



# Preliminary Alternatives Report

April 2013



U.S. Department  
of Transportation

**Federal Railroad  
Administration**



# TABLE OF CONTENTS

<b>1. Introduction</b>	<b>1</b>
<b>2. Alternatives Development Process</b>	<b>1</b>
2.1 PURPOSE AND NEED .....	2
2.2 STUDY AREA .....	3
2.3 DEVELOPMENT OF THE ALTERNATIVES .....	4
2.3.1 No Action Alternative .....	5
2.3.2 Sources for the Initial Alternatives .....	6
2.3.3 Developing and Assembling the Initial Alternatives .....	7
2.3.4 Assembling the Initial Alternatives .....	12
2.4 DEVELOPMENT AND ORGANIZATION OF THE PRELIMINARY ALTERNATIVES .....	13
2.4.1 Service and Investment Level .....	13
2.4.2 Network/Route Definition .....	14
2.4.3 Service Definition/Operational Environment .....	14
2.5 PRELIMINARY ALTERNATIVES .....	15
<b>3. Next Steps</b>	<b>16</b>

## APPENDIX

### NEC PRELIMINARY ALTERNATIVES

## TABLES

Table 1: Initial Alternatives Building Blocks .....	9
Table 2: Capacity Increments Required to Grow the NEC .....	14
Table 3: NEC Preliminary Alternatives .....	16

## FIGURES

Figure 1: NEC FUTURE Study Area .....	4
Figure 2: NEC Alternatives Development Process .....	5
Figure 3: Northeast Travel Demand for All Modes .....	7
Figure 4: Population Growth (2010-50) by County .....	8
Figure 5: Employment Growth (2010-50) by County .....	8
Figure 6: Initial Alternatives Networks for NEC Spine and Connecting Corridors .....	10



# 1. Introduction

The goal of NEC FUTURE is to develop a long-term investment program for improving and growing the Washington, D.C., to Boston, Northeast Corridor (NEC) rail service to accommodate projected year 2040 commuter and intercity rail ridership, as part of the regional transportation system in the Northeast. This Preliminary Alternatives Report summarizes the process by which a large set of Initial Alternatives, which would contribute to achieving this goal, was refined and repackaged into a smaller set of “Preliminary Alternatives.” The Preliminary Alternatives, in turn, will be evaluated and narrowed to an even smaller set of “Reasonable Alternatives,” and ultimately to a preferred investment program as NEC FUTURE advances. The NEC FUTURE program is being undertaken pursuant to the National Environmental Policy Act (NEPA), which includes preparation of a Tier 1 Environmental Impact Statement (EIS), in which the Reasonable Alternatives will be analyzed and compared based on the environmental, socioeconomic and transportation impacts. The Federal Railroad Administration (FRA), the lead Federal agency, is preparing the EIS and will identify a preferred investment program. At the end of the EIS process FRA will issue a Record of Decision (ROD) selecting an investment program.

The Preliminary Alternatives Report consists of a summary of the alternatives development process through the selection of the Preliminary Alternatives. The Appendix includes Fact Sheets describing each of the Preliminary Alternatives.

The NEC FUTURE project team will prepare an Alternatives Development Report (ADR), which will summarize the processes for evaluation and screening of the Preliminary Alternatives and the identification of the Reasonable Alternatives that will be further evaluated as part of the Tier 1 EIS.

# 2. Alternatives Development Process

The alternatives development process is directed at defining a broad range of alternatives that address the problems identified in the Purpose and Need Statement, and progressively narrows those alternatives to a reasonable set that can best address those problems. The process is intended to answer several key questions:

- ▶ Markets
  - Where are travelers going?
  - Where is population and employment growth occurring?
  - Will rail investment change travel behavior?
- ▶ Rail Network
  - How do trains physically access the markets?
- ▶ Service Level
  - How much service can be provided to meet demand?
  - What types of rail service are needed to meet demand?

- What are the best ways to provide that service?
- ▶ Improvements
  - What improvements are required to provide the service?
  - How can they best be implemented?

As the alternatives progress from Initial to Preliminary, the focus turns from “which markets” are most important to be served, to how best to serve those markets. This requires evaluation using a number of technical tools to assess feasibility, ridership, operational impacts, capital and operating costs, environmental impacts, and benefits. The level of technical scrutiny increases as the alternatives progress from Initial to Preliminary to Reasonable.

A defining aspect of the NEC FUTURE program is that alternatives will only be developed to a programmatic level of detail, consistent with the focus of a corridor-wide Tier 1 EIS. The alternatives are intended to address the broad infrastructure needs and corridor-wide service options required to meet projected growth and demand. More detailed project-level issues relating to design configurations, specific alignments, and engineering solutions for site-specific projects and improvements must be addressed after completion of the Tier 1 EIS through Project (Tier 2) NEPA documents.

## 2.1 PURPOSE AND NEED

The development of alternatives begins with the Purpose and Need Statement, which defines the problems and challenges experienced by the transportation network in the Northeast generally and by the NEC rail line in particular. To be considered, an alternative must be capable of addressing at least some of the issues identified in the Purpose and Need Statement. A copy of the Purpose and Need Statement is included in the Scoping package accessible on the NEC FUTURE website.

The Purpose and Need Statement identifies that accommodating the 2040 capacity, frequency, reliability and travel-time needs of NEC rail travelers with market-competitive passenger rail service will be critical to providing the mobility that will allow the future population, employment, freight, and economic growth of the Northeast to reach its full potential.

To achieve these results, a set of goals and criteria derived from the Preliminary Purpose and Need were developed to assist in evaluating and organizing proposed alternatives. In general, alternatives must:

- ▶ Provide for state-of-good-repair on the NEC.
- ▶ Attempt to meet projected 2040 travel demand.
- ▶ Improve service reliability and frequency to the primary markets of Washington, Philadelphia, New York, and Boston.
- ▶ Include some options for new or improved rail service to intermediate markets with significant ridership potential.
- ▶ Support service to and from the connecting corridor markets in addition to the existing NEC Spine, including consideration of both run-through and transfer options.

- ▶ Provide equitable and fair levels of service across the Study Area, treat connecting corridors with similar size and market potential in a consistent manner, provide comparable service strategies for the various commuter rail networks focused on Washington, D.C., Philadelphia, New York and Boston, and provide consistent treatment of rail freight along the NEC.
- ▶ Support strong intermodal connections between intercity passenger rail modes and corridors, regional and local transit services, and other modes.
- ▶ Accommodate freight rail growth by preserving windows for rail freight operations, access to freight customers, and access to rail freight main lines.
- ▶ Support the Northeast region's efforts to reduce environmental impacts and energy use resulting from projected growth in travel demand.

In addition, in the case of duplicative and overlapping proposals, alternatives will be dropped that:

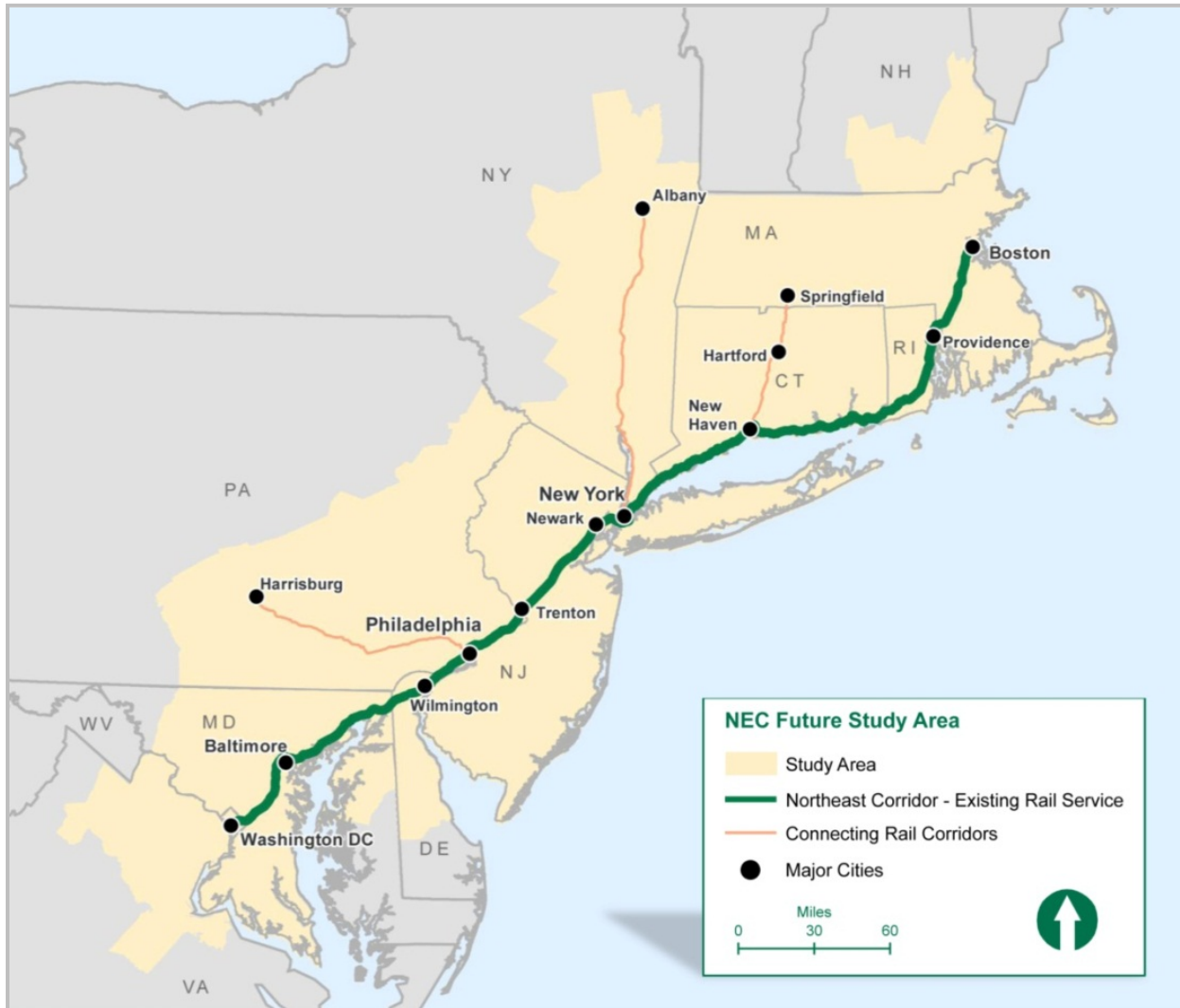
- ▶ Are less efficient in serving specific markets (e.g., longer distance, longer travel time) or generate substantially more adverse environmental or transportation impacts compared to other similar service alternatives.
- ▶ Provide similar investment levels and performance characteristics, but with a higher implementation risk, or greater impact or clearly higher cost (e.g., significantly longer mileage).

These goals will continue to be refined through dialogue with stakeholders, agencies, and the public to ensure that they provide the basis for evaluating whether identified alternatives meet the needs of the program.

## **2.2 STUDY AREA**

The Purpose and Need identifies transportation challenges in the Northeast generally and along the NEC in particular. For purposes of the early planning effort, the Northeast is defined to encompass the greater Washington, D.C., area, the greater Boston, MA, area, and all points in between. The existing NEC rail transportation spine links Washington Union Station, Pennsylvania Station New York, and Boston South Station. For purposes of defining and analyzing transportation alternatives for NEC FUTURE, the project Study Area encompasses the region served by the NEC spine, plus those areas that can be reached directly by train or via a transfer to connecting rail corridors from the NEC spine. Figure 1 shows a map of the Study Area, indicating the existing passenger rail network that comprises the NEC spine, existing connecting intercity short-distance corridor, and commuter rail corridor connections, other major rail and highway links and major airports. The Tier 1 EIS will be focused on the areas surrounding the NEC spine where impacts from the implementation of improvements are most likely to occur. The Study Area definition will be refined as the alternatives development process advances.

**Figure 1: NEC FUTURE Study Area**



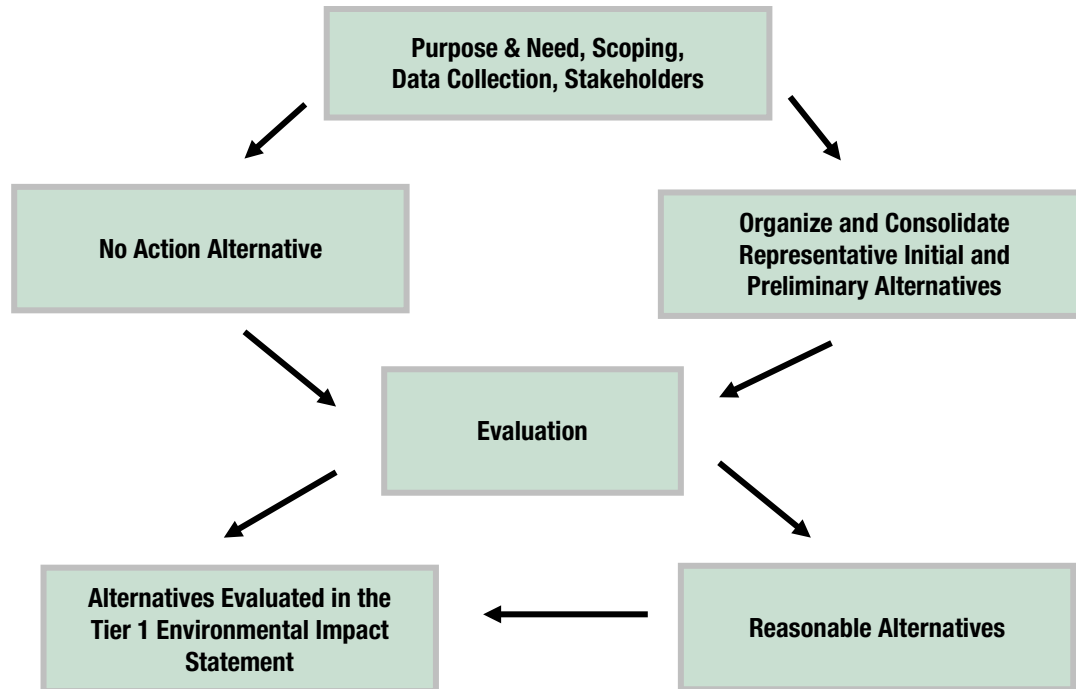
## 2.3 DEVELOPMENT OF THE ALTERNATIVES

The development of alternatives starts with the No Action Alternative, against which each of the “Build” alternatives must be compared with regard to benefits, costs and impacts. The Build Alternatives consist of combinations of market, route, capacity upgrades and rail service options capable of meeting 2040 ridership demand and addressing other problems identified in the Purpose and Need. They include a broad spectrum of potential service and investment options within the Study Area, including on- and off-corridor routes, service to new markets, different ways of serving markets, and variations in the level of investment in the NEC.

Figure 2 depicts the alternatives development process.



**Figure 2: NEC Alternatives Development Process**



### 2.3.1 NO ACTION ALTERNATIVE

All transportation projects evaluated under NEPA must include a No Action (or No Build) Alternative against which all of the build alternatives are compared to assess environmental and transportation benefits and impacts. The No Action Alternative defines the conditions that would prevail if the project or program under consideration was not advanced. For NEC FUTURE, the No Action Alternative describes the NEC as it would be in the year 2040 if no additional improvements beyond those currently planned, programmed, mandated or otherwise expected were implemented across the region's transportation system, including rail, highways, transit and air.

Assembling the No Action Alternative starts with today's Northeast rail, transit, highway (automobile and freight) and air system, and adds the following future improvements:

- ▶ Commuter, intercity and freight rail projects and transit, highway and airport projects currently in planning or under design, with an identified or reasonably anticipated funding source, or included in fiscally constrained regional, state and modal planning documents. These would include, for example, electrification upgrades between New Haven and Stamford, CT; construction of the MARC Wedge Yard at Washington Union Station; and implementation of the new FAA New Generation air traffic control system.
- ▶ Commuter and intercity rail projects mandated by law, such as Americans with Disabilities Act of 1990, as amended (ADA) station upgrades and Positive Train Control.
- ▶ Investments in state-of-good-repair and basic infrastructure renewal as generally required to maintain the operation and safety of the railroad at a level of annual expenditure consistent with the 20-year historical rate of capital investment in the NEC.

Future rail service on the NEC under the No Action Alternative is assumed to remain generally constant, once all currently funded and committed improvements have been implemented. Beyond those projects, capital investment in the No Action Alternative will not make any significant changes to capacity or serve new markets.

### 2.3.2 SOURCES FOR THE INITIAL ALTERNATIVES

---

There are two primary sources for the Initial Alternatives: 1) stakeholder input and data, including prior plans, studies and reports; and 2) input from public and agency scoping.

The NEC consists of a very large group of stakeholders:

- ▶ NEC and connecting corridor rail operators, including commuter, intercity, and freight railroads
- ▶ State resource agencies, including transportation, environmental, and economic development agencies and departments
- ▶ Federal modal agencies, including highways, transit, rail and waterways within the U.S. Department of Transportation
- ▶ Planning organizations, including Metropolitan Planning Organizations, and academic institutions
- ▶ Non-governmental and private organizations that study and otherwise impact the NEC

Over the years, these stakeholders have produced demographic data and growth projections, and prepared a large number of transportation plans and capital investment programs to address specific challenges and to plan future investment in the region's transportation assets. Data collected by NEC FUTURE include the capital and operating plans for Amtrak and each of the commuter and freight operators serving the NEC, upgrade programs prepared by individual railroads or groups of operators, high-speed rail feasibility studies (such as Amtrak's Next Generation program), environmental data and studies, growth and ridership projections, short and long range plans, and other visioning and planning documents. Many of these plans and documents recommend projects and ideas that constitute alternatives that can be used by NEC FUTURE. One major example is the NEC Master Plan, developed by Amtrak and the NEC commuter authorities in 2009. This document recommends a 25-year program of improvements to upgrade and grow the NEC to meet future demand.

In addition to stakeholder information, a number of important ideas, issues and proposals came from the public and from Federal, state and local agencies through the formal NEC FUTURE Scoping process. Scoping is required under NEPA and provides an opportunity for the public to provide input on publicly funded projects. The NEC FUTURE Scoping process included 18 agency and public meetings across the corridor, as well as one internet-based agency webinar. Scoping began June 22, 2012, and remained open through October 19, 2012. In all, some 700 individuals and 193 public agency staff submitted over 2,300 comments and ideas. These focused on new routes and alignments, specific projects, service issues such as reliability, trip time, and affordability, and the ability to connect to transit at stations, and the importance of high-speed rail on the NEC. One of the most common comments from many members of the public and from agency staff and stakeholders was the importance of addressing deferred maintenance and upgrading the existing NEC spine prior to investments to expand rail service to markets off the NEC spine.

### 2.3.3 DEVELOPING AND ASSEMBLING THE INITIAL ALTERNATIVES

Developing and assembling the Initial Alternatives begins with analysis of Northeast travel demand and growth data to understand where people are traveling to, where growth in population and employment will occur, and whether travel patterns are likely to change in the coming decades.

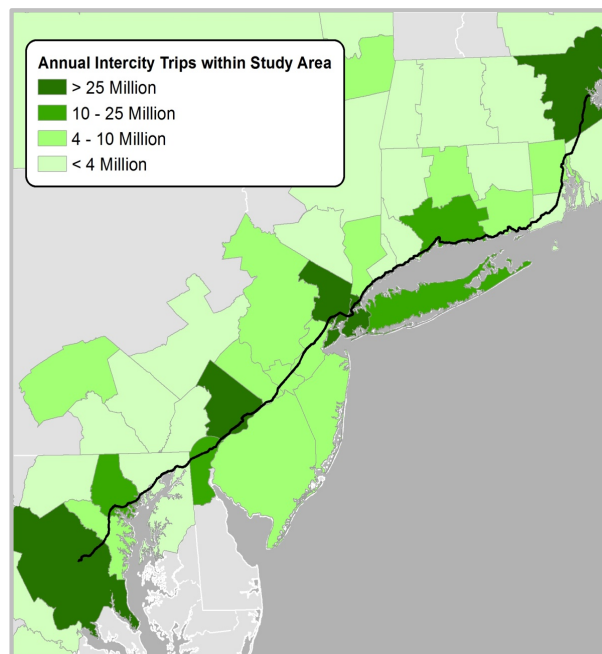
NEC FUTURE looked to existing regional and state travel demand and population growth data, ridership projections made by Amtrak and the commuter authorities, data /discussions with states and planning organizations, and public and agency comments made during Scoping to identify current travel patterns and potential new rail markets. These data will be validated in 2013 as results from new NEC FUTURE demand modeling become available. Figure 3 shows the travel demand for all modal trips in the Northeast in 2010. Analysis of regional travel demand, overlaid on population and employment growth projections, helps to identify where people are going and the size of those markets.

The data underscore the dominance of the four primary markets on the existing NEC spine—Washington, D.C., Philadelphia, Boston and particularly New York. This is reflected by the current pattern of intercity passenger rail service and data:

- ▶ South End (Washington-New York)
  - 95 percent of all trips begin or end at Washington, Philadelphia or New York
  - 57 percent of all trips begin and end at Washington, Philadelphia and/or New York
- ▶ North End (New York-Boston)
  - 85 percent of all trips begin or end at Boston or New York
  - 27 percent of all trips begin and end at Boston and New York
- ▶ Through New York trips
  - Only 9 percent of all trips begin either north or south of New York and end on the other side of New York

The data also show that there are other strong Northeast travel markets, both on and off the existing NEC spine. Those on the spine—such as Baltimore, Wilmington, Newark, Stamford, and New Haven—already receive significant intercity and commuter/regional rail service. Those off the existing spine hold potential as future important rail markets, either via connecting rail service to the NEC spine, or as markets along new NEC alignments, including potential high-speed rail (HSR) routes. These include

**Figure 3: Northeast Travel Demand for All Modes**



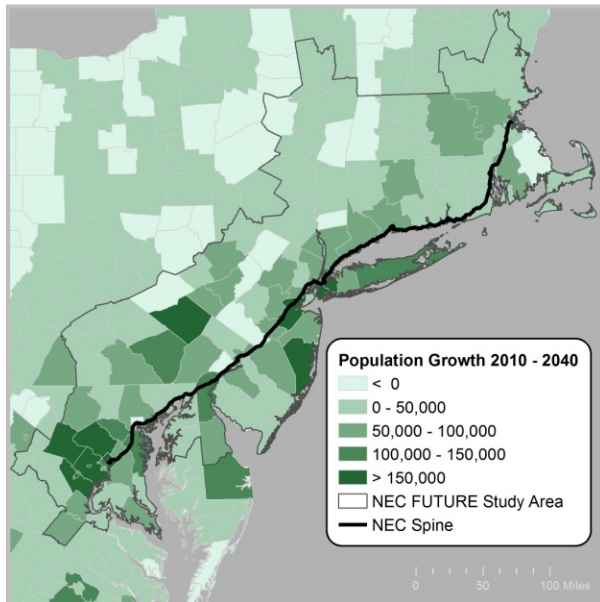
Source: National Transit Database (NTD 2010).

Annapolis; Long Island (both Nassau and Suffolk Counties); Hartford; Springfield; and Worcester. The data also support the importance of markets located on connecting rail corridors, including Richmond, Harrisburg, Lancaster, and Albany. Many of these off-corridor markets are under-served by passenger rail. These include the following:

- ▶ Long Island to: Washington, Boston, Albany and points in New Jersey
- ▶ Hartford to: New York and Boston
- ▶ New York to: Albany and Richmond

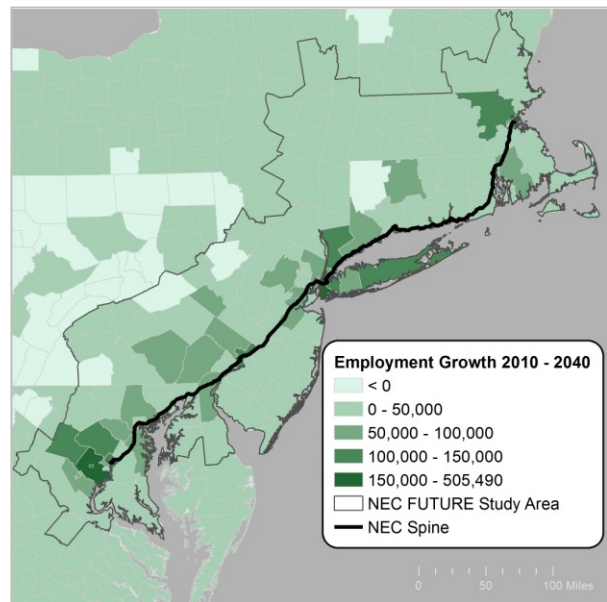
Regional population and employment growth projections through 2040 support the continued attractiveness and expansion of these primarily urban markets, which will increase demand for both commuter rail and intercity rail services (Figure 4 and Figure 5).

**Figure 4: Population Growth (2010-50) by County**



Source: Moody's Analytics

**Figure 5: Employment Growth (2010-50) by County**



Once the strongest Northeast travel markets have been identified, the many route and service ideas identified through data collection and scoping can be organized by developing combinations of options for serving those markets. These options include how trains will access the markets (route/rail network), how much service to provide to each market (level of service and investment), and the type of service to be provided (service definition and operational environment). Mixing and matching these options provides the basis for testing and comparing multiple market, investment and service proposals. Table 1 describes these three Building Blocks for serving the markets.

**Table 1: Initial Alternatives Building Blocks**

Building Blocks	Variations
<b>Service/Investment Level</b> <ul style="list-style-type: none"> <li>▪ How robust is the program?</li> <li>▪ How much service can be provided?</li> <li>▪ Which new markets can we serve?</li> </ul>	A (Low): 2040 growth on existing NEC serving existing markets B (Medium low): Additional capacity on existing NEC to add new types of express, regional and connecting corridor services C (Medium high): Targeted expansion of the NEC to serve new off-spine markets and expand service options to NEC and connecting corridor markets D (High): Extensive end-to-end expansion of the NEC to serve new markets and HSR
<b>Network/Route Definition</b> <ul style="list-style-type: none"> <li>▪ How do we access the markets by rail?</li> </ul>	<ul style="list-style-type: none"> <li>▪ Existing NEC Spine</li> <li>▪ Potential second NEC Spine</li> <li>▪ Potential new right-of-way segments</li> <li>▪ Potential connecting corridor links</li> </ul>
<b>Service Definition/Operational Environment</b> <ul style="list-style-type: none"> <li>▪ How can we best serve the market?</li> </ul>	<ul style="list-style-type: none"> <li>▪ Current/Conventional Service Mix</li> <li>▪ Enhanced Service Mix</li> </ul>

The three Building Blocks are detailed below.

**Service/Investment Level.** Service and investment level answers the question: How robust of a vision for passenger rail is planned? In large part, this relates to the amount of funding available to increase capacity in the NEC, as the ability to increase service and serve new markets depends on such new capacity in terms of tracks, systems, stations and equipment. However, it also is shaped by the focus and objectives of the vision—the types and amount of service that can be provided and the range of markets to be served. Service/Investment Level, when combined with Service Definition, ultimately defines the potential for the investment program alternatives to serve the transportation needs of the region.

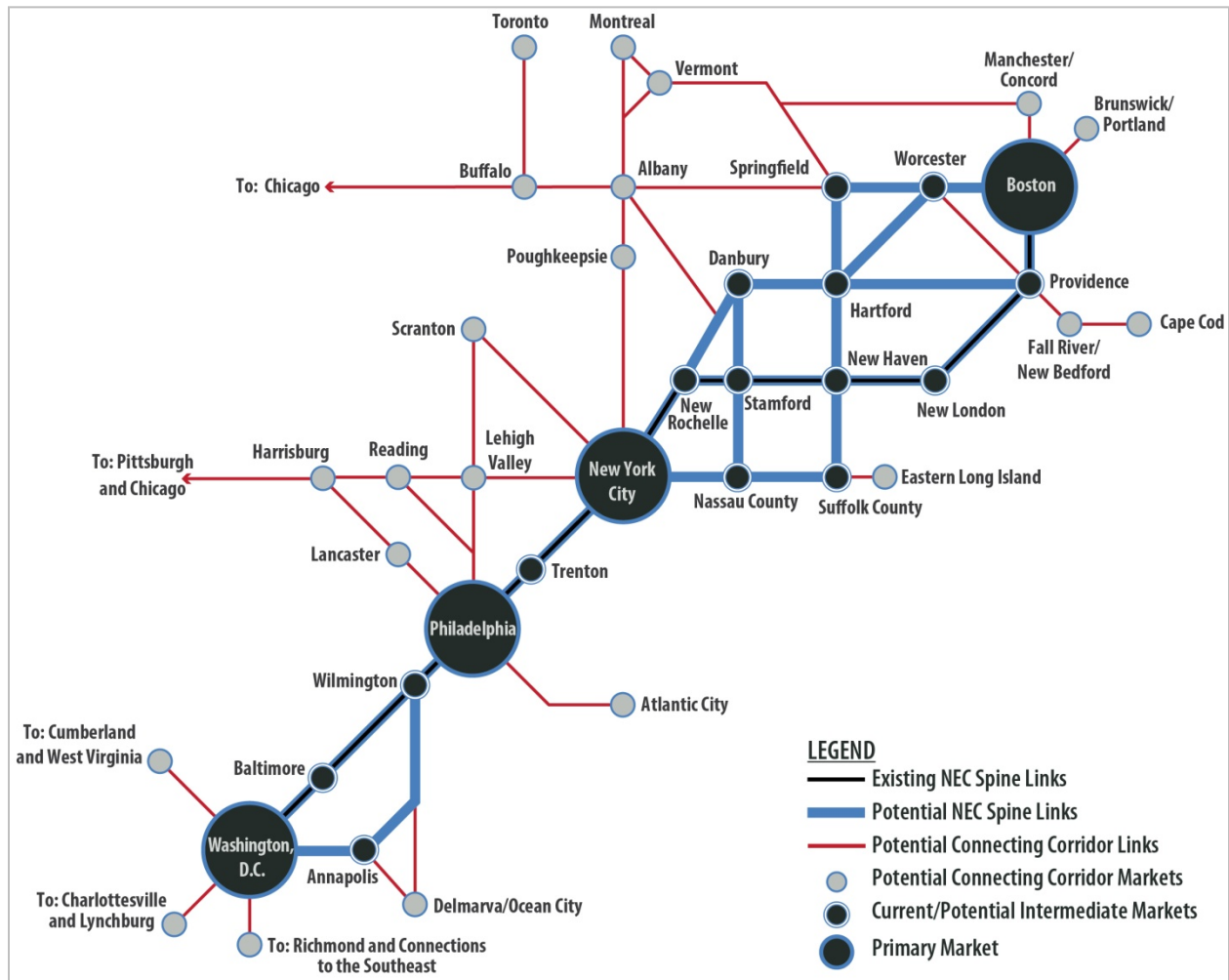
NEC FUTURE applied four incremental investment levels to broadly test investment options in the NEC over the next 30 years. This results in a range of visions for the NEC—from continuation of today’s rail operations at the low end to the opportunity to provide significantly different types of service to existing and new markets, including HSR options, at the high end. As the investment level increases, the additional capacity enables carriers to consider a broad assortment of new services and targeted expansion of the rail line to new markets. The nature and extent of these new services and markets will be dynamic as the market for passenger rail on the NEC responds and grows. The four levels of investment—and their predicted outcomes—used for the Initial Alternatives were as follows:

- ▶ A (Low): Supports some increase in service and capacity along the existing NEC spine with goal of meeting projected 2040 travel demand; achieves state-of-good-repair. One alternative will represent a fiscally constrained option that represents a minimal level of investment that will not accommodate the full 2040 travel demand.
- ▶ B (Medium Low): Supports increased service to existing and connecting rail markets and additional capacity for expanded service types, but assumes no construction of new routes; meets projected 2040 travel demand in all markets on existing NEC spine (maintaining rail mode share).
- ▶ C (Medium High): Supports service to new off-spine markets and additional service options to existing NEC spine and connecting corridor markets by adding capacity and/or new rail access in targeted locations and markets.

- ▶ D (High): Supports a major increase in the quantity and types of rail services and significantly improved trip time to existing and new markets on and off the NEC through construction of a second NEC main line spine for the entire length of the corridor, which can be combined with increases in capacity along the existing NEC as required to support regional and intercity service operating on the existing spine.

**Network/Route Definition.** Network definition addresses the question: How do trains physically access markets? Accessing the Northeast markets by rail requires use of existing or new rail alignments and service options, and continued access to the connecting rail corridors. These are illustrated in Figure 6.

**Figure 6: Initial Alternatives Networks for NEC Spine and Connecting Corridors**



On the basis of these data and input/ideas generated by stakeholders and through scoping, the following route segments and combinations would support passenger rail service to a broad spectrum of Northeast markets, and provide continued access to connecting rail corridors. Accordingly, these were used to define the market networks for the Initial Alternatives:

- ▶ NEC mainline/existing spine
- ▶ Wilmington-Annapolis-Washington
- ▶ New Haven-Long Island-New York
- ▶ Hartford-Danbury-New York
- ▶ Boston-Providence-Hartford-New Haven
- ▶ Boston-Springfield-New Haven

**Service Definition/Operational Environment.** Service definition/operational environment answers the question: What types of rail service can best serve the markets? This will depend on a number of factors: the long-term vision for the NEC; the capacity available to operate specific types of service; and the markets to be served. For the Initial Alternatives, service definition was described in three general categories: current or today’s conventional mix of intercity and commuter rail service; and two types of enhanced service—simplified service mix, which would provide more frequent service to most markets (including via transfer between trains), and expanded one-seat ride service to more markets. These categories encompass a broad range of potential service options for the study area. Current Mix forms the baseline for analyzing the impacts of the other service strategies. Enhanced Service includes a number of different service patterns that extend beyond today’s distinct intercity and commuter options to provide broader coverage, faster service and more travel options. These service strategies are intended to guide the development and testing of potential service options for the alternatives. Their features are not intended to be absolute or exclusive to each service strategy, and will change depending on the availability of capacity and as access to new markets expands. As the alternatives are refined in future phases of work, features from each of these service strategies may be combined to develop the best service plan for a given alternative.

Various “connection strategies”—such as coordinated transfers or run-through service from connecting corridors—will be applied to each service strategy to ensure that all potential market pairs in the study area are served.

- ▶ **Current Mix:** Includes the current or conventional mix of train types (Acela/Premium High-Speed Rail, Regional/Limited Intercity, commuter, and freight) and institutional arrangements with the number of trains increased as needed to meet future demand. The service would still have a mix of train types, but the proportional mix would be “rebalanced” to respond to market demand.
- ▶ **Enhanced Service Mix:**
  - Simplified service that maximizes the number of trains to all markets.
  - Provides a limited group of services on a regular, repeating schedule to deliver higher frequency and throughput capacity than service plans with a greater variety of stopping patterns and train types.

- This high-density service approach provides the opportunity for greater frequencies to secondary markets through highly coordinated schedules and transfers. Total travel times may be slower than other options, and the approach may require transfers for passengers in secondary markets, but overall trip times are competitive with other service approaches and service frequencies are increased.
- Simplified Service Mix could include the following service types:
  - Limited-stop express service
  - Multi-stop local service
  - Supplemental peak commuter service
  - Convenient transfers from connecting corridors to services on NEC Spine
- Expanded one-seat ride: Focuses on maximizing the number of market pairs served with one-seat ride service, particularly for intermediate and connecting corridor markets, through the use of several services. These services include high-speed trains operating exclusively on high-speed or express tracks and other high-performance services that share high-speed tracks and utilize available capacity on portions of high-speed territory with maximum speeds of 160 mph or less and without intermediate station stops (e.g., on final approach to NYC, Washington, and/or Boston).

### 2.3.4 ASSEMBLING THE INITIAL ALTERNATIVES

---

Combinations of the three building blocks generated 98 separate Initial Alternatives that cover the spectrum of opportunities to upgrade and expand the NEC, serve existing and new markets both on and off the NEC, provide better connectivity to other rail markets, transit and airports, and develop new high-speed rail service. These include the following, as examples:

- ▶ A current/conventional service mix over the existing NEC spine funded at a Low Service/ Investment Level, serving existing NEC markets.
- ▶ An enhanced/simplified service mix over the existing spine funded at a Medium-Low Service/Investment Level, serving existing NEC markets with expanded service and additional service to connecting corridors.
- ▶ An enhanced/expanded one-seat ride service mix over a new HSR network funded at a High Service/Investment Level, provided new and expanded service both on the existing NEC spine and on a second NEC spine serving the HSR network.
- ▶ Some options and ideas were not carried into the Initial Alternatives. These included non-spine market options better served through potential future connecting corridors, such as connections to Ocean City, MD, Lehigh Valley (in Pennsylvania), Cape Cod, MA, Worcester MA (from the NEC mainline in Providence, RI), and Montreal Canada; less efficient spine options, such as New York City to Boston via Albany; and options suggesting specific engineering and alignment solutions that exceed the scope of a corridor-wide Tier 1 Program NEPA document and would be appropriately considered in a subsequent Tier 2 Project NEPA document, such as specific alignments and engineering solutions for trans-Hudson River tunnels and access to downtown Philadelphia.



## 2.4 DEVELOPMENT AND ORGANIZATION OF THE PRELIMINARY ALTERNATIVES

The Initial Alternatives comprise the spectrum of feasible options for enhancing service on the NEC. At this point in the NEC FUTURE Program, there are insufficient data to comprehensively compare the merits of each Initial Alternative or to select certain concepts while eliminating others. Thus, defining a smaller set of Preliminary Alternatives involved consolidating and reorganizing the Initial Alternatives to facilitate future isolation and testing of incremental service levels and route options. All concepts included in the Initial Alternatives were carried forward into the Preliminary Alternatives through this consolidation process. In addition, the Preliminary Alternatives remain technology neutral. This process of consolidating the Initial Alternatives resulted in 15 Preliminary Alternatives.

As described below, the Preliminary Alternatives were grouped within the four Service/ Investment Levels, as each of these levels presents a different vision for the NEC. Within each Level, capacity is added that permits the testing of a variety of service types and objectives, including minimizing travel time, increasing the density of service, and adding one-seat ride options. In this manner, the operational and ridership impacts of these incremental changes and different service can be isolated, tested and compared. Each Service and Investment Level includes three to four alternatives that test these variables. Level A is a lower cost program. Capacity is increased through operational efficiencies, such as longer, higher-capacity trains, and implementation of the most critical infrastructure upgrades. This would enable operators to accommodate 2040 demand, and, as capacity grows, to begin to implement new enhanced service types, such as regional train service across broad urban areas and better service to connecting rail corridors. In Levels B and C, capacity is sufficiently robust to support specific corridor objectives. These include service options and operational changes focused on three different goals: minimizing travel time; provision of high-density service; and increased one-seat ride options. Level C would also include targeted construction of new tracks to improve service on the existing NEC spine and to serve new off-corridor markets. Program Investment Level D would allow for construction of a second NEC spine that could support significant expansion and improvement of HSR operations and may free up capacity on the existing NEC spine for improved commuter and regional services.

These changes are described below.

### 2.4.1 SERVICE AND INVESTMENT LEVEL

---

The four Service/Investment Levels provide a broad range of investment opportunities within which to test various route and service alternatives. As Program Levels increase from A to D, additional capacity is required to support the desired level of service and the ability to serve new markets. Capacity increment levels—ranging from a low of 1 (initial and most pressing capital improvement projects) to 5 (second NEC spine)—were developed to provide a platform for matching capacity with desired levels and types of service. During the technical analysis of the alternatives, the specific capacity improvements required to achieve the service objectives of each alternative can be better defined.

These capacity levels (Table 2) define the types of improvements generally required to address bottlenecks and other constraints and to provide the infrastructure required to serve new markets and support high-speed rail.

**Table 2: Capacity Increments Required to Grow the NEC**

Capacity Increment Level	Improvements
1	Service and operational efficiencies; high-priority capacity improvement projects with low-to-moderate capital costs
2	Additional cost-effective capacity improvement projects, including high-cost projects with substantial capacity benefits such as tunnel and bridge replacements.
3	Elimination of bottlenecks that constrain throughput capacity, such as at-grade junctions and slow-speed interlockings, and add capacity at major terminals.
4	Targeted construction of limited portions of new railroad right-of-way along and/or connecting to the NEC spine as required for capacity, trip time and/or market access.
5	Construction of a second NEC spine between Boston and Washington and rationalization of service on the existing NEC spine to optimize service objectives.

### 2.4.2 NETWORK/ROUTE DEFINITION

Route segments from the Initial Alternatives were combined to create three network alternatives south of New York and four network alternatives north of New York. These network alternatives preserve the ability to add future connecting corridor service to various proposed markets such as Cape Cod, Scranton and Ocean City. Most alternatives—those in Service/Investment Levels A, B and C—remain primarily on the existing NEC spine. Alternatives that involve a second NEC spine are limited to Service/Investment Level D. These network alternatives are representative only—specific alignments and station locations along new right-of-way will not be developed until commencement of Tier 2, project-specific environmental processes. The representative network alternatives are illustrated in the NEC Preliminary Alternatives Fact Sheets, included in the Appendix. The rail networks are as follows:

- ▶ Existing NEC via Baltimore Penn and Philadelphia 30th Street Stations
- ▶ Existing NEC via downtown Baltimore and Center City Philadelphia
- ▶ Delmarva Route via Annapolis and Center City Philadelphia
- ▶ Existing NEC New Haven Line – Shore Line
- ▶ New York-Nassau-Suffolk via Hartford and Worcester
- ▶ Central Connecticut via Providence
- ▶ New York-Nassau-Stamford via Danbury and Springfield

The performance and impacts of operations over each of these networks—and submarkets/segments within each network—will be evaluated in the next phase of the alternatives development process to determine the best combinations of routes north and south of New York.

### 2.4.3 SERVICE DEFINITION/OPERATIONAL ENVIRONMENT

Service definition—the various types of service that could be run on the corridor, from today’s conventional service to novel enhanced service concepts—saw significant development after completion of the Initial Alternatives. A number of alternate service types were defined and will be developed and

tested with both simplified and one-seat-ride strategies to measure their effectiveness at filling market gaps left under-served or unserved by today's conventional mix of services. These variations include the following:

- ▶ Super Express: HSR to primary markets only—Washington, D.C., Philadelphia, New York, and Boston
- ▶ Premium Express: HSR to primary markets and secondary markets, with multiple stopping patterns
- ▶ Limited Express: HSR service expanded to more stations on conventional and HSR tracks
- ▶ Limited: Regional service with multiple stopping patterns
- ▶ Metropolitan: Limited-stop, run-through service for longer-distance commute trips within broad metro areas
- ▶ Regional Zone Express: Mainline and branch express operations, collecting travelers from a specific area and then operating at high speed express trains to major terminals
- ▶ Commuter Zone Express: Peak-period trains serving local stops within a zone of stations and otherwise operates non-stop
- ▶ Local Commuter: All-stop local service
- ▶ Rail Transit Service on NEC right-of-way: Short-distance, short-headways, high-capacity trains within metropolitan core

It should be noted that a number of independent elements must also be considered as they may impact some or all of the alternatives. These include terminal and intermediate station solutions; airport access solutions; and rail freight solutions. As the analytic tools and data become available for evaluation and screening of alternatives, these elements will be analyzed as overlays on the alternatives. This might include, for example, an overlay analysis with respect to the potential options for making rail connections to and between airports, and for configuring the stations, yards, and railroad alignments within the major terminal areas.

## **2.5 PRELIMINARY ALTERNATIVES**

Fifteen Preliminary Alternatives were developed through the combination of different service, capacity and network options under each of the four Service/Investment Levels. These alternatives continue to capture the broad array of options for growing the NEC to accommodate projected 2040 demand and to support the region's transportation needs. Each is sufficiently distinct to permit quantitative evaluation, enabling the analysis of key differentiating variables, including capacity (in terms of train frequency and seat availability), ridership, trip time, operational impacts, network expansion capabilities, connectivity, economic impacts, and costs. The alternatives will be compared with one another and against the No Action Alternative.

The 15 Preliminary Alternatives are described by individual Fact Sheets per alternative (included in the Appendix) and are listed in Table 3.

**Table 3: NEC Preliminary Alternatives**

Alt	Level	Network	Service Environment
1	A	Some increase in service and capacity along the existing NEC Spine	Conventional intercity/commuter
2			Conventional intercity/commuter
3			Introduce intra-urban metropolitan service
4	B	Increased service to existing and connecting markets along the existing NEC Spine	Conventional intercity/commuter
5			Focus: Maximize train frequency / service
6			Focus: Minimize travel time
7			Focus: Maximize one-seat ride options on and off NEC Spine
8	C	Targeted expansion of the existing NEC Spine to serve new markets, reduce trip time, and introduce robust regional services	Conventional intercity/commuter
9			Focus: Maximize train frequency / service
10			Focus: Minimize travel time
11			Focus: Maximize one-seat ride options on and off NEC Spine
12	D	2nd spine generally parallel to existing NEC	Dedicated high-speed rail; robust intercity and regional services on existing NEC Spine
13		2nd spine via Danbury-Hartford-Providence	
14		2nd spine via Suffolk-Hartford-Worcester	
15		2nd spine via Delmarva and Nassau-Stamford-Danbury-Springfield	

### 3. Next Steps

In the next phase of the alternatives development process, the Preliminary Alternatives will be comparatively evaluated to understand their transportation and environmental benefits and impacts. Screening criteria will be applied to guide the process for identifying the best service and network options to be used to develop the Reasonable Alternatives, which will then be further evaluated as part of the Tier 1 EIS, ultimately resulting in a preferred investment program.

**APPENDIX  
NEC PRELIMINARY ALTERNATIVES**



# Preliminary Alternatives Key



## Program Levels

### [A] Improve Existing NEC Spine

Some increase in service and capacity with goal of meeting projected 2040 travel demand;  
Achieves State of Good Repair

### [B] Optimize Existing NEC Spine

Increased service to existing and connecting rail markets, but no construction of new routes;  
Meets projected 2040 travel demand in all markets on existing NEC spine (maintaining rail mode share)

### [C] Expand NEC and Connections

Service to new markets and additional growth in existing markets by adding capacity/new alignments in targeted locations (e.g., new downtown service in Baltimore and Philadelphia)

### [D] Add'l NEC Route (2-Trk. Equiv.)

Major increase in the quantity and types of rail services and significantly improved trip time to existing and new markets on and off the NEC; new main line tracks for the entire length of the corridor; capacity optimized on existing NEC for continuing regional and intercity operations.

## Operational Environment

### Conventional/Current Service Mix

Existing service types operating over existing railroad; peak trains per hour increased as capacity is made available; selected new connections to connecting corridors (one-seat ride and transfers at hub stations)

### Enhanced Options

Introduces new types of express, limited stop and skip-stop service; commuter rail evolves into regional service; endpoints and frequency respond to travel markets and potential operating efficiencies, irrespective of railroad territory; assumes well-coordinated/highly-disciplined operations on the NEC and all connecting corridors feeding into the NEC

## Service Types

### Premium Express

**Super Express:** Trains stopping only at Boston, New York, Philadelphia and Washington  
**Premium Express:** High-speed service with few stops to primary & secondary markets; multiple stopping patterns  
**Limited Express:** High-speed service expanded to more stations, operating on both conventional and high-speed express tracks.  
*Note: these services represent the high-speed rail brand on the Northeast Corridor*

### Inter-Regional

**NEC Inter-Regional:** Limited-stop intercity service with multiple stopping patterns serving primary and secondary intercity markets  
**Connecting Corridor Inter-Regional:** Inter-Regional trains also operating off-corridor  
**Metropolitan:** Limited-stop trains serving both intercity and regional/commuter markets within broad metro areas or NEC-wide, with greater frequency, more station stops and lower fares than Inter-Regional service, operating as run-through trains at major terminals

### Regional / Urban

**Regional Rail (Commuter) Zone Express:** Peak period trains serving local stops within a zone of stations and otherwise operating non-stop or with limited stops to a major terminal.  
**Regional Rail (Commuter) Local:** All-stop local service  
**Zone Express:** Commuter Express service – zone express or branch line service with express operations on high-speed express tracks approaching major terminals (HST-type trains)  
**Urban Rail Transit Service on NEC ROW:** short distance, short headways, high-capacity trains within urban core areas

### Capacity Improvement Increments

1. Lower-cost incremental improvements
2. Cost-effective higher-cost improvements
3. Elimination or relief of selected choke points, major terminal capacity expansion
4. Portions of new right-of-way parallel to existing NEC
5. New dedicated high-speed route(s)

### Trip Time Improvement Increments

1. New high-speed rolling stock (top speed 160 mph)
2. Track realignment (curve mods, terminal areas, turnouts) and widening of track center spacing
3. Bypass tracks at stations
4. New alignments to bypass slow-speed NEC segments
5. New dedicated high-speed right-of-way

### Connecting Corridor Service Options

(evaluated as part of Program Level B, C and D Alts)

- High-quality transfer to NEC Spine services at hub stations
- Run-through Inter-Regional service
- Run-through Premium Express service

### Rolling Stock Technology

Very-high-speed technology options (e.g., MAGLEV) will be analyzed for the best-performing Program Level D alternatives (which provide new right-of-way between Washington and Boston via New York).

### Overlay Analyses

(evaluated in parallel with Prelim Alts)

- Major Terminal Configurations (Bos, NY, Wash)
- Rail Freight Options
- Airport Access Options
- Fare Policy Options

# Program Level A – Preliminary Alternative 1

## Conventional Operations w/ Lower-Cost Incremental Capacity Improvements

### General Characteristics

Relative Magnitude

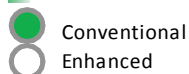
Quantity of Service



Level of Investment



Operational Environment



Capacity Improvement



Trip Time Improvement



Variety of Service Types



Level of Service to:

- Intermediate NEC Markets



- Existing Connecting Corridors



- New Connecting Corridors



### Capacity Improvements (Increment #1):

Relatively low-cost incremental improvements (resource-constrained)

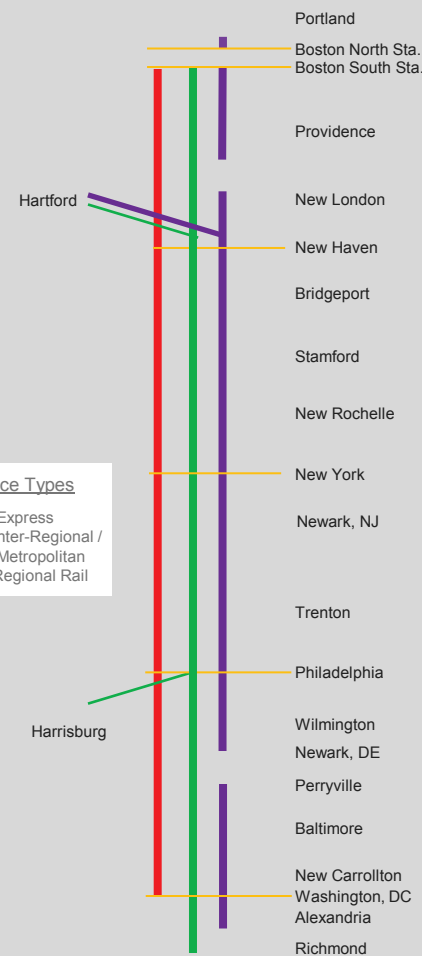
### Trip-Time Improvements:

New trainsets for Express service and capital improvements needed to achieve top speed of 160 mph

### Service Types

- Super Express
- Premium Express
- Limited Express
- Inter-Regional (Spine)
- Metropolitan
- Regional Rail
- Zone Express
- Urban Rail Transit (on NEC)
- Connecting Corridor Express
- Connect'g Corr Inter-Regional

### Train Type by Service Area





# Program Level A – Preliminary Alternative 2

## Conventional Operations w/ Cost-Effective Incremental Capacity Improvements

### General Characteristics

Relative Magnitude

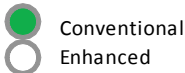
Quantity of Service



Level of Investment



Operational Environment



Capacity Improvement



Trip Time Improvement



Variety of Service Types



Level of Service to:

- Intermediate NEC Markets



- Existing Connecting Corridors



- New Connecting Corridors



### Capacity Improvements (Increment #2):

Cost-effective projects (including high-cost, high-benefit projects) providing increased capacity at choke points.

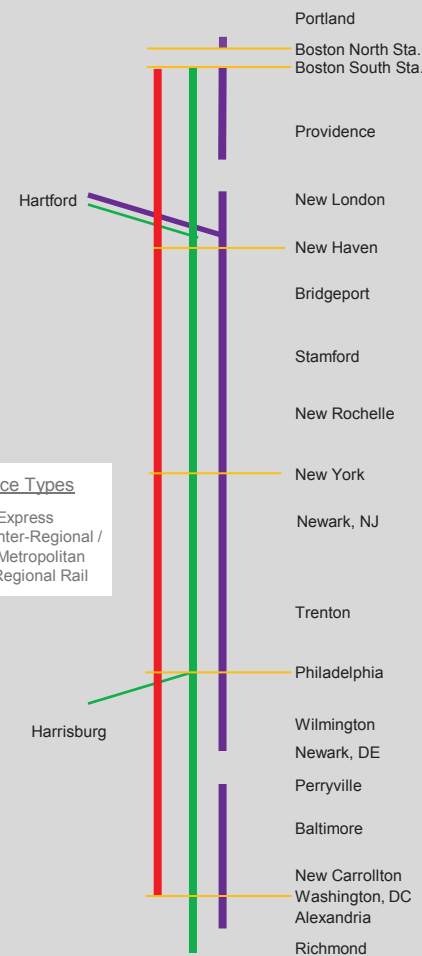
### Trip-Time Improvements:

New trainsets for Express service and capital improvements needed to achieve top speed of 160 mph

### Service Types

- Super Express
- Premium Express
- Limited Express
- Inter-Regional (Spine)
- Metropolitan
- Regional Rail
- Zone Express
- Urban Rail Transit (on NEC)
- Connecting Corridor Express
- Connect'g Corr Inter-Regional

### Train Type by Service Area



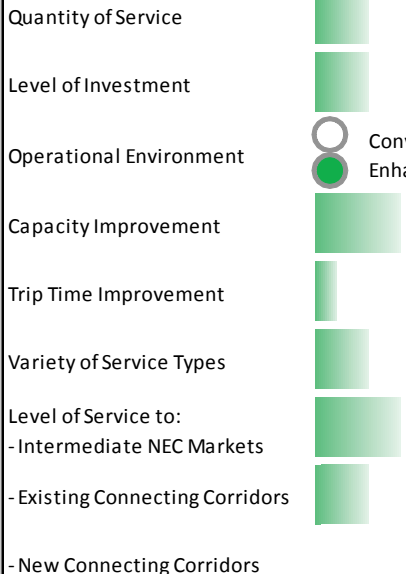
# Program Level A – Preliminary Alternative 3

## Enhanced Operations w/ Cost-Effective Incremental Capacity Improvements



### General Characteristics

Relative Magnitude



○ Conventional  
● Enhanced

### Capacity Improvements (Increment #2):

Cost-effective projects (including high-cost, high-benefit projects) providing increased capacity at choke points.

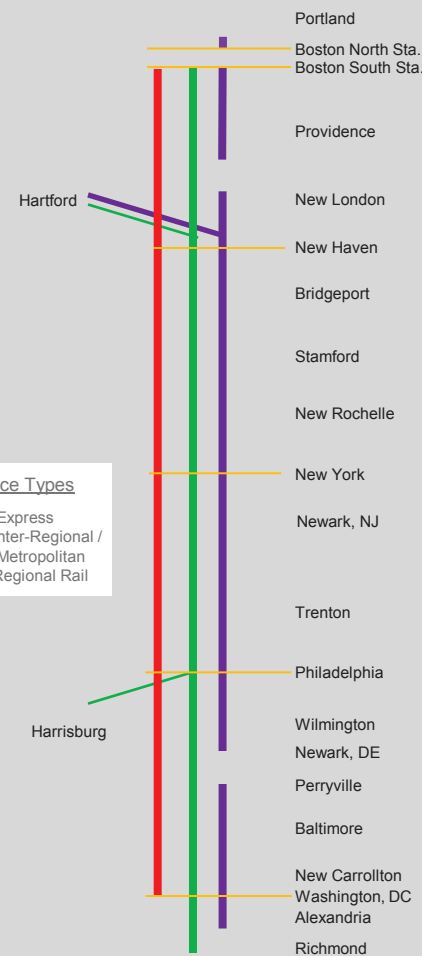
### Trip-Time Improvements:

New trainsets for Express service and capital improvements needed to achieve top speed of 160 mph

### Service Types

- Super Express
- Premium Express
- Limited Express
- Inter-Regional (Spine)
- Metropolitan
- Regional Rail
- Zone Express
- Urban Rail Transit (on NEC)
- Connecting Corridor Express
- Connect'g Corr Inter-Regional

### Train Type by Service Area



Service Types  
█ Express  
█ Inter-Regional / Metropolitan  
█ Regional Rail



### LEGEND

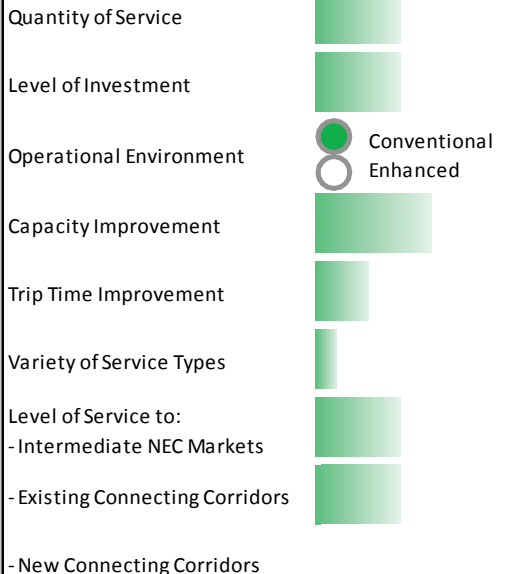
- █ Existing NEC Spine
- █ Second NEC Spine
- █ Existing Connecting Rail Corridor
- █ Potential Connecting Service
- █ Commuter/Regional Rail
- Existing Rail Station
- Potential Rail Station

# Program Level B – Preliminary Alternative 4

## Conventional Operations w/ Increased Capacity on Existing NEC Spine

### General Characteristics

Relative Magnitude



### Capacity Improvements (Increment #3):

Increased capacity at all significant choke points; terminal capacity improvements; express bypass tracks at selected stations to facilitate overtakes

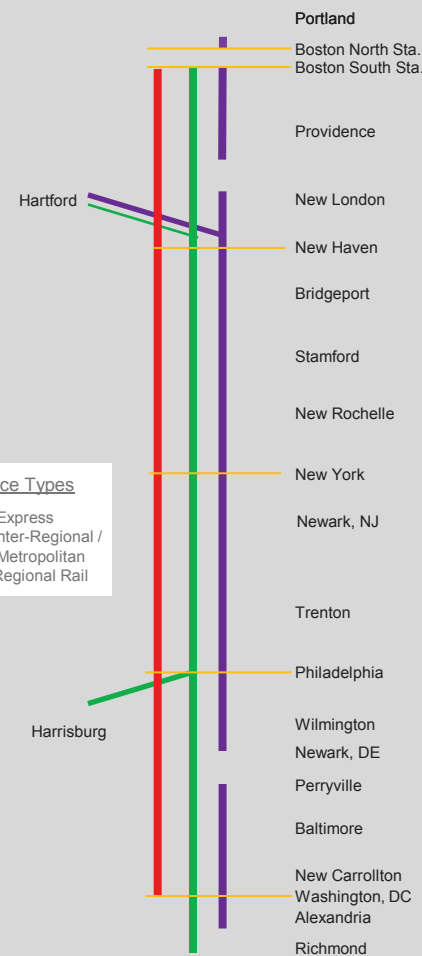
### Trip-Time Improvements:

Limited to cost-effective projects that also increase capacity.

### Service Types

- |  |   |
|--|---|
| <input type="checkbox"/> Super Express                     | <input checked="" type="checkbox"/> Regional Rail                 |
| <input checked="" type="checkbox"/> Premium Express        | <input type="checkbox"/> Zone Express                             |
| <input type="checkbox"/> Limited Express                   | <input type="checkbox"/> Urban Rail Transit (on NEC)              |
| <input checked="" type="checkbox"/> Inter-Regional (Spine) | <input type="checkbox"/> Connecting Corridor Express              |
| <input type="checkbox"/> Metropolitan                      | <input checked="" type="checkbox"/> Connect'g Corr Inter-Regional |

### Train Type by Service Area



### LEGEND

- Existing NEC Spine
- Second NEC Spine
- Existing Connecting Rail Corridor
- Potential Connecting Service
- Commuter/Regional Rail
- Existing Rail Station
- Potential Rail Station

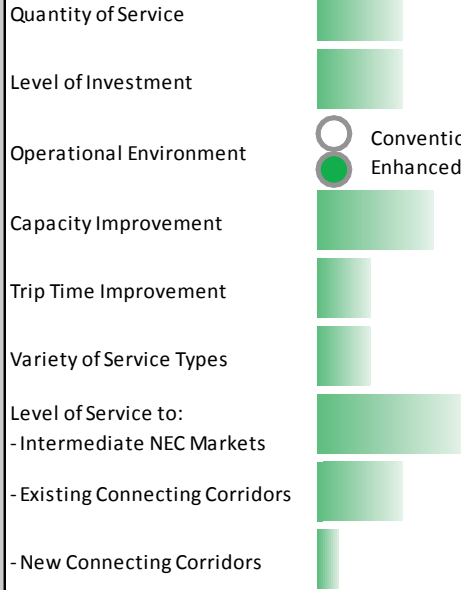
# Program Level B – Preliminary Alternative 5

## Enhanced Operations w/ High-Density Service, Increased Capacity on Existing NEC Spine



### General Characteristics

Relative Magnitude



### Capacity Improvements (Increment #3):

Increased capacity at all significant choke points; terminal capacity improvements; express bypass tracks at selected stations; improved track and platform configurations at transfer hubs

### Trip-Time Improvements:

Limited to cost-effective projects that also increase capacity.

### Service Types

- Super Express
- Premium Express
- Limited Express
- Inter-Regional (Spine)
- Metropolitan
- Regional Rail
- Zone Express
- Urban Rail Transit (on NEC)
- Connecting Corridor Express
- Connect'g Corr Inter-Regional

### Train Type by Service Area



### LEGEND

- Existing NEC Spine
- Second NEC Spine
- Existing Connecting Rail Corridor
- Potential Connecting Service
- Commuter/Regional Rail
- Existing Rail Station
- Potential Rail Station

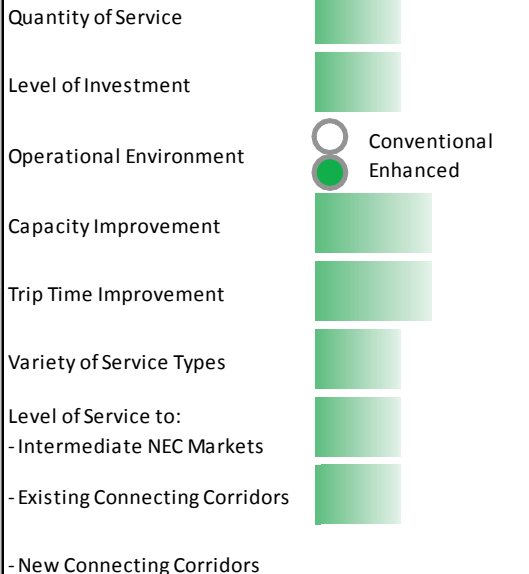
# Program Level B – Preliminary Alternative 6

Enhanced Operations w/ Higher-Speed Express Services, Increased Capacity on Existing NEC Spine



## General Characteristics

Relative Magnitude



## Capacity Improvements (Increment #3):

Increased capacity at all significant choke points; terminal capacity improvements; express bypass tracks at selected stations to facilitate overtakes

## Trip-Time Improvements:

Realignment of track center spacing, curve modifications and other improvements within existing NEC right-of-way.

## Service Types

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Super Express          | <input checked="" type="checkbox"/> Regional Rail                 |
| <input checked="" type="checkbox"/> Premium Express        | <input type="checkbox"/> Zone Express                             |
| <input type="checkbox"/> Limited Express                   | <input type="checkbox"/> Urban Rail Transit (on NEC)              |
| <input checked="" type="checkbox"/> Inter-Regional (Spine) | <input type="checkbox"/> Connecting Corridor Express              |
| <input checked="" type="checkbox"/> Metropolitan           | <input checked="" type="checkbox"/> Connect'g Corr Inter-Regional |

## Train Type by Service Area



## LEGEND

- Existing NEC Spine
- Second NEC Spine
- Existing Connecting Rail Corridor
- Potential Connecting Service
- Commuter/Regional Rail
- Existing Rail Station
- Potential Rail Station

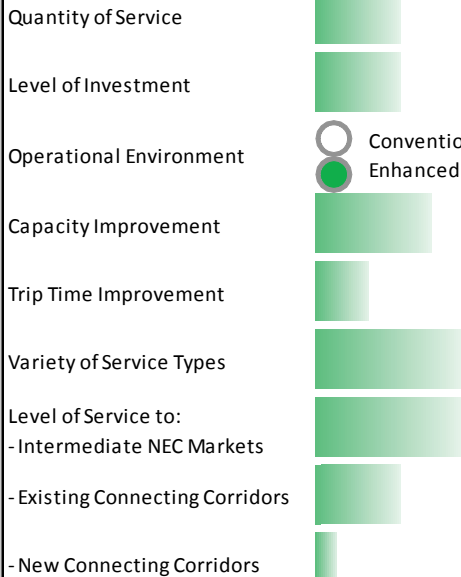
# Program Level B – Preliminary Alternative 7

Enhanced Operations w/ Greater Variety of Service Types, Increased Capacity on Existing NEC Spine



## General Characteristics

Relative Magnitude



## Capacity Improvements (Increment #3):

Increased capacity at all significant choke points; terminal capacity improvements; express bypass tracks at selected stations to facilitate overtakes

## Trip-Time Improvements:

Limited to cost-effective projects that also increase capacity.

## Service Types

- Super Express
- Premium Express
- Limited Express
- Inter-Regional (Spine)
- Metropolitan
- Regional Rail
- Zone Express
- Urban Rail Transit (on NEC)
- Connecting Corridor Express
- Connect'g Corr Inter-Regional

## Train Type by Service Area



## LEGEND

- Existing NEC Spine
- Second NEC Spine
- Existing Connecting Rail Corridor
- Potential Connecting Service
- Commuter/Regional Rail
- Existing Rail Station
- Potential Rail Station



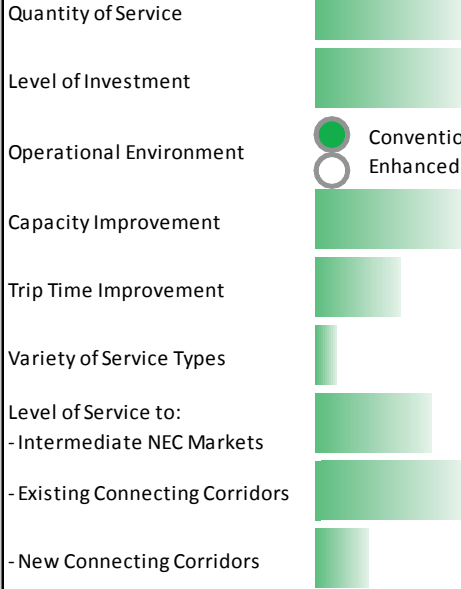
# Program Level C – Preliminary Alternative 8

## Conventional Operations w/ Partial New Alignments Parallel to NEC



### General Characteristics

Relative Magnitude



### Capacity Improvements (Increment #4):

Additional mainline tracks or bypass tracks on new right-of-way at targeted locations along NEC Spine to maximize capacity; terminal capacity improvements, relief of all significant bottlenecks.

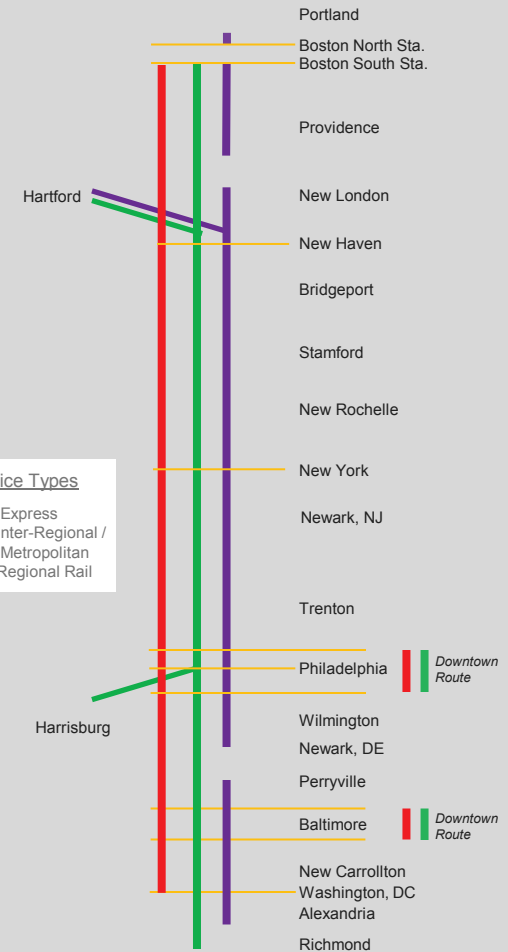
### Trip-Time Improvements:

Limited to cost-effective projects that also increase capacity.

### Service Types

- Super Express
- Premium Express
- Limited Express
- Inter-Regional (Spine)
- Metropolitan
- Regional Rail
- Zone Express
- Urban Rail Transit (on NEC)
- Connecting Corridor Express
- Connect'g Corr Inter-Regional

### Train Type by Service Area



### LEGEND

- Existing NEC Spine
- Second NEC Spine
- Existing Connecting Rail Corridor
- Potential Connecting Service
- Commuter/Regional Rail
- Existing Rail Station
- Potential Rail Station

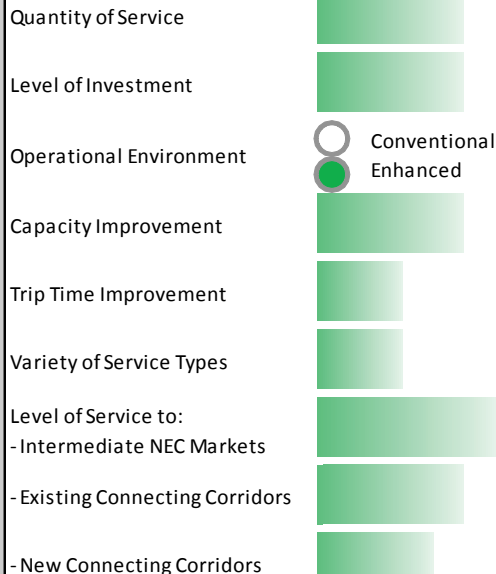
# Program Level C – Preliminary Alternative 9

Enhanced Operations w/ High-Density Service, Partial New Alignments Parallel to NEC



## General Characteristics

Relative Magnitude



## Capacity improvements (Increment #4):

Additional mainline tracks or bypass tracks on new right-of-way at targeted locations along NEC Spine to maximize capacity; terminal capacity improvements, relief of all significant bottlenecks; improved track and platform configurations at transfer hubs.

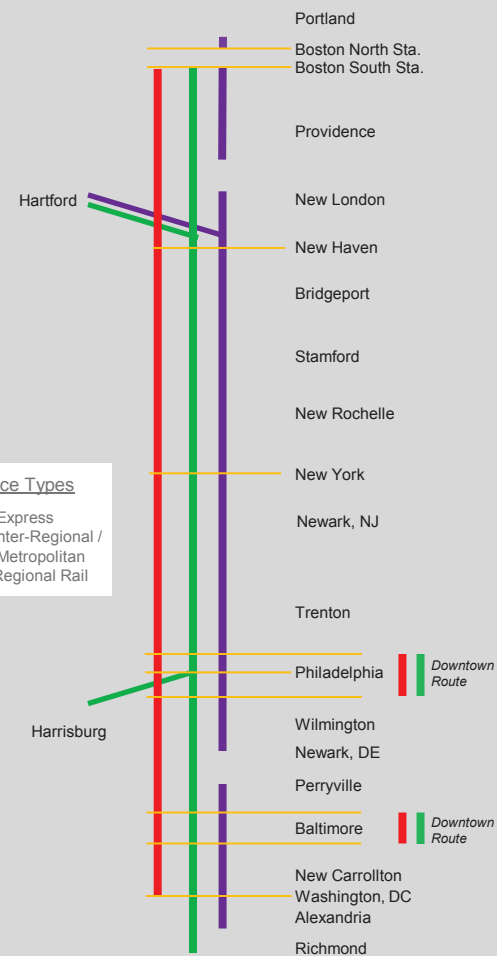
## Trip-Time Improvements:

Limited to cost-effective projects that also increase capacity.

## Service Types

- |  |   |
|--|---|
| <input type="checkbox"/> Super Express                     | <input checked="" type="checkbox"/> Regional Rail                 |
| <input checked="" type="checkbox"/> Premium Express        | <input type="checkbox"/> Zone Express                             |
| <input type="checkbox"/> Limited Express                   | <input type="checkbox"/> Urban Rail Transit (on NEC)              |
| <input checked="" type="checkbox"/> Inter-Regional (Spine) | <input type="checkbox"/> Connecting Corridor Express              |
| <input checked="" type="checkbox"/> Metropolitan           | <input checked="" type="checkbox"/> Connect'g Corr Inter-Regional |

## Train Type by Service Area





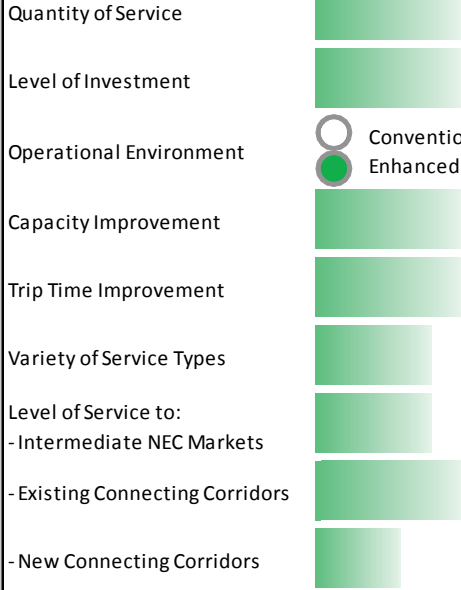
# Program Level C – Preliminary Alternative 10

Enhanced Operations w/ Higher-Speed Express Services, Partial New Alignments Parallel to NEC



## General Characteristics

Relative Magnitude



## Capacity improvements (Increment #4):

Additional mainline tracks or bypass tracks on new right-of-way at targeted locations along NEC Spine to maximize capacity; terminal capacity improvements, relief of all significant bottlenecks.

## Trip-Time Improvements:

New alignments to bypass slow-speed portions of NEC; Realignment of track center spacing, curve modifications on existing NEC right-of-way.



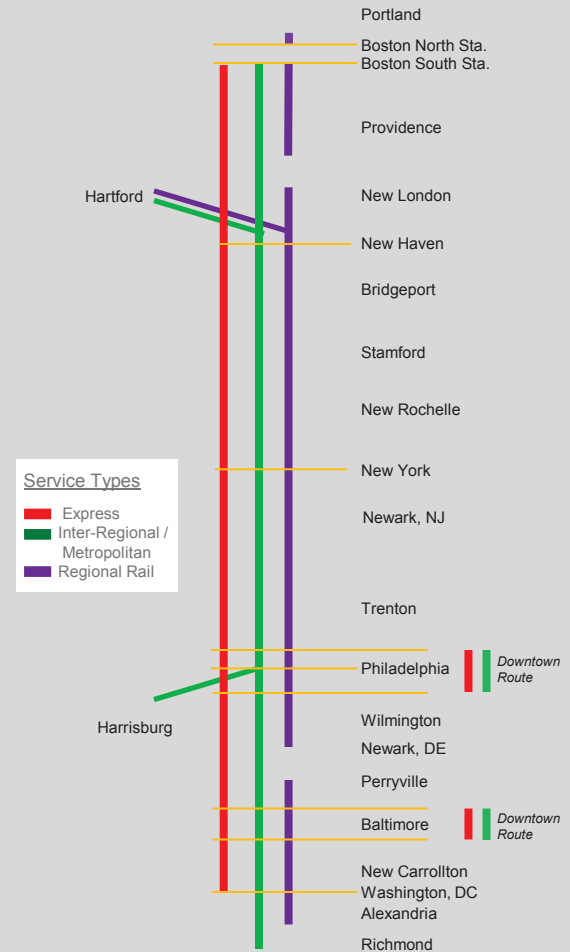
### LEGEND

- Existing NEC Spine
- Second NEC Spine
- Existing Connecting Rail Corridor
- Potential Connecting Service
- Commuter/Regional Rail
- Existing Rail Station
- Potential Rail Station

## Service Types

- Super Express
- Premium Express
- Limited Express
- Inter-Regional (Spine)
- Metropolitan
- Regional Rail
- Zone Express
- Urban Rail Transit (on NEC)
- Connecting Corridor Express
- Connect'g Corr Inter-Regional

## Train Type by Service Area



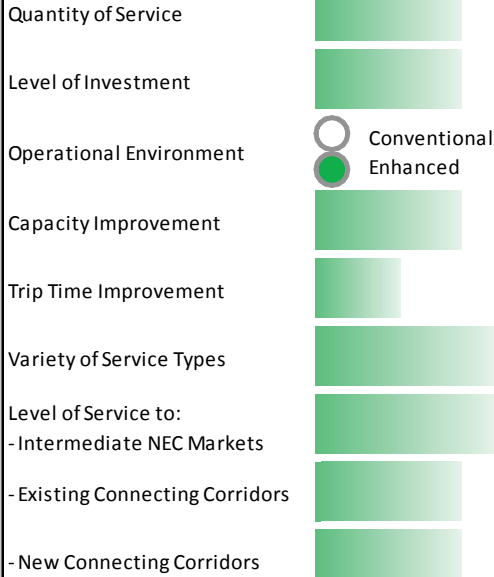
# Program Level C – Preliminary Alternative 11

Enhanced Operations w/ Greater Variety of Service Types, Partial New Alignments Parallel to NEC



## General Characteristics

Relative Magnitude



## Capacity improvements (Increment #4):

Additional mainline tracks or bypass tracks on new right-of-way at targeted locations along NEC Spine to maximize capacity; terminal capacity improvements, relief of all significant bottlenecks.

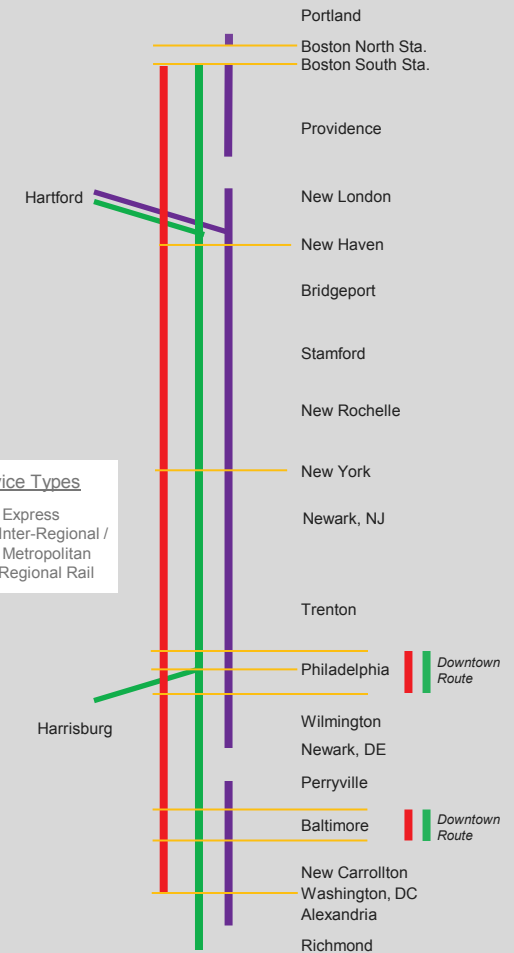
## Trip-Time Improvements:

Limited to cost-effective projects that also increase capacity.

## Service Types

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Super Express          | <input checked="" type="checkbox"/> Regional Rail                 |
| <input checked="" type="checkbox"/> Premium Express        | <input checked="" type="checkbox"/> Zone Express                  |
| <input checked="" type="checkbox"/> Limited Express        | <input checked="" type="checkbox"/> Urban Rail Transit (on NEC)   |
| <input checked="" type="checkbox"/> Inter-Regional (Spine) | <input checked="" type="checkbox"/> Connecting Corridor Express   |
| <input checked="" type="checkbox"/> Metropolitan           | <input checked="" type="checkbox"/> Connect'g Corr Inter-Regional |

## Train Type by Service Area



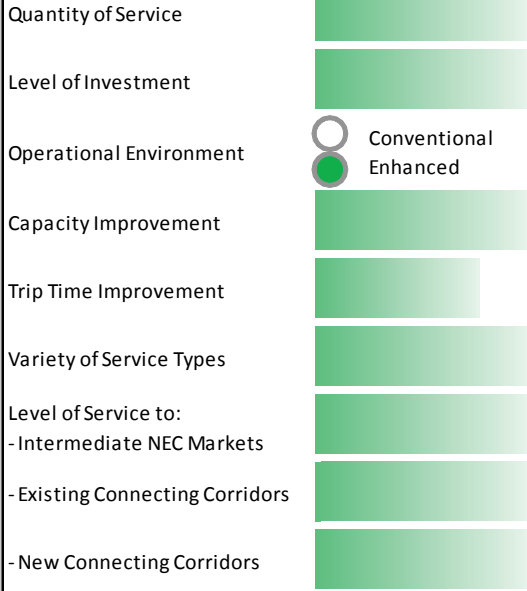
# Program Level D – Preliminary Alternative 12

## Enhanced Operations via New Alignment Parallel to Existing NEC and Improved Existing NEC Route



### General Characteristics

Relative Magnitude



### Capacity improvements (Increment #5):

New right-of-way and major increase in capacity, Boston-to-Washington; terminal capacity improvements, relief of bottlenecks and targeted improvements on existing NEC Spine to optimize capacity for continuing operations.

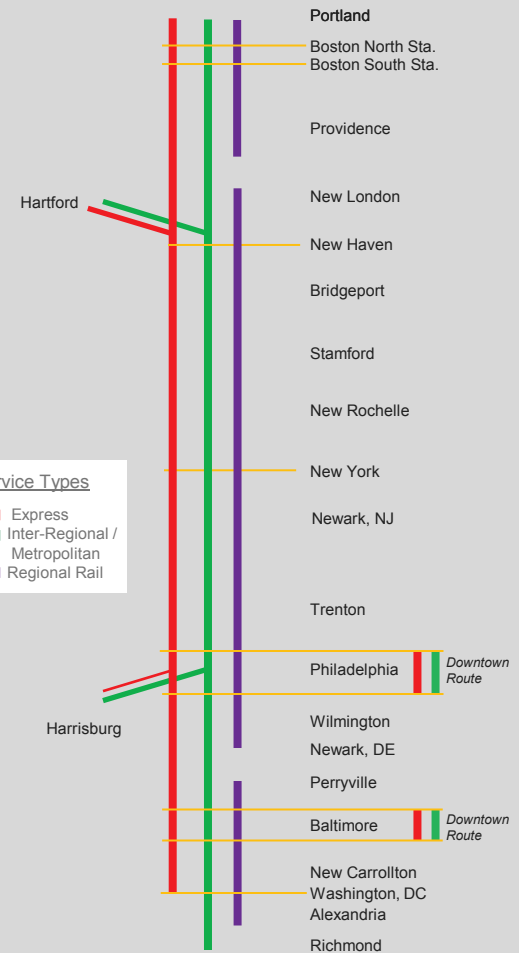
### Trip-Time Improvements:

New right-of-way designed for 220 mph top speed; targeted speed and trip-time improvements along existing NEC spine

### Service Types

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Super Express          | <input checked="" type="checkbox"/> Regional Rail                 |
| <input checked="" type="checkbox"/> Premium Express        | <input checked="" type="checkbox"/> Zone Express                  |
| <input checked="" type="checkbox"/> Limited Express        | <input checked="" type="checkbox"/> Urban Rail Transit (on NEC)   |
| <input checked="" type="checkbox"/> Inter-Regional (Spine) | <input checked="" type="checkbox"/> Connecting Corridor Express   |
| <input checked="" type="checkbox"/> Metropolitan           | <input checked="" type="checkbox"/> Connect'g Corr Inter-Regional |

### Train Type by Service Area



### LEGEND

- Existing NEC Spine
- Second NEC Spine
- Existing Connecting Rail Corridor
- Potential Connecting Service
- Commuter/Regional Rail
- Existing Rail Station
- Potential Rail Station

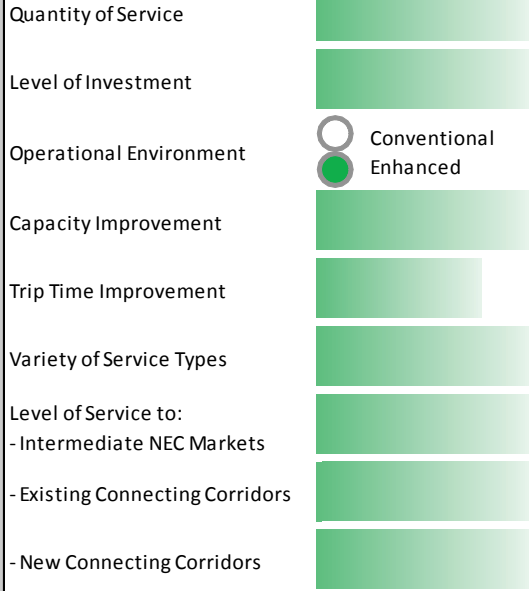
# Program Level D – Preliminary Alternative 13

## Enhanced Operations via Danbury-Hartford-Providence and Improved Existing NEC Route



### General Characteristics

Relative Magnitude



### Capacity improvements (Increment #5):

New right-of-way and major increase in capacity, Boston-to-Washington; terminal capacity improvements, relief of bottlenecks and targeted improvements on existing NEC Spine to optimize capacity for continuing operations.

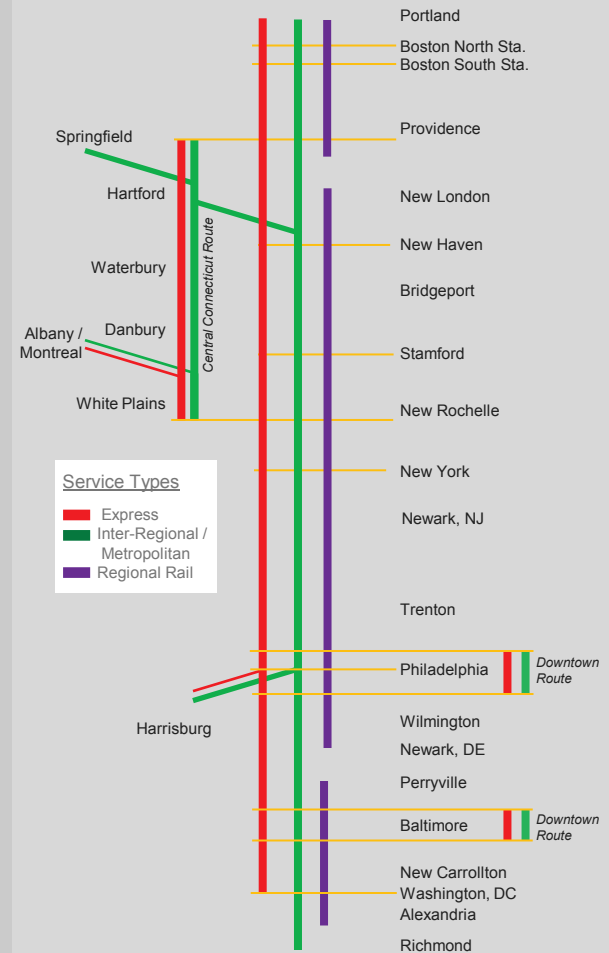
### Trip-Time Improvements:

New right-of-way designed for 220 mph top speed; targeted speed and trip-time improvements along existing NEC spine

### Service Types

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Super Express          | <input checked="" type="checkbox"/> Regional Rail                 |
| <input checked="" type="checkbox"/> Premium Express        | <input checked="" type="checkbox"/> Zone Express                  |
| <input checked="" type="checkbox"/> Limited Express        | <input checked="" type="checkbox"/> Urban Rail Transit (on NEC)   |
| <input checked="" type="checkbox"/> Inter-Regional (Spine) | <input checked="" type="checkbox"/> Connecting Corridor Express   |
| <input checked="" type="checkbox"/> Metropolitan           | <input checked="" type="checkbox"/> Connect'g Corr Inter-Regional |

### Train Type by Service Area



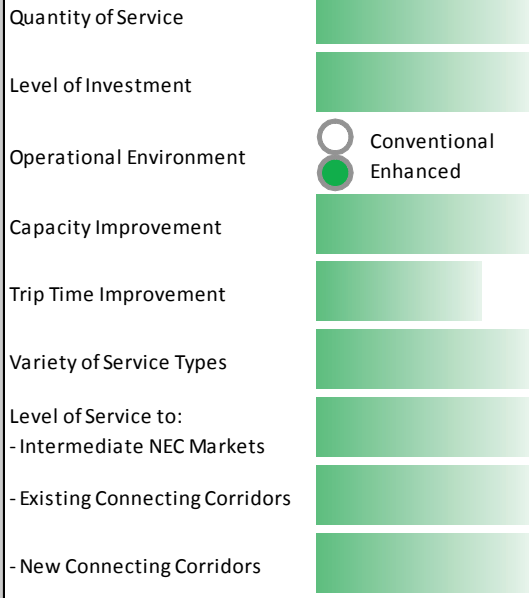
# Program Level D – Preliminary Alternative 14

## Enhanced Operations via Suffolk County-Hartford-Worcester and Improved Existing NEC Route



### General Characteristics

Relative Magnitude



### Capacity improvements (Increment #5):

New right-of-way and major increase in capacity, Boston-to-Washington; terminal capacity improvements, relief of bottlenecks and targeted improvements on existing NEC Spine to optimize capacity for continuing operations.

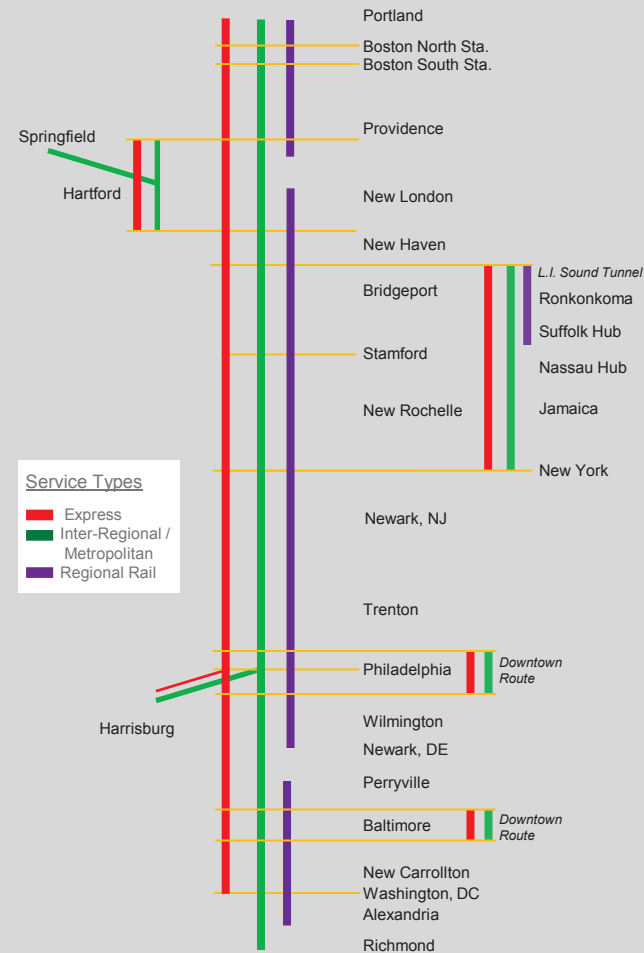
### Trip-Time Improvements:

New right-of-way designed for 220 mph top speed; targeted speed and trip-time improvements along existing NEC spine

### Service Types

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Super Express          | <input checked="" type="checkbox"/> Regional Rail                 |
| <input checked="" type="checkbox"/> Premium Express        | <input checked="" type="checkbox"/> Zone Express                  |
| <input checked="" type="checkbox"/> Limited Express        | <input checked="" type="checkbox"/> Urban Rail Transit (on NEC)   |
| <input checked="" type="checkbox"/> Inter-Regional (Spine) | <input checked="" type="checkbox"/> Connecting Corridor Express   |
| <input checked="" type="checkbox"/> Metropolitan           | <input checked="" type="checkbox"/> Connect'g Corr Inter-Regional |

### Train Type by Service Area



### LEGEND

- Existing NEC Spine
- Second NEC Spine
- Existing Connecting Rail Corridor
- Potential Connecting Service
- Commuter/Regional Rail
- Existing Rail Station
- Potential Rail Station

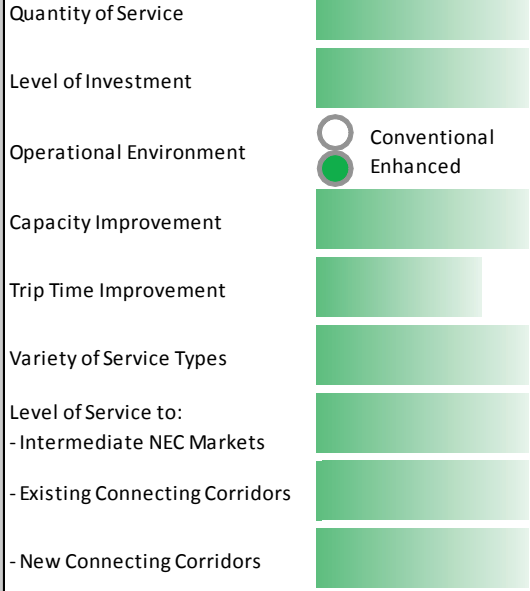
# Program Level D – Preliminary Alternative 15

## Enhanced Operations via Delmarva and Nassau-Stamford-Springfield-Worcester and Improved NEC



### General Characteristics

Relative Magnitude



### Capacity improvements (Increment #5):

New right-of-way and major increase in capacity, Boston-to-Washington; terminal capacity improvements, relief of bottlenecks and targeted improvements on existing NEC Spine to optimize capacity for continuing operations.

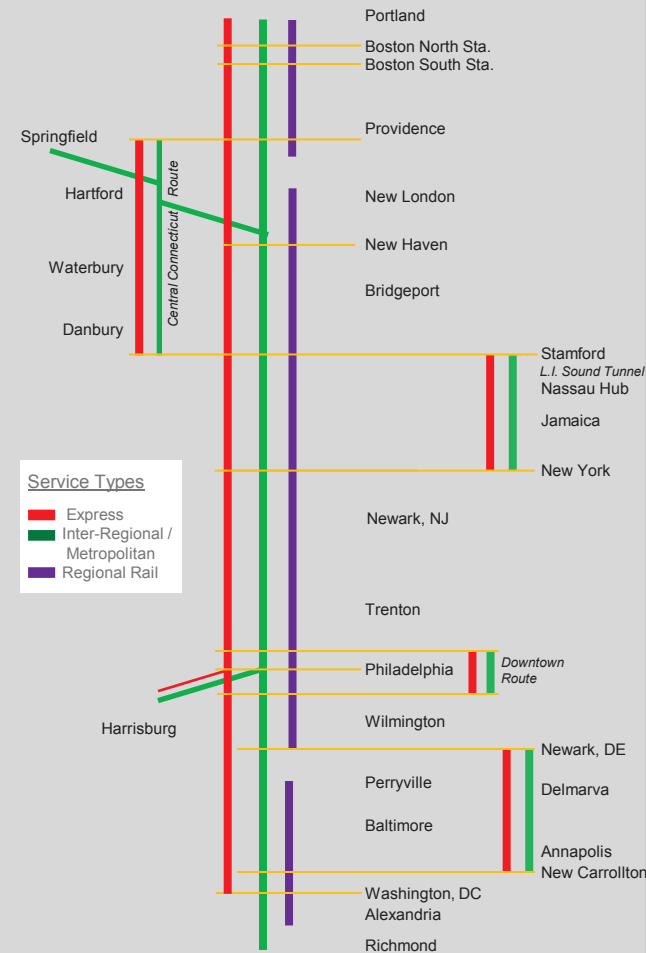
### Trip-Time Improvements:

New right-of-way designed for 220 mph top speed; targeted speed and trip-time improvements along existing NEC spine

### Service Types

- Super Express
- Premium Express
- Limited Express
- Inter-Regional (Spine)
- Metropolitan
- Regional Rail
- Zone Express
- Urban Rail Transit (on NEC)
- Connecting Corridor Express
- Connect'g Corr Inter-Regional

### Train Type by Service Area



### LEGEND

- Existing NEC Spine
- Second NEC Spine
- Existing Connecting Rail Corridor
- Potential Connecting Service
- Commuter/Regional Rail
- Existing Rail Station
- Potential Rail Station