3. Purpose and Need

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3. Purpose and Need

This chapter describes the purpose of and need for the NEC FUTURE program (NEC FUTURE). Passenger-rail services that operate along the Northeast Corridor (NEC) rail network are a critical component of the transportation system in the NEC FUTURE Study Area (Study Area) (see Chapter 2, Readers' Guide). By 2040, continued population and employment growth in the Study Area is expected to create increasing demand for travel options across the passenger transportation system—rail, air, auto, transit, and intercity bus. Yet the aging infrastructure and capacity limitations of the NEC already result in congestion and delays for daily commuters, and for regional[1] and interregional[2] travelers. Forecast growth in population and employment in the Study Area will put increasing pressures on this already constrained NEC rail network. NEC FUTURE will define a long-term vision to improve passenger rail service on the NEC in a manner that will enhance mobility options and expand passenger rail service in support of future population and employment growth in the Study Area.[3] This chapter documents existing and forecast deficiencies in the NEC rail network and defines the Purpose and Need for NEC FUTURE.

NEC FUTURE focuses on the passenger rail network, the needs of today's customers, and the changing demands of future travelers—all in the context of the broader multimodal transportation system.

3.1 OVERVIEW

The 457-mile NEC and its connecting rail corridors form the most heavily utilized rail network in the United States. The NEC ranks among the busiest rail corridors in the world, moving more than 750,000 passengers every day[4] on 2,200 trains operated by Amtrak and eight commuter railroads.[5] Ownership of the NEC is divided among Amtrak, MTA-Metro-North Railroad, Connecticut Department of Transportation, and Massachusetts. Freight operators share the NEC with passenger railroads and are responsible for the movement of over 350,000 car loads of freight per year on the NEC.[6] This volume of traffic and diversity of service today operates on an NEC with capacity constraints that require scheduled and real-time trade-offs in frequency, speed, and performance of passenger and freight services. The congestion caused by these capacity constraints limits operations and

[1] Regional trips (see Chapter 13, Glossary) refer to trips that start and end within the same metropolitan area.

[2] Interregional trips (see Chapter 13, Glossary) refer to trips that start and end in different metropolitan areas.

[3] Consistent with the long-term vision to improve passenger rail service on the NEC, NEC FUTURE focuses specifically on the need for improving passenger rail. Alternatives that specified modes other than passenger rail were eliminated early in the alternatives development process since they did not meet the Purpose and Need. However, the NEC FUTURE Action Alternatives are considered in the context of the multi-modal transportation system.

[4] Northeast Corridor Infrastructure and Operations Advisory Commission. (February 2014). *State of the Northeast Corridor Region Transportation System.* Northeast Corridor Infrastructure and Operations Advisory Commission.

[5] Amtrak. (2014). *NEC Maps & Data: Growing Demand for Rail Services in the Northeast*. Retrieved January 2015 from *http://nec.amtrak.com/content/growing-demand-rail-services-northeast*

[6] Northeast Corridor Infrastructure and Operations Advisory Commission. (February 2014). *State of the Northeast Corridor Region Transportation System.*

opportunities to improve or expand passenger rail services. The NEC's aging infrastructure further limits operations and constrains the ability to improve and expand services. This infrastructure, in many cases built over 100 years ago, does not provide the resiliency or redundancy necessary to respond to unanticipated natural disasters or other disruptive events.

Growth in population and employment in the Study Area combined with changes in travel preference will increasingly require a level of service, integration of services, capacity, and connectivity that is not supported by the existing NEC. Challenges to passenger rail travelers today include poorly coordinated transfers and unattractive service frequencies. A well-defined and coordinated investment program to support both preservation and enhancement of the NEC is essential to meet the needs of the NEC's passenger rail market in the coming decades.

An investment program is also critical to the economic health of the region to connect passenger and freight markets with established and growing business centers in the Study Area. Approximately 20 percent of the nation's gross domestic product (GDP) comes from areas within the Study Area,[7] making the NEC an economic engine for the nation. In fact, if the Study Area were an independent country, it would represent the fifth largest economy in the world.[8] The NEC is a key element of the mobility necessary to support economic activity in the Study Area. Failure to improve the NEC and address existing and forecast deficiencies will undermine the Study Area's global competitiveness.

3.2 DEVELOPMENT OF THE PURPOSE AND NEED

As part of the scoping process for this Tier 1 Draft Environmental Impact Statement (Tier 1 Draft EIS), the FRA requested public and agency input regarding the goals for the NEC and for the NEC FUTURE process. This initial input resulted in the identification of five broad goals, which were developed based on comments received during the NEC FUTURE Tier 1 Draft EIS Scoping process and through a series of public workshops known as the "December Dialogues" (see Chapter 11). These broad goals include the following:

- Provide attractive, equitable, competitive, high-quality, safe and reliable passenger rail service with the capacity and connectivity required to meet growing demand from existing and new markets
- Define an integrated passenger rail network that cost effectively strengthens intermodal passenger connections, maximizes the interoperability of existing and new infrastructure, and accommodates freight rail growth
- Develop a passenger rail investment plan that addresses near- and long-term mobility solutions and prioritizes critical NEC needs

[7] United States Department of Commerce, Bureau of Economic Analysis. (2015). *Regional Economic Accounts*. *http://www.bea.gov/regional/index.htm*

[8] Northeast Corridor Infrastructure and Operations Advisory Commission. (April 2014). *The Northeast Corridor and the American Economy. http://www.nec-commission.com/wp-content/uploads/2014/02/NEC_american_economy_report.pdf*

- Promote environmental sustainability with positive effects on transportation energy consumption and reduced vulnerability to climate change factors
- Maintain and enhance the economic viability of the region

These broad goals identified during scoping provided important input into the development of the purpose and need statement for this Tier 1 Draft EIS. The purpose and need statement incorporates all of the elements contained within the initial set of five goals. The purpose and need statement also incorporates, and was informed by, the overall goals for the NEC identified by the Northeast Corridor Infrastructure & Operations Advisory Commission (NEC Commission) pursuant to legislative direction in the Passenger Rail Investment and Improvement Act of 2008 (PRIIA) (49 USC 24905(b)). (See Chapter 1, Introduction, for more information regarding the NEC Commission and PRIIA.)

3.3 PURPOSE OF THE NEC FUTURE PROGRAM AND PROPOSED ACTION

The ***purpose*** of NEC FUTURE is to upgrade aging infrastructure and to improve the reliability, capacity, connectivity, performance, and resiliency of future passenger rail service on the NEC for both Intercity and Regional trips, while promoting environmental sustainability and continued economic growth.

The ***proposed action*** of NEC FUTURE evaluated in this Tier 1 Draft EIS is the adoption of an investment program to improve passenger rail service within the Study Area. Chapter 4, Alternatives Considered, describes the multistep alternatives development process undertaken in support of this Tier 1 Draft EIS. Each Action Alternative evaluated in this Tier 1 Draft EIS represents an investment program that articulates a different vision for the role of passenger rail services in the Study Area. As described further in Chapter 10, Phasing Implementation, it is expected that each Action Alternative would be implemented incrementally.

3.4 THE NEED FOR PASSENGER RAIL IMPROVEMENTS

The focus of NEC FUTURE is to meet current and future passenger rail transportation needs in the Study Area. For the purposes of analysis, the Federal Railroad Administration (FRA) established a planning horizon of 2040. However, the investments proposed in NEC FUTURE are likely to include infrastructure improvements expected to last well beyond 2040 and into the next century. Therefore, while 2040 is the horizon year, the FRA considered future needs of the NEC beyond the 2040 planning horizon in the development and analysis of alternatives.

The overall ***needs*** addressed by NEC FUTURE include aging infrastructure, insufficient capacity, gaps in connectivity, compromised performance, and lack of resiliency. **Addressing these needs is essential to support the reliability of the passenger rail system**. In addition, the FRA is committed to promoting environmental sustainability and economic growth. These needs are summarized below:

- **Aging Infrastructure**: The quality of service on the NEC currently falls short due to the aging and obsolete infrastructure that has resulted from insufficient investment to maintain a state of good

repair.[9] Aging infrastructure also increases the cost and complexity of continuing railroad operations. Achieving and maintaining a state of good repair is needed to improve service quality.

Aging infrastructure, insufficient capacity, and gaps in connectivity are each factors that degrade the overall reliability of passenger service on the NEC.

- **Insufficient Capacity**: Severe capacity constraints at critical infrastructure chokepoints limit service expansion and improvement as well as recovery from service disruptions, making it difficult to offer reliable service and accommodate growth in ridership. These constraints are further exacerbated by individual railroad operating practices,[10] which are driven by their individual policies or customer needs.
- **Gaps in Connectivity**: The reach and effectiveness of the passenger rail network are limited by gaps in connectivity among transportation modes and between different rail services. In some cases, rail services between stations require lengthy layovers or difficult transfers, limiting mobility options for passengers on the NEC. The railroads operating on the NEC today share the infrastructure but in many cases operate different equipment with different performance capabilities. Both infrastructure (track configuration, power source) and equipment (diesel, electric) further limit the ability to provide passengers with direct service to some city pairs along the NEC or via connecting corridors.
- **Compromised Performance**: In many markets, the travel times on passenger rail within the Study Area are not competitive with travel by air or highway. Improvements in train frequency, travel time and ticket price are needed to make passenger rail competitive with other modes.
- **Lack of Resiliency**: The NEC is vulnerable to the effects of sea level rise, severe storms, extreme heat events, and other unanticipated weather-related events. It is similarly subject to delay and suspension of service as a result of routine or emergency maintenance, often in portions of the passenger rail network without the redundancy necessary to respond to or compensate for these disruptions. As a result, both natural and human-caused events can result in extensive service disruptions and delays. Without sufficient resilience and redundant capacity to work around these events, the NEC is vulnerable and reduces the reliability of the region's transportation system.

The FRA will address the above needs in a manner that supports environmental policies and practices and promotes continued economic growth. Therefore, although not passenger rail specific needs, environmental sustainability and economic growth are important considerations for NEC FUTURE:

- **Environmental Sustainability**: Throughout the Study Area, energy use and emissions associated with transportation diminish the environmental quality of the built and natural environments. Expanding the availability of more energy-efficient transportation modes, including passenger

[9] State of good repair is a condition in which assets are fit for the purpose for which they were intended. American Public Transportation Association. (2013). *Defining a Transit Asset Management Framework to Achieve a State of Good Repair.* Washington, D.C.: American Public Transportation Association. Note: As part of Moving Ahead for Progress in the 21st Century Act (P.L. 112-141), the Federal Transit Administration is required to establish a definition of the term state of good repair.

[10] Operating practices include the specification of service levels, stopping patterns, dwell times, and equipment types.

rail, is need to support desired improvements in air quality and environmentally-friendly growth patterns.

4 **Continued Economic Growth**: A transportation system that provides options for reliable, efficient, and cost-effective movement of passengers and goods is needed to support continued economic growth, including the retention of, and increase in, jobs in the Study Area.

The overall ***needs*** addressed by NEC FUTURE are described in more detail in the rest of this section.

3.4.1 Aging Infrastructure

The NEC rail network dates back to the mid-1800s, with portions built as early as the 1830s.[11] Investments have been made over two centuries to maintain and improve that rail network to accommodate contemporary railroad operations. Examples of these investments include improvements to the track, signal and communications systems, overhead catenary and power systems, and the rolling stock (i.e., train equipment) itself. However, in recent decades these investments have fallen short of the improvements necessary to maintain system reliability or to add service to meet growing demand. Intercity[12] and Regional[13] rail service quality is constrained by numerous state-of-good-repair needs throughout the NEC. In 2010, Amtrak and the eight commuter railroads operating passenger services over the NEC rail network together identified approximately $9 billion in state-of-good-repair needs.[14]

Reliably meeting the demand of today's Intercity and Regional rail passengers requires a continued investment to maintain existing infrastructure and bring the NEC rail network to a state of good repair.

In January 2013, the NEC Commission[15] published *Critical Infrastructure Needs of the Northeast Corridor,*[16] which identified the most critical upgrades, by segment, necessary to renew and enhance the NEC: Washington, D.C., to Baltimore; Baltimore to Philadelphia; Philadelphia to Newark; Newark to New York City; New York City to New Rochelle; New Rochelle to New Haven; New Haven to Boston; and corridor-wide. As shown in Table 3-1, each segment faces capacity constraints and reliability challenges due to multiple chokepoints and state-of-good-repair needs. Examples of infrastructure beyond its useful life include the Baltimore and Potomac Tunnels (B&P Tunnels, built in 1873) in

[11] The Northeast Alliance for Rail. (2014). *Northeast Corridor*. *http://www.northeastallianceforrail.org/corridor/*

[12] Intercity rail refers to the passenger rail service that provides transportation between cities or metropolitan areas at speeds and distances greater than that of Regional rail (see Chapter 13, Glossary).

[13] Regional rail refers to the commuter or regional rail operators that serve journey-to-work and other travel within a metropolitan area (see Chapter 13, Glossary).

[14] The NEC Master Plan Working Group. (2010). *The Northeast Corridor Infrastructure Master Plan.* *http://www.amtrak.com/ccurl/870/270/Northeast-Corridor-Infrastructure-Master-Plan.pdf*

[15] Congress established the Northeast Corridor Infrastructure and Operations Advisory Commission (NEC Commission) to develop coordinated strategies for improving the Northeast's core rail network. The NEC Commission is governed by a board composed of one member from each of the NEC states (Maryland, Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, and Massachusetts) and the District of Columbia; four members from Amtrak; and five members from the U.S. Department of Transportation.

[16] Northeast Corridor Infrastructure and Operations Advisory Commission. (January 2013). *Critical Infrastructure Needs on the Northeast Corridor.* *http://www.nec-commission.com/wp-content/uploads/2013/01/necc_cin_20130123.pdf*

Maryland, 10 movable bridges in Connecticut, and the North River Tunnels (built in 1910) connecting New Jersey and New York City under the Hudson River. By way of example, when one of the two North River Tunnels is taken out of service to make required repairs, service disruptions are unavoidable. To minimize service disruptions during heavy weekday commuting periods, the repairs are done on weekends only. Repairing the tunnels in this fashion, however, reduces weekend service into New York from New Jersey, increases the cost of constructing the improvements, extends the timeframe needed to complete improvements, and constrains the ability to make all necessary improvements in a timely manner.

Table 3-1: Critical Infrastructure Needs on the Northeast Corridor

SOUTHERN REGION	CENTRAL REGION	NORTHERN REGION
Washington, D.C., Maryland, Delaware, Pennsylvania	**New Jersey and New York**	**Connecticut, Rhode Island, Massachusetts**
▪ Washington Union Station Improvements ▪ Ivy City Yard Facilities Renewal / Service & Inspection Expansion ▪ Grove to Hanson Fourth Track ▪ BWI Marshall Airport Improvements and Fourth Track ▪ B&P Tunnel Replacement ▪ Gunpowder River Bridge Replacement ▪ Bush River Bridge Replacement ▪ Susquehanna River Bridge Replacement ▪ Maryland Track Stabilization ▪ Wilmington Third Track and New Brandywine River Bridge ▪ Bellevue Flyover ▪ Philadelphia Interlocking Flyover	▪ Trenton Capacity Improvements ▪ North Brunswick Loop ▪ Elizabeth Area Improvements ▪ Hunter Flyover ▪ Newark to New York Fourth Track & High Line Bridges ▪ Portal Bridge ▪ Hudson River Tunnels ▪ Moynihan Station & Penn Station New York Capacity Improvements ▪ East River Tunnel Track Replacement & Signal Upgrades ▪ Sunnyside Yard Facilities Renewal and Service & Inspection Expansion ▪ Pelham Bay Bridge Replacement	▪ Cos Cob Bridge Replacement ▪ Norwalk River Bridge Rehabilitation ▪ Saugatuck River Bridge Rehabilitation ▪ Devon Bridge Replacement ▪ New Haven Mainline Catenary and Bridge Replacement Program ▪ MTA-Metro-North Railroad New Haven Communication and Signal Upgrades ▪ Connecticut River Shoreline Movable Bridge Replacement ▪ Massachusetts Third Track: Sharon to Attleboro Third Track & Readville to Canton Third Track ▪ Boston South Station Improvements ▪ Southampton Yard

Source: Northeast Corridor Infrastructure and Operations Advisory Commission. (January 2013). *Critical Infrastructure Needs on the Northeast Corridor*. *http://www.nec-commission.com/wp-content/uploads/2013/01/necc_cin_20130123.pdf*

Amtrak and the eight commuter railroads operate more than 2,200 trains a day over this aging infrastructure. [17] The difficulties of maintaining outdated infrastructure create daily service disruptions. As noted in the *Critical Infrastructure Needs* report, Amtrak reports that track and signal malfunctions are responsible for more than 50 percent of NEC delays.

[17] Amtrak. (2014). *NEC Maps & Data: Amtrak Competetive Advantage*. Retrieved January 2015, from Amtrak, The Northeast Corridor: *http://nec.amtrak.com/content/amtrak® competitive-advantage*

Incremental maintenance and repairs to address problems resulting from aging infrastructure have proven insufficient to address a backlog of needs; continued underinvestment will result in further service disruptions and degradations in service quality. A long-term vision and investment program is needed to make improvements in a unified and coherent way.

3.4.2 Insufficient Capacity

The NEC lacks adequate capacity to meet today's demand for rail service. Thus, it cannot accommodate the projected demand from growing regional population and employment. The capacity of the NEC is defined as the number of trains per hour (tph) or the volume of traffic passing through a rail segment. The NEC's capacity is a function of both track and station capacity. Chokepoints result where track or station capacities are insufficient to meet rail-service requirements or where operations and infrastructure are out of balance. Capacity chokepoints along the NEC have repercussions throughout the NEC since they limit the overall system capacity. Operating the NEC at or near capacity further limits each operator's ability to recover from unanticipated events, often resulting in service delays and reduced reliability.

3.4.2.1 Physical and Operational Constraints

Many segments of the NEC are operating at or near capacity. Of the 2,200 daily trains operated on the NEC, over 1,000 operate into and out of Penn Station New York (PSNY), which serves over 500,000 daily riders.[18] In peak hours, the volume of inbound traffic from west of the Hudson River into PSNY operates at the maximum capacity of 24 tph.[19] Operating at the limits of available capacity for sustained periods of time erodes any ability to recover from unanticipated events, which degrades the overall reliability and on-time performance of all services on the NEC.

The NEC is a shared operating environment with Intercity, Regional rail, and freight railroads operating different types of equipment at different speeds and stopping patterns. Combined with capacity-constrained infrastructure, the service attributes of the multiple operators further limit capacity. Sharing tracks constrains the ability for a rail operator to add capacity because the rail operator has to consider the operating requirements, stopping patterns, and capacity needs of other rail operators in the shared right-of-way. Between New Rochelle, NY, and Stamford, CT, current rail operations exceed 75 percent of capacity[20] (MTA-Metro-North Railroad's New Haven Line and Amtrak's Northeast Regional, Acela, and Shore Line East services share the same tracks). Disruptions on any one of these services can affect the operations of the others. Between Newark, DE, and Trenton, NJ, the Southeastern Pennsylvania Transportation Authority (SEPTA), NJ TRANSIT, and

[18] Northeast Corridor Infrastructure and Operations Advisory Commission. (January 2013). *Critical Infrastructure Needs on the Northeast Corridor.* *http://www.nec-commission.com/wp-content/uploads/2013/01/necc_cin_20130123.pdf*

[19] The maximum capacity of trains per hour in the peak period consists of 21 NJ TRANSIT regional passenger trains, and three Amtrak intercity trains. One of the North River Tunnels must be preserved for service operating in the outbound direction.

[20] The NEC Master Plan Working Group. (2010). *The Northeast Corridor Infrastructure Master Plan.* *http://www.amtrak.com/ccurl/870/270/Northeast-Corridor-Infrastructure-Master-Plan.pdf*

Amtrak also share the same tracks, which constrains scheduling and the ability to add capacity to this passenger rail network.[21]

Chokepoints on the NEC also exist where physical constraints, such as track geometry, or curvature of the tracks, require reduced-speed operations. Examples of this kind of capacity constraint include the B&P Tunnels that connect Baltimore Penn Station with points south, where trains are limited to operating at reduced speeds of 30 mph for two miles because of the tunnel's difficult track geometry.[22] As such, the B&P Tunnels constrain capacity of the passenger rail network in both directions (see Chapter 5, Transportation, Section 5.5, Environmental Consequences, for additional details). Without such a constraint, Intercity and Regional rail could operate more frequent service.

Within the infrastructure constraints of the NEC, capacity is further limited by the need to accommodate a range of different services, from express to local, Intercity to Regional rail, passenger to freight. For example, one of the more critical freight rail infrastructure needs is in Rhode Island, where Intercity, Regional rail, and freight share the same two tracks between Central Falls and Quonset. As passenger rail demand and corresponding passenger train volume grows, freight rail operations will become increasingly constrained.[23]

Intercity passenger rail capacity constraints and delays from congestion are a growing problem in the Study Area. The travel markets around Trenton, NJ; New York City; and Stamford, CT, are among the most congested along the NEC, where 36 percent of rail segments exceed 75 percent of practical capacity,[24] and 12 percent of rail segments exceed 100 percent of practical capacity.[25] Intensive development adjacent to transportation corridors and hubs further limits the space to expand the existing NEC track and station infrastructure to address congestion and capacity constraints. By 2030, the number of over-capacity NEC infrastructure segments is forecast to more than triple without substantial improvements and operational changes.[26] Without addressing these chokepoints, the NEC cannot accommodate peak-service increases.

3.4.2.2 Passenger Travel Growth and Changing Trends

Growing demand for travel in the Study Area will strain the capacity of the passenger rail system. Within the Study Area, the population of approximately 51 million is expected to grow by approximately 7 million and employment of approximately 24 million is projected to grow by

[21] Delaware Valley Regional Planning Commission. (2008). *Speeding Up SEPTA: Finding Ways to Move Passengers Faster.* *http://www.dvrpc.org/reports/08066.pdf*

[22] U.S. Department of Transportation Federal Railroad Administration. (2005). *Baltimore's Railroad Network: Challenges and Alternatives.* U.S. Department of Transportation Federal Railroad Administration.

[23] Department of Administration, Division of Planning, Statewide Planning Program. (2014). *Rhode Island State Rail Plan 2014, Report 117: State Guide Plan Element 661.* *http://www.planning.ri.gov/documents/trans/Rail/RI_State_Rail_Plan_2014.pdf*

[24] Capacity is the number of trains that can pass through an area in a certain period of time, depending on quantity and configuration of tracks. Practical capacity considers factors such as possible disruptions, maintenance, human decisions, weather, equipment failures, supply and demand imbalances, and seasonal demand. Association of American Railroads. (2007). *National Rail Freight Infrastructure Capacity and Investment Study.* Cambridge Systematics, Inc.

[25] The NEC Master Plan Working Group. (2010). *The Northeast Corridor Infrastructure Master Plan.* *http://www.amtrak.com/ccurl/870/270/Northeast-Corridor-Infrastructure-Master-Plan.pdf*

[26] Ibid.

approximately 3 million from 2012 to 2040, representing a 14 percent growth in population and 13 percent growth in employment throughout the Study Area.[27] Projected growth in specific areas such as the Washington, D.C., Philadelphia, New York City, and Boston markets is significantly higher. This increase in overall population and employment will result in a growth in total Intercity trips on all modes within the Study Area of 159 million to 183 million per year by 2040—an increase between 10 and 26 percent.[28]

As an example, for Intercity rail services (Acela and Northeast Regional trains) operated by Amtrak between Washington, D.C., and Boston, passenger demand often exceeds capacity. Amtrak manages this demand by varying ticket prices when demand is highest. During these peak travel times, Amtrak often operates "sold out" trains, reaching the limit of available capacity on the train equipment and track infrastructure. These capacity limitations of both infrastructure and equipment limit passenger rail's ability to serve the growing interregional travel market.

Regional travel trends over the past three decades have already put new pressures on the aging and capacity-constrained infrastructure of the NEC. Both NJ TRANSIT and MTA-Long Island Rail Road (LIRR) have seen dramatic increases in off-peak travel into PSNY (Table 3-2).[29] The LIRR experienced small decreases in AM peak travel (7:00–9:00 a.m.) but did see increases in the shoulders of the peak (6:00–7:00 a.m. and 9:00–10:00 a.m.). Overall, LIRR growth between 1990 and 2012 was largely caused by a 50 percent increase in off-peak travel. Similarly, while NJ TRANSIT experienced the most significant growth in the AM peak in terms of actual numbers, the percentage increase in off-peak travel was nearly four times the ridership in 1990.

Table 3-2: Peak and Off-Peak Weekday Inbound Commuter-Rail Arrivals at Penn Station New York (1990–2012)

Time Period	1990	1995	2000	2005	2010	2012	% Change 1990–2012
Total AM Peak (6-10)	104,177	104,389	127,564	125,670	126,502	127,795	23%
Total AM Peak (7-9)	81,925	80,490	96,557	88,812	88,351	88,303	8%
Total Shoulders	22,252	23,899	31,007	36,858	38,151	39,492	77%
Total All Day	132,687	134,274	171,982	174,488	184,586	180,343	36%
Total Off-Peak	28,510	29,885	44,418	48,818	58,084	52,548	84%
Pct. Peak Travel	79%	78%	74%	72%	69%	71%	-10%
Pct. Off-Peak Travel	21%	22%	26%	28%	31%	29%	36%

Source: New York Metropolitan Transportation Council, Hub Bound Travel, January 2014. MTA-Long Island Rail Road and NJ TRANSIT arrivals

Changing trends in highway travel are also likely to add demand for passenger rail. A decrease in highway travel demand is driven in part by the changing travel behavior of the Baby Boom generation

[27] Moody's Analytics, Inc. (2012), *U. S. County Forecast, December 2012*

[28] NEC FUTURE (2014) and Moody's Analytics, Inc. (2012).

[29] New York Metropolitan Transportation Council. (2014). *Hub Bound Travel*. *http://www.nymtc.org/data_services/HBT.html*

(born between 1946 and 1964) and Generation Y or Millennials (persons born after 1980). Both Baby Boomers and Millennials are increasingly choosing to live in urban areas where they have readily available access to public transportation.[30] Among the Baby Boom generation, the number of private-vehicle trips rose sharply through the 1970s and 1980s but began to decline after 1995, while transit trips increased steadily and increased significantly between 2001 and 2009.[31] Between 2001 and 2009, the number of public transportation trips by persons 65 and older increased approximately 51 percent.[32] Similarly, Millennials are driving less and using public transportation more than generations before them.[33]

In addition to increases in Intercity and Regional rail trips, overall population and economic growth in the Study Area is expected to generate growth in goods movement and associated freight movement. The existing freight rail moves approximately 400 million tons of freight in the Study Area annually.[34] As the population of the Study Area continues to grow, so too will the absolute volume of freight. Estimates from the Federal Highway Administration's Freight Analysis Framework predict that by 2040, freight movement to and from the eight states and Washington, D.C., included in the Study Area will increase by 34 percent over 2010 totals, including 31 percent and 26 percent increases in truck and freight rail volumes, respectively.[35]

Current conditions make it difficult to both accommodate existing Intercity and Regional rail passengers and attract new riders. The NEC's limited track capacity and aging infrastructure is unable to deliver the quantity and quality of service needed today. If unchanged, these conditions will prevent the NEC from achieving its potential in accommodating future Intercity and Regional rail transportation demand.

3.4.3 Gaps in Connectivity

The existing NEC is the backbone for Intercity and Regional rail service between Washington, D.C., and Boston, and to connecting corridors. The effectiveness of this comprehensive passenger rail network is further limited by gaps in connectivity. Connectivity gaps exist where service, infrastructure, or equipment does not accommodate trips that require transfers between modes, such as air-to-rail or Intercity-to-Regional rail connections. The reach and effectiveness of the passenger rail network could be further expanded with improved accessibility and connectivity both within the NEC rail network and between the NEC and the multimodal transportation system.

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[30] Baxandall, P., & Dutzik, T. (Spring 2013). *A New Direction: Our Changing Relationship with Driving and the Implications for America's Future.* U.S. PIRG Education Fund.

[31] McGuckin, N., & Lynott, J. (October 2012). *Impact of Baby Boomers on U.S. Travel, 1969 to 2009.* Washington, D.C.: AARP Public Policy Institute.

[32] Transportation for America. (2011). *Aging in Place, Stuck Without Options: Fixing the Mobility Crisis Threatening the Baby Boom Generation.* Transportation for America.

[33] Baxandall, P., & Dutzik, T. (Spring 2013). *A New Direction: Our Changing Relationship with Driving and the Implications for America's Future.* U.S. PIRG Education Fund.

[34] Northeast Corridor Infrastructure and Operations Advisory Commission. (April 2014). *The Northeast Corridor and the American Economy.* Northeast Corridor Infrastructure and Operations Advisory Commission.

[35] U.S. Department of Transportation, Federal Highway Administration. (2012). *Freight Analysis Framework: FAF3*. Retrieved January 2015, from Freight Management and Operations: *http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/*

3.4.3.1 Air-to-Rail Connections

In markets that exhibit high-quality connectivity between Intercity service and airports, rail service complements air travel. This connectivity increases the number of markets served by the combined air-to-rail mode and provides access to and from the airports. Airlines are increasingly turning to these complementary rail connections to improve airport access, to address capacity constraints at busy airports, and to provide redundancy necessary to accommodate travelers when inclement weather or other service issues limit air travel. In Europe and Asia, rail systems have been successfully integrated with aviation systems. This results in a rail system that gains more riders going to an airport for longer-distance flights, and an air system that gets better-quality ground access for its air passengers.

Forecast growth in air travel will add pressure to an already constrained aviation network, resulting in increased air traffic congestion in the Study Area. By 2040, enplanements at Newark, Boston, and New York City are projected to grow approximately 83, 81, and 79 percent, respectively, making them among the fastest-growing airports nationally.[36] The top four most delay-prone airports in the country are also found in the Study Area.[37] The percentage of delayed flights caused by heavy air traffic volume has increased by approximately 44 percent over the past decade, with approximately 31 percent of all delayed flights in the Study Area caused by heavy traffic volume.[38] However, improved rail capacity and connectivity that complements air travel could alleviate congestion on the aviation network.

A recent study by the Airport Cooperative Research Program concluded that, when looking at air and rail together in Europe, rail serving in a complementary mode with air had higher numbers of passengers than the number of air passengers diverted from air to rail.[39] Specifically, the study documented approximately 6 million[40] air passengers who had been diverted to Intercity-Long Distance service, and approximately 26 million[41] air passengers who had gained access to the airport using Intercity service. This suggests that Intercity rail can provide key access to airports offering long-distance or international flights. Several such airports are located within the large metropolitan areas along the NEC: BWI Marshall Airport, Philadelphia International Airport, Newark International Airport, and JFK International Airport. As such, there is potential for growth in Intercity rail service on the NEC to these international airports.

[36] Federal Aviation Administration: Forecast and Performance Analysis Division. (2014). *Terminal Area Forecast Summary: Fiscal Years 2013-2040.* Federal Aviation Administration.

[37] United States Department of Transportation Bureau of Transportation Statistics. (2012). *Chronically Delayed Flights*. Retrieved April 2012, from Bureau of Transportation Statistics.

[38] United States Department of Transportation Bureau of Transportation Statistics. (2015, February). *Airline On-Time Statistics and Delay Causes*. Retrieved 2015, from Bureau of Transportation Statistics.

[39] Airport Cooperative Research Program. (2015). *ACRP Report 118: Integrating Aviation and Passenger Rail Planning*. Washington, D.C.: Transportation Research Board

[40] Ibid. Table 4.1, page 55

[41] Ibid. Table 1.1, page 3

3.4.3.2 Rail-to-Rail Connections

Nearly all of the Intercity and Regional rail stations along the NEC provide travelers with rail-to-rail connectivity. As shown in Chapter 5, Transportation, 90 percent of the NEC Intercity stations connect to Regional rail service and 90 percent connect to local transit. However, many of these types of connections suffer from a lack of coordinated service, infrequent service, or insufficient infrastructure to make convenient connections. For example, BWI Marshall Airport Station connects Amtrak's Intercity service with the Maryland Area Regional Commuter (MARC) service. However, the station, track, and platform configuration makes transfers difficult for passengers and restricts the frequency of service, which hinders the experience for both Intercity and Regional rail passengers.[42]

Several different owners and operators share responsibility for delivering passenger and freight rail service along the NEC. The different operating requirements for Intercity, Regional rail, and freight railroads, in combination with their specific service requirements, affect the connectivity and reliability of Intercity and Regional rail service overall. Each of the rail operators sets its own schedules within the constraints of existing network capacity and fleet availability, uses its own equipment, and manages its own ticketing systems. The result is a fragmented network that limits connectivity. Rail service providers have responded to passenger needs with a variety of transportation options that are sometimes uncoordinated with other providers and can be inefficient in how they consume available transportation infrastructure capacity.

The division of ownership of the NEC among numerous institutions complicates the coordination necessary to improve service to existing markets or reach new markets. As a result, passenger rail options are limited in some markets. For example, Regional travel between Philadelphia and points north of Trenton, NJ, requires a transfer between NJ TRANSIT and SEPTA in Trenton. An approximately 20-mile gap in MARC and SEPTA service between Perryville, MD, and Newark, DE, limits rail travel between these points and between markets south of Perryville and north of Newark. In New York City, Regional rail passengers arriving from west of the Hudson River must take local transit to travel east of the Hudson River. Likewise, Regional rail passengers arriving from east of the Hudson River must take local transit to travel west of the Hudson River.

In some instances, incompatible infrastructure, such as different rail power delivery systems, inconvenient pedestrian connections between modes, or operating limitations create inefficiencies for operations and passenger travel. For example, passenger rail service operating north of New Haven, CT, on the NEC currently requires a change in equipment from electric to diesel to continue north along the New Haven-Hartford-Springfield line, increasing travel times for passengers.

3.4.4 Compromised Performance

Travelers in the Study Area have a range of travel options. In many markets, however, Intercity passenger rail is not competitive with travel by air or highway. Congestion on passenger rail and concerns regarding reliability further erode the ability of passenger rail to offer time-competitive

[42] Northeast Corridor Infrastructure and Operations Advisory Commission. (January 2013). *Critical Infrastructure Needs on the Northeast Corridor.* Northeast Corridor Infrastructure and Operations Advisory Commission.

travel. Improvements in travel times, frequency of service, or span of service are necessary to make passenger rail competitive with other modes.

As shown in Table 3-3, for trips among the major markets of Washington, D.C., Philadelphia, New York City, and Boston, travel by air offers faster travel times than passenger rail. Furthermore, in certain markets, passenger rail is not price-competitive with air and highway travel. Particularly in markets served by discount air carriers, fares are often 30–50 percent below rail fares although travel times may be comparable.

Table 3-3: Comparative Travel Times by Mode

Travel Mode	Average Travel Time (h:mm)			
	Washington, D.C. – New York City	New York City – Boston	Washington, D.C. – Philadelphia	Boston – Philadelphia
Air	1:50	1:40	1:20	2:10
Highway	5:20	5:30	3:20	7:00
Rail: Northeast Regional	3:20	4:20	2:00	6:00
Rail: Acela	2:50	3:30	1:40	4:50

Source: NEC FUTURE team, 2015
Notes:
1. Air and Rail: average weekday travel times for city center to city center interchanges
2. Highway: average weekday travel times, accounting for free-flow and congested traffic conditions

Contributing to the compromised performance is the shared use of track by the Intercity and Regional rail operators. The mix of Intercity and Regional rail services with different service and operating attributes reduces the practical capacity of the existing NEC. Faster Intercity trains must pass slower Regional trains; Intercity-Express trains are slowed down by following trains making local stops. This shared use of track requires carefully managed and coordinated schedules by the Intercity and Regional rail operators to support reliable train operations, often limiting when trains can operate and where they can stop. SEPTA, for example, experiences slow speeds caused by capacity constraints from shared track with Amtrak and NJ TRANSIT at many points throughout its rail network.[43]

In addition, the use of the NEC by freight operators exacerbates the issue of shared track for passenger rail. In Massachusetts, Rhode Island and Connecticut, for example, portions of the NEC mainline tracks are shared during daytime hours by both freight and passenger rail. This creates challenges for scheduling and dispatching, especially on heavily traveled routes such as between Rhode Island and Connecticut where the Providence and Worcester Railroad Company freight trains serve local shippers on the same line used for higher-speed Intercity and Regional passenger services.

Consistent with Section 3.4.2, Insufficient Capacity, capacity constraints create a congested passenger rail network, which affects reliability. Reliability is measured by on-time performance, which reflects how often passenger trains arrive at their destinations on time.[44] The most recent

[43] Delaware Valley Regional Planning Commission. (2008). *Speeding Up SEPTA: Finding Ways to Move Passengers Faster.* Delaware Valley Regional Planning Commission.

[44] On-time performance is a measure of train performance. It is calculated by taking the total number of trains arriving "on-time" at its last stop, divided by the total number of trains operated, and expressed as a percent. A train is considered "on-

performance results shows that Acela Express trains arrive on time approximately 74 percent of the time, while Northeast Regional trains arrive on time approximately 80 percent of the time.[45] This is well below Amtrak's on-time performance goal of 95 percent for Acela Express trains, and 90 percent for Northeast Regional trains.[46] A primary cause of delays, accounting for approximately 24 percent and 26 percent of all delays on Acela Express and Northeast Regional, respectively, involves train interference, which is caused by freight, Regional rail, and other Intercity passenger train movements.[47]

3.4.5 Lack of Resiliency

Resiliency of the NEC passenger rail network is based on its ability to continue to function even during unanticipated outages, catastrophic, or weather-related events. The resiliency of the NEC is constrained by poor infrastructure, capacity, and redundancy, all of which are necessary to plan for and maintain operations during unplanned events. System redundancy is needed to support the reliability of the transportation system in the Study Area and to ensure that it is resilient and adaptable to changing circumstances. In the event of the unforeseen loss of essential network links, the availability of redundant components provides the necessary back-up that can maintain the services on which the economies of the larger urban areas depend (see Section 3.4.7, Economic Growth).

The NEC Commission's *Critical Infrastructure Needs* report has identified the need for additional capacity and redundancy, particularly under the Hudson River to/from New Jersey and New York City.[48] With only two single-track tunnels for in- and outbound service, any events that may affect the tunnel infrastructure and render it unusable would adversely affect not only service between New Jersey and New York City, but also service between any two points north and south of New York City on the NEC. In October 2012, all Intercity and Regional rail service that runs through these tunnels was suspended for several days as a result of flooding from Superstorm Sandy. This and other Intercity and Regional rail passenger rail disruptions caused by flooding in the New York City metropolitan area increased pressures on other modes.[49]

In addition, redundancy in parts of the rail network is needed to minimize service disruptions while maintaining and upgrading the NEC infrastructure. Redundant rail infrastructure provides not only additional capacity, but also flexibility for service operators to manage the challenges of maintaining

time" if it arrives at its last stop within an allowed number of minutes of its scheduled time. Amtrak. (2015). *Route Performance Glossary of Terms*. Retrieved February 2015, from Amtrak: *http://www.amtrak.com/servlet/Satellite?c=AM_Content_C&cid=1241245662251&pagename=am/Popup*

[45] Amtrak. (2015). *Route Performance*. Retrieved February 2015, from Amtrak: *http://www.amtrak.com/historical-on-time-performance*

[46] The NEC Master Plan Working Group. (2010). *The Northeast Corridor Infrastructure Master Plan.* Washington, D.C.: NEC Master Plan Working Group.

[47] Amtrak. (2015). *Route Performance*. Retrieved February 2015, from Amtrak: *http://www.amtrak.com/historical-on-time-performance*

[48] Northeast Corridor Infrastructure and Operations Advisory Commission. (January 2013). *Critical Infrastructure Needs on the Northeast Corridor.* Northeast Corridor Infrastructure and Operations Advisory Commission.

[49] Hanson, M., Kaufman, S., Levenson, N., & Qin, C. (November 2012). *Transportation During and After Hurricane Sandy.* New York, NY: Rudin Center for Transportation, NYU Wagner Graduate School of Public Service.

and upgrading infrastructure under operating conditions, where around-the-clock service prohibits shutting down service for maintenance or other activities.

Extreme weather events have become more commonplace. Severe storms have revealed both the vulnerability of the existing rail infrastructure and the lack of resiliency of that infrastructure to withstand flooding and other damage associated with storm surge events, such as Hurricane Irene or Superstorm Sandy. As described in the Coastal Resources section (Chapter 7.5, Hydrologic/Water Resources) approximately 40 percent of the NEC is located within a coastal zone, where the tracks are vulnerable to rises in sea level. Within Delaware and Connecticut, 100 percent of the NEC is located within a coastal zone, and in Pennsylvania nearly 60 percent is located within a coastal zone. To protect the rail transportation infrastructure and keep the riding public safe, Amtrak and Regional railroads operating along the NEC have had to shut down service in anticipation of severe storms. In other cases, the overhead catenary systems or power supplies are vulnerable to severe winds or flooding. In extreme heat events, railroad tracks can buckle and become distorted, which may cause derailments. To reduce the risk of track buckling and train derailment during a heat event, Amtrak and the commuter railroads operating along the NEC temporarily reduce train speed, which is costly since that action affects the schedule, reduces service quality, and affects time-sensitive freight rail shipments.[50]

The destruction caused by Hurricane Irene and Superstorm Sandy has raised awareness of the vulnerability of the NEC and connecting services as well as the need to improve resiliency and to provide redundancy to create a more sustainable rail network.

3.4.6 Environmental Sustainability

There is national, regional, state, and local interest in how the transportation system, and in particular the rail network, can positively contribute to the overall environmental quality of the region. A coalition of Northeast and mid-Atlantic states created the Transportation and Climate Initiative[51] to consider the linkages between passenger and freight transportation and environmental benefits such as reductions in greenhouse gas (GHG) emissions. Individually, several Northeast cities are taking similar steps to develop climate action plans.[52]

As described in Chapter 7.13, Air Quality, almost every county along the NEC, except for counties in Rhode Island and Massachusetts, fails to meet the National Ambient Air Quality Standards for one or more criteria air pollutants, such as ozone, carbon monoxide, and particulate matter. Air pollutants and GHG can be harmful to human or animal health, reduce the productivity of crops or natural vegetation, and contribute to climate change. Transportation is a major source of air pollutants and

[50] Safety Advisory 2012-03; Buckling-Prone Conditions in Continuous Welded Rail Track. (2012, July 16). *Federal Register, 77, No. 136*, 41881. Retrieved from *http://www.gpo.gov/fdsys/pkg/FR-2012-07-16/pdf/2012-17343.pdf*

[51] The Transportation and Climate Initiative is regional collaboration of 12 Northeast and mid-Atlantic jurisdictions that seeks to develop the clean energy economy and reduce greenhouse gas emissions in the transportation sector. Georgetown Climate Center. (2012). *Transportation & Climate Initiative of the Northeast and Mid-Atlantic States*. Retrieved January 21, 2015, from Georgetown Law: *http://www.georgetownclimate.org/state-action/transportation-and-climate-initiative*

[52] Baltimore Commission on Sustainability. (2013). *Baltimore Climate Action Plan.* Baltimore, MD: Balitmore City Planning Commission.

GHG emissions. Increasing rail's role in serving Intercity and Regional rail modes could reduce environmental impacts from transportation sources of air pollutants. As described in Chapter 7.14, Energy, Intercity and Regional rail consume less energy per passenger mile than do automobiles and other modes of transportation.

The Northeast's overall high-density settlement pattern is a legacy of an era before widespread use of the automobile. Settlement patterns of recent decades consistent with widespread use of the automobile are typically land-intensive, low-density developments. As previously discussed, substantial population and employment growth of more than 10 percent is expected within the Study Area through 2040. If this future growth is accommodated in the land-intensive manner of recent decades consistent with widespread use of the automobile, there will be greater development pressure on ecological and natural systems, resulting in the loss of important rural and open spaces.

There is also the need to invest in expanded NEC passenger rail service to complement local efforts to promote transit-oriented development. Throughout the Study Area, local and statewide policies, initiatives, and plans call for increased emphasis on passenger rail and transit-related land use changes. The Capitol Region Council of Governments—a metropolitan planning organization that includes Hartford, CT—has identified recommendations and land use plans to encourage transit-oriented development.[53] Such recommendations and plans support goals to protect and preserve wildlife and water resources from land-intensive development patterns. Similarly, the New Jersey State Development and Redevelopment Plan identifies goals and objectives for transit-supportive development to protect and preserve environmentally sensitive areas.[54] A majority of Americans surveyed (56 percent) prefer smart-growth communities with nearby access to public transportation, compared to communities where public transportation is distant or unavailable.[55] These smart-growth communities are characterized by compact development where markets and services are within walking distance and are supported by public transportation, and Intercity, and Regional rail services.

3.4.7 Economic Growth

A transportation system that provides options for reliable, efficient, and cost-effective movement of goods and passengers is needed for continued economic growth in the Study Area. The four largest metropolitan areas in the Study Area—Washington, D.C., Philadelphia, New York, and Boston—are projected to continue to account for approximately 70 percent of the Study Area's GDP, and approximately two-thirds of the Study Area's employment and population.[56] The Study Area's GDP is projected to grow by approximately 2 percent per year through 2040 (inflation-adjusted growth using 2004 as the reference year)[57] compared to GDP in the United States, which is forecast to grow

[53] Capitol Region Council of Governments. (2011). *Capitol Region Transportation Plan: A Guide for Transportaion Investments Through The Year 2040.* Hartford, CT: Capitol Region Council of Governments.

[54] New Jersey State Planning Commission. (2001). *The New Jersey State Development and Redevelopment Plan.* New Jersey State Planning Commission.

[55] Belden Russonello & Stewart. (2011). *The 2011 Community Preference Survey: What Americans Are Looking For When Deciding Where to Live.* Washington, D.C.: National Association of Realtors.

[56] Moody's Analytics, Inc. (2012).

[57] Ibid.

approximately 2.5 percent per year.[58] The lower rate of growth in GDP for the Study Area reflects the high cost of doing business, based on historical labor costs, energy costs, and tax rates.

Millions of workers in the Study Area depend on train service to commute to and from work each day and for access to business markets across the NEC. Because passenger rail serves the downtown centers of the NEC's largest cities, it often provides the fastest and most convenient means of access to jobs and business. Improvements in passenger and freight mobility to address increased congestion from population and workforce growth would improve productivity and support economic growth by lowering the cost of doing business. As shown in Table 3-4, the Texas Transportation Institute estimates that public transportation in the New York City–Newark urban area saved over 440 million hours of delay and over $9 billion in congestion costs in 2011. If public transportation had been discontinued in 2011, urban areas nationwide with populations over 3 million would have experienced, on average, a 24 percent increase over current congestion costs.[59]

Table 3-4: Public Transportation Cost Savings (2011)

Urban Area	Delay (1,000 hours)	Value ($ million)
Washington, D.C.–VA–MD	33,810	$711.0
Baltimore, MD	11,219	$248.6
Philadelphia, PA–NJ–DE–MD	30,167	$654.9
New York City–Newark, NY–NJ–CT	440,647	$9,586.8
Bridgeport–Stamford, CT–NY	382	$8.2
New Haven, CT	336	$7.0
Hartford, CT	1,460	$30.4
Springfield, MA–CT	349	$7.3
Providence, RI	1,184	$24.2
Boston, MA–NH–RI	37,943	$809.4

Source: Eisele, B., Lomax, T., & Schrank, D. (December 2012). *2012 Urban Mobility Report.* Texas A&M Transportation Institute, The Texas A&M University System.

Furthermore, the cost of doing business in the Study Area is relatively high compared to other locations in the United States and abroad. In fact, the NEC's eight states and Washington, D.C., rank among the top 10 most expensive states.[60] Already a high-cost region, the cost of congestion is a constraint to the Study Area's economic growth prospects. Productivity has been shown to be tied to the state of transportation infrastructure and system performance, both generally and with specific regard to locations within the Study Area.[61] A recent study on transportation's critical role in

[58] U.S. Energy Information Administration. (2013). *Annual Energy Outlook 2013: With Projections to 2040.* Washington, D.C.: U.S. Energy Information Administration, Office of Integrated and International Energy Analysis.

[59] Eisele, B., Lomax, T., & Schrank, D. (December 2012). *2012 Urban Mobility Report.* Texas A&M Transportation Institute, The Texas A&M University System.

[60] Moody's Analytics rankings of states based on business costs based on costs of labor, energy and taxes, 2012

[61] Aarabi, S., Graham, D. J., Levinson, D., & Melo, P. C. (January 13-17, 2013). Agglomeration, Accessibility, and Productivity: Evidence for Urbanized Areas in the US. *Transportation Research Board 92nd Annual Meeting.* Washington, D.C.: University of Minnesota: Nexus Research Group.

Massachusetts explored the cost of doing nothing with regard to transportation investments.[62] The study found that by 2030, doing nothing would result in increased operating and safety costs of $6.6 billion to $11.1 billion, increased business costs for the shipping industry, $11.1 billion to $14.9 billion in lost productivity as a result of increased congestion and greater travel times and distances, and the loss of 12,300 to 15,600 jobs caused by deficiencies of the highway network and environmental costs.[63]

Economic growth depends on connectivity and access to labor markets. Connectivity and access create economies of scale or agglomeration effects for individual metropolitan areas along the NEC. The economies of the individual metropolitan areas along the NEC benefit from the strength of the New York City metropolitan area economy. In workshops[64] conducted for NEC FUTURE, participants representing a wide range of public and private sector entities agreed on the importance of frequent, reliable, and fast access to New York City. Passenger rail connectivity and competitive travel times to major business and commercial centers in Washington, D.C., Philadelphia, New York, and Boston would create the potential for labor markets to become more interlinked as more people and places are accessible by rail and would promote economic growth in the Study Area.

Eliminating connectivity gaps at the stations increases the number of Intercity rail and Regional rail services that can access the region. Likewise, improvements to passenger rail travel times to station areas serving urban areas increases the distance from which passengers can travel in a given amount of time. Increasing the number of businesses and jobs accessible within a 20-minute travel time can lead to productivity benefits, such as an approximately 7-percent increase in average wages for employees, and a larger pool of diversified labor for employers.[65] For major metropolitan areas like New York City, where population and employment are very dense, these benefits can extend to places up to 60 minutes from the city center. The service industry tends to show the greatest benefit from transportation improvements because it depends more on proximity to large urban areas.[66]

In addition, economic growth depends on the continued viability of the knowledge-based economic sector in the Study Area. The numerous academic and research facilities located along the existing NEC depend on travel to connect academics, researchers, and medical professionals and their patients between facilities located along the NEC. For example, Yale University representatives have identified the dependence of associated medical facilities and research and research-related businesses in New Haven, CT, and surrounding areas on convenient, reliable, frequent rail access.[67]

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[62] The Boston Foundation and The Massachusetts Competitive Partnership. (2013). *The Cost of Doing Nothing: The Economic Case for Transportation Investment in Massachusetts.* Boston, MA: The Boston Foundation.

[63] Costs are forecast in discounted 2008 dollars. The Boston Foundation and The Massachusetts Competitive Partnership. (2013). *The Cost of Doing Nothing: The Economic Case for Transportation Investment in Massachusetts.* Boston, MA: The Boston Foundation.

[64] See Appendix D, Economic Development Workshop Technical Memorandum.

[65] Aarabi, Sarah, Daniel J. Graham, David Levinson, and Patricia C. Melo. (2012). *Agglomeration, Accessibility, and Productivity: Evidence for Urbanized Areas in the US*. Washington, D.C.: Transportation Research Board 92nd Annual Meeting (2013).

[66] Graham, Daniel J., Patricia C. Melo, and Robert B. Noland. "A Meta-Analysis of Estimates of urban Agglomeration Economies." *Regional Science and Urban Economics* 39, 2009: 332-342.

[67] Parker, H., & Jacob, R. (2013, May 14). Yale University meeting with the City of New Haven. (City of New Haven, Interviewer)

Although transportation has been identified as an important factor for economic growth, formulating a regional approach to transportation has been a challenge because the Study Area consists of multiple independent states and jurisdictions, each with its own interests and transportation policies. Planning efforts like those undertaken by the I-95 Corridor Coalition and the Coalition of Northeastern Governors have helped to define the Northeast region's transportation needs. Similarly, the NEC Commission has recently brought the Intercity and Regional rail operators together to develop a comprehensive five-year capital plan for the NEC.[68] However, there has yet to be a long-term vision to improve passenger rail service on the NEC and define a way to implement a balanced, efficient passenger rail program that meets the economic needs of the entire Study Area.

[68] Northeast Corridor Infrastructure and Operations Advisory Commission. (2015, April). *NEC Five-Year Capital Plan*. *http://www.nec-commission.com/five-year-capital-plan/*