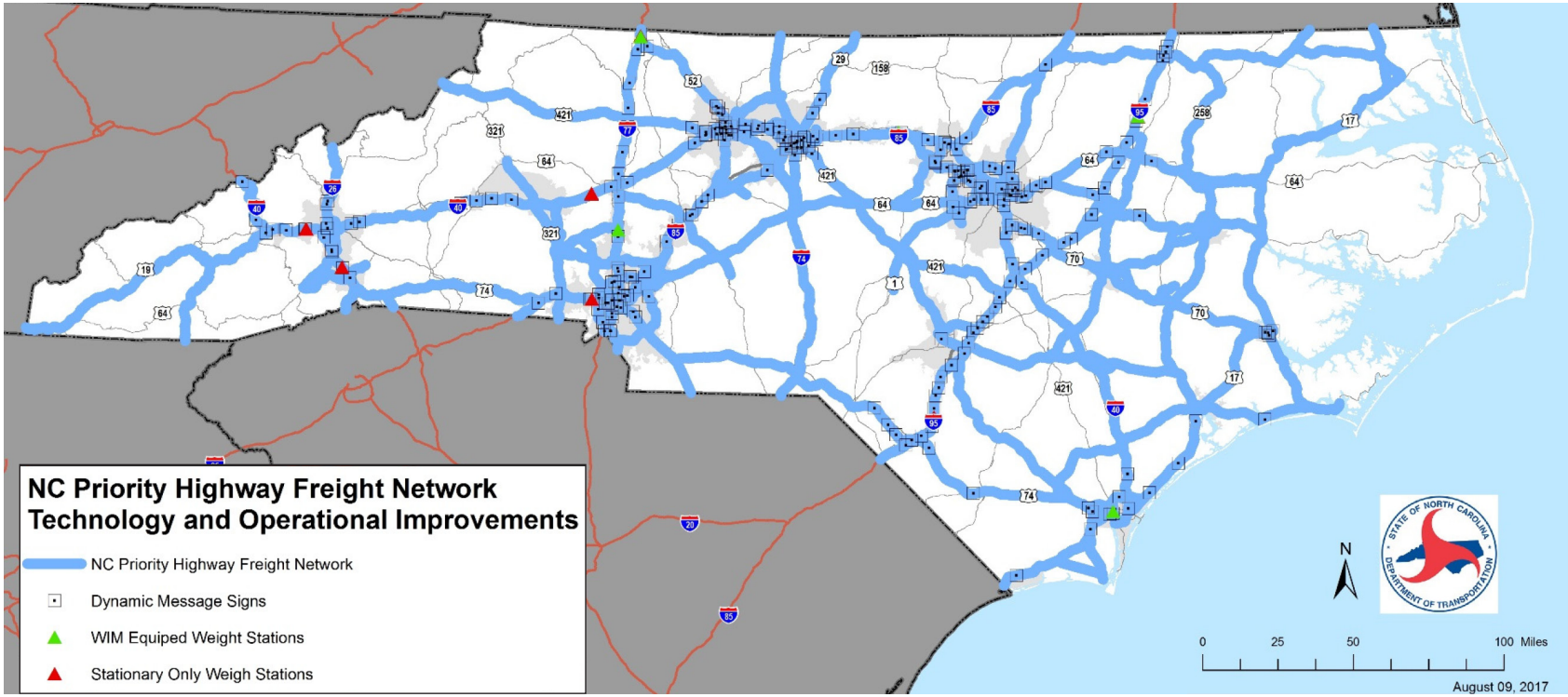
North Carolina has made significant investments in Intelligent Traffic Systems (ITS) technology along most major highway corridors. However, unlike South Carolina and Virginia which are digitally based, the North Carolina communication backbone is analogue. As a result North Carolina does not have the ability to exchange information with South Carolina and Virginia, nor manage its traffic operations system to the same level as the adjoining states.

There are 238 Dynamic Message Signs (DMS) located on the PHFN. These provide valuable information related to road closures and delays to truck drivers that permit adjustments to routes to minimize delays, while keeping drivers in compliance with distracted driving ordinances. When the DMS locations are overlain on the PHFN, one can identify corridors in need of additional infrastructure.

Another investment has been made equipping weigh stations with weigh-in-motion (WIM) technology. These benefit both the freight industry and the State, through reduced travel delay and more consistent compliance. Out of the 19 weigh stations on the PHFN, only 7 are equipped with WIM technology.

TECHNOLOGY AND OPERATIONAL IMPROVEMENTS

Dynamic message signs are found mainly along the interstates and roadways leading into major metropolitan areas. Other locations, such as U.S. 74, U.S. 421, U.S. 158, may benefit from the installation of these signs due to high congestion and poor travel time reliability. Weigh stations are scattered throughout the State's interstate system, including metropolitan areas close to North Carolina's borders. Additional stations may be beneficial in other key locations leading in and out of the State, including ports, while the installation/upgrade to WIM weigh stations can reduce truck delay and travel time.



Rail Needs Assessment

There are a number of factors that drive freight movement and will shape the changes in rail volumes over time. Changes in port capacities, from draft of vessels served to the mix of intermodal and bulk traffic, will have implications for the rail service to and from North Carolina and across the east and Gulf coasts. One emerging factor is the shift for Asian freight movements to use the Suez Canal and Atlantic routes to the U.S. and Canada rather than trans-Pacific routes. Another source of potential rail congestion is a result of shared use with passenger services that require freight and passenger movements to be coordinated and separated temporally. As demand continues to grow for intercity and commuter rail services, there is the potential for more congestion along the freight rail network. The congestion may be complicated by the fact that many industrial customers served by railroads are located in cities and counties that also house their workforce, thus shaping competing land use demands in the future.

Specific freight rail needs and opportunities in North Carolina are as follows:

- **Maintain and improve track capacities,** especially on Class III systems, for existing and future high flow corridors. The available maximum allowable gross weight for 286,000 pound loaded cars (the industry is considering 315,000 pounds) is becoming more important for industries as they manage productivity and transportation costs.
- **Improve safety and strive to minimize delays.** The increases in roadway and rail traffic will continue to lead to greater congestion and delay at at-grade crossings. As freight trains become longer and movements of unit trains increase, the delay hours at crossings will continue to grow. In addition, the movement of hazardous materials creates additional concerns at rail-highway crossings.
- **Expand freight rail infrastructure and/or add redundancy** in select locations across the State to support economic development aligned with rail-based markets as well as supply chain reliability. This arises from the continued development of the Class I railroad networks. The new intermodal facilities built by CSX in North Baltimore, Ohio and future facility in Rocky Mount, North Carolina; and by NS in Rossville, Tennessee and Charlotte, North Carolina demonstrate the continual growth of their respective networks. The changes on other segments of their networks affect how supply chains function for North Carolina industries.
- **Plan for increased passenger rail demand.** Congestion on lines that carry both passengers and freight traffic leads to interoperability and performance issues for both passenger and freight service providers.
- **Increased need for investment in transload facilities and in the intermodal network** to continue to efficiently serve industries and also provide consumable goods to the growing population.
- **Improved access and service to North Carolina's ports** is needed to better serve North Carolina industries and consumers.
- **Maintain short line support programs** such as the Rail Industrial Access Program and Short Line Industrial Access Program via Freight Rail and Rail Crossing Safety Improvement (FRRCSI) program funds to aid North Carolina industries in accessing Class I rail networks.
- **Continue efforts to partner with railroads** to evaluate new/expanded intermodal facilities to help mitigate future highway congestion in urban areas.
- **Leverage private sector rail capacity investments** and augment them to foster truck-to-rail mode shifts. For example, mobilize collateral efforts as appropriate, such as rail training programs to offset the declining numbers of truck drivers.

Maritime Needs Assessment

Development of the maritime industry to support the multimodal freight needs of North Carolina must address not only current needs but projected trends as well. Improvements at neighbor ports will influence steps necessary to remain competitive and/or complementary, and the upward trend of U.S. freight volumes will put pressure on North Carolina's maritime facilities while also providing economic opportunity.

INFRASTRUCTURE NEEDS

Port of Wilmington	Port of Morehead City
On-site	
• Expand and improve the container terminal including gates, berths, intermodal yard and storage areas • Expand intermodal rail yard to service longer intermodal trains, adding trackage • Expanded rail Improvements and access on the Port's general terminal • Additional cranes (2 Ship to Shore container cranes, 100-gauge rail mounted in current budget have been ordered) • Daily rail service to Charlotte, the Queen City Express, started in 2017	• Although, there is still room to improve on the current footprint of the port, Radio Island is a good development site for a stand alone facility and has potential to be further developed (Ro/Ro or containers would be good cargo here) • Replace aging equipment • Relocate scales, minimize need for re-weighing • Expand/repair rail track on the terminal to include West Lead and a rail loop • Infrastructure expansion to accommodate growing grain volumes • Replace aging warehouses and transit sheds/increase building setbacks near lower-numbered berths (for better rail access, crane movement) • Cover a portion of the rail yard on the north side of Arendell Street to handle commodities that require covered storage
Roads	
• Improvements along the U.S. 74 Corridor from Wilmington to Charlotte • Retrofit on-ramp from northbound U.S. 17/421 onto I-140 for safety • Improve the last mile to the Port • Complete design/ construction of fourth river crossing • Pursue highway-railroad grade separated access at the North Gate and South Gate to improve safety, reduce vehicular congestion, and significantly increase rail capacity • Pursue select State Transportation Improvement Program (STIP) projects	• Highway 70 improvements including bypasses to improve access to I-95 • Redesign intersection at Port's main gate (Arendell St/Port Terminal Rd) to reduce and/or eliminate oversized trucks' maneuvering issues upon exit that require blocking of on-coming traffic
Rail	
• Improvements to increase rail speed through City of Wilmington • Rebuild Wallace-Castle Haynes track to create dual connection to CSX's new CCX intermodal terminal in Rocky Mount • Investigate the feasibility of a new rail bridge across the Cape Fear River from the port connecting to the Brunswick County rail network to remove port rail traffic from Wilmington	• Study at-grade crossings for identifying improvements, reducing their numbers, and prioritizing implementation. • Raise the Arendell Street bridge in front of the main port property to enable railroad car access underneath it to the north side of the port property, thereby creating a rail loop

OPERATIONAL NEEDS

Port of Wilmington	Port of Morehead City
On-site	
• Consider having separate main gate lanes and/or segregating non-port truck traffic to the new cold storage facility to minimize processing times of both port and non-port freight • Optimize on-site routing to: » Minimize scale use » Decrease truck and train maneuvers with one-way loops through warehouses	• Move military operations to Radio Island, add secure gate there • Optimize on-site routing to: » Minimize scale use » Decrease truck and train maneuvers with one-way loops through warehouses
Roads (same concepts for both ports)	
• Regularly optimize traffic signals on freight connectors between the port and interstate system as well as in Rockingham and Monroe for Charlotte-bound freight • Use variable message signs to notify travelers when the at-grade crossings will be closed • Create a cellphone app that notifies mapping apps and drivers directly when the crossings will be closed	
Rail	
• Work with Wilmington Terminal Railroad to minimize and ultimately eliminate non-port freight from being handled on port property to both increase available space for port-specific freight and reduce potential security issues	• Since only 3 trains/week, prioritize movement through town to minimize closings of at-grade crossings and/or negotiate to have the trains arrive/depart at more optimal times of day • Investigate having NS drop/pick up cars west of the town and short line conduct operations through town at more convenient times

Aviation Needs Assessment

The air cargo industry was significantly affected by the global economic recession of 2008, which resulted in major decreases in air cargo activity. Today, air cargo carriers are experiencing price competition from other freight modes such as trucks, container ships, and railroads, while demand for expedited services (i.e., UPS and FedEx) has exploded in recent years. As consumers increasingly purchase their goods online, expedited carriers have had to balance speed of delivery with transportation cost competitiveness to deliver these goods on time.

The demand for expedited services has led to additional market demand for FedEx/UPS, who have in turn improved their trucking/ground logistics supply chains and increased their use of air cargo, though any increases in air cargo have been mitigated by the advances in ground logistics. In North Carolina, FedEx and UPS have consistently been the top air cargo carriers, and domestic belly cargo has remained relatively flat over the last decade. E-commerce has put intense pressure on carriers to transport packages as fast and efficiently as possible. Additionally, because transportation is inexpensive, a broader distribution market has been established across the U.S. More cities are capable of providing freight services through expanded warehousing and distribution facilities, as opposed to relying on major freight hubs. This shift has decreased the need for just-in-time air freight.

There are several ways to mitigate the effects of these global trends and address air cargo needs in North Carolina. Improvements could include infrastructure upgrades, master planning, and facility expansion to increase air cargo activity at CLT, GSO, RDU, and even potentially Kinston Regional Jetport (ISO) at the Global TransPark. As the value of goods shipped by air and demand for overnight or on-time services continues, access to air shipping via North Carolina airports will be a vital piece of supporting economic growth. Although capacity exists at airports in North Carolina, it will be important to expand access to reach more parts of the State and provide service for highly time-sensitive commodities produced in North Carolina. These products are well suited for air

cargo transport, and could take advantage of increased air cargo access to grow its manufacturing and distribution base within North Carolina and across the U.S.

North Carolina air cargo needs can be categorized into three areas: airport access, airport runway/facilities, and industrial development.

- **Airport access:** Air cargo access is critical to economic vitality, particularly for high value commodities. Consumer markets tied to e-commerce have increased the demand for express package services, which have been traditionally fulfilled by air cargo jets. However, because advances in ground logistics have made trucks a viable option for express service, North Carolina airports must ensure seamless access to air cargo facilities via the roadway network to stay competitive with other freight modes.
- **Airport runway/facilities:** There are opportunities to North Carolina's airports to improve runway and facility infrastructure on-site. This includes runway expansions, cargo aircraft aprons, and more space for commercial vehicle staging. CLT and RDU have identified runway reconstruction and expansion needs. RDU identified needs for cargo aircraft apron and space for commercial vehicle staging. GSO identified future land acquisition and development needs, including a terminal support area for belly cargo and ground service equipment, which could accommodate more cargo buildings, aircraft apron parking positions, and truck courts, which are areas next to loading docks to provide space for trucks to maneuver.
- **Industrial development:** Focusing industrial development around airports can help increase the value of air cargo services. There are opportunities to increase industrial development around RDU and GSO to support air cargo activity at these airports. At RDU, there are parcels of land surrounding the facility that are ideal for retail, office, recreation, and industrial space, as identified in RDU's Vision 2040 Master Plan. Additionally, the master plan for GSO calls for an extended northwest aviation-related development area west of Bryan Boulevard/Future I-73, which could be developed to support commercial/industrial activities that do not require direct access to the airfield. Efforts to develop industrial sites adjacent to CLT property have been unsuccessful due to the natural topography surrounding the airport, which is generally hilly with a few large and flat areas.

7 INVESTING IN THE PRIORITY FREIGHT NETWORK

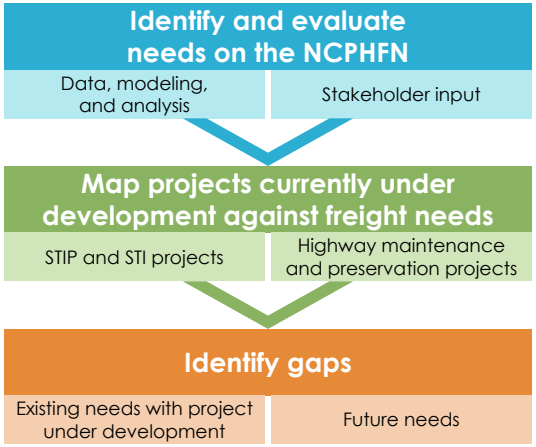
The Freight Investment Planning Process

NCDOT takes a transparent, data-driven, and stakeholder-informed approach to investment decision-making by applying an inclusive approach to the State's project identification and strategic transportation investment prioritization process. The process for identifying projects for the freight plan leveraged a variety of stakeholder outreach activities to gain across-the-board perspectives. Stakeholder input was combined with an assessment of needs, project identification and gap analysis, and project prioritization process to arrive at a strategic and cost-effective approach to freight investment in North Carolina. The process also involved developing North Carolina Freight Analysis System (FAS) which is a comprehensive spatial analysis database and evaluation tool that combines transportation, economic, industry and other relevant data in a geographic information system (GIS) platform. The system was developed to aid in the update of the Freight Plan, but it was designed to guide implementation following the update.

Building off from the needs assessment (Chapter 6), the remainder of this chapter summarizes the projects that were identified and discusses the prioritization process.

The North Carolina Priority Multimodal Freight Network was used as the basis for identifying and prioritizing recommendations for the Freight Plan. This network facilitates the majority of the freight movements in and through North Carolina and connects freight generators and gateways with markets.

Highway projects were identified with input from stakeholders and through a quantitative process of identifying highway system needs and matching them with planned NCDOT projects. Rail, port and airport projects were identified through input from stakeholders, as well as through the review of current NCDOT legislative appropriation requests and projects recommended in previous plans (such as the North Carolina State Rail Plan and port master plans).



Highway Freight Projects

The process for identifying highway freight projects starts with mapping projects already under development against the identified needs on the NCPHFN. Projects from the STIP and other bridge preservation and rehabilitation projects funded through the highway preservation and modernization fund were mapped to the North Carolina Priority Highway Freight Network. Projects already under development by NCDOT can be implemented within a shorter timeframe than new projects. Many early project development processes, such as right-of-way acquisition or environmental clearances, may have already been initiated or completed for these projects. In addition, funding may also already be in place.

Depending on the primary need being addressed, the projects on the State's PHFN were overlaid with the safety; mobility and connectivity; rural two lane highways; asset management and utilization; and technology and operational improvements needs.

NORTH CAROLINA FREIGHT INVESTMENT DECISION MAKING PROCESS

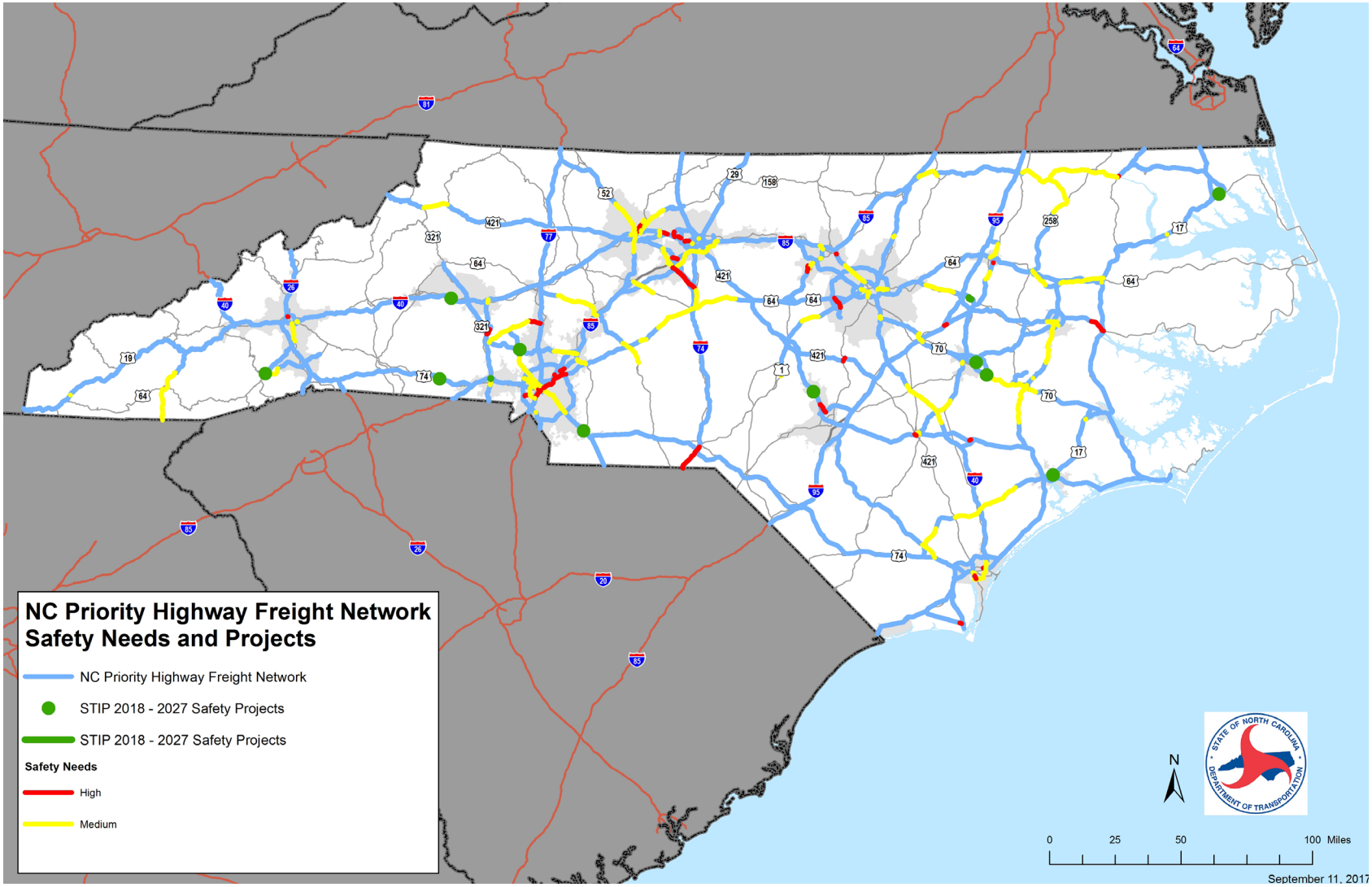
Needs Assessment
- Stakeholder input
- Data analysis of existing and future freight conditions and demand

Project Identification
- Map projects to freight network
- Compare existing projects to needs
- Develop strategic projects

Prioritization
- Develop evaluation criteria
- Screen and evaluate projects

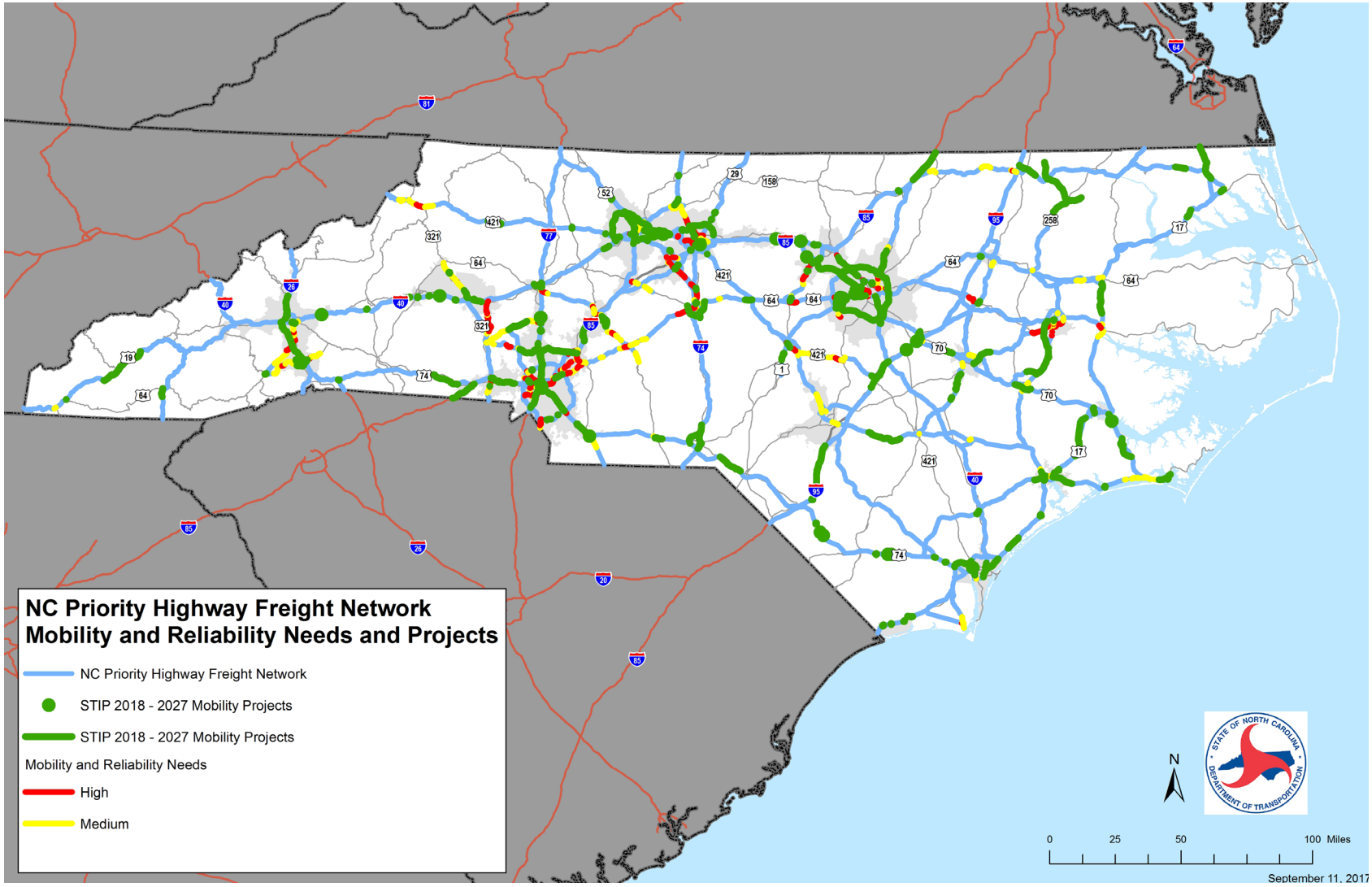
FREIGHT SAFETY NEEDS, PROJECTS AND GAPS

The comparison of existing safety projects to freight safety needs reveals gaps in some key areas including around the three largest metro regions of Charlotte, the Triangle region and the Triad region. Example rural safety gaps include U.S. 1 at the South Carolina border and U.S. 264 west of U.S. 17.



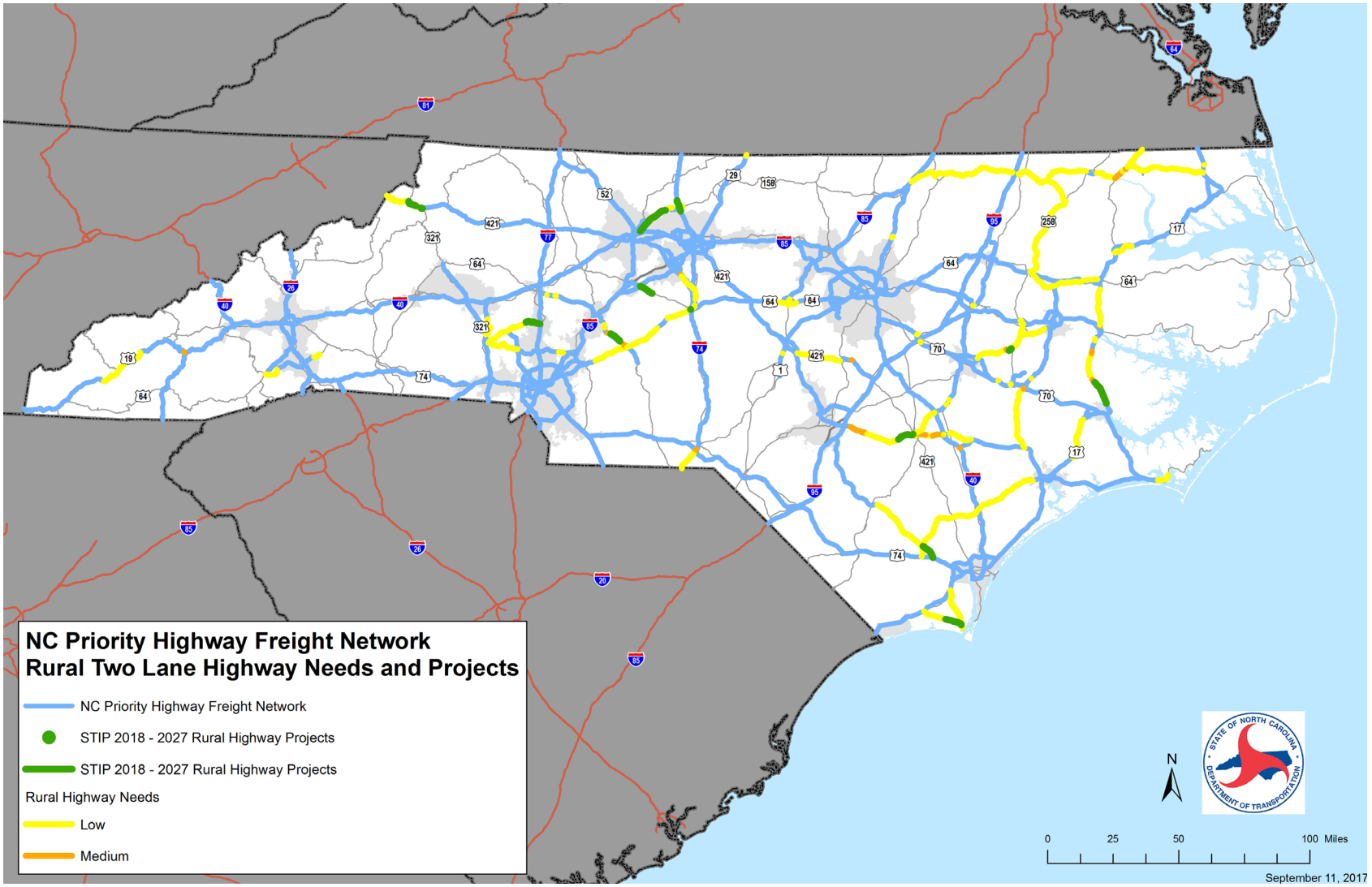
FREIGHT MOBILITY AND RELIABILITY NEEDS, PROJECTS AND GAPS

As expected, there are notable freight mobility and reliability gaps in the State's three largest metro areas. However, the gaps are not concentrated on the interstates but rather on U.S. and state routes. In addition, several smaller urban areas have unmet freight mobility needs, including Greenville, High Point, and Asheville. Rural facilities in both western and eastern North Carolina have segments with unmet freight mobility and reliability needs.



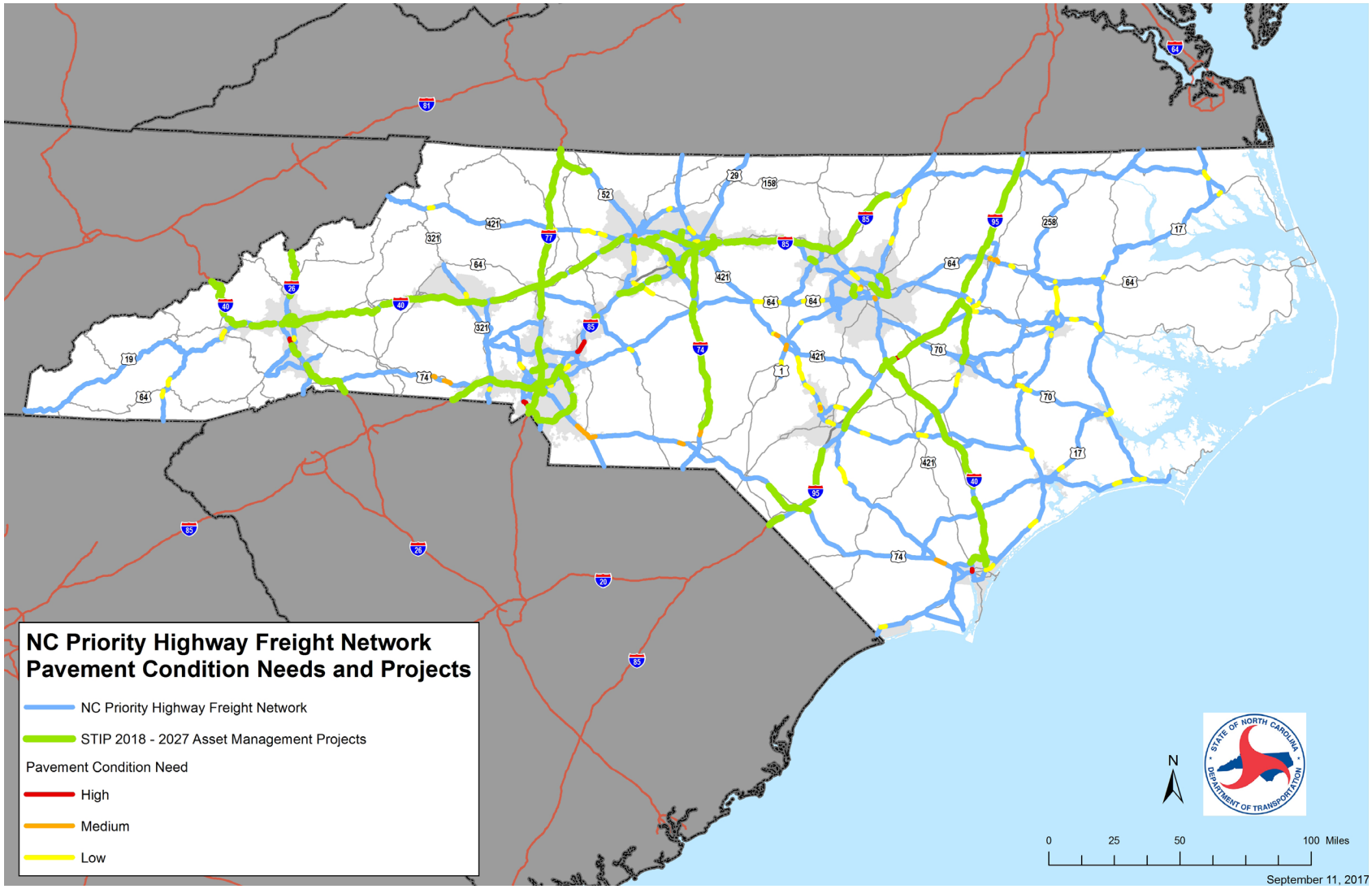
RURAL TWO-LANE FREIGHT HIGHWAY NEEDS, PROJECTS AND GAPS

For the most part, two-lane rural road needs ranked relatively low in terms of overall freight needs. However, there are a couple of moderate level needs that have no current planned improvement including NC 24 between I-95 and I-40 and NC 13 between Goldsboro and Greenville in the eastern North Carolina and U.S. 321 in western North Carolina.



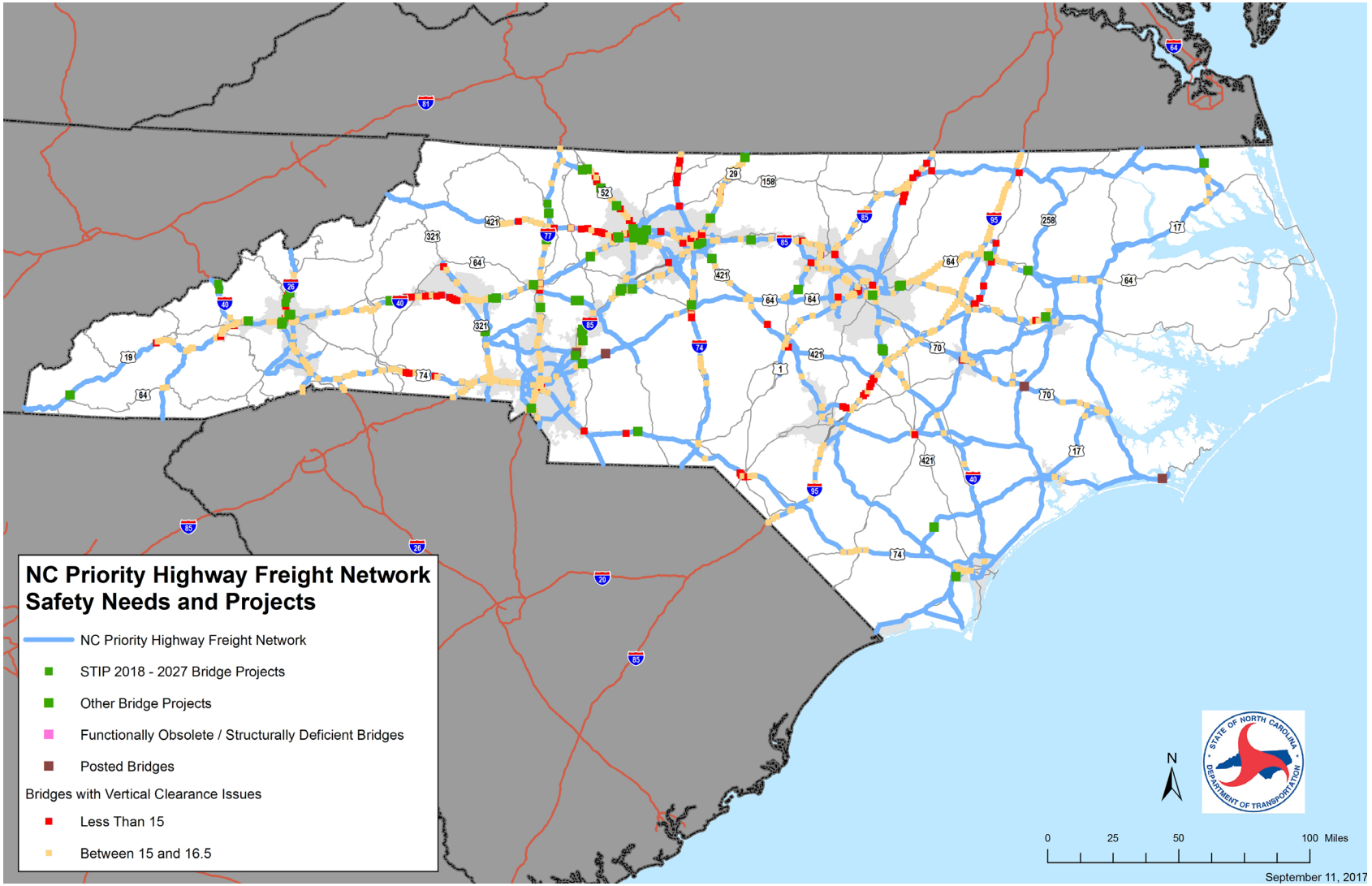
PAVEMENT CONDITION NEEDS, PROJECTS AND GAPS

In general, the pavement conditions on the NCPHFN are in good conditions and North Carolina's ongoing pavement preservation program continuously prioritizes pavement investments. The areas where needs are high and there is no current project are in the urban areas of Charlotte and Asheville.



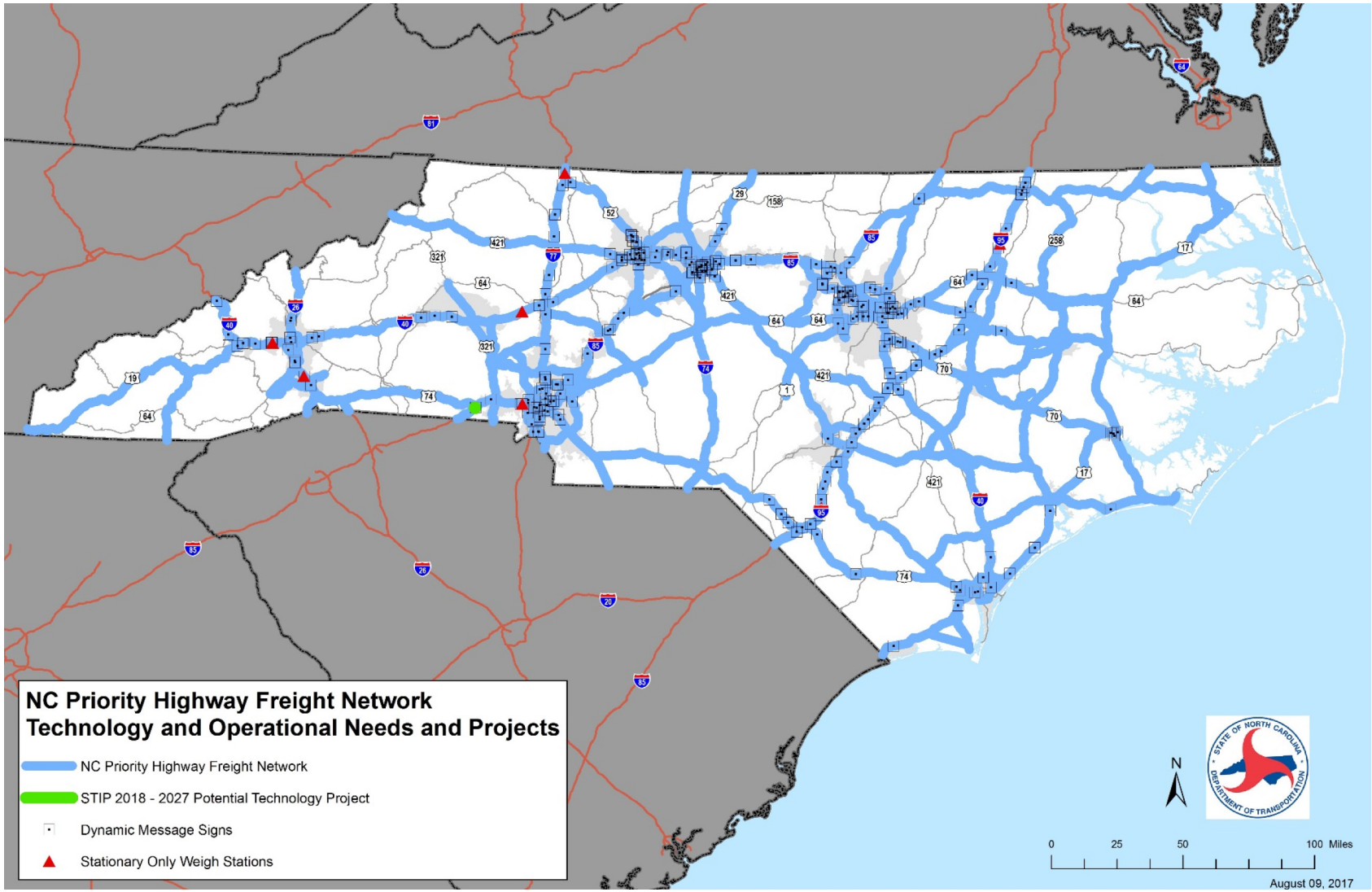
BRIDGE NEEDS, PROJECTS AND GAPS

When evaluating bridge needs and gaps on the NCPHFN, priority is given to posted bridges and bridges with low vertical clearances as these are the biggest issues for trucks. There are significant gaps in addressing bridge needs on the state's primary freight routes- its interstates. I-85, I-40, and I-95 all have numerous bridges that have vertical clearance less than 15 feet.



TECHNOLOGY AND OPERATIONAL NEEDS, PROJECTS AND GAPS

North Carolina has done a good job of implementing ITS along its major freight routes. However, only 7 of the 19 weigh stations are equipped with weigh-in-motion technology leading to technology gaps.



Project Screening Criteria

The Strategic Transportation Investment (STI) process is North Carolina's legislatively required project prioritization process. One of the desired outcomes of developing the North Carolina Multimodal Freight Plan was to establish recommendations for improving freight specific criteria in the STI process. Therefore, project evaluation involved not only existing STI criteria but a set of other potential criteria developed based on the freight plan goals. The criteria are meant to be applicable across modes and address economic competitiveness, mobility and reliability, safety, asset management, environmental stewardship, sustainable funding, and the use of technology. Stakeholder input via the NCFAC and the MPOs and RPOs was used to revise and refine the final criteria.

STI PRIORITIZATION 5.0 RECOMMENDED FREIGHT CRITERIA

Funding Category	Criteria Weight
Statewide Mobility	25%
Regional Impact	10%
Division Needs	5%

Purpose – Account for key indicators of freight movement

50% (Truck Volume) + 50% (Truck %) + Future Interstate Completion Factor

Future Interstate Completion Factor [Modernization Projects] = ((Project Length/Miles Needed to Complete Future Interstate Corridor between NHS Routes) X 100)/2

Future Interstate Completion Factor [All Other Projects] = ((Project Length/Miles Needed to Complete Future Interstate Corridor between NHS Routes) X 100)

Max FICF value = 25

POTENTIAL ADDITIONAL FREIGHT PROJECT PRIORITIZATION CRITERIA

Prioritization Criteria	Goal Area
Project supports access for freight-related target supply chains	Economic Competitiveness
Project supports economic preparedness	
Project supports freight employment intensity	
Project improves freight operational efficiency	Mobility and Reliability
Project increases travel time reliability	
Project improves access to freight terminal (on facilities from port/terminus to freeway)	
Project improves access to Megasite	
Project eliminates at-grade crossings on the NCPFN	
Project reduces freight travel time	
Project enhances the state of good repair on the NCPFN	Asset Management
Project addresses a freight safety hotspot	Safety
Project enhances safety on a Primary Extremely Hazardous Substance (PEHS) corridor	
Project eliminates rail crossings with no active warning devices	
Project encourage truck to rail diversion	Environmental Stewardship
Project has an alternate source for funding	Sustainable Funding
Project improves access to real-time travel information on the NCPFN	Technology

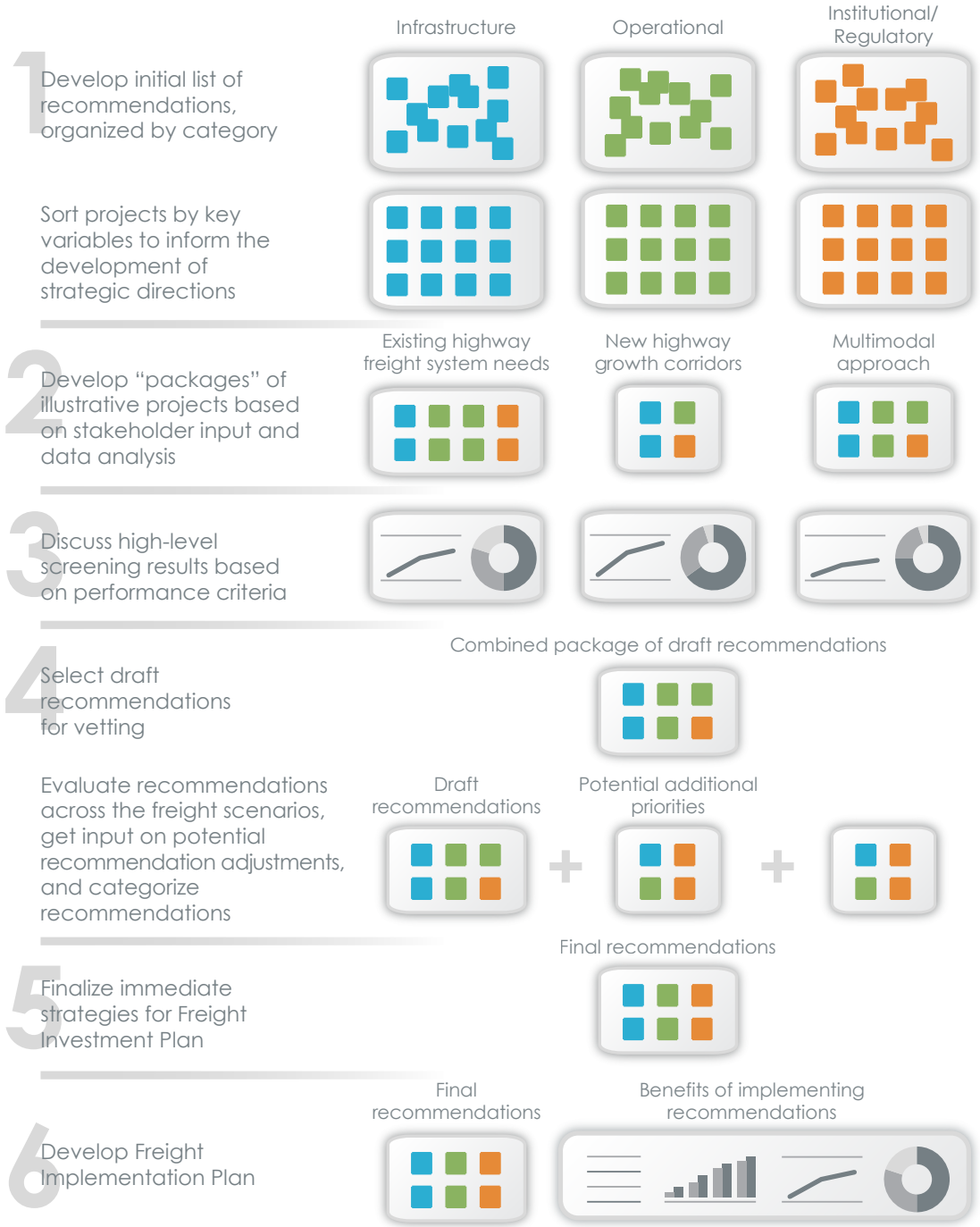
Projects, Recommendations, and Strategies

The framework for developing projects, recommendations, and strategies relied on conducting a systematic screening based on the project evaluation criteria. The first step combines input on needs and potential solutions from public and private sector stakeholders, data analysis, and previous and ongoing studies. This includes specific projects, actions and programs which in many cases represent illustrative examples of more systemic deficiencies. This input was organized based on the type of deficiency (infrastructure, operational or institutional) and the specific need being addressed. Individual projects and actions that addressed the same needs were grouped together and potential strategies for addressing the broad needs were developed. This evaluation was completed using available documentation, previous and concurrent studies, stakeholder input and new analyses by the project team. Information and data presented in previous task technical memoranda served as the primary basis for qualitative evaluations. The evaluations use a qualitative measurement of project and strategy performance as low, medium, or high.

It is understood that the qualitative evaluation methodology employed will not produce results suitable for documenting project-specific feasibility, nor will the qualitative evaluations result in a true cost benefit analysis of various projects or strategies. However, the analysis does provide generalizations about the types of impacts that can be expected from alternative categories of projects.

The results of the qualitative evaluation are meant to offer comparisons between each project and strategy for each specific evaluation criteria. The evaluation provides insight into the trade-offs of

SUGGESTED FRAMEWORK FOR DEVELOPING RECOMMENDATIONS



alternative strategies, allowing policy makers to move forward with the projects most in line with their goals and objectives.

Projects such as bridge replacement and pavement rehabilitation score high on asset management, and medium to low on the other goal areas. This could change if the bridge is weight restricted. This could cause a bridge replacement project to have a greater impact on economic competitiveness and mobility. Capacity expansions, new right-of-way and bypasses tend to score high on mobility and reliability and medium of other key goal areas such as economic competitiveness and safety. Freight rail expansions and intermodal facilities have the potential to have relatively high impacts on economic competitiveness and medium to high impacts on mobility, safety, and asset management depending on how much traffic gets diverted from truck to rail. It is important to note that this is a generalization based on relative impacts and is not to replace individual project evaluation as each project has unique circumstances that will influence its overall impact across the goal areas.

The next steps in the development of recommendations, which are discussed in Chapter 8, involves testing alternative freight scenarios and categorizing recommendations based on their overall robustness against those scenarios.

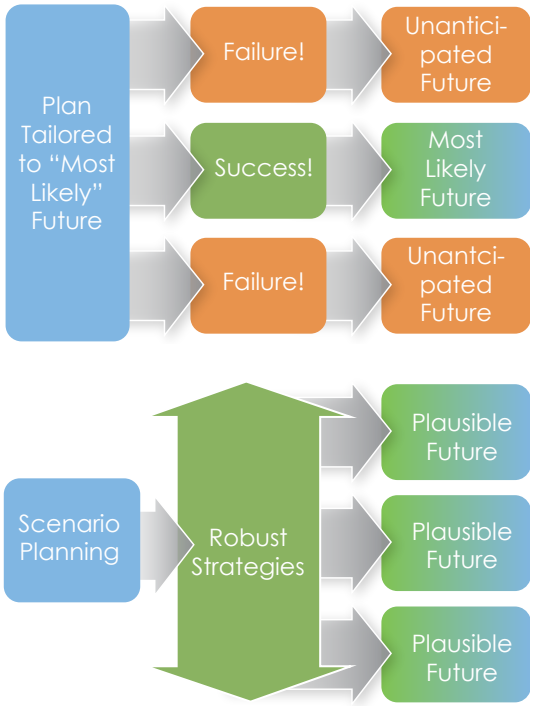
QUALITATIVE PROJECT EVALUATION

Types of Projects on the NCPFN	Economic Competitiveness	Mobility and Reliability	Safety	Asset Management	Environmental Stewardship	Innovative Technology
Bridge replacements	◔	◑	◑	●	◔	◔
Capacity expansions	◑	●	◑	◑	◔	◔
New right-of-way	●	●	◑	◔	◔	◔
Bypasses	◑	●	◑	◔	◔	◔
Maintenance/ rehabilitation	◔	◔	◔	●	◔	◔
Design modernization	◔	◑	◑	●	◔	◑
Interchange reconstruction	◔	◑	●	●	◑	◑
ITS implementation	◔	◑	◔	◑	◔	●
Freight rail expansion/upgrades	●	◑	◔	◑	◑	◔
Use of real-time traffic management systems	◔	◑	◔	◔	◔	●
Port connectivity and access	◑	◑	◑	◑	◑	◔
Intermodal facilities	●	◑	◔	◔	◑	◔
Safety improvements	◔	◑	●	◑	◔	◑
Incident management	◔	◑	◑	◑	◑	◑
Grade separation	◔	◑	●	◔	◔	◔

● = High score; ◑ = Medium score; ◔ = Low score.

8 SHAPING NORTH CAROLINA'S FUTURE

The world is quickly changing and North Carolina must be proactive, resilient, and flexible in responding to those changes. However, the traditional planning process relies on trying to predict the future based on a single long-term forecast. The peril of planning based on a single forecast is that, if the "most likely" future fails to occur, investments may be less effective, ineffective, or even counter-productive. There also is an opportunity cost – investing in the wrong solutions implies that not enough was invested in the right ones. The North Carolina Multimodal Freight Plan uses a Robust Decision Making (RDM) process with the guiding principle that there are many plausible futures. RDM defines success not as predicting the future accurately, but as pursuing strategies that are productive and appropriate even if events do not proceed as projected and that adapts as trends shift or become more clear.



Defining the Freight Futures for North Carolina

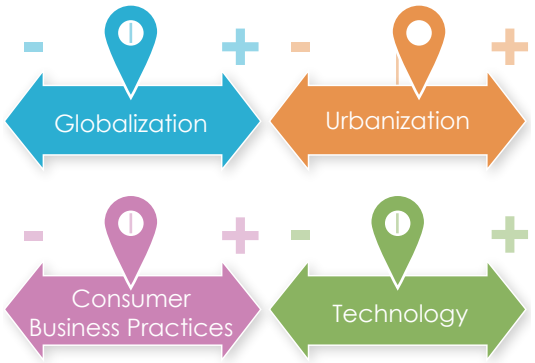
The plausible futures were developed based on research and stakeholder input on the key drivers impacting future freight flows discussed in Chapter 5. Four significant drivers of change in the U.S. and North Carolina include globalization, business and consumer practices, technology, and urbanization. The plausible futures are not meant to represent "good" or "bad', "success" or "crisis". They represent what happens if these fours drivers follow recent trends, accelerate or see current trends plateau or reverse.

Several plausible futures were examined during the development of the Freight Plan but three rose to the top.

Tar Heel State Quo: Tar Heel State Quo is a future in which urbanization accelerates and the status quo remains in other drivers such as globalization, business and consumer practices, and technology. North Carolina's urban areas grow rapidly in population and employment, while exurbs[8] and rural regions plateau, grow more slowly or sustain losses. Increasing real estate prices continue to drive a development boom but limit the ability

[8] Exurban (for "extra-urban") describes the ring of prosperous communities beyond the suburbs that are commuter towns for an urban area.

TAR HEEL STATE QUO



of new labor to move to city centers. The same forces place strong pressure on light industrial and distribution to move out of urban cores.

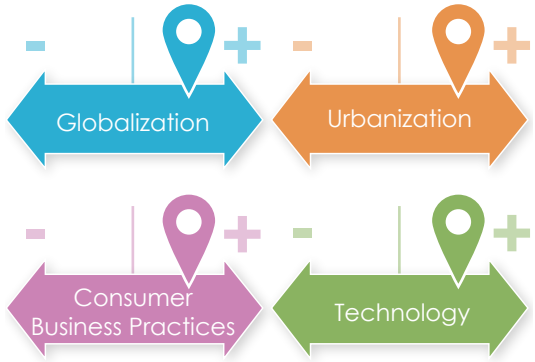
Globalization plateaus and potentially begins to recede, as manufacturing moves gradually back to the United States. This reduces demand for international sea shipping, which is already suffering from oversupply in some trade lanes. But it offers opportunities for North Carolina, especially in the urban fringes.

New freight-related technology fills important but niche markets. For example, 3D printing is used to manufacture some products at the point-of-sale and even in private homes. Automated driving and artificial intelligence have a presence in urban areas for short-distance deliveries (rolling drones on the sidewalk, ridesharing) and need to be accommodated by piloted vehicles, pedestrians, and bicycles.

The slow down in exurban and rural growth ripples over into e-commerce, causing a slowing in the growth. In turn, combined with slowing globalization, this leads to businesses reassessing their distribution and fulfillment center strategies to unload excess capacity.

Innovation Age: Innovation Age is an "uneven world" future in which technology, globalization, and the knowledge economy drive an economic boom in well-equipped cities but provide limited benefits for others. Research Triangle, Triad, and Charlotte, with innovation clusters, colleges, and universities sees a boom, but the State's smaller cities and rural areas struggle unless they are college towns or regional service centers (e.g., Asheville, Greenville). The State's ports and trade regions also fare well due to acceleration of global trade. Through a combination of globalization and automation, significant manufacturing jobs in the United States are eliminated. Shipments will arrive via ship, airplane, and potentially freight shuttles and airship, stressing the urban road networks and neighborhoods that surround these facilities in the port regions and along key trade corridors.

INNOVATION AGE



Automation largely displaces the trucking and warehousing workforce and its members require government support to educate themselves in professions and industries created by new technology. Automated trucks travel in platoons and require NCDOT to invest heavily in intelligent transportation and support systems on freight corridors – but they obviate the need for truck stops and truck parking.

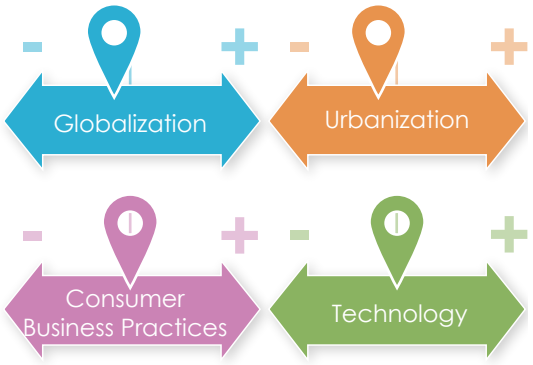
Consumer goods are largely 3D printed at "micro-manufacture" shops in urban areas. These business still require large shipments of raw materials, so communities are smart to invest in cargo-oriented development zones with rail and highway access.

Back to the Future: Back to the Future is a future in which urbanization and globalization plateau, while technologies and business and consumer practices continue to develop as they have in recent years. The migration to suburban and exurban areas from city centers is driven by concerns about schools, commute times, desire for open space, and cost. However, convenience and choice will not be sacrificed.

A spread-out population drives e-commerce and automated vehicle implementation (since it is easier to automate in a standardized, predictable environment). Electric cars are the dominant mode of transportation. Accelerated use of congestion pricing becomes necessary as demand increases. Telepresence becomes more practical.

Large distribution centers are necessary in rural and exurban communities. Communities are challenged to prepare for impacts in policy, zoning, and infrastructure.

BACK TO THE FUTURE



Globalization goes into retreat, with significant manufacturing returning to the United States. However, technology leads to increased automation and lower labor-intensive operations. Large numbers of products that used to arrive by ship from China and Southeast Asia arrive by truck, train or short sea ship from domestic factories. Heavy traffic challenges neighborhoods around intermodal rail terminals in urban areas, and limited capacity at those facilities drives goods to trucking and adds large vehicles to congested highways over long distances.

Recommended Strategies

Because North Carolina has an economy increasingly focused on urban offices, knowledge, and supporting services, combined with traditionally strong and expanding manufacturing and agricultural sectors, the demands on the State's transportation system are diverse and expanding.

With this in mind, strategies in the freight plan should address not only the plausible futures described previously but others as well. The three discussed scenarios stand in for an infinite range of possible outcomes. The key is to develop robust strategies that are sound investments of time and money regardless of what is coming, so that North Carolina continues to compete for people, jobs and freight. To facilitate more robust strategies, the recommendations developed to ensure safe and efficient freight mobility are evaluated and prioritized against alternative freight futures.

FHWA defines three categories of strategies for state freight plans: infrastructure improvements, operational innovations, and policies. Strategies were taken from several sources:

- NCDOT priorities and previous plans including the Divisions and Modal Offices;
- Priorities for North Carolina Port Authority, MPOs and RPOs, North Carolina Railroad;

- Industry priorities and suggestions, gathered through over 40 interviews and the Freight Advisory Council (FAC); and
- Best practices from FHWA, other states, and the private sector.

Based on these results and the established goals of FHWA and NCDOT, strategies were grouped into five categories.

This section lists the strategies in each of the following prioritization categories separately:

- **Funded Projects** address a current or near-term need. They are worthwhile ideas today, no matter what the future holds. For example, addressing a safety hotspot. These strategies are already under development, many with funding secured. They will form the five-year Freight Investment Plan.
- **Robust Strategies** are expected to be appropriate no matter what the future holds, but are not necessarily funded. For example, enhancing the resiliency of the freight network.
- **Hedging Strategies** might not be needed, but if they are needed we will need to have started implementing them now. For example, providing connectivity and access to major development sites.
- **Transformative Strategies** allow North Carolina agencies to influence – and hopefully direct – trends for the future. For example, increasing the use of underutilized gateways and rail assets.
- **Deferred Strategies** might be necessary, but it is safe to wait and see what happens. For example, implementing truck only lanes along major trade corridors such as I-85.

This process allows North Carolina to accommodate the risk that the future does not reflect the status quo, a continuation of current trends, or any other speculation – however educated – made during the development of the plan.

Fiscally Constrained Freight Investment Plan

Immediate Strategies

As noted in Chapter 1, the FAST Act established the NHFP funds which are available for obligation for up to four years. NHFP obligations are reimbursed from the Highway Account of the Highway Trust Fund – they come with contract authority and are subject to the annual obligation limitation imposed on the Federal-aid Highway Program. The Federal share for NHFP funds is generally 80 percent but certain types of improvements (predominately safety improvements) may have a Federal share of up to 100 percent. Beginning two years after FAST Act, a State may not obligate apportioned NHFP funds unless the State has developed a FAST Act-compliant State Freight Plan (the multimodal components of the plan may be incomplete) that provides for the immediate and long-range planning activities and investments of the State with respect to freight. Projects must be identified in the STIP/TIP and be consistent with the Long Range Plans. The State Freight Plan must provide a 5-year fiscally constrained Freight Investment Plan (FIP) that describe how the funds would be invested. Eligible projects, which must contribute to the efficient movement of freight on the NHFN, include planning, construction, ITS, bridges, alt fuel, etc.

North Carolina's apportionment of the NHFP funds for the period spanning 2016-2020 is $166.8 million. The table provided below shows the estimated Fast Act apportionments for the NHFP in addition to any NHFP carry over per year.

The FIP includes projects on the Primary Highway Freight System (PHFS), the Critical Urban Freight Corridors (CUFC), and Critical Rural Freight Corridors (CRFC), which are eligible for NHFP funds. All freight projects were selected from the pool of projects identified for funding in the 2018-2027 State Transportation Improvement Program(STIP). The required state matching funds needed for the Federal Aid Program will be funded by the State Highway Trust Fund. Rail and port projects follow. The airport projects are limited to airport access projects which will be presented in the highway project list.

FREIGHT INVESTMENT PLAN SUMMARY

Year	Total Projects Cost ($M)	Total Federal* ($M)	Total NHFP Allocated ($M)	Total Highway Trust Fund** ($M)	Total NHFP Available ($M)	NHFP Carried Over ($M)	Estimated FAST Act Apportionments for NHFP ($M)
2016	178.19	141.73	16.54	36.46	30.46	13.92	30.46
2017	231.79	185.43	40.13	46.36	43.05	2.92	29.13
2018	700.04	543.92	20.66	156.13	34.70	14.04	31.78
2019	557.52	387.50	49.62	170.02	49.79	0.17	35.75
2020	393.06	314.46	36.50	78.61	39.89	3.39	39.72
TOTAL 2016-2020	**2,060.61**	**1,573.04**	**163.45**	**487.58**			**166.84**

Note:

* Total Federal Share includes NHFP as well as any other Federal funding source. See STIP for detailed breakout of other Federal sources.

** The source of all match is the State Highway Trust Fund.

FREIGHT INVESTMENT PLAN

Project Name	TIP/Project Number	County	Programmed Project Cost ($M)	Total Federal Share* ($M)	NHFP ($M)	State Highway Trust Fund Match** ($M)
2016			**$178.19**	**$141.73**	**$16.54**	**$36.46**
Asset Management and Utilization			**$14.48**	**$10.76**	**$1.00**	**$3.72**
I-77: South Carolina Line to SR 1577 (West Tyvola Road). Pavement Rehabilitation.	I-5768	Mecklenburg	$12.20	$9.76		$2.44
I-485: Idelwild Road to U.S. 74. Pavement Rehabilitation.	I-5748	Mecklenburg	$2.28	$1.00	$1.00	$1.28
Mobility and Reliability			**$163.71**	**$130.97**	**$15.54**	**$32.74**
I-26: NC 191 (Brevard Road). Upgrade Interchange.	I-5504	Buncombe	$56.02	$44.82		$11.20
I-85: SR 2180 (Lane Street) in Cabarr U.S. County to U.S. 29/U.S. 601 Connector in Rowan County.	I-3802B	Rowan	$107.69	$86.15	$15.54	$21.54
2017			**$231.79**	**$185.43**	**$40.13**	**$46.36**
Asset Management and Utilization			**$109.82**	**$87.86**	**$5.33**	**$21.96**
I-40: Buncombe County Line to SR 1103 (South Catawba Avenue / Bat Cave Road). Pavement Rehabilitation.	I-5833	Buncombe, McDowell	$8.40	$6.72		$1.68
I-95: South of SR 1001 (Lizzie Mill Road) to The Johnston/Wilson County Line North Of NC 222. Pavement Rehabilitation.	I-5786	Johnston	$69.60	$55.68		$13.92
I-40: Milemarker 86.4 to Milemarker 92.8. Pavement Rehabilitation.	I-5809	McDowell	$8.86	$7.09		$1.77
I-95: NC 24 (Milemarker 53) to Johnston County Line (Mile Marker 78). Pavement Rehabilitation.	I-5788	Cumberland/ Harnett	$22.96	$18.37	$5.33	$4.59
Mobility and Reliability			**$121.97**	**$97.58**	**$34.80**	**$24.39**
I-40: West Of NC 801 in Davie County to SR 1101 (Harper Road) in Forsyth County.	I-0911A	Davie, Forsyth	$78.47	$62.78		$15.69
I-85: SR 2180 (Lane Street) in Cabarr U.S. County to U.S. 29/U.S. 601 Connector in Rowan County.	I-3802B	Rowan	$43.50	$34.80	$34.80	$8.70
2018			**$700.04**	**$543.92**	**$20.66**	**$156.13**
Asset Management and Utilization			**$80.60**	**$64.48**	**$10.92**	**$16.12**
I-40: Milemarker 37 to Milemarker 43.5. Pavement Rehabilitation.	I-5888	Buncombe	$6.00	$4.80		$1.20
I-40: Milemarker 46 to Milemarker 50. Pavement Rehabilitation.	I-5889	Buncombe	$5.00	$4.00		$1.00
I-40: Milemarker 55 to Milemarker 67.5. Pavement Rehabilitation.	I-5890	Buncombe, McDowell	$7.55	$6.04		$1.51
I-40: Milemarker 95.2 to Milemarker 119. Pavement Rehabilitation.	I-5891	Burke	$23.50	$18.80		$4.70

Note:
* Total Federal Share includes NHFP as well as any other Federal funding source. See STIP for detailed breakout of other Federal sources.
** The source of all match is the State Highway Trust Fund.

Project Name	TIP/Project Number	County	Programmed Project Cost ($M)	Total Federal Share* ($M)	NHFP ($M)	State Highway Trust Fund Match** ($M)
I-40: SR 1010 (Cleveland Road) (Milemarker 312.2) to West of SR 1211 (Morgan Road) (Milemarker 328.5). Pavement Rehabilitation.	I-5781	Johnston	$6.55	$5.24	$5.24	$1.31
I-40: West of I-73/U.S. 421 to SR 4121 (High Point Road) in Greensboro. Pavement Rehabilitation.	I-5811	Guilford	$2.13	$1.70		$0.43
I-77: Milemarker 71.8 to Milemarker 75.8. Pavement Rehabilitation.	I-5864	Yadkin	$4.50	$3.60	$3.60	$0.90
I-77: Milemarker 86.9 to Milemarker 91. Pavement Rehabilitation.	I-5909	Surry	$2.60	$2.08	$2.08	$0.52
I-85/U.S. 29/U.S. 70: 1 Mile South of SR 1129 (Groometown Road) to 0.3 Mile North of I-73/U.S. 421. Pavement Rehabilitation.	I-5853	Guilford	$1.02	$0.82		$0.20
I-85: 0.7 Mile North of Gaston County Line to 0.1 Mile North of SR 5901(Billy Graham Parkway). Pavement Rehabilitation.	I-5770	Mecklenburg	$6.40	$5.12		$1.28
I-85: I-77 to Milemarker 42.1. Pavement Rehabilitation.	I-5797	Mecklenburg	$0.35	$0.28		$0.07
I-85: North of U.S. 64 to NC 109 in Thomasville. Pavement Rehabilitation.	I-5793	Davidson	$15.00	$12.00		$3.00
Mobility and Reliability			**$612.17**	**$473.62**	**$9.74**	**$138.55**
I-26: U.S. 74/NC 108 Interchange. Revise Interchange.	I-4729A	Polk	$18.00	$0.00		$18.00
I-40/Business 85/U.S. 29/U.S. 70/U.S. 220: Elm-Eugene Street in Greensboro. Interchange Improvements.	I-5964	Guilford	$0.40	$0.32		$0.08
I-40/I-77: Final I-40/I-77 Interchange Improvements.	I-3819B	Iredell	$203.60	$162.88		$40.72
I-440/U.S. 1: South of SR 1313 (Walnut Street) to North of SR 1728 (Wade Avenue) in Raleigh. Widen from Four to Six Lanes, Improve Storage At Lake Boone Trail Interchange and Install Ramp Meters.	U-2719	Wake	$346.99	$277.59		$69.40
I-77: SR 2136 (Gilead Road) Interchange. Upgrade Existing Interchange.	I-5714	Mecklenburg	$11.80	$9.44		$2.36
U.S. 29/U.S. 70/U.S. 220 (O'Henry Boulevard): I-40/ Business 85 to South Of Florida Street in Greensboro. Add Lane on I-40/Business 85 Eastbound Ramp onto Northbound U.S. 29/U.S. 70/U.S. 220 and Extend U.S. 29/ U.S. 70/U.S. 220 Southbound Ramp Onto SR 3762 (Martin Luther King, Jr. Drive)	U-5754	Guilford	$17.06	$13.65		$3.41
U.S. 74 (Roosevelt Blvd): SR 1514 (Rocky River Road) Intersection. Reconfigure to Superstreet.	U-5703	Union	$2.15	$0.00		$2.15

Note:
* Total Federal Share includes NHFP as well as any other Federal funding source. See STIP for detailed breakout of other Federal sources.
** The source of all match is the State Highway Trust Fund.

Project Name	TIP/Project Number	County	Programmed Project Cost ($M)	Total Federal Share* ($M)	NHFP ($M)	State Highway Trust Fund Match** ($M)
U.S. 74/U.S. 76: SR 1001 (Hallsboro Road). Convert At-Grade Intersection to Interchange.	R-5749	Columbus	$6.42	$5.14	$5.14	$1.28
U.S. 74: SR 2220 (Broadbridge Road). Upgrade Intersection to Interchange.	R-5752	Robeson	$5.75	$4.60	$4.60	$1.15
Safety			**$7.27**	**$5.82**	**$0.00**	**$1.45**
I-85: I-85/U.S. 321. Geometric Safety Improvements to Interchange.	I-5000	Gaston	$7.27	$5.82		$1.45
2019			**$557.52**	**$387.50**	**$49.62**	**$170.02**
Asset Management and Utilization			**$134.40**	**$107.52**	**$33.30**	**$26.88**
I-40: 1.4 Miles East of I-77 to SR 2167 (Ward Road). Pavement Rehabilitation.	I-5772	Iredell	$10.25	$8.20		$2.05
I-40: East Of Sampson County Line (Milemarker 340) to West of NC 403 (Milemarker 355). Pavement Rehabilitation.	I-5780	Sampson	$11.63	$9.30	$9.30	$2.33
I-40: I-85 to East of SR 1734 (Erwin Road). Pavement Rehabilitation.	I-5822	Orange	$12.45	$9.96		$2.49
I-40: Mile Marker 27 to Mile Marker 34. Pavement Rehabilitation.	I-5834	Haywood	$7.40	$5.92		$1.48
I-40: Iredell County Line to 0.5 Mile West of U.S. 601. Pavement Rehabilitation.	I-5823	Davie	$30.00	$24.00	$24.00	$6.00
I-40: SR 1101 (Harper Road) in Clemmons to East of U.S. 421/Business 40 in Winston-Salem. Pavement Rehabilitation.	I-5952	Forsyth	$6.09	$4.87		$1.22
I-40: SR 1725 (Milemarker 352) in Sampson County to SR 1501 (Milemarker 388) in Pender County. Pavement Rehabilitation.	I-5940	Duplin, Pender, Sampson	$19.47	$15.58		$3.89
I-40: SR 2167 (Ward Road) to Davie County Line. Pavement Rehabilitation.	I-5805	Iredell	$6.40	$5.12		$1.28
I-40/Business 85/U.S. 29/U.S. 70/U.S. 220: Replace Bridge 400299 over South Buffalo Creek in Greensboro.	B-5356	Guilford	$8.38	$6.70		$1.68
I-77: Milemarker 75.8 to U.S. 21 (Exit 79). Pavement Rehabilitation.	I-5865	Yadkin	$2.20	$1.76		$0.44
I-85: Milemarker 42.1 to Milemarker 46.3. Pavement Rehabilitation.	I-5826	Mecklenburg	$5.00	$4.00		$1.00
I-85: U.S. 29/U.S. 601 in China Grove to U.S. 601 (Jake Alexander Boulevard) in Salisbury and from South of U.S. 52 in Salisbury to North of SR 2120 (Long Ferry Road) in Spencer. Pavement Rehabilitation.	I-5858	Rowan	$15.14	$12.11		$3.03

Note:
* Total Federal Share includes NHFP as well as any other Federal funding source. See STIP for detailed breakout of other Federal sources.
** The source of all match is the State Highway Trust Fund.

Project Name	TIP/Project Number	County	Programmed Project Cost ($M)	Total Federal Share* ($M)	NHFP ($M)	State Highway Trust Fund Match** ($M)
Mobility and Reliability			**$423.11**	**$279.98**	**$16.32**	**$143.14**
Existing U.S. 74: U.S. 601 Interchange. Construct Improvements.	U-5723	Union	$7.80	$0.00		$7.80
I-26: U.S. 25 Business (Exit 44) to NC 280 (Exit 40)	I-4400C	Henderson, Buncombe	$62.60	$50.08		$12.52
I-40 / I-85: SR 1007 (Mebane-Oaks Road) in Mebane. Interchange Improvements.	I-5711	Alamance	$17.45	$13.96		$3.49
I-40: Access Improvements in The Vicinity Of Existing I-40/ NC 42 Interchange (Exit 312).	I-4739	Johnston	$69.20	$55.36		$13.84
I-40: NC 54 in Raleigh. Interchange Improvements.	I-5873	Wake	$7.30	$5.84		$1.46
I-40: SR 1712 (Drexel Road). Upgrade Interchange.	I-5875	Burke	$15.70	$12.56		$3.14
I-40: SR 3015 (Airport Boulevard). Revise Interchange; Construct Auxiliary Lanes On I-40 Eastbound from I-540 to SR 3015 (Airport Boulevard) and from SR 3015 to SR 1002 (Aviation Parkway), and Construct Auxiliary Lane On I-40 Westbound from SR 3015 (Airport Boulevard).	I-5700	Durham, Wake	$34.22	$27.38		$6.84
I-77: NC 150 Interchange. Construct Interchange Improvements.	I-5717	Iredell	$10.20	$8.16		$2.04
I-85: SR 2200 (Cox Road) Interchange. Construct Interchange Improvements. (Coordinate With I-5719)	I-5713	Gaston	$1.16	$0.93		$0.23
I-95: SR 1770 (Sunset Avenue) in Rocky Mount. Convert Grade Separation to An Interchange.	U-5026	Nash	$45.74	$36.59		$9.15
I-95: SR 1808 (Jonesboro Road) (Exit 75) and SR 1709 (Hodges Chapel Road) (Exit 77). Improve Interchanges.	I-5883	Harnett	$14.58	$11.66	$11.66	$2.92
I-95: SR 1811 (Bud Hawkins Road) (Exit 70) and SR 1001 (Long Branch Road) (Exit 71). Improve Interchanges.	I-5877	Harnett	$14.58	$4.66	$4.66	$9.92
SR 1001 (Sugar Hill Road): I-40 Westbound Ramps to 0.3 Mile West Of I-40 Eastbound Ramps. Widen Roadway.	U-5818	McDowell	$3.84	$0.00		$3.84
U.S. 29: NC 150. Interchange Improvements.	U-5898	Guilford	$0.55	$0.00		$0.55
U.S. 70: SR 1124 (Grantham Road) to Neuse River Bridge. Upgrade Roadway to Freeway.	U-5713	Craven	$66.00	$52.80		$13.20
U.S. 70: Taberna Way. Convert At-Grade Intersection to Interchange.	R-5777A	Craven	$52.20	$0.00		$52.20

Note:
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** The source of all match is the State Highway Trust Fund.

Project Name	TIP/Project Number	County	Programmed Project Cost ($M)	Total Federal Share* ($M)	NHFP ($M)	State Highway Trust Fund Match** ($M)
2020			**$393.06**	**$314.46**	**$36.50**	**$78.61**
Asset Management and Utilization			**$33.88**	**$27.11**	**$0.00**	**$6.78**
I-40: 0.3 Mile East Of SR 3153 (Hanes Mall Boulevard) to 0.9 Mile East of NC 150 (Peters Creek Parkway) in Winston-Salem and SR 2747 (Clemmonsville Road) in Winston-Salem to Guilford County Line. Pavement Rehabilitation.	I-5795	Forsyth	$22.50	$18.00		$4.50
I-77: 0.3 Mile North of SR 2321 (East Broad Street) to SR 1892 (Jennings Road). Pavement Rehabilitation.	I-5813	Iredell	$1.90	$1.52		$0.38
I-85: Gaston County Line to 0.7 Miles North Of Gaston County Line. Pavement Rehabilitation.	I-5837	Mecklenburg	$0.50	$0.40		$0.10
I-85: SR 2472 (W. Mallard Creek Church Rd) to 0.8 Mile North Of SR 2467 (Mallard Creek Rd). Pavement Rehabilitation.	I-5860	Mecklenburg	$5.50	$4.40		$1.10
Willow Road: Replace Bridge 400352 over I-40/ Business 85 in Greensboro.	B-5713	Guilford	$3.48	$2.79		$0.70
Mobility and Reliability			**$359.18**	**$287.35**	**$36.50**	**$71.83**
I-26 (U.S. 19/U.S. 23): SR 1781 (Broadway Street) – Exit 25 in Asheville to U.S. 25	A-0010AA	Buncombe	$100.10	$80.08		$20.02
I-26: I-26/I-40/I-240 Interchange	I-2513C	Buncombe	$168.48	$134.78		$33.70
I-40/U.S. 421: SR 1850 (Sandy Ridge Road) in Greensboro. Interchange Improvements.	I-5712	Guilford	$15.70	$12.56		$3.14
I-40: NC 55 (Alston Avenue) to NC 147 (Durham Freeway/ Triangle Expressway) in Durham. Construct Westbound Auxiliary Lane.	I-5707	Durham	$3.87	$3.10		$0.77
I-40: SR 1007 (Lenoir Rhyne Boulevard) Interchange. Construct Interchange Improvements.	I-5716	Catawba	$1.16	$0.93		$0.23
I-40: SR 1142 (Jamestown Road) – Exit 100. Upgrade Interchange.	I-5874	Burke	$2.18	$1.74		$0.44
I-40: SR 1734 (Carolina Street Se)/SR 1826 – Exit 111. Revise Interchange.	I-5008	Burke	$3.36	$2.69		$0.67
I-40: U.S. 64 (Burkemont Road). Improve Interchange.	I-5009	Burke	$1.16	$0.93		$0.23
I-77: NC 73 Interchange. Upgrade Existing Interchange to Split Diamond Configuration.	I-5715	Mecklenburg	$17.55	$14.04		$3.51
I-95: U.S. 421 (Exit 73) and SR 1793 (Pope Road) (Exit 72). Improve Interchanges.	I-5878	Harnett	$31.32	$25.06	$25.06	$6.26
I-95: U.S. 70 Business. Upgrade Interchange.	I-5972	Johnston	$14.30	$11.44	$11.44	$2.86
Grand Total 2016-2020			**$2,060.61**	**$1,573.04**	**$163.45**	**$487.58**

Note:
* Total Federal Share includes NHFP as well as any other Federal funding source. See STIP for detailed breakout of other Federal sources.
** The source of all match is the State Highway Trust Fund.

SCREENED AND RECOMMENDED RAIL PROJECTS

Project Name	Source	TIP	Funding: P4.0 committed (C) or developmental programmed (P)?
Investing in facilities (intermodal, port, transload)			
Construct rail spur at Piedmont Triad International Airport, Greensboro, Guilford County	NCSRP		
Newport River Bridge (Port of Morehead City: Reconstruct bridge for RR clearances)	Stakeholders	U-5740	P4.0 HWY: P-DIV
CFT2040 FR-17: Construct Rail Across Cape Fear River – Port of Wilmington to Davis Yard	NCSPA, WMPO Cape Fear Transpo 2040		CFT2040: unfunded
Pursuing highway-RR grade separation			
Rail corridor speed increase from 10 to 25 mph and CFT2040 FR-7: Reduce At-grade Crossing Conflicts in Wilmington	SAIC, NCSRP, WMPO Cape Fear Transpo 2040, WTSS		CFT2040: funding anticipated
CFT2040 FR-14: Cape Fear River Crossing	NCSRP, WMPO Cape Fear Transpo 2040		CFT2040: unfunded
CFT2040 FR-5 Dan Cameron Bridge RR Safety Improvements	NCSRP, WMPO Cape Fear Transpo 2040, WMPO P5.0		CFT2040: funding anticipated
Grade separate: Blackwell St and Mangum St, Durham, Durham Cty	STI4	Durham TSS	P4.0 RAIL: unfunded
Construct extension of East Durham Siding with grade separations and crossing closures	NCSRP, STI4	P-5706	P4.0 RAIL: P-REG
Grade separate: Ellis Rd, Durham, Durham Cty	NCSRP, STI4	P-5716	P4.0 RAIL: P-REG
Grade separate: Rogers Rd Extension, Wake Forest, Wake Cty	NCSRP, STI4	P-5707, at grade improvements completed	C
Grade separate: Northside Loop (Harris Rd), Wake Forest, Wake Cty	NCSRP, STI4		
Grade separate: Walker St, Cary, Wake Cty	NCSRP, STI4	U-5117	P4.0 RAIL: unfunded
Grade separate: Harrison Ave, Cary, Wake Cty	NCSRP, STI4	P-5708	P4.0 RAIL: P-REG
Grade separate: South West St, Raleigh, Wake Cty	NCSRP		P4.0 RAIL: unfunded
Grade separate: Apex Peakway at South Salem St, Apex, Wake Cty	NCSRP, STI4		P4.0 RAIL: unfunded
Grade separate: Ward Rd, Greensboro, Guilford Cty	NCSRP, STI4		P4.0 RAIL: unfunded
Grade separate: Wagoner Bend Rd, Greensboro, Guilford Cty	NCSRP, STI4	P-5727	P4.0 RAIL: P-REG
Grade separate: 22nd St, Kannapolis, Cabarrus Cty	NCSRP, STI4	P-5723	P4.0 RAIL: P-REG
Grade separate: Clanton Rd, Charlotte, Mecklenburg Cty	NCSRP	P-5730	P4.0 RAIL: P-DIV
Grade separate: Old Dowd Rd, Charlotte, Mecklenburg Cty	NCSRP		
Crossing Improvement: Hovis Rd, Charlotte, Mecklenburg Cty [supports Charlotte-Wlilmington rail corridor]	NCSRP		
Grade separate: S. Hoskins Rd, Charlotte, Mecklenburg Cty [supports Charlotte-Wlilmington rail corridor]	NCSRP		

Project Name	Source	TIP	Funding: P4.0 committed (C) or developmental programmed (P)?
Grade separate Wesley Chapel Stouts Rd, in Indian Trail, Union Cty. [supports Charlotte-Wlilmington rail corridor]	NCSRP		
Grade separate: Helms Rd, Waxhaw, Union Cty	NCSRP		
Grade separate: Rogers Lake Rd, Kannapolis, Cabarrus Cty	NCSRP, STI4	Y-4810K	P4.0 RAIL: P-SW
Increasing capacity with track improvements			
Construct rail line from Global TransPark in Kinston to CSXT line parallel with NC 11, in Lenoir Cty	NCSRP, STI4		
CFT2040 FR-6: Evaluate providing rail access to Pender Commerce Industrial Park, New Hanover Cty	NCSRP, WMPO Cape Fear Transpo 2040		CFT2040: funding anticipated
CFT2040 FR-16: Freight Rail Connection from Castle Hayne to Wallace	Stakeholders		CFT2040: unfunded
CSXT A-line Capacity Improvements: P-5711 (A) state funding for intermodal terminal, (B) approx. 5 mi doubletracking, (C) highway connections.	Stakeholders	P-5711A, P-5711B, P-5711C	P4.0 RAIL: P-SW
CSXT A-line and Weldon, NC Improvements	Stakeholders		
Upgrade of the Oxford – Durham line to 286-lb rail	NCSRP, STI4		
Polkton Siding Improvements, Polkton, Anson Cty [supports Charlotte-Wlilmington rail corridor]	NCDOT		
Richardson Creek Siding, Monroe, Union Cty [supports Charlotte-Wlilmington rail corridor]	NCDOT		
Waxhaw Siding, Waxhaw, Mecklenburg Cty	NCDOT		
Improving operations with track improvements			
Construct new siding at Sophia, Randolph Cty	NCSRP, STI4		
Extend NS tracks for operational efficiencies in Linwood Yard, Davidson Cty	NCSRP, STI4		
Extend Pomona Yard auxiliary track and add power turnouts in Greensboro, Guilford Cty	NCSRP, STI4		
Monroe Connector: Improve junction at Monroe, NC for CSX SF and SG Lines [supports Charlotte-Wlilmington rail corridor]	Stakeholders		
Improving highway/rail intermodal connections			
Implement Recommendations of the CCX Regional Freight Master Plan that is currently being conducted to look at highway and rail connections to the CSX intermodal network (see P-5711 projects)	SIAC		

SCREENED AND RECOMMENDED PORT PROJECTS

Project Name	Source	TIP	Funding: P4.0 committed (C) or developmental programmed (P)?
Investing in port facilities			
Newport River Bridge (Port of Morehead City: Reconstruct bridge for RR clearances) (with U-5876)	Stakeholders	U-5740	P4.0 HWY: P-DIV
Investing in port facilities and Pursuing highway-RR grade separation			
CFT2040 FR-14/R-58: Fourth Cape Fear River Crossing (in conjunction with FR-17 and FR-25) (highway)	NCSRP, WMPO Cape Fear Transpo 2040		CFT2040: unfunded
CFT2040 FR-17: Construct Rail Across Cape Fear River – Port of Wilmington to Davis Yard (in conjunction with FR-14 and FR-25)	NCSRP, WMPO Cape Fear Transpo 2040		CFT2040: unfunded
CFT2040 FR-25: Dedicated Truck Interstate Access to NC Port of Wilmington (in conjunction with FR-14 and FR-17)	NCSRP, WMPO Cape Fear Transpo 2040		CFT2040: unfunded
Improving roadways			
Widen U.S. 70 (Arendell St) and Radio Island Compressed Diamond (with U-5740)	Div 2	U-5876	P4.0 HWY: unfunded
U.S. 70 Havelock Bypass	NCSPA	R-1015	C
Convert intersections to interchanges on U.S. 70 between James City and Havelock Bypass	NCSPA	R-5777A, R-5777B	
U.S. 70 upgrade to freeway in James City	NCSPA	U-5713	P4.0 HWY: P-SW
U.S. 70 Kinston Bypass	NCSPA	R-2553	P4.0 HWY: P-REG
CFT2040 FR-2/R-15: Front Street Widening and Redesign (Wilmington)	NCSPA, WMPO Cape Fear Transpo 2040	U-5734	P4.0 HWY: P-REG; CFT2040: funding anticipated
CFT2040 R-18: Isabel Holmes Bridge Flyovers	NCSPA	U-5731	P4.0 HWY: C and P-SW
Wilmington Local Road Projects	NCSPA		
U.S. 74 Upgrade to Freeway (I-74): Wilmington to Monroe Bypass	NCSPA	R-4462, R-5819, R-5820, R-5749, R-5797 R-5751, R-5752, R-4441, FS-1508A, R-3421, U-5710	P4.0 HWY: P and unfunded

Project Name	Source	TIP	Funding: P4.0 committed (C) or developmental programmed (P)?
Pursuing highway-RR grade separation			
Implement Wilmington Traffic Separation Study (WTSS) Recommendations	SIAC, WTSS		
Rail corridor speed increase from 10 to 25 mph and CFT2040 FR-7: Reduce At-grade Crossing Conflicts in Wilmington	SAIC, NCSRP, WMPO Cape Fear Transpo 2040, WTSS		CFT2040: funding anticipated
CFT2040 FR-5 Dan Cameron Bridge RR Safety Improvements	NCSRP, WMPO Cape Fear Transpo 2040, WMPO P5.0		CFT2040: funding anticipated
Increasing capacity with track improvements			
Relocate NCRR along a new alignment between Morehead City and Havelock (along NC 101) (GTP to Morehead City Mobility Corridor)	NCSRP		
CFT2040 FR-16: Freight Rail Connection from Castle Hayne to Wallace	WMPO Cape Fear Transpo 2040		CFT2040: unfunded

Medium and Long Term Strategies

The longer term strategies fall into the categories of Robust, Hedging, and Deferred. The robust strategies are highest priority since they are needed and effective under multiple plausible freight futures. The hedging strategies are medium priorities but may become high priorities depending on the direction and pace of the trends. Thus, sufficient planning and preparation should be in place to allow NCDOT to move relatively quickly if needed. The deferred strategies are lower priority and do not require much pre-work. Key robust and hedging strategies are summarized.

Hedging Strategies

Infrastructure

Expand key two lane rural routes on the NCPHFN. The priority facilities that need expanding will depend on regional and industry growth trends but plans should be advancing for all two-lane facilities on the NCPHFN.

Develop and modify infrastructure to be capable of handling platooning and autonomous trucks.

Invest in upgrading rail lines and other rail facilities.

Invest in alternate routes for highly congested corridors.

Invest in roadways, interchanges and rail spurs to serve large development sites.

Preserve rail corridors, especially those going out of service.

Operations

Invest in urban locations to service increasing number of fulfillment centers.

Develop alternative freight delivery vehicle operating guidelines.

Robust Strategies

Infrastructure

Maintain safe, reliable connections to ports, rail terminals, air cargo facilities, military bases and major logistics and manufacturing sites.

Invest in modernizing the interstates, ensuring that they meet design standards to accommodate freight vehicles of today and in the future. This includes replacing bridges with weight restriction and weight limits on the NCPHFN.

Pursue mitigation strategies to protect the NCPFN against climate change and increasing weather events.

Invest in mobility solutions in the major urban areas to more efficiently and safely move both people ad freight.

Ensure adequate connectivity between rural regions and the state's gateways and urban centers.

Invest in heavy haul corridors in regions with ports, energy exploration and agricultural production.

Implement truck parking strategies at abandoned rest areas and weight stations from the Statewide Truck Parking Study. The trucking industry suggested exploring industry user fees as a funding mechanism.

Address congestion hot spots on NCPHFN. This may include examining mass transit opportunities for removing passenger vehicles from these routes.

Operations

Develop resiliency strategies to mitigate impact of man-made or natural disruptions of the NCPFN.

Invest in incident clearance on the NCPHFN. Reexamine the MOVES program for incident clearance for potential implementation.

Develop digital backbone to deploy technology to leverage real-time travel and truck parking data aimed at the freight industry.

Institutional

Enhance public awareness program on "Sharing the Road" with trucks.

Add safety signage on NCPHFN about safe traveling distances and passing guidelines related to trucks.

Implement Freight Performance Measure Program and target setting.

Integrate freight into Strategic Transportation Investments (STI) process.

Conduct a vehicle inventory and use survey (VIUS) for commercial vehicles to enhance NCDOT's tools and processes for identifying and evaluating freight needs and projects.

Maintain on-going engagement with the industry through the Freight Advisory council and an annual Freight Leadership Summit that includes leaders from the industry, NCDOT, other state agencies and the NC Legislature.

Conduct a Statewide Rail Access and Utilization Study that assesses the opportunity for truck to rail diversion and an assessment of regional rail bottlenecks and solutions.

Develop a comprehensive "Freight Moves North Carolina" public awareness campaign that addresses the role of freight and how to better facilitate safe and efficient freight transportation and mitigate the potential negative impacts.

Implement freight planning requirements into the Comprehensive Transportation Planning (CTP) program at NCDOT.

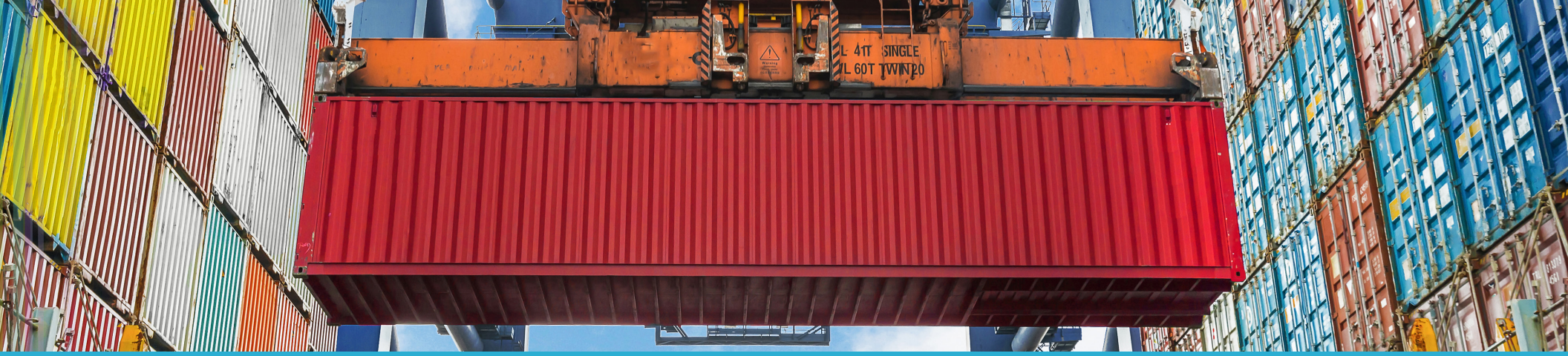
Transformative Strategies

Transformative or shaping strategies are those that can alter the State's freight future. In other words, the State's public and private sectors proactively pursue strategies with the intention of altering current trends. Following are three potential transformative strategies.

The Central Coast Gateway Strategy

Next Gen Truck Technology

Expand Rail Freight Market Opportunities



The Central Coast Gateway Strategy

North Carolina is strategically located about midpoint on the eastern seaboard of North America. This provides efficient reach from Canada to Florida. The State's two deep-water ports and its expansive highway system and two Class I railroads are assets that benefit businesses and residents statewide. While North Carolina may not become the East Coast's biggest gateway, it can become a very strategic gateway for shippers in North Carolina and beyond. Developing a vision of what the State wants to be as a gateway and developing a plan to achieve that vision could reshape the State's economic future.

The Central Coast Gateway Strategy would be guided by a shared vision to be achieved through a series of goals and objectives. It would be comprised of a set of key policies and programs, infrastructure investments and partnerships necessary to plan and implement the strategy.

The core pillars for the gateway strategy would be:

Invest in a world-class transportation network

- Increase major road and rail capacity necessary for accessing the ports
- Increase container cargo capacity and handling capabilities
- Increase bulk cargo capacity and handling capabilities

Ensure attractive investment climate

- Workforce development
- Competitive costs
- Community and political support
- Foreign trade zone and import/export assistance

Develop key partnerships

- Federal, state and local public partners
- Private sector including railroads, steamship liners, and developers
- Financing community
- Communities, residents, and businesses

The investment is already starting to happen with the CCX terminal in Rocky Mount, the Queen City Express service from Port of Wilmington to Charlotte and the upgrade of U.S. 70 and 74 to interstates. Additional investments are being studied including rail realignment at Port of Wilmington and Morehead City, master planning for major logistics activity around the CCX facility and expansion of opportunity at Global TransPark.

North Carolina also has a very competitive business climate, ranking 2nd in the nation in 2016 survey by Site Selection magazine.

Overall Rank	2
State	North Carolina
Survey Rank	5
Comp. Rank	2
2015 NP Rank	4
2015 NP Rank PC	7
2016 NP Rank	4
2016 NP Rank PC	10
Mature Firm TI Rank	7
New Firm TI Rank	13
Final Total Points	94

Source: Conway Projects Database.

Comp. – Competitiveness
NP – New Plant
PC – Per Capita
TI – Tax Index

2016 Figures from January – August 2016

The first step in pursuing the Central Coast Gateway Strategy is developing some key public, private and political partnerships necessary to garner support and start the planning.

Next Gen Truck Technology

Autonomous and Connected Trucking a Game Changer for Fuel Efficiency, Safety, and Mobility

A technique that has been used for years in the trucking industry, now drafting or truck platooning, is about to enter the world of autonomous driving known as Level 2 truck platooning. Level 2 truck platooning is an extension of cooperative adaptive cruise control that uses automated lateral and longitudinal vehicle control, while maintaining a tight formation of vehicles with short following distances. A platoon is led by a manually driven truck and allows the drivers of the following truck(s) to disengage from the driving tasks and monitor the system performance. Driving in a platoon formation has demonstrated the potential for significant fuel saving benefits and associated reductions in emissions from the vehicles within the platoon.

> "Research suggests that platooning technology can provide a 5 to 20 percent fuel savings, depending on the gap, speed, number of vehicles and location of a vehicle within a platoon" "Platooning also offers other benefits, such as emission reductions, additional vehicle safety features and increased highway throughput, just to name a few."
>
> TTI Senior Research Engineer Beverly Kuhn

A recent report issued by the U.S. Energy Information Administration on autonomous projects that heavy-duty, long-haul commercial vehicles will be the first large group of early autonomous technology adopters simply due to the potential for efficiency gains and lower operating costs. Other likely developments the report predicts include:[9]

- Truck platooning provides most of the fuel economy benefits associated with autonomous trucks. Platooning can be carried out by Level 1 autonomous vehicle technology and the industry can expect to see it deployed far earlier than more advanced autonomous technology.
- The real driver of the rate of adoption for high levels of autonomous driving technology in trucking is dependent on the driver shortage and associated cost issues. If these trends do not improve, it is likely the industry will move toward those greater degrees of autonomous technology.
- Truck platooning has the potential to ease congestion on highway corridors, since it does away with the "accordion" effect of having lines of vehicles speed and slow-down in unpredictable ways. Even a market penetration rate of around 10 percent for truck platooning can provide a noticeable increase in roadway throughputs and associated increased vehicle efficiencies.
- Drivers in trucks operating in autonomous mode will also be able to engage in route optimization and seek out freight in real time, which the report says will increase trucking revenue, reduce miles driven, and possibly reduce the number of trucks required to haul cargo, while increasing the cargo density of the trucks that are moving freight.
- By 2050, fuel consumption could be reduced by as much as 18 percent for commercial light trucks, buses and heavy-duty "freight trucks."
- Ninety-four percent of insurance executives expect liability coverage to change as a result of autonomous vehicles, while 52 percent expect property damage coverage to change.

[9] http://www.truckinginfo.com/blog/truck-tech/story/2017/04/autonomous-vehicles-will-change-society-and-industry-dramatically-and-soon-says-new-report.aspx, accessed July 17, 2017.

PROCESS FOR PLANNING AND IMPLEMENTING TECHNOLOGY PILOTS

Conceptualization and Initial Planning	Secure Pilot Funding	Pilot Deployment	Pilot Evaluation	Mainstreaming/ Operations
State's transportation needs and private sector interest Real-world measurable benefits	State Private sector Federal (ATCMTD and INFRA grant programs)	Detailed architecture and design Hardware and software Technologies and applications Operation	Independent system performance and benefits evaluation	Examine full deployment of the technologies across the State

North Carolina is a leader in the knowledge economy and a hub for research and development for all things technology, especially truck manufacturing. Combining this with the State's expansive highway system positions North Carolina to take advantage of this opportunity. Not only could deploying the technology be a boom for shippers and carriers, but leading the research and development, and equipment production could have unprecedented impacts on the State's role in freight transportation and all its related upstream and downstream opportunities.

Expand Rail Freight Market Opportunities

North Carolina is in a position to significantly grow rail freight in the State by capitalizing on recent developments within the State as well as global shifts in trade patterns. Through strategic actions North Carolina can expand its rail freight market, making the State more competitive for shippers and easing the pressures on the highway system.

Expanding/Modernizing Rail Infrastructure

North Carolina recognizes the need and importance of continually improving its rail infrastructure to benefit all residents and businesses. The rail network serves both passenger and freight needs with direct improvements to one often indirectly impacting the other. Rail is also a vital economic development asset as many shippers require reliable, efficient rail service to remain competitive. Modernizing the rail system increases its functionality, for example:

- Upgrading all trackage to sustain 286,000 lb. loads, such as on the Oxford to Durham line and several short lines, improves customer service by standardizing load limits throughout the State to minimize transfer and repacking issues and time.
- Continuing the strong FRRCSI program increases safety by replacing aged and obsolete rail structures, and reducing at-grade highway/rail crossings.
- Reconstructing rail corridors to accommodate double-stacked containers and oversized (wide) project cargo creates flexible, high-capacity facilities that dovetail well with private industry's push to intermodal yard automation.
- Partnering with private rail carriers to provide expedited, regular service.
- Preserving and increasing the number of direct rail-served sites.

Shifting Distribution Center Activity Along Eastern Seaboard

North Carolina can capitalize on trade shifts from the Panama Canal's expansion – which has led to larger ships reaching the U.S. East Coast – by encouraging distribution center clusters around North Carolina's freight hubs, including the ports, airports, intermodal facilities, and short rail corridors. The State can build on the momentum of the CCX Intermodal Terminal being developed in Rocky Mount, North Carolina on CSX's crucial A-Line which parallels I-95, the National Gateway Corridor, through coordinated rail corridor improvements – such as installing passing sidings and/or double-tracking busy sections of track, and grade-separating highway/railroad crossings – that increase corridor safety, efficiency, and reliability. Additionally, the State can incentivize rail-centric mega sites plus encourage rail connections to other mega sites (Siler City, Randolph County, Brunswick County, and New Hanover County) to aid in the clustering to further support the East Coast's growing container ship market.

Truck to Rail Diversion

As the roads become further congested and widening them becomes less of an option to meet growing demand, diverting truckloads to rail cars can extend the life of the current road network as well as better utilize the State's extensive rail network. Adding last-mile highway connectors to rail-served facilities will aid in simplifying diversions. Removing at-grade crossings will benefit both road and rail travel time reliability.

New Industrial or Other Freight-Oriented Development

Starting with the North Carolina Statewide Logistics Plan in the early 2000's, North Carolina's agencies, railroad companies, and private businesses have taken an active role in addressing freight and logistics needs to shape the State of North Carolina through policies, programs, and projects that support and encourage freight movement and freight-oriented developments. For instance, from talks with agricultural and pharmaceutical industry experts, it was found that North Carolina had a lack of refrigerated facilities near their ports so cold shipments were often sent to neighboring states' ports. Highlighting this gap in services was one step that led to the new in-port cold storage facility in Wilmington. Similarly, North Carolina's Port of Morehead City was found to be one of the stronger project cargo ports on the East Coast that could further expand by offering white glove service for new industries such as windmills.

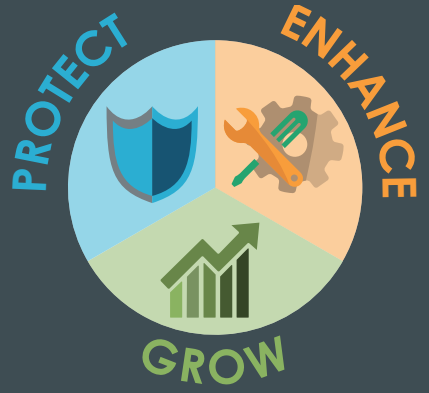
Attracting North Carolina Traffic from Neighboring States' Intermodal Facilities

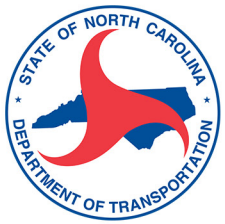
South Carolina has Greer and Dillon, Virginia has Front Royal – directly streaming goods to their ports and the two Class I railroads in the North Carolina region thereby creating booming economic development in their vicinities. Each of these out-of-state intermodal facilities is currently serving several of North Carolina's home grown industries and agriculture. North Carolina has an opportunity to recapture this business by building on its current facilities, including the Charlotte Intermodal Terminal. By carefully master planning the soon-to-be-constructed CCX Intermodal Terminal in Rocky Mount along with its surrounding areas, North Carolina can draw in additional traffic. Additionally, North Carolina can capitalize on the large number of short lines in the State to further increase economic development by connecting these large national terminals with local industry.

Conclusion

The North Carolina Statewide Multimodal Freight Plan documents the freight transportation strengths, weaknesses, opportunities and challenges, both currently and into the future. The Plan sets forth recommendations and strategies to assist the State in meeting existing needs and future challenges. More importantly, it lays out strategies that can shape not only the future of the State's freight transportation system, but the future of the North Carolina's economic well-being. In meeting the FAST Act requirements, the plan also positions the State to take advantage of federal funding opportunities for freight infrastructure. However, that will not be enough. The needs far exceed available resources. This plan can serve as a call for action to position North Carolina to compete in a global economy dependent on the safe and efficient movement of freight.

The North Carolina Freight Network is one of the State's most important economic assets. To continue to compete in a global economy, the State must ensure sufficient investment to *Protect*, *Enhance*, and *Grow* freight transportation assets and opportunities. *Protect* the assets and the businesses that depend on them by ensuring a state of good repair; *Enhance* the assets by addressing congestion, safety, and modernization needs; and *Grow* the assets by investing in critical new facilities and programs necessary to meet the rapidly expanding and changing needs of manufacturers, logistics providers, and consumers.

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