NEC FUTURE

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NEC FUTURE is a comprehensive planning effort to define, evaluate, and prioritize future investments in the Northeast Corridor (NEC) from Washington, D.C., to Boston. The NEC is the rail transportation spine of the Northeast and a key component of the region's transportation system. The NEC supports the operation of eight Regional rail authorities and Amtrak—the Intercity rail service provider—as well as four freight railroads.

The Federal Railroad Administration (FRA) launched NEC FUTURE in 2012 to evaluate improvements to address passenger rail transportation needs within the Study Area shown in Figure S-1. NEC FUTURE will result in a Passenger Rail Corridor Investment Plan (PRCIP) for the NEC that will establish a framework for future investment in the corridor through 2040 and beyond. The PRCIP comprises a Tier 1 Environmental Impact Statement (Tier 1 EIS) and a Service Development Plan (SDP). Together, these documents will provide a long-term vision for the role of passenger rail on the NEC in the regional transportation system and a phased investment plan to accomplish that vision.

The term **"Intercity"** is defined as passenger rail service between metropolitan areas. The term "**interregional"** describes travel flows that start and end in a different metropolitan area. "**Interregional**" and "**Intercity**" may be used interchangeably when referring to markets, passengers, trips, and passenger rail service.

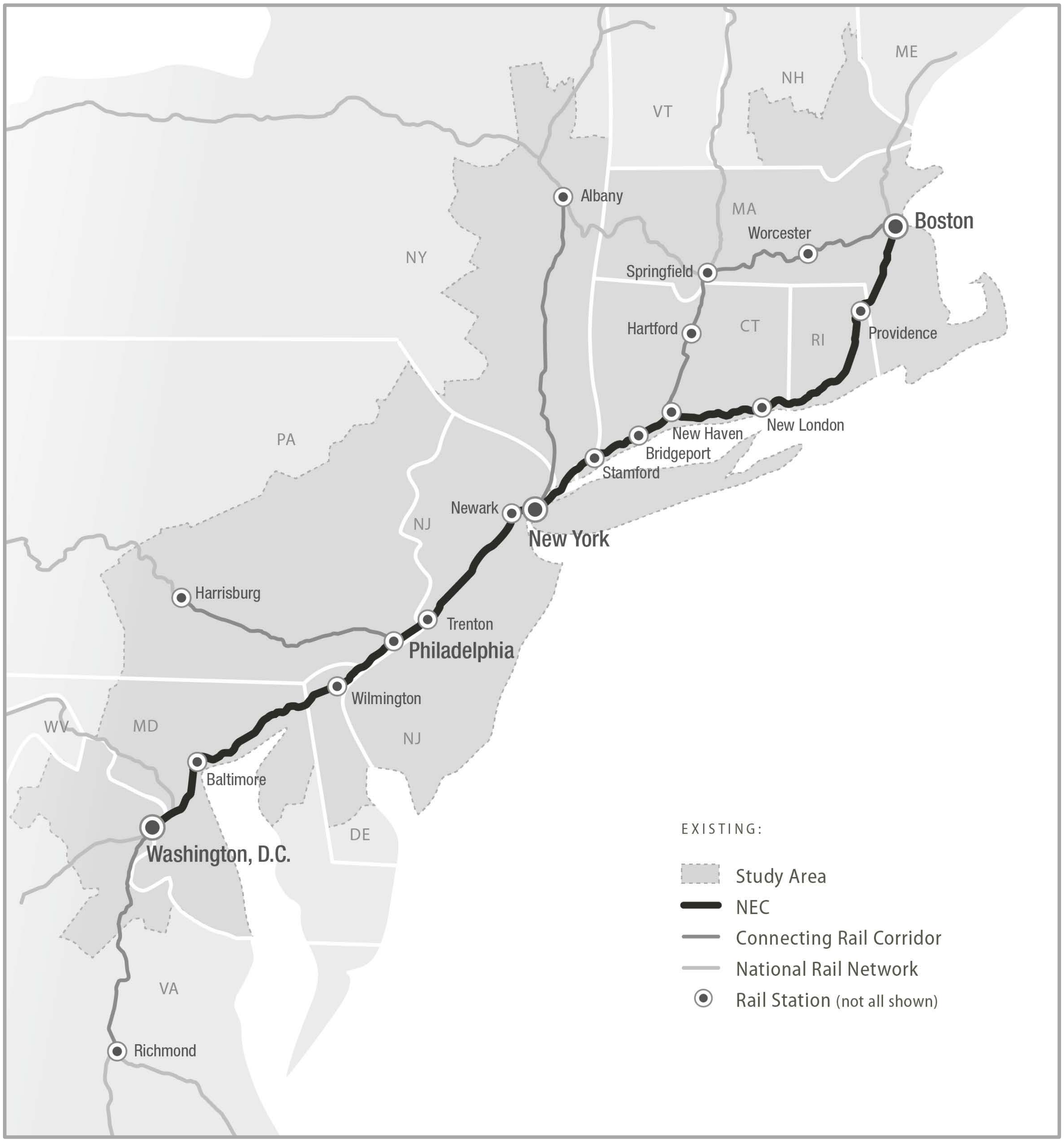
"Regional" describes travel within a metropolitan area. "**Regional rail**" is defined as passenger rail service within the travel shed of a metropolitan area. "**Regional rail**" provides local and commuter-focused service characterized by a high-percentage of regular travelers. Regional rail is a broad term that reflects the expanded role of commuter railroads to also serve metropolitan travel needs throughout the day and beyond the work week.

S.1 TIER 1 DRAFT ENVIRONMENTAL IMPACT STATEMENT

This document is the Tier 1 Draft Environmental Impact Statement (Tier 1 Draft EIS) for the NEC FUTURE program. This Tier 1 Draft EIS was prepared in compliance with the National Environmental Policy Act (42 USC §4332 et seq.) and implementing regulations (40 CFR Parts 1500–1508) (NEPA), and other applicable laws and regulations. It presents the analysis completed by the FRA to assess the potential effects of NEC FUTURE rail investment alternatives on the economy, transportation system, and the human and natural environment within the Study Area. It provides information to inform the public and stakeholders about the findings of the analysis, and to help inform the FRA's decision on a Preferred Alternative for NEC FUTURE. Concurrent with the Tier 1 Draft EIS, the FRA is conducting a review of potential effects on historic properties under Section 106 of the National Historic Preservation Act. (Appendix G presents a Draft Programmatic Agreement under Section 106.)

The term "Tier 1" in the title of this document refers to a "tiered" approach to environmental review. NEPA provides the flexibility to assess projects in a staged approach known as "tiering," which addresses broad programs and issues in an initial (Tier 1) analysis, and analyzes site-specific, project-level (Tier 2) proposals and impacts in subsequent studies. The FRA determined that a Tier 1 EIS was the appropriate level of NEPA documentation for NEC FUTURE.

Figure S-1: Study Area Map



Source: NEC FUTURE, 2015

Both a Tier 1 EIS and project-level (or Tier 2) EIS follow the same process. The major difference is the level of detail and analysis that are presented. For a Tier 1 EIS, since the federal action is broad or programmatic in nature, the information required by decision-makers includes "big picture" constraints and opportunities. In this case, the proposed federal action being evaluated in this Tier 1 Draft EIS is the **adoption of an investment program** to improve passenger rail service within the Study Area. The Action Alternatives that the FRA examined in this Tier 1 Draft EIS represent various levels of investment in passenger rail.

If the FRA adopts an investment program, the projects would be implemented incrementally over the next few decades; the FRA will prepare a phasing and implementation plan in the SDP to be published after the Tier 1 Final EIS and Record of Decision. An example of a Tier 2 project that might take place would be adding a new bridge at an existing river crossing. A Tier 1 EIS identifies the train service a bridge will need to carry, but the specifics of the operations, bridge design, and localized impacts of that bridge are not identified. A subsequent Tier 2 project and NEPA process would focus on the specific design and construction of the bridge crossing and local impacts of that structure.

S.2 CONSIDERATION OF OTHER TRANSPORTATION MODES AND FREIGHT RAIL SERVICE

While NEC FUTURE focuses on passenger rail, it is important to understand the connectivity and interface of rail with other modes in the Northeast transportation network. Travelers within the NEC have multiple transportation options to move through and along it, including air, rail, automobiles, and buses. To better understand the role of rail within this transportation network, the FRA began by examining the role that rail service plays today in the Northeast transportation network and considering what role it could play in the future. These questions are fundamental to how the FRA has developed the rail alternatives being evaluated in this Tier 1 Draft EIS.

While NEC FUTURE is focused on passenger rail services, the investment program will be defined in a way that preserves current and planned service levels for freight railroad operations. Opportunities are also being considered to accommodate improvement of freight rail service within the NEC FUTURE Study Area.

S.3 AGENCY AND PUBLIC INVOLVEMENT

Decisions about the future of the NEC affect a wide range of stakeholders, from today's rail passengers as well as the agencies and operators currently providing services on the NEC, to the residents, travelers, businesses, and communities potentially affected by the outcomes of NEC FUTURE. The FRA has conducted an extensive agency and public involvement process to engage these stakeholders and the public in the decision-making process for NEC FUTURE. This effort began with an agency and public scoping process in 2012 that elicited over 2,000 comments from 800 participants. These comments helped shape the alternatives that have been analyzed and the technical analyses conducted for this Tier 1 Draft EIS.

Rail transportation projects are typically sponsored by a locality, state, or railroad. However, the NEC covers a 457-mile corridor through eight states and Washington, D.C., and is used by multiple railroads that share the NEC's limited infrastructure. The FRA has sponsored NEC FUTURE to provide a uniform look at the NEC as a whole in order to ensure an integrated and prioritized approach to investments in the NEC that benefits not only all users and operators of the NEC, but that also promotes economic activity and environmental sustainability of the entire Northeast region of the Unites States. The FRA is serving as the lead federal agency for the Tier 1 EIS, working in coordination with other federal and state agencies and stakeholders, including the Federal Transit Administration, which is a Cooperating Agency to the NEPA process, the Northeast Corridor Infrastructure and Advisory Commission (NEC Commission), and the metropolitan planning organizations in the corridor.

The FRA has conducted a variety of public involvement activities, including 18 public meetings, six regional workshops, multiple webinars, direct outreach at 18 rail stations, presentations to interested organizations, and outreach to organizations and local officials representing Environmental Justice populations. Communication tools were developed to support the public outreach and environmental review process, including a comprehensive website, contact database, newsletters, fact sheets, and media outreach, including press advisories and media briefings. The information gained through agency and public engagement was used by the FRA team to better understand stakeholder concerns and to integrate information and ideas provided by the public and stakeholders into the work process.

S.4 NEED FOR NEC FUTURE

Passenger rail services that operate along the NEC rail network are a critical component of the transportation system in the Study Area. By 2040, continued population and employment growth in the Study Area is expected to create increasing demand for travel options across the passenger transportation system—rail, air, auto, transit, and intercity bus. Yet the aging infrastructure and capacity limitations of the NEC already result in congestion and delays for daily commuters and for regional[1] and interregional[2] travelers. Forecast growth in population and employment in the Study Area will put increasing pressures on this already constrained NEC rail network.

The 457-mile NEC and its connecting rail corridors[3] form the most heavily utilized rail network in the United States. The NEC ranks among the busiest rail corridors in the world, moving more than 750,000 passengers every day[4] on 2,200 trains.[5] Freight operators share the NEC with passenger railroads and

[1] Interregional refers to the interregional travel market, and includes trips that start and end in different metropolitan areas (see Chapter 13, Glossary).

[2] Regional refers to the regional travel market, and includes trips that start and end within the same metropolitan area (see Chapter 13, Glossary).

[3] Connecting corridors are those rail corridors that connect directly to a station on the NEC. These include (1) corridor service south of Washington Union Station to markets in Virginia and North Carolina including Lynchburg, Richmond, Newport News, Norfolk, and Charlotte; (2) Keystone (connects Philadelphia 30th Street Station to Harrisburg Station); (3) Empire (connects Penn Station New York to Niagara Falls Station); and (4) New Haven-Hartford-Springfield (connects New Haven Union Station to Springfield Union Station) as described in Chapter 13: Glossary.

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

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

are responsible for the movement of over 350,000 car loads of freight per year on the NEC.[6] This volume of traffic and diversity of service today operates on an NEC with capacity constraints that require scheduled and real-time trade-offs in frequency, speed, and performance of passenger and freight services. The congestion caused by these capacity constraints limits operations and opportunities to improve or expand passenger rail services. The NEC's aging infrastructure further limits operations and constrains the ability to improve and expand services. This infrastructure, in many cases built over 100 years ago, does not provide the resiliency or redundancy necessary to respond to unanticipated natural disasters or other disruptive events.

Growth in population and employment in the region, combined with changes in travel preference, will increasingly require a level of service and connectivity that cannot be supported by the existing NEC infrastructure. Challenges to passenger rail travelers today include poorly coordinated transfers and unattractive service frequencies, which make other travel choices more appealing. A well-defined and coordinated investment program to support both preservation and enhancement of the NEC is essential to meet the needs of the NEC's passenger and freight markets in the coming decades. A rail transportation system that better connects residents and visitors with established and growing business centers in the Study Area is critical to the economic health of the region.

S.5 STATEMENT OF PURPOSE AND NEED (CHAPTER 3)

The following is the statement of Purpose and Need adopted for the NEC FUTURE Tier 1 EIS:

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

Overall ***needs*** addressed by NEC FUTURE include aging infrastructure, insufficient capacity, gaps in connectivity, compromised performance, and lack of resiliency. These needs are essential to support the reliability of the passenger rail system. In addition, there is a need to promote environmental sustainability and economic growth. These needs are summarized below:

- **Aging Infrastructure**: The quality of service on the NEC currently falls short due to the aging and obsolete infrastructure that has resulted from insufficient investment to maintain a state of good repair.[7] Aging infrastructure also increases the cost and complexity of continuing railroad operations. Achieving and maintaining a state of good repair is needed to improve service quality.
- **Insufficient Capacity**: Severe capacity constraints at critical infrastructure chokepoints limit service expansion and improvement as well as recovery from service disruptions, making it difficult to offer reliable service and accommodate growth in ridership. These constraints are

[6] Northeast Corridor Infrastructure and Operations Advisory Commission. (February 2014). *State of the Northeast Corridor Region Transportation System.* State of the Northeast Corridor Region Transportation System.
[7] State of good repair is a condition in which assets are fit for the purpose for which they were intended. American Public Transportation Association. (2013). *Defining a Transit Asset Management Framework to Achieve a State of Good Repair.* Washington, D.C.: American Public Transportation Association.

further exacerbated by individual railroad operating practices,[8] which are driven by their individual policies or customer needs.

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

In addressing the overall needs of aging infrastructure, insufficient capacity, gaps in connectivity, compromised performance, and lack of resiliency, the FRA is committed to the NEC FUTURE Action Alternatives promoting environmental sustainability and continued economic growth:

- **Environmental Sustainability**: Throughout the Study Area, energy use and emissions associated with transportation diminish the environmental quality of the built and natural environments. Expanding the availability of more energy efficient transportation modes, including passenger rail, is needed to support desired improvements in air quality and growth patterns.
- **Continued Economic Growth**: A transportation system that provides options for reliable, efficient, and cost-effective movement of passengers and goods is needed to support continued economic growth, and retention and increase in jobs, in the Study Area.

S.6 ALTERNATIVES CONSIDERED (CHAPTER 4)

In developing the alternatives for evaluation in this Tier 1 Draft EIS, the FRA considered a broad spectrum of future possibilities to meet the Purpose and Need. The unique geographic, technical, and institutional complexity of NEC FUTURE led the FRA to an innovative approach to developing and evaluating alternatives, focused on analysis of markets and services. This process is described in greater detail in various alternatives documents, including the *Initial Alternatives Report*, *Preliminary*

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

Alternatives Report, *Preliminary Alternatives Evaluation Report*, and *Tier 1 EIS Alternatives Report* (see Appendix B).

The FRA began the evaluation of alternatives with an initial list of 98 rail market and service options, developed through extensive outreach with the NEC FUTURE stakeholders, the Northeast Corridor Infrastructure and Operations Advisory Commission (NEC Commission), and the general public. These Initial Alternatives were then organized into 15 Preliminary Alternatives representative of the broad spectrum of approaches that could be used to serve existing and new markets in the region. (See Appendix B, *Preliminary Alternatives Evaluation Report*, for additional information regarding the Preliminary Alternatives and their evaluation.) The FRA considered whether and how the Preliminary Alternative met the Purpose and Need, and analyzed their benefits in terms of ridership, travel time, service quality, and performance (for those that included second-spine route options). Based on this analysis, the FRA repackaged the Preliminary Alternatives to form the alternatives analyzed in this Tier 1 Draft EIS.

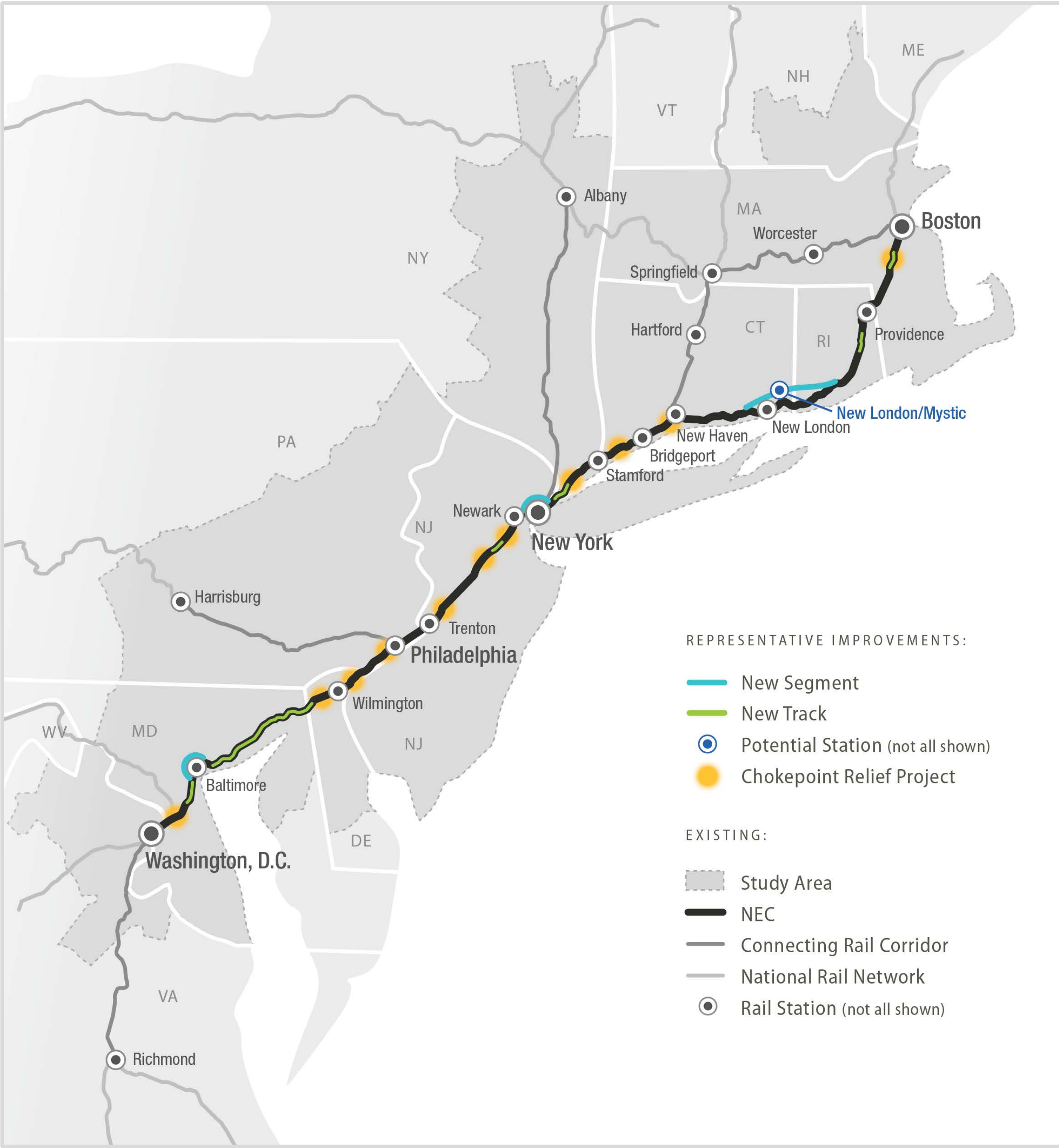
The FRA is considering three Action Alternatives that represent unique visions for the role of rail in the transportation system of the Northeast, and enable a broad analysis of benefits and impacts in the Tier 1 Draft EIS. The FRA compared the Action Alternatives to a No Action Alternative using ridership and service planning characteristics estimated with models customized for this effort. The transportation effects, economic effects, and environmental assessment of the Action Alternatives are presented in Chapters 5, 6, and 7, respectively.

The **No Action Alternative** represents an NEC in 2040 that would operate at today's service levels, which are defined as the number of trains per hour by operator[9] and type of service. The No Action Alternative is a normalized baseline used to understand the consequences of continuing to invest in and operate the NEC as it is today, particularly in comparison with Action Alternatives. The No Action Alternative does not allow for increased peak-hour rail service but does allow for some modest increases in off-peak service, where there may be some existing unused capacity. The No Action Alternative does not increase or significantly change capacity, speeds, or the markets served. Instead, it makes annual investments in programmed and funded major projects and in maintaining existing infrastructure sufficient to operate today's level of rail service, but falls short of achieving a corridor-wide state of good repair.

Alternative 1 maintains the role of rail as it is today, keeping pace with the level of rail service required to support growth in population and employment. Future service plans developed by the NEC service operators were also examined to assess projected increases in travel demand that were assumed by the service operators. To keep pace with the demand generated by the region's growing population and employment, Alternative 1 includes new rail services and commensurate investment in the NEC to expand capacity, add tracks, and relieve key chokepoints, particularly through northern New Jersey, New York, and Connecticut. Figure S-2 shows the principal infrastructure investments included in Alternative 1.

[9] Current operators on the NEC include Intercity services operated by Amtrak and Regional rail services operated by eight individual commuter railroads within the Study Area.

Figure S-2: Alternative 1 (Chokepoint, New Track, and New Segment Locations)



Source: NEC FUTURE team, 2015

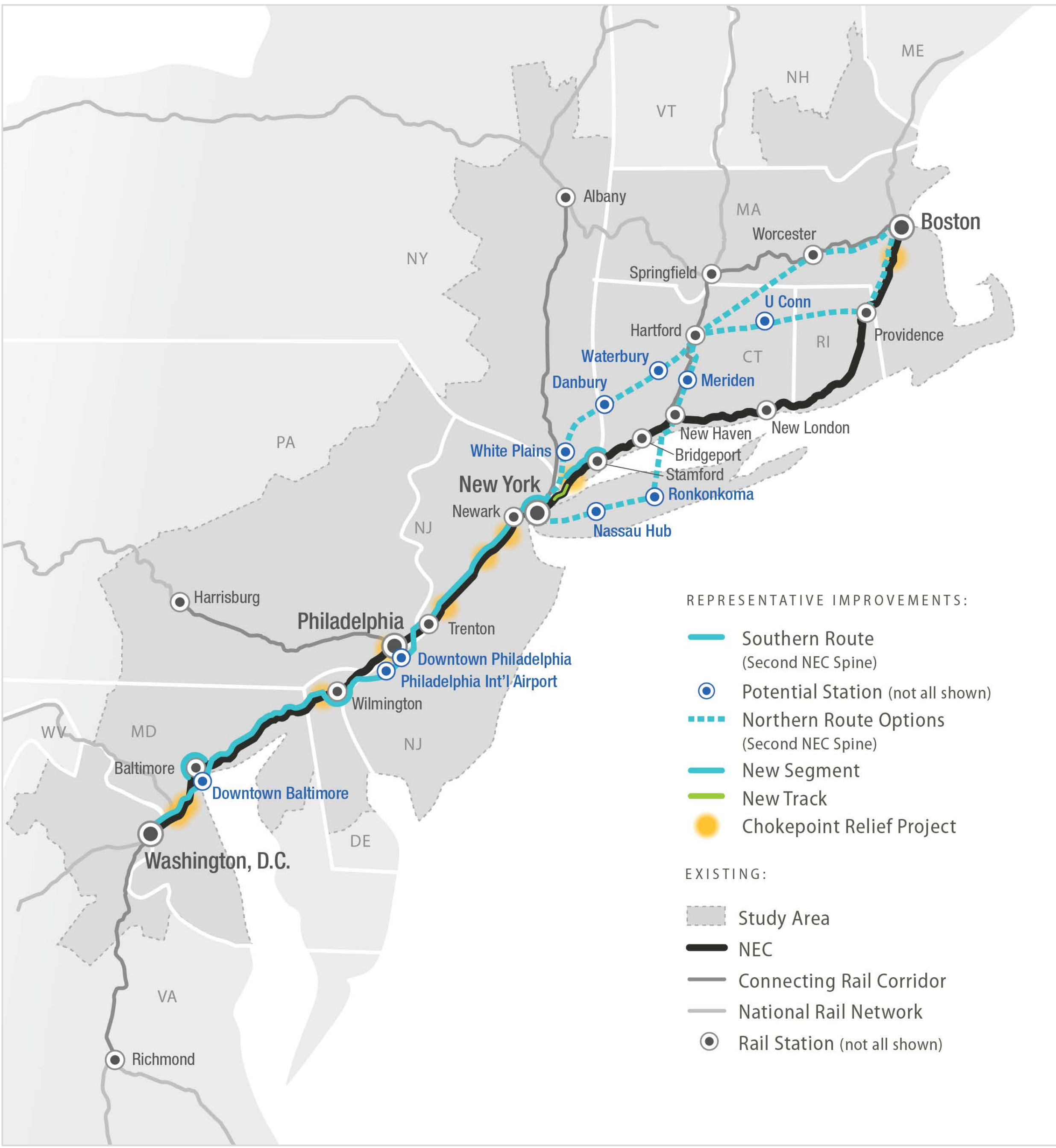
Alternative 2 grows the role of rail, expanding rail service and passenger use at a faster pace than the growth in regional population and employment. The existing NEC generally expands to four tracks, with six tracks through portions of New Jersey and southwestern Connecticut. South of New Haven, CT, service and infrastructure improvements are focused generally within the existing NEC. However, as shown in Figure S-3, north of New Haven, Alternative 2 adds a new supplemental, two-track route between New Haven and Hartford, CT, and Providence, RI, to increase resiliency, serve new markets, reduce trip times, and address capacity constraints.

Figure S-3: Alternative 2 (Chokepoint, New Track, and New Segment Locations)

Source: NEC FUTURE team, 2015

Alternative 3 transforms the role of rail, positioning it as a dominant mode for Intercity travelers and commuters across the NEC. Service and infrastructure improvements include upgrades on the existing NEC and the addition of a two-track second spine within the Study Area. This new spine supports high-performance rail services between major markets and provides additional capacity for anticipated growth (Figure S-4).

Figure S-4: Alternative 3 (Chokepoint, New Track, and New Segment Locations)



Source: NEC FUTURE team, 2015

In Alternative 3, four route options are under consideration for the northern portion of the second spine, as shown in Figure S-4. These options include routings via Central Connecticut/Providence, Long Island/Providence, Long Island/Worcester, and Central Connecticut/ Worcester. In addition to comparing each Action Alternative against the No Action Alternative, the evaluation of alternatives in the Tier 1 Draft EIS includes comparisons of these route options as part of Alternative 3.

S.6.1 Service Types

The No Action and Action Alternatives incorporate assumptions about the mix of service types to be provided. For NEC FUTURE, the FRA categorized passenger rail service into two types: Intercity and Regional rail.

Intercity is passenger rail service between cities or metropolitan areas, operating at speeds and distances greater than that of Regional rail. Intercity serves large, mid-size, and selected smaller markets, with station stops typically every 10 to 25 miles. Intercity is further categorized into two service sub-types:

- **Intercity-Express** is premium Intercity service operating on the NEC, making limited stops and serving only the largest markets. Intercity-Express service offers the shortest travel times for Intercity trips, higher-quality on-board amenities, at a premium price, using high-performance trainsets.[10]
- **Intercity-Corridor** is Intercity service operating both on the NEC and on connecting corridors that reach markets beyond the NEC. This service provides connectivity and direct one-seat rides to large and mid-size markets on the NEC.

Regional rail is service within a single metropolitan area to local markets with station stops typically every 2 to 10 miles. Regional rail trains provide local and commuter-focused service characterized by relatively low fares and a high percentage of regular travelers.

Chapter 4, Alternatives Considered, provides additional detailed information about the mix of service types included in each Action Alternative, as well as stations served and assumptions about the level of service by station. A hierarchy of station types was defined for this effort, including Major Hub, Hub, and Local stations. Major Hubs serve the largest markets in the Study Area and have a full complement of rail service types; Hub stations offer some Intercity service, and Local stations only offer Regional rail service. Each Action Alternative includes new stations, station upgrades (e.g., Local to Hub, Local to Major Hub, and Hub to Major Hub), and physical improvements to stations.

While each Action Alternative has a distinct vision for the NEC, they all include common elements that address the following to varying degrees:

- Maintain and improve service on the existing NEC
- Bring the NEC to a state of good repair by replacing or renewing aging infrastructure on the existing NEC and eliminating the backlog of infrastructure requiring replacement

[10] New state-of-the-art train equipment consisting of electric multiple units cars with high rates of acceleration and deceleration and capable of operating at speeds of 150 mph or greater.

- Address the most pressing capacity and service chokepoints that constrain capacity on the existing NEC
- Protect freight rail access and the opportunity for future expansion
- Incorporate national and international best practices to address capacity constraints, broaden the mix of station pairs served, improve performance, and generate operating efficiencies

S.6.2 Technology

As documented in Chapter 11, Agency and Public Involvement, in defining a long-term vision for the role of passenger rail on the NEC, the FRA actively sought stakeholder and public input via an early and proactive outreach process. The overwhelming message received is that the users of the NEC are seeking reliable, integrated, and expanded train service to meet both Intercity and Regional rail travel needs. As such, the FRA focused on Action Alternatives that meet that Purpose and Need by improving steel-wheel passenger train technology that is used today by all the railroads sharing the NEC, including both Intercity and Regional rail operations, as well as freight service.

Given the accelerating pace of change in consumer technology, business practices and transportation patterns, application of future emerging and new technologies may help to support rail service on the NEC and meet other transportation needs across the region. These might include new information systems and services, new train propulsion and guideway systems, fare collection innovations, and safety enhancements. An advanced guideway system, such as magnetic levitation technology, could possibly be used to develop a second spine or portions thereof as envisioned in Alternative 3. Such technologies could be studied separately, and are not precluded as future transformative investments in the regional transportation system. Other potential applications of new technology transportation systems could support the NEC passenger rail network by connecting off-corridor markets to the NEC, or a major market to the NEC.

S.7 ANALYSIS AND EVALUATION OF ALTERNATIVES

The FRA has performed an extensive analysis of each Action Alternative and the No Action Alternative as a basis for an alternatives evaluation. As described in separate chapters of this Tier 1 Draft EIS, these analyses consider transportation effects, economic effects, environmental consequences, and construction effects, as well as capital and operations and maintenance costs. A variety of indicators and metrics are presented for each topic and used to compare each Action Alternative with the No Action Alternative. A cross-cutting evaluation links these findings to the needs defined in the Purpose and Need statement.

This summary briefly describes each of the analyses performed and highlights several key findings. However, the reader is referred to the appropriate chapters within this Tier 1 Draft EIS for additional context, details, and conclusions.

S.7.1 Transportation Effects (Chapter 5)

The No Action and Action Alternatives would result in both positive and negative effects to the multimodal transportation network within the Study Area. Chapter 5, Transportation Effects, describes the transportation effects of the Action Alternatives. A summary of these findings is presented below.

Each of the Action Alternatives creates new connections and travel options within the Study Area. Alternatives 2 and 3 provide service to new off-corridor markets. By providing more travel options, the Action Alternatives generate significantly greater Intercity and Regional rail ridership compared to the No Action Alternative: the greater the improvement in frequency of service, types of services, travel times, and the number of metropolitan areas connected to the rail network, the higher the projected ridership.

The Action Alternatives also improve connectivity at Intercity stations by increasing the daily duration of rail service at many stations, making rail service available for longer periods of the day and hence more convenient to travelers. Alternatives 2 and 3 include service frequencies and daily durations of service that are more robust than the No Action Alternative, which expand mobility options for travelers and improve the attractiveness of passenger rail as a travel choice. The Action Alternatives result in more convenient passenger rail with increased service frequency at many Regional rail and Intercity stations. The greatest change in trip frequencies between stations is possible with the capacity and travel-time improvements included in Alternative 3.

As the frequency of service, types of services, and travel times improve with the Action Alternatives, passenger rail ridership increases. Table S-1 shows the number of trips for all passenger rail service types predicted for the No Action and Action Alternatives, and Table S-2: highlights the anticipated passenger rail trips by Alternative 3.

Table S-1: Number of Annual One-Way Trips (1,000s) by Service Type for the No Action and Action Alternatives (2040)

Mode	No Action Alternative	Alternative 1	Change vs. No Action (%)	Alternative 2	Change vs. No Action (%)	Alternative 3 (average)	Change vs. No Action (%)
Intercity	19,300	33,700	75%	37,100	92%	39,000	102%
Regional rail	419,800	474,500	13%	495,400	18%	545,500	30%

Source: NEC FUTURE Travel Demand Model, April 2015

Table S-2: Number of Annual One-Way Trips (1,000s) by Service Type for the Alternative 3 Route Options (2040)

Service Type	via Central CT/ Providence (3.1)	via Long Island/ Providence (3.2)	via Long Island/ Worcester (3.3)	via Central CT/ Worcester (3.4)
Intercity	38,900	38,700	39,800	38,600
Regional rail	545,500	545,500	545,500	545,500
TOTAL	584,500	584,200	585,300	584,100

Source: NEC FUTURE Travel Demand Model, April 2015

In the No Action Alternative, approximately 439 million passenger rail trips are predicted, while in Alternative 3, there are 579–580 million passenger rail trips predicted, an increase of 32 percent compared to the No Action Alternative. The greatest growth is predicted for Regional rail tripmaking, which is the dominant passenger rail travel type, even within the No Action Alternative. Regional rail ridership shows steady gains in all Action Alternatives compared to the No Action Alternative, as capacity grows to support more robust peak-hour and off-peak service.

S.7.2 Economic Effects (Chapter 6)

The construction and operation of the rail improvements and services in the No Action and Action Alternatives would result in changes to economic activity throughout the Study Area. Some changes would be immediate, while others would take place over a long period of time. These economic effects include Economic Development Response, Travel Market Effects, Construction and Rail Sector Employment Effects, and Indirect Effects associated with potential economic growth, as summarized below.

Economic Development Response

The Action Alternatives accommodate greater numbers of rail travelers and allow these travelers to make their trips faster and to a greater variety of destinations within and between the urban economies that line the corridor. The expansion of regional travel choices would allow households to access a greater range of employment and leisure options via rail from their home location—thereby improving quality of life. Businesses gain access to a larger, more diverse, and specialized pool of labor—thereby increasing productivity. The Action Alternatives would also accommodate a greater flow of people between major commercial centers and metropolitan areas.

- The largest potential economic impact of the Action Alternatives would be a greater flow of people within the major metropolitan economies through the increased volume of Regional rail relative to the No Action Alternative.
- The No Action Alternative is capacity constrained and insufficient for future demand. Potential rail travelers would be forced to take their second-best choice, imposing a cost on the economy. Alternative 1 offers an improvement over the No Action Alternative that would lessen this economic penalty. Alternatives 2 and 3 fully address the capacity constraints present in the No Action Alternative. Alternative 3 provides service levels and capacity to accommodate demand beyond that forecast for 2040.
- More-frequent service, faster travel times, and connections to new markets not currently served by rail would create opportunities for station area development. The support for station area development generally rises with the increase in travel-time savings, frequencies, and direct connections achieved across the Action Alternatives; gains are generally largest in the northern portion of the corridor.
- Discussions with experts from academic, development, business, and planning communities highlighted the importance of other local factors, such as quality schools, supportive infrastructure, or planning and zoning, in creating opportunities for station area development. (See Economic Development Workshop description in Chapter 6.)

- Improved passenger rail service to new markets has the potential to transform development patterns and in turn create greater demand for passenger rail. For the economics effects analysis, the FRA did not model local alternative economic growth or development scenarios, but did rely on insights from discussions with experts to understand the potential for economic growth with passenger rail improvements proposed in the Action Alternatives.

Travel Market Effects

Changes in mobility and connectivity proposed for each Action Alternative can be monetized to estimate the economic effects of transportation improvements as a function of travel time and cost savings as well as other factors such as safety and air quality impacts. The Action Alternatives offer faster travel times for many existing rail-served markets, expand service to markets not currently served, and offer a greater range of pricing.

- The volume of Intercity trips more than doubles under Alternative 3, over what is experienced in the No Action Alternative. All Action Alternatives would result in growth in intercity travel.
- Collectively, the changes in service frequencies, pricing, and markets in the Action Alternatives would allow travelers to make different travel choices than under the No Action Alternative. This change in travel behavior can influence economic outcomes.
- One of the key changes in travel behavior observed is that when offered a greater range of travel options, some travelers selected travel modes with longer travel times in order to save money. Thus, some existing rail and air travelers would shift from faster trains and planes to slower, less expensive rail options. When the value of the change in travel time was compared against the savings in travel cost, travelers realized a net savings. The travel cost savings, which are the smallest in Alternative 1 and greatest in Alternative 3, represent real gains in disposable income that support economic activity in the region.
- All of the Action Alternatives offer an increase in direct connections relative to the No Action Alternative. The magnitude of the gains varies by Action Alternative and by individual market, but the general pattern is that markets between the Greater Boston metropolitan area and the New York—North Jersey metropolitan area would experience the greatest gains in direct connectivity.
- All three Action Alternatives would help ease select chokepoints in the corridor, offering benefits for freight movements as well as passenger service compared to the No Action Alternative. The Action Alternatives do not differ measurably with regard to freight-related economic outcomes.

Construction and Rail Sector Employment Effects

- Potential construction effects occur primarily within the Affected Environment and represent a large, one-time stimulus to the economy. Construction jobs (measured as job-years) range from approximately 300,000 under the No Action Alternative to a high of 3.5 million for Alternative 3 (average of Alternative 3 route options), rising with the level of capital investment.
- Additional hiring would be required to operate and maintain the expanded rail service; the amount of employment supported rises incrementally across the No Action (lowest at 3,100 job-years) and Action Alternatives. Alternative 3 offers the greatest expansion and accordingly supports the greatest employment gain (24,200 job-years).

- The expansion of Intercity service proposed in the Action Alternatives would generate revenues in excess of projected operation and maintenance (O&M) costs. As such, no additional public subsidy would be required for the operation of the representative Intercity service included in the Action Alternatives.

Indirect Effects

- Induced growth can result in both positive and negative indirect effects. The potential for induced growth effects is higher under the Action Alternatives relative to the No Action Alternative and rises incrementally across Action Alternatives 1 through 3 with expansion of rail service offered.
- The north region would have the highest potential for indirect effects—the Greater Providence and Boston metropolitan areas under all Action Alternatives, and the greater Hartford metropolitan area under Alternatives 2 and 3. The New York-North Jersey metropolitan area also has the potential for indirect effects, largely attributed to improvements in travel time and capacity within the area to New York City.

Across the Action Alternatives, the Greater New York-North Jersey, Greater Philadelphia, and Greater Baltimore markets have the greatest gains in station connectivity. These markets have the greatest gains under Alternative 3 as compared to other Action Alternatives. Moreover, each Action Alternative gains one or more hub stations, which are focal points for development in the surrounding area. Hubs support greater development intensity than stations with just rail service. These stations have potential for indirect effects to occur as a result of induced growth.

S.7.3 Environmental Consequences (Chapter 7)

S.7.3.1 Approach to Analyzing Environmental Consequences

The FRA analyzed the effects of each Alternative on the resources shown in Table S-3. For each resource, an Affected Environment was studied to assess potential for impact and was defined generally as a “swath” of land centered on the Representative Route for each Action Alternative. Some potential environmental effects are due to changes in the physical footprint of the rail infrastructure, while others are due to changes in the type and volume of passenger rail service associated with each Action Alternative. The environmental effects assessment is based on readily available secondary source data, including geographic information system (GIS) data, published reports, and technical analyses. No field investigations occurred as part of this analysis.

Table S-3: Environmental Resources and Limits of Affected Environment

Resource	Description of Resource	Affected Environment
Land Cover	Land cover within the Affected Environment	½-mile-wide swath centered on the Representative Route for each Action Alternative
Agricultural Lands (Prime Farmlands and Timberlands)	Prime farmland and timberlands	2,000-foot-wide swath centered along Representative Route for each Action Alternative

Table S-3: Environmental Resources and Limits of Affected Environment (continued)

Resource	Description of Resource	Affected Environment
Parklands and Wild and Scenic Rivers	Publicly owned parklands; parklands receiving funding from the Land and Water Conservation Fund Act; Rivers identified as Wild and Scenic by the National Rivers Inventory within the Affected Environment	2,000-foot-wide swath centered along Representative Route for each Action Alternative
Hydrologic/Water Resources	Coastal zones and saltwater wetlands, freshwater resources (including wetlands), and floodplains	2,000-foot-wide swath centered on the Representative Route
Ecological Resources	Critical habitats and federally listed Threatened & Endangered Species	3,000-foot-wide swath centered along Representative Route for each Action Alternative
Geologic Resources	Soil, geological, groundwater and topographic resources	3,000-foot-wide swath centered along Representative Route for each Action Alternative
Hazardous Waste and Contaminated Material Sites	Known sources and potential suspected sources of contaminated and hazardous materials	2-mile-wide swath centered along Representative Route for each Action Alternative
Cultural Resources and Historic Properties	Resources listed in or eligible for listing in the National Register of Historic Places within the Affected Environment or identified as significant by Indian Tribes	1-mile-wide swath centered along Representative Route for each Action Alternative
Visual and Aesthetic Resources	Prominent visual resources and aesthetic qualities within the Affected Environment	1-mile-wide swath centered along Representative Route for each Action Alternative
Environmental Justice	Minority and low-income populations within the Affected Environment	1-mile-wide swath centered along Representative Route for each Action Alternative
Noise and Vibration	Ambient noise and vibration conditions, and noise-sensitive land cover categories	5,000-foot-wide swath centered along Representative Route for each Action Alternative
Air Quality *(including greenhouse gas emissions)*	Current attainment status for criteria pollutants established by the U.S. Environmental Protection Agency for air-sheds within the Study Area	Determined by metropolitan planning organization by state within the Study Area
Energy	Energy consumed, particularly by the transportation sector	Entire Study Area
Climate Change and Adaptation *(excluding greenhouse gas emissions)*	Identification of areas susceptible to the impacts of climate change (sea-level rise, storm surge and/or extreme heat and cold events)	For flood hazards: 2,000-foot-wide swath For extreme heat and cold events: Entire Study Area

Table S-3: Environmental Resources and Limits of Affected Environment (continued)

Resource	Description of Resource	Affected Environment
Section 4(f) and Section 6(f) Resources	Parklands converted to transportation use, including publicly owned public parks, recreation areas, and wildlife/waterfowl refuges	2,000-foot-wide swath centered along Representative Route for each Action Alternative
	Converted lands or facilities that were acquired with Land and Water Conservation Fund Act funds	
	Historic resources converted to transportation use, including historic sites of local, state or national significance (eligible or listed)	1-mile-wide swath centered along Representative Route for each Action Alternative
Electromagnetic Fields and Electromagnetic Interference	Electromagnetic Fields (EMF) associated with electric conventional or high-speed train operations and electromagnetic interference that occurs when EMFs are produced	2,000-foot-wide swath centered on Representative Route for each Action Alternatives
Safety	Operational, infrastructure and overall modal safety	Entire Study Area
Public Health	Potential public health-related effects for each of the relevant Tier 1 Draft EIS resource areas	As per the resource areas
Cumulative Effects	Combined result of the incremental direct and indirect effects of the Tier 1 Draft EIS Action Alternatives as well as the effects of other past, present, and reasonably foreseeable future actions, regardless of agency, on key resources	Study Area, expanded to include connecting corridors

1. Chapter 5 addresses transportation effects and Chapter 6 addresses economic effects and growth.

In general, impacts on environmental resources are greatest in areas where the Representative Route goes off-corridor, away from the existing NEC. These areas are often less developed than the current NEC. However, some impacts do exist to resources located along and within the existing NEC right-of-way. All Action Alternatives include improvements to the existing NEC; therefore, all effects-assessments consider potential effects that occur to <u>both</u> the existing NEC and any proposed off-corridor routing.

S.7.3.2 Key Resource Areas

While all environmental factors are important, some have greater potential to influence the identification of a Preferred Alternative as they are tied to Executive Orders, environmental laws, regulations and regulatory requirements, including but not limited to Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations), Section 404 of the Clean Water Act, Section 106 of the National Historic Preservation Act, Section 7 of the Endangered Species, and Section 4(f) of the U.S. Department of Transportation Act. Some of these laws require avoidance of impacts or selection of an alternative that has the least environmental impact. At a Tier 1 level of assessment, site-specific constructability or feasibility factors are unknown. The FRA is considering key effects on resources that could result from implementation of an Action Alternative and key findings from the NEC FUTURE analysis in deciding on a Preferred Alternative for the NEC FUTURE program, including:

- Land Cover (Chapter 7.2): Potential for land cover conversion to a transportation-related land use, or changes to existing land cover that could result in loss or fragmentation of ecological resources; loss of or changes to hydrologic resources; conversion of recreational resources; acquisitions and displacements; and conversion of prime farmlands or timberlands.
- Parklands (Chapter 7.4): Conversion of parkland resources to non-recreational uses informs the Section 4(f) analysis (Chapter 7.16).
- Hydrologic Resources (Chapter 7.5): Dredge or fill of wetlands; encroachment of floodplains; development within designated coastal zones; crossing Navigable Waterways.
- Ecological Resources (Chapter 7.6): Loss or fragmentation of habitat; changes to migratory patterns of transient species; effects on protected species.
- Cultural Resources and Historic Properties (Chapter 7.9): Loss of or damage to cultural resources and historic properties.
- Environmental Justice (Chapter 7.11): Concentrations of minority populations and low-income populations that could benefit or be affected by environmental impacts occurring in their communities.
- Climate Change and Adaptation (Chapter 7.15): Areas at highest risk from inundation from sea level rise, storm surge flooding, and riverine flooding.
- Section 4(f) (Chapter 7.16): Conversion of recreational properties, cultural resources and historic properties to a transportation use.

S.7.3.3 No Action Alternative

The No Action Alternative includes projects and transportation improvements that range in scope and complexity. Most of the projects and activities included as part of the No Action Alternative occur within the existing NEC right-of-way. Under the No Action Alternative, passenger rail service along the NEC operates and provides approximately the same level of service as provided today. As a result, "service-related" effects on noise and vibration would be unlikely. However, service-related effects on air quality could result due to increased congestion on the overall multimodal transportation network. "Footprint" effects on environmental resources under the No Action Alternative would vary, depending on the scope of the project being implemented. In a few cases, projects that are part of the No Action Alternative have footprints and effects that extend beyond the existing NEC right-of-way. Those types of projects, depending on the scope and complexity, have a greater potential to affect environmental resources than those activities occurring within the existing NEC right-of-way. However, the majority of passenger rail projects included in the No Action Alternative occur within the existing NEC right-of-way.

S.7.3.4 Action Alternatives

A range of benefits and impacts would occur with each of the Action Alternatives since each proposes varying degrees of both service and infrastructure improvements. As such, benefits and impacts associated with each Action Alternative would differ due to the level of service and infrastructure proposed. All Action Alternatives would result in the following:

- Travel options and improved mobility, and access to employment for all populations, including Environmental Justice populations.
- Decrease of greenhouse gas emissions for the year 2040 due to predicted shifts in mode choice (reduction in vehicle miles traveled (VMT) in personal automobiles) and changes in renewable energy usage.
- Decrease in energy usage from roadways from expected decrease in roadway VMT (autos) and an increase in energy use from power sources due to increase train service/frequencies.

Each Action Alternative provides for improvements that may affect environmental resources. Table S-4 identifies the key findings for the key resources by Action Alternative.

Table S-4: Summary of Key Resource Findings by Action Alternative

Resource	Alternative 1	Alternative 2	Alternative 3
Land Cover	- Greatest total conversions – MD, CT - Alternative with least total conversions	- Greatest total conversions – MD, CT - Alternative with the greatest undeveloped land conversions (CT)	- Greatest total conversions – MD, CT - Alternative with the greatest total conversions (via Long Island/Worcester)
Parklands	- State with greatest impacts to parklands – RI - 97 parks affected - Key parks affected – Greenway (RI), Great Swamp (RI)	- State with greatest impacts to parklands – RI - 111 parks affected - Key parks affected – Greenway (RI), Natchaug State Forest (CT)	- States with greatest impacts to parklands – NY, RI - 116–130 parks affected - Key parks affected – Greenway (RI), Natchaug State Forest (CT), Pelham Bay Park (NY), Eisenhower County Park (NY), Patuxent Research Refuge (MD), Gunpowder Falls State Park (MD), Saxon Woods County Park (NY), Norfolk County Canoe River Wilderness (MA), Natchaug State Forest (CT)
Hydrologic	- State with greatest effects: CT (particularly with water resources located in New Haven, Middlesex, and New London counties)	- State with greatest effects: CT (particularly water resources located in New Haven, Middlesex, Hartford and New London counties) - Only Alternative that bisects John Heinz Wildlife Refuge in Delaware and Philadelphia, PA	- State(s) with greatest effects NY and CT (resources associated with Long Island Sound) - Crosses 11 Navigable Waterways

Table S-4: Summary of Key Resource Findings by Action Alternative (continued)

<table>
<tr><th>Resource</th><th>Alternative 1</th><th>Alternative 2</th><th>Alternative 3</th></tr>
<tr><td>Ecological</td><td colspan="3">Under all Action Alternatives:
< New Haven, New London, and Fairfield Counties, CT, are, in general, the counties with highest overall potential ecological resource impacts (ESH[1], T&E[2], EFH[3])
< A number of large ESHs and wildlife refuges are clipped or bisected by the Action Alternatives: Patuxent Research Refuge, Anacostia and Gunpowder Falls (MD); John Heinz National Wildlife Refuge (PA), Laurel Ridge Setauket Woods Nature Preserve, Pelham Bay Park, and Saxon Woods County Park (NY); Great Swamp Management Area/Great Swamp (RI); and Paugussett State Forest and Rocky Neck State Park (CT).
< Suffolk County, NY, has the greatest potential T&E species occurrence by county in the Affect Environment for all the Action Alternatives.</td></tr>
<tr><td>Environmental Justice (Counties with EJ populations with highest number environmental impacts)</td><td>< Baltimore City, MD,
< Fairfield County, CT</td><td>< Philadelphia County, PA
< Middlesex County, NJ
< Queens County, NY
< Fairfield County, CT</td><td>< Baltimore City and Harford Counties, MD
< Philadelphia County, PA
< Bronx and Queens Counties, NY
< Fairfield and Hartford Counties, CT
< Providence County, RI
< Worcester County, MA</td></tr>
<tr><td>Cultural/Historic Properties (total # of NRHP and NHL sites within Representative Route, and key cultural/historic property(ies) affected)</td><td>< NRHPs: 143
< NHLs: 2 (Fairmount Waterworks, Andalusia, PA)</td><td>< NRHPs: 171
< NHLs: 3 (Fairmount Waterworks, John Bartram House, Andalusia, PA)</td><td>< NRHPs: 132-150
< NHLs: 3-4 (Washington Square West Historic District, Reading Terminal and Trainshed, Andalusia, PA, John B. Smith Building, MA)</td></tr>
<tr><td>Climate Change (Counties that have or are proposed to have rail assets in areas at highest risk of inundation)</td><td>< New London, CT
< Hudson, NJ
< New York City, NY
< New Haven, CT
< Fairfield, CT
< Provides resilience/redundancy with Old Saybrook-Kenyon Segment</td><td>< New London, CT
< Hudson, NJ
< Philadelphia, PA
< New London, CT
< New Haven, CT
< Provides resilience/redundancy with New Haven-Hartford-Providence Segment</td><td>< Hudson, NJ
< New Castle, DE
< New York City, NY
< New London, CT
< Hudson, NJ
< Provides resilience/redundancy with route options between New York City and Hartford and Hartford to Boston</td></tr>
</table>

Table S-4: Summary of Key Resource Findings by Action Alternative (continued)

Resource	Alternative 1	Alternative 2	Alternative 3
Section 4(f) (parks with the highest acreage potentially affected and NHLs within the Representative Routes)	Parklands: < The Greenway, RI < The Great Swamp Management Area, RI NHLs: < Fairmount Waterworks, PA < Andalusia, PA	Parklands: < Natchaug State Forest, CT < The Greenway, RI NHLs < Fairmount Waterworks, PA < John Bartram House, PA < Andalusia, PA	Parklands: < Patuxent Research Refuge, MD < Gunpowder State Falls, MD < Natchaug State Forest, CT < The Greenway, RI < Pelham Bay Park, NY < Eisenhower County Park, NY < Saxon Woods County Park, NY < Norfolk County Canoe River Wilderness, MA NHLs < Washington Square West Historic District, PA < Reading Terminal and Trainshed, PA < Andalusia, PA < John B. Smith Building, MA

Source: NEC FUTURE team, 2015

[1.] Ecologically Sensitive Habitat (ESH) is a term for those areas dedicated to conserving and maintaining biological diversity and natural resources, such as national wildlife refuges, parks, or forests. Other natural areas (such as wetlands, streams, and coastal areas) can also be considered ecologically sensitive. Federal or state agencies do not designate ESHs.

[2.] Federally listed Threatened and Endangered (T&E) species are vulnerable to endangerment in the near future or are in imminent danger of becoming extinct due to the loss of habitat or the decline in population numbers. For some T&E species, federal agencies designate and protect critical habitats.

[3.] Essential Fish Habitat (EFH) comprise all aquatic habitats where fish spawn, breed, feed, or grow to maturity. These habitats include wetlands, coral reefs, sea grasses, and rivers.

S.7.4 Construction Effects (Chapter 8)

The Action Alternatives involve construction of significant rail infrastructure—tunnels, bridges, embankments, stations, and ancillary roads and support facilities—across the Affected Environment over an extended time period. Since detailed project design and construction information is not available at the Tier 1 level of analysis, the FRA developed potential construction types based on available conceptual information for each Action Alternative.

Six construction types comprise the potential infrastructure associated with all of the Action Alternatives: tunnel, trench, at-grade, embankment, aerial structure (bridges and viaducts), and major bridge. The FRA considered existing NEC construction features, as well as land use, topographic and other environmental features, and cost in developing the construction types. Figure S-5 describes the percentage of construction types by route distance for the existing NEC and each Action Alternative.

As presented in Figure S-5, the route miles by construction type for Alternatives 1 and 2 are similar to the existing NEC, with the exception of additional tunnel route miles as part of Alternatives 1 and 2. For Alternative 3, the route miles by construction type increase for tunnel, aerial structure, and trench, along with a decrease in embankment and at-grade route miles.

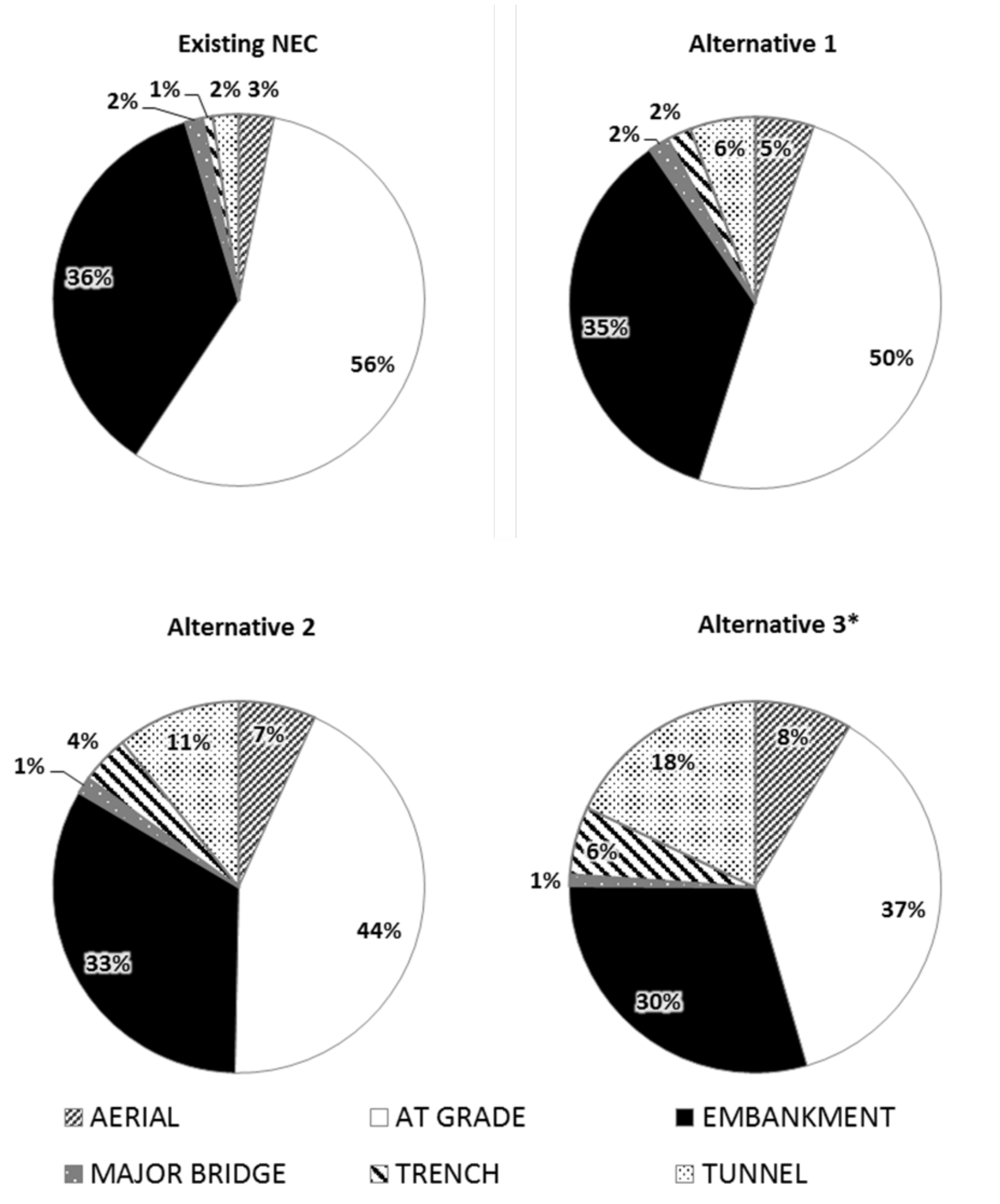
Regardless of the alternative selected, minimizing construction impacts on on-going rail operations can be best planned and achieved through the packaging of projects into multiple phases of the Selected Alternative. Through such phasing, individual projects can be timed to meet a number of important objectives. These include optimizing the benefits across the NEC of complementary capacity and travel-time projects, balancing the demand on resources, and spacing projects to take maximum advantage of construction outages and minimize adverse impacts on on-going train operations. The SDP will include a full phasing plan for the Selected Alternative that seeks to achieve these benefits.

S.7.5 Costs

Capital cost estimates were developed to understand the differences between the No Action Alternative and the Action Alternatives. An estimate of the capital cost of the No Action Alternative is $19.9 billion in 2014 dollars. This includes $8.35 billion in funded projects, $980 million in funded and unfunded mandates, and $10.53 billion in unfunded projects that are necessary to keep the railroad operating. The estimated $9 billion cost of the first two types of projects (funded or mandated projects) is also included in each of the Action Alternatives. The No Action Alternative may have additional costs from emergency or unplanned repairs since the corridor will remain at heightened risk of service disruption and unpredictable failures. These additional costs are not accounted for in the estimate.

Table S-5 provides estimates of the capital cost of each Action Alternative. The capital cost of Alternative 1 is estimated at between $64 billion and $66 billion in 2014 dollars; Alternative 2 is estimated at $131 billion to $136 billion, and Alternative 3 is estimated at $267 billion to $308 billion. The large range for Alternative 3 is due to the difference in cost associated with each route option, as shown in Table S-6.

Figure S-5: Percentage of Route Miles by Construction Type – Washington, D.C., to Boston, MA



* The percentage of route miles shown in Alternative 3 is the average route miles by construction type for all route options between Washington, D.C., and Boston, MA.

Table S-5: Capital Costs – Action Alternatives ($2014 billions)

Category	Alternative 1 (range)	Alternative 2 (range)	Alternative 3 (range)
Infrastructure	$52–54	$116–$121	$252–$293
Vehicles	$3	$5	$6
Subtotal	$54–$57	$122–$127	$257–$299
No Action Alternative Projects	$9	$9	$9
TOTAL	$64–$66	$131–$136	$267–$308

Source: NEC FUTURE team, 2015
Notes: Infrastructure costs include professional services. Cost does not include property acquisition costs for yards or stations. Each of the Action Alternatives includes the $9 billion cost associated with the No Action Alternative projects.

Table S-6: Capital Costs – Alternative 3 Route Options ($2014 billions) (end-to-end costs)

Category	Central Connecticut/ via Providence	Long Island/ via Providence	Long Island/ via Worcester	Central Connecticut/ via Worcester
Infrastructure	$267–$279	$252–$262	$265–$276	$281–$293
Vehicles	$6	$6	$6	$6
Subtotal	$273–$285	$257–$268	$271–$281	$286–$299
No Action Alternative Projects	$9	$9	$9	$9
TOTAL	$283–$294	$267–$277	$280–$291	$296–$308

Source: NEC FUTURE team, 2015
Notes: Infrastructure costs include professional services. Cost does not include property acquisition costs for yards or stations.

The FRA also estimated annual operating and maintenance costs for each alternative. In the No Action Alternative and in Alternative 1, annual Intercity operating revenue is estimated at approximately $2 billion and O&M costs at $1 billion. In Alternatives 2 and 3, annual operating revenue would be approximately $3 billion and O&M costs approximately $2 billion. Surplus net operating revenues from Intercity service would be realized in each alternative and would range from an estimated $500 million to $1 billion annually.

S.7.6 Comparison of Alternatives: Summary of Findings (Chapter 9)

Table S-7 summarizes the factors and metrics discussed in this Summary and in Chapter 9 of the Tier 1 DEIS the FRA used to evaluate the similarities and differences between the No Action and Action Alternatives. Metrics such as service frequency, capacity, and annual passenger trips increase as the level of investment and service improvements increase, demonstrating the range of possibilities for the role of rail in the Study Area. Table S-7 illustrates the overall potential for improved mobility and economic growth. Metrics that capture changes in service frequency and travel times demonstrate how each Action Alternative would change travel from a local perspective. Both the end-to-end and local (sub-region or city-pair) perspectives are important in considering the benefits and costs of the No Action and Action Alternatives.

S.7.7 Phasing and Implementation (Chapter 10)

The ability to implement expanded passenger rail service as envisioned in the Action Alternatives, and to construct the improvements necessary to support such service, will depend on many factors, including funding, environmental approvals, market growth, regional cooperation, and practical constraints relating to construction on a very busy rail corridor. Therefore, project sponsors will implement improvements incrementally. Some work, such as state-of-good-repair projects, could advance on a continual basis through annual bridge, track, electric-traction, systems, and structures programs, while larger projects would be planned and implemented separately.

To ensure that incremental capital investment in the NEC will result in benefits for the entire corridor, the FRA anticipates that the alternative selected in the Record of Decision (Selected Alternative) will be implemented in phases consisting of integrated, complementary projects. Phasing ensures that an appropriate integrated package of improvements is planned and implemented in order to meet specific service and operational objectives and to lay the foundation for future phases of work. In this way, travelers will experience near- and mid-term service benefits over the extended period of time that it will take to implement the full service plan envisioned by each Action Alternative.

Each of the Action Alternatives assumes the implementation of a common set of projects, or "Universal First Phase," that would support important enhancements to service and serve as a foundation for advancing subsequent work. In addition to a core set of projects common to the three Action Alternatives, the Universal First Phase includes operational efficiencies and corridor-wide service enhancements that will require significant coordination between the NEC railroads, including potential changes to existing institutional arrangements.

The Universal First Phase consists of high priority projects currently in planning for replacing aging infrastructure and relieving major chokepoints; additional infrastructure needed to support construction activities and to minimize adverse impacts on passenger rail operations during construction; equipment, and operational and institutional changes required to maximize the benefit and cost-effectiveness of investment in the NEC and provide for an enhanced customer experience.

Chapter 10, Phasing Implementation, provides information on the projects included in the Universal First Phase. Implementation of these projects would support a modest increase in both Intercity and Regional rail service, greatly enhance the overall reliability of passenger rail on the NEC, and prepare the NEC for future phases of work.

Table S-7: Summary of Alternatives – Characteristics and Evaluation Factors

Project Needs Addressed	Metrics for Evaluating	No Action	Alternative 1	Alternative 2	Alternative 3 (average)
Aging Infrastructure	< NEC in a state of good repair	NO	YES	YES	YES
Capacity	< Peak Rail Capacity utilization (# of trains, peak hour, peak direction)	Washington: 6 Hudson River:24 Boston: 11	Washington: 12 Hudson River: 37 Boston: 17	Washington: 20 Hudson River: 52 Boston: 22	Washington: 24 Hudson River: 70 Boston: 24-32
	< Peak trains per hour (Intercity Trains at NYC)	—	2X the No Action	3X the No Action	5X the No Action
	< Peak passenger capacity utilization (# of passengers, peak hour, peak direction)	WAS: 6,610 Hudson: 30,374 Boston: 9,562	WAS: 9,615 Hudson: 44,993 Boston: 13,528	WAS: 11,173 Hudson: 61,280 Boston: 14,682	WAS: 12,403 Hudson: 71,111 Boston: 18,480
	< Annual Passenger Rail Trips (1,000s of Trips)	439,100	508,100	532,500	584,500
	o Intercity	19,300	33,600	37,100	39,000
	o Regional Rail	419,800	474,500	495,400	545,500
	< Annual Passenger Miles (in 1,000s)	13,957,565	17,640,308	19,142,079	20,710,292
	o Intercity	3,103,000	5,610,200	6,232,400	6,565,500
	o Regional Rail	11,264,400	12,547,100	13,455,800	14,713,900
	< Reduction in Annual VMT (in millions)	N/A	-2,000	-2,600	-3,100
	< % Intercity Trips Diverted to Rail (% of trips on the NEC diverted from other modes)	—	36%	44%	46%

Table S-7: Summary of Alternatives – Characteristics and Evaluation Factors (continued)

Project Needs Addressed	Metrics for Evaluating	No Action	Alternative 1	Alternative 2	Alternative 3 (average)
Connectivity	< Daily Trains Serving Airport Stations (total number of trains)	BWI: 141 PHL: 0 EWR: 152 T.F. Green: 25	BWI: 252 PHL: 0 EWR: 240 T.F. Green: 81	BWI: 386 PHL: 149 EWR: 364 T.F. Green: 74	BWI: 450 PHL: 88 EWR: 414 T.F. Green: 101
	< Air-to-rail diversions (annual trips in 1,000s)	—	WAS-NJ/NY: 83 NJ/NY-BOS: 216 PHL-BOS: 42	WAS-NJ/NY: 164 NJ/NY-BOS: 274 PHL-BOS: 47	WAS-NJ/NY: 225 NJ/NY-BOS: 248 PHL-BOS: 45
	< Daily service volumes – train volume for key city-pairs and key stations	WAS-NYC: 36 NYC-BOS: 19	WAS-NYC: 70 NYC-BOS: 47	WAS-NYC: 96 NYC-BOS: 88	WAS-NYC: 150 NYC-BOS: 143
	< Daily service volumes – train volume for connecting corridors	Richmond-NYC: 9 Harrisburg-NYC: 9 Albany-NYC: 12 Springfield-NYC: 2	Richmond-NYC: 13 Harrisburg-NYC: 13 Albany-NYC: 22 Springfield-NYC: 9	Richmond-NYC: 14 Harrisburg-NYC: 22 Albany-NYC: 22 Springfield-NYC: 27	Richmond-NYC: 14 Harrisburg-NYC: 21 Albany-NYC: 22 Springfield-NYC: 37
	< Number of Stops by Station (daily)				
	o Intercity Service	Odenton: 0 PHL Airport: 0 Secaucus: 0 Providence: 38	Odenton: 44 PHL Airport: 0 Secaucus: 0 Providence: 98	Odenton: 92 PHL Airport: 92 Secaucus: 108 Providence: 198	Odenton: 112 PHL Airport: 86 Secaucus: 174 Providence: 167
	o Regional rail Service	Odenton: 59 PHL Airport: 72 Secaucus: 367 Providence: 74	Odenton: 108 PHL Airport: 72 Secaucus: 522 Providence: 84	Odenton: 164 PHL Airport: 216 Secaucus: 722 Providence: 104	Odenton: 188 PHL Airport: 288 Secaucus: 970 Providence: 140
	o Total (Intercity Service + Regional rail Service)	Odenton: 59 PHL Airport: 72 Secaucus: 367 Providence: 74	Odenton: 152 PHL Airport: 72 Secaucus: 522 Providence: 182	Odenton: 256 PHL Airport: 308 Secaucus: 830 Providence: 302	Odenton: 300 PHL Airport: 374 Secaucus: 1144 Providence: 307

Table S-7: Summary of Alternatives – Characteristics and Evaluation Factors (continued)

Project Needs Addressed	Metrics for Evaluating	No Action	Alternative 1	Alternative 2	Alternative 3 (average)
Performance	< Travel-Time savings for key city-pairs (Intercity-Corridor times in min)	—	WAS-NYC: 15 NYC-BOS: 40	WAS-NYC: 22 NYC-BOS: 70	WAS-NYC: 32 NYC-BOS: 97
	< Station-to-station travel times (h:mm) – Intercity-Corridor	ODN-TRE: — WAS-HFD: 6:35 PHL-NHV: 3:23	ODN-TRE: 2:10 WAS-HFD: 5:14 PHL-NHV: 2:48	ODN-TRE: 2:03 WAS-HFD: 5:02 PHL-NHV: 2:35	ODN-TRE: 1:43 WAS-HFD: 4:19 PHL-NHV:2:36
	< Top speed by segment	WAS-NYC: 160 NYC-BOS: 150	WAS-NYC: 160 NYC-BOS: 160	WAS-NYC: 160 NYC-BOS: 160	WAS-NYC: 220 NYC-BOS: 220
Resiliency	< Redundancy for key network links (# of routes WAS-BOS)	WAS-NYC: 1 NYC-BOS: 1	WAS-NYC: 1 NYC-BOS: 1	WAS-NYC: 1 NYC-BOS: 2	WAS-NYC: 2 NYC-BOS: 2
	< Acres of the Representative Route vulnerable to flooding (At-grade and Construction)				
	o Alternative 1: Old Saybrook-Kenyon New Segment (Existing NEC/Alt 1)	—	SLR*:5/2 SSF*: 126/3 RF*:141/4	—	—
	o Alternative 2: New Haven-Hartford-Providence (Existing NEC/Alt 2)	—	—	SLR:7/1 SSF: 138/10 RF:353/139	—
	o Alternative 3: New York County, NY, to Suffolk County, MA (Existing NEC/Alt 3 range)				SLR:10/0-1 SSF: 193/5-16 RF:277/42-97
	< Number of Stations vulnerable to flooding – Current Climate Conditions, one or more flood hazards				
	o New Stations	—	7	10	15-16
	o Existing Stations	—	54	55	55

* Sea Level Rise (SLR); Storm Surge Flooding (SSF); Riverine Flooding (RF)

Table S-7: Summary of Alternatives – Characteristics and Evaluation Factors (continued)

Project Needs Addressed	Metrics for Evaluating	No Action	Alternative 1	Alternative 2	Alternative 3 (average)
Environmental Sustainability	< Change in Greenhouse Gas and Criteria Pollutants (tons/year)				
	o CO_2e	—	-274,650	-327,180	-252,461
	o CO	—	-2,480	-3,375	-3636
	o VOC	—	-30	-45	-44
	o NOx	—	-75	-80	8
	o PM10	—	-30	-35	-34
	o PM2.5	—	-10	-10	-5
	o SO2	—	170	340	516
	< Change in energy use (MMBtu)		-3,813,815	-4,899,110	-4,526,791
	o Roadways	—	-4,815,105	-6,516,805	-7,108,620
	o Diesel Trains	—	-1	-128,585	3
	o Electric Trains	—	1,001,290	1,746,280	2,581,826
Economic Growth	< Employment Impacts in the Study Area (# of job-years)	300,900	784,670	1,583,000	3,483,400
	o Construction Effects Employment	297,800	773,670	1,561,100	3,453,200
	o Rail Operations Effects Employment	3,100	11,000	21,900	30,200
	< Annual Travel Market Savings				
	o Total Intercity Travel-Time Savings (millions)	—	$1,973	$1,941	$2,106
	o Total Emissions Savings	—	$22	$20	$6
	< Number of New and Modified Stations	5 stations	24 stations	27 stations	42–47 stations
	< Jobs Accessible in a 30-Minute Train Travel Time (000s of jobs, net of No Action	—	WAS: 60 NYP: 840 BOS: 0	WAS: 440 NYP: 1,410 BOS: 330	WAS: 430 NYP: 1,850 BOS: 370

Table S-7: Summary of Alternatives – Characteristics and Evaluation Factors (continued)

Project Needs Addressed	Metrics for Evaluating	No Action	Alternative 1	Alternative 2	Alternative 3 (average)
Environmental Impacts	< Rating of magnitude of effects on environment:				
	o Population: Total population of census tracts intersecting the Affected Environment	4.4 million	4.5 million	4.9 million	5.9–6.5 million
	o EJ Census Tracts: Percentage of EJ census tracts among all census tracts within the Affected Environment	59% census tracts	59% census tracts	57% census tracts	54–56% census tracts
	o Land Cover Conversion: Percentage of Representative Route with potential conversion of Undeveloped Land	18% of the Representative Route	19% of the Representative Route	21% of the Representative Route	16-19% of the Representative Route
	o 6(f) Parks: Total Resources	20	21	23	23-27
	o 4(f) Parks: Total Resources	95	97	111	116-130
	o NRHP-Listed: Total Resources	30 resources	142 resources	171 resources	136-150 resources
Cost	< Total Capital Cost ($B 2014)	$19.9	$63.6–$66.2	$131.0–$136.1	$266.8–$308.0
	< Total O&M Net Revenue ($M 2014)	$970	$840	$680	$570

Source: NEC FUTURE team, 2014

S.8 NEXT STEPS

The FRA encourages public dialogue on the evaluation of the No Action and Action Alternatives presented in this Tier 1 Draft EIS. A public comment period will be held, beginning with a Notice of Availability in the *Federal Register* and extending through January 30, 2016. During the public comment period, the FRA will host public hearings on this Tier 1 Draft EIS in various locations within the Study Area. Information on the public hearings and other methods of submitting comments will be available online at *www.necfuture.com*. The Tier 1 Draft EIS will be available for download from the website and in hard copy form at major libraries throughout the Study Area, including in all counties through which the existing NEC and Action Alternative Representative Routes run.

Following the public comment period, the FRA will identify a Preferred Investment Program (Preferred Alternative) that achieves a vision for passenger rail in the NEC. The Tier 1 Final EIS will describe the Preferred Alternative, which could be one of the Alternatives considered in this Tier 1 Draft EIS or an Action Alternative that is made up of elements of the Action Alternatives considered in this Tier 1 Draft EIS.

Finally, the FRA will formally select an alternative in a Record of Decision (ROD) to complete the Tier 1 environmental review process. The FRA will then prepare an SDP for the Selected Alternative as defined in the ROD. Future decisions by the U.S. Department of Transportation, the NEC states and Washington, D.C., and rail operators will shape the manner in which NEC FUTURE will be incrementally implemented over several decades.