Chapter 2: Project Alternatives

A. INTRODUCTION

This chapter reviews the alternatives development and screening process, describes the No Action Alternative and the Build Alternatives retained for detailed study, and identifies the Preferred Alternative. The estimated project costs and a list of potential permits and approvals required to build the Proposed Project are also provided.

The Proposed Project is located between Philadelphia and Washington D.C. along the National Railroad Passenger Corporation's (Amtrak) Northeast Corridor (NEC). The direction on the rail line from Philadelphia to Washington D.C. is south. Therefore, unless otherwise noted in this Environmental Assessment (EA), north is towards Philadelphia, south is towards Washington D.C., east is downstream or towards the Chesapeake Bay, and west is upstream or towards the Conowingo Dam. Proposed Project construction is scheduled to commence in 2020. Year 2025 is analyzed as the Proposed Project build year (the year when the Proposed Project elements are scheduled to be fully connected to the NEC). For long-term planning this EA also considers a 2040 analysis year. This EA is based on conceptual engineering alignments. The disclosure of effects is based on the design information available at the time of conceptual design completion. The engineering design has since progressed and further refinements and changes will continue to be made. While the Project Team assessed reasonable worst-case effects that are anticipated for the Proposed Project based on the conceptual design, it is possible that future design changes could lead to adverse effects that are not known at this time. If as a result of design changes the Project Team identifies the potential for additional or greater adverse effects in the future, the Project Team will prepare a follow up targeted environmental review.

B. ALTERNATIVES DEVELOPMENT AND SCREENING

The Project Team developed a rigorous alternatives development and screening process for the Proposed Project. This process considered both alignment alternatives as well as bridge type alternatives. **Appendix A**, "Alternatives Screening Report and Bridge Types," includes a detailed report describing alternatives development; input solicited from the public, agencies, and other stakeholders; and the methodology used to screen alternatives and selected those retained for detailed study. The section below presents a summary of that process.

DEVELOPMENT OF ALIGNMENT ALTERNATIVES

The Project Team (including FRA and MDOT) identified design factors to be incorporated into the conceptual alternatives. These design factors, which were considered independently and collectively:

- Geometry—any feasible conceptual alternative must consider the existing geometry of the NEC. Existing alignments of commuter and freight facilities were also considered including use of Norfolk Southern Railway's (NS) Port Road route and service to/from the Perryville

Maryland Area Regional Commuter (MARC) Station. Furthermore, Amtrak has standard plans and specifications that provide detailed geometry requirements for tracks carrying Amtrak passenger service. These standards are required to meet federal regulations, assure passenger comfort, and provide a safe, maintainable design.

- Design Speed—A critical element of the project's Purpose and Need is to reduce trip times and optimize infrastructure to accommodate future high-speed rail operations along the NEC. This approach is consistent with the congressional mandate placed on Amtrak to reduce travel times along the NEC and the desire to identify 160 miles per hour (mph) as the maximum authorized speed, wherever feasible. Feasible conceptual alternatives must provide at least two tracks for high-speed rail service, and at least one track primarily for freight and commuter rail service (supporting speeds of up to 90 mph).
- Bridge Spacing—Maintaining continuous rail service during construction cannot preclude navigation for extended periods of time. Increasing the distance between bridges more than necessary would result in greater property acquisitions. For those conceptual alternatives involving two bridges across the Susquehanna River, a phased construction of the bridges will generally be required to maintain continuous rail traffic across the river (i.e. two bridges will not be built simultaneously nor could the existing bridge be removed from service until a replacement bridge has been constructed).
- Navigational Clearances—A temporary winter closure of the existing movable span may be necessary during the construction period. This closure will temporarily restrict navigation of high-mast vessels during the winter months, which is the time of the year with the least navigation activity. A navigation study[1] for the project determined that a vertical clearance of 60 feet above the mean high water (MHW) elevation for any new river span is the optimal balance between the needs of mariners and of the passenger and freight rail providers. The navigation study also determined that while the existing horizontal clearance (two 100-foot-wide channels) is sufficient, further widening of the horizontal clearance could increase sight distance, reduce vessel congestion, and aid tug boat and barge navigation through the bridge opening, increasing safety and resilience against potential bridge and fender system strikes.
- Grades—Amtrak's standards generally permit up to a 1.5 percent compensated grade on mainline tracks. This grade is consistent with industry standards for maximum grades on freight and passenger mainline track. However, the existing grades on NS's Port Road and Amtrak's NEC are less than this maximum, ranging from 0.14 percent to 0.24 percent for the NS Port Road route and between 0.3 percent and 0.68 percent north and south of the bridge. The conceptual designs considered the existing maximum effective or ruling grade for the route. In coordination with NS, the Project Team determined that, for this project with current and anticipated freight train usage, a 0.65 percent maximum grade is appropriate for tracks primarily dedicated to freight operation.
- Relationships to Other Projects—The Project Team designed all conceptual alternatives so as not to preclude adjacent and related planned transportation projects. Such projects include freight rail improvements (e.g., the Chesapeake Connector Project), Maryland Transit Administration's (MTA) MARC Northeast Maintenance Facility and Penn Line extension, the Federal Railroad Administration's (FRA) NEC FUTURE, regional bicycle and pedestrian trails, and others.

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[1] Susquehanna River Rail Bridge Reconstruction and Expansion Project Navigation Study, dated January 21, 2014, HNTB Corporation.

Using the design factors described above, the Project Team identified 18 conceptual alternatives. The approximate locations of each of the 18 conceptual alternatives are shown in **Figure 2-1**. A brief description of each of the conceptual alternatives is detailed in **Table 2-1**.

Table 2-1
Description of 18 Conceptual Alternatives

Alternative	Alternative Description*
1A	• New high-speed 2-track bridge to east of existing bridge; second bridge in place of existing bridge • Up to 4 tracks total; max speed of 140 mph
1B	• Similar to 1A but closer to existing bridge, requiring temporary closure of swing span • Up to 4 tracks total; max speed of 140 mph
2A	• New high-speed 2-track bridge to the west of existing bridge; second bridge in place of existing bridge • Flyover structure in Perryville • Up to four tracks total; max speed of 135 mph
2B	• Similar to 2A but closer to existing bridge; requiring temporary closure of swing span • Up to 4 tracks total; max speed of 135 mph
3A	• New curved high-speed 2-track bridge to east of existing bridge; second bridge in place of existing bridge • Up to 4 tracks total; max speed of 160 mph
3B	• Similar to 3A but closer to existing bridge, requiring temporary closure of swing span • Up to four tracks total; max speed of 160 mph
4A	• New high-speed 2-track bridge to east of existing bridge; second bridge in place of existing bridge • Requires reconstruction of Lewis Lane overpass • Up to 4 tracks total; max speed of 160 mph
4B	• Similar to 4A but closer to existing bridge, requiring temporary closure of swing span • Up to four tracks total; max speed of 160 mph
4C	• Similar to 4B but with reduced speed • Up to 4 tracks total; max speed of 135 mph
4D	• New high-speed 3-track bridge to the east of existing bridge • Requires reconstruction of Lewis Lane overpass and temporary closure of swing span • 3 tracks total; max speed of 160 mph
4E	• Similar to 4D but with reduced speed • Requires temporary closure of swing span • 3 tracks total; max speed of 135 mph

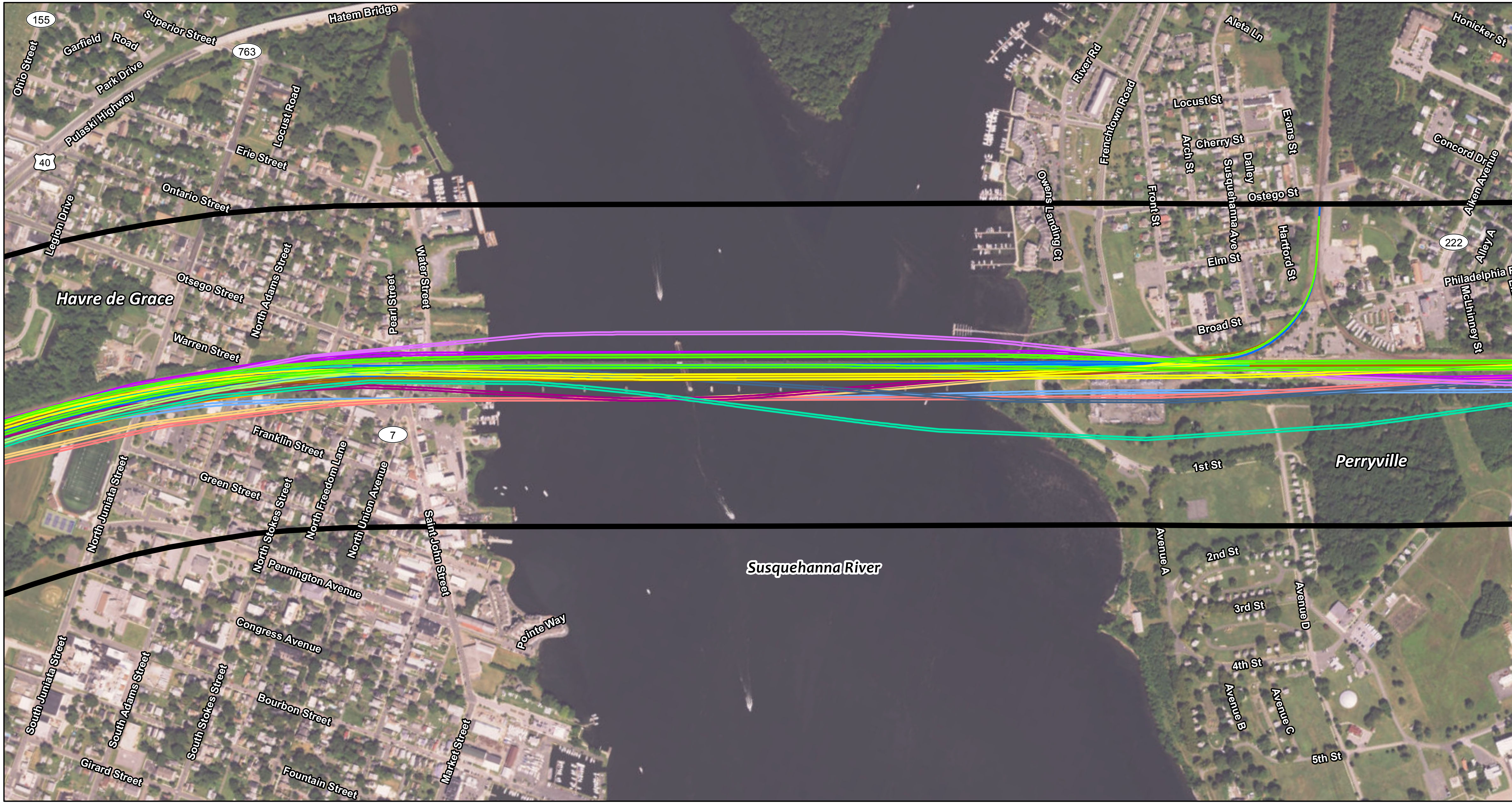
Table 2-1 (cont'd)
Description of 18 Conceptual Alternatives

Alternative	Alternative Description*
5	• New high-speed 2-track bridge to east of existing bridge; second bridge in place of existing bridge • Substantial curve to avoid right-of-way impacts • Up to 4 tracks total; max speed of 130 mph
6	• New high-speed 2-track bridge to east of existing bridge; second bridge in place of existing bridge • Elevated through Havre de Grace; extensive, complicated double decker structure • Requires temporary closure of swing span during winter season • Up to 4 tracks total; max speed of 160 mph
7	• New high-speed 2-track bridge to east of existing bridge; second bridge in place of existing bridge • Significant curvature to avoid Perryville substation • Up to 4 tracks total; max speed of 160 mph
8A	• Similar to 1B but with reduced speed; requires temporary closure of swing span • Up to 4 tracks total; max speed of 120 mph
8B	• New high-speed 3-track bridge to the east of existing bridge • Requires temporary closure of swing span • 3 tracks total; max speed of 120 mph
9A	• New 90-mph bridge to the west of existing bridge; high-speed 2-track bridge in place of existing bridge • Requires reconstruction of Lewis Lane Bridge and temporary closure of swing span • 4 tracks total; max speed of 160 mph
9B	• New 90-mph bridge to the west of existing bridge; high-speed 2-track bridge in place of existing bridge • Requires reconstruction temporary closure of swing span • 4 tracks total; max speed of 150 mph

The Project Team also considered:

- Rehabilitating the existing bridge without modifying the track alignments;
- Converting the swing bridge into a lift bridge during rehabilitation; and
- Rehabilitating the existing bridge for non-rail use.

After the Project Team developed the 18 conceptual alternatives and the Rehabilitation Alternative ("Rehab"), it identified three additional conceptual alternatives ("CE") and considered two alternatives suggested by the public ("P") and a value engineering alternative ("VE"). These additional alternatives are described in **Table 2-2**.



Legend

Alignment - 1A	Alignment - 3A	Alignment - 4C	Alignment - 6	Alignment - 9A
Alignment - 1B	Alignment - 3B	Alignment - 4D	Alignment - 7	Alignment - 9B
Alignment - 2A	Alignment - 4A	Alignment - 4E	Alignment - 8A	1,000 ft Study Area
Alignment - 2B	Alignment - 4B	Alignment - 5	Alignment - 8B	

0 530 1,060 Feet

Susquehanna River Rail Bridge Project

Figure 2-1
Conceptual Alternatives Development

Table 2-2
Description of Additional Alternatives

Alternative	Alternative Description
CE1	• Construction of two 1-track bridges on either side of the existing bridge • A third bridge replacing the existing bridge
CE2	• Utilization of an abandoned grade-separated crossing, located north of the existing bridge
CE3	• Construction of a 3-track high speed bridge, located west of the existing bridge
P1	• Construction of an underground tunnel for high speed rail • Alternative suggested by a member of the public
P2	• Rerouting the NEC to join the existing CSX bridge, located to the north of the existing Amtrak bridge • Alternative suggested by a member of the public
VE	• Two 2-track bridges on either side of the existing bridge • Developed during the value engineering study

In all, the Project Team developed 25 alternatives throughout the course of the alternatives development process.

ALIGNMENT ALTERNATIVES SCREENING PROCESS

As detailed in **Appendix A**, the Project Team used a two-step screening process to evaluate these 25 alternatives. The first step entailed a "fatal flaw screening" and the second step entailed a "detailed screening." Throughout the screening process, the Project Team considered input provided through public outreach efforts, coordination with local officials, Section 106 consulting party meetings, interagency review meetings, and other stakeholder meetings.

The fatal flaw screening evaluated the 25 alternatives based on their ability to satisfy the following criteria. These criteria were developed from the Project's Purpose and Need Statement and through coordination at Interagency Review Meetings (IRM).

- Rail connectivity;
- Navigational requirements;
- Logical termini;
- Feasibility and constructability; and
- Avoidance of critical property impacts.

As shown in **Table 2-3** (and discussed further in **Appendix A**), the fatal flaw screening eliminated the Rehab alternative and nine of the 18 conceptual alternatives. Of the six other alternatives (CE, P, and VE), the VE conceptual alternative passed the fatal flaw screening.

Table 2-3
Fatal Flaw Screening of Conceptual Alternatives

Alt #	Build Scenario	Fatal Flaw Screening Criteria					
		Rail Connectivity	Navigational Requirements	Logical Termini	Feasibility and Constructability	Avoids Critical Property Impacts	Pass or Fail
1A	1	No	Yes	Yes	Yes	No	Fail
1B	1	Yes	Yes	Yes	Yes	Yes	Pass
2A	2	No	Yes	Yes	No	No	Fail
2B	2	No	Yes	Yes	No	No	Fail
3A	1	No	Yes	Yes	Yes	No	Fail
3B	1	No	Yes	Yes	Yes	Yes	Fail
4A	1	No	Yes	Yes	Yes	No	Fail
4B	1	Yes	Yes	Yes	Yes	Yes	Pass
4C	1	Yes	Yes	Yes	Yes	Yes	Pass
4D	3	Yes	Yes	Yes	Yes	Yes	Pass
4E	3	Yes	Yes	Yes	Yes	Yes	Pass
5	1	No	Yes	Yes	Yes	Yes	Fail
6	1	No	Yes	Yes	No	Yes	Fail
7	1	No	Yes	Yes	Yes	Yes	Fail
8A	1	Yes	Yes	Yes	Yes	Yes	Pass
8B	3	Yes	Yes	Yes	Yes	Yes	Pass
9A	4	Yes	Yes	Yes	Yes	Yes	Pass
9B	4	Yes	Yes	Yes	Yes	Yes	Pass
Rehab	N/A	Yes	No	Yes	No	Yes	Fail
CE1	N/A	No	Yes	Yes	No	Yes	Fail
CE2	N/A	No	Yes	No	Yes	No	Fail
CE3	N/A	Yes	Yes	Yes	No	Yes	Fail
P1	N/A	No	Yes	No	No	Yes	Fail
P2	N/A	No	Yes	No	No	No	Fail
VE	N/A	Yes	Yes	Yes	Yes	Yes	Pass

The Project Team based the second step of the screening process on a more detailed evaluation of each of the 10 remaining alternatives. The detailed screening considered each alternative's impacts to environmental resources – human and natural – as well as each alternative's ability to meet the project's operational and engineering goals. Concurrent to conceptual engineering, the Project Team inventoried environmental resources in the study area, and factored that information into the detailed screening. Property impacts were further evaluated beyond the critical property assessment used in the fatal flaw screening, as discussed in **Appendix A**. The Project Team considered input received during public and agency meetings during the screening process. Each conceptual alternative's ability to meet the following goals and objectives of the Proposed Project were compared and contrasted:

- Improve rail service reliability and safety;
  - Ability to eliminate operational disruptions and delays;

  - Ability to connect to NS wye and provide grades acceptable for freight operations;
  - Ability to provide adequate number of bridge structures;
- Improve operational flexibility and accommodate reduced trip times;
  - Ability to reduce operational conflicts;
  - Ability to eliminate or reduce speed restrictions for intercity trains;
  - Ability to provide flexibility for operational and maintenance work windows;
- Optimize existing and planned infrastructure and accommodate future freight, commuter, intercity, and high-speed rail operations;
  - Ability to eliminate two-track section in this portion of the NEC;
  - Ability to not preclude future high-speed rail;
  - Ability to minimize impacts to Perry Electrical Substation;
  - Ability to allow for potential shared corridor with bike/pedestrian path;
- Maintain adequate navigation and improve safety along the Susquehanna River;
  - Ability to provide suitable vertical and horizontal clearance;
  - Construction-period effects to navigation (i.e. whether the alternative requires temporary winter closure of movable span).

As described above, a total of 10 conceptual alternatives proceeded to detailed screening: Alternatives 1B, 4B, 4C, 4D, 4E, 8A, 8B, 9A, 9B, and VE. All required decommissioning and removing the existing bridge. Among the 10 remaining conceptual alternatives, the maximum achievable speed ranges from a low of 120 mph (which does not meet the design criterion) to a high of 160 mph (which meets the design criterion). Every option includes either three or four tracks. A detailed Alternatives Comparison Matrix evaluating all human environmental considerations, natural environmental considerations, and operational and engineering considerations for each of the 10 conceptual alternatives is presented in **Figure 2-2**.

Based on the detailed screening, the Project Team retained Alternative 9A and Alternative 9B for detailed study in the EA. The primary reasons for selecting Alternatives 9A and 9B for detailed study included: maximum authorized speed, potential property impacts, and the total number of tracks across the river. Based on current operational information, the Project Team deemed a four-track river crossing (or a three-track river crossing with the potential for the addition of a fourth track) superior to a three-track river crossing. Additionally, a maximum authorized speed of 160 mph is needed to optimize the NEC as a high-speed rail corridor. The Project Team determined that Alternative 9A and Alternative 9B best meet the goals and objectives of the project, while minimizing environmental and property impacts. The rationale for eliminating each of the other alternatives, as well as the interagency and public consultation process used during the alternatives screening process is detailed in **Appendix A**.

BRIDGE TYPE ALTERNATIVES

Independent of the alignment alternative screening process and selection of alternatives for detailed study, the Project Team reviewed four bridge types for the project. The bridge types are independent from the two-step screening process, since any of the bridge types could be feasible with the alternative alignments under consideration.

Alternatives Comparison Matrix - Operational and Engineering Considerations

EVALUATION CRITERIA	Units	Alternative 1B	Alternative 4B	Alternative 4C	Alternative 4D	Alternative 4E	Alternative 8A	Alternative 8B	Alternative 9A	Alternative 9B	VE
Improve rail service reliability and safety											
Eliminates operational disruptions/delays	Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Connects to NS wye and provides grades acceptable for freight operations		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of bridge structures	#	2	2	2	1	1	2	1	2	2	2
Improve operational flexibility and accommodate reduced trip times											
Reduces operational conflicts	Level at which alterntaive meets criteria	Excellent	Excellent	Excellent	Fair	Fair	Excellent	Fair	Excellent	Excellent	Excellent
Eliminates or reduces existing speed restrictions for intercity trains		Eliminates	Eliminates	Eliminates	Eliminates	Eliminates	Reduces	Reduces	Eliminates	Eliminates	Eliminates
Provides flexibility for operational and maintenance work windows		Very Good	Very Good	Very Good	Good	Good	Very Good	Good	Very Good	Very Good	Very Good
Ability to provide for NS/MARC Operations during Construction		Good	Good	Good	Good	Good	Good	Good	Excellent	Excellent	Good
Optimize existing and planned infrastructure											
Eliminates two-track section in this portion of NEC and meets corridor wide improvement needs along NEC	# of tracks provided by alternative	4 tracks	4 tracks	4 tracks	3 tracks	3 tracks	4 tracks	3 tracks	4 tracks	4 tracks	4 tracks
Meets future planned 160 mph corridor-wide improvement without future speed restrictions for intercity trains	Y/N - Maximum allowable speed (mph)	No - 140 mph	Yes - 160 mph	No - 135 mph	Yes - 160 mph	No - 135 mph	No - 120 mph	No - 120 mph	Yes - 160 mph	No - 150 mph	No - 140 mph
Impacts to Perry Electrical Substation	Level of impact	Major	Major	Major	Major	Major	Major	Major	Minor	Minor	Major
Allows shared corridor with Bike/Ped path (feasibility evaluation in progress)	Whether alternative precludes	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude
Maintain adequate navigation and improve safety along the Susquehanna River											
Provides suitable vertical clearance (at least 60')	Y/N - Clearance provided (feet)	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'
Maintains or widens horizontal clearance (at least 200')		Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +
Requires temporary winter closure of movable span?	Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Retained for further evaluation		**No**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**No**
Elimination Rationale		**Lower maximum allowable speed than 9B with comparable environmental impacts**	**Impact to Lafayette Senior Housing Facility**	**Impact to Lafayette Senior Housing Facility and low maximum authorized speed**	**Impact to Lafayette Senior Housing Facility; provides three tracks only**	**Impact to Lafayette Senior Housing Facility; offers low maximum authorized speed and three tracks only**	**Undesirable maximum authorized speed**	**Undesirable maximum authorized speed**	**N/A**	**N/A**	**Higher property and natural environmental impacts, but lower speed than 9B**

First Tier of Impacts (green) — Second Tier of Impacts (yellow) — Third Tier of Impacts (orange)

Susquehanna River Rail Bridge Project

Figure 2-2
Detailed Alternatives Comparison Matrix

GIRDER APPROACH / ARCH MAIN SPAN

Under this bridge design type, the proposed east bridge would have a total of 19 in-water piers. The proposed west bridge also would have 19 in-water piers. Sixteen piers would be removed from the existing bridge and 11 remnant piers (from the prior 1860s bridge) would be removed for a net gain of 11 piers. The girder approach / arch main span bridge design is based on typical 170-foot approach spans. As part of the ongoing design effort, longer spans are under consideration.

DELTA FRAME APPROACH / ARCH MAIN SPAN

This bridge design type consists of a network tied arch over the navigable channel with delta frames for the approach spans. Under this bridge design type, the proposed east bridge would have a total of 13 in-water piers. The proposed west bridge would have 13 in-water piers. Sixteen piers would be removed from the existing bridge and 11 remnant piers would be removed for a net reduction of one pier. The delta frame approach / arch main span bridge design is generally based on 200-foot approach spans. Approach spans ranging from 230 to 260 feet were also considered.

TRUSS APPROACH / TRUSS MAIN SPAN

Under this bridge design type, the proposed east bridge would have a total of 13 in-water piers. The proposed west bridge would have 13 in-water piers. Sixteen piers would be removed from the existing bridge and 11 remnant piers would be removed for a net reduction of one pier. The truss approach / truss main span bridge design is generally based on 260-foot approach spans.

GIRDER APPROACH / TRUSS MAIN SPAN

Under this bridge design type, the proposed east bridge would have a total of 19 in-water piers. The proposed west bridge would have 19 in-water piers. Sixteen piers would be removed from the existing bridge and 11 remnant piers would be removed for a net gain of 11 piers. The girder approach / truss main span bridge design is based on typical 170-foot approach spans.

SELECTED BRIDGE TYPE

FRA and MDOT have selected the girder approach / arch main span bridge type for the Proposed Project. The Project Team based this selection on an array of factors, including: environmental resources considerations; engineering and operational factors; agency feedback; and public and mariner input. At various public outreach information sessions, the girder approach / arch main span bridge design received the most support. The top factors of public preference, based on input received, are the overall look, cost minimization, and opening up views to the Susquehanna River. The bridge design types also were presented to various federal and state agencies, and evaluated for their potential to affect various environmental resources—including surface water, submerged aquatic vegetation, and historic resources. Overall, the girder approach / arch main span bridge design is more favorable than the other bridge design types with respect to environmental resources. From an engineering and operations perspective, the girder approach / arch main span bridge design is superior in terms of ease of maintenance for approach spans, structural redundancy for approach space, ease of construction, trespasser resistance from water and land, side-span navigation clearance, and estimated cost. For a detailed discussion of the bridge type screening process, see “Bridge Design Selection Memo” in **Appendix A**.

C. NO ACTION ALTERNATIVE

The No Action Alternative assumes the Susquehanna River Rail Bridge would remain in service as-is, with no intervention besides minimal repairs and continuation of the current maintenance regime. The No Action Alternative will not include any changes to the existing track configuration. Service over the bridge would worsen in the future under the No Action Alternative. The bridge would continue to age, problems would occur more frequently, and the bridge would remain as a bottleneck. The No Action Alternative is used as a baseline scenario against which potential project impacts are measured. The No Action Alternative includes major planned transportation projects within the study area that are expected to be completed by 2025, which is the Proposed Project build year. Such projects include the following:

- **Amtrak State of Good Repair and Service Improvements:** The No Action Alternative would include elements of Amtrak's State of Good Repair program, which involves investments along the NEC to maintain a state of good repair, address deferred maintenance projects, and replace infrastructure that has reached the end of its useful life.
- **MARC Northeast Maintenance Facility:** The MARC Northeast Maintenance Facility would entail construction of a new operation, maintenance, and storage facility located on a 115-acre site in Perryville, adjacent to the NEC. The Federal Transit Administration (FTA) issued a Finding of No Significant Impact (FONSI) to conclude the National Environmental Policy Act (NEPA) review but MTA lacks funding for final design, right of way acquisition or construction. For the analysis of the Proposed Project, it was assumed that by the MARC Northeast Maintenance Facility would be constructed and operational by 2040, the Proposed Project long-term analysis year.

D. BUILD ALTERNATIVES

Based on the detailed screening, the Project Team retained Alternative 9A and Alternative 9B for detailed study. Both would improve rail service and reliability, improve operational flexibility, accommodate reduced trip times, optimize existing and planned infrastructure, maintain adequate navigation, and improve safety along the Susquehanna River. These Build Alternatives vary slightly by alignment and by maximum achievable speed. The Build Alternatives would construct two new high-level fixed bridges. These Build Alternatives could accommodate a four-track scenario or a three-track scenario with an option of a future fourth track expansion. For purposes of a conservative environmental review, the EA analyzes the potential environmental impacts of a full four-track river crossing.

ALTERNATIVE 9A

Alternative 9A would construct a new two-track 90 mph bridge[2] to the west of the existing bridge and a second new two-track 160 mph bridge on the existing bridge alignment (see **Appendix B**, "Engineering Alignments"). The bridge to the west of the existing bridge would be constructed first. Under normal operations, this bridge would be used primarily by MARC commuter rail and NS freight rail service.

[2] Accommodating speeds of up to 100 mph on this bridge is under consideration as part of the ongoing design effort.

Once the new bridge to the west is completed, the existing bridge would be taken out of service, demolished, and replaced. A new high-speed passenger rail bridge would be built in the center of the right-of-way of the existing bridge alignment. The Alternative 9A design would lessen the curve in Havre de Grace, allow for 160 mph speeds, and require property acquisitions (see Chapter 4, "Land Use and Community Facilities"). Since the west bridge will be built first, freight, MARC and Amtrak operations can be maintained throughout construction of both bridges. As shown in **Appendix B**, "Engineering Alignments" the south wye track (connecting the NS Port Road to the NEC in Perryville) would be realigned to accommodate the revised configuration of Perry Interlocking. Although this alternative is based on a four track scenario, it could accommodate a three-track scenario with an option of a future fourth track expansion.

Alternative 9A would modify Perry Electrical Substation but a substantial reconfiguration is not required. This alternative would also demolish the remnants of the former Havre de Grace train station and require shifting of the Perry Interlocking Tower. The Proposed Project would extend the Havre de Grace abutment south towards Freedom Lane. A summary of all affected existing infrastructure is provided in **Table 2-4**. Alternative 9A has an estimated 5-year construction period and an estimated construction cost of $930 million (2015 dollars), based on the construction of the girder approach / arch main span bridge type.

PROFILE CHANGES

For Alternative 9A the rail bridge structures would extend across the Susquehanna River and Union Avenue in Havre de Grace and Avenue A in Perryville. In Havre de Grace, the track would be supported on an embankment with a retaining wall. On the east side, a retaining wall would extend from Union Avenue to a point between Juniata Street and Lewis Lane. On the west side, the retaining wall would extend from Union Avenue to Juniata Street. South of the Havre de Grace Middle/High School athletic fields to Oak Interlocking, the track would remain in its existing roadbed at grade, except near Lewis Run to maintain an existing Amtrak access road west of the tracks. In Perryville, the track would be supported by an embankment with a retaining wall, extending roughly from Avenue A to Mill Creek on the east side and from Avenue A to the existing south access road on the west side. North of these limits to Prince Interlocking, the track would remain in its existing roadbed at grade. The track would also remain at grade along the south wye track.

The proposed profile will raise the elevation of the tracks between Perryville Station and Adams Street in Havre de Grace. The approximate limits of the raises in elevation (i.e., the increase in track height from existing elevation to proposed) are as follows:

- Access Road Undergrade (UG) 59.52 in Perryville - 1 foot
- North Abutment, Susquehanna River Rail Bridge in Perryville - 2.5 feet
- Navigation Channel of the Susquehanna River - 14 feet
- South Abutment in Havre de Grace - 6 feet
- Stokes Street in Havre de Grace - 3 feet
- Adams Street in Havre de Grace - 2 feet

Alternative 9A provides a vertical clearance of 60 feet above MHW at the channel span. Both the east and west bridges would be approximately 38 feet wide with a top-of-rail elevation of 72 feet above MHW. The top of the proposed arch structure spanning the navigation channel would be approximately 152 feet above MHW. The top of the transmission lines would be 190 feet above MHW.

APPROACH STRUCTURES

There are three existing undergrade structures (located below the railroad) located on the Perryville approach that will require modification to accommodate the proposed track alignments. There are seven undergrade structures and one overhead structure between the Susquehanna River and Grace Interlocking in Havre de Grace that will require modifications to accommodate the proposed track alignments (including reconstruction of the Lewis Lane Bridge). The improvements to Grace Interlocking require Track 4 to shift six feet west, resulting in permanent disturbances extending 35 feet from the existing Track 4. This will require extending the culvert at the Lily and Lewis Run crossings. The required modifications to these structures are shown in **Table 2-4**. Alternative 9A requires long sections of track to be built away from the existing corridor on fill. Retaining walls are recommended in order to minimize right-of-way acquisition.

Table 2-4
Summary of Affected Existing Infrastructure

West Side of Corridor
Replace ballast deck bridge 59.52, over Access Road in Perryville
Retaining wall in Perryville to support the west-bridge tracks
New permanent higher-level UG Bridges in Havre de Grace for new western Tracks
60.51 Freedom Lane - extend existing arch
60.56 Stokes Street - new span
60.61 Centennial Lane - extend existing arch
60.62 Adams Street - new span
60.77 Juniata Street - new span
East Side of Corridor
Relocate C&S/third-party utility duct bank
Extend existing masonry arch culvert 59.01, Mill Creek UG Bridge in Perryville
Relocate signal bungalow "59.0" in Perryville
Extend ballast deck bridge 59.39, over Access Road in Perryville
Relocate Perry Interlocking signal equipment
Relocate or demolish Perry Tower in Perryville
Replace ballast deck bridge 59.52, over Access Road in Perryville
Construct retaining wall and viaduct support structures in Perryville
Modify Perry Electrical Substation in Perryville
New permanent higher-level UG Bridges in Havre de Grace for new eastern tracks
60.51 Freedom Lane - extend existing arch
60.56 Stokes Street - replace existing span
60.61 Centennial Lane - extend existing arch
60.62 Adams Street - new span
60.77 Juniata Street - new span
60.85 Stream (Lily Run) - extend existing culvert
61.72 Lewis Run (also referred to as Unnamed tributary to Lily Run) – extend culvert
Reconstruct Lewis Lane Bridge 61.35 to accommodate track shift (Alternative 9A only)
Source: HNTB.

ALTERNATIVE 9B

The main difference between Alternative 9A and Alternative 9B occurs in Havre de Grace along the east side of the corridor from Lewis Lane to the Susquehanna River. Alternative 9B lessens the curve in Havre de Grace and would limit the speed to a maximum of 150 mph. This lower speed, as compared to Alternative 9A, reduces the amount of property acquisitions required, including at the T&D Enterprise parcels and the avoidance of the Havre de Grace Middle/High School athletic fields (see Chapter 4, “Land Use and Community Facilities”, Chapter 9, “Draft Section 4(f) Evaluation”, and Chapter 10, “Section 6(f) Evaluation”). Reconstruction of the Lewis Lane Bridge would not be required. Alternative 9B has an estimated 5-year construction period and an estimated construction cost of $890 million (2015 dollars) based on the construction of the girder approach / arch main span bridge type.

Alternative 9B is very similar to Alternative 9A. Like Alternative 9A, Alternative 9B would result in a new two-track 90 mph bridge west of the existing bridge and a second new two-track bridge replacing the existing bridge. Alternative 9B would also realign the south wye track and modify Perry Electrical Substation, while maintaining freight, MARC, and Amtrak operations throughout construction. Alternative 9B would result in identical profile changes to the rail bridge structures as Alternative 9A, including a vertical clearance of 60 feet above MHW at the channel span. In addition, all impacts to the approach structures located in Perryville are the same for Alternative 9A and Alternative 9B. A summary of all affected existing infrastructure is provided in **Table 2-4**.

ADDITIONAL PROJECT ELEMENTS

In addition to the new bridges and their approaches, the Proposed Project would require modifications to various railroad components—including communication systems, signal systems, traction power, catenary, and rail interlockings. While this type of work would be the same for either Alternative 9A or Alternative 9B, a brief description is provided below.

RAIL SYSTEMS

Communications System

Continuity of the Open Transport Network (OTN) system must be maintained during all phases of construction. It is a communication system that can connect the stations, the control centers, trackside equipment, signal boxes, and other rail infrastructure. New signal houses and block points will be interfaced via local fiber cable and connected to the OTN for communications to Centralized Electrification and Traffic Control (CETC).

Signal System

The signal system design will be based on the new track configuration. New Grace Interlocking will be constructed to extend the length of the interlocking south. A new signal system will be installed at Grace, Perry and Prince Interlockings. New signal houses will be installed at Grace Interlocking between Perry and Prince Interlockings.

Traction Power

Amtrak’s Perry Electrical Substation is located adjacent to the existing right-of-way. Alternative 9A and Alternative 9B would require minimal modifications to Perry Electrical Substation, within the existing substation footprint. Retaining wall construction immediately adjacent to the transmission tower on the west side of the tracks is under consideration to potentially avoid the relocation of the transmission tower.

Overhead Contact System

Tracks 2 and 3 within the project's limits will be upgraded to an auto-tensioned style catenary. The proposed auto-tensioned catenary will be designed to support the new track speeds in accordance with Amtrak and American Railway Engineering and Maintenance-of-Way Association (AREMA) standards. New catenary structures, wires and power sectionalization configurations will be proposed for Grace, Perry and Prince Interlockings based on the track options and staging plans.

IMPACTS TO INTERLOCKINGS

Prince Interlocking

Prince Interlocking is located at MP 57.3, north of the existing bridge. The limits of Prince Interlocking will not change with Alternative 9A or Alternative 9B. Within Prince Interlocking, an existing 45 mph track switch will be removed and replaced with an 80 mph track switch. A second 45 mph track switch will be removed from service.

Perry Interlocking

Perry Interlocking is located at MP 59.5, south of Prince Interlocking, but north of the existing bridge. Both Alternative 9A and Alternative 9B require raising the grade of the tracks at Perry Interlocking. In addition, they require a reconfigured layout to support the bridge alignments and operational requirements. The portion of Perry Interlocking that leads to the NS Port Road Branch will have the north and south track switches upgraded from 40 mph to 45 mph.

Grace Interlocking

Grace Interlocking is located at MP 61.5, south of the existing bridge and south of the curve in Havre de Grace. Modifications to the curve in Havre de Grace are required to support speed improvements. The spirals of the curve in Havre de Grace extend into the existing turnouts at Grace Interlocking. Grace Interlocking will be substantially modified with either Alternative 9A or Alternative 9B. The southern limits will be extended and the three existing 80 mph track switches will be removed and replaced with seven 80 mph track switches. Changes to Grace Interlocking will require extending the culvert at the Lily and Lewis Run crossings.

Oak Interlocking

Oak Interlocking is currently located at MP 63.5. No changes to Oak Interlocking are anticipated with either Alternative 9A or Alternative 9B.

E. REQUIRED APPROVALS

Both Alternative 9A and Alternative 9B would potentially require a number of federal, state, and local permits and approvals (see **Table 2-5**). In addition to these permits, the project must comply with numerous laws, including those regarding worker and public safety, use of parkland and historic resources, and endangered and protected species.

Table 2-5
List of Potential Federal, State, and Local Permits and Approvals

Permits/Approval	Responsible Agency	Activity
Section 106	Federal Railroad Administration, Advisory Council on Historic Preservation, Maryland Historical Trust	Consultation pursuant to National Historic Preservation Act
Section 7 Consultation	National Marine Fisheries Service/US Fish and Wildlife Service	Impacts to federally-listed rare, threatened, or endangered species
Section 4(f)	U.S. Department of Interior (USDOI) (potentially including concurrence from local entities)	Consultation for Section 4(f) Evaluation
Section 6(f)	USDOI	Consultation for Section 6(f) Evaluation for impacts to properties purchased or developed with Land and Water Conservation Funding (LWCF)
Section 404 Permit	United States Army Corps of Engineers (USACE)	Discharge of dredged or fill material into the waters of the U.S.
Section 10 Permit	USACE	Construction of structures in navigable waters
Section 9 Permit	United States Coast Guard (USCG)	Construction/modification of a bridge over navigable waters
Hazards to Navigation Assessment	USCG	Obstructions in navigable waters
Nontidal Wetlands and Waterways Permit, Water Quality Certification, Construction within a 100-year floodplain	Maryland Department of the Environment (MDE)	Discharge of dredged or fill material into waters of the U.S., wetlands, and 100-year floodplains
Water Appropriations Permit	MDE	Dewatering of surface and groundwater during construction
Tidal Wetland License	MDE/Board of Public Works	Filling of open water and vegetated wetlands and construction of piers and associated structures
Maryland Reforestation Law/Forest Conservation Act compliance	Maryland Department of Natural Resources (DNR)	Impacts to forested areas

Table 2-5 (cont'd)
List of Potential Federal, State, and Local Permits and Approvals

Permits/Approval	Responsible Agency	Activity
State-Listed Rare, Threatened, and Endangered Species	DNR	Impacts to rare, threatened, or endangered species
Stormwater Management Approval	MDE	Inclusion of appropriate drainage structures and/or Environmental Site Design (ESD) techniques to manage stormwater runoff
Erosion & Sediment Control Approval	MDE	Applicable erosion and sediment control practices during construction
Maryland Critical Area Commission Approval	Critical Area Commission for the Chesapeake Bay	Impacts within the Critical Areas resulting from earth disturbance, removal of vegetation, placement of fill, and impervious area
Maryland Heritage Areas Authority, Lower Susquehanna Heritage Greenway	Maryland Department of Planning, Maryland Historical Trust (MHT)	Coordination on the protection and enhancement of natural resources and sites, structures, districts, or landscapes which are deemed to be of historic, archeological, or architectural significance.
Note: Other permits may be required.		

F. PREFERRED ALTERNATIVE

In selecting the Preferred Alternative, FRA and MDOT compared the two Build Alternatives and the No Action Alternative for the ability of each alternative to meet the project's purpose and need and goals and objectives. Since the Build Alternatives were developed in consideration of these goals and objectives, there are few differences among the Build Alternatives; however, a key operational consideration is the Proposed Project's ability to optimize existing and planned infrastructure by providing for a maximum authorized train speed of 160 mph, while taking both benefits and potential impacts into consideration. As described above, Amtrak developed the NEC Master Plan with planned speed increases up to a maximum authorized speed of 160 mph for this location along the NEC. Amtrak's NEC Master Plan is consistent with the congressional mandate placed on Amtrak to reduce travel times along the NEC. In addition, USDOT has developed a way to value time travel saving, based on minutes saved per passenger by value of travel time savings per hour.

As discussed above, Alternative 9A would allow for a maximum speed of 160 mph, while Alternative 9B would limit the speed to a maximum of 150 mph. Therefore, Alternative 9A is consistent with operational goals and with broader plans along the NEC. In addition, Alternative 9A would reduce travel times, which would in turn lead to associated cost savings. Although Alternative 9A would result in a minimal increase in impacts (e.g., a commercial displacement, Havre de Grace Middle/High School impact and floodplain, streams, wetland, forest, and Chesapeake Bay Critical Area impacts) as compared to Alternative 9B, these additional impacts can be mitigated and potentially reduced during final design. Additionally, one of the anticipated benefits of a reliable high-speed passenger rail system would be a reduction in greenhouse gas emissions associated with vehicular travel and roadway congestion. FRA has therefore selected Alternative 9A as the Preferred Alternative. ✷