



NC MOVES 2050
CONNECTING YOUR COMMUNITY,
YOUR VOICE AND YOUR FUTURE

STATE OF THE SYSTEM



NC MOVES

2016

CONNECTING YOUR COMMUNITY,
YOUR VOICE AND YOUR FUTURE



LIST OF ACRONYMS

3DP – 3D Printing
AASHTO – American Association of State Highway and Transportation Officials
ACS – American Community Survey
ADP – Airport Development Plan
BCO – Beneficial Cargo Owners
BMIP – Bridge Maintenance Improvement Program
BMS – Bridge Management System
BOT – Board of Transportation
CLT – Charlotte Douglas International Airport
CPTA – Choanoke Public Transportation Authority
CSC – Corridor Steering Committee
CSX – CSX Transportation
CUTR – Center of Urban Transportation Research
DBPT – Division of Bicycle and Pedestrian Transportation
DOA – Department of Aviation
DOT – Department of Transportation
ECHS – Executive Committee for Highway Safety
TIGER - Transportation Investment Generating Economic Recovery
FAA – Federal Aviation Administration
FAK – Freight All Kinds
FAST – Fixing America’s Surface Transportation
FCAP – Facility Condition Assessment Program
FHWA –Federal Highway Administration
FMMU – Fleet and Material Management Unit
FRA – Federal Railroad Administration
GSO – Piedmont Triad International Airport
HMIP – Highway Maintenance Improvement Program
HSIP – Highway Safety Improvement Program
HSP – Highway Safety Plan
INFRA – Infrastructure for Rebuilding America
ISTEA – Intermodal Surface Transportation Efficiency Act
ITRE – Institute of Transportation Research and Education
MaaS – Mobility as a Service
MAP-21 – Moving Ahead for Progress in the 21st Century Act
MOPAR – Maintenance Operations and Performance analysis
MPO – Metropolitan Planning Organization
NACTO – National Association of City Transportation Official
NCASP – North Carolina Airport System Plan
NCDOA – North Carolina Division of Aviation
NCDOT – North Carolina Department of Transportation
NCPHFN- North Carolina Priority Highway Freight Network
NCSPA – North Carolina State Ports Authority

NCTN – North Carolina Transportation Network
NHS – National Highway System
NHTSA – National Highway Traffic Safety Administration
NS – Norfolk Southern Railway
OSBM – State Budget and Management
PART – Piedmont Authority for Regional Transportation
PCI – Pavement Condition Index
PIP – Piedmont Improvement Program
PRIIA – Passenger Rail Investments and Improvement Act
RDU – Raleigh-Durham International Airport
RMIP – Routine Maintenance Improvement Program
RPO – Rural Planning Organization
SHC – Strategic Highway Corridors
SHSP – Strategic Highway Safety Plan
STC – Strategic Transportation Corridors
STI – Strategic Transportation Investment
STIP – State Transportation Improvement Program
SURTC – Small Urban and Rural Transit Center
TAM – Transportation Asset Management
TAMP – Transportation Asset Management Plan
TAP – Transportation Alternatives Program
TNC – Transportation Network Companies
VMT – Vehicle Miles Traveled
YVEDDI – Yadkin Valley Public Transportation

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EXECUTIVE SUMMARY

This State of the System Briefing Paper provides a high-level overview of North Carolina's multimodal transportation system and its various system elements. Understanding the existing system is one of the first steps to developing NC Moves 2050, a long-range multimodal transportation plan for the state of North Carolina that will help guide future transportation policy and investment. NC Moves 2050 is a strategic transportation plan connecting communities across North Carolina, focused on creating a more responsive, diverse, and inclusive transportation system for keeping people and freight moving safely and efficiently. The State of the System is a snap shot of each of North Carolina Department of Transportation's (NCDOT) system elements as they currently operate in terms of service provided, funding, economic impacts, and challenges/trends that the different modes and geographic Divisions are facing. It also shows the goals and objectives of those Divisions, highlighting the service that exists and the ways they are looking to improve.

This report lays the ground work for understanding how each individual system element contributes to North Carolina's economy and quality of life, and begins to build a framework for how these individual modes and elements work together to create a fully integrated transportation system, from planning to implementation and operation. Each chapter covers a review of all NCDOT system element or mode, how it contributes to the quality of life for residents and explores the challenges and trends for the future. Additionally, they provide a review of the current long-range planning process, if documented, for that element and how those processes operate.

North Carolina has a comprehensive and interconnected transportation system, however, like many other DOTs; it struggles with limited funding, competing resources, service bottlenecks, and heavy congestion. While system elements run by the NCDOT Divisions have natural overlaps, they often suffer from working in isolation from other Divisions which can cause issues in connectivity between modes. In several areas, North Carolina has been successful and innovative when developing its transportation system, but in other areas it is still lacking and could benefit from a comprehensive, long-range multimodal transportation plan that looks at all elements as parts of a whole that work together for the citizens of North Carolina.

This Executive Summary presents the key findings from the review of the individual modes and system elements.

KEY FINDINGS

AVIATION

There are 72 public airports in the North Carolina Airport System Plan (NCASP), representing important assets to the national air transportation system as identified by the National Plan of Integrated Airport Systems (NPIAS). The economic impact of the airport system is \$52 billion and supports over 307,000 jobs. The airports also provide vital services, such as emergency response, medical transport, and law enforcement to the surrounding communities that contribute to the health, safety, and overall quality of life for North Carolina residents. The Aviation Division faces challenges of capacity restraint, shrinking regional markets, increasing capital costs, and needs for more funding to reach their target goals for the performance measures and Airport Development Plan objectives.

FERRY

The NCDOT Ferry Division operates 21 ferries, providing service 365 days per year on seven regular routes across the Currituck and Pamlico Sounds as well as the Cape Fear, Neuse, and Pamlico rivers. It is the second-largest state-run ferry system in the U.S. The communities located along ferry routes depend on the system's valuable connections for passenger and vehicle transportation to school, work, tourism, and other needed

services. In addition to transporting people and vehicles, ferries also transport goods and provide critical community service and public safety. The Division faces challenges from declining ridership, responding to changes in technology, service and operational interruption resulting from extreme weather events, and a need for more sustainable funding towards maintenance and operations. The Ferry Division is currently creating their first long-range transportation plan which is expected to be completed in 2019.

PUBLIC TRANSIT

In North Carolina, all 100 counties are served by some form of public transportation, providing transit options to citizens in major urban centers, small towns, and rural areas. Public transportation is used on average by 1.1% of the state's population for their daily commute, though usage can be higher in regions with extensive coverage, and lower for regions with less coverage. Public transportation plays an important role in providing access to other significant functions of daily life including medical appointments, education, shopping, and recreational activities. NCDOT provides technical assistance to improve mobility options and determines future public transportation needs through planning efforts. It is estimated that North Carolina received \$848 million in annual benefits from transit use in 2017. The growing population, changes in technology, including trends of Mobility as a Service (MaaS) and autonomous vehicles, and funding sources that are uncertain and constantly shifting are several challenges the Public Transportation Division faces.

PEDESTRIAN/BICYCLE

More North Carolina residents are choosing to walk, bike, scooter, and take transit in place of driving an automobile. Residents often walk or bicycle to their destinations out of necessity due to economic status or age, and others prefer these modes by choice. North Carolina has made significant efforts and investments in statewide, regional, and local trails, walkways, and bikeways, yet is still ranked 38th nationally in the amount of per capita spending on bike/walk projects. The Division also faces unique challenges between urban and rural areas, as higher populations with denser land uses in urban areas drive more funding and investment than rural areas do. Factors of health and safety are being addressed by the Division of Bicycle and Pedestrian Transportation as North Carolina continues to urbanize, while largely facing the challenge of lacking consistent and connected infrastructure. The Division completed and adopted its Comprehensive Statewide Plan in 2013 (WalkBikeNC).

PASSENGER RAIL

North Carolina has two short-distance passenger routes operated by Amtrak, the Carolinian (service between Charlotte and Washington, D.C.) and the Piedmont (service between Charlotte and Raleigh). Financial support for these routes is provided by 18 states, including North Carolina, who provide Amtrak with state funding for their operations. In addition to the two routes originating in North Carolina, there are four intercity passenger rail routes providing service to North Carolina; the Palmetto, the Silver State, the Silver Meteor, and the Crescent. Ridership and ticket revenue have slowly declined over the past four years, largely attributed to the Piedmont Improvement Program and the numerous track outages and train schedule cancellations due to construction associated with this program. Passenger rail provides an important alternative to auto travel, especially for intercity business and tourism related travel, and can contribute to a reduction in vehicle miles traveled on the interstate system. The General Assemblies of Virginia and North Carolina established the Virginia-North Carolina Interstate High-Speed Rail Compact in 2014, to coordinate efforts to establish higher-speed rail services in the region and advocate as a bi-state unit for federal funding for the implementation of high-speed rail service. The last State Rail Plan was completed in 2015 and is expected to be updated by the end of 2019.

FREIGHT

North Carolina's transportation system had 557 million tons of freight valued at \$955 billion moved in 2015, and by 2045 the State's transportation system is projected to carry more than 794 million tons of freight valued at \$1.7 trillion annually. This is an increase of 43% by tonnage and 82% by value. Trucks are the dominant mode utilized for carrying these goods, while rail moved the second highest volume. The Logistics and Freight Division faces many complex challenges in energy trends, technology innovations, evolving business and consumer practices, and labor shortages. The first North Carolina Statewide Multimodal Freight plan was approved and adopted in 2017, and the NCDOT Rail Division is currently updating their Comprehensive State Rail Plan which is updated every five years.

STRATEGIC TRANSPORTATION CORRIDORS

An important outcome of North Carolina's 2040 Statewide Transportation Plan was the designation of Strategic Transportation Corridors (STC), a system of roadway facilities and rail lines designed to maximize mobility and protect travel time reliability to key transportation terminals, hospitals, military bases, and population centers while simultaneously promoting environmental stewardship through project-based decisions. The system has a total of 2,592 centerline miles on primary highways, along with an additional 631 centerline miles where individual STCs overlap, and 1,556 miles of primary and secondary rail lines. STCs face several trends that can affect the reliability and efficiency of travel along these corridors including population growth, the shift towards performance based planning, changes in technology, and project prioritization and programming activities.

SAFETY

North Carolina has adopted a Vision Zero initiative with a goal of eliminating roadway deaths and injuries. Crash statistics show a slight increase in fatalities between 2017 and current data available for 2018 (January-August), indicating that the state has not yet reached its goal. Several factors consistently contribute to severe crashes, including impaired driving (drugs and alcohol), distracted driving, and speeding. As North Carolina continues to see growth in population and vehicle miles traveled, the challenges for providing a safe transportation system will also increase. To address these and other issues related to safety, North Carolina will need to continue to invest in safety improvements along with the Vision Zero principles.

ASSET MANAGEMENT AND MAINTENANCE/OPERATIONS

North Carolina assets include the maintenance and operation of pavements, bridge, pipes, signs, traffic signals and right of ways by the Division of Highways; 72 general aviation airports by the Division of Aviation; over 3,300 miles of railroad tracks; rolling stock and facilities by the Rail Division; an intricate ferry system by Ferry Division; as well as 100 equipment shops; 97 Count maintenance yards; 14 Division offices; and over 18,000 pieces of equipment. The Division of Highways has the most significant portion of assets, operating the state highway system that was valued at \$575 billion in 2016, and has an annual budget of \$1.4 billion for maintenance and operations. NCDOT manages these operations through the development of the Transportation Asset Management Plan (TAMP) and the Maintenance Operations and Performance Analysis Report (MOPAR). North Carolina is one of the leading states in the nation to use and implement Transportation Asset Management (TAM) philosophies to develop their own asset management methods and procedures that include maintaining, preserving, and improving the performance and conditions of the state's transportations system.

1. INTRODUCTION

This State of the System Briefing Paper is one of the first steps to developing North Carolina's update to its Long-Range Multimodal Transportation Plan, NC Moves 2050. NC Moves 2050 is a strategic transportation plan connecting communities across North Carolina, focused on creating a more responsive, diverse, and inclusive transportation system for keeping people and freight moving safely and efficiently. The plan will provide a 30-year transportation blueprint that meets the needs of a dynamic state, characterized by differing regional priorities while maintaining a focus on broader, statewide benefits.

This briefing provides a high-level evaluation of the North Carolina multimodal transportation system and establishes an understanding of its role in the local, regional, statewide, and national economy and its contribution to North Carolina's quality of life. Each chapter covers an overview of North Carolina Department of Transportation's (NCDOT or Department) transportation modes, existing services provided across the state, national and regional trends that are affecting the modes, contributions to the quality of life, economics and vision for the state, and a review of the mode's current long-range plan if they have one. This inventory of analysis will provide a reference point for the continued development of NC Moves 2050, providing a starting point for white papers on various Drivers and Opportunities and building an early foundation to the baseline of the plan's Needs Assessment.

The information found in this briefing paper has been collected by reviewing NCDOT's existing family of plans, listed below, as well as meetings with agency staff to address elements such as goals and performance measures; changes in existing facilities; unforeseen changes in demand; the emerging role of technology; and the overall state of the system.

NCDOT's Family of Plans:

- NC Transportation Asset Management Plan (TAMP, 2018)
- NC Multimodal Freight Plan (2017)
- Comprehensive State Rail Plan (2015)
- Strategic Highway Safety Plan (2014)
- NC Airports System Plan (2015)
- NC Public Transportation Division Statewide Strategic Plan (on-going)
- Strategic Transportation Corridors Policy (2015)
- Maintenance Operations and Performance Report (2016)
- NC Ferries 20-year Capital Plan
- WalkBikeNC (2013)

1.1 OVERVIEW

The state of the system is a snap shot of each of NCDOT's system elements as they currently operate today in terms of the service they provide, their funding sources, their economic contributions to the state, and the challenges and trends that they are facing. It also shows the goals and objectives met all are represented by divisions, highlighting the services and operations that exist, the ways they are looking to improve, and if they have a plan to make those improvements. The information from this State of the System Briefing Paper t will be used to inform and develop the next steps in the plan, including understanding better the drivers and opportunities for the transportation future of North Carolina, and the possible alternatives for the state based on each mode's vision.

North Carolina has a comprehensive and interconnected transportation system experiencing the challenges of increasing population and travel, and decreasing funding. As the umbrella organization to all the modes and system elements, NCDOT has their own organizational goals and objectives but should also be reflective of the individual modal visions. In this report, each chapter covers one of the nine system elements that are managed by NCDOT and provides an overview of each, and how it contributes to the quality of life for residents through level of service. It also provides a basis for understanding NCDOT's role in the process of developing and operating existing service and connections in the face of rapidly changing trends.

This report lays the ground work for understanding each system individually, but also provides a framework for moving towards better system integration in order to create more harmony among the modal plans.

THE IMPORTANCE OF TRANSPORTATION IN NORTH CAROLINA

North Carolina has one of the largest state-maintained highway systems in the nation with nearly 80,000 miles of roadway and more than 13,500 bridges. There are nearly 15,000 miles of primary highways (Interstate, U.S., and NC routes) and nearly 65,000 miles of secondary roads. Ninety-nine transit systems provide transportation options to residents in all 100 counties of the state and have provided more than 78 million passenger trips in 2017. Every year more than 56 million passengers fly to and from North Carolina and over 1.3 billion pounds of cargo pass through the state's airport. The state has the 2nd largest state-operated ferry system and the largest on the East Coast, with about 2 million passengers relying on service. There are more than 5,000 miles of regional or statewide bicycle and pedestrian routes planned, and NC By Train's Piedmont and Carolinian provide three daily roundtrips to Charlotte, Greensboro, Raleigh, and nine other North Carolina cities with nearly 427,000 passengers¹.

Without the transportation system in North Carolina, the state's 10 million residents would lack access to jobs, school, healthcare, social communities, and commerce. This system is a multimodal collection of assets that enable the efficient and safe movement of people and goods into, out of, and around the state. Residents, businesses, and visitors alike all depend on the transportation system to function, making it critical to maintain and enhance North Carolina's economy and quality of life. As North Carolina continues to grow and change, the transportation system will need to be responsive to these changes, including but not limited to, a growing population that will put additional stress on the existing system, fast-paced technological advances that may change NCDOT's role in transportation, and extreme weather events that impact system reliability and resiliency. To prepare for these challenges, NCDOT must plan by understanding their current services and needs and assessing how these challenges will impact their future services and needs.

NCDOT AND ITS ROLE IN THE SYSTEM

NCDOT is a performance-based organization with a strategic, data-driven decision-making process that is both transparent and accountable. While political discourse is an important part of transportation decision making, NCDOT's performance-based approach ensures that politics do not determine transportation project selection, aligning project implementation with the Department's overall mission and goals. The mission of NCDOT is *"Connecting people, products and places safely and efficiently with customer focus, accountability, and environmental sensitivity to enhance the economy and vitality of North Carolina."*

¹ Data provided by the NCDOT 2017 Annual Report: <https://www.ncdot.gov/about-us/our-mission/Documents/2017-annual-report.pdf>

This mission is achieved through six goals:

- Make transportation safer
- Provide GREAT customer service
- Deliver and maintain our infrastructure effectively and efficiently
- Improve the reliability and connectivity of the transportation system
- Promote economic growth through better use of our infrastructure
- Make our organization a great place to work

NCDOT updates to the North Carolina multimodal statewide transportation plan must have a 20-year outlook and occur at the discretion of the Department. The current plan update, NC Moves 2050, endeavors to further NCDOT's reputation as a national leader in transportation, and to create a blueprint that will meet the needs of a dynamic state, characterized by differing regional priorities while maintaining a focus on broader, system-wide benefits. NC Moves 2050 will also provide a framework for integrating the various modal and system elements, including Aviation, Bicycle and Pedestrian, Ferry, Global Transpark, Governor's Highway Safety Program, Highways, Motor Vehicles, Public Transportation, Rail, State Ports, and the Turnpike Authority. The plan will align with the vision and values of NCDOT to future their mission.

2. STATE OF THE SYSTEM - AVIATION

2.1 OVERVIEW

In 2015, the North Carolina Division of Aviation published the North Carolina Airport System Plan (NCASP), which provides information on the system of airports serving North Carolina. There are 72 public airports in the NCASP and the National Plan of Integrated Airport Systems (NPIAS) identifies them as being important to the national air transportation system. At the time of the North Carolina Airport System Plan, 94% of the state's population was within 30 minutes of one of these airports, and 89% of the population resides within 60 minutes of a commercial service airport. The airport system in North Carolina had an economic impact of \$52 billion and supported over 307,000 jobs in 2018. The airport system is vital to the economy of North Carolina by providing employment, serving the business community, and accommodating tourism.

2.2 AVIATION IN NORTH CAROLINA

STATEWIDE

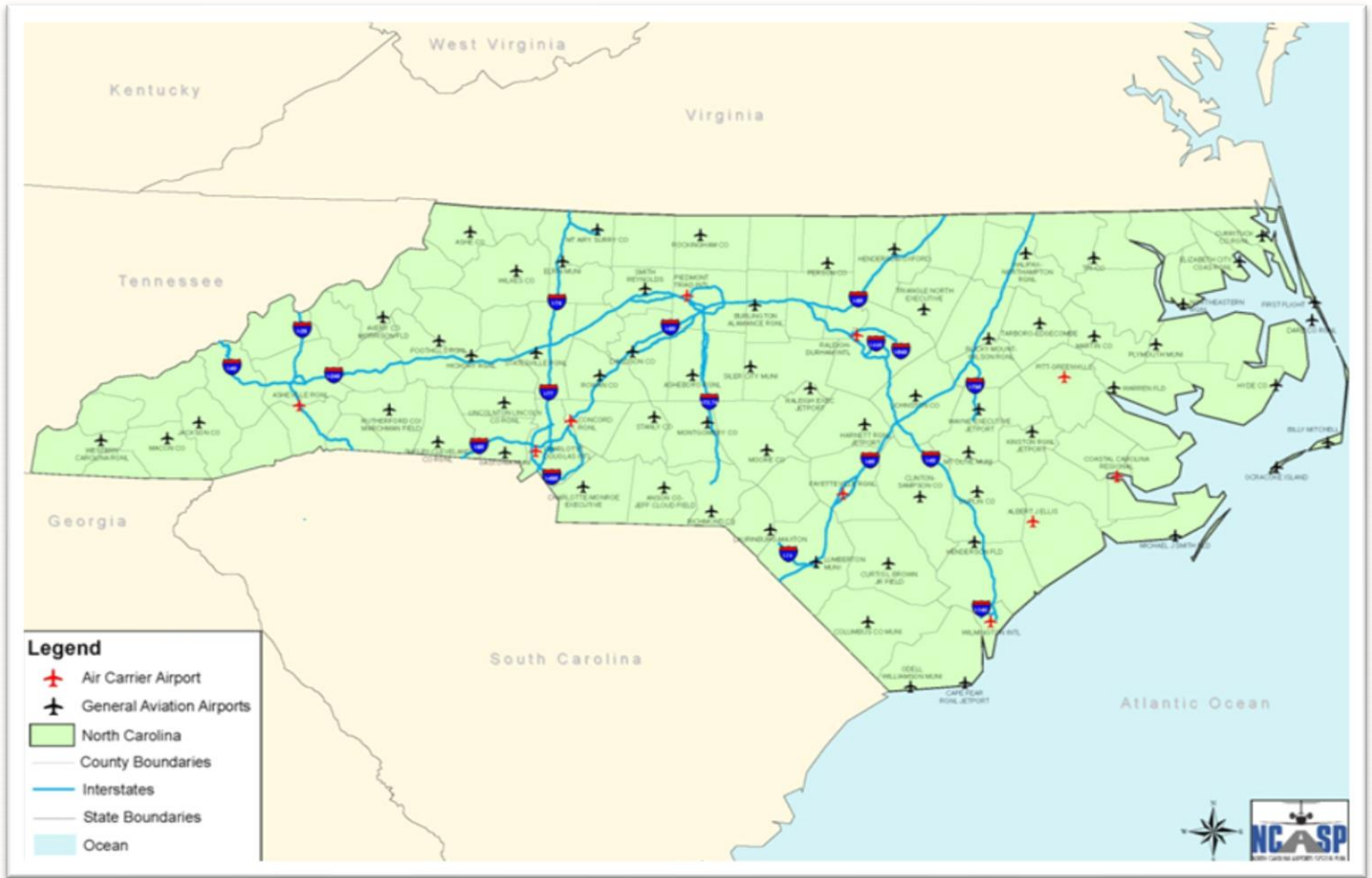
North Carolina has 72 publicly owned airports, 62 general aviation airports and 10 commercial service airports based on Federal Aviation Administration (FAA) defined criteria, that are listed in the NPIAS and shown in **Error! Reference source not found.** The NPIAS identifies airports that are important to the national air transportation system. The general aviation airports combined have more than 8,000 based aircrafts. For commercial service airports, those that enplane more than 10,000 passengers annually are considered primary commercial service airports, which include all the commercial service airports in North Carolina. Two of the commercial service airports in North Carolina are ranked in the Airport Council International Top 50 Airports in North America for passenger movements, Charlotte Douglas International Airport (CLT) and Raleigh-Durham International Airport (RDU), and one is ranked in the top 10 of the Airport Council International Top Airports for aircraft movements (CLT). Overall, the commercial service airports in North Carolina transport over 62 million passengers each year.

The NPIAS general aviation airports were studied further to classify their functions, which were published in the report General Aviation Airports: A National Asset (ASSET) in 2012. These functions, which are provided in North Carolina by the 62 NPIAS general aviation airports, are:

- Emergency preparedness and response
- Critical community access for remote areas
- Commercial, industrial, and economic activity functions
- Access to tourism and special events and
- Other aviation specific functions including corporate flights and flight instruction

General aviation airports were then categorized in the ASSET plan based on roles as either National, Regional, Local, Basic, or Not Classified. The state of North Carolina uses a different classification system that is more depictive of the airports role in the state and community and helps guide the overall system's development. The North Carolina groupings for general aviation airports are Red, Blue, and Green. These classifications are based on characteristics of the associated county, including total population, population growth rate, annual per capita income, gross retail sales, and tourism revenue, along with airport specific characteristics, such as available infrastructure, local support, proximity to other airports, topographical restraints, and airspace restraints. Figure 2 shows the airport locations and their North Carolina classification and Table 1 shows the comparison of the ASSET and North Carolina categorizations.

Figure 1 North Carolina System of NPIAS Airport



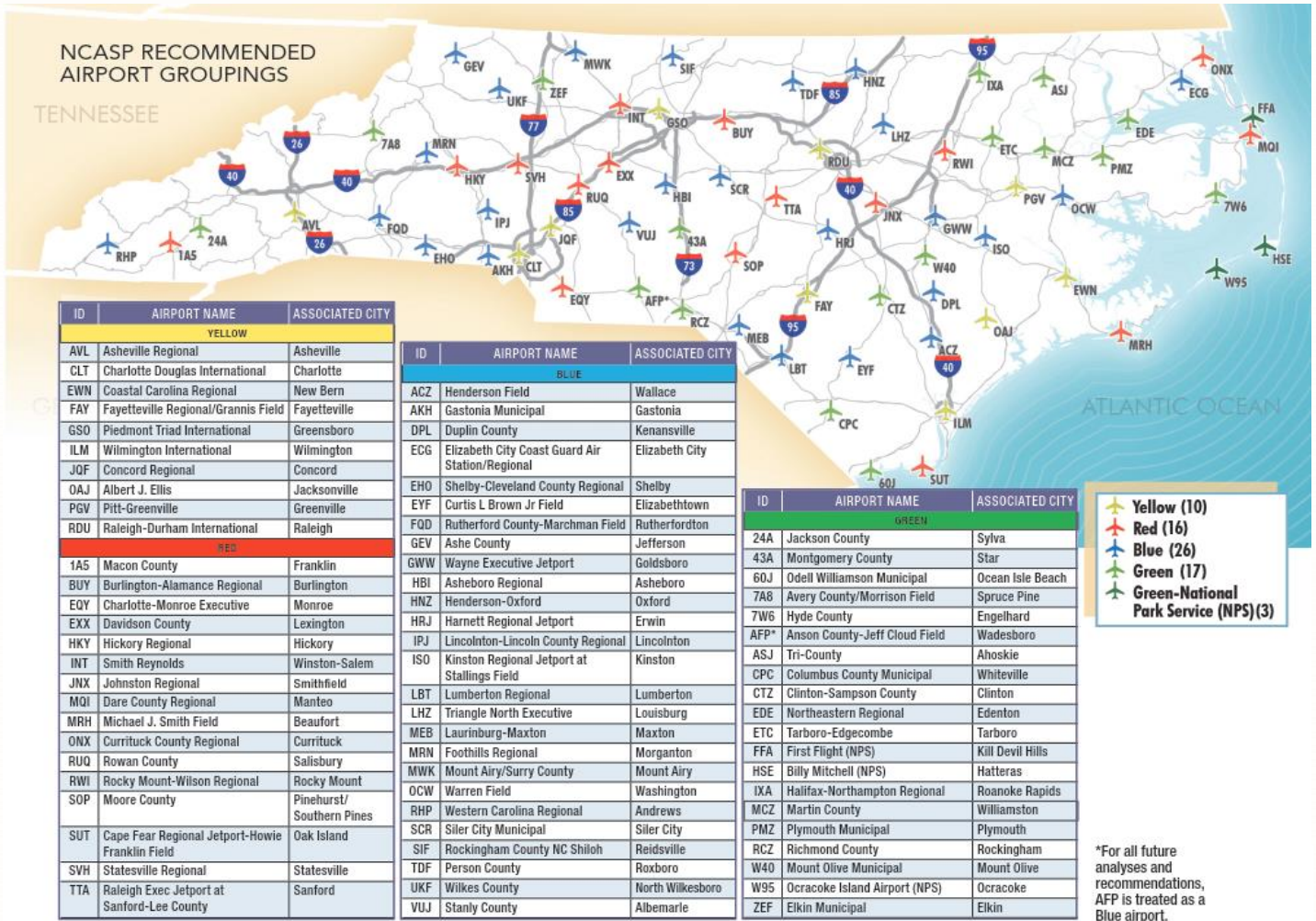
Source: North Carolina Airport System Plan

Table 1 Summary Comparison of ASSET Roles and North Carolina Airport Groupings

ASSET Category	NORTH CAROLINA AIRPORT GROUPINGS				Total
	Red	Blue	Green	NPS	
National	1				1
Regional	12	6			18
Local	3	18	8		29
Basic		2	8	3	13
Not Classified			1		1
Total	16	26	17	3	62

Note: NPS means National Park Service airports
 Source: North Carolina Airport System Plan

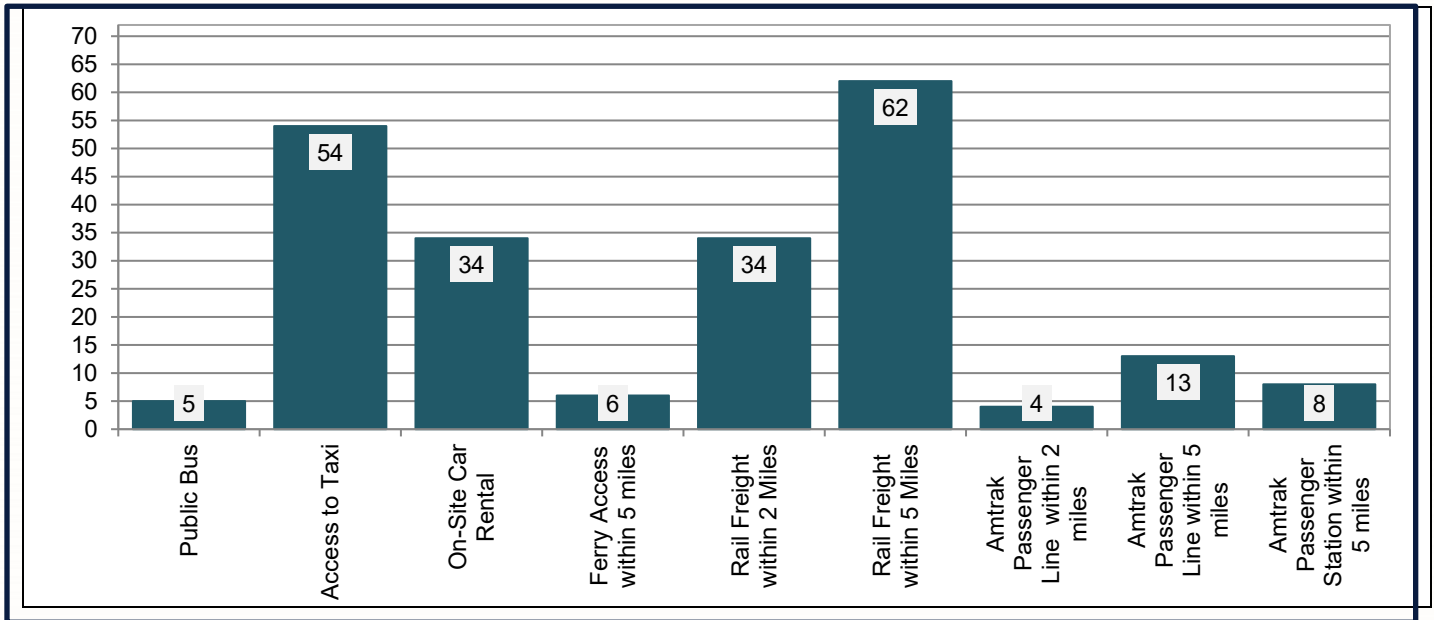
Figure 2 North Carolina Airport Classifications



Source: North Carolina Airport System Plan

Another important factor of the system is the connection to intermodal options, which provide visitors and employees affordable access and can provide an economic benefit to the local communities. These connections can also be important for future growth and development. Airports with access to intermodal options are shown in Figure 3.

Figure 3 Airports with Access to Intermodal Options



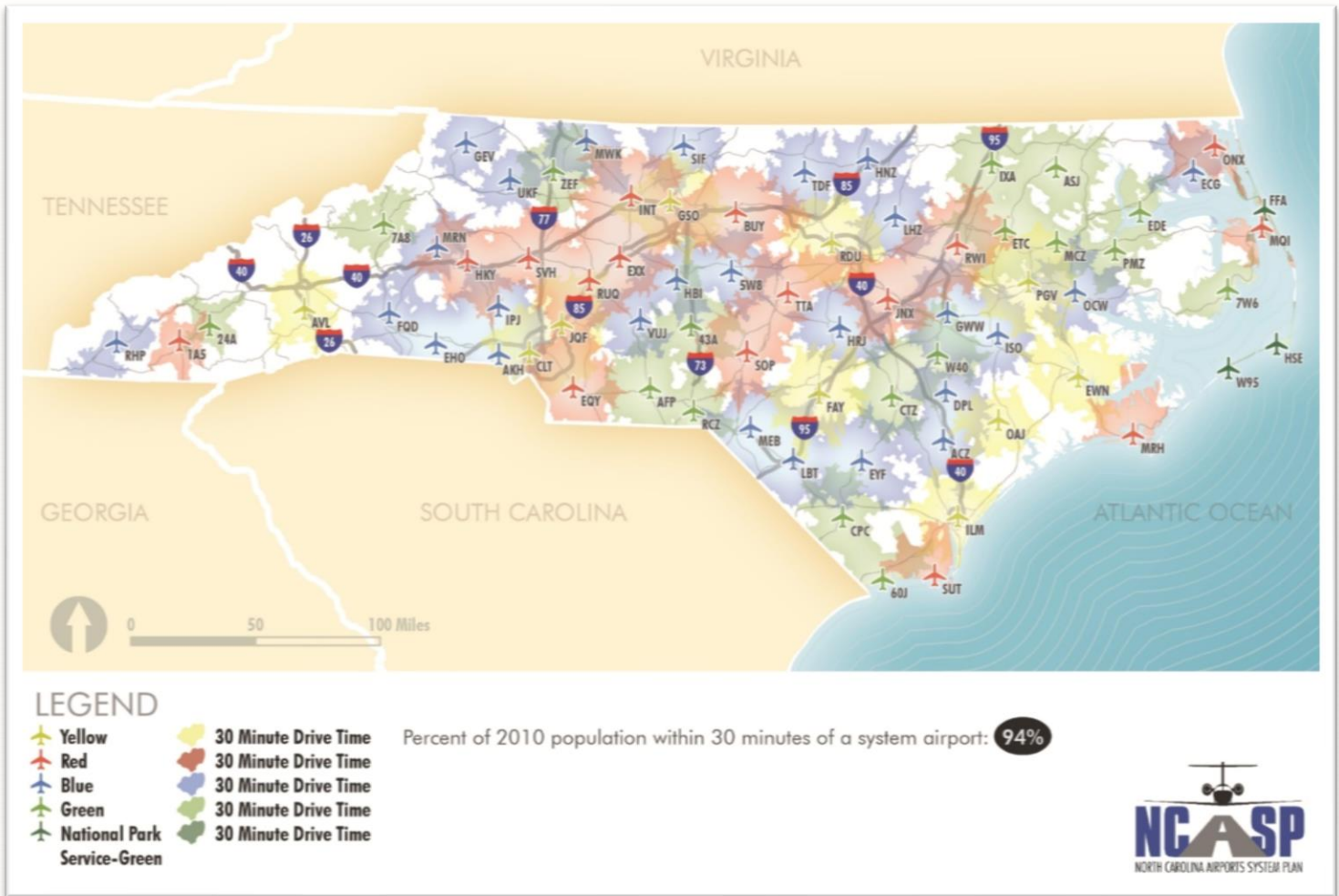
Source: North Carolina Airport System Plan

2.3 WHY AVIATION IS IMPORTANT TO NORTH CAROLINA

QUALITY OF LIFE

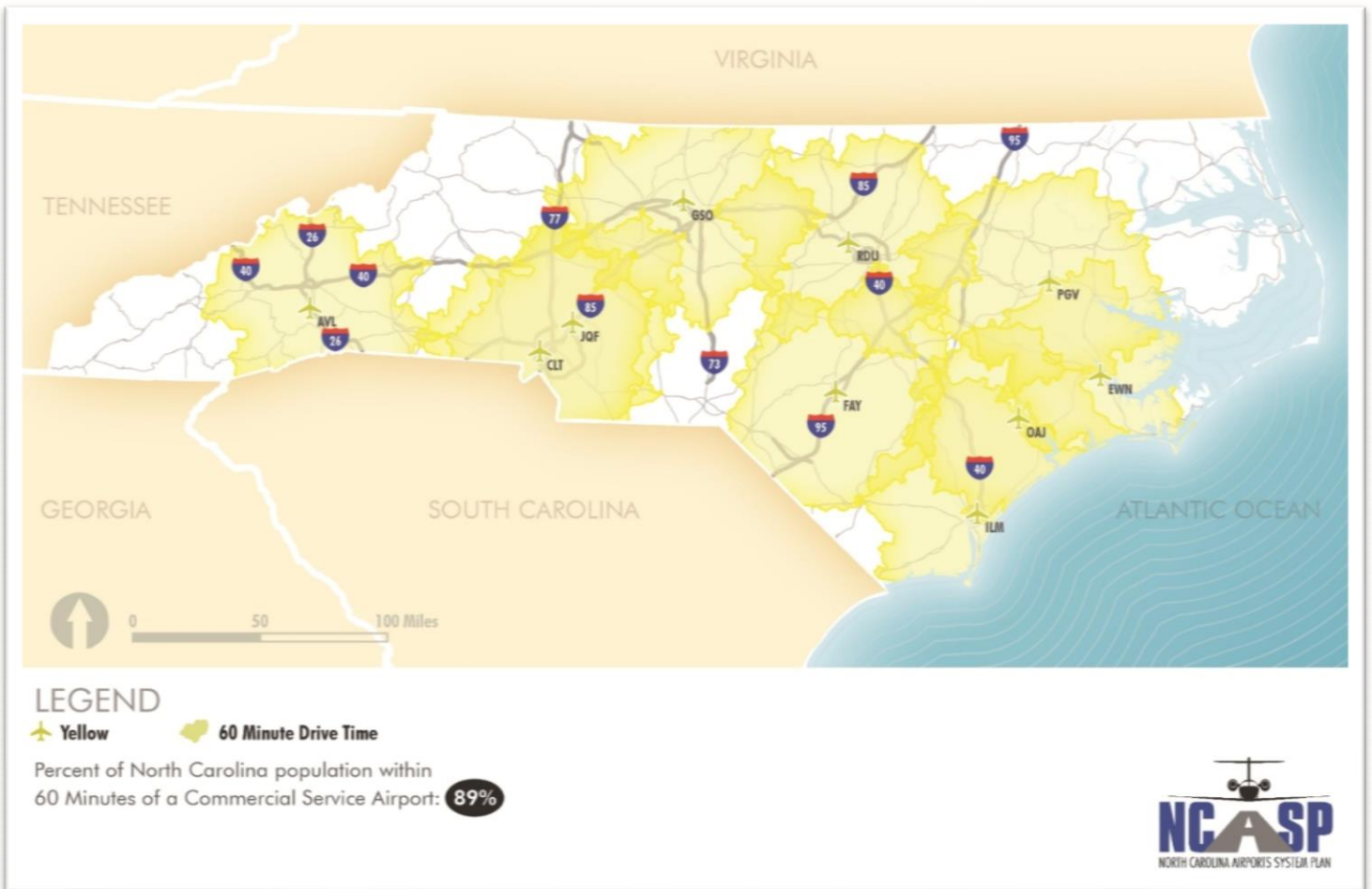
Aviation contributes significantly to the economy of North Carolina by providing employment, serving the business community, and attracting tourism. The airports also provide vital services, such as emergency response, medical transport, and law enforcement, to the surrounding communities contributing to the health, safety, and overall quality of life for North Carolina residents. In 2010, 94% of North Carolina residents lived within 30 minutes of one of the 72 airports, which can be seen in Figure 4, and 89% live within 60 minutes of a commercial service airport, shown in Figure 5. The 10 commercial service airports connect passengers to 168 cities worldwide and move 56 million passengers to and from North Carolina each year.

Figure 4 30-Minute Drive Times of Yellow, Red, Blue, and Green Airport



Source: North Carolina Airport System Plan

Figure 5 Population within 60-Minute Drive of Commercial Service Airport



Source: North Carolina Airport System Plan

ECONOMICS

The 2018 economic impact study shows that the publicly-owned airports in North Carolina contribute \$52 billion in economic impact. These airports support over 307,000 jobs, and provide \$2.2 billion in state and local tax revenue. The airports of North Carolina support over 300,000 jobs that generate \$12.6 billion in personal income. The airports not only contribute to the overall economic impact to the state, but also to their local communities. Statesville Regional Airport, which is utilized by local companies such as Lowe’s, extended the runway and improved the approach, which resulted in growth in the economic impact to the region, which was \$135 million based on the 2019 North Carolina The State of Aviation: What Aviation Means to Our Economy. The economic output of Mount Airy/Surry County based on the 2012 Economic Contribution of North Carolina Airports was \$222 million and has increased to \$650 million based on the 2019 North Carolina The State of Aviation: What Aviation Means to Our Economy.

VISION FOR AVIATION IN NORTH CAROLINA

The vision for aviation in North Carolina, based on the NCASP, is to “provide an airport system that connects people and places in North Carolina – safely and efficiently, with accountability and environmental sensitivity.” The goals for the system plan, discussed later, are used to describe how this vision can be achieved.

2.4 TRENDS AFFECTING AVIATION

NATIONALLY

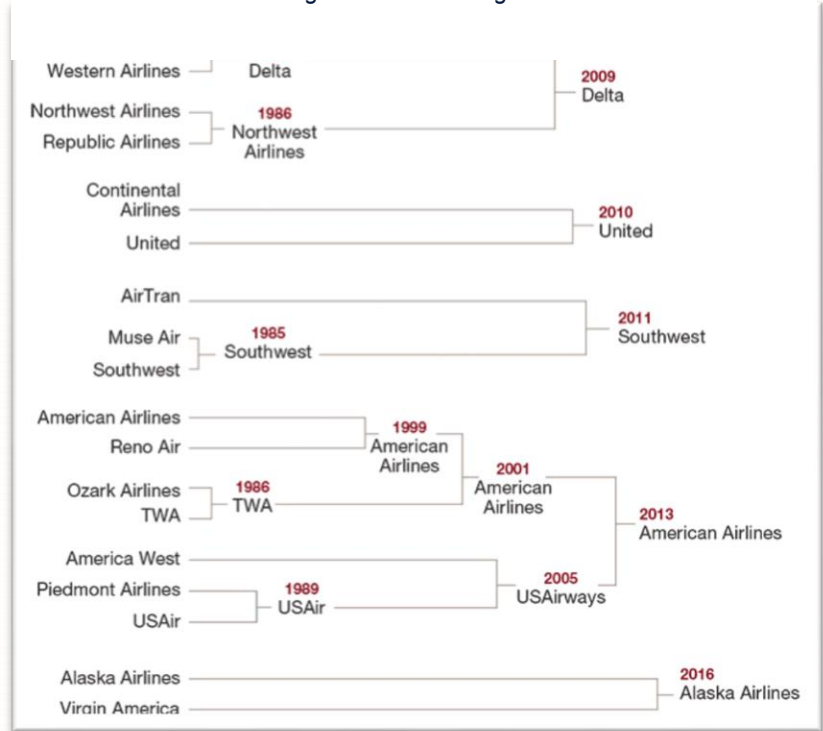
According to the FAA Aerospace Forecast 2017-2037, there are three main trends in commercial aviation in the U.S. One of these trends is industry consolidation and restructuring, shown in Figure 6. The consolidation to 5 major airlines began after the 2007-2009 recession, where there were 12 major airlines prior to 2005, but further consolidation is considered unlikely. Fourteen airlines operate in North Carolina, connecting North Carolinians to 187 domestic and international destinations.²

Another trend is capacity restraint, which differs between the mainline and regional carriers. In 2016, mainline carriers provided 5% more capacity and carried 8% more passengers than in 2007, but regional carrier capacity decreased by 2.6% and passengers carried decreased by 3% over the same period. Regional markets continue to shrink, due to pilot shortages and more regulation on pilot training, causing labor cost to increase. Also, their capital costs increase as they replace aircraft with higher capacity, more fuel-efficient jets.

The third trend is an increase in ancillary revenues, such as through checked bags and on-board meals. It also includes new services adds such as boarding priority and internet access. Another portion of this is the move many airlines have made to offer basic economy fares, which remove more services such as limitations to carry on bags and amount of leg room.

Figure 7 shows forecasted U.S. commercial airline enplanements which are projected to increase above 1 billion by 2037. International enplanements by U.S. carriers are also expected to increase, as shown in Figure 8.

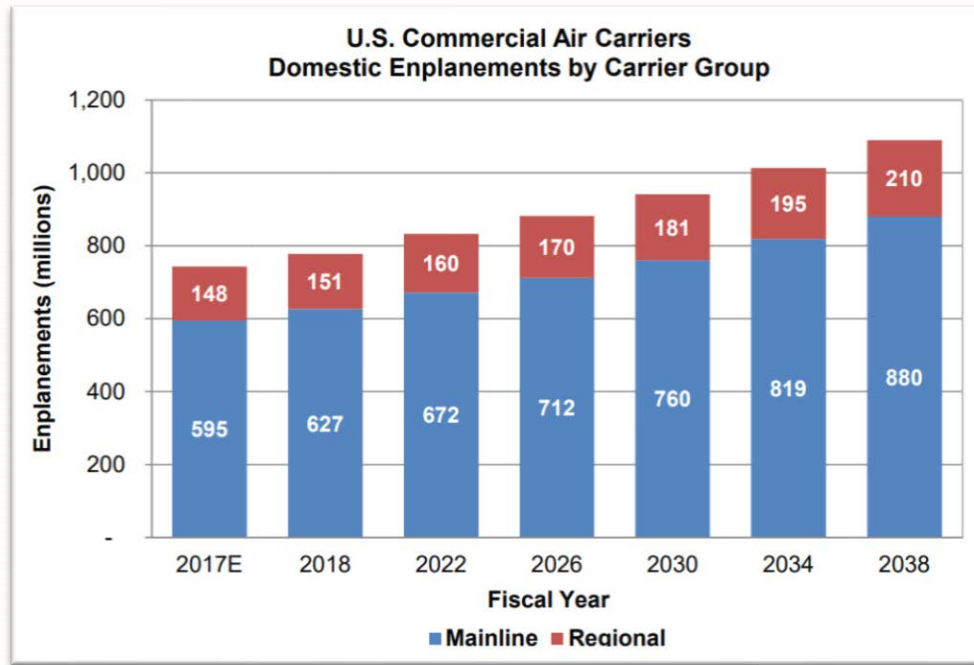
Figure 6 Airline Mergers



Source: Company Filings

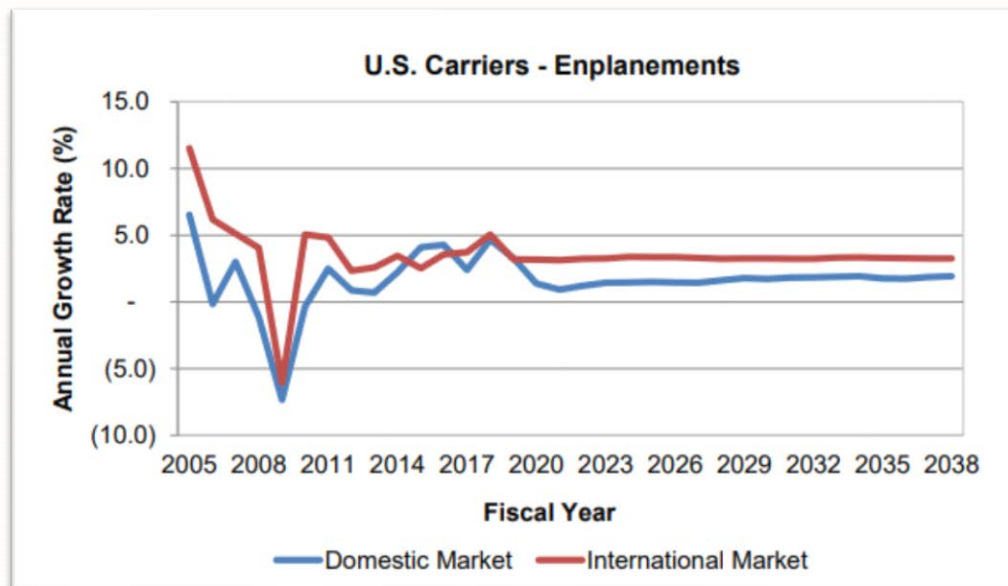
² NCDOT. *North Carolina State of Aviation: What Aviation Means to Our Economy*. January 2019.

Figure 7 U.S. Commercial Air Carriers Domestic Enplanements



Source: FAA Aerospace Forecast 2017-2037

Figure 8 U.S. Carrier Enplanement Growth Rate



Source: FAA Aerospace Forecast 2017-2037

There are 222,520 general aviation aircraft registered in the U.S. that fly over 24 million hours annually. Two thirds of those hours are for business purposes. Single engine aircraft are the most numerous, but this segment is decreasing, with business jets accounting for the largest increase.

STATEWIDE

The 10 commercial service airports in North Carolina account for 56 million enplanements annually. Overall, enplanements have increased at all the commercial service airports in North Carolina. According to the NCASP, aviation activity is tied to economic trends, such as income and population growth. The Charlotte-Gastonia-Salisbury consolidated metropolitan statistical area is projected to see the largest growth in North Carolina, and the Raleigh-Durham-Cary population is expected to double over the 20-year period. In North Carolina, there are 8,000 based aircraft at the general aviation airports and the state is home to 18,000 licensed pilots and 15,000 mechanics. Table 2 shows the operation for the top airports in North Carolina, both commercial and general aviation airports.

In addition, North Carolina is at the forefront of drone integration. The state has over 26,000 recreational uses and over 5,000 permitted commercial and government operators, operating the only state permitting program for government and commercial users. North Carolina has implemented programs for public education and outreach to expand safe, beneficial drone use and has also used public workshops, social media outreach, pilot programs, among other things to inform residents, businesses, and agencies of the benefits of drones. Drones can be used for a variety of things including improving service delivery, investigation of traffic collisions, and agricultural applications. North Carolina is working to support drone use through establishing best practices and working with agencies to safely integrate the technology.

KEY CHALLENGES FOR AVIATION IN NORTH CAROLINA

A key challenge will be obtaining the funding needed to ensure the Division of Aviation's (NCDOA) objectives can be met along with safety improvements, and mobility and infrastructure projects can occur. In 2015, \$1.2 billion was needed to meet the minimum target goals, equating to nearly \$144 million of funding needed annually, where the NCDOA currently only receives \$42 million annually from the FAA and NCDOT.

Table 2 Operations for Top North Carolina Airports

Airport	Total Annual Operations *	Annual Commercial Service Operations (2016)	Annual General Aviation Operations†
Charlotte Douglas (CLT)	547,301	405,157	139,460
Raleigh-Durham (RDU)	176,768	103,200	70,334
Piedmont-Triad (GSO)	85,527	21,284	60,227
Cape Fear (SUT)	77,000	-	74,000
Johnston County (JNX)	73,350	-	72,350
Asheville (AVL)	67,234	6,389	54,984
Hickory (HKY)	65,674	1,693	63,270
Concord Regional (JQF)	65,115	2,108	62,257
Raleigh Executive (TTA)	63,000	-	62,000
Charlotte-Monroe (EQY)	56,100	-	55,100
Harnett Regional (HRJ)	51,300	-	44,300
Wilmington (ILM)	50,821	7,756	36,380
Burlington-Alam. (BUY)	50,450	-	50,000
Pitt-Greenville (PGV)	48,220	2,720	45,000
Smith Reynolds (INT)	46,233	162	42,983
Michael J Smith (MRH)	43,800	-	41,005
Mid-Carolina Reg. (RUQ)	43,000	-	46,000
Albert J. Ellis (OAJ)	37,653	6,830	22,857
First Flight (FFA)	37,500	-	37,000
Fayetteville (FAY)	36,765	2,926	26,374
Statesville Reg. (SVH)	36,200	-	36,000
Person County (TDF)	34,750	-	33,550
Coastal Carolina (EWN)	32,799	586	30,547
Rocky Mt Wilson (RWI)	29,810	90	29,099
Stanly County (VUJ)	28,068	-	17,493
Kinston (ISO)	13,574	115	10,181

*Includes commercial, air taxi, general aviation local and itinerant, and military operations.
Source: ITRE North Carolina: The State of Aviation Report 2018

2.5 REVIEW OF THE CURRENT PLAN

AVIATION PLANNING PROCESS

According to the NCASP, the Aviation System Planning process is to study the performance and interaction of an entire aviation system to understand the interrelationship of the member airports. It is a strategic approach that sets the standards to ensure that the North Carolina Airport System can meet the State's current and future air transportation needs in a sustainable manner. The planning method follows the FAA Advisory Circular (AC 150/5070-7) for Airport System Planning and includes insights from key stakeholders. It was also developed to be consistent with statewide plans related to other transportation modes.

GOALS AND PERFORMANCE MEASURES

The NCASP has five main goals:

- The State should be served by a system of airports that are safe, secure, and meet applicable FAA design standards that will satisfy the current and future needs of aviation.
- The State should be served by an efficient airport system with sufficient facilities and services to maintain the airport and address the current/future needs of the aviation community.
- The State should be served by a system of airports that support integration with other modes of transportation.
- The State should be served by a system of airports that complies with all federal, state, and local environmental regulatory requirements.
- The State should be served by a system of airports that promote and support aviation educational programs and community outreach programs.

These five goals fall into three NCDOT project goal categories:

- Infrastructure Health: Projects where the primary purpose is to improve the condition of the existing infrastructure
- Mobility: Projects where the primary purpose is to improve mobility or improve access. This includes the majority of projects that add capacity or improve travel time, even if the safety or condition of the facility is also improved
- Safety: Projects where the primary purpose is to improve safety. A safety project may also improve the condition of the facility or mobility along the corridor

In order to assess the system, performance measures were assigned to each of the three goal categories, which can be seen in Table 3. These measures are used to evaluate the overall State's airport system.

Table 3 NCASP Goal Categories and Performance Measures

Goal Category: SAFETY	
1	Percent of airports with controlling interest over the FAA design standard Runway Protection Zones for each runway end.
2	Percent of system airports with an Airport Emergency Plan.
3	Percent of system airports addressing wildlife issues.
4	Percent of system airports with a General Aviation Security Plan.
5	Percent of system airports that support search and rescue operations.
6	Percent of hospitals in the state within 30 minutes of a system airport with Instrument Meteorological Conditions capability, on-site weather reporting, and jet fuel availability.
7	Percent of system airports meeting 2013 FAA taxiway geometry standards.
8	Percent of system airports meeting FAA threshold siting surface requirements.
Goal Category: INFRASTRUCTURE HEALTH	
1	Percent of system airports that meet applicable FAA runway/taxiway separation design criteria on their runways for their current Airport Reference Code.
2	Percent of airports meeting all mandatory items in the NC Airport Development Plan (ADP).
3	Percent of airports meeting all system objectives in ADP.
4	Percent of system airports that are adequately accessible in terms of signage and access road quality.
Goal Category: MOBILITY	
1	Percent of population within 30 minutes of a system airport by category.
2	Percent of total employment/businesses within 30 minutes of a system airport.
3	Percent of system airports with a published instrument approach procedure.
4	Percent of population within 30 min of a system airport meeting business user needs (5,000' runway, jet fuel, approach (250 foot ceiling & ¾ mile visibility), and ground transportation).
5	Percent of population within 60 minutes of a system airport with commercial airline service by at least one airline.
6	Percent of system airports that provide intermodal options for their community, including public transportation interfaces at the airports.
7	Percent of system airports with 24/7 fueling.
8	Percent of system airports with Jet Fuel.
9	Percent of system airports needing additional operational capacity.
10	Percent of system airports meeting service objectives (Fixed-Base Operators, pilot training, maintenance, charter/aircraft rental, terminal amenities).
11	Percent of system airports that are incorporated in local comprehensive transportation plans.

Source: North Carolina Airport System Plan

Airport Development Plan Objectives are another performance measure for the system. These objectives are based on the North Carolina classification of the airport and are the minimum level of development the airport needs to accomplish its role in the system. These objectives were used to evaluate the overall system, as well as each airport individually, and can be used to track the airports' progress in the future. These objectives can be seen in Table 4.

Table 4 Airport Development Plan Objectives

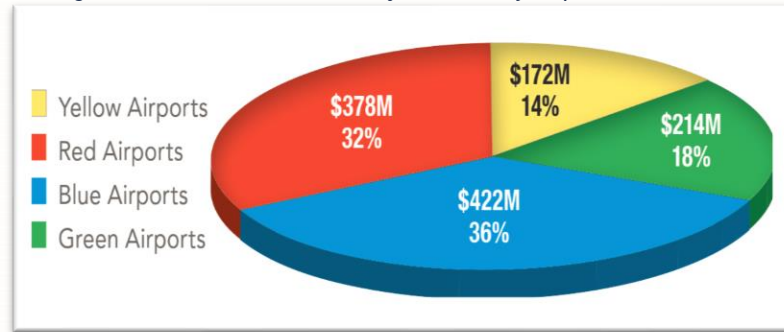
Development Category	System Objectives			
	Commercial Service	General Aviation	General Aviation	General Aviation
	Yellow	Red	Blue	Green
Runway Approach	Clear Threshold Siting Surface on all Runway Ends	Clear Threshold Siting Surface on Primary Runway	Clear Threshold Siting Surface on Primary Runway	Clear Threshold Siting Surface on Primary Runway
Runway Safety Area (RSA)	Meet Runway Design Code (RDC)	Meet Runway Design Code (RDC)	Meet Runway Design Code (RDC)	Meet Runway Design Code (RDC)
Runway Protection Zone	Fee Simple	Fee Simple	Fee Simple	Fee Simple
Pavement Condition	PCI>75	PCI>75	PCI>75	PCI>75
Runway Length	6500'	6000'	5000'	4200'
Runway Width	150'	100'	100'	75'
Pavement Strength	Per PCN Analysis	> 60,000lbs SW or DW or Per PCN Analysis if a Part 139	> 30,000lbs SW or DW and < 60,000lbs SW or DW or Per PCN Analysis if a Part 139	< 30,000lb SW or DW and > 12,500lb SW or DW
Visual Navigational Aids	Rotating Beacon, Lighted Wind Sock, PAPI-4	Rotating Beacon, Lighted Wind Sock, PAPI-4	Rotating Beacon, Lighted Wind Sock, PAPI-4	Rotating Beacon, Lighted Wind Sock, PAPI-2
Runway Edge Lighting	High Intensity	Medium Intensity	Medium Intensity	Medium Intensity
Weather Reporting Capability	AWOS-IIIP	AWOS-III	AWOS-III	AWOS-III
Standard Instrument Approach	PA <250' and < 3/4mile	APV 250' - 3/4mile	APV 250' - 3/4mile	APV 400' - 1mile
Taxiway	Full Parallel	Full Parallel	Full Parallel	Full Parallel
Aircraft Apron	20% Based Aircraft + 20% Busy Day Transient (GA operations)	25% Based Aircraft + 20% Busy Day Transient	25% Based Aircraft + 20% Busy Day Transient	50% Based Aircraft + 20% Busy Day Transient
General Aviation Terminal Building	Commercial Passenger Terminal-Not Eligible. General Aviation Terminal Bldg./Parking per Master Plan	5,500 SF Terminal/Admin Bldg. w/ FBO -Public Meeting Area- Restrooms and 1 auto space per based aircraft + 50% for visitors/ employees	4,500 SF Terminal/Admin Bldg. w/ FBO -Public Meeting Area- Restrooms and 1 auto space per based aircraft + 50% for visitors/ employees	3,200 SF Terminal/Admin Bldg. w/ FBO- Public Meeting Area- Restrooms and 1 auto space per based aircraft + 20% for visitors/ employees
Taxiway & Apron Edge Lighting	MITL	MITL	MITL	Reflective Markers
Airfield Signage	Runway Hold Position, Location, Guidance, and Distance Remaining	Runway Hold Position, Location, Guidance, and Distance Remaining	Runway Hold Position, Location, and Guidance	Runway Hold Position, Location, and Guidance
Ground Communication	UNICOM, RCO or GCO	UNICOM, RCO or GCO	UNICOM, RCO or GCO	UNICOM, RCO or GCO
Approach Lighting	Approach Lighting System (ALS)	ALS	ALS	ALS
ARFF Equipment	As required for Part 139	Case by Case	Case by Case	Case by Case
Hangars	Not eligible	75% Based Aircraft	75% Based Aircraft	50% Based Aircraft
Airfield Maintenance Equipment/Storage Bldg.	Not eligible	Approved Tractor/ Building	Approved Tractor/ Building	Approved Tractor/ Building
Perimeter Fencing	Not eligible	8' Perimeter	8' Perimeter	8' Perimeter
Fuel Facilities	Not eligible	Based on Demand	Based on Demand	Based on Demand

Source: North Carolina Airport System Plan

KEY STRATEGIC ISSUES, NEEDS, AND TRENDS

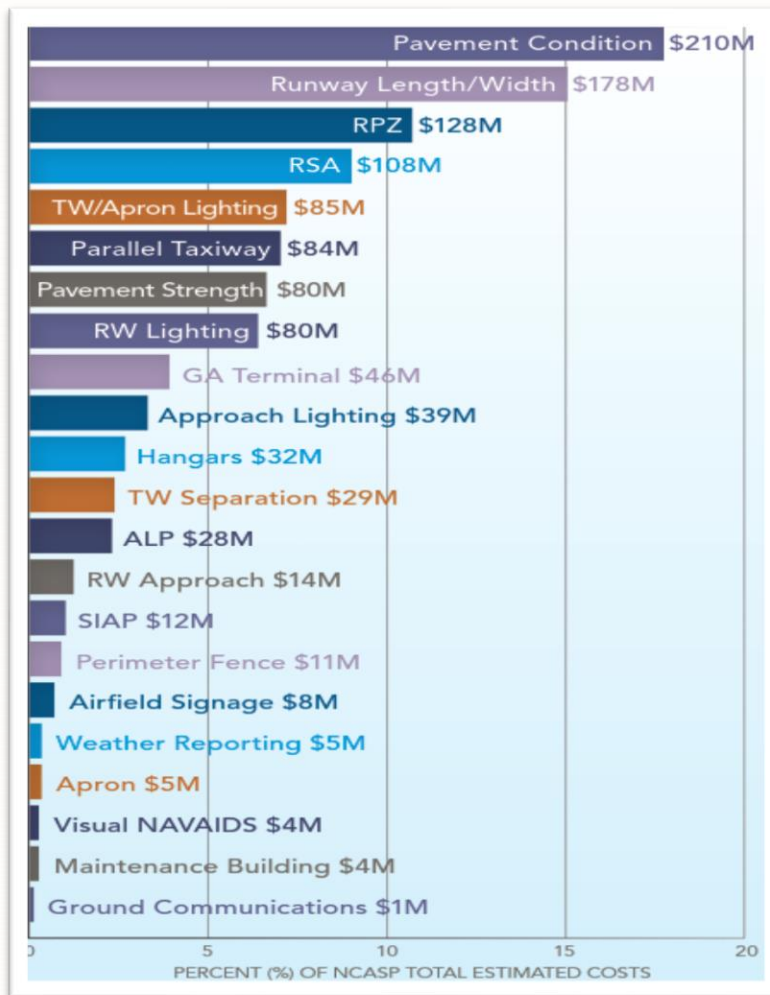
Based on the recommendations of the NCASP, nearly \$1.2 billion is needed to meet the target goals for the performance measures and Airport Development Plan objectives. These costs can be seen in Figure 9 broken down by North Carolina Airport Classification type and in Figure 10 by the project types. There are additional aviation needs, which have been identified at a local level, that increase the North Carolina Airport System need for the next 20 years to \$3.2 billion. In 2015, the NCDOA only received \$42 million annually from the FAA and NCDOT to distribute to the system airports for safety improvements, and mobility and infrastructure projects, where the system would need over \$144 million each year to address the individual airport needs.

Figure 9 Estimated 20-Year Project Costs by Airport Classification



Source: North Carolina Airport System Plan

Figure 10 NCASP 20-Year Project Costs by Types



Source: North Carolina Airport System Plan

3. STATE OF THE SYSEM - FERRY DIVISION

3.1 OVERVIEW

The NCDOT Ferry Division operates 21 ferries to provide every day service on seven regular routes across the Currituck and Pamlico Sounds as well as the Cape Fear, Neuse, and Pamlico rivers. The North Carolina Ferry System is the second-largest state-run ferry system in the U.S., following Washington State. The Division transported 794,000 vehicles in 2017, including 253,000 vehicles from out of state. Additionally, the North Carolina Ferry Division also operates several support vessels and the largest maintenance shipyard between Norfolk, Virginia. and Charleston, South Carolina.

Ferry travel is a vital service for many residents, workers, and visitors in eastern North Carolina who use ferries to access schools, jobs, county services, and tourist attractions. The Ferry Division in the past eight years has seen a decrease in ridership while facing challenges from changing technology and extreme weather patterns. The Division hopes to address these challenges, among others, in their first long-range ferry plan that they are currently working to produce.

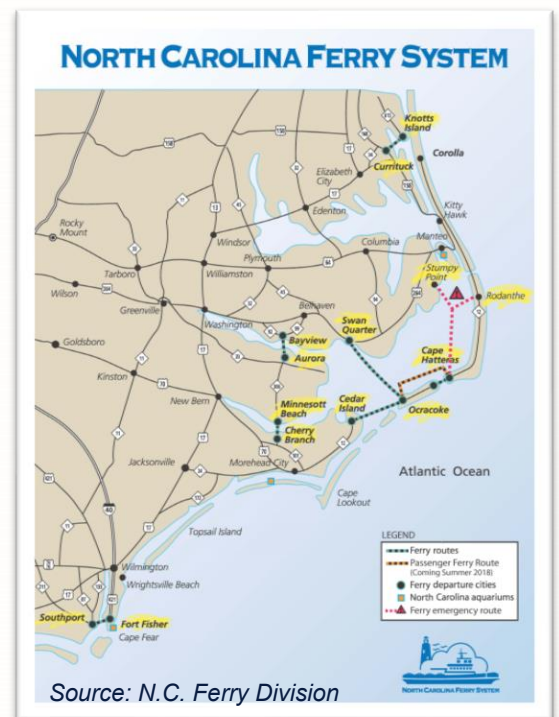
With their new long-range ferry plan, the Division hopes to address the need for innovative funding strategies, creating new partnerships, and updating their fleet. The development of this long-range plan aligns with the NC Moves 2050 plan which they hope will work in parallel to their plan, capturing the Division’s unique needs while also connecting other modes such as freight, highway, and bicycle/pedestrian to ferry services.

3.2 FERRY IN NORTH CAROLINA

The ferry system in North Carolina operates in the eastern counties of Currituck, Hyde, Beaufort, Dare, Pamlico, Craven, Brunswick, and New Hanover. Each of the routes, shown in Figure 11, provide valuable connections to and from communities located across the Currituck and Pamlico Sounds as well as the Cape Fear, Neuse, and Pamlico rivers. These routes provide Knott’s Island school children a route to their school on the mainland, connect residents of Ocracoke to their county seat for Hyde County, and provide workers at the mining companies in Aurora and the Cherry Point Marine Corps Air Station a direct connection to their homes.

While the ferry system operates in and serves these eastern communities, the system is very important statewide as a driver for tourism in North Carolina. In 2017, approximately 31% of the vehicles using the ferry were from out of state. Two of the most used routes, Southport-Fort Fisher and Hatteras-Ocracoke operate primarily to link tourists to attractions on the Outer Banks and the Cape Fear area.

Figure 11 Ferry Routes



3.3 WHY FERRY IS IMPORTANT TO NORTH CAROLINA

QUALITY OF LIFE

Many residents depend on the Ferry Division for passenger and vehicle transportation to school, work, and other needed services. Ferries also carry goods that are essential to water-locked communities. Without the ferry routes, these trips would be significantly longer, or in the case of Ocracoke Island, impossible. Four of the seven routes are toll-free, providing an affordable service for the surrounding communities.

Both the Bayview-Aurora route and the Cherry Branch–Minnesott Beach route provide service for workers commuting to and from their homes. The Bayview-Aurora service connects NC 306 across the Pamlico River, providing the employees of the PotashCorp phosphate mine in Aurora with a direct connection to their homes on the north bank of the river. The mine is the largest integrated phosphate mining and chemical plant in the world. The Cherry Branch–Minnesott Beach route is heavily used by the Cherry Point Marine Corps Air Station workers who live across the Neuse River in Pamlico County.

The Knott’s Island–Currituck route links NC 615 to the mainland across the Currituck Sound between Knott’s Island and Currituck. The route shortens the travel time for Knott’s Island school children to their school on the mainland, a trip that otherwise would involve a two-hour bus ride through Virginia.

The Swan Quarter–Ocracoke route connects residents of Ocracoke to their county seat of Hyde County, giving them access to important services and goods. The alternative driving route would take nearly four hours and would require traveling via the ferry from Ocracoke to Hatteras Island.

The Cedar Island-Ocracoke, Hatteras-Ocracoke, and Southport-Fort Fisher routes all provide vital connections for tourists traveling along the Outer Banks and across Cape Fear. These routes connect state routes that are interrupted by water, such as NC 12 and NC 211. The Southport-Fort Fisher and Hatteras-Ocracoke are the two busiest routes, transporting 31% and 26% respectively of all vehicles transported by the Ferry Division in 2017.

Ferries serve in critical community service and public safety roles, providing emergency services to residents and visitors, offering a means of emergency evacuation. The emergency route between Stumpy Point and Rodanthe typically runs after a hurricane washes out NC 12 near the Oregon Inlet. Additionally, ferries have also been involved in rescuing distressed boaters. The Ferry Division is also responsible for operating a fleet of support vessels that perform marine maintenance and dredging activities.

Table 5 Routes Operated by Ferry Division

Route	Distance	Crossing Time	Purpose
Cedar Island-Ocracoke	26 mi	135 min	Provides a connection for NC 12 to the mainland and allows better travel to and from the Outer Banks across the Pamlico Sound.
Cherry Branch-Minnesott Beach	2 mi	20 min	This route is used heavily by workers at the Cherry Point Marine Corps Air Station to commute to and from their homes in Pamlico County.
Currituck-Knotts Island	5 mi	40 min	Links NC 615 to the mainland, across the Currituck Sound to shorten the travel time for Knott's Island school children to their school on the mainland.
Hatteras - Ocracoke	4.5 mi	30 min	Connect the islands of Hatteras and Ocracoke, linking NC 12.
Bayview - Aurora	3.5 mi	30 min	Connects NC 306 across Pamlico River to provide workers at the mining companies in Aurora a direct connection to their homes on the north bank of the river.
Southport-Fort Fisher	4 mi	30 min	Links NC 211 for use by tourists traveling between the attractions north and south of the mouth of the Cape Fear.
Swan Quarter-Ocracoke	30 mi	150 min	Crosses the Pamlico Sound to link NC 45, connecting residents of Ocracoke to their county seat for Hyde County.

Source: N.C. Ferry Division

ECONOMICS (LOCAL, REGIONAL, STATEWIDE, AND NATIONAL)

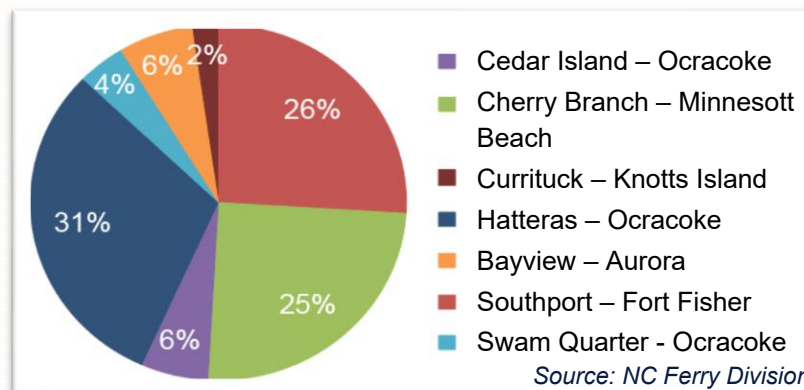
The Ferry Division plays a vital role in the economic success of eastern North Carolina, connecting workers to jobs, residents to services, and tourists to attractions. An economic contribution study is currently being conducted by Institute of Transportation Research and Education (ITRE), which is an update for the 2009 Benchmarking and Optimization of the North Carolina Ferry System report. The new study is expected to be completed in February of 2019.

Table 6 Demand by Ferry Route

Route	Fiscal Year	Trips Made	People Transported	Vehicles Transported
Cedar Island-Ocracoke	2017	2,545	108,667	46,201
Cherry Branch-Minnesott Beach	2017	18,689	349,953	196,831
Currituck-Knotts Island	2017	3,863	45,159	18,198
Hatteras - Ocracoke	2017	19,597	603,282	240,984
Bayview - Aurora	2017	4,895	69,717	49,519
Southport-Fort Fisher	2017	10,511	555,160	208,890
Swan Quarter-Ocracoke	2017	2,287	69,635	32,549
TOTAL	2017	62,387	1,801,573	793,172

Source: N.C. Ferry Division

Figure 12 Percentage of Ridership for Division by Route



Three of the Ferry Division routes are tolled, while the remainder is subsidized by the state, keeping ridership free. The three routes that are tolled are the Swan Quarter-Ocracoke, Cedar Island-Ocracoke, and Southport-Fort Fisher. The Division collected approximately \$2 million in revenue between the individual ticket sales and the purchase of commuter passes, which grant unlimited ridership on any route. Swan Quarter-Ocracoke earns 32%, Cedar Island-Ocracoke earns 22%, and Southport-Fort Fisher earns 46% of the total revenue that the Division collects. To operate the collection of tolls, the Division spends about \$1.4 million to maintain the infrastructure and service of toll collection. Because their return is so low, the Ferry Division has discussed the possibility of making all routes tolled or eliminating all tolls. If all routes were tolled, Ocracoke Island would then only be assessable by a tolled route. Inversely, if all tolls were eliminated then the Division would need to receive more funding for operations.

Table 7 Fare Cost for Tolled Routes

	Swan Quarter-Ocracoke Cedar Island-Ocracoke	Southport-Fort Fisher
Type	One-Way Fare	
Pedestrian	\$1	\$1
Bicycle Rider	\$3	\$2
Motorcycle	\$10	\$3
Scooter, Golf Cart or ATV	\$10	\$3
3-Wheel Motorcycle	\$10	\$3
Motorcycle with Trailer or Side Car	\$15	\$7
Vehicle and/or Combination less than 20 feet	\$15	\$7
Vehicle and/or Combination 20 to 40 feet	\$30	\$14
Vehicle and/or Combination 40 to 65 feet	\$45	\$28

Source N.C. Ferry Division

VISION FOR FERRIES IN NORTH CAROLINA

Looking forward to the future of the North Carolina ferry services, the Division would like to increase opportunities for generating additional ridership, which they believe they can do through marketing efforts. Increased marketing would make more potential users, particularly tourists, (both in and out of state) aware of the services. Changes to the funding mechanisms for the ferry service are also needed, such as, considering ferries as equipment, rather than assets, which would not create new money but would allow the Ferry Division to create a sinking fund for the maintenance and replacement of ferries. The Ferry Division has been successful in getting additional ferries and support vessels funded through Strategic Transportation Investment (STI), but greater cooperation is needed among some Rural Planning Organizations (RPOs) to support the need for new ferry vessels.

The Division is also looking at ways to move towards lower cost ferries, such as operating pedestrian only ferries. This could also create synergies with other modal Divisions such as pedestrians/bicyclists and transit. By including other modes in their plans, they could also create other opportunities to increase ridership. Additionally, the Ferry Division is considering alternative forms such as diesel-electric and battery, which present some challenges in terms of maintenance costs relative to operating in a marine environment, but offer benefits in decreased fuel costs and emissions. The Ferry Division is also considering how freight moves on the ferry system, and the impact of shifting freight to routes such as the sound routes, which could free space on other commuter routes, such as the Hatteras routes.

Additionally, furthering the Division’s partnerships with community colleges to serve the shipyard and other non-state-owned shipyards in the region is an important opportunity for growth of the Division. As technology

increases, they need more technicians and operators with increased capabilities. The average years of service for their employees is 20 years, so they are facing an aging workforce and are losing staff to other regions. By potentially considering the use of the Ferry Division as a training base for a maritime college they could build a strong work force which would also provide economic benefits to rural counties. Looking at these more unique and creative solutions to regenerating revenue and increasing ridership is an important part of the Ferry Division's vision.

3.4 TRENDS AFFECTING FERRY

NATIONALLY

Many of the trends that affect the Ferry Division can be more easily seen at a statewide or region level; however, several national trends have the potential to affect the Division's operations. The national trend of growing tourism (4.2% increase in North Carolina from 2016 to 2017³) plays a role, as more visitors come to North Carolina's coast to enjoy the summer attractions. As the tourism industry continues to grow, especially in eastern North Carolina, ferries will continue to be an important part of the transportation system, connecting those tourism communities and providing a reliable service.

The rapid development in propulsion technology is also affecting the operations of the Ferry Division. Vessels with alternative fuel systems are becoming more common, rendering older vessels outdated and costly. These changes have pushed the Ferry Division to focus more on passenger ferries and vehicle ferries with diesel-electric or battery powered propulsion systems. Switching propulsion systems will reduce the amount of flexibility the Division has in terms of using those vessels on other routes when necessary. New technology that is more advanced also requires more experienced and specialized trained staff to operate and maintain.

STATEWIDE

Population growth in North Carolina by 2050 is expected to add an additional 4 million residents statewide. Six of the eight counties that have ferry routes will see a positive population growth⁴. Several of those counties will see a population growth of more than 50% of their current population. Additionally, all eight counties can expect an increase in the number of housing units, with five counties projected to have an increase of more than 70%⁵. With these trends, it is expected that there will be more demand for reliable transportation between jobs, schools, and services to the communities that need them.

North Carolina is also already prone to extreme weather events such as hurricanes and flooding, events that have proven to be devastating for the eastern part of the state. Climate change science shows that the state can expect to see more extreme storms and more frequently⁶, which will greatly affect both the need for ferry service but also the operations and maintenance of the Division.

KEY CHALLENGES FOR FERRY IN NORTH CAROLINA

While both the Statewide and National trends would seem to create more demand for the ferry service, demand has been decreasing since 2011 (see Figure 13). The Ferry Division believes this downward trend is based on

³ <https://governor.nc.gov/news/record-visitor-spending-north-carolina-highlights-tourism-week>

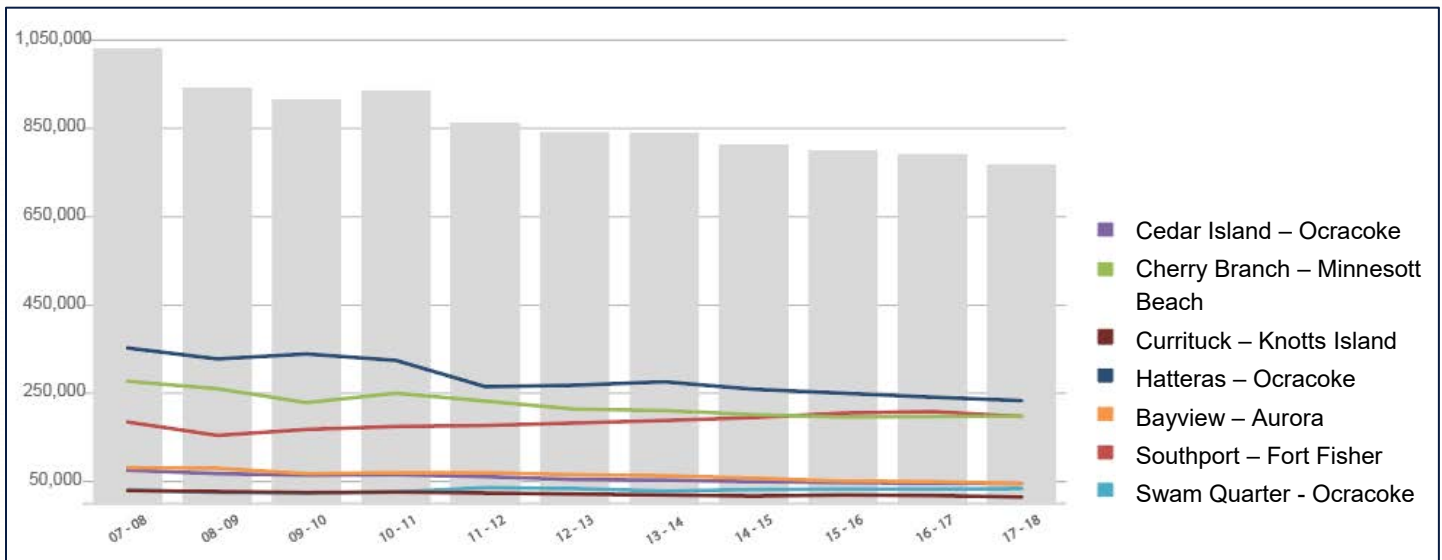
⁴ & ⁵ North Carolina Office of Budget and Management, County/State Population Projections

⁶ <https://www.epa.gov/climate-indicators/weather-climate>

the lack of advertising for ferry services, something they would like to address in their upcoming modal plan. To use funds to increase advertising efforts there would need to be a reallocation of their budget.

Several of the key challenges for the Ferry Division are related to the funding of capital projects and the funding of operations and maintenance. Operations and maintenance are funded as part of the state’s biennial budget. For capital projects, they either utilize their toll revenue, which goes into a reoccurring sinking fund, or they complete projects through STI. While they have had reasonably good success getting capital projects (particularly vessels) funded through STI it reduces their flexibility with vessels. This is because public officials want the vessels to stay in the Metropolitan Planning Organization (MPO)/RPO that they were funded in. However, the Division does still have some flexibility to move them around. The MPO/RPOs have been reasonably helpful with putting points on ferry projects, but increased coordination is needed. The Division has had success with packaging projects (like support vessels) together to get them funded. However, due to historic funding levels and the sheer number of vessels operated by the Division, they are very far behind the age curve on vessels, which means increased maintenance costs and more frequent interruptions of service due to breakdowns. They would like to switch their ferries in DOT’s system from “assets” to “equipment” which will not mean new money at the statewide level but will create a fund for vessel replacement.

Figure 13 Ridership Trends by Route from 2007-2017



Source: N.C. Ferry Division

The Division also faces significant environmental challenges. Dredging is always an issue, and at Silver Lake (Ocracoke) and Fort Fisher they are having issues receiving permits to dredge because of the specific environmental conditions in those two areas. The Army Corps is reducing funding for dredging and although the state provided funds to Dare County to purchase and operate a dredge, the primary function of that dredge will be to maintain the marine navigation channel in the Oregon Inlet. The Ferry Division would be much more capable with two dredges and work barges because the dredging window is so short (only 3 months out of the year). The Ferry Division needs its own additional side caster or hopper dredge.

The long-term viability of South Dock, the ferry terminal at the southern end of the Hatteras-Ocracoke ferry route, is a concern for the Division. This route is the most heavily utilized route in the entire system and is located at the north end of Ocracoke Island. If Hurricane Florence in September 2018 had made landfall a few miles further north, it could have been devastating for South Dock or NC 12 south of South Dock, rendering South Dock

useless. The Division could relocate South Dock farther south towards Ocracoke, but due to environmental permitting issues, they may have to design a terminal similar to Virginia DOT's terminals which are constructed as ridges that end at a ferry gantry out in deeper water. NCDOT currently constructs ferry terminals, which generally are primarily land based with basins or protecting groins. However, operating in the deeper waters of sound with their vessels on the Hatteras-Ocracoke route requires larger vessels than the Hatteras ferry basin can accommodate. The Hatteras basin is already too small to accommodate the larger vessels due to the longer Hatteras-Ocracoke route (which precipitated the need for the passenger ferry) and it does not have enough berths.

Finally, space at the shipyard has become a major concern. This is a byproduct of the Division being behind the curve on ferry replacement, meaning longer and more frequent maintenance intervals. They are creating a new platen, a flat area at a shipyard configured for movement of vessels out of the water during the construction or refitting/refurbishment process, at the shipyard, which is currently designed but not funded. They also would like to create a larger service area at Cherry Branch with a travel lift/gantry crane, and a rail system to accommodate their maintenance needs. They have also considered a facility at Radio Island. This is a possible item for the statewide plan in terms of the various modal aspects working together (Ports and Ferry Division). Previously the Division has done work for other agencies, generating revenue, but they no longer have the capacity and only have done \$60,000-90,000 worth of work this year.

3.5 REVIEW OF THE CURRENT PLAN

FERRY PLANNING PROCESS

Traditionally the Ferry Division has not completed a long-range plan. However, they are currently in the process of scoping their first mode specific plan. It is expected to be completed in 2019. They have several other planning efforts in the works, including:

- Economic contribution study (ITRE) – expected February 2019
- Ferry Lifecycle study (UNC Charlotte) – expected February 2019
- Terminal asset study – completed October 2017
- Manpower study – expected February 2019
- Freight study – expected July 2019
- Six Sigma study on inventory
- Alternative Fuel Study- awarded December 2018, due July 2019

GOALS AND PERFORMANCE MEASURES

The only metric that the Ferry Division has displayed on the NCDOT dashboard is on-time performance. They are looking at some additional public facing metrics relative to the passenger ferry. However, they track many other internal metrics that relate to the operations and management of the Division.

COORDINATION OPPORTUNITIES AND CHALLENGES FOR NEXT PLAN UPDATE

As the Division goes through the process of creating their first long-range plan, they hope that the NC Moves 2050 plan will mirror their needs and goals, and work as a guide for creating more opportunities for other NCDOT modes to work together. It will be important that the NC Moves 2050 compliments the new ferry plan, rather than contradicting it.

4. STATE OF THE SYSTEM – PUBLIC TRANSPORTATION

4.1 OVERVIEW

Public transportation provides economic and health benefits to communities, as well as access to work, education, training, medical transportation and shopping. Utilizing transit reduces individual transportation costs, congestion and delay, and road construction and maintenance. The transit network continues to shape communities because residents gravitate to mobility options that improve their quality of life and provide connections to opportunities.

4.2 PUBLIC TRANSPORTATION IN NORTH CAROLINA

North Carolinians living in major urban centers, small towns, and rural areas have access to transit as all 100 counties in the State are served by public transportation. This service comes in the form of either fixed route or deviated fixed route bus services, light rail, street car, demand response and community transit services. While approximately 1.1% of the State’s population uses transit for their daily commute, transit also provides access to other significant functions of daily life including medical appointments, education, shopping, and recreational activities. Other ways North Carolinians benefit from public transportation include:

- In 2017, the 98 transportation systems in North Carolina provided 70.1 million trips to residents in all 100 counties, in major urban centers, small towns and rural areas from Manteo to Murphy.
- Every \$1 the State of North Carolina invests in transit generates approximately \$6 of total investment in North Carolina from federal, state and local sources. In 2017, North Carolina invested \$52.4 million in state operating funds, which helped bring in \$287 million in federal and local funds.
- More than \$125 million in state and federal funds supported transit operations in all 100 counties. This funding supported 11,000 transit-related jobs, resulting in \$556 million in wages⁷.
- \$1.11 billion statewide business output – expenditure-related economic contribution refers to statewide economic effects supported by the capital and operational expenditures of North Carolina’s transit systems⁸.
- Presence of transit options in North Carolina communities provides an \$848 million annual benefit, including:⁹
 - Transportation cost savings – using transit instead of other modes
 - Affordable mobility options – benefit from having transit services available

STATEWIDE

Established by the North Carolina General Assembly in 1974, NCDOT’s Public Transportation Division provides technical assistance to public transportation systems in North Carolina to improve mobility options to residents. Additionally, the Public Transportation Division oversees federal and state transportation grant programs, and determines future public transportation needs through planning efforts.

As of July 2018, there are 98 public transportation systems in North Carolina. The breakdown includes 31 systems serving large urban areas (population greater than 200,000), 14 systems serving small urban areas (population between 50,000 and 199,999), and 53 systems serving rural areas (population less than 50,000).

The Public Transportation Division separates transit systems into seven different system categories. The public transit system type and a description of each category can be found in Table 8.

⁷ <https://www.ncdot.gov/divisions/public-transit/Pages/transit-benefits.aspx> 7/10/18

⁸ Transportation Economic Development Impact System

⁹ Small Urban and Rural Transit Center / Center for Urban Transportation Research

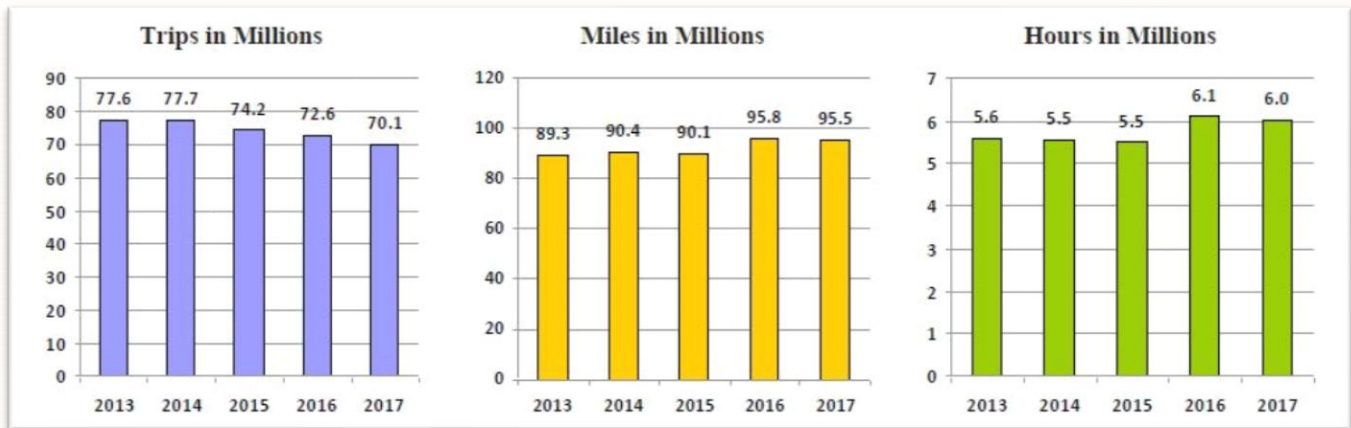
Table 7 Public Transportation Division System Categories

Transit System Type	Description
Community	A single-county system providing transportation to the general public, as well as to eligible human service agency and elderly clients. Some are organized as authorities, while others are private non-profit or county departments.
Urban Single-City	Includes transportation programs operating in single cities located in metropolitan areas (with a population of more than 50,000).
Fixed Route in Small Cities	Operates fixed-route transit in urbanized area clusters less than 50,000 in population.
Consolidated Small City – Community	A single-county system with a significant level of service in a town of less than 50,000 urbanized area population.
Regional	A multi-county transit program operating primarily in rural areas.
Consolidated Urban – Community	Includes an urbanized area and a single county.
Regional Urban	Regional public transportation authorities serving primarily urbanized areas.

Source NCDOT's Public Transportation Division

In 2016, North Carolina's public transportation system accounted for 95.8 million service miles, 6.1 million hours of service, and provided 72.6 million trips. In 2017, each of those metrics slightly decreased to 95.5 million service miles, 6 million service hours, and 70.1 million trips. Figure 14 below shows the total annual trips, service miles, and service hours for the State's public transportation system over the last 5 years.

Figure 14 OnStats



Source: NCDOT FY 2017 Public Transportation Operating and Financial Statistics Report

Urban public transportation systems in North Carolina include several different system and service types. Urban public transportation systems in the State include urban single-city systems, consolidated urban-community systems, regional urban systems, and fixed route systems in small cities. The services provided by the urban public transportation systems are fixed-route services, demand response services, light rail, and street car.

In 2017, urban public transportation systems in North Carolina accounted for 63.3 million trips, 49.2 million service miles, and 3.5 million service hours. Fixed-route services accounted for a majority of those totals with 56.4 million trips provided, 35 million service miles, and 2.5 million service hours logged in 2017. Fixed-route service is provided in the cities of Asheville, Boone, Burlington, Cary, Chapel Hill, Charlotte, Concord/Kannapolis, Durham, Fayetteville, Gastonia, Goldsboro, Greensboro, Greenville, Hendersonville, Hickory, High Point, Jacksonville, Raleigh, Rocky Mount, Salisbury, Wilmington, Wilson, and Winston-Salem.

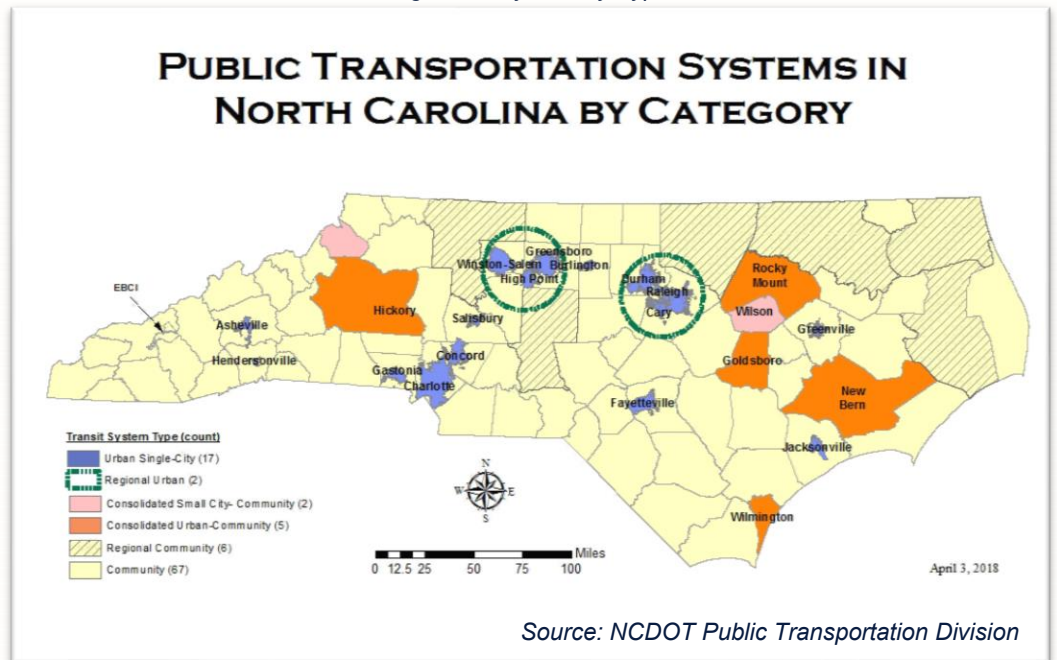
Rural public transportation systems play a critical role in the State’s overall public transportation network as they connect people living outside of large metropolitan areas to life sustaining services and important destinations such as medical facilities and employment opportunities. The 74 public transportation systems providing service to rural areas in North Carolina are made up of community systems, regional community systems, and consolidated small city-community systems. These rural public transportation systems accounted for 6.8 million trips, 46.2 million service miles, and 2.5 million service hours in 2017.

There are two regional urban public transportation systems in the State: GoTriangle and the Piedmont Authority for Regional Transportation (PART). GoTriangle primarily serves the Raleigh–Durham–Chapel Hill area and the region surrounding these cities. The services GoTriangle provides include regional bus and shuttle service, paratransit services, ride matching, vanpools, Bus on Shoulder, and an emergency ride home program. PART serves the Piedmont Triad Region in North Carolina providing regional express bus services, vanpool, commuter resources, and other transit planning efforts. The Piedmont Triad Region service area is made up of ten counties and includes the cities of Asheboro, Burlington, High Point, Lexington, Greensboro, Winston-Salem, and Chapel Hill.

There are nine regional community public transportation systems in North Carolina primarily serving rural areas. These systems include the Choanoke Public Transportation Authority (CPTA), Inter-County Public Transportation Authority, Craven Area Rural Transit System, Yadkin Valley Public Transportation, Hyde Co Transportation, Tar River Transit, Kerr Area Regional Transportation Authority, Western Piedmont Regional Transportation Authority, and Regional Coordinated Area Transportation. These systems operate fixed route, flex route, demand response and paratransit services.

Figure 15 shows the public transportation systems in North Carolina by system type.

Figure 15 System by Type



Source: NCDOT Public Transportation Division

4.3 WHY PUBLIC TRANSPORTATION IS IMPORTANT IN NORTH CAROLINA

QUALITY OF LIFE

Transit in North Carolina serves the needs of diverse residents in each of the 100 counties in the state. Whether it's providing a commuting option for people going to and from work or transporting those who are not able to drive to appointments, public transportation can improve the quality of life for users and provide mobility options other than traditional automobile travel. Although public transportation directly impacts those using it, transit also supports a healthy state economy by ensuring workers can access jobs and students can travel to school or training, thus improving the lives of every North Carolinian indirectly. Public transportation affords most North Carolinians the ability to make choices on their mode of travel, whether they want to own a vehicle, or even where they want to live. As the state's demographics continue to change, public transportation will be useful in meeting the demand for those residents who rely on it to perform their everyday responsibilities.

Where North Carolinians choose to live has a major impact on their quality of life, and the public transportation system in the state allows them to expand their choices when selecting a location and finding a housing option that is affordable. Depending on housing location, transit can provide access to daily activities such as jobs, education, and medical appointments, which reduces the overall cost of living as using public transportation for these occurrences is less expensive than owning and using a car. This is especially important for low income households that rely on public transportation, often due to a lack of a personal vehicle. The NCDOT recognizes the strong relationship between public transportation, affordable housing, and improved quality of life, and has recently published a white paper titled *Transit and Affordable Housing in North Carolina* that details the opportunities and challenges the state faces in effort to use transit and affordable housing to improve the quality of life.

Improvements in public transportation can also lead to health benefits for North Carolinians and reductions in congestion and pollution. People who live in areas of the state with access to high quality public transportation are more likely to rely on alternative modes of transportation (such as walking, biking, and using transit) and drive significantly less. Not only does this reduce their chances of being in a traffic accident, it also reduces emissions and can improve their physical and mental fitness.

Access to public transportation is vital to improving the quality of life of every resident in North Carolina. As detailed in a subsequent section, the mission of the *Public Transportation Strategic Plan* published by NCDOT's Public Transportation Division is to improve the quality of life for all North Carolinians, further signifying the importance of transit and the role it plays in successfully completing the state's mission.

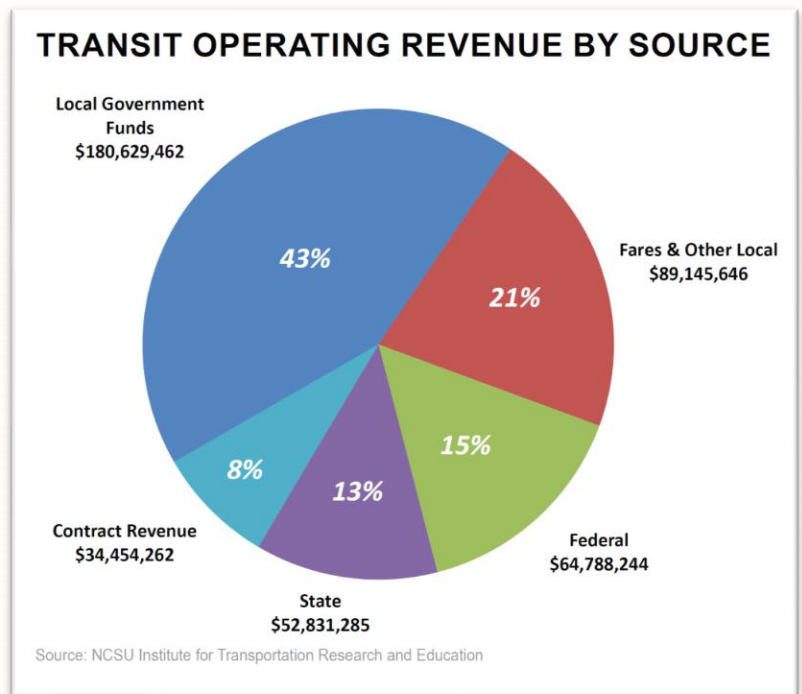
ECONOMICS (LOCAL, REGIONAL, STATEWIDE, AND NATIONAL)

With combined state, local and federal investment and strong community partnerships, North Carolina's transit ridership has more than doubled since 1995. The success can be traced to the Transit 2001 Study Commission's call for statewide transit investments. With support from the North Carolina General Assembly, the state's annual transit investment reached \$93 million for 2018. The breakdown of sources of operating revenue for transit statewide is shown in Figure 16.

In North Carolina, the public transportation system benefits both the transit customers in the state as well as the economy overall. According to a report published in 2015 by ITRE at North Carolina State University titled “Benefits of Transit in North Carolina”, the state’s transit system received operating revenue of \$346 million in fiscal year 2014.

Other economic benefits to the state’s economy spurred by transit can be categorized as either benefits received directly from transit use or expenditure-related economic benefits. Benefits from transit use are separated as either transportation cost savings (using transit instead of other modes) or affordable mobility options (the benefit of having transit as an option). In 2015, the Small Urban and Rural Transit Center (SURTC) and the Center for Urban Transportation Research (CUTR) estimated North Carolina received \$781.4 million in annual benefits from transit use. In 2017, SURTC/CUTR estimated the state received \$848 million in benefits from transit use.

Figure 16 Sources of Operating Revenue for Transit Statewide, 2017



VISION FOR PUBLIC TRANSPORTATION IN NORTH CAROLINA

The Public Transportation Division recognizes the role of transit in North Carolina will continue to change as the state itself continues to grow and the transportation industry in general evolves. In their *Public Transportation Strategic Plan*, detailed further in a subsequent section, the Public Transportation Division used input from stakeholders and community members from across the state to create the following shared vision and mission for public transportation in North Carolina.

VISION

Connecting North Carolinians to Opportunities

People across the state rely on transit to get around for daily needs. With increased traffic congestion and longer commute times, employers increasingly rely on quality transit for access to talented workers. Transit can serve to reduce travel time, offer people greater choice and flexibility, increase the number of destinations that one can reach, and contribute to the overall attractiveness and quality of life a community has to offer. Some people rely on transit more than others, such as those with financial constraints, physical or mental impairments, or other limitations that may prevent them from operating a personal vehicle. For those people, transit services mean the difference between being stuck in one place and getting to education, training, jobs, medical appointments, and other needs. Today and even more so in coming years, North Carolina’s transit network provides a vital connection to opportunities.

MISSION

Improve Quality of Life for North Carolinians by:

- Building healthy communities
- Supporting job creation and economic development
- Providing equal opportunities so all people can thrive

Transit plays an integral role in strengthening communities, providing access to employment and to employees and enabling people to thrive in urban and rural places across the state.

4.4 TRENDS AFFECTING PUBLIC TRANSPORTATION

NATIONALLY

As autonomous and connected vehicles become much more prevalent and the technology surrounding these innovations continues to rapidly improve, public transportation systems across the Country may see major impacts. While most people and manufacturers are focused on private autonomous and connected vehicles, small scale autonomous shuttles are currently being tested in a handful of major American cities with the hopes of one day aiding traditional public transportation service in urban cores. These driverless shuttles are being tested in places like Detroit, Michigan; Lincoln, Nebraska; Las Vegas, Nevada; and Austin, Texas who recently announced their plans to begin testing driverless shuttles at the end of 2018. The shuttles operate at slower speeds (15-25 mph) usually along fixed routes and they have capacity for about 12-15 passengers. This new technology has the potential to improve first-mile/last-mile connection challenges for transit in downtown areas while also potentially serving as a feeder service to expand the reach of existing transit systems. Autonomous public transportation vehicles would also be more efficient and environmentally friendly than the existing fleet for many systems in the country and would ultimately cost less due to a reduction in maintenance and labor costs.

Another national trend that has the potential to greatly impact public transportation is Mobility as a Service, or MaaS. This is the concept of consumers shifting away from personal automobile ownership and using mobility solutions offered as a service for which one pays for based on their travel needs. For example, MaaS consumers could potentially use one application on their smartphone to pay for their transport for the entire day, utilizing both public and private transportation services to travel where and when they want. Consumers can pay for the service per trip or sign up for a subscription-based payment based on their travel needs. This trend is driven by consumer acceptance of new transportation innovation such as ride hailing, bike sharing, and on-demand bus services. As autonomous vehicles become a reality, the need to own a personal car may become less important and consumers may be more likely to pay for their travel based on their own personal demand. The widespread acceptance of MaaS could have a significant implication on public transportation.

Public transportation agencies have the opportunity to utilize new technologies and consumer data to make their entire system responsive to consumers' real-time demand. They also can partner with private transportation companies and other public agencies to connect existing gaps in their network and provide a connected transportation experience for users. MaaS also has the potential to allow transit agencies to modernize the way they collect fares and how consumers would transfer between multiple services.

Another national trend is microtransit, which is currently in an early stage and offers the potential to significantly change how riders utilize transit by enhancing first-mile/last-mile connections and operating in a real-time environment. Microtransit refers to a privately-operated demand response transit (e.g. UberPool or LyftLine) using mobile apps and algorithms to match passengers making similar trips in a single vehicle. The public providers are entering this space as well. This trend will be further explored as this study continues.

STATEWIDE

While the rapidly approaching trend of connected and autonomous vehicles may be one that is affecting public transportation at a national level, the Public Transportation Division is keen on enhancing the awareness of the technology and the impacts it may have on transit across the state. Specifically, the Public Transportation Division recently published a brochure detailing autonomous shuttle technology, where it is currently being tested, and best practices for states preparing for its emergence. The brochure also describes different policies and regulations regarding autonomous vehicles, and provides recommendations for how the state should prepare.

Another statewide trend affecting public transportation is the desire to create a connected statewide network. While transit operates in all of North Carolina’s 100 counties, the systems do not necessarily integrate to allow seamless and easy travel for customers and prospective users. Geographic and political boundaries, and funding sources often hold transit back from being a fully integrated system. Through their *Public Transportation Strategic Plan*, the Public Transportation Division identified proposed routes to add to the existing system, creating a connected network and improving transit access to key areas throughout the state. Titled *ConCPT*, the coordinated routes and consolidated systems program was initially funded in 2017 and includes seven key initiatives to create a connected statewide network.

KEY CHALLENGES FOR PUBLIC TRANSPORTATION IN NORTH CAROLINA

As part of the *Public Transportation Strategic Plan*, nine community workshops were held across the state in May 2017 and participants were asked to identify what he/she believes would be the greatest challenge facing transit in North Carolina. Funding was overwhelmingly the greatest concern, with local and state funding identified by over 50% of participants and federal funding identified by another 9%.

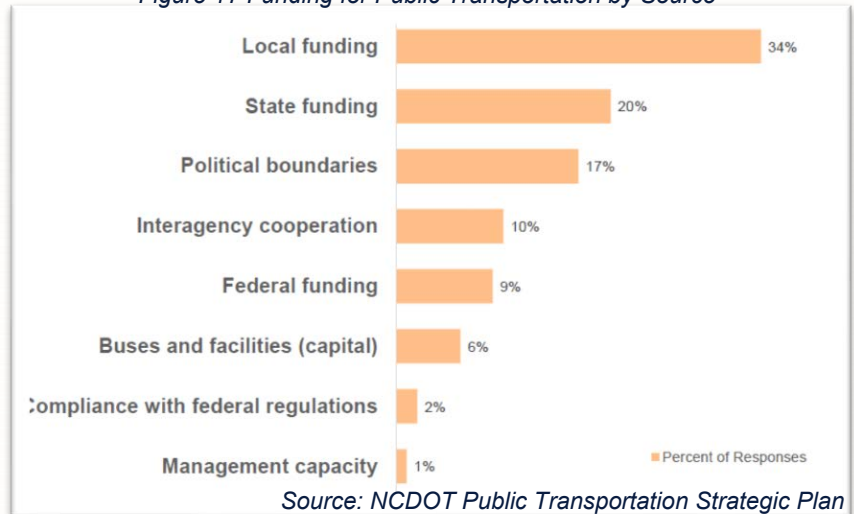
A significant ongoing challenge for the transit industry is to plan for infrastructure and operational growth when funding at the federal, state and local levels is uncertain and constantly shifting.

While Congress has authorized through 2020 \$2.3 billion annually for the Fixing American’s Surface Transportation (FAST) Act and nearly \$5.5 billion for Amtrak’s national network, there are still concerns about sustainable federal funding for public transportation. The current Administration proposed major reductions in its 2018 budget for the Federal Transit Administration, Capital Investment Grants, the Transportation Investment Generation Economic Recovery Grant (TIGER) program, and Amtrak network improvement.

North Carolina lawmakers placed a \$500,000 cap on state funding for light rail projects which creates additional risks to implementation, notably for a 17-mile light rail line connecting Durham and Chapel Hill.

Funding uncertainty continues at the local level. Even though four urban counties in North Carolina have passed dedicated half-cent sales taxes to support transit infrastructure and operation, there are rural counties

Figure 17 Funding for Public Transportation by Source



contributing zero dollars to their paratransit systems and expecting those systems to find local matches through other sources.

With the release of 2010 Census data, many communities in North Carolina crossed the 50,000-person threshold which required their rural community paratransit agencies within the urbanized areas to transition from 5311 to 5307 formula grants. In Chapter 53 of the FAST Act, Sections 5311 and 5307 include programs that provide capital, operating, and planning assistance to support public transportation in rural and urban areas respectively. Depending on the size of a jurisdiction (areas with population less than 50,000 refer to Section 5311 and areas with population greater than 50,000 refer to Section 5307), the programs included in Sections 5311 and 5307 provide guidelines and funding formulas that are necessary to receive support. As a result of population growth in some communities, shifts in funding grants have occurred which may or may not reduce the flow of dollars; the uncertainty can constrain a transit agency's short-term growth.

As North Carolina continues to evolve, public transportation systems in the state are challenged with serving the public's mobility needs as context changes. Funding, new policies, new technology, and changing demographics and needs are all important issues that transit agencies need to consider as they continue to provide transportation services in North Carolina.

4.5 REVIEW OF THE CURRENT PLAN

PUBLIC TRANSPORTATION PLANNING PROCESS

The Public Transportation Division is in the process of finalizing the *Public Transportation Strategic Plan*. The purpose of the Plan is to establish a shared vision and a coordinated, updated approach for providing transit and mobility services for North Carolinians. The Plan evaluates the existing challenges facing transit systems in the state, forecasts future transit needs, and aims to provide the roadmap for transit to better communities. To maintain consistency with the Public Transportation Strategic Plan, excerpts are included in this document.

As mentioned in a previous section, the vision for public transportation in North Carolina emerged during this planning process was *Connecting North Carolinians to Opportunities*. To achieve this vision the Public Transportation Division set forth a mission of improving the quality of life for all North Carolinians by following three specific strategies. The three strategies emerging from the Plan are:

-  Building thriving, healthy communities - Partner for a successful future
-  Improving access to jobs and economic development - Support local transit systems
-  Connecting communities to opportunities - Build the Connected Statewide Network

GOALS AND PERFORMANCE MEASURES

With the vision and mission for public transportation in North Carolina in mind, the Plan also identifies tactics for achieving the desired goals. These tactics are intended to be the specific action items necessary to successfully complete the strategies detailed in the plan and improve the quality of life for all North Carolinians.

Table 8 NCDOT Public Transportation Division Goals

1. Partner with local organizations, community colleges, state agencies, and customers to focus transit services so people thrive	10. Utilize employer-based carpooling, vanpooling, and telework programs to provide regional transportation choices
2. Provide enhanced access for seniors, veterans and persons with disabilities	11. Build the Connected Statewide Network
3. Build quality transit stops and safe pedestrian crossings	12. Use technology to foster transit system integration, innovation, and operating efficient
4. Support transit-friendly land use	13. Extend the public transportation network's reach
5. Provide enhanced local services in response to changing demographics	14. Consolidate transit agencies and coordinate transit service
6. Establish regional multi-county commuter services	15. Improve transit travel times through implementing operating innovations
7. Enable new local services	16. Support and enable greater flexibility in funding transit investments
8. Engage the business community in strengthening job creation and economic development	17. Embrace Smart, Connected, and Autonomous Technology
9. Push planning beyond local boundaries	

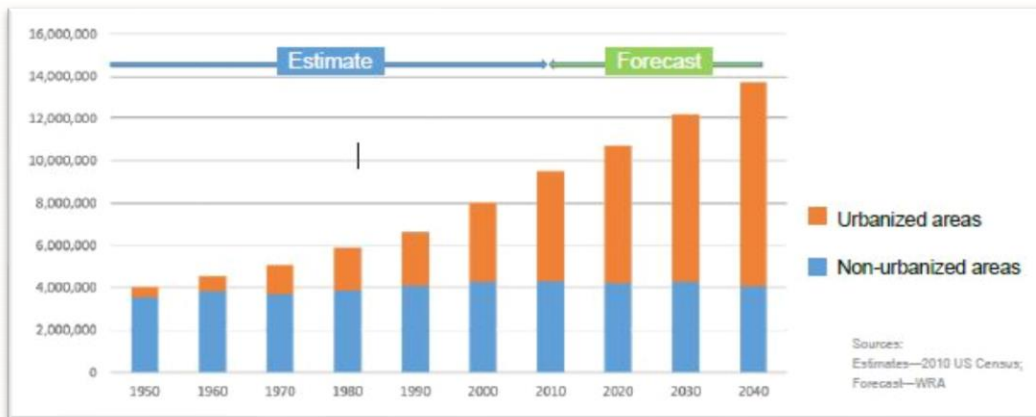
Source: NCDOT Division of Public Transportation

KEY STRATEGIC ISSUES, NEEDS, AND TRENDS

4.5.1.1 NORTH CAROLINA'S POPULATION AND DEMOGRAPHIC CHANGE

From 1950 to the present, the population of North Carolina more than doubled to 10.3 million people. Figure 18 illustrates recent trends in population change by county. The population added during this time was almost entirely in census-defined urbanized areas, as shown in Figure 19. As of the 2010 census, more than 50% of the state's population resides in an urbanized area. In future decades, the urbanized areas of the state are expected to continue to absorb most of the overall growth, while the smaller cities and towns, and rural areas will more likely grow at a slower rate or stay the same, and some rural counties will continue to lose population.

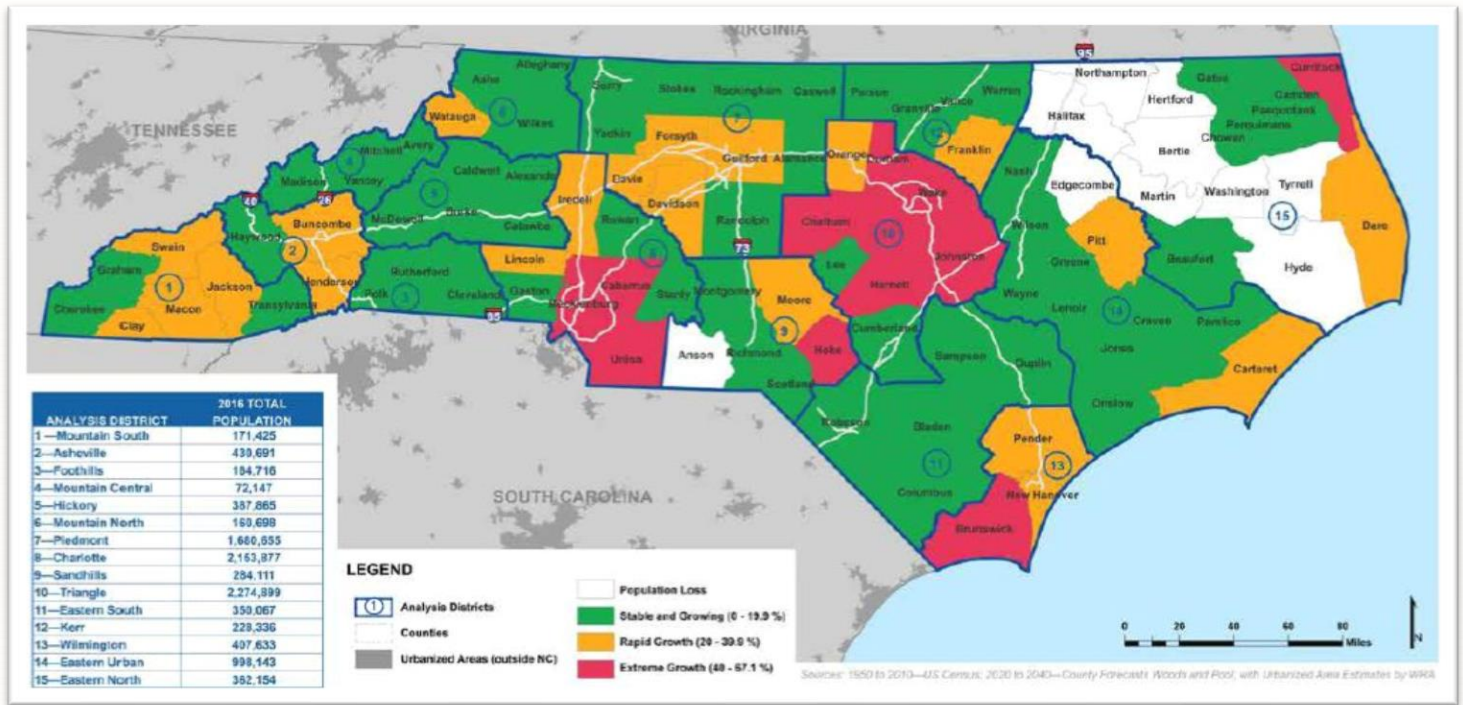
Figure 18 Population Growth Statewide



Over time, the proportion of the population age 65 years and older will also significantly increase. On average, older people are more likely to need medical attention and have trouble driving or simply not be able to drive. Consequently, the need for mobility services and medical travel will increase. Research indicates older adults increasingly seek to remain in their home and community as they age. Paired with the trend for a significant proportion of baby-boomers to seek retirement in denser, mixed-use communities, this impact will likely be seen

in urbanized communities as well as more rural parts of the state. Strategies will be needed to support mobility needs of older adults in communities of all sizes.

Figure 19 Population Change by County (2010 – 2040)



As North Carolina has grown, so has regional long-distance commuting. Many co-workers and neighbors commute long distances to access quality employment while living in suburban neighborhoods and small towns. As of 2016, the U. S. Census American Community Survey (ACS) estimated 26% of North Carolina workers cross county lines to reach jobs. Fifty-seven percent of North Carolina workers travel more than 10 miles to work while 18% travel more than 50 miles each way.

Long distance commuting affects both urban, suburban and rural counties. Harnett County, located southeast of Raleigh, is transitioning from a rural to suburban area. Since 1986, the county’s population has doubled with a 2018 population of 39,448. By 2040 the county is projected to be home to 56,168 residents. In 2016, estimates from the ACS indicated 63% of Harnett County workers commute to jobs outside the county with many traveling to Fayetteville/Fort Bragg or the Research Triangle region.

Durham County, which is predominantly urban, has experienced an increase in population of 117% since 1986. Since 2005, Durham County has experienced a 16% increase in out-of-county commuting with average commuting times increasing by 8% overall. Population growth along with longer commutes is placing a burden on our roads and highways.

Longer distance commuting can be especially common in rural counties. In Jones County, located to the south of Kinston and New Bern, 88% of the county’s 3,402 workers cross county boundaries to reach their jobs. In Bertie County, north of Greenville, 60% of the county’s 5,160 workers leave the county with 28% traveling more than 50 miles to work.

Telecommuting and transit will play important roles in managing regional commuting. As high-speed internet becomes available in some areas, telecommuting has become an option for long distance commuters while

carpooling, vanpooling, commuter bus, and commuter rail can be effective for the long-distance commutes prevalent across the state.

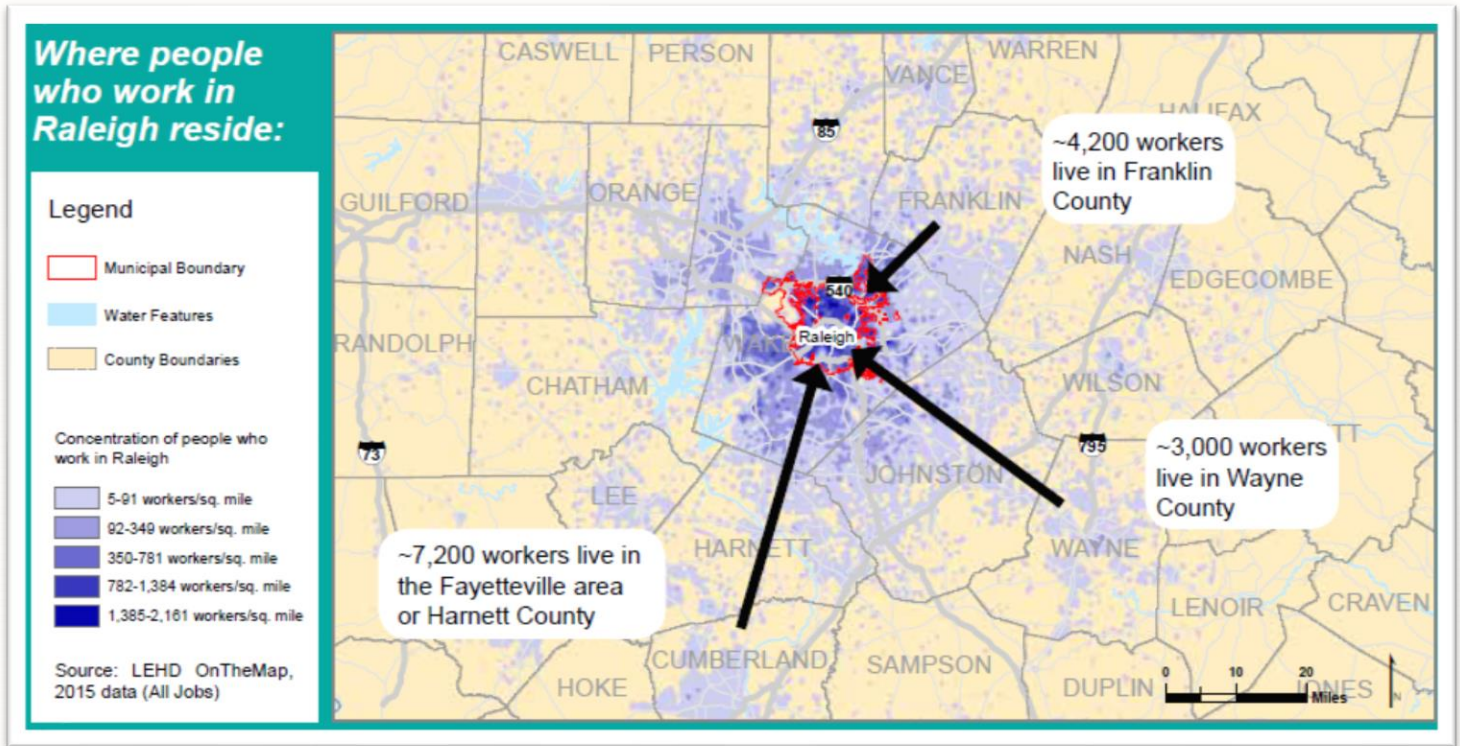
4.5.1.2 REGIONAL TRAFFIC CONGESTION

North Carolina's urban centers, like other areas across the country, have experienced increasing traffic congestion. The Texas Transportation Institute's 2015 Urban Mobility Scorecard estimated Raleigh motorists' hours of delay—a measure of time spent in traffic—increased by 279% for the period 1990 through 2014, while Charlotte area travelers experienced a 333% increase in delay over the 24-year period. Although we continue to invest in transportation infrastructure, our expanded roadways have not been able to keep pace with increased travel demand. Unfortunately, future projections mirror our past experience and we are unlikely to build our way out of traffic congestion.

In the Triangle Region, Wake County's more than one million residents are growing at a rate of 63 people per day. With the large anticipated increases in the Triangle Region's population and jobs over the next 30 years, the amount of daily vehicle miles traveled (VMT) is expected to grow by 80 %. In 2013 there were 50,646,000 daily VMT in the Triangle Region. Based on the Capital Area MPO and the Durham-Chapel Hill-Carrboro MPO forecasts, there will be 91,406,000 daily VMT by 2045 resulting in most major Triangle area roads experiencing severe traffic congestion. Triangle Region motorist hours of delay are expected to grow by 375% by 2045 and Charlotte Region forecasts are similar with daily VMT growing by 47% and hours of delay growing by 142%.

To maintain North Carolina's quality of life, we must establish policies and plans to achieve best outcomes in light of the technology and available travel choices. Transit, shared vehicle programs, and transportation network companies will be some of the strategies to overcome mobility challenges in the new transportation future. Fostering collaborations across sectors, integrating systems, and proactively establishing the policies supporting regional travel will help our communities leverage transit's benefits and pave the way towards a more sustainable future.

Figure 20 Regional Travel Patterns, Public Transportation Strategic Plan



4.5.1.3 NEED FOR TRANSIT

People across the state rely on transit to get around for daily needs and as a critical resource for breaking through barriers and reaching new goals. Transit connects North Carolinians to opportunities and will be increasingly important as the proportion of the population who rely most on its services grows. In the next 20 years, the population will have 1 million more people 65 years and older, growing four times the rate of growth of any other age group.

The future is also likely to include continued change in the economic structure of the state. According to estimates by the Labor and Economic Analysis Division of the North Carolina Department of Commerce, between 2014 and 2024 approximately 550,000 jobs will be added across the state. Three out of four of those jobs are expected to be in industries where the average weekly income is less than \$1,000 per week. Recent employment trends show service-providing industries are increasing in number of jobs, while goods-producing industries are making up a smaller share of added jobs. Jobs with low educational requirements (occupations requiring no post-secondary or college experience) are projected to produce the most job openings (mostly due to replacements) but are also projected to have the slowest rate of growth. Occupations requiring a master's degree or higher are projected to experience the greatest percentage increase in employment.

Transit has a role in navigating these changes in the economy for workers at both ends of the spectrum. With the greatest proportion of job growth in predominantly low-wage jobs, affordable transportation and housing options are likely to see increased demand. And, as knowledge-based companies seek to establish themselves or expand, they will look for places offering top quality of life for their workers and prospective workers, including robust transit systems. The recent search for Amazon's east coast headquarters included transit as a criteria and companies, such as Citrix, recently locating or expanding in North Carolina have also voiced the importance

of transit in their choice. These are examples of the importance of a well-rounded community including robust regional transit networks.

COORDINATION OPPORTUNITIES AND CHALLENGES FOR NEXT PLAN UPDATE

There is a key opportunity for the Public Transportation Division to coordinate with transit agencies across the state as they attempt to successfully create a connected statewide transit network. In the ConCPT program report, there are seven initiatives described to make the connected statewide network a reality and many of these initiatives involve coordinating with different agencies. To successfully implement a connected statewide network, it will be necessary to coordinate with local transit providers, regional transit providers, major employers, and inter-city passenger rail providers.

It is also vital for the state to coordinate with necessary parties regarding emerging transportation trends and technologies. As North Carolina continues to grow and the demographics continue to change, the public transportation system needs to be responsive to the mobility needs of the public. Coordination with private transportation providers about new technologies or shared services and with key stakeholders about evolving mobility needs will be necessary for North Carolina to stay at the forefront of emerging trends in public transportation, and to provide the best possible service to the public.

5. STATE OF THE SYSTEM – PEDESTRIAN/BICYCLE

5.1 OVERVIEW

Bicycling and walking are the most basic and efficient modes of transportation available. These trips require fewer infrastructures, reduce congestion, and improve personal health. Most North Carolinians are pedestrians at some point each and every day, and bicycling continues to grow in popularity with younger generations and the advent of bike share. Today, in North Carolina, residents often walk or bicycle to their destinations out of necessity due to economic status or age. However, a cultural shift has also occurred with millennials and other generations choosing to walk, bike, scooter, and take transit in place of driving an automobile.

The following briefing describes current conditions, issues, needs, trends, and drivers for walking and bicycling transportation in North Carolina.

5.2 PEDESTRIAN/BICYCLE IN NORTH CAROLINA

The vision of North Carolina’s Statewide Pedestrian and Bicycle Plan (WalkBikeNC 2013) is: “North Carolina is a place that incorporates walking and bicycling into daily life, promoting safe access to destinations, physical activity opportunities for improved health, increased mobility for better transportation efficiency, retention and attraction of economic development, and resource conservation for better stewardship of our environment.” While this vision is strong, North Carolina, like many of its southeastern state counterparts, has a long way to go to create consistent, connected bikeway and walkway systems that make active modes of transportation desirable.

North Carolina features an ideal climate throughout the year for walking and bicycling. While only 1.8% of commuters walk to work and 0.2% bicycle to work¹⁰ in North Carolina, the majority of bicycling and walking trips, which are recreational and utilitarian, are largely unaccounted for. In the NCDOT “Evaluating the Economic Impact of Shared-use Paths in North Carolina,” it was estimated that over 480,000 trips occurred on the American Tobacco Trail in Durham (456,000 of which were non-commute trips, including running errands). In addition, 1.2% of commuters take transit to work – many of those trips begin and end with a walking or bicycling trip to a transit stop or station.

The state of North Carolina has referred to itself as the “Great Trails State” due to the significant efforts and investments in statewide, regional, and local trails, walkways, and bikeways. Rapidly increasing separated shared-use paths and separated bikeways are providing transportation that can be used by all ages and abilities. Major trail systems like the Mountains-to-Sea Trail (1,000 miles in North Carolina) and the East Coast Greenway (400 miles in North Carolina) are continuing to expand through the planning, design, and construction of segments. However, the State as a whole is ranked 38th nationally in the amount of per capital spending on bike/walk projects.¹¹ Cities across the state have begun setting aside higher dollar amounts to implement sidewalks, improved intersections, bike lanes, and separated bikeways so progress is being made.

Currently, in North Carolina, sidewalks and bikeways are largely disconnected, and sometimes in poor condition. Providing safe, connected, and protected bicycle and pedestrian infrastructure increases walking and bicycling.

¹⁰ ACS 2013

¹¹ FHWA FMIS 2013-2014

In a survey of 16,000 North Carolina residents for the 2011 North Carolina Bicycle and Pedestrian Safety Summit, 70% said they would walk or bicycle more if provided with safe walkways and bikeways.¹²

From a safety perspective, North Carolina ranks poorly with its state peers. Safety for bicycling and walking is a critical issue across the state of North Carolina with an average of 176 pedestrians and 22 bicyclists killed each year (between 2011 and 2015).¹³ There are 23.3 bike/pedestrian fatalities per 10,000 commuters (ranked 7th worst nationally).¹⁴ In addition, almost 14% of all roadway fatalities are pedestrians.¹⁵

5.2.1.1 NCDOT DIVISION OF BICYCLE AND PEDESTRIAN TRANSPORTATION

NCDOT has always been a leader nationally in recognizing bicycling and walking as legitimate modes of transportation. NCDOT established the North Carolina Bicycle Program in 1974, the first of its kind in the U.S. In 1992, the program expanded to focus on pedestrian accommodations. The Division integrates bicycle and pedestrian mobility, safety, and accessibility into NCDOT's overall transportation system. In 2004, the Division of Bicycle and Pedestrian Transportation (DBPT) initiated a bicycle and pedestrian planning grant program that has led to tremendous success in communities across the state. The 2013 Statewide Pedestrian and Bicycle Plan (WalkBikeNC) is a blueprint for improving walking and bicycling in the state. The Division also educates citizens of all ages through statewide campaigns. Today, with an increasing demand and need for safe and connected bicycling and walking infrastructure, the state of North Carolina will need to remain a leader in providing safe, quality transportation choices for its residents.

REGIONAL

Consistent across all regions is a lack of connected bicycle and pedestrian infrastructure. Regionally, there are unique circumstances and challenges. There is a more clearly distinguishable difference between urban and rural areas in North Carolina as opposed to regional differences. The key issues of urban versus rural include:

- There is a stronger likelihood of walking and bicycling for transportation in urban areas, where there are higher populations and greater density of land uses and destinations.
- Greater funding is available for walking and bicycling infrastructure in urban areas where cities have larger tax bases and budgets to implement (also, STI's data driven processes highly favor projects that improve safety, reduce congestion and have a high return on investment).
- Typically, urban areas support expenditures for walking and bicycling infrastructure with a combination of local and federal funding, which makes it more acceptable politically to fund improvements.

Mountains

The mountains of North Carolina feature a few larger cities with urban characteristics, like Asheville and Boone, but largely feature rural areas and small towns. Challenges to improve bicycling and walking infrastructure include topography, right-of-way, and funding. Winding, hilly, and/or narrow roads in rural areas are largely not conducive to bicycling and walking for the majority of the population but do provide a beautiful resource for recreational bicyclists.

Mountain communities have committed municipal dollars and receive federal funding to add bicycle and pedestrian infrastructure to address resident needs and support tourism. Asheville is growing its approximately

¹² NCDOT DBPT and the Institute of Transportation Research and Education, 2011 Bicycle and Pedestrian Safety Summit Report

¹³ http://www.pedbikeinfo.org/pbcat_nc/pdf/summary_bike_facts11-15.pdf

¹⁴ FARS 2011-2013

¹⁵ <https://connect.ncdot.gov/business/DMV/DMV%20Documents/2016%20Crash%20Facts.pdf>

5-mile greenway network with 16 more miles being designed and built currently. The City of Brevard has committed to growing its greenway, walking, and bicycling network with the Brevard Greenway, a 3.7-mile system of multi-use paths. The Thermal Belt Rail Trail continues to expand near the Rutherfordton/Spindale/Forest City area. The City of Boone has expanded its greenway and sidewalk network and installed the first HAWK signal in North Carolina. Unique funding from the Appalachian Regional Commission provides a good source for bicycling and walking studies and facility development.

Piedmont

The Piedmont region of North Carolina features the largest cities and fastest growing portions of the state. The Piedmont includes the Charlotte, Triad, and Triangle metro areas. With a greater density of destinations and land uses, bicycling and walking trips are more feasible for larger portions of the population. In the Piedmont, the large cities have been committed to improving bicycling and walking infrastructure through funding allocations in local capital improvement programs, and allocation of Direct Attributable funds to MPOs. State law currently prohibits the use of state dollars on bicycle and pedestrian projects. Examples include the American Tobacco Trail, Neuse River Greenway, Salem Greenway, A&Y Greenway, and Little Sugar Creek Greenway. Raleigh and Charlotte have begun implementing separated bikeways and protected intersections. In an analysis of North Carolina communities' progress in implementing projects identified in plans from the DBPT Bicycle and Pedestrian Planning Grant Initiative, the Piedmont cities had the most success.

Coastal Plain

The Coastal Plain features the unique geographic characteristic of being largely flat, which is more hospitable to a larger population of potential bicyclists and pedestrians. In addition, however, are the broad low-lying, wet areas that are not developable. Many rural roadways present a challenge to implementation with little opportunity for expansion of bikeways and walkways given the water and drainage issues. Communities directly along the coast feature significant walking and bicycling from seasonal tourism and the desire for outdoor access. Those communities have added shared-use side paths along their roadways. The City of Wilmington has committed significant resources, including a bond measure, to grow its greenway network. The medium-sized communities like Goldsboro, Wilson, Rocky Mount, and Fayetteville are realizing the positive impact of improving bicycle and pedestrian infrastructure and are beginning to invest more to grow local greenway, bikeway, and pedestrian networks. Each City has invested into downtown streetscapes and greenway expansion in recent years.

5.3 WHY PEDESTRIAN/BICYCLE IS IMPORTANT TO NORTH CAROLINA

Bicycling and walking are more important than ever to North Carolina. This is due to many factors, including an urbanizing population, aging population, cultural shifts, and undeniable quality-of life, health and economic benefits.

North Carolina is urbanizing with populations migrating back to downtowns. Population groups, including millennials want more transportation choices, and often prefer to travel by walking, biking, or transit. In many cases, people are choosing a more car-free lifestyle because it is more convenient; while others are dependent upon walking and bicycling to get around because of economic status or age. Car share, bike share, scooter share, and other new technologies are becoming more prevalent and quickly spreading across North Carolina including small to medium-sized towns. The sections below describe the growing importance of bicycling and walking in North Carolina.

QUALITY OF LIFE

Walkable and bikeable communities have a higher quality of life for a variety of reasons. Today, much of the population desires those facilities to support their way of life, as a means to improve health, and to create stronger community. More walking and bicycling infrastructure and activity adds vibrancy, community engagement, increased choices for travel, reduces in roadway congestion and parking demand, improves the public realm, and provides healthy, recreational opportunities. North Carolina cities have come to recognize that providing walking and biking facilities has a positive impact to retaining populations, recruiting people and employers, health, and overall quality of life.

- 56% of millennials and 46% of active baby boomers would prefer to live someday in a walkable community, whether an urban, suburban, or small-town location.¹⁶
- 52% of Americans would like to live in a place where they do not need to use a car very often.¹⁷

HEALTH

The way that we build our communities and provide transportation options has a direct impact on health. Sprawling communities with segregated land uses are environments that necessitate driving a personal vehicle. Communities that are built with connected transportation infrastructure and a mixture of uses allow for healthier transportation choices such as walking and biking. Historic downtown cores in North Carolina feature grid roadway networks, sidewalks, and a density of destinations. Because of urban sprawl occurring over multiple decades, often without bicycle and pedestrian infrastructure, there are large gaps in bicycle and pedestrian networks. This transportation-land use scenario creates a situation where most North Carolinians have to drive to work, school, and services.

Nationally, only one-third of adults are physically active and one-third of children and adolescents are considered overweight or obese¹⁸. Because of our land use and transportation decisions, along with other influencers, North Carolina has consistently ranked as one of the least healthy states in the U.S.

- 48.6% of North Carolinians are getting recommended physical activity (ranked 36th nationally)¹⁹
- 65% of adults in North Carolina are either overweight or obese.²⁰
- 31.8% (or 2.52 million people) are considered obese, according to data from the Centers for Disease Control and Prevention's behavioral risk factor surveillance system for 2017. This ranks as the 16th highest obesity rate in the country.
- North Carolina is ranked as the 5th worst in the nation for childhood obesity²¹

Providing walking, bicycling, and transit infrastructure can make a difference in public health outcomes as evidenced by scientific study and research in North Carolina. A Charlotte study found that residents who stopped driving to work and started walking to the light rail station to take light rail to work, weighed an average of 6.5 pounds less than those who continued to drive to work.²²

Replacing car trips with walking and bicycling trips can also have a positive impact on the environment. Replacing 2 miles of driving with walking or biking each day of the year equals 650 pounds of carbon dioxide prevented from entering the atmosphere.²³

¹⁶ Investing in Place – APA 2014

¹⁷ Urban Land Institute – American in 2015

¹⁸ Centers for Disease Control and Prevention

¹⁹ BRFSS 2013

²⁰ North Carolina State Center for Health Statistics. (2007) Behavioral Risk Factor Surveillance System, 2007 Results.

²¹ 2017 North Carolina DHHS, Physical Activity and Nutrition Branch, Eat Smart, Move More NC. The Obesity Epidemic in North Carolina.

²² MacDonald, J.M., Stokes, R.J., Cohen, D.A., Kofner, A., & G.K. Ridgeway. (2010). The effect of light rail transit on body mass index and physical activity. *American Journal of Preventive Medicine* 39(2): 105-112

²³ Environmental Protection Agency. (2018). Greenhouse Gas Emissions from a Typical Passenger Vehicle.

ECONOMICS (LOCAL, REGIONAL, STATEWIDE, AND NATIONAL)

Numerous studies completed at the national, regional, statewide, and local levels have concluded that bikeable and walkable communities have a positive economic impact to property values, businesses, sales, and tourism, along with providing health care cost reductions. From a simple economics perspective, the cost of walking and bicycling are practically free when compared to the cost of owning, operating, and maintaining a motor vehicle. Individually, reducing car ownership and/or trips reduces household expense, provides more discretionary income, reduces healthcare costs, and improves upward mobility.

- 6.3% of households in North Carolina do not have a vehicle available.²⁴ This is largely due to income and the ability to own or operate a vehicle.
- There is a \$700 to \$3,000 property value increase for each additional point on Walk Score.²⁵
- \$5.6 billion could be saved in healthcare costs if 1 in every 10 people started a regular walking program.²⁶
- Since improving Broad Avenue in Memphis, Tennessee with separated bikeways, there have been 16 new businesses and 29 property renovations.
- In West Jefferson, NC, since implementing streetscape improvements in the Downtown core, the number of vacant storefronts and apartments in the downtown area has dropped from 33 to 5²⁷.
- Property values within 0.5-mile of the Monon Trail in Indianapolis see 11% higher property values.
- The 2018 study, “Evaluating the Economic Impact of Shared Use Paths in North Carolina,” funded by NCDOT, found that every \$1.00 of shared-use path capital investment supports \$1.72 annually from local business revenue, sales tax revenue, and benefits related to health and transportation²⁸. It is also likely that shared-use paths increase property values in North Carolina as national studies support this notion.
- In the Outer Banks, a one-time public investment of \$6.7 million in paths and wide paved shoulders has generated \$60 million in annual tourism revenue from bicyclists.²⁹

SAFETY

Safety is a critical issue in the state of North Carolina for all roadway users. Bicyclists and pedestrians are the most vulnerable of users.

Bicycling Safety

- From 2006 to 2015, there were 9,594 reported bicycle crashes for an average of 959 per year.³⁰
 - Over the 10-year time period, 71% of crashes happened in urban areas; 29% happened in rural areas.
- From 2011 to 2015, an average of 22 bicyclists was killed in roadway crashes each year.³¹
- While 56% of the bicycle crashes happened in the Piedmont, only 41% of fatal crashes happened in the Piedmont (while 53% of fatal crashes happened in the Coastal Plain and 6% in the Mountains).

²⁴ U.S. Census Bureau, 2013-2016 American Community Survey 5-Year Estimates

²⁵ Cortright, Joe. “How Walkability Raises Home Values in U.S. Cities.” CEO for Cities. 2009

²⁶ National Governor’s Association Report on Healthy Living

²⁷ <https://www.completestreetsnc.org/project-examples/ex-westjefferson/>

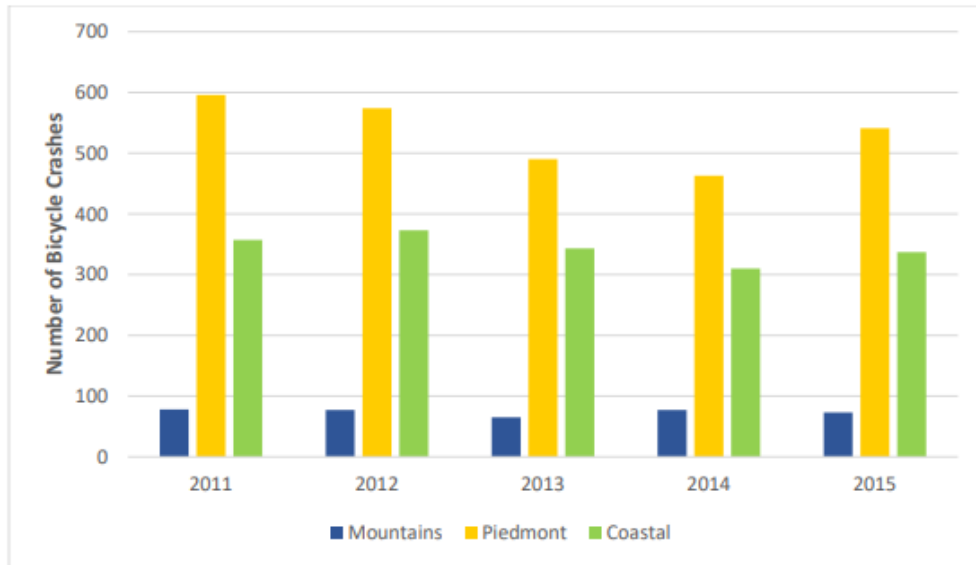
²⁸ <https://itre.ncsu.edu/focus/bike-ped/sup-economic-impacts/>

²⁹ *Pathways to Prosperity: The Economic Impact of Investments in Bicycle Facilities*, 2004, NCDOT

³⁰ http://www.pedbikeinfo.org/pbcat_nc/pdf/summary_bike_facts11-15.pdf

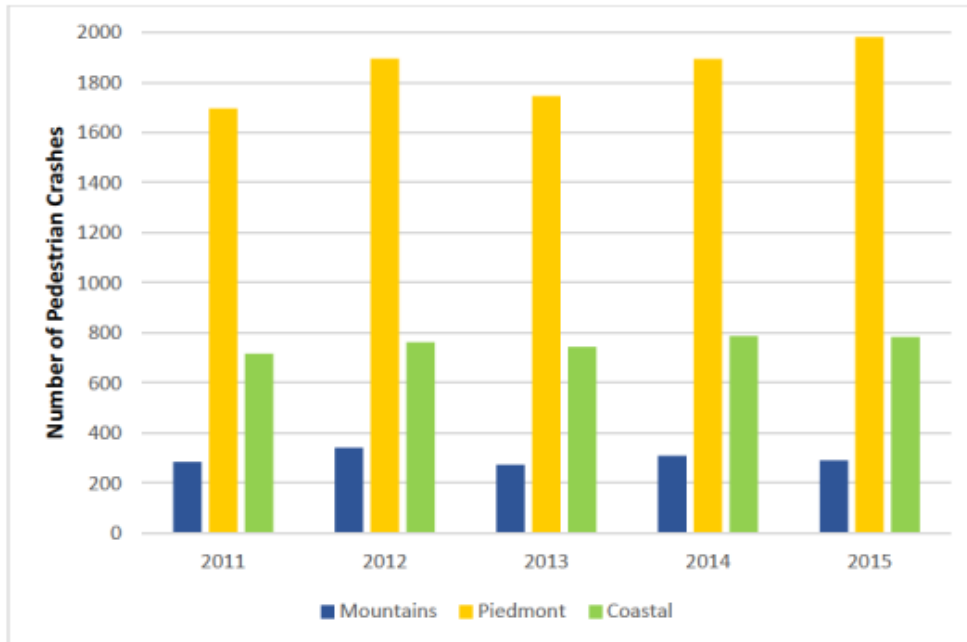
³¹ http://www.pedbikeinfo.org/pbcat_nc/pdf/summary_bike_facts11-15.pdf

Figure 21 Five-Year Bicycle Crash Trends by Regions of North Carolina



Source: North Carolina Bicycle Facts, 2011-2015

Figure 22 Fatal and Total Crash Proportions by Region of North Carolina

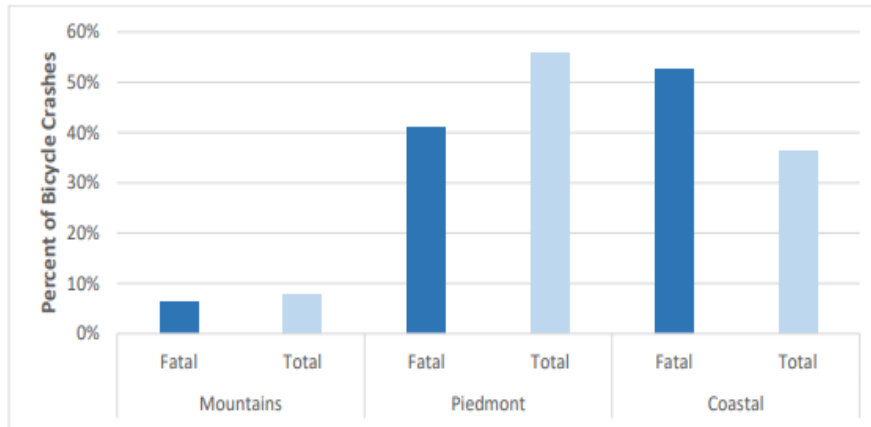


Source: North Carolina Bicycle Facts, 2011-2015

Pedestrian Safety

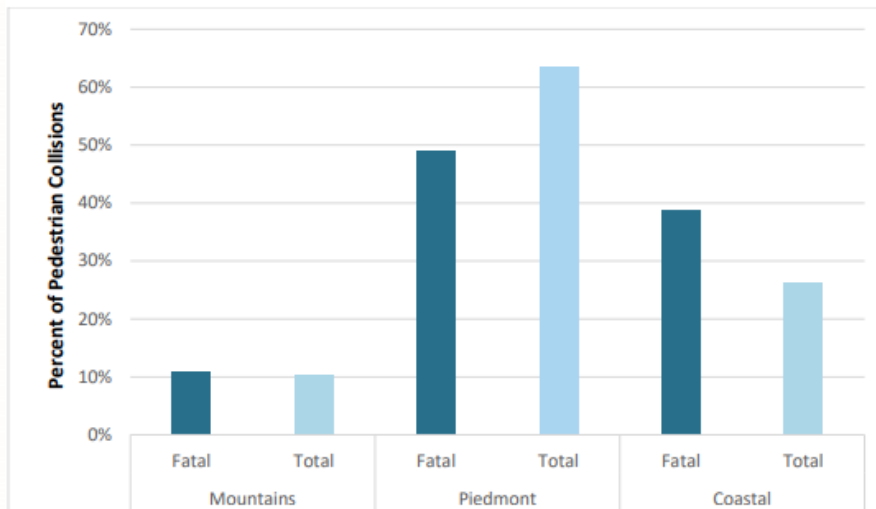
- 13.7% of all traffic fatalities in 2016 were pedestrians.³²
- 8.8% of all pedestrians involved in a motor vehicle crash in 2016 were killed.³³
- From 2006 to 2015, there were 27,050 reported pedestrian crashes for an average of 2,705 per year³⁴.
 - Over the 10-year time period, 73% of crashes happened in urban areas; 27% happened in rural areas.
- From 2011 to 2015, an average of 176 pedestrians were killed in roadway crashes each year.³⁵
- While 64% of the pedestrian crashes happened in the Piedmont, only 50% of fatal crashes happened in the Piedmont (while 39% of fatal crashes happened in the Coastal Plain where 26% of total crashes occurred).

Figure 23 Five-Year Pedestrian Crash Trends by Region of North Carolina



Source: NC Pedestrian Crash Facts, 2011-2015

Figure 24 Fatal and Total Crash Proportion by Region of North Carolina



Source: NC Pedestrian Crash Facts, 2011-2015

³² <https://connect.ncdot.gov/business/DMV/DMV%20Documents/2016%20Crash%20Facts.pdf>

³³ <https://connect.ncdot.gov/business/DMV/DMV%20Documents/2016%20Crash%20Facts.pdf>

³⁴ http://www.pedbikeinfo.org/pbcat_nc/pdf/summary_bike_facts11-15.pdf

³⁵ http://www.pedbikeinfo.org/pbcat_nc/pdf/summary_bike_facts11-15.pdf

VISION FOR PEDESTRIAN/BICYCLE IN NORTH CAROLINA

In late 2018, the NCDOT DBPT initiated a process of refining a vision, mission, and strategy for the future. The 2013 WalkBikeNC Plan established a vision statement that “North Carolina is a place that incorporates walking and bicycling into daily life, promoting safe access to destinations, physical activity opportunities for improved health, increased mobility for better transportation efficiency, retention and attraction of economic development, and resource conservation for better stewardship of our environment.”

The vision from the 2013 Plan remains the same today. The vision is that North Carolinians have choices for their transportation, and that bicycling and walking infrastructure is connected and safe.

5.4 TRENDS AFFECTING PEDESTRIAN/BICYCLE

NATIONALLY

Nationally, there are trends occurring that will increase demand for bicycling and walking transportation options. Some state DOTs have made bicycling and walking modes of transportation a higher priority. Cities across the country have led the way with progressive leadership and investment in separated bikeways, connected pedestrian infrastructure, and greenways. Cities have done this to remain economically competitive, to attract major employers, and to provide a higher quality of life.

Our demographics and culture are shifting as well. Senior and elderly populations are growing statewide and nationally; these groups may be more dependent on walking and transit in the future. The number of teens getting their full provisional driver's license dropped by 5% from 2008 through 2010, according to the North Carolina Division of Motor Vehicles. Forty-five percent of millennials are consciously replacing driving with other modes. Between 2001 and 2009, there were 24% more bike trips, 16% more walk trips, 40% more trips on public transit.³⁶

In recent years, an explosion of car share, bike share, and scooter share has occurred across the country, along with new and emerging technologies such as dock-less bikes and scooters. This has largely been driven by private operators and aggressive approaches to get these transportation options on the streets. The impact and visibility of these options has only added to the number of non-motor-vehicle trips. The likelihood for further disruptions in the area of micro-mobility is significant.

STATEWIDE

In addition to national trends mentioned above, North Carolina trends also support the growing need to support bicycling and walking modes of transportation. As discussed in the WalkBikeNC Plan, North Carolina's population is urbanizing. In 2010, 66.1% of North Carolina's population resided in urban areas (up from 50% in 1990). By 2040, it is expected to reach over 75%. Also, senior and elderly populations are growing significantly and these groups will be more dependent on walking and transit in the future. The WalkBikeNC Plan stated that in 2010, the 65+ age group in North Carolina accounted for 13% of the population but that by 2032, this number is projected to be nearly 20%. Since the WalkBikeNC Plan, an explosion of micro-mobility options has occurred with bike share and scooters appearing in more North Carolina cities. In the era of smartphones and technology, these micro-mobility (personal, compact transportation) options will continue to encourage North Carolina residents, especially those in urban areas, to move about apart from their automobile.

³⁶ Frontier Group – U.S. PIRG – Transportation and the New Generation

In addition to demographic, cultural, and technology shifts, the world of bicycle and pedestrian design has changed dramatically over the last decade. New facility treatments such as separated bikeways, bicycle boulevards, and protected intersections are being added to North Carolina roadways. While the bicycle lane was the standard treatment for many years, national studies and North Carolina anecdotal analysis confirms that a stripe of paint for bicycling does not feel safe for the majority of North Carolinians. However, the newer and innovative treatments, such as separated bikeways and protected intersections, are coming from National Association of City Transportation Officials (NACTO), Federal Highway Administration (FHWA), and American Association of State Highway and Transportation Officials (AASHTO). Kinston, Raleigh, and Charlotte have implemented separated bikeways; Charlotte has implemented protected intersections; Wilmington, Raleigh, and Durham are implementing bicycle boulevards.

While there is growing understanding among NCDOT, county, RPO/MPO, and municipal officials in North Carolina about the importance of providing facilities for bicycling and walking, there is still progress to be made. The DBPT Bicycle and Pedestrian Grant Initiative, described below, have helped to create wider understanding and support of walking and bicycling as forms of transportation. In addition, NCDOT's complete streets policy and the Complete Streets Design Guidelines have improved the application of this approach, but the success has been uneven across the state. The policy today has not transcended into the way NCDOT "does business." Until that level of adoption is achieved, there will remain inconsistency across the state.

KEY CHALLENGES FOR PEDESTRIAN/BICYCLE IN NORTH CAROLINA

The most significant challenge for bicycling and walking in North Carolina is the lack of consistent and connected infrastructure. While this infrastructure is being added in locations across the state, it will take a significant increase in resources to have it be connected, allowing for complete, safe, and accessible walking and bicycling trips. Related to this is a lack of funding and challenges with state-level funding that make it difficult to implement bikeways and walkways. Because we have built transportation networks almost exclusively for automobiles over the past several decades, the challenge is to retrofit biking and walking facilities into the existing build environment. Often, the challenges include limited right-of-ways, competing interests such as parking, driveways, and utilities, and funding for significant pedestrian and bicycling infrastructure.

Today, in most North Carolina communities, a standard walking trip would likely encounter sidewalk gaps, missing curb ramps, faded marked crosswalks, transit stops without accommodations, no street trees, and multiple driveway crossings. Because of policy and land use decisions over the past few decades, connected, consistent walking trips are the rarity, not the norm. In addition, motorist compliance such as yielding to pedestrians in crosswalks is often lacking.

A standard biking trip in North Carolina may include a short section of shared-use path but more commonly long stretches of sharing travel lanes with automobiles without a distinct bicycling facility. Even when a bike lane is present, the lane fades away entering an intersection, making a bicyclist have to re-enter the travel lane without separated or denoted space. In addition, motorist-bicyclist conflicts still occur with improper spacing given to the bicyclist when passing and a lack of understanding, by some, that a bicyclist has the same rights to the road. In addition, some bicyclists disobey traffic laws which only exacerbate motorist-bicyclist conflict. Additional education and enforcement programs will be needed in the future to ensure the safety of all roadway users.

NC MOVES 2050 DRIVERS & OPPORTUNITIES

North Carolina is experiencing a growing population, a rising senior population, a movement of millennials away from car ownership and towards more urban environments, continued major bicyclist and pedestrian safety

issues, rising obesity in part due to how we've built our car-oriented communities, and continued challenges around state policy and funding that make providing bicycle and pedestrian infrastructure challenging. The following are key strategic issues, needs, and trends.

The most pressing and current trend, issue, and disruption are new mobility and micro-mobility. Micro-mobility is defined as compact sized, lighter weight vehicles, often electric powered, designed for personal mobility. New mobility includes the electrification of bikes, bike share, scooters, and other micro-mobility options. The DBPT has been tasked in determining how these current changes can be addressed at the state level for both policy and infrastructure. Currently, state statutes are unclear in relation to policies around this fast-growing micro-mobility industry. DBPT is looking at other states and how they have dealt with these issues.

Funding for bicycling and walking infrastructure remains a critical issue and need across the state. Current STI law limits the use of state funds to support bicycle and pedestrian projects and requires that the local government act as the project sponsor and provide the required match for federal funds. Part of the reason for this is that federal Transportation Alternatives Program (TAP) funds requires non-DOT entities to serve as the project sponsor and take the responsibility for project delivery. In addition, many municipal partners lack the technical capacity to take on the project. Projects will sometimes drop out of the State Transportation Improvement Program (STIP) because the local project sponsor doesn't local match or capacity. In addition, the local match and "betterment" (sidewalks) is in contrast from NCDOT Complete Streets policy where "additional" sidewalks, side-paths, and bikeways aren't seen as an extra or "betterment," but as a standard part of the project. State law also has significant impact on DBPT being able to be a good partner for implementing projects. DBPT receives operational funds only. Finally, STI is not conducive to spreading independent bicycle and pedestrian project monies across the state. It's dependent upon MPOs and RPOs to not only make sure those projects score well but are included in the prioritization process.

NCDOT's Roadway Design Manual is out-of-date with the latest revision date of 2002. Bicycle and pedestrian design has changed dramatically since the development of this Design Manual to include separated bikeways, protected intersections, bicycle boulevards, etc. The NCDOT Complete Streets Design Guidelines provides some advancement but does not include separated bikeways (the Complete Streets Design Guidelines are being updated currently). The Design Manual will need to be updated to normalize and operationalize current bicycle and pedestrian design options. In addition, NCDOT could have a policy that links current NACTO, AASHTO, and FHWA guidance to be utilized by NCDOT engineers.

Finally, **analysis of the 2013 WalkBikeNC Plan and Complete Streets implementation progress** will identify additional issues and needs for consideration. Currently, Complete Streets implementation and the 2013 WalkBikeNC Plan's implementation is not being monitored or tracked.

5.5 REVIEW OF THE CURRENT PLAN

PEDESTRIAN/BICYCLE PLANNING PROCESS

The DBPT completed and adopted its comprehensive statewide plan in 2013 (WalkBikeNC). This was the state's first comprehensive bicycle and pedestrian plan, providing an update to the policy-focused 1996 Bicycling and Walking in North Carolina: A Long-Range Transportation Plan. WalkBikeNC was jointly funded by North Carolina Departments of Environmental Quality, Commerce, and Health and Human Services. The plan focuses on five principles: mobility, health, economy, environment, and safety. The Plan provides a “kitchen sink” of action strategies for NCDOT, MPOs, RPOs, and municipalities across the state to more effectively accommodate bicycling and walking as modes of transportation. As part of WalkBikeNC, the plan analyzed state bike routes, which were established in North Carolina in the 1970s. The plan identifies improvements to existing routes, re-routes in some cases, and the addition of new routes. Because the character of North Carolina had changed over a 40-year period, some roadways previously dedicated as state bike routes were no longer safe for long distance bicycling.

The DBPT has also supported municipalities, RPOs, MPOs, and some counties through its Bicycle and Pedestrian Planning Grant Initiative. This program has illuminated bicycling and walking as modes of transportation and helped to build support, introduced the importance of bicycling and walking safety, and helped to build local coalitions that strive to make their communities more walkable and bikeable. Started in 2004, this competitive grant process has allowed municipalities to receive funding support to complete a bicycle and/or pedestrian plans for their community. Through 14 years of the program, 193 planning grants have been awarded (190 municipalities and 3 counties) with a total of \$5.5 million allocated. In addition, 13 regional bicycle plans have been funded outside the Planning Grant Initiative. Since 2008, 30 communities have implemented 1 to 4 projects from their completed plan; 37 communities have completed 5 to 9 projects; 24 communities have completed 10 or more projects. In addition, since 2008, the plans have generated over 500 STI project submissions with close to 40 projects allocated funding in the 2018-2027 STIP. Currently, in the 2018-2019 cycle, DBPT is funding “accelerated” bicycle and pedestrian plans for small communities under 5,000 in population to give them new opportunities to have a bicycle and/or pedestrian plan of their own.

Figure 25 Implementation Progress of Communities that received planning grant funds



Source: Bicycle and Pedestrian Planning Grant Initiative

Stronger bicycle/pedestrian project implementation rates can be found along the I-85 corridor, in the Piedmont, where North Carolina’s largest cities are. This corridor is also seeing the greatest development and population increase, specifically the Charlotte and Triangle metro regions. Other investment zones can be found along the immediate coast and some mountain communities.

Currently, DBPT has no immediate plans to update WalkBikeNC; much of the determination as to how and when the bicycle/pedestrian plan will be updated will be guided by an evaluation of the implementation of the 2013 WalkBikeNC Plan. The DBPT is interested in utilizing the NC Moves 2050 Plan to continue to move bicycling and walking transportation forward within NCDOT. At the end of 2018, the Division began developing an updated vision and strategic plan. The straightforward and simple plan will identify what the Division is doing well now and what they can do differently to implement their vision. Part of this effort involves the assessment of how much the Division has accomplished.

GOALS AND PERFORMANCE MEASURES

Goals and performance measures were identified in the 2013 WalkBikeNC Plan. WalkBikeNC identified five specific overarching goals related to the five pillars of the Plan. It is a current goal of DBPT to evaluate progress in implementing the goals and action items of WalkBikeNC. Because WalkBikeNC was funded by multiple agencies outside NCDOT, goals related to health, economic development, and the environment were included:

- Improve **safety** for all roadway users through strategic, consistent, and connected pedestrian and bicycle facility improvements, education, and enforcement strategies.
- Improve **mobility** strategically with greater investment in walking and biking infrastructure (through a Complete Streets approach), improved transportation equity and choice, connectivity between transportation modes, reduced traffic congestion, and through better coordination between land use and transportation planning.
- Contribute **to public health** by providing active living environments with safe, connected, accessible facilities along with programs that encourage walking and bicycling.

- Maximize **economic competitiveness and return on investment** by creating more attractive walkable and bikeable communities and jobs through additional NCDOT, public, and private funding.
- Advance **environmental stewardship** by reducing automobile dependence and connecting and protecting North Carolina’s natural resources through a network of greenways.

WalkBikeNC provided a library of potential performance measures that were gathered from research on other state DOTs. However, no performance measures have been explicitly tracked since the development and adoption plan, largely due to a lack of resources and data. The current NCDOT Dashboard, which measures how well the department is scoring on performance targets, does not include any measurement related to bicycle and pedestrian transportation. Currently, DBPT is working to identify measures that can be legitimately tracked and whether the tracking can happen in an automated fashion. Performance measures under consideration include bike/pedestrian crash rate (crashes per capita) and spending rate on TAP monies. As described above, DBPT is planning to do a comprehensive evaluation of WalkBikeNC’s implementation progress. In addition, DBPT will be seeking research assistance in 2019 to evaluate how NCDOT is doing compared to its peer states related to funding, TAP delivery rates and system performance.

KEY STRATEGIC ISSUES, NEEDS, AND TRENDS

The health, safety, mobility, and demographic trends described in the previous sections apply here and much of this was identified in the 2013 WalkBikeNC Plan. Key strategic issues, needs, and trends are centered on the five pillars of the Plan:

Mobility: Less than 2% of total transportation funding goes towards pedestrian and bicycle infrastructure development. The 2040 Statewide Transportation Plan reported pedestrian and bicycle conditions to be at the low end of grade “D” for level of service.

Safety: North Carolina ranks as one of the least safe states in the U.S. for walking and bicycling. From 2007-2011, an average of 162 pedestrians and 19 bicyclists were killed each year; from 2011 to 2015, an average of 176 pedestrians and 22 bicyclists were killed each year. According to a survey of 16,000 North Carolina residents for the 2011 North Carolina Bicycle and Pedestrian Safety Summit, the most commonly reported safety issue for walking and bicycling was inadequate infrastructure (75% of respondents).

Health: North Carolina’s transportation system is one of the most important drivers of how we interact with our environment. The land use/transportation combination effectively determines whether trips are reasonable to make by walking or bicycling. North Carolina is ranked in the top 10 worst in most categories of health, and physical inactivity costs \$3.67 billion annually in North Carolina. Meanwhile, every dollar invested in pedestrian and bicycle trails can result in a savings of nearly \$3 in direct medical expenses.

Economics: Facilities for bicyclists and pedestrians generate economic returns through improved health, property values, tourism, spending, etc. WalkBikeNC estimates that the addition of 300 miles of greenway would result in \$64 million increase in property values; 1,600 jobs; 26,000 newly active residents; \$68 million increase in visitor spending; and a reduction in health care by \$76 million annually. The 2018 NCDOT Evaluating the Economic Impact of Shared-use Paths in North Carolina study found that every \$1.00 of shared-use path capital investment supports \$1.72 annually from sales revenue, sales tax revenue, and benefits related to health and transportation.³⁷

³⁷ <https://itre.ncsu.edu/focus/bike-ped/sup-economic-impacts/>

Environment: The impact of automobile traffic and congestion is harmful to air quality and to larger climate change issues. Walking and bicycling have a neutral impact on the environment. Replacing two miles of driving each day, in one year, with walking and bicycling prevents 730 pounds of carbon dioxide from entering the atmosphere.

COORDINATION OPPORTUNITIES AND CHALLENGES FOR NEXT PLAN UPDATE

Because many of the underpinnings and pillars of WalkBikeNC are closely aligned with focus areas of the NC Moves 2050 Plan, providing opportunities for significant coordination. The Plan, in its effort to be comprehensive across all modes, can help set the tone for DBPT and bicycling and pedestrian transportation in North Carolina. The demographic changes, safety, equity, health, accessibility, and micro-mobility disruption affect all modes of transportation. It also could be part of an update to WalkBikeNC, and the action steps could springboard into a full update to WalkBikeNC. NC Moves 2050 is a real opportunity for walking and bicycling to have a significant and visible role in the statewide plan.

As described above, one of the next steps for DBPT is to identify the implementation progress that has occurred since WalkBikeNC. That information will be useful for consideration during the plan development and the next bicycle/pedestrian plan update. In addition, the micro-mobility disruptions that are ongoing should be closely monitored and addressed. The DBPT is already a willing partner in studying what other states are doing from a policy and infrastructure standpoint; the NC Moves 2050 Plan can include this driver in the larger context of transportation in North Carolina.

6. STATE OF THE SYSTEM – PASSENGER RAIL

6.1 OVERVIEW

North Carolina is served by multiple intercity passenger rail routes provided by the National Railroad Passenger Corporation known as Amtrak. Amtrak was established in 1970 by Congress with the passage of the National Railway Passenger Service Act. Today Amtrak operates a national rail network providing over 31 million trips annually on more than 300 Amtrak trains, serving over 500 destinations in 46 states, the District of Columbia, and three Canadian provinces. Amtrak service covers over 21,000 miles of passenger rail routes, along with approximately 600 Thruway bus routes serving over 400 additional communities that do not have passenger rail service.

North Carolina is one of 18 states that provide financial support of 29 short-distance routes. Short distance routes are defined as routes less than 750 miles. There are two routes within North Carolina that are classified as short-distance routes, the *Carolinian* which operates from Charlotte to Washington D.C. and the *Piedmont* which operates from Charlotte to Raleigh. The *Carolinian* ends in New York City; however, that portion of the route is not included in the state supported funding allocation. State supported routes allocate funding per Section 209 of the Passenger Rail Investment and Improvement Act (PRIIA) of 2008. Under PRIIA, Amtrak and the state partners developed a joint cost sharing methodology that standardized the costs states are charged for supporting intercity passenger rail service.

Besides the two state-supported routes, there are four other intercity passenger rail routes, the Palmetto, the Silver Meteor, the Silver Star and the Crescent. The Silver Meteor and Silver Star both operate between Miami, Florida and New York City with a roundtrip per day in each direction. The Palmetto operates between New York City and Savannah, Georgia with a roundtrip per day in each direction. The Crescent operates between New York City and New Orleans, Louisiana with a roundtrip per day in each direction. Figure 26 depicts passenger train service in North Carolina.



Passengers board an Amtrak train

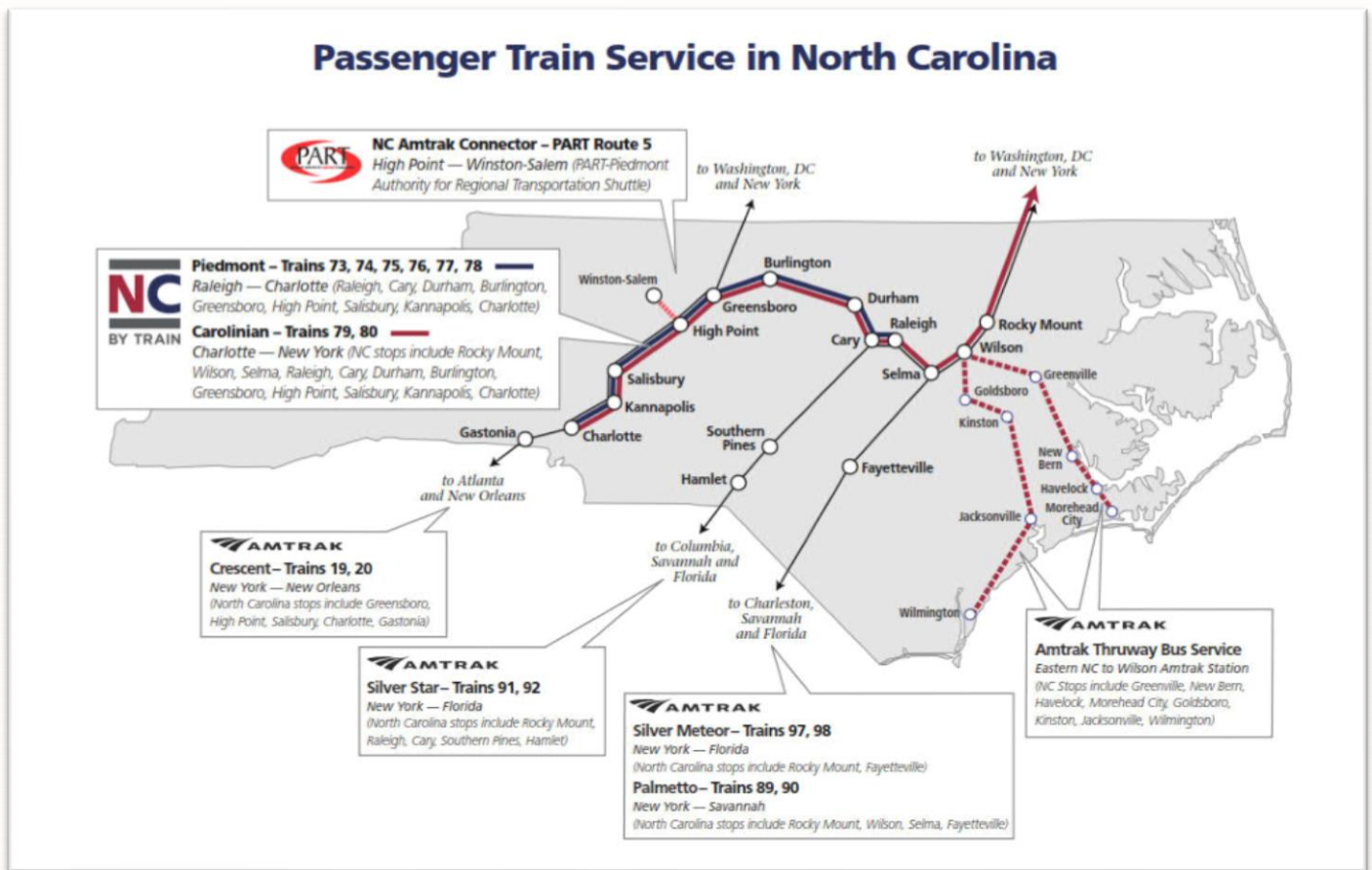


Salisbury, North Carolina Train Station

Amtrak also operates two Thruway Bus routes in eastern North Carolina that connects with the north and south bound Palmettos at Wilson, North Carolina. One Thruway bus route serves Morehead City with intermediates stops at Greenville, New Bern, and Havelock. The other Thruway routes serves Wilmington, with stops at Goldsboro, Kinston and Jacksonville.

North Carolina has 16 stations serving the 5 Amtrak routes. There are a number of stations that serve multiple routes, as shown in Figure 26 below. Stations are either staffed by Amtrak personnel (Cary, Charlotte, Durham, Fayetteville, Greensboro, Raleigh, Rocky Mount, and Wilson), NCDOT (Burlington, High Point, Kannapolis, Salisbury, and Selma), or are unattended (Gastonia, Hamlet, and Southern Pines). The amenities vary by station from bike racks to visitor centers, and North Carolina is proud to have both historic stations and new state-of-the-art stations. Raleigh's intercity passenger rail station, Raleigh Union Station, was recently opened. Bus includes retail, office and event spaces in conjunction with the Amtrak waiting area, ticketing facilities, and crew base.

Figure 26 Passenger Train Service in North Carolina



Source: NCDOT Rail Division

Many of the North Carolina stations provide first-mile/last-mile connections to local transit agencies, private providers, and other modes of transportation. NCDOT Rail Division has recently developed a formal transit transfer agreement between the NCDOT Rail Division and 11 transit agencies located along the *Carolinian/Piedmont* passenger rail corridor. The agreement allows rail passengers two bus rides (1 ride and 1

transfer) by using the NCBYTrain transfer pass. The pass is good for the day it is received and is included in the price of the passenger's train ticket.

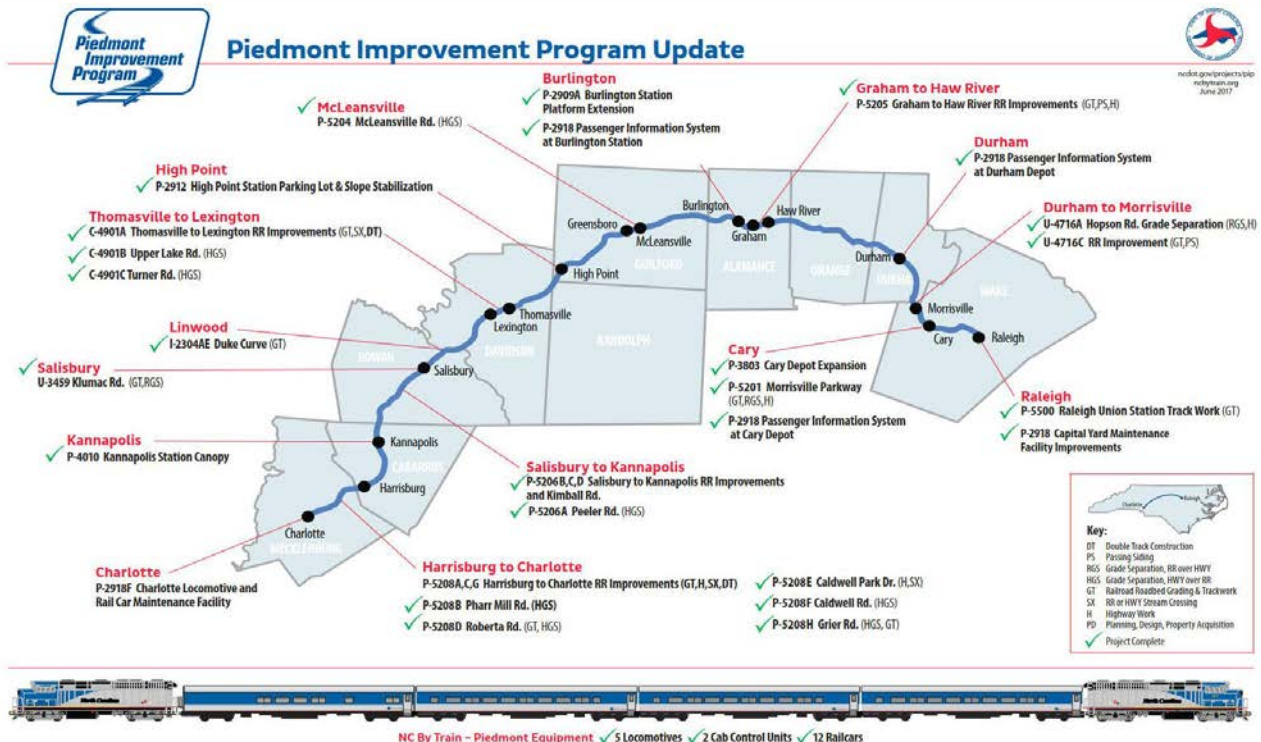
6.2 PASSENGER RAIL IN NORTH CAROLINA

PASSENGER RAIL CORRIDOR IMPROVEMENTS

In 2010, NCDOT was extremely successful in securing \$520 million in Federal Railroad Administration (FRA) grants from the American Recovery and Reinvestment Act. These improvements known as the Piedmont Improvement Program (PIP) invested the money into a series of railroad and highway projects that enhanced passenger rail and freight service between Charlotte and Raleigh in order to make train travel safer and more reliable, as shown in Figure 27. This is an important need since the rail corridor is shared with Amtrak, Norfolk Southern (NS), and CSX Transportation (CSX). This program of improvements also enabled the addition of a new daily *Piedmont* passenger train round-trip, which began revenue service in June 2018. The PIP Improvements included:

- Constructing 13 bridges to eliminate at-grade crossings
- Adding 27 miles of parallel, or second track, between Greensboro and Charlotte, thus creating a continuous 92-mile double track corridor
- Adding 5 miles of passing sidings between Raleigh and Greensboro
- Constructing approximately 12 miles of new highways to connect to the new grade separations and eliminate existing at-grade crossings
- Eliminating more than 40 at-grade crossings
- Improving railroad curves in order to increase train operating speeds
- Renovating train stations in Cary, High Point, Burlington, and Kannapolis
- Refurbishing and adding passenger rail cars to the existing NCDOT and Piedmont fleet

Figure 27 Piedmont Improvement Program



Source: NCDOT Rail Division

6.3 WHY PASSENGER RAIL IS IMPORTANT TO NORTH CAROLINA

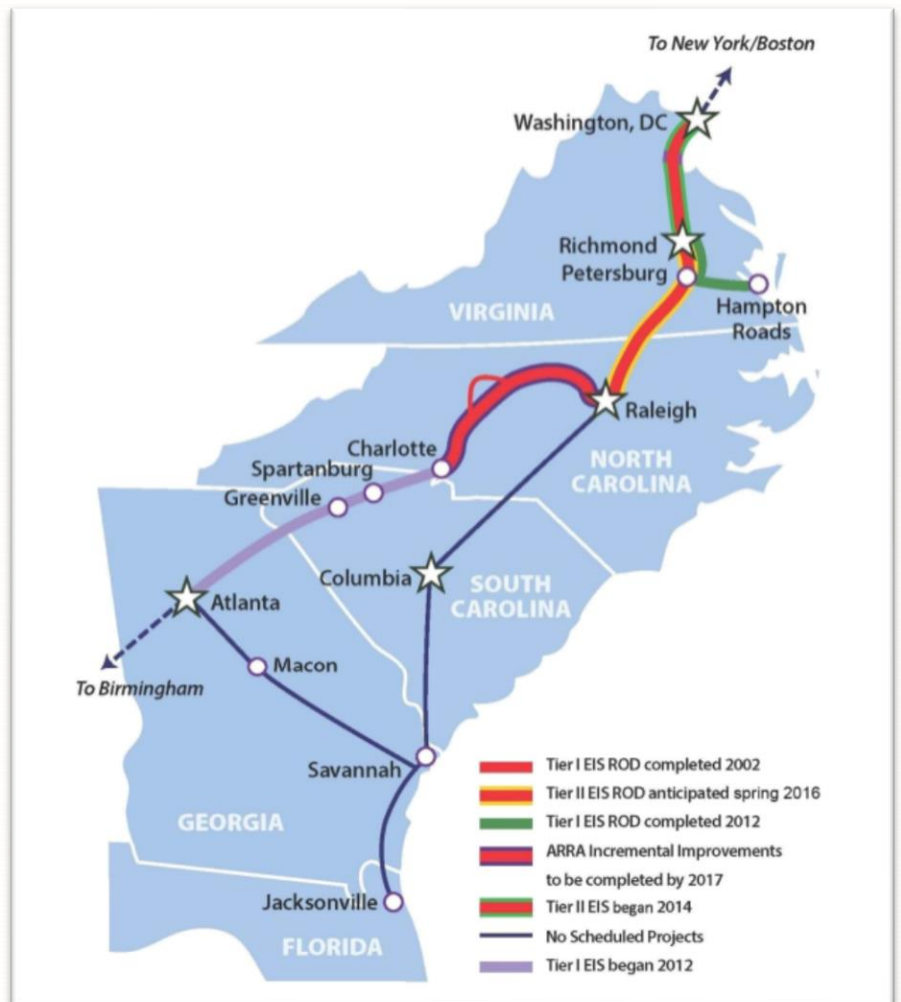
Even though passenger rail is viewed as an alternative mode of transportation, it is a critically important element in North Carolina’s transportation platform. North Carolina’s goal is to increase passenger rail capacity through efficiency, reliability, and expansion. As noted in the 2015 Comprehensive State Rail Plan, over 70% of North Carolina’s population is within 30 miles of an existing passenger rail station. Due to growth patterns, employment centers may not always be within an urban core. Providing passenger rail service for employees to access jobs is one way to increase ridership and assists in the deduction of vehicles on the major interstates.

NCDOT’s vision is to add rail passenger miles in North Carolina and serve more of the state. This goal may be accomplished by adding additional frequencies to the Piedmont route, expansion of the Amtrak Thruway bus service, and investigation of the feasibility of passenger rail service to Eastern and Western North Carolina. With the completion of the Richmond to Raleigh High Speed Rail study, a subset of the Southeast High-Speed Rail Corridor expanded and higher speed passenger rail service is envisioned. NCDOT is currently progressing with grade separation projects along this corridor and hopes to purchase of a portion of the CSX S-Line moving forward. The FRA issued a Record of Decision in 2017 for the development of the Richmond to Raleigh project.³⁸ This is a section of the overall Southeast Rail Corridor as depicted in Figure 28.

REGIONAL COOPERATION

Virginia and North Carolina established the Virginia-North Carolina Interstate High-Speed Rail Compact in 2004. The intention was to coordinate efforts to establish higher speed rail service in Virginia, North Carolina, and adjacent states and advocate as a bi-state unit for federal funding for implantation of higher speed rail service. Virginia and NCDOT (The Compact) voted to start the process to expand the Compact and add Washington D.C., South Carolina, Georgia, Florida, and Tennessee. Those States will then enact the required enabling legislation to allow the state’s to apply for federal funding for rail projects as a region. The vision is that working together as a cohesive regional team, the Southeast Rail Commission, will strengthen the region’s opportunities to receive federal funding

Figure 28 Southeast Rail Corridor



Source: NCDOT Rail Division

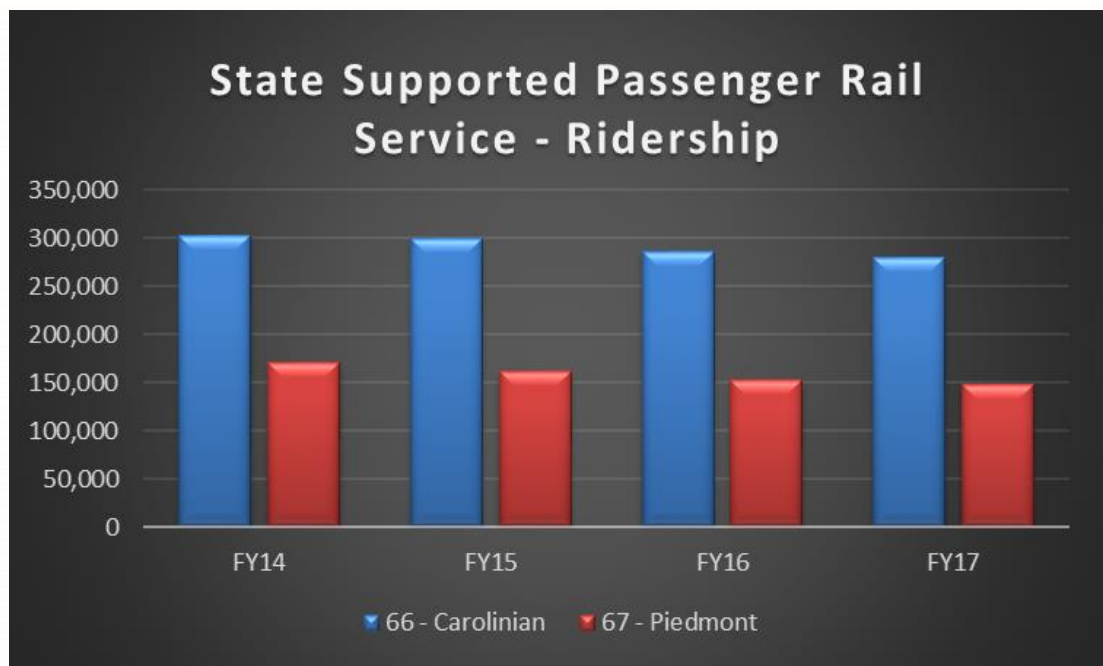
³⁸ <https://www.ncdot.gov/projects/southeast-corridor/Pages/study-history.aspx>

and implement significant rail improvement projects. FRA's Southeast Charlotte – Atlanta Regional Study is about to be released and contains important information on the goals and steps required to establish this new Multi-State Rail Compact.

6.4 TRENDS AFFECTING PASSENGER RAIL

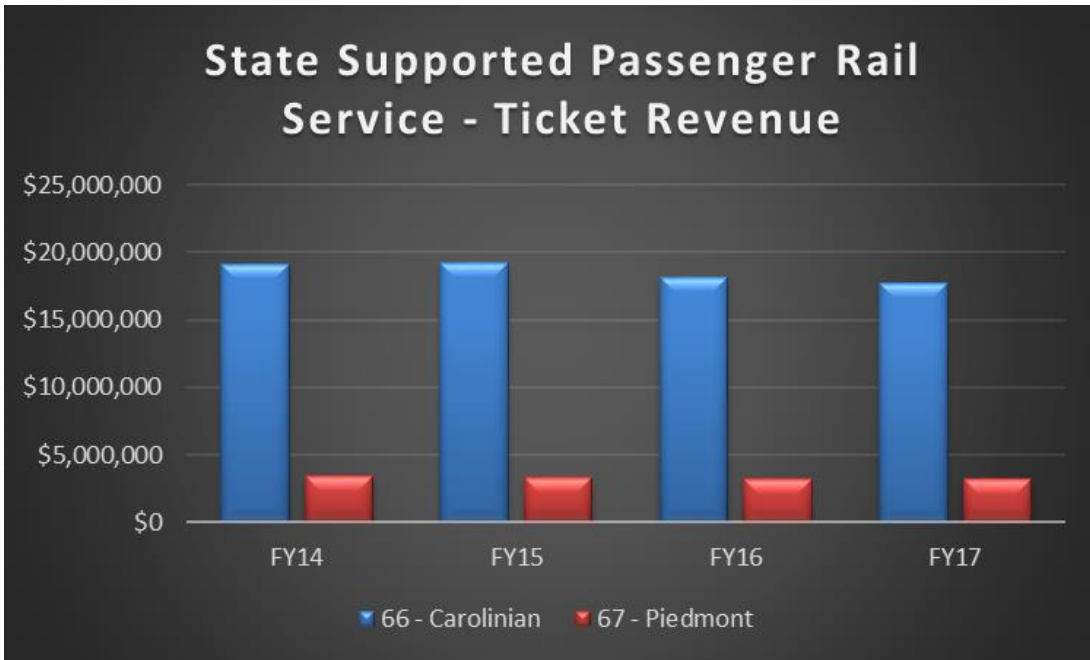
Figures 29 through 31 reflect the trends in ridership and ticket revenue for the two-state supported passenger rail routes in North Carolina since 2014. Ridership and ticket revenue have slowly declined over the past four years. This is mainly attributed to the PIP construction projects that the required numerous track outages and train annulments. As for Amtrak long distance trains, the Figures below reflect the trends in ridership and ticket revenue since 2014 for the three long distance passenger rail routes that traverse North Carolina.

Figure 29 State Supported Passenger Rail Service Ridership Trends



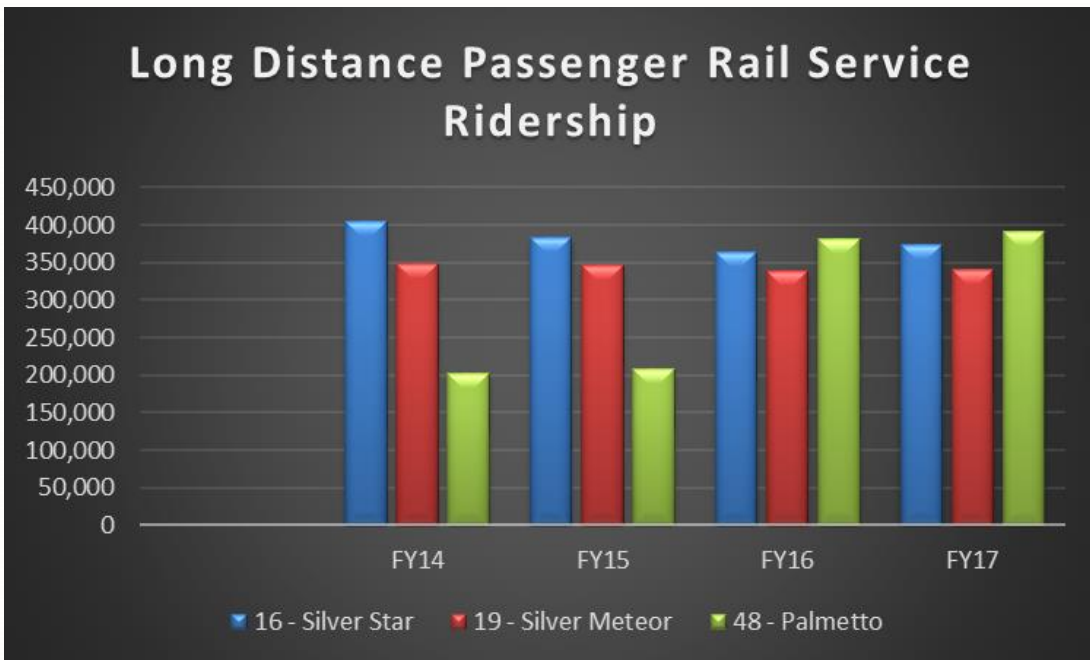
Source: NCDOT Rail Division

Figure 30 State Supported Passenger Rail Service Ticket Revenue Trends



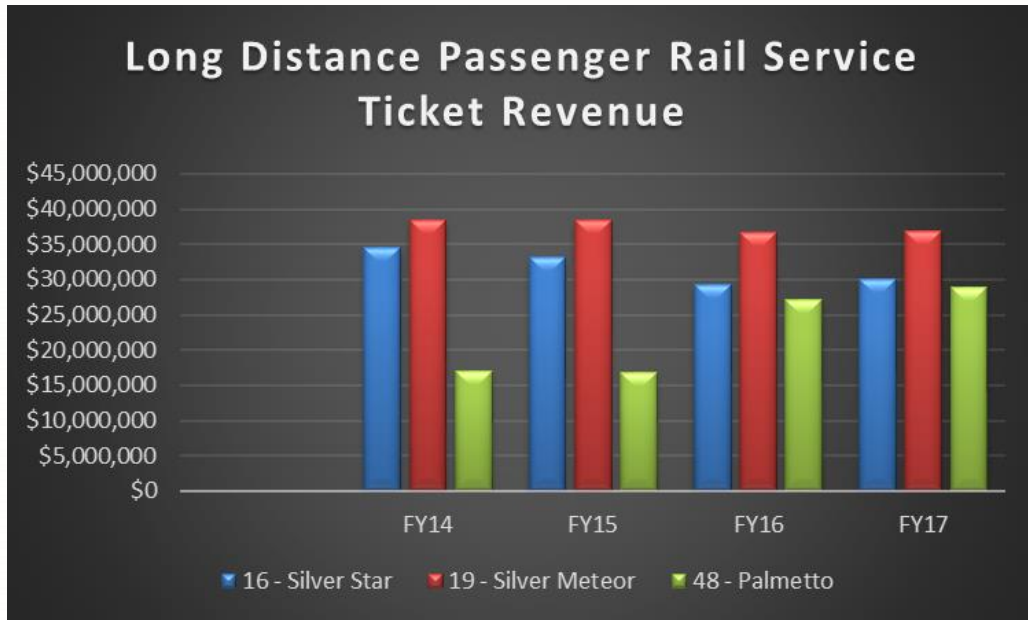
Source: NCDOT Rail Division

Figure 31 Long Distance Passenger Rail Service Ridership Trends



Source: NCDOT Rail Division

Figure 32 Long Distance Passenger Rail Service Ticket Revenue Trends



Source: NCDOT Rail Division

Passenger rail operations data is collected monthly by Amtrak. Data metrics collected include ridership, revenue, and performance.

Some of the effects impact declining ridership are due to inexpensive gas, the ease of personal automobile use and passenger rail performance and reliability challenges. On the other side of rail operations, there has been an increase in freight movement via rail. As the majority of passenger rail service operates on Class 1 owned freight railroad corridors, the increase in freight train traffic movement due to either additional freight trains or and the increasing length of freight trains creates more impediments to reliable passenger rail service.

6.5 REVIEW OF THE CURRENT STATE RAIL PLAN

The latest State Rail Plan was completed in 2015. The NCDOT Rail Division is currently in the process of updating the plan to meet FRA requirements and intends to have a 2020 Rail Plan completed by the end of 2019. Since the 2015 plan was published, NCDOT Rail Division has been able to complete a number of improvements that were outlined in the 2015 plan. These include: PIP, design and construction of the Phase I of the Charlotte Maintenance Facility, opening of the new Raleigh Union Station in July 2018, and the addition of the third *Piedmont* frequency in June 2018.

NCDOT Rail Division continues to identify future needs along the passenger rail corridors. Station planning continues for three jurisdictions, Hillsborough, Lexington, and Harrisburg. NCDOT Rail Division continues to evaluate opportunities for implementing Thruway bus service between Asheville and Salisbury. These initiatives, along with the current Phase I construction of a new Charlotte Gateway Station, continue to emphasize the importance of passenger rail service in North Carolina.

7. STATE OF THE SYSTEM – FREIGHT

7.1 OVERVIEW

North Carolina's freight system plays a critical role every day for every resident and business, such as 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;
- 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; and
- Rail line closures and rail service reductions.

7.2 FREIGHT IN NORTH CAROLINA

STATEWIDE

North Carolina has a well-connected multimodal freight transportation network which includes truck, rail, air, water, and pipeline transportation, as well as interchange points between the modes, such as airport terminals, seaports, rail terminals, and warehouse/distribution centers. The state's freight network provides shipping alternatives for all types of commodities produced or consumed in the state and carries a significant volume of freight for the state's businesses and residents, in addition to international freight that moves through ports. 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.

7.2.1.1 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 about 77% of total inbound, outbound, internal, and 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. North Carolina maintains approximately 79,600 miles of roadway, including Interstate Highways, U.S. Routes, State Routes, and Secondary Roads. Secondary Roads account for the largest share of the state-maintained system, over 80% of all roads.

Most of North Carolina's truck flows occur on the interstate highway system. In general, I-85 is the heaviest utilized freight corridor in North Carolina based on truck volumes. Truck volumes on I-85 range from 10,000 to 16,000 trucks per day. In particular, the highest truck volumes occur on I-85 between Greensboro and Durham, nearly 16,000 trucks per day utilize this corridor. Other interstate highways with particularly high truck volumes include I-77, I-40, I-26, and I-95, experiencing between 8,000 and 11,000 trucks daily.

There are also non-interstate 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 non-interstate highway freight corridors are U.S. 74 and U.S. 70 that support North Carolina's two ports in Wilmington and Morehead City.

The top commodities 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.

7.2.1.2 RAIL FREIGHT ASSETS

Rail transport is one of the most cost effective and environmentally friendly means of moving freight and it is vital to many of North Carolina's key exporting industries. There are over 3,200 miles of railroad serving 86 of the state's 100 counties, serving both rural and urban communities. The state's network features two Class I railroads, NS and CSX, and 20 short line railroads that connect businesses and industries to the Class I network. CSX and NS operate approximately 70% of the state's rail system. Short lines and switching companies operate the remainder of the system.

North Carolina's rail network includes two major classification yards, three intermodal terminals, 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 their respective waterfront facilities, as well as 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 network freight rail in North Carolina provides services to ports, power plants, mines, military installations, and industries including agriculture, forestry, plastics, furniture, food products, and chemicals. The top commodities moved by rail carload are coal, hazardous materials and chemicals. Intermodal commodities, such as consumer goods, can be difficult to tease apart and are referred to as Freight All Kinds (FAK). 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. 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 also are notable trading partners. The rail intermodal trade is more balanced with outbound flows accounting for 55%. The top trading partners for intermodal rail include Illinois, Florida, Tennessee, Texas, California, and Georgia.

7.2.1.3 MARINE FREIGHT ASSETS

The state'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. North Carolina's ports depend not only on their respective design and infrastructure, but also on additional facilities such as inland ports and mega-sites that support maritime and other freight movement. Port experts agree that U.S. ports must modernize their terminals and inland infrastructure while planning for bigger cargo volumes and larger ships. Beneficial Cargo Owners (BCO) are focused on port productivity while shipping companies look to consolidate and cascade larger ships into the U.S. trade. Major capital investment at U.S.

ports, in addition to process and equipment improvements like trucker appointment systems, shared equipment/chassis pools and the overall enhancement of terminals and systems will be mandatory.

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. The port of Wilmington has access to one Class I rail line served by CSX. The Port of Morehead City handles bulk and breakbulk goods. The Port of Morehead City is served by NS. North Carolina also has an inland port, the Charlotte Inland Terminal. Out of the nation's more than 300 seaports, 13 have been identified as strategic commercial ports and have been provided with Port Planning Orders so they may fulfill defense requirements. North Carolina's Port of Wilmington and Port of Morehead City have been identified as two of the nation's thirteen Strategic Seaports capable of simultaneously handling commercial and military requirements.

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. These inland wet ports are important options for shippers to and from North Carolina's northeastern coastal region, especially for shipments of bulk, large, or heavy commodities. Shipping via barge saves shippers money relative to rail and truck, avoids wear and tear to the state's roads, improves safety and emissions by reducing truck trips, and allows the ports to serve industrial and commercial locations farther inland.

In fiscal year 2018, containers at North Carolina ports were up 38% over prior year with a compounded annual growth of 6% over the last four years. The volume of refrigerated containers tripled between 2014 and 2018. In 2014, only 6 container carriers were calling Wilmington versus 17 in 2018, with 65 port combinations compared to only 12 in 2014. In Morehead City, annual tonnage was up almost 75% in 2018 from 2014. Setbacks like the Hanjin bankruptcy proved to be a short-term impediment turned opportunity, as NC Ports seized additional market share, proving that best in class crane productivity, lack of berth congestion, yard productivity, gate productivity and fast turn times translates into a meaningful value proposition for container shipping companies and BCOs.

A public private partnership with Enviva Wood Pellets is forecasted to grow to as much as two million tons of exported pellets within the next year. The Port of Wilmington Cold Storage facility is strategically positioned for growth in both the fresh and frozen refrigerated markets. In mid-2017, cost competitive intermodal service was re-established by CSX between the Port of Wilmington and Charlotte to make the container services more viable with a greater market reach.

The Port of Wilmington leveraged state capital funds with Port revenues to allow for infrastructure investments to accommodate ultra-Panamax ships with a wider turning basin, expanded container berthing, and multiple new cranes to handle the size and volume of the new ships. Between 2015 and 2018, the number of container services at the Port of Wilmington increased from 5 to 7, an overall increase of 40%. The Port has plans to continue the container yard expansion into the terminal backlands to improve key exchange nodes, refrigerated container facilities, and terminal upgrades.

NC Ports has initiated a feasibility study with the U.S. Army Corps of Engineers for enhancing the Cape Fear River channel in Wilmington. At the Port of Morehead City, funding from North Carolina helped to resolve shoaling and maintain the current approved channel depth, securing long-term customers like Nutrien. Major transportation nodes and corridors have incorporated freight improvements in road and rail projects to streamline the supply chain and provide a seamless flow between sea, terminal, and hinterland destinations.

North Carolina's marine 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. However, due to the availability of ship calls, storage/equipment availability, among other factors, North Carolina shippers choose to use out-of-state ports to reach some of their leading trade partners.

Trade through North Carolina's ports provides an enormous benefit to the overall regional economy, as identified in the recent economic contribution study that was independently completed by the North Carolina State University's Institute for Transportation Research and Education. Study findings show that there is approximately \$15.4 billion in annual economic contribution to the state's economy constituted by goods moving through North Carolina ports and 87,000 jobs are associated with businesses that use North Carolina's ports.

The large difference between NC Ports compared to that of other South Atlantic ports is mainly reflected in differences in existing transportation infrastructure. Neighboring ports benefit from better rail and highway connections than Wilmington and Morehead City. Inadequate hinterland connectivity is a major factor limiting the geographical area that a port can serve. Given the inland connectivity, it is no surprise that Wilmington and Morehead City have a noticeably smaller economic impact than competing ports that are better supported. It is highly likely that if North Carolina were to improve the infrastructure that impacts NCSPA's ability to attract cargo, there would be an increase in employment, output, income and tax collections that would exceed the cost of the investment.

7.2.1.4 AIR CARGO ASSETS

There are 20 airports with air cargo activity in the state, including both dedicated all-cargo operations and commercial passenger belly cargo. However, three airports comprise over 99 % of air cargo activity in North Carolina: CLT, Piedmont Triad International Airport (GSO), and RDU.

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 % of the state's air cargo. Both Federal Express (FedEx) and United Parcel Service (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 commodities by air at North Carolina airports were electronics, machinery, pharmaceuticals, and precision instruments.

7.2.1.5 NORTH CAROLINA PRIORITY FREIGHT NETWORK

As part of the 2017 Statewide Multimodal Freight Plan, the State's Priority Freight Network was developed and comprised of the highway, rail, seaport, and airport facilities responsible for moving the majority of freight in North Carolina and serving the State's key businesses. Figure 33 shows the priority freight network.

The priority highway freight network includes:

- 4,220 highway miles including all of the interstates and key freight U.S. highways and state highways.

The rail freight assets included in the priority freight network include:

- Two Class I railroads, CSX and NS with 2,300 route miles;
- Two major classification yards;
- Three intermodal terminal and one future intermodal terminal and rail hub; and
- Fifty-five transload facilities that are on the Class I railroad system.

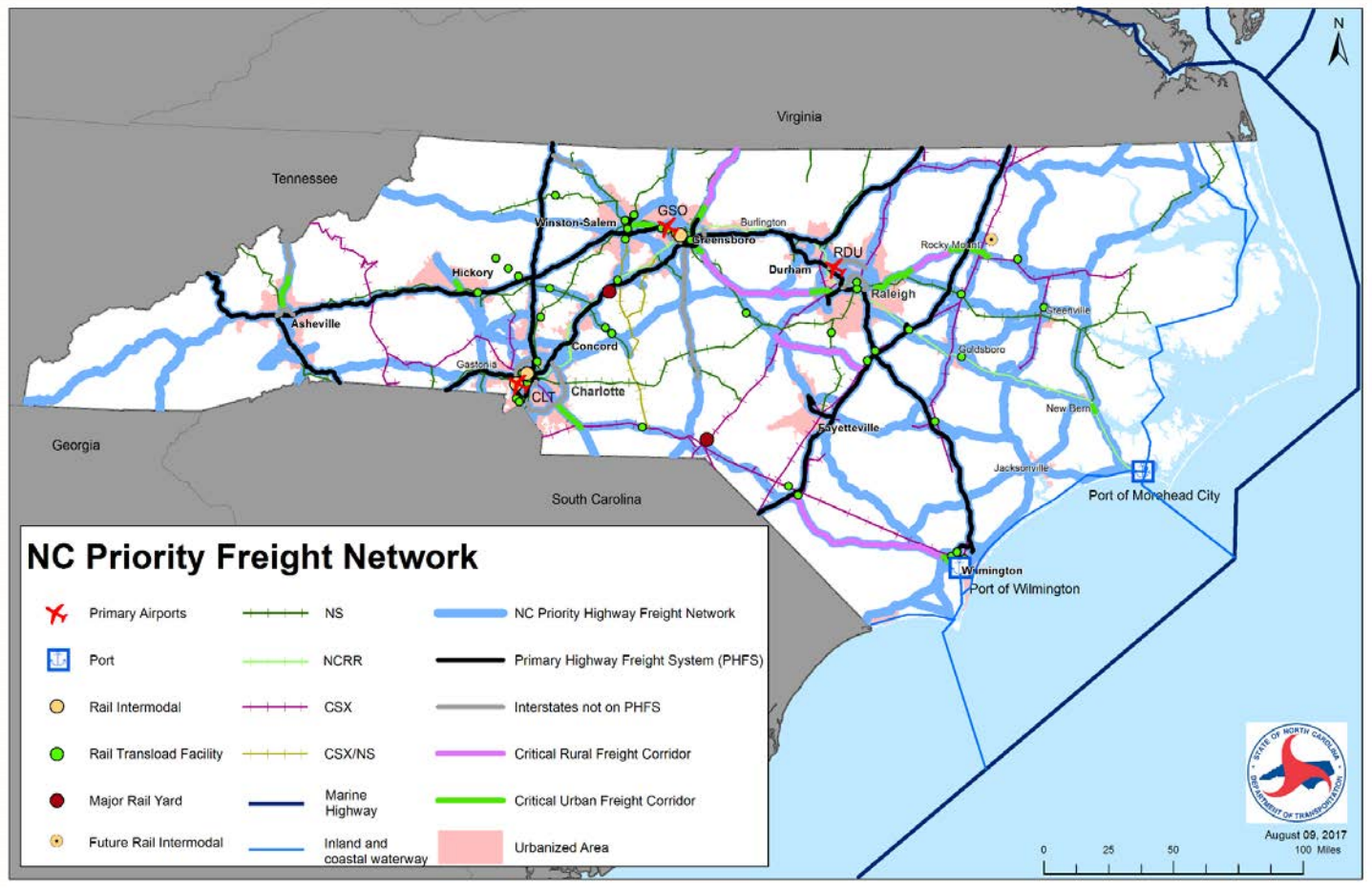
The priority maritime freight assets include:

- Port of Wilmington;
- Port of Morehead City;
- M-95 marine highway corridor and inland and coastal waterway routes Atlantic Intracoastal Waterway, Pasquotank River, and Great Dismal Swamp Canal.

The three largest cargo airports, carrying 99 % of the air cargo in the state are include:

- CLT;
- RDU; and
- GSO.

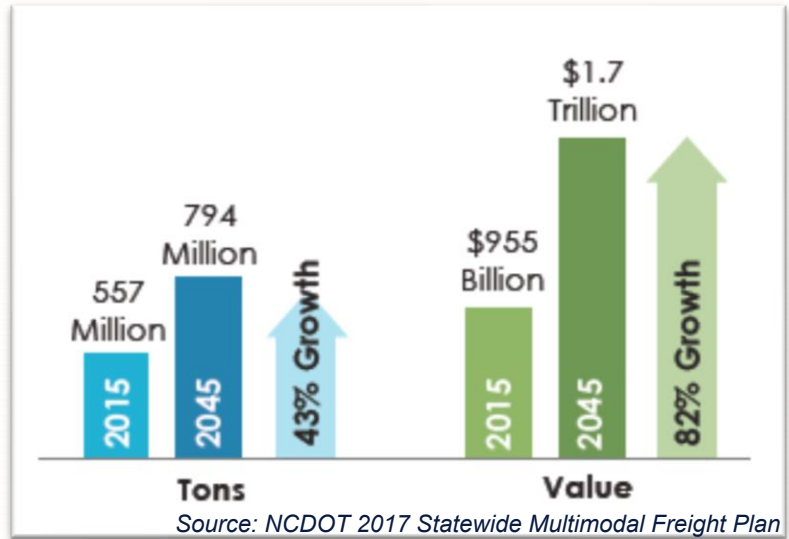
Figure 33 North Carolina Priority Freight Network



Source: NCDOT 2017 Statewide Multimodal Freight Plan

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% by tonnage and 82% by value (see Figure 34).

Figure 34 Current and Projected Freight Moved Across North Carolina



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% 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%). 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.

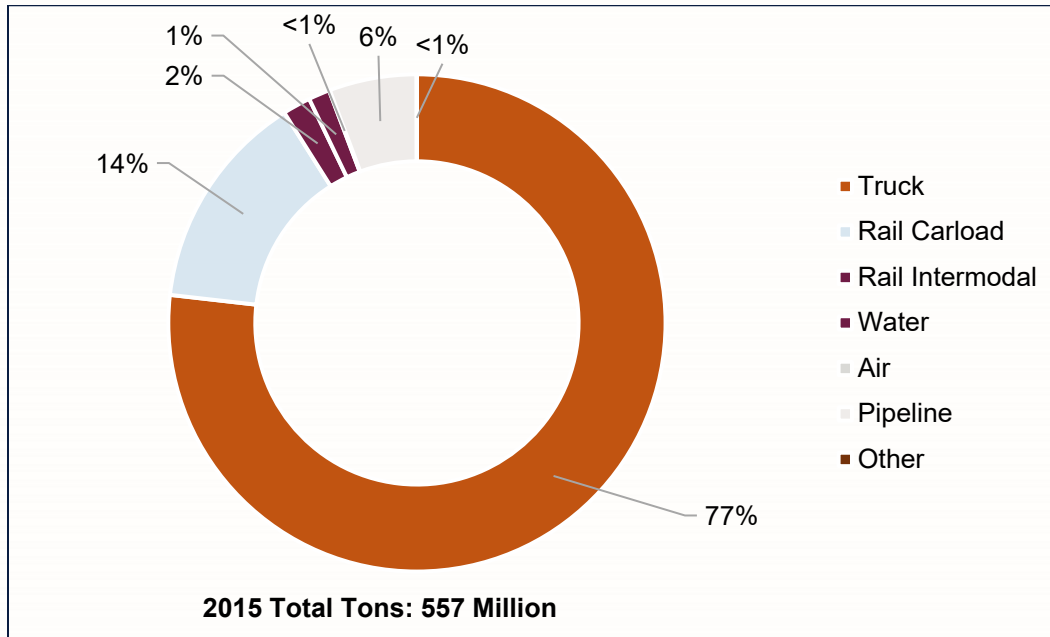
As shown in Figure 35, trucks are the dominant mode utilized for carrying these goods, transporting 77% of the total volume in 2015 (428 million tons worth \$765 billion). The heavy reliance on trucks to move freight has cascading impacts on infrastructure (i.e., roads and bridges), air quality, and the cost to businesses and consumers.

Rail moved the second highest volume of freight, carrying 16% (85 million tons of cargo worth \$143 billion) of the state’s freight volumes, with 14% in full carloads and 2% by intermodal cars. Carload service carries the majority of rail tons in the state, though when measured in units carload and intermodal services are more evenly divided.

Nearly 7 million tons of cargo (1% of the total state tonnage) worth \$15.4 billion were imported and exported by North Carolina ports in 2017. The two North Carolina Ports, located at Wilmington and Morehead City, offer services for a variety of commodity types. Whether it is containers (including increasing volumes of refrigerated containers), bulk and break bulk goods or military vehicle roll on/roll off can be handled by at least one if not both ports.

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

Figure 35 North Carolina Tonnage by Mode, 2015-2045



Source: NCDOT 2017 Statewide Multimodal Freight Plan

Across all modes the top commodities moved by weight throughout North Carolina are bulk commodities such as gravel and crushed stone, other coal and petroleum products not elsewhere classified (including gaseous hydrocarbons such as liquefied natural gas, liquefied propane, liquefied butane, petroleum coke, petroleum asphalt, among others), non-metallic mineral products (including hydraulic cements, ceramic products, glass and glass products, cement and concrete products), coal, and wood products. When measured in value, the top commodities moved are mixed freight, machinery, pharmaceutical products, textiles and leather products, and electronic and electrical equipment and components.

REGIONAL

Most of North Carolina’s top domestic trading partners are concentrated in the Southeast and Mid-Atlantic regions (see Figure 36). 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, and intermodal terminals and inland ports in neighboring states. 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.

Figure 36 North Carolina's Trading Partners



Source: NCDOT 2017 Statewide Multimodal Freight Plan

7.3 WHY FREIGHT IS IMPORTANT TO NORTH CAROLINA

QUALITY OF LIFE

The movement of goods is a major contributor to the North Carolina economy and quality of life. 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 to businesses and residents across the state. Goods movement is critical to everyday life. Goods are the food in the pantry, the clothes bought in the store and ordered online, the office supplies used in the businesses, the walls holding up the buildings, and the trash people generate. The majority of industries and economic activities that consumers and producers depend upon – from grocery stores and restaurants to retail shops, office supplies and construction – rely on the distribution of goods.

A safe and efficient freight transportation system is an important component of business retention and attraction in the state and helps build quality communities with efficient people and goods mobility. NCDOT recognizes the need to set specific multimodal transportation goals, strategies, and actions that contribute to North Carolina job growth, improved economic competitiveness, and enhanced quality of life. The Statewide Multimodal Freight Plan includes a goal for improved livability and environmental sustainability. The objectives under this goal are to: reduce freight-induced negative impacts on natural, cultural and environmental resources; reduce mobile source emissions, greenhouse gases, and energy consumption; reduce noise, vibration and other freight-induced negative impacts on residential communities; and improve quality of life for those communities most impacted by freight operations.

ECONOMICS

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.

The return on transportation investments in economic development generally is greatest for freight, services, and business travel. Freight transport supports economic activity and has high marginal costs, so reductions in travel time translate into relatively high increases in efficiency and productivity. Thus, truck lanes, port and airport improvements, improved port and airport access, and efficient road pricing that gives preferential treatment to higher-value trips (freight, service vehicles, business travel) are likely to produce the greatest returns in economic development.³⁹

There are approximately 236,600 persons in freight-related jobs in North Carolina, ranging from truck drivers to couriers to wholesale workers (see Figure 37). Most of these employees are related to the truck transportation sector, with 119,000 jobs, or 50% of the total freight related jobs. Warehousing and storage provides the second largest number of jobs, amounting to approximately 70,800 or 30% 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.

Figure 37 Economic Contribution of Freight Transportation



Source: NCDOT 2017 Statewide Multimodal Freight Plan

Freight transportation has an important economic role in the state of North Carolina. Other than its potential to support jobs at the local level and its strong linkages with local industries, efficiency in freight transportation is another aspect driving economic development. A complete and well-maintained multimodal transportation network is important in order to reduce logistics costs, which has the potential to lower consumer prices, reduce producer’s costs, and improve the economic competitiveness of local businesses.

VISION FOR FREIGHT IN NORTH CAROLINA

As part of the 2017 Statewide Multimodal Freight Plan, NCDOT developed a freight vision that drives performance measures and freight investment decision-making: “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.”

³⁹ https://www.planning.dot.gov/documents/EconDevelopmentFinal_8-11-14.pdf

To achieve this vision, goals and objective were defined. The goals (see Figure 38) 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 Statewide Multimodal Freight 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.

Freight goals need to also address reliability (consistency/reliability in network) and resiliency (i.e., Hurricane Florence).

- Some thoughts: Enhance reliability and incorporate the ability to rapidly restore access/reliability (what are the techniques to restore functionality after a disaster occurs?)
- Build resiliency to extreme events and hazards by designing and constructing less vulnerable infrastructure to minimize loss/improve and maintain the reliability of core freight corridors (even if that means going above and beyond typical designs to ensure that we can restore operations/access during and after an incident (i.e., build up roadways prone to flooding, etc.)
- Focus on the key freight nodes, challenges, and bottlenecks (part of this is ensuring we have redundancy)
- Quickly respond to clear accidents and restore mobility
- Projects that facilitate future adaptations (futureproof) to accommodate changing demands (i.e., climate change, technology, etc.)

Figure 38 North Carolina Statewide Multimodal Freight Plan Vision and Goals



Source: NCDOT 2017 Statewide Multimodal Freight Plan

7.4 TRENDS AFFECTING FREIGHT

NATIONALLY

7.4.1.1 ENERGY

Energy trends are driven by the relationship between traditional oil prices and the evolution of renewable energy and alternative fuels in the transportation sector. Oil prices are down from last decade's record highs, and a continuation of lower oil prices will favor international movements and longer supply chains as opposed to trends such as near-sourcing. Meanwhile, the growth in renewable energy technologies and the changes in tax credits and other government inducements will be capped by the ability of providers to achieve production efficiencies. Liquefied natural gas and biofuel are a small percentage of current consumption but are expected to increase dramatically between now and 2040. Expansion would mean changes in the fueling, service, and truck stop industries.

7.4.1.2 TECHNOLOGY

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% of total congestion. Decreased congestion provides the opportunity to get more capacity out of the existing system, lessening the need for expensive, time consuming capacity expansion solutions.

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 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.

7.4.1.3 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, three-dimensional printing (3DP) 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.

Additionally, 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.

7.4.1.4 RESHORING OF DOMESTIC MANUFACTURING

The combination of growing wages in China and Southeast Asia and higher transportation costs has led to a number of firms shifting manufacturing back to the U.S., a trend known as reshoring. In spite of 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 for foreign direct investment from international firms.

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. 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.

7.4.1.5 LABOR SHORTAGES

Labor shortages are being felt in the railway and the trucking industries as companies struggle to find a sufficient number of qualified employees for driving trucks and operating trains to both accommodate growth and renew a rapidly aging workforce. Commercial driver's licensing requirements that require drug tests and criminal

background checks greatly reduces the traditional pool of labor that has worked in the trucking industry. Trucking productivity is further challenged by electronic log devices that enforce hours of service.

As of 2017, the American Trucking Association estimated that the trucking industry was short nearly 50,000 drivers.⁴⁰ One reason for the shortage relates to the age of the current truck driver workforce. The median age of an over-the-road truck driver is 49 years, which is significantly higher than the median age of all U.S. workers, which stands at 42 years. In addition, truck drivers must be 21 years old to drive across interstate lines. Interstate motor carriers miss out on hiring individuals aged 18 to 21, who may obtain long-term employment in other sectors prior to their 21st birthdays. The trucking industry has also struggled to recruit women. As of 2016, just 6% of truck drivers in the U.S. were women.⁴¹ Another contributing factor to the truck driver shortage pertains to the quality of the available workforce. In a 2015 survey, 88% of fleets reported receiving a high number of job applications, but the majority were not qualified to become a truck driver. Disqualifying factors included an insufficient driving history, experience, or other factors.⁴² Railroads are also vulnerable to a labor shortage for similar issues of workforce retirements and barriers to bringing in new employees, particularly in operations. Quality of life issues loom large, as irregular hours, drug testing, and other safety requirements, such as background checks, discourage traditional sources of employees for these sector jobs.

7.4.1.6 RAIL FREIGHT TRENDS

Railway business decisions in today's environment face volatility and uncertainty about future markets and modal competition. Since 2010, the railway industry has experienced shifting traffic patterns and flat growth, even with the broad upturn in traffic that began in late 2016 in manifest (or bulk) rail movement. Between 2010 and 2017 carload volumes were flat, declining an average of 0.2% per year, while tonnages have declined on average 1.7% per year. The relative difference between carload volume and tonnage declines reflects the continuing shift to the far lower carrying capacity of intermodal trailers and containers versus conventional railcars. In spite of the recent gains, total carloads have yet to achieve pre-recession levels, with the Class I railroads originating about 3.5 million fewer carloads in 2017 than the peak year of 2006. This trend is evident in Figure 40, which shows annual carload traffic volumes by commodity averaged over five year increments between 1981 and 2017 for all Class I railroads. The drop in both carload as well as tonnage (see Figure 41) can largely be attributed to a 40% decline in coal tonnage since 2008, although some other bulk commodities also experienced declining volumes.

However, intermodal rail volume has been growing rapidly for many years with exports and imports accounting for around half of U.S. rail intermodal traffic. Railroads have invested billions of dollars on new intermodal terminals, track upgrades, and other infrastructure projects that have made intermodal rail more reliable and cost effective. In 2017, rail intermodal volume in the U.S. was a record 13.7 million units, accounting for approximately 24% of revenue for major U.S. railroads (well ahead of coal), and containers accounted for a record 92% of this volume.

Intermodal rail enables ports to reach further into the hinterland compared to the limited reach of transportation via trucks. According to the Journal of Commerce, rail lift shares at neighboring ports are up with major investment plans in place to continue to grow rail volumes.

⁴⁰"2017 Truck Driver Shortage Analysis". American Trucking Association.

<http://progressive2.acs.playstream.com/truckline/progressive/ATAs%20Driver%20Shortage%20Report%202017.pdf>

⁴¹ Ibid.

⁴² Ibid.

Figure 39 Total TEUs and Rail Lift Shares for Neighboring South Atlantic Ports

Port	TEUs (mil)	% of Rail
Savannah	3.9	20%
Virginia	2.8	38%
Charleston	2.2	25%
Jacksonville	1.0	10%

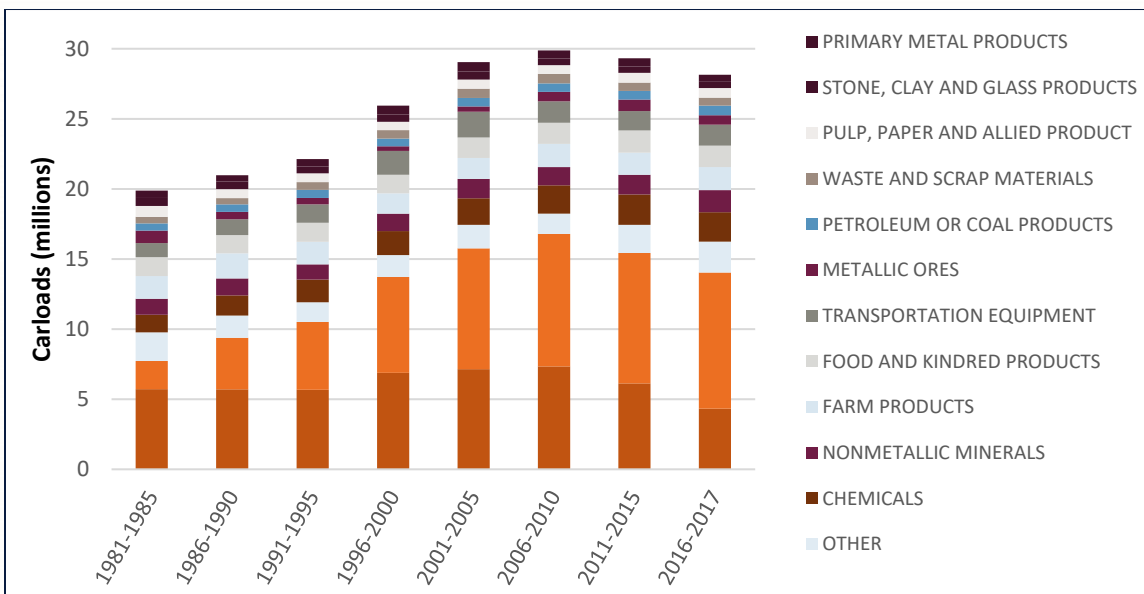
*Information courtesy Journal of Commerce

Source: NCDOT 2017 Statewide Multimodal Freight Plan

In addition, major east coast ports such as Charleston, Savannah, and Virginia have successfully leveraged the inland port concept to their advantage, which were originally envisioned as means to expand market reach to hinterland customers. Today, inland ports help to reduce congestion around urban port facilities and provide truckers a variety of locations to pick up and drop off containers, thereby minimizing truck driving miles at a time of Electronic Logging Device mandate and truck driver shortages. New intermodal facilities in North Carolina would provide similar benefits.

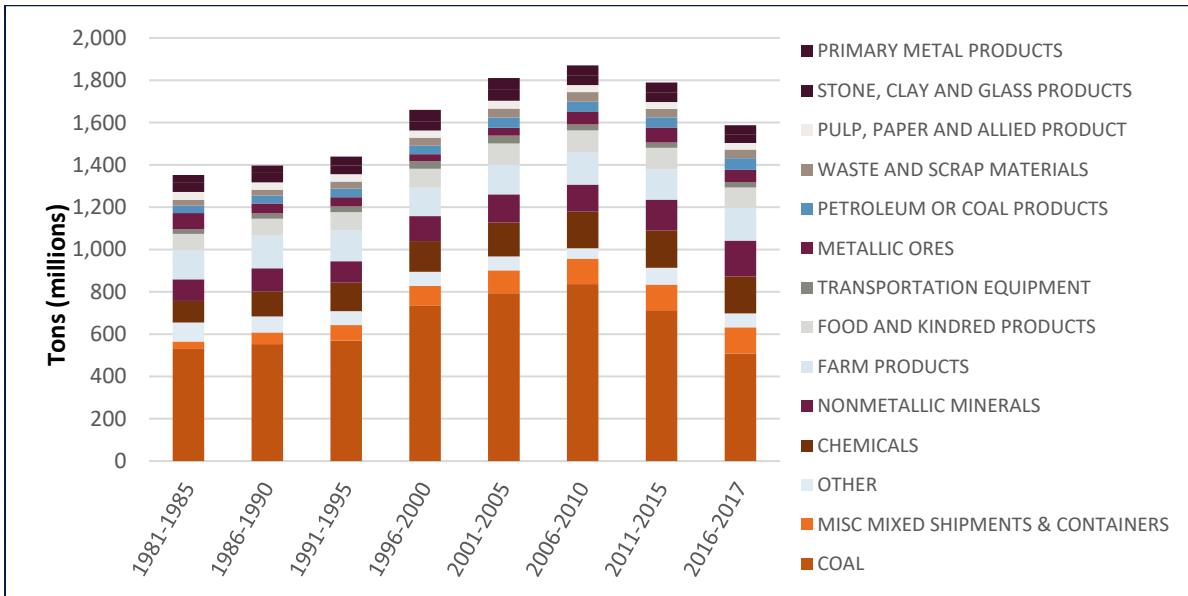
Expanded intermodal rail access via CSX to other inland port locations in North Carolina, as well as access to the broader CSX and U.S. intermodal system, is another strategic imperative for North Carolina. Container lines are mandating that east coast ports have the option of connectivity to the U.S. intermodal rail network. Failure to acquire this competitive competency will have a negative material impact on the Port of Wilmington and the state of North Carolina.

Figure 40 Class I Annualized Carload Trends in Five Year increments by Major Commodity, 1981-2017.



Source: CS, AAR, STB Freight Commodity Statistics

Figure 41 Class I Annualized Tonnage Trends in Five Year increments by Major Commodity, 1981-2017



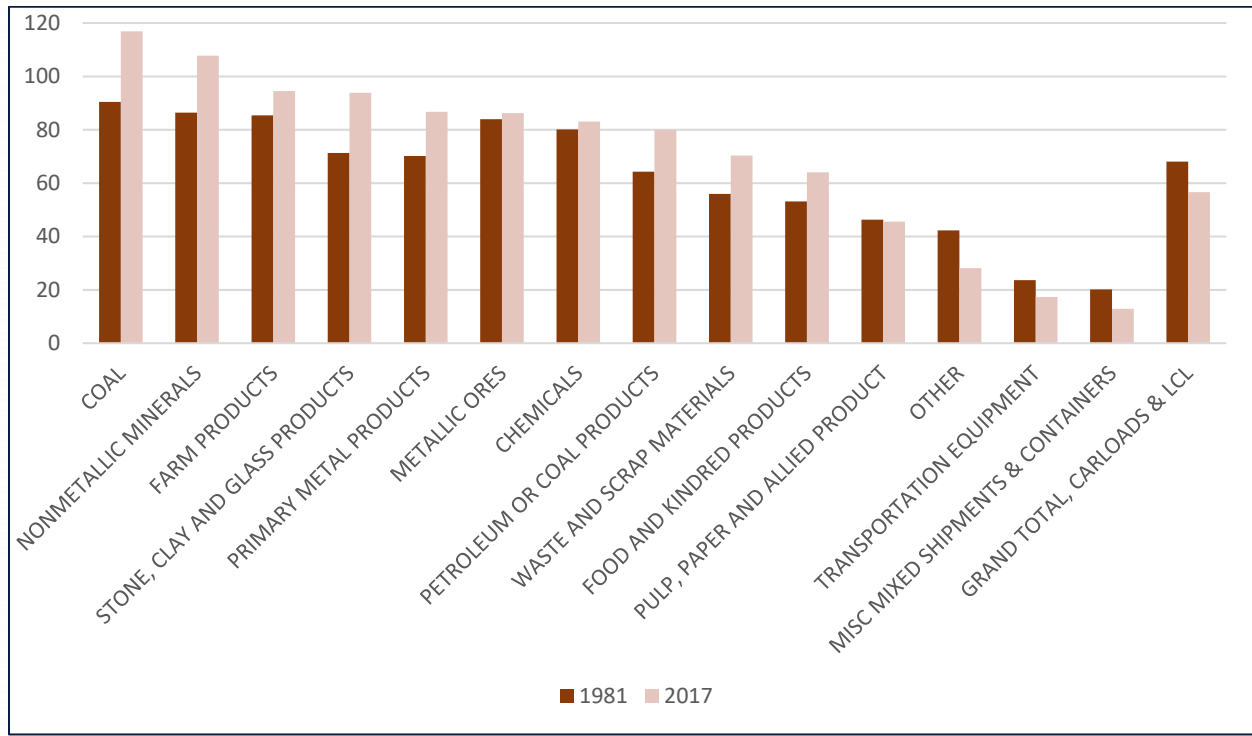
Source: CS, AAR, STB Freight Commodity Statistics

The continued shift from mostly heavy bulk commodities like coal to less dense commodities such as intermodal is evident in Figure 42, which compares the average number of tons per carload for each primary commodity group between the years 1981 and 2017. Overall, for all commodities combined, the average tons per car is declining, a reflection of the growing portion of intermodal traffic and its lower unit capacity than conventional railcars. On the other hand, bulk commodities have experienced an increase in tons per carload between 1981 and 2017. Heavy bulk products such as coal, nonmetallic minerals, stone, and primary metal products increased the most, which came about from the industry-wide adoption of higher capacity railcars that began in 1995.⁴³ At that time, the railroad industry increased the standard maximum weight from 263,000 to 286,000 pounds gross vehicle weight. The only commodities experiencing a decline in tons per car over the past 36 years are paper, other, transportation equipment, and intermodal traffic. These shipments are often limited by volume rather than weight.⁴⁴

⁴³AAR Standard S-259 (S-259) allowing 286,000 pound railcars in unrestricted interchange became effective January 1, 1995.

⁴⁴The decrease in average tons shipped per carload for these commodities could be caused by a different mix of products being shipped. An influx in large and relatively light products would lower average tons per carload.

Figure 42 Class I Average Tons per Carload by Major Commodity, 1981 and 2017.



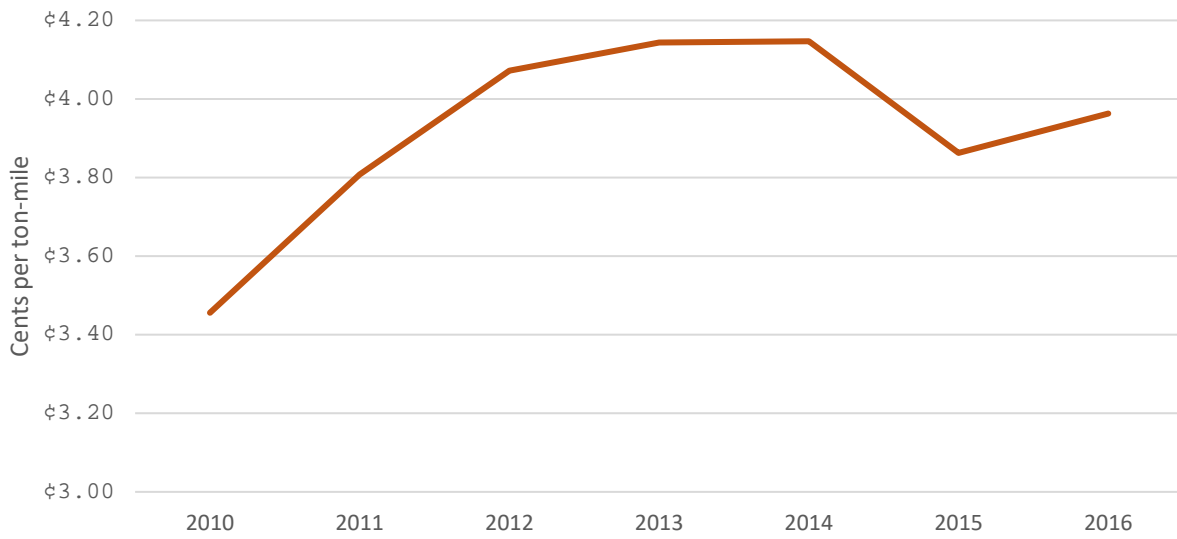
Source: CS, AAR, STB Freight Commodity Statistics

Coal movement by tonnage has been declining since 2008, as electricity production began to shift from coal to natural gas, solar, and wind. Between 2010 and 2016, the transport of crude oil rose and declined rapidly, a volatile market that is also modally competitive. Crude oil produced high margins for railroads, and thus became an important element to maintaining profitability to offset the drop in coal traffic, their leading source of revenue. While oil producers can leverage the flexibility that rail provides in accessing markets across North America, pipeline transport is usually more cost effective. Thus, when the crude oil supply exceeds pipeline capacity, the demand for transporting crude by rail increases.

Pricing strategy has a direct bearing on traffic development. From 1981 through 2004, rates trended downwards, in response to a combination of inter- and intra-modal competition, changes in supply chains and railroad service offerings. Subsequent to 2004, railroads moved to increase rates and the gap between the pricing of rail transportation and competing modes diminished (see Figure 43). As a result, profitability increased about 400% between 2004 and 2014. As rail rates have increased, the relative discount between rail and truck pricing shrank. This in part contributed to the decline in rail volumes that occurred between 2010 and 2016, but were reversed in 2017 as capacity in trucking became tight and costs increased as a result of higher fuel costs, labor shortages, and declining productivity.⁴⁵

⁴⁵Stifel, Transportation and Logistics Advisors, LLC. "Time for a New North American Rail Strategy." Presentation. November 28, 2017.

Figure 43 Average U.S. Rail Rates, 2010-2016



Note: Rail rates are based on the nominal revenue (cents) per ton-mile.
Source: STB Summary Statistics

The current struggles of the trucking industry are not enough for railroads to maintain their market position. In order to drive future growth, there is a need for new strategies. Such changes include reexamining existing services, developing new service offerings, and creating new channels that align with modern supply chain needs. The growth or decline of traffic that is suitable for railway delivery and the industry’s ability to compete with other modes of transportation are the key institutional factors that will drive the success of the railway industry.

7.4.1.7 MARINE FREIGHT TRENDS

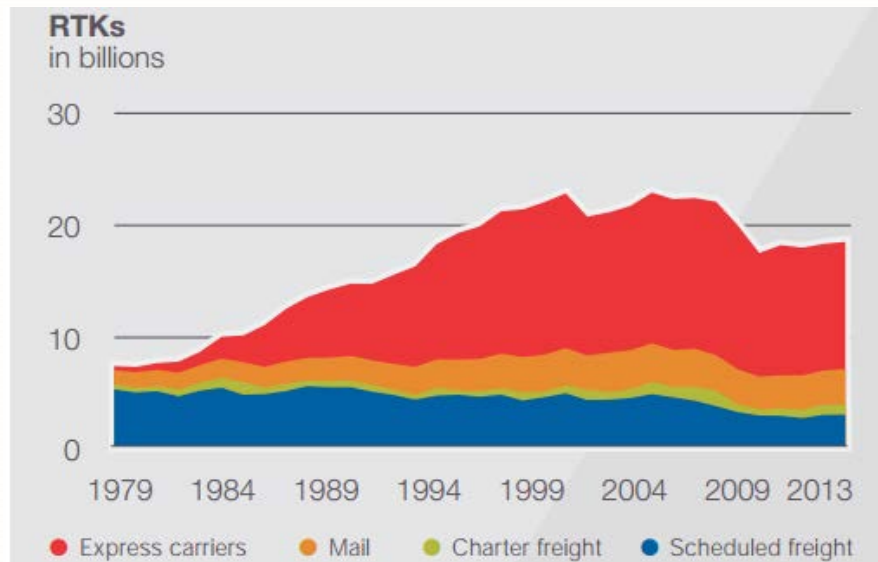
Port experts agree that U.S. ports must modernize their terminals and inland infrastructure while planning for bigger cargo volumes and larger ships. BCOs are focused on port productivity while shipping companies look to consolidate and cascade larger ships into the U.S. trade. Major capital investment at U.S. ports, in addition to process and equipment improvements like trucker appointment systems, shared equipment/chassis pools and the overall enhancement of terminals and systems will be mandatory.

7.4.1.8 AIR CARGO TRENDS

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. Figure 44 presents the breakdown in domestic U.S. air cargo service from 1979 to 2013, with express carrier service comprising the largest share of revenue ton-kilometers since the mid-90s. 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. Ecommerce 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.

Figure 44 U.S. Air Cargo Service, in Revenue Ton-Kilometers, 1979-2013.



Source: Boeing World Air Cargo Forecast, 2014-2015.

One logistical challenge of expedited package service is planning for seasonal volumes. The November/December peak holiday season continues to test carriers. For example, after many Amazon customers did not receive their deliveries in time for Christmas Day in 2013, Amazon refunded shipping charges and sent gift cards to affected customers. Despite the delivery guarantee, a last-minute surge in online orders, coupled with bad weather, overwhelmed UPS' logistics network and resulted in late deliveries for many Amazon customers.⁴⁶ Although peak season is still considered to be in November and December, e-commerce has altered that pattern somewhat. Carriers such as UPS and FedEx are finding it increasingly difficult to anticipate and manage the spikes that occur during the remaining 10 months of the year. Air cargo carriers are trying to work with some major shippers to learn ahead of time of expected increases. In some cases, carriers are attempting to establish a limit on overnight deliveries so that they avoid guaranteeing too many without adequate resources.

The growing use of technology such as e-documents and web-based materials has reduced the need for express package services. 3DP, which has the potential to provide on-demand and custom-made manufactured goods, may also contribute to the declining demand for express air cargo services. Currently, experts disagree on the extent to which 3DP will disrupt the industry; DHL estimates that it will affect 2-4% of shipping volume while

⁴⁶ Amrita Jayakumar. "Amazon, UPS offer refunds for Christmas Delivery Problems". *The Washington Post*. December 26, 2013. Available from: https://www.washingtonpost.com/business/economy/amazon-ups-offer-refunds-for-christmas-delivery-problems/2013/12/26/c9570254-6e44-11e3-a523-fe73f0ff6b8d_story.html

PricewaterhouseCoopers estimates as much as 41% of air cargo revenues being lost to 3DP activity.⁴⁷ Regardless, as the technology continues to advance, the relative cost of 3DP compared to priority/express air shipments may lead some companies to opt for 3DP for some commodities.

Additionally, Amazon has continued to make changes to its logistics supply chain in order to more easily guarantee express delivery services for its customers, without having to rely on UPS and FedEx. In December 2015, Amazon announced that it would deploy Amazon-branded tractor trailer trucks to transport items between Amazon fulfillment centers and sort centers, where they organize packages to be sent to local post offices for customer delivery.⁴⁸ As of August 2016, Amazon is leasing 40 Boeing 767-300 cargo jets to expand its logistics network and take control over air cargo shipments. The initial purpose of the plans is to fly cargo between major clusters of fulfillment centers, but depending on its success could expand the use of these jets to provide other freight services.⁴⁹ Because Amazon is such a massive player in the online retail market, these changes are expected to impact express package services across North America.

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 Kinston Regional Jetport (ISO). 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.

STATEWIDE

7.4.1.9 POPULATION AND URBANIZATION GROWTH

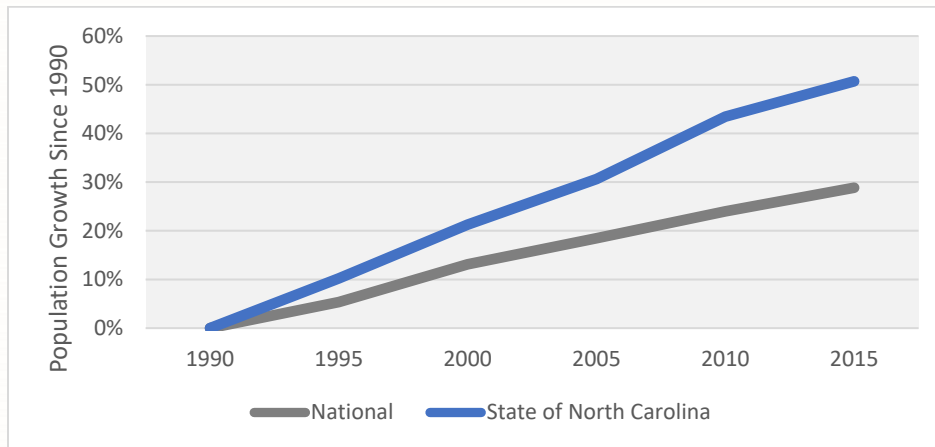
North Carolina's demographics are changing. Over the last 25 years (from 1990 to 2015) the pace of population growth in North Carolina has outstripped the national growth rate by a considerable amount. The population of North Carolina has grown from 6.7 million people in 1990 to 10 million people in 2015. This represents a total growth rate of 51%. Over the same time period, the population of the U.S. has increased by 29% (see Figure 45).

⁴⁷ Sandeep Fernandes. "How 3D Printing Changes the Economics of Air Cargo Transportation". Mercator. March 3, 2016. Accessed October 19, 2016. Available from: <https://www.mercator.com/blog/how-3d-printing-changes-the-economics-of-air-cargo-transportation>

⁴⁸ Jason Del Rey. "Amazon Buys Thousands of Its Own Truck Trailers as Its Transportation Ambitions Grow". Recode.net. December 4, 2015. Available from: <http://www.recode.net/2015/12/4/11621148/amazon-buys-thousands-of-its-own-trucks-as-its-transportation>

⁴⁹ Alex Fitzpatrick. "See Amazon's Massive New 'Prime Air' Cargo Jet Plane". *Time Inc.* August 5, 2016. Available from: <http://time.com/4440542/amazon-one-airplane-fedex-ups/>

Figure 45 Population Growth for the U.S. and North Carolina, 1990 to 2015.



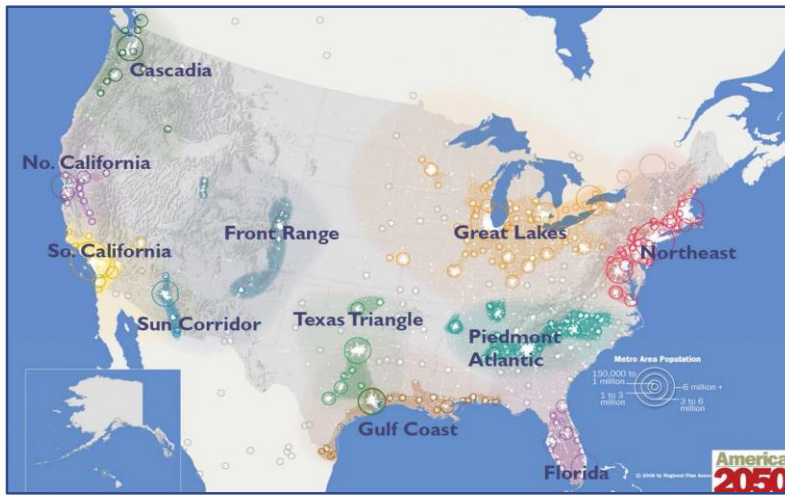
Source: U.S. Census Bureau, *Intercensal Estimates of the Residential Population*

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 and higher traffic volumes will further strain existing roadway capacity, resulting in more severe congestion. As highway capacity is reduced, freight rail will be an increasingly appealing alternative 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. Figure 46 shows the megaregions in the U.S. identified by the Regional Plan Association. 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 megaregions, 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. 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.

Figure 46 Mega-Regions in the U.S..



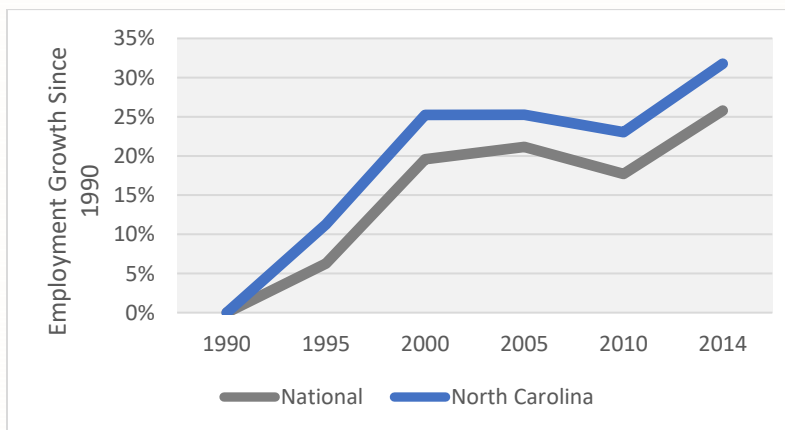
Source: Regional Planning Association, "America 2050: A Prospectus."

7.4.1.10 EMPLOYMENT GROWTH

One of the most tangible measures of a region’s economic vitality is its employment growth. As demand rises for business’s products and services, employees and equipment are added to better satisfy the needs of customers. The jobs produced by these companies provide the incomes people need to sustain themselves and their families.

Like population growth, employment growth in North Carolina has diverged from the national trends over the 1990 to 2014 time period. This can be seen in Figure 47. Initially outpacing the rest of the country from 1990 to 2000, the rate of employment growth slowed from 2000 to 2010. North Carolina did not, however, see the extreme drop in employment experience by the rest of the country in the 2009 recession, and the recovery since then has been strong.

Figure 47 Employment Growth for the U.S. and North Carolina, 1990 to 2014.



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

KEY CHALLENGES FOR FREIGHT IN NORTH CAROLINA

Some of the key freight challenges in North Carolina provided by the NCDOT Logistics and Freight Division include:

- Rail freight network reduction: Implications and service impacts in the state of CSX reducing its network nationally.
- Need to improve rail access to the Port of Wilmington.
- Need to incorporate freight into highway designs to make sure freight mobility is preserved around freight generators and corridors.
- Incomplete truck traffic data collection is impacting the ability to accurately design roads for trucks.
- Impacts of e-commerce on increasing deliveries and congestion around urban areas.
- Advent of autonomous and connected vehicles and monitoring progress, implementation and implications for regulations.

Additional needs and challenges identified in the Statewide Multimodal Freight Plan include:

- Mitigate impacts of increased traffic on the congestion and reliability of the highway freight system, especially around urban areas, and on corridors that provide connectivity between rural region's and the state's gateways and urban centers.
- Maintain and improve rail track capacities, especially on the short-line 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 connectivity to major freight terminals, particularly intermodal connectors (ports, rail terminals, air cargo facilities, military bases and major logistics and manufacturing sites). As motor carriers approach their pick-up or delivery locations, especially within major metropolitan areas, they face significant congestion and uncertainty in highway system performance which greatly affects the last mile.
- Improve highway access and last-mile to the Port of Wilmington: Improvements along the U.S. 74 Corridor from Wilmington to Charlotte.
- Improve highway access to the Port of Morehead City: Highway 70 improvements including bypasses to improve access to I-95.
- Improve rail access to the Port of Morehead City: Study at-grade crossings for identifying improvements, reducing their numbers, and prioritizing implementation.
- Improve safety and strive to minimize delays at at-grade highway-rail crossings. 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.

NC MOVES 2050 DRIVERS & OPPORTUNITIES

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 waterborne to landside freight gateway, it can play a very strategic role for a very strategic gateway for shippers in North Carolina and beyond. Implementing the Statewide Multimodal Freight Plan and adapting to changing industry conditions is a critical aspect of how NCDOT can support the state's economic future.

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.

7.4.1.11 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.

- 1 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.
- 2 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 on CSX's crucial A-Line which parallels I-95, the National Gateway Corridor, through coordinated rail corridor improvements 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.
- 3 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.
- 4 New Industrial or Other Freight-Oriented Development:** 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.

7.5 REVIEW OF THE CURRENT PLAN

FREIGHT PLANNING PROCESS

The first North Carolina Statewide Multimodal Freight Plan was approved and adopted in 2017. The State Freight Plan was developed by Transportation Planning Division with support from the Strategic Planning/Logistics Director.

The freight plan:

- 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 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 FAST Act, which requires states to develop State Freight Plans.

The Logistics and Freight Division also provides support to regional freight studies across the state including the recently completed Triangle Regional Freight Plan and Greater Charlotte Regional Freight Mobility Plan, and other efforts currently underway such as the Eastern North Carolina Freight Mobility Study, Wilmington Freight Study, Greensboro Intermodal Study, Charlotte Airport Freight Study, among others.

The NCDOT Rail Division is currently developing the latest Comprehensive State Rail Plan. The Rail Plan is updated every 5 years and the last plan was developed in 2015. Developed every five years in compliance with the PRIIA, NCDOT's Comprehensive State Rail Plan helps identify needs and guides investments in North Carolina's freight and passenger rail network for the next 25 years. Last approved and adopted in 2015, by the North Carolina Board of Transportation Multimodal Committee, the plan establishes the public vision for North Carolina's rail system and supports the state's goals and policies when it comes to rail. The plan also:

- Analyzes and prioritizes rail corridors, programs and proposed projects.
- Proposes future improvements and investments and assesses funding options
- Provides a current inventory of the rail system and identifies trends, markets, and needs.
- Describes how programs managed by the Rail Division work with other government agencies, businesses and industries to deliver rail services that are integrated in the state's overall transportation system.

NCDOT's Logistics and Freight Division works closely with the Rail Division, the NCSPA, Global TransPark, and the Transportation Planning Division on incorporating freight into the planning process at NCDOT. Better processes should be developed to improve the communication and coordination with the Highway Division.

The Logistics and Freight Division is working on developing a Freight Guide to distribute and use to train NCDOT staff including all the highway divisions across the state on the importance of freight for the state, the importance of freight transportation planning, and incorporating freight into the planning process for highways.

GOALS AND PERFORMANCE MEASURES

The 2017 Statewide Multimodal Freight Plan developed a set of freight performance measures under each of the Plan goals as follows:

Economic Competitiveness:

- North Carolina's employment growth relative to national growth in freight-related defined target supply chains
- Cargo volume through state seaports
- Percent import versus export commodities by weight and value
- Rail modal share from ports

Mobility and Reliability:

- Travel time reliability
- Incident clearance times

- Number of congested directional-miles
- Percent of short line rail network with 286,000 capacity
- Number of at-grade crossings within 85% of volume threshold for grade separation eligibility
- Average travel time from port gate to freeway
- North Carolina airports' versus all U.S. airports' air cargo total tonnage

Safety and Security

- Percent of fatal motor-vehicle crashes involving trucks from total fatal motor-vehicle crashes
- Percent of fatal crashes involving trucks at at-grade rail crossings from total fatal crashes at at-grade rail crossings
- Percent of crashes involving trucks
- Percent of rail crossings with no active warning devices

Asset Management:

- Percent of lane miles on the North Carolina Priority Highway Freight Network (NCPHFN) in fair or better condition
- Percentage of NCDOT state-maintained bridges on the NCPHFN that are structurally deficient or functionally obsolete

Innovative Technology:

- Percent of NCPHFN with ITS infrastructure
- Percent of weigh stations on NCPHFN with Weigh in Motion

Environmental Sustainability and Livability:

- Emissions from truck delay
- Freight rail modal share (excluding pass-through)

Sustainable Funding:

- Percent spent of Freight Program Funding
- Percent STI Funding on NCPHFN

Additionally, the Logistics and Freight Division is familiar with NCDOT's organizational performance dashboard, and the main freight goals that are tied to the organizational dashboard are improving safety and improving transportation reliability and connectivity. However, there are no freight specific measures in the organizational dashboard and the Logistics and Freight Division has not been asked to contribute to the organizational dashboard's performance measures. In a separate effort, the Logistics and Freight Division is developing a freight dashboard that will show the freight traffic volumes and bottlenecks in the highway system. This information will be shared within NCDOT and outside of the agency.

COORDINATION OPPORTUNITIES AND CHALLENGES FOR NEXT PLAN UPDATE

The Logistics and Freight Division recommends that the information generated and analysis developed as part of the Statewide Multimodal Freight Plan be used to support the NC Moves 2050 Plan development, including the vision, goals and objectives, freight forecast, designation of the state's freight priority network, performance measures, trends, needs and opportunities, and recommendations.

8. STATE OF THE SYSTEM – STRATEGIC TRANSPORTATION CORRIDORS

8.1 OVERVIEW

Various approaches are used by state transportation agencies to establish and promote transportation corridors or networks of particular mobility and/or operational significance. One of these approaches is to focus transportation planning resources on a strategic system or subset of facilities and assets which are important to statewide and regional transportation movement.

States that have pursued this approach attempt to strengthen and better coordinate decisions within programs which link and support statewide and local long-term planning, project development, and programming. Setting long term performance targets under state and MPO plans are part of new federal requirements. Linking the progress achieved towards meeting these targets while also advancing project schedules which address short term performance targets will become an increasingly important exercise. Collectively, these efforts seek to identify, assess, and highlight significant state transportation investment systems which may include multimodal facilities and assets and involve a variety of stakeholders.

8.2 STRATEGIC TRANSPORTATION CORRIDORS TO NORTH CAROLINA

Since the early 2000's NCDOT has studied how a subset of transportation corridors play a significant role in moving people and goods across the state. Fifty-five facilities (referred to as the Strategic Highway Corridors or SHC) were officially designated under NCDOT's 2040 Statewide Transportation Plan. The corridors were selected based on demand criteria, such as volume, truck traffic and connectivity to major destinations (tourist, military, educational, healthcare) with an eye towards future demand and growth potential. The corridors were a mix of interstate and non-interstate facilities promoted within other state agencies and to local partners to signify broader, long term statewide mobility expectations. SHC implementation was led by NCDOT and closely coordinated with the state Departments of Environment and Natural Resources and Commerce. The primary goal was to maximize mobility efficiency and protect travel time reliability to key transportation terminals, hospitals, military bases and population centers while simultaneously promoting environmental stewardship through project-based decisions. The SHC initiative also sought to more closely align supportive land use decisions and address longer term operational solutions. Overall SHC represented 7% of the state's centerline mileage but nearly 45% of all state traffic and seen as critical to achieving the state's longer-term development and mobility goals. Under NCDOT's 2040 Plan the SHC evolved to include multimodal criteria and the strategic focus narrowed to 25 corridors renamed Strategic Transportation Corridors (STC). In March 2015, the North Carolina Board of Transportation (BOT) adopted the North Carolina STC Policy, which formally established STCs and directed NCDOT to develop master development plans heavily guided by stakeholder input and technical analyses. These plans were expected to be carried out sequentially over time and were expected to establish broad planning level operational and multimodal mobility vision for each corridor. The Policy also directs NCDOT to review the status and criteria which designate and support STC development through future statewide plan updates.

8.3 WHY STC IS IMPORTANT IN NORTH CAROLINA

Across the nation state DOT efforts to focus on a core, subset of strategic transportation facilities and assets has evolved. Through the 1991 passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) USDOT began to evaluate the implications of a broader multimodal transportation network and associated planning needs. ISTEA also gave additional transportation authority to the MPOs to coordinate and develop greater consistency for transportation coordination and investment decisions with State DOTs. Many states responded to these new Federal requirements, as well as other factors such as increased traffic congestion and economic development needs, by developing corridor planning programs for better utilization and management of intermodal corridors. Florida, one of the earliest adopters, would designate its Florida Interstate Highways System (FIHS) in 1990, which not only looked at planning requirements, but also set performance standards and an early funding methodology.

While Federal policy mandated state and local planning collaboration, each state developed their own unique coordination programs, taking into account their transportation history, current usage rates, and long-term strategic goals. No two states are identical in context and needs, so there is no one-size-fits-all approach which will work.

States such as Virginia, North Carolina, and West Virginia have state level ownership of 70-80% of their total road system, meaning that overall planning and maintenance can be coordinated more easily in state level initiatives, but with the added pressure that state investments and maintenance expenditures must be spread across a large geographic area. Florida and Ohio, with much higher levels of local responsibility for roads (state-level ownership is between 10-20%) must coordinate more extensively with local agencies to ensure planning level consistency between and across localities, regions and the state network.

8.4 TRENDS AFFECTING STC

Population growth forecasts in North Carolina are expected to continue unabated for the foreseeable future bringing new residents and industry to the state. Although the majority of the 4 million people North Carolina is expected to absorb by 2050 will reside in the piedmont crescent, clusters of residential and employment activity across the state are also expected to bolster local and regional economies. The North Carolina Department of Commerce has reorganized its support for regional economies through eight Prosperity Zones.⁵⁰ This defined focus along with ongoing community assistance and rural economic development initiatives are redefining how communities which relied on declining industries can attract new business and skilled workforce in a rapidly shifting, knowledge and service-based economy. The reliability and efficiency of travel in interconnected regional and long distant transportation corridors will continue to play a key role in seamlessly moving freight and providing options to meet the mobility needs of residents and commuters.

PERFORMANCE BASED PLANNING

Recent federal reauthorization bills - Moving Ahead for Progress in the 21st Century Act (MAP-21) and FAST Act - transformed the Federal aid highway program by establishing new performance-based planning requirements for state DOTs, MPOs, and providers of public transportation.

⁵⁰ <https://nccommerce.com/about-our-department/north-carolina-prosperity-zones>

The performance management framework focuses on seven national performance goal areas:

- Safety; Infrastructure condition; Congestion reduction; System reliability; Freight movement and economic vitality; Environmental sustainability; and Reduced project delivery delays.

The performance-based planning requirements are intended to increase accountability and transparency throughout the planning and decision-making process and focus federal transportation investments on projects that support the national performance goals. New planning factors and considerations (such as the integration of planning processes, performance measures, and targets into a performance-based program) need to characterize state long range plan updates. The new requirements along with STC update policy provide a natural opportunity to review how STC, project prioritization, and achieving longer range system performance targets can align more closely.

INFRASTRUCTURE AND TECHNOLOGY DEPLOYMENT WITHIN CORRIDORS

Federal code for many years has permitted state DOTs to accommodate broadband conduit in highway right of way (ROW). A number of states (Virginia, Georgia, California, Pennsylvania to name a few) are also undertaking shared resource agreements with telecommunication companies to explore transportation technology interests (such as higher speeds/bandwidth to serve traffic cameras, signals, variable message signs). Virginia is studying expansion of fiber resource sharing to improve connections to District offices and I-64/66 tolling systems. NCDOT was recently awarded a \$147 million grant through the Infrastructure for Rebuilding America program to advance improvements on I-95 and U.S. 70 while simultaneously expanding broadband access (300 miles of fiber optic cable) to more rural and remote locations. Ohio DOT has designated 36 miles of U.S. 33 as a “smart mobility” corridor. The designation has leveraged state and research investment to deploy asset and operational based technologies which provide more real time information to state and local officials. Future STC master plans can start to consider these broader infrastructure and technology opportunities as long-distance transportation becomes more of a utility to serve state goals and interests beyond traditional transportation users.

REDUNDENCY AND RESILIENCY OPPORTUNITIES

North Carolina has experienced three significant hurricanes in the last three years, some of which have caused landslides and road closures in the western part of the state due to heavy rains and wind. As extreme weather continues to play a role in preparedness planning, state DOTs are taking proactive approaches to understand vulnerable components of their transportation networks. These vulnerability assessments help identify critical linkages for large evacuation events but also uncover redundant facilities in proximity of Interstates or major rail lines which can serve as temporary facilities to move large volumes of freight and passenger traffic. Identification of system vulnerabilities can inform design and asset management decisions, leading to stronger, more resilient infrastructure. Additionally, MAP-21 mandates state DOTs perform periodic evaluations to determine if reasonable alternatives exist to roads, highways, or bridges that repeatedly require repair and reconstruction activities. Although identifying hurricane evacuation routes has been part of early master plans, future STC plans could highlight coordination, planning, modeling and additional analytical opportunities to understand the risks and benefits of redundant facilities which fall into individual corridors.

ROLE OF CORRIDOR DEVELOPMENT ENGINEERS

In response to state legislation, NCDOT recently established Corridor Development Engineers to coordinate planning to project prioritization and programming activities. These individuals operate to NCDOT’s STIP unit but play a liaison role to NCDOT’s 14 field Divisions. Future STC master plans could further involve Corridor Development Engineers to act as additional planning and communication resources between NCDOT, the Corridor Steering Committee, and various stakeholders within a corridor. Their knowledge of local long-range

plans, project prioritization scoring, and other in the field operational knowledge could serve to support the process and extend NCDOT’s engagement of key stakeholder perspectives and needs.

INCORPORATE BEST PRACTICE FROM OTHER STATES WITH MATURE PROGRAMS

NCDOT should be commended for advancing the next step in the evolution of STCs. Establishing Master Plans built around extensive stakeholder input whose implementation actions are monitored over time is in line with growing best practice in corridor management in the country. Development of STC master plans can incorporate the experience, lessons learned, and applications of other leading states that are pushing towards their own performance envelope. Similar to other southeastern and southwestern states, North Carolina is experiencing the dichotomy of needing to meet future demand created by explosive growth while also maintaining and optimizing current assets. Within this context and as seen in NCDOT’s Strategic Prioritization process, not all future congestion can be solved by highway widening and/or new location improvements. Low cost/high benefit improvements implemented in a logical construction sequence can have a significant operational impact. Achieving a mobility vision to address recurring congestion and improve reliability requires a mix of transportation investment and the support of local and regional communities to sustain the corridor vision.

8.5 REVIEW OF CURRENT STS

“It is the Board of Transportation’s vision that North Carolina should have an identified network of high priority, integrated multimodal transportation corridors comprised of facilities that interconnect statewide and regional transportation-dependent activity centers, to enhance economic development in all regions of the state, promote highly reliable and efficient mobility and accessibility, and support good decision-making.” (March 2015)

NORTH CAROLINA’S STRATEGIC TRANSPORTATION CORRIDORS

Updating the SHC Policy became an implementation item under NCDOT’s 2040 Plan. The 2040 Plan utilized system stratification, referred to as the North Carolina Multimodal Investment Network, to categorize future needs across statewide, regional, and sub-regional tiers. This designation had been used in prior statewide plans to associate and contrast the size, scope, and scale of North Carolina’s system needs and analyze the impact of a more consistent vision for longer distance corridors to meet regional and statewide mobility goals. This is an important planning practice given NCDOT’s level of system ownership and funding eligibility for individual projects through a similar (but separate) tier designation in the state’s 2013 Strategic Transportation Investments law.

Under the 2040 Plan, designation criteria expanded to include all modes and a revised stratification of economically important activity centers. Thresholds for determining activity centers started under the original SHC concept; however as seen in Table 10, more specificity was added to define employment centers, trauma level healthcare facilities, and education or military institutions. The update also included a review of all facilities to ensure designation consistency. The result was a narrower focus to 25 high priority corridors or STC within a newly termed North Carolina Transportation Network (NCTN). This shift to a broader, multimodal framework reflects all modes of North Carolina’s transportation system (highways, aviation, public transportation, freight and passenger rail, bicycle/pedestrian facilities, ferries, and ports) and required mobility and land access levels. In March 2015, NCDOT’s BOT adopted the STC Policy and a map of STC facilities and initiated a master plan development process to implement the policy.

Table 9 System Planning Evolution

Planning Cycle	System Evaluation Tool	Core system	Number of corridors /modes served	Designations	Threshold metrics (examples)	Stakeholder involvement
2000-2004 (2025 Plan)	Multimodal Investment Network	Strategic Highway Corridors	55 / Highways	Activity centers and highway activity level criteria	Federal highway classification, Truck volumes, Annual Average Daily Traffic	Initially targeted at cross-state coordination; ultimately pushed to CTPs
2010-2012 (2040 Plan)	Multimodal Investment Network (basis for NCTN)	Strategic Transportati on Corridors	25 / Highways, Air, Freight/passenger Rail, Bike/Ped, Aviation, Ports, Ferries, Public Transportation	Activity centers and service level of modal activity by tier	Highest use modal facilities based on activity and proximity	Corridor Steering Committee sets mobility and operational vision; coordinate with CTP and other sub-corridor studies

Source: NCDOT - Strategic Highways Corridors, 2040 Report

8.5.1.1 PROGRAM CRITERIA AND STRUCTURE

The August 2015 NCTN and STC Framework report details the development process and operationalizes how NCTN and STC will be implemented. The report presents the following key elements which support and guide the development process and introduce goal themes, objectives and performance measures to track and report progress:

- NCTN structure and mobility definitions
- STC vision, goals and objectives, and performance measures
- STC identification process and application
- STC network and policy, and
- STC and NCTN application.

Service levels are described for each tier in order to convey long term and highest use performance in safety, travel speed, operational efficiency, and travel time reliability. Performance targets are to be established for each STC as individual master plans are initiated and unique aspects of corridors are explored and documented. The development of the overall STC network is also bounded by the following goal themes, regardless of municipal or regional boundaries. Each goal is associated with an objective which can be monitored and tracked over time.

- **System Connectivity** – provide essential links to national transportation networks, such as U.S. Interstates, major U.S. seaports/airports, significant freight or passenger rail lines, and/or connection to economic clusters in bordering states.
- **Mobility** – Facilitate significant high-volume, inter-regional movements of people and goods; facility or asset serves high volume or long distance (20+ miles) passenger or freight traffic. Usually 30,000+ daily vehicles or 2,500+ trucks in urban areas, and 15,000+ daily vehicles or 1,500+ trucks for rural areas. For rail lines, both primary and secondary rail lines are considered if freight totals are over 20 million tons annually.
- **Economic Development** – support economic development and efficiency of transport logistics; network elements within designated Prosperity Zones, provide access to identified Tier 1 Economic Development areas and/or industry clusters classified as “Activity Centers” which are hub facilities deemed critical to the state’s economy, and can either have statewide or regional significance.

Although measuring progress is instituted in STC policy monitoring and reporting performance has yet to be realized. This is partly due to corridor master plans only recently being initiated but also to the complexity associated with assessing the aggregate impact of individual and/or multimodal project improvements within a corridor. STC designations are viewed as a planning tool and are not a prerequisite to STI funding eligibility. To date there has not been a comprehensive comparison of STI criteria and eligibility which score and program individual projects in NCDOT's Strategic Prioritization process to the services levels and thresholds articulated in the STC network. New federal planning requirements warrant state DOTs and their partners to prove how their respective Transportation Improvement Programs (TIPs) are advancing system wide performance goals and objectives. STC goals would also need to be cross referenced to the Department's vision statements (when updated or during administrative changes) to ensure optimal alignment.

8.5.1.2 UPDATES TO STC POLICY AND NETWORK

Each of the current 25 STCs is described by differing lengths, conditions, and socioeconomic factors. Overall, the STC system has a total of 2,592 centerline miles on primary highways in the STC network, along with an additional 631 centerline miles where individual STCs overlap. STCs also include 1,556 miles of primary and secondary rail lines. Appendix C of the STC Framework reports describes the transportation facilities, services and activity centers which fall within each STC and also assigns them an alphabetical label (A-Y). The STC policy and network is updated either by petition of local partners and/or as part of updating NCDOT's Statewide Transportation Plan. The update process is intended to capture changes in transportation characteristics used to define STC segments and corridors, which may include (but are not being limited to) the following:

- New intercity/cross-state Interstate routes approved by Congress (and not already designated STC)
- Additions to federally defined road and rail networks
- Significant increased roadway volumes due to changes in land uses or shifts in traffic on nearby roads
- Newly identified statewide or regional activity centers, and changes in strategic corridors designation in border states

Each update of the STC network is expected to include a list of changes from previous versions.

MASTER PLAN DEVELOPMENT AND STAKEHOLDER INVOLVEMENT

Achieving a consistent vision for each corridor assumes increased internal and external coordination between NCDOT and its partners through the development of corridor master plans. These plans must be constructed with an awareness of needs articulated in local long-range Comprehensive Transportation Plans (CTP) along the corridor as well as coordinate with sub-corridor study activities. Additionally, a Corridor Steering Committee (CSC) is established at the inception of master plans to ensure key components of integrated planning define corridor development and support the long-term vision. Corridor planning through the master plans is intended to be aspirational and inclusive potentially taking one or more years to complete and involving stakeholders extensively throughout the process. The role of Division staff and external partners to support long term mobility and operational goals can also lead to consistent decision making in future project preconstruction and design phases. Such decisions include access management, asset management, land use, and other operational strategies and design elements which may also streamline decisions in project planning and alternatives analysis.

CORRIDOR STUDIES INITIATED

NCDOT initiated corridor master plans for five corridors in January 2018. Soon after, the decision was made to organize corridor studies into two bundles based on similarity of transportation and land use issues and to

streamline the outreach process. The respective master plans within each bundle were to run simultaneously over two planning phases.

Bundle 1 (central/eastern North Carolina)

- **Corridor P:** Future I-42 – Future I-42/U.S. 70E/NCRR from I-440 in Wake County to Port of Morehead City
- **Corridor S:** Future I-795 – I-795/U.S. 117 in Wilson County to I-40 in Sampson County
- **Corridor X:** Jacksonville to Greenville – U.S. 258/NC 11/U.S. 13 from U.S. 17 in Onslow County to U.S. 64E in Edgecombe County

Bundle 2 (western/central North Carolina)

- **Corridor U:** U.S. 74/CSX – From I-26 in Polk County to U.S. 117 Wilmington
- **Corridor D:** U.S. 321 /CSX – From South Carolina state line to Tennessee state line

Master plan development is divided into two phases – the first lays a foundation for data gathering, engaging stakeholders through a Public Involvement Plan, and establishing project management parameters. Phase 1 also identifies the CSC (including internal and external staff and stakeholders). Phase 2 is designed to carry the bulk of the technical analysis – including a deeper planning, operational and modeling (if necessary) analysis. Developing both bundles simultaneously has challenged agency resources, both with the size and scope of the master plan and the complexity of navigating various stakeholder expectations and interests regarding the ability to balance regional access with statewide mobility goals. NCDOT is currently reevaluating the best way to reset study expectations and reframe how the STC can serve as a more robust planning tool to better link local/regional planning activities with broader, end to end corridor focused results.

9. STATE OF THE SYSTEM – STRATEGIC HIGHWAY SAFETY

9.1 OVERVIEW

North Carolina's fatalities decreased overall between 2002 and 2017, but similar to national trends, increased in 2015 and 2016 and saw a slight decrease in 2017. By the end of 2017, 1,400 transportation-related fatalities had occurred and preliminary year to date numbers (January-August 2018) showed fatalities tracking 3% higher than the same time last year. The factors that consistently contribute to severe crashes include: alcohol impairment, distracted driving, drugged driving, heavy trucks, intersections, lane departures, motorcycles, older drivers, pedestrians, rear-ends, sideswipe, speeding, young drivers, unbelted drivers, and work zones. In addition to these factors, NCDOT needs to contend with emerging issues, leading to fatalities, including significant population growth, increases to vehicle miles traveled, challenges in investing significantly in multimodal solutions, and demographic shifts.

Despite these challenges, NCDOT and key stakeholders have, and continue to, identify the leading causes of crashes and address those through an array of policies, programs, and projects. The document central to this is the Strategic Highway Safety Plan (SHSP). It provides data-driven framework, complete with performance targets, to reduce transportation-related fatalities and serious injuries. When the elements of this plan, the Highway Safety Plan (HSP), and the Highway Safety Improvement Program (HSIP) are integrated into all transportation and safety plans and implemented in a coordinated fashion, fatality and serious injury reductions become more likely.

The vision in North Carolina is zero fatalities (Vision Zero), which NCDOT and other stakeholders take very seriously. Not only is it an important quality of life factor for people choosing to move to North Carolina or continue to reside there, but it also has a huge impact on the economy. To enhance the safety for all transportation users, North Carolina invests a significant amount in the current and future transportation network. Opportunities to continue driving down fatalities and serious injuries include:

- Implementation of the Vision Zero culture and ideals.
- Continued coordination of transportation safety planning efforts across all agencies and disciplines to achieve Vision Zero.
- Data-driven safety analysis to constantly understand the key safety issues and needs and enhance performance.
- Engaged leadership to oversee, support, and enhance implementation of safety policies, programs, and projects.
- Understanding and implementation of proven countermeasures to address current and emerging safety trends.
- Implementation of solutions to lower the rural fatality rate.
- Continued investment in multimodal transportation solutions.
- Implementation of new ideas and solutions to address key safety needs.

The purpose of this paper is to support the development of NC Moves 2050 by providing an overview of current transportation safety related trends, initiatives, programs, and projects in North Carolina, along with describing future safety opportunities. North Carolina has advanced a number of impactful initiatives, which have driven down fatalities and serious injuries over time. These programs, along with other multimodal, systemic considerations are highlighted here to inform the goals, strategies, and policies, which develop NC Moves 2050 and position the state to successfully navigate future challenges.

9.2 SAFETY IN NORTH CAROLINA

STATEWIDE

The U.S. touted decades of downward fatality and serious injury trends, but changes in the economy around 2014 led to lower fuel prices, job growth, and increases in vehicle purchases. This translated into more vehicles on the roadway and increases in fatal crashes. Similar to national trends, North Carolina saw average annual decreases in fatalities through 2011, but started to feel the impact of these national trends sooner than the rest of the country. Roadway fatalities in North Carolina decreased on all public roads by 25% from 2002 to 2011 reaching a low of 1,225 in 2011. Since then, fatalities have increased every year, reaching a high of 1,440 fatalities in 2016. On average, 1,334 people died per year in traffic crashes between 2012 and 2016. Tremendous success had been made in reducing serious injuries, which decreased by 56% between 2002 to 2015, but in 2016, the serious injury definition changed and the numbers between 2015 and 2017 nearly doubled.

The NCDOT implements the SHSP and HSIP to identify and address the causes of transportation-related fatalities and serious injuries. However, one of the biggest challenges in North Carolina is trying to keep safety investments on pace with growth. North Carolina has one of the larger interstate systems with 1,270 miles and NCDOT maintains 79,955 miles out of the 106,975 in the state. The state ranks fourteenth in the nation for growth, seeing a 1.13% population increase between 2010 and 2018. Hand in hand with population growth, VMT has increased by 29% from 2000 to 2016. This resulted in an overall traffic fatality rate of 1.24 fatalities per 100 million VMT in 2015 and 2016, although this rate decreased in 2017.

In addition to the safety challenges caused by growth, the following factors have contributed most significantly to crashes between 2012 and 2016: roadway departures, impaired drivers, unrestrained vehicle occupants, speed, older drivers, intersections, and interactions between vehicles and vulnerable users (pedestrians and motorcyclists).

9.3 WHY SAFETY IS IMPORTANT TO NORTH CAROLINA

North Carolina is a Vision Zero state, embracing the notion that everyone has the right to be safe on the roadways and even one fatality is too many. By accepting this goal, North Carolina's leadership, and transportation and safety stakeholders have committed to addressing fatalities (and serious injuries) through policies, programs, and projects. A safe transportation system is critical because it will bring North Carolina closer to its vision of zero, but it also benefits the statewide economy and quality of life factors that draw in or retain residents.

QUALITY OF LIFE

People reside in or move to a state for a number of reasons, but a key decision point is often centered on quality of life amenities. North Carolinians are no different and when it comes to transportation - there is the expectation that projects will reduce delay, improve accessibility, and provide safe environments to walk, bike, or drive. To ensure these priorities are met, NCDOT weights these factors highly during the transportation project prioritization process. Each of those quality of life measures, all include safety considerations. A significant portion of delay can be caused by non-recurring congestion attributed to traffic crashes. Having an efficient and effective emergency response system in place not only minimizes delay, but also reduces the risk of dying on North Carolina's transportation system. Being accessible means having options to travel to work, home, and points of interest. Ensuring that these options are developed with the safety of all users in mind is critical. And

lastly, residents appreciate the ability to exercise or take advantage of non-motorized modes. Enhancing or building environments where people feel safe to walk or bike is a critical quality of life factor.

ECONOMICS (LOCAL, REGIONAL, STATEWIDE, AND NATIONAL)

The National Highway Traffic Safety Administration (NHTSA) revised a report in 2015 that monetized the costs associated with motor vehicle crashes. At the time (using 2010 data), the national economic and societal costs of crashes totaled \$836 billion. The standardized crash cost estimates for North Carolina (2016 dollars) are \$10,462,000 for a fatality, and \$590,000 for a serious injury. On average, the cost of a crash in North Carolina is \$99,000. In 2016, the socioeconomic impact of crashes in North Carolina resulted in a loss of over \$26.6 billion to the economy. This impact translated into a crash cost of over \$3 million every hour and approximately \$73 million every day. The figures include loss of productivity, medical costs, legal and court costs, emergency medical costs, insurance, congestion costs, property damage, workplace loss, and lost market and household productivity, and speak to the need to reduce the frequency and severity of crashes.

In addition to the costs associated with crashes, the ability to move within and through North Carolina, especially for freight, is critical to economic success and growth. This includes ensuring pavement and bridges are maintained to enhance truck and vehicle safety; addressing unsafe interactions between heavy trucks and vehicles; and ensuring emergency medical services are robust enough to transport victims quickly to medical care and clear non-recurring congestion.

VISION FOR SAFETY IN NORTH CAROLINA

The safety vision, as worded in the 2014 North Carolina SHSP is “Through our partnerships, we foster safety awareness and provide safe access throughout North Carolina for all users and modes of travel such that everyone arrives safely at their destination.” Ultimately, the vision from 2014 is still true today - achieving zero fatalities and serious injuries through the coordinated implementation of proactive safety programs and projects. To track and assess progress toward this vision, NCDOT sets annual performance targets for fatalities and fatality rate, serious injuries and serious injury rate, and combined fatalities and serious injuries for non-motorized users.

9.4 TRENDS AFFECTING SAFETY

Current and emerging trends have implications to the safety of the transportation system. The following Sections details what is being seen nationally, as well as in North Carolina.

NATIONALLY

9.4.1.1 FATALITIES

According to NHTSA there were 37,133 motor vehicle related fatalities in 2017, a 1.8% decrease from 37,806 in 2016. Preliminary 2018 numbers (through June) are also positive, showing a 3.1% decrease from the same time last year. These come after two consecutive years of increases in 2015 and 2016 but are still much higher than the 32,479 low recorded in 2011. When looking at fatalities by land use, urban areas have seen a 17.4% increase since 2008 while rural areas have experienced an 18% decline. In 2017, there were 19,038 fatalities in urban areas and 17, 216 fatalities in rural areas and this is the second year in a row that more fatalities occurred in urban areas. These trends are attributed to the significant population and VMT growth in urban areas.

9.4.1.2 RATES

The national fatality rate per 100 million VMT also went down in 2017, decreasing to 1.16 from 1.18 in 2016. This is a positive sign considering more people drove in 2017, as evidenced by a 1.2% increase in VMT. However, the current national rate is still higher than the low it reached of 1.08 in 2014.

9.4.1.3 CONTRIBUTING FACTORS

Fatalities decreased in many key emphasis areas in 2017 including passenger car occupants (1.1%); van occupants (5.8%); pickup truck occupants (4.5%); motorcyclists (3.1%); pedestrians (1.7%); bicyclists (8.1%); alcohol-impaired drivers (1.1%); and speeding (5.6%). Areas where fatalities increased included SUV occupants (3%) and crashes involving large trucks (9%).

In addition to the above-mentioned emphasis areas statistics, NHTSA does research into other contributing factors, especially those that have trended up in recent years, like distraction, older drivers, and drugged driving. In 2015, distracted driving fatalities rose 8.8% over the previous year and overall contributed to 10% of the total fatalities nationally. To put this into perspective, total fatalities increased by less (7.2%) over the same period. In 2015, 47.8 million drivers were 65 and older and contributed to 18% of all crashes in 2015. And while drug-impaired driving has been historically hard to detect, states have been training law enforcement, which had led to improvements in crash reporting and higher fatality and serious injury numbers.

STATEWIDE

9.4.1.4 FATALITIES

Similar to recent national fatality trends, North Carolina saw significant increases in 2015 and 2016, but a 2.8% decrease between 2016 and 2017. However, the 1,400 fatalities in 2017 are still 13% higher than the low of 1,225 recorded in 2011. And preliminary year to date numbers (January-August 2018) show fatalities tracking 3% higher than the same time last year. A larger proportion of fatalities occur in the rural parts on North Carolina, but similar to national trends, the number of urban fatalities has been steadily increasing. In 2017, there were 903 fatalities in the rural regions and 509 in urban areas.

Between 2012 and 2016, there were 6,190 fatal crashes which were generally clustered in and around the major metro areas of the state, including Charlotte, Raleigh/Durham, Greensboro, Winston-Salem, Asheville, Fayetteville, and Wilmington. This clustering can be attributed to the urban areas being densely populated with more vehicles on the roadways.

9.4.1.5 RATES

Since 2014, VMT in North Carolina has continued to increase. This has impacted the fatality rate, which reached 1.24 fatalities per 100 million VMT in 2015 and again in 2016. However, similar to national trends, the rate decreased to 1.18 in 2017. While a direct correlation cannot be specified, vehicle and roadway technologies are improving, infrastructure improvements and education/enforcement are reducing the severity of crashes, and alternative transportation options are increasing. Despite the recent positive trend, the North Carolina fatality rate is still higher than the national rate and in particular, counties in rural areas are experiencing negative trends in relationship to fatality rates. In 2016, the rural fatality rate in North Carolina was 2.30. This could be due to a number of factors, but a critical input is the fact that North Carolina has the highest number of rural residents of

any state. While the most recent year of fatality rate data is positive, this performance metric will continue to be tracked in North Carolina to understand trends and target resources in both the urban and rural areas.

9.4.1.6 GROWTH

In looking ahead to changes in fatality rates, it is important to track where population growth is occurring. The North Carolina Office of State Budget and Management (OSBM) analysis shows that the state's population growth has been and will continue to be in the major metropolitan areas. This correlates with the increasing fatality trends in the urban parts of the state over the last few years. This can create a number of safety risks – roadway maintenance needs may not be able to keep up with demand; the number of vehicles on the road will increase; bicycle and pedestrian infrastructure may not be able to keep up with demand; and more people on the road will contribute to unsafe behaviors.

9.4.1.7 CONTRIBUTING FACTORS

The major factors contributing to fatalities and serious injuries in North Carolina have been consistent over the years. Crash data related to alcohol impairment, distracted driving, drugged driving, heavy trucks, intersections, lane departures, motorcycles, older drivers, pedestrians, rear-ends, sideswipe, speeding, young drivers, unbelted drivers, and work zones are tracked annually. Lane departures, alcohol impairment, unbelted drivers, older drivers, and speed contributed to the most fatal crashes between 2012 and 2016. However, a number of other areas have been trending up, especially distracted drivers, young drivers, and heavy trucks. Another interesting fact that will play a role in future safety trends is by 2030, OSBM projects that one in five North Carolinians will be at least 65 years old, and by 2035 there will be more older adults (ages 65+) than children (ages less than 18).

9.4.1.8 ALTERNATIVE MODES AND VULNERABLE USERS

The availability of public transportation and safe environments to walk and bike also affect North Carolina's safety trends. A recent report from the American Public Transportation Association demonstrated that metro areas with higher public transportation use have lower traffic fatality rates. In particular, it concludes that transit is ten times safer per mile than traveling by car because it has less than a tenth the per-mile traffic casualty (injury or death) rate as automobile travel. Continued transit investments in the urban areas of Raleigh/Durham and Charlotte could help decrease fatalities and serious injuries, although this could be a costly approach without as much benefit as other safety solutions. In addition, NCDOT's Complete Streets policies and bicycle/pedestrian improvements have enhanced quality of life and safety. However, with more people projected to live in urban areas, the safety of bicyclists and pedestrians will continue to be an important issue in North Carolina.

KEY CHALLENGES FOR SAFETY IN NORTH CAROLINA

North Carolina has been successful in delivering safety programs and projects. Between July 2016 and June 2017 (North Carolina fiscal year), \$50 million was obligated to the HSIP which funds infrastructure projects. A separate amount of NHTSA grant funding was also spent to address behavioral safety needs. Despite the funding levels and North Carolina's data-driven approach to identifying safety needs and solutions, the following challenges impact overall crash reduction potential.

Growth – Between 2010 and 2040, North Carolina's population is expected to grow by 32% and is projected to be more concentrated in the metropolitan areas. Growth, no matter where it occurs, will lead to more vehicle miles traveled, which can increase the level of exposure to safety risk. Growth in urban centers, in particular

could lead to more residents using bicycles, sidewalks, or rideshare options to get around. Again, this increased exposure can lead to new or higher safety risks for non-motorized users.

Rural Fatality Rate – Despite projections of shrinking populations in North Carolina’s rural areas and the uptick in urban fatalities over the last few years, 64% of the fatalities in 2017 occurred in the rural parts of the state. The rural fatality rate of 2.30 in 2016 is also extremely high compared to the 0.70 rate in urban areas. In addition, the highest contributor to fatal crashes is roadway departures (primary contributor to 56% of the fatal crashes between 2012 and 2016), which are mostly occurring on rural roads.

Older Drivers – By 2030, OSBM projects that one in five North Carolinians will be at least 65 years old, and by 2035 there will be more older adults (ages 65+) than children (ages less than 18). Older driver fatal crashes have trended up over the last five years with 21% involving someone over the age of 65. The challenge is identifying the specific issues (i.e. lack of education, lack of licensure testing, signage, etc.) and implementing programs to be able to reduce these numbers. Another challenge is older drivers are distributed fairly evenly across the state, making it harder to pinpoint a specific region for improvements.

Transit Investments – A new national report has correlated increased transit ridership with decreases in fatalities. While cities such as Charlotte and Raleigh/Durham are still developing out their transit systems, there are limitations to the amount of money of money that can be spent on these types of projects.

Motorcycle Crashes – Motorcycle fatalities remain overrepresented in relation to all contributing factors to crashes. While the numbers decreased in North Carolina in 2017, they were higher through August 2018 than they were in the previous year. More specifically, single unit motorcycle fatal crashes increased 66%; increasing 59% in rural areas (mostly caused by roadway departures) and 107% in males, age 50-59. In addition, there have not been significant increases to the number of registered motorcycles in state, meaning the issue is not a matter of more motorcycles on the road.

Pedestrians – Nationally, the percentage of pedestrian fatalities has continued to trend up. In 2016, they made up 16% of the total fatalities – up from 11% in 2007. In North Carolina, pedestrian fatalities plateaued between 2012 and 2016, but still made up 15% of the total fatalities. With projected growth in the metropolitan areas of the state, where more people are likely to walk, fatalities and serious injuries could increase.

NC2050 DRIVERS & OPPORTUNITIES

Despite the challenges, North Carolina has committees, policies, programs, and projects in place that present significant opportunities to lower fatalities and serious injuries now and in the future.

Vision Zero - NCDOT, from leadership to employees, have adopted and embraced the notion that no loss of life on the transportation system is acceptable. Having this in place, and reminding people of it consistently through committee work, planning processes, programs, and projects, will continue to engrain it as part of the DOT culture.

Data-Driven - NCDOT and other transportation safety partners utilize crash data to understand the key statewide safety issues, where they are occurring, and why. The data is also used to track crash trends to know how the transportation system is performing. This level of detail enables NCDOT to understand the full array of safety need, but better focus investments to the roadways, regions, or contributing factors that are leading to the highest number of fatalities and serious injuries.

SHSP Executive Committee - North Carolina, unlike many other states, has a system of checks and balances in place when it comes to safety. The Executive Committee for Highway Safety (ECHS) composed of top level

agency and department heads meets approximately three times a year to discuss, track, and evaluate progress on safety goals and targets. The group provides a level of accountability to safety, overseeing activities and ensuring investments are being targeted appropriately.

Coordinated Planning – The North Carolina SHSP, HSIP and HSP rely on data-driven approaches to identify the most pressing safety needs and provide solutions. While the SHSP is the umbrella document for safety in the state, all of these plans, which are updated regularly, provide guidance to other transportation plans to enable every agency to work toward the same goals.

Project Prioritization – Many state DOTs struggle with the inclusion of safety in all roadway, bridge, or multimodal projects. NCDOT's project prioritization process is touted as cutting edge in many respects, but it also prioritizes the integration of safety improvements into all transportation projects. Continuing to implement safety goals in all projects and not only at high crash locations enables North Carolina to be more proactive about reducing fatalities and serious injuries.

Multidisciplinary Approach – Crashes are often caused by a variety of factors, including infrastructure gaps (i.e. lack of guardrail), but more predominantly, unsafe behaviors (i.e. texting while driving). As a result, it's hard to address crash causation from a single viewpoint or with an individual solution. NCDOT has a number of multidisciplinary "tools" in place already to address this, including the SHSP, data tools, and the ECHS. However, over the short-term (and over the longer-term if successful), there is interest in identifying locations (small corridors) where a broader range of safety solutions can be implemented.

Safety Corridors – In the near term, NCDOT is interested in developing a framework for statewide safety corridors. The goal is to identify corridors where crashes are over-represented and implement education, enforcement, and infrastructure treatments in tandem. If successful, and deployed at multiple locations, the approach can save lives by reducing speed and unsafe driver behaviors.

Project Evaluation – To meet performance targets and invest HSIP (and other resources) wisely, it's beneficial to know if, and to what extent, projects are reducing fatalities and serious injuries. Like most states, North Carolina uses crash modification factors and countermeasures that work to increase the chances of effectiveness for their programs and projects. However, NCDOT has taken this a step further and evaluates the success for safety project types. This provides information on the benefit or lack of benefit, by project type, enabling NCDOT to make better decisions about how to spend future dollars.

Complete Streets – With population growing and development inevitable, especially in the urban areas, it will be important to move vehicles, pedestrians, and bicyclists safely. NCDOT has in place, and has been implementing with some success, a complete street policy for years. Having a jump start on implementing these types of programs and projects, and baseline knowledge of current challenges and opportunities improve positions in the DOT (and other agencies) to proactively address safety in dense areas.

Alternative Intersections and Interchanges – North Carolina is a leader in superstreet implementation, and among the top couple of states in installing diverging diamond interchanges. Both of these designs are proven safety measures, saving many crashes and injuries. NCDOT should keep installing superstreets, diverging diamond interchanges, and other similar alternative designs wherever possible.

Connected and Autonomous Vehicles – The safety benefits that will be recognized from automated and connected vehicles are enormous. In 2017 the North Carolina legislature passed a law allowing autonomous

vehicles on the roadways, Since then, NCDOT is generally promoting the introduction of these vehicles in many ways and should continue to promote this technology by all means possible.

9.5 REVIEW OF THE CURRENT PLAN

The 2014-2018 SHSP is the most recent statewide safety planning framework. The plan relies on the results of a data-driven analysis to identify safety needs and proven solutions. Per federal requirements, a SHSP must be updated every five years, so the next North Carolina SHSP will be updated in 2019. Although SHSP's are on a five-year cycle, NCDOT reviews crash data on an annual basis and discusses SHSP implementation with the ECHS three times a year. As a result, NCDOT is constantly aware of fatality and serious injury trends and able to focus partnerships and resources where needed. The following discusses the key elements of the North Carolina SHSP, including opportunities and challenges for transportation safety moving forward.

SAFETY PLANNING PROCESS

The planning and update process for a SHSP is outlined in federal transportation legislation, which went into effect under SAFETEA-LU (2005) and was expanded with MAP-21 (2012). The fundamental requirements, and how NCDOT met those in the 2014 update, are outlined in Table 11.

Table 10 SHSP Planning Requirements and NC SHSP Planning Process

Legislative Requirement	Requirements Addressed in the 2014 NC SHSP
Be developed using a consultative approach and engage a handful of required stakeholders.	<ul style="list-style-type: none"> - Safety partners, representative of those required to participate in an SHSP, were engaged throughout. Other interested partners also participated. - Stakeholders were engaged during two SHSP workshops and through emphasis area working groups. - Members of the ECHS were also engaged in the planning process.
Provide strategic direction for other plans (i.e. HSIP, HSP) and be coordinated with plans (i.e. state and regional LRTPs)	<ul style="list-style-type: none"> - Agencies, who manage other safety and transportation plans in North Carolina, were engaged in the SHSP planning process. - Several statewide and regional reports and plans were reviewed to identify safety goals, programs, or issue areas to inform the SHSP.
Use a data-driven approach to problem identification	<ul style="list-style-type: none"> - Ten years of statewide crash data were analyzed to identify crash scenarios and primary factors contributing to crashes.
Adopt performance based goals and objectives	<ul style="list-style-type: none"> - At the time of this plan update, annual safety targets, which align with SHSP objectives, were not yet required (this happened in 2017). However, the North Carolina SHSP did establish goals to cut fatalities and serious injuries in half by 2030.
Identify effective strategies and countermeasures	<ul style="list-style-type: none"> - Strategies and countermeasures (from previous SHSP) were reviewed and revised, based on data and stakeholder input. They are included in the SHSP and emphasis area action plans.
Develop a process for implementing SHSP strategies	<ul style="list-style-type: none"> - Formed emphasis area working groups to develop action plans and implement solutions. - The ECHS is intended to monitor and assist with implementation.
Consider the 4Es of safety when determining SHSP strategies	<ul style="list-style-type: none"> - Interactive workshop was held with 4E stakeholders to identify emphasis areas. - Emphasis area teams, inclusive of 4E representation, were formed to develop strategies and actions.
Develop a process for SHSP evaluation	<ul style="list-style-type: none"> - Emphasis area action plans lay out a tracking mechanism, inclusive of strategies, actions, implementing agencies, and performance measures to be able to evaluate safety progress. - ECHS meets regularly to review crash trends and evaluate SHSP strategies and actions.

GOALS AND PERFORMANCE MEASURES

The requirement to set targets for the five safety performance measures was established in the MAP-21 transportation legislation, but the actual target setting identification and reporting process did not go into effect until 2017. The current 2014-2018 North Carolina SHSP sets a visionary goal of zero as well as short term fatality and serious injury performance measures, with the goal of cutting both in half by 2030. For the 2019 SHSP update, the planning process should include a review of the five annual safety targets (identified in the HSIP and HSP) to establish longer term goals and objectives that align with the annual targets. This approach provides consistency across plans and ensures every agency is working toward the same safety targets.

KEY STRATEGIC ISSUES, NEEDS, AND TRENDS

The emphasis areas identified in the 2014 North Carolina SHSP represent the greatest opportunity to lower fatalities and serious injuries, based on a review of the crash trends through 2014. At the time of the plan update, the following key safety needs were identified:

- Demographic Considerations (Older and Younger Drivers)
- Driving While Impaired (Alcohol)
- Emerging Issues and Data (Data Improvements to Continually Address Most Pressing Safety Concerns)
- Intersection Safety
- Keeping Drivers Alert (Distracted and Drowsy Driving)
- Lane Departure
- Occupant Protection/Motorcycles
- Pedestrians and Bicyclists
- Speed

For the 2019 update, a similar data-driven process will be undertaken to understand how significantly these emphasis areas and/or others (AASHTO identifies up to 22 potential emphasis areas for states to consider) contribute to fatalities and serious injuries. Based on the results of that trend analysis and stakeholder input, North Carolina's safety needs will be identified.

Although the SHSP is updated every five years, NCDOT and its partners, review and evaluate safety data on an annual basis. The goal is to understand if and how safety issues are changing over time as a result of program and project implementation. Five-year trends (between 2012-2016) show that distracted driving, drugged driving (not a 2014 emphasis area), heavy trucks (not a 2014 emphasis area), lane departures, older drivers, speeding, young drivers, and unbelted drivers have been trending up on average. These, and other safety needs, will be reviewed carefully in the 2019 update.

COORDINATION OPPORTUNITIES AND CHALLENGES FOR NEXT PLAN UPDATE

The SHSP is the umbrella document, identifying statewide safety needs and solutions. Ideally, every transportation and safety stakeholder in North Carolina is referring to its contents and implementing its strategies to sustain a coordinated approach to zero fatalities. In addition to its' coordination focus, the SHSP provides a number of other benefits (described in the FHWA publication *SHSP Quick Reference Guide*). The 2019 SHSP update is a prime opportunity to recognize or improve on these benefits. Table 12 shows the benefits and links those to possible challenges and opportunities in North Carolina.

Table 11 2019 SHSP Opportunities and Challenges

SHSP Benefit	Challenge in NC	Opportunity in NC
Establishes common statewide safety goals and priorities	- Ensuring all NCDOT Divisions/Units understand how the SHSP impacts their job responsibilities.	- Align the SHSP vision of zero fatalities, the SHSP objectives, and SHSP emphasis areas with NC Moves 2050.
Strengthens existing partnerships	- Keeping all partners, besides those on the ECHS, engaged in SHSP (and safety in general) efforts. - Keeping NCDOT Divisions/Units engaged in/thinking about safety needs and priorities.	- Continuing with emphasis area team meetings after the plan is updated.
Promotes safety data, knowledge, and resource sharing	- Ensuring everyone understands the data and has access to it.	- Ability for stakeholders to understand SHSP data and decisions and share it with their own partners. - Opportunity to meet other transportation and safety stakeholders and put faces to names.
Focuses on the State's most serious safety problems	- Understanding of key safety issues, but inability to fund every effective program and project.	- Understanding of the key safety issue areas statewide. - Opportunity to share results of data-driven analysis with all stakeholders to encourage more state, regional, and local agencies to coordinate implementation of SHSP strategies.
Avoids redundant activities among partners and leverages resources	- Encouraging and enabling (with funding) all partners to implement SHSP actions.	- Educating stakeholders on SHSP emphasis areas and strategies to encourage coordination on implementation activities.
Provides a multidisciplinary approach to solving safety problems	- Breaking down agency silos to get partners from different types of agencies to realize partnership potential.	- Inviting all agencies to participate in the SHSP update as well as keeping them engaged through implementation activities.
Address both behavioral and infrastructure strategies and countermeasures	- Challenge in taking a truly multidisciplinary approach to crashes due to agency or funding silos.	- Engagement of multidisciplinary stakeholders in SHSP update and implementation processes to encourage coordination.

10. STATE OF THE SYSTEM – ASSEST MANAGEMENT AND MAINTENANCE AND OPERATIONS

10.1 OVERVIEW

The NCDOT Division of Highways has an annual budget of approximately \$1.4 billion to address the maintenance and operation needs of its diverse assets which include pavements, bridges, pipes, signs, traffic signals, and right of way. In 2016 the state highway system was valued at approximately \$575 billion, as demonstrated in Table 13.⁵¹ In addition, the Department has over 100 equipment shops, 97 County maintenance yards, 14 Division offices, an intricate ferry system, and over 18,000 pieces of equipment. The Rail Division provides oversight, funding, and planning for over 3,300 miles of railroad tracks, rolling stock, and facilities in North Carolina. NCDOT’s Division of Aviation manages the funding for planned projects and renovations as well as administration of loans and grants to the 72 general aviation airports across the state. These assets must be maintained to ensure they can fulfil their intended purpose and must eventually be replaced as life cycle expectations are met.⁵²

Table 12 2016 Highway Assets

HIGHWAY ASSET TYPE	APPROXIMATE QUANTITY	ESTIMATED ASSET VALUE
Bridges (number)	13,500	\$60 billion
Pavement (lane miles)	163,000	\$62 billion
Other Roadway Assets (centerline miles)	80,000	\$446 billion
Large Pipe and Culverts (each)	27,000	\$7 billion
Total	N/A	\$575 billion

Source: NCDOT 2016 Maintenance Operations and Performance Analysis Report

In the past, NCDOT’s major program areas independently developed their own asset management methods and procedures. The Department has made positive strides to achieve a total Transportation Asset Management (TAM) approach in recent years. As described in FHWA’s Transportation Asset Management Case Studies, Comprehensive Transportation Asset Management, The North Carolina Experience, Part Two, “North Carolina is among the leading states in the nation in the use and implementation of TAM philosophies. These philosophies involve proactively maintaining, preserving and improving the performance and condition and thereby extending the productive life of transportation assets in order to effectively service the mobility and access needs of the state.”⁵³

⁵¹ NCDOT 2016 Maintenance Operations and Performance Analysis Report

⁵² NCDOT 2017 Annual Report Performance

⁵³ FHWA 2011 Transportation Asset Management Case Studies, Comprehensive Transportation Asset Management, The North Carolina Experience, Part Two

10.2 MAINTENANCE AND OPERATIONS & ASSET MANAGEMENT TO NORTH CAROLINA

STATEWIDE

Two significant efforts by NCDOT to address the maintenance and operation of the Department's largest asset, the state-maintained highway network, is the development of the Transportation Asset Management Plan (TAMP) and the Maintenance Operations and Performance Analysis Report (MOPAR). The TAMP, and subsequent annual plan certification, was required by MAP-21. The goal of the federal law and FHWA rule was to ensure that states use data-driven approaches to program federal funding to achieve national performance standards. NCDOT submitted the initial TAMP to FHWA in April 2018, with the final TAMP expected by June 2019. The TAMP focus is on the National Highway System's (NHS) pavements and bridges as required by MAP-21.⁵⁴

The development of the MOPAR is a legislative requirement, NCGS 136-44.3, obligating the Department to survey and report on the condition of the roadway network every two years. The most recent MOPAR was submitted to the North Carolina General Assembly in January 2019.

The Right of Way Branch is involved in the management of right of way, a significant asset of NCDOT. This central branch is responsible for purchasing all necessary property for NCDOT construction projects statewide, including providing property appraisals and relocation services.⁵⁵ As this large asset continues to grow, a concerted effort is being made to ensure the disposal of property that the Department no longer needs. Session Law 2015-241, Section 29.9 mandated the Department of Administration and DOT to develop a plan to reduce the amount of remnant property resulting from right of way acquisition. Remnant property, also referred to as "residue", is property that was acquired in addition to the right of way necessary for a transportation project because that property would be unusable after project completion. At the time of the publication of the Joint Legislative Transportation Oversight Committee Report concerning remnant properties, there were approximately 3,300 remnant properties available for disposal with an estimated market value of \$12 million.⁵⁶

The Department also has procedures for disposing of surplus right of way, which is property that was purchased as part of transportation project but, after project completion and meeting specific criteria, is determined to no longer be needed. After reviewing requests submitted through the local Division Engineer, the Surplus Right of Way Disposal and Control of Access Review Committee makes the determination whether the property is needed by the Department or if the criteria is met for the property to be sold.⁵⁷

NCDOT's Facility Maintenance Unit is responsible for managing the maintenance, repairs, renovations and replacement of the Department's buildings and facilities. Session Law 2015-241 requires a report to the Joint Legislative Transportation Oversight Committee on how the Department forms the six-year capital improvement needs estimate, including how much funding will be required for each fiscal year and what types of projects will be excluded. The Department developed and implemented its own Facility Condition Assessment Program (FCAP) in 2012, which compiles data on building and facility conditions, and is then utilized to develop a database

⁵⁴ NCDOT 2016 Interim Transportation Asset Management Plan

⁵⁵ NCDOT 2018 Right of Way Manual

⁵⁶ NCDOT 2016 Right-of-Way Acquisitions / Reduce Remnant Property Report to the Joint Legislative Transportation Oversight Committee

⁵⁷ NCDOT 2017 Surplus Right of Way Disposal and Control of Access Review Committee Operating Procedures

of needed improvements and repairs. The final prioritization list takes into consideration the facilities' condition and the ability of the Department's plan to adequately deliver its services.⁵⁸

The NCDOT's Ferry Division manages the second largest state-run ferry system in the U.S., which includes 21 ferries on seven regular routes across the Currituck and Pamlico Sounds, and the Cape Fear, Neuse and Pamlico Rivers.⁵⁹ Ferry vessel replacement is now included in the STIP, which is the data-driven, 10-year plan developed under the 2013 STI Law to identify and prioritize transportation projects. The regular maintenance and repairs of ferry vessels is managed by the central Ferry Division.

Another large collection of NCDOT's assets is the fleet of light and heavy-duty construction and maintenance equipment, valued at approximately \$650 million. Unlike other states, NCDOT's fleet is managed under an "enterprise fund" known as the Equipment Revolving Fund, which is maintained by the Fleet and Material Management Unit (FMMU). The enterprise fund utilizes pre-determined rental rates for each FMMU managed piece of equipment and includes all maintenance and replacement costs. The utilization of the equipment is then tracked by the local user, and the rental rate provides funding for maintenance activities and replacement as the equipment meets predetermined milestones. This process rewards high equipment utilization by the field offices and discourages retaining an inventory of extra or spare equipment.⁶⁰

REGIONAL

While the statewide units provide oversight for many functions, NCDOT's 14 Division Offices are responsible for implementing the maintenance and operation plans for the assets contained within the state highway network. These include pothole repair, bridge rehabilitation, pavement resurfacing, and right of way maintenance including mowing and litter pick up.⁶¹

In the spring of 2016, the Department engaged in an asset management, self-assessment process to determine the effectiveness of its current maintenance practices and procedures. Staff from all 14 Divisions participated in discussions which provided essential information on the current state of the process. This information was utilized to develop the vision and approach throughout the field offices to ensure that there were no major dissimilarities of the highway network throughout the regions of the state.⁶² This effort led to the development of what is now known as the Routine Maintenance Improvement Program (RMIP) and Bridge Maintenance Improvement Program (BMIP) that identify multi-year work tasks for various routine maintenance and bridge related activities to be completed by the Divisions. These programs work in conjunction with the previously established Highway Maintenance Improvement Program (HMIP) that established a multi-year work program to address pavement needs, including contract resurfacing, rehabilitation, and preservation. Collectively, the HMIP, RMIP, and BMIP establish a detailed plan for investing limited maintenance allocations into activities that will better maintain and preserve the State's assets.

In 2017, legislation was passed by the General Assembly that required the Department to merge each of these plans into a single five-year HMIP by April 1, 2020. The vision is that the HMIP will be a guide to aid the local field offices in planning the distributions of their maintenance and operations budget, with all major assets being evaluated consistently across the state.

⁵⁸ NCDOT 2015 Report on Capital Improvement Needs Estimate

⁵⁹ NCDOT 2017 Annual Report Performance

⁶⁰ NCDOT 2011 Fleet and Material Management Manual

⁶¹ NCDOT 2017 Annual Report Performance

⁶² NCDOT 2016 Maintenance Operations and Performance Analysis Report

10.3 WHY MAINTENANCE AND OPERATIONS & ASSET MANAGEMENT ARE IMPORTANT TO NORTH CAROLINA

QUALITY OF LIFE

NCDOT's mission is to "connect people, products and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina." To meet this mission, the Department must provide a safe, well-maintained and reliable transportation system. The state highway network and other assets are crucial to the wellbeing of North Carolina, affecting the lives of its residents daily. Developing a strategy to keep the state's roadway network and other critical assets operating efficiently while staying within the current funding limits are key to maintaining a high standard of living for the residents of North Carolina.

ECONOMICS (LOCAL, REGIONAL, STATEWIDE, AND NATIONAL)

Infrastructure condition is one of the key factors used to decide where to locate future developments. Reliable connections with regional hubs, train stations, ports, airports, and inland freight facilities, as well as the ability for workers to access work places safely and efficiently, are necessary to attract industry and promote strong economic growth. The condition of the Department's infrastructure directly affects the reliability, which in turn shapes the overall economic health of North Carolina.⁶³

VISION FOR MAINTENANCE AND OPERATIONS & ASSET MANAGEMENT IN NORTH CAROLINA

By continuing to utilize the data-driven TAM approach, specifically through the HMIP as discussed previously, NCDOT will be able to further sustain and extend the effective life cycle of the state's transportation assets. The Department's desire to be more transparent and accountable to the public is achievable, and a TAM approach allows the Department to link employee job performance directly to the condition of the state's resources, allowing employees to directly contribute to the desired vision and goals.⁶⁴

As TAMP is developed, and the HMIP continues to be refined and improved, the Department intends to have each of these plans work in concert and incorporate elements of the Department's Statewide Long-range Transportation Plan. As these plans are developed with an overall asset management vision, the duplication of efforts is expected to be reduced, ensuring that available funding will be utilized as efficiently and consistently as possible.

10.4 TRENDS AFFECTING MAINTENANCE AND OPERATIONS & ASSET MANAGEMENT

NATIONALLY

As the nation's infrastructure ages, transportation agencies across the country must find new and innovative maintenance and operations processes to extend the life cycle of critical assets and utilize budgets more efficiently.⁶⁵ Federal requirements such as MAP-21 and the FAST Act are requiring agencies to develop a risk-based TAMP for pavements and bridges on the NHS. Its purpose is to improve or preserve the condition of

⁶³ NCDOT 2016 Interim Transportation Asset Management Plan

⁶⁴ FHWA 2011 Transportation Asset Management Case Studies, Comprehensive Transportation Asset Management, The North Carolina Experience, Part Two

⁶⁵ FHWA 2011 Transportation Asset Management Case Studies, Comprehensive Transportation Asset Management, The North Carolina Experience, Part Two

assets and the performance of the system, along with strategies to program projects that will help states meet targets for maintenance and operations of critical assets within the NHS consistent with national goals. When utilized effectively, the TAMP, used in conjunction with our existing state level asset management plans, is a powerful budgeting and management tool providing methodologies that can prolong the life cycle of critical assets while determining future financial needs.

STATEWIDE

In recent years, the Department had experienced a cash build up due to inefficiencies in project and program delivery. Significant efforts were made to reduce the balance through accelerating project delivery and increased effectiveness in delivering maintenance and operations programs. Since November 2017 a total of 350 projects were accelerated and 144 new projects added to the 2018-2027 STIP. While the accelerated project delivery has strong economic impacts and enhances the state's economic competitiveness, the growth in highway assets will require effective asset management for meeting infrastructure health objectives.⁶⁶ As these projects are completed, the long-term maintenance of these new assets must be considered, and the additional budgetary needs identified and resourced appropriately.

KEY CHALLENGES FOR MAINTENANCE AND OPERATIONS & ASSET MANAGEMENT IN NORTH CAROLINA

Although there have been improvements by the Department in transportation asset management in the past, there remain many opportunities to bring the various plans together, ensure that efforts are not duplicated, and confirm that all activities are working to achieve the Department's overall mission and goals. Maintaining consistency throughout the extremely diverse climatic, topographical, and economic areas that exist in the state will always be a challenge.

As many other states have discerned as they prepare and implement effective asset management plans, having an evolving and accurate inventory of all major assets is difficult to develop and maintain. NCDOT has made a concerted effort to develop accurate databases for its largest assets and utilize the information for developing maintenance and operations programs and procedures. These include extensive data collections for the state's pavement and bridge conditions, residual and surplus right of way, and fleet size and condition.

As the roadway network continues to grow and age, and all the various other assets compete for the limited resources, the challenge to the Department is to balance maintenance needs with the available funding.⁶⁷ Funding has an impact on all aspects of the maintenance program, influencing the ability to plan, produce, and deliver. Table 14 identifies the annual funding needs to reach target levels of service for maintenance and operations. The recommended funding takes into account that highway funds are limited and is based on a reasonable timeline to reach target levels of service. In keeping with the strategic direction set by the General Assembly in 2014, the Department's recommended funding departs from past precedence of relying on historical expenditures to establish current year plans, instead basing it on Division Improvement Plans, life cycle costs, and statewide production goals for the highway network.⁶⁸

⁶⁶ Build NC Presentation, February 5, 2018

⁶⁷ NCDOT 2017 Annual Report Performance

⁶⁸ NCDOT 2018 Maintenance Operations and Performance Analysis Report

Table 13 Maintenance Program Appropriation and Investment Recommendations

MAJOR PROGRAMS	FY 2019 STATE APPROPRIATE (\$ MILLION)	INVESTMENT RECOMMENDATION (\$ MILLION)
Contract Resurfacing	\$504	\$519
Pavement Preservation	\$98	\$110
Bridge Program	\$272	\$272
Bridge Preservation	\$82	\$82
Roadside Environmental	\$101	\$122
General Maintenance Reserve		
Highway Maintenance	\$159	\$455
Statewide Programs	\$150	\$150
Subtotal, General Maintenance Reserve	\$309	\$605
Total	\$1,366	\$1,710

Note: Statewide programs include asset maintenance and operations, snow and ice, non-declared emergencies, research and development, and state and federal obligations⁶⁹

NC MOVES 2050 DRIVERS & OPPORTUNITIES

Directly in line with NCDOT’s goal to improve the reliability and connectivity of the transportation system, the U.S. Congress’ MAP-21 Act requires states to develop a data-driven approach to achieve national performance measures on the NHS when expending federal funding.⁷⁰ The Department can use this federal requirement as a starting point to ensure consistent delivery methods through a TAM program approach.

A primary stakeholder of NCDOT is the North Carolina General Assembly, which guides NCDOT’s activities through statute and funding. They are among the agency’s biggest customers for asset management system analysis, and NCDOT personnel regularly provide reports that assist members in their oversight functions. The movement forward is to transform the MOPAR from a General Assembly required report into an actual maintenance plan that NCDOT field staff can utilize to meet target performance measures.

⁶⁹ NCDOT 2016 Maintenance Operations and Performance Analysis Report

⁷⁰ NCDOT 2016 Interim Transportation Asset Management Plan

The Department has historically embraced a data-driven process for developing an effective asset management program. Continuous data quality issues play an important role in asset management and remain a primary focus of the Department.⁷¹

The congressional and legislative requirements provide an excellent opportunity to bring several separate stand-alone reports and processes together under one umbrella to maintain the Department's wide array of assets more efficiently with the overall goals and mission at the forefront.

10.5 REVIEW OF THE CURRENT PLAN

MAINTENANCE AND OPERATIONS & ASSET MANAGEMENT PLANNING PROCESS

For its largest asset, the state roadway network, NCDOT collects information on the condition of pavement and bridges to evaluate the transportation system's performance. Performance measures and targets are established based on the operations, future conditions, and maintenance of the roadway system in conjunction with customer input. These performance measures have served as a good basis for NCDOT to determine investment strategy, funding amounts, and project identification and provide a good foundation for the TAMP.⁷²

At the beginning of every year, the Division of Highways commences pavement condition surveys of all Department assets along interstate, primary, and secondary systems. These surveys provide a point-in-time snapshot of the system condition and the results of these surveys are used to rate the pavement condition using a Pavement Condition Index (PCI). The PCI has a rating scale of 0 to 100 and considers observed defects in the pavement such as cracking, patching, rutting, raveling, corner breaks, seal breaks, and faulting. A segment of pavement with multiple defects will score lower on the PCI and trend towards "fair" or "poor." Pavement repair is influenced primarily by activities funded through state programs for contract resurfacing and pavement preservation, and NCDOT's Interstate Maintenance Program. The most recent pavement condition data is collected and stored in the Pavement Management System. This data helps to identify the recommended treatment for pavement sections to achieve the best pavement condition rating. NCDOT utilizes the pavement condition data to produce the HMIP, a five-year work plan based on annual funding appropriations.

Bridge inspections are performed in accordance with the federal National Bridge Inspection Standards and results are uploaded to the Bridge Management System (BMS). These are utilized to determine feasible maintenance and rehabilitation strategies and network optimization based on performance and funding constraints. The system can perform multiple optimization scenarios, and the results from the BMS analysis, in conjunction with information contained in the bridge inspection reports, are used to develop the 5-year Bridge BMIP.⁷³

NCDOT developed and implemented the FCAP in 2012, which is a data-driven assessment of its facilities. The information is used to develop a numerical score based on weighted values for building features and functionality, and input from end-users. The operational targets and goals are tied directly to the Department's Strategic Plan and the final prioritization list considers, in addition to the facility's physical condition, how the facility enables the Department to adequately deliver its services.⁷⁴

⁷¹ FHWA 2011 Transportation Asset Management Case Studies, Comprehensive Transportation Asset Management, The North Carolina Experience, Part Two

⁷² NCDOT 2016 Interim Transportation Asset Management Plan

⁷³ NCDOT 2016 Maintenance Operations and Performance Analysis Report

⁷⁴ NCDOT 2015 Report on Capital Improvement Needs Estimate

Unlike most DOT fleets, the NCDOT's fleet is managed under an "enterprise fund" known as the Equipment Revolving Fund. The FMMU is charged with managing the fund and with providing the right equipment, at the right price, in a timely manner. Its role is to promote a strong repair and preventative maintenance program to improve fleet performance.

The FMMU does not receive any directly appropriated funding and is totally funded from the Equipment Revolving Fund as described in Section 2.1. Monies are generated by equipment rent which is charged to each cost center within the Department, and from funds generated by the sale of used equipment. The revolving fund supports salaries and wages for all FMMU and division equipment employees, maintenance and repair of equipment, fuel facilities, fuel, repair parts, tires, lubricants, depreciation, and all other expenses incurred in the operation of the DOT fleet, including purchase of replacement equipment.⁷⁵

GOALS AND PERFORMANCE MEASURES

Tracking measurable conditions for its assets in relation to performance targets is an effective tool for NCDOT to determine if the agency's goals are being achieved at a network level as well as at a division and local level. The Department has made considerable progress in moving toward a data-driven process for determining the performance of most of its assets, especially related to highway infrastructure. The challenge is to bring all performance measures and goals together to show the relation between each specific area to the Department's overall Organizational Performance Scorecard. This serves as an indicator for meeting its key mission of "connecting people, products and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina."

KEY STRATEGIC ISSUES, NEEDS, AND TRENDS

NCDOT faces several challenges in meeting the transportation needs of the state's growing population. The Department is responsible for all modes of transportation in the state including highways, ferries, aviation, rail, public transportation, bicycle, and pedestrian and adequate funding is always a concern. To balance the ever-increasing maintenance and operation needs versus funding availability, the Department must find new revenue streams and become more effective in managing existing funds.

In the last few years, state and federal lawmakers have required additional reporting procedures to increase the transparency of state and federal fund expenditures to meet specific performance measures. An effective TAM program will be required to ensure that the desired results are achieved.

COORDINATION OPPORTUNITIES AND CHALLENGES FOR NEXT PLAN UPDATE

A key element for consistency in the maintenance and operations of the entire state transportation system is having an accurate asset inventory which identifies assets, their location, condition, and expected life span. NCDOT recently collected an asset inventory and condition assessment that includes all pipes and culverts and retaining and noise walls. Division maintenance personnel will utilize the data to aid in developing their RMIP. The plan includes cyclical maintenance and replacement activities for these assets on a five-year basis, and thus enables Divisions to identify funding needs accordingly.

In concert with the 14 Divisions' HMIP and BMIP, the next TAMP will utilize the results for life cycle cost planning, along with risk analysis to aid in development of a ten-year financial plan as required by MAP-21. The future goal

⁷⁵ NCDOT 2011 Fleet and Material Management Manual

is to combine all the maintenance related documents, such as the RMIP, BMIP, and HMIP, into the MOPAR, which in turn is expected to streamline the asset management and maintenance budgeting process.⁷⁶

⁷⁶ NCDOT 2016 Interim Transportation Asset Management Plan

11. CONCLUSION

North Carolina has a very comprehensive and interconnected transportation system; however the state faces many challenges from funding, congestion, and other national and regional trends. While each of NCDOT's divisions is responsible for operations and maintaining unique services, they face many of the same challenges. They face external forces such as rapidly developing technologies they must incorporate and plan for, severe weather which threatens their assets and services, and a growing population that adds additional demand. They also face internal challenges, such as how to operate with their current level of funding and with their existing funding mechanisms, regional and no urban/rural connectivity, and a lack of coordination between modes and their planning processes.

Understanding these challenges and how they will affect the state overall, as well as regionally, is vital to the success of NCDOT's long-range planning efforts, as well as the planning efforts by each NCDOT Division. NCDOT's goal with NC Moves 2050 is to create plan alignment among each of the divisions with NCDOT's organizational mission. This includes each mode having a common vision and shared goals and objectives throughout their individual planning processes. NC Moves 2050 will then act as an umbrella for those modal plans and will be a "living document" updated as modal plans are updated.

To achieve this goal, this State of the System briefing report has set the foundation for Plan Integration among all the modes. This will lead to the creation of a cohesive family of plans that share common goals and objectives guided and informed by North Carolina's multimodal long-range transportation plan.



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