



North Carolina Statewide Multimodal Freight Plan

Air Cargo Profile

prepared for
North Carolina
Department of Transportation

prepared by
Cambridge Systematics, Inc.

with
AECOM
Volkert, Inc.
IEM
Baseline Mobility Group



January 18, 2017

report

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List of Acronyms

3DP	Three-dimensional printing
AASHTO	American Association of State Highway and Transportation Officials
ASM	Available seat miles
BIP	Business Investment Program
BTS	Bureau of Transportation Statistics
CAGR	compound annual growth rate
CCOG	Centralina Council of Governments
CLT	Charlotte Douglas International Airport
CVG	Cincinnati/Northern Kentucky International Airport
DDTW	Double dual tandem
DOT	Department of Transportation
FAA	Federal Aviation Administration
FAF	Freight Analysis Framework
FASTLANE	Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies Grant Program
FHWA	Federal Highway Administration
FTZ	Foreign trade zone
GSO	Piedmont Triad International Airport
GTP	North Carolina Global TransPark
IND	Indianapolis International Airport
ISO	Kinston Regional Jetport
JDIG	Job Development Investment Grant
MEM	Memphis International Airport
NS	Norfolk Southern Railway
OneNC	One North Carolina Fund
PMFN	National Primary Multimodal Freight Network
R&D	Research and development
RDU	Raleigh-Durham International Airport
RTK	Revenue ton-kilometers
SCTG	Standard Classification of Transported Goods
SDF	Louisville International Airport

TSA	Transportation Security Administration
ULI	Urban Land Institute
UPS	United Parcel Service
USPS	United States Parcel Service
WACF	Boeing World Air Cargo Forecast

1.0 Overview

The purpose of the Air Cargo Profile, as part of the North Carolina Statewide Freight Plan, is to catalogue existing statewide air cargo infrastructure, operations, carriers, markets and shippers. This information will be used to describe the existing and future conditions, and provide a needs assessment and analysis of existing and future trends for air cargo in North Carolina.

1.1 Methods and Data Overview

Information and data for this element of the Study has been gathered from multiple sources, including:

- **Bureau of Transportation Statistics (BTS) TranStats Database T-100 Market data** provides annual air cargo statistics for all North Carolina airports with reported activity. The data contains domestic and international market data reported by U.S. and foreign air carriers, and contains market data by carrier and origin/destination for enplaned freight and mail. Information about freight and mail tonnage, origin-destination geographies, and carriers for North Carolina airports came from this data source.
- **Federal Highway Administration’s (FHWA) Freight Analysis Framework (FAF) version 4.1** contains aggregated annual volume summaries by origin-destination geography (using FAF zones¹), mode, and commodity and provided this information on a historical and forecast basis using a combination of actual data and modeled behavior. FAF4.1 has a base year of 2012, with annual estimates for 2013 through 2015, as well as 5-year increment forecasts through 2045. FAF4.1 provided information on commodities and cargo value for North Carolina Airports.
- **RDU Vision 2040 Airport Master Plan**, which is not expected to be completed until winter 2016/2017, provided 2040 forecast tonnage estimates for Raleigh-Durham International Airport (RDU), which were approved by the Federal Aviation Administration (FAA). The Plan published a compound annual growth rate (CAGR) for air cargo from 2015 to 2040. This growth rate was used to develop the “low growth scenario” for North Carolina’s air cargo markets.
- **2015 Boeing World Air Cargo Forecast (WACF)** is a biennial report that provides an overview of the air cargo industry at the National level. The report summarizes major air trade markets, trends and forecasts for domestic and international markets. These growth rates were used to develop the “high growth scenario” for North Carolina’s air cargo markets.

The Air Cargo Profile sourced tonnage estimates for the base year (2015) from the BTS T-100 data, and used FAF4.1 commodity distribution for 2012 to allocate BTS figures to Standard Classification of Transported Goods (SCTG) codes. Value estimates for 2015 were calculated by applying FAF4.1 2012 value per ton rates to the BTS tonnage estimates at the commodity level.

This Profile also estimates future activity and demand at North Carolina airports for a “low growth scenario” and a “high growth scenario” for air cargo activity statewide, as well as at each of the three primary air cargo airports: Charlotte Douglas International (CLT), Raleigh-Durham International (RDU) and Piedmont Triad International (GSO). To calculate the low growth scenario, this analysis applied the growth rate from the

¹ There are four FAF zones in North Carolina: Charlotte area, Greensboro/Winston-Salem/High Point, Raleigh-Durham, and the rest of North Carolina, which covers three distinct portions of the State.

RDU Vision 2040 to the 2015 BTS tonnage estimates, and used FAF4.1 commodity distribution for 2045 to allocate the forecasted tonnage figures to SCTG codes. Low growth value estimates for 2045 were calculated by applying FAF4.1 value per ton rates from 2045 to the low growth tonnage estimates at the commodity level. To calculate the high growth scenario, this analysis applied the growth rates from the Boeing WACF to the 2015 BTS data, taking into account origin/destination pairings and domestic/international activity. High growth value estimates for 2045 were calculated by applying FAF4.1 value per ton figures from 2045 to the high growth tonnage estimates at the commodity level.

1.2 Section Organization

The remainder of the report is divided into four additional sections. Section 2 will detail the inventory/supply of air cargo activity in North Carolina, which includes air cargo facilities, freight significant corridors, capacity, service and service providers. Section 3 will detail the network use and performance, which focuses on the activity/demand element of air cargo activity. This section will identify the industries served by air cargo, and how these connect to the state's economy, the markets served and connections to global marketplaces, as well as bottlenecks and deficiencies. Section 4 describes long-term trends for the state, including future activity, performance and demand. This section will also discuss statewide trends affecting the air cargo industry and the implications of growth. Finally, Section 5 will feature an assessment identifying the needs and issues associated with airport access, airport infrastructure and adjacent industrial development. Additionally, Appendix A features a description the SCTG commodity codes, which will be used to discuss commodity flow throughout this report.

2.0 Inventory – Supply

This section provides an inventory of the supply of air cargo activity in North Carolina. It lists all airport facilities, highlights the facilities with air cargo activity, and details the facility infrastructure and capacity. The three primary airports with reported air cargo activity are Charlotte Douglas International (CLT), Piedmont Triad International (GSO), and Raleigh-Durham International (RDU). This section will also discuss the North Carolina Global TransPark (GTP) facility, as well as service providers at North Carolina’s airports.

2.1 Airport Facilities

North Carolina has 74 publicly-owned airports and nearly 300 privately-owned airports throughout the State, as shown in Figure 2.1. Out of these airports, 9 have regularly scheduled airline service and 4 provide international service.² North Carolina is served by 18 airports with reported cargo activity in 2015, as reported by the Bureau of Transportation Statistics (BTS), including both dedicated all-cargo operations as well as commercial passenger belly cargo. Figure 2.2 depicts a map of the 18 airports with reported air cargo activity throughout the state. Two airports in North Carolina, RDU and GSO, are designated as part of the National Primary Multimodal Freight Network (PMFN). Thus, these two facilities could be eligible for federal funding under the FASTLANE grant program or North Carolina’s portion of the National Freight Program that can be spent on non-highway modes.

NC Airports with Cargo Activity

COMMERCIAL SERVICE AIRPORTS

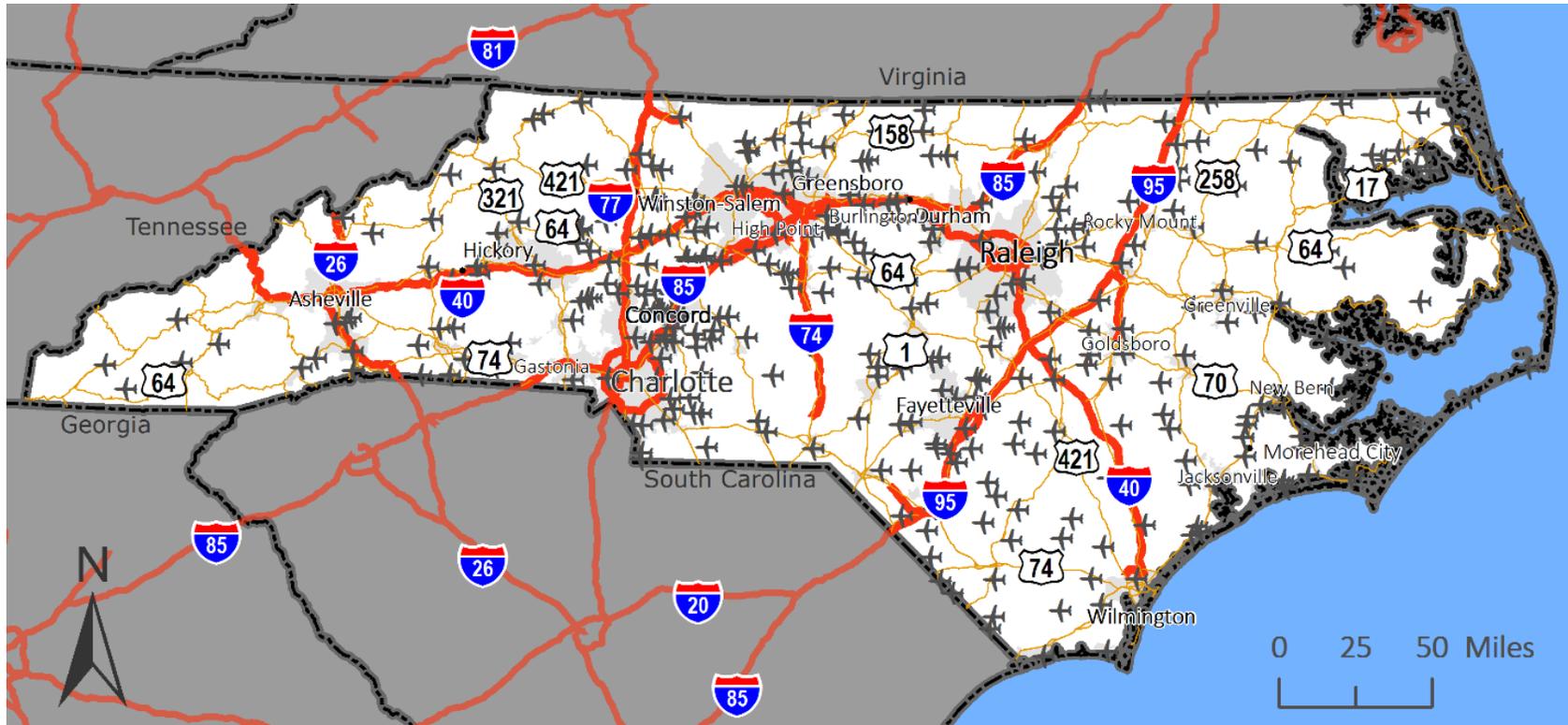
- ✈ Asheville Regional Airport (AVL)
- ✈ Charlotte/Douglas International Airport (CLT)
- ✈ Fayetteville Regional/Grannis Field Airport (FAY)
- ✈ Piedmont Triad International Airport (GSO)
- ✈ Pitt-Greenville Airport (PGV)
- ✈ Albert J. Ellis (OAJ)
- ✈ Coastal Carolina Regional Airport (EWN)
- ✈ Raleigh-Durham International Airport (RDU)
- ✈ Wilmington International Airport (ILM)

GENERAL AVIATION AIRPORTS

- ✈ Clinton Sampson County Airport (CTZ)
- ✈ Hickory Regional Airport (HKY)
- ✈ Smith Reynolds Airport (INT)
- ✈ Dare County Regional Airport (MEO)
- ✈ Cherry Point MCAS (N1C)
- ✈ Gastonia Municipal Airport (NC1)
- ✈ Rocky Mount-Wilson Regional Airport (RWI)
- ✈ Statesville Regional Airport (SVH)
- ✈ Person County Airport (TDF)

² “Frequently Asked Questions”. North Carolina Department of Transportation. Accessed October 13, 2016. Available from: <https://www.ncdot.gov/aviation/download/faq.pdf>

Figure 2.1 Airports in North Carolina, All Functions, 2015



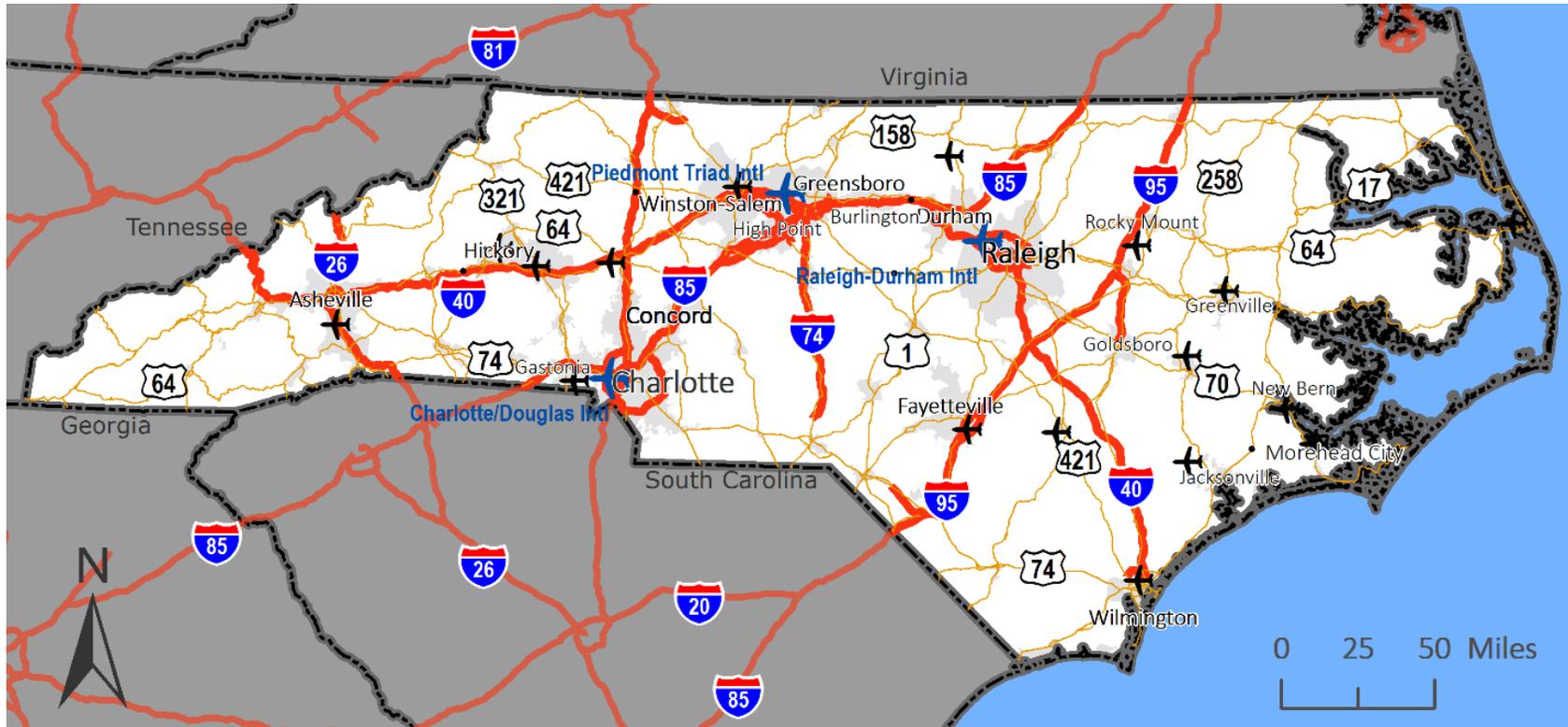
Airports in North Carolina

- ✈ Airport
- Interstate Highway
- US Highway



Source: North Carolina DOT; National Transportation Atlas Database.

Figure 2.2 Airports with Air Cargo Activity in North Carolina, 2015



Airports with Air Cargo Activity in North Carolina

-  Primary Airports
-  Other Airports
-  Interstate Highway
-  US Highway

Source: North Carolina DOT; National Transportation Atlas Database.



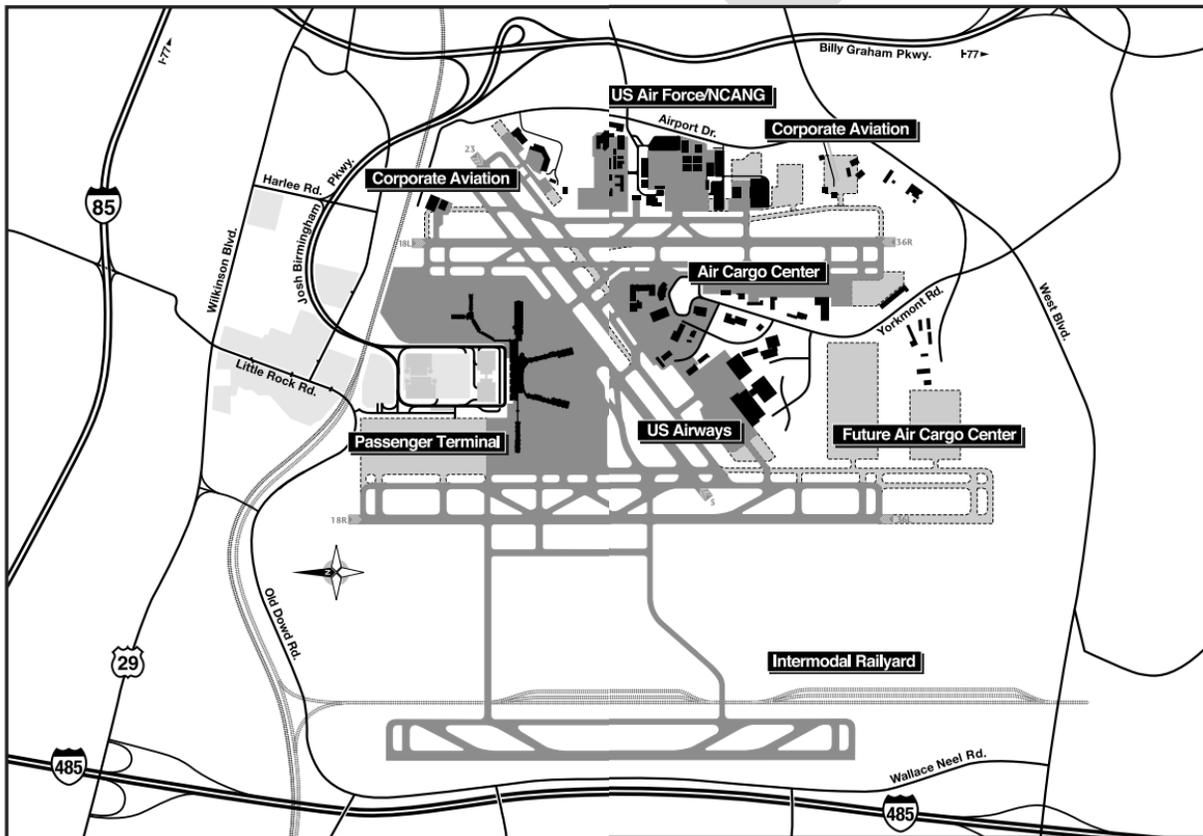
2.2 Freight Significant Facilities

This section features descriptions of the three primary airport facilities for air cargo activity. Three airports comprise 99 percent of air cargo activity in North Carolina: Charlotte Douglas International Airport (CLT), Piedmont Triad International Airport (GSO) and Raleigh-Durham International Airport (RDU). This section also details North Carolina’s Global TransPark facility.

2.2.1 Charlotte Douglas International (CLT)

CLT, located in Charlotte, is currently ranked 6th nationwide and 7th globally in the number of passengers and the volume of cargo enplaning and deplaning at the airport. The airport averages 1,500 operations daily and serves more than 40 million passengers each year, offering nonstop service to nearly 150 destinations, including 37 international destinations. CLT is served by seven domestic carriers, 14 regional carriers, and three foreign flag carriers.³ Air cargo is processed at CLT’s Air Cargo Center. The Air Cargo Center, which is adjacent to CLT’s four runways, has a total of approximately 570,000 square feet of available space and approximately 2.2 million square feet of aircraft ramp space, as shown in Figure 2.3.

Figure 2.3 Charlotte Douglas International Airport Cargo Center Facilities



Source: Charlotte Douglas International Airport “Quick Caller”, 2014.

³ “Quick Caller”. Charlotte Douglas International Airport, 2014.

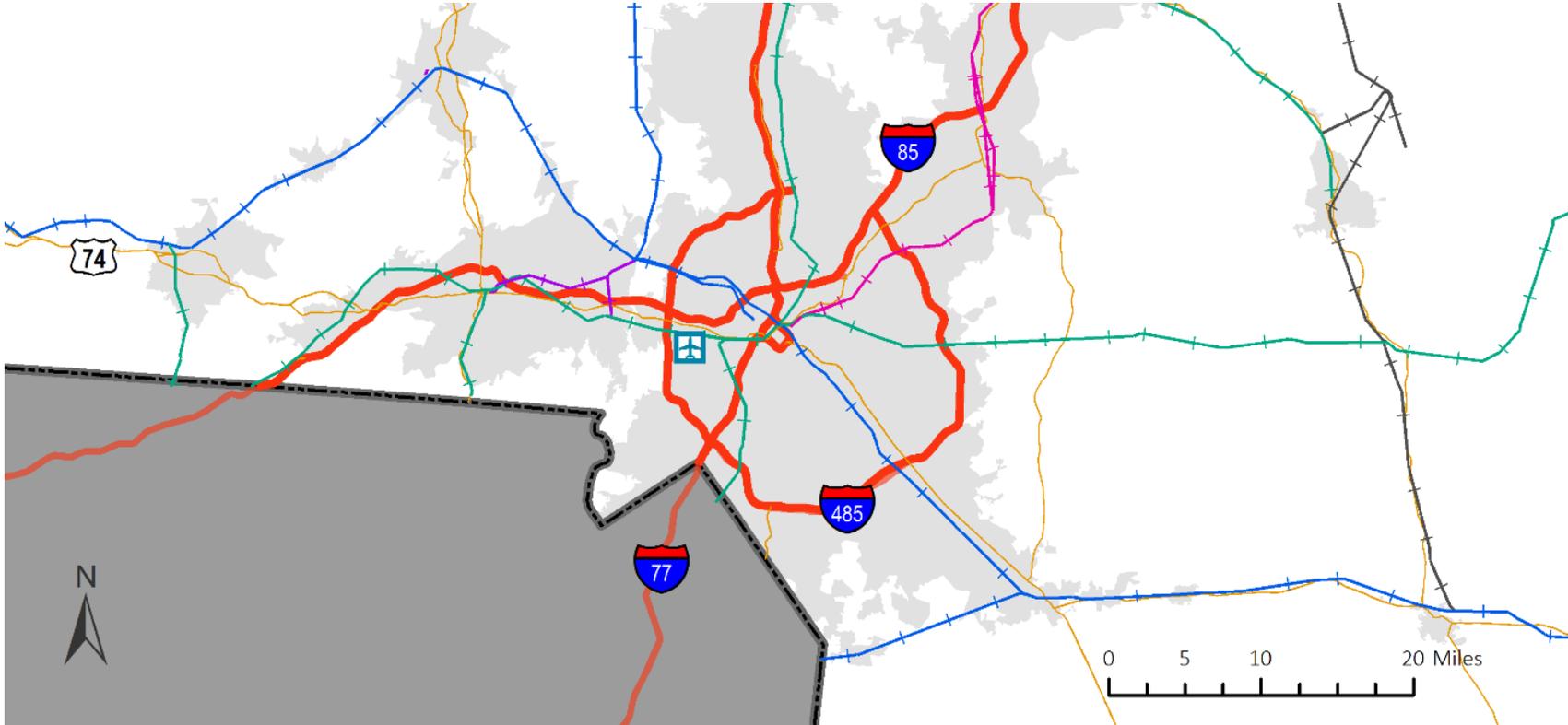
As of 2014, the Air Cargo Center is used by over 60 freight forwarders, customs brokers, and international service providers, over 15 cargo airlines (including cargo lift by commercial carriers), and over 300 trucking companies. CLT is also adjacent to a Foreign Trade Zone (FTZ). Since December 2013, there is also an on-site intermodal rail/truck facility. The Air Cargo Center at CLT is able to link freight between air, rail, water and truck modes, and processed nearly 128,000 tons of air cargo in 2015. Rail connection is provided by both Norfolk Southern Railway (NS) and CSX. **Error! Reference source not found.** presents the rail connections near CLT. NS operates an intermodal container facility on the southwest side of CLT, which can process up to 200,000 lifts annually and has compatibility with aviation operations. To access the Port of Morehead City for maritime freight shipments, NS track runs from Charlotte through Greensboro and Raleigh to the coast. CSX also operates both east-west and north-south in North Carolina, serving Charlotte. It has an intermodal terminal and bulk transfer terminal in Charlotte, east of CLT, but does not connect directly to CLT itself.⁴ Additionally, CSX track runs from Charlotte to the Port of Wilmington.

In addition to the present facilities, CLT's Air Cargo Center has the capacity to handle more than 1 million square feet of building space facilities, including 70 additional acres of aircraft ramp space. There are custom-built facilities including nearly 15,000 square feet of office space, nearly 28,000 square feet of cargo warehouse, and a 21-foot minimum height warehouse clearance, all of which are located on-site and adjacent to the aircraft ramps.⁵

⁴ "North Carolina Maritime Strategy: Existing and Planned Railroad Infrastructure". North Carolina Department of Transportation. May 2012. Available from: <https://www.ncdot.gov/download/business/committees/logistics/maritime/railroadsexistingplannedinfrastructure.pdf>

⁵ "Quick Caller". Charlotte Douglas International Airport, 2014.

Figure 2.4 Rail Service near Charlotte Douglas International Airport



Rail Connection at Charlotte Douglas International Airport (CLT)

- CLT Airport
- Interstate Highway
- US Highway
- Railroads
 - CSX Transportation
 - Norfolk Southern
 - North Carolina Department of Transportation
 - North Carolina Railroad Company
 - All Others



Source: North Carolina DOT; National Transportation Atlas Database.

2.2.2 Piedmont Triad International (GSO)

Piedmont Triad International Airport (GSO) is located approximately 10 miles west of downtown Greensboro, North Carolina. It services the Piedmont Triad Region, which is a manufacturing, trade and financial center including the areas of Greensboro, High Point and Winston-Salem. GSO's core service area includes 12 North Carolina counties and 6 southern Virginia counties, a total population of approximately 1.8 million people.⁶

GSO is a multimodal cargo facility, providing connections to major trucking lines operating terminals near the airport. **Error! Reference source not found.** shows the rail and highway access in and around the airport. Air cargo companies providing all-cargo services include FedEx, DHL Express, Mountain Air Cargo, TradeWinds, and United Parcel Service (UPS). In addition, a Norfolk Southern (NS) track runs along the south of GSO, along W. Market Street, but does not connect directly with the airport. However, there are plans to build a rail spur for a multimodal facility at GSO in the future. In addition, all other airlines provide belly cargo services based on space available, including Allegiant, American Airlines, Delta Airlines, Frontier Airlines and United Airlines.

The airfield layout for GSO is shown in **Error! Reference source not found.** There are four apron areas at GSO dedicated to air cargo services, totaling nearly 227,000 square feet of air cargo apron space. GSO has FedEx Express' Mid-Atlantic Air Hub, which is a 1 million square foot facility able to sort up to 24,000 packages per hour for freight destined for various east coast locations.⁷ Mountain Air Cargo is FedEx's express cargo carrier. DHL Express leases nearly 15,000 square feet of space at GSO, and TradeWinds provides both international and domestic air cargo services out of a hangar and apron on the south side of the airport. UPS operates both express overnight cargo and ground cargo out of the airport in two separate facilities.⁸

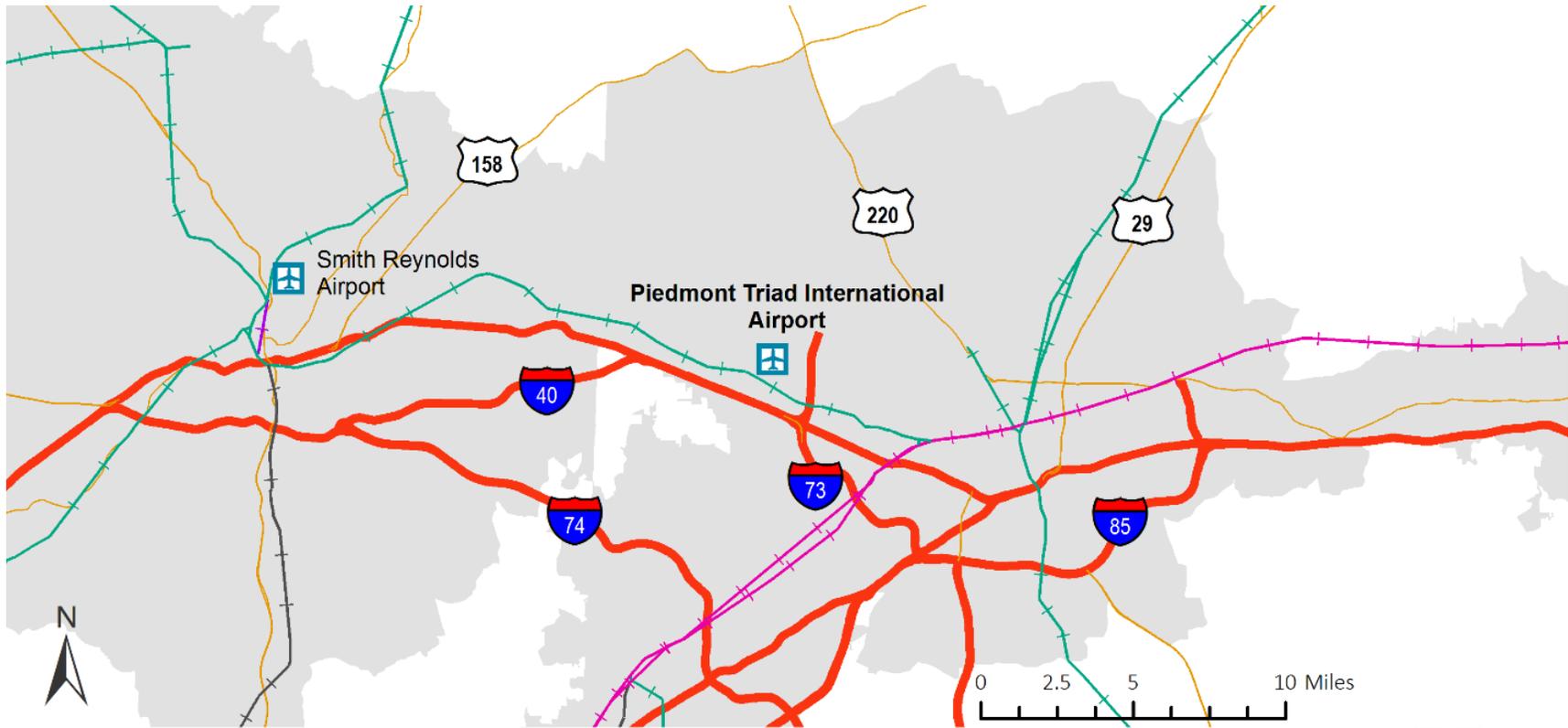
According to GSO's Airport Master Plan Update from 2010, there was significant vacant space in several of the airport's six onsite air cargo buildings, as shown in Table 2.1. Air Cargo Building #1 was primarily occupied by the Piedmont Triad Airport Authority, but had four vacancies totaling 7,500 square feet of its nearly 30,000 square foot facility. In addition, Air Cargo Building #3 had a sizable vacancy for one tenant, amounting to 37 percent of the building's square footage. However, it is important to note that this inventory does not include FedEx Express' one million square foot facility, which was recently developed.

⁶ Airport Master Plan Update and Strategic Long-Range Visioning Plan. Piedmont Triad International Airport Authority. September 2010. <http://flyfrompti.com/wp-content/uploads/2014/08/Airport-Master-Plan-Update.pdf>

⁷ Piedmont Triad International Airport. Greensboro North Carolina Economic Development Association. May 2013. <http://www.greensboropartnership.com/sites/default/files/pdf/econdev/AirportText.pdf>

⁸ Airport Master Plan Update and Strategic Long-Range Visioning Plan. Piedmont Triad International Airport Authority. September 2010. <http://flyfrompti.com/wp-content/uploads/2014/08/Airport-Master-Plan-Update.pdf>

Figure 2.5 Access to Piedmont Triad International Airport



Access to Piedmont Triad International Airport (GSO)

- | | |
|--------------------|---|
| Airport | Railroads |
| Interstate Highway | CSX Transportation |
| US Highway | Norfolk Southern |
| | North Carolina Department of Transportation |
| | North Carolina Railroad Company |
| | All Others |



Source: North Carolina DOT; National Transportation Atlas Database.

Table 2.1 Piedmont Triad International Airport Air Cargo Building Space/Tenant Inventory, 2010

Building	Tenant	Building Area (Square Feet)
Air Cargo Building #1	Comair (Delta Airlines)	1,920
	Vacant #1	1,500
	Vacant #2	3,000
	Vacant #3	2,000
	Vacant #4	1,000
	Piedmont Triad Airport Authority	19,905
	TOTAL	29,325
Air Cargo Building #1A	Landmark Aviation	3,000
	TOTAL	3,000
Air Cargo Building #2	Continental (United Airlines)	7,560
	Aviation Repair Technology	4,158
	Vacant #1	2,142
	Delta	3,780
	Vacant #2	3,150
	UPS	3,276
	Piedmont Triad Airport Authority –Mechanical	1,281
	Quantem	168
	Vacant #3	8,945
	U.S. Postal Service (USPS)	12,001
	Jetstream	2,646
	Vacant #4	5,017
	Piedmont Triad Airport Authority – Mechanical	1,260
	TOTAL	55,384
Air Cargo Building #3	Vacant #1	18,150
	TIMCO	10,000
	B & C. DHL (Airborne)	14,950
	Vacant #2	5,200
	Piedmont Triad Airport Authority - Mechanical	1,200
	TOTAL	49,500
TradeWinds Cargo Building	Hangar B	24,300
	TOTAL	24,300
UPS-SCS Building	Vacant	16,808
	TOTAL	16,808
FedEx Building	Main Sort Building	317,200
	TOTAL	317,200
	TOTAL	495,517

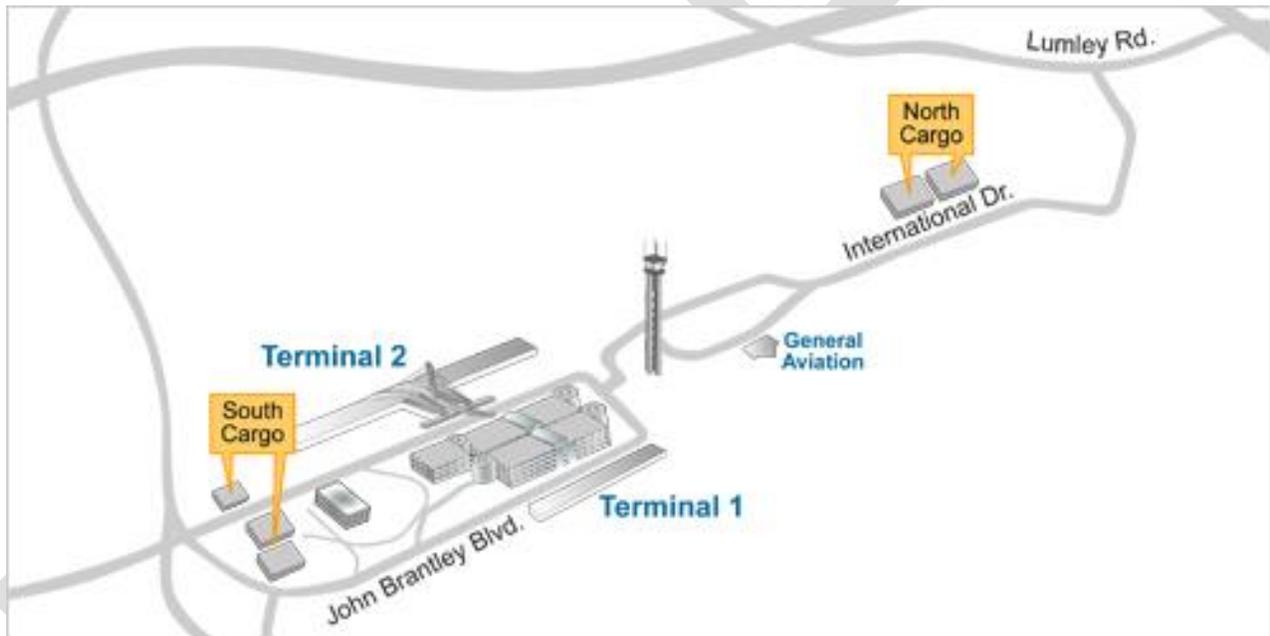
Source: Airport Master Plan Update. Piedmont Triad International Airport Authority, 2010.

2.2.3 Raleigh-Durham International (RDU)

Raleigh-Durham International Airport (RDU) is situated between the cities of Raleigh and Durham, located a few miles east of the I-40/I-540 interchange near the town of Morrisville in Wake County. Nine air carriers operate at RDU, including Southwest, American Airlines, Delta, Frontier, Jet Blue, and United Airlines. Its primary service area includes Raleigh, Durham, and the surrounding Research Triangle Region of North Carolina. The Research Triangle is known as a hub for education/research facilities and technology companies, and is anchored by North Carolina State University, Duke University, and the University of Chapel Hill.

Together, the North Cargo and South Cargo areas of RDU's campus have over 672,000 square feet of cargo space. Figure 2.7 provides an illustration of the airport's layout. The North Cargo area is located along International Drive near Cemetery Road. The North Cargo facilities house RDU's two all-cargo carriers, FedEx and UPS. The South Cargo facilities, reserved for cargo shipped via commercial airlines, are located near Aviation Pkwy.

Figure 2.7 Raleigh-Durham International Airport Cargo Facilities



Source: Raleigh Durham International Airport. <http://www.rdu.com/general-aviation-and-cargo/>.

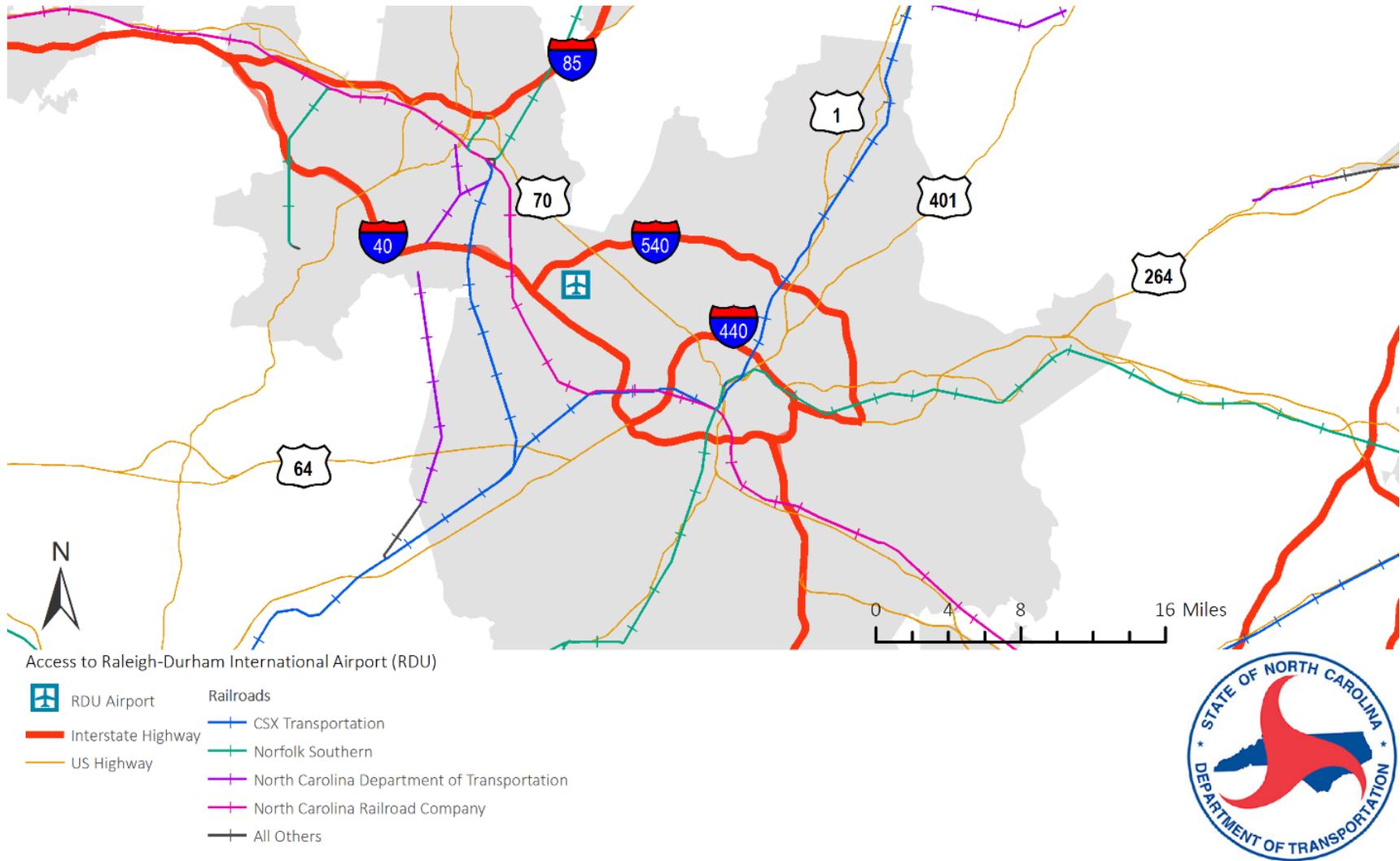
Although there is no direct rail connection to either CSX or Norfolk Southern Railway (NS) at RDU, both rail lines pass through Raleigh and near to RDU. **Error! Reference source not found.** presents a map of the rail and highway access to RDU.

In 2014, the Raleigh-Durham Airport Authority along with the Urban Land Institute (ULI) reviewed the airport's physical assets and developed a set of recommendations that would benefit the greater region. As

a result, the report identified several opportunities for cargo expansion on-site.⁹ One such recommendation was to set aside 50 acres for development of cargo operations, including refrigerated space. The report also suggested that RDU increase efforts to expand international cargo operations specifically expanded shipping operations for forestry-based products such as furniture, and pork products, both of which are major products from North Carolina. Finally, it recommended that significant portions of undeveloped land owned by RDU be dedicated to freight-related economic development opportunities such as bonded warehouse facilities, a just-in-time manufacturing park, a freight-forwarders corridor, research & development (R&D) parks, and flex industrial/warehouse parks.

⁹ An Urban Land Institute (ULI) Advisory Services Panel Report. <http://connect.rdu.com/wp-content/uploads/2015/01/ULIfinal.pdf>

Figure 2.8 Access to Raleigh-Durham International Airport



Source: North Carolina DOT; National Transportation Atlas Database.

2.2.4 North Carolina Global TransPark

The North Carolina Global TransPark (GTP), located in Kinston in Lenoir County, is a 2,500-acre industrial site with highway, airport and rail access. Kinston Regional Jetport (ISO) is located onsite, which features the longest commercial runway in North Carolina at 11,500 feet, and is able to handle the largest cargo aircraft, unlike RDU and CLT, which have shorter runways. ISO, which was renovated in 2010, handles commercial, military, and general aviation flights, has over 404,000 square feet of apron space, a TSA security station onsite, runway strength of 806,000 pounds double dual tandem (DDTW), and the ability to accommodate the world’s largest aircraft.¹⁰ As of June 2014, over 450 full-time employees worked in various job classifications at GTP.¹¹ There are nine tenants on-site, many of which directly benefit from ISO access, as shown in Table 2.2.¹²

Table 2.2 Public- and Private-Sector Employers at Global TransPark

Tenant	Products/Services	Tenant Description
CrateTech	Full service packing and crating solutions	Full service packing and crating company providing customized solutions for a variety of industries. Aside from Kinston, CrateTech has locations in Wichita, KS, Seattle, WA, and Chicago, IL.
DB Schenker	Integrated transportation and logistics solutions	Provides an array of transportation and logistical solutions to move goods throughout the supply chain in the world’s major economic regions.
Henley Aviation	Flight instruction	Offers training and certification for all levels of pilots and prospective pilots.
Lenoir Community College	Education and workforce training	Community college offering degree programs and continuing education. Main campus is located in Kinston. Offers both degree and non-degree programs serving approximately 5,500 curriculum students and 15,000 extension students annually.
MJE Telestructure	Emergency services	Offers inside plant infrastructure products and services specializing in direct-current power; provides disaster recovery programs to support network infrastructure reliability.
Mountain Air Cargo	Express cargo delivery and fleet maintenance	Provides flight and maintenance services throughout much of North and South America as an express cargo carrier; contract carrier and services provider for FedEx in the eastern United States, Canada, and the Caribbean islands.
N.C. Emergency Management	Emergency services	Protects life, property, and environment through a partnership among local, state, and federal agencies
N.C. Forestry Service	Emergency services	Responsible for the protection and development of 101,700 acres of woodland in Lenoir County.

¹⁰ “Kinston Regional Airport”. North Carolina Global TransPark. Accessed October 13, 2016. Available from: <http://www.ncgtp.com/features/kinston-regional-jetport.html>

¹¹ North Carolina Global TransPark 2014 Annual Report. Available from: http://ncgtp.com/downloads/default-document-library/2014-gtpannual-report_final_web.pdf

¹² North Carolina Global TransPark. 2016. Accessed November 3, 2016. Available from: <http://ncgtp.com/about/gtp-companies.html>

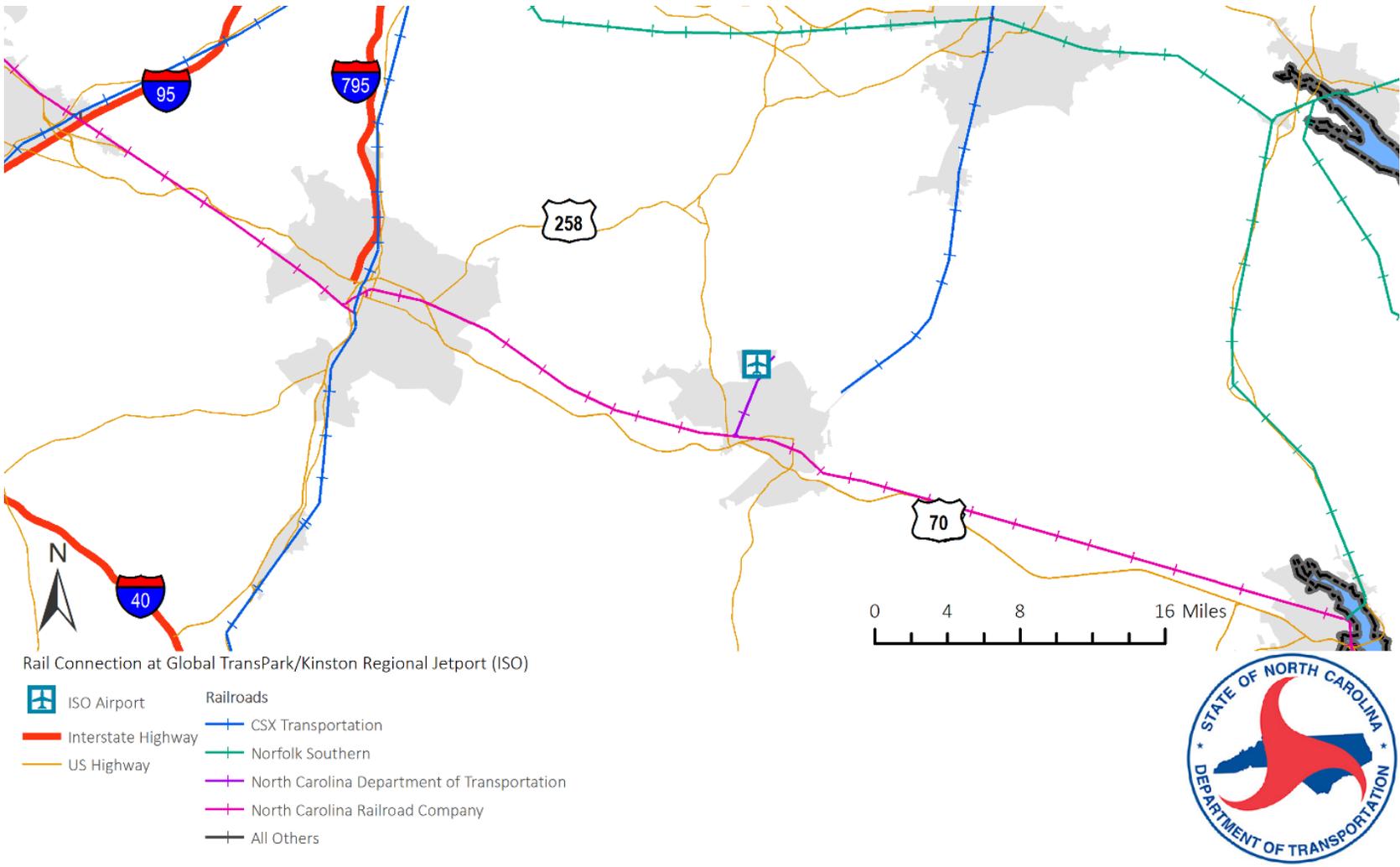
Tenant	Products/Services	Tenant Description
Spirit AeroSystems	Aircraft fuselages and wings	World's largest supplier of commercial airplane assemblies and components. Produces the center fuselage and front wingspan for the Airbus A350 using state-of-the-art composite technology.

Source: North Carolina Global TransPark (2016)

GTP is located near to U.S. Highway 70, which is a major trucking route in North Carolina. It is also within close proximity to deep-water ports in Morehead City, Wilmington, Norfolk and Charleston, and features a 5.8-mile rail spur provides direct access to Port of Morehead City. Additionally, GTP is approximately 50 miles away from I-95 and approximately 46 miles to I-40, both of which are major interstate truck routes.

Error! Reference source not found. presents a map of the rail and highway access to GTP and ISO.

Figure 2.9 Access to Kinston Regional Jetport and Global TransPark



Source: North Carolina DOT; National Transportation Atlas Database.



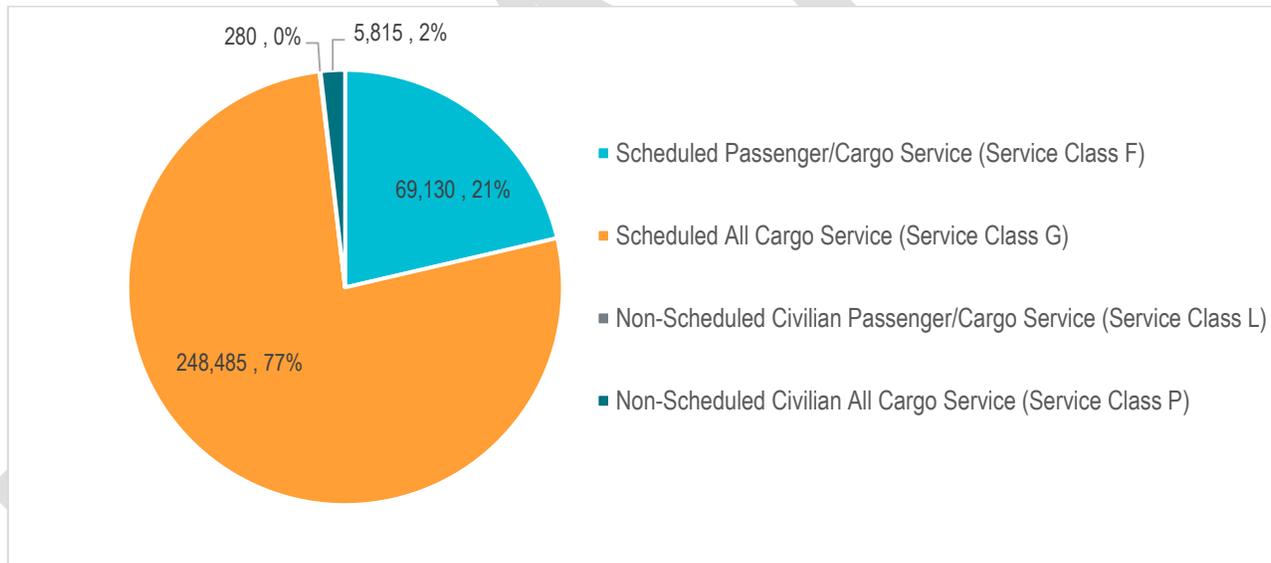
2.3 Air Cargo Service Providers

According to the Bureau of Transportation Statistics (BTS), there are four types of air cargo services available to and from North Carolina:

- Service Class F: Scheduled passenger/cargo service (includes freight/mail belly cargo)
- Service Class G: Scheduled all cargo service (no passengers, including FedEx/UPS)
- Service Class L: Non-scheduled civilian passenger/cargo service (includes freight/mail belly cargo)
- Service Class P: Non-scheduled civilian all cargo service (no passengers)

Scheduled all cargo service was by far the most common in 2015, comprising 77 percent of all tonnage. Scheduled passenger/cargo service (i.e. belly cargo) occurred 21 percent of the time, and non-scheduled services comprised 2 percent of all activity. Non-scheduled service is defined as revenue flights, such as chartered flights, that are not operated on a regularly scheduled service. Service classes L and P do not include military service activity.

Figure 2.10 Air Cargo Service Types, North Carolina Airports, 2015



Source: BTS TranStats Database, 2015.

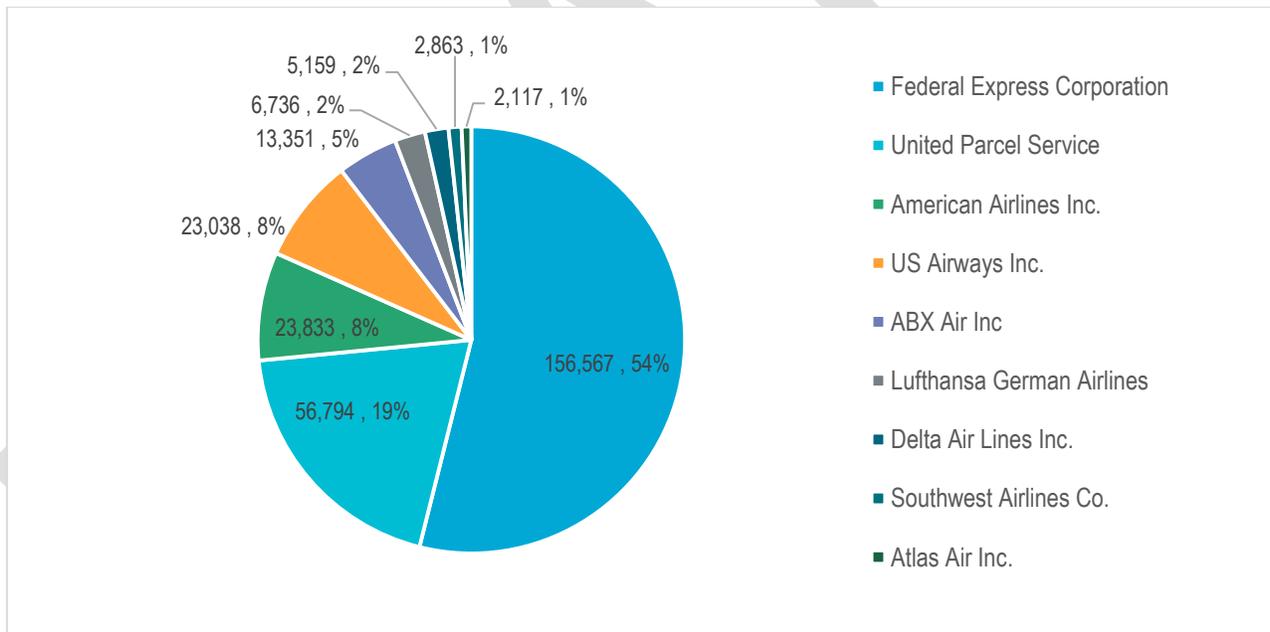
Two primary carriers – FedEx and United Parcel Service (UPS) – transported air cargo, which includes both freight and mail, as shown in Table 2.3 and Figure 2.11. FedEx carried over 156,000 tons of air freight in 2015, which comprised 53 percent of all cargo. UPS carried nearly 57,000 tons of both freight and mail, which comprised 19 percent of the total. Other domestic and international passenger carries, including American Airlines, US Airways, and Lufthansa, carried a small amount of belly cargo. ABX Air, which carried 5 percent of all air cargo in North Carolina, is a cargo airline that provides aircraft, crew, maintenance and insurance freight services, primarily for DHL.

Table 2.3 Top Air Cargo Carriers at North Carolina Airports, 2015

Carrier Name	Freight Tons	Mail Tons	Total Tons	% of Total Tons
FedEx	156,567	-	156,567	53%
United Parcel Service (UPS)	56,242	552	56,794	19%
American Airlines Inc.	15,782	8,051	23,833	8%
US Airways Inc.	13,656	9,383	23,038	8%
ABX Air Inc	13,351	-	13,351	5%
Lufthansa German Airlines	6,736	-	6,736	2%
Delta Air Lines Inc.	1,346	3,814	5,159	2%
Southwest Airlines Co.	2,863	-	2,863	1%
Atlas Air Inc.	2,117	-	2,117	1%
All Other Carriers	2,425	839	3,264	1%
TOTAL	271,086	22,638	293,724	100%

Source: BTS TranStats Database, 2015.

Figure 2.11 Top Air Cargo Carriers at North Carolina Airports, in Tons, 2015

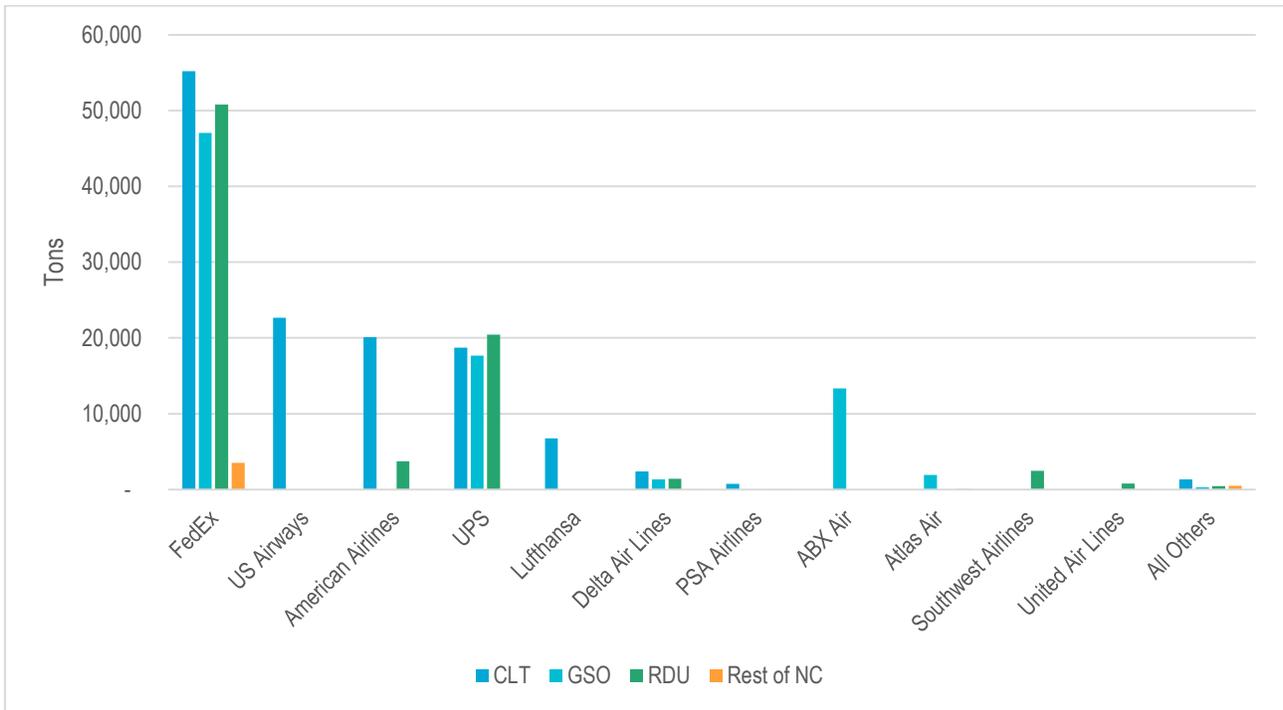


Source: BTS TranStats Database, 2015.

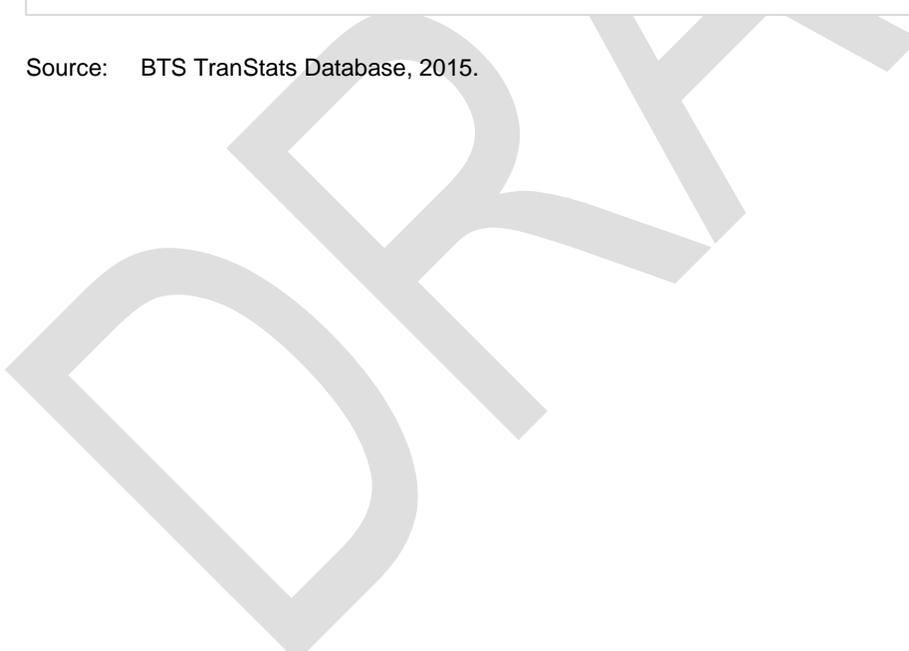
Although FedEx comprises the majority of tonnage, other carriers have a stronger presence at some of North Carolina’s top airports compared to the rest of the State, as shown in Figure 2.12. At Charlotte-Douglas International (CLT), U.S. Airways, American Airlines and UPS handled roughly the same amount of tonnage in 2015, ranging from 15 percent to 18 percent of the total. UPS (22 percent of total) and ABX Air (16 percent) also service Piedmont Triad International (GSO), though FedEx is the major cargo carrier. This is also the case at Raleigh-Durham International (RDU); though FedEx handled 63 percent of air cargo, UPS

handled 26 percent, with carriers such as American Airlines and Southwest comprising a small portion of remaining tonnage.

Figure 2.12 Top Air Cargo Carriers at Top 3 North Carolina Airports, in Tons, 2015



Source: BTS TranStats Database, 2015.



3.0 Network Usage and Performance

This section details the demand for air cargo in North Carolina, statewide and at each of the three hubs for air cargo. It will include air cargo trade partners, tonnage, value and top commodities.

3.1 Air Cargo Activity and Demand

3.1.1 Statewide Demand

In 2015, North Carolina airports handled nearly 294,000 tons worth \$23 billion. Compared to other modes, air cargo is a relatively small amount of the State's overall freight activity: 400 million tons worth \$531 billion traveled by truck, 85 million tons worth \$143 billion traveled by rail, and 8.5 million tons worth \$10 billion traveled by water. However, air cargo has a substantially higher value per ton compared to the rest of the modes, over \$78,000 per ton compared to \$1,300 per ton (highway), \$1,700 per ton (rail) and \$1,200 per ton (water).

There were 18 airports with reported freight and mail activity in the State in 2015. North Carolina traded air cargo with over 200 airports in the U.S. and across the world, including 47 international airports in 2015. Table 3.1 presents the top air cargo trading partners from 2015, which include 4 international cities and 14 U.S. cities. Memphis International Airport (MEM) is by far North Carolina's top air trade partner, with over 110,000 tons transferred in 2015, 38 percent of all air cargo in the State. The two other significant cities for air cargo trade include Louisville, KY (Louisville International Airport) and Indianapolis, IN (Indianapolis International Airport). Together, these top three airports comprise 69 percent of all air cargo to and from North Carolina. UPS has hubs at Memphis, Louisville, Indianapolis and Cincinnati, and FedEx has sorting facilities at Memphis (global hub) and Indianapolis (national hub).

Table 3.1 Top North Carolina Air Cargo Trade Partners, 2015

Airport Code	Airport	City	Total Tons	%
MEM	Memphis International	Memphis, TN	110,587	38%
SDF	Louisville International-Standiford Field	Louisville, KY	51,406	18%
IND	Indianapolis International	Indianapolis, IN	37,593	13%
CVG	Cincinnati/Northern Kentucky International	Cincinnati, OH	11,154	4%
LHR	London Heathrow	London, United Kingdom	10,182	3%
MUC	Munich Airport	Munich, Germany	6,736	2%
FRA	Frankfurt Main	Frankfurt, Germany	5,755	2%
ROA	Roanoke Blacksburg Regional Woodrum Field	Roanoke, VA	4,439	2%
ATL	Hartsfield-Jackson Atlanta International	Atlanta, GA	4,280	1%
BWI	Baltimore/Washington International Thurgood Marshall	Baltimore, MD	3,921	1%
GSO	Piedmont Triad International	Greensboro/High Point, NC	3,480	1%
PHX	Phoenix Sky Harbor International	Phoenix, AZ	2,876	1%
LAX	Los Angeles International	Los Angeles, CA	2,784	1%

Airport Code	Airport	City	Total Tons	%
SJU	Luis Munoz Marin International	San Juan, PR	2,775	1%
CDG	Paris Charles de Gaulle	Paris, France	2,079	1%
SFO	San Francisco International	San Francisco, CA	2,016	1%
EWN	Coastal Carolina Regional	New Bern/ Morehead/ Beaufort, NC	1,798	1%
ILM	Wilmington International	Wilmington, NC	1,673	1%

Source: BTS TranStats Database, 2000-2015.

The top three airports for air cargo activity in North Carolina are Charlotte Douglas International (CLT), Piedmont Triad International (GSO) and Raleigh-Durham International (RDU). Each of these airports will be described in more detail in this section. Table 3.2 presents the total air cargo activity reported at each airport in 2015, which includes both freight and mail. Activity at CLT, GSO and RDU comprises 99 percent of all air cargo activity in the State.

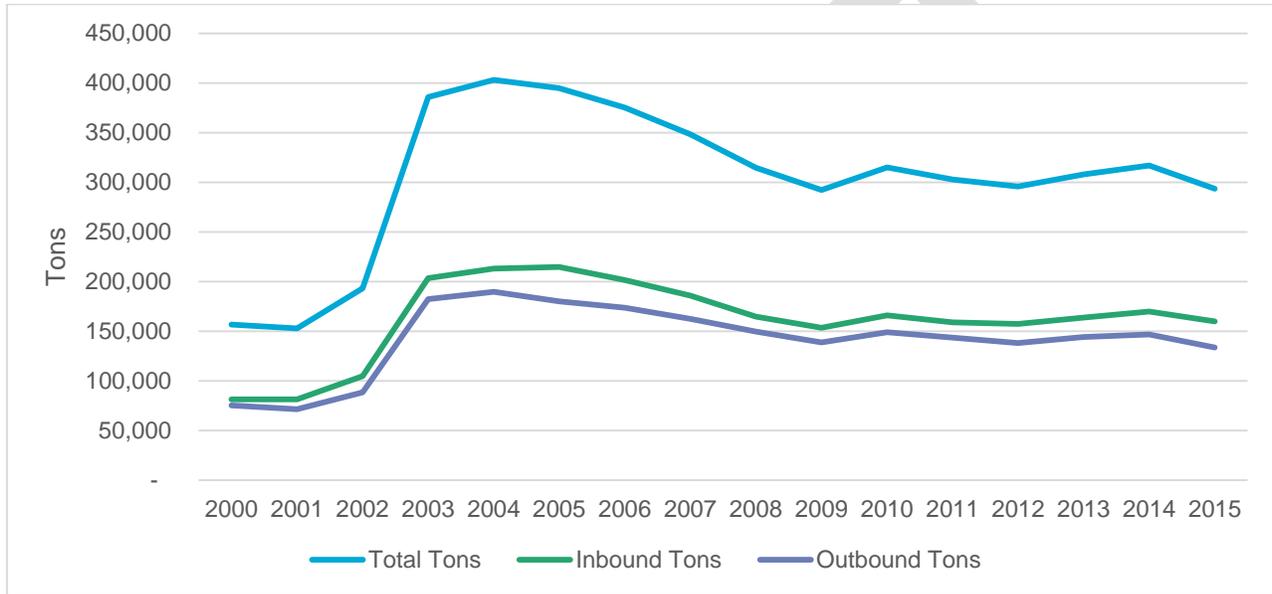
Table 3.2 Total Air Cargo Activity in North Carolina, 2015

Airport Code	Airport Name	Total Tons	% of Total
CLT	Charlotte Douglas International	127,874	44%
GSO	Piedmont Triad International	81,627	28%
RDU	Raleigh-Durham International	80,051	27%
EWN	Coastal Carolina Regional	1,804	1%
ILM	Wilmington International	1,756	1%
SVH	Statesville Regional	227	< 1%
HKY	Hickory Regional	100	< 1%
TDF	Person County	96	< 1%
MEO	Dare County Regional	65	< 1%
AVL	Asheville Regional	51	< 1%
N1C	Cherry Point MCAS	20	< 1%
RWI	Rocky Mount-Wilson Regional	19	< 1%
PGV	Pitt Greenville	10	< 1%
FAY	Fayetteville Regional / Grannis Field	10	< 1%
OAJ	Albert J Ellis	4	< 1%
CTZ	Clinton Sampson County	3	< 1%
NC1	Gastonia Municipal	3	< 1%
INT	Smith Reynolds	2	< 1%
All Airports		293,724	100%

Source: BTS TranStats Database, 2015.

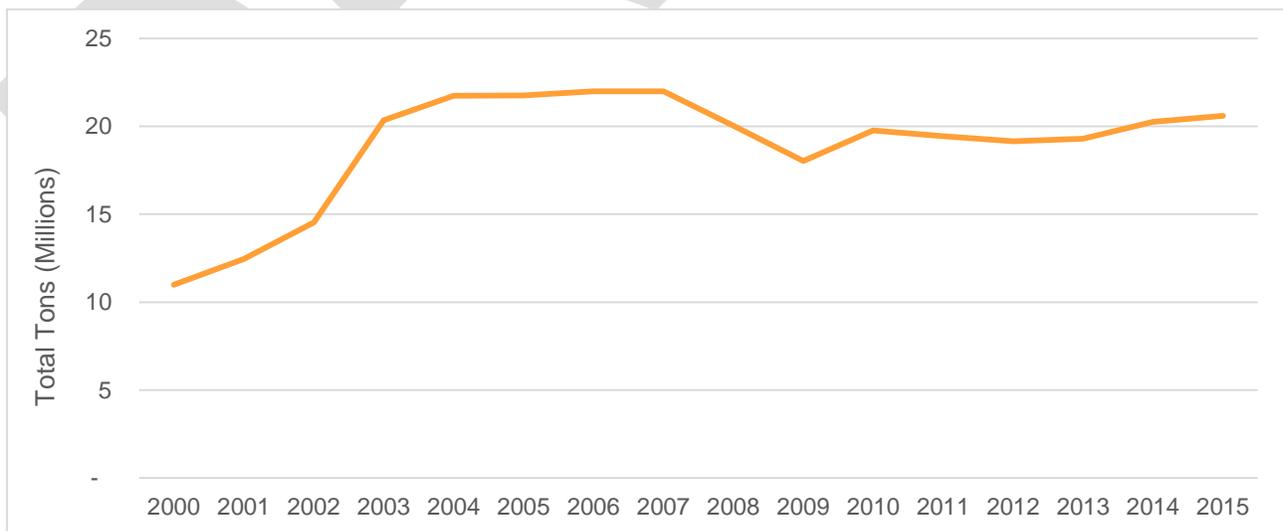
Since 2000, air cargo activity throughout North Carolina has fluctuated significantly. Figure 3.1 presents a chart with inbound, outbound and total air cargo tonnages in North Carolina from 2000 to 2015. The State experienced a substantial jump in total tonnage between 2002 and 2003, peaking in 2004 at over 400,000 total tons of air cargo. Since 2004, the weight of air cargo shipments has declined and hovered around the 300,000 tons mark. However, in the past decade, total tonnage has hit two low points: following the global recession in 2009, (292,000 total tons) and during a year of rapidly declining fuel prices in 2015, (293,000 total tons). Overall, inbound air cargo exceeds outbound air cargo by weight. Nationwide air cargo activity between 2000 and 2015 takes a similar shape, as shown in Figure 3.2.

Figure 3.1 North Carolina Air Cargo Activity, 2000-2015



Source: BTS TranStats Database, 2000-2015.

Figure 3.2 Nationwide Air Cargo Activity (Domestic & International), 2000-2015



Source: BTS TranStats Database, 2000-2015.

Generally, airfreight modes tend to receive the highest proportion of high-value, low-weight commodities due to the high cost of air transport when compared with surface modes. In 2015, the top transported commodity by air at North Carolina airports was electronics, totaling nearly 63,000 tons (21 percent of total tonnage) and worth over \$5.1 billion, as shown in Table 3.3 and Table 3.4. This commodity category comprises electric motors, appliances, computers, and other electronic components and parts. Similarly, machinery was the second-most transported commodity by air in North Carolina, totaling over 41,000 tons (14 percent) and worth nearly \$3.5 billion. Pharmaceuticals was another important commodity by value, worth over \$4.2 billion (18 percent) in 2015. Table A.1 in Appendix A features a description the SCTG commodity codes, which will be used to discuss commodity flow throughout this report.

Table 3.3 Top 10 Commodities by Tonnage at North Carolina Airports, 2015

SCTG Code	Commodity	Total Tons	% of Total
35	Electronics	62,961	21%
34	Machinery	41,210	14%
30	Textiles/leather	25,451	9%
38	Precision instruments	19,187	7%
21	Pharmaceuticals	17,467	6%
24	Plastics/rubber	15,577	5%
36	Motorized vehicles	12,055	4%
20	Basic chemicals	11,305	4%
23	Chemical prods.	11,280	4%
33	Articles-base metal	11,081	4%

Source: BTS TranStats Database, 2015; FAF4.1 data.

Table 3.4 Top 10 Commodities by Value at North Carolina Airports, 2015

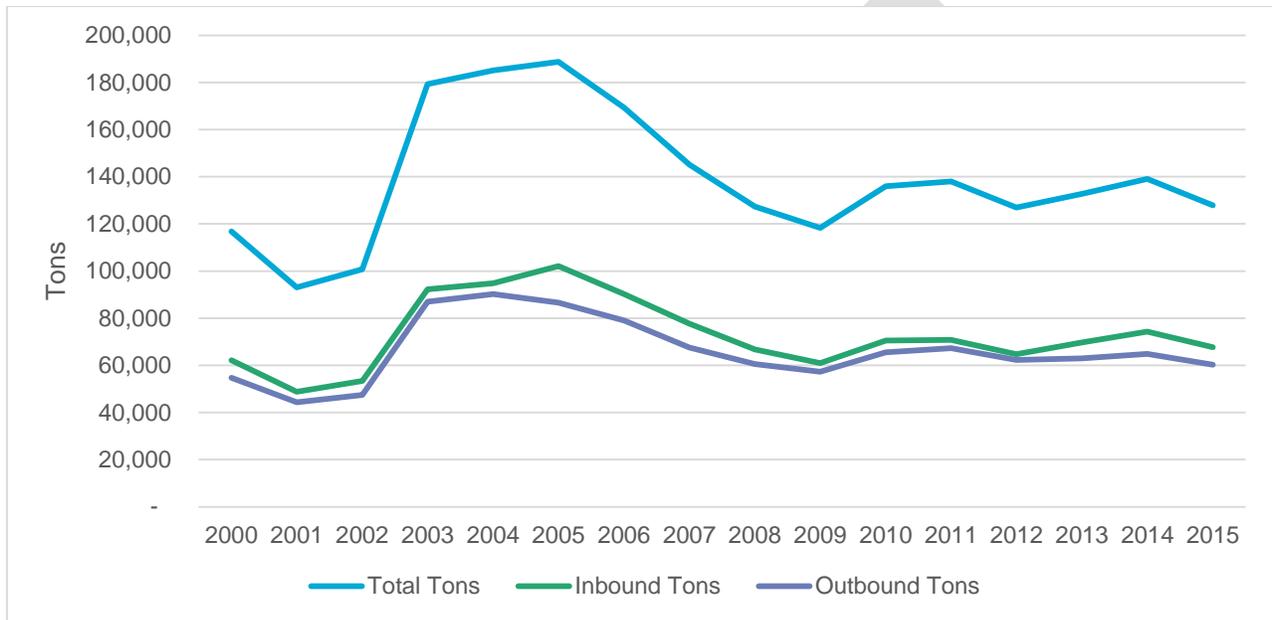
SCTG Code	Commodity	Total Value (\$M)	% of Total
35	Electronics	5,156	22%
21	Pharmaceuticals	4,247	18%
34	Machinery	3,459	15%
38	Precision instruments	2,198	10%
20	Basic chemicals	1,565	7%
37	Transport equip.	1,018	4%
24	Plastics/rubber	928	4%
23	Chemical prods.	692	3%
40	Misc. mfg. prods.	667	3%
30	Textiles/leather	603	3%

Source: BTS TranStats Database, 2015; FAF4.1 data.

3.1.2 Charlotte Douglas International (CLT)

Charlotte Douglas International Airport (CLT) handles the most air cargo of all of North Carolina's airports, nearly 128,000 tons in 2015. Figure 3.3 presents air cargo activity at CLT from 2000 to 2015. It experienced a peak in total tonnage in 2005 (nearly 189,000 tons), but has since declined, reaching a low point in 2009 (118,000 pounds). Although inbound air cargo has been consistently higher than outbound air cargo tonnage, the gap has remained fairly small.

Figure 3.3 Charlotte Douglas International Air Cargo Activity, 2000-2015



Source: BTS TranStats Database, 2000-2015.

CLT exchanged air cargo with 179 airports, both domestic and international, in 2015. However, only a handful of airports handled the majority of cargo to and from CLT, as shown in Table 3.5. These top airports include Memphis International Airport (MEM), Louisville International Airport (SDF), and Indianapolis International Airport (IND), which comprised 58 percent of all cargo. FedEx has its global hub in Memphis and its national hub in Indianapolis, and UPS has hubs in Memphis, Louisville, and Indianapolis. CLT exchanged approximately 20 percent of all air cargo with international airports, including London, Munich, Frankfurt, Paris, and Rome. Out the state's air cargo airports, CLT provides the most service to international markets.

Table 3.5 Charlotte Douglas International Top Air Cargo Trade Partners, 2015

Airport Code	Airport	City	Total Tons	% of Total
MEM	Memphis International	Memphis, TN	42,100	33%
SDF	Louisville International-Standiford Field	Louisville, KY	18,604	15%
IND	Indianapolis International	Indianapolis, IN	13,073	10%
LHR	London Heathrow	London, United Kingdom	6,990	5%
MUC	Munich Airport	Munich, Germany	6,736	5%

Airport Code	Airport	City	Total Tons	% of Total
FRA	Frankfurt Main	Frankfurt, Germany	5,755	5%
PHX	Phoenix Sky Harbor International	Phoenix, AZ	2,722	2%
LAX	Los Angeles International	Los Angeles, CA	2,408	2%
CDG	Paris Charles de Gaulle	Paris, France	2,079	2%
ATL	Hartsfield-Jackson Atlanta International	Atlanta, GA	1,595	1%
SFO	San Francisco International	San Francisco, CA	1,510	1%
PHL	Philadelphia International	Philadelphia, PA	1,296	1%
DFW	Dallas/Fort Worth International	Dallas/Fort Worth, TX	1,255	1%
FCO	Fiumicino	Rome, Italy	1,190	1%
SJU	Luis Munoz Marin International	San Juan, PR	1,171	1%

Source: BTS TranStats Database, 2015.

In 2015, the top transported commodity by air at CLT was machinery, totaling over 24,000 tons (19 percent of total tonnage) and worth \$2.2 billion, as shown in Table 3.6. Electronics were another top commodity, totaling nearly 19,000 tons worth \$2.1 billion. Notably, the top three commodities by value – electronics, machinery, and pharmaceuticals – comprised 55 percent of the total value of air freight at CLT.

Table 3.6 Top 10 Commodities at Charlotte Douglas International, 2015

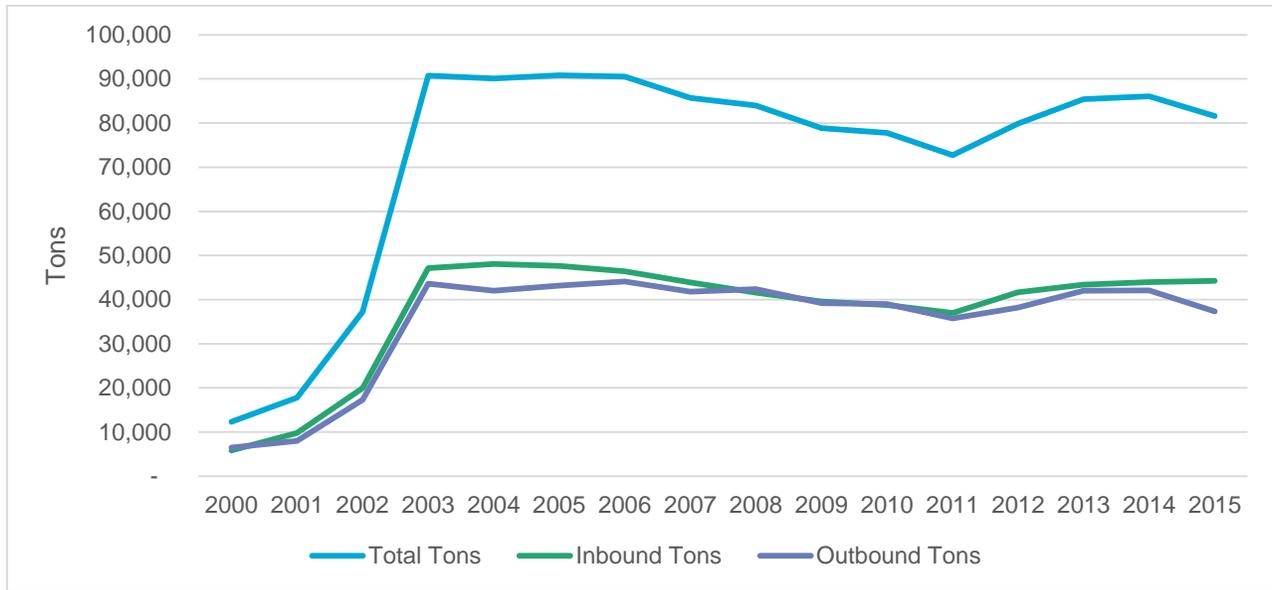
SCTG Code	Commodity	Total Tons	% of Total	Total Value (\$M)	% of Total
34	Machinery	24,331	19%	2,246	22%
35	Electronics	18,921	15%	2,120	21%
30	Textiles/leather	11,817	9%	291	3%
36	Motorized vehicles	8,340	7%	370	4%
24	Plastics/rubber	7,475	6%	376	4%
38	Precision instruments	7,285	6%	754	7%
20	Basic chemicals	6,430	5%	680	7%
5	Meat/seafood	6,057	5%	32	< 1%
21	Pharmaceuticals	5,628	4%	1,161	12%
33	Articles-base metal	5,474	4%	258	3%

Source: BTS TranStats Database, 2015; FAF4.1 data.

3.1.3 Piedmont Triad International (GSO)

GSO had the second-highest air cargo volumes by weight in 2015, nearly 82,000 total tons. Figure 3.4 presents air cargo activity at GSO from 2000 to 2015. Between 2003 and 2006, total tonnage was over 90,000 tons, after which it steadily declined until 2011 (nearly 73,000 total tons), and increased thereafter. Inbound air cargo volumes have generally been higher than outbound cargo, although the difference was negligible between 2008 and 2011, when volumes were nearly equal. The difference between inbound and outbound cargo has since notably widened.

Figure 3.4 Piedmont Triad International Air Cargo Activity, 2000-2015



Source: BTS TranStats Database, 2000-2015.

GSO exchanged air cargo with 37 airports in 2015, 2 of which were international cities (Chihuahua, Mexico and Hamilton, Canada). Four airports handled 84 percent of all cargo trade with GSO: Memphis International Airport (MEM), Louisville International Airport (SDF), Indianapolis International Airport (IND), and Cincinnati/Northern Kentucky International Airport (CVG). Again, FedEx has its global hub in Memphis and its national hub in Indianapolis, and UPS has hubs in Memphis, Louisville, Indianapolis, and Cincinnati.

Table 3.7 Piedmont Triad International Top Air Cargo Trade Partners, 2015

Airport Code	Airport	City	Total Tons	% of Total
MEM	Memphis International	Memphis, TN	31,522	39%
SDF	Louisville International-Standiford Field	Louisville, KY	13,575	17%
IND	Indianapolis International	Indianapolis, IN	11,517	14%
CVG	Cincinnati/Northern Kentucky International	Cincinnati, OH	11,085	14%
ROA	Roanoke Blacksburg Regional Woodrum Field	Roanoke, VA	4,413	5%
BWI	Baltimore/Washington International Thurgood Marshall	Baltimore, MD	2,763	3%
EWN	Coastal Carolina Regional	New Bern/ Morehead/ Beaufort, NC	1,785	2%
ILM	Wilmington International	Wilmington, NC	1,643	2%
SJU	Luis Munoz Marin International	San Juan, PR	1,599	2%
ATL	Hartsfield-Jackson Atlanta International	Atlanta, GA	1,366	2%

Source: BTS TranStats Database, 2015.

Table 3.8 presents the top air commodities at GSO in 2015. Consistent with the statewide figures, electronics and machinery were the top commodities at over 21,000 tons and 9,600 tons, respectively. When including

pharmaceuticals, these three commodities comprised 56 percent of total air freight value transported at GSO.

Table 3.8 Top 10 Commodities at Piedmont Triad International, 2015

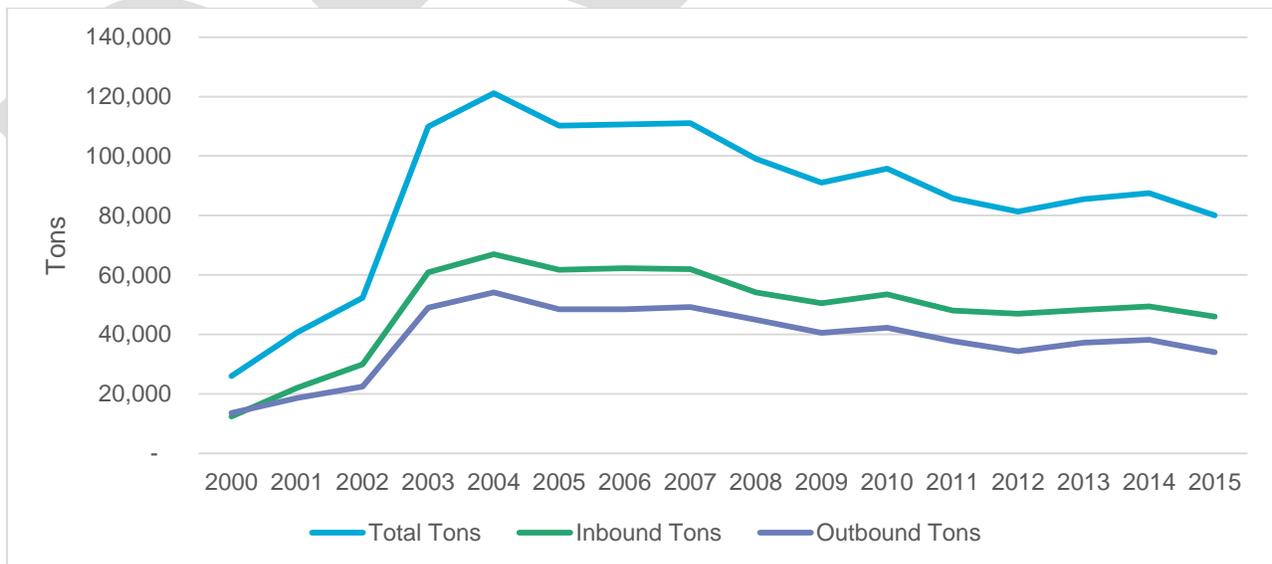
SCTG Code	Commodity	Total Tons	% of Total	Total Value (\$M)	% of Total
35	Electronics	21,050	26%	1,778	33%
34	Machinery	9,687	12%	482	9%
30	Textiles/leather	8,124	10%	173	3%
38	Precision instruments	6,452	8%	489	9%
40	Misc. mfg. prods.	5,532	7%	235	4%
24	Plastics/rubber	3,895	5%	226	4%
23	Chemical prods.	3,664	4%	173	3%
21	Pharmaceuticals	3,241	4%	782	14%
37	Transport equip.	2,893	4%	253	5%
33	Articles-base metal	2,465	3%	87	2%

Source: BTS TranStats Database, 2015; FAF4.1 data.

3.1.4 Raleigh-Durham International (RDU)

Raleigh-Durham International Airport (RDU) primarily serves the Triangle Region in North Carolina, and had the third-highest cargo volumes in 2015, just over 80,000 total tons. Figure 3.5 presents air cargo activity at RDU from 2000 to 2015. After peaking in 2004 at over 121,000 total tons, air cargo activity has declined steadily. Additionally, since 2000 inbound air cargo has been consistently and notably higher than outbound cargo.

Figure 3.5 Raleigh-Durham International Air Cargo Activity, 2000-2015



Source: BTS TranStats Database, 2000-2015.

RDU air cargo traveled between 85 airports in 2015, 4 of which were international cities (London, United Kingdom, Hamilton, Ontario (Canada), Tokyo, Japan, and Ezeiza, Argentina), as shown in Table 3.9. Three airports handled 86 percent of all cargo: Memphis International Airport (MEM), Louisville International Airport (SDF), and Indianapolis International Airport (IND). As noted previously, FedEx has its global hub in Memphis and its national hub in Indianapolis, and UPS has hubs in Memphis, Louisville, and Indianapolis.

Table 3.9 Raleigh-Durham International Top Air Cargo Trade Partners, 2015

Airport Code	Airport	City	Total Tons	% of Total
MEM	Memphis International	Memphis, TN	36,961	46%
SDF	Louisville International-Standiford Field	Louisville, KY	19,219	24%
IND	Indianapolis International	Indianapolis, IN	13,003	16%
LHR	London Heathrow	London, United Kingdom	3,193	4%
ATL	Hartsfield-Jackson Atlanta International	Atlanta, GA	1,291	2%
PIE	St Pete Clearwater International	St. Petersburg, FL	1,032	1%
CLT	Charlotte Douglas International	Charlotte, NC	617	1%
SFO	San Francisco International	San Francisco, CA	505	1%

Source: BTS TranStats Database, 2000-2015.

The top commodities at RDU were consistent with other top airports in the state, as shown in Table 3.10. Electronics and machinery were the top two commodities by weight, comprising 18 percent and 13 percent of total tonnage, respectively. When including pharmaceuticals, these three commodities comprised 53 percent of total air freight value transported at RDU. Precision instruments, which includes a number of specialized apparatuses such as optical elements and medical devices, is another valuable air commodity at RDU, and comprised 12 percent of total value in 2015.

Table 3.10 Top 10 Commodities at Raleigh-Durham International, 2015

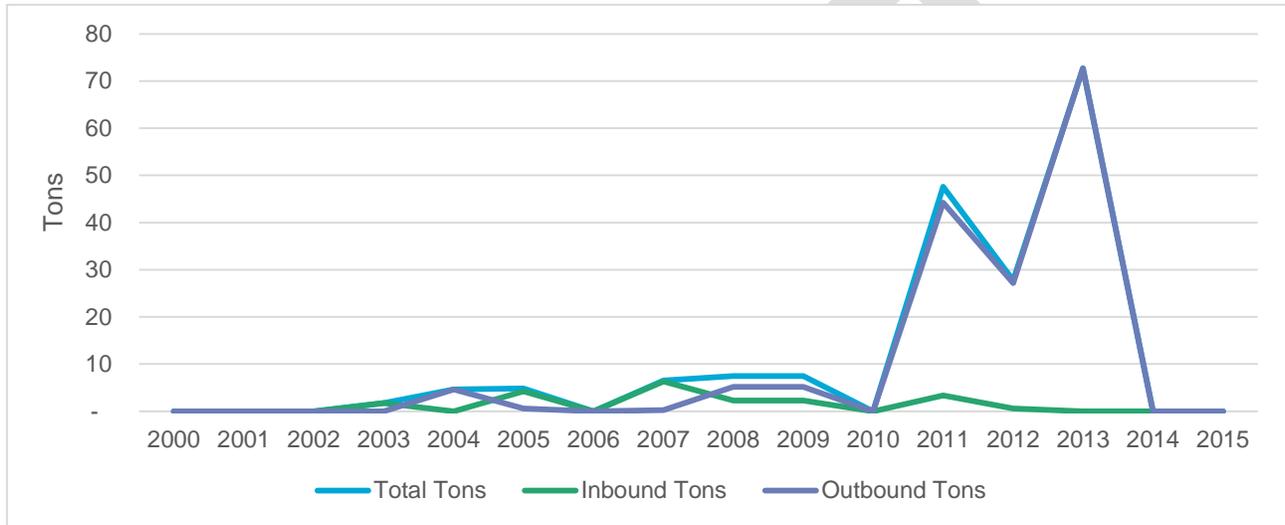
SCTG Code	Commodity	Total Tons	% of Total	Total Value (\$M)	% of Total
35	Electronics	14,418	18%	1,462	21%
34	Machinery	10,270	13%	1,012	14%
30	Textiles/leather	6,567	8%	167	2%
38	Precision instruments	6,555	8%	812	12%
21	Pharmaceuticals	5,462	7%	1,253	18%
24	Plastics/rubber	4,764	6%	358	5%
23	Chemical prods.	4,074	5%	279	4%
5	Meat/seafood	3,557	4%	15	< 1%
29	Printed prods.	3,141	4%	108	2%
20	Basic chemicals	2,817	4%	575	8%

Source: BTS TranStats Database, 2015; FAF4.1 data.

3.1.5 North Carolina Global TransPark

The North Carolina Global TransPark (GTP) contains Kinston Regional Jetport (ISO), which has had small, fluctuating volumes of air cargo activity since 2003. Figure 3.6 presents inbound, outbound, and total volumes at ISO from 2000 to 2015. The airport experienced a notable uptick in 2010, when GTP underwent extensive renovations in an attempt to become a major freight hub. However, since peaking in 2013 at 73 tons, all of which was exported at ISO via Volga-Dnepr Airlines, air cargo activity has all but disappeared at ISO.

Figure 3.6 Kinston Regional Jetport Air Cargo Activity, 2000-2015



Source: BTS TranStats Database, 2000-2015.

4.0 Future Performance and Long-Term Trends

The U.S. airline industry has changed significantly since the 1990s. After terror attacks on the World Trade Center on September 11, 2001, the airline industry consolidated and restructured, from 12 major U.S. airlines in 2005 to four major U.S. airlines in 2015: Delta, American, Southwest, and United.¹³ Additionally, the U.S. economy entered a period of downturn after the 2008 recession. The airline mergers, coupled with a difficult economic climate and competition from emerging low-cost airlines, has resulted in reduced profitability for air cargo. Many airlines have increased the number of small size regional jets in their fleet to save on operating costs, which reduces the availability of belly cargo services.¹⁴ In addition, there are several other market factors that have reduced the dependency of shippers on air cargo. Security regulations by the Federal Aviation Administration (FAA) and Transportation Security Administration (TSA) have made it more difficult to transport certain types of cargo. Air cargo carriers are experiencing price competition from other freight modes such as trucks, container ships, and railroads. Additionally, demand for express service from all-cargo carriers such as FedEx and UPS has exploded in recent years as consumers increasingly purchase their goods online. This accelerated growth has occurred on top of an already large market share.¹⁵

This section presents two forecasts: low growth scenario and high growth scenario. The low growth scenario was developed using a growth rate from the ongoing RDU Vision 2040 Master Plan, which was recently approved by the Federal Aviation Administration (FAA). The high growth scenario was developed using rates from Boeing's World Air Cargo Forecast, which takes into account economic and market factors, such as fuel prices and regulations, for air cargo activity between major regions throughout the globe. This section will provide detail on both results for North Carolina and for the three primary airports in the State.

4.1 Future Activity and Demand Statewide

By 2045, total air cargo tonnage in North Carolina is expected to increase overall. In the low growth scenario, tonnage is expected to moderately grow by 31 percent, from nearly 294,000 tons in 2015 to over 384,000 tons in 2045. This is an annual growth of 0.9 percent over the 30-year period. In the high growth scenario, tonnage is expected to nearly double to over 569,000 tons in 2045. This is an overall growth of 94 percent, with an annual growth rate of 2.2 percent. By comparison, the FAA projects U.S. air cargo activity (measured in revenue ton miles) to more than double between 2015 and 2036, a total growth of 108 percent at an annual rate of 3.6 percent.¹⁶ In light of the aforementioned air cargo market trends, the low growth scenario is more realistic in predicting future demand for air cargo in North Carolina, and the next sections will summarize both scenarios while highlighting key statistics from the low growth scenario analysis. Figure 4.1 illustrates the difference between the high and low growth scenarios.

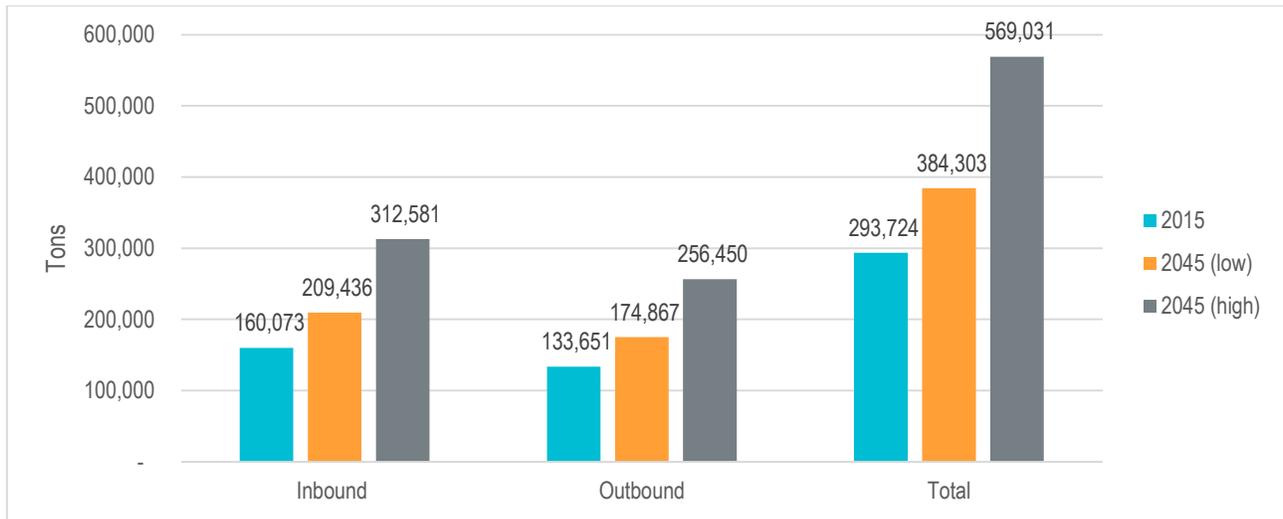
¹³ "FAA Aerospace Forecast: 2016-2036". Federal Aviation Administration. Available from: https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2016-36_FAA_Aerospace_Forecast.pdf

¹⁴ "Airport Master Plan Update and Strategic Long-Range Visioning Plan". Piedmont Triad Airport Authority. September 2010. Accessed October 13, 2016. Available from: <http://flyfrompti.com/wp-content/uploads/2014/08/Airport-Master-Plan-Update.pdf>

¹⁵ "FAA Aerospace Forecast: 2016-2036".

¹⁶ "FAA Aerospace Forecast: 2016-2036".

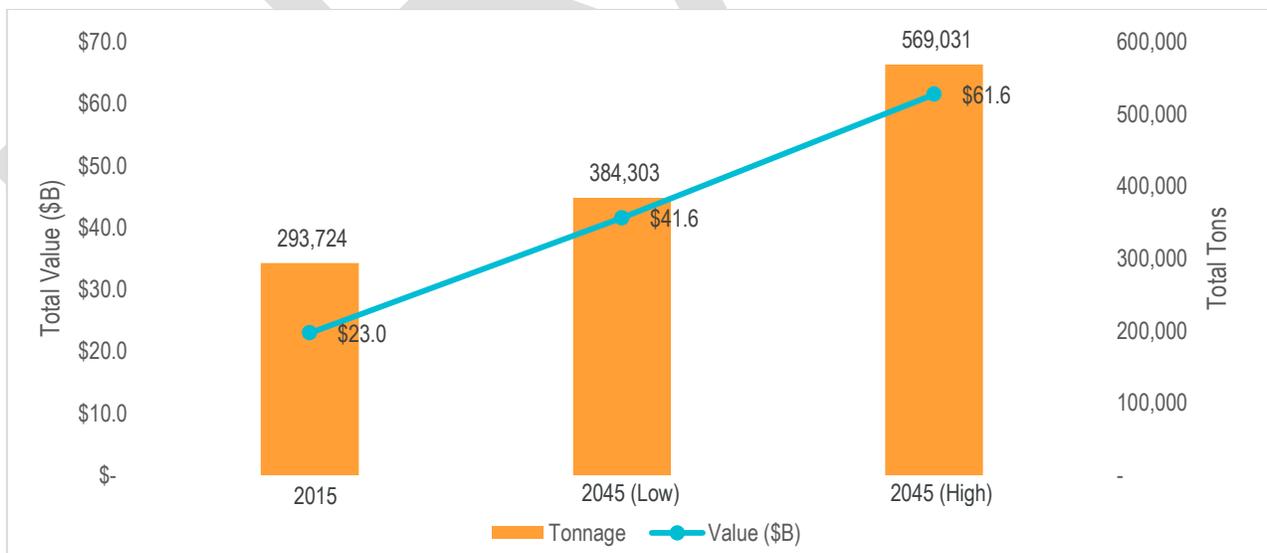
Figure 4.1 Projected Air Cargo Tonnage in North Carolina, by Direction and Growth Scenario, 2015-2045



Source: BTS TranStats Database, 2015; growth rates from 2015 Boeing WACF and RDU Vision 2040 Master Plan.

The value of air cargo in North Carolina is also expected to increase substantially according to the low growth scenario, from \$23 billion in 2015 to \$41.6 billion in 2045, an increase of 81 percent. Additionally, the high growth scenario forecasts growth of 168 percent, to over \$61.6 billion. Overall, air cargo value is expected to grow significantly more than tonnage, suggesting that primarily lighter and more expensive goods will continue to be shipped via air in North Carolina. Figure 4.2 shows total tonnage as compared to total value from 2015 to 2045. The value per ton is projected to increase from approximately \$78,300 per ton in 2015 to approximately \$108,200 per ton in the growth scenarios.

Figure 4.2 Projected Total Air Cargo Tons and Value in North Carolina, 2015-2045



Source: BTS TranStats Database, 2015; growth rates from 2015 Boeing WACF and RDU Vision 2040 Master Plan.

Top air freight commodities are expected to shift slightly from 2015 in the low growth scenario, though all are expected to increase in tonnage and value. Electronics and machinery are projected to remain the top two commodities, increasing in total share from 35 percent to 41 percent. Transportation equipment and furniture are expected to enter the top 10, totaling nearly 17,000 tons and 12,000 tons, respectively. Finally, pharmaceuticals are expected to remain an important commodity when measured by value, with a projected worth of \$7 billion. Table 4.1 presents the top 10 commodities by tonnage, and Table 4.2 presents the top commodities by value.

Table 4.1 Projected Top 10 Air Cargo Commodities by Tonnage at North Carolina Airports, Low Growth Scenario, 2045

SCTG Code	Commodity	Tonnage Rank Change	Total Tons	% of Total
35	Electronics	-	97,603	25%
34	Machinery	-	60,463	16%
38	Precision instruments	+1	29,175	8%
30	Textiles/leather	-1	29,095	8%
21	Pharmaceuticals	-	25,395	7%
23	Chemical prods.	+3	21,953	6%
24	Plastics/rubber	-1	17,675	5%
37	Transport equip.	+5	16,693	4%
39	Furniture	+5	11,778	3%
33	Articles-base metal	-	10,998	3%

Source: BTS TranStats Database, 2015; growth rates from RDU Vision 2040 Master Plan.

Table 4.2 Projected Top 10 Air Cargo Commodities by Value at North Carolina Airports, Low Growth Scenario, 2045

SCTG Code	Commodity	Value Rank Change	Total Value (\$M)	% of Total
35	Electronics	-	10,771	26%
21	Pharmaceuticals	-	6,969	17%
34	Machinery	-	5,461	13%
38	Precision instruments	-	3,940	9%
23	Chemical prods.	+3	3,724	9%
24	Plastics/rubber	+2	2,549	6%
20	Basic chemicals	-2	1,759	4%
37	Transport equip.	-2	1,671	4%
40	Misc. mfg. prods.	-	1,093	3%
30	Textiles/leather	-	733	2%

Source: BTS TranStats Database, 2015; growth rates from RDU Vision 2040 Master Plan.

North Carolina’s top air cargo trading partners are not expected to change substantially between 2015 and 2045, as shown in Table 4.3. Memphis International (MEM), Louisville International (SDF), and Indianapolis International (IND) are projected to remain the top three trade partners by tonnage, together comprising 65 percent of total tons. Approximately 13 percent of North Carolina’s airport tonnage is expected to be exchanged with international airports in 2045.

Table 4.3 Projected Top 10 North Carolina Air Cargo Trade Partners, Low Growth Scenario, 2045

Airport Code	Airport	City	Tonnage Rank Change	Total Tons	% of Total
MEM	Memphis International	Memphis, TN	-	144,690	36%
SDF	Louisville International-Standiford Field	Louisville, KY	-	67,259	17%
IND	Indianapolis International	Indianapolis, IN	-	49,186	12%
LHR	London Heathrow	London, UK	+1	14,594	5%
CVG	Cincinnati/Northern Kentucky International	Cincinnati, OH	-1	13,322	4%
MUC	Munich Airport	Munich, Germany	-	8,814	3%
FRA	Frankfurt Main	Frankfurt, Germany	-	7,529	3%
ROA	Roanoke Blacksburg Regional Woodrum Field	Roanoke, VA	-	5,807	1%
ATL	Hartsfield-Jackson Atlanta International	Atlanta, GA	-	5,599	1%
BWI	Baltimore/Washington International Thurgood Marshall	Baltimore, MD	-	5,130	1%

Source: BTS TranStats Database, 2015; growth rates from RDU Vision 2040 Master Plan.

4.2 Future Activity and Demand at Top Airports

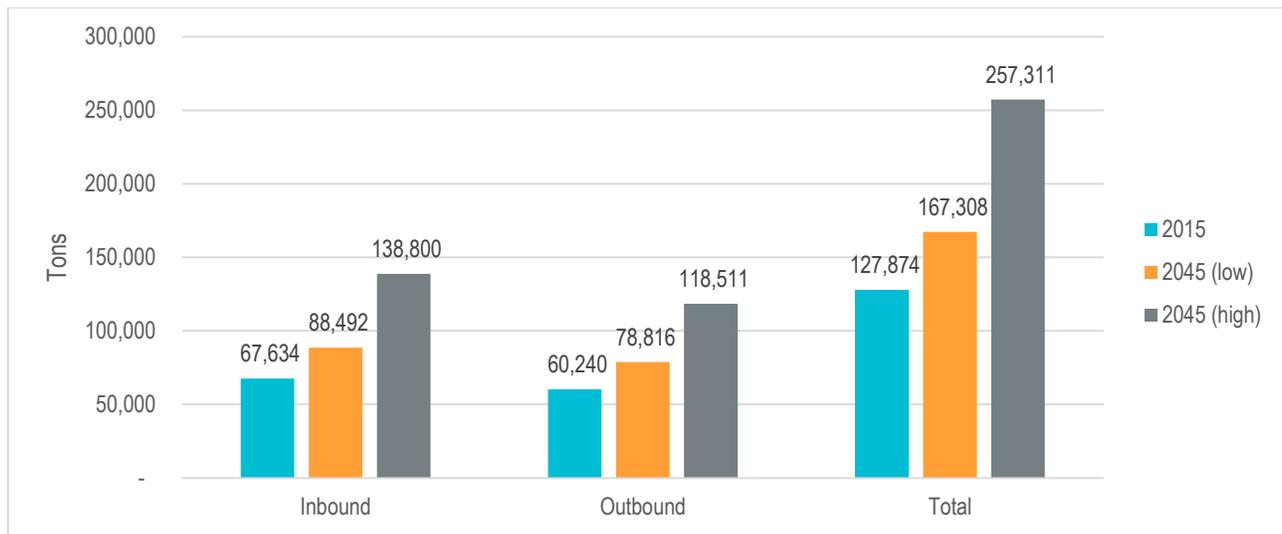
This section presents the forecasts developed for Charlotte Douglas International, Piedmont Triad International, and Raleigh-Durham International airports.

4.2.1 Charlotte Douglas International (CLT)

Charlotte Douglas International (CLT), the top airport for air cargo activity, is expected to experience an increase in air cargo tonnage by 2045, from nearly 128,000 tons to over 167,000 tons. This is a total growth of 31 percent, with an annual rate of 0.9 percent. In the high growth scenario, tonnage is expected to increase its overall tonnage by 101 percent to over 257,000 tons, with an annual growth rate of 2.4 percent. Figure 4.3 illustrates the growth for the two forecast scenarios.

The value of air cargo at CLT is also expected to increase substantially according to the low growth scenario, from \$10.1 billion in 2015 to \$16.7 billion in 2045, an increase of 66 percent over the next 30 years. Additionally, the high growth scenario forecasts growth of 155 percent to \$25.7 billion.

Figure 4.3 Projected Air Cargo Tonnage at Charlotte Douglas International, by Direction and Growth Scenario, 2015-2045



Source: BTS TranStats Database, 2015; growth rates from 2015 Boeing WACF and RDU Vision 2040 Master Plan.

By 2045, electronics and machinery will remain top commodities, with projected tonnages of over 34,000 and 32,000, respectively. Together, they are expected to comprise 44 percent of total value (\$7.4 billion). In addition, pharmaceuticals (9,100 tons), precision instruments (11,500 tons), and chemical products (8,100 tons) are expected to be top air cargo commodities shipped at CLT over the next 30 years.

Table 4.4 Projected Top 10 Commodities at Charlotte Douglas International, Low Growth Scenario, 2045

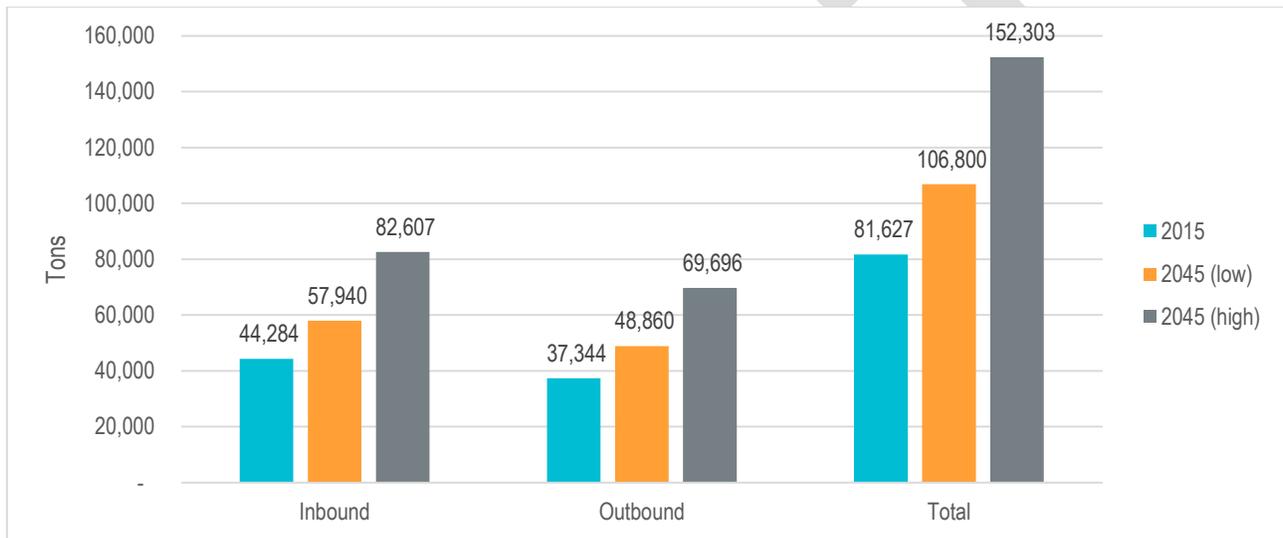
SCTG Code	Commodity	Tonnage Rank Change	Total Tons	% of Total	Total Value (\$M)	% of Total
35	Electronics	+1	34,333	21%	4,231	25%
34	Machinery	-1	32,438	19%	3,156	19%
30	Textiles/leather	-	13,351	8%	342	2%
38	Precision instruments	+2	11,480	7%	1,369	8%
21	Pharmaceuticals	+4	9,108	5%	2,313	14%
24	Plastics/rubber	-1	8,456	5%	783	5%
23	Chemical prods.	+4	8,183	5%	1,066	6%
37	Transport equip.	+4	8,145	5%	804	5%
36	Motorized vehicles	-5	6,485	4%	362	2%
33	Articles-base metal	-	5,383	3%	254	2%

Source: BTS TranStats Database, 2015; growth rates from RDU Vision 2040 Master Plan.

4.2.2 Piedmont Triad International (GSO)

Air cargo is expected to moderately increase at Piedmont Triad International (GSO) from 82,000 tons in 2015 to nearly 107,000 tons in 2045. In the high growth scenario, tonnage is expected to grow by 87 percent to 152,000 tons. Figure 4.4 illustrates the difference between the high and low growth scenarios. The value of air cargo at GSO is expected to increase by 94 percent, according to the low growth scenario, from nearly \$5.5 billion in 2015 to \$10.6 billion in 2045. Additionally, the high growth scenario forecasts growth by 177 percent to \$15.1 billion in 2045.

Figure 4.4 Projected Air Cargo Tonnage at Piedmont Triad International, by Direction and Growth Scenario, 2015-2045



Source: BTS TranStats Database, 2015; growth rates from 2015 Boeing WACF and RDU Vision 2040 Master Plan.

The projected top 10 commodities at GSO are presented in Table 4.5 below. By 2045, electronics and machinery are projected to comprise 43 percent of total tonnage and 41 percent of total value. In addition, pharmaceuticals and precision instruments are projected to increase their share of air freight value, comprising 15 percent (\$1.6 billion) and 10 percent (\$1.1 billion) of the 2045 total respectively.

Table 4.5 Projected Top 10 Commodities at Piedmont Triad International, Low Growth Scenario, 2045

SCTG Code	Commodity	Tonnage Rank Change	Total Tons	% of Total	Total Value (\$M)	% of Total
35	Electronics	-	33,577	31%	3,666	35%
34	Machinery	-	12,697	12%	664	6%
38	Precision instruments	+1	10,017	9%	1,073	10%
30	Textiles/leather	-1	8,869	8%	198	2%
23	Chemical prods.	+2	5,885	6%	939	9%
21	Pharmaceuticals	+2	5,678	5%	1,568	15%

SCTG Code	Commodity	Tonnage Rank Change	Total Tons	% of Total	Total Value (\$M)	% of Total
37	Transport equip.	+2	5,115	5%	421	4%
24	Plastics/rubber	-2	4,553	4%	648	6%
40	Misc. mfg. prods.	-3	4,199	4%	310	3%
39	Furniture	+3	2,898	3%	158	35%

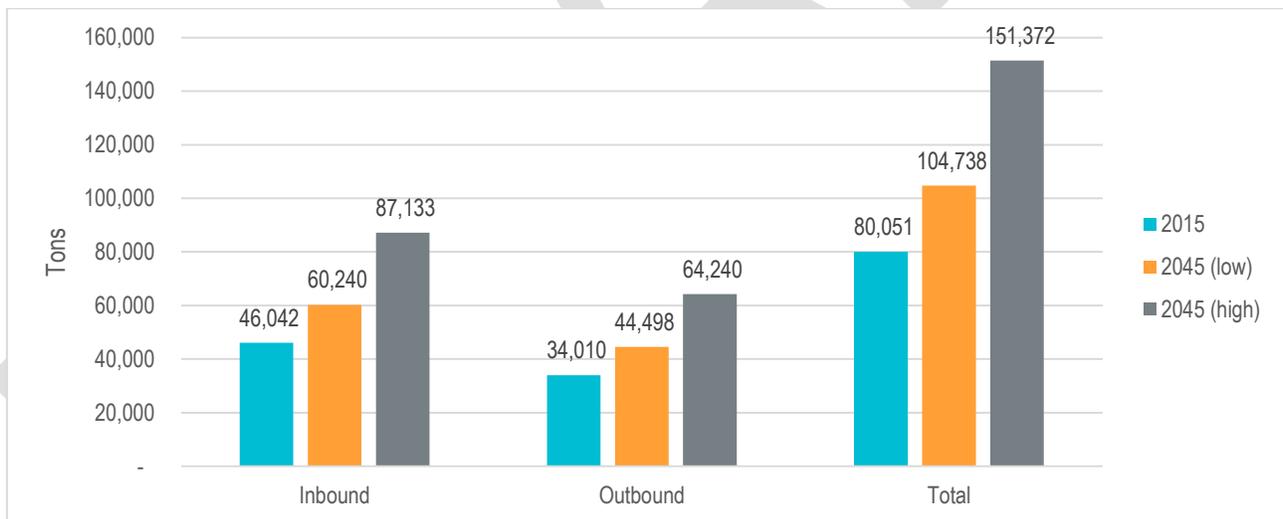
Source: BTS TranStats Database, 2015; growth rates from RDU Vision 2040 Master Plan.

4.2.3 Raleigh-Durham International (RDU)

Raleigh-Durham International (RDU) is expected to increase its air cargo tonnage 46,000 tons in 2015 to nearly 105,000 tons in 2015, a moderate annual growth of 0.9 percent. In the high growth scenario, air cargo tons are expected to grow by 89 percent to 152,000 tons in 2045, exhibiting an annual growth of 2.1 percent. Figure 4.5 illustrates the difference between the high and low growth scenarios.

The value of air cargo at RDU is expected to increase substantially. According to the low growth scenario, air cargo is expected to grow from \$7 billion in 2015 to \$13.8 billion in 2045, an increase of 95 percent over the next thirty years. The high growth scenario forecasts growth by 182 percent to \$19.9 billion in 2045.

Figure 4.5 Projected Air Cargo Tonnage at Raleigh-Durham International, by Direction and Growth Scenario, 2015-2045



Source: BTS TranStats Database, 2015; growth rates from 2015 Boeing WACF and RDU Vision 2040 Master Plan.

Electronics, machinery and pharmaceuticals will remain top commodities by 2045, as shown in Table 4.6. Together, they are expected to comprise 46 percent of total tonnage and 52 percent of total value. Precision instruments and chemical products will also emerge as top commodities by value, and are projected to comprise 9 percent (\$1.3 billion) and 12 percent (\$1.7 billion), respectively.

Table 4.6 Projected Top 10 Commodities at Raleigh-Durham International, Low Growth Scenario, 2045

SCTG Code	Commodity	Tonnage Rank Change	Total Tons	% of Total	Total Value (\$M)	% of Total
35	Electronics	-	24,416	23%	3,053	22%
34	Machinery	-	15,998	15%	1,765	13%
38	Precision instruments	+1	8,589	8%	1,295	9%
21	Pharmaceuticals	+1	7,991	8%	2,372	17%
30	Textiles/leather	-2	7,397	7%	203	1%
23	Chemical prods.	+1	7,325	7%	1,720	12%
24	Plastics/rubber	-1	5,196	5%	1,154	8%
37	Transport equip.	+7	4,785	5%	549	4%
5	Meat/seafood	-1	2,713	3%	12	< 1%
33	Articles-base metal	+2	2,404	2%	73	1%

Source: BTS TranStats Database, 2015; growth rates from RDU Vision 2040 Master Plan.

4.3 Trends and Implications of Growth

By 2045, North Carolina air cargo tonnage is projected to grow from 294,000 tons valued at \$23 billion to over 384,000 tons worth \$41.5 billion, according to the low growth scenario. Overall, air cargo value is expected to grow significantly more than tonnage, suggesting that primarily lighter and more expensive goods will continue to be shipped via air in North Carolina. The top commodities transported by air in North Carolina by 2045 are expected to be high-value goods such as electronics, machinery, pharmaceuticals and precision instruments. Electronics and pharmaceuticals are expected to remain top commodities in terms of value, with projected values of nearly \$11 billion and \$7 billion by 2045, respectively.

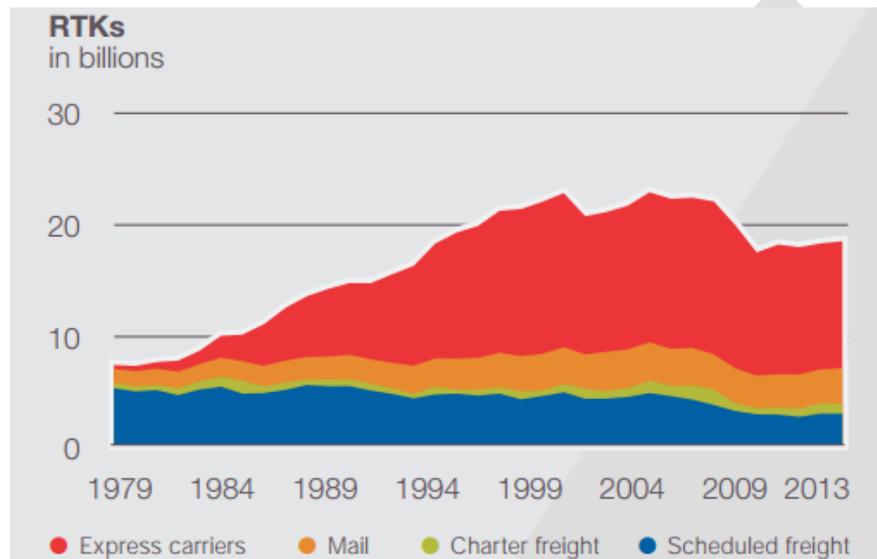
These projections are consistent with national air cargo trends¹⁷. Nationwide, there are three trends that continue to shape the airline industry: industry consolidation and restructuring, continued “capacity discipline” of passenger available seat miles (ASM) in response to external shocks, and increases in ancillary revenues, which are revenues from products or services beyond the passenger plane ticket. Air cargo has been affected mostly by the first trend, while passenger air travel has been affected more by the latter two trends. As noted in prior sections, the airline industry dramatically consolidated after the World Trade Center terrorist attacks on September 11, 2001, but it was the global economic recession of 2008 that resulted in major decreases in air cargo activity.

Overall, 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 4.6 presents the breakdown in domestic U.S. air cargo service from 1979 to 2013, with express carrier service

¹⁷ FAA Aerospace Forecast, 2016-2036. Available from: https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2016-36_FAA_Aerospace_Forecast.pdf

comprising the largest share of revenue ton-kilometers (RTK) 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 4.6 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's logistics network and resulted in late deliveries for many Amazon customers.¹⁸ Although peak season is still considered to be in November and December, ecommerce 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.

¹⁸ 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

The growing use of technology such as e-documents and web-based materials has reduced the need for express package services. 3D printing (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 percent of shipping volume while PricewaterhouseCoopers estimates as much as 41 percent of air cargo revenues being lost to 3DP activity.¹⁹ 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.²⁰ In March 2016, Amazon leased 20 Boeing 767 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.²¹ 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, which will be detailed in the following section. Improvements could include infrastructure upgrades, master planning, and facility expansion to increase air cargo activity at CLT, GSO, RDU, and even potentially Kinston Regional Jetport (ISO). 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.

¹⁹ 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>

²⁰ 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>

²¹ Dominic Gates. "Amazon lines up fleet of Boeing jets to build its own air-cargo network". *The Seattle Times*. March 9, 2016. <http://www.seattletimes.com/business/boeing-aerospace/amazon-to-lease-20-boeing-767s-for-its-own-air-cargo-network/>

5.0 Needs Assessment

North Carolina air cargo needs can be categorized into three areas: airport access, airport runway/facilities, and industrial development. Air cargo access is critical to economic vitality, particularly for high value commodities. Consumer markets tied to ecommerce have increased the demand for express package services, which have been traditionally fulfilled by air cargo jets. However, because advances in ground logistics have made trucks a viable option for express service, North Carolina airports must ensure seamless access to air cargo facilities via the roadway network to stay competitive with other freight modes. Additionally, there are opportunities to North Carolina's airports to improve runway and facility infrastructure on-site. This includes runway expansions, cargo aprons, and more space for commercial vehicle staging. Finally, focusing industrial development around airports can help increase the value of air cargo services.

North Carolina can position itself to strengthen air cargo activity throughout the state by making investments in places that support economic vitality and growth. This should occur in areas where companies using air cargo services are located, particularly for companies involved in electronics, pharmaceuticals, machinery, and other high-value, low-weight commodities. If existing air cargo facilities are not adequate in these areas, there is an opportunity to expand air cargo access. These investments should be made for all of the modes – including truck, rail, and maritime – that collectively support air cargo activity in North Carolina. A planning-level economic assessment that combines insight from air cargo stakeholders with freight flow data will help highlight key corridors and areas for investment. The following sections will discuss projects related to each of the three investment areas to support air cargo activity in North Carolina.

5.1 Airport Access Needs

Airport access is an important component of the needs assessment for North Carolina air cargo activity. In eastern North Carolina, there are two major road projects in the works to upgrade key corridors to interstate highways, both of which will benefit airport access. The first project involves U.S. 70, which the American Association of State Highway and Transportation Officials (AASHTO) approved upgrading to Interstate 42. U.S. 70 is an east-west highway and major freight corridor originating from I-40 near Raleigh and stretching all the way to Morehead City, connecting to Raleigh, Smithfield, Goldsboro, Kinston, and the Port of Morehead City. In addition, the Kinston Regional Jetport and Global TransPark (GTP), which are located less than 10 miles from U.S. 70 in Kinston, will have improved highway access for trucks a result of the new interstate connection.

The second roadway improvement involves portions of U.S. 64 and U.S. 17. The corridor begins in central Raleigh with U.S. 64 and travels northeast to Williamston, where it transitions to U.S. 17 to the Virginia state line. The upgrade has been approved by AASHTO and will become Interstate 87 once upgrades are complete. This upgrade could increase freight traffic from eastern North Carolina into Raleigh and Raleigh-Durham International Airport (RDU). RDU's Vision 2040 Master Plan notes that two-thirds of on-airport roadway links and several key intersections will become highly congested by 2040, which may lead to reduced truck access to RDU facilities. Coupled with the roadway upgrade to I-87, addressing these potential future access issues is critical to maintaining adequate roadway access at RDU.

Finally, two projects were identified in the ongoing Regional Freight Mobility Plan for the Centralina Council of Governments (CCOG) and the North Carolina State Rail Plan that could enhance access to air cargo facilities at CLT and GSO. The first project is to construct a rail spur at Piedmont Triad International Airport (GSO). There is a Norfolk Southern (NS) track that runs south of GSO, along W. Market Street, but does not

connect directly with the airport. Constructing a rail spur at GSO will facilitate rail freight movement into and out of the airport facilities. The other project is to enhance the I-85/I-485 interchange, which is directly northwest of the CLT campus and frequently congested. Improving this interchange will address the need of expanding truck access at CLT and throughout the Charlotte region.

5.2 Airport Runway/Facility Needs

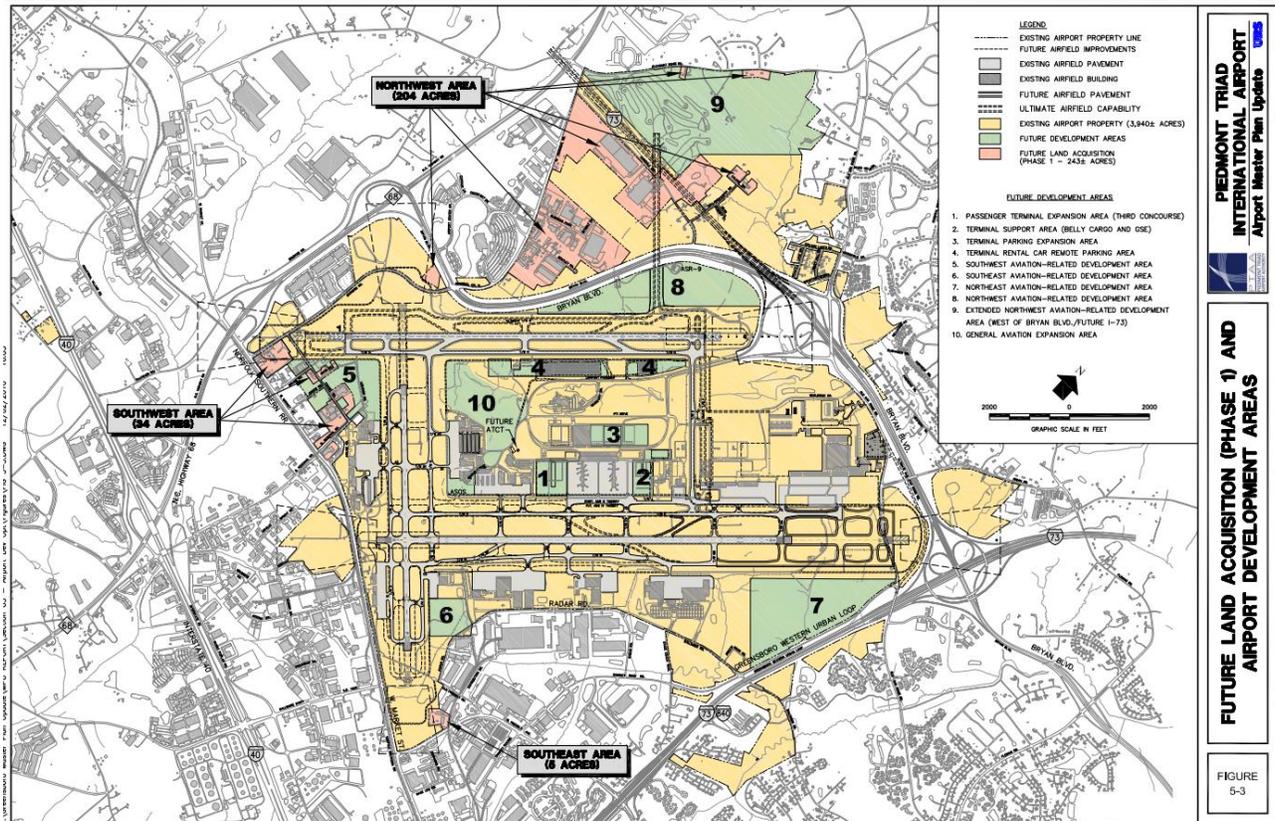
In addition to airport access, there is also a need for improvements to some of North Carolina's airport runways and on-site facilities. At CLT, the current runway is 10,000 feet, which is not long enough to handle large cargo jets and limits air cargo capacity at the airport. Centralina Council of Governments (CCOG) noted expanding CLT's runway as part of its Regional Freight Mobility Plan. This project involves planning for a 12,000-foot runway, which will be large enough to accommodate the heaviest air freighters, helping to expand capacity and increase air cargo activity at CLT.

As part of its Vision 2040 Master Plan, RDU is also planning to reconstruct and expand runway 5L/23R to 11,500 feet to better accommodate international service. The expansion will also enable RDU to handle the largest air freighters, which may lead to increased domestic and international air cargo activity. RDU has also identified a need for a cargo aircraft apron and space for commercial vehicle staging, both of which will strengthen its long-term viability not only for air passenger service, but also for air cargo service.

Piedmont International Airport's (GSO) most recent master plan²² called for future land acquisition and airport development, as shown in Figure 5.1. There are ten specified areas for future development, in addition to land acquisition in the northwest (204 acres), southwest (34 acres), and southeast (5 acres). Future development plans related to air cargo include a terminal support area for belly cargo and ground service equipment, which could accommodate more cargo buildings, aircraft apron parking positions, and truck courts, which are areas next to loading docks to provide space for trucks to maneuver. This infrastructure will directly support air cargo activity at GSO and may help increase its competitiveness as a regional air cargo facility.

²² Airport Master Plan Update and Strategic Long-Range Visioning Plan. Piedmont Triad International Airport Authority. September 2010. <http://flyfrompti.com/wp-content/uploads/2014/08/Airport-Master-Plan-Update.pdf>

Figure 5.1 Future Land Acquisition and Airport Development Areas, Piedmont Triad International Airport



Source: Airport Master Plan Update. Piedmont Triad International Airport Authority, 2010

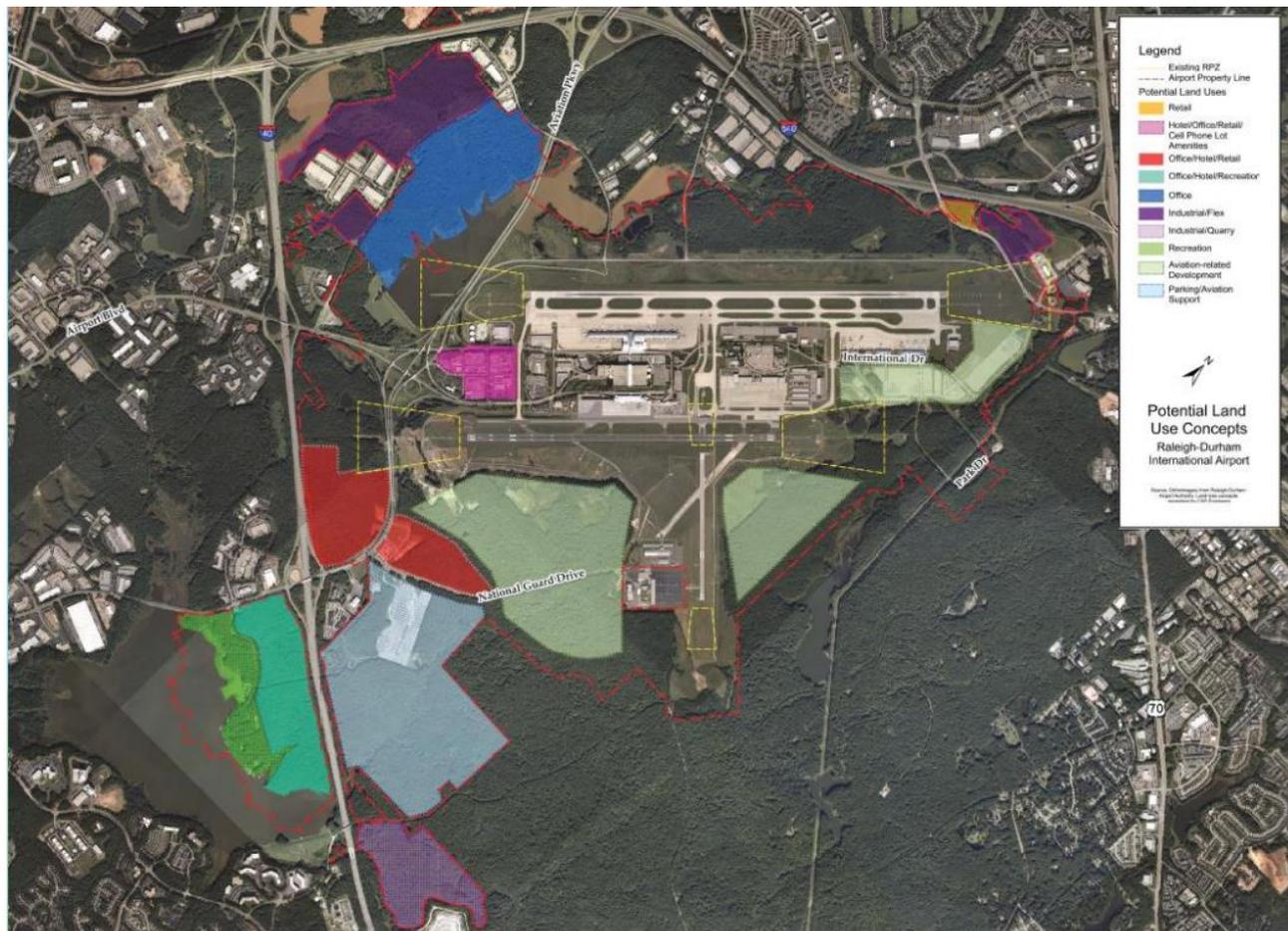
5.3 Industrial Development Needs

The last element of the air cargo needs assessment focuses on industrial development around key airports. Specifically, efforts to develop industrial sites adjacent to Charlotte Douglas International Airport (CLT) property have been unsuccessful due to the natural topography surrounding the airport, which is generally hilly with a few large and flat areas. Companies do not typically build industrial sites on land with grades above 3 percent because grading costs on these sites are cost-prohibitive. As a result, this land is less desirable for industrial development compared to other areas where the grade is already below 3 percent, and industrial development has been pushed across the region and away from CLT. State or federal funding resources may be needed to level the land in order to increase its competitiveness and enhance freight activity at CLT. Although economic development funding opportunities exist in North Carolina, such as One North Carolina Fund (OneNC) and Job Development Investment Grant (JDIG), they may not be appropriate funding sources to support leveling the land surrounding CLT. However, the City of Charlotte and the County of Mecklenburg offer cash grants as part of the Business Investment Program (BIP) to companies that invest

in “large economic impact projects” anywhere in the City of Charlotte²³, which may be a more suitable funding source for this purpose.

There are also opportunities to increase industrial development around RDU and GSO to support air cargo activity at these airports. At RDU, there are parcels of land surrounding the facility that are ideal for retail, office, recreation, and industrial space, as identified in RDU’s Vision 2040 Master Plan and shown in Figure 5.2. Additionally, the master plan for GSO calls for an extended northwest aviation-related development area west of Bryan Boulevard/Future I-73, as shown in Figure 5.1, which could be developed to support commercial/industrial activities that do not require direct access to the airfield.

Figure 5.2 Potential Land Use Concepts at Raleigh-Durham International Airport



Source: RDU Vision 2040 Master Plan

Lastly, Global TransPark (GTP) was originally built around a multimodal transportation network, including Kinston Regional Jetport (capable of handling international flights), undeveloped acreage surrounding the site, proximity to military bases, and the potential for highway, rail, and deep-water port access. However, it has not become the multimodal manufacturing and distribution hub originally envisioned; rather, GTP is an

²³ “Mecklenburg County Incentives Summary”. Charlotte Chamber Economic Development. Accessed October 19, 2016. Available from: http://charlotte.global/clientuploads/Economic_pdfs/charlotte_incentives.pdf

industrial park with multimodal attributes. Before its current location was selected, the feasibility study projected significant job creation associated with a global air cargo industrial complex. However, GTP is located approximately 50 miles away from I-95 and approximately 46 miles to I-40, making it difficult for trucks to quickly access the site from an interstate highway. As a result, it has fallen short of projections, and despite renovations to the air hub in 2010, air cargo activity has tapered off since 2014. Coupled with better roadway access to GTP as U.S. 70 is upgraded to an interstate, increasing development around the facility could help increase its relevance as an air cargo hub.

Appendix A. SCTG Commodity Classification

Table A.1 SCTG Commodity Code Descriptions

2-Digit Code	Commodity	Description
01	Live animals/fish	Includes live animals, poultry, fish, and other live animals.
02	Cereal grains	Includes field crops such as wheat, corn, rye, oats, and other seeds.
03	Other agricultural products	Comprised of vegetables, fruits (fresh and dried), nuts, flowers, oil seeds, and other agricultural products.
04	Animal feed	Forage products, residues and waste from food industries used in animal feeding, other products of animal origin not elsewhere classified.
05	Meat/seafood	Fresh or frozen meat, fish, and poultry products.
06	Milled grain products	Comprised of processed field crops into flours and meals, in addition to bakery and baked products such as pasta, dough, baked snack products, rice preparations, and other processed bakery products.
07	Other foodstuffs	Includes dairy products, processed or prepared vegetables, fruit, and nuts, coffee/tea, oils, sugars and confectionary products, edible oils, and non-alcoholic beverages.
08	Alcoholic beverages	Beer, wine, spirits, and denatured ethyl alcohol (not for human consumption).
09	Tobacco products	Cigarettes and other manufactured tobacco products.
10	Building stone	Calcareous monumental or building stone.
11	Natural sands	Sands and quartz sands used for construction, building, and other uses.
12	Gravel	Gravel and crushed stone.
13	Nonmetallic minerals	Includes various types of salts, including table salt, clays, sulfur, asbestos, and other non-metallic minerals.
14	Metallic ores	Includes iron, copper, nickel, aluminum, lead, zinc, and other ores.
15	Coal	Non-agglomerated and agglomerated coal.
16	Crude petroleum	Crude petroleum oil and oils obtained from bituminous minerals.
17	Gasoline	Includes gasoline and gasoline blends, aviation turbine fuel, kerosene, ethanol and ethanol blends.
18	Fuel oils	Fuel oils including diesel, Bunker C, and biodiesel.
19	Coal and petroleum products	Includes lubricating oils and greases, and gaseous hydrocarbons such as liquefied natural gas (LNG), propane, butane, and others.
20	Basic chemicals	Includes a variety of inorganic chemicals (i.e. sodium hydroxide and hydrogen chloride) and organic chemicals (i.e. phenols and organic dyes).
21	Pharmaceuticals	Any pharmaceutical products.
22	Fertilizers	And fertilizer products, such as manufactured fertilizer products, slag, or other materials.
23	Chemical products	Includes paints and varnishes, inks, essential oils, glues, and other chemical products.
24	Plastics/rubber	Articles of plastic and rubber, including tubes, pipes, packaging goods, foam, and other products.
25	Logs	All logs for pulping, lumber, fuel wood, and other untreated wood products.

26	Wood prods.	Contains lumber and other manufactured wood parts.
27	Newsprint/paper	Wood pulp, newsprint, toilet/facial tissue, and other rolled paper and paperboard in large rolls or sheets.
28	Paper articles	Household paper products, wallpaper, envelops, and other paper or paperboard articles.
29	Printed products	Books, newspapers, journals, and other printed products.
30	Textiles/leather	Textile fibers and clothing, carpets, and articles of leather.
31	Non-metallic mineral products	Features products made from ceramic, glass, concrete, and other plaster products.
32	Base metals	Contains metal products such as iron, steel, copper, and aluminum, among others.
33	Articles-base metal	Pipes, tubes, and fittings, structures and structural parts, hand tools, and other articles of base metal.
34	Machinery	Features a number of types of engines, energy generators, pumps, climate control machinery, household heavy appliances, and other types of tools and manufacturing machinery.
35	Electronics	Electric motors, appliances, entertainment products, computers, and other electronic components and parts.
36	Motorized vehicles	Examples include personal vehicles, vehicles for the transport of goods, tractors, motor cycles, bicycles, and motor vehicle parts such as chassis, wheels, and other parts.
37	Transport equip.	Includes railway equipment, aircraft and spacecraft, ships, boats, and floating structures.
38	Precision instruments	This includes a number of specialized apparatuses such as optical elements, photocopying machines, surveying or geophysical equipment, or medical devices.
39	Furniture	All types of furniture, mattresses and supports, lamps, and illuminated signs.
40	Misc. manufactured products	Includes a variety of manufactured goods, including toys, musical instruments, artwork, and other manufactured products.
41	Waste/scrap	Includes both metallic waste and scrap and non-metallic waste and scrap.
43	Mixed freight	Virtually all kinds of freight that can be moved in a trailer or container and is not reported as a specific commodity. The primary commodities handled in this manner consist of consumer goods, including packaged foods, electronics, office supplies, and durable goods, along with a broad range of intermediate components for manufacturing, such as auto parts.
99	Unknown	Unknown or not available.