NEC FUTURE
A Rail Investment Plan for the Northeast Corridor

Stations Location and Access Analysis Technical Memorandum

October 1, 2015
Final Version

Submitted by:

PARSONS BRINCKERHOFF AECOM
A JOINT VENTURE

Table of Contents

Tables

1. Introduction

This technical memorandum describes the process for identifying stations served by the Action Alternatives. The station identification focuses on both existing stations and potential new stations where local and regional service gaps have been identified and improvements are recommended. For this process, the FRA defined general requirements for new and upgraded stations intended to serve as hubs, including the availability of multiple connecting modes of transportation, proximity to employment centers or significant activity centers, opportunities for station area development, availability of land for parking, and accessibility to regional highways.

The level of analysis for a Tier 1 Draft Environmental Impact Statement (Tier 1 Draft EIS) is intended to be conceptual and should be considered as representative of expected future conditions for planning purposes. While the stations identification is not intended to be used to select new station sites or to prescribe the extent of specific capital improvements at stations, assumptions about where train stations are located and how they are served are critical to the understanding of future travel behavior in the Study Area. These assumptions are also necessary to perform rail operations analysis, develop ridership projections and service plans, estimate capital costs, measure the benefits associated with improving rail service, and assess the environmental consequences of modified or expanded service and capital improvements.

This document also describes the station-related analyses performed by the FRA. Passenger rail stations represent the nexus between the rail network and passengers. As such, the quality of the rail passenger experience is determined based on travel metrics associated with existing and future rail stations and the trips between these stations. The evaluation of the Action Alternatives considers the impact on rail passengers, as the Action Alternatives represent new and improved mobility options compared to the No Action Alternative. Impacts are presented for 25 representative stations and 17 representative station-pairs to highlight the type and magnitude of benefits and effects on travel related to the No Action and Action Alternatives.

2. Methodology

To identify station upgrades and expansions, as well as new stations served by the Action Alternatives, the FRA first categorized existing stations using a typology, based on type of rail service and level of use. Through this effort, the FRA determined whether existing stations are adequately serving travel markets within the Study Area, and identified opportunities to better serve existing and future travel markets by either reconfiguring or expanding existing stations. In addition, locations for new stations were identified based on passenger demand and the needs of the rail network as well as local conditions, including population and employment levels, proximity to special activity centers, and access to highways or other modes of connecting transportation. To understand and describe the potential changes in service quality for passengers at stations, the FRA identified travel metrics associated with station-based and station-pair-based data.

2.1 STATION TYPOLOGY

For NEC FUTURE, the FRA developed a station typology, based on the size of the geographic market and type and quantity of rail service offered. (For a description of service types, refer to the *Service Plans and Train Equipment Options Technical Memorandum*.) This typology applies to existing stations and future stations included in each of the No Action and Action Alternatives. Stations are grouped based on similar characteristics into one of three categories:

- **Major Hub stations** serve the largest markets in the Study Area and have a full complement of rail services types, including Intercity-Express, Intercity-Corridor and Regional rail service. Major Hub stations serve the four primary markets: Washington, D.C., Philadelphia, New York, and Boston as well as other major markets within the Study Area, including but not limited to Baltimore, MD; Stamford, CT; and Providence, RI. Major Hub stations are located in the most populous and densely developed metropolitan areas along the NEC, serving Intercity and Regional rail travel to these major population and employment centers.
- **Hub stations** generally offer both Intercity and Regional rail service, although the Intercity service is limited to Intercity-Corridor service. The absence of regular Intercity-Express service is what distinguishes these stations from the Major Hub Stations. Hub stations include existing intermediate Amtrak stations like New Carrollton, MD; Trenton, NJ; Newark Airport, NJ; and New Rochelle, NY. This category also includes selected key Regional rail stations and new stations that have the potential to fill connectivity gaps in the existing intercity passenger rail network, serve significant employment and activity centers (including military installations and universities) and/or provide important inter-modal connections. Examples include Odenton, MD (adjacent to Fort Meade); Newark, DE (adjacent to the University of Delaware and a major redevelopment site); and T.F. Green Airport in Warwick, RI (major airport); and Willimantic/Storrs, CT (new station serving the University of Connecticut).
- **Local stations** only offer Regional rail service. Examples of Local stations include Halethorpe, MD; Claymont, DE; Torresdale, PA; Edison, NJ; Larchmont, NY; Westport, CT; Wickford Jct., RI; and Attleboro, MA. There are a limited number of locations on the NEC outside of Regional rail service areas where the existing Amtrak stations are best classified as Local stations (e.g., Mystic

and Westerly). Similarly, smaller stations on connecting corridors beyond the NEC are considered Local stations (e.g., Ashland, VA; Mt. Joy, PA; Rhinecliff, NY; Wallingford, CT).

2.2 STATION IDENTIFICATION

Station identification included identifying station upgrades and expansions, as well as new stations served by the Action Alternatives. To identify station upgrades and expansions, the FRA compiled information about existing NEC stations: location; physical configuration and characteristics (including extent to which stations meet ADA and applicable station standards); ownership; types and characteristics of train service; operational characteristics (including train schedules and track assignments); accessibility to other modes; and type and quantity of parking. In addition, information on planned capital improvements/service changes (including No Action Alternative projects) at existing stations was collected from multiple sources (commuter agencies, states, and Amtrak).

The FRA also used the Service Plans[1] identified for each Action Alternative to evaluate the adequacy of existing stations to meet market and service needs, and identify gaps or constraints along the NEC where existing stations will be unable to meet future needs or respond adequately to new service opportunities. Opportunities for new stations were investigated, both to fill gaps along the existing NEC and along the Representative Route[2] for each Action Alternative. This evaluation allowed the FRA to compile a list of candidate new stations, including multiple station locations when a clear solution was not apparent. Where multiple locations existed, the FRA selected one station as the basis for analysis. The FRA identified prototypical footprints for selected new stations and associated scopes for capital investment. Station locations were selected based on their likelihood to generate ridership and on their cost characteristics.

Using this information, the FRA evaluated each station and developed criteria for identifying stations that will need to be reclassified or upgraded to meet the service and infrastructure investments associated with each Action Alternative. Specifically, stations were categorized based on changes associated with:

- Reclassification, due to anticipated future change in the type or level of rail service
- Expansion to serve increased levels of ridership and/or better facilitate the movement of trains through the station

[1] Service Plans are a hypothetical train schedule for a typical future weekday and includes the train stops by station for both peak and non-peak periods. They provide a technical basis for the FRA to estimate future ridership, capital investment needs and costs, and assess the environmental impacts associated with planned construction and future operations.

[2] A Representative Route refers to a proposed route or potential alignment for an Action Alternative. The Representative Route includes horizontal and vertical dimensions, which are based on prototypical cross sections and define its footprint. Prototypical cross sections identify construction methods (tunnel, viaduct, bridge, fly-over, bypass, track type, etc.) and right-of-way requirements for tracks, structures, ancillary facilities, and stations associated with each Action Alternative. The Representative Route is the physical footprint used to asses potential effects of an Action Alternative within the Affected Environment. The Representative Route is used as a proxy for estimating the potential effects of a route whose location could shift during subsequent project-level reviews.

- Relocation to enable expansion, better serve travel markets and realize local development opportunities, or
- Partial reconstruction to enable expansion of railroad track capacity.

A common set of criteria was established to guide the identification of stations that warranted reclassification, expansion, relocation, and/or reconstruction, as well as new stations where none currently exist, based on the factors listed below. A station had to meet at least one criterion. However, many stations met multiple criteria.

- Ridership potential in either the interregional or regional travel markets. Virtually all stations proposed for inclusion to be upgraded have been identified based on their potential to serve new markets or better serve existing markets.
- Fills gap in Intercity or Regional rail service on a portion of the NEC or a new route that is not currently served by a station or where the distance between stations is greater than elsewhere on the corridor. This criterion is applied separately to the interregional and regional markets, since these markets are served by different sets of stations.
- Highway Access. The station can be conveniently accessed from interstate and/or major regional highways, particularly serving portions of the study area not well served by the existing NEC.
- Transit Access. The station provides existing or potential future transit connections.
- Airport Access. The station is located at or relatively close to an airport with air carrier service.
- Population/Employment Concentration. The station is located within an intermediate-sized city or at an existing, planned, or potential employment district.
- Activity Center. The station serves a significant local institution or potential generator of trips, including universities, hospitals, cultural centers, major recreation areas.
- Transit-Oriented Development (TOD) and Regeneration Potential. The station location generates significant development potential at or immediately adjacent to the station site, or where improved rail access potentially can contribute to the uplifting of existing communities and neighborhoods.
- New Intercity Route. The station is located along a new intercity route (NEC second spine or connecting corridor).
- Outside current Regional rail Service Area. The station expands the reach or coverage of the regional rail network.

The methodology employed to identify new stations was slightly different from that used to identify planned upgrades to existing stations. The FRA compiled information on planned new stations, from multiple sources including commuter agencies, states, and Amtrak and developed the following criteria to determine the need for new stations and identify appropriate station locations:

- Areas with significant and growing population and employment centers that are currently not served or underserved by rail.

- Fills gaps in Intercity or Regional rail service.
- Located in strategic locations with respect to the regional transportation network, such as near a major highway interchange, local or regional transit stop, or adjacent to an airport.
- Located near or adjacent to major activity center, such as university, military installation, medical facility, tourist attraction, or government center.
- Areas with significant Transit Oriented Development or economic regeneration potential.

2.3 STATION ANALYSIS

The FRA identified and evaluated a series of travel metrics associated with station-based and station-pair-based data to more succinctly describe the potential changes in service quality for users. These travel metrics are described below and categorized in Table 1, along with the unit of analysis and the measure used to analyze each metric.

- **Connectivity** measures the frequency and duration of passenger rail services. A higher frequency of service, or a shorter average headway, increases travel options. Similarly, a longer duration of service provides greater opportunity for travel
- **Accessibility** measures the type and number of connections available to passengers to arrive and depart from representative stations
- **Capacity** measures the ability of the station to provide the quantity of service predicted in the future alternatives by assessing whether the station will be new, expanded, or upgraded
- **Travel Time** is measured as the average scheduled time required to travel between representative station-pairs
- **Frequency** is measured as the number of trains per day providing service between representative station-pairs

Table 1: Travel Metrics

Unit of Analysis	Travel Metric	Measure
Representative station	Connectivity	▪ Frequency of service measured in average headway ▪ Daily hours of service
	Accessibility	▪ Transit service ▪ Private automobile access, roadway congestion, and parking ▪ Independent (pedestrian and bicycle) and shared (taxis and carshare) access
	Capacity	▪ Capital improvements
Representative station-pair	Travel Time	▪ Average travel time
	Frequency	▪ Number of trains per day

Source: NEC FUTURE team, 2015

Accessibility describes the travel modes available for passengers to arrive or depart from a passenger rail station. The FRA measured accessibility of representative stations in three major categories: transit, personal automobile, and independent and shared modes of transportation. The

metrics for personal automobile and independent and shared modes of transportation are presented in Table 2.

Table 2: Accessibility Methodology

Accessibility Measure	Metric	High	Medium	Low	Poor	Data Source
Private automobile Accessible	Private automobile accessible yes or no	NA	NA	NA	NA	Google Earth Station Owner
Adjacent Roadway Congestion	High, Medium, Low, Poor	Uncongested	Occasional Peak Congestion	Regular Peak Congestion	Regular Peak and Off-Peak Congestion	Station Owner Station Master Plan
Parking Inventory	Number of parking spots available	NA	NA	NA	NA	Station Owner Station Master Plan
Station Environment	CBD, Urban, Suburban, Rural, Airport	NA	NA	NA	NA	Google Earth Station Owner
Pedestrian Network	High, Medium, Low, Poor	Sidewalk approaches from all directions (3 or more) AND sidewalk present on both sides of the street	Sidewalk approaches from 2 directions AND present on both sides of the street OR sidewalk approaches from more than 2 directions, but only present on one side of the street	Sidewalk approaches from one direction	No pedestrian pathway to station	Google Earth Station Owner
Bicycle Accessibility	High, Medium, Low, Poor	Dedicated, separated bike infrastructure to station	Dedicated but not separated	No bike infrastructure, but roadway can accommodate cyclists	Station inaccessible by bike	Google Earth Station Owner
Carshare and Rental Car Availability	High, Medium, Low, Poor	Carshare or rental car within station or in the immediate station vicinity	Carshare or rental car within half mile of the station	Carshare or rental car between a half mile and one mile from the station	Carshare and rental car unavailable within 1 mile of the station	Google Map Search Results, Zipcar.com, Enterprise.com, Avis.com, Hertz.com
Provision for Taxis	Presence of taxi queue yes or no	NA	NA	NA	NA	Station Owner Station Master Plan

The FRA based the existing conditions analysis on a review of 2012 printed timetables for Amtrak and the commuter railroads in the Study Area. For the No Action Alternative and the Action Alternatives, conceptual schedules were used to support the analysis of the travel metrics for 2040. Table 3 lists the data sources that were compiled and consulted by travel condition factor.

Table 3: Travel Metric Data Sources

Travel Metrics	Data Source / Existing Conditions	Data Source / 2040 Forecast
Connectivity	■ Passenger Railroads (including Intercity and Commuter Railroads) ■ NEC FUTURE No Action Alternative and capital plans/programs from State DOTs, transit agencies or public authorities, and rail station master plans	■ NEC FUTURE Operations Model ■ Passenger Railroads (including Intercity and Commuter Railroads) ■ NEC FUTURE No Action Alternative and capital plans/programs from State DOTs, transit agencies or public authorities, and rail station master plans
Accessibility	■ Passenger Railroads websites (including Intercity and Commuter Railroads) for parking and station access amenities ■ NEC FUTURE No Action Alternative and capital plans/programs from State DOTs, transit agencies or public authorities, and rail station master plans ■ Rail Station Master Plans ■ Amtrak Master Plan, Amtrak High-Speed Rail Vision ■ Public transportation provider websites ■ Intercity bus carriers' websites ■ Google Earth	■ Passenger Railroads websites (including Intercity and Commuter Railroads) for parking and station access amenities ■ NEC FUTURE No Action Alternative and capital plans/programs from State DOTs, transit agencies or public authorities, and rail station master plans ■ Rail Station Master Plans ■ Amtrak Master Plan, Amtrak High-Speed Rail Vision ■ Public transportation provider websites ■ Intercity bus carriers' websites ■ Google Earth
Capacity	■ NEC FUTURE No Action Alternative and capital plans/programs from State DOTs, transit agencies or public authorities, and rail station master plans	■ NEC FUTURE No Action Alternative and capital plans/programs from State DOTs, transit agencies or public authorities, and rail station master plans
Frequency Travel Time	■ Passenger Railroads (including Intercity and Commuter Railroads) Timetables	■ NEC FUTURE Operations Model

Source: NEC FUTURE team, 2015

2.3.1 Representative Stations and Station-Pairs

To simplify and standardize the identification of changes in travel metrics, the FRA selected a series of "representative stations" and "representative station-pairs" as proxies for rail travel between stations within a metropolitan area. The final selection of the 25 representative stations was based on service type (Intercity and Regional rail), the volume of service (frequency), and location (representative of the entire NEC, connecting corridors, and Action Alternative route options). Table 4 presents these 25 representative stations, which consist of the four Major Hub stations (Washington Union Station, Philadelphia 30th Street Station, Penn Station New York, and Boston South Station) and a selection of 21 other stations, including some of the new stations proposed in Alternative 2 and Alternative 3. In addition, the FRA selected 17 station-pairs to highlight how the

No Action and Action Alternatives provide new Intercity travel linkages between markets or improve Intercity connections between existing markets. Table 5 presents the representative station-pairs.

Table 4: Representative Stations and Existing Station Type

Station	Existing Station Type	Station	Existing Station Type
Washington Union Station	Major Hub	Cross-Westchester	—
Odenton	Local	Nassau Hub	—
Baltimore Downtown	—	Ronkonkoma	Local
Newark, DE	Hub	Stamford	Major Hub
Wilmington	Major Hub	Danbury	—
Philadelphia 30th Street	Major Hub	New Haven	Major Hub
Philadelphia Market East	—	New London	Hub
Trenton	Hub	Hartford	Hub
Newark Liberty	Hub	Tolland/Storrs	—
Newark Penn Station	Major Hub	TF Green	Local
Secaucus	Local	Worcester	Local
Penn Station New York	Major Hub	Boston South Station	Major Hub
New Rochelle	Hub		

Source: NEC FUTURE team, 2015

Table 5: Representative Station-Pairs

Station 1	Station 2
Washington Union Station	Philadelphia
Washington Union Station	Penn Station New York
Washington Union Station	Boston South Station
Washington Union Station	Newark, DE
Philadelphia	Odenton
Penn Station New York	Baltimore (Penn Station and Downtown)
Penn Station New York	Wilmington
Ronkonkoma	Baltimore (Penn Station and Downtown)
Penn Station New York	Philadelphia
Boston Station	Philadelphia
Nassau Hub	Trenton
Danbury	Newark Penn Station
New Haven	Newark Penn Station
Stamford	Secaucus
Boston South Station	Penn Station New York
Hartford	Ronkonkoma
Boston South Station	Tolland / Storrs

Source: NEC FUTURE team, 2015
Philadelphia includes both Philadelphia 30th Street and Market East stations
Baltimore includes both Baltimore Penn and Downtown stations

3. Station Identification

3.1 EXISTING STATIONS

The FRA identified existing stations on the NEC that require station upgrades and expansion associated with implementation of the Action Alternatives. Future modifications fall into four main categories: reclassification, relocation, expansion, and partial reconstruction.

3.1.1 Reclassification

Station reclassification involves a change in the station type, reflecting a proposed or anticipated change in the mix of rail service available at the station. The most common reclassification represents an upgrade from a purely local station to a Hub station served by Metropolitan[3] trains. Odenton, MD is an example of this classification change.

Table 6 lists the existing stations that meet the criteria for an upgrade, along with the primary reasons why these stations were initially selected. The last two stations listed, Trenton, NJ and Hartford, CT, are reclassified as stations to receive Intercity-Express service. Hartford's reclassification reflects its location on the new segment in Alternative 2 and each of the Alternative 3 route options and the city's important role in the region, the concentration of population and employment that exists in that part of central Connecticut. Like Hartford, Trenton is a state capital and an important economic center; it is served by some Intercity-Express trains in Alternatives 2 and 3. As the level of Intercity-Express service increases to 4 trains per hour in the peak travel periods, the station is further reclassified as a Major Hub station.

Two existing stations with very limited Amtrak service today, Princeton Junction and New Brunswick NJ, are candidates for Metropolitan service. However, based on suburban population, concentrations of employment, and proximity to major research universities, there is very limited ability to expand the footprint of the existing stations to accommodate platforms on the express tracks or major increases in parking and access capacity. Therefore, the FRA has proposed a new station at North Brunswick, halfway between these two more constrained stations to more adequately serve as the Metropolitan station for this part of New Jersey. However, this station is intended to be representative, and any future decisions on a location for a new station will be part of a project level, Tier 2 environmental analysis.

[3] A new Intercity-Corridor rail service concept that upgrades the level of Intercity-Corridor rail service provided on the NEC which , offers frequent service (2–4 trains per hour) to large and mid-size markets and key transfer locations, and stops at more stations than current Intercity –Corridor service.

Table 6: Selection Criteria for Existing Stations Proposed for Metropolitan Service

Name	Volume of Commuter / Regional Ridership	Gap in Intercity or Regional Service	Highway Access	Transit Access	Airport Access	Population/Employment Concentration	Activity Center	TOD / Regeneration Potential	New Intercity Route	Outside Regional Rail Service Area
Odenton, MD	✓	✓	✓	✓			✓			
West Baltimore, MD				✓		✓		✓		
Aberdeen, MD							✓			
Newark, DE							✓	✓		
North Philadelphia, PA								✓		
Cornwells Heights, PA	✓	✓	✓			✓				
Princeton Junction, NJ	✓						✓			
New Brunswick, NJ							✓			
Secaucus, NJ										
New Rochelle, NY	✓					✓	✓			
Greens Farms, CT		✓	✓			✓			✓	
Mystic, CT										✓
Westerly, RI										✓
TF Green, RI		✓	✓		✓					
Ronkonkoma, NY	✓				✓				✓	
Trenton, NJ	✓	✓		✓		✓	✓	✓		
Hartford, CT						✓	✓	✓	✓	

Source: NEC FUTURE team, 2015

3.1.2 Expansion

Existing NEC stations were identified that are expected to require expansion to meet changing market demands and growing traffic levels. Station expansion, as defined for purposes of this document, includes a change in the configuration of tracks and platforms at the station, the introduction of new connecting modes of transportation such as rail or bus, or reconstruction or significant enlargement of the station facilities that handle passengers. Less intensive capital improvements such as the expansion of station parking, the extension of existing platforms or the conversion of platforms from low-level to high-level, is necessary at many stations along the NEC and by themselves are not considered expansion projects.

Table 7 presents the criteria used to identify the expansion associated with each station. The FRA performed this analysis using existing available information.

Table 8 summarizes the type of work expected at each of these stations associated with the Action Alternatives. No station expansions are required for the No Action Alternative. Examples of station expansion projects include construction of new platforms on either existing or new tracks, the conversion of stations with side platforms on the outer tracks to island platforms serving multiple tracks, or reconstruction of station concourses to improve passenger-handling capacity.

At many locations, these improvements reflect existing plans developed locally or at the regional or state level (e.g., Washington Union Station; Martin Airport, MD; and Newark, DE). At other locations, the FRA identified the need for future improvements based on projected future passenger demand, increases in the volume of train service, and proposed changes in train operating patterns and the types of train services offered at stations (e.g., stations requiring upgrades to support Metropolitan service, including new platforms on the express tracks or multiple station tracks and platforms).

Table 7: Selection Criteria for Identifying Existing Stations that Require Expansion

Station Name	Scope of Expansion				Criteria for Selection										
	Reclassified	Additional Platforms	Additional Tracks	Other Construction	Projected Regional Rail Ridership	Projected Intercity Ridership	Improved Highway Access	Improved Transit Connectivity/Access	Improved Airport Access	Improved Rail Passenger Transfers	Platforms on Express Tracks	Expanded Railroad Right-of-Way	Improved Train Operations	Activity Center	TOD / Redevelopment Potential
Washington Union, D.C.		✓	✓	✓	✓	✓		✓		✓			✓	✓	✓
New Carrollton, MD		✓	✓			✓		✓				✓	✓		✓
Odenton, MD	✓	✓	✓		✓	✓	✓	✓			✓		✓		
BWI Airport, MD		✓	✓		✓	✓			✓		✓	✓	✓		
Martin Airport, MD		✓		✓	✓			✓					✓		✓
West Baltimore, MD	✓	✓			✓			✓					✓		✓
Baltimore Penn Station, MD		✓	✓	✓						✓			✓	✓	✓
Aberdeen, MD	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Newark, DE	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓
Philadelphia 30th Street, PA				✓	✓	✓		✓	✓	✓			✓	✓	✓
North Philadelphia, PA	✓	✓		✓	✓			✓		✓			✓		✓
Cornwells Heights, PA	✓	✓			✓	✓				✓	✓	✓			
Trenton, NJ		✓	✓	✓	✓	✓				✓		✓	✓	✓	✓
Metropark, NJ		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓
Newark Airport, NJ		✓	✓	✓		✓	✓	✓	✓	✓		✓			
Newark Penn Station, NJ		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
Secaucus, NJ	✓	✓	✓	✓	✓	✓		✓		✓		✓			✓
Penn Station New York, NY		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
Jamaica, NY	✓	✓	✓		✓	✓		✓	✓	✓		✓	✓		✓
New Rochelle, NY	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓		✓
Ronkonkoma, NY	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓
Stamford, CT		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓
Green's Farms, CT	✓	✓	✓		✓	✓	✓			✓	✓	✓			
Bridgeport, CT		✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓
New Haven, CT		✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
Old Saybrook, CT		✓	✓			✓	✓			✓	✓	✓			
Mystic, CT	✓													✓	
Hartford, CT		✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓
Westerly, RI	✓													✓	
Kingston, RI		✓	✓		✓	✓				✓	✓		✓	✓	
TF Green Airport, RI	✓	✓	✓			✓	✓		✓	✓			✓	✓	

Station Name	Scope of Expansion				Criteria for Selection										
	Reclassified	Additional Platforms	Additional Tracks	Other Construction	Projected Regional Rail Ridership	Projected Intercity Ridership	Improved Highway Access	Improved Transit Connectivity/Access	Improved Airport Access	Improved Rail Passenger Transfers	Platforms on Express Tracks	Expanded Railroad Right-of-Way	Improved Train Operations	Activity Center	TOD / Redevelopment Potential
Providence, RI		✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
Westwood/Rte 128, MA		✓	✓		✓					✓		✓	✓		✓
Readville, MA		✓						✓		✓		✓	✓		✓
Forest Hills, MA		✓						✓		✓		✓	✓		✓
Ruggles, MA		✓						✓		✓		✓	✓		✓
Boston Back Bay, MA		✓	✓	✓	✓	✓		✓		✓		✓	✓		
Boston South Station, MA		✓	✓	✓	✓	✓		✓		✓		✓	✓		

Source: NEC FUTURE team, 2015

Table 8: Station Expansion Associated with the Action Alternatives

Station	Expansion Scope	Action Alternatives
Washington Union, DC	Station and terminal expansion**	All
New Carrollton, MD	Additional track, 2 additional platforms	All
Odenton, MD	Additional track, track/platform reconfiguration	All
BWI Airport, MD	Additional track, 2 additional platforms New high-speed tracks and additional platforms*	All 3
Baltimore Penn Station, MD	Track and platform reconstruction, station expansion	All
Martin Airport, MD	Station relocation, track/platform reconfiguration	All
Aberdeen, MD	Station relocation, track/platform reconfiguration	All
Newark, DE	Station relocation, track/platform reconfiguration	All
Philadelphia 30th Street, PA	Station facilities, approach tracks	All
Trenton, NJ	New tracks and platforms on high-speed line*	3
Cornwells Heights, PA	Track and platform reconfiguration	All
Metropark, NJ	Track and platform reconfiguration New tracks and platforms on high-speed bypass*	1,2 3
Newark Airport, NJ	New tracks and platforms on high-speed bypass*	3
Newark Penn Station, NJ	Station capacity expansion New tracks and platforms on high-speed bypass*	All 3
Secaucus, NJ	Additional platforms and station tracks connected to new Hudson River tunnels	All
Penn Station New York, NY	Station and terminal expansion	All
Jamaica, NY	New upper level station on high-speed line*	3
New Rochelle, NY	Track platform and station reconfiguration, w/ potential upper level station on high-speed line*	All 3
Ronkonkoma, NY	Additional track and platform capacity	3
Stamford, CT	New tracks and platforms on high-speed bypass*	All
Green's Farms, CT	Additional track, track/platform reconfiguration	2
Bridgeport, CT	New lower level station on high-speed line*	3
New Haven Station, CT	Additional platform tracks on main level New lower level station on high-speed line*	All 3
Old Saybrook, CT	New tracks and platforms on high-speed bypass*	1,2
Hartford, CT	New lower level station and track relocation*	2, 3
Kingston, RI	Additional track and platform capacity	1,2
TF Green Airport, RI	Additional track and platform capacity	All
Providence, RI	New lower level station on high-speed line*	3
Westwood/Rte 128, MA	Additional track and platform capacity	All
Readville, MA	Additional platform	2
Forest Hills, MA	Additional platform	2
Ruggles, MA	Additional platform	2
Boston Back Bay, MA	New lower level station on high-speed line*	2,3
Boston South Station, MA	Station and terminal expansion	All

Source: NEC FUTURE team, 2015

* Improvements entail construction of new station facilities adjacent to and connected with existing station.

** Includes station facilities such as platforms, platform tracks, concourses and passenger-handling facilities, and other terminal facilities including rolling stock storage and maintenance facilities and the configuration of track connections to and from multiple branch lines.

3.1.3 Relocation

Stations were assumed to remain at existing locations, except in situations where:

- Station relocation is already planned by Amtrak or a commuter agency/operator
- Regulatory mandates (e.g., ADA, NFPA 130) require expansion at a different location (e.g., relocation of high-level station platforms off of curves)
- Sufficient space does not exist to expand tracks, platforms and/or parking to support future station demand and functional requirements
- Local environmental conditions indicate relocation is feasible and preferable to expansion at existing station site
- Station area development and TOD opportunities support and favor station relocation

Hartford Union Station in Hartford, CT, is the only major station relocation currently under consideration. The station is currently located under the Hartford Viaduct, a 100-year old structure that needs replacement. The station could be relocated as part of a parallel effort to rebuild I-84 through downtown Hartford. Minor relocations are already planned or envisioned at some stations, such as Martin Airport, MD and Newark, DE, in response to local transit-oriented development plans and to permit expansion of station infrastructure. No other stations are currently planned for relocation or explicitly require relocation as a result of the Action Alternatives. The need for station relocation due to the implementation of specific projects in an Action Alternative will be determined as part of a future Tier 2 environmental review process.

3.1.4 Partial Reconstruction

In the Action Alternatives, there are a number of existing stations that will need to be partially reconstructed to provide for additional main tracks within or adjacent to the existing right-of-way. These stations, typically served by Regional rail only, otherwise do not change their type or level of use. As a result, they are not included as a station upgrade or expansion.

Examples include Seabrook and Bowie State in Maryland, where the addition of a fourth main line track in all Action Alternatives requires one of the two existing station platforms to be reconstructed, with relatively minor modifications to pedestrian access and station parking. Similar situations would occur elsewhere, particularly in Alternative 2, which builds out a 4-track railroad along most of the NEC, impacting Regional rail stations at: Martin Airport, Edgewood and Perryville, MD; Churchman's Crossing, DE; North Philadelphia, PA; Jersey Avenue, NJ; and Hyde Park, MA. The FRA included capital costs associated with partial station reconstructions in capital cost estimates for each Action Alternative. Environmental impacts associated with reconstructing platforms and possibly relocating or expanding parking lots also were taken into account, based on analysis of the general station footprint requirement and the type of construction for the new main track(s), in the Tier 1 Draft EIS.

3.2 NEW STATIONS

In addition to existing stations, the FRA identified new stations. This section summarizes the assumptions regarding the identification of new stations on the NEC rail network, including those serving areas along the existing NEC that were previously unserved, high-speed express stations adjacent to existing stations, and those associated with new segments or new track. The analysis includes stations currently under planning by commuter rail operators or other entities, as well as stations identified to meet future market demand. New stations fall into one of the following categories.

- NEC stations planned by commuter rail operators, municipalities, or other transportation agencies
- NEC stations on the existing NEC
- Stations on potential new segments
- Stations serving new high-speed express tracks adjacent to existing stations

3.2.1 Planned Regional Rail Stations

Most new stations along the existing NEC are Regional rail stations under development or included in the long-range plans of the Regional rail operators and planning agencies. Table 9 lists these stations, along with the selection criteria used to identify these stations.

Table 9: Selection Criteria for Planned Regional Rail Stations

Name	Ridership Potential	Gap in Intercity or Regional Service	Highway Access	Transit Access	Airport Access	Population/ Employment Concentration	Activity Center	TOD / Regeneration Potential	New Intercity Route
Bayview, MD	✓		✓	✓		✓	✓	✓	
Elkton, MD	✓	✓							
Newport, DE	✓	✓				✓			
Edgemoor, DE	✓	✓				✓			
North Brunswick, NJ	✓	✓	✓					✓	
Hunts Point, NY	✓					✓			
Parkchester, NY	✓					✓			
Morris Park, NY	✓	✓		✓		✓	✓		
Co-op City, NY	✓					✓			
East Bridgeport, CT	✓					✓		✓	
North Haven, CT	✓	✓							✓
Newington, CT	✓	✓		✓					✓
West Hartford, CT	✓	✓		✓					✓

Source: NEC FUTURE team, 2015

The FRA included these new stations in the Action Alternatives generally as Regional rail (local) stations. Stations that are under construction, funded, or in the capital plans of local agencies or rail operators are included in the No Action Alternative. Some of these planned new Regional rail

stations represent candidates for Metropolitan service. For example, Bayview, North Brunswick, and Morris Park, NY, fall into this category. These stations exhibit the following characteristics:

- Fills gap in existing Amtrak service
- Provides service to active or growing suburban area or outer portion of metro area
- Provides improved regional highway or transit access
- Coincides with major activity center, employment center or development zone

The other new Local stations are all anticipated to have ridership catchment areas that are more local in nature and best served by Regional rail.

3.2.2 New Stations on the Existing NEC

The FRA also selected stations on the existing NEC that serve a purpose consistent with the vision in one or more of the Action Alternatives. Table 10 identifies these new stations, and the criteria used to identify them.

Table 10: Selection Criteria for New Stations on the Existing NEC

Name	Ridership Potential	Gap in Intercity or Regional Service	Highway Access	Transit Access	Airport Access	Population/ Employment. Concentration	Activity Center	TOD / Regeneration Potential	New Intercity Route
Upton, MD	✓			✓		✓		✓	
Broadway, MD	✓			✓		✓		✓	
Baldwin, PA	✓	✓	✓					✓	
Cross-Westchester, NY	✓		✓						

Source: NEC FUTURE team, 2015

Baldwin, MD, and Cross-Westchester, NY, both provide highway access to the NEC and serve large suburban areas in the southwestern Philadelphia and northern New York suburbs, respectively. Baldwin is close to the interchange of I-95 with I-476 (the Blue Route), the western circumferential highway in the Philadelphia region. Cross-Westchester is at the eastern end of the Cross-Westchester Expressway (I-287), which provides access to all of Westchester County and the suburban counties lying west of the Hudson River across the Tappan Zee Bridge. A new station on the NEC is a logical terminus for future transit (e.g., bus rapid transit (BRT) or enhanced bus service) in the I-287 corridor that would link the NEC with White Plains, NY, and western portion of Westchester County, as well as Rockland and Orange Counties on the west side of a reconstructed Tappan Zee Bridge. These stations support visions of the NEC that either grow or transform the role of rail (i.e., Alternative 2 or 3).

Upton and Broadway, within Baltimore City, provide direct transfer connections from Regional rail and Metropolitan service operating on the NEC to the Baltimore Metro, providing connections to downtown Baltimore and the northern suburbs. These stations also offer potential development opportunities. These station concepts depend upon several external factors, including the outcome of engineering studies for the B&P and Union tunnels, and plans for the possible extension of the Baltimore Metro line. They provide transit system connectivity consistent with NEC FUTURE's service objectives for major urban areas.

The feasibility, practicality, and cost-effectiveness of these new stations should be assessed in future Tier 2 environmental analyses.

3.2.3 New Stations on New Segments

The FRA identified new stations along new segments (new right-of-way, parallel to the NEC, where the existing track is retained), as identified in Table 11. Select stations are also described in more detail below.

Table 11: Selection Criteria for New Stations on New Segments

Name	Action Alts.	Ridership Potential	Gap in Intercity or Regional Service	Highway Access	Transit Access	Airport Access	Population/ Employment Concentration	Activity Center	TOD / Regeneration Potential	New Intercity Route
Baltimore Downtown, MD	3	✓			✓		✓	✓	✓	✓
Rosedale, MD	3	✓					✓			✓
White Marsh, MD	3	✓		✓			✓			✓
Joppatowne, MD	3	✓					✓			✓
Philadelphia Market East, PA	3	✓			✓		✓	✓	✓	✓
Philadelphia Int'l. Airport, PA	2	✓				✓	✓	✓		✓
White Plains East, NY	3	✓		✓			✓	✓		✓
Nassau Hub, NY	3	✓			✓		✓	✓	✓	✓
Suffolk Hub - Rte 110, NY	3	✓					✓	✓	✓	✓
Nesconset Highway / Setauket / Stony Brook, NY	3	✓						✓		✓
Danbury, CT	3	✓					✓			✓
Waterbury South, CT	3	✓					✓			✓
New London/ Mystic, CT	1	✓								✓
Willimantic / Storrs, CT	3	✓	✓					✓		✓
Meriden, CT	2	✓	✓							✓
Worcester, MA	3	✓						✓		✓
Riverside/I-95, MA	3	✓		✓				✓		✓
Blue Star/I-495, MA	3	✓		✓				✓		✓

Source: NEC FUTURE team, 2015

Downtown Baltimore and Philadelphia stations, included in Alternative 3, provide two primary benefits: they are located on an Alternative 3 New Segment that significantly decrease trip times for New York-to-Washington, D.C. Intercity-Express service; and they are located in the central business

districts of both cities (in contrast to the existing Amtrak stations, which are located on the periphery of those central business districts). In both cities, considerable development is already planned around the existing train stations, and Alternative 3 assumes that rail service to these stations also is increased significantly over existing levels.

The Philadelphia International Airport station provides access to this airport that is comparable to the service now provided to Newark Liberty International and BWI Thurgood Marshall Airports. The rail station could be located directly adjacent to the air terminal or accessible via a people-mover from the Chester Secondary/SEPTA Eastwick Station area. The station also has good highway access from I-95 and will serve the employment zone that surrounds the airport.

The New London/Mystic station is located on the Old Saybrook CT-Kenyon RI bypass in Alternative 1. Meriden/I-91 serves as a highway intercept point between New Haven and Hartford, CT in Alternative 2. These stations are in more suburban and rural areas, but provide good access to population in zones that are relatively far from other Intercity stations.

3.2.4 New Stations Adjacent to Existing Stations

The FRA also proposed new stations for development adjacent to existing stations, as part of expanded NEC capacity where a new segment is built parallel to the existing NEC (Alternatives 2 and 3). Rather than being wholly new and separate stations, these stations function as a single integrated facility in terms of access and parking – with multiple levels of tracks and platforms and convenient passenger connections between them. Examples of these types of stations are shown in Table 12, along with the criteria used to identify them.

Table 12: Selection Criteria for New Stations Adjacent to Existing Stations

Name	Ridership Potential	Gap in Intercity or Regional Service	Highway Access	Transit Access	Airport Access	Population/ Employment Concentration	Activity Center	TOD / Regeneration Potential	New Intercity Route
Trenton, NJ H.S.	✓			✓		✓	✓		
Metropark, NJ H.S.	✓		✓			✓	✓		
Newark Penn Station, NJ H.S.	✓			✓		✓	✓	✓	
Stamford, CT H.S.	✓					✓	✓		
Bridgeport, CT H.S.	✓					✓	✓	✓	
New Haven Station, CT H.S.	✓					✓	✓	✓	
Old Saybrook, CT H.S.	✓								✓
Providence Station, RI H.S.	✓					✓	✓		
Back Bay, MA H.S.	✓					✓	✓		
Hartford, CT H.S.*	✓					✓	✓	✓	✓
Jamaica, NY H.S.	✓			✓		✓	✓	✓	✓
Ronkonkoma, NY	✓				✓			✓	✓

Source: NEC FUTURE team, 2015

* The State of Connecticut is considering relocation of this station.

3.3 SUMMARY

Table 13 contains a complete list of the stations identified by the FRA, their location, type, and the Action Alternative(s) in which each station appears. The FRA assigned a station ID for use in the Tier 1 Draft EIS.

Table 13: NEC FUTURE Stations

Geography	County	Station ID	Station Name	Station Type	Alt 1	Alt 2	Alternative 3			
							Alt 3.1	Alt 3.2	Alt 3.3	Alt 3.4
D.C.		1	Washington Union	Existing	X	X	X	X	X	X
MD	Prince George's	2	New Carrolton	Existing	X	X	X	X	X	X
		3	Seabrook		X	X	X	X	X	X
		4	Bowie State		X	X	X	X	X	X
	Anne Arundel	5	Odenton	Existing	X	X	X	X	X	X
		6	BWI Airport		X	X	X	X	X	X
		6	BWI Airport H.S.	New			X	X	X	X
	Baltimore County	7	Halethorpe	Existing	X	X	X	X	X	X
		15	Martin Airport		X	X	X	X	X	X
	Baltimore City	8	West Baltimore	Existing	X	X	X	X	X	X
		9	Upton	New	X	X	X	X	X	X
		10	Baltimore Penn Station	Existing	X	X	X	X	X	X
		11	Baltimore Downtown	New			X	X	X	X
		12	Broadway		X	X	X	X	X	X
		13	Bayview		X	X	X	X	X	X
		14	Bayview H.S.				X	X	X	X
	Harford	16	Edgewood	Existing	X	X	X	X	X	X
		17	Aberdeen (NEC)		X	X	X	X	X	X
	Cecil	22	Perryville	Existing	X	X	X	X	X	X
		23	Elkton	New	X	X	X	X	X	X
DE	New Castle	24	Newark, DE	Existing	X	X	X	X	X	X
		25	Churchman's Crossing		X	X	X	X	X	X
		26	Newport	New	X	X	X	X	X	X
		27	Wilmington Station	Existing	X	X	X	X	X	X
		28	Edgemoor	New	X	X	X	X	X	X
		29	Claymont	Existing	X	X	X	X	X	X
PA	Delaware	30	Marcus Hook	Existing	X	X	X	X	X	X
		31	Highland Avenue		X	X	X	X	X	X
		32	Chester		X	X	X	X	X	X
		33	Eddystone		X	X	X	X	X	X
		34	Baldwin	New	X	X	X	X	X	X
		35	Crum Lynne	Existing	X	X	X	X	X	X
		36	Ridley Park		X	X	X	X	X	X
		37	Prospect Park		X	X	X	X	X	X
		38	Norwood		X	X	X	X	X	X
		39	Glenolden		X	X	X	X	X	X
		40	Folcroft		X	X	X	X	X	X
		41	Sharon Hill		X	X	X	X	X	X
		42	Curtis Park		X	X	X	X	X	X
		43	Darby		X	X	X	X	X	X

Table 13: NEC FUTURE Stations (continued)

Geography	County	Station ID	Station Name	Station Type	Alt 1	Alt 2	Alternative 3			
							Alt 3.1	Alt 3.2	Alt 3.3	Alt 3.4
PA (cont'd)	Philadelphia	44	Philadelphia Airport*	New		X	X	X	X	X
		45	Philadelphia 30th St	Existing	X	X	X	X	X	X
		46	Philadelphia Market East				X	X	X	X
		47	North Philadelphia		X	X	X	X	X	X
		48	Bridesburg		X	X	X	X	X	X
		49	Wissinoming		X	X	X	X	X	X
		50	Tacony		X	X	X	X	X	X
		51	Holmesburg Junction		X	X	X	X	X	X
		52	Torresdale		X	X	X	X	X	X
	Bucks	53	Cornwells Heights	Existing	X	X	X	X	X	X
		54	Eddington		X	X	X	X	X	X
		55	Croydon		X	X	X	X	X	X
		56	Bristol		X	X	X	X	X	X
		57	Levittown		X	X	X	X	X	X
NJ	Mercer	58	Trenton	Existing	X	X	X	X	X	X
		60	Hamilton		X	X	X	X	X	X
		61	Princeton Junction		X	X	X	X	X	X
	Middlesex	62	North Brunswick	New	X	X	X	X	X	X
		63	Jersey Avenue	Existing	X	X	X	X	X	X
		64	New Brunswick		X	X	X	X	X	X
		65	Edison				X	X	X	X
		66	Metuchen		X	X	X	X	X	X
		67	Metropark		X	X	X	X	X	X
		68	Metropark H.S.	New			X	X	X	X
	Union	69	Rahway	Existing	X	X	X	X	X	X
		70	Linden		X	X	X	X	X	X
		71	Elizabeth		X	X	X	X	X	X
		72	North Elizabeth		X	X	X	X	X	X
	Essex	73	Newark Airport	Existing	X		X	X	X	X
		74	Newark Penn Station		X	X	X	X	X	X
		75	Newark Penn Station H.S.	New			X	X	X	X
	Hudson	76	Secaucus	Existing	X	X	X	X	X	X
NY	New York	77	Penn Station New York	Existing	X	X	X	X	X	X
		9993	Grand Central Terminal				X			X
	Queens	144	Jamaica	Existing				X	X	
		145	Jamaica H.S.	New				X	X	
	Bronx	78	Hunts Point	New	X	X	X	X	X	X
		79	Parkchester		X	X	X	X	X	X
		80	Morris Park		X	X	X	X	X	X
		81	Co-op City		X	X	X	X	X	X

Table 13: NEC FUTURE Stations (continued)

Geography	County	Station ID	Station Name	Station Type	Alt 1	Alt 2	Alternative 3			
							Alt 3.1	Alt 3.2	Alt 3.3	Alt 3.4
NY (cont'd)	Westchester	82	New Rochelle	Existing	X	X	X	X	X	X
		83	Larchmont		X	X	X	X	X	X
		84	Mamaroneck		X	X	X	X	X	X
		85	Harrison		X	X	X	X	X	X
		86	Rye		X	X	X	X	X	X
		87	Cross-Westchester	New	X	X	X	X	X	X
		88	Port Chester	Existing	X	X	X	X	X	X
		151	White Plains East	New			X			X
	Putnam	153	Brewster - Katonah	New			X			X
	Nassau	146	Nassau Hub	New				X	X	
	Suffolk	148	Suffolk Hub	New				X	X	
		149	Ronkonkoma	Existing				X	X	
CT	Fairfield	89	Greenwich	Existing	X	X	X	X	X	X
		90	Cos Cob		X	X	X	X	X	X
		91	Riverside		X	X	X	X	X	X
		92	Old Greenwich		X	X	X	X	X	X
		93	Stamford		X	X	X	X	X	X
		94	Stamford H.S.	New	X					
		95	Noroton Heights	Existing	X	X	X	X	X	X
		96	Darien		X	X	X	X	X	X
		97	Rowayton		X	X	X	X	X	X
		98	South Norwalk		X	X	X	X	X	X
		99	East Norwalk		X	X	X	X	X	X
		100	Westport		X	X	X	X	X	X
		101	Greens Farms		X	X	X	X	X	X
		102	Southport		X	X	X	X	X	X
		103	Fairfield		X	X	X	X	X	X
		104	Fairfield Metro		X	X	X	X	X	X
		105	Bridgeport		X	X	X	X	X	X
		107	East Bridgeport	New	X	X	X	X	X	X
		108	Stratford	Existing	X	X	X	X	X	X
		154	Danbury	New			X			X
	New Haven	109	Milford	Existing	X	X	X	X	X	X
		110	West Haven		X	X	X	X	X	X
		111	New Haven Station		X	X	X	X	X	X
		112	New Haven Station H.S.	New		X		X	X	
		113	New Haven State Street	Existing	X	X	X	X	X	X
		156	Meriden High Speed	New		X		X	X	
		114	Branford	Existing	X	X	X	X	X	X
		115	Guilford		X	X	X	X	X	X
		116	Madison		X	X	X	X	X	X
		155	Waterbury South	New			X			X

Table 13: NEC FUTURE Stations (continued)

Geography	County	Station ID	Station Name	Station Type	Alt 1	Alt 2	Alternative 3			
							Alt 3.1	Alt 3.2	Alt 3.3	Alt 3.4
CT (cont'd)	Middlesex	117	Clinton	Existing	X	X	X	X	X	X
		118	Westbrook		X	X	X	X	X	X
		119	Old Saybrook		X	X	X	X	X	X
		120	Old Saybrook H.S.	New	X					
	New London	121	New London	Existing	X	X	X	X	X	X
		124	New London / Mystic H.S.	New	X					
		122	Mystic	Existing	X	X	X	X	X	X
	Hartford	160	West Hartford	New		X				
		160	Berlin	Existing		X				
		161	Newington	New		X				
		164	Hartford			X	X	X	X	X
	Tolland	165	Willimantic / Storrs	New		X	X	X		
		166	Tolland / Storrs						X	X
RI	Washington	123	Westerly	Existing	X	X	X	X	X	X
		125	Kingston		X	X	X	X	X	X
		126	Wickford Junction		X	X	X	X	X	X
	Kent	127	TF Green	Existing	X	X	X	X	X	X
	Providence	128	Providence Station	Existing	X	X	X	X	X	X
		129	Providence Station H.S.	New		X	X	X	X	X
		130	Pawtucket		X	X	X	X	X	X
MA	Bristol	131	South Attleboro	Existing	X	X	X	X	X	X
		132	Attleboro		X	X	X	X	X	X
		133	Mansfield		X	X	X	X	X	X
	Worcester	172	Worcester	Existing					X	X
		173	Grafton-Shrewsbury	New					X	X
		174	Westborough						X	X
		175	Blue Star Hwy (I-495)						X	X
	Middlesex	176	Southborough/Ashland	New					X	X
		178	Framingham						X	X
		181	Riverside (I-95)						X	X
	Suffolk	182	Beacon Park	New					X	X
	Norfolk	134	Sharon	Existing	X	X	X	X	X	X
		135	Canton Junction		X	X	X	X	X	X
		136	Rte 128		X	X	X	X	X	X
	Suffolk	137	Readville	Existing	X	X	X	X	X	X
		138	Hyde Park		X	X	X	X	X	X
		139	Forest Hills		X	X	X	X	X	X
		140	Ruggles Street		X	X	X	X	X	X
		141	Back Bay		X	X	X	X	X	X
		142	Back Bay H.S.	New			X	X	X	X
		143	Boston South Station	Existing	X	X	X	X	X	X

Source: NEC FUTURE team, 2015

* The airport is currently served by Regional rail service located off the existing NEC. The Philadelphia International Airport Station identified in the Action Alternatives would be built as part of the NEC FUTURE. The station area is co-located in Delaware County, PA.

H.S. = high speed

4. Station Analysis

This section describes the analysis of the travel metrics associated with station-based and station-pair-based data for representative stations and representative station-pairs. These metrics identify and quantify the potential changes in service quality for passengers.

4.1 CONNECTIVITY

Connectivity is a measure of the intensity and quality of transportation connections available to passengers at Regional rail stations. For NEC FUTURE, the FRA measured connectivity in two ways:

- Frequency: The availability of Intercity service at the station throughout the day is measured as average headway in minutes between train departures. Average headway, is an indication of how often a train is available, and how easy or convenient it is for passengers to make a trip or a connection via Intercity service.
- Hours of Service: The availability of Intercity service at the station throughout the day is measured by hours of service, which is a temporal measure of connectivity that indicates how long during the day the station serves as a useful connection point for Intercity service.

4.1.1 Frequency

Average headway is a measure of how frequently service is available at stations. The more frequently trains arrive; the more convenient it is for passengers to choose to travel via passenger rail. Shorter average headways for transportation services offer passengers more opportunities to travel, and less time spent at stations waiting to make connections to the Intercity network and last mile connections from a station to their final destination via rail. The greater the frequency of Intercity and Regional rail services at a station, the easier it is for travelers to make connections between these services at that station. Higher frequencies of service provide passengers with increased opportunities to choose a rail service that fits their needs.

The FRA calculated average headway by dividing the daily number of scheduled train departures at a station by the daily number of minutes that service is available at that station. Actual rail service at the station may be more or less frequent than the average, depending on the time of day. For example, during peak service, most Regional rail service runs more frequently, and during the late night and/or midday, service runs less frequently.

Table 14 presents the frequency of existing Intercity and Regional rail service, expressed as the average headway in minutes, for the representative stations. Shorter average headways indicate a greater frequency of service. In Table 14, Intercity includes Intercity-Express and Intercity-Corridor services on the NEC. For stations with more than one Regional rail line, the measure represents an average of each line's average headway.

Table 14: Average Headway (Minutes) by Representative Station, 2012

Station	Intercity	Regional Rail
Washington Union Station	31	66
Odenton	No Service	40
Baltimore Downtown	New Station in Action Alternatives	
Newark, DE	60	84
Wilmington	31	57
Philadelphia 30th Street	25	45
Philadelphia Market East*	No Service	45
Trenton	41	31
Newark Liberty	101	20
Newark Penn Station	27	28
Secaucus	No Service	34
Penn Station New York	26	9
New Rochelle	151	25
Cross Westchester	New Station in Action Alternatives	
Nassau Hub	New Station in Action Alternatives	
Ronkonkoma*	No Service	45
Stamford	53	20
Danbury	No Service	92
New Haven	62	49
New London	102	153
Hartford	403	No Service
Tolland/Storrs	New Station in Action Alternatives	
TF Green	No Service	104
Worcester	No Service	69
Boston South Station	52	60

*Philadelphia Market East and Ronkonkoma stations are existing Regional rail stations on new Action Alternatives alignments. These stations have existing transportation infrastructure but they are not on the NEC.
Source: Published online schedules for Amtrak, WMATA, Maryland MTA, MARC, DART, SEPTA, NJ TRANSIT, LIRR, Metro-North, MTA NYCT, Shoreline East, MBTA, 2012

Table 15 identifies the average headways of Intercity service for the No Action and Action Alternatives. For Alternative 3, the average headway is presented as a range for representative stations not served by all of the Alternative 3 route options.

Table 15: Average Intercity Headway (Minutes) by Representative Station for Action Alternatives, 2040

	No Action	Alternative 1	Alternative 2	Alternative 3
Washington Union Station	31	17	11	8
Odenton	0	46	22	19
Baltimore Downtown	0	0	0	13
Newark, DE	60	46	22	19
Wilmington	31	17	11	12
Philadelphia 30th Street	25	17	11	25
Philadelphia Market East	0	0	0	9
Trenton H.S.	41	19	15	9
Newark Liberty	101	19	15	11
Newark Penn/Newark H.S.	27	14	10	7
Secaucus	0	0	19	12
Penn Station New York	26	14	10	7
New Rochelle	151	33	17	17
Cross-Westchester	0	33	16	21
Nassau Hub	0	0	0	0–14*
Ronkonkoma	0	0	0	0–14*
Stamford/Stamford H.S.	53	22	11	16
Danbury	0	0	0	0–22*
New Haven/New Haven H.S.	62	22	11	12
New London	102	175	58	43
Hartford/Hartford H.S.	403	67	10	8
Tolland/Storrs	0	0	0	0–21*
TF Green	0	39	41	43
Worcester	0	0	0	0–14*
Boston South Station	52	23	10	8

Source: NEC FUTURE team, 2015

* These stations have service in only two of the four Alternative 3 route options. Their average headways are represented as a range from zero (in the scenarios where there is no service) to an average of the headways for the two route options with service.

.

4.1.2 Daily Hours of Service

Greater hours of service per day increase the availability of transportation services at that station for passengers. Stations that offer more hours of service for both Intercity and Regional rail modes increase the opportunities for connected transportation services between those modes.

Daily hours of service measures the number of hours in an average 24-hour weekday that passenger rail service is available. Longer service periods create opportunities for more convenient service. Stations with very limited hours of service require passengers to plan their travel within the limited service window. Passengers have more flexibility in deciding when to travel if service is available in the early morning, throughout the midday, in the evening, and late at night (an 18-hour service day or longer). Table 16 presents the existing hours of service for Intercity and Regional rail at the representative stations, and Table 17 demonstrates the daily hours of service for Intercity service at each of the Representative stations for the No Action Alternative and Action Alternatives.

Table 16: Daily Hours of Service by Representative Station, 2012

Station	Intercity	Regional Rail
Washington Union Station	18	12
Odenton	No Service	17
Baltimore Downtown	New Station in Action Alternatives	
Newark, DE	1	14
Wilmington	19	15
Philadelphia 30th Street	19	18
Philadelphia Market East*	No Service	18
Trenton	20	20
Newark Liberty	15	20
Newark Penn Station	20	20
Secaucus	No Service	19
Penn Station New York	20	24
New Rochelle	13	20
Cross-Westchester	New Station in Action Alternatives	
Nassau Hub	New Station in Action Alternatives	
Ronkonkoma*	No Service	22
Stamford	17	20
Danbury	No Service	17
New Haven	21	18
New London	17	15
Hartford	13	No Service
Tolland/Storrs	New Station in Action Alternatives	
TF Green	No Service	17
Worcester	No Service	19
Boston South Station	16	17

Source: Published online schedules for Amtrak, WMATA, Maryland MTA, MARC, DART, SEPTA, NJ Transit, LIRR, Metro-North, MTA NYCT, Shoreline East, MBTA, 2012

*Market East and Ronkonkoma stations are existing Regional rail stations on Action Alternatives new segments. These stations have existing transportation infrastructure but they are not on the NEC Spine.

Table 17: Daily Hours of Intercity Service by Representative Station for No Action and Action Alternatives, 2040

Station	No Action	Alternative 1	Alternative 2	Alternative 3
Washington Union Station	18	20	20	20
Odenton	—	17	17	18
Baltimore Downtown	—	—	—	18
Newark, DE	1	17	17	18
Wilmington	19	20	20	20
Philadelphia 30th Street	19	20	20	20
Philadelphia Market East*	—	—	—	18
Trenton	20	20	20	20
Newark Liberty	15	20	20	20
Newark Penn Station	20	20	20	20
Secaucus	—	—	17	18
Penn Station New York	20	20	20	21
New Rochelle	13	21	22	22
Cross-Westchester	—	21	18	18
Nassau Hub	—	—	—	0–19*
Ronkonkoma*	—	—	—	0–19*
Stamford	17	21	22	22
Danbury	—	—	—	0–17*
New Haven	21	21	22	22
New London	17	18	17	18
Hartford	13	15	18	18
Tolland/Storrs	—	—	—	0–17*
TF Green	—	18	17	18
Worcester	—	—	—	0–18*
Boston South Station	16	19	18	19

Source: NEC FUTURE team, 2015
*Average headway for the Alternative 3 route options for stations served by Intercity.
— = Not applicable within that alternative/route option.

4.2 ACCESSIBILITY

Accessibility describes the travel modes available for passengers to arrive or depart from a passenger rail station. For NEC FUTURE, the FRA measured accessibility of stations in three major categories:

- Via the multimodal transit network, including access to the station with Intercity, Regional rail, public transportation modes, and via intercity bus.
- Via private automobile, including a determination of the level of traffic congestion near the station, and the availability of station-related parking.
- Via independent and shared modes of transportation, including access to the station through pedestrian, cycling, carshare, car rental, and taxi. The assessment for independent modes also considered the station environment, (CBD, urban, suburban, or airport).

The FRA also considered that station accessibility is partially a function of the physical location of a station. For instance, an airport station is not expected to feature extensive pedestrian amenities. However, a station in a business district is evaluated for its accessibility to cyclists, transit users, pedestrians, and taxis.

4.2.1 Transit

The FRA examined the representative stations to determine the degree to which they are linked to the multi-modal transportation network. The greater the number of modes available at stations the greater the number of people who have access to the station and the greater the geographic reach of the station into the city and region.

The FRA assessed the multi-modal accessibility of existing stations by examining published rail and transit schedules. The presence of a multi-modal stop in the schedule at the station was assigned a "Yes" or "No." The modes evaluated include:

- **Intercity rail**
- **Regional rail**
- **Public transit, excluding bus**
- **Public transit bus**
- **Intercity bus (private carriers)**

Table 18 outlines the availability Intercity-Express, Intercity-Corridor, Regional rail, public transit modes, and intercity bus service at each representative station. The "Public transit excl. Bus" category includes rail-based transit modes such as subway, trolley, and light rail. Table 18 also includes the availability of pedestrian, cyclist, or automobile network connections by representative station.

Some rail stations, such as Washington Union Station, Philadelphia 30th Street Station, Penn Station New York, and Boston South Station have a high degree of accessibility. Other stations have a more moderate degree of accessibility with one or both types of Intercity service, Regional rail service, but without some public transit modes or without intercity bus. For example, the New Rochelle Station today is served by Intercity-Corridor service, Regional rail, and public transit bus service, but is not accessible via Intercity-Express, rail-based public transit, or intercity bus.

Some stations have a more limited set of connections available because they lack Intercity service. For example, Danbury, a station included in two of the four Alternative 3 route options, is not currently served by Intercity trains. The station has Regional rail service and public transit bus service, but is not connected to a rail-based public transit network and is not served by intercity bus.

Table 18: Transit Service by Representative Station

Station	Intercity-Express	Intercity-Corridor	Regional Rail	Public Transit excl. Bus	Public Transit Bus	Intercity Bus
Washington Union Station	Yes	Yes	Yes	Yes	Yes	Yes
Odenton	No	No	Yes	No	Yes	No
Baltimore Downtown	New Station in Action Alternatives					
Newark, DE	No	Yes	Yes	No	Yes	No
Wilmington	Yes	Yes	Yes	No	Yes	Yes
Philadelphia 30th Street	Yes	Yes	Yes	Yes	Yes	Yes
Philadelphia Market East*	No	No	Yes	Yes	Yes	Yes
Trenton	Yes	Yes	Yes	Yes	Yes	No
Newark Liberty	No	Yes	Yes	No	No	No
Newark Penn Station	Yes	Yes	Yes	Yes	Yes	Yes
Secaucus	No	No	Yes	No	Yes	No
Penn Station New York	Yes	Yes	Yes	Yes	Yes	Yes
New Rochelle	No	Yes	Yes	No	Yes	No
Cross-Westchester	New Station in Action Alternatives					
Nassau Hub	New Station in Action Alternatives					
Ronkonkoma*	No	No	Yes	No	Yes	No
Stamford	Yes	Yes	Yes	No	Yes	Yes
Danbury	No	No	Yes	No	Yes	No
New Haven	Yes	Yes	Yes	No	Yes	Yes
New London	Yes	Yes	Yes	No	Yes	No
Hartford	No	Yes	No	No	Yes	No
Tolland/Storrs	New Station in Action Alternatives					
TF Green	No	No	Yes	No	Yes	No
Worcester	No	No	Yes	No	Yes	No
Boston South Station	Yes	Yes	Yes	Yes	Yes	Yes

Source: NEC FUTURE team, 2015
*Market East and Ronkonkoma stations are existing Regional rail stations on Action Alternatives routes. These stations have existing transportation infrastructure but they are not on the NEC Spine.

4.2.2 Private Automobiles

Vehicular accessibility is especially important for travelers whose origin or destination is far from the station, not accessible via the Regional rail or transit network, or who may be making a journey to the station from outside the metropolitan area. Travelers with luggage may also find accessing a station via personal vehicle is more convenient than other modes. As such, the FRA examined representative stations assess to identify if the station is accessible via private vehicle, the level of vehicular congestion, and the availability of parking.

The analysis measures the following:

- **Vehicle Accessible**: a determination of whether each station is accessible via personal vehicle with a Yes/No categorization.
- **Adjacent Roadway Congestion**: a determination of recurring roadway traffic congestion near the station and scored “High” (regular peak and off-peak congestion); “Medium” (Regular Peak Period Congestion); and “Low” (Occasional Peak Period Congestion or Uncongested).

- **Parking Inventory**: the number of parking spaces at or immediately adjacent to the station available. An inventory of parking spots provides insight on the degree to which stations are designed for access by users of the highway and roadway networks.

Table 19 presents the results of this examination.

Table 19: Private Automobile Access by Representative Station

Station	Automobile Accessible	Adjacent Roadway Congestion	Parking Inventory*
Washington Union Station	Yes	Medium	1,000
Odenton	Yes	Low	1,977
Baltimore Downtown	—	High	—
Newark, DE	Yes	Low	368
Wilmington	Yes	Medium	606
Philadelphia 30th Street	Yes	High	1,855
Philadelphia Market East	Yes	High	0
Trenton	Yes	Medium	2,300
Newark Liberty	No	Medium	—
Newark, NJ	Yes	High	400
Secaucus	Yes	High	1,094
New York Penn	Yes	High	0
New Rochelle	Yes	Medium	200
Cross-Westchester	—	—	—
Nassau Hub	—	Medium	—
Ronkonkoma	Yes	Medium	6,100
Stamford	Yes	Medium	600
Danbury	Yes	Low	147
New Haven	Yes	Medium	1,200
New London	Yes	Low	500
Hartford	Yes	Medium	161
Tolland/Storrs	—	Low	—
TF Green	Yes	Low	650
Boston South Station	Yes	High	446

Source: NEC FUTURE team, 2015

*This is a measure of the number of parking spaces associated with the station and does not include municipal, public, or available parking in the vicinity of the station.

— = Not applicable within that alternative/route option.

4.2.3 Independent and Shared Modes of Transportation

In addition to personal automobile accessibility, the FRA reviewed representative stations to evaluate the station environment and accessibility for pedestrians, cyclists, and users of carshare, rental cars, and taxis.

The type of station environment (CBD, urban, suburban, or airport) is a descriptive measure that assesses the context of the station's physical situation in terms of urban form, fabric, accessibility, and environment. The FRA assumed stations in a CBD or urban environment to have better non-personal-vehicle accessibility, closer access to more jobs, access to more commercial opportunities and businesses, and residential neighborhoods with more activities available around the immediate station area. Similarly, stations in a suburban environment were assumed to have a higher focus on automobile access compared to non-automobile access and fewer jobs and activities in the immediate station area. Stations in an airport environment were assumed not to be connected to any transportation networks other than walking or shuttle access directly into the airport.

Crosswalks and walking paths create a pedestrian network that accommodates station access for walkers. Stations with pedestrian amenities are accessible to travelers without the need for any other means of transportation. Similarly, a bicycle network makes cycling to a station a safer and more desirable option. Cycling allows travelers to access a station with a very low level of investment in a transportation mode. Available bicycle parking, in particular secure and weather protected parking, is another element that can make cycling easier and more attractive.

Carshare and rental car accessibility allows travelers to arrive at or depart from a station without the use of a personal automobile. Typically, a carshare service has a membership fee that ranges from $0 to about $250 a year, and members pay a fee for hourly or mileage based usage ranging from $0 to about $90 a day, depending on the membership type. Examples of carshare services include ZipCar and Enterprise CarShare.

Rental car users pay a fee based on hours and mileage ranging from about $70 to about $200+ per day, depending on the car and location. Examples of car rentals include Enterprise, Hertz, and Avis. The major carshare and rental car companies have a presence throughout the Study Area and a traveler from Boston is able to use their membership or rent a car just as easily in Boston as in Washington, D.C. Due to the state of technology, the ubiquitous nature of both carshare and rental car companies throughout the Study Area, and the changing nature of ownership in both modes (Enterprise now operates extensive carshare and rental car markets), the accessibility for carshare and rental cars are measured together.

Provisions for taxis means that a station is equipped for taxi service and that a traveler arriving at that station can reasonably expect that there will be a taxi queue with vehicles available. The availability of taxis is an important measure for passengers arriving at a station that need to make a connection to their final destination and travelers with tight schedules must be able to rely on getting into a taxi at the station in a timely manner.

The analysis measures the following:

- **Station Environment:** identifies the land use within which the station resides (CBD, Urban Suburban, Rural or Airport) based on station location.
- **Pedestrian Network:** measures the quality of the Pedestrian Network connection at stations to the adjacent pedestrian facilities. A "High" degree of pedestrian connectivity means that roadways with sidewalks are available from four directions and the sidewalk network around the station is complete; a "Medium" degree of pedestrian connectivity means that roadways with sidewalks are available from three directions and the sidewalk network around the station is incomplete; a "Low" degree of pedestrian connectivity means that roadways with sidewalks are available from one or two directions and the sidewalk network around the station is incomplete; a "Poor" degree of pedestrian connectivity means that the station is not accessible for pedestrians and this includes stations that are not connected to the roadway network (such as airport stations) or stations that are only accessible via the interstate or highway or stations with no sidewalks leading to the station.
- **Bicycle Accessibility:** A "High" degree of bicycle connectivity means that dedicated separated or protected cyclist infrastructure is available. A "Medium" degree of bicycle connectivity means that unprotected bicycle infrastructure (e.g., buffered lanes) is available. A "Low" degree of bicycle connectivity means that there are bicycle-accessible roadways but no bicycle-specific separate infrastructure (e.g., sharrows or no markings) is available. A "Poor" degree of bicycle infrastructure means that the station is not accessible via bicycle and this includes stations that are not connected to the road network (such as airport stations) or stations that are only accessible via the interstate or highway.
- **Carshare and Rental Car Availability:** identifies the degree of convenience and access for travelers needing short term access to a vehicle. A "High" degree of carshare and rental car accessibility means that a carshare or rental car available within the station or curbside adjacent to the station. A "Medium" degree of carshare or rental car accessibility means that a carshare or rental car is available within one-half mile of station. A "Low" degree of carshare or rental car accessibility means that a carshare or rental car available between one-half mile and one mile of station; and a "Poor" degree of carshare or rental car accessibility means that a carshare or rental car not available within one mile of station.
- **Provision for Taxis:** identifies the presence of a regular taxi queue at the station and scored as a Yes/No based on the presence of a regular queue of taxi service at station.

Table 20 presents the results of this examination.

Table 20: Independent and Shared Access by Representative Station

Station	Station Environment	Pedestrian Network	Bicycle Accessibility	Carshare and Rental Car Availability	Provision for Taxis
Washington Union Station	CBD	High	Low	High	Yes
Odenton	Suburb	Medium	Low	Poor	No
Baltimore Downtown	Urban	—	—	—	—
Newark, DE	Suburb	Medium	Low	Low	No
Wilmington	CBD	Medium	Medium	High	Yes
Philadelphia 30th Street	Urban	Med	Low	High	Yes
Philadelphia Market East	CBD	High	Low	High	TBD
Trenton	Urban	Medium	Low	Poor	No
Newark Liberty	Airport	Poor	Poor	High	No
Newark Penn Station	CBD	High	Low	Low	Yes
Secaucus	Suburb	Poor	Poor	Medium	Yes
Penn Station New York	CBD	High	High	High	Yes
New Rochelle	Suburb	Medium	Low	High	Yes
Cross-Westchester	Suburb	—	—	—	—
Nassau Hub	Suburb	—	—	—	—
Ronkonkoma	Suburb	Medium	Low	Poor	Yes
Stamford	Urban	Medium	Low	High	Yes
Danbury	Suburb	Medium	Low	Low	No
New Haven	Urban	High	Low	High	Yes
New London	Urban	High	Low	Poor	No
Hartford	CBD	High	Low	Low	Yes
Tolland/Storrs	Suburb	—	—	—	—
TF Green	Suburb	High	Low	High	No
Boston South Station	CBD	High	Medium	High	Yes

Source: NEC FUTURE Project team, 2015
— = Not applicable within that alternative/route option.

4.3 CAPACITY

Existing stations serving the Intercity and Regional rail services are considered to have generally adequate capacity in terms of platforms, concourse sizing, ticketing, and compatibility with equipment to serve the present-day level of service. However, many stations have some measure of capacity constraint, which could result in a degradation of station operations and functionality as the level of service at the station increases with the Action Alternatives.

In 2040, accessibility at the representative stations will depend on a number of factors, including the frequency of Intercity and Regional rail service, and changes to public transit and transportation networks. For example, cities that currently lack rail-based public transit may have built new systems by 2040. In response, the FRA has developed classifications for stations for the No Action Alternative and Action Alternatives based on a presumption of anticipated passenger volumes, estimated future metropolitan area populations, modeled Intercity service volumes, and modeled Regional rail operations to estimate what type of station classification best fits the service and passenger volumes expected. Changes in accessibility related to public transit, intercity bus,

pedestrian networks, bicycle networks, and personal automobile use have not been estimated, but the changes in Intercity service and station classification can indicate whether existing levels of accessibility may be enough to meet future needs within the Action Alternatives.

Through the station identification process, the FRA qualitatively examined stations for the degree to which the service levels presumed as part of the No Action Alternative and Action Alternatives require station upgrades and station expansion. Table 21 identifies the type of capital improvement anticipated at the representative stations.

Definitions for the proposed station modifications used in Table 21 include the following:

- **New**: Construction of a new station
- **Expand**: Station will expand with additional tracks or platforms to accommodate additional trains or more frequent service.

Table 21: Potential Capital Improvements by Representative Station

Representative Station	Existing Station Type	Future Station Type	Station Modification Type
Washington Union Station	Major Hub	Major Hub	Expand
Odenton	Local	Hub	Expand
Baltimore Downtown	—	Major Hub	New
Newark, DE	Hub	Hub	Expand
Wilmington	Major Hub	Major Hub	Expand
Philadelphia 30th Street	Major Hub	Major Hub	Expand
Philadelphia Market East	—	Major Hub	New
Trenton	Hub	Hub	Expand
Newark Liberty	Hub	Hub	Expand
Newark Penn Station	Major Hub	Major Hub	Expand
Secaucus	Local	Hub	Expand
Penn Station New York	Major Hub	Major Hub	Expand
New Rochelle	Hub	Hub	Expand
Cross-Westchester	—	Hub	New
Nassau Hub	—	Hub	New
Ronkonkoma	Local	Hub	Expand
Stamford	Major Hub	Major Hub	Expand
Danbury	—	Hub	New
New Haven	Major Hub	Major Hub	Expand
New London	Hub	Hub	Expand
Hartford	Hub	Major Hub	Expand
Tolland/Storrs	—	Hub	New
TF Green	Local	Hub	Expand
Worcester	Local	Hub	Expand
Boston South Station	Major Hub	Major Hub	Expand

Source: NEC FUTURE team, 2015

— = Not applicable within that alternative/route option or not yet determined.

4.4 TRAVEL TIME

The Action Alternatives result in savings of travel time for users of both the Intercity and the Regional rail network. Table 22 shows the average travel time (hours:minutes) between representative station-pairs for the No Action and Action Alternatives. For Alternative 3, an average is provided of the four route options. Table 23 shows the average travel time between representative station pairs for each Alternative 3 route option.

Table 22: Average Travel Time (Hours:Minutes) by Representative Station-Pair for No Action and Action Alternatives, 2040

Average Station to Station Travel Time		No Action		Alt. 1		Alt. 2		Alt. 3*	
Station 1	Station 2	Intercity-Express	Intercity-Corridor	Intercity-Express	Intercity-Corridor	Intercity-Express	Intercity-Corridor	Intercity-Express	Intercity-Corridor
Washington Union Station	Philadelphia	1:37	1:55	1:37	1:49	1:29	1:46	1:04	1:40
Washington Union Station	Penn Station New York	2:47	3:23	2:43	3:08	2:26	3:01	1:48	2:51
Washington Union Station	Boston South Station	6:33	8:02	5:45	6:57	5:07	6:22	3:57	5:47
Washington Union Station	Newark, DE		1:24		1:25		1:19		1:11
Philadelphia	Odenton				1:39		1:32		1:21
Penn Station New York	Baltimore	2:11	2:39	2:11	2:30	1:56	2:24	1:29	2:16
Penn Station New York	Wilmington	1:28	1:49	1:28	1:41	1:15	1:37	1:08	1:31
Ronkonkoma	Baltimore							1:58	2:56
Penn Station New York	Philadelphia	1:07	1:23	1:04	1:18	0:55	1:11	0:43	1:11
Boston South Station	Philadelphia	4:53	6:00	4:06	4:59	3:36	4:24	2:52	3:53
Nassau Hub	Trenton								1:11
Danbury	Newark Penn Station								1:01
New Haven Station	Newark Penn Station	1:59	2:16	1:36	1:43	1:24	1:34	1:14	1:31
Stamford	Secaucus						0:51		0:53
Boston South Station	Penn Station New York	3:31	4:13	2:54	3:34	2:33	3:15	2:01	2:45
Hartford	Ronkonkoma							0:39	0:42
Boston South Station	Tolland / Storrs								0:49

Source: NEC FUTURE team, 2015

* Average for Alternative 3 route options with service between station-pairs

Travel times for Philadelphia and Baltimore include an average of travel times for Philadelphia Market East and Philadelphia 30th Street and Baltimore Penn Station and Baltimore Downtown, respectively.

Blank cell = No service

Table 23: Average Travel Time (Hours:Minutes) by Representative Station-Pair for Alternative 3 Route Option, 2040

Average Station to Station Travel Time		Alternative 3.1		Alternative 3.2		Alternative 3.3		Alternative 3.4	
Station 1	Station 2	Intercity-Express	Intercity-Corridor	Intercity-Express	Intercity-Corridor	Intercity-Express	Intercity-Corridor	Intercity-Express	Intercity-Corridor
Washington Union Station	Philadelphia	1:04	1:38	1:04	1:38	1:05	1:38	1:05	1:38
Washington Union Station	Penn Station New York	1:47	2:51	1:48	2:51	1:47	2:51	1:48	2:51
Washington Union Station	Boston South Station	3:52	5:44	3:54	5:53	4:03	5:48	4:01	5:44
Washington Union Station	Newark, DE		1:11		1:11		1:11		1:11
Philadelphia	Odenton		1:18		1:18		1:18		1:18
Penn Station New York	Baltimore	1:29	2:12	1:29	2:12	1:29	2:12	1:29	2:12
Penn Station New York	Wilmington	1:08	1:31	1:08	1:31	1:08	1:31	1:08	1:31
Ronkonkoma	Baltimore			1:58	2:58	1:58	2:54		
Penn Station New York	Philadelphia	0:43	1:08	0:43	1:07	0:42	1:08	0:43	1:07
Boston South Station	Philadelphia	2:47	3:23	2:49	3:39	2:58	3:30	2:56	3:22
Nassau Hub	Trenton				1:11		1:11		
Danbury	Newark Penn Station		1:01						1:01
New Haven Station	Newark Penn Station	1:22	1:35	1:07	1:27	1:07	1:26	1:21	1:35
Stamford	Secaucus		0:53		0:53		0:53		0:53
Boston South Station	Penn Station New York	1:57	2:43	1:57	2:49	2:07	2:47	2:03	2:42
Hartford	Ronkonkoma			0:41	0:43	0:37	0:41		
Boston South Station	Tolland / Storrs						0:50		0:49

Source: NEC FUTURE team, 2015

Note: Blank cell = No service

Alternative 3.1 = via Central CT/Providence route option; Alternative 3.2 = via Long Island/Providence route option; Alternative 3.3 = via Long Island/Worcester route option; Alternative 3.4 = via Central CT/Worcester route option

Travel times for Philadelphia and Baltimore include an average of travel times for Philadelphia Market East and Philadelphia 30th Street and Baltimore Penn Station and Baltimore Downtown, respectively.

In The No Action Alternative, a trip between Washington, D.C., and Boston takes 6:41 on an Intercity-Express train and 8:10 on an Intercity-Corridor train. In Alternative 1, those times are reduced to 5:45 and 6:55, a travel time savings of 14 percent on the Intercity-Express trip and 15 percent on the Intercity-Corridor trip. In Alternative 2 those times are reduced to 5:07 and 6:07, a travel time savings for 35 percent on the Intercity-Express trip and 25 percent on the Intercity-Corridor trip. In the Alternative 3 scenarios the Intercity-Express trip is reduced to 3:52 to 4:03, a travel time savings of 39 percent to 42 percent. In the Alternative 3 route options, the Intercity-Corridor trip is reduced to 5:31 to 5:42, a travel time savings of 30 percent to 32 percent.

4.5 FREQUENCY

The Action Alternatives also result in an increase in the number of Intercity trains per day. Table 24 shows the number of trains per day between representative station-pairs for the No Action and

Action Alternatives, and Table 25 shows the number of trains per day between the representative stations-pairs for the Alternative 3 route options. The FRA identified the number of trains per day between station pairs to represent the number of options that passenger rail travelers have to make these specific train pair journeys. The more trips that are offered during the day the more options a passenger has to make that journey and the more convenient the rail journey is. All of the Action Alternatives represent an increase in the number of trips per day offered between all of the representative station-pairs.

Between Boston and Washington, D.C., the No Action Alternative includes 9 Intercity-Express and 8 Intercity-Corridor trips while Alternative 1 includes 16 and 24, Alternative 2 includes 27 and 27, and Alternative 3 includes 59–62 and 42–43 trips. The Alternative 3 route options represent a nearly five-fold increase in service between Boston and Washington. This pattern is true for many of the representative station-pairs. This results in rail travel options that are more convenient for rail travelers and greatly increased rail connectivity between the representative station-pair markets.

The introduction of Metropolitan service as a subset of Intercity-Corridor expands connections between adjacent or proximate markets, resulting in added frequency and expanded travel choices. Examples of rail station pairs that experience significant changes in number of Intercity trains per day from the No Action Alternative to the Action Alternatives include:

- **Washington Union Station-Penn Station New York**: For the No Action Alternative, the number of trains per day southbound for combined Intercity services is 36 trains per day in the No Action Alternative; under Alternative 1, there are 70 trains per day; under Alternative 2, there are 96 trains per day; and under Alternative 3 (maximum), there are 152 trains per day. Alternative 3 results in an Intercity train from New York City to Washington, D.C., averaging a departure every 10 minutes.
- **Hartford-Stamford**: For the No Action Alternative, the number of trains per day southbound from Hartford to Stamford is 2; under Alternative 1, there are 9 southbound Intercity trains per day; under Alternative 2, there are 100 trains per day; and under the Alternative 3 (maximum), there are 60. Alternative 2 results in an Intercity train from Hartford to Stamford averaging a departure every 14 minutes.
- **Philadelphia 30th Street-BWI Airport:** For the No Action Alternative, the number of combined Intercity trains per day southbound from Philadelphia 30th Street to BWI Airport is 31; under Alternative 1 the number of Intercity trains per day southbound is 71; under Alternative 2 the number of Intercity trains per day is 111; and under Alternative 3 (maximum), the number of combined Intercity trains per day is 48, due to the introduction of trains to Philadelphia Market East. Alternative 2 results in an Intercity train from Philadelphia 30th Street to BWI Airport every 13 minutes.

Table 24: Number of Intercity Trains per Day by Representative Station-Pair by No Action and Action Alternatives, 2040

Station 1	Station 2	No Action		Alt. 1		Alt. 2		Alt. 3*	
		Intercity-Express	Intercity-Corridor	Intercity-Express	Intercity-Corridor	Intercity-Express	Intercity-Corridor	Intercity-Express	Intercity-Corridor
Washington Union Station	Philadelphia	16	22	24	46	41	69	74	80
Washington Union Station	Penn Station New York	16	22	24	45	41	54	74	76
Washington Union Station	Boston South Station	10	8	16	24	27	30	60	45
Washington Union Station	Newark, DE	—	1	—	22	—	46	—	57
Philadelphia	Odenton	—	—	—	22	—	46	—	57
Penn Station New York	Baltimore	16	22	24	45	41	54	53	76
Penn Station New York	Wilmington	16	22	24	45	41	54	21	76
Ronkonkoma	Baltimore	—	—	—	—	—	—	28	29
Penn Station New York	Philadelphia	16	32	24	62	41	77	74	110
Boston South Station	Philadelphia	10	8	16	26	27	45	60	50
Nassau Hub	Trenton	—	—	—	—	—	—	—	33
Danbury	Newark Penn Station	—	—	—	—	—	—	—	34
New Haven Station	Newark Penn Station	9	10	16	35	27	58	31	62
Stamford	Secaucus	—	—	—	—	—	47	—	35
Boston South Station	Penn Station New York	10	9	19	28	42	50	75	72
Hartford	Ronkonkoma	—	—	—	—	—	—	32	44
Boston South Station	Tolland / Storrs	—	—	—	—	—	—	—	46

Source: NEC Model, 2015

* Average for Alternative 3 route options with service between station pairs

— = Not applicable within that alternative/route option or not yet determined.

Frequencies for Philadelphia and Baltimore are included for both Philadelphia Market East and Philadelphia 30th Street and both Baltimore Penn Station and Baltimore Downtown, respectively.

Table 25: Number of Intercity Trains per Day by Representative Station-Pair for Alternative 3 Route Options, 2040

Station 1	Station 2	Alternative 3.1		Alternative 3.2		Alternative 3.3		Alternative 3.4	
		Intercity Express	Intercity Corridor	Intercity Express	Intercity Corridor	Intercity Express	Intercity Corridor	Intercity Express	Intercity Corridor
Washington Union Station	Philadelphia	73	79	73	80	73	79	75	80
Washington Union Station	Penn Station New York	73	75	73	76	73	75	75	76
Washington Union Station	Boston South Station	59	45	59	45	60	45	62	46
Washington Union Station	Newark, DE	—	56	—	57	—	56	—	57
Philadelphia	Odenton	—	56	—	57	—	56	—	57
Penn Station New York	Baltimore	52	75	52	76	52	75	54	76
Penn Station New York	Wilmington	20	75	20	76	20	75	22	76
Ronkonkoma	Baltimore	—	—	28	29	28	29	—	—
Penn Station New York	Philadelphia	73	108	73	112	73	108	75	110
Boston	Philadelphia	59	49	59	51	60	48	62	52
Nassau Hub	Trenton	—	—	—	33	—	33	—	—
Danbury	Newark Penn Station	—	34	—	—	—	—	—	34
New Haven Station	Newark Penn Station	16	44	44	78	44	78	19	46
Stamford	Secaucus	—	33	—	36	—	34	—	35
Boston South Station	Penn Station New York	75	72	75	70	75	72	76	72
Hartford	Ronkonkoma	—	—	32	43	32	44	—	—
Boston South Station	Tolland / Storrs	—	—	—	—	—	46	—	46

Source: NEC Model, 2015

— = Not applicable within that alternative/route option or not yet determined.

Note: Alternative 3.1 = via Central CT/Providence route option; Alternative 3.2 = via Long Island/Providence route option; Alternative 3.3 = via Long Island/Worcester route option; Alternative 3.4 = via Central CT/Worcester route option
Frequencies for Philadelphia and Baltimore are included for both Philadelphia Market East and Philadelphia 30th Street and both Baltimore Penn Station and Baltimore Downtown, respectively.