# Northeast Corridor Five-Year Capital Needs Assessment

Fiscal Years 2015 to 2019

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### 1. Executive Summary

The Northeast Corridor Five-Year Capital Needs Assessment: FY15-19 is the result of a collaborative effort among the members of the Northeast Corridor Infrastructure and Operations Advisory Commission (the Commission) to identify high-priority capital investments across all owners of Northeast Corridor (NEC) infrastructure, operators of NEC service, state departments of transportation, and the federal government. The Assessment serves as the Commission's annual submission to Congress regarding NEC infrastructure, as required by Section 212 of the Passenger Rail Investment and Improvement Act of 2008 (PRIIA).

This document represents progress on the Commission's 2013 submission to Congress, "Critical Infrastructure Needs on the Northeast Corridor," by demonstrating how long-term needs might be addressed in the short term with additional funding, resources, and planning. The Assessment covers the NEC main line from Boston, MA to Washington, DC and connecting corridors to Harrisburg, PA; Albany, NY; and Springfield, MA. It covers the full range of capital needs, from the routine renewal of basic infrastructure to the incremental advancement of major reconstruction projects for century-old bridges and tunnels.

**Challenges Ahead:** Funding availability remains the largest obstacle to addressing the backlog of necessary investment in NEC infrastructure. This assessment of needs identified approximately \$2.8 billion in potential capital investments for fiscal year 2015. If federal funding levels remain consistent with those in fiscal year 2014, only \$1.9 billion in total state and federal funding will be available.

**Supporting the Economy:** A failure to invest adequately in the NEC could have potentially serious consequences for the Region's economy. The NEC moves a workforce that contributes \$50 billion per year to the United States gross domestic product, carries more intercity passengers within the Northeast than all airlines combined, and is a critical link in the national freight rail network. If the NEC were lost for just one day, it could cause nearly \$100 million in congestion, lost productivity, and other impacts.

**Milestone for Collaboration**: The Assessment is a major achievement in the development of a collaborative planning process for the NEC by providing a consolidated tabulation of near-term capital needs across all owners and operators, and documentation of available funding across all sources for the first time since the NEC entered public ownership.

**Next Steps:** By spring 2015, the Commission expects to enhance this needs assessment with the development and publication of the first-ever NEC Five-Year Capital Plan for FY16-20 to inform the budget and appropriations process with an integrated and unified investment strategy. This effort will improve upon progress to date with further integration to ensure proposed projects are clearly justified and achievable in the context of corridor-wide construction capacity and available agency resources, meet common goals and objectives, and are not in conflict or duplicative of one another.

The FY16-20 Plan will also follow a more comprehensive process according to guidelines being developed through ongoing discussions regarding the allocation of operating and capital costs among NEC users. However, this collaborative investment strategy will only be successful in increasing investment in NEC infrastructure with strong support from the federal government as a funding partner. In particular, it has been the longstanding position of NEC stakeholders that the federal government has primary responsibility for restoring the infrastructure to a state of good repair. Without that commitment, the condition and performance of the NEC will continue to deteriorate, creating economic and mobility risks for the region.

# 2. Introduction

The Northeast Corridor Five-Year Capital Needs Assessment: Fiscal Years 2015 to 2019 identifies work that the Region could pursue with sufficient funding, necessary resources, and continued coordination and planning among all agencies. The Assessment was developed collaboratively by the members of the Northeast Corridor Infrastructure and Operations Advisory Commission (the Commission), including owners of NEC infrastructure, operators of NEC service, state departments of transportation, the federal government, and other agencies that contribute capital funding. It marks the beginning, not the end, of an ongoing planning process that will consist of yearly reports on how available capital funding will be spent and where additional capital needs remain unmet.

The Passenger Rail Investment and Improvement Act of 2008 (PRIIA) authorized the Commission. Among other tasks, PRIIA directed the Commission to develop a shared cost allocation investment strategy and annual submissions on infrastructure needs. This document addresses the second requirement. The cost allocation investment strategy continues to undergo development in close coordination with this new capital planning process. Before implementation of the cost allocation investment strategy, Commission stakeholders wanted to share this preliminary work with Congress to document capital needs and funding gaps. When operational, the intent is that the cost allocation investment strategy will bolster capital funding available for a FY16-20 NEC Five-Year Capital Plan to be published in spring 2015. However, full funding of capital needs will require sizable investment from the federal government to modernize the NEC and lay a foundation for growth. If the federal government is not a partner with states and other agencies, sufficient funding will not be obtained and the NEC will continue to degrade in terms of infrastructure condition and service quality.

#### 2.1 Overview

The NEC Five-Year Capital Needs Assessment builds on the foundation of the 2010 Northeast Corridor Infrastructure Master Plan<sup>1</sup> and the 2013 Critical Infrastructure Needs on the Northeast Corridor<sup>2</sup> report to articulate how identified longer-term needs could be addressed on an annual basis over the next five years. The Assessment, covering federal fiscal years (FY) 2015 to 2019, documents capital needs and the funding available to address them.

The intention is that future iterations of the planning process will generate a more fully integrated capital plan. By spring 2015, the Commission expects to publish an NEC Five-Year Capital Plan for FY16-20 to provide a unified investment strategy for the NEC, incorporating refinements including improved methods of tracking capital data across agencies, additional analysis to ensure implementation feasibility, and more robust efforts to establish mutual project priorities. Future iterations of a Capital Plan will also be refined to account for the development of longer-term plans, including the Federal Railroad Administration's (FRA) NEC FUTURE Tier 1 Environmental Impact Statement (EIS) and Service Development Plan (SDP).

Additional refinements, however, will not change the fact that funding availability is the greatest obstacle to addressing the serious backlog of necessary investments. To highlight this point, this Assessment identifies both programmed funding from known sources and unfunded capital needs across all major project types. This report presents preliminary figures in this manner for FY15 to FY19 (Figure 1).

<sup>&</sup>lt;sup>1</sup> http://www.amtrak.com/ccurl/870/270/Northeast-Corridor-Infrastructure-Master-Plan.pdf

<sup>&</sup>lt;sup>2</sup> http://www.nec-commission.com/critical-infrastructure-needs/

Across all stakeholders, the Assessment identified approximately \$2.8 billion in possible capital investments for FY15. If federal funding levels remain consistent with those in FY14, only \$1.9 billion in total state and federal funding will be available. Over the next five years, the level of identified capital funding actually decreases further to \$872 million in FY19 as one-time federal grants<sup>3</sup> are depleted. At the same time, investments required to fully fund regular infrastructure renewal, eliminate most of the state-of-good-repair backlog over 15 years, and advance critical projects to modernize the NEC are expected to be \$4.3 billion in FY19 (Table 1).



Figure 1: NEC Five-Year Funded v	s. Unfunded Capital Needs S	ummary
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	FY14 Program	FY15 Prelim. Program	FY15	FY16	FY17	FY18	FY19
Funded Activities	1,663	1,962	1,655	1,341	1,003	833	872
Amtrak Main Line	864	1,154	911	774	521	435	439
New Haven Line	492	495	495	360	292	331	377
Connecting Corridors	334	313	249	208	190	67	56
Unfunded Needs	-	-	1,142	1,777	3,130	2,075	3,441
Amtrak Main Line	-	-	832	1,439	2,506	1,621	2,293
New Haven Line	-	-	81	70	334	94	700
Connecting Corridors	-	-	228	268	289	360	448
Total	1,691	1,962	2,798	3,118	4,133	2,908	4,313

#### Table 1: NEC Five-Year Funded vs. Unfunded Capital Needs Breakdown

Millions of USD

Note: For MTA Metro-North Railroad, FY15 Program figures on the New Haven Line (excluding Connecticut territory) and the Connecting Corridors (i.e., the Metro-North Hudson Line) are estimated to be consistent with FY14 figures. For FY15-19 Funded Activities, annual figures supported by Amtrak's General Capital Grant and by Metro-North (excluding Connecticut territory) are estimated to consistent be with FY14 levels.

<sup>&</sup>lt;sup>3</sup> The American Recovery and Reinvestment Act (ARRA), the High-Speed Intercity Passenger Rail (HSIPR) program, the Transportation Investments Generating Economic Recovery (TIGER) program, Hurricane Sandy disaster relief funding, and other programs.

The Assessment does not address how unmet funding needs could or should be addressed. Members of the Commission are currently at work developing cost allocation investment strategies that, if supported by a strong commitment from the federal government, could contribute to increased levels of funding availability. However, much additional work remains to be done to identify sufficient funding to cover the full estimated capital needs presented in the Assessment, including:

- 1. Basic Infrastructure: Investments to address maintenance and replacement of existing basic assets, including elimination of the basic state-of-good-repair backlog defined in Section 2.2
- 2. Major Backlog Projects: Investments to replace and/or rehabilitate existing large assets that are considered in the major state-of-good-repair backlog defined in Section 2.2
- 3. Improvements: Investments to modernize the NEC, improve reliability, expand capacity, and reduce travel times

The Assessment covers these investments for the full geography listed below:

- 1. NEC main line Amtrak-maintained: Washington, DC to New Rochelle, New York and New Haven, Connecticut to Boston, Massachusetts
- 2. NEC main line New Haven Line: New Rochelle, New York to New Haven, Connecticut
- 3. Connecting corridor: Philadelphia to Harrisburg, Pennsylvania
- 4. Connecting corridor: New York City to Albany, New York
- 5. Connecting corridor: New Haven, Connecticut to Springfield, Massachusetts

#### Table 2: NEC Five-Year Capital Needs by Geography

	FY14 Program	FY15 Prelim. Program	FY15 Need	FY16 Need	FY17 Need	FY18 Need	FY19 Need
Amtrak Main Line	864	1,154	1,744	2,212	3,027	2,056	2,731
New Haven Line	492	95	577	430	626	425	1,077
Connecting Corridors	334	313	477	476	479	427	504
Total	1,691	1,962	2,798	3,118	4,133	2,908	4,313

Millions of USD

#### Table 3: NEC Five-Year Capital Needs by Project Category

	FY14 Program	FY15 Prelim. Program	FY15 Need	FY16 Need	FY17 Need	FY18 Need	FY19 Need
Base Capital Needs	772	987	1,473	1,530	1,630	1,731	2,483
Basic Infrastructure	621	672	993	1,075	1,027	1,075	1,128
Major Backlog	32	186	344	380	525	633	1,330
Safety / Mandates	119	129	137	76	78	24	26
Improvement Capital Needs	919	975	1,325	1,588	2,503	1,177	1,829
Total	1,691	1,962	2,798	3,118	4,133	2,908	4,313

Millions of USD

The Assessment is also inclusive of funding needs for all stages of project development and implementation. For major backlog projects and improvements, it covers both programmed (funded) and proposed (unfunded) spending as appropriate for advancing each project's relevant planning, feasibility, engineering, environmental review, permitting, and construction phases. Partially funded projects (e.g. funded through final design but unfunded for construction) in the Assessment document both available funding and remaining need. The Assessment then parcels funding elements on an annual basis to advance projects through the stages of development. In that sense, the Assessment is constrained by project readiness; demonstrated funding needs only cover practical next steps, not necessarily full construction costs.

For basic infrastructure elements (such as the general programs of rail and tie renewal), funding needs ramp up over five years to reflect how such programs would require time to develop appropriate workforces to achieve higher levels of productivity. Similarly, projects and programs are scoped to consider track space availability such that required outages would not unduly impact existing NEC services.

Though project readiness, workforce development, and track outage constraints have been considered, the cumulative impacts of undertaking all this work is still under analysis and will be reflected in future versions of the planning process, beginning with the FY16-20 NEC Five-Year Capital Plan in early 2015. Annual updates will account for changing conditions on the railroad, refinements to long-term plans, and the shifting nature of funding availability. Future versions will also be more technically detailed and geographically specific as better asset management systems and service planning tools are developed. The ultimate goal is to maintain an investment strategy that is feasible and implementable.

It should be noted that for many projects currently under development, annual spending figures are estimates based on the best information currently available to stakeholders. As adequate streams of funding are identified and projects advance through engineering and design, stakeholders will be able to better identify project construction costs. Future versions of the planning process will be updated to reflect new information.

The Commission believes this NEC Five-Year Capital Needs Assessment covering FY15 to FY19 is an important milestone in documenting a new collaborative process, articulating capital needs, identifying funding gaps, and forging a shared path forward to modernize the NEC.

#### 2.2 Background on the Northeast Corridor

The NEC is one of the great railroad corridors of the world. Its 457-mile main line between Boston, Massachusetts and Washington, DC carries 710,000 commuter rail riders and 40,000 Amtrak riders each day on over 2,000 trains. It supports a workforce that contributes \$50 billion annually to the United States gross domestic product. It provides high capacity and reliable access to core employment centers that contain for one out of every three jobs in the larger NEC Region, whose overall economy is the fifth largest in the world. The NEC plays an important role in supporting the broader transportation system. An unexpected loss of the NEC for one day alone could cost the nation \$100 million in additional highway congestion, productivity losses, and other transportation impacts.<sup>4</sup>

<sup>&</sup>lt;sup>4</sup> The Northeast Corridor and the American Economy, 2014. http://www.nec-commission.com/reports/nec-and-american-economy/

The NEC is a shared resource. The Boston-to-Washington main line is used by eight commuter railroads, Amtrak, and four freight railroads (Figure 2). Ownership of main-line infrastructure is shared by Amtrak, the New York Metropolitan Transportation Authority (MTA), Connecticut, and Massachusetts, though Amtrak maintains the Massachusetts portion through an agreement. Ownership of connecting-corridor infrastructure is shared by Amtrak, the New York MTA, and CSX, though Amtrak maintains the CSX portion in New York through an agreement. Station ownership across the entire network is shared among Amtrak, commuter rail agencies, states, local governments, and other organizations (Figure 3).



#### Figure 2: NEC Rail Network



#### Figure 3: NEC Rail Network Ownership

Though the NEC continues to post historically high ridership levels, this success belies the fact that NEC infrastructure is deteriorating and reaching the limits of its practical capacity. The *Critical Infrastructure Needs* report from 2013 serves as a guide to the infrastructure challenges the NEC faces. It describes major infrastructure assets like the 1873 Baltimore and Potomac Tunnels in Maryland, the 1910 Portal Bridge in New Jersey, and the 1896 Norwalk River Bridge in Connecticut, all beyond their useful life with aging components that degrade reliability and capacity limitations that restrict ridership growth. Due to the delicate nature of the bridge's condition, opening the four-track Norwalk River Bridge for marine traffic requires a crew of about 30 workers. In 2013, the Norwalk River Bridge opened 271 times and failed to close properly 16 of those times. This past May, one failed closure severed service for six hours.<sup>5</sup>

#### State-of-Good-Repair Backlog

Assets beyond their useful life are considered in the backlog of necessary investments for the NEC to achieve a state-of-good-repair. Major infrastructure assets, like the large movable bridges and tunnels described above, represent one component of the NEC's state-of-good-repair backlog. The elimination of the major project component of the backlog between Boston and Washington is estimated to cost at least \$13 billion in replaced and refurbished assets and would take many years to complete, especially while supporting existing rail service while upgrades and repairs are finished (Table 4).

The second component of the NEC's state-of-good-repair backlog comprises basic infrastructure assets. Railroads are composed of thousands of different types of assets (rail, ties, ballast, small undergrade bridges, signals, electric wires, etc.), each with a different useful life after which it should be replaced. Deferred investment in basic infrastructure has also created a backlog. Railroad ties are one familiar type of asset and of those alone there are over 4.1 million between Boston and Washington. The replacement of ties has not been able to keep pace with the rate at which they have aged beyond their useful life. As a result, approximately 15% of all ties are now also in what is referred to as "backlog." The same can be said for most other asset types, ranging from the hundreds of small bridges that carry the NEC over roads and streams to the thousands of miles of electric wire called catenary that deliver power to locomotives. The funding needed to replace all basic infrastructure assets beyond their useful life, across all asset types and geographies, is estimated to be \$21.1 billion (Table 4).

Across almost all asset types, investment levels today are so small that the number of assets in the backlog actually increases rather than decreases on an annual basis. When state-of-good-repair investments are deferred, overall maintenance costs increase, as well as the potential for delay incidents due to infrastructure conditions that degrade train performance.

A key challenge in eliminating the backlog of both major and basic assets while undertaking annual infrastructure maintenance and renewal is that a railroad is a system that requires all major components to be functional, including subsystems for track, structures, electric power, and signals. In most cases, the NEC lacks sufficient redundant systems to allow replacement and maintenance to occur without impacts on existing service. Major work outages in one location can have operational impacts corridor wide. Feasible strategies for repairing the railroad require intense coordination and flexibility to address rapidly changing conditions on the ground.

<sup>&</sup>lt;sup>5</sup> http://www.dariennewsonline.com/local/article/Norwalk-rail-bridge-takes-an-army-to-keep-running-5593510.php#page-2

	Major Backlog Projects	Basic Infrastructure Backlog	Total
Amtrak Main Line	11,100	4,800	15,900
New Haven Line	2,400	1,600	4,000
Connecting Corridors	300	900	1,200
Total	13,800	7,300	21,100

#### Table 4: State-of-Good-Repair Backlog by Type and Geography

Millions of USD

Notes: Major backlog project figures represent most recent order-of-magnitude cost estimates for projects to replace, rehabilitate, or build new assets to provide sufficient capacity to allow rehabilitation of the following assets: Baltimore and Potomac Tunnels (Maryland), Bush River Bridge (Maryland), Gunpowder River Bridge (Maryland), Susquehanna River Bridge (Maryland), Sawtooth Bridges (New Jersey), Portal River Bridge (New Jersey), Hudson River Tunnels (New Jersey and New York), East River Tunnels (New York), Pelham Bay Bridge (New York), Cos Cob Bridge (Connecticut), Norwalk River Bridge (Connecticut), Saugatuck River Bridge (Connecticut), Devon Bridge (Connecticut), Connecticut River Bridge (main line Connecticut), Connecticut River Bridge (Springfield Line Connecticut), Hartford Viaduct (Connecticut), and Livingston Avenue Bridge (New York).

This new shared capital planning process is intended to be a path forward that will address this problem, eliminating the backlog of most major and basic assets within 15 years, and then instituting an ongoing replacement and maintenance program that will keep assets within their useful life. However, those investments alone will only bring existing NEC infrastructure into a state-of-good-repair. Stakeholders also now recognize that existing NEC infrastructure is reaching the limits of its capacity in the face of strong growth projections. The new shared planning process integrates backlog elimination and ongoing replacement/maintenance programs with investments that will modernize the NEC, improve reliability, expand capacity, and reduce travel times.

#### **Recent Capital Investment**

Despite a growing backlog, the NEC has been the beneficiary of investment among owners of NEC infrastructure, operators of NEC service, state departments of transportation, and the federal government. These investments have maintained safe travel on the NEC, replaced some aging components with modern technology, added capacity at select chokepoints, and built or maintained stations to grow ridership and spur economic development. As noted above, members of the Commission are working together to establish new cost sharing investment strategies to strengthen their role as committed funding partners with the federal government.

As illustrated below in Table 5, Amtrak and the state agencies invested approximately \$6.0 billion between fiscal year 2004 and fiscal year 2013 in shared-benefit infrastructure on the NEC main line and connecting corridors. State agencies invested approximately \$2.4 billion or 40% of the total investments. Amtrak invested approximately \$2.6 billion in shared-benefit infrastructure or 43% of total investments. Amtrak and state spending was supplemented by an additional \$1 billion in grants funded by the American Recovery & Reinvestment Act (ARRA) and High-Speed Intercity Passenger Rail (HSIPR) Program. This total represents only a fraction of the total ARRA and HSIPR grants awarded to NEC infrastructure projects, which will be spent in current and upcoming fiscal years.

Agency	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	TOTAL
NEC Main Line											
(Amtrak & MNR											
Controlled)	359	291	250	354	423	467	761	778	733	600	5,016
Federal ARRA/HSIPR <sup>a</sup>	0	0	0	0	2	8	403	312	72	87	884
State Agencies <sup>b</sup>	179	144	99	150	185	209	190	199	381	197	1,933
Amtrak <sup>c</sup>	180	147	151	204	236	250	168	267	280	316	2,199
Connecting Corridors <sup>d</sup>	91	100	110	90	98	67	108	106	95	154	1,017
Federal ARRA/HSIPR	0	0	0	2	2	2	39	38	12	39	135
State Agency	59	52	44	60	62	24	36	34	55	60	485
Amtrak	32	48	65	28	34	41	33	34	28	55	398
GRAND TOTAL	450	391	360	444	520	533	869	884	828	754	6,033

Millions of USD

Notes: (a) State agency figures include state- and locally-funded matches to ARRA/HSIPR grants.
 (b) Investments on the Connecting Corridors include: state "shared-benefit" investments, state investments in intercity rail sole-use infrastructure, and all investments reported by Amtrak, excluding System-wide investments.

#### 2.3 Needs Assessment Structure

The NEC Five-Year Capital Needs Assessment has two main components, Base Capital Needs and Improvement Capital Needs, which are discussed in greater detail in Sections 3 and 4 of this document. Base Capital Needs covers maintenance and replacement of existing NEC assets and Improvement Capital Needs covers new assets above and beyond existing infrastructure. While project categories are useful to help understand the different kinds of investment needs on the Corridor, many projects cannot be strictly defined as one category or another. Often when making repairs on basic infrastructure, investments result in a more reliable asset with slightly greater capacity. Similarly, many improvement projects renew existing assets while installing new ones. In all cases, staffs at stakeholder agencies have used professional judgment to place projects and programs in the most appropriate category as described in greater detail in Sections 3 and 4.

#### **Base Capital Needs**

**Basic Infrastructure.** Basic infrastructure investments are categorized in this report according to the core engineering disciplines of track, structures, power, and communications and signals. For each of the four core disciplines, the Assessment provides an estimate of the annual spending required to perform ongoing maintenance, referred to as normalized replacement, and to eliminate the state of good repair backlog. The **normalized replacement rate** is the annual funding needed to keep existing assets maintained and replaced within their useful life. The normalized replacement rate is a sufficient level of investment only if all assets start in a state of good repair. However, as noted in Section 2.2, most asset types have significant numbers of assets beyond their useful life, or in the backlog. As a result, the Assessment estimates the **backlog elimination rate**, which is the normalized replacement rate plus the additional annual funding required to eliminate the backlog and bring the NEC into a state-of-good-repair in 15 years. (See Appendix A-2.)

The Assessment demonstrates that, in most cases, spending levels in FY14 and anticipated budgets for FY15 are currently far below both the annual needs for normalized replacement and achieving a state-of-good-repair in 15 years. Such insufficient spending rates have characterized NEC investment for many years,

allowing the backlog of assets beyond their useful life to grow. The Assessment shows how agencies propose to increase the level of investment in FY15, ramping up in most cases by FY19 such that annual rates of spending would begin to reduce the backlog, rather than allowing it to grow.

**Major Backlog.** Investments in major infrastructure assets are also included in Base Capital Needs, such as Portal Bridge in New Jersey and Susquehanna River Bridge in Maryland. As noted in Section 2.1, proposed funding levels reflect annual amounts required to advance projects through their next respective stages of development. The Assessment identifies which funds have already been secured via state capital budgets or special federal grants, though the vast majority of this work remains unfunded. Significant planning and engineering on these projects could be done through the assistance of contractors outside existing agency staff and much of the construction could be completed outside the existing right-of-way with minimal impacts on NEC service. However, there are still practical constraints that would limit the number of these large projects that could advance at the same time. The figures presented in the Assessment already represent efforts to prioritize spending and ensure feasibility, with further refinement to be completed by publication of the NEC Five-Year Capital Plan for FY16-20 in spring 2015. Though the Assessment seeks to achieve substantial completion of many of these projects within the same 15-year goal for backlog elimination as basic infrastructure, the large resource requirements for these major projects will require a longer window for backlog elimination.

Stations, Facilities, Safety, and Mandated Investments. Finally, Base Capital Needs covers funded and unfunded investments in stations and facilities, like rail storage and maintenance yards, and safety or mandated projects, like the implementation of positive train control (PTC), the renovation of stations to comply with the Americans with Disabilities Act (ADA), and the remediation of environmentally damaged sites.

#### Improvement Capital Needs

Improvement Capital Needs covers proposed investments in assets above and beyond existing NEC infrastructure that aim to significantly improve reliability, increase capacity, and/or reduce travel times. As with investments in major backlog projects covered in Base Capital Needs, the Improvement Capital Needs section provides funding levels that reflect annual amounts required to advance projects through their next respective stages of development. The Improvement Capital Needs section also identifies which funds have already been secured via state capital budgets or special federal grants and which projects have unfunded needs.

#### 2.4 Goals and Outcomes

The capital planning process reflected in the NEC Five-Year Capital Needs Assessment is aimed at stabilizing and improving infrastructure assets to increase service reliability, add capacity, and decrease travel times in select locations. However, the near-term need is most focused on achieving infrastructure state-of-good-repair with targeted service improvements.

#### Infrastructure

Shoring up the condition of existing NEC infrastructure is itself a notable goal of the capital planning process. The Assessment points a path toward fully funding the NEC's basic infrastructure capital needs to eliminate the backlog and sustain a state-of-good-repair. With the exception of select categories of assets, the

levels of investment reported by the Assessment would eliminate the backlog of basic infrastructure needs in 15 years. The Assessment points a path toward advancing major backlog projects as well, which are just as critical in achieving a state-of-good-repair. These outcomes are detailed in Section 2.

#### Service

Stabilizing the condition of existing NEC infrastructure would have the most immediate service impact of improving reliability. However, the capital planning process has a variety of service goals beyond improved reliability that include increased efficiency, added capacity, and decreased travel times. At this time, many such goals are modest and targeted. These outcomes are detailed in Section 3. Future iterations of the capital planning process will have more robust descriptions of service goals and outcomes, especially as longer-term plans, including NEC FUTURE, are completed.

## 3. Northeast Corridor Base Capital Needs

Base Capital Needs covers investments in existing infrastructure with the goals of bolstering programs of maintenance and normalized replacement of assets and eliminating the backlog of most basic infrastructure and major projects beyond their useful life within 15 years to achieve a state-of-good-repair. Information below indicates that existing funding levels are far from those required for ongoing maintenance and replacement, and significantly further from those required to eliminate the backlog and achieve a state-of-good repair over the next 15 years. In select cases, additional investments counted as improvements also address basic infrastructure needs for existing assets. Such situations are described in Section 4.

#### 3.1 Track

Track-related assets are among the most fundamental components of railroad infrastructure. Across the entire geography of the Assessment, it is estimated that \$246 million is needed on an annual basis to replace and maintain these assets. Elimination of the backlog of track work would raise that annual rate to \$336 million for each of the next 15 years. Only \$231 million was available for this work in FY14. Though stakeholders identified \$308 million in track work that could be completed in FY15, preliminary budgets show that only \$255 million will be available (Table 6).

	Normalized Replaceme nt Annual Rate	Backlog Elimination Annual Rate	FY14 Program	FY15 Preliminar y Program	FY15 Need	FY16 Need	FY17 Need	FY18 Need	FY19 Need
Amtrak Main Line	175	245	169	210	259	330	327	317	294
New Haven Line	30	43	40	25	25	40	30	32	42
Connecting Corridors	41	48	22	20	23	20	22	15	20
Total	246	336	231	255	308	391	380	364	357

#### Table 6: Capital Needs for Track

Millions of USD

Track work comprises not just the regular replacement of rail and ties, but also the ongoing maintenance and periodic renewal of the roadbed beneath the tracks to ensure safe and comfortable travel. This foundation consists of a layer of crushed stone, or ballast, around and beneath the ties, followed by subgrade layers, constructed above the natural ground. The roadbed prevents the track from shifting under train traffic and enables proper drainage to prevent damage to the track structure. The subgrade layers must also be properly engineered to ensure good drainage.

These assets slowly deteriorate over time. Ballast gets fouled with soil and impedes drainage, ultimately creating "mud spots" which can allow the track alignment to shift. Water can also expedite the deterioration

of ties, which are made of either wood or concrete. With constrained resources, track work has frequently been limited to cyclical replacement of ties and rail. Such repairs can temporarily allow the railroad to maintain safe and comfortable travel but may be insufficient to remedy more serious problems within the foundation, ultimately requiring much more costly reconstruction. Full replacement of the track structure, called undercutting, is now necessary across much of the NEC and is reflected in the Assessment's demonstrated capital need on track work. Underinvestment in the track structure can cause its condition to fall substandard such that trains must reduce speed along these sections of track, causing delays and decreased ride comfort. Even with additional funding, undercutting is one area where the 15-year window for backlog elimination is not feasible given the highly disruptive nature of this work on train service.

The Assessment's demonstrated capital need for track work also includes the cyclical replacement of rail and ties. Tie replacement needs include both wood and concrete ties. Though both types offer advantages in certain situations, efforts have been underway for several decades to replace most main line stretches with concrete ties because of lower lifecycle costs and better ride quality.

In addition to regular ties and rail, track work includes the maintenance and renewal of interlockings. Interlockings are groups of turnouts and crossovers that enable trains to move from one track to another or to exit and enter the NEC. Interlockings are highly complex assets that are among the most difficult components of the right-of-way to maintain. Many interlockings were renewed as part of the NEC Improvement Program (NECIP) between 1978 and 1985. These interlockings are now approaching the end of their service life. With limited resources, interlocking work is limited to tactical repairs aimed at short extensions of useful life. The Assessment includes a more ambitious replacement program to take advantage of technological advances over the last few decades that would improve the utility, prolong the useful life, and reduce maintenance costs. Like undercutting, interlocking renewal requires continuous track outages that disrupt train service and is another program where the 15-year window for backlog elimination is not feasible.

#### 3.2 Structures

Structures work consists chiefly of the maintenance of bridges and tunnels that support track infrastructure as the railroad crosses above or below roads, rivers, or changes in topography. This section covers programmed and needed spending on routine maintenance and replacement of existing structural assets. Replacements of major existing assets (i.e. large movable bridges) are covered in Section 3.6. Across the entire geography of the Assessment, it is estimated that \$101 million is needed on an annual basis to replace and maintain existing structural assets. Elimination of the backlog of structural assets would raise that annual rate to \$399 million for each of the next 15 years. Only \$100 million was available for this work in FY14. Though stakeholders identified \$224 million in structural work that could be completed in FY15, preliminary budgets show that only \$160 million will be available (Table 7).

	Normalized Replaceme nt Annual Rate	Backlog Elimination Annual Rate	FY14 Program	FY15 Preliminar y Program	FY15 Need	FY16 Need	FY17 Need	FY18 Need	FY19 Need
Amtrak	72	268	25	41	87	88	93	104	99
Main Line					0.1				
New Haven	14	87	66	104	106	72	40	77	85
Line	11	07	00	101	100	14	10	11	05
Connecting Corridors	15	44	9	15	32	49	40	79	79
Total	101	399	100	160	224	209	172	260	263

**Table 7: Capital Needs for Structures** 

Millions of USD

Note: Table 7 above does not include basic infrastructure investments in stations or maintenance-of-equipment facilities, which are included below in Section 3.5 Stations and Facilities, or investments in major bridge replacements, which are included below in Section 3.6 Major Backlog Projects.

Investments in structures include the maintenance and replacement of several types of assets, including bridges, tunnels, culverts, and retaining walls. This section of the Assessment includes needed spending on the maintenance and replacement of fixed bridges called undergrade bridges that carry the railroad over streams and roads. While maintenance of movable bridges across larger rivers that open for passing marine traffic is covered here, major replacement projects are covered in Section 3.6. Similarly, maintenance of existing tunnels is covered in this portion of the Assessment, with new tunnels covered in Section 3.6 and 4.

Culverts are small structures beneath the railroad that allow for proper drainage and prevent pools of water from degrading the quality of the track. Retaining walls are structures that hold earth in place either above or below the track to keep the railroad's slopes manageable despite changes in natural topography.

The most significant need for investment in this category is in undergrade bridges. There are approximately 1,000 such bridges on the NEC, hundreds of which date back to 1880 or earlier with nearly half of them built between 1900 and 1920. Though these assets can have useful lives lasting 100 years or more, the fact that so many were built in a small window of time means that large numbers of them now or will soon require major rehabilitation or replacement. At the current rate of available funding, it would take over 300 years to replace all assets, well beyond the timeframe in which such assets would simply be shut down, degrading continuous service along the NEC. The longer the delay in ramping up to a more robust bridge replacement program, the more assets will have aged beyond their useful life and, given the highly disruptive nature of bridge replacements on train operations, the more severe the service impacts will be.

#### 3.3 Power

The electric power supply system, consisting of frequency converters, substations, transformers, transmission lines, and catenary, delivers energy from commercial electric utilities to trains. The power supply system also provides electricity for the signal system. Across the entire geography of the Assessment, it is estimated that \$89 million is needed on an annual basis to replace and maintain these assets. Elimination of the backlog of power supply work would raise that annual rate to \$154 million for each of the next 15 years. Only \$127 million was available for this work in FY14. Though stakeholders identified \$122 million in power supply

work that could be completed in FY15, preliminary budgets show that only \$83 million will be available (Table 8).

Table 8: Cap	Table 8. Capital Needs for Power										
	Normalized Replaceme nt Annual Rate	Backlog Elimination Annual Rate	FY14 Program	FY15 Preliminar y Program	FY15 Need	FY16 Need	FY17 Need	FY18 Need	FY19 Need		
Amtrak Main Line	66	107	41	19	34	53	55	71	52		
New Haven Line	15	25	80	60	68	68	48	8	8		
Connecting Corridors	8	22	6	4	20	42	41	41	17		
Total	89	154	127	83	122	163	144	120	77		

#### Table 8: Capital Needs for Power

Millions of USD

The nature and the condition of the power supply system are not consistent across the geography covered by the Assessment. The portion of the NEC between New Haven and Boston was electrified in the 1990s. This infrastructure is within its useful life and only requires periodic maintenance to sustain a state-of-good-repair between FY15 and FY19. Portions of the power supply system between New Haven and New Rochelle were updated to modern standards in the 1980s and 1990s, however the catenary support structures in Connecticut are currently in the midst of a large-scale upgrade program that will conclude over the five-year period.

The power supply system that supports the south end of the NEC between New York and Washington dates back to the 1930s and has received only partial upgrades. Newer power supply infrastructure on the north end of the NEC features constant-tension catenary that automatically maintains proper alignment of the cables from which trains pull electricity. Between New York and Washington, catenary wires are subject to expansion in hot weather and contraction in cold. Trains are given speed restrictions during temperature extremes to prevent train pantographs from pulling down drooping wire in summer or snapping taut wire in winter. Catenary failures have resulted in an increasing percentage of train delays on the NEC. Expenditures outlined in the Assessment would begin to upgrade this infrastructure to modern standards, improving capacity and reliability. Investments to achieve a state-of-good-repair for substations, frequency converters, transmission lines, and signal power lines would similarly have reliability benefits.

#### 3.4 Communications and Signals

The communications and signal system controls the movements of trains up and down the NEC, ensuring safe and efficient service. Investments in positive train control (PTC), a modern signaling technology designed to reduce the risk of train collisions that is mandated by the federal government, are covered in Section 3.7. Across the entire geography of the Assessment, it is estimated that \$57 million is needed on an annual basis to replace and maintain these assets. Elimination of the backlog of communications and signal system work would raise that annual rate to \$86 million for each of the next 15 years. Only \$32 million was available for this work in FY14. Though stakeholders identified \$89 million in communications and signal

system work that could be completed in FY15, preliminary budgets show that only \$29 million will be available (Table 9).

				- <b>J</b>					
	Normalized Replaceme nt Annual Rate	Backlog Elimination Annual Rate	FY14 Program	FY15 Preliminar y Program	FY15 Need	FY16 Need	FY17 Need	FY18 Need	FY19 Need
Amtrak	42	57	13	14	49	54	83	80	47
Main Line	Aain Line					• •	~~		••
New Haven Line	8	14	19	15	16	16	16	16	38
Connecting Corridors	7	15	0	0	24	27	29	26	25
Total	57	86	32	29	89	96	128	122	111

Table 9: Ca	pital Needs	for Communications	and Sianals

Millions of USD

The signal system consists of assets in two main categories, signal components at interlockings which control the movement of switches that enable trains to move from one track to another and automatic block signals (ABS) that control the movement of trains between interlockings. Investments in the signal system also include the maintenance and modernization of the control centers that manage the movement of trains. Investments in the broader communications system include radio, telephone, and data networks that support safe, secure, and efficient operation of the railroad.

The communications and signal system is perhaps the most outmoded of the major systems, largely due to the fact that it is an area that has broadly experienced the most rapid advances in technology over the last several decades. In the digital age, much of the NEC is still decidedly analog. Mechanical train control systems dating back 70 years or more, some still operated by manually pulling levers, continue to be used. There are switches still powered by compressed air and switch heaters for melting ice and snow in the winter still powered by gas instead of electric machines.

The slow pace of investment has resulted in higher maintenance costs and increased the challenge of making necessary repairs. Replacement parts are no longer manufactured for many aging signal assets which need much more intensive and costly maintenance than modern technology would require. Infrastructure components are often retained after they are replaced with upgraded technology so they can serve as spare parts for older systems that remain. Even with required inspection and maintenance practices, these systems have high failure rates with serious impacts on service reliability. Obsolete infrastructure is compounded by a lack of redundant systems that can allow service to continue in the event of a failure. In addition, while modern technology often can alert maintenance crews to the exact nature and location of a failure, sometimes before it occurs, many existing systems require manual inspection to diagnose and resolve problems.

#### 3.5 Stations and Facilities

Stations and maintenance facilities suffer from deterioration over time just like track, bridges, power lines, and signals. This section covers necessary investments to maintain and replace assets in existing stations and facilities. Upgrades to address ADA mandates for accessibility are covered in Section 3.7. Expansions or investments in new stations or facilities are covered in Section 4. Though stakeholders identified \$222 million in station and facilities maintenance work that could be completed in FY15, preliminary budgets show that only \$99 million will be available (Table 10).

	FY14 Program	FY15 Preliminar y Program	FY15 Need	FY16 Need	FY17 Need	FY18 Need	FY19 Need
Amtrak Main Line	65	85	182	157	146	153	161
New Haven Line	16	6	14	14	14	14	14
Connecting Corridors	28	30	27	27	24	24	24
Total	109	99	222	197	184	190	198

Table 10: Capital Needs for Stations and Maintenance Facilities

Millions of USD

Station ownership on the NEC is divided between Amtrak, states, agencies, and local governments. Stations vary greatly in scale and maintenance needs. Large-scale stations, like those in Boston, New York, Philadelphia, and Washington have many complex subsystems, including plumbing, electricity, lighting, escalators, elevators, and HVAC, all with assets requiring ongoing replacement and refurbishment. In addition, the structures supporting platforms and the station buildings themselves need periodic investment to stay operable. As with track, bridges, and other elements of the railroad, water infiltration is a particularly serious challenge, especially at stations where platforms are located below ground level. Water corrodes support beams, requiring ongoing maintenance to maintain safe conditions. Smaller stations may or may not have station buildings, but still have ongoing capital needs for maintaining platforms and access areas.

The Assessment also includes investments in facilities that support the operation and maintenance of train equipment. Facilities include crew bases, maintenance shops, and other associated buildings. These assets include plumping, electrical, HVAC and other systems typical of stations as well as basic structural elements.

#### 3.6 Major Backlog Projects

Many major structural assets on the NEC were built in the early 1900s, with some dating back decades further. Though these large movable bridges and tunnels have had long useful lives, an immense challenge is the number of them that are requiring replacement or overhaul within the same relatively narrow window of time. Already, most of these assets have limited capacity that is constraining ridership growth and failing components that are diminishing reliability. While the Assessment puts these projects in a special category because the sheer cost of undertaking just one can cost a billion dollars or more, investments in these assets will result in a wide range of benefits, from rehabilitating existing assets, improving reliability, reducing travel time, and providing capacity for additional service. Though stakeholders identified \$338 million in major backlog project work that could be completed in FY15, preliminary budgets show that only \$186 million will be available (Table 11).

Across all projects identified in Table 11, the vast majority of necessary investments are unfunded. While Federal grants and state funding have supported or are currently supporting preliminary engineering and design for several projects, such as Portal Bridge North, Susquehanna River Bridge, the Baltimore Tunnels, and Devon Bridge, little or no funding for these projects has been identified for construction.

Total	32	186	338	380	525	633	1,330
Devon Bridge	0	15	15	15	0	0	300
Walk and Saga Bridges	6	142	142	40	40	120	120
Cos Cob Bridge	0	0	0	0	0	0	300
New Haven Line							
Connecticut River Bridge	0.2	2	5	5	151	250	250
Pelham Bay Bridge	1.4	0.1	5	5	10	3.6	50
Portal Bridge North	6	5	134	279	279	204	120
Susquehanna River Bridge	5	5	7	6	15	15	150
B&P Tunnel Replacement	14	17	20	20	20	30	30
Gunpowder River Bridge	0	0	5	5	5	5	5
Bush River Bridge	0	0	5	5	5	5	5
Amtrak Main Line							
	FY14 Program	FY15 Prelim. Program	FY15 Need	FY16 Need	FY17 Need	FY18 Need	FY19 Need

#### Table 11: Capital Needs for Major Backlog Projects

Millions of USD

As noted in Section 2.2, the total cost of addressing the major backlog project need is at least \$13 billion. Without these investments, service as we know it today would not be sustainable. However, as with basic infrastructure assets described above, investments in major backlog projects would not simply involve replacement in kind. Just as new signal systems take advantage of the latest in communications technology, new bridges and tunnels should be built to meet the needs of today and tomorrow, especially because assets of this scale are built to last a century or more.

As a result, one major asset accounted for in the \$13 billion major backlog project figure, the Hudson River Tunnels in New York, is represented in the Assessment as an improvement in Section 4 because currently proposed investments would create new capacity above and beyond what exists today. The Assessment acknowledges the creation of new tunnel capacity between NY and NJ is necessary to support current service levels while the existing assets are overhauled, ultimately doubling capacity. These improvement project costs are reflected in the \$13 billion major backlog need because they are required to maintain existing service.

The Baltimore & Potomac (B&P) Tunnels in Baltimore, Maryland, completed in 1863, exemplify a major backlog asset where investment will result in a broad range of benefits. Due to their obsolete design and aging infrastructure, the existing B&P Tunnels require extensive maintenance and force trains to travel at slow speeds. By replacing and possibly augmenting existing tunnel capacity, new tunnel infrastructure could offer faster travel times, improved reliability, and additional capacity for freight and passenger service. The Assessment identified \$130 million in capital needs over the next five years to complete preliminary engineering, environmental review, and design, which could enable construction to begin just outside the five-year window. However, only \$60 million in funding is available from a federal HSIPR grant, short of the funding necessary to complete these preliminary phases and well below the funding necessary to perform construction.

Portal Bridge offers another example of a major backlog asset which has both backlog and improvement initiatives. Portal Bridge North, shown above in Table 11, is classified as a major backlog project because it would replace the existing two-track Portal Bridge with a new two-track bridge. However, this location has also been identified as a capacity chokepoint. A parallel effort was undertaken to conceptually design a second two-track bridge, referred to as Portal Bridge South, as part of a Final EIS submitted to FRA for which a record of decision (ROD) was issued. That second parallel bridge project would increase overall capacity across the Hackensack River to four tracks and is classified as an improvement in Section 4. Therefore, only Portal Bridge North is accounted for in the \$13 billion major backlog need.

As described in Section 2.3, the Assessment lays out a path for advancing long-term major backlog projects over the next five years. Figures in Table 11 reflect efforts on behalf of stakeholders to work within the realities of the project development process to put forward annual spending levels that could be feasibly expended to carry projects forward.

As the planning process advances, stakeholders have the opportunity to coordinate to perform investments while minimizing impacts on riders. Large-scale investments in major backlog assets may require that portions of the NEC be shut down for brief period of time. Instead of returning to the same area multiple times—and impacting riders over and over—agencies may be able to complete major backlog investments and other repairs and improvements simultaneously, resulting in only one period of service reductions or delays.

#### 3.7 Safety/Mandates

Certain types of projects, often for reasons of preserving safety or accessibility, are mandated by federal government laws or regulations. Though at present these needs are shown to diminish over the next five years, funding gaps still remain in completing all mandated investments in the NEC. Stakeholders identified \$137 million in mandated work that could have been completed in FY15, but preliminary budgets show that only \$89 million will be available (Table 12).

	FY14 Program	FY15 Preliminar y Program	FY15 Need	FY16 Need	FY17 Need	FY18 Need	FY19 Need
Amtrak Main Line	59	83	91	14	6	7	10
New Haven Line	29	39	39	56	66	11	10
Connecting Corridors	31	7	7	6	6	6	6
Total	119	89	137	76	78	24	26

Table 12: Capital Needs for Safety/Mandated Projects

Millions of USD

The vast majority of capital need in this category supports the implementation of PTC signaling throughout the geography covered by the Assessment. PTC is intended to prevent human error from allowing train collisions or other accidents through enhanced positioning technologies that automatically avert unsafe movements. Installation of PTC is set for completion before the end of the Assessment's five-year timeframe. Once completed, normalized maintenance and replacement of these assets will covered by spending in the signaling and communications program.

This section of the Assessment also includes spending on environmental remediation projects and on stations to ensure compliance with ADA regulations and satisfy requirements for protection and evacuation in case of emergency.

### 4. Northeast Corridor Improvement Capital Needs

Improvement Capital Needs covers investments that would enhance or expand existing infrastructure in order to improve reliability, increase capacity, and/or reduce travel times. Approximately \$900 million in investment in such projects is underway in FY14. Identified funding for improvement projects, however, rapidly decreases between FY15 and FY19 as one-time special federal grants from several years ago expire. At the same time, capital needs for improvement projects grow to more than \$2 billion by FY19. Some individual projects are partially funded (e.g. final design funding has been identified but construction funding has not), in which case spending figures are split between Section 4.1 for identified funding and Section 4.2 for remaining funding need. Some investments listed below also address replacement of existing basic infrastructure assets as described in Section 3, but in the context of larger projects that are overall more geared toward improving NEC assets. Such situations are described in more detail in Sections 4.1 and 4.2.

#### 4.1 Funded Projects and Initiatives

Funded projects cross many categories, from new or expanded stations, to new track, power supply systems, storage facilities, and structural assets. Existing funding comes from a variety of sources, including state and transit agency capital budgets, and Federal Transit Administration (FTA), FRA, and other federal grants (Table 13). FRA funding comes through the American Recovery and Reinvestment Act (ARRA) and the High-Speed Intercity Passenger Rail (HSIPR) program. Funding through these special federal grants zeroes out by the end of FY18. Many projects are funded through planning or engineering phases (Table 13), but are unfunded for construction (Table 14).

	FY14 Program	FY15 Preliminary Program	FY16 Plan	FY17 Plan	FY18 Plan	FY19 Plan
Amtrak Main Line	422	656	414	188	102	20
New Haven Line	236	87	55	55	70	75
Connecting Corridors	232	231	155	137	14	3
Total	890	975	624	380	185	98

#### Table 13: Funded Projects and Initiatives

Millions of USD

Benefits that will result from funded improvement projects include new or upgraded infrastructure that will improve reliability, enable more efficient service patterns, add new services, or decrease travel time and new or upgraded station projects that will improve the customer experience or add new service. Many projects will provide multiple benefits at the same time. While many are only funded through planning or design, those projects described in the following paragraphs are funded through construction.

Major investments in the New York area will include over \$500 million to prepare space adjacent to Penn Station for a future set of Hudson River tunnels, over \$200 million to build an initial phase of Moynihan Station to alleviate congestion at Penn Station, and over \$100 million to reconfigure Harold interlocking, the NEC's busiest junction, for more efficient traffic flow. Farther south, the New Jersey High-Speed Rail Improvement Program will invest nearly \$300 million over the next five years in a comprehensive effort to renew track, signals, and power supply systems with benefits that will include travel speed increases from 135 to 160 mph on Acela trains and enhanced reliability for all Amtrak and NJ TRANSIT services. The latter project is an example of one that will have benefits in achieving a state-of-good-repair by replacing existing basic infrastructure assets while making improvements. Also, NJ TRANSIT is seeking to advance a complementary set of improvements with funding they have on the same portion of the NEC that will amplify the benefits of the investment Amtrak is making.

Each of the connecting corridors to Harrisburg, Albany, and Springfield has funded improvements underway, with an ambitious program in Connecticut to begin operating higher levels of service to Hartford, Connecticut and Springfield, Massachusetts starting in 2016. There are funded station projects in every state along the NEC, including major projects in Newark, Delaware, Elizabeth, New Jersey, and along the Shore Line East route in Connecticut.

#### 4.2 Unfunded Projects and Initiatives

Unfunded projects cover a similarly wide variety of project categories. As with major backlog projects described in Section 3.6, unfunded improvements were proposed within the realities of the project development process. If additional funding were available, initial estimates suggest that \$1.7 billion worth of additional improvements could be under design and construction by FY19.

		FY15 Need	FY16 Need	FY17 Need	FY18 Need	FY19 Need
Amtrak Main Line	Amtrak Identified	161	629	732	461	785
	State/Agency Identified	142	141	905	240	540
Now Hoven Line	Amtrak Identified	0	0	0	0	0
New Haven Line	State/Agency Identified	63	52	316	76	85
Connecting Corridore	Amtrak Identified	0	0	0	0	0
Connecting Corridors	State/Agency Identified	139	142	171	214	321
Total		506	964	2,124	992	1,731

#### Table 14: Unfunded Projects and Initiatives

Millions of USD

Many unfunded capital project activities captured here reflect spending that could advance projects past their currently funded planning or design phase into construction. A significant amount of such proposed investment would be in the vicinity of terminals in Washington, New York, and Boston, each of which are capacity constrained and could benefit from upgrades to the passenger experience. Planning and design are underway for improvements and more robust construction could begin within the five-year timeframe at each terminal. Other unfunded station investments, both new stations and station upgrades, throughout the NEC main line and connecting corridors were identified in the Assessment.

The largest block of unfunded spending in the Assessment would be for the Gateway Program in New Jersey and New York. This investment would be a series of infrastructure improvements that would create four continuous tracks from Newark, New Jersey to New York where there are currently two. The \$500 million investment adjacent to Penn Station described in Section 4.1 would be only a small down payment on this initiative. The overall increase in capacity would require the construction of several major new assets, including tunnels under the Hudson River, a second two-track Portal Bridge over the Hackensack River as described in Section 3.6, and reconstruction of several other 100-year-old bridges that carry the NEC over roads, marshes, and other railroads. In this regard, like the New Jersey High-Speed Rail Improvement Program, the Gateway Program would combine state-of-good-repair benefits with improvements. Though construction on several program components could begin in the five-year timeframe, completion of the Program would lie well beyond the five-year window.

Both funded improvements and unfunded capital needs in the Assessment represent consideration of longerterm plans. The NEC Infrastructure Master Plan, the Washington Union Station Master Plan, the MARC Growth and Investment Plan, the Boston South Station Expansion Project, and other initiatives completed or underway are guiding needed investments. Overarching these more geographically-specific planning efforts is NEC FUTURE, the Tier 1 EIS and SDP being led by FRA in collaboration with the NEC Commission, states, agencies, Amtrak, and other stakeholders, that is establishing a vision for the entire NEC for 2040.

State of good repair for the existing NEC will be a key goal for NEC FUTURE regardless of the nature or ambition of improvements in its preferred investment alternative. At the same time, this Capital Needs Assessment lays out baseline investments in improvements which can be made over the next five years because they are common to all investment alternatives analyzed in NEC FUTURE. As NEC FUTURE moves toward defining a preferred investment alternative with a ROD in 2016, the capital planning process under development will grow into a tool for identifying and prioritizing investments on an iterative short-term basis in support of the implementation of the shared long-term vision for the NEC.

# **Appendix A-1: Recent Capital Investment**

At the December 2013 Commission meeting, Commission Members directed staff to collect information on recent capital spending on Northeast Corridor (NEC) infrastructure. According to the data provided so far, Amtrak and the state agencies invested approximately \$6.0 billion between Fiscal Year 2004 and Fiscal Year 2013 in shared-benefit infrastructure on the NEC Main Line and Connecting Corridors.

The breakdown of investment is as follows:

- The majority of investment occurred on the NEC Main Line (\$5.0 billion or 83%).
- State agencies invested approximately \$2.4 billion or 40% of the total investments. (Separately, state agencies made additional sole-benefit investments summarized in the final section of this appendix.)
- Amtrak invested approximately \$2.6 billion in shared-benefit infrastructure or 43% of the total investments.
- The American Recovery and Reinvestment Act (ARRA) and High-Speed Intercity Passenger Rail (HSIPR) Program supplemented state and Amtrak spending with an additional \$1 billion in sharedbenefit investments. This total represents only a fraction of the total ARRA/HSIPR grants awarded to NEC infrastructure projects, which are still being spent by Amtrak and the states.

Agency	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	TOTAL
NEC Main Line (Amtrak & MNR Controlled)	359	291	250	354	423	467	761	778	733	600	5,016
Federal ARRA/HSIPR	0	0	0	0	2	8	403	312	72	87	884
State Agencies <sup>a</sup>	179	144	99	150	185	209	190	199	381	197	1,933
Amtrak	180	147	151	204	236	250	168	267	280	316	2,199
Connecting Corridors <sup>b</sup>	91	100	110	90	98	67	108	106	95	154	1,017
Federal ARRA/HSIPR	0	0	0	2	2	2	39	38	12	39	135
State Agency	59	52	44	60	62	24	36	34	55	60	485
Amtrak	32	48	65	28	34	41	33	34	28	55	398
GRAND TOTAL	450	391	360	444	520	533	869	884	828	754	6,033

#### Table A-1: Recent Capital Investment on NEC Main Line & Connecting Corridors, Shared-Benefit

Millions of USD

Notes: (a) State agency figures include state- and locally-funded matches to ARRA/HSIPR grants.

(b) Investments on the Connecting Corridors include: state "shared-benefit" investments, state investments in intercity rail sole-use infrastructure, and all investments reported by Amtrak, excluding System-wide investments.

#### **Background on Recent Capital Investment**

Agencies were requested to provide a list of all capital projects in the given timeframe and, for each project, annual spending, project category, funding sources, and the project's status as a shared- or sole-benefit investment.

- State investments: For state agencies, the investments described below include state projects supported by state/local funding, Federal formula funding, and locally funded matches toward large Federal grants (specifically ARRA, HSIPR, and New Starts). The state agency investments *do not* include spending funded directly by large Federal grants or investments in rolling stock.
- Amtrak investments: For Amtrak, the investments described below include all spending reported by Amtrak, including spending funded by Amtrak's annual General Capital grant (GCAP), large Federal grants (ARRA and HSIPR), and state contributions under joint-benefit agreements. On the NEC Main Line, Amtrak spending data is not broken out between sole- and shared-benefit, nor is it broken out by spending source. It is expected that additional work will refine Amtrak spending data.
- Agencies: For this exercise, Commission staff collected data from Amtrak, Connecticut DOT, Delaware DOT, District DOT, Maryland DOT, Massachusetts DOT, MTA Long Island Rail Road, MTA Metro-North Railroad, NJ Transit, New York State DOT, Pennsylvania DOT, Rhode Island DOT, and SEPTA.
- **Geographic definitions**: The NEC Main Line is defined as the shared- and sole-use infrastructure from Boston, MA to Washington, DC. The Connecting Corridors are the Springfield Line (New Haven, CT to Springfield, MA), the Harrisburg Line (Philadelphia to Harrisburg, PA), and the Albany Line (New York Penn Station to Albany, NY).
- Shared-and Sole-Benefit: The analysis attempts to distinguish investments that clearly benefit multiple operators (i.e., shared-benefit investment) and those that primarily benefit one operator (i.e., sole-benefit). It should be noted, however, that in practice investments primarily aimed at benefiting one operator (i.e., sole-benefit) may have secondary benefits for those other operators. For example, an investment in new capacity for a commuter rail operator might also benefit Amtrak by reducing operational conflicts on existing infrastructure. While this Assessment recognizes that there is considerable gray area in the distinction between sole- and shared-benefit investments, for the purposes of analysis, sole- and shared-benefit were defined consistently as follows:
  - Shared-benefit: On the NEC Main Line and Connecting Corridors, shared-benefit investments include all investments in shared-use infrastructure and investments that benefit multiple users. On the Connecting Corridors, shared-benefit investments also include investments in intercity-rail-sole-use infrastructure. For example, investments by Connecticut DOT and Amtrak on the Springfield Line are considered share-benefit.
  - Sole-benefit: On the NEC Main Line, sole-benefit investments include all investments in sole-use infrastructure that primarily benefit only one operator (e.g., a commuter rail-only station). On the Connecting Corridors, sole-benefit investments only include investments in commuter rail sole-use infrastructure; investments in intercity rail sole-use infrastructure are considered shared-benefit.

#### Shared-Benefit Investments: Summary Tables

\$ Millions	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	TOTAL
Connecticut DOT	41	32	9	18	25	49	44	95	140	114	566
Delaware DOT	0.8	0.8	5	1.2	4	5	5	0.5	0.8	7	31
District DOT	0	0	0	0	0	0	0	0.5	0.6	1	3
Maryland DOT	0.4	4	13	3	9	7	5	6	4	10	60
MBTA	0	0.01	0.1	0.6	1	6	4	0.4	2	0.4	14
MTA LIRR	32	33	30	38	48	12	32	9	57	24	314
MTA Metro-North	4	7	7	7	6	23	4	14	48	3	123
NJ Transit	42	42	24	82	82	92	86	66	34	34	582
NY State DOT	0	0	0	0	0	0	0	0	90	1	91
Pennsylvania DOT	0	0	0	0	0	0	0	0	0	0	0
Rhode Island DOT	60	25	10	0	6	8	9	8	5	3	133
SEPTA	0	0.6	1.8	0.5	4	8	1	0.07	0	0	16
State Total	179	144	99	150	185	209	190	199	381	197	1,933
Amtrak	180	147	151	204	236	250	168	267	280	316	2,199
Fed. ARRA/HSIPR	0	0	0	0	2	8	403	312	72	87	884
GRAND TOTAL	359	291	250	354	423	467	761	778	733	600	5,016

#### Table A-2. Shared-benefit Investments, NEC Main Line

Note: Table A-2 includes state "shared-benefit" investments and all Amtrak investments reported on the NEC Main Line. Table 2 <u>does not</u> include Rolling Stock investments, state "sole-benefit" investments, or Amtrak System-wide investments.

Table A-3. Shared-benefit Investments	, Connecting	g Corridors
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\$ Millions	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	TOTAL
Connecticut DOT	0	0.6	0.6	5	5	3	4	5	18	18	55
MTA Metro-North	37	20	24	27	22	16	29	26	26	25	252
NY State DOT	0	0	0	3	0	0	0	1	7	13	24
Pennsylvania DOT	22	29	18	18	2	2	1	2	4	3	101
SEPTA	0.6	2	1	8	35	2	2	0.1	0.3	1	52
State Total	59	52	44	60	62	24	36	34	55	60	485
Amtrak	32	48	65	28	34	41	33	34	28	55	398
Fed. ARRA/HSIPR	0	0	0	2	2	2	39	38	12	39	135
GRAND TOTAL	91	100	110	90	98	67	108	106	95	154	1,017

Note: Table A-3 includes the following investments on the Springfield, Harrisburg, and Albany lines: state "shared-benefit" investments, state investments in intercity rail sole-use infrastructure, and all investments reported by Amtrak, excluding System-wide investments.

#### Sole-Benefit Investments: Summary Table

\$ Millions	Ongoing Payments	Stations	Track	Power	C&S	Bridges /Struct.	Yards /Fac.	Other	Grand Total
Connecticut DOT	0	208	0	0	0	0	383	0	592
Delaware DOT	0	0	0	0	0	0	0	0	0
District DOT	0	0	0	0	0	0	0	0	0
Maryland DOT	0	36	0.1	0	0	0	31	1	69
MBTA	0	0	0	0	0	0	0	0	0
MTA LIRR	0	0	0	0	0	0	0	0.5	0.5
MTA Metro-North	0	180	4	11	0	0	222	0	417
NJ Transit	0	3	0	0	0	0	159	0	162
NY State DOT	0	0	4	0	0	0	0	0	4
Pennsylvania DOT	0	0	0	0	0	0	0	0	0
Rhode Island DOT	3	83	0	0	0	0	16	0	102
SEPTA	0	68	0.2	0	0	0	0	3	71
State Total	3	578	8	11	0	0	811	5	1,418
Amtrak	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GRAND TOTAL	3	578	8	11	0	0	811	5	1,418

#### Table A-4. Sole-benefit Investments, NEC Main Line & Connecting Corridors

Note: Table A-4 includes state "sole-benefit" investments on the NEC Main, Springfield, Harrisburg, and Albany Lines. Amtrak "sole-benefit" investments are reported in the shared-benefit tables above. Amtrak and state investments in intercity rail-only infrastructure along the Connecting Corridors are considered shared benefit-investments and reported in Table A-3 above. Amtrak investments in intercity rail-only segments of the NEC Main are not broken out separately, and are included in Table A-2 above.

#### Agency Summaries – Shared- and Sole-Benefit Investments

Amtrak reported \$2.6 billion in spending, including \$2.2 billion on the NEC Main Line, \$260 million on the Harrisburg Line, \$198 million on the Springfield Line, and \$45 million on the Albany Line. (In addition, Amtrak reported \$448 million on Amtrak system-wide infrastructure/projects, which is not included in the tables above.)

**Connecticut DOT** reported approximately \$1.2 billion in spending, about evenly split between shared- and sole-benefit investments, including \$1.15 billion on the NEC Main Line and \$55M on the Springfield Line. By category, the largest investments included electric traction (\$286M), including ongoing work to replace overhead catenary wire on the New Haven Line, commuter rail yards and maintenance facilities (\$383M), Metro-North stations on the New Haven Line (\$208M), and bridges and structures (\$125M), including ongoing replacement of undergrade bridges on the New Haven Line.

District DOT reported \$2.6 million in spending, specifically at Washington Union Station.

**Delaware DOT** reported \$31 million in spending on shared infrastructure. The largest investments included shared Amtrak-SEPTA stations at Wilmington and Newark (\$18M) and the Delaware Fourth Track project (\$10M). (Spending on sole-benefit infrastructure has not yet been collected.)

Maryland DOT reported \$129 million in spending, about evenly split between shared- and solebenefit investments. Maryland DOT provides all the funding to support the joint-benefit program. The investments included ongoing joint-benefit projects including Amtrak station improvements (\$53M), solebenefit MARC station improvements (\$36M), and MARC storage facilities (\$31M).

**MBTA** reported \$14 million in shared-benefit spending on the NEC Main Line. The largest areas of investment were track (\$5 million) and communications and signals projects (\$4.5 million).

MTA Long Island Rail Road reported \$182 million in spending between 2008 and 2013, comprised primarily of shared-benefit investments. Amtrak also reported spending by MTA LIRR prior to 2008 totaling an additional \$134 million. During the 2008-2013 period, the largest investments occurred in the East River Tunnels, including Fire & Life Safety (\$94M), Tunnel Ventilation (\$32M), and Track Replacement (\$24M).

MTA Metro-North Railroad reported approximately \$790 million in spending, including \$172 million in sole- and shared-benefit investments on the NEC Main Line (i.e., the New York State portion of the Metro-North New Haven Line between New Rochelle and the NY/CT state line) and \$618 million on the Albany Line (i.e., the Metro-North Hudson Line between Spuyten Duyvil and Poughkeepsie, NY). On the Albany/Hudson Line, the largest investments included the Harmon Yard Improvement Program (\$221M), ongoing improvements to Metro-North stations (\$130M), and ongoing track maintenance (\$115M). On the NEC Main/New Haven Line, the largest investments included ongoing investments in Metro-North station improvements (\$50M), electric traction (\$47M), and signals (\$20M).

New Jersey Transit reported an estimated \$744 million in spending, comprised primarily of sharedbenefit investments. The largest investments were ongoing payments to Amtrak under a joint-benefit agreement (\$328M) and improvements to shared Amtrak-NJ Transit stations (\$203M), including Trenton, Metropark, and Newark Penn Station.

New York State DOT reported \$120 million in spending, including \$95 million on the NEC Main Line and \$35 million on the Albany Line, comprised almost entirely of shared-benefit investments. The largest investment was state/local spending on Moynihan Station (\$90M) and multiple, smaller-scale investments on the Albany Line (i.e. the Empire Corridor between Poughkeepsie and Albany, NY).

**Pennsylvania DOT** reported \$101 million in spending (separate from investments funded by ARRA/HSIPR grants). The largest investment included \$96 million for comprehensive improvements to the Keystone Corridor that reduced the state of good repair backlog, modernized infrastructure, and reduced travel time.

**Rhode Island DOT** reported \$235 million in spending, including about \$132 million in sharedbenefit investments. The largest investments included the Freight Rail Improvement Project (FRIP) (\$95M), T.F. Green station and tracks (\$85M), and Wickford Junction station and tracks (\$32M).

**SEPTA** reported \$139 million in spending, about evenly split between shared- and sole-benefit investments, including \$95 million on the Harrisburg Line and \$44 million on the NEC Main Line. The largest investments were improvements at SEPTA-only stations (\$68M) and concrete ties and continuous welded rail on the Harrisburg Line (\$42M).

# Appendix A-2: Normalized Replacement and Backlog Elimination Rate Calculations

#### Normalized Replacement Rate

Normalized replacement is defined as the annual rate of spending required to keep existing assets maintained and replaced within their useful life. For each of the four core disciplines (track, power, communications & signals, and structures), normalized replacement rates are calculated based on the Amtrak 2011 Engineering State-of-Good-Repair Assessment and corollary data from other railroads. These estimates, called normalized replacement rates, are made according to the sample calculation shown in Figure A-1 for railroad ties. Inputs into the calculation of the normalized replacement annual spending rate of an asset type include the total numbers of assets of that type, the average useful life of that asset type, and the unit cost of that asset type. This calculation was undertaken for all asset types for each engineering discipline. Aggregations in this report are shown for the Amtrak-maintained main line, the New Haven Line, and the connecting corridors to demonstrate how funding needs vary by location. The outputs of these calculations represent estimates of the required annual cost to keep assets in a state of good repair assuming the NEC was starting in a state of good repair.



Figure A-1: Sample calculation of normalized replacement annual spending rate for railroad ties

#### **Backlog Elimination Rate**

As noted in Section 2.2, most asset types have significant numbers of assets beyond their useful life, or in the backlog. For each of the four core engineering disciplines, the Assessment provides an estimate of the annual funding need to eliminate the backlog in 15 years, bringing the NEC into a state-of-good-repair. As illustrated in Figure A-2, the backlog elimination rate is equal to the normalized replacement rate plus the additional rate of spending required to replace all assets currently in backlog over a 15-year period. Exceptions from this 15-year window, identified in Section 3, need to be made for a few types of basic infrastructure assets based on

both the size of the backlog and the specific nature of the impact of their maintenance and replacement activities on existing service.



