NEC FUTURE

A Rail Investment Plan for the Northeast Corridor

Preliminary Alternatives Evaluation Report

November 2014

U.S. Department of Transportation

Federal Railroad Administration

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1. Alternatives Development Process

NEC FUTURE is a comprehensive planning effort to define, evaluate, and prioritize future investments in the Northeast Corridor (NEC), the rail transportation spine of the Northeast region of the United States. The planning effort will establish an investment plan for NEC, which, if implemented, will improve the capacity and reliability of passenger rail service in the Northeast, for both regional and intercity trips, in a manner that will meet mobility needs as the region's population and employment continue to grow. This plan will strengthen service to existing rail markets and address additional travel markets that rail does not adequately serve today, both on and off the NEC. While the study horizon year for NEC FUTURE is 2040, the vision for rail on the NEC will provide a foundation for growth well beyond 2040. With the alternatives development process, the Federal Railroad Administration (FRA) is evaluating potential options for maintaining or growing the role of rail in the Northeast region. The process includes three stages:

- **Initial Alternatives (July 2012–March 2013):** Through extensive outreach to the region's eight states, the District of Columbia, the NEC's eight regional rail operators, Amtrak, freight railroads, the Northeast Corridor Infrastructure & Operations Advisory Commission (NECC), and the general public (during scoping), a broad range of 98 passenger rail market and service options were assembled and evaluated. These options included specific route recommendations, new service and market options, and a second spine to support 220 mph high-speed rail (HSR) service.
- **Preliminary Alternatives (April 2013–July 2014):** The 98 Initial Alternatives were organized into four distinct program levels, A through D, encompassing the broad spectrum of approaches to serving existing and new markets in the region. Each program level articulates a different vision for the role that rail can play in meeting regional transportation needs.

  Within each program level, separate scenarios were developed to better understand and quantify key rail market and service dynamics, such as the trade-offs between frequency of service, trip time, and the convenience of direct "one-seat" service. Four separate second-spine route alternatives were also developed for Program Level D. A total of 15 alternatives were assembled within the four program levels. Separate service plans and capital investment requirements were created for each alternative. Data were generated using existing ridership, operations simulation, and cost models.
- **Tier 1 Draft Environmental Impact Statement (EIS) Alternatives (August 2014–June 2015):** From the 15 Preliminary Alternatives, a smaller set of alternatives will be developed for full analysis in the Tier 1 Draft EIS. These alternatives will draw from the evaluation of the Preliminary Alternatives and will repackage the best service concepts to provide distinct alternative visions for the role of rail on the NEC. In the Tier 1 Draft EIS, these alternatives will be compared against each other and with the No Action Alternative, using new ridership and operations models now under development.

The Tier 1 Final EIS will identify the FRA's preferred service vision and associated program of investments, including implementation phasing. The FRA will consider the Tier 1 Draft EIS findings and stakeholder input, including comments on the Tier 1 Draft EIS, in identifying a preferred investment program. With the Record of Decision (ROD), the FRA will select the Investment Program and subsequently prepare a Service Development Plan to define how it will be implemented.

Because of the unique geographic, technical, and institutional complexity of the program, the FRA has taken an innovative approach to develop NEC FUTURE alternatives. The alternatives development process being used is iterative, and allows for corridor-wide service plans and infrastructure projects to be developed, tested, refined, recombined, and optimized for different service and geographic markets within the NEC. This modular approach has made it possible to understand how discrete elements perform relative to one another, so that the strongest "package" of separate route, infrastructure, and service options can ultimately be crafted into the alternatives to meet specific market needs within different NEC sub-regions.

With a range of asset owners and service operators that utilize the NEC, the alternatives development process has entailed frequent coordination with state and railroad stakeholders, as well as federal and state environmental, transportation, and non-transportation officials. Additional information on the alternatives development process can be found in the Preliminary Alternatives Report, available on the NEC FUTURE website at necfuture.com.

2. The Preliminary Alternatives

The Preliminary Alternatives were developed by organizing the 98 Initial Alternatives into four program levels that differ by the quantity and types of rail service they provide to the region. The four program levels represent a broad range of options for the role that passenger rail can play in the NEC and across the region, from a lower cost approach focused on the minimum investment required to accommodate future demand to a transformational vision that includes a second spine designed to support HSR service at speeds up to 220 mph. Analysis of these four program levels has enabled FRA to assess the benefits and impacts of different levels of investments in the NEC.

The year 2040 was selected as a reasonable horizon year for ridership demand forecasts based on the availability of data. Many of the regional rail authorities have projected demand through 2030–35, as well as the service levels to support that demand. These projections include both organic growth, based on expected increases in population and employment, and, in some cases, an additional share of the travel market that would shift to rail as other modes become more and more congested. FRA is using these projections to help define demand and capacity needs for the horizon year. Moreover, projecting demand more than 25 years into the future can prove overly speculative.

The following variations were developed within each program level to test key service attributes and dynamics:

- Contrasting Conventional and Enhanced Train Service: Passenger rail service on the NEC today is provided by eight regional rail operators and by Amtrak, which provides intercity service. Regional rail generally connects cities and towns within one state or on the border of two states (e.g., NJ TRANSIT service within New Jersey and connecting to New York City). Each regional rail service operates independently on the NEC and, historically, each regional rail market was geographically distinct, though with the distributed growth of population along the NEC, those distinctions have blurred. Amtrak operates across the full length of the NEC, serving 25 cities with express trains, which offer the fastest trip times and serve fewer cities, and intercity-corridor trains, which stop

more often and serve a wider variety of city-pairs. The eight regional rail operators and Amtrak coordinate dispatching of trains and management of track capacity, but there is little integration of service, schedules, or fares across the different NEC markets.

Program Levels A, B, and C include alternatives that contrast today's "conventional" intercity and regional independent operating approach and stopping patterns with an integrated network of "enhanced" services designed to accommodate changing travel patterns along the NEC and provide a more customer-friendly travel experience. These include both new types of train service and changes in the way intercity and regional rail service is operated:

- A new train service, called "metropolitan," would serve both regional and intercity rail stations on the same train. Metropolitan trains would supplement intercity and regional service in the busiest markets during peak periods each day, as well as operate across the NEC to serve a broader mix of stations. These trains would fill the gap between today's intercity and regional rail markets with fares and service amenities that are between those offered by regional and intercity trains.
- Operational improvements would be implemented to better integrate train service across today's separate markets. This would include "through-service" at major stations to reduce the need to transfer between trains; clockwork train departures and standard stopping patterns, to improve travel time and capacity; integrated ticketing and fares across the NEC to reduce passenger inconvenience; and reduced dwell time at stations to reduce travel time. In addition, stations would be enhanced and train schedules integrated across the NEC to provide easier transfers between trains, thereby increasing travel options and frequencies to many stations.

  Program Level A includes a conventional and an enhanced alternative. Program Levels B and C test three different enhanced operating approaches. These operating approaches are designed to quantify the trade-offs between frequency of service, trip time, and the convenience of one-seat service. This test allows for comparison among the operating approaches and between enhanced and conventional operations within each program level. Comparison of conventional and enhanced operations has helped FRA to identify ways to improve service and performance, and to define the most efficient approaches to upgrading the NEC.

- New Markets: Where Program Level A addresses only the minimal additional service and improvements required to meet growing demand for rail service on the existing NEC, Program Levels B, C, and D look to expand rail service off the existing spine and to better integrate with rail service on connecting corridors. Program Level C adds a 60-mile bypass route in southeastern Connecticut and new routes to downtown Baltimore and Philadelphia, and Program Level D adds a second spine to the NEC to serve new markets and support significant new service, including HSR. Program Level D includes four different second-spine route options to quantify differences in ridership, travel time, and connectivity to other markets.

The following Preliminary Alternatives were developed:

- **Program Level A:** Program Level A tests the lower bounds of improvements to attempt to meet the Purpose and Need. This program level generally supports the minimum service levels needed to carry regional travel demand as projected for 2040 (or extrapolated from data provided) by the NEC regional rail operators and/or regional metropolitan planning organizations (MPO). Program Level A would provide only a modest expansion of intercity rail service by increasing the carrying capacity of

trains (increasing the number of seats), filling passenger train slots that are currently not filled due to lack of equipment, and expanding the number of stations served. Program Level A does not grow rail's share of the travel market and provides no spare capacity beyond 2040.

Targeted investments address the significant state-of-good-repair backlog and relieve major capacity constraints along the NEC. Investments would include the following:

- Two new tracks under the Hudson River to accommodate additional trains operating to and from New York City. The tracks would stub end at New York Penn Station.
- Expansion of New York Penn Station.
- Additional tracks between: New Carrollton, MD, and Wilmington, DE; New York and Stamford, CT; and Canton, MA, to the Route 128 station. Expansion of the right-of-way to provide bypass routes to avoid choke points at key locations in Maryland, New Jersey, and Connecticut.
- Systemic upgrades to enhance reliability.

Within Program Level A, three alternative scenarios were tested:

- **Alternative A1** serves as a financially constrained alternative. While it includes improvements to the NEC that go beyond the No Action Alternative, it would fail to meet projected growth in demand resulting from population and employment increases, and hence would not meet the Purpose and Need. It was included to help quantify the gap between today's level of service and that required to meet future regional travel demand.
- **Alternative A2** would grow the railroad to attempt to meet regional rail travel demand projected in existing markets for 2040 and provide for a minor expansion of intercity service. It would carry forward the same conventional operating approach and stopping patterns used today by the eight regional rail authorities and Amtrak. It illustrates how the railroad would perform in 2040 if it were modestly improved and operated in the same manner as it operates today.
- **Alternative A3** would grow the railroad to attempt to meet regional rail travel demand projected in existing markets for 2040 and provide for a minor expansion of intercity service. It would also introduce limited metropolitan service, carrying intercity and commuter passengers on the same train, to provide additional train service in the peak periods in the busiest NEC markets, and, where feasible, supplement intercity rail service to support a broader mix of stations. Alternatives A2 and A3 allow comparison of conventional and enhanced operations performance.

- **Program Level B:** Program Level B would provide substantially more rail service by expanding the NEC generally to its full extent within the existing railroad right-of-way. In addition to the upgrades included within Program Level A, all Program Level B alternatives would include the following infrastructure improvements:
  - Expansion of the entire length of the NEC to four tracks, and to as many as six tracks in the busiest sections of New Jersey and Connecticut
  - Expansion of the right-of-way to provide bypass routes to avoid choke points at additional key locations, including Wilmington DE, Trenton NJ and New Rochelle NY

- Expansion of rail passenger facilities at Washington Union Station, New York Penn Station, and Boston South Station to support the increased number of trains and passengers

The added capacity would support expansion of regional rail service to accommodate growth in demand projected in existing markets for 2040. It would also double the number of intercity trains, and modestly improve intercity travel times, providing travelers a broader range of rail service options. This would enable rail to capture a larger share of the travel market. Program Level B was intended to represent the largest role passenger rail can play in the region if investment is predominantly limited to the existing NEC right-of-way.

Program Level B includes four alternatives intended to test different service dynamics:

- **Alternative B4** would grow the railroad to the full extent of its right-of-way, providing the capacity for a substantial growth in rail service. Like Alternative A2, it would carry forward to 2040 the same conventional operating approach and service patterns used today by the eight regional rail authorities and Amtrak, expanded as appropriate to take advantage of the new capacity.
- **Alternative B5** would grow the railroad to the full extent of its right-of-way, providing the capacity for a substantial growth in service. However, the service plan applied to this alternative was designed to maximize the frequency of train service between markets on the NEC. To provide the capacity to maximize train frequencies, there were fewer high-speed intercity-express trains (which consume capacity to pass slower moving trains). In addition, train schedules were integrated across the corridor to support the convenient transfer of passengers from one train to another as well as from one type to the other (e.g., regional rail to intercity) rather than to rely solely on one-seat end-to-end rides to some markets. Thus, for example, service between the Philadelphia and New York City market might be substantially expanded, but passengers arriving from Harrisburg, PA, on the connecting Keystone corridor might be required to transfer to an NEC train at Philadelphia rather than expect a one-seat ride to New York City.
- **Alternative B6** would grow the railroad to the full extent of its right-of-way, providing the capacity for a significant growth in service. However, the service plan applied to this alternative was designed to support the fastest possible intercity-express trip time. This would necessarily reduce the number of trains that can otherwise operate at slower speed on the NEC, providing a direct comparison between frequency of service (Alternative B5) and travel time (Alternative B6) or one-seat ride convenience (B7).
- **Alternative B7** would grow the railroad to the full extent of its right-of-way, providing the capacity for a significant growth in service. However, the service plan applied to this alternative was designed to maximize the number of one-seat rides for both trips starting and ending on the NEC and trips starting or ending at stations on connecting rail corridors, such as Richmond, VA, or Springfield, MA. Maximizing the number of one-seat rides is more convenient for some passengers, but necessarily reduces the total number of trains that can serve a specific station. Alternative B7 (one-seat ride) enabled a direct comparison with frequency of service (Alternative B5) and travel time (Alternative B6).

- **Program Level C**: Program Level C would build on Program Level B to further expand service by adding trains to various new markets in the Northeast. While remaining primarily on the existing

NEC, Program Level C would add portions of a second spine in order to serve new markets and to improve travel time. Anticipated improvements include the following:

- New downtown stations in Baltimore, MD, and Philadelphia, PA, to supplement service to existing stations
- A new 60-mile supplemental two-track route between Old Saybrook, CT, and Kenyon, RI, to address capacity constraints over five movable bridges in southeastern Connecticut along the existing New Haven-Providence shoreline route
- Additional track and right-of-way between New Haven, CT, and New Rochelle, NY, to accommodate additional intercity and regional rail trains in what is the busiest segment of the NEC
- Two additional tracks under the East River in New York to accommodate expanded intercity service and additional regional rail trains at Penn Station New York from Long Island and from New York and Connecticut suburbs north of the city. New stub-end Penn Station tracks included in Program Level A and B from the two additional Hudson River tunnels would extend eastward to the six East River tunnels and connect with the existing NEC tracks near Sunnyside Yard.

Program Level C includes four alternatives intended to test service dynamics similar to Program Level B:

- **Alternative C8** would carry forward to 2040 the same operating approaches and service patterns used today by the eight regional rail operators and Amtrak, expanded as appropriate to take advantage of the new capacity. It illustrates the Program Level C performance if the railroad operates in the same manner as it operates today.
- **Alternative C9** would maximize the frequency of train service between markets on the NEC.
- **Alternative C10** would support the fastest possible intercity-express trip time.
- **Alternative C11** would maximize the number of one-seat rides for both trips starting and ending on the NEC and trips starting or ending at stations on connecting rail corridors, such as Richmond, VA, or Springfield, MA.

- **Program Level D**: Program Level D would transform the role that rail plays on the NEC and in the region by adding a "second spine" from Washington, D.C., to Boston to support significant additional rail service across the region, as well as new air-competitive HSR service between major NEC markets. The addition of a second spine—coupled with improvements to the existing NEC generally equivalent to those included in Program Level B—would support a significant increase in the number of regional rail and intercity trains. Both regional and intercity rail ridership would jump as a result of the significant new capacity, service to new markets, faster trip times, and the opportunity to operate new types of service. In addition, the second spine would allow for implementation of true HSR service on the NEC, operating at speeds up to 220 mph, with the goal of travel times of less than 100 minutes between Washington, D.C., and New York City and between New York City and Boston. The second spine would also be used for new types of regional service, including high-speed zone express service (serving small groups of stations before operating express on the new high-speed tracks), as well as very limited-stop intercity-express service.

South of New York City, the second spine would be built in close proximity to the existing spine and serve existing stations (with the exception of portions of Alternative D15). North of New York, large portions of the second spine would be located to serve new markets, expanding the market reach of the NEC (with the exception of Alternative 12).

Program Level D includes four second-spine route options:

- **Alternative D12** would include a second spine generally parallel to the NEC from Washington, D.C., to Boston, MA
- **Alternative D13** would include a second spine generally parallel to the NEC from Washington, D.C., to New York City, then to Boston, MA, via White Plains, NY, Danbury and Hartford, CT, and Providence, RI
- **Alternative D14** would include a second spine generally parallel to the NEC from Washington, D.C., to New York City, then to Boston, MA, via Ronkonkoma, NY (on Long Island), New Haven and Hartford, CT, and Worcester, MA
- **Alternative D15** would include a second spine serving the Delmarva Peninsula between Washington, D.C., and Wilmington, DE, then generally parallel to the NEC to New York City, then to Boston, MA, via Nassau County (on Long Island), Stamford and Hartford, CT, and Springfield and Worcester, MA.

Table 1 summarizes the Preliminary Alternatives.

As noted, service and route options were separately tested, refined, and optimized for different geographic markets within the NEC in order to be able to develop a range of Tier 1 EIS alternatives. For example, while the fifth and sixth Hudson River tunnels were included and tested only as a component of the most expansive program level, they could be added to a future lower-level investment scenario if needed to meet projected regional and intercity rail demand. Similarly, each major route segment included in the Program Level D alternatives (e.g., Hartford-Worcester-Boston; Hartford-Providence-Boston; and Hartford-Springfield-Boston) was separately tested to enable the possible repackaging of the best-performing segments for analysis in the Tier 1 EIS. This modular approach will be used to craft the strongest “package” of separate route, infrastructure and service options into the alternatives to meet specific market needs within different NEC sub-regions.

Table 1: Summary of Preliminary Alternatives

Service Program	Alternative	Intended Service Outcomes	Service or Route Options
A	1	**Addresses State of Good Repair and Grows Commuter & Intercity Service** ▪ Attempts to meet projected regional rail demand for existing NEC markets ▪ 2 intercity trains/hr each direction	Fiscally Constrained
	2		Conventional Service
	3		Enhanced Service
B	4	**More Capacity on Existing NEC Route** ▪ Meets growth in regional rail demand for existing NEC markets ▪ 4 intercity trains/hr each direction	Conventional Service
	5		Enhanced: High-density service
	6		Enhanced: Fastest Express Service
	7		Enhanced: Most One-Seat Service
C	8	**Targeted Growth to New Markets** ▪ Meets growth in regional rail demand for existing and expanded regional rail markets ▪ 4 intercity trains/hr each direction ▪ Downtown Baltimore and Philadelphia stations	Conventional Service
	9		Enhanced: High-density service
	10		Enhanced: Fastest Express Service
	11		Enhanced: Most One-Seat Service
D	12	**Additional NEC Spine** ▪ Meets and exceeds growth in existing and expanded regional rail markets ▪ 9 intercity trains/hr each direction ▪ Downtown Baltimore and Philadelphia stations ▪ Serves major and intermediate markets along second-spine route	Generally parallel to existing NEC
	13		Via Danbury–Hartford–Providence
	14		Via Suffolk–Hartford–Worcester
	15		Via Delmarva and Nassau–Stamford–Danbury–Springfield

3. Analysis of the Preliminary Alternatives

Evaluation of the four program levels consisted of comparing the 15 Preliminary Alternatives to understand how they meet the purpose of the NEC FUTURE Investment Program and to understand the effect of the different service plans on ridership, travel time and service quality, and, in the case of the different Program Level D second-spine route alternatives, to compare performance and impacts.

Evaluation Criteria: Evaluation criteria and associated performance measures derived from the Purpose and Need were used in the overall alternatives development process. The criteria are based on best practices and models used in transportation investment programs of similar physical and programmatic magnitude at a Tier 1 level of analysis, as well as stakeholder input. The criteria and data used to evaluate the Preliminary Alternatives, such as ridership and travel time, are detailed below. Data supporting other criteria and associated metrics, such as economic impacts, capital and operating costs, and construction phasing, will not be developed until later in the study process and will be used to evaluate the Tier 1 EIS alternatives. Table 2 presents the set of evaluation criteria used to evaluate the Preliminary Alternatives.

Table 2: NEC FUTURE Evaluation Criteria

Evaluation Criteria	Metrics
Accommodate Growth and Expand Capacity	▪ Annual passengers ▪ Annual passenger miles ▪ Peak-hour passengers ▪ Trains per peak-hour
Rebuild Aging Infrastructure	▪ NEC in a state of good repair
Service Effectiveness and Performance	▪ Travel-time savings ▪ Express trip time by segment ▪ Number of hourly corridor-wide intercity train frequencies ▪ Total number of peak-hour trains operating on NEC ▪ Stations and city-pairs served by intercity trains
Connectivity	▪ Stations served by intercity trains ▪ City-pair combinations ▪ Improved air-rail connections ▪ Ability to share existing and future tracks, stations and other railroad infrastructure

The metrics and data for each criterion were used to compare the program levels, as well as to compare the separate alternatives within each program level. This comparison is presented below. In addition, Section 3.6 includes separate ridership and travel-time data for different geographic segments of the Program Level D second-spine alternatives. Separately evaluating the second-spine alternatives by geographic segment will enable the FRA to identify the strongest second-spine route segments and to ultimately assemble the best-performing second-spine route combinations.

3.1 ACCOMMODATE GROWTH AND EXPAND CAPACITY

Ridership is a key measure of the ability to grow the NEC to accommodate future travelers on the rail system. It also reflects the impact of adding new markets and introducing new types of service. Preliminary ridership data were developed from existing models used by Amtrak and the NEC regional rail operators, or were provided directly from the railroads. In the Tier 1 EIS, travel demand and ridership data will be updated using results from a new NEC demand-forecasting model currently under development.

The performance metrics for this criterion include the following:

- Annual passengers
- Annual passenger miles
- Peak-hour passengers
- Peak-hour trains

3.1.1 ANNUAL PASSENGERS/ANNUAL PASSENGER MILES

Table 3 presents preliminary estimates of annual trips and annual passenger miles for the existing condition and the four program levels. Not surprisingly, the data indicate that ridership has a direct relationship with the level of service (and consequently investment). As service increases, projected ridership also increases, indicating that demand for expanded rail service is high.

Table 3: Current and Preliminary Estimates of Future NEC Ridership

	Annual Trips (millions) (average across program level)	Annual Passenger Miles (billions) (average of alternatives within each program level)
Existing (2012)	330	10
Program Level A (2040)	471	15
Program Level B (2040)	495	17
Program Level C (2040)	505	18
Program Level D (2040)	550	24

In addition to comparing annual ridership at the program level, ridership and passenger miles by service type can be compared within each program level to better understand the impacts of service plans designed to emphasize different service attributes. The ridership data in Figures 1 and 2 have been disaggregated to show ridership by service type, as follows:

- **Intercity–express** represents express passenger train service to the largest NEC markets (i.e., today's Acela service operated by Amtrak).
- **Intercity–corridor** represents passenger train service that covers longer distances than commuter or regional trains, but makes more stops compared to intercity-express service. Alternatives A3, B5, B6 and B7, and C9, C10, and C11 include proposed metropolitan service, which would expand the number of stations served by intercity trains well beyond the current 25 Amtrak station stops. While metropolitan trains also carry longer-distance regional rail riders, they are included as intercity-corridor trains in Figures 2 and 3.
- **Regional rail** represents commuter rail service between suburban and urban markets operated today by the eight regional rail operators.

Figure 1: Preliminary Incremental Increase in Annual Passenger Trips (millions)

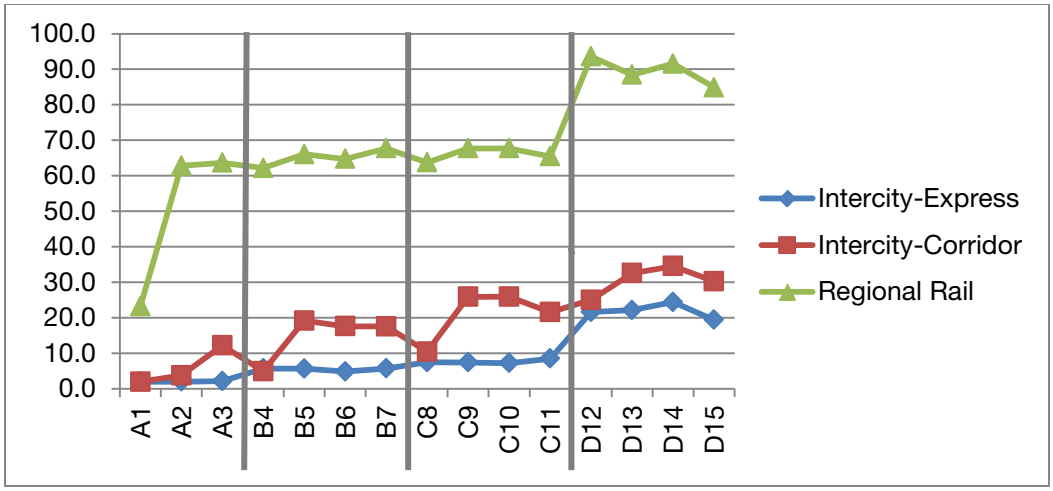
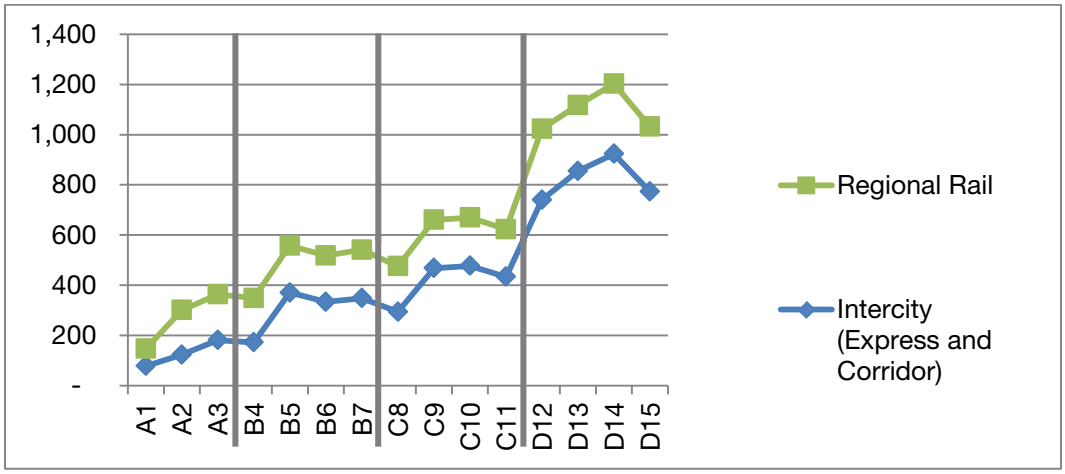


Figure 2: Preliminary Incremental Increase in Annual Passenger Miles (millions)



3.1.2 NEC PEAK-HOUR RIDERSHIP

Peak-hour ridership reflects the highest demand on the rail network during the morning and evening rush hour. Accommodating this level of peak demand drives the need for additional service, which in turn requires changes in operations and additional infrastructure. The easiest metric to illustrate peak-hour demand is the number of people passing a single point or "screen-line location" in the rail system during the rush hour based on the maximum reasonable throughput capacity the railroad infrastructure can support. Screen-line data are provided in Table 4 at the program level for four of the busiest locations on the NEC: Washington, D.C. (between Union Station and New Carrollton station); Philadelphia (between Chester, PA, and 30th Street Station); New York (Hudson River); and Boston (south of Back Bay Station at Forest Hills). The data represent the average for the program level across all alternative service types.

Table 4: Preliminary Peak-Hour Ridership at Major Screen Lines

Program Level	Washington	Philadelphia	New York City (Hudson River)	Boston
A (excluding Alt 1)	8,600	16,200	40,650	10,150
B	10,250	17,150	40,550	11,200
C	10,950	17,750	42,200	11,550
D	13,900	19,200	50,250	13,850

3.1.3 PEAK-HOUR TRAINS

Measurement of peak-hour trains provides a way in which to compare capacity. This is particularly important in the New York City region, which experiences the heaviest peak-hour traffic and suffers from severe train capacity issues. Table 5 provides a preliminary estimate of the number of peak-hour trains for all rail services crossing the Hudson River, the most constrained point on the NEC, for each program level, compared to the maximum number of trains currently projected by the regional rail operators as required to meet future demand (2040). These preliminary projections will be refined for the Tier 1 EIS alternatives later in the study using the new NEC demand-forecasting and operations models.

Table 5: Total Preliminary Peak-Hour Crossings, Hudson River Screen-Line, All Services

Program Level	Maximum Possible Peak-Hour Trains	Maximum Number of Trains Projected for All Services (2040)
Existing (2012)	24	N/A
A (Alts A2 and A3)	44	44–50
B	48	
C	51	
D	70	> 60

Program Levels A, B, and C include construction of two additional trans-Hudson tracks (for a total of four tracks), which permits a doubling of train throughput compared to today's levels. Program Levels B and C also facilitate some through-service for regional trains across Manhattan, providing operational efficiencies that increase throughput under the Hudson River. Program Level D adds a fifth and sixth track across the Hudson River, supporting a large increase in peak-hour crossings.

3.2 REBUILD AGING INFRASTRUCTURE

A primary objective of any long-term investment program on the NEC is to bring the NEC to a "State of Good Repair," where the backlog of infrastructure requiring replacement is eliminated and future capital upgrades are planned and implemented according to a regular replacement cycle. Amtrak has estimated that it will cost in excess of $10 billion to bring the NEC to a state of good repair, in addition to any investments associated with expansion of capacity or improved travel time.

All of the Preliminary Alternatives include and add to the improvements required to achieve a state of good repair.

3.3 SERVICE EFFECTIVENESS AND PERFORMANCE

Service effectiveness measures the adequacy of an alternative to meet key performance standards that influence ridership. This criterion includes various metrics that focus on the passenger experience, such as travel time and frequency of service. Metrics currently available include the following:

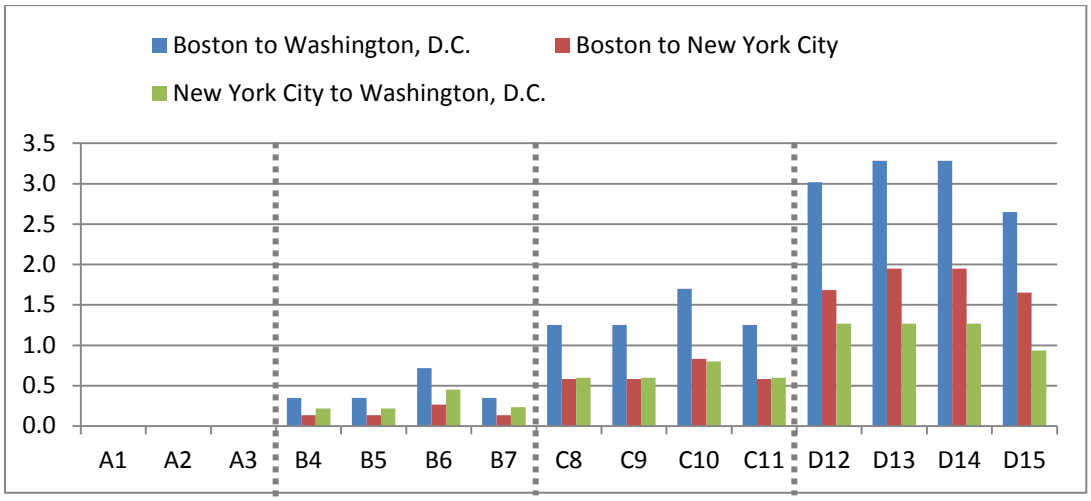
- Express trip times between major cities (New York City to Washington, D.C. and New York City to Boston)
- The number of hourly corridor-wide intercity train frequencies
- The total number of peak-hour trains operating across the NEC
- Stations and station-pairs served by express, intercity-corridor, and metropolitan trains

3.3.1 NEC TRAVEL-TIME SAVINGS

Measurement of express trip time savings is a key measure of service effectiveness. This metric considers how much time can be saved on trips across the existing NEC, and quantifies the trip time benefit of building a second spine specifically designed to support world-class HSR service. Figure 3 presents the preliminary estimates of trip time savings (in hours) for express trips from Boston to

Washington, D.C., Boston to New York City, and New York City to Washington, D.C., compared to today.

Figure 3: Preliminary Incremental Express Trip Time Savings (Hours) Compared to Today



3.3.2 TRAIN FREQUENCIES

Table 6 details the maximum number of peak-hour intercity trains (express, intercity-corridor, and metropolitan trains) that can operate in each direction.

Table 6: Express, Intercity-Corridor, and Metropolitan – Maximum Trains per Hour

Program Level	Maximum Express/Intercity/Metropolitan Trains Per Hour in Each Direction
No Action	4–5
A	6–10
B	10–14
C	10–14
D	23–28

Table 7 details the total number of peak–hour trains operating on the NEC in both intercity and regional rail services.

Table 7: Total (Intercity and Regional Rail) Peak–Hour Trains Operating on the NEC

Program Level	Total Trains Per Peak Hour Operating on the NEC
No Action	174
A	196–236
B	239–241
C	236–244
D	310–320

3.4 CONNECTIVITY

A primary objective of NEC FUTURE is to enhance connectivity between existing NEC markets and the NEC for travelers connecting to it from other rail corridors, such as Southeast HSR Corridor and the Keystone Corridor, or from other modes of transportation, such as airports. Key metrics for measuring the increase in connectivity include the following:

- Stations served by intercity trains
- City-pair combinations
- Improved air-rail connections
- Ability to share existing and future tracks, stations and other railroad infrastructure

3.4.1 NEC STATIONS SERVED

Today's Amtrak intercity trains stop at only 25 of the over 100 intercity and regional rail stations on the NEC, and 61 stations when including the Keystone, Empire, Inland Route and northern Virginia stations. As development patterns have changed over the past 40 years, and as intercity, inter-suburban and regional travel have grown, many smaller markets traditionally served only by regional rail could benefit from inclusion in the broader Northeast rail network. This would support new market connections and increase the number of one-seat rides and other convenient connections available to travelers. Moreover, treating the NEC as an integrated network of rail services to all NEC markets—with coordinated schedules and a common fare system regardless of the operator—would benefit all travelers across the region and likely increase demand for rail.

As noted, Alternatives A3, B5–7, C9–11, and D12–15 include metropolitan trains, which serve a broad mix of intercity and regional rail stations across the NEC and increase the number of city-pair connections. In addition, Program Levels C and D add new markets to the NEC, increasing the number of stations and city-pairs served. The increase in city-pair combinations is reflected on Table 8, which compares the number of stations and station-pairs served by both intercity-corridor and metropolitan trains.

Table 8: Stations Served by Intercity-Corridor and Metropolitan Trains (NEC, Keystone, Empire, Inland Route and northern Virginia)

Alternative	Stations Served	Station-Pairs Served
No Action	61	766
A1	63	825
A2	64	856
A3	71	1,095
B4	62	820
B5	71	1,038
B6	71	1,038
B7	72	1,052
C8	68	981
C9	72	1,116
C10	72	1,149
C11	75	1,171
D12	75	1,242
D13	79	1,306
D14	79	1,411
D15	85	1,446

3.4.2 RAIL-TO-AIRPORT CONNECTIONS

The existing NEC provides direct rail-to-airport connections (via regularly scheduled shuttle service) at three NEC stations:

- Baltimore/Washington International (BWI) Airport near Baltimore
- Newark Liberty International (EWR) Airport in New Jersey
- T.F. Green (PVD) Airport in Providence

Program Levels C and D would expand the number of airport stations (Table 9).

Table 9: Airport Stations

Program Level	Airport Stations	Airports Added
No Action	3	BWI; EWR; PVD
A	3	BWI; EWR; PVD
B	3	BWI; EWR; PVD
C	5	BWI; EWR; PVD; DCA; PHL
D12	5	BWI; EWR; PVD; DCA; PHL
D13	6	BWI; EWR; PVD; DCA; PHL; HPN (White Plains)
D14	7	BWI; EWR; PVD; DCA; PHL; ISL; ORH (Worcester)
D15	8	BWI; EWR; PVD; DCA; PHL; JFK; BDL; ORH

3.5 ENVIRONMENTAL CONSEQUENCES TO NATURAL AND BUILT ENVIRONMENT

Full evaluation of the environmental consequences will occur in the Tier 1 EIS. Nonetheless, it was instructive at this preliminary stage to consider the potential for relatively lesser or greater environmental effects of each of the Preliminary Alternatives. This involved identifying environmentally sensitive areas adjacent to or bisecting the representative route[1] of the Preliminary Alternatives. For example, to measure the environmental sensitivity associated with each of the Preliminary Alternatives, areas of environmental sensitivity were identified along the representative routes for each alternative for five resource categories. Figure 4, Figure 5, and Figure 6 present these areas of environmental sensitivity in the southern, central, and northern regions of the NEC, respectively. They include the following categories:

- Hydrologic Resources (identified in blue)
- Environmental Justice populations (identified in yellow)
- Cultural Resources (identified in pink)
- Parklands and Wild and Scenic Rivers (identified in brown)
- Ecological Resources (identified in green)

[1] Representative route refers to a proposed route or potential alignment for a Preliminary Alternative. The representative route includes the physical footprint of the improvements associated with the Preliminary Alternative. The horizontal and vertical dimensions of the footprint of the representative route are based on prototypical cross-sections for these improvements. The representative route is used as a proxy for estimating the potential effects of a route whose location could shift during further alternatives development and/or subsequent project-level reviews.

Figure 4: Preliminary Areas of Environmental Sensitivity – Southern Region

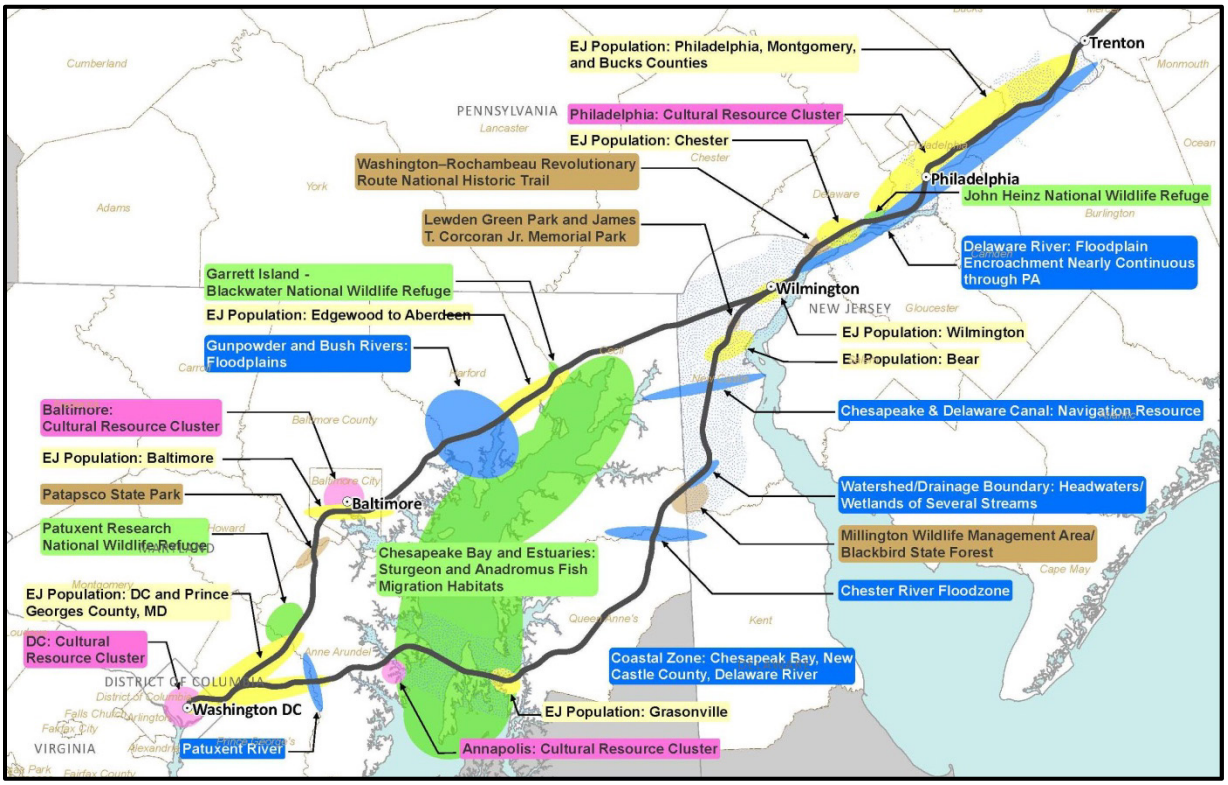


Figure 5: Preliminary Areas of Environmental Sensitivity – Central Region

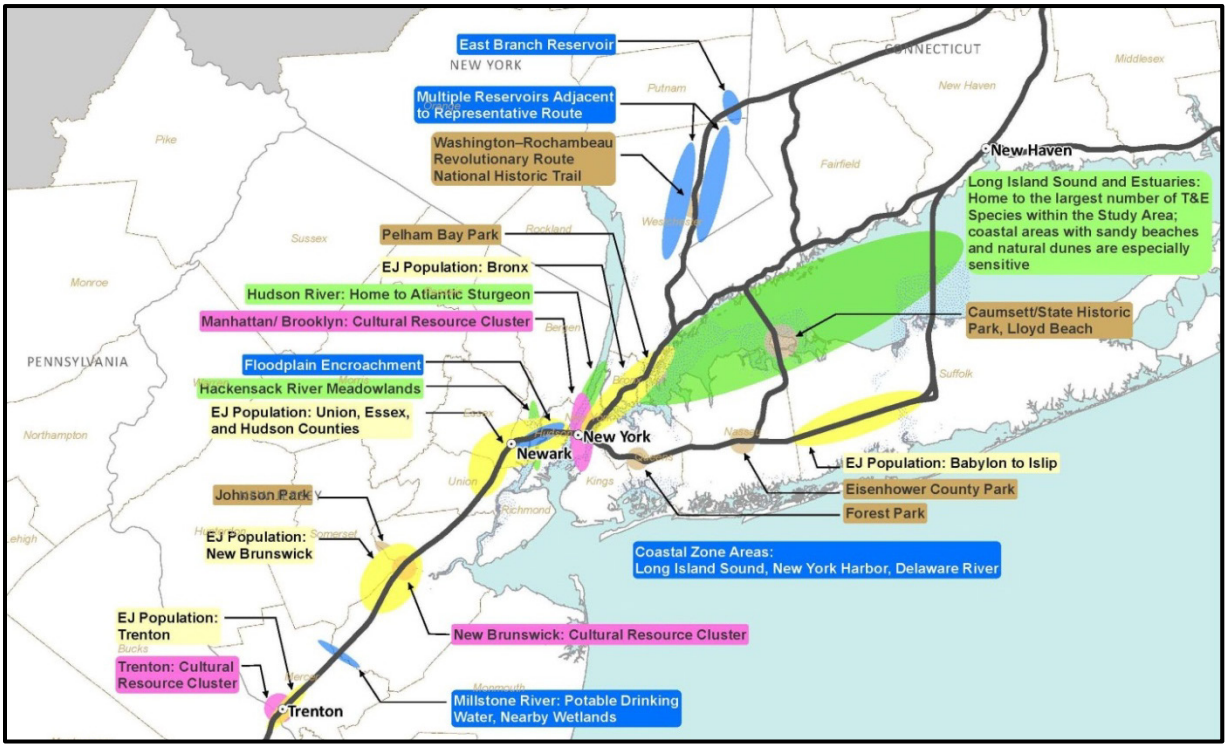
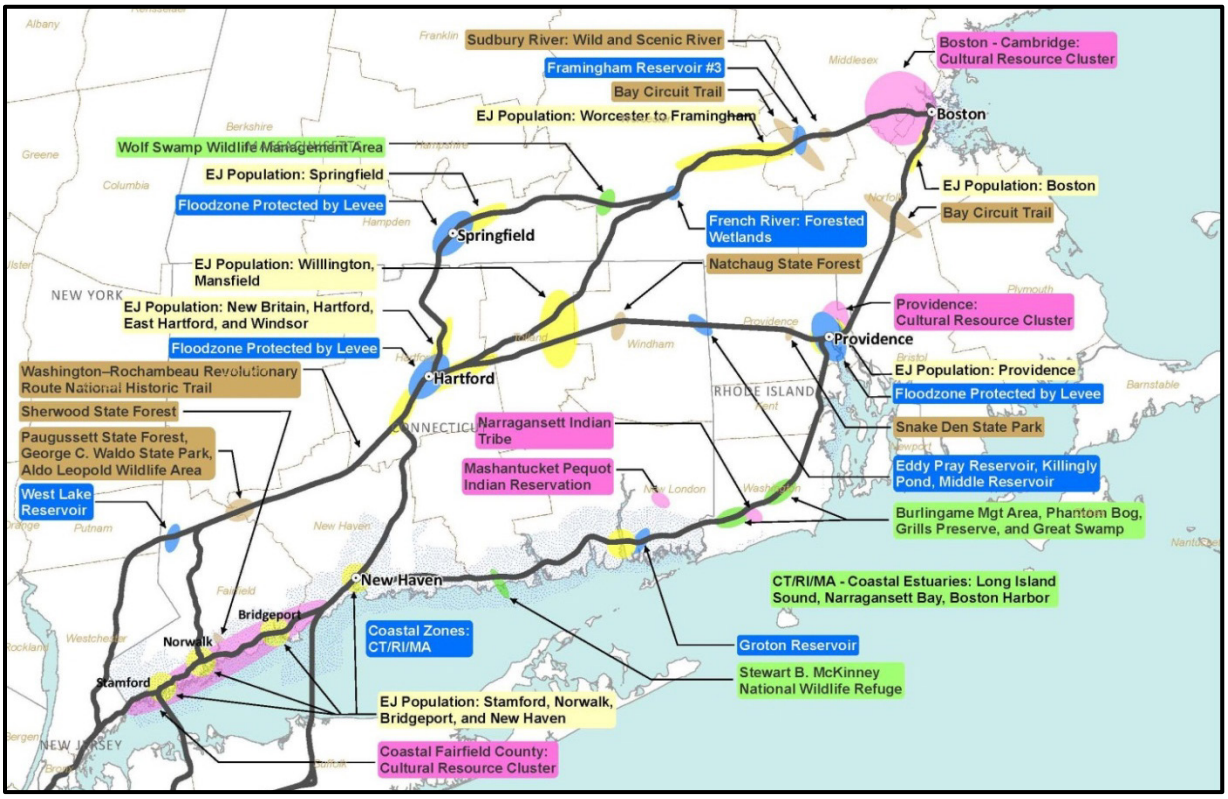


Figure 6: Preliminary Areas of Environmental Sensitivity – Northern Region



The areas of environmental sensitivity are common for all the Preliminary Alternatives along the existing NEC; the only differences between the alternatives are for those portions of the Program Levels B, C, and D alternatives that would add tracks on new rights-of-way off the existing NEC. Potential impacts to multiple resources, each of which is regulated by multiple federal and state agencies, were identified for the following locations and alternatives:

- Chesapeake Bay/Delaware Canal (D15)
- New York City to Danbury to Hartford, Connecticut (D13, D15)
- Long Island Sound (D14, D15)
- New Haven to Providence along NEC (D12)

This early environmental evaluation indicates that each of the alternatives would have environmental effects, some of which would likely require mitigation. At this step of evaluation, however, it does not appear that any single area of environmental sensitivity is a differentiator to recommend dismissing an alternative from further consideration. More-detailed consideration of effects on each of the environmental resource areas and comparison of possible environmental consequences among Tier 1 EIS alternatives will be undertaken in the Tier 1 Draft EIS.

3.6 SECOND-SPINE SEGMENT ANALYSES

The Program Level D second-spine alternatives were designed to permit separate testing of key market segments, such as New York to Hartford and Hartford to Boston. In this way, the best-performing combinations of second-spine route segments could be reassembled for consideration in the Tier 1 EIS. Ridership data for these key segments are presented below. Other data currently under development, including capital and operating costs, constructability, and environmental impacts, will be critical to decisions regarding whether and where to build a second spine. Thus, the evaluation of the second-spine alternatives and the performance of individual route segments within those alternatives will continue as part of the Tier 1 EIS analysis using the new forecasting model and other refined tools.

The preliminary evaluation was conducted for the following second-spine market segments:

- South of New York City: parallel to existing spine versus Delmarva
- North of New York City: New York-Boston; New York-Hartford; and Hartford-Boston

3.6.1 SOUTH OF NEW YORK CITY

The only second-spine alternative south of New York was the Delmarva route option included in D15. Stakeholder feedback indicated that this option conflicts with Maryland state policy of focusing transportation and development along the existing BWI/Baltimore corridor. In addition, it could not be incrementally built and would have limited utility until the entire new route segment is constructed. Ridership compared to the routes parallel to the existing NEC also was modestly lower, as shown in Table 10.

Table 10: Preliminary Intercity Annual Boardings (Express and Corridor) – South of New York City

Annual trips ***South of New York***	**NEC Parallel (D12, D13, D14)**	**Delmarva (D15)**
Total annual trips (millions)	38.0	37.0
Primary markets* (millions)	23.4	21.8
Secondary markets** (millions)	2.6	1.7

* New York City, Philadelphia, Washington, D.C.
** Baltimore, BWI Airport, Middletown/Dover, Annapolis

3.6.2 NORTH OF NEW YORK CITY

Table 11 presents the intercity annual boardings for the north of New York City segment of each of the Program Level D alternatives, which are illustrated in Figure 7.

Table 11: Preliminary Intercity Annual Boardings (Express and Corridor) – North of New York City

Annual Trips ***North of and through New York***	**D12**	**D13**	**D14**	**D15**
Total annual trips (millions)	23.8	28.4	29.7	25.4
Boston / Back Bay to New York City (millions)	7.3	9.9	8.9	7.9

Figure 7: Preliminary Alternatives – North of New York City Segments

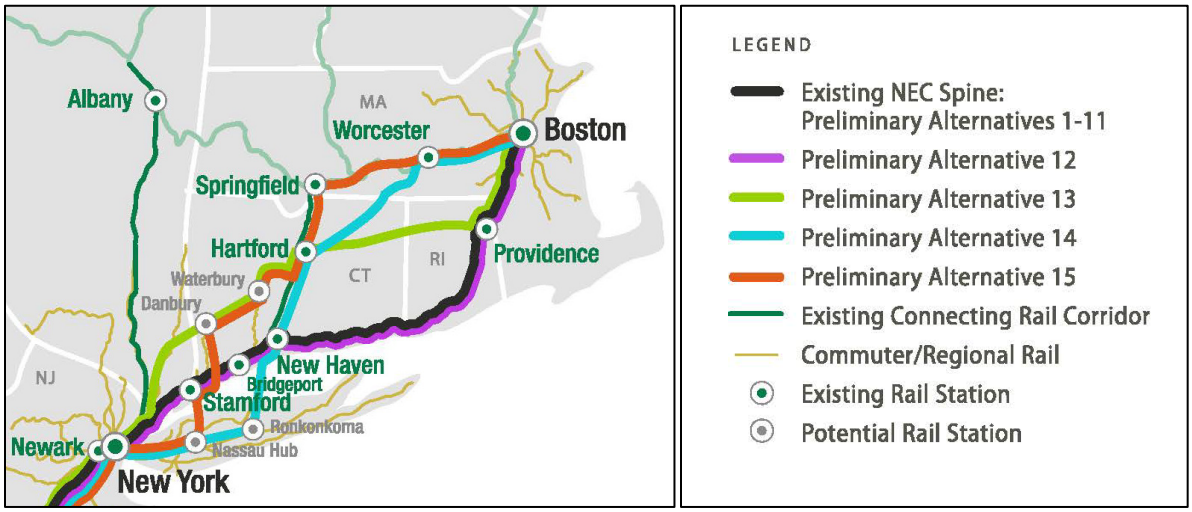


Table 12 presents the intercity annual boardings for the New York City-Hartford segment for Alternatives D13, D14, and D15. The data indicate there are strong markets for new intercity passenger rail service on Long Island and in Central Connecticut.

Table 12: Preliminary Intercity Annual Trips (Express and Corridor) – North of New York City (New York–Hartford)

Annual Trips *North of and through New York*	**Central Connecticut (D13)**	**Nassau-Suffolk-New Haven (D14)**	**Nassau-Stamford-Danbury (D15)**
Total annual trips (millions)	28.1	29.4	25.1
Primary markets* (millions)	26.7	26.4	24.4
Secondary markets** (millions)	3.3	5.3	4.0

* Boston, New York City
** Hartford, New Haven, Stamford, Nassau Hub, Suffolk Hub-Ronkonkoma, Danbury-Waterbury

Table 13 presents the intercity annual boardings for the Hartford-Boston segment options. The data indicate a modestly stronger market potential via Hartford-Providence, as Providence is the largest secondary travel market between New York and Boston.

Table 13: Preliminary Intercity Annual Boardings (Express and Corridor) – North of New York City (Hartford-Boston)

Annual Trips ***North of and through New York***	**Via Providence**	**Via Worcester**	**Via Springfield-Worcester**
Primary markets* (millions)	28.7	28.4	27.7
Secondary markets** (millions)	5.6	5.0	5.3

* Boston, New York City
** Route 128/Riverside, Providence, Hartford, Worcester, Springfield

Review of the second-spine alternatives data indicate that two of the four Program Level D alternatives—D13 (Central Connecticut to Providence) and D14 (Suffolk County to Hartford and Worcester)—generate better ridership and travel-time results. However, as noted, selection of the

second-spine route will depend on a broad range of criteria and additional data to be developed using refined tools that will be available in the Tier 1 EIS.

4. Key Findings from Preliminary Alternatives Evaluation

Analysis of the data generated by comparison of the Preliminary Alternatives has helped FRA to develop a smaller set of alternatives for detailed analysis in the Tier 1 EIS. The findings fall into three categories:

- Service dynamics within each of the program levels (i.e., comparison of enhanced and conventional service approaches and differences between service plans optimized for frequency, trip time or one-seat rides). This relates to Program Levels A, B, and C.
- Differences between the program levels in terms of defining the role that rail can play in transporting travelers in the NEC region.
- Comparisons between the different Program Level D route alternatives.

Key findings from the evaluation of the data are discussed below.

4.1 SERVICE DYNAMICS: COMPARING ALTERNATIVES WITHIN EACH PROGRAM LEVEL

Within each program level, studying different enhanced service operating plans allowed for a comparison of rider preferences for frequency of service, trip time, and one-seat-ride service. Each preference also was compared against today's conventional operations service alternative.

Evaluation of the alternatives supports two important conclusions:

- **Enhanced Operations Outperform Conventional Service in All Cases**. Whether optimized for train frequency, trip time, or one-seat rides, the use of service plans that go beyond the bounds of today's conventional approach to service generate more—sometimes significantly more—ridership than simply growing and applying today's operations. This can be seen by comparing ridership for Alternative A3 with A2; Alternatives B5, B6, and B7 with B4; and Alternatives C9, C10 and C11 with C8.

  This result is not surprising, as the markets on the NEC have evolved since the current operating structure—with Amtrak and eight regional rail authorities—was created following the bankruptcy of the Penn Central Railroad some 40 years ago. The geographic boundaries of most urban areas have grown; commuting distances have expanded; many small bedroom communities now are business and travel destinations of their own; and important inter-suburban travel markets that cross regional rail service boundaries have developed. Most important, the Northeast itself has grown into a more contiguous region of more than 42 million people. Enhanced operations treat the NEC as a single network of inter-related rail services. It connects markets more directly, by providing greater frequency of service and more service options (either by reliable timed transfer or one-seat ride), and supports faster trip times. In this way, enhanced operations provides a framework for adapting to

changing markets on the NEC and catalyzing a more integrated corridor-wide operating environment.

A key element of enhanced operations is metropolitan service. FRA envisions that metropolitan service would be operated with high-performance equipment and at regular headways either within an extended metropolitan area or over the entire length of the corridor from Boston to Washington. By serving a mix of both intercity and commuter rail markets, and offering a price point between traditional commuter and intercity fares, metropolitan trains can fill gaps that exist in current market coverage by stopping more frequently at a broader mix of stations. Which markets offer the best service and ridership options will have to be tested and validated using the new NEC demand-forecasting model later in 2014.

Table 8 showed the significant increase in number of stations and station-pairs served under the enhanced service alternatives compared to the conventional service alternatives.

- **The Different Enhanced Service Plans Generated Similar Performance**. While enhanced service alternatives consistently outperformed conventional service alternatives, differences in performance between the different enhanced alternatives within each program level were not meaningful at this stage of analysis. In Program Level B, for example, enhanced service designed to accentuate train frequency generated slightly higher ridership than those designed to accentuate the best travel time or one-seat-rides. On the other hand, in Program Level C, the best performer was travel time, but it was only marginally better than the alternative favoring frequency of service. These results underscore the benefits of providing sufficient capacity to permit a broad range of services across the NEC with the flexibility to support future travel needs as they develop. This may mean a different service focus for different portions of the NEC at any given time, or the ability to adapt rail operations across the NEC to changing demographics. The key is providing sufficient capacity to meet market demands, and the flexibility to adapt operations to the changing needs of the market.

4.2 THE ROLE OF RAIL: COMPARING THE PROGRAM LEVELS

The four program levels articulate different visions for the role of rail on the NEC—from the role it plays today, in comparison to other modes, to a much more significant role through creation of a second spine capable of supporting high-speed operations. Given the significant growth in population and employment projected for the region, changing land use patterns that have increased the demand for travel to downtown urban areas, and the severe congestion that already clogs highway and air transportation, it becomes clear that provision of additional rail service nets large numbers of additional rail passengers. While it is essential to validate the preliminary ridership data using the new NEC demand-forecasting model, it appears the maxim “build it and they will come” indeed applies to rail service on the NEC.

A number of findings can be made regarding each of the program levels:

- **Program Level A** would provide the least robust program for upgrading the NEC and fails to meet the Purpose and Need. It would support the immediate growth needs of the regional rail operators, but, as noted below, would facilitate only small increases in intercity rail service. Importantly, it would leave no margin for growth after attempting to meet initial projections of regional travel

demand. The capital improvements required to support Program Level A would serve as a building block for other program levels rather than a long-term vision defining the role of rail on the NEC.

- The lack of infrastructure expansion in southeastern Connecticut, and rail congestion between New Rochelle, NY, and New Haven, CT, would prevent the addition of more intercity train service north of New York City. The only increase in intercity rail service would come from expanding train capacity (more seats on existing trains) and filling up all intercity rail slots during non-peak portions of the day.
- Capacity constraints would remain in New York under Program Level A due to the limits on the number of trains that can pass through the additional Hudson River tunnels, which stub end at Penn Station (see Table 5). NJ TRANSIT forecasts maximum train levels in 2040 to Penn Station that may exceed the carrying capacity of the two existing and planned two additional Hudson River tunnel tracks. The number of trains passing through the East River tunnels would also be at capacity, limiting options for additional Long Island Rail Road service and possible Metro-North Railroad service to New York Penn Station.
- Total ridership would increase by 140 million annual trips to 471 million compared to 2012, and annual passenger miles would increase to 15.3 billion, 54 percent more than in 2012. However, 95 percent of the growth in annual trips would be in the regional rail market; continued capacity constraints would strictly limit opportunities for growth in intercity ridership.
- Express travel time would be essentially the same as today.
- No new markets would be added; however, some stations served today only by commuter trains would be served by metropolitan trains in Alternative A3.
- Program Level A would provide little or no capacity for additional growth beyond 2040 and little flexibility to adapt to changing conditions along the NEC.

With these limitations, Program Level A fails to meet the Purpose and Need. It is not so much a vision for the future as an interim step toward a longer-term investment program.

- **Program Level B** would expand the railroad generally to its full extent within the existing right-of-way, with additional capacity for more regional and intercity rail service.
  - Building out a 4–6 track NEC would eliminate many choke points across the NEC and would support reliable and more flexible rail operations.
  - By using metropolitan service to consolidate on one train what would have required both a regional and intercity train slot, capacity issues through the Hudson River tunnels could be eased. Like Program Level A, the number of trains passing under the East River would remain at capacity, limiting options for additional Metro-North and Long Island Rail Road service to New York Penn Station.
  - Total ridership would grow substantially to over 495 million trips per year—24 million more than Program Level A. Passenger miles would grow to 17.5 billion for all modes—a 75 percent increase over 2012 levels and 14 percent more than Program Level A.
  - The number of express, intercity-corridor, and metropolitan trains would double from two trains per hour in each direction to four trains per hour in each direction, with ridership increasing 35 percent compared to Program Level A.

- The fastest Washington–Boston express train would be 20–30 minutes faster than today and the number of intercity stations and city-pairs served would grow appreciably.
- Some stations served today only by regional rail trains would be served by metropolitan trains, increasing the number of city-pairs with direct NEC service.
- Program Level B would provide some room to grow beyond 2040 demand except in the New York area.

Program Level B would support a modest long-term growth vision for the NEC. Like Program Level A, this alternative would eventually face capacity constraints in the New York City area. Program Level C, which would add two additional tracks under the East River, and Program Level D, which would add a fifth and sixth track under the Hudson River, would better accommodate projected New York City demand and hence a larger role for rail in the future. Although Program Level B would add few new markets to the NEC, enhanced operations would create new city-pair opportunities, with both one-seat rides and via more convenient transfers.

- **Program Level C** would open up service to new markets off the NEC, which is an important goal of NEC FUTURE, and would support substantial travel-time reductions for express trains.
  - New markets would be added to the NEC by providing new downtown stations in Baltimore and Philadelphia.
  - Capacity constraints in New York City would be partially addressed by constructing two additional East River tracks. This would support new Long Island Rail Road and Metro-North Railroad service to New York Penn Station, as well as facilitate through-service at New York Penn Station, reducing dwell times in the station and adding to throughput of trains across Manhattan. Tracks under the Hudson River would remain at full capacity.
  - Washington–Boston travel time would be reduced 75–85 minutes compared to today and approximately 50–60 minutes compared to Program Level B due to the Old Saybrook, CT, to Kenyon, RI, bypass; new bypasses between New Rochelle, NY, and New Haven, CT; and the two new downtown stations.
  - Ridership would grow to an average 505 million annual trips. Express, intercity-corridor, and metropolitan trips would grow to some 40 million trips—more than three times today's level. This would account for much of the increase compared to Program Level B. Passenger miles would grow to 18.7 billion per year, nearly 90 percent higher than in 2012 and 7 percent more than in Program Level B.

  The primary benefit of Program Level C would be the expansion of the NEC to new downtown business markets in center Baltimore and Philadelphia. These new markets would help to generate an average of 10 million additional trips across the NEC, six million of which would be by express, intercity-corridor, or metropolitan trains. There would be only modest gains in regional rail trips, as Program Level C focuses on existing regional rail markets.

- **Program Level D** would dramatically change the role of rail on the NEC by providing a very significant additional increment in capacity, which would be used to implement new HSR service as well as new types of intercity and regional services that could take advantage of the new high-speed infrastructure. The new NEC demand-forecasting model is expected to quantify the significant

increase in mode share with new rail services compared to the highway and air modes, as rail would increasingly fill both intercity and regional travel needs. All four proposed second-spine routes would perform well, with Alternatives D13 (NYP-White Plains-Danbury-Hartford-Providence-BOS) and D14 (NYP-Ronkonkoma-New Haven-Hartford-Worcester-BOS) performing the best through access to new markets on Long Island and in Central New England.

- Ridership would jump to an average 550 million annual trips and 24 billion passenger miles, which would be nearly 70 percent more passengers than are carried by rail today on the NEC. The increment over Program Level C would be significant: 45 million additional annual trips and 4.9 billion additional passenger miles.
- Express travel times would be reduced to less than 100 minutes between Washington and New York City and between New York City and Boston, a more than 60 percent reduction in travel time south of New York and less than half of today's travel time north of New York. A passenger would save more than two and one-half hours in travel time compared to today for a trip from Washington, D.C., to Boston. Rail service across the NEC would be competitive with air, and would have the advantage of serving stations located directly in the downtown business hubs.
- New York City area capacity constraints would be resolved through the addition of two additional tracks under the Hudson River, providing a total of six tracks under the Hudson and East Rivers. With corresponding improvements at New York Penn Station to accommodate HSR, capacity would remain adequate to handle growth in New York City for decades to come.
- Regional rail trains could take advantage of access to the new markets north of New York City with new types of long-commute zone express service that could collect passengers at specific locations and then operate at high-speed on the new second spine to access major city center stations in significantly reduced time.

Program Level D would provide the capacity to operate new types of service and to significantly enhance the travel options available to NEC travelers. As such, it has the potential to transform the way people travel in the Northeast, with train service across the region the mode of choice for many travelers. It should be noted that, as the Tier 1 EIS alternatives are developed, it may be possible to incorporate some of these service options and associated infrastructure improvements into alternatives that do not include a full second spine.

More-detailed data and a broader set of evaluation criteria are required to fully compare the NEC second-spine route options. Environmental impact factors, of less significance for evaluating changes in service on the existing NEC, become paramount when considering a new rail line through highly populated and environmentally sensitive areas. Other factors—such as economic impacts and impacts on other modes—will also be important. At this point, the data are insufficient to select one second-spine route over another. Accordingly, the options for a second spine will be further analyzed in the Tier 1 EIS, using the latest models and tools.

5. Defining the Tier 1 EIS Alternatives

On the basis of the analysis of the Preliminary Alternatives and reflecting extensive discussions with NEC stakeholders, FRA is advancing three distinct alternatives through the Tier 1 EIS analysis in addition to the No Action Alternative. The alternatives will describe unique visions for the role of rail in the NEC and enable a broad analysis of the benefits and impacts in the Tier 1 EIS.

Program Level A is better understood as a building block rather than a distinct vision for the NEC. It would address some of the most pressing regional rail capacity issues on the NEC, but would be inadequate to support a meaningful increase in intercity rail service or to meet the longer-term projected capacity needs for the New York City area. Adding to Program Level A some of the capital improvements included in Program Level B that support expanded intercity service and improve capacity in New York City could result in a "lower-end" vision that meets Purpose and Need. Similarly, combining some elements of Program Level C with Program Level B would further address capacity issues in New York City and would support service to new markets and some new types of service, thereby providing a middle-range alternative. Carrying the second-spine Program Level D alternatives forward would provide a high-end alternative.

The FRA will advance three alternatives into the Tier 1 EIS, in addition to the No Action Alternative.

- **No Action Alternative** does not equate to *no investment*. It represents a substantial increase in maintenance and renewal expenditures from today's level necessary to continue today's service in the corridor through 2040. Nonetheless, it simply maintains today's level and types of service, meaning no increases or significant changes to capacity, speeds, or markets served, but making the annual investments in the state-of-good repair backlog that are necessary to maintain today's general service characteristics. Because of the projected population and employment growth in the region, and the inability to expand service to accommodate growing demand, the No Action Alternative necessarily will undermine the role that plays in the region.
- **Alternative 1** would maintain the role of rail as it is today, keeping pace with the level of rail service required to support the proportional growth in population in the Study Area. To keep pace with growth in population, Alternative 1 would include new rail services and commensurate investment in the NEC to expand capacity, add tracks, and relieve key chokepoints. This would be accomplished by combining the best-performing elements defined within Program Level A and the low end of Program Level B, with sufficient capacity to support balanced increases in regional rail and intercity rail services, facilitating a doubling of intercity train service (and a near tripling of seats) compared to today. It would build off service plans developed by the NEC service operators for 2020–2030 to meet the projected organic increase in travel demand. Alternative 1 would include a significant investment in capacity expansion, adding tracks where required, and would provide solutions for the most pressing choke points, including a bypass between Old Saybrook, CT, and Kenyon, RI, to address movable bridge capacity constraints. It would also include, to the extent possible with available capacity, enhanced operations consisting of metropolitan service to help address capacity constraints through New York City and to broaden the mix of stations pairs served, as well as various best operating practices to provide additional capacity, improve performance and generate operating cost efficiencies.

Capacity would not be provided to accommodate proportional demand beyond 2040 or to meet changing market needs, particularly in the New York metropolitan area. Alternative 1 would not support meaningful travel-time improvements for intercity trains.

- **Alternative 2** would grow the role of rail by expanding rail service at a faster pace than the proportional growth in population in the Study Area. Service and improvements would be focused generally within the existing NEC right-of-way with some route variations, including a new supplemental route between New Haven–Hartford and Providence to improve performance, address capacity constraints, and/or to serve new markets. This alternative would combine the best-performing elements of Program Levels B and C to provide a single intermediate investment alternative that would provide the necessary capacity and faster travel times to grow rail mode share. The railroad would expand to four tracks, with six tracks through portions of New Jersey and southwestern Connecticut, and would include two new East River tracks (in addition to the two additional Hudson River tracks and tunnels included in Alternative 1). Capacity in the New York metropolitan areas would be sufficient to accommodate continued growth, which would eventually overtake full throughput capacity in the absence of more trans-Hudson River tunnels. Alternative 2 would include new service to Philadelphia International Airport, and some regional rail run-through service in New York City and Washington, D.C., to increase terminal throughput.
- **Alternative 3** would transform the role of rail, positioning rail as a dominant mode for intercity travelers and commuters across the NEC. Service and infrastructure improvements would include upgrades on the NEC Spine and the addition of a second spine, which would operate adjacent to the NEC Spine south of New York and expand to reach new markets north of New York. This new second spine would support high-performance rail services between major NEC markets and would provide additional capacity for intercity and regional rail services on both the existing and the new spines. This alternative would increase the level and variety of train service and expand the market reach of the NEC. The FRA will evaluate the four New York City-Boston second-spine route options included in Program Level D.

The alternatives have been defined to provide the FRA, the region, and other stakeholders with a broad range of options and sufficient information to make a reliable, long-term decision about the appropriate role for rail to play within the region's multimodal transportation network. While focused on rail solutions (following the program's Purpose and Need), the alternatives would have different implications for other transportation modes, including the region's airports, highways, and transit networks, and provide important information for policymakers to make decisions with this broader transportation system in mind.

6. Next Steps

The Tier 1 EIS alternatives are being refined and evaluated in the Tier 1 Draft EIS. Refinement will optimize service plans and ensure that capacity and infrastructure improvements are sufficient to reliably deliver proposed service objectives. As was the case in creating the 15 Preliminary Alternatives, this process will involve consultation with railroad operators and other stakeholders. With refinement, the Tier 1 EIS alternatives will be fully evaluated in the Tier 1 Draft EIS.