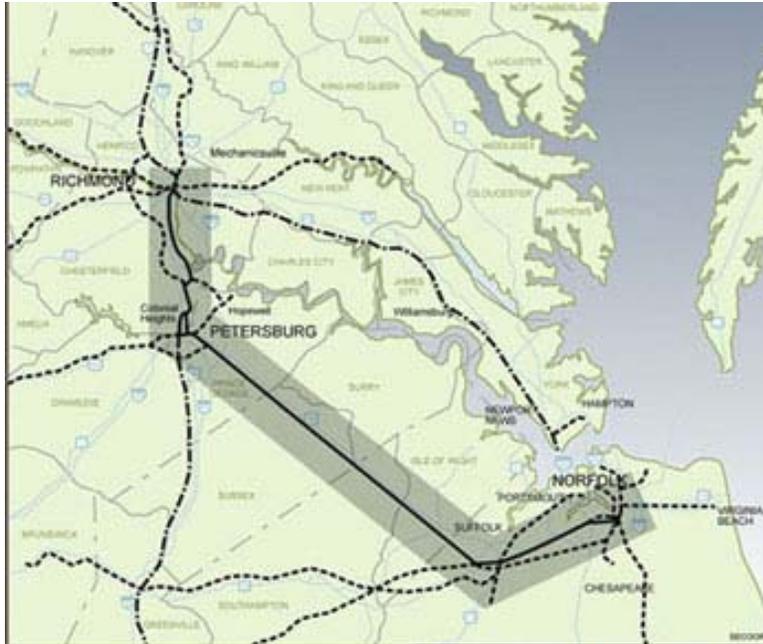


Richmond to South Hampton Roads High-Speed Rail Feasibility Study

TASK 1 - ENGINEERING



Prepared for:
Virginia Department of
Rail and Public Transportation

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Richmond to South Hampton Roads High-Speed Rail Feasibility Study

Introduction

The findings of the Parsons Transportation Group (PTG) team’s Engineering Feasibility Analysis of the Richmond to South Hampton Roads corridor are summarized in this report. Topics addressed in the Engineering Feasibility Analysis Task Report include:

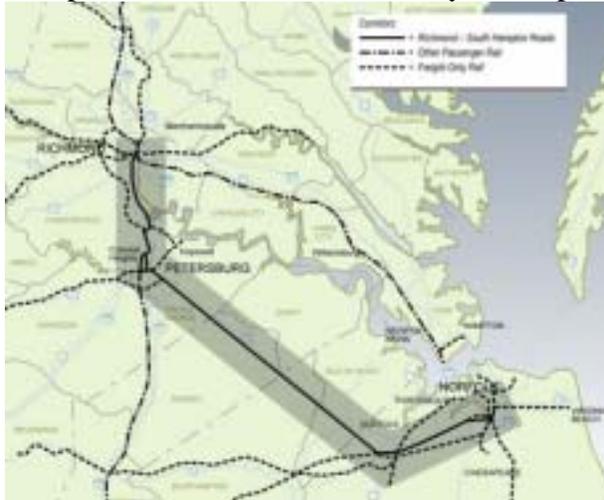
- assessment of current conditions;
- analysis of critical locations;
- projection of future traffic and capacity requirements; and
- preliminary identification of improvements.

Capital Cost Estimates for the improvements were developed in a subsequent task.

The purpose of this task was to perform an analysis of the rail infrastructure of the study area and determine the improvements that would be necessary to accommodate frequent passenger trains operating at speeds of up to 110 mph.

Proposed Richmond - South Hampton Roads High-Speed Rail Service

The Virginia Department of Rail and Public Transportation (DRPT) contracted The Parsons Transportation Group (PTG) to evaluate the Richmond-Petersburg-South Hampton Roads corridor. The study developed an overall long-range track configuration,



alignment plan, and operating plan that would support the proposed expanded requirements of all users of the rail line. The corridor may be considered a natural extension of the Washington-Charlotte Southeast High-Speed Rail (SEHSR) Corridor,¹ extending from Petersburg, to the South Hampton Roads area. The route studied would extend between Richmond’s Main Street Station and a terminal station in the South Hampton Roads area. The route would require a combination of CSX Transportation (CSXT) and

¹ The Parsons Transportation Group (PTG) has recently completed two related studies of the Washington-Richmond corridor and the Richmond-Petersburg-Raleigh-Charlotte corridor for the FRA. The studies were performed in coordination with DRPT, NCDOT, Amtrak, CSXT, and NS.

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Norfolk Southern (NS) rail lines². CSXT operates the rail lines between Richmond and Petersburg and a segment in the Hampton Roads area. NS operates a rail line between Petersburg and Norfolk.

The proposed Richmond - South Hampton Roads high-speed rail service would provide stations located conveniently to Norfolk, Virginia Beach, and other communities south of Hampton Roads. The current bridge-tunnel link between the Newport News Amtrak station and south side of Hampton Roads, a connecting bus, provides a somewhat circuitous and often congested route to Norfolk and Virginia Beach. New stations on the south side would require much shorter and more reliable access times and make service convenient to more communities.

A variety of alternative south side station locations have been evaluated. Key Hampton Roads markets include:

- Downtown Norfolk,
- Downtown Portsmouth,
- Virginia Beach,
- Norfolk Naval Base,
- Other Norfolk destinations,
- Other Portsmouth destinations,
- Chesapeake, and
- Suffolk.

Downtown Norfolk and Portsmouth are relatively compact markets that could be served by a station located in one of these areas. The remaining markets are spread over a much larger geographic area and would be best served by a “suburban” station with good access to the highway system.

Background

The Existing Services

A varied network of surface transportation options exists in the James River Corridor between Richmond and Hampton Roads; however, public transportation is limited. Amtrak currently operates conventional rail service providing two round trips per day between Richmond and Newport News, with Thruway bus service between the Newport News station, Norfolk and Virginia Beach. These trains also serve Williamsburg as an intermediate stop between Richmond and Newport News. In 1999, a total of about 110,000 passengers were served at Newport News (including those using the connecting bus service) and about 45,000 passengers were served at Williamsburg. Most of these passengers travel to/from Washington, New York, and other locations in the Northeast Corridor. Greyhound and Carolina Trailways Lines collectively operate nine round trips in the corridor. Service on the south side of the river is extremely limited, with only one Carolina Trailways bus schedule, and no Amtrak service. Bus service on the north side of the river ranges in travel time from 1 hour 45 minutes to 2 hours 50 minutes between Richmond and Norfolk. Passengers from Petersburg to South Hampton Roads are routed via Richmond and Newport News, with an average travel time of over four hours. In

² The potential for utilizing trackage owned by Short Line railroads in the South Hampton Roads area also has been evaluated as part of the study.

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part, this is due to the fact that the highway, US 460 is inferior to I-64, on the north side. It has numerous at-grade highway intersections and substantial cross traffic, making travel time significantly longer, for both buses and cars. A substantial amount of truck traffic intensifies this problem.

To effectively and efficiently develop a market, a number of critical tasks must be undertaken to ensure that informed choices are made. This report is an important beginning. The following tasks were undertaken:

- Ridership forecasts were developed,
- Operating scenarios were analyzed, and
- Facility options were evaluated.

Rail Passenger Service in Virginia

The DRPT is actively pursuing significant increases in intercity rail passenger service throughout the state. All corridors evaluated include Richmond's Main Street Station as the hub for these services. Presently, Main Street Station is closed, although Amtrak service to Newport News uses the eastern-most station tracks. The City of Richmond has purchased the station from the Commonwealth and has developed an extensive program of improvements to upgrade it, and restore it to service. Working with DRPT and Amtrak, the city of Richmond intends to re-institute rail passenger service into and through the station.

Amtrak's Staples Mill Road Station, located almost 15 minutes by rail north of Main Street Station, is the only rail passenger station presently serving Richmond. Amtrak trains to points south of Richmond stop at Staples Mill Road Station, but bypass downtown on the CSXT A Line (the former Atlantic Coast Line route) to reach Petersburg, VA. Once Main Street Station is re-opened, all trains, with the exception of Amtrak's AutoTrain, would utilize the S Line (the former Seaboard Air Line route) to reach Petersburg, VA³.

³ PTG presently is under contract to the FRA to determine the requirements to re-institute rail passenger service on the S Line. Performed in cooperation with DRPT, NCDOT, Amtrak, and CSXT, the study is defining an alignment that would utilize the S Line from the south to a point in the vicinity of the Appomattox River in Petersburg.

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Rail Services That Will Utilize Main Street Station		
Corridor	Existing Station Stop	Proposed Station Stops
Washington – Richmond	Staples Mill Road	Staples Mill Road Main Street
Richmond-Newport News	Staples Mill Road Station (passes through Main Street)	Staples Mill Road Main Street
Amtrak Florida Service	Staples Mill Road	Staples Mill Road Main Street
North Carolina Service	Staples Mill Road	Staples Mill Road Main Street
Proposed Bristol Service	Does not presently operate	Main Street Station
Proposed South Hampton Roads Service	Does not presently operate	Staples Mill Road Main Street

When Main Street Station is first opened only the Newport News trains will stop. The second phase will allow for two Richmond round trips to be extended to terminate there, after new storage, maintenance and turning facilities are constructed. The final phase will have all trains, including the Florida and North Carolina (SEHSR) services, stop at the station. Improvements on the tracks between Main Street Station and Centralia will be needed before this phase can be implemented.

NS and CSXT Fundamental Requirements To Be Fulfilled Before New Passenger Service Begins

NS's stated position is that prior to initiation of new passenger service on their tracks, the proposed operation must:

- Improve safety of all rail operations in the area;
- Be transparent to freight operations, i.e., sufficient infrastructure must be provided to enable freight trains and passenger trains to operate without delay to either, and to allow for the growth of both;
- Furnish sufficient indemnity for liability; and
- Compensate NS for the use of its asset with a level of return similar to that of freight trains.

In addition, NS and CSXT state that they will retain control of dispatching of trains on all tracks over which their freight trains will operate after inauguration of the high-speed passenger service.

Prior Richmond to South Hampton Roads Rail Service

The Norfolk and Western (N&W), now NS, the Seaboard Air Line (SAL) and the Atlantic Coast Line (ACL), both now CSXT, previously operated passenger rail service to the south side of Hampton Roads from points in Southside Virginia and North Carolina. The Virginian Railway (VGN) and an earlier Norfolk Southern Railway, both now part of NS, also operated local passenger service.

The N&W, Virginian and the earlier Norfolk Southern Railway utilized the N&W Terminal Station in Norfolk, which was located at 1200 East Main Street. The SAL

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operated trains from Raleigh, NC to a terminal in Portsmouth, located at High and Water Streets. The ACL ran trains from Rocky Mount, NC to a terminal in north Portsmouth (a portion of this line is now owned by the Commonwealth Railway).

Amtrak intermittently offered services from Norfolk and Washington to the west via the N&W to Petersburg. The Norfolk train utilized the final N&W passenger station, located at the Lamberts Point Yard.

The N&W Service Between Richmond and Norfolk

Historically, the ACL and N&W operated a service like that envisioned. For most passengers, connections were made at Petersburg between trains of the two railroads, although some through cars were handled from New York. ACL cooperated with N&W on service to Norfolk from Richmond's Broad Street Station running the trains as far as Petersburg, where either coaches were added to NS trains, or passengers transferred to NS trains to/from Cincinnati. Norfolk & Western did operate one through train a day, called The Cannonball, using trackage rights on the ACL from Broad Street Station, in Richmond to Petersburg. The Cannonball lasted until 1967, but by then, it had become a night train that carried a through New York-Norfolk sleeper.

Assessment of Current Conditions

Because of the schedule requirements necessary to process the study, initial emphasis would be given to documenting the **condition assessment**. Consultations have been held with the freight railroads. On-site inspections have been made. Maps and documents available from State and local agencies, and rail operators have been collected and reviewed. Current information on use of the lines and any current plans for upgrading the rail corridor facilities has been obtained and reviewed.

The PTG team has reviewed the current condition of the rail lines included in the Study Area. Their suitability to safely and efficiently accommodate high-speed passenger trains and the levels of freight rail service was evaluated. The review has included, but not been limited to, track conditions and configurations, roadbed (both existing and abandoned) conditions, signal and traffic control systems, grade crossings, curves and grades, etc. The Richmond - South Hampton Roads rail plant and systems are summarized below.

Initiation of high-speed rail service between Richmond and South Hampton Roads would require a connection between the north south, Richmond to Charlotte route and the east west, Petersburg to Norfolk route. This presents a number of difficulties due to the disparity of alignment orientations and elevations. Avoiding freight traffic is also of critical importance. Several alternatives have been identified and are discussed in the Critical Areas subsection. The five connection alternatives were named:

- North Collier Connection (A line to NS Belt Line),
- Secoast Connection (S Line to NS Belt Line),
- West Connection (S Line to NS Main Line),
- Ettrick Connection (A Line to NS Main Line via Ettrick Station), and
- Dunlop Connection (A Line to NS Main Line via original ACL main line through Colonial Heights).

Original Atlantic Coast Line Main Line Alignment

Historically, the connection between the A Line and the NS line to South Hampton Roads was the original main line of the Atlantic Coast Line Railroad (ACL) between Richmond and Petersburg. This line ran through the city of Colonial Heights and crossed the Appomattox River at Pocahontas Island, between the present day US-1 (Martin Luther King, Jr.) and Interstate 95 bridges. The railroad then climbed a steep grade out of the river valley as it ran along Washington Street before turning south toward Emporia. This steep grade and street trackage was bypassed in 1895 with the construction of a six-mile long "belt line" to the west of the city, crossing the Appomattox River valley on a single-track bridge more than two miles to the southwest of the original ACL bridge. When built, the belt line was primarily intended for freight trains, but passenger trains were gradually transferred to it. The bridge was built some sixty feet above the river to minimize the gradient on the approaches. The difference in elevations between the A Line (belt Line) and the NS Main Line would make a new connection using this bridge difficult and expensive.

The original main line of the ACL was eventually severed to eliminate rail traffic on Washington Street, with the two disconnected leads remaining in service. The north lead (later referred to as the Appomattox Lead), was still used as late as 1989, but was removed sometime in the early 1990s. PTG and staff from R. L. Banks examined the potential use of this line as a connector from the A Line to the NS Main Line during a field investigation on March 13, 2001.

The connection between the original main line and the present A Line, at Dunlop, has been removed and a self-storage complex has been constructed on the old railroad right of way, south of the former junction. Just to the south of this point, Ellerslie Avenue crosses the existing A Line on a new bridge. Ellerslie Avenue also crosses over the old main line nearby. However, the recent construction project that rebuilt the bridge over the nearby A Line removed the bridge over the old main line, as well as most of the earth fill that served as approaches. The roadway is still elevated above the railroad alignment because it ascends to the level of the bridge over the A Line, but is not high enough to provide clearance over the old ACL right of way.

One mile south of Ellerslie Avenue, Temple Avenue crosses the old main line right of way on two separate bridges. These bridges appear to be in fair-to-good shape. Conduit Road, three-fourths of a mile south of Temple Avenue, once crossed the track on a bridge, but the bridge was removed and the railroad cut has been filled in. Highway ramps for the Roslyn Road interchange of Interstate 95 have encroached on the right of way 0.7 mile south of Conduit Road, but there appears to remain enough room to restore the track in this area. Just south of the Roslyn Road interchange, the track begins a curve toward the west of approximately 2 degrees. At the end of this curve the track crossed the Appomattox River on a five-span bridge. The superstructure of this bridge has been removed but the piers are still intact. At the southwest end of the bridge, the roadbed turns back to the south, and eventually east, on a compound curve that in some sections is as sharp as 9 degrees. This was formerly the east leg of the wye track between the ACL and the NS Main Lines. A new road connecting the Pocahontas community to downtown Petersburg has been built on this alignment. The N&W Appomattox Street station is located south of the east-west NS right of way between the two legs of the wye. The

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present NS Main Line continues eastward, and meets the Petersburg Belt Line at Poe, four miles east of the station.

The general assessment of this line is that it would be possible to restore and use it for high-speed rail service.

NS Main Line - Petersburg to Suffolk

The NS Main Line between Petersburg (Poe), milepost N 77.7, and Brico (Kilby), at milepost N 26.4 (where the NS crosses the CSXT Portsmouth Subdivision), is a double track line, 51 miles long, with not one single curve. An Automatic Block System (ABS) controls train traffic, with each track signaled in one direction between Kilby and Disputanta (42 miles), and bi-directional signals between Disputanta and Poe (9 miles). The average block length (distance between signals) is four miles. Current freight train speed on the line is 60 mph for intermodal trains and 50 miles per hour for other freight trains. Rail is a mixture of main line quality 132RE and 136RE⁴ laid on large tie plates, main line ties, and a deep ballast section. Rail, ties, surface and alignment are all in very good condition. This track presently is maintained to FRA Class 4⁵ standards that would allow passenger train operating speeds of 79 miles per hour.

Federal Railroad Administration (FRA) regulations require that, where any train operates at a speed of 80 or more miles per hour, there must be in place an automatic cab signal, automatic train stop or automatic train control system. The current ABS system on the NS Main Line has none of these additional systems, and therefore it is limited to a top speed of only 79 miles per hour. The four-mile long blocks presently in place are long enough to provide adequate stopping distances for 110 miles per hour passenger train speeds, but the installation of either an automatic cab signal, an automatic train stop, or automatic train control system would be necessary in order to allow the higher speeds contemplated for the Richmond to South Hampton Roads High-Speed service⁶.

There is currently only one passing siding on the line between Poe and Kilby. The "Ivor Middle Track", located at Milepost 44 (one third of the way from Kilby to Poe) is only slightly more than one-half mile long. Minimum siding length for meeting or passing today's freight trains is six to eight times this length. Segments of third track between the two main tracks, connected at both ends, existed at one time in a number of locations. Siding locations and lengths in 1979 were as follows:

⁴ Rails are described in terms of their weight in pounds per yard and the cross section of the rail, e.g. RE. 132RE and 136 RE rail sections generally are installed on high-density heavily traveled freight lines.

⁵ Following a series of major derailments in the 1970s, the Federal Railroad Administration was given statutory authority to define track safety standards for all U.S. railroads. These standards defined nine track classes, with Class 1 being the lowest and Class 9 the highest. Specific geometry and condition standards were established for each class of track, and speed limits (defined separately for freight and passenger traffic) also were defined. Specific signal and train control standards also were developed for higher-speed track.

⁶ NS is not convinced that, considering the present state of signal and train control development, 110 mph trains can coexist with freight trains on the same track without cumbersome and inefficient limitations being placed on freight train operation. Therefore, it is NS's position that any tracks over which passenger trains operate at above 90 mph must be completely separate from (but may be parallel to) tracks where freight trains operate.

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Location	Milepost	Length (Feet)
Myrtle	N 30.2	8282
Ivor	N 47.7	9504
Wakefield	N 54.5	8511

These "middle tracks" provided for faster trains to overtake slower ones (e.g., passenger trains overtaking freight trains) as well as locations for staging coal trains for the coal export facility at Norfolk. The introduction of high-speed passenger trains with a potential speed differential greater than 50 miles per hour would require an increase in capacity, and some of these middle tracks could be restored.

Traffic levels on this line segment have declined in recent years due to the decrease in demand for export coal. The following table illustrates this decline:

Year	U.S. Coal Exports (Thousand Short Tons)
1989	100,815
1994	71,359
1995	88,547
1996	90,473
1997	83,545
1998	78,048
1999	58,476
2000 (est.)	58,368

Source: U.S. Department of Energy

The U.S. Department of Energy projects that the level of coal exports will stabilize, with the volume settling at 56 million tons by 2020. This is slightly more than half of the 1989 volume. NS reports that its export coal volume in 2000 was 19.8 million tons (down from 40 million tons ten years ago) and that volume at Lambert's Point in Norfolk dropped by 500,000 tons from 1999 to 2000. This reduction in coal exports results in reduced numbers of coal train volumes on the NS main line between Petersburg and Norfolk, making implementation of passenger service somewhat easier than it would have been ten years ago.

Suffolk to South Norfolk

High-speed rail service could utilize either the Norfolk Southern main line or the combination CSXT/VGN route between Kilby and South Norfolk. The two have significant similarities. The primary difference is the high level of traffic on the NS line, when compared to the CSXT line. The following table provides a comparison of the two routes:

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Characteristic	NS	CSXT/VGN
Length (miles)	21.9	21.55
Maximum Curvature (degrees)	2	1.7
Curved Trackage (feet)	13,500	12,300
Public Highway Grade Crossings	13	15
Railroad Grade Crossings	2	1
Current Maximum Speed	50	49/10
Drawbridges	1	1
Daily Trains	21.5	6.6/<1

The CSXT line also has the advantage of a better suburban station site, at Bowers Hill. Preliminary study indicates that it is superior to any potential site on the NS Main Line.

The Brico Connection

The possibility of establishing high-speed passenger service on the CSXT line from Kilby to Algren, thence on the former Virginian Railway from Algren to South Norfolk, has been examined as an alternative to avoid the heavily used NS main line. This diversion would require a new connection at Brico, just west of Kilby.

Located 3 miles west of downtown Suffolk, Kilby is where the double track NS main line crosses over top of the former VGN right of way as well as the CSXT Portsmouth Subdivision at a 43-degree angle. U.S. Highway 58 crosses over all three railroads on two overhead bridges at a 90-degree angle to the NS main line. A connection between the CSXT and NS lines exists in the southwest quadrant of the intersection, but it is not in the proper quadrant for passenger train movements. A potential connection in the preferred northeast quadrant is blocked by the large earthen fill approaches to the U.S. 58 highway bridges. The recommended alternative is a “jug handle” connection in the southwest quadrant that would connect the NS Main Line from Petersburg to the CSX Portsmouth Subdivision to Portsmouth.

CSXT Portsmouth Subdivision - Kilby to Algren

The CSXT Portsmouth Subdivision is a single-track line running between the A Line at Weldon, NC and Portsmouth. It passes under the NS Main Line at Kilby (MP 20.1) and crosses the VGN at grade at Algren (MP 9.5), a distance of 10.6 miles. The track was in fair condition at the time of PTG’s field inspection, but CSXT was performing tie installation, track surfacing and road crossing rebuilding on this entire stretch of line. The line is tangent for its entire distance except for three curves in Suffolk, none of which exceed 1 degree 15 minutes, and the maximum grade is .55 percent. The current track speed is 49 miles per hour except for a two-mile speed restriction in Suffolk of 25 miles per hour. Maximum speed is limited by the lack of a signal system on the line. The rail is welded, and in good condition.

The line’s favorable geometry makes it a good candidate for high-speed rail service; however, the numerous grade crossings present potential problems that would need to be addressed.

Former VGN Jarratt Subdivision - Kilby to Algren

The right-of-way of the abandoned VGN Jarratt District parallels the CSXT Portsmouth Subdivision between Kilby and Algren, and could serve as an alternative to the CSXT alignment. The two lines are from 25 to 300 feet apart. The VGN right of way is mostly intact, but the following problem areas would need to be addressed:

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- The Broad Street bridge over the railroad in Suffolk has been recently rebuilt, and the profile of the span over the VGN may have been changed;
- The railroad station on Main Street in Suffolk has been restored as a museum and a parking lot has been built on the VGN right of way;
- A tourist line has been proposed that would use the right of way for a short distance to the east before turning northward on the former NF&D right of way;
- The superstructure of the single span bridge over Shingle creek, east of Suffolk, has been removed, although the abutments remain; and
- The line is close enough to CSXT in most locations that grade crossing signal systems would have to be integrated with the existing CSXT systems.

It may not be necessary to use the former VGN line because the parallel CSXT line is so lightly used, however, it is considered to be a candidate for restoration and use as a high-speed rail route, pending further study. The entire line could be utilized if negotiations to use the CSXT line are unsuccessful, or parts of the line could be used to expand capacity on the single track CSXT line.

Former VGN Jarratt Subdivision - Algren to South Norfolk

The VGN alignment crosses from the north side of the CSXT Portsmouth Subdivision to the south side at Algren, (CSXT MP SA 7.5, NS MP V 15.4). Presently, the track begins a short distance to the east of that crossing. The first two miles of the track are out of service and overgrown. The in-service portion of the line begins at milepost 13, just west of the Military Highway overhead bridge. The track extends eastward to milepost 6.9, where it crosses the South Branch of the Elizabeth River on a vertical lift bridge. The line then turns to the north to connect with the NS main line at South Norfolk (milepost V 5.2) where the VGN crossed the N&W on its way to the Sewells Point Terminal. This equates to MP N 3.3 on the NS Main Line to Lamberts Point. The proposed route continues on the NS main line to Bridge 5, a moveable bridge, located 2.03 miles north of this connection. Downtown Norfolk is to the west, and the proposed passenger terminal location is located immediately north of Bridge 5.

Although once a main line track, the Jarratt Subdivision is now a switching lead. It has a mixture of 100 and 131-pound rail, none of which is welded. Train speed is currently limited to 10 miles per hour. Movements on this line were once governed by a traffic control system, but this system is no longer in service.

The line is tangent from Algren to the west approach for the South Branch Drawbridge (milepost V 7.2). It curves to the south to cross the bridge, then curves to the north after crossing the bridge. In this curve the line crosses the Norfolk & Portsmouth Belt Line (NPLB) at grade at Belt Junction (milepost V 6.5). The line is tangent for the last mile to South Norfolk, where it crosses the NS main line.

This line, when upgraded, could be used for passenger service. The tangent track between Algren and the South Branch drawbridge could be operated over at high speeds, but the residential neighborhoods adjacent to the line, and the (currently) seven public highway grade crossings, must be addressed. The segment between the South Branch drawbridge and South Norfolk includes speed limitations at the drawbridge, the NPBL crossing, the two curves, and the South Norfolk interlocking.

South Hampton Roads Terminal

Discussions with DRPT and local officials reveal a strong state and local preference for bringing the Richmond to South Hampton Roads High Speed Rail service as close as possible to downtown Norfolk. The most direct rail route into downtown Norfolk is via the NS main line over Bridge 5. The most advantageous available location for the Norfolk passenger terminal is adjacent to the Harbor Park baseball stadium, just north of Bridge 5.

Bridge 5 is a double track, bascule-type moveable bridge spanning the Eastern Branch of the Elizabeth River. A parallel and adjacent span, Bridge 5A, is a single-track bridge similar to Bridge 5. Bridge 5A is kept in operating condition, but is not currently in use, and is not connected to operating tracks at either end. A reconnected Bridge 5A potentially could be utilized for freight train movements and would free one of the existing tracks on Bridge 5 for passenger train movements.

There is approximately 1000 feet of track between the north end of Bridge 5 and the Park Avenue (referred to as *Lovitt Avenue*, its former name, in Norfolk Southern records) grade crossing, and there is adequate space to the west of the current tracks to install additional tracks. With adjacent parking at the stadium and convenient access to I-264, this location is well suited for the location of a passenger terminal.

Analysis of Critical Locations

Except for the CSXT A Line, the rail lines involved in the study essentially have been freight lines for more than 30 years. Development of a reliable high-speed route has required an analysis of numerous locations and stretches of rail line to define a rail network that reliably would support projected future freight and passenger operations. The evaluation of current conditions and potential improvements to support high-speed passenger services to South Hampton Roads has been coordinated for consistency with planned improvements for the *SEHSR Corridor* (Richmond-Charlotte, NC) services, particularly in the common Richmond—Petersburg section. Both high-speed services must be planned and designed to:

- Provide cost-effective improvements necessary to increase capacity on existing rail lines;
- Provide one station in the Petersburg-Ettrick-Colonial Heights area that can serve all current and proposed passenger trains (South Hampton Roads Service to Norfolk, SEHSR Service to Charlotte, and current Amtrak Service to Florida);
- Coordinate train schedules in the “shared” corridor among South Hampton Roads, Charlotte, and existing Amtrak (long-distance) trains; and
- Minimize conflicts with freight operations.

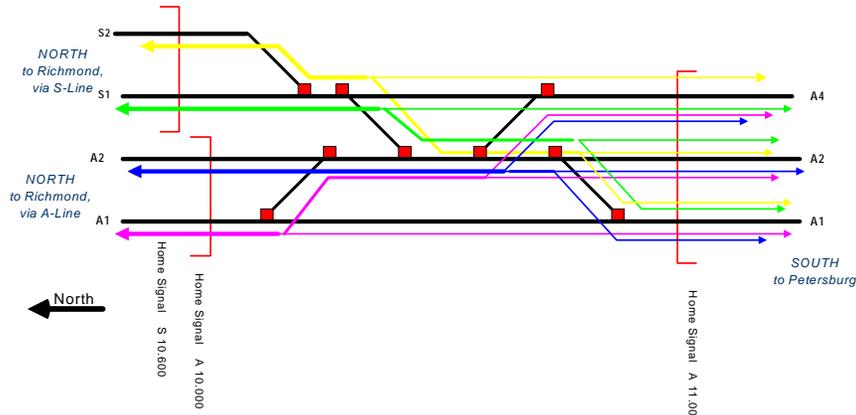
The S Line from Main Street Station to Centralia

The South Hampton Roads High-Speed service would utilize the CSXT S Line between Richmond, VA, and Centralia. Previous studies for the *SEHSR Corridor* have identified improvements to the S Line necessary to operate high-speed passenger service over the line, including restoration of a second main track between Rocketts (MP S 0.7) and Centralia (MP S 11.0), and installation of universal interlockings at “Dale” (S 4.7) and “Falling Creek” (S 7.0). Combined with signal system improvements, this route would

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provide entry into the restored Main Street Station in downtown Richmond, VA, for all passenger trains operating from the south.

The S Line between MP S 10 and Burgess has been abandoned since the late 1960s. A connection between the S Line and the A Line was constructed at Centralia Interlocking when the S Line trackage was removed. Subsequent development and highway construction prevent this portion of the S Line from being restored. Therefore, the connecting track would be retained and Centralia Interlocking upgraded, as shown in the diagram, to improve the connectivity of the two lines.



Centralia Interlocking

Notes: Yellow indicates routes to/from Track S2; Green indicates routes to/from Track S1;

Blue indicates routes to/from Track A2; and Purple indicates routes to/from Track A1.

The new interlocking at Centralia would provide universal route access, while providing route separation for passenger trains, operating primarily between the S Line and track A4, from freight trains operating mainly on tracks A1 and A2.

Centralia to Petersburg

A third track, designated for passenger use, would be constructed on the east side of CSXT's "A Line" between Centralia (MP A 10.6) and one of several proposed diverging points on the north side of Petersburg. The construction of this third track eliminates the need to restore the old S Line between Centralia and Petersburg (Ettrick) previously planned for the *SEHSR Corridor*⁷. This added track (A4 main track) would be the preferred track for passenger operations, both north- and southbound, and would provide

⁷ The alignment described in the draft *Potential Improvements to the Richmond – Charlotte Railroad Corridor* Report prepared by PTG for the FRA.

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passenger trains access to the S Line, to Richmond, without crossover movements and conflicts with CSXT’s freight operations on the A Line.

Petersburg

Where and how passenger trains between Richmond and South Hampton Roads would pass through Petersburg is the key critical issue to be addressed. A direct rail connection at Petersburg from Richmond to South Hampton Roads has not existed for years. Recent developments and construction make re-institution difficult, but not impossible. Five different route alternatives have been identified, each having different impacts on operations, and each requiring different levels of capital investment to construct. The route selection criteria are:

- Provide one station in the Petersburg-Ettrick-Colonial Heights area that can serve all current and proposed passenger trains;
- Minimize operating conflicts with freight trains by minimizing the need for “crossing” moves (when a freight or passenger train must move across other tracks to use a connection);
- Avoid operating *passenger* trains through busy freight yards;
- Minimize the capital cost of bridges, structures, and additional tracks required; and
- Provide segments of track where passenger trains can run or stop at stations, clear of freight trains.

The five connection alternatives, discussed in detail below are the:

- North Collier Connection (A line to NS Belt Line),
- Secoast Connection (S Line to NS Belt Line),
- West Connection (S Line to NS Main Line),
- Ettrick Connection (A Line to NS Main Line via Ettrick Station), and
- Dunlop Connection (A Line to NS Main Line via original ACL main line through Colonial Heights).

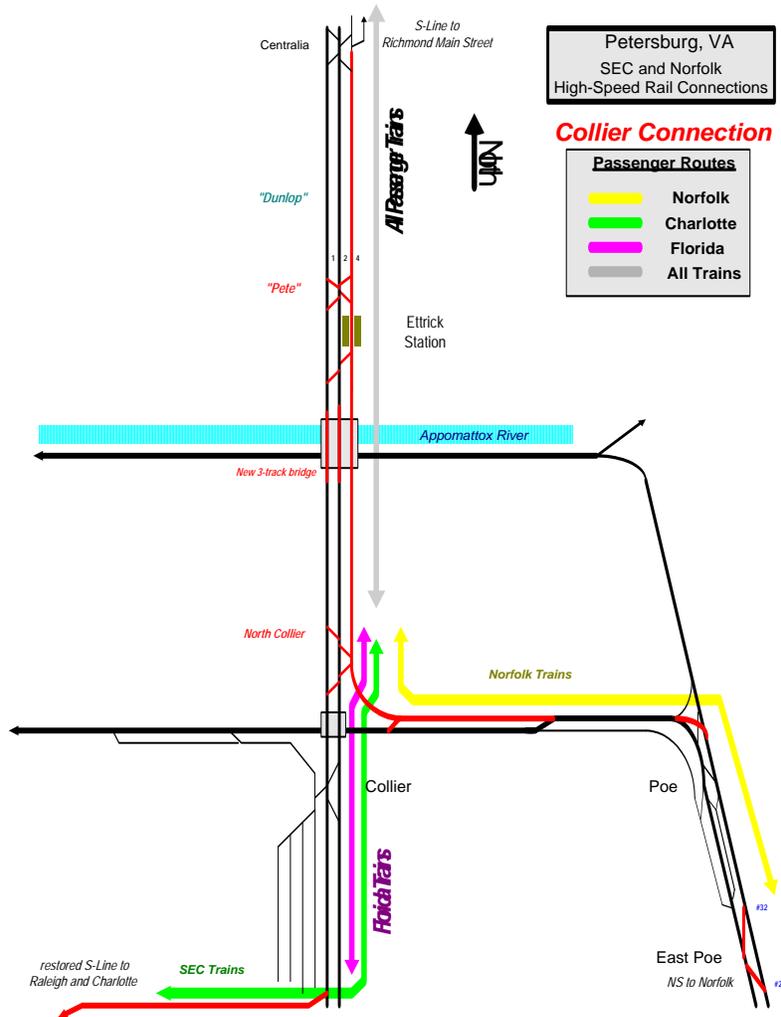
The first two options would use the NS Belt Line, passing south of Petersburg. The other three would use the older NS Main Line. The Main Line appears to have an advantage in avoiding the considerable amount of freight traffic on the Belt Line. Using the Belt Line for passenger trains would require an additional track over the segment between North Collier and Poe.

On the other hand, it might be necessary to double-track the Belt Line in order to reduce the need to run freight trains on the Main Line. The level of freight traffic projected would affect this, and further study of activity and capacity would be required.

Preliminary investigation indicates that the cost of upgrading either line would be approximately the same if double tracking of the Belt Line were required.

Recently, it has been recommended that the north – south route for A- and S Line trains be revised from that initially recommended in the study prepared for the FRA. Rather than restoring the S Line between Centralia and Burgess, it has been determined that intercity and SEHSR trains would operate on an upgraded A Line through Petersburg, between Centralia and South Collier. Trains for stations on the A Line would continue southward, while S Line trains would utilize a restored Burgess Connection between South Collier and Burgess to access the S Line to Raleigh. Ettrick would remain the location of the intercity passenger station.

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Collier Connection

The *Collier Connection* would involve building a track connection in the northeast quadrant from the CSXT A Line, just north of Collier Yard, to the NS Petersburg Belt Line. This could be the least complicated of the five alternatives to construct, depending on the difficulty in interfacing with the Halifax Road grade separation, currently under construction, but it requires a new high bridge, with three tracks over the Appomattox River. Initial investigation indicates that it could be built entirely east of the Halifax Road highway project, but further study is necessary. This connection would allow the continued use of the existing Petersburg passenger station at Ettrick, north of the Appomattox River. Use of this alternative would require:

- Operation of all passenger trains, including Florida and SEHSR Corridor trains, on the A Line between Centralia and Collier;
- Construction of a third main track, at least to the connection at North Collier;

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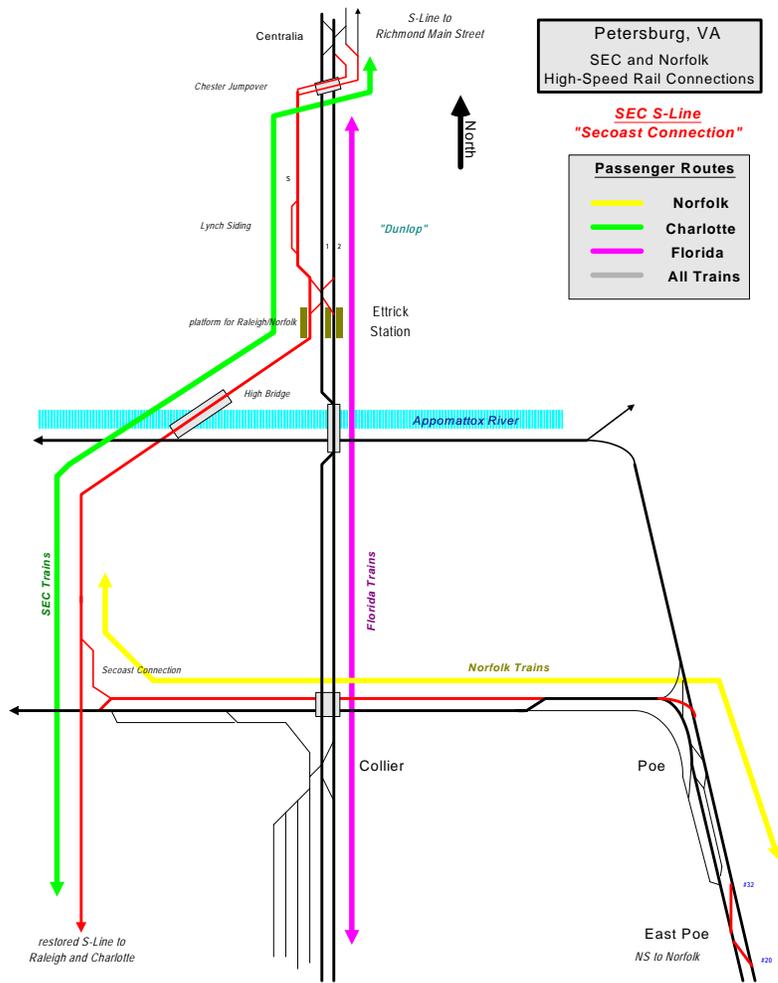
- Replacement of CSXT’s existing single-track bridge over the Appomattox River with a new three-track structure (This would eliminate the need to construct planned new bridge for the restored S Line over the Appomattox River).
- Restoration of CSXT’s connection from South Collier (Rheems) to the restored S Line at Burgess.
- A second main track might also need to be installed on the NS Belt Line between Poe and Collier. Bridges and grading already are in place to accommodate the second-track.

Disadvantages

The connection might be complicated by the interface with the new highway overpass for Halifax Road. The development of the adjacent property is a potential physical impediment. While relatively simple to build, the *North Collier Connection* would require an additional main track on the NS Belt Line between North Collier and Poe. A new interlocking would have to be built on straight track at East Poe to avoid the need to provide turnouts on the superelevated curve at Poe. Additionally, the replacement bridge over the Appomattox River will be expensive to build.

While relatively simple to build, the *Collier Connection* would be an adjunct to a SEHSR route via South Collier that would present substantial operating issues unless a significant expenditure was included to separate southbound passenger trains from freight trains, including a jumpover at South Collier.

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The Secoast Connection

The *Secoast Connection* takes its name from the interchange between CSXT (former Seaboard Coast Line) and NS Belt Line, west of Collier. The connection is a logical outgrowth of the planned restoration of the S Line for SEHSR Corridor high-speed service to Charlotte, N.C., if the S Line were restored north of Burgess. This concept would require construction of a new bridge over the Appomattox River for the S Line, upstream from the current CSXT A Line Bridge, and restoration of the S Line⁸ southward from that point. South Hampton Roads trains would traverse the S Line from the station at Ettrick to connection in the northeast quadrant at the intersection of the S Line and the NS Belt Line, and then use the NS Belt Line to go eastward.

This option would require:

- Reconstruction of the S Line between Centralia and Petersburg, including

⁸ Improvements defined in the draft Richmond to Charlotte Report.

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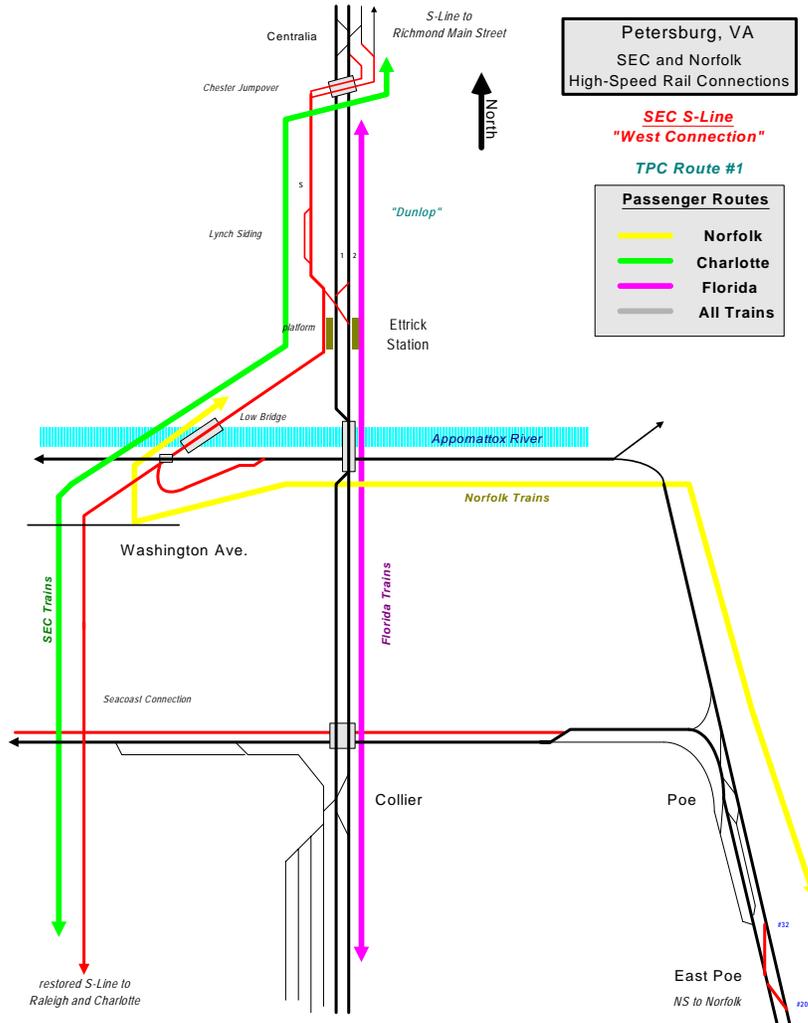
- - Construction of the Chester Jumpover to enable the S Line to crossover the A Line,
- - Revision of Ettrick Station to include a third track through the station and a second platform,
- Construction of a “high” bridge over the Appomattox River for the S Line;
- Reconstruction of the S Line between the Appomattox River and Burgess,
- Construction of the Secoast Connection between the S Line and the NS Belt Line, and
- Double tracking the NS Belt Line between Secoast and Poe.

Similar to the Collier Connection, the Secoast Connection would require the South Hampton Roads passenger trains to utilize the NS’s Belt Line, thereby, necessitating the undesirable commingling with their freight operations at Collier and Poe.

Disadvantages

The connection would take right-of-way from the Virginia State University experimental farm for the connecting track from the Ettrick Station to the bridge. Similar to the North Collier Connection, the Secoast Connection would require the South Hampton Roads passenger trains to utilize the NS’s Belt Line. It would require an additional main track on the NS Belt Line between Secoast and Poe. A new interlocking would have to be built on straight track at East Poe to avoid the need to provide turnouts on the superelevated curve at Poe. Furthermore, more of the S Line would have to be restored, including the crossing of Washington Street, and a new Appomattox River bridge that would not be available to A Line trains.

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The West Connection

The *West Connection* would connect a restored S Line to the NS Main Line through Petersburg, instead of the Belt Line. A low-level bridge would be constructed for the S Line about one-half mile upstream from the existing A Line bridge, with a low-speed connection to the NS Main Line on an eight-degree curve from the S Line. This connection would retain the existing Ettrick station and would not require changes to CSXT freight and Amtrak long-distance operations south of Petersburg.

The *West Connection* addresses the desire to minimize the commingling of passenger and freight trains through Petersburg by using NS’s Main Line through Petersburg instead of the Belt Line. The concept includes a low-speed eight-degree connection from the restored S Line onto the NS Main Line by means of a proposed S Line bridge over the Appomattox River, which would be located west of (upstream from) the existing CSXT A Line bridge. It would be lower and less expensive to build than the high structure required for the Seacoast Connection, but there are trade-offs involved, as noted below. All passenger trains would continue to use the existing Ettrick station, and like the

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Secoast Connection, the planned restoration of the separate S Line from Centralia to Petersburg, the “jumpover” of the A Line at Centralia, and the use of new and separate passenger platforms on the west side at Ettrick station would be required.

Advantages

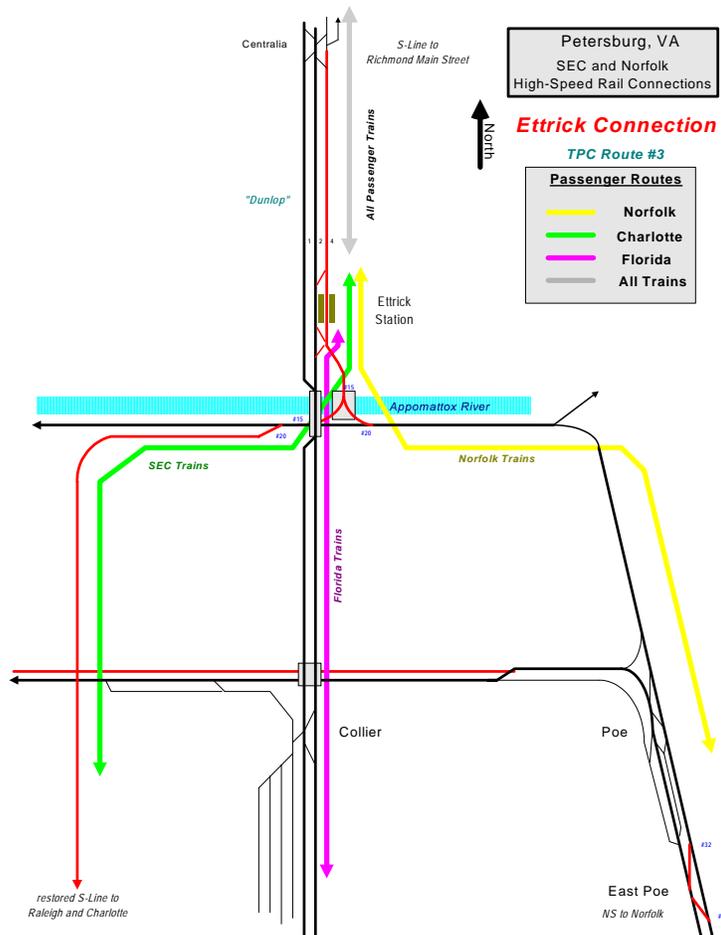
The *West Connection* would retain the features of the proposed SEHSR Corridor plan and permit South Hampton Roads trains to use the NS Main Line through Petersburg, avoiding freight conflicts at Poe, on the NS, and at CSXT’s Collier Yard. This connection would retain the existing Ettrick station and would require no changes to CSXT freight and Amtrak long-distance operations south of Petersburg.

Disadvantages

A bridge that would enable the S Line to go under both the NS Main Line and Washington Street would require a steep approach on the north bank, and a bridge deck that would almost be at the level of the river. The connection would take right-of-way from the Virginia State University experimental farm for the track from the Ettrick Station to the bridge, and would require a 30-foot deep cut through the center of the farm to descend to the level necessary to pass under the NS Main Line. Although the bridge would be lower and less expensive to build than any high level bridge for either the A line or S Line, this would be offset by the need to tunnel under the NS Main Line in order to make the connection to it, and the fact that the bridge over the river would not be available for A Line trains. The connecting track from the S Line onto the NS Main Line would require a sharp, slow speed eight-degree curve. The Bridge over the Appomattox River that would be required for this connection is located considerably west of the existing CSXT A Line Bridge. It would add about two miles distance over any other South Hampton Roads alternative.

The *West Connection* would require construction of a new platform at the Ettrick Station, for the use of Charlotte and South Hampton Roads trains, as well as a third track. Because South Hampton Roads and S Line trains would use a different platform from A Line trains, underground or overhead passageways and elevators would be required for access. Finally, as with the *Secoast Connection*, a greater portion of the S Line would have to be restored.

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Ettrick Connection

Further consideration resulted in the development of alternatives that would use the NS Main Line, rather than the Belt Line, while simplifying the construction requirements of the connection. The *Ettrick Connection* was developed to retain the operating benefits of using the A Line and the Ettrick Station and the NS Main Line. The *Ettrick Connection*, which begins south of Ettrick Station, consists of a track on the east side of the A Line that descends to the level of the NS Main Line across the Appomattox River. A low level-bridge would be constructed to connect to the NS Main Line, eastward. Optionally, the bridge could provide a Wye connection to the NS Main Line, westward, for Raleigh-bound S Line trains.

Advantages

The Ettrick Connection:

- Substitutes a low-level bridge for the more expensive high-level S Line bridge upstream, west, of the A Line bridge;
- Retains the existing station, and
- Provides a passenger train route to South Hampton Roads that does not require use of the NS Belt Line.
- SEHSR Corridor trains would:
- Operate on the existing A Line alignment to the Ettrick Station,

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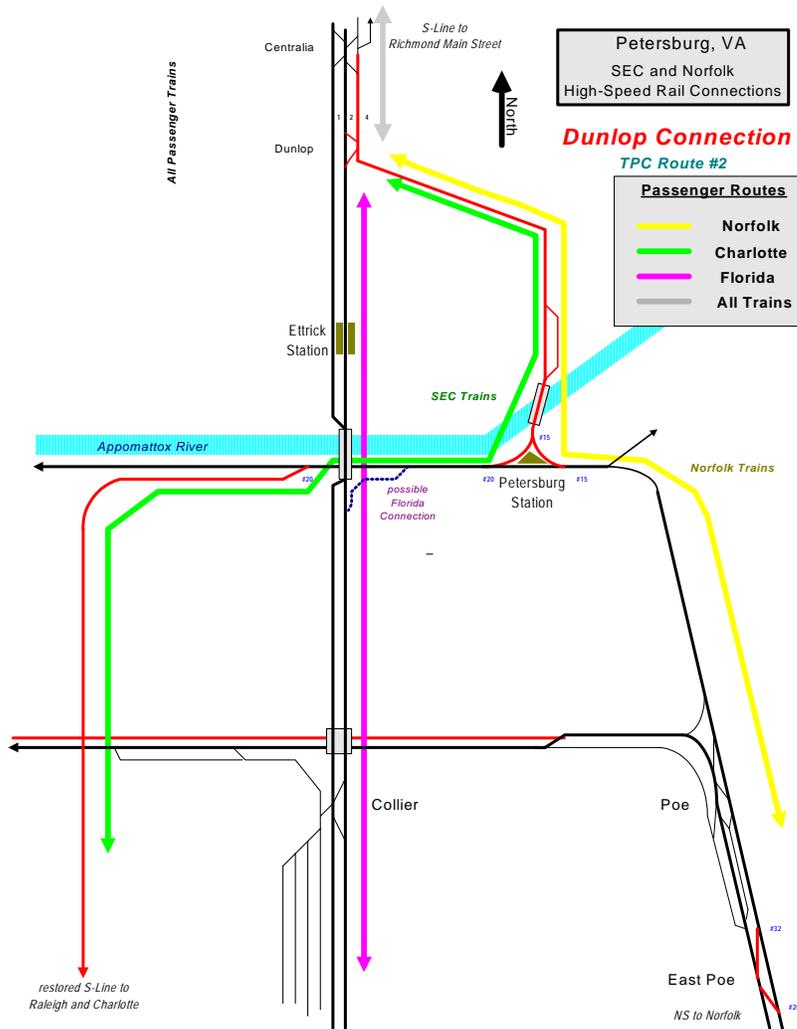
- Use the west Wye Track of the low-level bridge, then
- Connect onto the NS Main Line immediately west of the A Line bridge (the NS Main Line and the S Line are at the same elevation), and
- Connect to the proposed restored S Line alignment.

Disadvantages

The Ettrick Connection would:

- Require construction of a new bridge over the Appomattox River with a slow-speed connection at its south end to the NS Main Line;
- Take right-of-way from the Virginia State University experimental farm property for the connecting track from the Ettrick Station to the bridge;
- Require lower speed operations through the approach tracks' curves and switches because of the geographical constraints existing at the connection site; and
- Require high-speed trains to operate over a short-segment of the NS Main Line, creating the need for cooperation between CSXT and NS dispatchers.
- Should the S Line be included, it must be restored north of Burgess, and construction of a more complex bridge with a “Wye” connection to the NS Main Line in both directions, a complex and unusual bridge design, would be required, as well as a connection from the NS Main Line to the S Line (to Raleigh) with grade-separated crossing of Washington Street.

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The Dunlop Connection

The last alternative, the *Dunlop Connection*, would involve restoration of the original Atlantic Coast Line Railroad route from Dunlop to Petersburg, including reconstruction of the superstructure of the old railroad bridge over the Appomattox River and restoration of the Wye connection with the NS Main Line. Should the S Line be restored north of Burgess, separate platforms for South Hampton Roads and Charlotte trains would be required along with a connection to the restored S Line from the NS Main Line. Should the A Line trains be routed to the downtown station in Petersburg, construction of *The Battersea Connection*, between the NS Main Line and the A Line, south of the Appomattox River bridge would also be required. This connection would skirt the grounds of the Battersea Mansion, for which the connection has been named, and enable all Amtrak trains to reach a single downtown Petersburg station, permitting the Ettrick station to be closed. If the Battersea Connection should prove to be infeasible, a single station that could serve all trains would have to be located north of Dunlop. The *Dunlop*

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Connection requires a less-expensive bridge to cross the river, and permits the use of a single passenger station for all Amtrak trains in downtown Petersburg.

The Battersea Connection

An important element of the consolidation all train service at a downtown Petersburg station is the Battersea Connection, a “south side” connection for A Line trains. The proposed 40 mph connection would extend 3,000 feet, from the NS Main Line to the A Line, immediately east of the CSXT A Line bridge, at a point north of the Washington Street Bridge. It would skirt the grounds of the Battersea Mansion, for which it has been named, on a sweeping 5-degree curve and a 1.75-percent grade. The connection would require a substantial length of fill to avoid the mansion. Number 20 turnouts, permitting 40 mph are proposed at each end of the connection.

Alternative station location

If the Dunlop Connection is preferred and the Battersea Connection should prove to be infeasible, a station that could serve all trains would have to be located north of Dunlop. This is necessary to include A Line trains at a single station.

Operations

All trains would operate over the existing A Line, expanded to three tracks, between Centralia and Dunlop, and then use the old ACL line to the Petersburg Station. South Hampton Roads trains would:

- Use the east Wye Track at the station,
- Continue on the NS Main Line to Poe.
- SEHSR Corridor and Florida trains would:
- Use the west Wye Track at the station,
- Continue onto the NS Main Line immediately west of the station, and
- Continue onto either the proposed restored S Line alignment west of the existing A Line bridge, or the Battersea Connection to the A Line.

The Petersburg station would be rehabilitated and used by all trains, but two separate platforms would be required. There would be one on the east leg for south Hampton Roads trains, and another on the west leg for A- and S Line trains.

Advantages

The Dunlop Connection:

- Eliminates the need for any new S Line bridge upstream;
- Provides the opportunity for a single passenger station for all Amtrak trains in downtown Petersburg;
- Provides a passenger train route eastward to South Hampton Roads that does not require use of the densely trafficked NS Belt Line; and
- Provides the easiest crossing of the Appomattox River, at its narrowest point, and at the lowest elevation.

Disadvantages

- Buildings and new highway construction compromise the proposed alignment in the vicinity of Ellerslie Road, at Dunlop.
- Portions of the old right-of-way have either been sold or have been encroached upon.
- Some bridges that provided grade separation have been replaced by fill.
- The Battersea Connection adds to the cost, and adds to travel time.

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- High-speed trains would have to operate over a short-segment of the NS Main Line, creating the need for interaction between CSXT and NS dispatchers.

Conclusion – Preferred Route Through Petersburg

Preferred Route Through Petersburg – Florida and SEHSR Raleigh and Charlotte trains

Recently, it has been recommended that the north – south route for these intercity and high-speed trains be revised from that initially recommended in a study prepared for the FRA. Rather than restoring the S Line between Centralia and Burgess, it has been determined that intercity and SEHSR trains would operate on an upgraded A Line between Centralia and South Collier. Trains destined for points on the A Line would continue southward, while S Line trains would utilize a restored Burgess Connection between South Collier and Burgess to access the S Line to Raleigh. Ettrick would remain the location of the intercity passenger station.

Preferred Route Through Petersburg – South Hampton Roads trains:

There are three options that appear to justify further study:

1. Dunlop connection,
2. Ettrick connection, and
3. North Collier connection

Each of these options possesses positive attributes, but each raises concerns in terms of cost, circuitry, and station location. If there is to be one station, the more direct the route to South Hampton Roads, the more circuitous the routes to the south, and vice versa. For example, a downtown Station would require A and S Line trains to use connections from the NS Main Line to continue south.

If a new high bridge and a direct route to Collier are selected for SEHSR improvements, The South Hampton Roads alternatives might require either:

1. Dunlop connection - a separate station,
2. Ettrick connection - a separate bridge, or
3. North Collier connection - avoiding the Halifax Road overpass at North Collier, an additional main track on the NS Belt Line between North Collier and Poe, and a new interlocking East Poe to avoid the need to provide turnouts on the superelevated curve at Poe.

The *Dunlop Connection* and the *Ettrick Connection* fulfill the planning requirements to reduce passenger train conflicts with NS freight operations in Petersburg, but each requires an additional Appomattox River Bridge. Although the Dunlop Connection requires a less-expensive bridge, it requires a restored right of way (that raises substantial neighborhood issues), and a second station (if the other trains continue to use a station on the A Line. The *North Collier Connection* can overcome conflicts with freight operations only at greater expense to provide some additional trackage and interlocking improvements. Further study is required to determine the extent of these tradeoffs.

The final decision on station location and route at Petersburg is not required to complete the other analysis and planning requirements of the study. For rail operations simulation the *Dunlop Connection* has been assumed, but keeping the station at Ettrick and using the wye bridge would not compromise the project to South Hampton Roads.

The route should be planned to protect NS's ability to serve the industries of Petersburg and Hopewell, and to freely operate freight trains through the Petersburg area.

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NS Main Line between Petersburg and Suffolk

The NS Main Line between Petersburg (Poe) and Suffolk (Brico) is the primary location for potential operational conflicts. High-speed passenger trains would be overtaking slower freight trains and a primary goal of the study is that high-speed train operations be transparent to freight train operations. Optimizing the Richmond – South Hampton Roads trip time for passenger rail service on a consistent basis – while preserving and enhancing the dependability of the NS freight operations – would require improvements that would increase rail capacity at strategic locations. Reduced trip times and improved capacity would enable the high-speed service to operate reliably without adversely affecting, or being delayed by the large number of long freight trains.

Three strategies were pursued in designing the plant and operations to minimize the probability of schedule conflicts in this critical segment of the corridor:

1. Create track connections, modify interlockings, and make additional operational improvements that would result in segments of track where freight and passenger train conflicts would be minimized in Petersburg (west end) and at Suffolk (east end);
2. Provide a passing siding of sufficient length in the most effective location—a third track to be used by freights—where a passenger trains could overtake and pass a slower train without either train being required to stop;
3. Design passenger schedules so that trains traveling in opposite directions “meet” in terminals or “pass” at locations where freight operations would not be disrupted.

Given their higher speeds, passenger trains would occupy the shared 48.3 mile Poe-Brico main line segment for as little as:

- 110 mph: 27 minutes;
- 90 mph: 33 minutes; or
- 79 mph: 37 minutes.
-

A 45 mph freight train would take 65 minutes to cover this distance.

The high rate of passenger train speed also would mean that any delay to freight trains held up from entering the Poe-Brico section would be minimal, since the passenger trains would reach the line segment at speed and accelerate away from the freight trains.

Initially a long 12-mile third track, or center siding, is proposed between interlockings at “Waverly” (N59.5) and “47 Crossover” (N46.5). The siding would be long enough to permit freight trains to enter it at 45 mph and proceed at speed through the siding while a passenger train overtakes and passes.

Using the NS’s Main Line through downtown Petersburg (the West, Dunlop, and Ettrick Connections), permits the high-speed South Hampton Roads trains to avoid the yard operations at Poe, where the Belt Line joins the Main Line. Offsetting this advantage might be the need to construct a second track on the Belt Line, by connecting the existing sidings, to allow NS to avoid using the Main Line. This would create a passenger route through Petersburg having minimal interface with freight operations. The Belt Line would continue to be the primary NS freight line, bypassing downtown Petersburg. Passenger trains would operate in both directions on the (westbound) Number 2 track

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past Poe Yard (see Figure Poe), and avoid conflicts with freight trains working at the yard, or the automobile unloading facility located to the east.

Connecting the A Line to the Belt Line (the North Collier and Secoast Connections) would route high-speed passenger trains through an area of heavy freight activity. It appears that the following would be required:

- an additional main track on the NS Belt Line between North Collier and Poe, and
- a new interlocking built on straight track at East Poe, to avoid the curve at Poe.

Poe Interlocking and Yard

Norfolk Southern's operations between Norfolk and all other parts of its freight network use the railroad's double track main line from Norfolk, through Suffolk, to Poe, VA, southeast of Petersburg. At Poe, the Main Line continues north into Petersburg, then west along the Appomattox River to Crewe, VA, Lynchburg, and Roanoke. Because of unfavorable grades in both directions on the Main Line, the railroad also operates an 8.86-mile bypass between "Poe" at N 77.81 and "Jack" at N 88.31, called the Petersburg Belt Line. This line is 1.64 miles shorter and has much more favorable grades, particularly eastbound in the heavy tonnage direction. As a result, the Belt Line is used as the railroad's primary freight route, and Main Line is used for some westbound movements and as an emergency and overflow route.

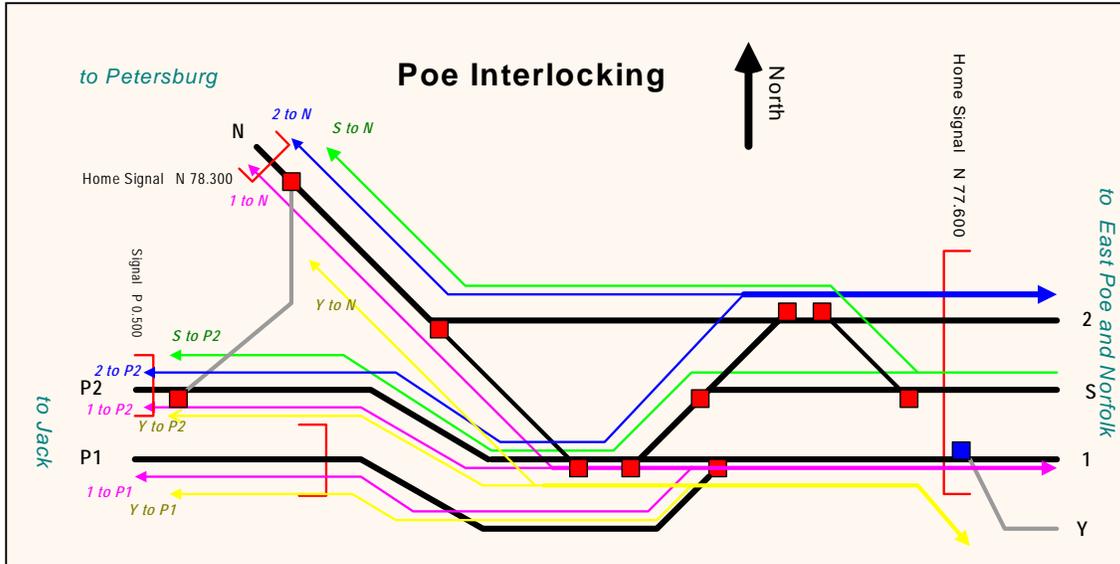
The NS has a small yard and a busy automobile unloading facility at Poe, both of which require freight trains to stop and work for substantial time intervals. These freight trains occupy the siding at Poe, and often occupy the eastbound main track. The Belt Line has a 2-mile siding extending westward from Poe, another 2-mile siding at its west end at "Jack", and a long interchange and setoff siding in its middle at Secoast where NS interchanges with CSXT. Bridges and overhead structures between Poe and Secoast are already built to accommodate a second track.

The NS's heavy use of the Belt line, the congestion that arises from trains stopping and working at the CSXT interchange or at Poe Yard, and the possible need to add track capacity to the Belt Line to maintain quality freight service, indicate that an additional track would be needed on the Belt Line, between North Collier and Poe, on which to move passenger trains.

If the passenger trains were operated on the Main Line, a second track on the Belt Line, consisting of the existing sidings connected by additional track, might be required.

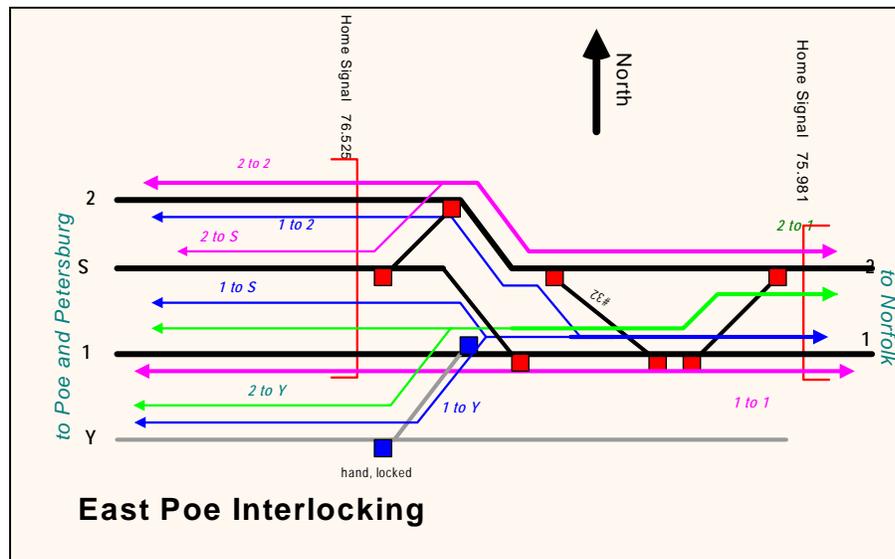
Further study will be necessary to make either of these determinations.

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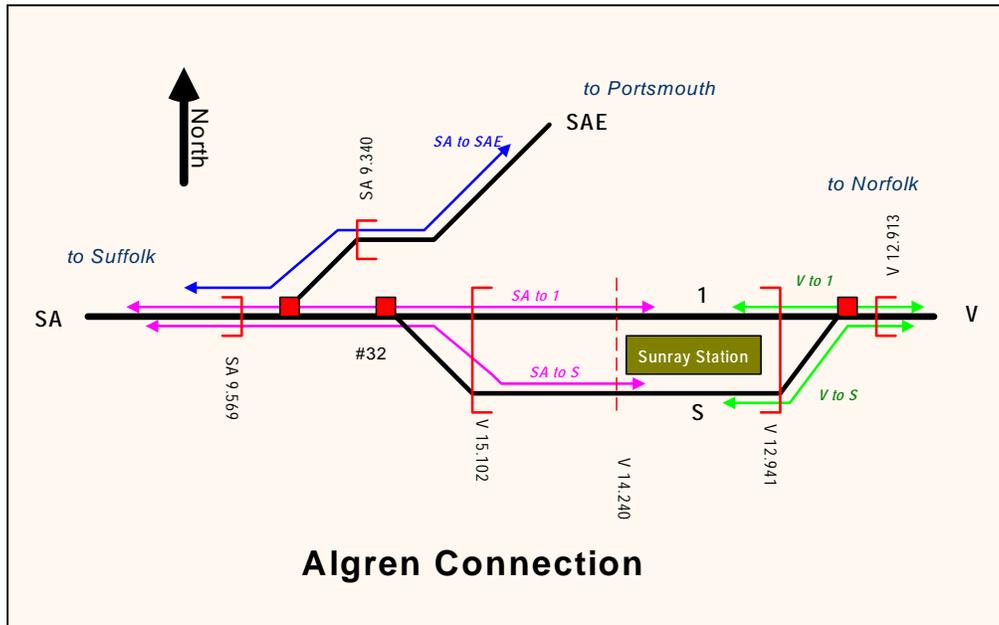
Notes: Green indicates routes to/from Track S, Blue indicates routes to/from Track 2, Purple indicates eastward routes to/from Track 1, and Yellow indicates routes to/from Track Y.

The current Poe interlocking is built on a 1° curve, and presents a complex challenge to creating a passenger “bypass” from the Belt Line to the Main Line going east, particularly when one considers the number of freight trains working at Poe. By using the Main Line to Petersburg, passenger trains could be operated on Number 2 track, on the north side of the right of way, staying clear of the yard and freight operations. South Hampton Roads-bound passenger trains will cross over to the Number 1 main at East Poe, where it is recommended that a high-speed crossover be built to permit 80 mph movements. Normally, a 45 mph crossover would be specified because of the cost. However, since every southbound South Hampton Roads train would use the crossover, the collective reduction in trip time, and the increase in capacity that would result, make this specific application of an 80 mph crossover a justifiable recommendation.



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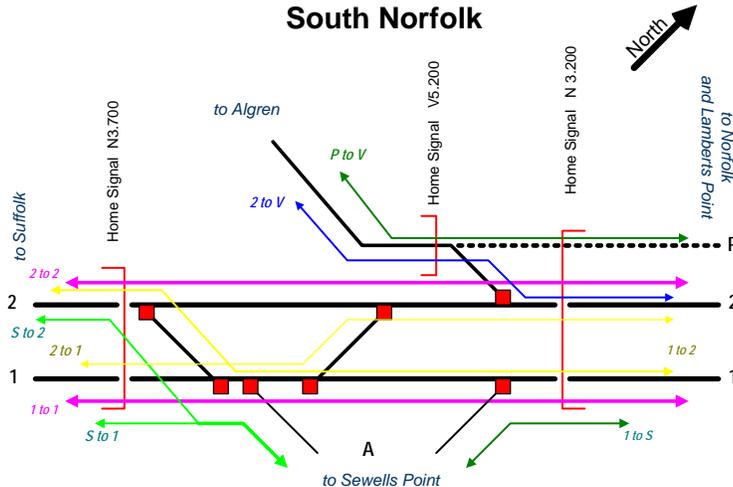
The “beltway station” also offers important market trade-offs for the proposed system. It should be in a location that has both space for parking and other facilities, and good highway access, to attract riders from the widest possible area. An analysis of the rail-highway interface has led the study team to conclude that a station located east of the Algren track connection, at the crossing of Homestead Road, would best serve the projected travel market.



Access to Downtown Norfolk

Operation over the NS's "V-Line" (former Virginian main line) between Algren and South Norfolk continues the separation of the passenger operation from the bulk of NS's freight movements into Norfolk. The single track V-Line between Algren (V15.5) and South Norfolk would require rehabilitation, but is a straight, well-engineered right of way. It includes a drawbridge over the Southern Branch of the Elizabeth River, on the Inland Waterway. This is an unavoidable crossing, since the NS Main Line has its own drawbridge over this navigable waterway a few miles further south. At South Norfolk (V2.3), the passenger route would re-enter the NS main track, but could only operate on the westbound Number 2 main track over bridge 5 into the proposed Norfolk station.

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South Hampton Roads Passenger Terminal

Alternative Terminal Locations

Downtown Norfolk and Portsmouth are relatively compact markets that could be served by a station located in either. It is likely that a potential Downtown Norfolk station site near the Harbor Park baseball stadium would be the most desirable location available. It is reasonably close to both downtown Norfolk, and Portsmouth. The location is on the railroad at the east (geographically north) end of Bridge 5, immediately adjacent to the baseball stadium parking lot.

The N&W Norfolk Terminal station was located in the vicinity of Water Street and the Eastern Branch of the Elizabeth River. It has been gone for a number of years, and the area has been developed such that restoring rail service is not feasible. The historic SAL Station building in downtown Portsmouth still exists, however, rail access has been eliminated by recent development around the city hall complex.

At the location proposed for the passenger station, station tracks need to be accommodated within the 1500 feet between Bridge 5 and the grade crossing for Park Avenue (formerly Lovitt Avenue). The location is the closest available to downtown Norfolk, and could share parking and highway access with the stadium. Public transit services, including the planned light rail line could be coordinated with the proposed service.

The site's singular drawback is its relatively small size, and the inability to locate either a maintenance/servicing facility or a convenient wye track or turning loop nearby.

At initial lower frequencies of passenger service, passenger trains would operate on the current Number 2 main track between Norfolk and South Norfolk. If volumes of either freight or passenger trains require it, a dedicated passenger track could be constructed between these interlockings alongside the alignment of Number 2 main track; the eastbound (to Lamberts Point) freight track could be shifted to use the "reserve" Bridge 5A to cross the Eastern Branch, leaving the current westbound track on Bridge 5 for passenger use.

Projection of Future Traffic and Capacity Requirements

Freight Traffic

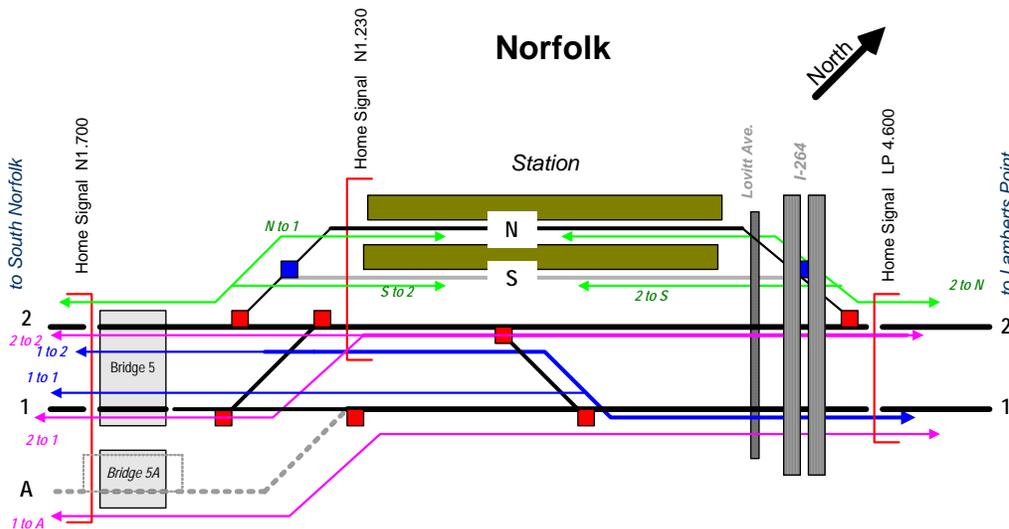
The frequency, schedules, and variability of freight trains on the CSXT and NS main lines are a critical component of the analysis of the South Hampton Roads High-Speed service. CSXT freight traffic on the S Line between Richmond and Centralia, and the A Line from Centralia to Collier, VA, is assumed to be at the same forecasted levels expected by the SEHSR Corridor planning. Current CSXT freight schedules are used, reflecting 12 southbound trains and 14 northbound trains per day between Collier and Centralia. To project future growth in CSXT freight traffic, additional train schedules were added to produce a total of 54 trains/day operating between Centralia and Collier:

- 6 daily coal trains added southbound between Centralia and Collier
- 8 daily trains of empty coal cars operated northbound from Collier to Richmond over the S Line;
- 3 daily merchandise (and municipal waste) train pairs added between Centralia and Collier;
- 4 daily pairs of intermodal trains added to operate via the restored S Line between Raleigh and Centralia.

The bulk of CSXT freight trains would continue to operate via the A Line between Acca Yard in Richmond and Collier. CSXT has indicated that, given a reconstruction of the S Line for high-speed passenger use between Raleigh and Petersburg, it would run up to 4 pairs of intermodal trains per day over that route. Depending on the route and connections used in Petersburg, these trains may have a significant effect on capacity and train delay through Petersburg. Trains of empty coal cars are also expected to operate north on the S Line to Richmond as part of CSXT’s equipment repositioning strategy, but the loaded trains would continue to run south on the A Line. Two pairs of locals are also expected on the S Line, serving Bellwood and Fanshawe Yards from Collier.

Norfolk Southern freight trains between Petersburg (Poe) and Norfolk also reflect current NS train schedules, but with the following provisions for future traffic growth:

- 6 daily *pairs* of coal trains (loaded and empty), sufficient to produce an annual



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throughput in excess of 38 million tons of coal at Lambert’s Point;

- 2 additional *pairs* of intermodal trains to Sewells Point;
- 2 *pairs* of intermodal trains to the new intermodal facility in Portsmouth;
- 1 new *pair* of “automotive” trains serving Norfolk.

In all, 16 pairs of merchandise freight, intermodal, and coal trains are planned for daily operation between “Jack” (west of Petersburg) and the Norfolk terminal. A local freight “turn” is operated daily between Suffolk and Poe to serve industries on the NS Main Line, and a pair of trains operates between “Jack” and Hopewell Junction, over the Main Line.

NS freight service in the Norfolk terminal fans out to any one of several yards, depending on commodity. Coal trains operate to Lamberts Point, crossing Bridge 5, and running past the site of the planned Norfolk passenger station. Merchandise and domestic intermodal traffic are served at Portlock Yard, while international container traffic is handled at Sewells Point; the planned new intermodal terminal on the west (Portsmouth) side of the harbor would be reached by NS off the main line at Suffolk. The Ford plant and other automotive traffic are also handled through Portlock. While the freight trains run to various locations in the Norfolk terminal, the railroad conducts all locomotive servicing at Lamberts Point, so there is a significant number of light engine movements over Bridge 5 and past the proposed passenger station location that must be taken into account.

Passenger Schedules

Train Performance Calculator (TPC) Analyses

PTG has performed a series of TPC (train performance calculator) analyses to determine unimpeded running times over the route’s current configuration. Changes in the route’s basic engineering—track connections, curve realignments to obtain goal speeds (particularly lengthened spirals to ensure passenger comfort at the increased levels of *maximum authorized speed* [MAS]), elimination of speed restrictions due to track condition or municipal speed restrictions—have been evaluated using the TPC to determine the actual transit time improvements that would be achieved in the Richmond to South Hampton Roads corridor. Improved train speeds would be essential if the railroad is to establish a competitive position in the intercity passenger market.

The TPC runs indicated that all the Petersburg connections produced Richmond-South Hampton Roads running times that were within one minute of each other. The TPC running times included two-minute stations stops at Bowers Hill and Petersburg (either the existing Ettrick station or the former downtown station). The TPC results indicate, for planning purposes, that the selected connection route through Petersburg would have no effect on the scheduled running times of the South Hampton Roads High-Speed trains.

The initial TPC runs were made with a maximum passenger train speed of 110 mph.

Additional runs were made on the “Ettrick” alignment to evaluate the running times for 90 mph and 79 mph train services. The TPC results were supplied to Amtrak, who used its standard scheduling methodology to apply a schedule “pad” for schedule reliability to produce the passenger schedules used in the *Train Operations Reliability Analyses*.

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TPC Running Times Richmond - Main Street -to Norfolk			
Petersburg connection used	South	North	Speed
West	1:22	1:22	110 MAS
Dunlop	1:20	1:19	110 MAS
Ettrick	1:21	1:21	110 MAS
Ettrick	1:29	1:29	90 MAS
Ettrick	1:36	1:36	79 MAS

Amtrak Schedule Running Times			
	South	North	Speed
via any route	1:27	1:28	110 MAS
via any route	1:36	1:35	90 MAS
via any route	1:43	1:43	79 MAS

The running times for various types of NS freight trains in the critical Poe - Brico section of the route also were evaluated using the TPC. Heavy coal trains, general merchandise, and intermodal trains were run in both directions to determine probable running times. An additional TPC run was made with a loaded coal train stopping midway between Poe and Brico, waiting 5 minutes, then accelerating up to speed again to investigate the impacts of having to stop then accelerate a heavy coal train from a dead stop.

TPC Running Times, NS Freight trains, Poe -- Brico						
	South	North	Speed	Cars	Feet	Tons
Coal Load/Empty	1:11	1:05	50 MAS	175	9000	5250 (empty)
Coal Load (5 minute stop) *	1:25		50 MAS	175	9000	22750 (loaded)
Merchandise	1:02	1:05	50 MAS	110	6000	8250
Intermodal Freight	1:02	1:03	50 MAS	75	6000	6000

* includes a 5 minute stop on the siding

The resulting freight running times are used in the *Train Operations Reliability Analyses* to evaluate how the freight and passenger trains on the shared Poe—Brico section would interact and affect schedule performance and trip time reliability for both the freight and passenger trains. Passenger train schedules for services other than the South Hampton Roads are the same used for the *SEHSR Corridor* (Richmond-Charlotte) project. The planned 4 daily pairs of high-speed trains between Richmond and Charlotte and the current 4 pairs of Amtrak long-distance passenger trains would share the route and station stops with the South Hampton Roads service between Richmond and Petersburg.

Passenger Service Scenarios

South Hampton Roads service frequencies and schedules were developed by Amtrak using the Train Performance Calculator (TPC) inputs of running times, combined with schedule “pad” and station dwell times. Amtrak provided schedules for 79 mph trains, 90 mph trains, and 110 mph trains, progressing from a single pair of trains running at 79 mph, to twice-daily service at 79 mph, then moving to 4 daily round-trips at 90 mph and 110 mph, and finally reaching a complete schedule of 6 daily round-trips operating at a maximum speed of 110 mph.

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One Daily Train Pair at 79 mph

		South	North	
Richmond-Main St	Dp	8:05 PM	8:18 AM	Ar
Petersburg	Ar	8:26 PM	7:57 AM	Dp
Petersburg	Dp	8:28 PM	7:55 AM	Ar
Bowers Hill	Ar	9:29 PM	6:54 AM	Dp
Bowers Hill	Dp	9:31 PM	6:52 AM	Ar
Norfolk	Ar	9:48 PM	6:35 AM	Dp

One Daily Train Pair at 90 mph

		South	North	
Richmond-Main St	Dp	8:05 PM	8:20 AM	Ar
Petersburg	Ar	8:26 PM	8:00 AM	Dp
Petersburg	Dp	8:28 PM	7:58 AM	Ar
Bowers Hill	Ar	9:23 AM	7:03 AM	Dp
Bowers Hill	Dp	9:25 AM	7:01 AM	Ar
Norfolk	Ar	9:41 AM	6:45 AM	Dp

Two Daily Train Pairs at 79 mph

		South	South	North	North	
Richmond-Main St	Dp	10:30 AM	8:05 PM	8:18 AM	5:53 PM	Ar
Petersburg	Ar	10:51 AM	8:26 PM	7:57 AM	5:32 PM	Dp
Petersburg	Dp	10:53 AM	8:28 PM	7:55 AM	5:30 PM	Ar
Bowers Hill	Ar	11:54 AM	9:29 PM	6:54 AM	4:29 PM	Dp
Bowers Hill	Dp	11:56 AM	9:31 PM	6:52 AM	4:27 PM	Ar
Norfolk	Ar	12:13 PM	9:48 PM	6:35 AM	4:10 PM	Dp

Two Daily Train Pairs at 90 mph

		South	South	South	South	
Richmond-Main St	Dp	10:30 AM	8:05 PM	8:20 AM	5:55 PM	Ar
Petersburg	Ar	10:51 AM	8:26 PM	8:00 AM	5:35 PM	Dp
Petersburg	Dp	10:53 AM	8:28 PM	7:58 AM	5:33 PM	Ar
Bowers Hill	Ar	11:48 AM	9:23 AM	7:03 AM	4:38 PM	Dp
Bowers Hill	Dp	11:50 AM	9:25 AM	7:01 AM	4:36 PM	Ar
Norfolk	Ar	12:06 PM	9:41 AM	6:45 AM	4:20 PM	Dp

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Four Daily Train Pairs at 110 mph

		South	South	South	South	North	North	North	North	
Richmond-Main St	Dp	10:30 AM	12:25 PM	8:05 PM	10:00 PM	7:23 AM	8:18 AM	10:53 AM	5:53 PM	Ar
Petersburg	Ar	10:51 AM	12:46 PM	8:26 PM	10:21 PM	7:03 AM	7:58 AM	10:33 AM	5:33 PM	Dp
Petersburg	Dp	10:53 AM	12:48 PM	8:28 PM	10:23 PM	7:01 AM	7:56 AM	10:31 AM	5:31 PM	Ar
Bowers Hill	Ar	11:40 AM	1:35 PM	9:15 PM	11:10 PM	6:13 AM	7:08 AM	9:43 AM	4:43 PM	Dp
Bowers Hill	Dp	11:42 AM	1:37 PM	9:17 PM	11:12 PM	6:11 AM	7:06 AM	9:41 AM	4:41 PM	Ar
Norfolk	Ar	11:57 AM	1:52 PM	9:32 PM	11:27 PM	5:55 AM	6:50 AM	9:25 AM	4:25 PM	Dp

Four Daily Train Pairs at 90 mph

		South	South	South	South	North	North	North	North	
Richmond-Main St	Dp	10:30 AM	12:25 PM	8:05 PM	10:00 PM	7:25 AM	8:20 AM	10:55 AM	5:55 PM	Ar
Petersburg	Ar	10:51 AM	12:46 PM	8:26 PM	10:21 PM	7:05 AM	8:00 AM	10:35 AM	5:35 PM	Dp
Petersburg	Dp	10:53 AM	12:48 PM	8:28 PM	10:23 PM	7:03 AM	7:58 AM	10:33 AM	5:33 PM	Ar
Bowers Hill	Ar	11:48 AM	1:43 PM	9:23 AM	11:10 PM	6:08 AM	7:03 AM	9:38 AM	4:38 PM	Dp
Bowers Hill	Dp	11:50 AM	1:45 PM	9:25 AM	11:12 PM	6:06 AM	7:01 AM	9:36 AM	4:36 PM	Ar
Norfolk	Ar	12:06 PM	2:01 PM	9:41 AM	11:27 PM	5:50 AM	6:45 AM	9:20 AM	4:20 PM	Dp

Six Daily Train Pairs at 110 mph

southbound		South	South	South	South	South	South
Richmond-Main St	Dp	8:20 AM	10:30 AM	12:25 PM	6:05 PM	8:05 PM	10:00 PM
Petersburg	Ar	8:41 AM	10:51 AM	12:46 PM	6:26 PM	8:26 PM	10:21 PM
Petersburg	Dp	8:43 AM	10:53 AM	12:48 PM	6:28 PM	8:28 PM	10:23 PM
Sunray	Ar	9:30 AM	11:40 AM	1:35 PM	7:15 PM	9:15 PM	11:10 PM
Sunray	Dp	9:32 AM	11:42 AM	1:37 PM	7:17 PM	9:17 PM	11:12 PM
Norfolk	Ar	9:47 AM	11:57 AM	1:52 PM	7:32 PM	9:32 PM	11:27 PM

northbound		North	North	North	North	North	North
Norfolk	Dp	5:55 AM	6:50 AM	9:25 AM	11:25 AM	1:25 PM	4:25 PM
Sunray	Ar	6:11 AM	7:06 AM	9:41 AM	11:41 AM	1:41 PM	4:41 PM
Sunray	Dp	6:13 AM	7:08 AM	9:43 AM	11:43 AM	1:43 PM	4:43 PM
Petersburg	Ar	7:01 AM	7:56 AM	10:41 AM	12:31 PM	2:31 PM	5:31 PM
Petersburg	Dp	7:03 AM	7:58 AM	10:43 AM	12:33 PM	2:33 PM	5:33 PM
Richmond-Main St	Ar	7:23 AM	8:18 AM	10:53 AM	12:53 PM	2:53 PM	5:53 PM

Maximum Authorized Speed (MAS):

In addition to affecting the trip times between Richmond and South Hampton Roads, the assumed MAS has a significant impact on capacity, particularly on the NS line(s) between Petersburg and Norfolk. As the speed differential between freight and passenger trains increases the potential for passenger trains to overtake freight trains increases. Although there are a very limited number of curves between Petersburg and Norfolk, the optimal physical characteristics of each curve may vary with the goal speed defined by the MAS. These interrelationships are analyzed as part of our systematic analysis of the improvements necessary to upgrade a corridor's rail service facilities.

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The MAS assumed will drive the level of signal system and grade crossing improvements/enhancements required. For example, with a 79 mph MAS, cab signals would not be required. This would eliminate the cost associated with equipping fleets of NS and CSXT locomotives with cab signals. With a 110 mph MAS, a larger number of grade crossings would be considered for closure or separation and the level of protection necessary for those that remain would increase.

Frequency of Service:

A variety of peak and off-peak service patterns have been evaluated, both to identify Improvements and analyze demand. The Final Report's service implementation recommendations will reflect the most cost-effective blend of short- and long-term infrastructure improvements, operating scenarios, and ridership.

Recommended Improvements

The improvements identified, thus far, to implement the Richmond - South Hampton Roads High-Speed Rail Service assume that:

- Main Street Station improvements are implemented by City of Richmond; and
- Main Street Station - Centralia improvements recommended in the *Potential Improvements to the Richmond to Charlotte Railroad Corridor* report are implemented.

The following additional improvements would be required.

Centralia to Petersburg (Dunlop – A19.2)

An alternative routing between Centralia and Petersburg was suggested for consideration by DRPT and has been incorporated as an alternative in the Richmond – Charlotte High-Speed Corridor report. The alternative includes construction of a third track east of the present CSXT A Line . The third track would provide direct access to the proposed Dunlop Connection. Dunlop Interlocking would be constructed in place of Pete Interlocking. Dunlop Interlocking would provide universal access to all main tracks.

Petersburg – Dunlop Connection

The Dunlop Connection would be double tracked for 2.8 miles, between Dunlop Interlocking and the north end of Poca Interlocking. The north end of Poca would be located north of the former five-span 313-foot long ACL Appomattox River Bridge. The south end of Poca would be the location of the Wye Track split, eastward (to Norfolk on the NS) and westward/southward, to A Line and the S Line. The piers for the bridge remain in place, but the superstructure has been removed. The former N&W Petersburg station would be restored to service. Platforms would be constructed adjacent to each leg of the Wye –on the east leg for Norfolk-bound trains and on the west leg for A and S Line-bound trains.

Battersea Interlocking

The west leg of the Wye track would be extended parallel to the NS Main Line, to Battersea Interlocking, where the Wye track would merge with the NS Main Line. Connections to the A Line and the S Line, and the NS Main Line would extend westward/southward from the west end of the interlocking.

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Battersea Connection

The Battersea Connection would enable movements from the NS Main Line at Battersea to the A Line. The connection to the A Line would require that the south end of existing Appomattox Interlocking, which controls the turnout connecting the double track to the single-track Appomattox River Bridge, be modified to include the turnout to the Battersea Connection and a crossover between the two main line tracks.

S Line Connection

The S Line Connection would enable movements from the NS Main Line at Battersea to the proposed S Line south of the Appomattox River and west of the A Line Appomattox River Bridge. The connection would continue as the restored S Line, to Raleigh, NC.

Petersburg – NS Main Line, Petersburg Station to Poe Interlocking

The east leg of the Wye at Petersburg Station would extend eastward to Hopewell Jct, where it would connect to the NS Main Line, at approximately MP N81. The Main Line would be a single-track to Poe Interlocking (MP N77.8), the existing connection with the Belt Line. Poe would be modified to make the route from Track 2, on the Main Line east of Poe, to the Main Line west of Poe a straight move. At present the route is through a turnout.

The route from the Belt Line to Track 1, eastward to Norfolk, would remain a straight move, while alternative 45 mph routes from Track 1 to the Belt Line would be provided.

Petersburg Belt Line Improvements

Poe Interlocking would provide the capability of making simultaneous movements westward from Main Line Track 2 to the Belt Line track P1 and eastward from Belt Line Track P2 to Main Line Track 1. The Poe modifications would include a one-mile center siding that would enable eastward trains to be routed around freight trains standing on Main Line Track 1 to work the yard tracks located east of Poe. The modifications would be intended to minimize the impact of the proposed passenger train operations and the local yard operations on the heavy volume of NS trains that use the Petersburg Belt Line. The 8.8-mile Petersburg Belt Line would remain as presently configured between Poe and Jack. The line is double tracked in two segments for a total of 3.6 miles, between Poe and Walnut Creek and between Ingram and Jack, and has a 1.4-mile siding on the south side of the right-of-way, at Secoast. In exchange for NS surrendering its control and ability to operate on the NS Main Line through Petersburg, the 3.5-mile balance of the Belt Line could be double tracked so that NS would no longer need to operate through freight trains on the Main Line. The only NS freight left on the Main Line would be the trains to and from Hopewell Junction.

NS Main Line – Poe to Brico

Additional flexibility would be created by the installation of three new, or reconfigured, universal interlockings and a 12.6-mile center siding in this segment of extended tangent track. Five interlockings, with No. 20 crossovers, and turnouts where necessary, would be located in this track segment at:

- ***East Poe (N76.1)***, configured as the east end of the three track segment, permitting passenger trains to bypass the yard and auto facility at Poe;
- ***Disputanta (N69.2)***, a universal interlocking where existing No. 20s will remain,
- ***Waverly (N59.7)***, to be reconfigured as the west end of the three-track segment,

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- **47 Crossover (N46.8)**, to be reconfigure as the east end of the three-track segment, and
- **Wight (N37.3)**, a new universal interlocking.

Brico Connection

A 1.8-mile jug handle connection between the NS Main Line and the CSXT Portsmouth Subdivision would be constructed at Brico (N27.3). At the west end of the connection, Brico Interlocking would provide access to both Main Line tracks from the connecting track through a left hand No. 20 crossover and a left hand No. 20 turnout. A new interlocking would be constructed on the CSXT Portsmouth Subdivision at the east end of the connecting track. The passenger train moves from the connecting track to the CSXT Portsmouth Subdivision would be the straight, high-speed route, while a No. 20 turnout would provide the access route for CSXT trains.

Brico to Algren

The CSXT Portsmouth Subdivision would be upgraded to support high-speed rail service. The 14.6-mile segment would remain a single track. At Algren the route to the former Virginian Main Line would be the straight route and a No. 20 turnout would provide the CSXT a route to Portsmouth. A 2.3 mile siding would be located between Algren and a new interlocking, North Algren. The siding was placed to support the meets that occur with the proposed schedules at Bowers Hill Station. A No. 32 turnout would be installed at the north end of the siding. The turnout would facilitate 80 mph, instead of 45 mph speeds for eastward passenger trains. The anticipated high percentage of passenger train meets at this location make the higher speed turnout the preferred option.

Algren to South Norfolk

This segment of the former Virginian Railway main line would be upgraded to support the proposed high-speed rail service. A beltway station would be located at Bowers Hill, about two miles east of Algren.

The connection of the Virginian to the NS Main Line at South Norfolk would not be modified.

South Norfolk to Norfolk

This track segment will not be improved.

Norfolk Passenger Terminal

The station tracks would be located in the 1500 feet of space between Bridge 5 and the Park (formerly Lovitt) Avenue grade crossing. Station platforms would be located on the west, or downtown Norfolk side of the double-track NS Lamberts Point Line. Two station tracks would be located adjacent to the line, and the platform would be located between them. Access to the station tracks would be interlocked on both ends to provide and control movements to and from the platform in either direction. Interlocked crossovers would be installed between the two Lamberts Point Line tracks.

Maintenance Facilities

Sufficient yard storage capacity should be provided to handle layovers, and to store equipment-awaiting maintenance. Yard lighting, water and power hookups, a fueling facility, crew quarter facilities, employee locker room, and supervisory office space would be included. Commissary facilities to service train sets would be furnished.

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As of this time a location to service trains that would be stored in Norfolk between runs has not been identified. An efficient storage yard and maintenance facility in the vicinity of the Norfolk Passenger Terminal would be necessary to properly clean and inspect trains. Further evaluation of train operations through the area, and potential locations, would be required to finalize the location

Signal System Upgrade

To efficiently handle increased train traffic on the route and to permit improved intercity passenger service with greater safety, signal system upgrades should be implemented incrementally, as passenger train service levels and maximum authorized speeds are increased. These improvements also would enable freight service to safely and efficiently operate on the same tracks. A cab signal system (necessary to operate passenger trains at speeds greater than 79 mph), a new block layout⁹, and new signal aspects, would be installed incrementally, to accommodate speeds up to 110 miles per hour¹⁰. Block spacing would anticipate increased train speeds. The installation of cab signals would require that all NS and CSXT locomotives operating on the South Hampton Roads corridor be equipped with Automatic Train Control (ATC). Reverse signaling would be installed throughout the route.

Ultimately, a new signal system would improve the reliability of train operations for all services, contribute to reducing maintenance-related operating costs, and would be a component critical to enabling higher speed train operations.

Identification of Improvements

The network of improvements necessary to provide adequate track structure and sufficient capacity to reliably operate freight and high-speed passenger service between Richmond and South Hampton Roads have been defined.

Ultimately, the types of improvements that would be included are projects to:

- Upgrade the track structure,
- Upgrade signal systems,
- Realign selected curves to permit higher operating speeds and reduce trip time,
- Reconfigure, relocate, eliminate, or install interlockings to improve operating flexibility,
- Install additional trackage to reliably accommodate increased freight and passenger traffic levels,
- Restore abandoned track, and
- Improve Stations.

As previously described, a series of alternative alignments and operational scenarios were evaluated to achieve the maximum integration of intercity and freight rail services. A train simulation modeling exercise, which included anticipated future freight and passenger volumes, was performed to ensure that critical operational capacity constraints have been identified and mitigated.

The list of improvements is intended to be an additive list of improvements that will :

⁹ The spacing between signals that represents the best compromise maximizing capacity (more signals, closer together, creating shorter blocks) and economy (fewer signals, further apart, creating longer blocks).

¹⁰ The braking distance for a 110 mph passenger train is essentially equal to that of a 60 mph freight train.

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- Enable the specified running times for the Richmond - South Hampton Roads intercity passenger service to be achieved,
- Provide capacity required to accommodate future long-term growth in freight service volumes, sizes of shipments and clearances¹¹.
- Provide safety-related improvements.

The initial list of improvements has been updated by PTG to reflect the results of our simulation modeling. The final report will include:

- A description of the project,
- Location on the route,
- Project cost, and
- The rationale for the improvement.

Summary Track Charts

PTG prepared a summary railroad track chart locating the improvements (Appendix Track Chart). The chart enables the reader to clearly comprehend the geographical interfaces of the improvements.

Cost Estimates

PTG cost estimating personnel developed conceptual, order of magnitude working estimates in Year 2000 dollars for each improvement identified as necessary and sufficient.

Testing of the Improvements

The proposed schedules were incorporated into our simulation of the operations utilizing our LogsimTM simulation program. The simulation included the preliminary set of improvements defined by PTG's operations and facility analysts

PTG has used its **Corridor Operations Methodology** to evaluate the physical characteristics and capacity of the rail facilities to determine the transit time South Hampton Roads to Richmond trains could realistically achieve under various service scenarios¹². The major elements that were evaluated are speed and service reliability. Other than those freight operations through the proposed passenger terminal location, freight terminal operations in South Hampton Roads were not simulated. Our staff has evaluated train operations between the various NS and CSXT facilities in the south of Hampton Roads area, and utilized our understanding of them to evaluate the impact of the commingling of passenger and freight operations. The alignment alternative selected between Suffolk and South Norfolk has eliminated the need for this study to simulate NS operations in the vicinity of Portlock Yard, while the Norfolk passenger terminal location selected has eliminated the need for this study to model NS intermodal and coal terminal operations.

¹¹ For the simulation analysis PTG utilized train volume data provided by CSXT for previous Washington to Richmond corridor studies and growth projections supplied by NS.

¹² The Corridor Operations Methodology is an integrated set of computer models, including a TPC and dispatching simulation, track geometry, construction cost estimating spreadsheets, and a tested analysis technique to evaluate corridor improvements. It has been used intensively to evaluate high speed, high-density corridor operations for Amtrak and FRA.

Train Operations Reliability Analyses

The rail simulation performed by PTG enabled us to assess the number of additional trains that could transit the Richmond to South Hampton Roads corridor in a timely fashion and the range of delay that might be incurred. A combination of “string line” and simulation tools were utilized to determine the degree to which the upgraded rail lines would reach the performance levels required to support the proposed HSR service. PTG modified its Logsim™ model of the SEHSR Corridor to perform an operations simulation of the Richmond to South Hampton Roads corridor. The simulation ensured that the commingling of the new train service with the Richmond - Charlotte SEHSR Corridor was properly analyzed