State of the Northeast Corridor Region Transportation System

prepared for

Northeast Corridor Infrastructure and Operations Advisory Commission

prepared by

Cambridge Systematics, Inc.

with

SYSTRA
Parsons Transportation Group

Table of Contents

List of Tables

List of Figures

1.0 Introduction

1.1 The Northeast Corridor and Region

This report is a summary of information on the multimodal passenger and freight transportation system of the Northeast Corridor (NEC) Region of the United States. The report draws primarily from existing studies and databases, aggregating information, as feasible, for the study area defined by the counties in light gray in Figures 1 through 5.

The NEC is a 457-mile rail corridor, shown in Figure 1, connecting Boston, MA; New York City, NY; Washington, DC; and many cities in between. It serves portions of eight states and the District of Columbia. It is a shared-use rail corridor (intercity, commuter, and freight), owned primarily by Amtrak, with portions owned by the New York Metropolitan Transportation Authority (MTA), and the states of Connecticut and Massachusetts.

Northeast Corridor Region

- 17% of U.S. residents
- 20% of U.S. jobs
- 21% of U.S. GDP
- Busiest passenger rail system in North America
  - 75% of weekday commuter rail trips (1.2 M)
  - 50% of daily Amtrak trips (40,000+)
- 12% of U.S. highway lane miles (1.1M)
  - 91 M daily auto trips under 75 miles
  - 450,000+ daily auto trips over 75 miles
- 30% of U.S. air trips
  - 8 of the 30 busiest airports in the U.S.
  - More than 30,000 people fly between cities in the NEC Region each day
- 1 out of every 5 tons of U.S. freight

The NEC is a vital and heavily used transportation asset in the most densely populated region of the United States. The NEC Region is home to one out of every six Americans and one out of every five U.S. jobs. It contains New York City, the nation's largest metropolis, and several other large metropolitan areas, including Boston, Philadelphia, Baltimore, and Washington. The NEC Region's economy generates a gross domestic product (GDP) of over three trillion dollars annually, which accounts for more than 21 percent of the total national GDP.[1] If the NEC Region were an autonomous country, its economy would be the fifth largest in the world, just behind Germany and ahead of France.[2]

Amtrak and the eight commuter railroads that operate over the NEC carry over 750,000 passengers every day, making it the most heavily traveled passenger-rail corridor in the United States.[3] Figure 1 shows the location of the NEC and the other Amtrak intercity rail lines that serve the NEC Region. Figure 2 shows the service areas of the eight commuter railroads that use portions of the NEC.

Freight railroads also use the NEC, moving approximately 350,000 carloads over the line each year, connecting the region's major ports, manufacturing facilities, and distribution centers. Figure 3 shows the freight railroad networks that are tied to the NEC.

The NEC is only one component of the region's larger transportation system, which is the most diversified in the country. Figure 4 shows the region's highway network, branching out from the Interstate 95 corridor that runs roughly parallel to the NEC. Figure 5 shows the location of airports providing service in the region. These facilities and others described in this report enable regional mobility, sustain economic productivity, and support residents' quality of life.

1.2 Purpose of the Report

This report documents the current state of the NEC Region's multimodal transportation system, describes trends affecting its performance, and explores future challenges and opportunities. It synthesizes information across all major modes that provide mobility in the NEC Region: the metropolitan highway, commuter rail, and transit systems; and the intercity highway, rail, and aviation systems.

The study area, generally displayed in light gray in the report, aligns with NEC FUTURE, a Service Development Plan and Tier 1 Environmental Impact Statement, being developed by the Federal Railroad Administration (FRA) in coordination with the Northeast states, Amtrak, the Northeast Corridor Infrastructure and Operations Advisory Commission (NEC Commission), and other stakeholders. NEC FUTURE is a comprehensive planning effort to define, evaluate, and prioritize future investments in the NEC through 2040.[4]

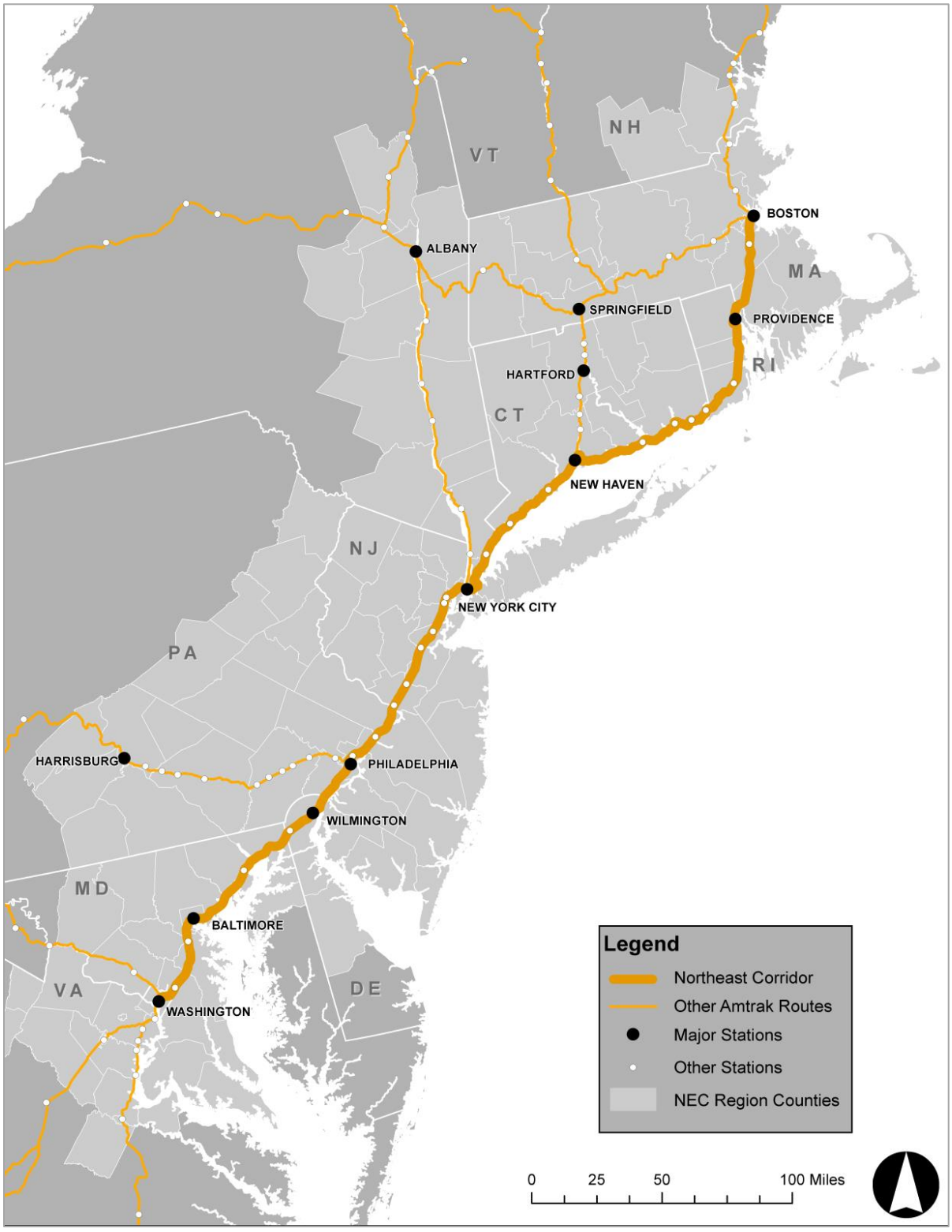
The report is intended to provide regional stakeholders and the public with a consolidated source for information on the overall state of the transportation system in the NEC Region. It presents data from a wide variety of sources on current supply, demand, and performance for each mode. The report also describes trends that might affect the region's transportation system in the future, including population and economic growth, and the outlook for transportation capacity and state-of-good-repair investment needs. The forward-looking elements of this report are intended to inform NEC stakeholders of the challenges and opportunities facing the region to guide planning, policy, and investment decisions.

Northeast Corridor Commission

Congress established the NEC Commission to develop coordinated strategies for improving the Northeast's core rail network in recognition of the inherent challenges of planning, financing, and implementing major infrastructure improvements that cross multiple jurisdictions. The expectation is that by coming together to take collective responsibility for the NEC, these disparate stakeholders will achieve a level of success that far exceeds the potential reach of any individual organization.

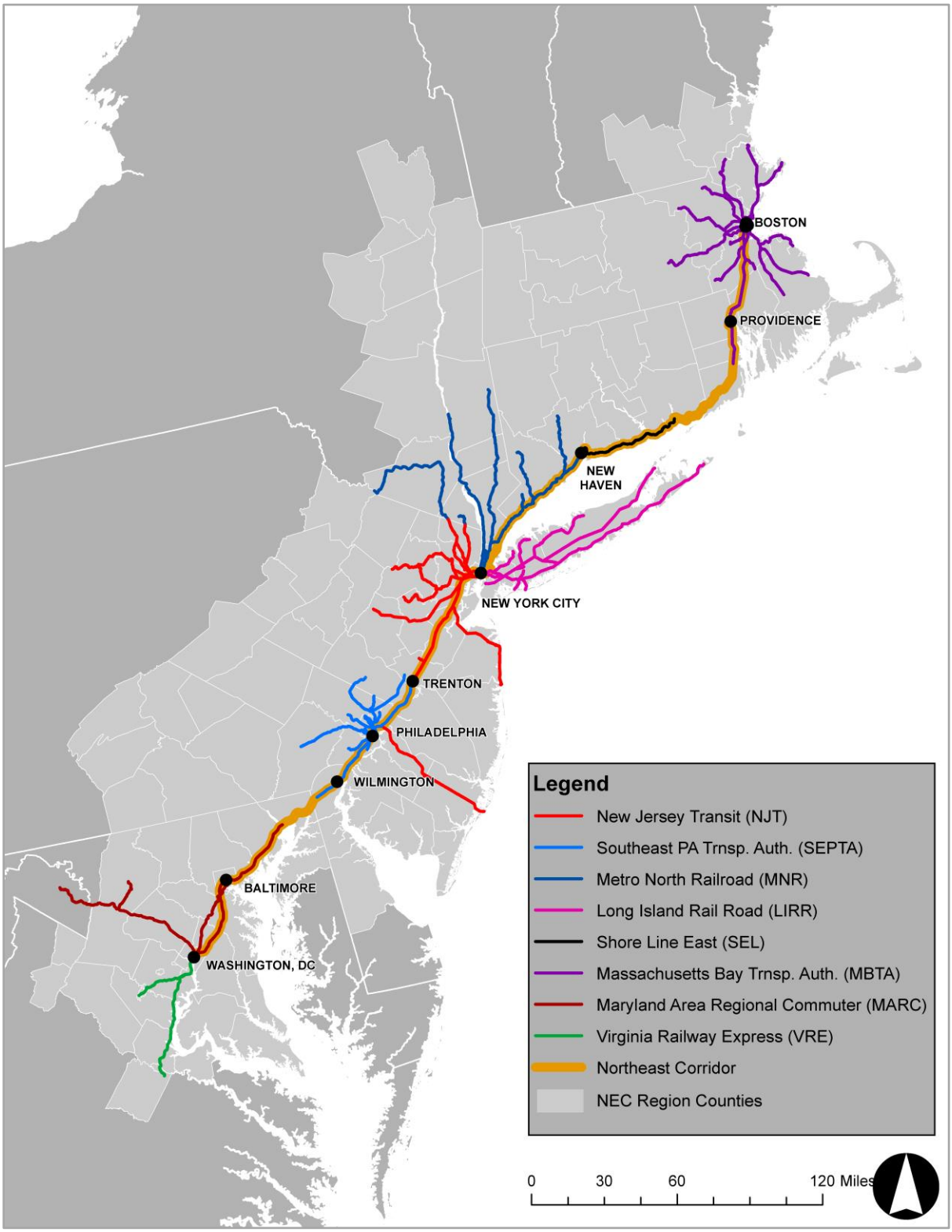
The Commission is governed by a board comprised of one member from each of the NEC states (MA, RI, CT, NY, NJ, PA, DE, and MD) and the District of Columbia; four members from Amtrak; and five members from the U.S. Department of Transportation (DOT). The Commission also includes non-voting representatives from commuter railroads, freight railroads, and states with connecting corridors.

Figure 1. ***Intercity Rail System: NEC Region***



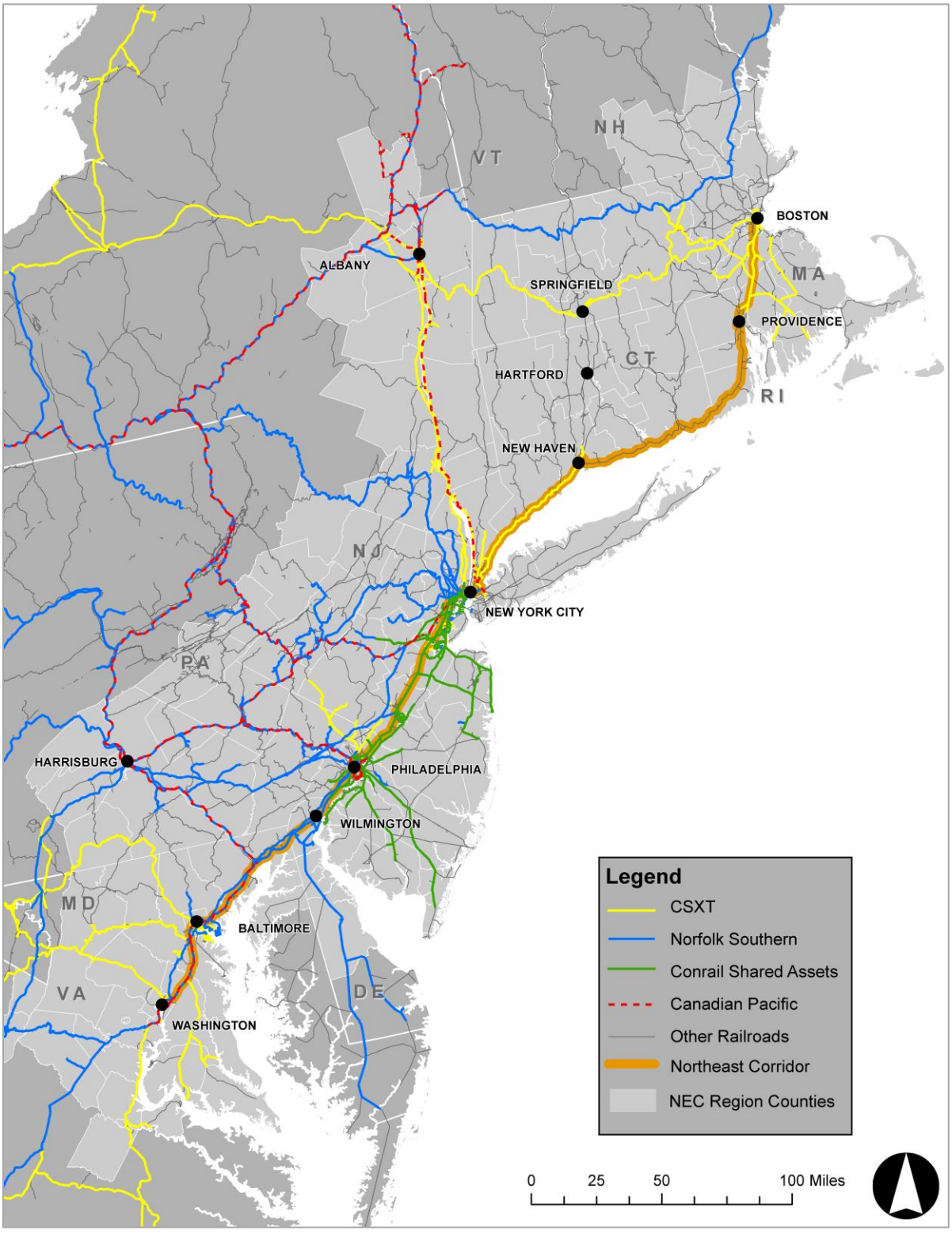
Source: National Transportation Atlas Database.

Figure 2. ***Commuter Rail System: NEC Region***



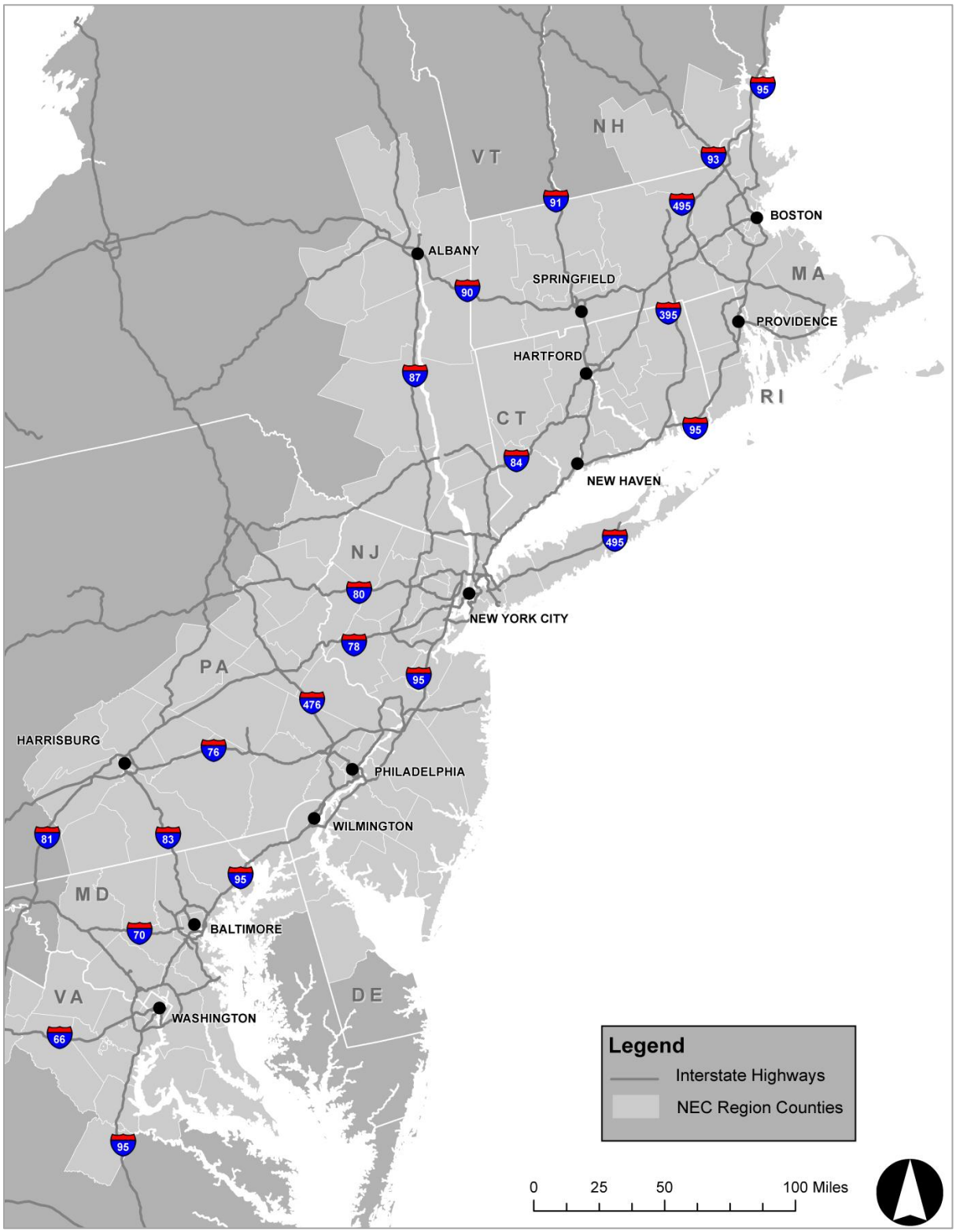
Source: National Transportation Atlas Database, Commuter Railroads.

Figure 3. ***Freight Rail System: NEC Region***



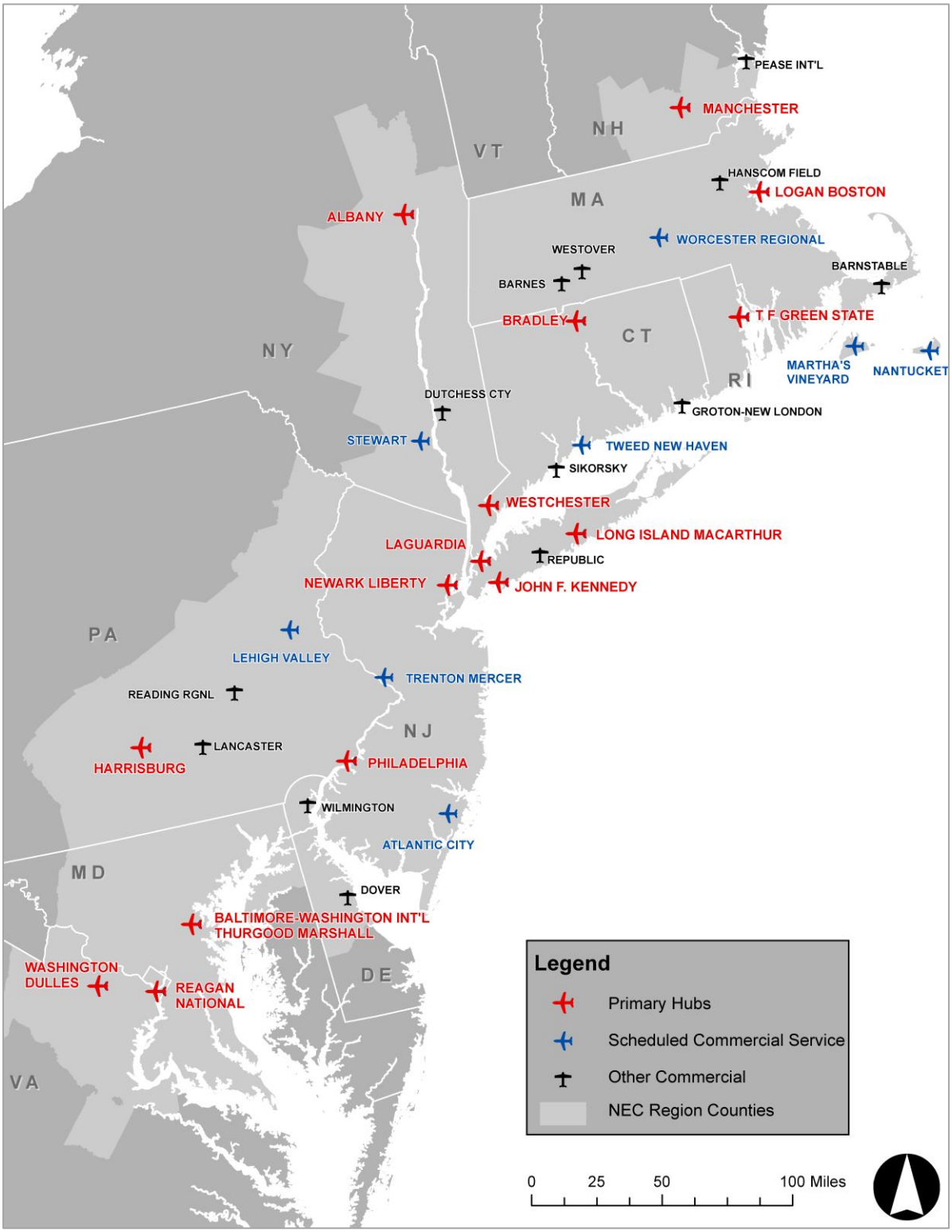
Source: National Transportation Atlas Database.

Figure 4. ***Highway System: NEC Region***



Source: National Transportation Atlas Database.

Figure 5. ***Aviation System: NEC Region***



Source: National Transportation Atlas Database.

1.3 Sources of Information

Key Resources

- U.S. Census Bureau population and economic data
- U.S. Bureau of Economic Analysis (BEA) economic data
- Moody's Analytics population and economic forecasts
- Federal Transit Administration (FTA) National Transit Database (NTD)
- Transit agencies and state departments of transportation
- Amtrak
- Northeast Corridor Master Plan
- I-95 Corridor Coalition ICAT Model
- 2040 Vision for the I-95 Coalition Region
- Texas Transportation Institute (TTI) Urban Mobility Report
- Bureau of Transportation Statistics (BTS) airline information
- Federal Aviation Administration (FAA) FACT 2 report
- Federal Highway Administration (FHWA) Freight Analysis Framework (FAF3)

Information in the report comes from existing databases and prior studies, reflecting the most current data available publicly from authoritative sources. Demographic and economic data come from the U.S. Census Bureau and the U.S. Bureau of Economic Analysis (BEA). Future population and economic forecasts were purchased from Moody's Analytics. Information on passenger rail services and ridership is drawn from Amtrak and published commuter rail schedules and reports. Data on freight rail services and volumes come from prior federal and state studies and railroad reports.

Federal and state traffic counts, the I-95 Corridor Coalition's ICAT database, and the Federal Highway Administration's (FHWA) Freight Analysis Framework (FAF) database were used to estimate highway travel volumes by automobiles and trucks, and to measure performance. The Texas Transportation Institute's Urban Mobility Report also provided data on highway system performance. Intercity bus passenger volumes were estimated from online schedules and published survey data. The Bureau of Transportation Statistics (BTS) provided information on air travel volumes and system performance. Information on transit ridership was pulled from the Federal Transit Administration's (FTA) National Transit Database (NTD) and agency reports.

Analyses of future prospects for the transportation system were collected from the NEC Master Plan, the I-95 Corridor Coalition's 2040 Vision for the I-95 Coalition Region, the Federal Aviation Administration's (FAA) Capacity Needs in the National Airspace System, 2007-2025 (FACT 2), and related studies prepared by NEC Region transportation agencies.

Key Questions

- Where do we work?
- Where do we live?
- Who travels and why?
- Where do we travel?
- How do we get there?
- How well does the NEC Region transportation system perform for its users?
- What are the future prospects for the NEC Region transportation system?

1.4 Structure of the Report

The technical sections of this report start with a look at ***where we work*** and ***where we live*** within the region (Section 2.0). These are the starting points because the types of businesses in the region, their location, the number of people they employ, and where those employees and their families live shape the core of demand for transportation services. The section maps employment and population patterns and summarizes recent trends that are changing the demand for transportation in the NEC Region.

The report builds on the employment and population data to understand ***who travels, where, and how*** (Section 3.0). It looks at:

- Metropolitan commuting by:
  - Automobile,
  - Commuter rail, and
  - Transit;
- Intercity business and leisure travel by:
  - Highway,
  - Rail, and
  - Air; and
- Freight movement by:
  - Highway,
  - Rail, and
  - Air.

Urban, Suburban and Rural/Exurban

For select discussions of demographic, economic, and travel behavior data, this report sorts the 121 counties and the District of Columbia in the NEC Region into the following categories, correlated with population density:

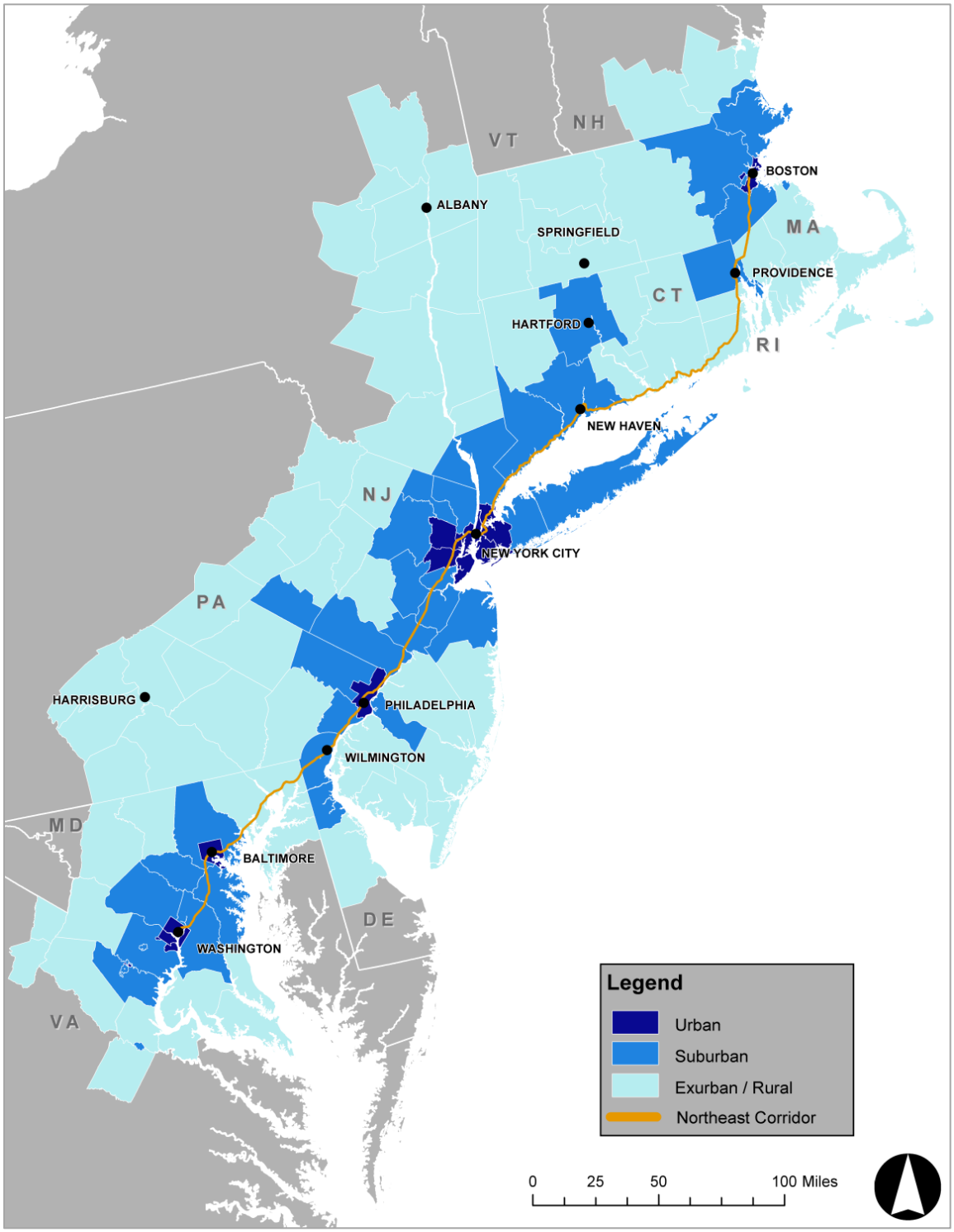
- **Urban**. Core counties with central cities and dense settlement patterns. Population densities above 5,000 people per square mile. Urban counties cover 956 square miles or 2 percent of the study area.
- **Suburban.** The first echelon of counties surrounding urban counties. Population densities between 1,000 and 5,000 people per square mile. Suburban counties cover 13,343 square miles, or 26 percent of the study area.
- **Rural/Exurban.** Rural and exurban counties on the fringe of metropolitan areas. Population densities less than 1,000 people per square mile. Rural/Exurban counties cover 37,641 square miles, or 72 percent of the study area.

Figure 6 maps the counties by category.

The report then summarizes information on how well the NEC Region transportation systems perform, discussing ***how well the highway, rail, and air networks serve metropolitan and intercity travelers*** (Section 4.0).

The subsequent sections of the report look at the future of the NEC Region and its transportation system. The section on future travel demand looks at employment and population forecasts that may influence ***where we might work*** and ***where we might live*** in 2040 and reviews existing forecasts of travel demand by mode for future time horizons (Section 5.0). The final section reviews plans and programs to improve transportation infrastructure in the region to explore ***future challenges and opportunities*** for the NEC Region transportation system (Section 6.0). Information on needs, challenges, plans, and programs is drawn from authoritative studies. This report does not include original forecasts of future travel demand or system performance.

Figure 6. ***Urban, Suburban, and Rural/Exurban Counties: NEC Region***



Source: U.S. Census Bureau. U.S. Geological Survey.

2.0 The NEC Region: Where Do We Work and Live?

This section looks at ***where we work*** and ***where we live*** within the region. The first half looks at recent trends in employment, industry growth, economic productivity, and income. The second half looks at settlement patterns based on population and population density. The employment information – about the types of businesses in the region, their location, and the number of people they employ – helps explain the demand for business travel and goods movement. The population information – about where people live – helps explain the demand for commuting and local travel.

2.1 Employment and Industries

2.1.1 Employment

Over 24 million people work in the NEC Region. Urban counties represent the greatest concentration of jobs, where 30 percent of regional jobs are located on just 2 percent of the NEC Region's land area. However, the suburban counties hold the greatest sum total of jobs, representing 45 percent of regional jobs.

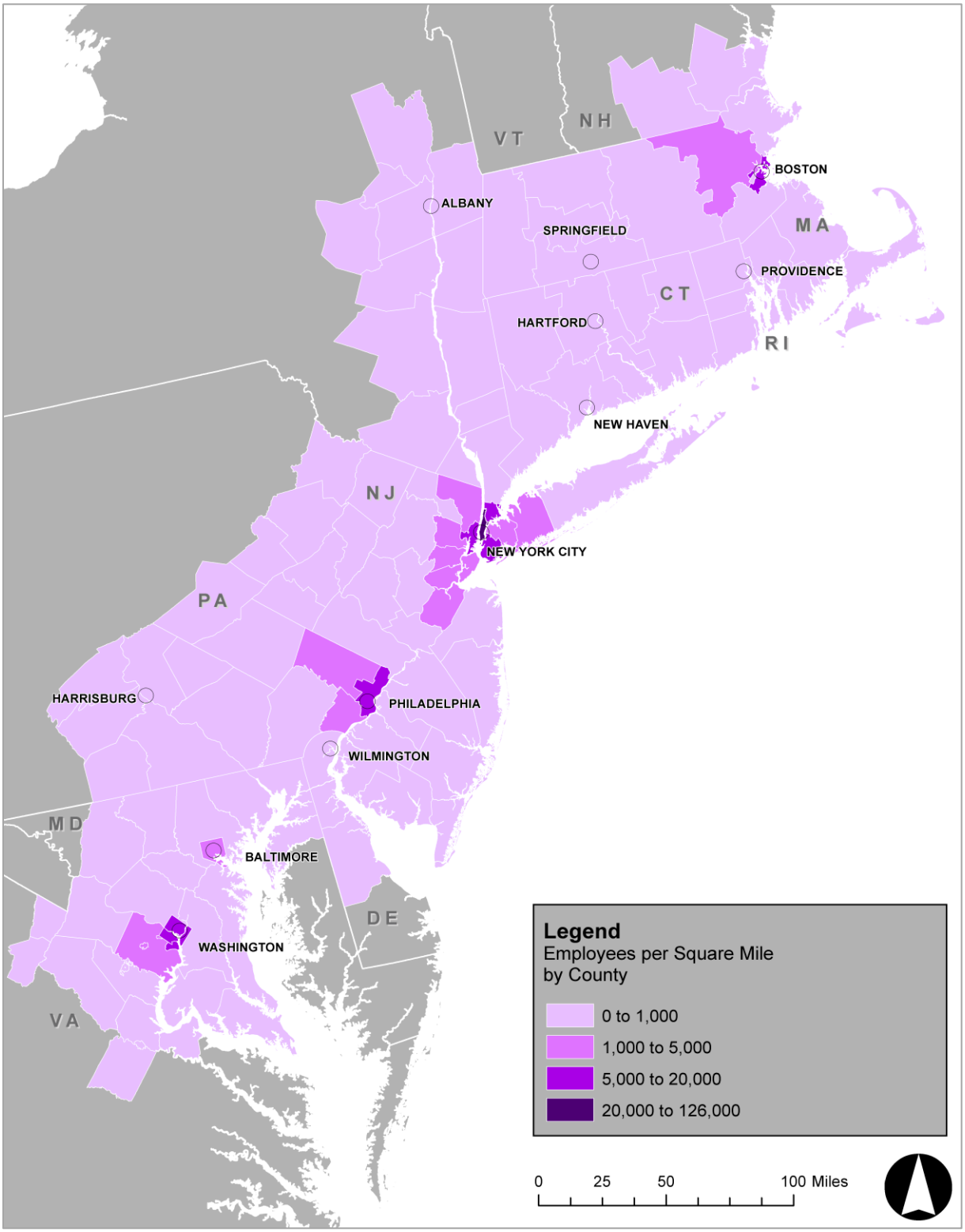
There are over 24 million jobs in the NEC Region, accounting for approximately one out of every five U.S. jobs. Employment in the NEC Region is concentrated in the major metropolitan areas along the NEC –Boston, New York, Philadelphia, and Washington. These four Metropolitan Statistical Areas (MSAs) account for over 75 percent of employment in the study area.[5] New York County, NY (Manhattan) has the highest number of jobs of any county in the Region followed by Middlesex County, MA; Washington, DC; and Philadelphia City/County, PA (Table 1). New York County, NY (Manhattan); Washington, DC; and Suffolk, MA (Boston) have the highest job densities among all counties (Figure 7).

Table 1. Top 10 Counties by Number of Jobs: NEC Region
2010

County	MSA/CSA	Jobs
New York, NY (Manhattan)	New York NY-NJ-CT-PA CSA	2,407,000
Middlesex, MA	Boston MA-NH CSA	864,000
Washington, DC	Washington, DC-VA-MD-WV MSA	745,000
Philadelphia, PA	Philadelphia PA-NJ-DE-MD CSA	685,000
Fairfax, VA[a]	Washington, DC-VA-MD-WV MSA	669,000
Suffolk, NY (Boston)	New York NY-NJ-CT-PA CSA	635,000
Nassau, NY	New York NY-NJ-CT-PA CSA	620,000
Suffolk, MA	Boston MA-NH CSA	614,000
Queens, NY (Queens)	New York NY-NJ-CT-PA CSA	531,000
Kings, NY (Brooklyn)	New York NY-NJ-CT-PA CSA	530,000
Total for Top 10		**8,301,000**
Total All Other NEC Region Counties		**16,116,000**
Total for NEC Region		**24,417,000**

Source: Bureau of Economic Analysis, Wage and Salary Employment (CA34). a) Includes Fairfax City, VA and Falls Church City, VA

Figure 7. ***Employment Density by County: NEC Region***
2010



Source: Bureau of Economic Analysis, Wage and Salary Employment (CA34).

Region wide employment growth was stagnant between 2000 and 2010, declining by one-half percent during the recession. However, many counties grew during the period, some showing strong gains. The greatest percentage and absolute job growth occurred in the suburban and rural/exurban counties of the Washington, DC region, led by Stafford and Loudoun Counties in Virginia (Table 2). Several urban counties also saw the greatest absolute growth in jobs. These included Washington, DC; Kings County, NY (Brooklyn); and Bronx County, NY (Bronx) (Table 3).

Table 2. Top 10 Counties by Percent Increase in Jobs: NEC Region
2000 to 2010

County	MSA/CSA	Percent Increase
Loudoun, VA	Washington, DC-VA-MD-WV MSA	53.4%
Stafford, VA	Washington, DC-VA-MD-WV MSA	42.1%
Prince William, VA[a]	Washington, DC-VA-MD-WV MSA	26.0%
Pike, PA	New York NY-NJ-CT-PA CSA	24.1%
Calvert, MD	Washington, DC-VA-MD-WV MSA	23.0%
St. Mary's, MD	Washington, DC-VA-MD-WV MSA	20.5%
Cecil, MD	Philadelphia PA-NJ-DE-MD CSA	20.5%
Fauquier, VA	Washington, DC-VA-MD-WV MSA	20.1%
Spotsylvania, VA[b]	Washington, DC-VA-MD-WV MSA	18.8%
Frederick, MD	Washington, DC-VA-MD-WV MSA	18.5%

Source: Bureau of Economic Analysis, Wage and Salary Employment (CA34). a) Includes Manassas, VA and Manassas Park, VA; (b) Includes Fredericksburg, VA.

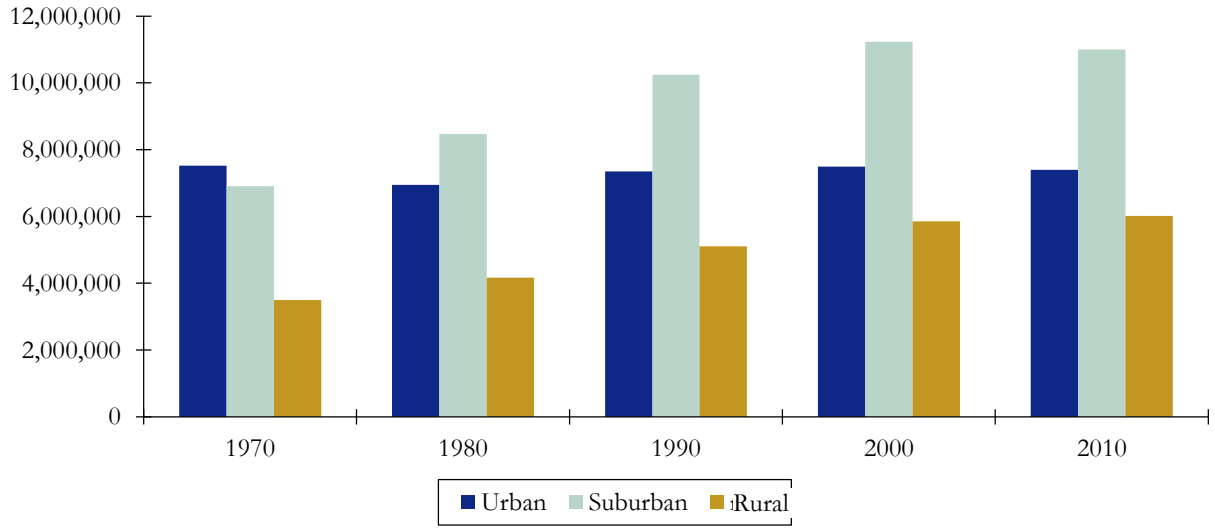
Table 3. Top 10 Counties by Absolute Increase in Jobs: NEC Region
2000 to 2010

County	MSA/CSA	Absolute Increase
Washington, DC	Washington, DC-VA-MD-WV MSA	60,642
Loudoun, VA	Washington, DC-VA-MD-WV MSA	49,753
Kings, NY (Brooklyn)	New York NY-NJ-CT-PA CSA	49,059
Fairfax, VA[a]	Washington, DC-VA-MD-WV MSA	40,176
Anne Arundel, MD	Baltimore–Columbia–Towson MD MSA	37,281
Prince William, VA[b]	Washington, DC-VA-MD-WV MSA	30,319
Suffolk, NY (Boston)	New York NY-NJ-CT-PA CSA	22,145
Chester, PA	Philadelphia PA-NJ-DE-MD CSA	20,442
Bronx, NY (Bronx)	New York NY-NJ-CT-PA CSA A	20,199
Howard, MD	Baltimore–Columbia–Towson MD MSA	17,988

Source: Bureau of Economic Analysis, Wage and Salary Employment (CA34). a) Includes Fairfax City, VA and Falls Church City, VA; b) Includes Manassas, VA and Manassas Park, VA.

The distribution of employment between urban, suburban, and rural/exurban counties has shifted since 1970, with the number of jobs in suburban counties surpassing the number of jobs in urban counties in 1980 and outpacing urban growth through 2000 (Figure 8). In 2010, the suburban counties accounted for about 45 percent of jobs, the urban counties accounted for about 30 percent of jobs, and the rural/exurban counties accounted for the remaining 25 percent. The rural/exurban counties experienced job growth of about 3 percent during the last decade. Within the urban counties, the patterns of job growth and decline have been highly variable. While Manhattan (New York County) has 100,000 fewer jobs in 2010 than in 2000, the four other New York City boroughs collectively gained more than 80,000 jobs (Kings, Queens, Bronx, and Richmond Counties) during the same period. Washington, DC, which shed tens of thousands of jobs in the 1990s, added over 60,000 in the past decade. Similarly, Baltimore City, which lost jobs in the 1990s, added several thousand jobs between 2000 and 2010.[6]

Figure 8. ***Employment Trends of Urban, Suburban, and Rural/Exurban Counties: NEC Region***
1970 to 2010



Source: Bureau of Economic Analysis, Wage and Salary Employment (CA34).

2.1.2 Industries

Five industry sectors provide half of all jobs in the NEC Region: the education, health, and social services sector; the professional, scientific, and management sector; the retail trade sector; the finance sector; and the accommodations and food services sector. The Region has a higher concentration of jobs in several knowledge-industry sectors than the country as a whole.

Knowledge-based industries are prominent in the NEC Region. Knowledge industries include fields such as information technology, finance, legal services, management consulting, architecture, engineering, education, healthcare, and the scientific occupations. These are industries that make intensive use of technology and

human capital.[7] According to a definition of knowledge-industry sectors illustrated in Table 4, the NEC Region employs 46 percent of workers in knowledge-based industries versus 42 percent nationally.

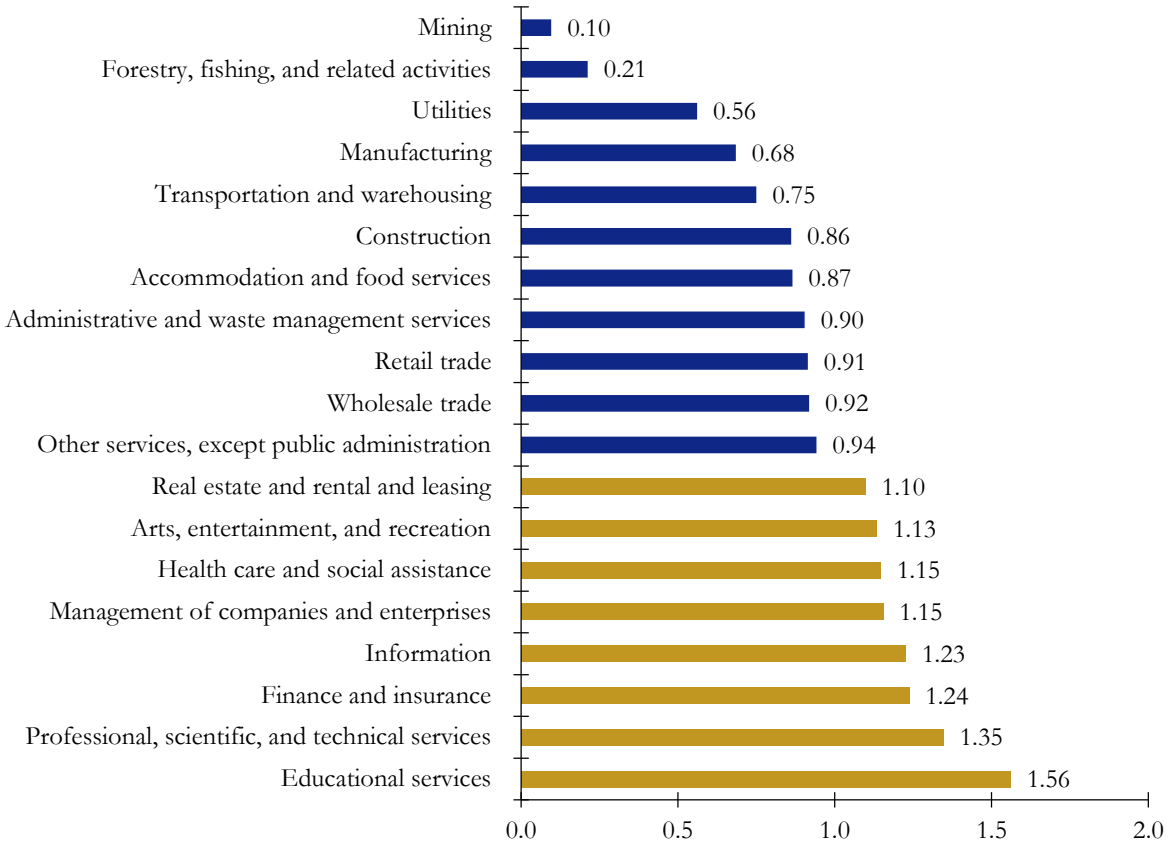
Table 4. Major Employment Sectors: NEC Region

Knowledge Sector	Industries
	Accommodation and food services
	Administrative and waste management services
●	Arts, entertainment, and recreation
	Construction
●	Educational services
●	Finance and insurance
	Forestry, fishing, and related activities
●	Health care and social assistance
●	Information
●	Management of companies and enterprises
	Manufacturing
	Mining
	Other services, except public administration
●	Professional, scientific, and technical services
●	Real estate and rental and leasing
	Retail trade
	Transportation and warehousing
	Utilities
	Wholesale trade

Source: Bureau of Economic Analysis.

For each of these knowledge-based industries, the NEC Region has higher concentrations of employment than the national average – or "location quotients" greater than 1.0 (Figure 9). More than 28 percent of the nation's educational service jobs, 24 percent of its professional and scientific jobs, and 22 percent of its finance and insurance jobs are located in the NEC Region.

Figure 9. ***Employment Concentrations by Industry: NEC Region***
2010 Location Quotients



Source: Bureau of Economic Analysis, Wage and Salary Employment (CA34).

Note: Location Quotient: <1 = below national average; ~1 = national average; >1 = above national average.

2.1.3 Economic Productivity

The NEC Region generates 21 percent of the nation's GDP, and, as a standalone country, would be the fifth largest economy in the world.

The GDP of the NEC Region is 3 trillion dollars annually – equivalent to 21 percent of the total national GDP.[8] If the NEC Region were an autonomous country, its economy would be the fifth largest in the world, ahead of France and just behind Germany.[9] The economy of the NEC, measured by GDP, has grown at about the same rate as the nation since 2001, with an approximate 40 percent increase in current dollars.[10]

2.1.4 Household Income and Transportation Costs

The NEC Region is prosperous. The average household earns almost 30 percent more than the national average of households. Households in the NEC Region spend slightly less of their income on transportation than households in the rest of the country.

Although wide variations exist within the region and across industries, employees in the NEC Region are among the highest paid in the country. Households in the NEC Region earn an average of $66,343 per year compared to an average of $50,221 for all U.S. households.[11]

Households in the NEC Region's major metropolitan areas spend about 10 percent of their annual, pretax, household income on transportation. This rate is lower than the national average of 12 percent.[12] Transportation expenses include expenditures on vehicles (e.g., purchase, rental, maintenance, fuel) and public transportation. The percentage of income spent by metropolitan area households dropped between 2000 and 2010, with most of the decline attributed to decreasing expenditures on vehicles.[13]

2.2 Population and Density

2.2.1 Population

Fifty-one million people live in the NEC Region, which added 2.7 million residents over the past decade. New York remains by far the largest city in the NEC Region and the U.S. Counties in the Washington, DC metropolitan area were among the fastest growing in the nation.

More than 51 million people live in the NEC Region, accounting for 17 percent of the nation's population.[14] The NEC Region added 2.7 million residents between 2000 and 2010 at a growth rate of approximately 6 percent. The New York metropolitan area had 19 million residents as of 2010. Philadelphia, Washington, and Boston make up the next tier with about five million residents each (Table 5). These four metropolitan areas are among the 10 largest in the nation.

The majority of counties in the NEC Region gained population over the past decade. The counties surrounding Washington experienced the greatest absolute growth in population, adding 750,000 new residents. Loudoun County, VA, which was the fastest growing county in the study area, grew by more than 85 percent between 2000 and 2010, increasing from 170,000 to 312,000 residents.

Table 5. Metropolitan Area Populations and Growth Rates: NEC Region
2000 to 2010

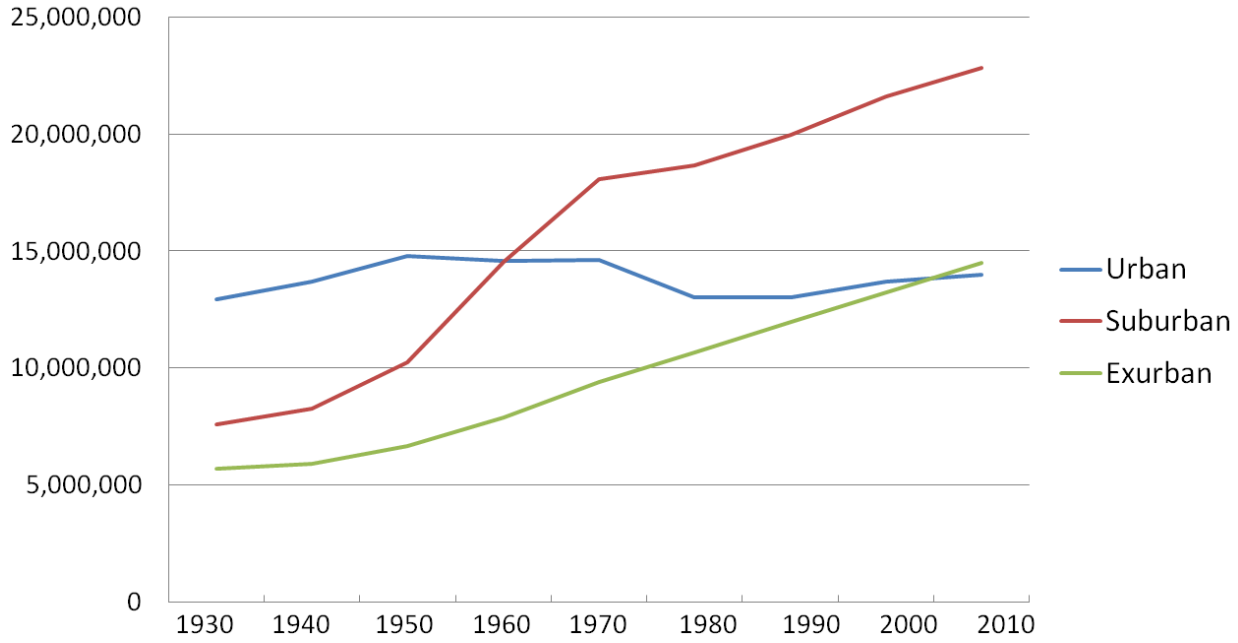
U.S. Rank	Metropolitan Area	2000 Population	2010 Population	Population Increase	Growth Rate
1	New York City NY-NJ-PA	18,323,002	18,897,109	574,107	3.1%
5	Philadelphia PA-NJ-DE-MD	5,687,147	5,965,343	278,196	4.9%
7	Washington, D.C.-VA-MD-WV	4,796,183	5,582,170	785,987	16.4%
10	Boston MA-NH	4,391,344	4,552,402	161,058	3.7%
20	Baltimore MD	2,552,994	2,710,489	157,495	6.2%
37	Providence RI-MA	1,582,997	1,600,852	17,855	1.1%
45	Hartford CT	1,148,618	1,212,381	63,763	5.6%
56	Bridgeport-Stamford-Norwalk, CT	882,567	916,829	34,262	3.9%
58	Albany NY	825,875	870,716	44,841	5.4%
60	New Haven CT	824,008	862,477	38,469	4.7%
64	Allentown PA-NJ	740,395	821,173	80,778	10.9%
67	Worcester MA	750,963	798,552	47,589	6.3%
76	Springfield MA	680,014	692,942	12,928	1.9%
78	Poughkeepsie NY	621,517	670,301	48,784	7.8%
93	Harrisburg PA	509,074	549,475	40,401	7.9%
99	Lancaster PA	470,658	519,445	48,787	10.4%
113	York, PA	381,751	434,972	53,221	13.9%
125	Reading, PA	373,638	411,442	37,804	10.1%
129	Manchester NH	380,841	400,721	19,880	5.2%
138	Trenton NJ	350,761	366,513	15,752	4.5%
166	Atlantic City NJ	252,552	274,549	21,997	8.7%
167	New London, CT	259,088	274,055	14,967	5.8%
	NEC Study Area Total	**46,785,987**	**49,384,908**	**2,598,921**	**5.6%**
	U.S. Total	**281,421,906**	**308,745,538**	**27,323,632**	**9.7%**

Source: U.S. Census Bureau.

Historically, population growth has varied over time and by county type. Figure 10 shows the population trends of urban, suburban, and rural/exurban counties in the NEC Region from 1930 to 2010 to illustrate these fluctuations. The population of the suburban counties in the NEC Region increased 200 percent between 1930 and 2010, surpassing the population of the urban counties in about 1960. In the past decade, the population of the region's rural/exurban counties also surpassed that of its urban counties.

By comparison, the population of major cities in the NEC Region peaked between 1960 and 1970 and declined during the 1980s and early 1990s. The urban populations started to rebound in the 1990s, first in New York City, and then in Washington, Boston, and Philadelphia. Between 2000 and 2010, New York added more than 160,000 new residents, and Boston, Philadelphia, Washington each added about 30,000 new residents. In 2010, Baltimore City also started growing again.[15]

Figure 10. ***Population Trends of Urban, Suburban, and Rural/Exurban Counties: NEC Region***
1930 to 2010



Source: U.S. Census Bureau.

2.2.2 Density

The NEC Region is the most densely settled part of the U.S. with an average density that is more than 10 times greater than the rest of the nation.

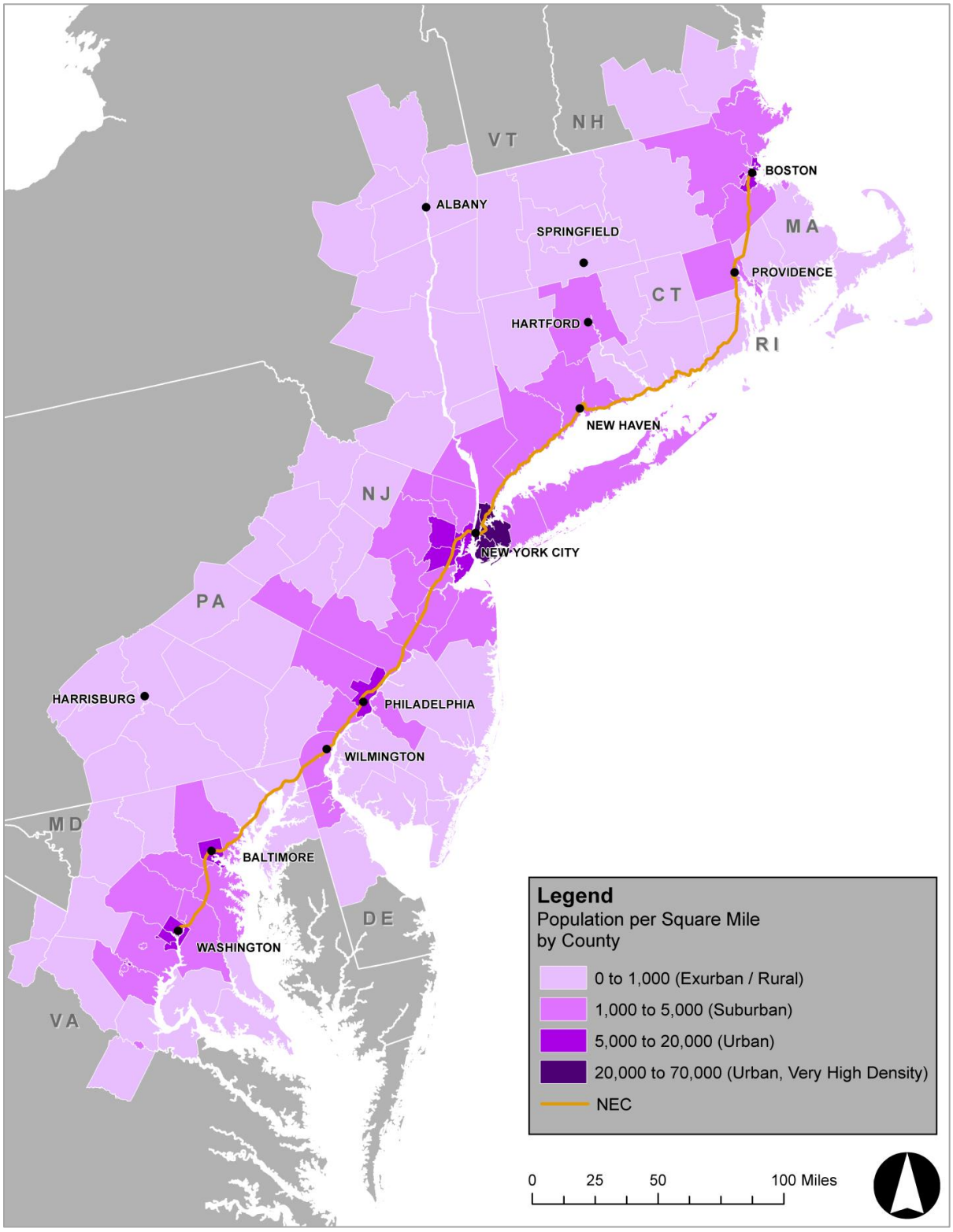
The NEC Region is the most densely settled part of the country with an average of 987 residents per square mile compared to the national average of 87 persons per square mile. The NEC Region is home to 17 of the 20 most densely populated counties in the nation (Table 6). Figure 11 maps the population density of the NEC Region counties. The densities are calculated based on population per square mile per county. The counties are sorted into four categories. Counties with less than 1,000 persons per square mile are designated as "rural/exurban" counties; with 1,000 to 5,000 persons per square mile, as "suburban" counties; with 5,000 to 20,000 persons per square mile, as "urban" counties; and with 20,000 to 70,000 persons per square mile, as "very high-density" counties. These distinctions are only illustrative as the land areas of counties can vary widely, with some "urban" counties exhibiting significant areas of "suburban" level densities and vice versa.

Table 6. Top 20 Counties by Population Density: U.S.
2010

U.S. Rank	NEC Region	County	People per Square Mile
1	●	New York, NY (Manhattan)	69,464
2	●	Kings, NY (Brooklyn)	35,367
3	●	Bronx, NY (Bronx)	32,900
4	●	Queens, NY (Queens)	20,554
5		San Francisco, CA	17,180
6	●	Hudson, NJ	13,732
7	●	Suffolk, MA (Boston)	12,417
8	●	Philadelphia, PA	11,380
9	●	District of Columbia	9,856
10	●	Alexandria, VA	9,312
11	●	Richmond, NY (Staten Island)	8,030
12	●	Arlington, VA	7,995
13	●	Baltimore City, MD	7,672
14	●	Essex, NJ	6,212
15	●	Falls Church, VA	6,166
16	●	Manassas Park, VA	5,642
17		Cook, IL (Chicago)	5,495
18	●	Union, NJ	5,216
19		St. Louis City, MO	5,157
20	●	Nassau, NY	4,705
		NEC Study Area Total	**987**
		U.S. Total	**87**

Source: U.S. Census Bureau.

Figure 11. ***Population Density by County: NEC Region***
2010



Source: U.S. Census Bureau. U.S. Geological Survey.

3.0 Travel in the NEC Region: Who Travels, Where, and How?

Section 2.0 described the patterns of employment and population that create the demand for transportation – for commuting from homes to jobs and for business and leisure travel between cities. This section describes how that demand plays out on the region's highway, rail, and aviation systems. The section breaks travel demand into two broad categories: metropolitan travel by people traveling for work, errands, or other reasons; and longer-distance, intercity travel for business and leisure. Within each travel purpose, subsections describe available data on the number of trips, the origins and destinations of those trips, and the mode of travel. The final part of the section presents data on goods movement in the region.

Travel in NEC Region

- Metropolitan Commuting and Local Travel
  - Roadways
  - Commuter Rail
  - Transit
  - Bicycle, Pedestrian, and Other Modes
- Intercity Business and Leisure Travel
  - Highways
  - Rail
  - Air

3.1 Metropolitan Commuting and Local Travel

Residents of the NEC Region enjoy a broad range of transportation options for metropolitan and local travel, and exhibit a more diversified set of travel behaviors than the nation as a whole. While home to extensive roadway networks like much of the nation as a whole, the NEC Region also includes several of the largest transit systems in the U.S. and robust pedestrian and bicycle infrastructure. The share of NEC Region residents who use public transportation to commute is over three times higher than the national average and is growing. The eight commuter rail systems in the Northeast carry 75 percent of commuter rail riders nationally. Fifty percent of commuter rail riders nationally travel at least a portion of their trip on the NEC.

Commutes to work represent only about 15 percent of trips, but they tend to be longer than trips for other purposes (shopping, errands, social/recreational) and have large quantities of data available for analysis.[16] Sixty-six percent of commuting trips in the NEC Region are made by people driving alone in their cars. However, this share is shrinking and smaller than the 76 percent nationally (Table 7). For workers whose jobs are located in the urban counties of the NEC Region (regardless of their county of residence), the share of commute trips by driving alone is even lower at 38 percent (Table 8). Public transportation delivers more workers to jobs in these counties than automobiles.

Table 7. Mode Shares for Journey-to-Work: NEC Region and U.S. 2000 and 2011

Transportation Mode	NEC Region		U.S.	
	2000	2011	2000	2011
Car, truck, or van	77.2%	74.1%	87.9%	86.3%
Drove alone	*67.1%*	*65.7%*	*75.7%*	*76.1%*
Carpooled	*10.1%*	*8.4%*	*12.2%*	*10.2%*
Public transportation	14.1%	15.9%	4.7%	5.0%
Bus or trolley bus	*4.8%*	*5.4%*	*2.5%*	*2.6%*
Streetcar or trolley	*0.1%*	*0.1%*	*0.1%*	*0.1%*
Subway or elevated	*7.1%*	*8.2%*	*1.5%*	*1.7%*
Railroad	*2.0%*	*2.1%*	*0.5%*	*0.5%*
Ferry Boat	*0.1%*	*0.1%*	*0.0%*	*0.0%*
Walked	4.4%	4.5%	2.9%	2.8%
Bicycle	0.3%	0.5%	0.4%	0.5%
Taxi, motorcycle or other means	1.0%	1.2%	1.0%	1.2%
Worked at home	3.1%	4.0%	3.3%	4.2%

Source: U.S. Census Bureau Decennial Census, 2000 and American Community Survey, 2011.

Though the share of automobile commuters in the NEC Region fell by over 3 percent between 2000 and 2011, population growth helped the actual number of automobile commuters grow by around 671,000. However, the number of new transit commuters over the same period increased by around 708,000. On a percentage basis, the number of automobile commuters grew by 3.9 percent, while the number of bus commuters grew by 21.9 percent, subway commuters by 25.7 percent, railroad commuters by 12.0 percent, bicycle riders by 69.2 percent, and home workers by 40.0 percent.

For workers who have jobs in the urban counties of the NEC Region (Tables 8), the share of workers who commute on public transportation is about eight times higher than the national share (Table 7). The share of workers in NEC Region urban counties who travel to their jobs on commuter railroads is about 10 times higher than the national share. Jobs in Boston, Philadelphia, and Washington have public transit mode shares of 35.8 percent, 27.3 percent, and 36.8 percent, and walking rates of 8.4 percent, 7.3 percent, and 4.7 percent, respectively. In Manhattan, nearly 75 percent of jobs are accessed via public transportation (49.5 percent via subway, 11.6 percent on bus, and 11.6 percent via commuter rail) and 7.9 percent on foot.

Table 8. Mode Shares for Journey-to-Work by County of Employment: NEC Region 2011

Transportation Mode	Urban Counties	Suburban Counties	Rural/Exurban Counties
Car, truck, or van	45.0%	87.3%	89.4%
Drove alone	*37.8%*	*78.2%*	*80.4%*
Carpooled	*7.2%*	*9.1%*	*9.1%*
Public transportation	42.3%	4.2%	1.4%
Bus or trolley bus	*11.7%*	*2.9%*	*1.3%*
Streetcar or trolley	*0.4%*	*0.0%*	*0.0%*
Subway or elevated	*24.3%*	*0.8%*	*0.1%*
Railroad	*5.7%*	*0.6%*	*0.1%*
Ferry Boat	*0.2%*	*0.0%*	*0.0%*
Walked	7.4%	2.9%	3.1%
Bicycle	0.7%	0.3%	0.3%
Taxi, motorcycle or other means	1.6%	1.0%	0.9%
Worked at home	2.9%	4.2%	4.9%

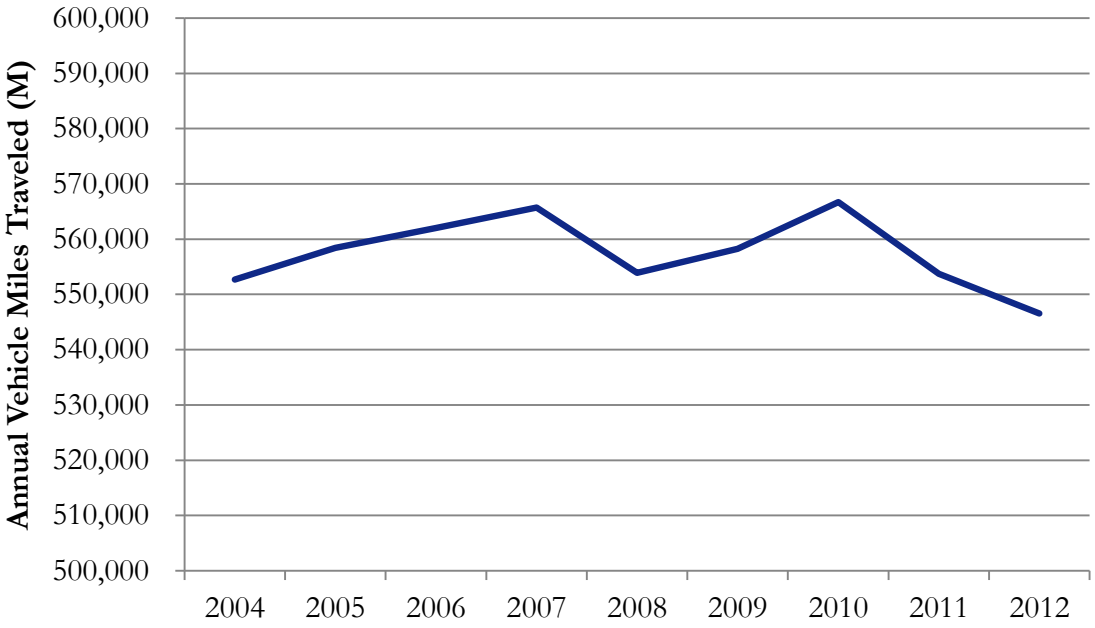
Source: U.S. Census Bureau American Community Survey, 2011.

3.1.1 Roadways

Automobile travel dominates other modes of transportation in the NEC Region, as it does elsewhere in the nation. According to the I-95 Corridor Coalition's Integrated Corridor Analysis Tool (ICAT), drivers in the NEC Region travel more than 487 million miles each day on highways and major arterials in the study area. This is equivalent to nearly 10 miles of travel per resident. The majority of automobile trips are local for work, school, errands, visiting friends and relatives, or other purposes. Of the 91 million highway and major arterial trips estimated by ICAT within the NEC Region each day, about 74 million originate and terminate within a single county; the remaining 18 million cross a county boundary.[17]

The FHWA monitors automobile travel with estimates of total miles traveled by all vehicles on all roads (highways, arterials, and local roads) by state. As with rates of automobile use for journey-to-work trips, vehicle miles traveled in the states covered by the study area (Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, the District of Columbia, and Virginia) have slowed in recent years (Figure 12).[18]

Figure 12. ***Annual Vehicle Miles Traveled in NEC Region States***
2004 to 2012



Source: FHWA Traffic Volume Trends Report.

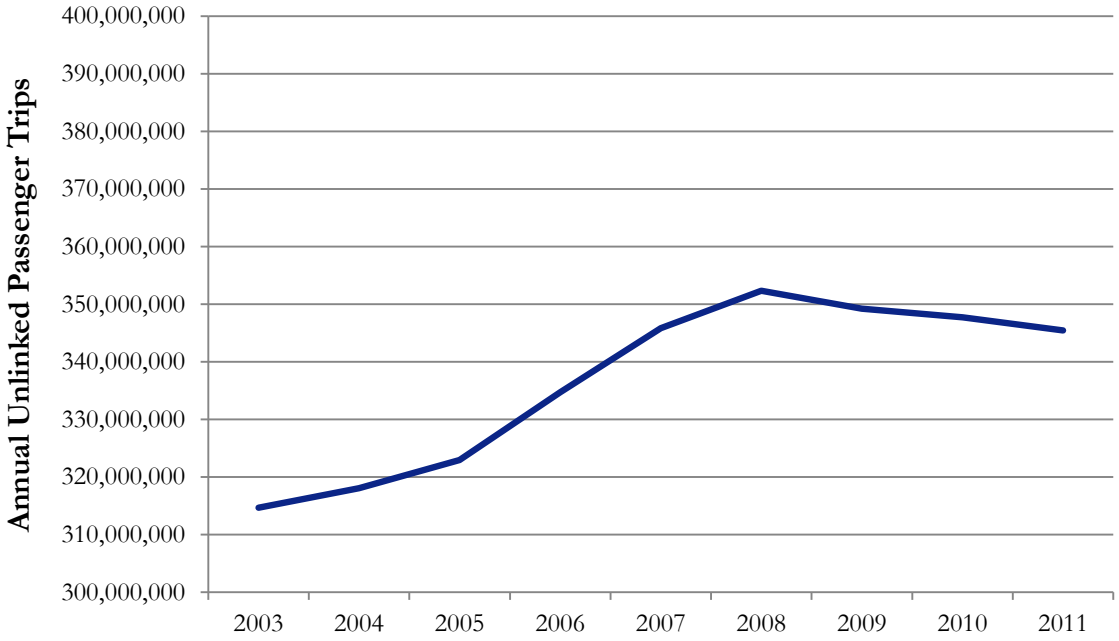
3.1.2 Commuter Rail

The eight commuter railroads in the NEC Region carry 75 percent of commuter rail passengers in the U.S. Commuter rail ridership grew 10 percent between 2000 and 2011. Both mature systems, such as Metro-North in New York, and new commuter-rail systems, such as Virginia Railway Express, have experienced strong growth.

Commuters in the NEC Region make nearly 1.2 million weekday trips on commuter rail (Table 10), accounting for 75 percent of all commuter rail trips made in the U.S.[19] Commuter rail ridership in the NEC Region grew by nearly 10 percent over the past decade. As with vehicle miles traveled, growth in commuter rail ridership curtailed following the recession in the late 2000s (Figure 13). However, overall ridership remains significantly higher now than at the beginning of the 2000s.

Virginia Railway Express and Shore Line East saw their ridership more than double (Table 9). NJ TRANSIT and Metro-North Railroad experienced the greatest numeric growth in passenger trips since 2000. In total, the commuter railroads generated 8.3 billion passenger miles (summation of miles traveled by each individual passenger) in 2011.[20] The three agencies that serve New York City (Metro-North, Long Island Rail Road, and NJ TRANSIT) carry 75 percent of commuter rail trips in the NEC Region.

Figure 13. ***Annual Commuter Rail Ridership in NEC Region States***
2003 to 2011



Source: National Transit Database for LIRR, MARC, MBTA, MNR, NJT, SEPTA, SLE, and VRE.

Table 9. Annual Commuter Rail Passenger Trips by Railroad: NEC Region
2000 and 2011

	Annual Trips 2000	Annual Trips 2011	Numeric Change	Percent Change
Massachusetts Bay Transportation Authority (MBTA)	36,416,816	36,212,904	(203,912)	-0.6%
Shore Line East (SLE)	285,456	601,708	316,252	110.8%
Metro-North Railroad (MNR)	71,735,218	81,841,665	10,106,447	14.1%
Long Island Rail Road (LIRR)	105,148,000	96,457,658	(8,690,342)	-8.3%
NJ TRANSIT (NJT)	63,894,352	79,632,021	15,737,669	24.6%
Southeastern Pennsylvania Transportation Authority (SEPTA)	29,774,426	37,820,990	8,046,564	27.0%
Maryland Area Regional Commuter (MARC)	5,317,006	8,232,729	2,915,723	54.8%
Virginia Railway Express (VRE)	2,014,339	4,645,591	2,631,252	130.6%
Total	**314,585,613**	**345,445,266**	**30,859,653**	**9.8%**

Source: National Transit Database.

Table 10. Commuter Rail Operations and Ridership, Total and on the NEC Main Line
2012

	Daily Trains			Average Daily Ridership		
	Entire System	On the NEC	Percent on NEC	Entire System	On the NEC	Percent on NEC
Massachusetts Bay Transportation Authority (MBTA)	483	283	59%	127,000	86,000	68%
Shore Line East (SLE)	27	27	100%	2,200	2,200	100%
Metro-North Railroad (MNR)	729	285	39%	281,000	112,000	40%
Long Island Rail Road (LIRR)	728	473	65%	285,000	230,000	81%
NJ TRANSIT (NJT)	667	410	62%	275,000	214,000	78%
Southeastern Pennsylvania Transportation Authority (SEPTA)	738	241	33%	125,300	32,000	25%
Maryland Area Regional Commuter (MARC)	91	91	100%	36,100	34,000	94%
Virginia Railway Express (VRE)	30	30	100%	18,800	4,000	21%
Total	**3,493**	**1,840**	**53%**	**1,150,400**	**714,200**	**62%**

Source: Commuter rail agency and Amtrak schedules and reports. Note: Daily trains excludes non-revenue train movements.

All commuter railroads in the NEC Region run services that use at least a portion of the NEC for their trip, often in congested terminal areas near the center of major metropolitan areas like Boston South Station, New York Penn Station, and Washington Union Station. Tracks leading into such stations are frequently shared between Amtrak and commuter trains.

The NEC Region's smallest commuter rail service, Connecticut's Shore Line East, operates entirely on the NEC between New London, CT and Stamford, CT. Operators of larger systems in Boston, New York, Philadelphia, and Washington have a combination of lines that serve communities along the NEC and extensive networks beyond the NEC that feed into it for the final miles leading into the urban core. In total, 53% of trains and 62% of riders travel on the NEC for at least a portion of their trip (Table 10).

3.1.3 Transit

The NEC Region is home to many of largest transit agencies in the nation. Every day, residents of the NEC Region take more than 15 million transit trips.

The commuter rail systems in the NEC Region connect to even larger transit networks comprised of bus, light rail, and heavy rail (subway or metro) services (Table 11). Many of these systems are provided by the same agencies that operate commuter rail systems on the NEC Region's railroads. As with commuter rail, the agencies that serve the New York City market (New York City Transit, PATH, and NJ TRANSIT) provide by far the highest volume of transit trips.

Table 11. Annual Ridership on Major Transit Systems in the NEC Region
2011

	Bus	Light Rail	Heavy Rail
Massachusetts Bay Transportation Authority (MBTA)	112,368,259	74,395,590	154,048,373
New York City Transit (NYCT)	800,093,788		2,497,626,015
Port Authority of New York and New Jersey (PATH)			85,949,966
NJ TRANSIT (NJT)	155,676,004	17,871,570	
Southeastern Pennsylvania Transportation Authority (SEPTA)	189,748,689	28,447,095	101,032,347
Maryland Transit Administration (MTA)	72,520,531	8,752,463	14,002,609
Washington Metropolitan Area Transit Authority (WMATA)	130,732,652		286,620,549

Source: National Transit Database, 2011.

3.1.4 Bicycle, Pedestrian, and Other Modes

The commuter rail and transit networks in the cities and smaller communities of the NEC Region are connected to and complemented by significant bicycle and pedestrian infrastructure. Rates of walking and bicycling to work are among the highest in the nation, and are growing. Car sharing programs throughout the Region, as well as bicycle sharing programs in Boston, New York, and Washington also broaden the transportation options available to residents. Capitol Bikeshare in Washington was the Region's first such program and provided 2,457,058 trips for a total of 2,899,328 miles traveled in its third year of operation between September 2012 and September 2013. Those figures represent 33 percent growth in trips and 39 percent growth in miles traveled over year two. Citi Bike in New York City provided over 2,500,000 trips in only its first three months of service beginning in May 2013 with over 5,000,000 miles traveled.

These various systems and facilities make the NEC Region one of the easiest areas of the nation to travel without an automobile. The metropolitan areas of the Northeast have higher rates of car-free households than the U.S. average. The New York area alone accounts for 28 percent of all car-free households in the United States.[21]

Table 12. Households without Cars: NEC Region MSAs
2009

Region MSA	Households
New York MSA	2,093,861
Philadelphia MSA	310,583
Boston MSA	223,207
Washington MSA	193,558
NEC Region Total	**3,281,025**
Total U.S.	**9,909,977**

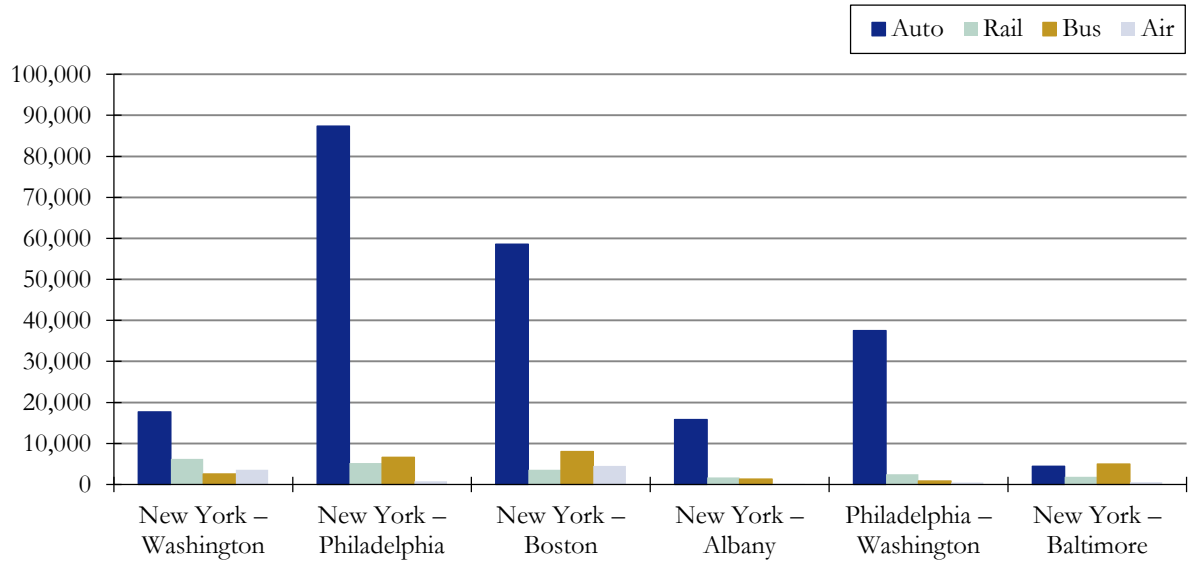
Source: Brookings Institution, "Transit Access and Zero Vehicle Households," 2011. U.S. Census American Community Survey, 2009.

3.2 Intercity Business and Leisure Travel

Business and leisure travel generate over 560,000 longer-distance passenger trips each day in the NEC Region. Rail ridership between several major city pairs in the NEC Region has grown to match or exceed air passenger volumes.

Trips longer than 75 miles account for 560,000 daily passenger trips within NEC Region or about 2 percent of all daily passenger trips.[22] About 80 percent of the intercity trips are by auto, 7 percent by train, and less than 6 percent each are by air and bus, although the mode shares differ depending on the origin and destination city. About half of the passenger trips occur between the major metropolitan areas shown in Figure 14.

Figure 14. ***Daily Intercity Passenger Flows by Mode between Major Markets: NEC Region*** *2010*



Source: *Amtrak, U.S. Bureau of Transportation Statistics (BTS), I-95 Corridor Coalition.*

Note: *Philadelphia market includes Wilmington, DE. Intercity bus ridership estimated from scheduled services. Air passenger data from BTS DB1B Origin-Destination Survey data for major NEC Region airports and are limited to trips made entirely within the NEC Region (e.g., does not include passengers who fly between the region's airports as part of a multi-stop itinerary with an origin or destination outside the NEC Region).*

The NEC Region is an increasingly popular tourist destination, especially for international travelers. More than 12 million people visited the cities of New York, Washington, Boston, or Philadelphia in 2010. The four cities are among the top 13 destinations for international tourists in the United States. Between 2000 and 2010, the number of international visitors to these four cities increased by 35 percent.[23] Many such visitors move between more than one metropolitan area in the NEC Region during their trips.

3.2.1 Highways

Driving is the most common means of traveling between cities in the NEC Region. Each day, highway travelers make more than 450,000 intercity passenger trips of 75 miles or more.

The highway corridor between New York and Philadelphia carries more than 87,000 intercity automobile trips each day. Highway volumes are generally lower for city pairs longer the 2.5 hours apart. The data describing intercity highway travel are estimates from the I-95 Corridor Coalition's ICAT model, which approximates flows based on population, distance, and the location of businesses in the Region. One of the weaknesses of existing data and models is that they might consider commuting or local trips as part of intercity trip totals where trips cross borders between adjacent metropolitan areas. For example, trips between the northern end of the Philadelphia MSA and the southern end of the New York MSA could be mischaracterized in the current model. The Northeast Corridor Commission is currently engaged in an effort to develop improved intercity flow data through an automobile origin-destination study.

Table 13. Top 10 City Pairs by Daily Intercity Vehicle Passenger Volumes: NEC Region *2010*

Rank	City-Pair Highway Segment	Daily Vehicle Passenger Volume
1	New York-Philadelphia	87,355
2	Washington-Richmond[a]	60,169
3	New York-Hartford	42,828
4	Philadelphia-Washington	37,492
5	New York-Boston	38,610
6	Washington-Norfolk[a]	33,865
7	New York-Bridgeport	27,952
8	New York-Providence	26,682
9	Norfolk-Richmond[a]	21,990
10	New York-Washington	17,674

Source: I-95 Corridor Coalition ICAT.

[a] *MSA outside the study area but with significant intercity vehicle passenger volumes with study area MSAs.*

Automobiles share regional highways with intercity bus companies that carry more than 25,000 passengers daily between cities in the NEC Region. Most intercity bus services operate using a curbside model that takes passengers from downtown to downtown, allowing customers to transfer to local services. The service between New York City and Boston is the most highly developed in the NEC Region, attracting the largest number of bus operators and the highest number of daily riders (Table 14).

Table 14. Intercity Bus Operations and Ridership: NEC Region
2012

City Pairs	Daily Bus Passengers
New York-Boston	8,000
New York-Philadelphia	6,600
New York-Baltimore	5,000
New York-Washington	2,600*
New York-Albany	1,350
New York-Hartford	>1,000
Philadelphia-Washington	850
Boston-Hartford	250-400
Philadelphia-Boston	150

*Source: Intercity bus ridership was estimated using industry occupancy rates and the published schedules of the carriers operating between the major cities in the NEC Region. *Some carriers were not included due to Federal Motor Carrier Safety Administration suspension.*

3.2.2 Rail

About half of all U.S. intercity rail trips are made in the NEC Region. Each day, over 40,000 passengers ride Amtrak trains between NEC Region cities. Amtrak's mode share continues to grow.

Amtrak's intercity trains carry 46,000 people on average each day in the NEC Region, making up 54 percent of all Amtrak intercity rail trips in the U.S. Amtrak estimates it captures 75 percent of air-rail travelers between New York and Washington and 54 percent of air-rail travelers between New York and Boston.[24] Table 15 shows Amtrak ridership by station, listing the top 10 stations by the total of boardings and alightings during fiscal year 2012. New York City's Penn Station is the busiest station, followed by Washington's Union Station, Philadelphia's 30th Street Station, and Boston's South Station.

Amtrak's national ridership has been growing steadily over the past decade, and all routes in the NEC Region have contributed to the growth. A recent report by the Brookings Institution indicates that Amtrak ridership in the Northeastern U.S. increased by about 48 percent from 1997 to 2012 compared to 55 percent nationally.[25] The development of new and additional short-distance (400 miles of less) service in other parts of the nation – including California – accounted for much of the strong national growth. The well-established NEC routes experienced strong growth and continue to anchor national ridership totals. Amtrak's Northeast Regional and Acela services alone account for more than one-third of Amtrak's total national ridership (Table 16).

Table 15. Average Daily Boardings and Alightings: Top 10 Amtrak Stations, NEC Region
FY 2012

State	Station	FY 2012 Average Daily Boardings and Alightings
NY	New York City Penn Station	26,009
D.C.	Washington Union Station	13,737
PA	Philadelphia 30th Street Station	11,147
MA	Boston South Station	3,966
MD	Baltimore Penn Station	2,819
NY	Albany-Rensselaer Station	2,108
CT	New Haven Union Station	2,070
DE	Wilmington Station	2,021
MD	BWI Station	1,928
NJ	Newark Penn Station	1,668

Source: Amtrak.

Table 16. Amtrak Ridership for Major Services that Operate in the NEC Region
FY 2012

NEC Route	Service	Average Daily Riders FY 2012	Percent of National Total FY 2012
●	Northeast Regional (NEC)	21,957	26.5%
●	Acela Express (NEC)	9,302	10.87%
◘	Keystone (New York City-Philadelphia-Harrisburg)	3,891	4.6%
○	Empire (New York City-Albany)	2,912	3.4%
◘	Northeast Regional to Newport News, VA	1,709	2.0%
○	Downeaster (Boston-Portland, ME)	1,484	1.7%
○	Albany, Niagara Falls, Toronto	1,117	1.3%
○	New Haven-Springfield Shuttle	1,054	1.2%
◘	Carolinian (New York City-Richmond-Charlotte)	840	1.0%
◘	Pennsylvanian (New York City-Pittsburgh)	581	0.7%
◘	Northeast Regional to Lynchburg, VA	507	0.6%
○	Adirondack (New York City-Albany-Montreal)	361	0.4%
◘	Vermonter (Washington, D.C.-St. Albans, VT)	225	0.3%
○	Ethan Allen (New York City-Albany-Rutland, VT)	149	0.2%
	Total	**46,089**	**53.9%**

Source: Amtrak. Key: ● = Operates on NEC; ◘ = Portion of route on NEC, ○ = Connects with NEC.

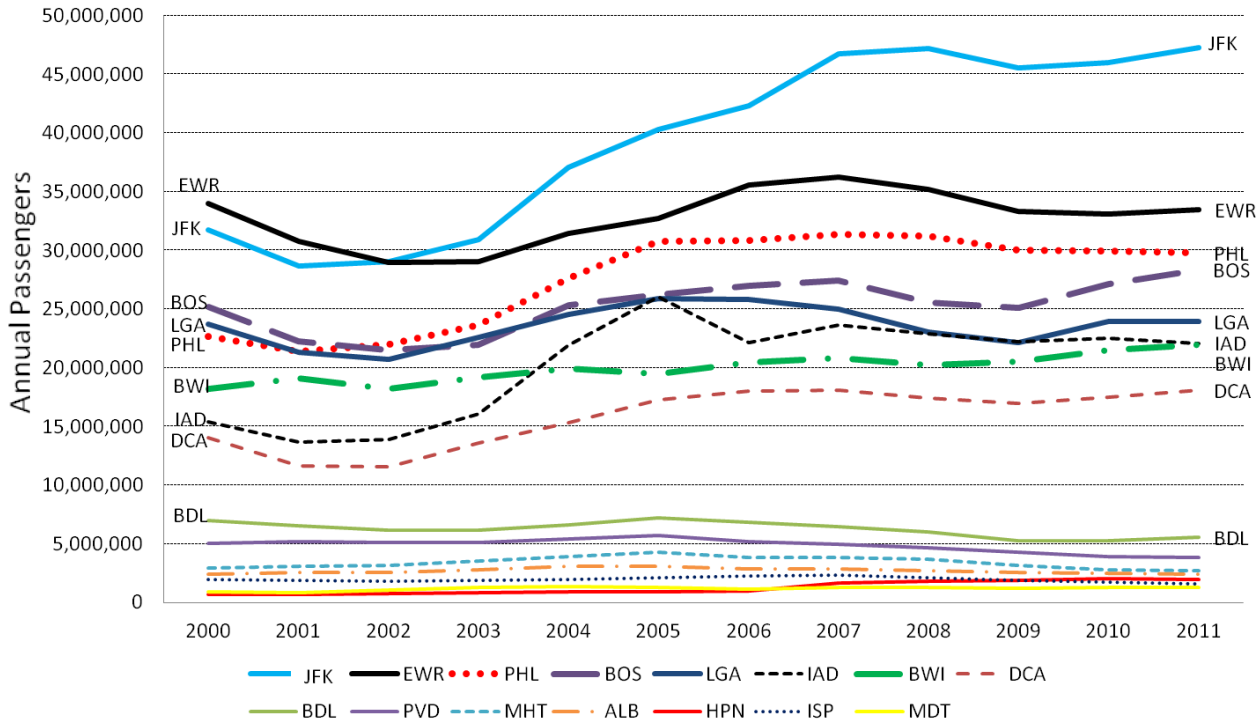
Note: Excludes Amtrak long-distance services.

3.2.3 Air

More than 33,000 people fly between cities of the NEC Region each day with much of the travel concentrated on routes over 200 miles.

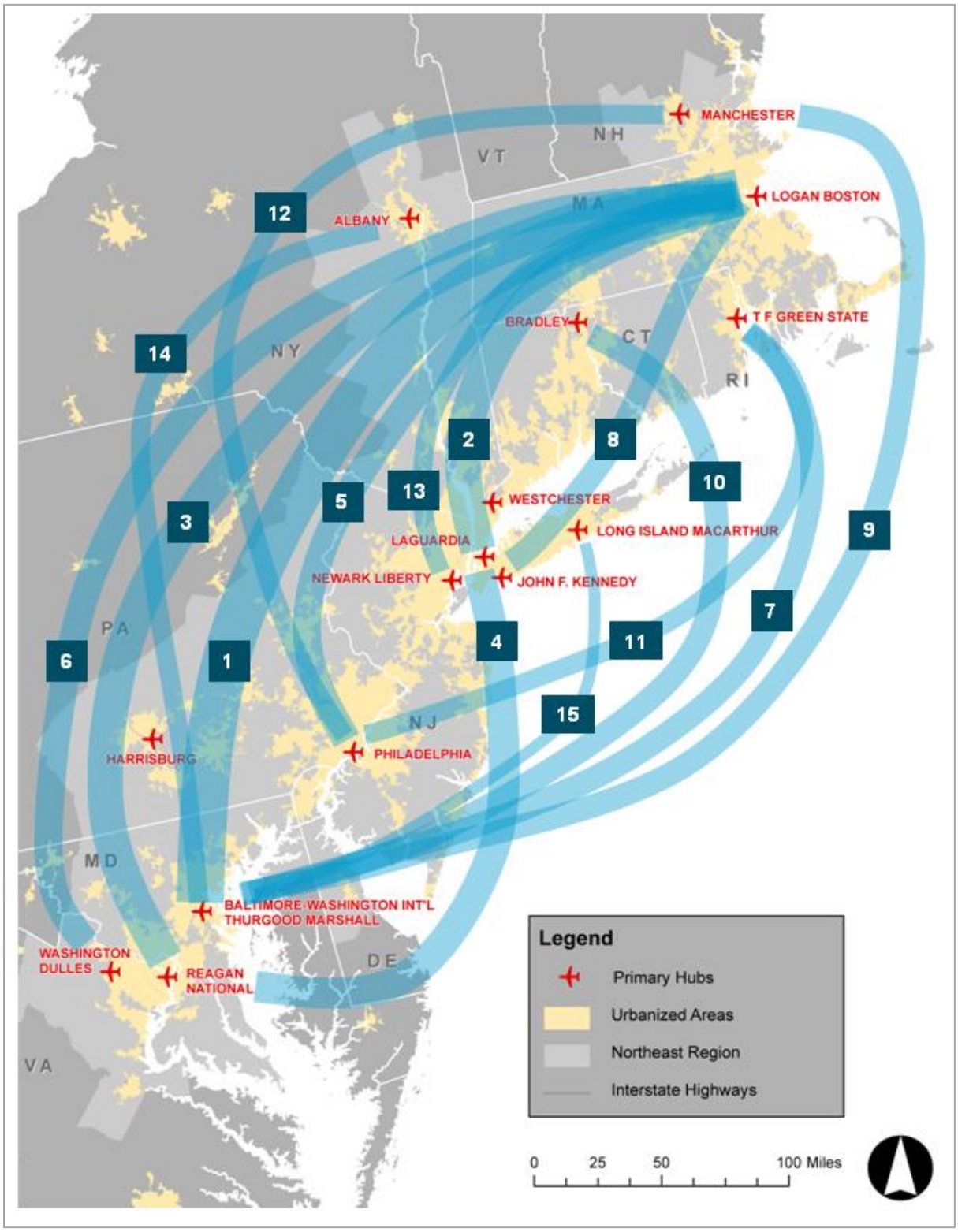
The Northeast airports serve 244 million annual passenger trips, representing 30 percent of all U.S. trips. Passenger activity – measured by total passengers flying to and from the study area's primary hub airports – increased by 18 percent, or 38 million trips, between 2000 and 2011.[26] Though all airports experienced a drop in passenger traffic following the September 11th attacks, most now experience greater activity than before the attacks, in some cases far greater. John F. Kennedy International Airport (JFK) is the NEC Region's leading passenger airport and also the airport that has experienced the most growth since 2000. At JFK, domestic passenger volumes increased by 53 percent and international passenger volumes by 35 percent between 2002 and 2011. At neighboring Newark Liberty international Airport (EWR), domestic traffic fell by 12 percent and international traffic grew by 54 percent during the same period.[27] Figure 15 plots the change in the volume of air passenger trips by airport for the years 2000 and 2011. The data include both locally boarding passengers and connecting passengers.[28] More than 33,000 trips each day are between airports within the NEC Region.[29] The busiest routes are longer distance trips that tie together cities on the north and sound ends of the NEC Region (Figure 16 and Table 17).

Figure 15. ***Air Passenger Trips by Airport: NEC Region***
2000 to 2011



Source: Bureau of Transportation Statistics, "TranStats," 2000 to 2011.

Figure 16. ***Top Air Passenger Flows between Airports: NEC Region***
2010



Source: Volpe Transportation Center Analysis of BTS TranStats DB1B Data.

Table 17. Air Passenger Flows between Major Airports: NEC Region
2010

NEC Rank	Airport Pair		2010 Passengers
1	Logan Boston	Balt-Wash Thurgood Marshall	1,054,490
2	Logan Boston	LaGuardia	875,700
3	Logan Boston	Washington Reagan National	826,640
4	Washington Reagan National	LaGuardia (NYC)	755,500
5	Logan Boston	Philadelphia	663,980
6	Logan Boston	Washington Dulles	651,900
7	Balt-Wash Thurgood Marshall	T.F. Green State (Providence)	490,430
8	Logan Boston	John F. Kennedy (NYC)	476,510
9	Balt-Wash Thurgood Marshall	Manchester	440,070
10	Bradley (Hartford)	Balt-Wash Thurgood Marshall	407,560
11	Philadelphia	T.F. Green State (Providence)	374,180
12	Manchester	Philadelphia	364,350
13	Logan Boston	Newark Liberty	297,460
14	Albany	Balt-Wash Thurgood Marshall	293,350
15	Balt-Wash Thurgood Marshall	Long Island MacArthur	242,890

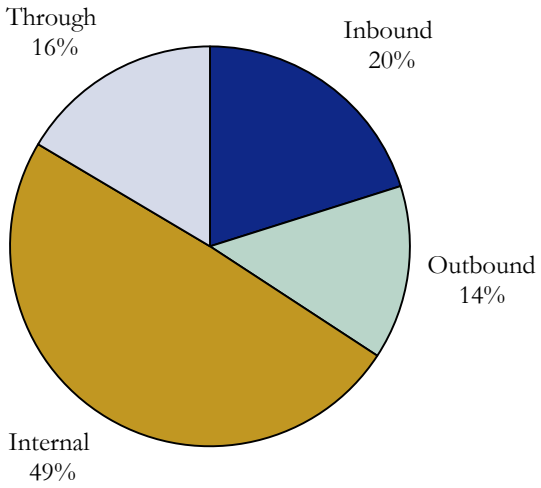
Source: Volpe Transportation Center Analysis of BTS TranStats DB1B Data.

3.3 Goods Movement

The freight network of highways, rail lines, and ports supplies the NEC Region's households and businesses with food, clothing, fuel, building materials, and manufacturing parts and equipment. The NEC Region is heavily dependent on trucking. Freight rail serves east-west traffic, but almost all north-south and intraregional freight movement is handled by truck.

In 2010, freight shippers and carriers moved over 1.6 billion tons of freight into, out of, through, or within the NEC Region by truck, rail, and air. The top commodities (by tonnage) carried into and out of the NEC Region by truck and rail were gravel for construction, waste, nonmetallic mineral products, food, and fuels. Nearly half of the freight moving in the NEC Region traveled entirely within the study area, representing internal trade between the 121 study area counties. Inbound and outbound freight flows were relatively balanced, with a slightly greater share of inbound trade than outbound, as illustrated in Figure 17. Approximately 16 percent of the tonnage moved through the NEC Region, much of it moving between the NEC Region's seaports and the Midwest.

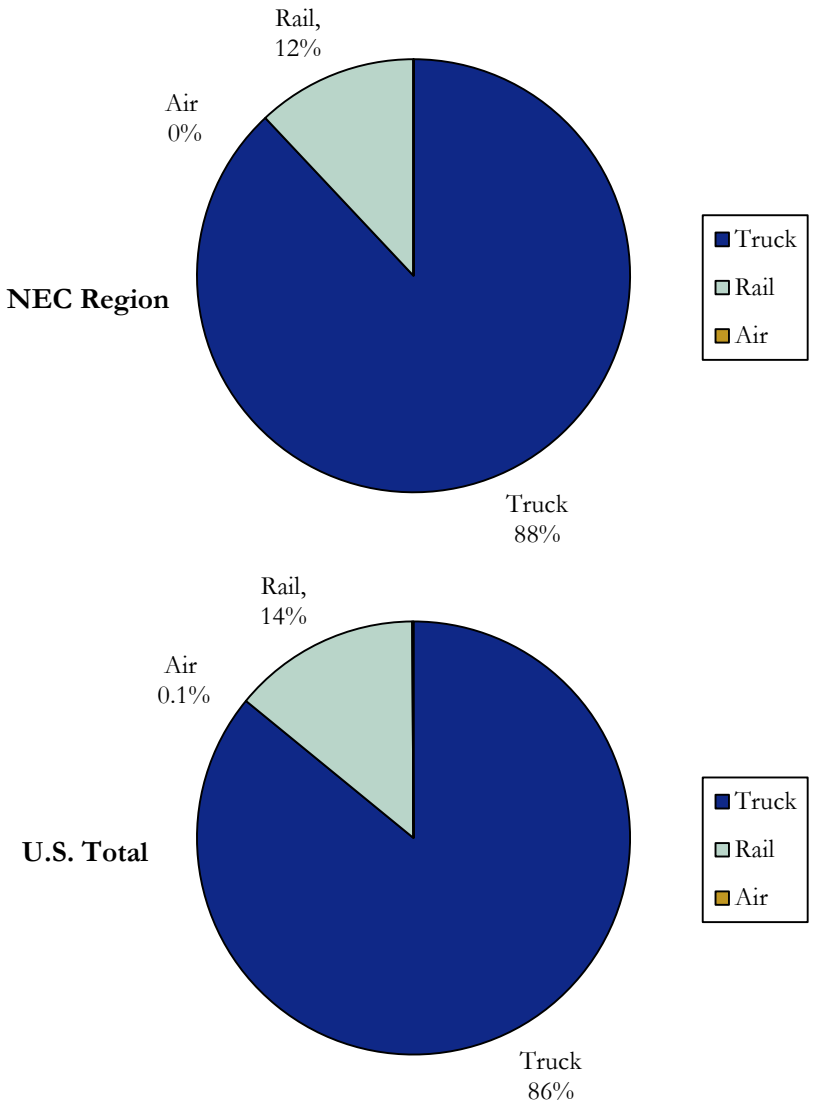
Figure 17. ***Freight Tonnage Flows by Direction: NEC Region***
2010



Source: FHWA Freight Analysis Framework 3, ICAT.

Trucks moved the majority of the freight in the NEC Region. Figure 18 shows the shares carried by truck, rail, and air in NEC Region, as well as the shares by mode for the nation. Air cargo tonnage barely registers in the figures, but accounts for a substantial share of the value of freight moved in the NEC Region and the nation.

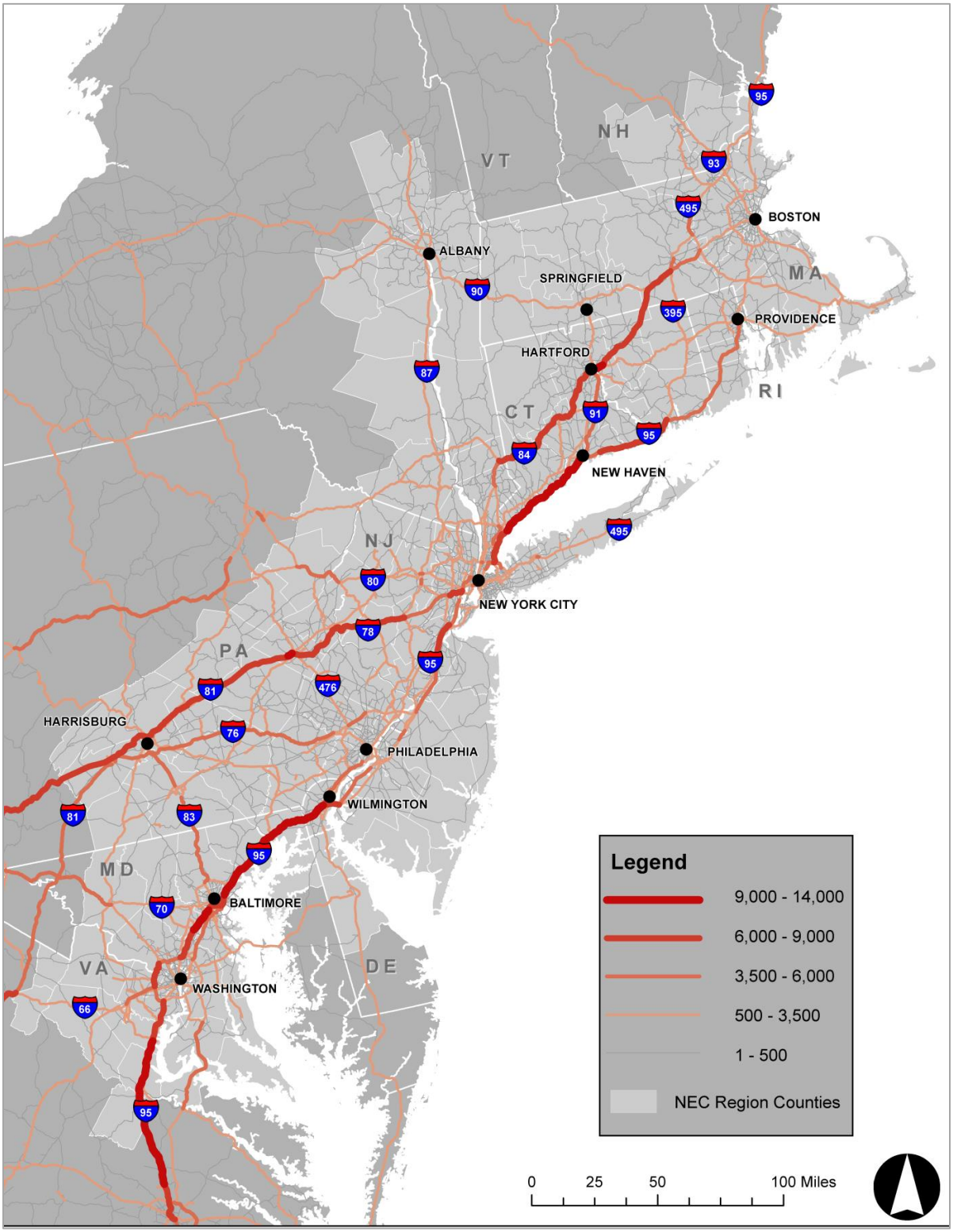
Figure 18. ***Freight Tonnage by Mode: NEC Region and U.S.*** *2010*



Source: FHWA Freight Analysis Framework 3.

The NEC Region is slightly more dependent on trucking than the rest of the U.S., and on average, truck shipments in the NEC Region are of higher value and move shorter distances than elsewhere in the country. The most important freight transportation corridor in the NEC Region is I-95, which carries as many as 14,500 trucks per day on the segments with the heaviest truck traffic. One of the highest volume truck flow segments is I-95 north of Baltimore with 14,575 average daily trucks.[30] The inland route that serves as the most important reliever to I-95 is I-81, and functions as a bypass around the congested urban areas along I-95. The I-81 corridor has become an increasingly important location for distribution centers serving major East Coast population centers. Figure 19 maps the volume of truck flows on the NEC Region highway system.

Figure 19. ***Estimated Daily Truck Flows on Major Highways: NEC Region***
2012



Source: I-95 Corridor Coalition ICAT, estimated daily truck flows, 2012.

The Class I freight railroads operating in the NEC Region are CSX Transportation (CSXT), Norfolk Southern (NS), and Canadian Pacific (CP). CSXT and NS operate the Conrail Shared Assets rail lines in the New York City/Northern New Jersey and Philadelphia areas, providing competitive freight rail service to the ports, shippers, and distribution centers in those metropolitan regions. Dozens of regional and short line railroad operators move freight in the Region, providing local connections to the Class I carriers and terminals, manufacturing centers, and distribution hubs.

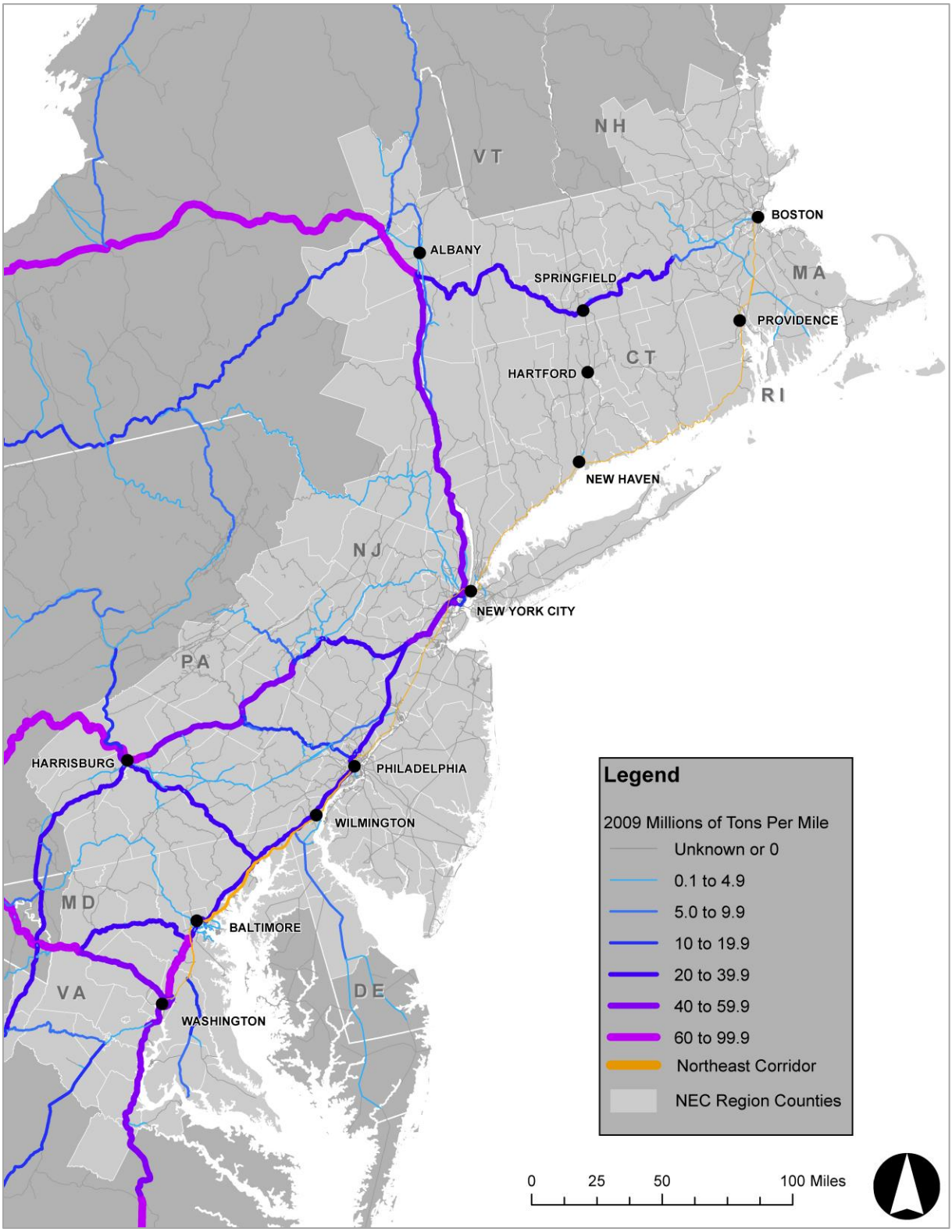
The freight railroads move nearly 190 million tons of freight in the NEC Region each year.[31] Figure 20 maps the tonnage of freight rail by major rail line in the NEC Region.

Within the NEC Region, freight rail flows are predominately east and west. These flows serve two markets: the delivery of consumer goods, food, and fuel from other regions of the U.S. and the Pacific Rim for consumption in the NEC Region; and the import and export of goods and manufactured products through the NEC Region's ports. The Ports of New York and New Jersey handle a significant share of the Region's containerized freight, while the Port of Baltimore is a national center for the export of vehicles, including automobiles, tractors, and farm equipment, and bulk commodities like coal.

While it is not a major freight corridor, the NEC Main Line supports the operations of four freight rail carriers: CSXT, NS, Conrail, and Providence and Worcester (PW). Freight can travel along the entire NEC Main Line and connecting corridors with the exception of the Hudson River tunnels, NY Penn Station, or the East River Tunnels (and nearby areas). The NEC Main Line accommodates more than 70 daily freight trains with the heaviest tonnage flows in Maryland and Delaware. Each year the NEC carries 14 million annual car-miles of freight movements.[32] Figure 20 illustrates the freight operations on the NEC Main Line and primary branches.

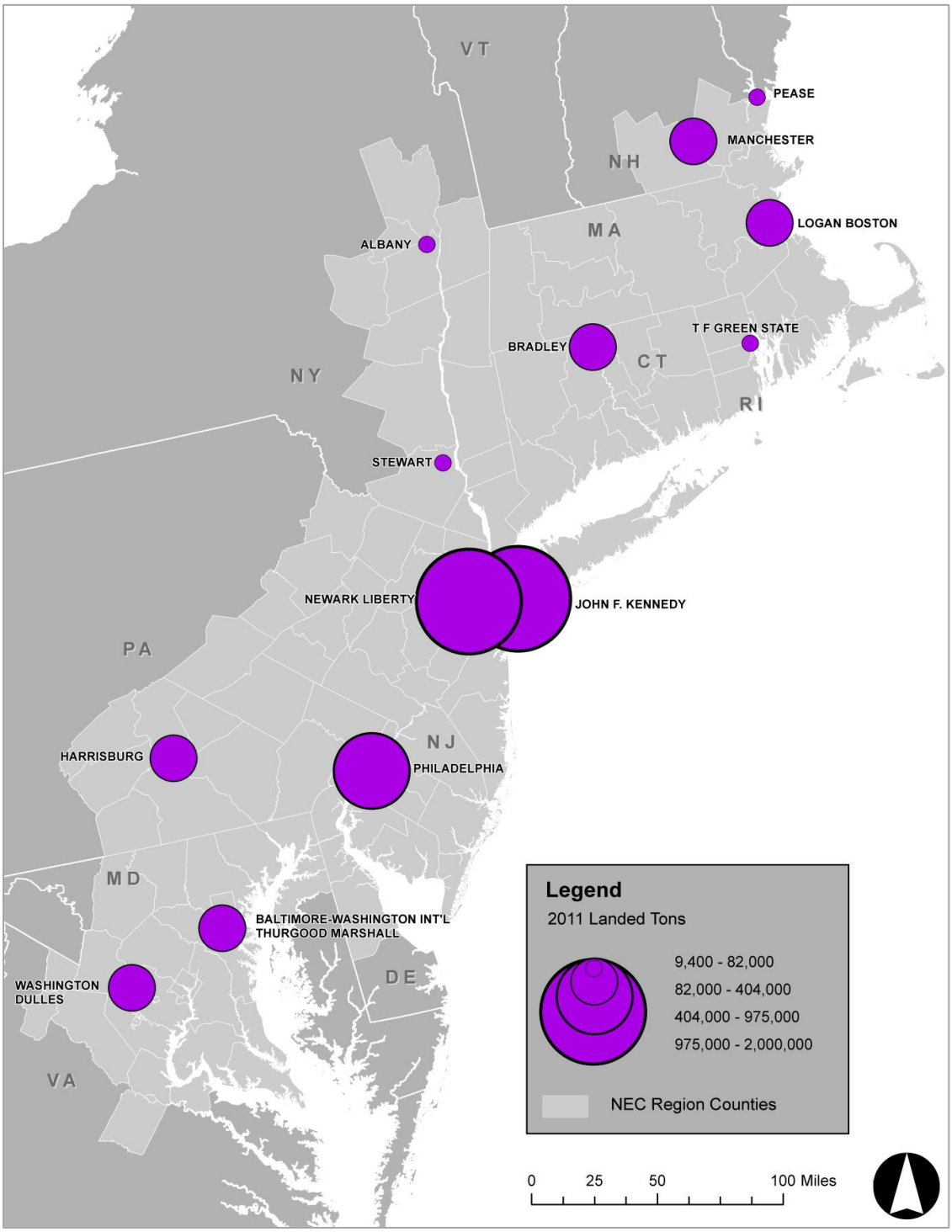
In addition to truck and rail freight, the NEC Region's airports accommodated more than 6 million tons of landed air cargo tonnage in 2011, representing about 6 percent of all landed air cargo tonnage in the U.S.[33] Several of the airports in the Region are among the top 20 air cargo airports in the nation. Figure 21 shows the volume of air cargo (measured in landed tons) at the Region's airports.

Figure 20. ***Annual Freight Rail Flows by Tonnage Density: NEC Region***
2009



Source: National Transportation Atlas Database, FRA.

Figure 21. ***Air Cargo Tonnage by Airport: NEC Region***
2011



Source: National Transportation Atlas Database, FAA.

4.0 The NEC Transportation System: How Does it Perform?

Facilities across all modes of the NEC Region's transportation system are heavily utilized and congested. The NEC Region is home to more than 50 percent of the nation's worst highway bottlenecks, seven of the country's 10 most delayed airports, and the most congested passenger rail system in the country.

Transportation System Performance

- Highways
- Rail and Transit
- Air

This section summarizes information on ***how well the highway, rail, and air networks of the NEC Region transportation system perform for users.***

4.1 Highways

The highway system in the NEC Region experiences some of the highest levels of congestion in the nation with 170 of the nation's top 328 bottlenecks. Automobile commuters incur 47 hours of delay annually on the urban highways in the NEC Region compared to an average of 38 hours for automobile commuters in urban areas nationwide.

Both local and long distance travelers share the NEC Region's highway network. As described in Section 3.0, local trips comprise the vast majority of travel activity, with the highest volumes during rush hours for morning and evening commutes. Congestion experienced during these peak periods, however, has repercussions for both local and long distance trips.

By many measures, the highway network in the NEC Region struggles to perform for its users. Capacity bottlenecks restrict movement, especially near the centers of the NEC Region's metropolitan areas, increasing congestion and reducing travel speeds, ultimately resulting in time lost by travelers to delay. The Texas Transportation Institute's *2011 Congested Corridors Report* identified major national bottlenecks (Table 18). Those highway segments, which range in length from 3 to 40 miles, have portions that experience at least 10 hours of congestion (travel speeds less than half of free-flow conditions) per week, typically during the morning and evening peak periods, but increasingly during the midday and on weekends. Drivers on these segments experience stop-and-go traffic, and the day-to-day variation in the congestion levels makes it difficult for drivers to predict how much time their trip will actually take.

The most congested highway segment in the NEC Region is a 4.5-mile stretch of the Hutchinson River Parkway northbound from New York City. It takes 6 minutes in free-flow conditions to cover this segment. During peak periods, it takes on average around 9 minutes to travel this same distance. However, such stretches of highway are prone to periodic traffic jams of significant size. The average worst travel time experienced in any given month on this short 4.5-mile stretch, which is roughly 20 miles outside Manhattan, is over 28 minutes. A longer corridor identified in this report is a 23.9-mile stretch of I-95 outside Washington, where a 24-minute free-flow trip is 45 minutes during the average peak hour, and as bad as 113 minutes any given month.

Table 18. Major Highway Bottlenecks: NEC Region
2011

Rank		Characteristics				Travel Time (Minutes)	
U.S.	NEC	Area	Location	Length (Miles)	Free-Flow	Average Peak Hour	Average Worst Day in a Month
3	**1**	New York	Hutchinson River Pkwy NB	4.5	6	9	28
4	**2**	New York	Bronx Whitestone Bridge NB/Whitestone Expwy NB	3.4	5	9	23
6	**3**	New York	Pulaski Skwy NB	3.3	4	7	17
7	**4**	New Haven	I-84 WB	3.4	3	5	14
11	**5**	New York	Major Deegan Expy SB	3.5	4	8	19
12	**6**	Washington	I-70 WB	6.8	7	9	23
15	**7**	Washington	I-95 SB	23.9	24	45	113
16	**8**	New York	I-95 SB (NE Thwy, Bruckner/Cross-Bronx Expwy)	22.7	25	69	138
18	**9**	Baltimore	John Hanson Hwy/U.S.-50/U.S.-301 EB	3.4	3	5	12
21	**10**	New Haven	I-95 NB	4.0	4	7	17

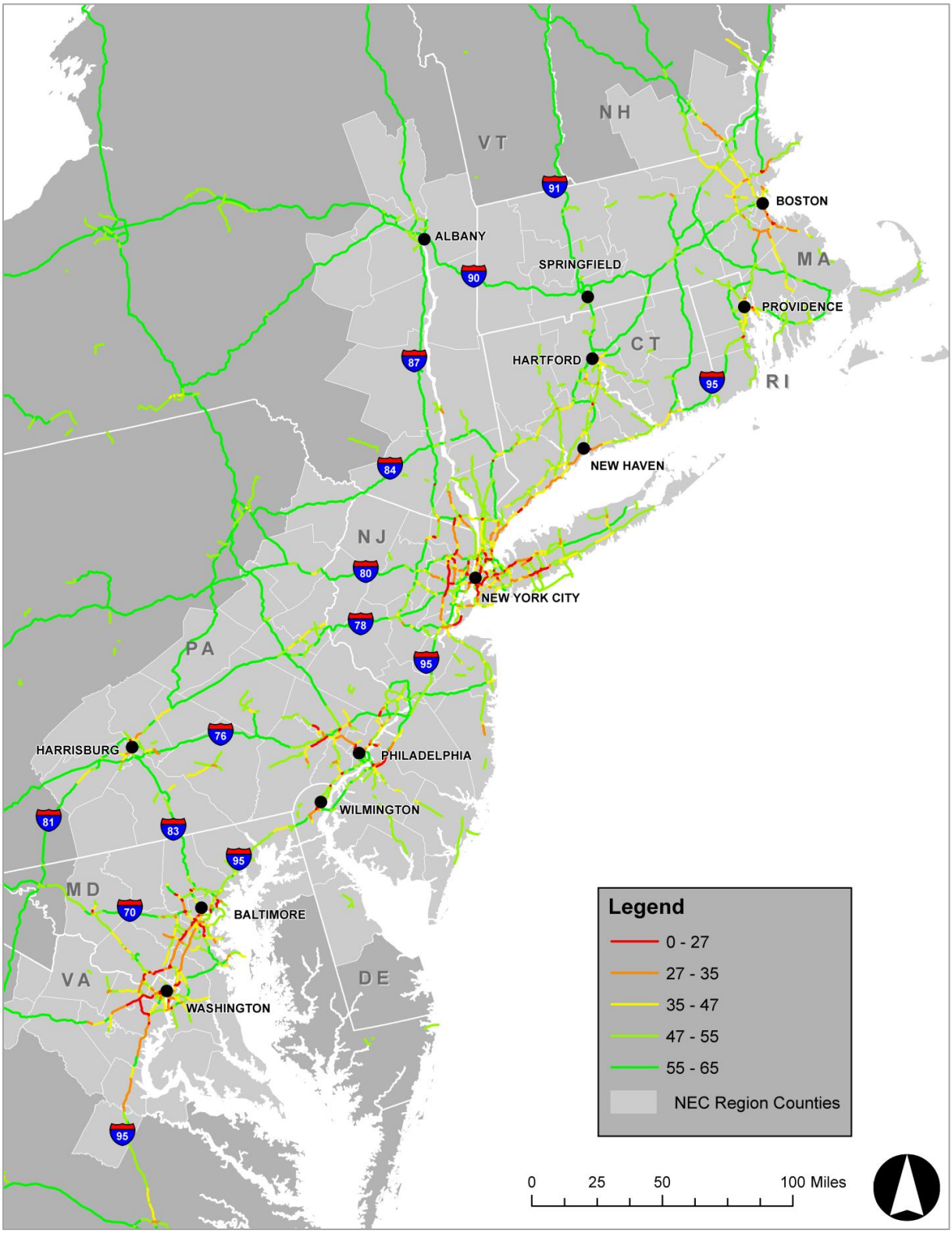
Source: Texas Transportation Institute 2011 Congested Corridors Report, INRIX.

As Table 18 indicates, nearly half of the top 20 such corridors are in the NEC Region. One hundred seventy, more than 50 percent, of the total 328 seriously congested segments identified in the report are located in the NEC Region.

Capacity bottlenecks and congestion reduce travel speed. Figure 22 maps the average travel speeds on NEC Region highways during congested peak periods. Red lines indicate highway segments that routinely experience very slow travel speeds; green lines indicate highway segments that generally experience free-flowing traffic conditions, even during peak hours. Low speeds can persist for many hours during daily peak periods and during holiday weekends. On average, metropolitan areas within the NEC Region experience about four "rush hours" per day. The most severely congested metropolitan areas in the NEC Region are New York and Washington, D.C., each of which experience about six to seven rush hours each day. [34]

Congestion and slower travel speeds create time lost in delay. The average automobile commuter in the NEC Region loses 47 hours a year to highway delays compared to 38 nationally.[35] Drivers in metropolitan Washington, New York, Boston, and Philadelphia spend the most hours stuck behind the wheel in traffic in the NEC Region and rank 1st, 4th, 5th and 9th, respectively, in the nation for hours of delay. Automobile commuters in these four metropolitan areas and Baltimore spend more than a 40-hour work week each year in traffic. In metropolitan Washington, automobile commuters waste close to two work weeks a year in congested traffic. The economic impact of this delay is equivalent to $1,000 or more each year per automobile commuter in the NEC Region's largest metropolitan areas (Table 19). In total, drivers in the NEC Region lose over 1.2 billion hours and $26.6 billion each year in traffic.

Figure 22. ***Average Peak-Period Travel Speeds (Miles per Hour): NEC Region***
2012



Source: ICAT, National Transportation Atlas Database.

Table 19. Congestion Impacts for Auto Commuters: NEC Region
2011

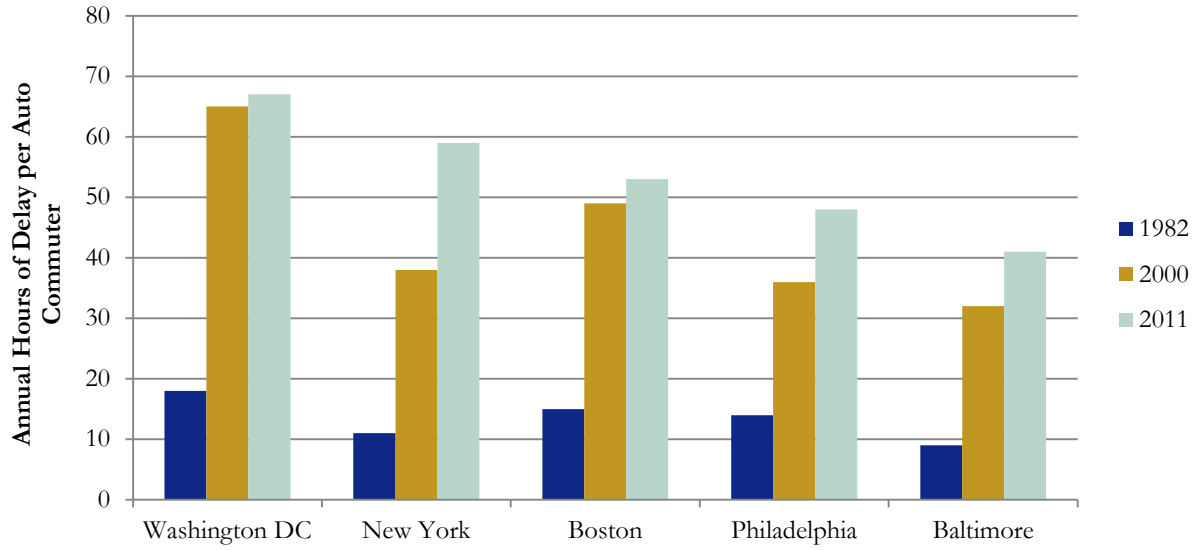
Classification	Metropolitan Area	Annual Hours Lost in Delay		Planning Index	Average Annual Value of Lost Productivity per Commuter
		Per Auto Commuter	National Rank		
Very Large Urban Areas	Washington, D.C.-VA-MD	67	1	5.72	$1,398
	New York-Newark NY-NJ-CT	59	4	4.44	$1,281
	Boston MA-NH-RI	53	5	4.25	$1,147
	Philadelphia PA-NJ-DE-MD	48	9	3.46	$1,018
	U.S. Average for Very Large Urban Areas	52		4.08	$1,128
Large Urban Areas	Baltimore MD	41	23	3.81	$908
	Providence RI-MA	30	53	2.86	$611
	U.S. Average for Large Urban Areas	37		3.12	$780
Medium Urban Areas	Bridgeport-Stamford CT-NY	42	21	4.40	$902
	Hartford CT	38	30	2.79	$781
	New Haven CT	35	40	3.02	$717
	Albany-Schenectady NY	31	50	2.57	$682
	Allentown-Bethlehem PA-NJ	30	53	2.61	$656
	Springfield MA-CT	28	63	2.16	$575
	Poughkeepsie-Newburgh NY	25	75	2.13	$531
	U.S. Average for Medium Urban Areas	29		2.66	$628
Small Urban Areas	Worcester MA	33	45	2.21	$677
	U.S. Average for Small Urban Areas	23		2.09	$497

Source: Texas Transportation Institute Urban Mobility Report, 2012.

To compensate for congestion on highways, drivers must allow for additional travel time if they want to ensure an on-time arrival. The Texas Transportation Institute estimates measures of this additional required time in their "Planning Time Index." This figure is the value by which one would multiply the free-flow travel time required for a highway trip in order to ensure on-time arrival 95 percent of the time based on average traffic conditions in a metropolitan area. For example, if a traveler wanted to be 95 percent certain to arrive on-time for a 20-minute freeway trip, he or she would need to allow 114.4 minutes in the Washington area and 88.8 minutes in the New York City area.

In all major metropolitan areas, annual hours of delay per automobile commuter grew significantly between 1982 and 2000. Between 2000 and 2011, this same metric grew somewhat less significantly in Washington and Boston than it did in New York, Philadelphia, and Baltimore.

Figure 23. ***Change in Annual Delay per Auto Commuter: NEC Region***
1982, 2000, and 2011



Source: Texas Transportation Institute Urban Mobility Report, 2012.

4.2 Rail and Transit

The robust rail and transit systems in the NEC Region provide relatively superior reliability where services do not compete for space on crowded roads and highways. As a result, the Region's residents collectively save roughly 559 million hours of time and $12.1 billion each year that would be lost to additional highway congestion. On-time performance rates of commuter rail and Amtrak services in the NEC Region indicate that passengers arrive within six minutes of schedule the vast majority of the time.

Each day, millions of residents of the NEC Region take advantage of public transportation facilities that operate in dedicated rights-of-way (commuter rail, subways, and light rail). By not mixing with general street traffic, these transportation modes provide relatively high service reliability. The benefits of these services accrue to both transit passengers, who on average experience low levels of unexpected delay, and automobile users, who would otherwise be sharing already congested roads and highways with even more drivers. The Texas Transportation Institute's *Urban Mobility Report* estimates the benefits of these services across all users of the multimodal transportation system (Table 20). Given its size, its extensive and well used transit network, and high level of highway congestion, the New York metropolitan area derives by far the greatest benefit from transit usage in the NEC Region and the country, with more than 440 million hours and $9.6 billion saved each year.

Table 20. Public Transportation Benefits: NEC Region
2011

	Annual Hours of Delay Avoided because of Public Transportation Usage		Total Annual Cost Savings for Metro Area
Metropolitan Area	**Total for all Metro Area Residents**	**National Rank**	
New York-Newark NY-NJ-CT	440,647,000	1	$9,586,000,000
Boston MA-NH-RI	37,943,000	3	$809,400,000
Washington, D.C.-VA-MD	33,810,000	5	$711,000,000
Philadelphia PA-NJ-DE-MD	30,167,000	7	$654,900,000
Baltimore MD	11,219,000	10	$248,600,000
Hartford CT	1,460,000	36	$30,400,000
Providence RI-MA	1,184,000	39	$24,200,000
Albany-Schenectady NY	567,000	52	$12,700,000
Poughkeepsie-Newburgh NY	395,000	57	$8,600,000
Bridgeport-Stamford CT-NY	382,000	58	$8,200,000
Springfield MA-CT	349,000	60	$7,300,000
Allentown-Bethlehem PA-NJ	344,000	62	$7,600,000
New Haven CT	336,000	64	$7,000,000
Worcester MA	98,000	92	$2,000,000
Total	**558,901,000**		**$12,117,900,000**

Source: Texas Transportation Institute Urban Mobility Report, 2012.

Compared to driving on metropolitan highways, commuter rail passengers experience relatively fast and reliable trips. One measure of reliability is on-time performance, the percent of trains that arrive within a specified threshold of the scheduled arrival time. On-time performance rates for the commuter rail systems of the NEC Region range from 85 to 98 percent with thresholds of four to six minutes (Table 21). For comparison to automobile travel, Table 19 showed that a commute via highways in every metropolitan area in the NEC Region requires drivers to allow at least twice the amount of time (and up to five times the amount of time) necessary for their trip in order to arrive on-time 95 percent of the time.

Table 21. Commuter Railroad On-Time Performance: NEC Region
2011

Agency	Percent On-Time Performance	How is On-Time Performance Measured
Massachusetts Bay Transportation Authority (MBTA)	98%	Percentage of trains arriving within 4 minutes of scheduled time[36]
Shore Line East (SLE)	92%	Percentage of trains arriving within 5 minutes and 59 seconds of scheduled time[37,38,39,40,41]
Metro-North Railroad (MNR)	97%	
Long Island Rail Road (LIRR)	95%	
NJ TRANSIT (NJT)	94%	
Southeastern Pennsylvania Public Transportation Authority (SEPTA)	91%	
Maryland Area Regional Commuter (MARC)	85%	
Virginia Railway Express (VRE)	85%	

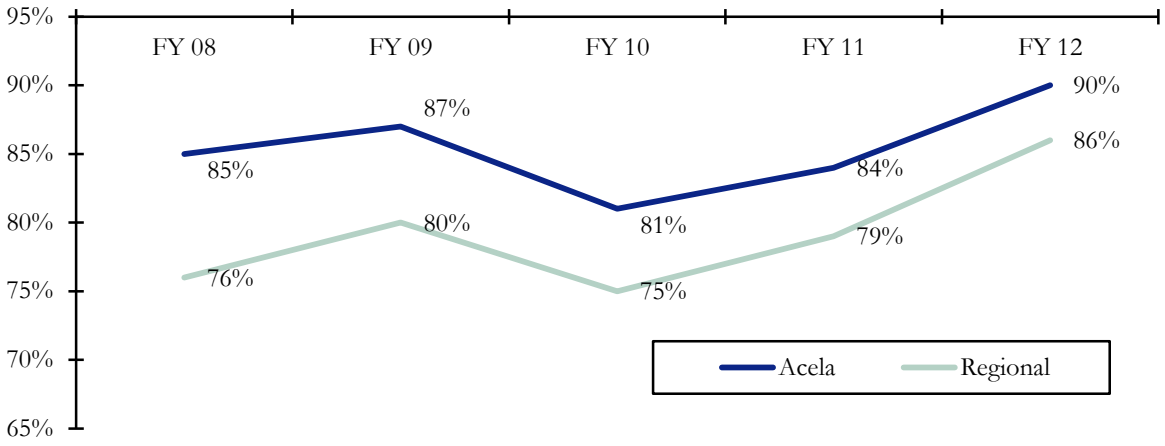
Source: Commuter railroads.

Passengers riding Amtrak intercity trains experience somewhat lower, but improving, on-time performance. The goals for NEC on-time performance are 95 percent for the Acela Express and 90 percent for the Regional trains, to be achieved by 2014.[42] As of FY 2012, Acela Express was at 90 percent and Regional trains were at 86 percent (Figure 24).

Though reliable compared to other modes, the railroad system still experiences performance challenges. Reliability of the commuter and intercity passenger rail systems in the NEC Region is highly interrelated. More than half of commuter trains use a portion of shared NEC infrastructure. In several critical terminal areas, Amtrak and multiple commuter operators compete for limited track space. Delays from one operator directly impact partner railroads. When longer distance Amtrak services experience disruption, resulting delays can cascade, impacting operators hundreds of miles away.

Congestion is a serious cause of delay along the NEC, where train volumes exceed 75 percent of practical capacity on 99.5 miles of the Main Line between Boston and Washington.[43] Bottlenecks such as the Hudson River tunnels between New York and New Jersey are already maxed out, with trains every 2.5 minutes during peak hours. There are many other reasons for delays, including passenger-related issues, crew-related issues, equipment failures (engine trouble, etc.), infrastructure failures (downed electrical wire, etc.), slow orders, weather, and trespassers.

Figure 24. ***Amtrak On-Time Performance History: Northeast Corridor***
FY 2008 to FY 2012



Source: Amtrak.

4.3 Air

Airports in the NEC Region are highly congested with eight of the 14 worst major airports in the country for on-time arrivals in 2012. Nearly one half of flight delays nationwide are attributed to the major airports in New York and Philadelphia.

The busiest airports in the NEC Region – Boston-Logan (BOS), New York-JFK (JFK), New York-LaGuardia (LGA), Newark-Liberty (EWR), Philadelphia (PHL), Baltimore-Washington Thurgood Marshall (BWI), Washington-Reagan National (DCA), and Washington-Dulles (IAD) – are among the lowest performing major airports in the nation for on-time arrivals and departures (Table 22). On-time performance at these airports declined during the middle of the previous decade, but has improved since 2007 (Figure 25). In 2009, average arrival delays at NWK, LGA, JFK, PHL, and BOS were all around 60 minutes long.[44]

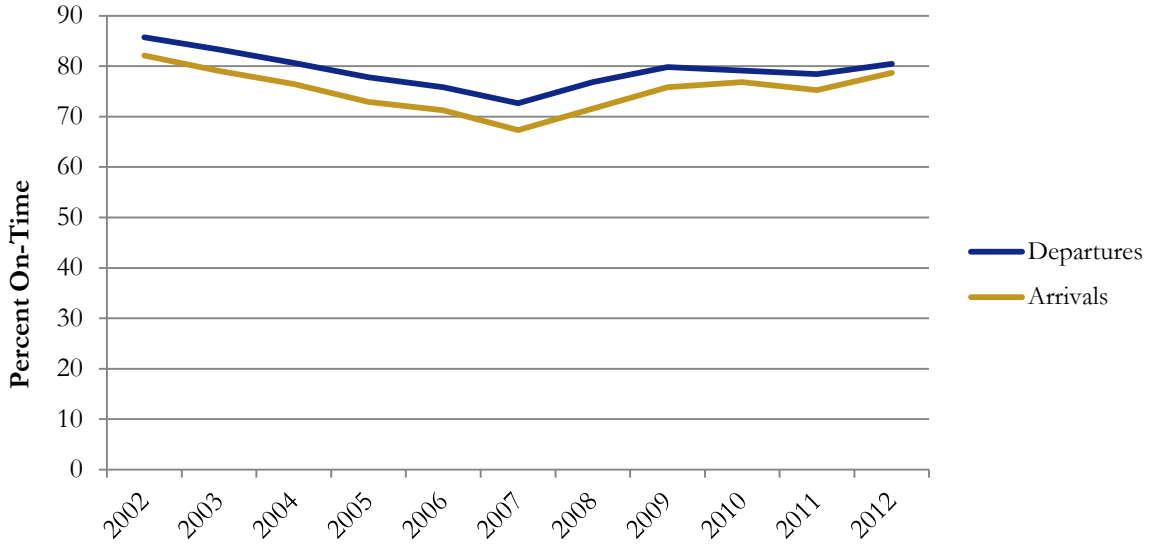
Airspace capacity in the Northeast aviation system is most constrained in the New York metropolitan area, which affects the JFK, LGA, EWR, and PHL airports. Government Accountability Office (GAO) reports from 2010 and 2012 demonstrate that performance challenges at these airports have national impacts. One third of the approximately 50,000 daily aircraft that the Federal Aviation Administration (FAA) guides through the national airspace system move through New York area.[45] When a flight is delayed, the Federal Aviation Administration (FAA) keeps track of which airport that delay is attributable to, even if it is different than the airport where the delay was experienced (e.g., a delayed departure from San Francisco International can be attributed to earlier problems at Philadelphia International). Nearly one half of all departure delays nationally were attributed to one of major airports in New York or Philadelphia in 2009.[46]

Table 22. On-Time Performance for Major Airports: NEC Region
2012

Departures			**Arrivals**		
Airport	**National Rank (1 is Least On-Time)**	**Percent On-time**	**Airport**	**National Rank (1 is Least On-Time)**	**Percent On-time**
EWR	1	71%	EWR	1	69%
IAD	6	78%	LGA	3	77%
BWI	7	78%	IAD	4	79%
JFK	12	81%	DCA	7	80%
LGA	14	83%	JFK	8	81%
BOS	19	84%	BOS	11	81%
DCA	20	84%	PHL	12	81%
PHL	22	85%	BWI	14	82%
Average		**80%**	**Average**		**79%**

Source: Bureau of Transportation Statistics Airline On-Time Data among Major Airports (29 busiest in the nation). Flights are considered on-time if they arrive or depart their gate within 15 minutes of schedule.

Figure 25. ***On-Time Performance for Major Airports: NEC Region***
2002 to 2012



Source: Bureau of Transportation Statistics Airline On-Time Data among major airports (29 busiest in the nation. Flights are considered on-time if they arrive or depart their gate within 15 minutes of schedule).

An Airport Cooperative Research Program (ACRP) report from 2010 estimated the amount of delay experienced per passenger (all passengers, not just delayed passengers) and the associated economic loss based on passenger value of time at the major airports in the NEC Region. In 2007, that loss was estimated at $2.5 billion (Table 23).

Table 23. Cost of Congestion at Major Airports: NEC Region
2007

	Delay per Passenger Served (Minutes)	Costs of Delay (2007 $ Millions)
Baltimore Marshall (BWI)	14	138
Boston Logan (BOS)	22	209
New York JFK (JFK)	28	633
New York LaGuardia (LGA)	29	299
Newark Liberty (EWR)	33	519
Philadelphia International (PHL)	24	289
Washington Reagan (DCA)	20	183
Washington Dulles (IAD)	23	182
Total		**2,452**

Source: ACRP 31, Innovative Approaches to Addressing Aviation Capacity Issues in Coastal Mega-regions, 2010.

5.0 Future of the NEC Region: How Might We Grow?

The transportation system of the NEC Region will face the challenge of accommodating increasing demand from economic and population growth over the next 30 years. This section summarizes information on the ***trends influencing travel demand*** in the NEC Region and ***how the volumes and nature of travel might impact the highway, rail, and aviation systems***. Forecasts of future population and employment are from Moody's for the period from 2010 to 2040.[47] Projections of travel demand are drawn from recent studies published by transportation agencies in the NEC Region. Together, the socioeconomic forecasts and travel demand forecasts describe a future in which the existing transportation system will face increasing pressure.

Future Trends

- Population, employment, and density trends
  - Where we will work (employment)
  - Where we will live (population)
- Travel demand trends
  - Summary of existing studies and data
  - Gaps in our understanding

5.1 Employment, Population, and Density Trends

Employment in the NEC Region is predicted to grow by nearly five million from 2010 to 2040, and the Region's population may grow by seven million.

5.1.1 Employment

Employment in the NEC Region is forecast to grow by 21 percent by 2040, bringing total employment in the region to 28.5 million.

Forecasts from Moody's Analytics project that NEC Region employment will grow at a steady pace over the next several decades, with continued growth in today's most significant job centers. The NEC Region is expected to add nearly 5 million new jobs, growing from 23.6 million jobs in 2010 to 28.5 million in 2040.[48] These forecasts expect the 10 counties with the highest number of jobs to remain unchanged from 2010, though the order would vary near the bottom of the list (Table 24). Each of the top 10 counties is forecast to add at least 100,000 new jobs over the next 30 years, including more than a half million new jobs in Manhattan (Table 25).

Table 24. Top 10 Counties by Number of Jobs: NEC Region
2040

County	MSA/CSA	Jobs 2040	Change in Jobs 2010 to 2040
New York, New York	New York NY-NJ-CT-PA CSA	2,871,000	525,000
Middlesex, Massachusetts	Boston MA-NH CSA	955,000	137,000
District of Columbia	Washington, D.C.-VA-MD-WV MSA	852,000	146,000
Philadelphia, Pennsylvania	Philadelphia PA-NJ-DE-MD CSA	789,000	134,000
Fairfax, Virginia[a]	Washington, D.C.-VA-MD-WV MSA	754,000	151,000
Suffolk, New York	New York NY-NJ-CT-PA CSA	740,000	118,000
Suffolk, Massachusetts	Boston MA-NH CSA	711,000	123,000
Nassau, New York	New York NY-NJ-CT-PA CSA	704,000	101,000
Kings, New York	New York NY-NJ-CT-PA CSA	681,000	179,000
Queens, New York	New York NY-NJ-CT-PA CSA	655,000	147,000
Total for Top 10		**9,711,000**	**1,760,000**
Total All Other NEC Region Counties		**18,786,000**	**3,191,000**
Total for NEC Region		**28,497,000**	**4,951,000**

Source: Moody's Analytics.
[a] *Includes Fairfax City and Falls Church City.*

Table 25. Top 10 Counties for Absolute Increase in Jobs: NEC Region
2010 to 2040

County	MSA/CSA	Absolute Increase
New York, New York	New York NY-NJ-CT-PA CSA	525,000
Kings, New York	New York NY-NJ-CT-PA CSA	179,000
Fairfax, Virginia[a]	Washington, D.C.-VA-MD-WV MSA	151,000
Queens, New York	New York NY-NJ-CT-PA CSA	147,000
District of Columbia	Washington, D.C.-VA-MD-WV MSA	146,000
Middlesex, Massachusetts	Boston MA-NH CSA	137,000
Montgomery, Maryland	Washington, D.C.-VA-MD-WV MSA	136,000
Philadelphia, Pennsylvania	Philadelphia PA-NJ-DE-MD CSA	134,000
Suffolk, Massachusetts	Boston MA-NH CSA	123,000
Loudoun, Virginia	Washington, D.C.-VA-MD-WV MSA	121,000

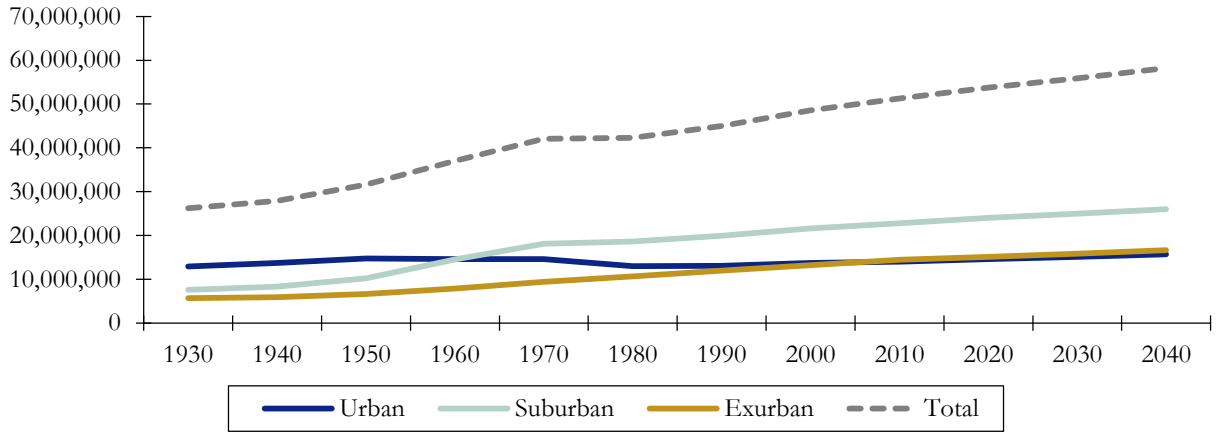
Source: Moody's Analytics.
[a] *Includes Fairfax City and Falls Church.*

5.1.2 Population

Population in the NEC Region is forecast to grow by seven million new residents between 2010 and 2040, the equivalent of adding a metropolitan area larger than Philadelphia.

Forecasts from Moody's Analytics project the NEC Region will grow from 51 million residents in 2010 to 58 million in 2040, representing an increase of about 14 percent.[49] This growth rate is equivalent to more than 600 new residents per day.[50] These expected trends reflect the pattern of growth observed over the last decade, with the urban, suburban, and exurban counties maintaining roughly the same proportion of population (Figure 26).

Figure 26. ***Population Change by Type of County***
1930 to 2040



Source: U.S. Census and Moody's Analytics.

Of the 122 counties in the NEC Region, 110 are projected to experience population growth between 2010 and 2040, with wide variation in growth rates ranging from nearly 100 percent growth to slight population loss. These forecasts predict growth to follow the same distribution observed over the last decade – with the greatest percentage growth in the counties around Washington, D.C. The greatest absolute population growth would occur in the largest urban and suburban counties in the New York and Washington metropolitan areas.

Table 26. Top 10 Counties by Population: NEC Region
2040

County	MSA/CSA	Population 2040	Change in Population 2010 to 2040
Kings, New York (Brooklyn)	New York NY-NJ-CT-PA CSA	2,877,000	376,000
Queens, New York (Queens)	New York NY-NJ-CT-PA CSA	2,477,000	249,000
New York, New York (Manhattan)	New York NY-NJ-CT-PA CSA	1,669,000	86,000
Philadelphia, Pennsylvania	Philadelphia PA-NJ-DE-MD CSA	1,620,000	97,000
Suffolk, New York	New York NY-NJ-CT-PA CSA	1,593,000	101,000
Middlesex, Massachusetts	Boston MA-NH CSA	1,592,000	90,000
Bronx, NY	New York NY-NJ-CT-PA CSA	1,520,000	136,000
Fairfax, Virginia [a]	Washington, D.C.-VA-MD-WV MSA	1,472,000	358,000
Nassau, New York	New York NY-NJ-CT-PA CSA	1,413,000	75,000
Montgomery, MD	Washington, D.C.-VA-MD-WV MSA	1,239,000	270,000
Total for Top 10		**17,474,000**	**1,838,000**
Total All Other NEC Region Counties		**40,758,000**	**5,183,000**
Total for NEC Region		**58,232,000**	**7,021,000**

Source: Moody's Analytics.
[a] *Includes Fairfax City and Falls Church City.*

Table 27. Top 10 Counties for Absolute Increase in Population: NEC Region
2010 to 2040

County	MSA/CSA	Absolute Increase
Kings, New York	New York NY-NJ-CT-PA CSA	376,000
Fairfax, Virginia [a]	Washington, D.C.-VA-MD-WV MSA	358,000
Prince William, Virginia [b]	Washington, D.C.-VA-MD-WV MSA	349,000
Loudoun, Virginia	Washington, D.C.-VA-MD-WV MSA	299,000
Montgomery, Maryland	Washington, D.C.-VA-MD-WV MSA	270,000
Queens, New York	New York NY-NJ-CT-PA CSA	249,000
Middlesex, New Jersey	New York NY-NJ-CT-PA CSA	213,000
District of Columbia	Washington, D.C.-VA-MD-WV MSA	187,000
Berks, Pennsylvania	Philadelphia PA-NJ-DE-MD CSA	166,000
Ocean, New Jersey	New York NY-NJ-CT-PA CSA	157,000

Source: Moody's Analytics.
[a] *Includes Fairfax City and Falls Church.*
[b] *Includes Manassas and Manassas Park.*

5.2 Travel Demand Trends

Travel demand for all modes is projected to increase over the coming decades at a rate faster than population growth.

Travel demand in the NEC Region is expected to grow faster than the 14 percent growth rate for population. Intercity rail is predicted to grow at the fastest rate, more than doubling the number of daily passengers by 2040.[51] Airport boardings and commuter rail ridership are also expected to experience significant growth.[52] Automobile travel demand is forecast to grow as well, though at a more modest rate.[53]

Passenger Travel Demand Forecasts 2010 - 2040

- Vehicle miles traveled +22%
- Commuter rail ridership +87%
- Intercity rail ridership +115%
- Airport boardings +102%

Freight Tonnage Forecasts 2010 - 2040

- Truck +37%
- Rail +67%
- Air +224%
- Overall +39%

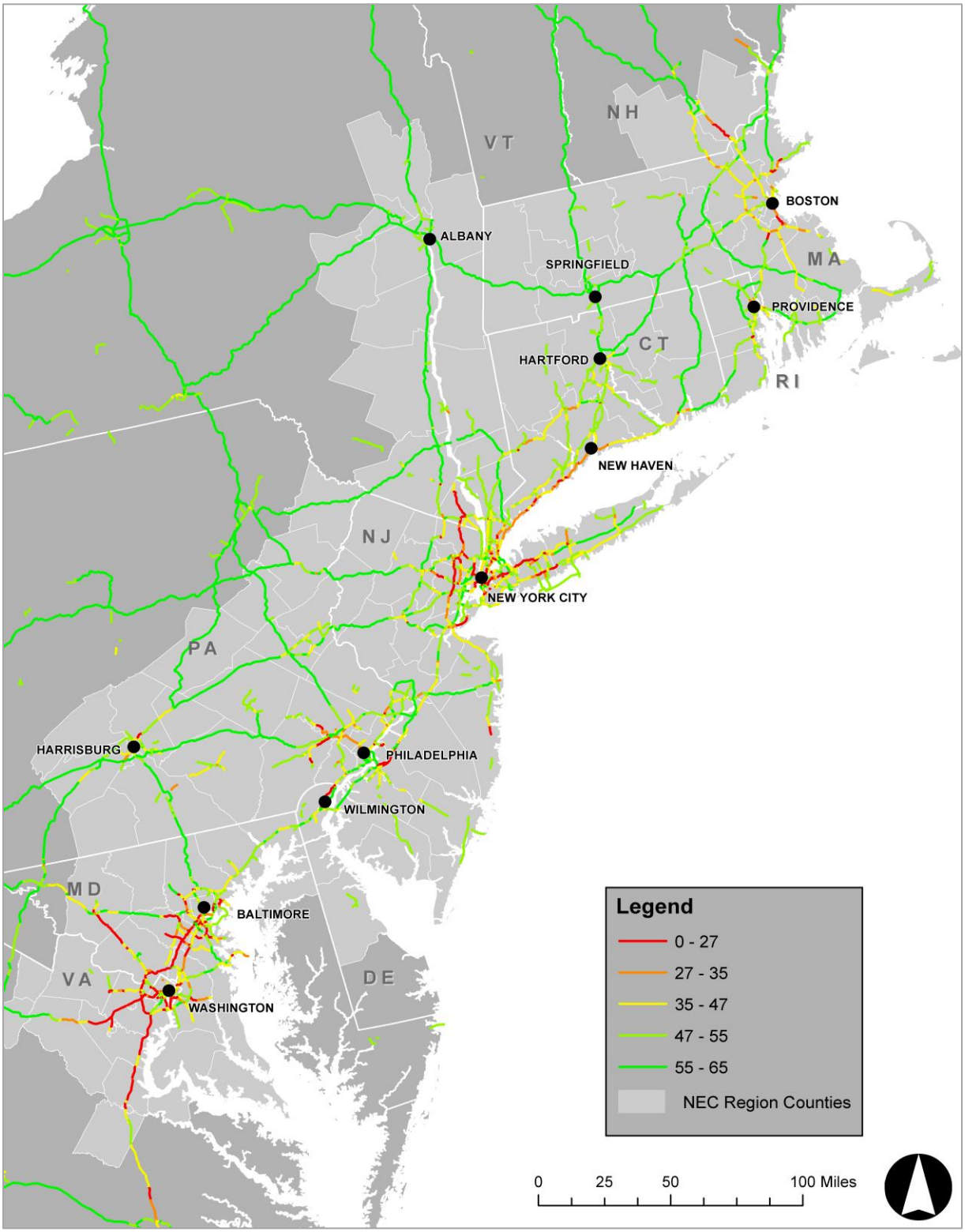
Faster rates of travel demand growth versus population growth would echo recent observed trends. NEC Region population growth between 2000 and 2010 was 5.6 percent. During the same period, intercity rail ridership grew by 23.5 percent,[54] commuter rail ridership grew by 10.5 percent,[55] and enplanements at major airports grew by 10.3 percent [56] in the NEC Region. Nationally, VMT grew by 8 percent during this period. The Federal Highway Administration started releasing VMT statistics by state in 2004, and from 2004 to 2012 VMT declined by 1.1 percent in NEC Region states.

This section summarizes existing studies and reports that provide forecasts of future travel demand on the region's highway, rail, and aviation systems and estimates of potential performance impacts where available. Such studies tend to focus on one particular mode and can differ in their underlying assumptions. However, they consistently point to strong and continued growth in travel demand over the coming decades.

5.2.1 Future Highway Demand

On the Region's highways, travel demand could grow by as much as 22 percent from 2010 to 2040 as measured in vehicle miles traveled (VMT).[57] This unconstrained highway forecast was produced using the I-95 Corridor Coalition's ICAT model (extrapolated from 2035 to 2040), which was based on population and economic growth projections alone, and did not consider where capacity for growth might be available now or in the future on any mode.[58] The highway system is already congested to the point where commuters experience more than 1.2 billion hours of annual delay in the Region's metropolitan areas,[59] and this additional travel would make that situation even worse. The ICAT model projected that applying such increased levels of demand in 2035 on today's highway capacity would increase the mileage of the NEC Region highway network operating at 27 mph or less during peak periods from 165 miles to 474 miles.[60] Figure 27 illustrates this potential level of highway performance in 2035 if no new highway capacity is built for comparison to 2012, which was illustrated in Figure 22. Degraded highway conditions would largely be focused in the Washington, DC metropolitan area which is projected to grow most significantly based on past trends.

Figure 27. ***Average Peak-Period Travel Speeds (Miles per Hour): NEC Region***
2035



Source: I-95 Corridor Coalition ICAT.

5.2.2 Future Rail Demand

Demand on the Region's intercity and commuter rail systems is projected to increase, with ridership on Amtrak's NEC services projected to grow from 13 million in 2010 to 23 million in 2030. Commuter rail ridership on the NEC is projected to increase from 246 million in 2010 to 389 million in 2030.[61] Overall commuter rail ridership in the NEC Region would be even higher with the inclusion of all non-NEC services. Increases of 115 percent and 87 percent for Amtrak and NEC commuter rail, respectively, between 2010 and 2040 are based on extrapolations of these trends. Amtrak and commuter rail ridership forecasts considered anticipated demand growth, but were also constrained on the basis of modest increases in infrastructure capacity. Amtrak predicts that with ambitious increases in capacity and reductions in travel time, intercity rail ridership could grow as high as 43.5 million annual riders by 2040, a 269 percent increase over 2010.[62]

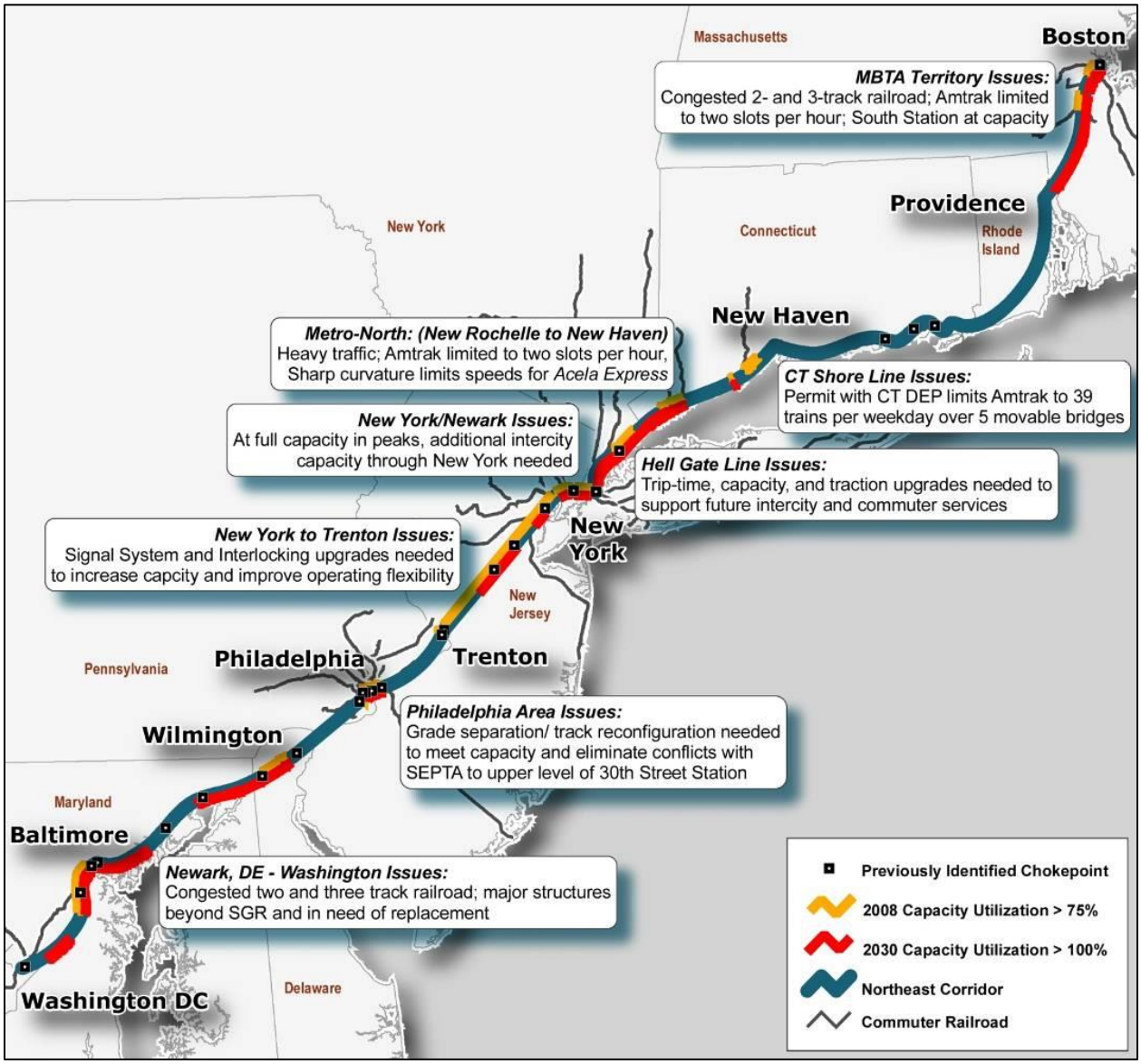
However, with capacity nearly or fully consumed, the rail system's ability to absorb future demand is severely limited. According to the NEC Infrastructure Master Plan, NEC passenger train miles (sum of all miles traveled by all trains on the NEC) grew by 90 percent between 1975 and 2010 to 19 million.[63] This growth was forecasted to continue in the future, with a 65 percent increase from 2010 to 2030. Demand on 186 miles of the NEC will exceed 100% of available track space in 2030 even with modest increases in capacity, leaving the rail network with congestion and reliability challenges worse than exist today (Figure 28).[64]

Table 28. Rail Ridership Growth: NEC Main Line and Connecting Corridors
2010 to 2030

Operator	2010 Ridership	2030 Ridership	Percent Change
Amtrak	13M	23M	76%
Massachusetts Bay Transportation Authority (MBTA)	23M	34M	48%
Shore Line East (SLE)	1M	2M	260%
Metro-North Railroad (MNR)	49M	99M	102%
Long Island Rail Road (LIRR)	86M	110M	28%
NJ TRANSIT (NJT)	58M	99M	71%
Southeastern Pennsylvania Public Transportation Authority (SEPTA)	18M	23M	26%
Maryland Area Regional Commuter (MARC)	8M	16M	98%
Virginia Railway Express (VRE)	4M	7M	76%
Total	260M	412M	59%

Source: NEC Infrastructure Master Plan, 2010. Includes Boston to Washington Main Line and connecting corridors to Richmond, VA; Harrisburg, PA; Albany, NY; and Springfield MA, but does not include full extent of commuter rail networks that have operations exclusively off the NEC.

Figure 28. ***Main Line Congestion and Constraints: NEC***
2008 and 2030



Source: NEC Infrastructure Master Plan.

5.2.3 Future Air Demand

Boardings at the Region's core airports are expected to more than double between 2010 and 2040, based on FAA estimates. The greatest predicted growth is expected at New York's JFK and Washington's Dulles airports (Table 29). Like the highway forecasts, these predictions of future air travel are based on anticipated demand and not constrained by expected available capacity.

Table 29. Annual Boardings at Major Airports: NEC Region
2010 and 2040

Code	Airport Name	2010 Boardings	2040 Boardings	Increase in Boardings	Percent Change
JFK	John F Kennedy International	22.4	61.3	38.9	173.5%
EWR	Newark Liberty International	16.5	32.2	15.7	95.4%
PHL	Philadelphia International	14.8	28.0	13.2	89.0%
BOS	General Edward Lawrence Logan International	13.2	22.6	9.4	70.8%
LGA	La Guardia	11.8	16.3	4.5	38.1%
IAD	Washington Dulles International	11.2	24.7	13.5	121.1%
BWI	Baltimore/Washington International Thurgood Marshall	10.6	22.0	11.4	107.6%
DCA	Ronald Reagan Washington National	8.5	12.7	4,197	49.2%
Total		**109.1**	**219.9**	**110.8**	**101.6%**

Source: Terminal Area Forecast Summary, Fiscal Years 2012-2040, Federal Aviation Administration, 2013.

However, capacity constraints exist at most major airports in the NEC Region. Expansion of the aviation system is limited by runway and taxi capacity, terminal and groundside capacity, and regional airspace capacity, especially in the New York and Washington metropolitan areas where the FAA has limited takeoff and landing slots to manage congestion. In 2007, the FAA released a report entitled Capacity Needs in the National Airspace System, 2007-2025 (FACT 2 Report) which compares expected demand with planned capacity. Its analyses considered capacity needs for 2015 and 2025 both with and without currently planned improvements. The 2025 estimates also assumed the successful implementation of NextGen air traffic control technologies that are expected to allow airports to process higher volumes of travel with their existing infrastructure.

The FACT 2 Report projects that, without planned improvements, four NEC Region airports in 2015 and six airports in 2025 will be capacity constrained (Table 30). Even with planned improvements, three airports in 2015 and five airports in 2025 will be capacity constrained (Table 31).[65] The 2010 ACRP report referenced in Section 4.3 estimated that a failure to accommodate this demand would increase congestion related costs at major NEC Region airports from $2.5 billion in 2007 to $7.1 billion in 2025 (Table 32).[66]

Table 30. Northeast Airports Requiring Additional Capacity If Planned Improvements Are Not Completed

	Without Planned Improvements 2015	Without Planned Improvements 2025
Boston Logan (BOS)		X
New York JFK (JFK)	X	X
New York LaGuardia (LGA)	X	X
Newark Liberty (EWR)	X	X
Philadelphia International (PHL)	X	X
Washington Dulles (IAD)		X

Source: FAA FACT 2 Report (2007).

Table 31. Northeast Airports Requiring Additional Capacity After Planned Improvements Are Completed

	With Planned Improvements 2015	With Planned Improvements 2025
Boston Logan (BOS)		
New York JFK (JFK)		X
New York LaGuardia (LGA)	X	X
Newark Liberty (EWR)	X	X
Philadelphia International (PHL)	X	X
Washington Dulles (IAD)		

Source: FAA FACT 2 Report (2007).

Table 32. Cost of Congestion at Major Airports with No Improvements: NEC Region
2007 and 2025

	Costs of Delay in 2007 (2007 $ Millions)	Costs of Delay in 2025 (2007 $ Millions)
Baltimore Marshall (BWI)	138	613
Boston Logan (BOS)	209	1,212
New York JFK (JFK)	633	1,343
New York LaGuardia (LGA)	299	1,082
Newark Liberty (EWR)	519	1,617
Philadelphia International (PHL)	289	533
Washington Reagan (DCA)	183	639
Washington Dulles (IAD)	182	82
Total	**2,452**	**7,121**

Source: ACRP 31, Innovative Approaches to Addressing Aviation Capacity Issues in Coastal Mega-regions, 2010.

5.2.4 Future Freight Demand

Freight volumes are expected to increase by nearly 40 percent across all modes with the greatest predicted growth for rail freight and air cargo.

The transportation system is shared by passenger and freight users and, as such, increased freight demand impacts both freight and non-freight users. Freight demand across all modes is projected to grow by 39 percent between 2007 and 2040.[67] Materials hauled into, out of, and within the Region by truck are projected to increase 37 percent by weight while those hauled by rail are projected to increase 67 percent by weight by 2040 (Table 33).

Table 33. Freight Tonnage Flows (In, Out, and Within) by Mode: NEC Region
2007 and 2040

Mode	2007 (Millions of Tons)	2040 (Millions of Tons)	Increase (Millions of Tons)	Percent Change
Truck	145,926	199,531	53,604	36.7%
Rail	12,816	21,375	8,559	66.8%
Air	40	131	90	223.5%
Other[a]	21,511	28,768	7,257	33.7%
Total	180,294	249,804	69,510	38.6%

Source: FHWA Freight Analysis Framework 3, ICAT.
[a] Includes water, mail, pipeline, multiple modes, and unknown.

6.0 Future Investments: Challenges and Opportunities

This section identifies the ***major challenges and opportunities for future investment*** in the transportation system of the NEC Region, focusing on the highway, railroad, and aviation systems. The purpose of this section is to describe the short- and long-term projects planned for the Region, including short-term projects that already have funding commitments. Overarching challenges facing regional transportation stakeholders will be the need to replace and rehabilitate aging assets and to address growing demand across modes that will outpace current and planned capacity.

Challenges and Opportunities for Future Investments

- Highways
  - Short- and long-term projects
  - Challenges
  - Opportunities
- Railroads
  - Short- and long-term projects
  - Challenge
  - Opportunities
- Aviation
  - Short- and long-term projects
  - Challenges
  - Opportunities

6.1 Highways

Short- and near-term investments in the highway system of the NEC Region are focused on preservation of aging infrastructure – especially bridges and interchanges. Some of these projects will increase the capacity of the system, but at current levels of investment, the improvements will not keep pace with the predicted growth in highway travel demand, resulting in more congestion.

Most existing highway plans in the NEC Region are focused on maintaining the current system with a limited number of projects dedicated to new capacity. With much of the highway infrastructure in the Region reaching the end of its original life expectancy, state departments of transportation (DOTs) are directing a significant share of their short- and long-term investments to renewal projects; very few are constructing or planning new, "greenfield" facilities. The most common types of highway investment projects currently underway in NEC Region include:

- ***Bridge Rehabilitation/Reconstruction.*** Bridge reconstruction projects are programmed throughout the NEC Region. The largest project in the coming years will be the Tappan Zee Bridge Replacement north of New York City. Other major projects include bridge replacements on the Cross Bronx Expressway (I-95) and the reconstruction of bridges on I-95 in Connecticut. Numerous smaller bridge projects also are planned.

- ***Interchange Reconstruction/Reconfiguration.*** Several interchanges in the NEC Region will undergo dramatic makeovers in coming years with the dual purpose of modernizing aging structures and adding new capacity at major bottlenecks. The largest planned interchange reconstruction is the Route 295/42/ I-76 Direct Connection in Camden, New Jersey. Other large-scale projects are planned for I-95 in Philadelphia, Delaware, and Connecticut.

- ***Managed Lanes Conversion.*** Transportation agencies are in the process of converting several sections of Interstate highway to expand existing managed lanes or include new managed lanes, typically express toll lanes and high-occupancy vehicle (HOV) lanes. Major projects include the I-95 Express Lanes in Northern Virginia, which will convert an existing two-lane HOV facility to a three-lane HOV and tolled express-lane facility, and the JFK Expressway (I-95) Express Lanes north of Baltimore.

- ***Widening Projects.*** Transportation agencies are widening several major roadways in the NEC Region. The single largest project is the widening of the New Jersey Turnpike between Exits 6 and 9, with a total cost of $2.7 billion.[68] Other major projects include the widening of U.S. 222 in suburban Philadelphia and the widening of I-66 in Northern Virginia from Manassas to Gainesville. The widening projects are intended to accommodate growing highway demand. There are relatively few projects of this nature.

While many highway projects are intended to tackle both state-of-good-repair and congestion relief objectives, an analysis of the Transportation Improvement Programs (TIPs) of the major metropolitan planning organizations (MPOs) and state DOTs of the NEC Region showed that transportation agencies have programmed a greater share of their near-term investments on projects addressing state of good repair over capacity-related projects. Typical state-of-good-repair projects include bridge rehabilitation, pavement maintenance, highway reconstruction, and other projects which extend the life of the existing system.[69] Few "greenfield" highway projects are in the planning stages in the NEC Region. One is in Virginia where the state is proposing to build a limited access highway that would connect I-95 in Prince William County to Dulles International Airport in Loudoun County.[70]

An examination of the long-range transportation plans in the NEC Region suggests that longer term investments (five or more years in the future) will largely mirror the short-term investments identified in the TIPs. Transportation agencies in the NEC Region are planning to continue focusing on state of good repair, fixing aging bridges, and maintaining pavements. The Delaware Valley Regional Planning Commission (Greater Philadelphia), for example, is following a "fix it first" philosophy, directing 90 percent of its long-term funding to highway maintenance projects and development of other modes and only 10 percent to new capacity projects.[71] Highway state-of-good-repair needs in the Philadelphia region alone through 2040 are estimated at roughly $19 billion.[72] Beyond state-of-good-repair projects, most long-range transportation plans include projects to rebuild or expand interchanges and study (but not yet plan, design, and construct) future options – including new highway facilities.

6.1.1 Challenges

Highway demand is forecast to grow faster than planned capacity additions in the future. State-of-good-repair needs are significant. The limited number of capacity projects will probably not be sufficient to maintain current highway performance. Highway investment needs are also likely to exceed available funds in the future.

Highway demand growth is forecast to continue to outpace capacity growth over the coming decades. Over the last 30 years, highway vehicle miles grew by approximately 103 percent while transportation agencies added only 38 percent more lane-miles.[73] This gap is expected to widen in the future, even with lower predicted VMT growth. According to the I-95 Corridor Coalition's ICAT model, total VMT may grow by 22 percent from 2000 to 2040.[74] Even if VMT grows at a slightly lower rate – matching the projected population growth rate of 13 percent from 2010 to 2040 – the gap between demand and capacity may still grow wider. In the Washington Metropolitan Area, for example, VMT is projected to grow by only one percent per capita by 2040. But with a projected 25 percent increase in population, and only a seven percent planned increase in roadway capacity, the percentage of congested lane-miles during the peak hours is expected to increase by 78 percent.[75]

To keep pace with projected VMT growth, transportation agencies would have to add another 14,000 lane-miles of highways and arterials to maintain today's ratio of lane-miles to VMT. Under the conservative assumption that VMT grows by only 13 percent (the forecasted population increase from 2010 to 2040), the

NEC Region's metropolitan areas would need to add 2,750 lane-miles of highways alone to maintain the current ratio of lane-miles to VMT.[76] At an estimated cost of between $14 and $78 million dollars per lane-mile to construct new highway capacity (depending on the nature and location of the infrastructure),[77] the cost of keeping pace with VMT growth on the freeways of the study area's major urban areas could be prohibitive. That cost would be compounded by challenges related to the limited availability of land for building new highways.

Even without adding capacity, state-of-good-repair needs on the NEC Region's roadway network are daunting. The condition of bridges is one measure of the overall need to replace or rehabilitate aging roadway infrastructure. Fourteen percent of roadway bridges in the NEC Region states listed in Table 34 are classified as structurally deficient, meaning engineers have identified a defect in the bridge's deck or support structure. These bridges require more frequent inspections to ensure safety, and can be subject to weight restrictions or eventually closed to traffic. The NEC Region states hold about 17 percent of the nation's structurally deficient bridges, but carry over 30 percent of the nation's traffic over structurally deficient bridges, almost 80 million cars each day.

Table 34. Structurally Deficient Bridges: NEC Region States
2013

State	National Rank	Total Bridges	Total Deficient	Percent Structurally Deficient	Daily Traffic on Structurally Deficient Bridges
Pennsylvania	1	22,667	5,543	24%	18,994,224
Rhode Island	4	754	156	21%	2,598,405
District of Columbia	16	242	31	13%	915,533
New York	17	17,420	2,170	12%	17,374,731
New Jersey	26	6,557	651	10%	11,285,681
Connecticut	27	4,169	406	10%	5,274,701
Massachusetts	28	5,132	495	10%	9,151,876
Virginia	31	13,769	1,251	9%	7,393,364
Maryland	40	5,286	364	7%	5,344,961
Delaware	42	862	53	6%	323,720
NEC Region Total		76,858	11,120	14%	78,657,196
National Total		604,995	66,405	11%	259,201,931

Source: 2013 FHWA National Bridge Inventory figures compiled by Transportation for America for The Fix We're In For: The State of Our Nation's Bridge, 2013.

Meanwhile, funding for highway projects has been dropping at the same time that the tide of highway infrastructure needs has been rising. The Federal gasoline tax ($0.184 per gallon) has not increased since 1993, so its buying power has weakened over time against inflation.[78] States levy their own gasoline taxes and supplement these funds with revenues from other sources, but it remains unclear if the total funding available – Federal and state – will be able to keep pace with maintenance and capital needs.

6.1.2 Opportunities

Some states in the NEC Region are exploring new methods to manage congestion and produce transportation revenues for highways and other infrastructure.

Transportation agencies in the NEC Region are advancing a number of different strategies to meet the challenges of the future on the Region's highway system. While state-of-good-repair needs will consume the greatest share of transportation resources, other programs are designed to meet other challenges, including capacity needs.

For example, agencies are investing in operations technology, such as electronic tolling and real-time delay information, to improve and actively manage traffic flow. The recently completed I-495 High-Occupancy Toll (HOT) lanes on the Washington Beltway exemplify this type of investment, which combines new capacity with technology that monitors traffic flow to dynamically manage demand through pricing. Because funding for new capacity is limited, these types of strategies, which leverage technologies and private sector investment in tolled lanes, may become more prevalent in the future. Another related strategy is the use of supply management approaches, like high occupancy vehicle lanes or special vehicle lanes for buses, such as those on I-66 in Northern Virginia or New York City's Lincoln Tunnel's Exclusive Bus Lane (XBL), which has been in operation for forty years.[79]

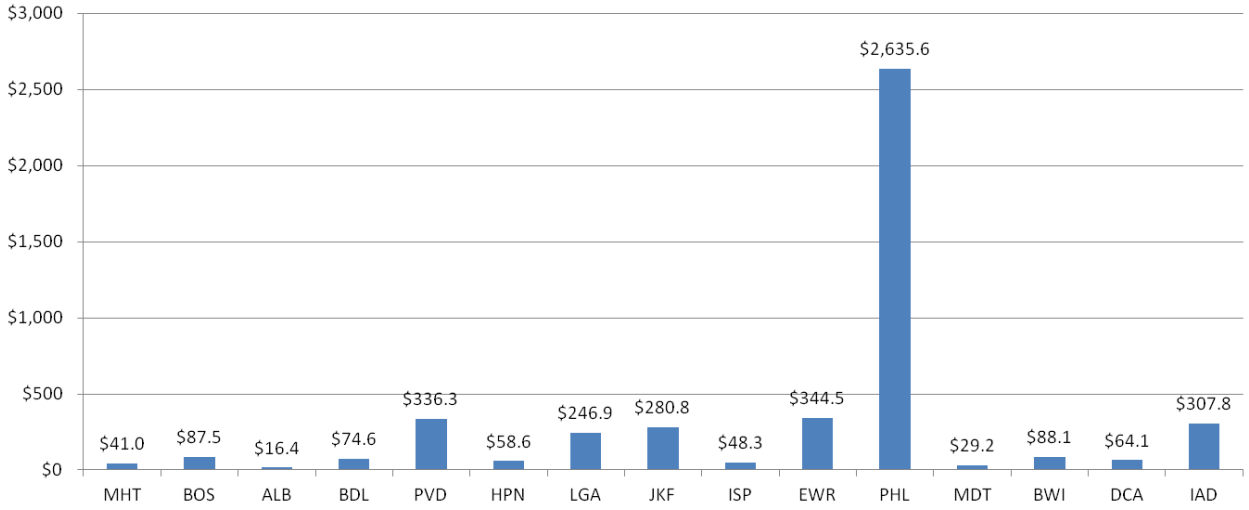
6.2 Aviation

While substantial capital investment is underway at airports in the NEC Region, the system capacity will be constrained by the small physical footprint of several of the major airports and overall airspace congestion, particularly in the New York and Philadelphia areas.

To meet growing demand and improve performance, airports in the NEC Region are making strategic investments in airport runway, taxiway, and terminal infrastructure. In addition to groundside and airside capacity issues, aviation system infrastructure in the NEC Region will require significant investment to keep pace with maintenance and rehabilitation costs.

One means of tracking investments in the intermediate term is through the Federal Aviation Administration's Airport Improvement Program (AIP), which provides grants to airport authorities for the planning and development of airports that are included in the National Plan of Integrated Airport Systems (NPIAS). The most recent summary of the AIP lists nearly $5 billion in eligible projects at major NEC Region airports between 2013 and 2017.[80]

Figure 29. ***Planned Airport Capital Developments: NEC Region***
2013 to 2017



Source: FAA Airport Improvement Program, 2013 to 2017.

However, the AIP is one of only several sources of funding that airports use for capital improvements. Near-term projects funded by a variety of sources include:

- ***Runway and Taxiway Improvements***. Runway and taxiway improvements increase the capacity of airports by providing more landing and takeoff slots, as well as more queuing space for airplane operations. One example of major near-term runway and taxiway improvements include the development of $32 million in high-speed taxiways at Newark Liberty International Airport. At T.F. Green Airport (Providence), runway safety improvements and the extension of Runway 5 to 8,700 feet are expected to be completed in 2017.[81] As part of a package of improvements, JFK is improving taxiways and navigational aids.[82] Massport has authorized $32 million to improve instrument landing systems and taxiways at Boston Logan.[83]

- ***Terminal Improvements.*** Airports across the NEC Region are renovating and improving terminals by adding new gates, expanding parking structures, reconfiguring existing facilities, and enhancing linkages to public transportation. Examples include Baltimore-Washington Thurgood Marshall International Airport, which is in the process of improving connections between Concourses B and C, and enhancing security in a $100 million project.[84] Planned improvements to John F. Kennedy International Airport include improvements centered on Delta Airlines' $1.2 billion expansion at Terminal 4 which is expected to be completed by 2015.[85] Massport has authorized a $931 million capital improvement program for Boston-Logan International Airport, which will fund runway safety improvements, renovation of Terminal B and improvements at other terminals, and security improvements with scheduled completion by 2017.[86] Dulles Airport currently is making modifications to handle wide body aircraft such as the Boeing 787 Dreamliner, the arrival of which is expected to strain baggage handling and passenger processing capacity.[87]

In the long term, some agencies are examining ways to relieve congestion by expanding service at smaller secondary airports. However, the Region has no greenfield sites under evaluation for major new airports. Long-term improvements at existing airports include the same broad categories as near-term improvements, but are dependent on available funding and future demand trends.

Examples of airport projects currently identified or planned by the Region—all of which, if constructed, would provide capacity expansion and passenger improvements—include:

- **Philadelphia International Airport** has the most ambitious long-term plans with a $6.4 billion Capacity Enhancement Program (CEP) to be completed in phases by 2025. Key improvements include:
    - Extension of two existing runways to 7,000 feet and 12,000 feet, respectively;
    - Construction of a new 9,100-foot runway;
    - Taxiway, lighting, and navigational aid improvements;
    - Reconstruction and expansion of existing terminals, and construction of a new commuter terminal; and
    - Expansion of parking facilities.
- **Hartford-Bradley International Airport** is planning to develop a new $600 million, 19-gate terminal, parking facilities, and on-airport car rental facilities.[88] Implementation of this plan is dependent upon materializing demand.[89]
- **La Guardia Airport** is planning to demolish the existing Central Terminal Building and replace it with a new 1.3 million-square-foot, 35-gate terminal building. Plans also include construction of new roadways and utilities throughout the airport, as well as improved field lighting.[90]
- **JFK Airport** is studying options for increasing capacity. A potential expansion into Jamaica Bay, proposed by Regional Plan Association, has been met with opposition from environmental groups and local residents and would pose high construction costs.[91]
- **Stewart Airport** may invest up to $450 million in building facilities over the next 15 years depending on market conditions.[92]
- **Washington-Dulles Airport** has long-term expansion plans that call for the development of a fifth runway, which will run parallel to an existing runway along the southern edge of Dulles Airport property. The fifth runway would be approximately 10,500-feet long and 150-feet wide. No date for completion or cost estimate is yet available.[93]

6.2.1 Challenges

Land, airspace, and funding constraints limit the ability of the NEC Region's airports to invest in new capacity.

Most major airports in the Northeast are highly land constrained due to adjacent water bodies and the density of their surrounding urban areas. JFK Airport has the largest footprint of any New York area airport, yet its land area has not changed significantly since opening in 1948.[94] According to a recent study by the Regional Plan Association (RPA), the only way major New York airports might expand is by creating new land in

adjacent waterways, which could be prohibitively expensive and environmentally damaging.[95] Similar constraints exist for Boston-Logan, Philadelphia, and Reagan-National airports.

Another major challenge for the future of aviation in the NEC Region is limited airspace capacity. In the New York City region, the FAA has placed limitations on some flights to alleviate airspace congestion, with flights to and from LaGuardia limited to a 1,500-mile perimeter. Groundside improvements can only do so much to relieve congestion without air navigation improvements. While Philadelphia International Airport is in the process of implementing major long-term groundside improvements, some stakeholders are concerned that air congestion may prevent the airport from fully realizing the benefits of expansion.[96]

6.2.2 Opportunities

Improvements in air navigation technology may ease some airspace constraints in the Region. Other opportunities to accommodate future aviation demand include increasing the efficiency of operations and growing operations at underutilized airports.

Technological advances could play a role in addressing some aviation system capacity challenges. The implementation of a precision navigation system is a key component of the FAA's Next Generation Air Transportation System (NextGen) and is expected to improve the total capacity of the system and the productivity of individual flights.[97]

Future efforts to accommodate demand may involve a shift in growth to underutilized, reliever airports to manage capacity at larger, more congested airports. The Port Authority of New York and New Jersey (PANYNJ) recently assumed operation of Stewart International Airport located about 55 miles north of New York City with the intention of expanding air service to the metropolitan area. A recent report by the Transportation Research Board identified several underutilized airports in the Northeast that could be developed into additional capacity. These include the Lehigh Valley International Airport; Atlantic City International Airport; Long Island MacArthur Airport; Stewart Airport; Westchester County Airport; and Tweed-New Haven Regional Airport.[98]

6.3 Railroads

Planned investments in the rail system of the NEC Region focus on bringing existing infrastructure into a state-of-good-repair while making improvements to accommodate growth. Improved coordination between rail operators, transit operators, and other modes has the potential to make the Region's rail system more efficient.

A regular schedule of maintenance and replacement of assets is required to keep a railroad in a state of good repair, defined as the condition in which aspects of physical infrastructure are functioning within their useful lives. Much of the passenger rail network in the NEC Region has long operated with many assets outside their useful lives, a condition referred to as having a backlog of deferred maintenance and replacement. The NEC Main Line and its connecting corridors require investment above and beyond normal maintenance and replacement to achieve a state of good repair where all assets are functioning within their useful lives. The backlog of needed repairs or replacements include both basic assets like track, undergrade bridges (short bridges across roadways or streams), electric systems, and signal systems, and major assets like tunnels in New York and Baltimore, and large movable bridges in Maryland, New Jersey, New York, and Connecticut. Many of these assets date back a century or more.

The other major issue facing both the intercity and commuter rail networks is capacity, which is especially scarce in the areas at and/or leading into Boston's South Station, New York's Penn Station, and Washington, D.C.'s Union Station. Though funding availability severely limits how many projects are advancing to construction, railroads of the Region are planning short- and long-term projects to address the state-of-good-repair backlog while providing new capacity to meet growing demand for intercity, passenger, and freight rail service.

- ***Bridge Rehabilitation/Reconstruction.*** Projects to replace or rehabilitate aging railroad bridges. The Portal North Bridge replacement project in New Jersey is designed and ready for construction,[99] but lacks funding for advancement. Other bridges are in various stages of planning and engineering.

- ***Station Improvements.*** Passenger railroads are undertaking a number of station improvements that will improve access, parking, and capacity. Examples of projects include platform expansions at NJ TRANSIT stations and major parking expansions at Virginia Railway Express stations.[100]

- ***Yard and Terminal Improvements.*** Railroads are undertaking projects to increase capacity for train storage, such as the new MARC Wedge Yard in Washington, or raise the elevations of facilities that are susceptible to flooding, including Norfolk Southern's Edgemoor Yard in Wilmington, Delaware.[101] Other projects will improve connectivity to other modes, such as CSX's Intermodal Terminal under development in Baltimore.[102]

- ***Safety and Signaling Improvements.*** Following Federal law, freight and passenger railroads are implementing Positive Train Control (PTC) on all railroads with passenger operations to improve collision avoidance. Signalization projects are also underway to improve operations and safety. A major component of SEPTA's Manayunk/Norristown Line Modernization Project is signalization improvements.[103]

- ***Rolling Stock.*** Rail agencies are rehabilitating existing coaches and locomotives, and purchasing new equipment to replace or expand capacity.

- ***System Capacity.*** To provide for growing demand, railroads are engaged in a number of projects to increase capacity, including sidings or additional tracks, such as the VRE third track project between Washington, D.C. and Fredericksburg, Virginia for freight and passenger rail and the Delaware Third Track Construction Project to add new track capacity along a stretch of the NEC in Delaware; grade separations to minimize train conflicts such as NJ TRANSIT's Hunter Flyover in Newark;[104] freight clearance projects such as CSX's Virginia Avenue Tunnel in Washington, D.C. to allow for double-stack freight trains; and upgrades to 286,000-pound weight limits to move heavier freight trains.[105]

- ***Power Improvements.*** Amtrak and the commuter railroads that operate on the NEC and other electrified lines are upgrading catenary wire and the delivery of power on electrified sections of the system. Railroads are also making improvements to traction power, including the NJ High-Speed Rail Improvement Program (NJHSRIP) by NJ TRANSIT and Amtrak between Trenton and New Brunswick to increase capacity, reliability, and speed on the NEC.[106]

Some major projects underway in the NEC Region span several of these categories, providing a combination of state of good repair, capacity, operational efficiency, safety, and other benefits through a package of investments. Currently, the NEC is benefiting from more than $1 billion in capital funding from the several Federal programs, including the American Recovery and Reinvestment Act (ARRA), the Transportation

Investment Generating Economic Recovery (TIGER) Grant Program, and the High-Speed Intercity Passenger Rail (HSIPR) Program. This money is funding the construction of projects, like the NJHSRIP, the New Haven-Hartford-Springfield Project in Connecticut and Massachusetts, and the Harold Interlocking Project in New York, that combine multiple state of good repair and improvement benefits. Those programs are also providing planning and engineering funds for other major projects, such as Susquehanna River Bridge in Maryland, Portal South Bridge in New Jersey, and the B&P Tunnel in Maryland. However, continuing availability of funding from programs like these is uncertain.

Several long-term planning efforts are or have been underway. Ten Northeastern states and Amtrak collaborated on the NEC Infrastructure Master Plan, published in 2010. That effort identified a list of capital projects that attempt to balance state-of-good-repair and system expansion needs by 2030 at a cost of $52 billion. Amtrak also released a Vision for the Northeast Corridor document in 2010 and an update in 2012 that outline more ambitious goals for 2040 that include next generation (NextGen) high-speed rail services in the Northeast, with speeds up to 220 miles per hour in some cases on greenfield alignments, up from brief stretches of 150 mile-per-hour service today. The 2012 update integrated projects from the NEC Master Plan with a total estimated cost of $151 billion (2011 dollars) by 2040. Commuter railroads also have long-range plans and needs assessments for infrastructure they own and operate in the NEC Region. Long Island Rail Road and Metro-North Railroad alone have a combined $22.3 billion in capital needs between 2015 and 2034.[107]

The Federal Railroad Administration (FRA) is now leading an effort called the NEC FUTURE program, which will complete a Tier 1 environmental impact statement (EIS) and a service development plan (SDP) to define, evaluate, and prioritize future investments for the NEC on a collaborative basis.[108] The NEC Commission is engaged in convening stakeholders for the NEC FUTURE program, as well as in the development of a shorter-term NEC Five-Year Capital Plan.

6.3.1 Challenges

Rail investments in the NEC Region are constrained by limited funding sources and the need for improvements to regional planning and cooperation. Other issues, including the high cost of construction and limited land availability, also affect the ability of railroads to make improvements to the system.

Railroads face significant challenges, including a backlog of state-of-good-repair needs, capacity constraints, and unreliable or insufficient funding. The railroads in the NEC Region also face a challenge in bringing existing assets to a state of good repair and making improvements because capacity constraints leave narrow windows available for maintenance and construction activities.

While a recent infusion of funding from special Federal programs has been beneficial, insufficient dedicated funding is one of the major challenges facing rail systems in the NEC Region. For many rail agencies, traditional funding levels will not be enough to meet state of good repair, let alone any increases in capacity to meet the projected growth in demand. A lack of funding predictability also decreases the efficiency of capital spending.

Coordination among the multiple jurisdictions and transportation agencies in the NEC Region is another challenge, as well as the high costs of construction and limited availability of land that challenge other modes. Like the highway and aviation systems, the rail system of the NEC Region largely serves densely developed areas. Expanding the existing rail right-of-way is costly, especially in urban areas. Greenfield alignments would be even more costly and challenging.

6.3.2 Opportunities

Rail system opportunities include the adoption of advanced technologies, potential operational efficiencies, and better coordination for near-term and long-term planning and investment.

Technology has already helped improve the rail system, ranging from systems that cut costs for operators to amenities like e-ticketing and real-time arrival/departure information that enhance the passenger experience. Additional opportunities exist to utilize technology for the benefit of both operators and passengers. Opportunities also exist to make systems more seamless, both between rail modes and to other modes, through integrated operations, synchronization of schedules and transfers, joint ticketing, and new services that connect existing markets on existing infrastructure in new ways.

Recent and ongoing planning activities aimed at achieving a state of good repair and making improvements represent increased regional coordination, with additional opportunities for collaboration moving forward. In the short term, Amtrak and the Northeast Corridor Commission are working with stakeholders throughout the Region to develop an NEC Five-Year Capital Plan that integrates planning and investment across all owners and operators of the NEC. Long-term planning is also increasingly collaborative in the NEC FUTURE program through the shared identification of goals and strategies for achieving them.

Endnotes

1 Bureau of Economic Analysis, 2010.

2 World Bank Gross Domestic Product Statistics, 2010.

3 Amtrak Ridership, 2011.

4 necfuture.com

5 Bureau of Economic Analysis, 2010.

6 Ibid.

7 Organization of Economic Cooperation and Development.

8 Bureau of Economic Analysis, 2010.

9 World Bank Gross Domestic Product Statistics, 2010.

10 Bureau of Economic Analysis, 2010.

11 U.S. Census Bureau American Community Survey, 2009.

12 Bureau of Labor Statistics, 2010.

13 Ibid.

14 U.S. Census Bureau, 2010.

15 U.S. Census Annual Estimates of the Resident Population for Counties, April 1, 2010 to July 1, 2012.

16 National Household Transportation Survey, 2009. http://nhts.ornl.gov/2009/pub/stt.pdf.

17 Cambridge Systematics estimates for 2012 using I-95 Corridor Coalition ICAT model and National Household Travel Survey Data.

18 Traffic Volume Trends Reports. Federal Highway Administration, 2004-2012.

19 2011 National Profile, National Transit Database. Federal Transit Administration. Based on 345 million annual commuter rail trips in the NEC Region vs. 461 million annual commuter rail trips in the U.S.

20 Ibid.

21 Adie Tomer "Transit Access and Zero-Vehicle Households," Metropolitan Infrastructure Initiative Series and Metropolitan Opportunity Series." http://www.brookings.edu/~/media/Files/rc/papers/2011/0818_transportation_tomer/0818_transportation_tomer.pdf.

22 Cambridge Systematics estimates for 2012 using I-95 Corridor Coalition ICAT model and National Household Travel Survey Data.

23 "Inbound Historic Visitation Statistics," U.S. Department of Commerce, International Trade Administration, available from: http://tinet.ita.doc.gov/.

24 Ron Nixon "Frustrations of Air Travel Push Passengers to Amtrak." http://www.nytimes.com/2012/08/16/business/hassles-of-air-travel-push-passengers-to-amtrak.html?src=me&ref=general&_r=0.

25 Rob Puentes, Adie Tomer and Joseph Kane "A New Alignment: Strengthening America's Commitment to Passenger Rail." Brookings Institution, 2012.

26 TranStats. Bureau of Transportation Statistics, 2000 to 2011.

[27] Flight Statistics, Port Authority of New York and New Jersey. http://www.panynj.gov/airports/pdf-traffic/ATR2011.pdf. Metropolitan Washington airports Authority. MassPort.

[28] TranStats. Bureau of Transportation Statistics, 2000 to 2011.

[29] Ibid. The national air traffic statistics compiled by the Bureau of Transportation Statistics (BTS) identify the origin airport and final destination airport of each trip, but the records do not identify transfer points – airports where passengers change planes en route. For example, a trip from Cleveland to Providence TF Green Airport with a transfer at Newark's Liberty Airport would be counted as an interregional trip, but the leg from Newark to Providence would not be counted as an intra-NEC Region trip. This means that the number of passengers flying each day between NEC Region airports is likely higher than the passengers reported in the BTS' national data.

[30] Maryland State Highway Administration (SHA). http://www.roads.maryland.gov/Truck_Volume_Maps/harford.pdf.

[31] FHWA Freight Analysis Framework 3, 2010.

[32] Amtrak NEC Master Plan, 2010.

[33] "CY 2011 All-Cargo Landed Weight for Fiscal Year 2013 Entitlements," FAA. http://WWW.FAA.Gov/Airports/Planning_Capacity/Passenger_Allcargo_Stats/Passenger/Media/Cy11_Cargo.Pdf.

[34] Urban Mobility Report. Texas Transportation Institute, 2012.

[35] Ibid.

[36] MBTA Scorecard. http://www.mbta.com/uploadedfiles/About_the_T/Score_Card/Scorecard-2011-01.pdf.

[37] MTA Long Island Rail Road (LIRR) and MTA Metro-North Railroad (MNR). Systemwide Service Standards. http://web.mta.info/mta/compliance/pdf/Title-VI-Railroad-Policies.pdf. New Jersey Transit Annual Report 2012. http://www.njtransit.com/pdf/NJTRANSIT_2012_Annual_Report.pdf.

[38] CTDOT Performance Measures http://www.ct.gov/dot/lib/dot/documents/dperformancemeasures/pmeasures2009q2.pdf.

[39] Regional Rail On-Time Performance. http://www.septa.org/service/rail/otp.html.

[40] "Summary Minutes MARC Riders Advisory Council Meeting, Thursday August 16, 2012." http://mta.maryland.gov/sites/default/files/minutes-2012-08-16.pdf.

[41] VRE On-Time Performance 2011. http://www.vre.org/about/company/releases/2011/OTP.pdf.

[42] Amtrak.

[43] Northeast Corridor Infrastructure Master Plan, 2010. SYSTRA calculations to convert from segments to miles.

[44] Setting On-Time Performance Targets at Congested Airports Could Help Focus FAA's Actions. Government Accountability Office, May 2010.

[45] Slot-Controlled Airports: FAA's Rules Could be Improved to Enhance Competition and Use of Available Capacity. Government Accountability Office, September 2012.

[46] Setting On-Time Performance Targets at Congested Airports Could Help Focus FAA's Actions. Government Accountability Office, May 2010.

[47] Moody's Analytics (www.moodysanalytics.com) provides economic research and data to inform business decisions. This study utilized Moody's forecasts for economic activity and population in the NEC Region. The forecast data is also being utilized by the NEC FUTURE project.

[48] Moody's forecast of Total Non-Farm Payroll, 2010 to 2040.

[49] Moody's forecast 2010 to 2040.

[50] Regional Plan Association. America 2050, Megaregions.

[51] Northeast Corridor Infrastructure Master Plan, 2010. Forecast extrapolated from 2030 to 2040.

[52] Terminal Area Forecasts. Federal Aviation Administration, 2012.

[53] I-95 Corridor Coalition, ICAT.

[54] Amtrak Press Release, FY11 Ridership Record, October 2011.

[55] National Transit Database. Federal Transit Administration, 2000 and 2010.

[56] Air Carrier Activity Information System. Federal Aviation Administration, 2000 and 2010.

[57] I-95 Corridor Coalition, ICAT.

[58] The I-95 Corridor Coalition Vision document does moderate the VMT growth projections taken from the 2006 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance (U.S. DOT, 2006) due to a number of demographic and economic trends that may have "played out" including female labor force participation, household vehicle availability, household size, household income growth, and female licensure rates, pages 2-15.

[59] Urban Mobility Report. Texas Transportation Institute, 2012.

[60] I-95 Corridor Coalition, ICAT. 2035 is the horizon year for the ICAT model, illustrated in the map. Region wide VMT growth by 2040 was extrapolated from 2035 projections.

[61] Northeast Corridor Infrastructure Master Plan, 2010

[62] Amtrak Vision for the Northeast Corridor, 2012 Update. 2040 ridership and increase over 2010 are based on Regional and NextGen high-speed rail ridership only. 2010 figures from the NEC Infrastructure Master Plan included other Amtrak services that utilize the NEC.

[63] Northeast Corridor Infrastructure Master Plan, 2010

[64] Supporting data from the Northeast Corridor Infrastructure Master Plan.

[65] An Analysis of Airports and Metropolitan Area Demand and Operational Capacity in the Future. Federal Aviation Administration, May 2007. http://www.faa.gov/airports/resources/publications/reports/media/fact_2.pdf.

[66] ACRP Report 31: Innovative Approaches to Addressing Aviation Capacity Issues in Coastal Mega-regions. National Academies, 2010.

[67] Freight Analysis Framework. Federal Highway Administration.

[68] FY 2012 Transportation Improvement Program. Delaware Valley Regional Planning Commission. http://www.dvrpc.org/tip/NJfinal/2012/TIP-Doc-NJ2012.pdf.

[69] Analysis of state department of transportation and metropolitan planning organization documents in the NEC Region including Massachusetts (2013-2016), Rhode Island (2013-2016), Connecticut (2012-2016), New Jersey (2013-2018), Maryland State Highway Administration and Office of Planning and Capital Programming, (2012-2017), District of Columbia DOT (2013-2018), Metropolitan Washington Council of Governments (2013-2018), Delaware Valley Regional Planning Commission (DVRPC), Wilmington Area Planning Council (2014-2017), New York Metropolitan Transportation Council (2011-2015), Capital District Transportation Committee (Albany) (2013-2018), Harrisburg Area Transportation Study (2012-2015).

[70] http://vtrans.org/northern_virginia_north-south_corridor.asp.

[71] Connections 2040 Transportation Investment Scenarios. Delaware Valley Regional Planning Commission, 2012. http://www.dvrpc.org/reports/13004.pdf.

[72] Ibid.

[73] Urban Mobility Report data from 1982 to 2010 for urban areas in the NEC Region. Texas Transportation Institute.

[74] I-95 Corridor Coalition, ICAT.

[75] 2012 Long Range Transportation Plan: Travel Demand. National Capital Region Transportation Planning Board. http://www.mwcog.org/clrp/performance/travel_demand.asp.

[76] Estimated future lane-mile needs using Texas Transportation Institute data.

[77] Federal Highway Administration. HERS-ST. http://www.fhwa.dot.gov/asset/hersst/pubs/tech/tech06.cfm. Costs inflated to 2013 using Bureau of Labor Statistics Inflation Calculator.

[78] When did the Federal Government begin collecting the gas tax? Federal Highway Administration. http://www.fhwa.dot.gov/infrastructure/gastax.cfm.

[79] The Lincoln Tunnel Exclusive Bus Lane. Port Authority of New York and New Jersey. http://www.panynj.gov/bridges-tunnels/lincoln-tunnel-xbl.html.

[80] Airport Improvement Program, 2013-2017. Federal Aviation Administration.

[81] "Construction," Green Airport, available from: http://www.pvdairport.com/corporate/construction.

[82] Rich Bockmann, "Delta prepares for Phase 2 of JFK expansion," *Queens Times Ledger,* February 16, 2013, available from: http://www.timesledger.com/stories/2013/7/deltaterminal_all_2013_02_15_q.html.

[83] "Massport Board Approves Billion Dollar Capital Program," Massport, February 21, 2013, available from: http://assets.listpilot.net/acina/files/Cap%20Prog%20News%20Release%202%2021%202013.pdf.

[84] Michael Dresser, "BWI plans a $100M expansion," *Baltimore Sun*, November 8, 2011, available from: http://articles.baltimoresun.com/2011-11-08/business/bs-bz-airport-plans-20111108_1_bwi-plans-paul-j-wiedefeld-airtran.

[85] Rich Bockmann, "Delta prepares for Phase 2 of JFK expansion," *Queens Times Ledger,* February 16, 2013, available from: http://www.timesledger.com/stories/2013/7/deltaterminal_all_2013_02_15_q.html.

[86] "Massport Board Approves Billion Dollar Capital Program," Massport, February 21, 2013, available from: http://assets.listpilot.net/acina/files/Cap%20Prog%20News%20Release%202%2021%202013.pdf.

[87] "Dulles expansion prepares airport for new wide-body jets" Washington Post, March 28, 2012. http://articles.washingtonpost.com/2012-03-28/local/35447868_1_international-passengers-dulles-airport-manager.

[88] Brian Dowling and Mara Lee, "New Bradley Terminal Would Nearly Double Airport Gates," *Hartford Courant*, July 10, 2012, available from: http://articles.courant.com/2012-07-10/business/hc-bradley-airport-expansion-20120710_1_murphy-terminal-new-terminal-parking-garage.

[89] Brian Dowling and Mara Lee, "A Glitzy Expansion Plan for Bradley-That Might Never Be Needed," *Hartford Courant*, July 23, 2012, available from: http://articles.courant.com/2012-07-23/business/hc-bradley-expansion-plans-20120719_1_airport-property-regional-airport-passenger-traffic.

[90] "LaGuardia Airport Central Terminal Building Redevelopment," Port Authority of New York and New Jersey, available from: http://www.panynj.gov/airports/lgactb/.

[91] "Lawmaker blasts possibility of expanding JFK Airport into Jamaica Bay: Opposition cites environmental damage and threat of bird strikes," *New York Daily News*, March 15, 2012, available from: http://www.nydailynews.com/new-york/queens/lawmaker-blasts-possibility-expanding-jfk-airport-jamaica-bay-article-1.1039123. "Local residents up in arms Over JFK runway expansion," *Queens Courier*, October 8, 2012, available from: http://queenscourier.com/2012/residents-up-in-arms-over-jfk-runway-expansion/.

[92] "An Airport Whose Time May Not Come," *New York Times*, Jan 30, 2011, available from: http://www.nytimes.com/2011/01/31/nyregion/31stewart.html.

[93] Metropolitan Washington Airports Authority.

[94] Upgrading to World Class – The Future of the New York Region's Airports. Regional Plan Association, 2011. http://www.rpa.org/pdf/RPA-Upgrading-to-World-Class-ES.pdf.

[95] Ibid.

[96] "Airport expansion estimate up $1.2B," *Philadelphia Inquirer*, October 7, 2011, available from: http://www.philly.com/philly/insights/in_money/20111007_Airport_expansion_estimate_up__1_2B.html.

[97] Fact Sheet – NextGen Goal: Performance-Based Navigation. http://www.faa.gov/news/fact_sheets/news_story.cfm?newsid=10856.

[98] ACRP Report 31: Innovative Approaches to Addressing Aviation Capacity Issues in Coastal Mega-regions. National Academies, 2010.

[99] New Jersey State Rail Plan. New Jersey Department of Transportation, 2012.

[100] Capital Improvement Projects. Virginia Railway Express. http://www.vre.org/about/projects/cip.html.

[101] Delaware State Rail Plan. Delaware Department of Transportation, 2011.

[102] Baltimore Rail Intermodal Facility. Maryland Department of Transportation. http://www.mdot.maryland.gov/Office_of_Planning_and_Capital_Programming/ICTF/Home.html.

[103] Manayunk/Norristown Line Modernization Project. Southeastern Pennsylvania Transportation Authority. http://www.septa.org/alert/man-nor-shuttle-details.html.

[104] New Jersey State Rail Plan. New Jersey Department of Transportation, 2012.

[105] Massachusetts State Rail Plan. Massachusetts Department of Transportation, 2010.

[106] New Jersey State Rail Plan. New Jersey Department of Transportation, 2012.

[107] Twenty-Year Capital Needs Assessment, 2015-2034. New York Metropolitan Transportation Authority.

[108] http://www.necfuture.com/.