B&P TUNNEL PROJECT

DRAFT ENVIRONMENTAL IMPACT STATEMENT & SECTION 4(f) EVALUATION

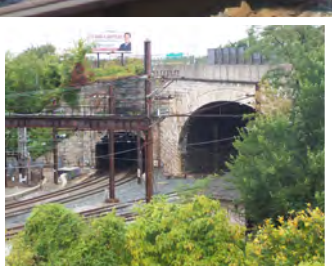
BALTIMORE & POTOMAC TUNNEL PROJECT

BALTIMORE, MARYLAND

DECEMBER 2015

U.S. Department of Transportation
Federal Railroad Administration

Maryland Department of Transportation



Baltimore and Potomac (B&P) Tunnel Project

Draft Environmental Impact Statement
&
Section 4(f) Evaluation

Prepared by:

Federal Railroad Administration

Cooperating Agency

Federal Transit Administration

Pursuant to:

National Environmental Policy Act (42 U.S.C § 4321 *et seq.*), and implementing regulations (40 C.F.R. Part 1500 *et seq.*), Federal Railroad Administration (FRA) Procedures for Considering Environmental Impacts (64 Federal Register [FR] 28545 [May 26, 1999] and 78 FR 2713 [January 14, 2013])., Section 4(f) of the U.S. Department of Transportation Act (49 USC § 303); National Historic Preservation Act (54 USC § 306101 et seq.) and implementing regulations (36 CFR Part 800); Clean Air Act as amended (42 USC § 7401 *et seq.*) and implementing regulations (40 CFR Parts 51 and 93); the Endangered Species Act of 1973 (16 USC § 1531 *et seq.*) and implementing regulations (50 CFR Part 402); the Clean Water Act (33 USC § 1251 *et seq.*) and implementing regulations (33 CFR Part 320 *et seq.* and 40 CFR Part 230); and the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (42 USC § 4601 *et seq.*).

Dec. 8, 2015
Date of Approval

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The Baltimore and Potomac (B&P) Tunnel Project Draft Environmental Impact Statement (Draft EIS) and Section 4(f) Evaluation describes existing environmental conditions within the Study Area and provides an analysis of impacts on environmental resources of the Baltimore and Potomac (B&P) Tunnel Project. The primary purpose of the Project is to address the structural and operational deficiencies of the existing B&P Tunnel, improve passenger rail services, and support existing and future demands along the Northeast Corridor. FRA has evaluated four alternatives, including the No-Build Alternative (Alternative 1), Alternative 3A, Alternative 3B, and Alternative 3C. FRA retained these alternatives following a comprehensive alternatives development and evaluation process that incorporated input from the public as well as federal, state, and local government agencies.

FRA is making the B&P Tunnel Project Draft EIS and Section 4(f) Evaluation available for public review at the B&P Tunnel Project website (www.bptunnel.com).

Printed copies have been placed in the following locations:

Baltimore City Department of Transportation, Transit Bureau
Bentalou Recreation Center
Bon Secours Community Works
Enoch Pratt Library-Central Branch
Enoch Pratt Library-Edmondson Avenue Branch
Enoch Pratt Library-Pennsylvania Avenue Branch
Enoch Pratt Library-Walbrook Branch
John Eagar Howard Recreation Center
Maryland Department of Transportation
Maryland Transit Administration

Comments on this document are due by **February 5, 2016** and may be submitted via postal mail to 81 Mosher Street, Baltimore, MD 21217; through the online comment form (www.bptunnel.com); or by e-mail to info@bptunnel.com.

EXECUTIVE SUMMARY

The Baltimore and Potomac (B&P) Tunnel Project ("Project") considers the rehabilitation or replacement of a 1.4-mile long rail tunnel located along the Northeast Corridor (NEC) in Baltimore, Maryland. The B&P Tunnel is owned by the National Railroad Passenger Corporation (Amtrak) and used for Regional and Acela intercity rail passenger trains, Maryland Area Rail Commuter (MARC) passenger trains, and Norfolk Southern Railway (NS) freight trains.

This Draft Environmental Impact Statement (DEIS) and Section 4(f) Evaluation analyzes impacts of the Project on the natural and human environment. The Federal Railroad Administration (FRA), as the lead federal agency, and the Maryland Department of Transportation (MDOT) prepared the document in accordance with the National Environmental Policy Act, 42 U.S.C. § 4321 *et seq.* (NEPA) to assist readers in understanding the B&P Tunnel Project, the environmental review process, alternatives evaluated, potential environmental effects and consequences, and mitigation measures. The Federal Transit Administration (FTA) is involved with the development of the Project through the NEPA process as a cooperating agency in accordance CEQ regulation 40 CFR 1508.5.

A. Overview of the NEPA Process

The DEIS for the B&P Tunnel Project is a milestone within the NEPA process for the Project. The DEIS provides a description of the alternatives that are still under consideration and presents impacts at a level of detail appropriate to evaluate the alternatives. The DEIS also provides documentation of the project decisions, including the Purpose and Need for the Project, background information on the Project, a description of the affected environment in the Study Area, and information on the public involvement and agency coordination that has occurred throughout the DEIS phase of the Project. Technical Reports prepared for the Project were coordinated with the public throughout the development the project and are available on the project website at www.bptunnel.com.

Subsequent to this DEIS, a Public Hearing will be held to receive public input and comments on the DEIS. Comments on the DEIS will be received through February 5, 2016. Following the Public Hearing and comment period for the DEIS, FRA in coordination with MDOT and Amtrak will identify a Preferred Alternative for the B&P Tunnel Project. The Preferred Alternative could be Alternative 1: No Build, Alternative 3A, Alternative 3B, Alternative 3C, or some refinement of any of these alternatives. The identification of the Preferred Alternative will be based on an assessment of how the Preferred Alternative meets Purpose and Need; an assessment of rail operations, engineering, transportation, cost, construction; an assessment of all environmental impacts; and on public and agency comments received.

Two additional steps in the NEPA process include the Final Environmental Impact Statement (FEIS) and Record of Decision (ROD). FRA in coordination with MDOT will prepare a FEIS to address comments received on the DEIS and document the identification of the Preferred Alternative. The ROD is the final step in the NEPA process. Following the receipt of comments on the FEIS, FRA will issue the ROD as the formal decision document for the selected alternative for the Project.

B. Project Background

The existing B&P Tunnel is located beneath the West Baltimore neighborhoods of Bolton Hill, Madison Park, Sandtown-Winchester, and Upton as shown in **Figure 1**. The existing tunnel is currently used by Amtrak, MARC, and NS. Built in 1873, the existing tunnel is one of the oldest structures on the NEC. It is approximately 7,500 feet (1.4 miles) long, and is comprised of three shorter tunnels and two daylighted sections. The double-track tunnel was originally constructed with brick and stone masonry; repairs have added additional building materials

over time. The existing B&P Tunnel was rehabilitated in the 1980s, and continuing repairs are required to maintain the structures.

The existing tunnel is a crucial link in the greater NEC, which runs through eight states and Washington, DC. The NEC is the nation's most congested rail corridor, and one of the highest volume corridors in the world. The NEC moves over 259 million passengers and 14 million car miles of freight cargo each year. The NEC and tunnel are owned and maintained by Amtrak, and are also used by eight commuter rail operators and four freight railroads.

C. Purpose and Need

The purpose of the Project is to address the structural and operational deficiencies of the existing B&P Tunnel and to accommodate future high-performance intercity passenger rail service goals for the NEC, including: to reduce travel time through the B&P Tunnel and along the NEC; to accommodate existing and projected travel demand for intercity and commuter passenger services; to eliminate impediments to existing and projected operations along the NEC; and to provide operational reliability, while accounting for the value of the existing tunnel as an important element of Baltimore's rail infrastructure.

The need for the project has been defined as follows:

- The existing B&P Tunnel is more than 140 years old and is approaching the end of its useful life with regard to its physical condition. While the tunnel currently remains safe for rail transportation, it requires substantial maintenance and repairs and it does not meet current design standards. The tunnel is considered to be structurally deficient due to its age, the original design, and wear and tear. The tunnel is also functionally obsolete and unable to meet current and future rail demands due to the combination of its vertical and horizontal track alignment, i.e. its grades and curves. The low-speed tunnel creates a bottleneck at a critical point in the NEC, affecting operations of the most heavily traveled rail line in the United States.
- The existing B&P Tunnel does not provide enough capacity to support existing and projected demands for regional and commuter passenger service along the NEC.
- The existing B&P Tunnel is not suited for modern high-speed usage due to the current horizontal and vertical track alignments, which limit passenger train speeds through the tunnel to 30 mph.
- The existing B&P Tunnel is a valuable resource. The disposition of the existing tunnel needs to be considered in the Project.

D. Alternatives

This DEIS includes a detailed evaluation of four Alternatives for the B&P Tunnel Project: Alternative 1: No-Build, Alternative 3A, Alternative 3B, and Alternative 3C. These alternatives were retained through a comprehensive alternatives development and evaluation process that incorporated input from the public as well as federal, state, and local government agencies. The alternatives development and evaluation process identified 16 Preliminary Alternatives as show in **Table 1**.


Liberty Square
Burleith Leighton
Hanlon Longwood
Gwynns Falls Pw
Mondawmin
Walbrook
W North Ave
Coppin Heights/Ash-Co-East
Rosemont
CSX
Winchester
Bridgeview/Greenlawn
Mosher
Edmondson Ave
Carroll-South Hilton
Druid Hill Park
Penn North
McCulloh St
Reservoir Hill
N Monroe St
N Fulton Ave
Druid Hill Ave
Sandtown-Winchester
Gilmor St Tunnel
Existing B & P Tunnel
Wilson St Tunnel
McMechen St
John St Tunnel
Charles Interlocking
Remington
CSX
Charles Village
Better Waverly
Barclay
East Baltimore Midway
Charles North
Penn Station
Amtrak Northeast Corridor
Bolton Hill
Eutaw Pl
Mid-Town Belvedere
Howard St Tunnel
St Paul St
Johnston Square
Upton
W Lafayette Ave
Pennsylvania Ave
Fremont Ave
Martin Luther King Jr. Blvd
Harlem Park
W Franklin St
W Mulberry St
Seton Hill
Mount Vernon
Downtown
Poppleton
Franklin Square
University
Bridge Interlocking
West Baltimore MARC
Amtrak Gwynns Falls Bridge
Amtrak Northeast Corridor
Existing B&P Tunnel
B & P Tunnel Openings
Light Rail Station
Metro Station
Metro Line
Light Rail Line
Railroad
Interstate
Parks
Charles and Bridge Interlockings
Figure 1: B&P Tunnel Project Study Area Overview
0 0.125 0.25 0.5 Miles
NORTH
U.S. Department of Transportation
Federal Railroad Administration
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Table 1: B&P Tunnel Project Preliminary Alternatives

Alternative 1: No-Build	Alternative 2: Restore/Rehabilitate Existing B&P Tunnel
Alternative 3: Great Circle Passenger Tunnel	Alternative 4: Presstman Street
Alternative 5: Route 40	Alternative 6: Locust Point
Alternative 7: Sports Complex	Alternative 8: Wilson Street – Existing Tunnel
Alternative 9: Mosher Street North	Alternative 10: Mosher Street South
Alternative 11: Robert Street South	Alternative 12: Robert Street North
Alternative 13: Wilson Street – Under Existing Tunnel	Alternative 14: North Avenue Bridge
Alternative 15: Gilmor Street – Existing Tunnel	Alternative 16: North Avenue Tunnel

These 16 alternatives were evaluated in a Preliminary Screening Analysis that resulted in four Alternatives remaining (Alternatives 1, 2, 3, and 11) based on environmental impacts, public comments, and meeting Purpose and Need. This process is documented in the *Preliminary Alternatives Screening Report*.

Alternatives 1, 2, 3, and 11 were further refined to include options for Alternatives 3 and 11 for a total of seven Alternatives: 1, 2, 3A, 3B, 3C, 11A, and 11B. These seven Alternatives were compared and evaluated, and Alternatives 2, 11A, and 11B were eliminated. The documentation of this step in the process can be found in the B&P Tunnel *Alternatives Report*.

The alternatives retained for further review in this Draft Environmental Impact Statement and Section 4(f) Evaluation include Alternatives 1, 3A, 3B, and 3C.

1. Alternative 1: No-Build

Alternative 1: No-Build serves as the baseline for analysis of the Build Alternatives. It entails continued use of the existing B&P Tunnel with no significant improvements aside from routine maintenance. Alternative 1 would not meet the Purpose and Need for the project, but is retained as the baseline for comparison of the Build Alternatives.

2. Alternatives 3A, 3B, and 3C

Alternatives 3A, 3B, and 3C would provide a tunnel in a wide arc north of the existing B&P Tunnel. The wide, continuous arc allows trains to travel at higher speeds in comparison to the existing NEC alignment. Each of the three alternatives propose tracks in four separate tunnel bores extending between the north and south portals. The track alignments would remain below ground until exiting through the tunnel portals, where the tracks would transition back to the surface. Alternatives 3A, 3B, and 3C would each involve open cut and cut-and-cover sections to bring the tracks to the surface after exiting the portals. Tracks would pass through the portals then through a cut-and-cover section, followed by an open cut (trench) section prior to connecting with the existing NEC alignment.

From an engineering standpoint, Alternatives 3A, 3B, and 3C:

- Have identical maximum and minimum design speeds.
- Have similar tunnel depths and vertical grades.
- Provide universal interlocking to the NEC mainline.
- Avoid MTA's Metro Subway tunnel.

- Service the West Baltimore MARC Station and Baltimore Penn Station
- Include four tracks in four separate tunnel bores, and each includes "duck under" alignments to permit conflict-free operations.
- Require a ventilation plant at each portal and at an intermediate point along the tunnel.

Alternatives 3A, 3B, and 3C differ from one another primarily with regard to the location and impact of the south portal, and their impact to the existing West Baltimore MARC station. Alternative 3A allows the existing West Baltimore MARC station to remain in its current location. As a separate project, the MTA could and has been studying rebuilding the station to accommodate high level platforms several hundred feet south of the existing station and parking lots. Alternatives 3B and 3C would impact the Station and reconstruct a new West Baltimore MARC Station as part of the Project in the same location as the existing station.

Table 2 provides a detailed comparison of Operations, Engineering, Transportation, Cost, Construction, and Environmental criteria used to evaluate and compare Alternatives 1, 3A, 3B, and 3C.

E. Future of the Existing B&P Tunnel

The existing B&P Tunnel is a functioning railroad structure connecting Baltimore Penn Station with the NEC. If Alternative 1: No-Build is selected as the Preferred Alternative, the tunnel would continue use in its current configuration and condition, with maintenance limited to that necessary to maintain safe operation. If any of the Build Alternatives are selected as the Preferred Alternative, the existing tunnel would be replaced by new tunnels north of the existing location. Under each Build Alternative, the disposition of the existing B&P Tunnel will need to be evaluated. Three options for disposition of the existing B&P Tunnel include: close with no additional use ("abandonment"); modify train use (ie. single track); or convert for alternative use.

F. Affected Environment and Environmental Consequences

The B&P Tunnel Project would impact the human and natural environment. This section describes existing environmental conditions in the Study Area as well as the environmental consequences of the Project.

Because Alternative 1: No Build would involve no significant changes to the existing B&P Tunnel alignment aside from routine maintenance, no environmental impacts would occur under Alternative 1.

Generally, because the majority of the alignments are below ground, impacts occur at the tunnel portals, along the surface sections of new tracks (trackways), and at the intermediate ventilation plant location.

1. Socioeconomics

a. Land Use

The Study Area encompasses approximately five percent of the total land in Baltimore City. Most land use is residential. In 2013, there were 38,059 housing units within the Study Area representing 12.8 percent of the total housing units within Baltimore City. Approximately 69.3 percent of the housing units were occupied, which is lower than the proportion of occupied housing in Baltimore City (81.5 percent) and Maryland (89.9 percent). The Study Area currently contains six publicly-owned housing developments, with a total of 2,467 units, dispersed throughout the Study Area. There are also 22 affordable housing apartment developments with a total of 3,111 units.

Table 2: Summary of Potential Engineering-and Environmental Impacts

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Operations	**1. Travel Time Between Baltimore Penn Station and Gwynns Falls Bridge (southbound/northbound)**	Minutes: Seconds	Amtrak Acela 5:43/6:10 Amtrak Regional 5:50/6:19 MARC 5:50/6:14	Amtrak Acela 3:59/4:02 Amtrak Regional 4:19/4:19 MARC 4:56/4:17	Amtrak Acela 3:24/3:25 Amtrak Regional 3:43/3:34 MARC 4:22/3:56	Amtrak Acela 3:27/3:27 Amtrak Regional 3:46/3:37 MARC 4:33/4:04
	2. Travel Time Savings over Alternative 1 (southbound/northbound)	Minutes: Seconds	Not Applicable	Amtrak Acela 1:56 Amtrak Regional 1:46 MARC 1:26	Amtrak Acela 2:32 Amtrak Regional 2:26 MARC 1:53	Amtrak Acela 2:30 Amtrak Regional 2:23 MARC 1:44
	3. Value of Time Savings for All Passengers[1]	Dollars per year	Not Applicable	$32.5 Million per Year	$43.4 Million per Year	$42.3 Million per Year
	4. Lowest Design Speed within the Alignment	MPH	30 mph	50 mph	50 mph	50 mph
	5. Maximum Design Speed along the Alignment	MPH	75 mph	100 mph	100 mph	100 mph
	6. Average Operating Speed (southbound/northbound)	MPH	Amtrak Acela 35/34 mph Amtrak Regional 34/34 mph MARC 34/34 mph	Amtrak Acela 54/56 mph Amtrak Regional 50/52 mph MARC 44/52 mph	Amtrak Acela 63/66 mph Amtrak Regional 57/63 mph MARC 49/57 mph	Amtrak Acela 65/68 mph Amtrak Regional 59/65 mph MARC 49/57 mph
	7. Operational Flexibility and Reliability	High Medium Low	Low – only two tracks in common bore	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks

[1] 2040 Projected ridership, 2015 dollars

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	8. Meets Projected Year 2040 Level of Service for Amtrak/ MARC/ Freight	Yes/No	No – two tracks does not accommodate projected level of service; does not accommodate double-stack freight	Yes	Yes	Yes
Engineering	**9. Length of Alignment between Baltimore Penn Station and Gwynns Falls Bridge**	Miles	3.5 Miles	3.66 Miles	3.66 Miles	3.83 Miles
	10. Length of Tunnel	Miles	1.42 Miles	1.91 Miles	2.03 Miles	2.23 Miles
	11. Steepest Vertical Grade	% Grade	1.3%	2.0%	2.0%	2.0%
	12. Ability to Meet Current Project Design Criteria: Passenger (P) and Freight (F)	High Medium Low	Low (P) Low (F) Two tracks in a single bore; does not accommodate double-stack freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores; accommodates double-stack freight, steep grades for freight
	13. Depth of Tunnel	Average Depth in Feet	15 foot average depth	130 foot average depth	130 foot average depth	140 foot average depth
	14. Extent of Major Utility Relocations	Minor Moderate Major Severe	None	Major – Relocations in the general vicinity of tunnel portals	Severe – Relocations extend significant distances outside of tunnel portal areas	Major - Relocations in the general vicinity of tunnel portals
Transportation	**15. Estimated Number of On-Street Parking Spaces Lost**	# Spaces	0	0	150	40
	16. Requires Reconstruction of West Baltimore MARC Station	Yes/No	No	No	Yes	Yes
	17. West Baltimore MARC Station in proximity to Existing MARC Parking	Yes/No	Yes	Yes	Yes	Yes

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	18. Allows for High-Level Platforms for West Baltimore MARC Station between Franklin and Mulberry Streets	Yes/No	No	No	Yes	Yes
Cost	**19. Capital Cost Estimate**	YOE $	$0	$ 3.7 Billion	$ 4.0 Billion	$ 4.2 Billion
Construction	**20. Impacts to Existing Amtrak Operations during Construction/ Rehabilitation**	Minor Moderate Major Severe	Minor – Scheduled maintenance would continue during off-peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Minor – Most work would be performed without affecting NEC operations; only final cutover would cause minor impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.
	21. Impacts to Existing MARC Operations During Construction/ Rehabilitation	Minor Moderate Severe	Minor – Scheduled maintenance would continue during off-peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Minor – Most work would be performed without affecting NEC operations; only final cutover would cause minor impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.
	22. Impacts to Existing LRT Operations During Construction/ Rehabilitation	Minor Moderate Severe	None – Construction would be contained within existing tunnel.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	23. Impacts to Existing NEC Freight Rail Operations During Construction/ Rehabilitation	Minor Moderate Severe	Minor – Scheduled maintenance would continue during off peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Minor – Most work would be performed without affecting freight operations; only final cutover would cause minor impacts.	Minor – Most work would be performed without affecting freight operations; freight trains could be scheduled around the numerous track shifts and temporary cutovers.	Minor – Most work would be performed without affecting freight operations; freight trains could be scheduled around the numerous track shifts and temporary cutovers.
	24. Temporary Community Impacts During Construction	High Medium Low	None	Low – The portal construction area is mostly located in either existing Amtrak ROW or industrial property.	Medium – Portal construction would impact residential and industrial areas east of the existing NEC.	Medium – Portal construction would impact residential and industrial areas west of the existing NEC.
Right-of-Way (ROW)	**25. Surface Right-of-Way Acreage Required, by land use type[2]**	Acres	Residential: 0 Acres Commercial: 0 Acres Industrial: 0 Acres Other: 0 Acres **Total: 0 Acres**	Residential: 0 Acres Commercial: < 0.1 Acres Industrial: 2.5 Acres Other: 5.3 Acres **Total: 7.8 Acres**	Residential: 1.9 Acres Commercial: 3.1 Acres Industrial: 5.1 Acres Other: 7.0 Acres **Total: 17.1 Acres**	Residential: 0.9 Acres Commercial: 1.7 Acres Industrial: 6.2 Acres Other: 7.1 Acres **Total: 15.9 Acres**
	26. Surface Acreage of Roadway LOD	Acres	0 Acres	1.4 Acres	4.0 Acres	5.4 Acres
	27. Estimated Surface Parcels Impacted	# of Parcels	0	10	100	40
	28. Area of Excavation (including open cut)	Acres	0 Acres	10.2 Acres	14.9 Acres	17.1 Acres
	29. Area of Permanent Open Cut	Acres	0 Acres	5.6 Acres	12.5 Acres	12.9 Acres

[2] Does not include existing Amtrak ROW. Includes temporary and permanent

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Community Resources	**30. Estimated Residential Building Displacements**	# Displaced	0	0	48	24
	31. Estimated Business Displacements	# Displaced	0	2	9	10
	32. Estimated Community Facility Displacements[3]	# Displaced	0	0	5	1
	33. Estimated Residential Properties Impacted, but Residence Not Displaced[4]	# of Parcels	0	< 5	15	< 5
	34. Estimated Non-Residential Properties Impacted with No Displacement[3]	# of Parcels	0	< 5	10	10
	35. Right-of-Way Impacts within Minority Population Areas	Acres	0 Acres	5.8 Acres	15.1 Acres	13.9 Acres
	36. Right-of-Way Impacts within Low Income Population Areas	Acres	0 Acres	0.9 Acres	2.4 Acres	5.0 Acres
	37. Impacts to Baltimore City's *West Baltimore MARC Station Master Plan*	Minor Moderate Severe	None – Compatible with West Baltimore MARC Station Master Plan	None – Compatible with West Baltimore MARC Station Master Plan	Moderate – Excavation would impact portions of industrial land proposed for redevelopment. MARC Station could remain between Franklin and Mulberry Streets.	Moderate – Excavation would impact portions of industrial land proposed for redevelopment. MARC Station could remain between Franklin and Mulberry Streets.
	38. Parks Potentially Impacted	# of Parks	0	0	1 – Lafayette and Payson Park	0
	39. Estimated Area of Parkland Impacted	Acres	0 Acres	0 Acres	< 0.1 Acres	0 Acres

[3] Includes schools, churches, community centers, libraries, hospitals, police and fire stations
[4] Permanent or temporary impacts to property

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
Cultural	**40. Adverse Effects for Historic Properties**	Number of Properties (Number of Contributing Elements)	0	6 (6 contributing historic elements impacted)	8 (87 contributing historic elements impacted)	10 (132 contributing historic elements impacted)
	41. Area of Surface disturbance within Historic District	Acres	0 Acres	12.0 Acres – Monroe-Riggs, Baltimore & Potomac Railroad, and Midtown-Edmondson Historic Districts	25.3 Acres – Edmondson Avenue, Baltimore & Potomac Railroad, Greater Rosemont, Midtown-Edmondson, and Monroe-Riggs Historic District	20.3 Acres – Baltimore & Potomac Railroad, Edmondson Avenue, Greater Rosemont, Midtown-Edmondson, and Monroe-Riggs Historic Districts
	42. Known Archaeological Resource Sites Impacted	# of Sites	0	0	0	0
Natural Resources	**43. Stream Impacts**	Linear Feet	0 Feet	0 Feet	0 Feet	0 Feet
	44. Wetland Impacts	Acres	0 Acres	0 Acres	0 Acres	0 Acres
	45. Estimated Street Trees Impacted	# of Trees	0	0	2	1
	46. Forested Land Impacted	Acres	0 Acres	1.5 Acres	2.5 Acres	3.7 Acres
	47. 100-Year Flood Plain Impact	Acres	0 Acres	3.5 Acres	3.5 Acres	3.5 Acres
Other Environmental	**48. Use of Section 4(f) Properties**	Number of Properties	0	5	11	10
	49. Hazardous Materials Sites Identified	# of Low, Medium, and High Priority Sites (and Total #)	N/A	57 Low, 29 Med, 6 High (92 Total)	71 Low, 37 Med, 6 High (114 Total)	92 Low, 52 Medium, 9 High (153 Total)
	50. Estimated Number of Buildings with Potential Noise Impacts	# of Buildings, Moderate or Severe	0 Severe 0 Moderate	0 Severe 254 Moderate	175 Severe 1,078 Moderate	111 Severe 979 Moderate

	Criterion	Measure	Alternative 1	Alternative 3A	Alternative 3B	Alternative 3C
	51. Estimated Number of Sites with Potential Vibration Impacts	# of Sites	24	69	138	92
	52. Permanent Negative Visual Impacts	Low Medium High	None	Medium – would construct new south tunnel portal and portal ventilation plant in primarily industrial area and construct an intermediate ventilation plant in Reservoir Hill residential area	High – would construct new south tunnel portal, portal ventilation plant, and new tracks in residential area and construct a new intermediate ventilation plant in Reservoir Hill residential area	High – would construct new south tunnel portal, portal ventilation plant, and new tracks in residential area and construct a new intermediate ventilation plant in Reservoir Hill residential area

The majority of the Alternative 3A, 3B, and 3C alignments would be bored approximately 100 feet below the existing surface. As a result, surface land use impacts would be minimized and restricted to primarily portal and ventilation plant area locations. No housing displacements would occur under Alternative 3A. Alternative 3B would potentially displace 48 housing units as a result of south portal construction. These potentially displaced housing units are located in the Bridgeview/Greenlawn and Midtown-Edmondson neighborhoods. Alternative 3C would potentially displace 24 housing units as a result of south portal construction. These potential housing unit displacements are located west of the existing tracks, clustered in the Rosemont Homeowners/Tenants neighborhood. Property acquisition activities, including relocations, would be performed in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act) and all applicable state laws. Two business displacements would occur under Alternative 3A, nine under Alternative 3B, and 10 under Alternative 3C.

The location of the intermediate ventilation plant location is proposed at the south side of the intersection of Brookfield Avenue and Whitelock Street avoiding existing residences. The parcel is currently owned by the City of Baltimore and used by the Reservoir Hill neighborhood as a community garden. The parcel is currently zoned as Neighborhood Business District/Community Business District and would be converted to a transportation use under Alternatives 3A, 3B, and 3C.

b. Environmental Justice

In 2013, the total population of the Study Area by Census Block Group was 65,762 people. Eighty-seven (87.2) percent identified as minorities, which was higher than the Baltimore City average of 72.0 percent. Of the 26,358 households for which income was calculated in the Study Area, 8,812 households (33.4 percent) had income at or below the federal poverty level, which indicates low-income for the purposes of this study. The Study Area Census Block Groups contained a percentage of low-income households that was substantially higher (33.4 percent) than the Baltimore City average of 22.0 percent.

The U.S. Department of Transportation has defined a “disproportionately high and adverse effect” on minority and low-income populations as an adverse effect that:

- Is predominantly borne by a minority population and/or a low-income population; or
- Will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non- low-income population.

As a tool for evaluating the proportionality of impacts and benefits, this analysis identifies “EJ populations” within the Study Area. An “EJ population” is defined to include any Census Block Group in which the minority or low-income population meets either of the following thresholds:

- The minority or low-income population in the Census Block Group exceeds 50 percent, or
- The percentage of a low-income population in the affected area is “meaningfully greater” than the percentage of low-income people in the general population.

To determine whether impacts would be disproportionately high and adverse to identified EJ populations, the analysis identifies the potential for adverse effects on human health and safety and environmental resources in the Study Area described in this DEIS. Those impacts by alternative, geographic areas and type of impacts are identified and determined whether they occur to EJ populations. When impacts to EJ populations are identified, the impacts experienced by the affected population are compared to those experienced by others residing in the entire project boundary. A disproportionately high and adverse effect on minority and low-income population is defined as an impact that:

- Would be predominately borne by a minority and/or low-income populations in an EJ population, or
- Would be appreciably more severe or greater in magnitude than the adverse effect to the non-minority or non-low-income population in the affected area.

The DEIS compares the impacts of the Build Alternatives to the No Build and to each other. Alternative 3A has no high and adverse impacts, whereas Alternative 3B and Alternative 3C have high and adverse impacts in the following areas: property acquisition; housing displacement; land use/zoning; visual quality; community facilities; and noise.

Measures that would mitigate the severity of potential effects to less than high and adverse impacts would include efforts to relocate impacted residents and community facilities within the same community and provide fair compensation and relocation assistance.

c. Transportation

Transportation infrastructure in the Study Area includes the NEC, MARC commuter rail service, MTA Light Rail and Metro Subway services, a roadway network, and local bus service. While the Project could create short-term impacts to the operation of existing streets, long-term impacts are minimal.

Alternatives 3B and 3C would require reconstruction of the West Baltimore MARC Station in order to align with the new trackway. The reconstructed MARC Station would remain in the same location between Franklin and Mulberry Streets and adjacent to existing parking facilities. Rail services would be maintained during construction of any of the three Build Alternatives.

d. Neighborhoods and Community Facilities

The Study Area neighborhoods reflect the typical character of older, established urban areas, with historic architecture, highly trafficked pedestrian spaces, busy thoroughfares, and quieter residential roads. The neighborhoods are primarily residential, composed mainly of single-family attached rowhomes and several garden apartment complexes. The Study Area features a variety of commercial and industrial businesses, such as convenience stores, bar/restaurants, clothing retail, and automotive care, located along the main thoroughfares of North Avenue and Pennsylvania Avenue. The Study Area contains a wide range of community facilities and public services that are locally oriented and serve the region, including churches and other places of worship, cemeteries, schools, libraries, and parks.

Under Alternative 3A, no community facilities would be displaced. Under Alternative 3B, five churches would be displaced, one park would require a partial acquisition, and one school would experience temporary impacts due to construction. Alternative 3C in the south portal area would require displacing one community facility, the Charles R. Thomas Fire Station at 2249 Edmondson Avenue. The Alternative 3C displacements would be clustered near the intersection of Lauretta Avenue and North Bentalou Street in the Rosemont neighborhood.

2. Cultural Resources

Determination of impacts to cultural resources includes definition of an Area of Potential Effects (APE) which is the geographic area within which the project may directly or indirectly alter the character or use of historic properties.

a. Historic Architecture

Eighteen historic properties were identified within the APE. Project effects were determined by applying the Section 106 criteria of adverse effect (36 CFR 800.5). The effects assessment concluded that Alternatives 3A, 3B, and 3C would have adverse effects on historic properties. Alternative 3A would have an adverse effect on six historic properties; Alternative 3B would have an adverse effect on eight properties; and Alternative 3C would

have an adverse effect on 10 historic properties. FRA has received concurrence from the State Historic Preservation Officer (SHPO) on the effects determination on November 20, 2015

b. Archaeology

The archaeological assessment of the Study Area consisted of the background research on the history of the area, and on previously identified archaeological sites (within a one-mile radius). Given the severity and extent of past disturbance, most of the land within the study corridors is considered to have a low probability for containing any intact prehistoric archaeological resources. However, extensive areas of historic fill exist within the study corridors. Under certain circumstances, land filling has been instrumental in the protection of historic archaeological deposits. Therefore, the potential for both pre- and post-contact archaeological sites still exists. After the selection of a Preferred Alternative, more detailed archaeological impact studies will proceed in coordination with the SHPO and consulting parties.

3. Section 4(f) Properties

Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 USC 303(c)) is a federal law that protects publicly-owned parks, recreation areas, wildlife and/or waterfowl refuges, or any significant historic sites, whether privately or publicly owned. Fifteen historic properties and public parks eligible for Section 4(f) protection would be potentially impacted by one or more of the Build alternatives.

According to federal law, FRA may only approve use of a public park or historic property if there is no prudent and feasible alternative and the project includes all possible planning to minimize harm to the resource. FRA may determine that a project has a *de minimis* impact on a Section 4(f) property if the project will have no adverse impact on the resource and the agency with jurisdiction over the park or the State Historic Preservation Officer concurs after consulting with interested parties.

Alternative 3A would result in potential use of five Section 4(f) properties. Construction of the south portal approach for Alternative 3A would require demolition of three historic buildings that have been identified as contributing elements to the Midtown Edmondson historic district. The harm to the historic site would alter historic characteristics in a manner that would diminish historic integrity, and thus meets the criteria of adverse effect per 36 CFR 800.5.

Alternative 3B would result in potential use of 11 properties qualifying for Section 4(f). Construction of the south portal approach for Alternative 3B would require demolition of 82 historic buildings or other contributing elements to the Midtown Edmondson Historic District. Construction of the south portal approach for Alternative 3B would require demolition of five historic buildings or other contributing elements to the Greater Rosemont Historic District.

Alternative 3C would result in potential use of 10 Section 4(f) properties. Alternative 3C would result in demolition of seven historic buildings or other contributing elements to the Midtown Edmondson Historic District, 31 historic buildings or other contributing elements to the Greater Rosemont Historic District, and 28 historic buildings or other elements contributing to the Edmondson Avenue Historic District.

4. Natural Resources

Natural resources in the Study Area were preliminarily identified based on a review of existing scientific literature, watershed reports, GIS databases, and mapping. Identified resources include soils; topography, geology, aquifers, and groundwater; water resources; floodplains and flood hazard areas; coastal zones; wildlife habitat; threatened and endangered species; and hazardous materials.

a. Streams and Wetlands

No streams of wetlands would be affected by the Alternatives 3A, 3B, or 3C.

b. Floodplains

Alternative 3A would impact approximately 3.5 acres of the Jones Falls floodplain, and Alternatives 3B and 3C would each impact approximately 3.5 acres. None of the alignments would impact the floodplain of the Gwynns Falls.

c. Wildlife

The project would have minor impacts on wildlife and their habitat, since most of the project will take place underground and ventilation plants will primarily impact urban areas with little habitat value.

d. Threatened and Endangered Species

No state or federally listed threatened or endangered species are known to exist within the Study Area.

e. Street Trees

Street trees within Alternatives 3A, 3B, and 3C, are only likely to be affected in areas where ventilation plants are proposed or due to cut-and-cover construction impacts near the tunnel portals. Street tree impacts are anticipated to be zero, two, and one for Alternatives 3A, 3B, and 3C, respectively.

5. Hazardous Materials

There are 92 hazardous material sites within the Study Area of Alternative 3A, including residences, dry cleaners/laundromats, schools, automotive maintenance facilities, fire stations, community resource centers, gas stations, industrial properties, and railway yards. Alternative 3B has 114 hazardous material sites, and Alternative 3C has 153 hazardous material sites.

6. Solid Waste

Alternative 3A, 3B, and 3C have the potential to generate large quantities of material from street and sidewalk demolition, building demolition, and excavated soil and rock. Between the re-use of some earthen material as fill and current land fill capacity, the disposal of generated solid waste by the project should be manageable. Thus, no substantial harmful impacts on the solid waste system would occur as a result of the solid waste created by any of the Build Alternatives.

7. Air Quality

The B&P Tunnel Project is located in Baltimore City, Maryland, which is presently designated by the Environmental Protection Agency (EPA) as a moderate nonattainment area for eight-hour ozone and a maintenance area for carbon monoxide (CO) and particulate matter (PM) equal to or less than 2.5 micrometers in diameter (fine particulates or $PM_{2.5}$).

As shown, the proposed Project would not have any effects on operational emissions due to no projected increase in diesel freight train operations and no significant air emissions generated by trains propelled by electric locomotives. For tunnel ventilation, the expected increases in emissions with the project are well within the prescribed values. For NO_2, the pollutant of most concern, the net change in emissions is also well within the applicable stationary source Prevention of Significant Deterioration threshold. Based upon these results, it is unlikely that emissions associated with the ventilation plants for the project will cause, nor substantially contribute to, a violation of air quality standards. Construction emissions stem from dust generated from earth moving activities and gaseous emissions generated from diesel-powered equipment at the project site. Emissions produced during construction activities will be temporary in nature and will not result in a long-term impacts to local air quality.

8. Noise

Project noise impacts are assessed based on land use categories and sensitivity to noise from transit sources under FTA's guidance manual, *Transit Noise and Vibration Impact Assessment*. The FTA noise criteria are delineated into two categories: moderate and severe impact. The moderate threshold defines areas where the change in noise is noticeable but may not be sufficient to cause a strong, adverse community reaction. The severe impact threshold defines the noise limits above which a significant percentage of the population would be highly annoyed by new noise. The level of impact at any specific site is established by comparing the predicted future Project noise level at the site to the existing noise level at the site. Project noise impacts are expected from future operations and from construction.

In terms of operations, noise levels in the immediate vicinity of the ventilation plant buildings would be affected by operation of the ventilation fans. Fans would only operate when NO_2 levels in the tunnel exceed a set threshold or during emergencies when smoke is present. Because of the unpredictable nature of this activity, it is not possible to predict how many hours per day, on average, the fans would operate.

For Alternative 3A, for both the construction and operating phases, 254 buildings would be subject to a moderate impact, while none would have a severe impact. For Alternative 3B, 1,078 buildings would have moderate impacts and 175 would have severe impacts. For Alternative 3C, 979 buildings would have moderate impacts and 111 would have severe impacts.

Mitigation during construction would include noise barriers, relocation of noise generating activities, time of day work restrictions, and use of best available control technologies. Ventilation plants would be designed to meet noise limits established in the *Noise Regulations of the Health Code of Baltimore City* (Baltimore City Department of Legislative Reference, 2013).

9. Vibration

Background levels refer to ambient ground vibrations not related to any specific transportation source (e.g. naturally occurring ground vibration). This background vibration level is assumed to be fairly constant from site to site. Background vibration levels in the vicinity of the project alternatives are dominated by local traffic, while background vibration levels in the vicinity of the existing B&P Tunnel are dominated by current rail operations.

Modeled impacts due to ground-borne vibration from train passbys are predicted to exceed the FTA frequent impact criterion for residential impacts are 69, 138, and 92 for Alternatives 3A, 3B, and 3C, respectively.

10. Construction Impacts

Construction of the tunnels for Alternative 3A, 3B, or 3C would primarily involve horizontal mining with a tunnel boring machine. The outside approaches, sloping down to the portals, would be built with a combination of trench cutting and cut-and-cover construction techniques.

Cut-and-cover construction requires removal of everything on the surface above the planned tunnel, excavating a deep and wide trench in which the tunnel structure is constructed, and restoring the ground cover. Horizontal excavation by mining involves boring at a portal where the alignment would transition from surface to underground and excavating horizontally; surface disturbance would only occur at the approaches to the portals on either end of the tunnel and for ancillary structures like emergency exits. Ancillary structures, such as ventilation shafts or emergency egress, could be mined in a combination of mechanical excavation and controlled blasting.

Construction impacts associated with construction of Alternative 3A, 3B, or 3C would include localized impacts at the mucking shaft and portal cut-and-cover locations; emissions and dust from construction vehicles; blasting noise and vibration near tunnel portal and ventilation shaft locations; temporary interruptions to vehicular and pedestrian traffic and temporary loss of on-street parking; and major utility relocations.

Measures that can be used to lessen construction noise fall into two general categories: design considerations and construction staging and/or sequencing of operations. Design considerations could potentially include erection of temporary walls or earth berms between the noise source and the sensitive receptor, the identification of haul routes that avoid sensitive receptors to the maximum extent possible, and location of stationary noise generating equipment at a distance from sensitive receptors. Construction activities can be planned to avoid prolonged noise generating activities and to minimize construction activities during the most sensitive time of day or night.

11. Indirect and Cumulative Impacts

Federal agencies are required to also consider the potential for indirect and cumulative effects (ICE) from a proposed project. The ICE analysis was completed using available information on past, present and foreseeable future development, as well as readily available data from published plans and studies. The ICE analysis geographic boundary was developed using the boundaries of environmental resources and socioeconomic units that would be directly and indirectly impacted by the Project. The temporal boundaries for the ICE analysis generally extend from approximately 1970 to 2040. Planned improvements and developments within the ICE analysis area are used to qualitatively analyze potential for indirect and cumulative effects.

a. Indirect Impacts

Alternatives 3A, 3B, and 3C, could potentially result in indirect effects. Each of the Build Alternatives could increase throughput capacity for freight traffic through the Study Area. Alternatives, 3A, 3B, and 3C, could indirectly result in changes in land use, population density, or growth rate in the city, but any effects would likely be relatively minor. Construction of a ventilation plant building in the Reservoir Hill neighborhood under Alternative 3A, 3B or 3C would permanently preclude future development at the proposed site. Alternative 3A would have minimal indirect community effects given that it would not result in any residential displacements. Alternative 3B and 3C could have indirect community impacts resulting from conversion of residential areas in the Midtown Edmondson and Bridgeview-Greenlawn neighborhoods to transportation use. Alternatives 3A, 3B and 3C would result in a beneficial indirect effect to transportation because each would result in downstream improvements to the efficiency of passenger rail service along sections of the NEC north and south of Baltimore as a result of the removed barrier. Indirect effects could also include changing travel behavior from automobile, air travel, and bus to passenger rail.

b. Cumulative Impacts

A review of master plans and planned development projects in the area does not indicate any projects or plans that would result in impacts or land use changes similar in nature to those resulting from the proposed Build Alternatives such as residential displacements, community facility and business displacements, historic building impacts, or conversion of land to transportation use. Therefore, no cumulative land-use impacts are anticipated from Alternatives 3A, 3B, and 3C.

Alternative 3A would not have any reasonably foreseeable cumulative socioeconomic or environmental justice impacts. Alternatives 3B and 3C would have community impacts such as displacements, noise, visual impacts, and loss of street connectivity that is similar in nature to the I-70 highway project.

Any reasonably foreseeable cumulative effects of the Build Alternatives along with planned projects along the NEC would be beneficial improvements to regional and high-speed rail service. Alternatives 3A, 3B, and 3C would improve travel times, improve reliability and safety, increase capacity, and allow for more high-speed travel.

G. Agency and Public Coordination

FRA and MDOT have provided opportunities for agencies and the public to stay informed of the B&P Tunnel Project and provide input into the study, including the alternatives. Agency and public input was received from

five Interagency Review Meetings, three Public Open Houses, ten community meetings, several individual community association meetings, the B&P Tunnel Project website, an online comment form, and via e-mail.

All comments received to date have been read, summarized, and responded to in previous deliverables and this DEIS. The comment period for this DEIS extends through February 5, 2016. Future Project activities providing additional opportunities for public comment prior to the completion of this project include a public hearing, public and community meetings, and updates to the project website. Comments received through future activities will be responded to in the Final Environmental Impact Statement prior to FRA issuing the final decision for the project in the Record of Decision.

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I. INTRODUCTION

The Federal Railroad Administration (FRA) prepared this Draft Environmental Impact Statement (DEIS) and Section 4(f) Evaluation in coordination with the Maryland Department of Transportation (MDOT) and in compliance with the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] Part 4321 et seq.), the Council of Environmental Quality (CEQ) NEPA Regulations (40 Code of Federal Regulations [CFR] Part 1500-1508), the FRA Procedures for Considering Environmental Impacts (64 Federal Register [FR] Part 28545 [May 26, 1999]), and FRA's Update to NEPA Implementing Procedures (78 FR Part 2713 [January 14, 2013]). The Federal Transit Administration (FTA) is involved with the development of the Project through the NEPA process as a cooperating agency in accordance CEQ regulation 40 CFR Part 1508.5.

The Baltimore and Potomac (B&P) Tunnel Project ("Project") considers the rehabilitation or replacement of a 1.4-mile long rail tunnel located along the Northeast Corridor (NEC) in Baltimore, Maryland. The B&P Tunnel is owned by Amtrak and used for Regional and Acela intercity passenger trains, Maryland Area Rail Commuter (MARC) passenger trains, and Norfolk Southern Railway (NS) freight trains.

Built in 1873, the B&P Tunnel is one of the oldest structures on the NEC. The narrow, single-bored, double-track, existing B&P Tunnel was constructed out of brick and stone masonry; additional materials were added over time. The Study Area surrounds the existing 1.4-mile B&P Tunnel in west-central Baltimore City. It includes Amtrak's NEC between Baltimore's Pennsylvania Station (Baltimore Penn Station) to the north and the Gwynns Falls Bridge to the south, as shown in **Figure 2**. The extent selected is intended to maximize capture of potential resources that could directly, or indirectly, be impacted by the B&P Tunnel Project. The Study Area for each alternative extends 500 feet on either side of the centerline and 500 feet to the northeast and southwest, past the termini.

NEPA requires the preparation of an Environmental Impact Statement (EIS) for all federal projects or actions that are likely to have a significant impact on the environment. This DEIS is a tool for FRA and MDOT to make informed decisions regarding the Project alternatives in accordance with NEPA. The DEIS includes a review of the alternatives, their ability to meet the needs of the study, and their likely impacts to the social, cultural, and natural environment. All technical reports and memoranda referenced in the DEIS are available for review on the Project website at www.bptunnel.com. The comment period for this DEIS ends February 5, 2016.

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II. PURPOSE AND NEED

A. Project Background

The existing B&P Tunnel is a crucial link in the greater NEC Main Line, which runs through eight states and Washington, D.C. The NEC is the nation's most congested rail corridor and one of the highest volume corridors in the world (Amtrak, 2010a). The NEC came under the control of one owner, Penn Central, in 1969 and under Amtrak in 1971. Currently, the fully electrified NEC provides a direct connection between Washington, D.C., Baltimore, Philadelphia, New York, and Boston. The NEC moves over 259 million passengers and 14 million car miles of freight cargo each year (Amtrak, 2010a). It is a shared resource used by Amtrak, eight commuter rail operators, and four freight railroads.

As shown in **Figure 2**, the existing B&P Tunnel is located beneath several West Baltimore neighborhoods, including Bolton Hill, Madison Park, Sandtown-Winchester, and Upton. The tunnel is currently used by MARC, Amtrak, and NS. Built in 1873, the tunnel is one of the oldest structures on the NEC. It is approximately 7,500 feet (1.4 miles) long and is comprised of three shorter tunnels: the John Street Tunnel, the Wilson Street Tunnel, and the Gilmor Street Tunnel. The narrow-profile, single-bored, double-track tunnel was originally constructed out of brick and stone masonry, though repairs have added additional building materials over time. Electrification was added in the 1930s, and the tunnel was rehabilitated in the 1980s. Continual repairs are required to maintain the aging structures.

B. Prior Studies - Baltimore's Railroad Network

Following a July 18, 2001 fire from a CSX train derailment that occurred in the nearby Howard Street Tunnel, Congress mandated that FRA provide a comprehensive assessment of the region's complex rail system. In response to the Congressional mandate, FRA completed two studies, *Baltimore's Railroad Network: Challenges and Alternatives* (FRA, 2005) and *Baltimore's Railway Network: Analysis and Recommendations* (FRA and MDOT, 2011). The 2005 report characterized the state of the rail network and the demands placed on it. The study evaluated the existing B&P Tunnel, as well as other components of Baltimore's rail network, and underscored the importance of the B&P Tunnel to the NEC. The study also recommended potential actions that could improve passenger and freight railway capabilities in the Baltimore region, which included replacement of the existing B&P Tunnel. The 2011 report supplemented the findings of the 2005 report and evaluated passenger and freight alternative routes through Baltimore. The 2011 report states that "the physical condition of the [existing B&P Tunnel] requires that it be rebuilt or replaced within the next 10-20 years." In addition, "the conditions in the [existing] B&P Tunnel—as well as its criticality to the protection of a reliable passenger service—preclude its expanded use for most freight and constrain the flow of commerce to and through the Baltimore region" (FRA and MDOT, 2011).

C. National High-Speed Rail Program Investments

The Passenger Rail Investment and Improvement Act of 2008 (PRIIA) and the American Recovery and Reinvestment Act of 2009 (ARRA) established guidelines for the development of intercity and high-speed rail corridors. These two Acts called for a collaborative effort by the federal government, states, railroads, and other key stakeholders to help transform America's transportation system through the creation of a national network of high-speed rail corridors. To achieve this vision, FRA published the *High-Speed Rail Strategic Plan* in April 2009 (USDOT, 2009) and launched the *High Speed Intercity Passenger Rail (HSIPR) Program* in June 2009.

Figure 2: Existing B&P Tunnel Project Vicinity

The ARRA and annual appropriations have provided $10.1 billion to date to expand passenger rail access to new communities and provide Americans with faster and more energy-efficient travel options. This funding has helped transform travel in America through targeted investments in five key "megaregions" around the country (Seattle-Portland, San Francisco-Los Angeles, Charlotte-Raleigh-Washington, D.C., Midwest hub, and Northeast Corridor) that together hold roughly 65 percent of the population and are expected to contain the bulk of future population growth. Baltimore, Boston, New York, Philadelphia, and Washington, D.C. make up the Northeast megaregion, which is the densest and most economically productive megaregion in the country. This megaregion depends on its ability to accommodate frequent business travel among the cities, thus requiring efficient, reliable, and convenient transportation connections (Amtrak, 2010b).

The HSIPR program is improving the safety, reliability, and accessibility of rail infrastructure for passengers around the country through renewal of corridor infrastructure and stations. The national program is expected to:

- serve as a catalyst for growth in regional economic productivity and expansion by stimulating domestic manufacturing, promoting local tourism, and driving commercial and residential development;
- increase mobility by creating new choices for travelers in addition to flying or driving;
- reduce national dependence on oil; and
- foster livable urban and rural communities.

Through the HSIPR program, FRA is investing $950 million to upgrade some of the most heavily used sections of the NEC. The investments will increase speeds from 135 to 160 mph on critical segments, improve on-time performance, and add more seats for passengers, enabling one of the nation's busiest corridors to continue to set ridership and revenue records. As noted previously, the preliminary engineering and NEPA analysis for the existing B&P Tunnel is one of the NEC projects funded through the HSIPR program. The B&P Tunnel Project is critical to existing and future NEC operations because the current tunnel is a bottleneck in the rail corridor, does not have detour options in or near Baltimore, and is approaching the end of its useful life.

The Baltimore Metropolitan Council and MDOT amended the Fiscal Year 2011 State Transportation Improvement Program (TIP) list to add federal funds to the 2011-2014 Baltimore Regional Transportation Board's (BRTB) TIP for the existing B&P Tunnel Improvement Project (TIP # 92-1101-99). This project is funded through a High-Speed Intercity Passenger Rail (HSIPR) grant for preliminary engineering and NEPA analysis. The BRTB approved funding for the study on May 24, 2011 (Resolution #11-26).

D. Purpose of the Project

The purpose of the Project is to address the structural and operational deficiencies of the existing B&P Tunnel and to accommodate future high-performance intercity passenger rail service goals for the NEC, including:

- To reduce travel time through the B&P Tunnel and along the NEC,
- To accommodate existing and projected travel demand for intercity and commuter passenger services,
- To eliminate impediments to existing and projected operations along the NEC, and
- To provide operational reliability, while accounting for the value of the existing tunnel as an important element of Baltimore's rail infrastructure

E. Need for the Project

The need for the Project has been defined as follows:

- The existing B&P Tunnel is more than 140 years old and is approaching the end of its useful life with regard to its physical condition. While the tunnel currently remains safe for rail transportation, it requires substantial maintenance and repairs, and it does not meet current design standards. The tunnel

is considered to be structurally deficient due to its age, the original design, and wear and tear. The tunnel is also functionally obsolete and unable to meet current and future rail demands due to the combination of its vertical and horizontal track alignment, i.e. its grades and curves. The low-speed tunnel creates a bottleneck at a critical point in the NEC, affecting operations of the most heavily traveled rail line in the United States.

- The existing B&P Tunnel does not provide enough capacity to support existing and projected demands for regional and commuter passenger service along the NEC.
- The existing B&P Tunnel is not suited for modern high-speed usage due to the current horizontal and vertical track alignment, which limits passenger train speeds through the tunnel to 30 mph.
- The existing B&P Tunnel is a valuable resource. The disposition of the existing tunnel needs to be considered in the Project.

1. Physical Condition

The existing B&P Tunnel's two-track cross-section is horseshoe-shaped with an approximate spring line width of 27 feet and centerline height of about 21 feet. The majority of the existing B&P Tunnel is supported by a multiple course brick-lined arch and masonry sidewalls. One of the existing B&P Tunnel's tracks is typically designated for northbound traffic and the other for southbound traffic. Safety refuge areas (referred to as manholes) are located in the sidewalls of the tunnel. There is no physical separation of the tracks, which prohibits major improvements to the existing tunnel while in service due to safety and operational requirements. The existing track layout causes difficulties for maintenance and repair. Short working windows require multiple mobilizations for repairs, thus slowing progress and substantially increasing maintenance costs.

Saturated soil beneath the tunnels is causing its aging floor slabs to sink, forcing Amtrak to repeatedly make repairs (NEC Infrastructure and Operations Advisory Commission, 2013). Also, drainage through the tunnel's walls, leakage from existing utility lines, poor drainage of the tunnel's invert, and insufficient clearance were noted in a prior study of the tunnel (FRA and MDOT, 2011). Most recently, the *Existing B&P Tunnel Visual Inspection* prepared for the B&P Tunnel Project provides a review of the tunnel's structural integrity, water infiltration[5], drainage system function, railroad components, safety, and security. The inspection was performed from July 8, 2014 to July 18, 2014 and generally reviewed the NEC from Milepost 96 to Milepost 97.5. It covered the full lengths of the three tunnel sections, the north and south portals, and the two intermediate day-light sections between the three tunnels.

The Inspection Report is summarized by tunnel section in the outline below. The report identifies glistening surfaces and/or wet conditions for all three of the tunnel sections. Leaking water through the tunnel walls can lead to structural, electrical and mechanical problems. Leaking water could also carry fill material required for stability from behind the walls; this is a particular problem for horseshoe-shaped tunnels (such as the B&P Tunnel segments) that rely on fill material outside of the tunnel structure to provide resistance to the compressive forces transferred from above. These materials and the proper balance of force is necessary for the continued stability of the tunnel. Once a leak develops and water establishes a flow path, the problem of leaking may continue to develop over time as water flows through the path of least resistance. The water leakage in all three tunnels may have detrimental structural effects to the tunnel segments.

In addition, the Wilson Street Tunnel and the John Street Tunnel both have "multiple rows of missing brick", indicative of deterioration over time of the tunnels' masonry and concrete elements.

[5] Water infiltration in the existing B&P Tunnel relates to water leaking into the tunnel. This water can carry fine deposits and can leave voids behind the tunnel's liner and under slabs. The water infiltration also has the potential to prematurely age sump pumps and increase maintenance requirements and costs.

a. Gilmor Street Tunnel

Of the three tunnel sections, the Gilmor Street Tunnel is currently in the best physical condition. However, issues with this tunnel include sections of brick and mortar loss. Other problems include:

- transverse (crossways) cracks,
- spalls (chips/fragments) in the bench wall (elevated walkway used by maintenance personnel),
- shallow delaminations (divisions of thin layers) in the gunite (proprietary name of an early form of shotcrete that is a mix of Portland cement and sand) coating, and
- glistening surfaces due to moisture, which may indicate the possibility of water flow that could lead to structural, mechanical, or electrical problems in the tunnel.

b. Wilson Street Tunnel

Of the three tunnel sections, Wilson Street Tunnel is currently in the poorest physical condition. The majority of the tunnel is wet and actively leaking. Many of the leaks come from behind the tunnel's liner and produce efflorescence (crystalline deposits). Other problems include:

- spalls in the bench wall,
- shallow delaminations in the gunite coating,
- inflow of water from the invert (floor),
- large amount of debris in invert,
- brick debris on top of duct bench,
- deteriorating manholes, and
- multiple rows of missing brick over extended lengths.

c. John Street Tunnel

The leakage and moisture conditions in the Wilson Street Tunnel continue into the John Street Tunnel, but are not present over its entire length. Most of the leakage has pooled in the invert where the drainage system is clogged. Other problems include:

- spalls in the bench wall,
- deteriorating manholes,
- thick efflorescence,
- multiple rows of missing brick, and
- missing mortar.

2. Existing Track Alignment

The existing B&P Tunnel's grades and horizontal alignment limit train speeds, increase travel time, and impact the NEC's ability to support high-speed rail systems. A railroad's efficiency is dependent on its vertical and horizontal alignment, i.e. its grades and curves. Steep grades and the presence of curvature result in additional resistance by increasing friction between the wheels and the rail. The NEC's curvature, especially near Winchester Street (where the existing B&P Tunnel turns sharply at the entrance of the Gilmor Street Tunnel), prohibits high-speed service.

According to *Baltimore's Railroad Network: Challenges and Alternatives* (FRA, 2005), the NEC has "very difficult tunnel alignments" and "especially noteworthy are the restrictions imposed by the [existing] B&P Tunnel" for

the roughly two miles between Mileposts 95.9 and 97.7. **Table 3** shows the maximum allowable speeds on Amtrak's NEC through Baltimore in and adjacent to the existing B&P Tunnel.

Table 3: Maximum Allowable Speeds on Amtrak's NEC through Baltimore

Route Segment	Max Speed Passenger Service	Max Speed Freight Service
Union Tunnels, north of Baltimore Penn Station	45 mph	30 mph
Existing B&P Tunnel, south of Baltimore Penn Station	30 mph	20 mph
South of existing B&P Tunnel to Baltimore Washington International (BWI) Rail Station	110 mph	50 mph or less

Note: These maximum allowable speeds are general guidelines, always subject to site- and time-specific considerations.
Source: Baltimore's Railroad Network: Analysis and Recommendations, Table 2-7 (FRA and MDOT, 2011).

The table shows that the maximum allowable speed for Amtrak trains in the existing B&P Tunnel is 30 mph for passenger service and 20 mph for freight service. All trains must slow down in order to stop at Baltimore Penn Station. Trains traveling from the north must slow down to pass through the B&P Tunnel before gaining speed south of the B&P Tunnel (up to 110 mph for passenger services).

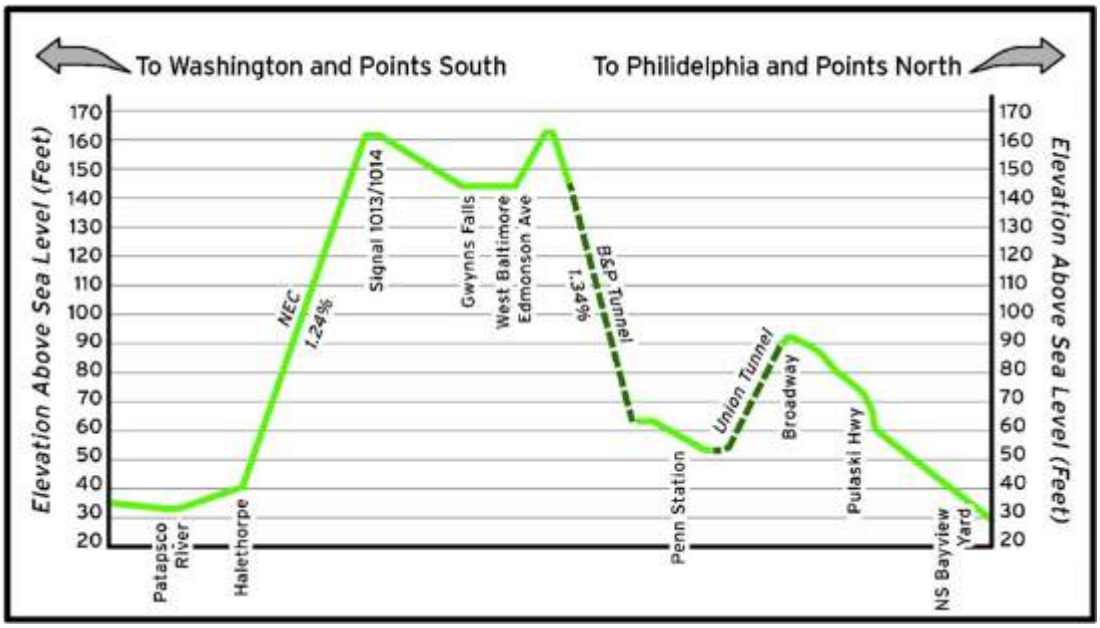
Southbound trains entering the existing B&P Tunnel slow for a sharp (8 degree) curve then ascend on a mile-long 1.34 percent grade, the steepest grade on the NEC between Philadelphia and Washington, D.C. **Figure 3** shows the elevation changes along the NEC. The elevation of the existing B&P Tunnel ranges from 150 feet above mean sea level to 70 feet above mean sea level. (FRA and MDOT, 2011).

Additionally, the approach section to the tunnel at the West Baltimore MARC Station is located on a curve (referred to as Curve 381) that limits train speeds to 55 mph. In addition to limiting the speed along the NEC at this location, Curve 381 also prohibits equal level alignment between the boarding platforms of the station and the MARC trains, resulting in a physical gap between the two. As such, the MARC Station is not accessible pursuant to the Americans with Disabilities Act (ADA) requirements. The need to provide ADA compliant facilities at the West Baltimore MARC Station has been the subject of previous planning studies conducted by MTA.

3. Bottleneck in NEC Operations

The NEC is the most heavily traveled rail corridor in the United States (NEC Master Plan Working Group, 2010). The NEC traverses eight northeast states and Washington, D.C. It is shared by eight commuter railroads and three freight railroads. It connects the five major metropolitan areas of Washington, D.C., Baltimore, Philadelphia, New York, and Boston. According to the *NEC Infrastructure Master Plan* (Amtrak, 2010a), this rail network is a centerpiece of the transportation infrastructure that contributes to the economic vitality of the Northeast region. By linking all the major northeastern cities, it moves more than 259 million passengers and 14 million car-miles of freight per year (Amtrak, 2010a).

Figure 3: Elevation Changes along the NEC



Source: Baltimore's Railroad Network: Analysis and Recommendations, Figure 2-20 (FRA and MDOT, 2011).

Due to the age of the existing B&P Tunnel and the technological advancement of the rail system in the more than 140 years since it was built, the existing B&P Tunnel limits the functionality of railroads through Baltimore and along the NEC. The existing B&P Tunnel is "a major chokepoint for intercity, commuter, and freight operations in the northeast" (Amtrak, 2010a). The tunnel creates a bottleneck in NEC operations due to its reduced travel speeds. The NEC, which has active use of three and four tracks elsewhere, has only two tracks through the existing B&P Tunnel, which must accommodate a mixture of regional and commuter passenger trains and freight service. The following sections review the existing travel times through the Study Area, the operational needs of the NEC, and the lack of rail connectivity/rerouting options.

a. Existing Travel Time

Travel times through the existing B&P Tunnel are listed in **Table 4**. Amtrak times are measured between a stop at Baltimore Penn Station and passing block signals 993/994 (at approximately Milepost 99.2, Gwynns Falls Bridge) while MARC times are measured between a stop at Baltimore Penn Station and a West Baltimore Station stop (Milepost 98.5). Trip times through the existing B&P Tunnel range from 5 minutes and 48 seconds to 7 minutes and 16 seconds. As indicated in the table, travel time is longer for northbound trains that stop at Baltimore Washington International (BWI) Rail Station because they must diverge at the Bridge Interlocking before entering the existing B&P Tunnel.

Table 4: Current Trip Times Through the Existing B&P Tunnel

Trip Direction	MARC Commuter[1]	Amtrak Regional/Intercity[2]	Acela[3]
Southbound	5 min, 48 sec	6 min, 20 sec	5 min, 52 sec
Northbound (No stop at BWI)	N/A	6 min, 5 sec	5 min, 56 sec
Northbound (Stop at BWI)	6 min, 18 sec	7 min, 16 sec	7 min, 1 sec

[1] *Trainset assumed for MARC Commuter trains: HHP-8 locomotive plus 7 MARC III cars*
[2] *Trainset assumed for Amtrak Regional/Intercity trains: AEM7 locomotive plus 8 Amfleet cars*
[3] *Trainset assumed for Acela trains: standard Acela trainset*
Source: General Orders Timetable (Amtrak, December 2012 and 2014)

4. Operational Needs of the NEC

Three major providers use the existing B&P Tunnel: Amtrak, MARC, and NS. The providers have documented the need for improvements along the NEC, particularly in Baltimore City and the area surrounding the existing B&P Tunnel. The following reports discuss the operational needs of the NEC, including the bottleneck created by the existing B&P Tunnel:

- *Baltimore's Railroad Network: Challenges and Alternatives* (FRA, 2005)
- *The Northeast Corridor Infrastructure Master Plan* (Amtrak, 2010a)
- *A Vision for High-Speed Rail in the Northeast Corridor* (Amtrak, 2010b)
- *Baltimore's Railway Network: Analysis and Recommendations* (FRA and MDOT, 2011)
- *The Amtrak Vision for the NEC* (Amtrak, 2012)
- *Critical Infrastructure Needs on the Northeast Corridor* (NEC IOAC, 2013)
- *MARC Growth and Investment Plan - Update 2013 to 2050* (MTA, 2013)
- *Washington Terminal Yard Future Operating Plans* (MARC/Amtrak 2020 and 2030 Plans) (LTK Engineering Services, 2014)
- *NEC FUTURE* (FRA, 2015)
- *Baltimore Penn Station Master Plan* (Amtrak, 2015)

a. Baltimore's Railroad Network: Challenges and Alternatives (2005)

FRA and MDOT developed *Baltimore's Railway Network: Challenges and Alternatives* (FRA and USDOT, 2005) in response to the November 2001 request from Congress. The study evaluates the condition and capabilities of the railroad network's fixed facilities and examines the benefits and costs of various alternatives for reducing congestion and improving safety and efficiency in the rail operations throughout the larger Baltimore region. Part 1 of the report characterizes the state of the network and demands placed on it. The study evaluates the existing B&P Tunnel, among other components of Baltimore's rail network, and emphasizes its importance to the overall NEC system. The study explains that "the conditions in the [existing] B&P Tunnel – as well as its criticality to the protection of a reliable passenger service – preclude its expanded use for most freight and constrain the flow of commerce to and through the Baltimore region." The study also describes the history of renovations made to the existing B&P Tunnel as well as its current car plate (i.e. height and width) clearance restrictions and "difficult geometry," noting that the "sharp curve at the south portal of the tunnel prevents southbound trains departing [Baltimore's Penn Station] from accelerating beyond 30 mph."

Part 1 of the 2005 study examines the horizontal and vertical track alignment of the existing B&P Tunnel, explaining that "grade, particularly in combination with curvature, has a major impact on the tractive effort and horsepower required to move a train of a given tonnage over a line. Collaterally, grades affect the speed, schedule, and on-time performance of a freight train, and to a lesser degree, a passenger train. Curves, in themselves, can severely limit train speeds because of the forces they create as trains pass over them, and the safety, ride quality, maintenance, and cost issues that these forces raise – issues that are worsened in mixed traffic conditions. For example, allowable superelevations (banking) on curves may differ for passenger and freight service. Where both services regularly share the same tracks, compromises must be made that may allow neither service to operate optimally."

The potential actions that could improve passenger and freight railway capabilities in the Baltimore region are detailed in Part 2 of the study. Replacement of the existing B&P Tunnel is a stated objective of the study. The study explains that "the tunnel's basic geometry was substandard when it was completed [in 1873]." Information from this study will be considered and incorporated into subsequent stages of the planning process during development of alternatives.

b. The Northeast Corridor Infrastructure Master Plan (2010)

The Northeast Corridor Infrastructure Master Plan (Amtrak, 2010a), prepared by Amtrak, provides a regional, corridor-wide perspective of the NEC Main Line and all its feeder lines. The Master Plan identifies an initial baseline of infrastructure investment needed to maintain the current NEC system in a state of good repair; integrates intercity, commuter and freight service plans; and moves the NEC forward to meet the expanded service, reliability, and trip-time improvements that are envisioned by the Northeast states and the District of Columbia. The plan identifies the existing B&P Tunnel as one of several major assets along the NEC that are approaching the ends of their useful lives, and which impede the overall speed, capacity, and reliability of the NEC Main Line. This plan states that the existing B&P Tunnel is "a major chokepoint for intercity, commuter, and freight operations in the northeast."

c. A Vision for High-Speed Rail in the Northeast Corridor (2010)

The need for high-speed rail in the NEC for present and future transportation networks is documented by Amtrak in *A Vision for High-Speed Rail in the Northeast Corridor* (Amtrak, 2010b). The report identifies general alignment constraints, such as dedicated tracks and curvature limits that would be required to implement next-generation high speed rail service along the NEC. This report includes a graphic from the 2010 NEC Master Plan, identifying the existing B&P Tunnel as a "previously identified chokepoint" and reiterates that the NEC through Baltimore exceeded 75 percent utilization capacity in 2008 and will exceed 100 percent by 2030. The report explains that "Amtrak services must play an expanded role in meeting the corridor's mobility and economic support needs. The NEC's daily use by major commuter rail operations and by numerous freight trains further underscores this importance. The benefits of the proposed Next-Gen High-Speed Rail system investment would extend beyond intercity rail passengers to air passengers, rail commuters, and highway drivers who will realize transportation network capacity gains."

d. Baltimore's Railroad Network: Analysis and Recommendations (2011)

Baltimore's Railway Network: Analysis and Recommendations (FRA and MDOT, 2011) is a feasibility study by FRA and MDOT that focused on large-scale, regional rail issues. The study supplements the findings of *Baltimore's Railroad Network: Challenges and Alternatives* (FRA and USDOT, 2005). It focuses on the principal elements of Baltimore's network of passenger and freight rail lines extending from Perryville—the junction of Amtrak's NEC with the NS principal route from Harrisburg and points west—to Halethorpe, where CSX Transportation and Amtrak lines from Washington, D.C. cross. Therefore, this 2011 study includes the existing B&P Tunnel, but covers a much larger area than the proposed B&P Tunnel Project. In Phase I of the report, a number of passenger and freight alternative routes through Baltimore are developed and evaluated. Phase II of the report further refines the engineering and cost aspects of two preferred alternatives.

The study states that "the conditions in the [existing] B&P Tunnel—as well as its criticality to the protection of a reliable passenger service—preclude its expanded use for most freight and constrain the flow of commerce to and through the Baltimore region." The study explains that "Amtrak's route through Baltimore is crucial to the viability of all intercity rail passenger service in the United States." Specifically, one-fifth of Amtrak's passenger-trips and one-third of its total revenues stem from trips making use of at least one of the NEC's Baltimore tunnels. Most of these trips depend on both the existing B&P Tunnel and the Union Tunnel (FRA and MDOT, 2011).

The study discusses the deteriorating condition of the existing B&P Tunnel and the tunnel's effects on NEC operations due to limited travel speeds, capacity, freight loading flexibility, and lack of detour route options. Track alignment through the existing B&P Tunnel and clearance are discussed in detail in the study. The study explains that "the physical condition of the tunnel requires that it be rebuilt or replaced within the next 10 to 20 years."

e. The Amtrak Vision for the NEC (2012)

The Amtrak Vision for the NEC report provides an update to the Vision for High-Speed Rail in the Northeast Corridor (Amtrak, 2010b), identifying recent developments in NEC planning and highlighting key findings related to how Amtrak can translate various strategies and concepts for growth and improvement of the NEC into reality. The report states that the entire network is often operating at or near capacity and is routinely hampered with congestion and delays. It recognizes that significant efforts are underway that address rehabilitation needs and reducing existing congestion. The NEC consists of aging infrastructure that will require extensive repair for safe and efficient operations at current traffic levels. Significant investments in the existing NEC will help eliminate key bottlenecks that limit service frequency and negatively affect reliability and performance. This report lists milestones over the next 30 years, with increases in tunnel and terminal capacity. Improvements to the existing B&P Tunnel are identified as a key project for trip-time and frequency improvements between Washington, D.C. and New York.

f. Critical Infrastructure Needs on the Northeast Corridor (2013)

Critical Infrastructure Needs on the Northeast Corridor (NEC IOAC, 2013) was prepared by the NEC Infrastructure and Operations Advisory Commission. The report was developed through a consensus-based process by the NEC Commission's members, which include representatives from the NEC States, USDOT, and Amtrak. This report recognizes that additional investment is necessary to renew and enhance the NEC as a world-class, high-performance rail corridor supporting the economic development and international competitiveness of the region and the nation with job creation, improved reliability of existing services, and a foundation for future mobility and economic growth. The report notes that the existing B&P Tunnel is one of the oldest structural assets on the NEC, it "severely" limits train speeds in Baltimore, and identifies it as "a major capacity bottleneck for both passenger and freight trains." "Development of the [existing] B&P Tunnel replacement project would mitigate a chokepoint, eliminate speed restrictions, and enhance freight access to the port of Baltimore" (NEC IOAC, 2013). The report identifies the B&P Tunnel Project as a necessary project on the NEC, and states that "while the alignment and design of any new tunnel is yet to be determined, planning will consider options for supporting higher speed train service and creating separate routes for passenger and freight trains through Baltimore." The report also explains that "new tunnels could free the existing tunnels for renewal, ultimately for additional capacity, and make Amtrak and MARC less susceptible to maintenance-related delays."

g. MARC Growth and Investment Plan - Update 2013 to 2050 (2013)

MARC Growth and Investment Plan - Update 2013 to 2050 (MTA, 2013) by MTA presents a summary of the commuter rail program whose service areas include Baltimore and Washington, D.C. and surrounding areas, with an average of 36,000 daily trips using the Penn, Camden, and Brunswick Lines. The plan identifies ridership and parking trends, re-aligns agency priorities, updates objectives for MARC service, and summarizes the growth of the Penn, Camden and Brunswick Lines. While the average annual growth from 2007 to 2012 in ridership for the Camden Line and Brunswick Lines were 0.5 percent and 1.7 percent, respectively, the Penn Line reported 3.5 percent growth. The Plan states that ridership demand is expected to continue to grow at historical rates. Challenges identified in the plan include insufficient track capacity on all three lines. In addition, the Plan notes that MARC's flexibility and ability to expand service is constrained by existing infrastructure and interactions with other rail operators.

The MARC Growth and Investment Plan also identifies a new station at West Baltimore under the State of Good Repair long-term plan (2020-2029). The November 2008 West Baltimore Master Plan noted opportunities and plans for economic growth in the area. The USDOT Ladders of Opportunity Program identified the West Baltimore MARC Station as one of seven national locations where the USDOT will help foster sustainable economic development related to planned transportation projects.

h. Washington Terminal Yard Future Operating Plans (MARC/Amtrak 2020 and 2030 Plans) (2014)

Amtrak and MARC developed the *Washington Terminal Yard Future Operating Plans* as draft conceptual Amtrak/MARC operating plans for the 2020 and 2030 time horizons for use in conjunction with the Washington Union Station (WUS) and Washington Terminal Yard (WTY) Master Plans. Based on this ongoing study, MARC expects a 3 percent ridership increase per year on the Penn Line, which is the equivalent of an approximately 60 percent ridership increase through 2030 when compounded annually.

i. NEC FUTURE (2015)

NEC FUTURE (FRA, 2015) is a comprehensive planning effort to define, evaluate, and prioritize long-term future investments in the Northeast Corridor (NEC), from Washington, D.C. to Boston. The Federal Railroad Administration (FRA) launched NEC FUTURE in February 2012 to consider the role of rail passenger service in the context of current and future transportation demands. Through the NEC FUTURE program, FRA will determine a long-term vision and investment program for the NEC. The Tier 1 Draft Environmental Impact Statement (Tier 1 Draft EIS) for NEC FUTURE was completed in December 2015 and assesses the broad impacts of investment programs to improve passenger rail service within the NEC FUTURE Study Area. A Service Development Plan (SDP) will be prepared based on the selection of the investment program identified through the NEC FUTURE Tier 1 EIS Process. The SDP will provide the platform for implementation of the program by the federal government, states, the NEC Infrastructure and Operations Advisory Commission (NEC Commission), and the NEC railroads.

FRA developed projections for the future passenger train volume through the B&P Tunnel for the year 2040 as part of the NEC FUTURE program. These projections identified the need for a minimum of four tracks through Baltimore to serve the future passenger demand along the NEC.

j. Baltimore Penn Station Master Plan (2015)

Amtrak is in the early planning stages of developing a master plan for the future needs at Baltimore Penn Station (Amtrak, 2015). The plan will outline a series of incremental and phased improvements to the station facility and select land assets to guide the station into the future. The master plan will build off three studies: the Operations and Facilities Study, which will assess the long-term operational and facility requirements for Baltimore Penn Station to meet the growing capacity demands; the State of Good Repair Study; and the Commercial Development Study. Early coordination between the B&P Tunnel Project team and Baltimore Penn Station representatives indicate that neither project would impact the other. Planned high level platforms at Baltimore Penn Station would not have any material effect to the alternatives considered for replacing the B&P Tunnel.

5. System Linkage and Rerouting

There are no practical detours available to route rail traffic around the existing B&P Tunnel for maintenance or in case of emergencies without rail services experiencing extensive delays. In an emergency or bottleneck situation, there is no way to route NEC traffic over the CSX, or vice versa. This lack of inoperability came to the forefront during the Howard Street Tunnel fire, when CSX had to route trains via Cleveland, Ohio (FRA and MDOT, 2011). Another constraint associated with system linkage is related to the close proximity of the Union Street Tunnel and its passenger and freight restrictions with substantial elevation changes.

With no practical detour route options for the existing B&P Tunnel, a major maintenance problem in the tunnel could have a substantial impact to rail operations, since the NEC does not have inherent redundancy at this location. The existing B&P Tunnel's two tracks are in the same structural envelope, which means that incidents that affect service on one track, most likely affect the other track as well, reducing the possibility of single-tracking around an issue. Single-tracking can be accomplished in some cases if a train can safely pass on the other track, but since there is no physical separation between the tracks, tunnel repairs typically impact service

on both tracks. Currently, if the existing B&P Tunnel were closed for major renovations/repairs or an emergency, passenger train service along the NEC through Baltimore would be stopped.

A three-hour delay and an additional 111.6 miles are added to Norfolk Southern freight trains' travel time and route when they must bypass the existing B&P Tunnel (Plate C Clearance) by leaving the main line at Manassas Junction and traveling to Front Royal in Virginia where they connect to Roanoke, Virginia; Hagerstown, Maryland; and Harrisburg, Pennsylvania. Use of the Hagerstown route eliminates the expensive and time-consuming need to exchange high dimension cars in order for a train to be routed through Baltimore.

6. Capacity to Support Existing and Projected Demands

Roughly 50 million people, or one out of every six Americans, live in the NEC region (NEC IOAC, 2013). "It is the country's economic powerhouse, generating $1 out of every $5 in gross domestic product....The density that supports this immense productivity, however, also creates congestion challenges for [the] transportation network….Every day, over 700,000 people, nearly half of all railroad commuters nationally, travel over portions of the NEC….Overall, ridership on Amtrak's NEC services has grown 37 percent since 2000" and the demand for rail service along the NEC is at record levels (NEC IOAC, 2013). "Contributing factors to this growth include a relative rebound in population and employment growth in its major urban markets, increasing delays affecting other major transportation options including highways and air travel, and the reliability and convenience of rail in serving core-city markets for both intercity and local travel. The NEC, however, cannot continue to accommodate this rising demand due to infrastructure that is highly constrained and in need of repair" (NEC IOAC, 2013).

As population increases and dependency on rail transportation grows, the demand for more efficient, better rail service within the Northeast megaregion is expected to rise. This will increase the service demands for the number of passenger trains for Amtrak and MARC along the NEC and require additional capacity and improved operations throughout the Project limits.

a. Existing Use

i. *Commuter and Passenger Rail*

As shown in **Table 5**, 57 MARC trains currently use the existing B&P Tunnel each day. Of those, 17 trains travel through the tunnel during the four-hour evening peak period. MARC has approximately 4,600 passenger trips that use the tunnel per day with 1,900 passenger trips using the tunnel during the four-hour evening peak period.

Amtrak has a total of 88 trains that currently use the existing B&P Tunnel per day, made up of 33 Acela Express trains, 43 Northeast Regional service trains, and 12 long-distance trains. Of those, 18 trains travel through the tunnel during the four-hour evening peak period. Amtrak has approximately 17,000 passenger trips that use the tunnel per day, with 3,400 passenger trips using the tunnel during the four-hour evening peak period.

i. *Freight Rail*

Approximately 50 Class 1 and regional freight trains use the NEC each day to serve industries, power plants and ports in the Northeast and Midwest. This heavy volume of freight traffic reinforces the NEC's role as a vital link in the national freight network. However, due to capacity, speed, and loading constraints, all rail freight movements between the northeast and southwest parts of the Port of Baltimore are difficult and costly to accomplish. Due to clearance limitations in the B&P Tunnel, NS cannot route many types of shipments to the southwest part of the Port and CSX cannot route many shipments to the northeast part of the Port. This lack of connectivity and routing flexibility diminishes the Port's efficiency and attractiveness. The Port is a major economic player in the Baltimore region and generates $1.5 billion in business revenue annually (Amtrak, 2010a).

Table 5: NEC Trips through the Existing B&P Tunnel Corridor

	Number of Trains (2014)		Number of Passengers (2014)	
Types of Service	Daily	4-Hour PM Peak Period	Daily	4-Hour PM Peak Period
Intercity	88	18	17,000	3,400
MARC Commuter Rail Service	57	17	4,600	1,900
NS Freight	2	0	N/A	N/A
TOTAL	**145**	**35**	**21,600**	**5,300**

Source: (Amtrak, December 2012 and 2014)

Amtrak has statutory and contractual obligations to permit the continued operation of freight trains. Currently, NS operates two trains through the existing B&P Tunnel daily for freight purposes, none of which travel through the tunnel during the four-hour peak evening period, as shown previously in **Table 5**. Due to the tunnel clearances, freight usage is limited and most freight on the NEC is routed around the existing B&P Tunnel.

Vertical clearance is a limiting characteristic of the existing B&P Tunnel. The existing vertical clearance of the B&P Tunnel ("Plate C") is unable to support passage of larger, newer freight cars ("Plate H"). **Table 6** shows the critical dimensions and examples of associated car types. "Plate" refers to a standard-sized opening of the tunnel, giving vertical and horizontal clearance of the train.

Table 6: Critical Dimensions and Associated Car Types

Plate	Maximum Height Above the Top of Rail	Width at Maximum Height Above Top of Rail	Typical Car Types Satisfying Plate
C	15'6"	7'0"	Conventional box cars, flats (depending on load), gondolas, coal hopper cars
H	20'2"	8'6⅜"	Double-stack container cars, tri-level auto rack cars, high-cube box cars

The existing B&P Tunnel's Plate C clearances do not allow sufficient clearance for modern, efficient Plate H double-stack container cars, tri-level auto carriers, and high-cube box cars (FRA and MDOT, 2011). For clearance plate C, the maximum height above the top of rail is 15'6" and width at maximum height above top of rail is 7'0". Typical car types used with clearance plate C are conventional box cars, flats, gondolas, and coal hopper cars. None of the north-south traffic lanes through Baltimore can currently accommodate Plate H double stack container cars and tri-level auto carriers. Therefore, NS cannot service any local shippers south of Baltimore with the most modern cars. In Washington, D.C., the District Department of Transportation (DDOT) and CSX are studying the Virginia Avenue Tunnel in order to accommodate Plate H clearances and address another major bottleneck in the eastern seaboard freight network. Completion of the Virginia Avenue Tunnel project[6] would

[6] Please refer to "www.virginiaavenuetunnel.com" for additional information regarding the Virginia Avenue Tunnel project.

shift greater focus on the existing B&P Tunnel as a freight clearance impediment, and further emphasize the need to improve the freight clearance at the existing B&P Tunnel.

b. Future Needs

"The aging and congested multimodal transportation network of the Northeast region is facing a crisis. An expected increase in population, estimated to grow by 30 percent from roughly 50 million residents today to 65 million in 2050, will create additional travel demand and strain an already stressed network that routinely operates near or at capacity along key segments" (Amtrak, 2012). According to the *Baltimore Railroad Network: Analysis and Recommendations* (FRA and MDOT, 2011), the demand for train movements of all types is expected to increase by 40 percent northeast of Baltimore and 37 percent southwest of Baltimore between 2008 and 2050. By mid-century, a heightened pressure for rail transport would place a huge incremental load on an antiquated rail network that, if left unchanged, would continue to detract from the speedy, efficient, and economical movement of passengers and goods along the East Coast (FRA and MDOT, 2011).

i. *Commuter and Passenger Rail*

Future needs for Amtrak in the NEC are identified in the series of reports and plans covered under **Section II.E.4.,** Operational Needs of the NEC.

The average annual growth from 2007 to 2012 for the MARC Penn Line was 3.5 percent, and ridership demand is expected to continue to grow at historical rates. MARC service is expected to increase substantially both north and south of Baltimore, with possible extensions to Elkton, Maryland, or Newark, Delaware, in the longer term. The *MARC Growth and Investment Plan Update - 2013 to 2050* identifies challenges related to trains being crowded at rush hour and states that adding flexibility and expanding service is constrained by infrastructure (MTA, 2013). MARC expects a three percent future ridership increase per year on the Penn Line, which is the equivalent of approximately 60 percent ridership increase through 2030 when compounded annually (LTK Engineering Services, 2014).

The *West Baltimore MARC Station Master Plan (Transit-Centered Community Development Strategy)* identifies improvements to the Penn Line and West Baltimore MARC Station that would reduce the amount of time between trains (Baltimore City and MDOT, 2008). The proposed improvements would allow a decrease from 25-minute to 15-minute headways during rush hour, from once an hour to once every 30 minutes in non-rush hour times, and providing late evening and weekend service.

The MTA has been considering the potential to create accessibility, in compliance with the Americans with Disabilities Act (ADA), to the West Baltimore MARC Station. One method to accomplish this is to relocate the existing MARC platforms several hundred feet south of the existing West Baltimore MARC Station.

ii. *Freight Rail*

According to the *Baltimore's Railroad Network - Challenges and Alternatives* report, the freight capacity of the Baltimore network is not enough to handle the expected freight volumes forecasted for 2050 (FRA, 2005). A 44 percent national increase in freight traffic is projected by 2030 (Amtrak, 2010a).

F. Summary

The Project purpose and need is to address the structural and operational deficiencies of the existing B&P Tunnel and support future high-speed rail services along the NEC. The Project would improve operations along the NEC, improve passenger rail services, and support existing and future demands along the NEC. The physical condition of the existing B&P Tunnel requires that it be rebuilt or replaced within the next 10-20 years (FRA and MDOT, 2011). Not only is the structure over 140 years old, the design of the railway is unable to support higher speed trains or more passenger and freight capacity. The structural and operational deficiencies result in a transit bottleneck along the NEC in Baltimore.

According to the *Northeast Corridor Infrastructure Master Plan*, the existing B&P Tunnel is important not only for Baltimore, but also the entire NEC (Amtrak, 2010a). The NEC traverses eight northeast states and Washington, D.C. It is shared by eight commuter railroads and three freight railroads. It connects the five major metropolitan areas of Washington, D.C., Baltimore, Philadelphia, New York, and Boston. The existing B&P Tunnel is a centerpiece of the Baltimore rail network that contributes to the economic vitality of the Northeast region. The Master Plan identifies the need to maintain the current NEC system in a state of good repair; integrate intercity, commuter, and freight service plans; and move the NEC forward to meet the expanded service, reliability, frequency, and trip-time improvements that are envisioned by the Northeast states and the District.

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III. ALTERNATIVES DEVELOPMENT

This DEIS includes a detailed evaluation of the four remaining alternatives for the B&P Tunnel Project: Alternative 1: No-Build, Alternative 3A, Alternative 3B, and Alternative 3C. These four alternatives were retained through a comprehensive alternatives development and evaluation process that incorporated input from the public as well as federal, state, and local government agencies.

The alternative development and evaluation process identified 16 Preliminary Alternatives. These 16 alternatives were evaluated in a Preliminary Screening Analysis and resulted in the elimination of 12 preliminary alternatives. Alternatives 1, 2, 3, and 11 remained for further studies based on the evaluation of environmental impacts, public comments, and ability to meet Purpose and Need. This process is documented in the *Preliminary Alternatives Screening Report*.

Alternatives 1, 2, 3 and 11 were further refined to address rail service demands and minimize impacts, leading to the development of three options (A, B, and C) for Alternative 3 and two options (A and B) for Alternative 11. Alternatives were compared and evaluated, and Alternatives 2 and 11 were eliminated and Alternatives 1, 3A, 3B, and 3C were retained. The evaluation of all the alternatives is documented in the B&P Tunnel *Alternatives Report*.

The following sections in this chapter summarizes the alternatives development process from the initial identification of preliminary alternatives through the elimination of alternatives for details studies. The Alternatives retained for further study in this DEIS are described in detail in following Chapter IV.

A. Preliminary Alternatives Development and Screening

The initial range of alternatives was identified based on previous studies, including *Baltimore's Railroad Network Study* (FRA, 2005; FRA and MDOT, 2011) and during the preliminary alternatives development phase of the Project. A total of 16 preliminary alternatives were identified, including Alternative 1: No-Build, Alternative 2: Restore/Rehabilitate Existing B&P Tunnel, and fourteen new location alternatives. The 14 new location alternatives included five alternatives based on previous studies (Alternatives 3 through 7), and nine additional alternatives identified by this Project (Alternatives 8 through 16). Alternative 16 was based on public comments received at the October 29, 2014 public open house.

FRA considered the following preliminary alternatives:

- Alternative 1: No-Build
- Alternative 2: Restore/Rehabilitate Existing B&P Tunnel
- Alternative 3: Great Circle Passenger Tunnel
- Alternative 4: Presstman Street
- Alternative 5: Route 40
- Alternative 6: Locust Point
- Alternative 7: Sports Complex
- Alternative 8: Wilson Street—Existing Tunnel
- Alternative 9: Mosher Street North
- Alternative 10: Mosher Street South
- Alternative 11: Robert Street South
- Alternative 12: Robert Street North
- Alternative 13: Wilson Street—Under Existing Tunnel
- Alternative 14: North Avenue Bridge
- Alternative 15: Gilmor Street—Existing Tunnel
- Alternative 16: North Avenue Tunnel (Alternative from Public Input)

The preliminary alternatives screening process was applied to all of the 16 preliminary alternatives with the exception of Alternative 1: No-Build and Alternative 2: Restore/Rehabilitate Existing B&P Tunnel. In accordance with Council on Environmental Quality guidance (40 CFR Part 1502.14(d)), Alternative 1: No-Build was not screened, as it is the baseline against which the impacts of the Build Alternatives are assessed. Alternative 2 was not fully evaluated because there was insufficient information at the time on the most appropriate manner of tunnel restoration and rehabilitation, future uses of the existing tunnel, and whether re-construction of the tunnel could reasonably accommodate train operations.

Alternatives 3 through 16 were first screened for fatal flaws that clearly rendered the alternative not feasible or unreasonable. An alternative was considered to have a fatal flaw if it did not meet Purpose and Need, did not utilize existing infrastructure at Baltimore Penn Station and the Gwynns Falls Bridge, or would result in an unacceptable engineering issue that could not be reasonably avoided or solved during the early stages of alternatives development. Alternative 5: Route 40, Alternative 6: Locust Point, Alternative 7: Sports Complex, Alternative 14: North Avenue Bridge, Alternative 15: Gilmor Street, Alternative 16: North Avenue Tunnel, were all found to have a fatal flaw.

The eight remaining preliminary alternatives that did not have a fatal flaw were then evaluated using criteria derived from the Project Purpose and Need, as well as functional needs identified by FRA, MDOT, and Amtrak. A total of 24 screening criteria within these categories were identified: Engineering, Operational, and Environmental. These criteria are summarized below.

1. Engineering

- Tunnel Separation: the minimum separation between existing underground structures (especially the MTA Metro tunnel) and the proposed tunnel should be 30 to 40 feet.
- Tunnel Clearance: alternatives should be able to accommodate Plate H (double stack) clearance for either twin single-track tunnels or a single double-track tunnel.
- Horizontal Curvature: alternatives should allow for design speed of 40 miles per hour or greater.
- Vertical Grade: the maximum vertical compensated grade should not exceed two percent.
- West Baltimore MARC Station Service: the alternative should be capable of serving the West Baltimore MARC commuter rail station.
- Track Grade at Baltimore Penn Station: alternatives should not alter existing track alignments at Baltimore Penn Station.
- Physical Constraints: the alternatives should not impact physical constraints, including MTA Light Rail, the CSX track under Howard Street, the Jones Falls Bridge, the Jones Falls Expressway and the Howard Street Bridge.
- Separated Right-of-Way: tunnels should be on physically separate right-of-way (ROW) within a well-protected perimeter.

2. Operational

- Amtrak and MARC Operations: Amtrak and MARC should be able to maintain the volume and frequency of trains through Baltimore Penn Station with no significant interruptions.
- Number of Tracks and Throughput Capacity: tunnels should include at least two tracks and a practical throughput capacity of at least 24 trains per hour per direction during and after construction. This is equivalent to a theoretical throughput capacity of 30 trains per hour or two-minute headways between trains.

- Travel Time: tunnels should reduce travel time between the northern and southern project limits.
- NEC Operational Reliability: each track should be bi-directional and the tunnel should have universal interlocking with the NEC mainline (the ability for a train on any track to reach any other track within the limits of the interlocking).
- Movement of Freight: alternative should accommodate movement of freight at current (2015) levels.

3. Environmental

- Primary Construction Method: tunnels should be primarily bored, and should require limited cut-and-cover construction.
- Parks: impacts to parks located within the surface disturbance footprint should be avoided or minimized.
- Residential Land Uses: impacts to residential land use areas within the surface footprint should be avoided or minimized.
- Existing Bridge over Jones Falls: alternatives should utilize the existing bridge over Jones Falls.
- Minority and Low-income Communities: alternatives should avoid or minimize impacts to low-income and minority populations.
- Historic Districts and Structures: effects to historic districts and structures within the surface footprint should be avoided or minimized.

As a result of this initial screening process, twelve alternatives were eliminated from further study, and four alternatives, including Alternative 1 and Alternative 2, were retained for further engineering development and environmental evaluation. This information was presented to the public in December 2014 in the *Preliminary Alternatives Screening Report*. The results of this evaluation are shown in **Table 7.**

Table 7: Preliminary Alternatives Screening Results

	Alternative	Basis for Elimination or Retention
Eliminated from Study	Alternative 4: Presstman Street	• Does not meet tunnel separation requirement. • Amount of cut-and-cover construction would likely result in more severe environmental impacts relative to the other alternatives.
	Alternative 5: Route 40	• Fatal flaw: Does not utilize existing infrastructure at Baltimore Penn Station.
	Alternative 6: Locust Point	• Fatal flaw: Does not utilize existing infrastructure at Baltimore Penn Station.
	Alternative 7: Sports Complex	• Fatal flaw: Does not utilize existing infrastructure at Baltimore Penn Station.
	Alternative 8: Wilson Street-Existing Tunnel	• Requires closing the existing tunnel during construction. • Fails to avoid a key physical constraint (CSX mainline). • Likely to have substantial environmental impacts.
	Alternative 9: Mosher Street North	• Conflicts with multiple rail lines at Baltimore Penn Station. • Fails to meet NEC reliability criterion that requires two-track operation and universal interlocking with the existing NEC mainline.

	Alternative 10: Mosher Street South	• Conflicts with multiple rail lines at Baltimore Penn Station. • Fails to meet NEC reliability criterion that requires two-track operation and universal interlocking with the existing NEC mainline. • Fails to avoid a key physical constraint (CSX mainline). • Likely to have substantial environmental impacts.
	Alternative 12: Robert Street North	• Fails to avoid a key physical constraint (MTA Metro rail line). • Fails to maintain existing passenger operations during construction. • May have substantial environmental impacts.
	Alternative 13: Wilson Street-Under Existing Tunnel	• Fails to avoid a key physical constraint (CSX mainline). • Fails to maintain existing passenger operations during construction. • May have substantial environmental impacts.
	Alternative 14: North Avenue Bridge	• Fails to meet profile grade requirements. • May have substantial environmental impacts.
	Alternative 15: Gilmor Street-Existing Tunnel	• Proposed geometry impossible to design or construct.
	Alternative 16: North Avenue Tunnel	• Fails to meet profile grade requirements.
Retained for Further Study	Alternative 1: No-Build	• Serves as baseline for comparison to other alternatives
	Alternative 2: Restore/Rehabilitate Existing Tunnel	• Additional information needed to determine the viability of alternative; in particular, the most appropriate method of tunnel restoration or rehabilitation and whether construction could reasonably accommodate train operations.
	Alternative 3: Great Circle Passenger Tunnel	• Does not contain a fatal flaw and meets engineering and operational criteria.
	Alternative 11: Robert Street South	• Does not contain a fatal flaw and meets engineering and operational criteria.

Based on the *Preliminary Alternatives Screening Report* (PASR) screening criteria, Alternatives 3 and 11 met tunnel separation goals, had less conflict with physical constraints, maintained existing Amtrak operations, maintained at least two tracks and throughput capacity of at least 24 trains per hour in each direction, supported NEC reliability, and required a potentially less-invasive primary construction method (boring instead of cut-and-cover). The remaining four alternatives (Alternative 1: No-Build, Alternative 2: Restore/Rehabilitate Existing B&P Tunnel, Alternative 3: Great Circle Passenger Tunnel, and Alternative 11: Robert Street South) were retained for further design development and environmental evaluation.

B. Development of Alternatives 1, 2, 3, and 11

Alternatives 1, 2, 3, and 11 carried forward from the *Preliminary Alternatives Screening Report* underwent additional, more detailed, preliminary engineering review based on refined design goals, criteria, future rail

demands, required operational services and safety. Construction methods and potential community impacts were also taken into consideration during the development of the alternatives and included public and agency input, as described in **Section VII.**

1. Alternatives Design Goals

Design development and environmental evaluation were based on refined design goals that considered existing and future NEC operations, the Baltimore Penn Station Master Plan, and input from agencies and the public.

a. NEC Operations

In the Project Area, NEC operations consist of shared rail service through the B&P Tunnel by Amtrak Northeast Regional and Acela Express passenger trains; the MARC commuter train between the West Baltimore MARC Station and Baltimore's Penn Station; and NS freight. Amtrak NEC service and some MARC Penn Line trains are powered by overhead electric wires (catenary), while other MARC and freight trains are powered by diesel-electric locomotives. MTA plans to increase the number of MARC diesel locomotives by 2019.

A total of 145 daily trains traverse the B&P Tunnel with a maximum of 35 trains during the four-hour afternoon peak period. The majority of trains using the B&P Tunnel are Amtrak trains (61 percent), 38 percent are MARC trains, and less than 1 percent are NS freight trains. In 2014, an estimated 21,600 people passed through the tunnel daily, of which 79 percent are Amtrak passengers and 21 percent MARC passengers.

The NEC is included in multiple national efforts including the HSIPR Program (implemented by the 2009 *High Speed Rail Strategic Plan* (USDOT, 2009)), 2008 Congressional Mandate for Amtrak to Reduce Travel Time along the NEC (Public Law 110-432), *Amtrak NEC Master Plan* (Amtrak, 2010a), and the NEC FUTURE Program (USDOT, Accessed September 8, 2014). Those efforts are described as follows:

- HSIPR Program
  - Strategic investments in the nation's transportation network of passenger rail corridors to connect communities across the country.
  - *High Speed Rail Strategic Plan* (USDOT, 2009).
- 2008 Congressional Mandate for Amtrak to Reduce Travel Time along the NEC
  - Section 212(d) of the PRIIA Public Law 110-432.
  - Goals are reduced travel time along the NEC, improved train operations, increased service capacity, maintenance of rail services, and cost benefits.
- *Amtrak NEC Master Plan* (Amtrak, 2010a).
  - Provides the baseline for infrastructure investments needed to maintain the current NEC system in a state of good repair (SOGR)[7].
  - Integrates intercity commuter and freight service plans and moves the NEC forward to meet the expanded service, reliability, frequency, and trip-time improvements envisioned by the Northeast states and Washington, D.C.
- NEC FUTURE Program
  - FRA comprehensive planning effort to define, evaluate, and prioritize future investments in the NEC, from Washington, D.C. to Boston, Massachusetts.
  - Improve the reliability, capacity, connectivity, performance, and resiliency of passenger rail service on the NEC for both intercity and regional trips.

[7] SOGR is defined by the USDOT as a condition in which the existing physical assets, both individually and as a system, (a) are functioning within their "useful lives" and (b) are sustained through regular maintenance and replacement programs.

As described in the NEC FUTURE *Tier 1 EIS Alternatives Report* (FRA, 2015), the NEC FUTURE Program considers the B&P Tunnel Project an element of the Program. The Project will continue to be coordinated with the NEC FUTURE Program to ensure compatibility with future design and construction of the NEC FUTURE alternatives.

b. Baltimore Penn Station Master Plan

The Baltimore Penn Station Master Plan is in its early planning stages that include consideration of both short- and long-term improvements. In the short term, general station improvements would include modifying existing low-level platforms to high-level platforms on certain tracks with level boarding. None of these changes would affect where B&P Tunnel tracks would tie into station tracks. Long-term improvements, such as a streetscape, bike lanes, etc., would not affect or need to be incorporated into the B&P Tunnel Project.

c. West Baltimore MARC Station Improvements

Over the last several years, MTA in coordination with FTA has been making incremental improvements to the existing West Baltimore MARC Station. These improvements include upgrades to the facilities including addressing some of the ADA compliant needs. It is not feasible to construct a fully accessible station with high level platforms and level boarding that is in compliance with ADA at the current station because it is is located along a curved portion of the track. Since the existing Station cannot be completely upgraded to be ADA compliant, MTA has been reviewing options to relocate the Station to the south along a straight portion of the track; however, there has been concern from the public and MTA regarding the distance of the potential new station in relation to the existing parking lots. Amtrak and MTA have been coordinating the need to maintain service and operations for MARC passengers and the potential to straighten the curve and provide a fully accessible Station at the existing location.

d. Overall Design Goals

Several goals for the B&P Tunnel Project guide the design process. The overall design for the B&P Tunnel Project will provide:

- Optimal safety
- Minimum travel times (maximum speeds)
- Maximum passenger comfort
- Optimum constructability
- Minimum long-term maintenance costs

The Alternative design must meet the purpose and need for the Project as well as preserve as much existing infrastructure as possible. The Alternatives should:

- Include four tracks optimized for Amtrak and MARC commuter services, with freight able to provide service on either set of tracks.
- Provide reduced trip times by enabling higher speeds.
- Offer greater capacity by increasing the number of tracks and supporting double stack container freight cars.
- Provide universal interlockings with the NEC mainline.
- Minimize substantial track modifications south of, and over, Gwynns Falls Bridge and through, or north of, Baltimore Penn Station.
- Serve the West Baltimore MARC Station and Baltimore Penn Station.
- Have no impact on the MTA Metro tunnels and underground Penn-North or Upton Avenue/Market stations.
- Preserve the CSX track under Howard Street, Amtrak Jones Falls Bridge, Jones Falls Expressway and the Howard Street Bridge.

- Enable freight movement at current levels.
- Continue operation of the two tracks through the existing tunnel during construction, with temporary outages taken as permitted by rail schedules weekday nights and on weekends during construction.

The B&P Tunnel design should not preclude implementing the alternatives of the NEC FUTURE Tier 1 EIS (USDOT and FRA, 2015). The following describes applicable NEC FUTURE constraints:

- Build alternatives include four tracks through the B&P Tunnel.
- Provide for a minimum of 70 mph speeds where possible for passenger trains throughout the project limits.
- Ensure that conflicts do not occur between express through-rail traffic at Baltimore's Penn Station and MARC commuter trains turning at the station. NEC FUTURE assumes NEC intercity operations would typically be on the railroad's west side of Baltimore's Penn Station (geographical north) with MARC operations on the railroad's east side (geographical south). Two mainline tracks would feed each line on either side of the station, which is consistent with the current operating pattern. To provide operational redundancy and resiliency, either service should be able to use alternate station tracks when conditions warrant.

2. Alternative Design Criteria

Design criteria establish the standards and guidance needed to complete the engineering and design work for the proposed B&P Tunnel modernization or replacement. These criteria, standards and guidance are described in the B&P Tunnel Project *Draft Final Design Criteria Report* and form the basis for design updates during the Preliminary Engineering phase of the Project.

Table 8 summarizes the design criteria and assumptions most relevant to the development and evaluation of B&P Tunnel alternatives. Many design criteria stipulate the components, size, clearance, and placement of design features. These criteria originate from regulations, oversight agency guidance, and knowledge of safety standards, constructability, operational parameters, and maintenance needs.

Table 8: Design Criteria and Assumptions

Design Criterion/Assumption	Description
Design Speed	Intercity Passenger Trains: Maximum 110 mph or greater Commuter Passenger Trains: Maximum 70 mph Freight Trains: Maximum 50 mph
Horizontal Geometry	Curvature should support desired maximum speeds. When a horizontal curve is located on the grade, the maximum allowed grade on the curve is reduced by 0.04 percent for each degree of horizontal curve.
Slope/Grade	Grades measured as the change in elevation in feet per 100 feet of horizontal distance shall not exceed 2 feet (or 2.000 percent grade). Avoid frequent changes in gradient.
Geotechnical	Maximize tunnel placement in bedrock to minimize the amount of soft ground and mixed-face mining required.
Mining Tunnel Portal	Minimum 50 feet depth from ground surface to top of rail for underground construction.
Tunnel Clearance	One set of tracks per bore. Design to Plate H clearances suitable for double stack container freight operations with an operating envelope, generally, of 10 feet 8 inches wide by 20 feet 3 inches tall.
Internal Tunnel Dimensions	Approximately 30 feet diameter to allow safe passage of trains, operation and maintenance of tunnel, and meet applicable regulatory code[1].

Design Criterion/Assumption	Description
Fire Life/Safety	Ensure emergency ventilation and exits. Emergency ventilation provided by jet fans in the tunnel and/or ventilation plants housing fans and other equipment. With multiple tunnels, place cross passageways for separate track tunnels at no more than 800 foot intervals between adjacent tunnels or use fire-resistant enclosed stairways/passageways with maximum distance to surface of 2,500 feet, separate from ventilation shafts. The maximum distance between emergency exits cannot exceed 2,500 feet. Evacuation Walkways: 30 foot clearance between composite clearance template and any continuous obstruction alongside the track in a designated passenger emergency evacuation path.
Signals	Design based on fixed interlockings at the "Charles" Interlocking on the north and the "Bridge" Interlocking on the south.
Utilities	Consider railroad alignment changes to avoid or minimize difficult or costly utility relocations.
Right-of-Way (ROW)	Safety and security of the public, as well as the neighborhoods that house the railroad, require a physically separate ROW with a well-protected perimeter. The Project must, by location and design, prevent unauthorized intrusion into or upon the operating railroad environment, discourage vandalism, loitering, or dumping on the ROW or adjacent to facilities.

3. Alternative Options and Track Alignments

During further engineering development and environmental evaluation, three options were developed for Alternative 3, and two options were developed for Alternative 11. The options follow similar alignments as their respective alternatives and were developed in order to address issues such as minimizing environmental impacts, flattening curves to increase speeds, and/or minimizing impacts to large underground utilities such as sanitary sewers or storm drains. Additionally, as the alternatives underwent continued development, Alternative 2 was modified to involve reconstruction and modernization of the existing tunnel. The *Alternatives Report* evaluated Alternative 1: No-Build, Alternative 2: Reconstruct and Modernize Existing Tunnel, Alternative 3 Option A, Alternative 3 Option B, Alternative 3 Option C, Alternative 11 Option A, and Alternative 11 Option B. A full description of the alternatives and evaluation is presented in the *Alternatives Report*.

Additional information on how tunnels are built and the basis for the number of tunnels developed for Alternative 3 and Alternative 11, is included below.

Railroad tunnels may be constructed in several ways, including:

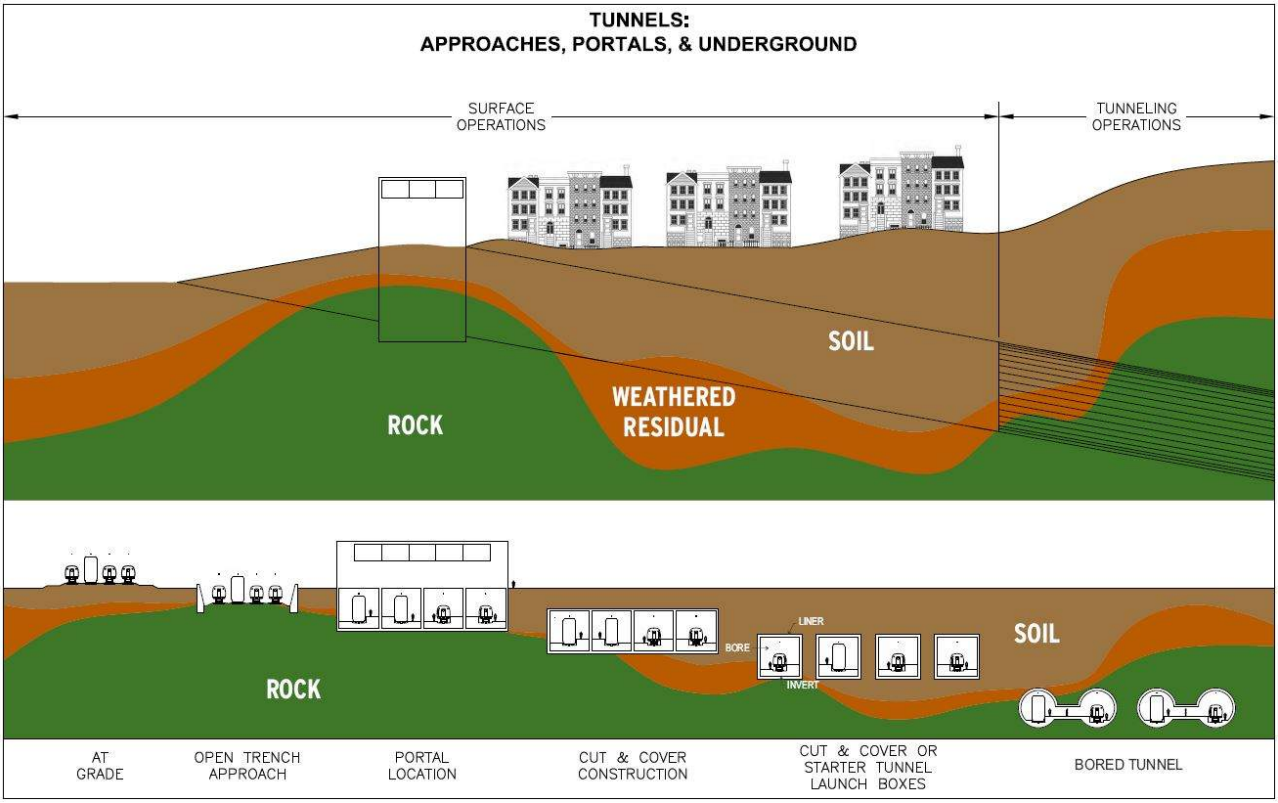
- Cut-and-cover construction where an open trench is excavated, the tunnel built, and then covered.
- Horizontal excavation by mining, which includes boring with a tunnel boring machine, drill and blast, or sequential excavation.

Cut-and-cover construction requires removal of everything on the surface, above the planned tunnel, and excavating a deep and wide trench; in which the tunnel structure is constructed and then covered, restoring the ground cover. After excavation, the trench would be covered with fill material. Where cut-and-cover construction would occur, the covered portion would likely exist as grass-covered open space. Any land use aside from open space would need to be planned and coordinated with B&P Tunnel Project engineers.

Horizontal excavation by mining involves boring at a portal where the alignment would transition from surface to underground and excavating horizontally; surface disturbance would only occur at the approaches to the portals on either end of the tunnel and for ancillary structures like emergency exits. Depending upon

topography, depth of the tunnel, and other factors; tunnels may have sections that are mined and other sections that are cut-and-cover. When both cut-and-cover and mining operations are employed, the portals would occur between the mined and cut-and-cover sections and would not be visible from the surface. In these cases, the permanent, visible entrances to the finished tunnel would occur at the exposed end of the cut-and-cover section. See **Figure 4** for a schematic diagram.

Figure 4: Tunnel Terminology Diagram



The tunnels proposed as options under Alternatives 3 and 11 would all predominantly use tunnel boring techniques to minimize surface impacts. A combination pressurized face/rock tunnel boring machine would be used to maintain stability of the excavation face in soil, bedrock, and weathered bedrock while advancing the tunnel excavation. The outside approaches, sloping down to the portals, would be built with a combination of trench cutting and cut-and-cover construction techniques. Ancillary structures, such as ventilation shafts or emergency egress, could be mined in a combination of mechanical excavation and controlled blasting.

4. Four Tracks

Consistent with NEC long-range planning needs identified in the NEC FUTURE Program, the B&P Tunnel Alternatives 3 and 11 propose a total of four tracks through Baltimore. The increased number of tracks will eliminate a chokepoint and expand capacity to accommodate future high-frequency, high-speed passenger train service anticipated on the NEC by 2040. Four tracks provide the resiliency/redundancy needed to maintain rail traffic between the West Baltimore MARC Station and Baltimore Penn Station and NEC connectivity in the event of interruptions to service on any of the tracks. Four tracks also provides the ability for conflict-free operation and separation of traffic types (intercity vs. commuter) which further improves operations, reduces travel time, and accommodates over-takes of slower trains by faster trains.

Alternatives 3 and 11 would have tunnel clearances to accommodate double stack container freight cars, known as AAR Plate H. Alternative 2 would increase the height of the rehabilitated tunnel to accommodate double stack

container freight cars. Neither Alternative 1: No-Build nor Alternative 2: Restore/Rehabilitate Existing B&P Tunnel would include four tracks. The current tunnel does not accommodate Plate H equipment and cannot be made so without reconstruction, therefore Alternative 1 would not accommodate Plate H.

5. Four Separate Tunnel Bores

For Alternatives 3 and 11, single sets of tracks in four separate, equally-sized tunnel bores are proposed. The single track design instead of two double-track tunnels is based on several criteria: conflict-free operations, physical constraints, and constructability. It has been determined that four tunnel bores, as opposed to two bores with two tracks each, would achieve the project's operational and safety needs. The design for four separate bores is driven by engineering issues related to conflict-free operations, physical constraints, and constructability as described below.

a. Conflict-free Operations

Alternatives were designed with the goal of conflict-free operations and service flexibility, so that the number of conflicting moves at railroad interlockings and places where two or more sets of tracks would cross (junctions) are minimized. These movements can be controlled by at-grade signaling or grade-separated crossings. A subterranean grade-separated track crossing or "duck under" is proposed as the most efficient method for preventing conflicts, and maintaining operational goals, for the new four-track B&P Tunnel. This could not be achieved if two sets of tracks were together in a single tunnel.

b. Physical Constraints

The separation of four sets of tracks into individual tunnel bores is driven by physical constraints that include passing beneath the existing Metro tunnel and its Penn-North or Upton/Avenue Market stations. The depth of the subway and geotechnical ground conditions require approximately one-half tunnel diameter of separation, which would result in a railroad grade just under the design criterion of 2.000 percent. Two percent is the maximum design grade allowable to connect to the existing NEC near the West Baltimore MARC Station. A single bore with two sets of tracks would be wider, resulting in an increased vertical separation between the new tunnel and the Metro subway. Lowering the tunnel to provide the additional clearance would increase the steepness of the grade and exceed the maximum for connection to the NEC at the West Baltimore MARC Station. To avoid an increase in profile grade, the connection between a new B&P Tunnel with double tracks and the existing NEC would have to be made further south of the West Baltimore MARC Station. This would increase surface impacts by requiring a longer trench excavation for the approach to the new tunnel, require modifications to the West Baltimore MARC Station, and cause more extensive impacts to adjacent communities.

c. Constructability

Another issue in the decision to construct four sets of tracks in four separate tunnel bores is constructability of the tunnel portal, where the surface transitions to the underground tunnel bore. A conservative criterion used to select the location of a tunnel portal is where ground cover above the tunnel is a minimum of 75 percent of the proposed tunnel diameter. Single tracks in a single bore would be a minimum of 50 feet below the overlying ground surface to the top of rail elevation. Two tracks per bore would be a minimum of 62 feet from top of rail elevation to the overlying ground surface. The latter would not work at the north portal because the grade would be too steep for connecting to the existing "Charles" Interlocking, which is a relatively short distance to the railroad north (geographical southeast).

The available space for the "Charles" Interlocking between the north portal and Baltimore Penn Station is a limiting factor. The limited space would also incur more surface impacts at the south portal from a longer trenched approach, which would connect to the existing NEC alignment further south. The north and south portals could be shifted further away from the existing alignment, but this would encroach further into neighborhoods and greatly increase environmental impacts to communities.

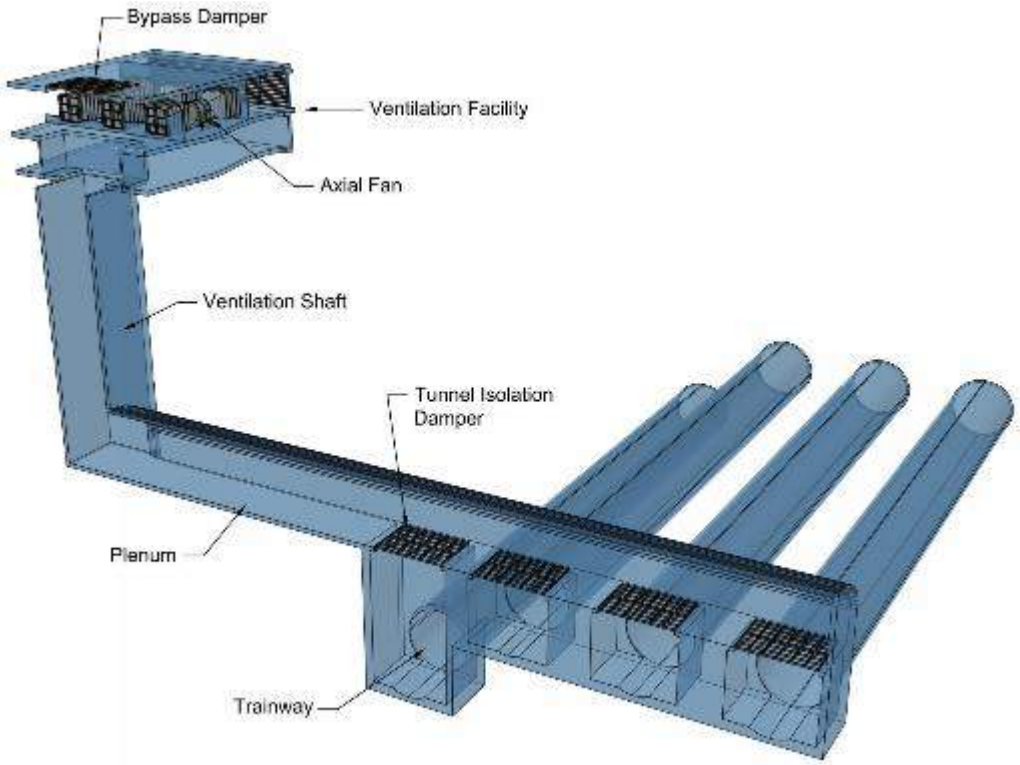
6. Ventilation Plants

Each Build Alternative proposed for the B&P Tunnel Project would require a ventilation system with three above-ground ventilation plants in order to meet current safety industry standards (NFPA 130) for projected NEC FUTURE train demand and headway.

Ventilation plants, are an essential Life/Safety component of the B&P Tunnel Project. As shown in **Figure 5**, they are an above-ground structure housing facilities essential to safely and securely performing necessary tunnel ventilation, including fans, operation and control equipment, fire protection equipment, and emergency exits. The purpose of the ventilation plant is to pull fresh air into the tunnel and ventilate the tunnel air to the outside; this is done through both passive (from train movement) and active (from fans) ventilation. Passive or active ventilation occurs depending on the following tunnel operations:

- Normal operation: trains run at their scheduled speed, providing sufficient ventilation through the piston effect, or "push-pull" movement.
- Congested operation: trains run at slower speeds and do not provide sufficient passive ventilation, necessitating active mechanical ventilation.
- Maintenance operation: while work is being performed in the tunnel, trains would not provide sufficient passive ventilation, requiring active mechanical ventilation to provide a safe atmosphere for workers. Ventilation plants maintain safe air quality by automatically turning on fans when sensors indicate air is nearing air quality standards for nitrogen dioxides, an indicator pollutant, regulated by the Occupational

Figure 5: Ventilation Plant Schematic



Safety and Health Administration (OSHA). The diesel emissions discharged from the fan plants will meet national ambient air quality standards (NAAQS). The ventilation plants will also reduce heat generated by train operations.

- Emergency operation: in a potential emergency situation, active mechanical ventilation is necessitated to control heat and smoke to provide a tenable environment for first responders and emergency egress

The number and placement of ventilation plants is determined by tunnel length and the necessary number of ventilation zones. Three ventilation plants— one at the north portal, one at an intermediate location along the tunnel alignment, and one at the south portal— are needed to divide each alternative into two ventilation zones. Current industry safety standards dictate that only one train can be permitted in a ventilation zone at a time. The tunnels proposed under each Build Alternative would be approximately two miles long, and projected NEC FUTURE train demand and headway could not be met with a single ventilation zone tunnel. Train performance models show that the NEC FUTURE demand and headway requirements can be met with two ventilation zones for this Project. The interface between the two ventilation zones must be located at the point that balances travel time in each ventilation zone (considering both directions). Due to asymmetrical curvature and grades, differing speeds trains enter the tunnel depending on their direction of travel, and braking distances; the ventilation zone interface is not in the geographic middle of the tunnel for each option under Alternative 3.

The ventilation zones are created by installing tunnel isolation dampers in the tunnel ceiling at the interface location (**Figure 3**). The dampers are connected to the intermediate ventilation plant at the surface by a horizontal connecting tunnel and vertical shaft. In order to meet practical air velocities and pressures, this conduit must have a cross-sectional area larger than 30 feet in diameter.

Preliminary engineering determined that a site sized approximately 100’ x 200’ and 55 feet tall would be needed. In order to function properly there needs to be at least 3,000 square feet of louvers and the bottom of the louvers must be at least 12 feet above ground. The facility is sized to address emergency ventilation requirements in one tunnel at a time; this emergency capacity provides sufficient capability for normal, congested, and maintenance operations in all four tunnel simultaneously

a. Intermediate Ventilation Plant Site Identification

The size of the ventilation plants are determined by the equipment that is located within them, which is largely dictated by the size of fire that is to be controlled by the ventilation plant. The ventilation plant footprint is estimated to be up to 200 feet by 100 feet and approximately 55 feet high. The ventilation plants must be large enough to house the required number of fans and ancillary equipment, such as silencers and dampers, as well as associated ductwork to connect to the tunnel. The ventilation plants contain electrical equipment such as transformers and motor starters and provide emergency and maintenance access to the tunnels. The ventilation plants would, to the greatest extent practical, conform to local building codes and complement/blend in with the built environment. **Image 1** and **Image 2** show examples of existing and proposed ventilation plant designs for similar (but smaller) projects in New York.

C. Elimination of Alternatives from Further Study

The Alternatives and Options summarized above were evaluated using the 52 criteria shown in **Table 2.** These criteria include design criteria, design goals, and environmental impacts. The overall categories are Operations, Engineering, Transportation, Cost, Construction, ROW, Community Resources, Cultural Resources, Natural Resources, and Other Environmental.

The *Alternatives Repor*t documented the conclusion that Alternative 1: No-Build, Alternative 3 Option A (Alternative 3A), Alternative 3 Option B (Alternative 3B), and Alternative 3 Option C (Alternative 3C) were still under consideration. Alternative 2, Alternative 11 Option A, and Alternative 11 Option B were eliminated from further consideration. The reasons for elimination are described below.

Image 1: Existing Ventilation Plant, 58 Joralemon Street, Brooklyn, NY

Image 2: Proposed Ventilation Plant Example in NY

1. Alternative 2: Reconstruct/Modernize Existing Tunnel

Alternative 2 would reconstruct and modernize the existing tunnel, but would not meet the project's Purpose and Need.

Specific reasons for the elimination of Alternative 2:

- Construction would require the complete cessation of rail service along the NEC corridor, including all Amtrak service, MARC service north of the West Baltimore MARC Station, and freight service using the B&P Tunnel during construction. Service would be interrupted for an extended period of time, as long as several years.
- Design speeds would be the same as the current tunnel; horizontal geometry would remain effectively unchanged. Design speed would be as low as 30 mph, significantly lower than the other Build Alternatives.
- No travel time savings over existing conditions.
- Can only accommodate two tracks, which does not allow for future growth in rail service along the NEC.
- An option to build four new tracks could be accommodated by more significant widening of the existing alignment. This option was not analyzed because there is no available ROW and widening would require significant residential takes for the entire length of the alignment. An option to build four new tracks under the existing tunnel (in a two-by-two arrangement) is not feasible due to the clearance needed from the MTA Metro Subway line and geometry needed to bring the tracks together in a four track arrangement transitioning from the tunnel portals.
- Due to the shallow depth of the existing tunnel, the only viable construction approach is open excavation along the entire tunnel length. This excavation would have significant impacts on the community, including the following:

- Full or partial closure of Wilson Street, Winchester Street, and numerous cross streets throughout construction.
- No parking along Wilson Street or Winchester Street during construction.
- Limitations for residential and commercial access along Wilson Street and Winchester Street during construction.
- Minor impacts to four parks—Eutaw Place Median Park, Park Avenue Median Park, Mount Royal Median Park, and Fitzgerald Park.
- Substantial residential property impacts.
- Severe impacts to North Avenue, central Light Rail line, and CSX Main Line operations due to open cut construction through North Avenue, light rail, and CSX track beds.

2. Alternative 11 Option A

Alternative 11 Option A would meet the project Purpose and Need. However, the overall impacts would not result in commensurate benefits compared to the alternatives still under consideration.

Specific reasons for the elimination of Alternative 11 Option A:

- Extensive excavation in a residential area, with the following resulting impacts:
  - 140 historic buildings impacted, more than any other Build Alternative.
  - 160 parcels impacted, more than any other Build Alternative.
  - 140 residential displacements, more than any other Build Alternative.
  - 20 business displacements, more than any other Build Alternative.
  - Loss of 120 on-street parking spaces.
  - High level of community impacts during construction.
  - Potential environmental justice considerations—impacts within minority communities and partially within low income communities.
  - 210 buildings with potential noise impacts, more than any other Build Alternative.
  - Permanent closure of some sections of local streets.
- West Baltimore MARC Station shifted further south, which is a less desirable location for the station and access to parking lots and bus lines.
- Demolition of the American Ice Company building, a locally-important, community historic resource.
- Potentially severe impact to redevelopment efforts envisioned in the West Baltimore MARC Station Master Plan due to relocation of the station away from planned redevelopment properties and demolition of the American Ice Company building, a centerpiece of the plan.
- Impacts to Winterling Elementary School.

3. Alternative 11 Option B

Alternative 11 Option B would meet the project Purpose and Need. However, the overall impacts, less operational flexibility, and high construction cost would not result in commensurate benefits compared to the alternatives still under consideration.

Specific reasons for the elimination of Alternative 11 Option B:

- Requires demolition of the entire block bounded by Edmondson Avenue, Franklin Street, Pulaski Street, and the Amtrak NEC. Due to the construction, the entire block is lost to excavation and the needs of the B&P Project. There is no opportunity to use cut-and-cover construction and gain back any of the property for other uses.
- Potential environmental justice considerations: all residences and businesses taken are within minority and low income communities.

- Potentially severe impacts to the redevelopment efforts envisioned in the West Baltimore MARC Station Master Plan, including demolition of nearby properties proposed for redevelopment.
- Historic resources: demolition of the American Ice Company building and other historic resources in the Midtown Edmondson Historic District.
- Minor impacts to Winterling Elementary School recreational facilities.
- Reconstruction of Franklin and Mulberry Streets at a higher elevation to accommodate Alternative 11 Option B passing underneath. The higher elevation would raise Franklin and Mulberry Streets to between 10 and 20 feet, with resultant impacts including visual effects.
- Highest capital cost among Build Alternatives, estimated at $4.2 billion.
- Requires a MARC Station to be constructed below surface grade, in a cut section.
- Requires taking of a portion of the existing West Baltimore MARC Station parking lots.
- Less operational flexibility compared with other build options:
    - During construction, most work would be performed without affecting NEC operations once temporary runaround tracks are in place. However, the runaround tracks require a lower operating speed, thereby affecting train movement during the project.
    - Alternative does not accommodate a new “Fulton” (partial) Interlocking. If one of the two tracks that serve the side platforms at West Baltimore MARC was out-of-service, one MARC platform would not be accessible.
    - Requires construction of a temporary viaduct west of the existing tracks between Franklintown Road and Edmondson Avenue to maintain NEC service throughout the duration of construction.

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