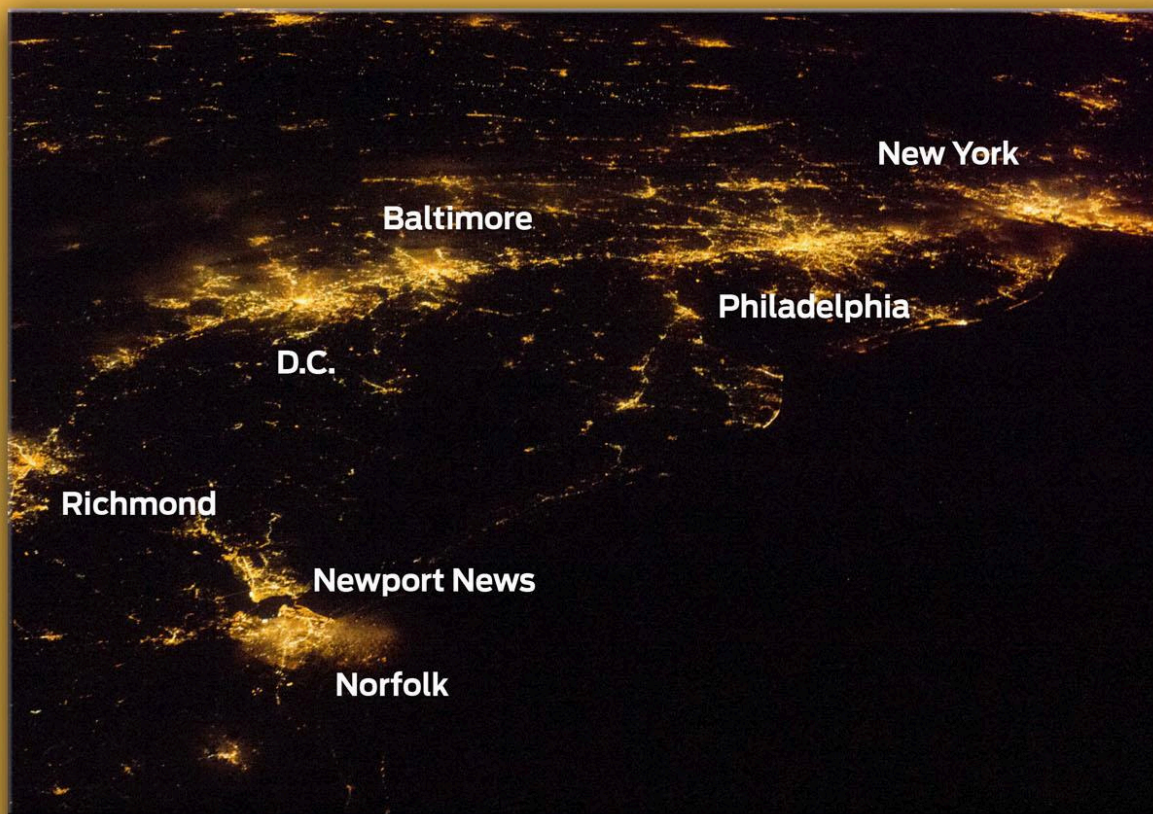


THE VIRGINIA CRESCENT LINE HIGH-SPEED INTERCITY PASSENGER RAIL VISION PLAN

MARCH 2015



PREPARED BY *TEMS* TRANSPORTATION ECONOMICS & MANAGEMENT SYSTEMS, INC.

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DEDICATION

For Mary Jane Taylor and in loving memory of Rear Admiral Raynor A. K. Taylor, USN (Ret.).

You both believed we could be more than anyone thought possible. The fingerprints of progress and grace you left on Hampton Roads and our lives were of the permanent variety.

You are world-changers and this work is dedicated to you both.



THE VISION

Hampton Roads Transportation Planning Organization Resolution #2009-05

- **Enhanced Intercity Passenger Rail along the CSXT/I-64 corridor**
 - **High-Speed Rail along the NS/Route 460 corridor**

HISTORICAL CONTEXT: The HRTPO Board Resolution #2009-05 expresses “The Vision” that the citizens of Hampton Roads have defined as a critical transportation need for the future: the development of a High-Speed and Enhanced Intercity Passenger Rail System for the Hampton Roads-Richmond-Washington D.C. Corridor (Virginia Crescent Line). In 2009, the DRPT and HRTPO took the strategic initiative of proposing a preliminary “Vision Plan” for implementing the goals of Resolution #2009-05.

This preliminary “Vision Plan” completed in 2010, was the first step in determining how High-Speed and Enhanced Intercity Passenger Rail can be brought to Virginia’s most important business, military and recreational intercity corridor. Continuing the goals of “The Vision” in Phase 2 of the study, a fundamental and more detailed evaluation of the corridor was completed by Transportation Economics & Management Systems, Inc. (TEMS) in February of 2014. Specifically, this study assessed a number of potential rail options for the corridor and developed costs for infrastructure and service operations for each option.

In developing the analyses for the study, in addition to working closely with community stakeholders, the study team also sought the support of the two freight railroad companies: Norfolk Southern (NS) and CSX Transportation (CSXT), who are the owners of the critical railroad rights-of-way in the corridor. Furthermore, the study team sought guidance and advice from the Virginia Department of Rail and Public Transportation (DRPT), who are focused on the incremental development of passenger rail and transit.

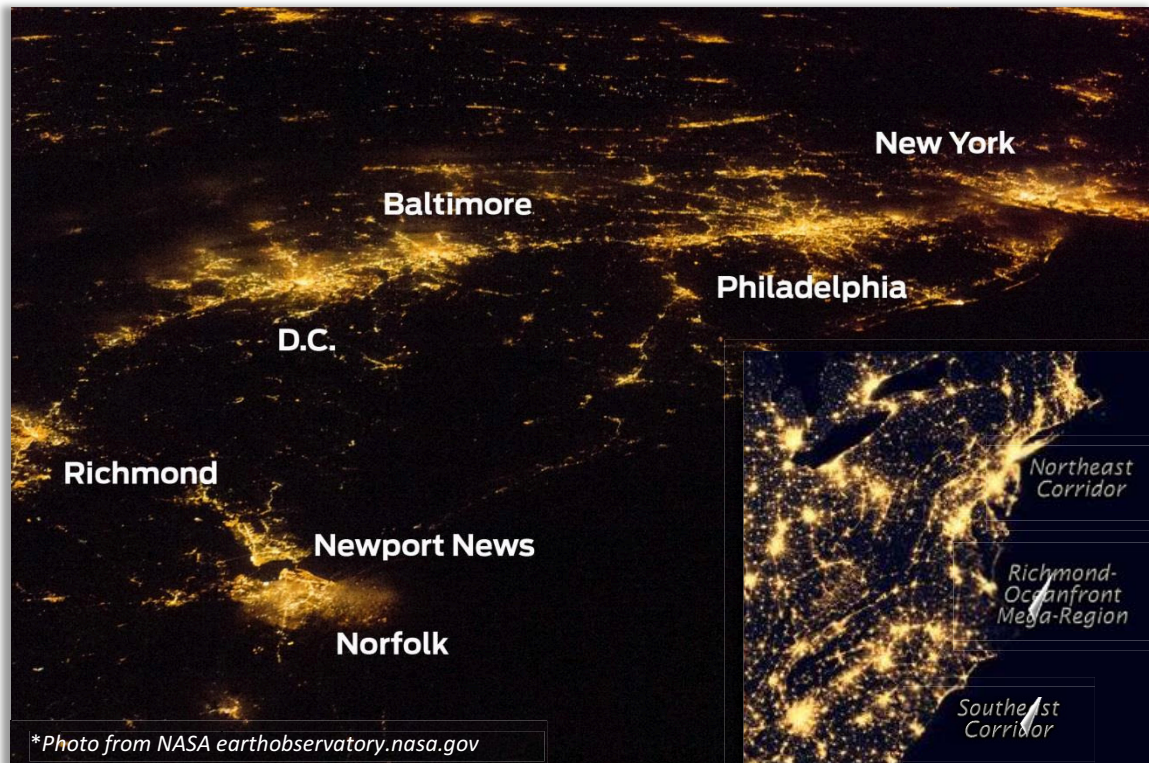
The preliminary results of the Phase 2 study showed that there is little doubt that the Virginia Crescent Line is one of the country’s leading corridors for High-Speed Rail and that it would achieve the public-private partnership (P3) thresholds established by the USDOT Federal Railroad Administration (FRA). Furthermore, the evaluation clearly showed that the case for “the Vision” is strong and that the corridor would be able to achieve “independent utility”. As such, since the required financial and economic criteria can be met, the corridor should be further developed in line with the aspirations of the emerging Richmond-Oceanfront Mega-Region.

It should be noted that DRPT already is taking significant steps to develop the corridor for conventional intercity passenger rail, including providing track and safety upgrades, as well as having introduced rail service to Norfolk. It is currently moving forward in preparing the next step to increase speed and service on the existing corridor with a goal for increasing rail speeds to 90 mph. These actions will set the scene for developing a High-Speed and Enhanced Intercity Passenger Rail improvement program that will eventually allow the objectives of the Virginia Crescent Line Vision Plan or “Vision” to be fulfilled.

THE VIRGINIA CRESCENT LINE HIGH-SPEED INTERCITY PASSENGER RAIL VISION PLAN

This assessment and report sets out both “The Vision” and a Vision Plan that defines the objectives, evaluation process and implementation plan necessary for bringing High-Speed and Enhanced Intercity Passenger Rail to the Richmond–Oceanfront Mega-Region. The Vision Plan developed by TEMS, Inc. maintains the original “Vision” for the corridor and advances it forward to meet the current and future demands and opportunities posed by this new era of connected communities and economies. Summarizing the key results of the Phase 2 study, this assessment will show how the implementation of the Vision Plan allows the Virginia Crescent Line to meet USDOT FRA financial and economic criteria. This establishes the business case for funding the project and moving forward with further analysis and assessment as required to complete the environmental and engineering work that will be needed to develop the corridor. In summary, this report will clearly define the conditions, process, procedures, and requirements necessary for turning the objectives of “The Vision” into a reality.

Photos of the Virginia Crescent with the Linked Cities of the East Coast from Space



THE CONCEPT: The Virginia Crescent Line “Vision” reflects the transformation of both High-Speed Intercity Passenger Rail technology and travel markets over the last thirty years, which have radically changed the potential for intercity passenger rail travel, particularly in 200-500 mile travel corridors such as the Virginia Crescent Line. This is due to a range of improvements such as technology improvements, productivity increases, economies of scale, and industrial cost reductions that have increased the efficiency of High-Speed Passenger Rail. As a result, today’s High-Speed Passenger Train is very different from its 20th Century predecessor. Furthermore, while Intercity passenger rail costs have been falling, the costs of alternative transportation modes have been rising due to increasing energy costs (and in particular oil) and rising costs from traffic congestion, environmental impacts and pollution, as Virginia’s highways and airports become increasingly more gridlocked.

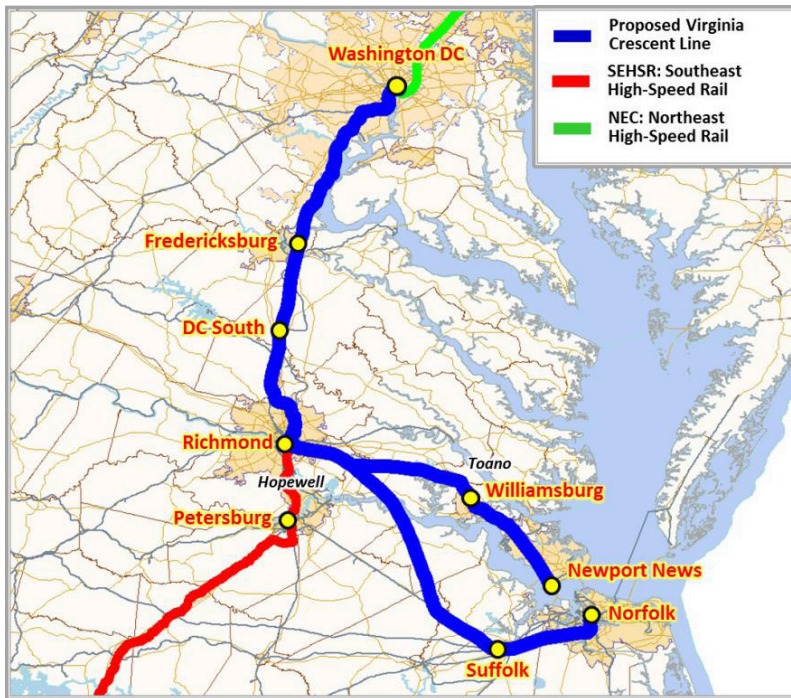
Around the world, High-Speed Passenger Rail systems generally operate in 200 to 500 mile corridors linking major urban centers and achieving a level of market attraction that gives them independent utility. To take advantage of the potential synergy of linking corridors and urban centers, the evaluation of High-Speed and Enhanced Intercity Passenger Rail for the Richmond–Oceanfront Mega-Region needs to consider the rail corridors linking both Newport News and Norfolk, to Richmond and all the way to Washington D.C. Likewise, the ridership and cost projections need to consider the significant benefits of using both the Peninsula and the Southside rail corridors for connecting the Hampton Roads metropolitan areas with Richmond and Washington D.C. This is key to increasing both the financial and economic performance and helps the project meet USDOT FRA funding requirements.

In addition to serving the cities of the Richmond–Oceanfront Mega-Region, the High-Speed and Enhanced Intercity Passenger Rail System should also aim to connect the cities of the corridor with the densely populated Northeast Corridor (NEC) from Washington D.C. to Philadelphia, New York and Boston, and with the Southeast Corridor extending down to North Carolina and Georgia. Extending the Virginia Crescent Line all the way to Washington D.C. allows it to connect to and attain the benefits of linking with the existing Northeast Corridor, which is already vibrant and prosperous in its own right. Likewise, the Virginia Crescent Line provides a bridge to the Southeast High-Speed Rail Corridor (SEHSR), increasing the overall benefits of that corridor and enhancing the quality of service that can be offered by modern high-speed passenger trains to the Southeast cities of Raleigh, Charlotte, and Atlanta*. It is worth noting that not just the Northeast Corridor, but the Atlanta – Charlotte Corridor is also assessing 220-mph high-speed train technology.

THE GOAL: The purpose of the Virginia Crescent Line’s “Vision Plan” is: to establish the potential for a true high-speed rail system within the Richmond–Oceanfront Mega-Region that would fully integrate with the existing Northeast Corridor and with the proposed Southeast High-Speed Rail (SEHSR) system as well. In particular, this study has determined that it is possible to transform passenger rail service from today’s very limited Amtrak service into a modern fast high-speed intercity passenger rail system serving the most vibrant and dynamic travel markets in Virginia and along the Eastern Seaboard.

*<http://www.sehsr.org/history.html>

**Proposed Virginia Crescent Line
With Links to the Proposed SEHSR and Existing NEC**

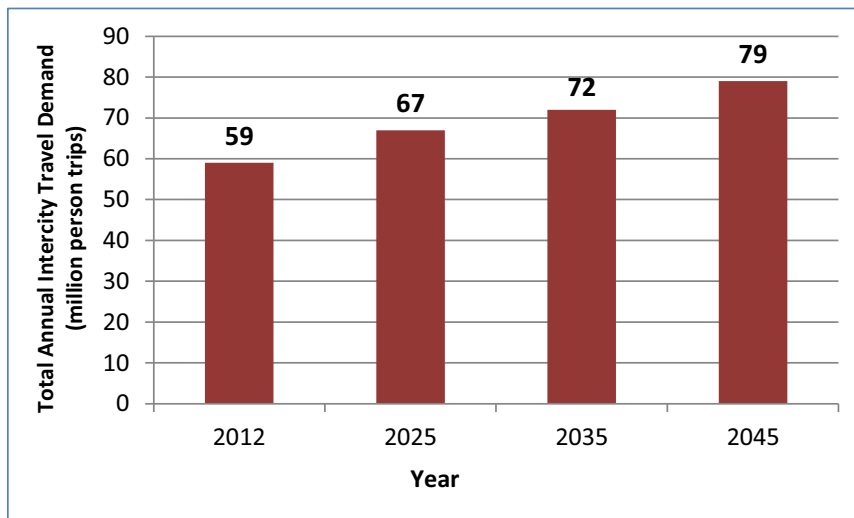


THE BENEFITS: The Virginia Crescent Line High-Speed and Enhanced Intercity Rail System proposed by the “Vision Plan” will provide many new travel options to citizens and visitors in the Richmond–Oceanfront Mega-Region. It will ensure that Virginia is not left out of the growing network of high-speed corridors that will eventually crisscross the U.S. in: California, Texas, and Florida; the Northeast from Washington D.C. to Boston; from New York to Chicago (via Albany, Buffalo, Rochester, and Cleveland); and from Philadelphia to Pittsburgh, Columbus and Cleveland (via Harrisburg). From Chicago, the U.S. high-speed rail network will reach out to the Twin Cities, Detroit, St. Louis, Cincinnati, Indianapolis and Omaha. To ensure that Virginia is properly represented and competitive in terms of travel options, the Virginia Crescent Line also needs to be connected by high-speed rail when and where the major financial and manufacturing firms make their east coast location decisions so that cities of coastal Virginia are a strong contender.

The new Virginia Crescent Line Rail System proposed by the “Vision Plan” will offer Virginia a new transport opportunity that links it with the 21st century and the New Economy that is developing to shape America’s future. Currently, the Virginia Crescent Line corridor (Hampton Roads – Richmond – Washington D.C.) is home to just under 10 million people. Like many intercity passenger rail corridors, the demand for travel in the corridor will grow strongly in the future with trip volumes increasing from 59 million to 79 million by 2050 or by nearly 34% for all travel modes. This increase will put significant pressure on the corridors’ transportation resources, which are already at or approaching capacity. This includes Interstate highways I-95 and I-64, but also the tunnels in Virginia and many arterial roads that serve the state highway system. At the north end of the corridor, there are already significant all day traffic flows into

and out of Washington D.C. that bottleneck in peak periods, adverse weather conditions, or whenever there is an accident. At the south end, there is congestion in peak time periods or when accidents occur on I-64 and on bridges and tunnels, which are the key gateways to Williamsburg and Newport News. In the middle of the corridor, congestion on Richmond’s interstates and beltways is considerable and growing fast. The proposed double tracked High-Speed Rail line will add the capacity equivalent of a six-lane freeway or the same as the existing I-95 highway. The Virginia Crescent Line is the answer to resolving this rapid increase in travel demand that is already causing significant congestion in the corridor, and that threatens to impose a significant cost and burden to the communities and cities of the Richmond-Oceanfront Mega-Region in the future if not resolved.

Total Intercity Travel Demand for the Richmond – Oceanfront Mega-Region



In considering the cost of transportation in the corridor, one significant factor is the price of gasoline. The International Energy Agency (IEA) suggests that, under its “central case,” gas prices will rise to \$5 per gallon by 2050 in real terms. This makes auto use increasingly expensive and options like passenger rail more competitive over time.

To meet its mobility needs in the future, “The Vision” has also recognized the potential for developing a “green” energy efficient, environmentally friendly travel option for the proposed Virginia Crescent Line corridor that can achieve a 2-hour travel time between Hampton Roads and Washington D.C. At a time when it is difficult to expand highways, increase air service, or build new bridges and tunnels, the proposed high-speed and enhanced intercity passenger rail will provide fast, efficient and environmentally friendly travel between the major cities and communities of the corridor and beyond. In this atmosphere of increasing transportation demands and energy costs, a new environmentally friendly mode of travel that can offer fast and frequent downtown to downtown travel while also offering competitive fares and a high level of reliability even in peak hours, presents a unique opportunity to improve travel in the corridor for all existing and future travelers.

THE VIRGINIA CRESCENT LINE PASSENGER RAIL SYSTEM

When implemented, the proposed High-Speed and Enhanced Intercity Passenger Rail system for the Virginia Crescent Line will offer modern comfortable energy efficient high-speed passenger trains with travel times of close to two hours or less between Hampton Roads (Norfolk, Newport News) and Washington D.C.; with one hour service between Richmond and Washington D.C., and between Hampton Roads and Richmond. It will use fast modern electric trains (220+ mph), similar to those proposed for the Northeast Corridor and California, to link Norfolk with Richmond and Washington D.C.; and, it will use fast modern diesel or dual-mode diesel/electric trains (130/220 mph) to connect Newport News to Richmond and Washington D.C.* Achieving a travel time of two hour or less for both the Southside service (Norfolk to Washington) and the Peninsula service (Newport News to Washington) provides significant access improvements and allows for “to” and “from” business, military and social trips to be made on the same day. Likewise, concurrent with this increase in speed, the new rail system will provide increases in safety via improvements to the track (e.g., highway rail separation) that will result in a “sealed” and “secure” corridor for high-speed rail travel while also reducing impacts to the community.

PROPOSED TECHNOLOGY

The development of High-Speed and Enhanced Intercity Passenger Rail for the Virginia Crescent Line corridor will require the purchase of a new fleet of modern diesel and electric high-speed rail trains. These advanced passenger rail systems will offer real advantages in terms of performance and comfort over existing Amfleet trains. Key attributes for the high-speed trains include:

- Energy efficient, fast and frequent rail service, with speeds up to 130 mph for the diesel fleet, and 220 mph plus for the electric trains. Dual mode diesel electric trains for the Peninsula service could operate seamlessly to New York City on the Northeast Corridor without needing to change locomotives at Washington D.C. as is the case today.
- A very high-level of performance including –
 - Rapid acceleration and deceleration
 - Low center of gravity
 - Tilt capabilities to increase the speed in curves
- A high-level of onboard comfort including onboard amenities for business and leisure travelers. This includes food and beverage, wireless access, comfortable seating, air conditioning and quiet cars.
- The latest vehicle design built to meet a high standard of safety and reliability. The system safety is enhanced by advanced signaling and IT technology, which not only improves train control and performance, but also provides a sealed corridor to prevent grade crossing conflicts and separation of highway and rail traffic.

*Dual mode technology would allow Peninsula trains to operate at 220 mph from Toano to Washington D.C.

High-Speed Diesel Train



High-Speed Electric Train



Upgrading the rail system would result in speed and running time improvements that, in turn, boost ridership and revenues and allow higher train frequencies to be operated. This results in a “multiplier effect” on the initial investment in speed improvement, since stronger market demand then supports the operation of more train frequencies as well.

The proposed High-Speed and Enhanced Intercity Passenger Rail service will also offer convenient travel times, a very high-level of service reliability, onboard services, and comfort that is more than equal to what is offered by auto or air at affordable competitive prices to the consumer of about 60% of the cost of air. In addition, it will provide comfortable large seats with room to stretch out, and the ability to have food and drink service at your seat or in the Bistro car. The service will also provide music and video facilities at each seat along with the ability to plug in a laptop, tablet or video games.



PROPOSED TRAIN SCHEDULES

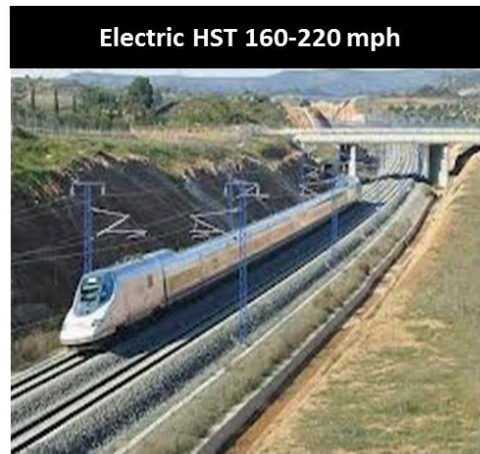
In order for conventional and high-speed rail to be efficient, it is essential to improve train schedules and frequencies during the implementation process. Typically as speeds increase, the market expands and train frequency and train size both need to be increased in a balanced way. The capability to attain the proposed 130-mph (diesel) and 220-mph (electric) train speeds necessary for achieving an approximate 1:46 to 2:05 (hr:mn) travel time from Hampton Roads to Washington D.C., depends on the opportunity for building greenfield segments in the rural parts of the corridor, as well as the ability to upgrade existing rail segments within urban areas. Using these assumptions for the current level of planning, the proposed train service schedules have been validated with previous rail planning studies, as well as verified using current train performance simulations (RightTrack™), and were found to be both reasonable and achievable.

In order to finalize train service schedules for the Virginia Crescent Line, detailed track and train performance calculations were completed for the corridor. The analysis developed optimized train schedules for both the Peninsula and South-side routes, as appropriate for their proposed train technologies. The following exhibit shows the latest proposed service scenarios for both the Peninsula and Southside routes, including their recommended train technologies and timetables. Although the planned Peninsula service to Newport News is slightly slower than the Southside service to Norfolk, this is based on using diesel trains for the Peninsula service. If the Roxbury-Toano segment were electrified and dual mode trains with a 220 mph top speed capability were used instead, Peninsula trains would save an additional 15 minutes and achieve a schedule under two hours.



Diesel HrST 90-130 mph

- Used for Peninsula
- Speeds up to 130-mph on dedicated high speed ROW
- 79-mph on NS; 90-mph on CSX ROW



Electric HST 160-220 mph

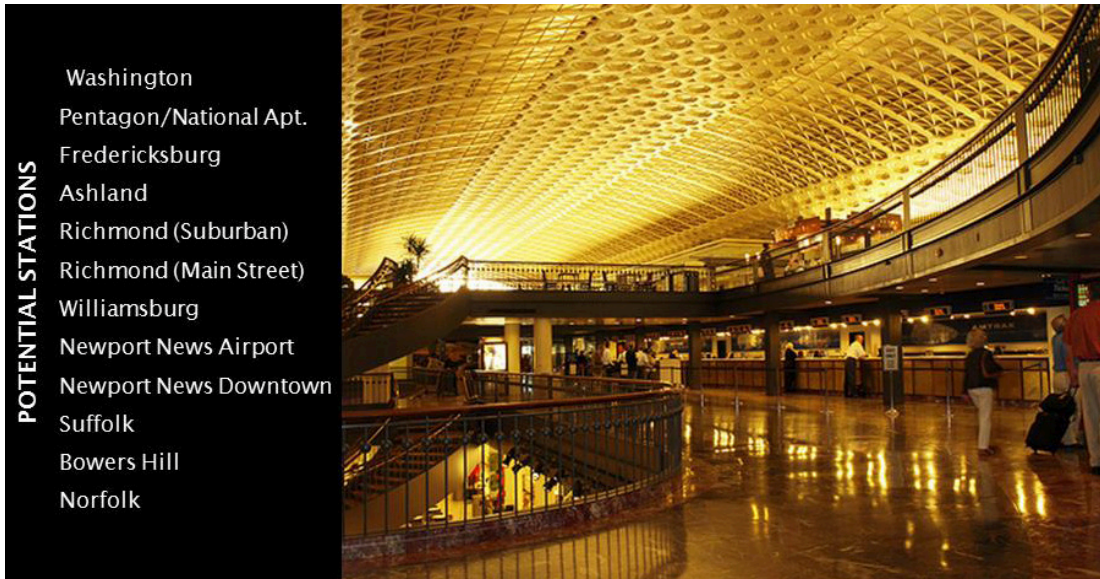
- Used for Southside
- Speeds up to 220-mph on dedicated high speed ROW
- 79-mph on NS; 90-mph on CSX ROW

Timetable	Super Express	Express 6 Stops	Local 7 Stops
Peninsula Total Trains	N/A	4 trains	4 trains
High-Speed Diesel 130-mph WAS-NPN	N/A	2:08	2:12
Dual-Mode 130/220 mph WAS-NPN	N/A	1:51	1:57
Timetable	Super Express 5 Stops	Express 6 Stops	Local 9 Stops
Southside Total Trains	5 trains	10 trains	3 trains
High-Speed Electric 220-mph WAS-NRF	1:46	1:51	2:05

PROPOSED STATIONS

A key part of “The Vision” for the Virginia Crescent Line Passenger Rail System is the provision of modern multimodal passenger terminals. These are a critical element in the success of a passenger rail system as they are not only the gateway to the system, but they provide the access and egress to the system for local residents. Access and egress should be as seamless and quick as possible, and should include LRT and Bus connections, Taxi and Van service, and Rental Car facilities. The terminals need significant parking facilities as many people will drive to the station. The terminals themselves should be modern with desirable spaces to sit, meet and wait. The station depending on size should offer a range of facilities such as restaurants and cafes, shops, newspaper and book stores, and the other travel facilities such as restrooms and seating areas needed by travelers. As with all modern high-speed stations, high level platforms will assure easy and rapid access to the trains.

Washington Union Station: The Northern Terminal



These multimodal terminals will also offer significant opportunities for Joint Development projects by local and private development communities. Work is needed with local communities to maximize the potential of these locations. Modern Passenger Rail Service requires terminals that are large in size and that offer significant opportunities for Joint Development including having enough retail and commercial space to entice private sector developers. Examples of modern HSR terminals incorporating joint development can be seen in Washington D.C.'s Union Station, London's King's Cross Station and California's proposed San Jose High-Speed Terminal.

London's King's Cross Station

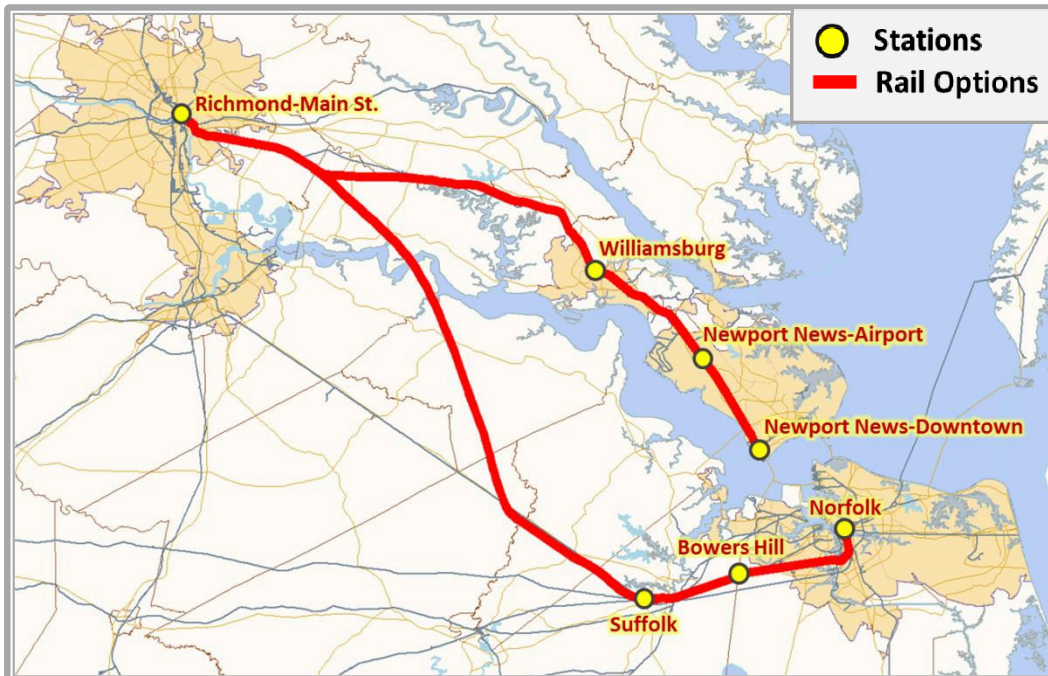


Proposed San Jose High-Speed Rail Station

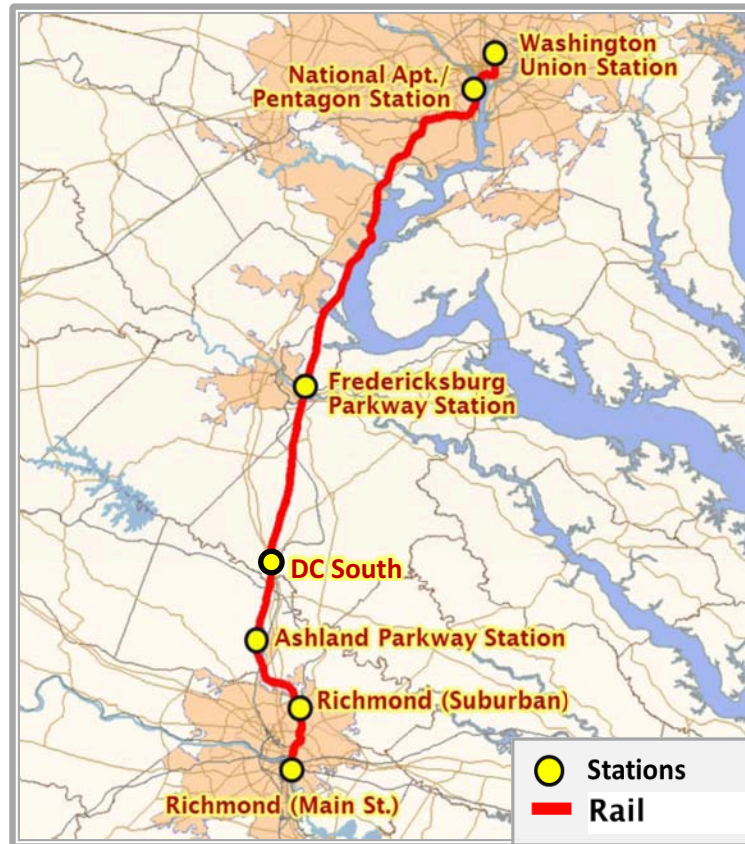


For the proposed Virginia Crescent Line, the passenger rail segment between Norfolk and Richmond would have at least three main stations at Suffolk, Bowers Hill, and Norfolk. The Southside route opens up the potential for a new community and a new stop at the James River crossing. For the Peninsula route, as many as three main stations would be located at Williamsburg, Newport News Airport and Newport News Downtown. The rail segment between Richmond and Washington would have stations located at Richmond Suburban (just north of Richmond), Ashland, DC South (just north of Doswell), Fredericksburg, and a suburban stop serving the Pentagon/National Airport for both the Southside and Peninsula trains. The stations located at Ashland, Richmond Suburban, and Suffolk would have limited stops.

Hampton Roads-Richmond Rail Segments: Proposed Route and Main Station Locations



Richmond to Washington Rail Segment: Proposed Route and Main Station Locations



Summarizing the key attributes, the proposed High-Speed and Enhanced Intercity Passenger Rail system for the Virginia Crescent Line will:

- Provide modern comfortable energy efficient high-speed passenger trains with travel times of close to two hours or less between Hampton Roads and Washington D.C.
- Be fully integrated with proposed and existing high-Speed rail corridors along the east coast such as the proposed SEHSR to the south and the existing NEC to the north.
- Be competitive with air travel and with high-speed rail corridors across the U.S.
- Provide “state of the art” intercity travel at affordable prices of 50 to 70 percent of air fares.
- Create opportunities for the private sector to participate in the building, operations and financing of the project.
- Support National Security, military and government mobility to and from the big cities and many smaller communities in between the major cities of the corridor, and the Northeast.
- Provide “state of the art” terminals that are large in size and that offer significant opportunities for Joint Development, including having enough retail and commercial space to entice private sector developers.
- Create new jobs, joint development, income and tax base increases in city centers where such development will help to bolster urban development.

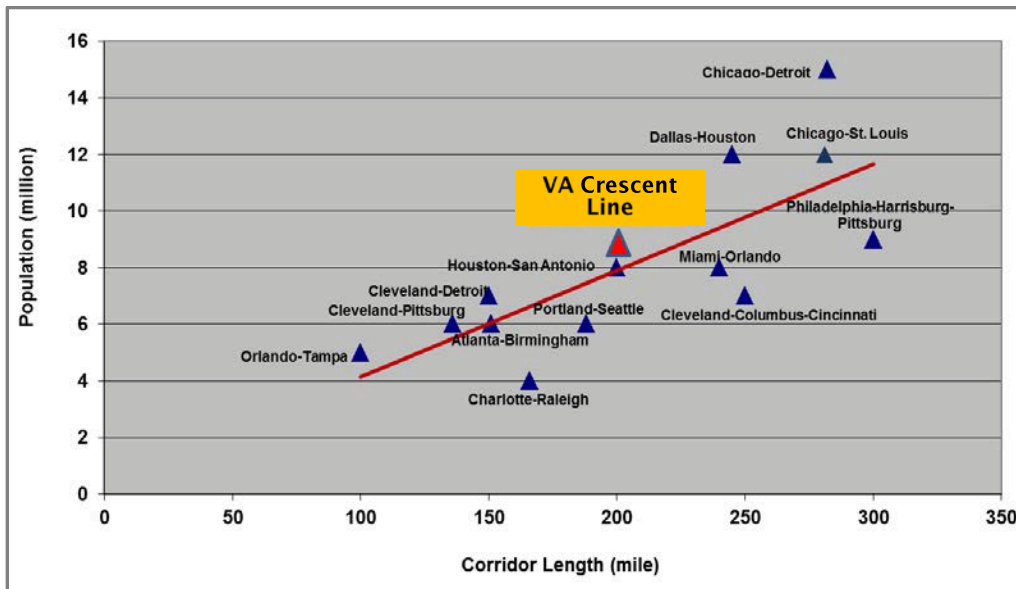
THE VIRGINIA CRESCENT LINE HIGH-SPEED INTERCITY PASSENGER RAIL VISION PLAN

- Support the freight railroad industry in the corridor providing capital for new technology (Positive Train Control - PTC) and increased capacity for compatible traffic and help support higher intermodal train speeds.
- Increase rail safety by ensuring a “sealed” and “secure” corridor and reduce community impacts by upgrading highway rail protection and separation.

THE MARKET

The Virginia Crescent Line is one of the top intercity corridors in the U.S., being comparable with Florida’s Miami-Orlando, Texas’ Dallas-Houston and Houston-San Antonio, Illinois’ Chicago-St. Louis, and Pennsylvania’s Philadelphia-Harrisburg corridor; and is much stronger than many other corridors like Atlanta-Birmingham, Portland-Seattle, or Charlotte-Raleigh. These corridors are recognized as top high-speed rail corridors by the USDOT and the FRA. As a high-speed corridor using 220-mph technology, the Virginia Crescent Line would have independent utility and would have the market growth, ridership and revenue necessary to sustaining the corridor in its own right.

Corridor Comparison



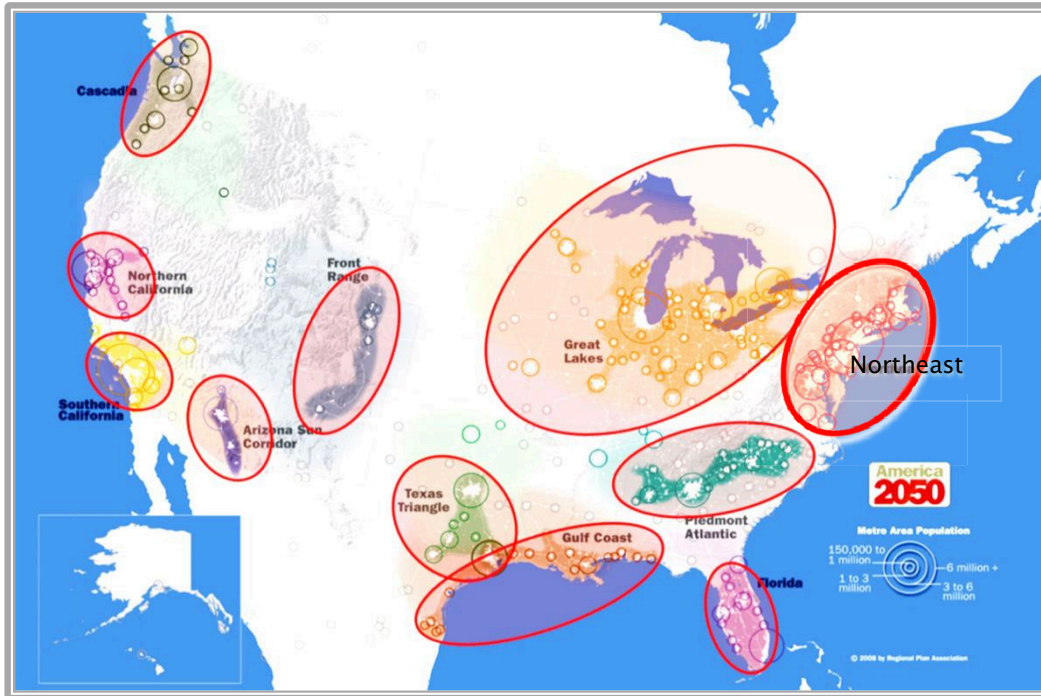
THE TRAVEL MARKET AND POTENTIAL RIDERSHIP

Unlike many corridors that are only “stand-alone’ corridors, the Virginia Crescent Line would have the benefit of also being linked directly to the Northeast Corridor. This raises the potential of the corridor to almost double that of a stand-alone corridor since over 50 percent of the trips would feed directly into the Northeast Corridor itself. It is widely recognized that the corridor defined by the Richmond - Oceanfront Mega-Region is really the southern extension of the Northeast Corridor and a logical part of the “East Coast Mega Region” that stretches from Boston to New York to Philadelphia to Washington D.C. and on to Richmond and Hampton Roads. The impact of being linked to this Mega Region effectively doubles the volume of trips or ridership that the corridor would have as a freestanding corridor; and thus, significantly enhances its potential for High-Speed and Enhanced Intercity Passenger Rail. Further increasing travel demands and potential sources of ridership is the fact that the Virginia Crescent Line’s urban centers and populations are highly integrated within the corridor itself and also with the cities and populations of the Northeast Corridor.

THE MARKET

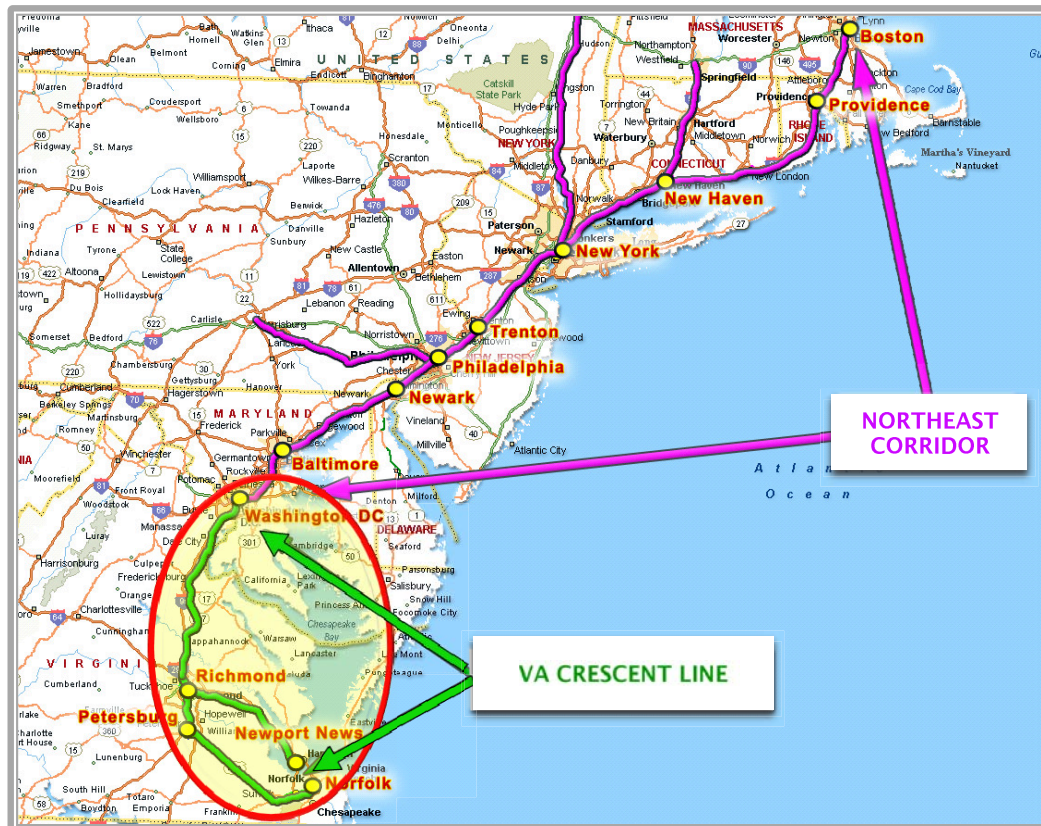
THE VIRGINIA CRESCENT LINE HIGH-SPEED INTERCITY PASSENGER RAIL VISION PLAN

U.S. 2050 Mega Region Map



Note: According to America 2050, the Northeast Corridor includes Richmond and Hampton Roads.

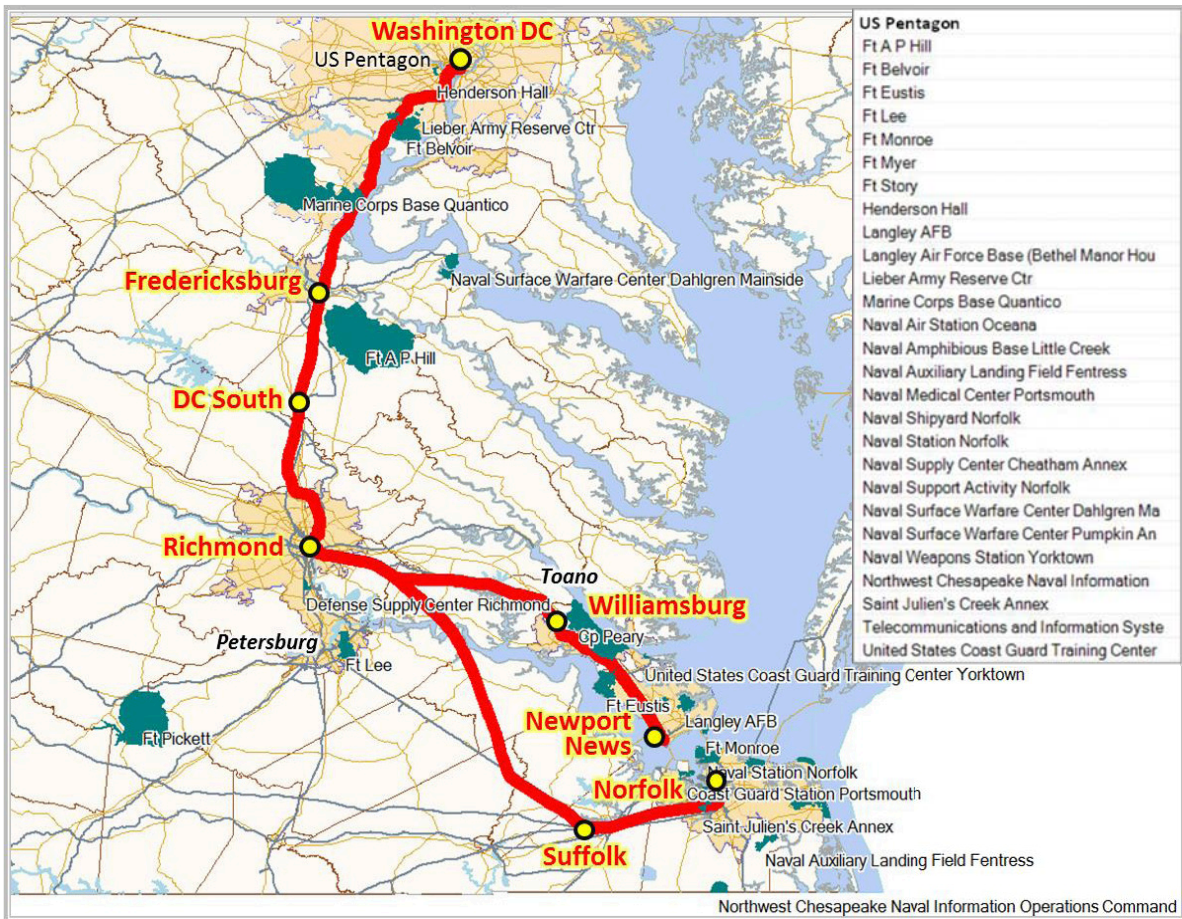
East Coast Mega Region



THE VIRGINIA CRESCENT LINE HIGH-SPEED INTERCITY PASSENGER RAIL VISION PLAN

In terms of the regional economy, the corridor supports a massive service industry that includes the U.S. Federal Government, the Department of Homeland Security and the State of Virginia. In particular, the proposed rail service would support the vital interaction of the Washington Pentagon with the world's largest naval and military complex in the Richmond - Oceanfront Mega-Region. This encompasses 25+ military installations from Hampton Roads to Washington D.C. which present unique travel demands for the region, as well as unique opportunities and sources of ridership for the proposed High-Speed and Enhanced Intercity Passenger Rail system.

Military Installations along the Virginia Crescent Line



Beyond the Government, Military and Business Service Industry (Banking, Finance, Merchandising, Education, and Transportation), the corridor is also home to major tourist and recreational centers and facilities including the I-95 corridor's Kings Dominion and Six Flags, as well as I-64's Colonial Williamsburg, Busch Gardens, Virginia Beach, and the outer banks of North Carolina each providing additional sources for potential ridership for the new rail system.

This extraordinary diversity of services that use the Virginia Crescent Corridor puts enormous pressure on the region's transportation facilities, resulting in congestion on the I-95 and I-64 corridors as well as

THE MARKET

straining the capacity of bridges and tunnels in the Hampton Roads region. The development of a High-Speed and Enhanced Intercity Passenger Rail System would resolve these large-scale transportation issues, while the system would generate enough revenues to sustain itself well into the future.

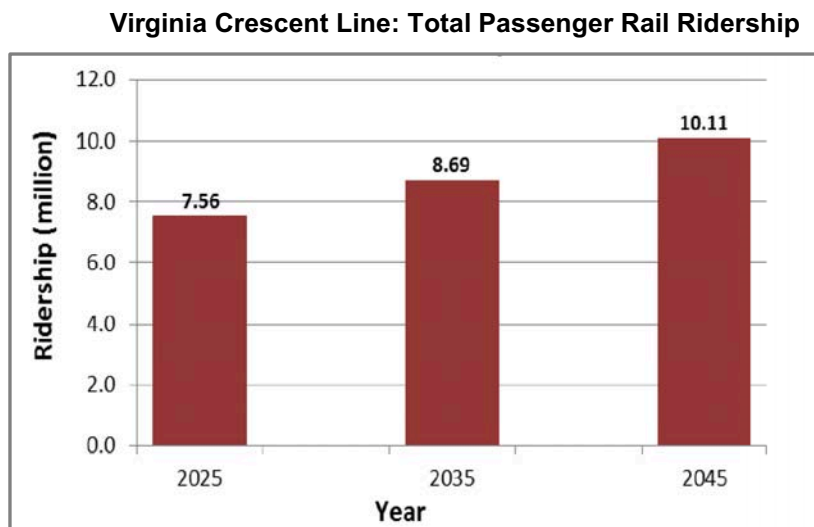
Likewise, future development along the corridor would result in additional strain to the already congested transportation system; and thus, will be an additional source of ridership for the proposed Virginia Crescent Line. Large multi-use developments are planned in Caroline and Spotsylvania counties along the Richmond to Washington D.C. segment of the corridor. These developments if implemented, are expected to draw high quality commercial activities such as government facilities, defense contractors, hospitals, universities, commercial and office facilities, and would result in thousands of jobs.

TRAVEL DEMAND FORECAST

In the study, TEMS' COMPASS™ Model was used to develop the Demand Forecast for the Virginia Crescent Line, including preparing the databases necessary for the development and calibration of the model. These databases included the latest available socioeconomic data, trip data, congestion figures and fuel prices for the region; and, included travel behavior data acquired through Stated Preference Surveys. All of the results presented for the Travel Demand Forecast (i.e., ridership, revenue, etc.) are based on the proposed Virginia Crescent Line route option presented earlier under “The Vision” section of this report.

RIDERSHIP

Based on the demand model and data analyses, the implementation of the Virginia Crescent Line High-Speed Rail System would handle more than 8 million travelers annually by the year 2035; with about 30 percent for business, 16 percent commuter, and 54 percent for social and recreational travel.



* Includes ridership for all corridor segments: Southside, Peninsula, and Richmond to Washington.

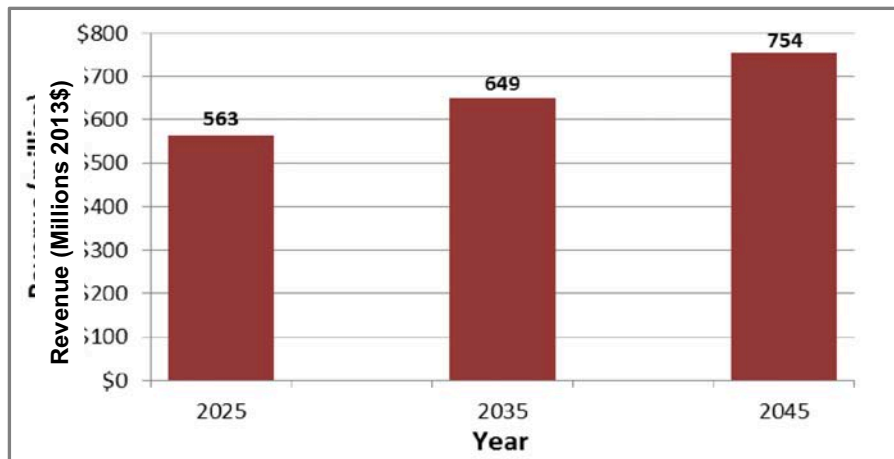
THE VIRGINIA CRESCENT LINE HIGH-SPEED INTERCITY PASSENGER RAIL VISION PLAN

The major source of passengers for the High-Speed Rail System would be from auto, with individuals increasingly choosing high-speed and enhanced intercity passenger rail options as congestion and gas prices rise for intercity travel. Eventually, the passenger rail system would carry 10 to 12 percent of total intercity travelers and provide significant relief to highways across the corridor. In the multimodal terminals along the corridor, the rail system would connect with urban bus, LRT, and METRO connections, and both car hire and taxi facilities. As such, the new passenger rail system could provide a seamless connection that allows individuals to complete their journey to the office, home, and to/from social and tourist attractions.

REVENUE

Revenue forecasts for the High-Speed Rail System are expected to increase steadily over the life of the project to over \$754 million annually by year 2045. This figure includes revenues for the entire Virginia Crescent Line going from Hampton Roads to Washington D.C.

Virginia Crescent Line: Total Revenue

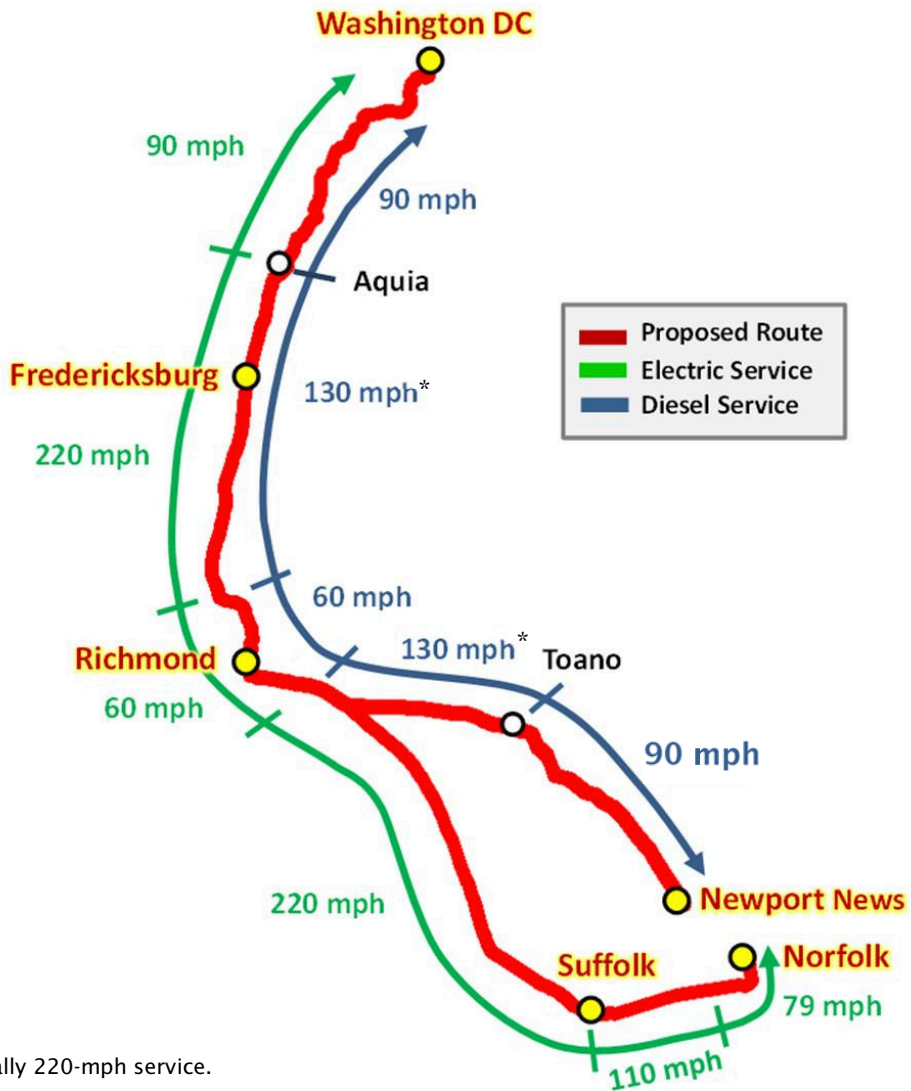


* Includes revenue for all corridor segments: Southside, Peninsula, and Richmond to Washington.

THE PROPOSED ROUTE AND COSTS

The Virginia Crescent Line “Vision” provides a balanced approach for providing High-Speed and Intercity Passenger Rail Service to all of the Hampton Roads, Richmond, and Washington communities. While today’s intercity passenger rail service operates at a top speed of 79 mph, the Virginia Crescent Line Vision Plan objectives would seek to increase this to 130 mph for the Peninsula Service and 220 mph for the Southside Service. The proposed rail services will require the purchase of a modern train fleet, the construction of new track and a sealed or grade separated corridor to handle 130-mph and 220-mph operations respectively. The proposed route and speeds by segment are shown in the Schematic diagram for both Southside and Peninsula services. Please note, that these speeds respect freight railroad requirements on all shared portions of the right-of-way.

Virginia Crescent Line: Speed Limits for Southside and Peninsula



THE PROPOSED ROUTE AND COSTS

PROPOSED INFRASTRUCTURE

Passenger trains from Newport News to Washington D.C. currently take more than four hours to travel the corridor with poor on-time performance. This is because of track conditions on some segments of the route, and delays as a result of congested infrastructure shared with the freight railroads.

Poor Track on Passenger Line South of Acca Yard in Richmond



Well Designed Modern Track



In order to achieve the full benefits of a high-speed rail system, improvements to existing rail and the development of new greenfield alignments capable of supporting High-Speed and Enhanced Intercity Passenger Rail operations, are proposed for the three major segments that comprise the Virginia Crescent Line. Where existing rail right-of-ways are used, improvements such as the adding of new track along-side the existing rail are proposed. In other areas of the corridor, new greenfield segments have been proposed due to the poor geometry of the existing track and due to the reluctance of freight operators to allow passenger trains onto their lines. By upgrading track quality and providing high-speed diesel or electric train service on high quality greenfield corridors between the urban areas and dedicated passenger tracks within urban areas, the travel time can be cut by more than half and reliability can be greatly improved.

A key feature for implementing passenger rail service to Virginia Crescent Corridor is the limited sharing of existing freight railroad right-of-ways in urban areas where capacity can be created in and around the city of Richmond and between the cities/towns of Newport News and Toano, and between Aquia and Washington D.C. In these areas, speeds would be restricted to 79-mph operations on NS owned right-of-way and 90-mph train operations on CSX owned right-of-way in compliance with each railroad's Passenger Principles. On the segment of the corridor between Aquia and Washington, it is recommended that the CSX line be quadruple tracked, thus giving the High-Speed Rail line its own dedicated electrified double track

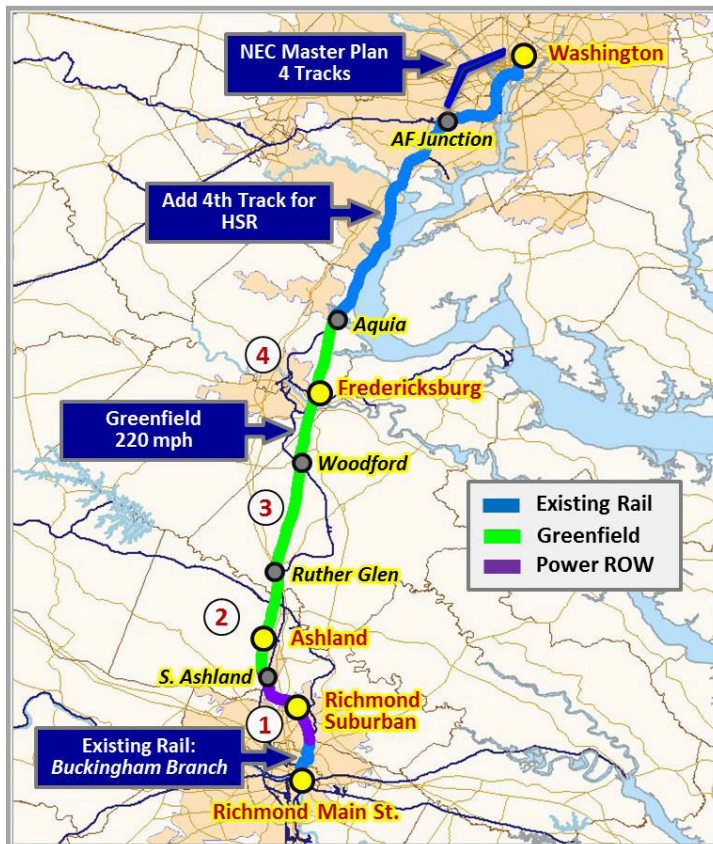
THE VIRGINIA CRESCENT LINE HIGH-SPEED INTERCITY PASSENGER RAIL VISION PLAN

so as not to conflict with freight operations there. On the Peninsula segment of the corridor where diesel trains would operate alongside heavy coal trains, the corridor, as recommended by CSX, would be completely double-tracked in order to provide enough capacity for rail operations.

Between Richmond and Washington D.C., the proposed greenfields would bypass environmental challenges in the tightly constrained urban areas such as Fredericksburg and Ashland, and would provide geometric alignments that could support High-Speed and Passenger Rail operations between cities. A mostly greenfield High-Speed alignment (Richmond Direct) has been proposed for the Southside service that would avoid potential conflicts with the busy NS freight corridor. In addition, a portion of the proposed alignment for the Southside could be used by the Peninsula Trains as well. Here, the proposed Virginia Crescent Line service would link the two corridors and provide a sharing of the benefits and costs for both legs of the corridor.

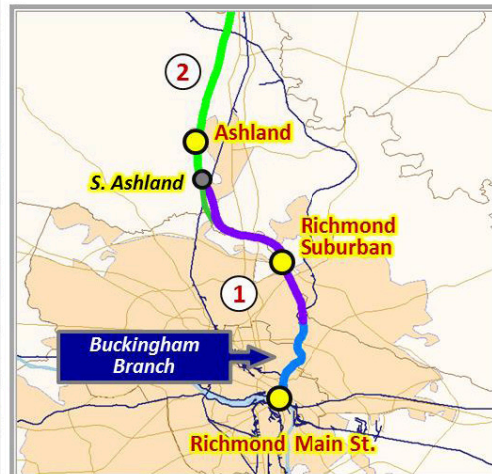
For all high-speed operations, new dedicated double electrified track would be required along with new greenfield alignments designed to support the higher train speed operations. On dedicated passenger tracks, diesel trains could achieve 130 mph with full separation from other rail operations as well as adjacent highways. From Norfolk to Washington D.C, speeds could be increased to 220 mph by electrification.

Proposed Track Improvements: Richmond to Washington D.C.



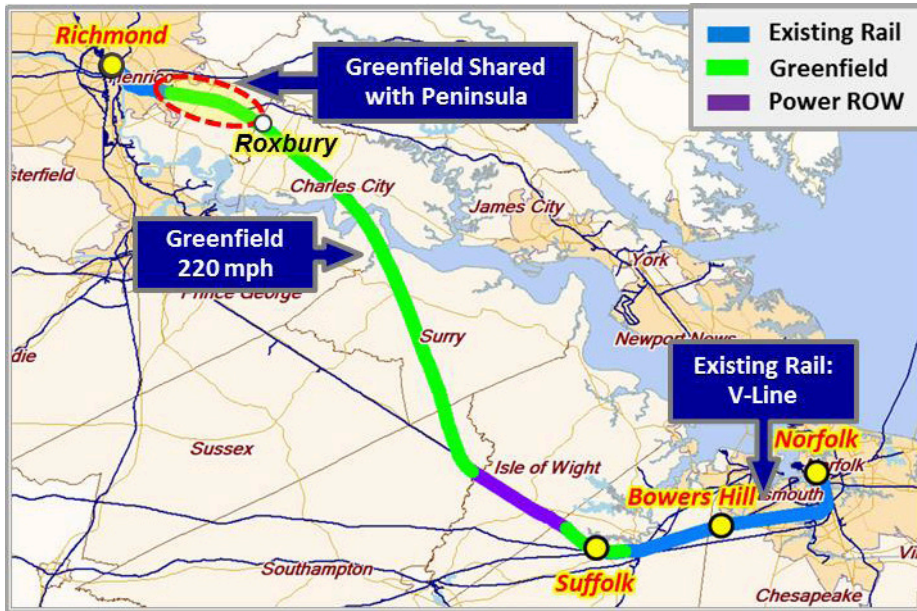
Greenfield Segment Recommendations

- 1 Main St. to Richmond Suburban (Beltway) to South Ashland: Provide Acca Yard bypass ("Existing Rail + Power Alley".)
- 2 South Ashland to Ruther Glen: Provide an Ashland bypass.
- 3 Ruther Glen to Woodford: High Speed Segment.
- 4 Woodford to Aquia: Provide a Fredericksburg bypass.

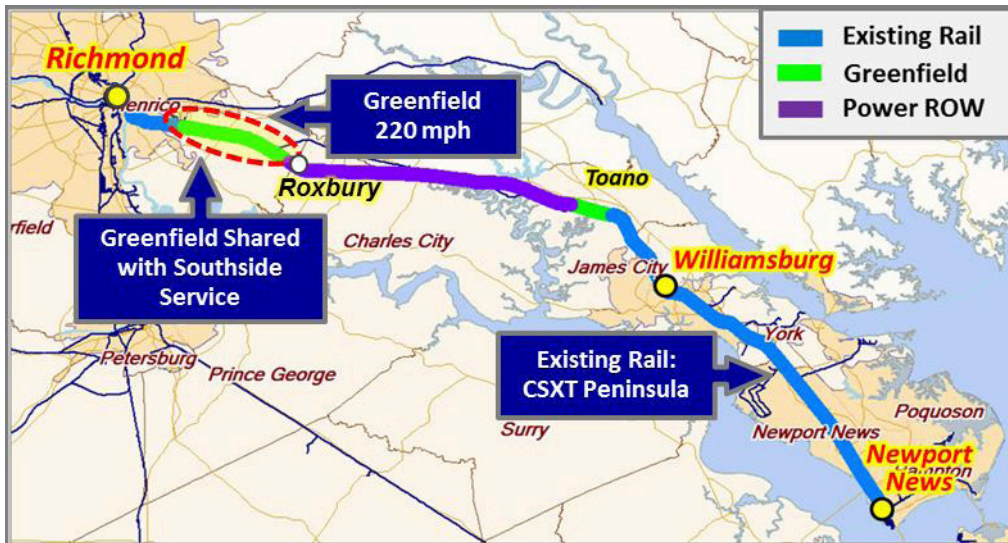


THE PROPOSED ROUTE AND COSTS

Proposed Track Improvements: Richmond to Norfolk (Southside Service)



Proposed Track Improvements: Richmond to Newport News (Peninsula Service)

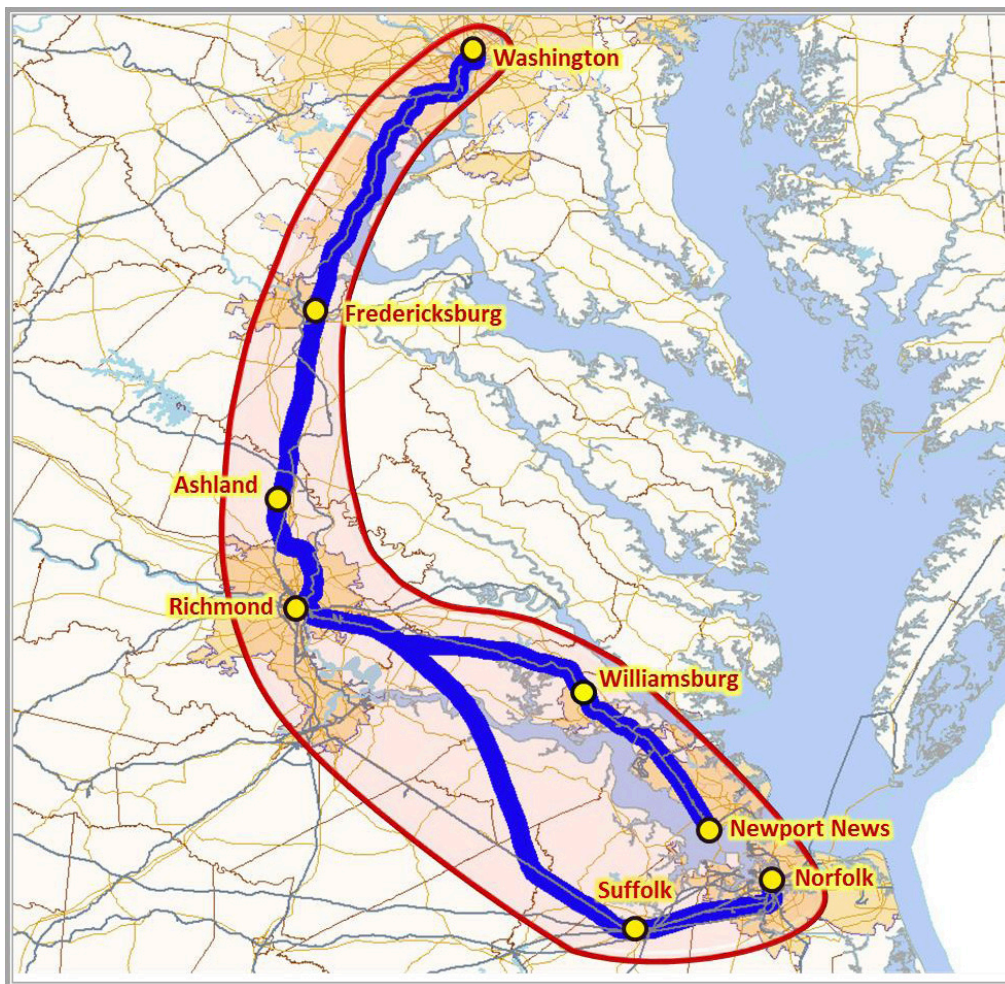


THE PROPOSED ROUTE AND COSTS

ENVIRONMENTAL ASSESSMENT

Rail improvements along the Virginia Crescent Line from Hampton Roads to Washington D.C. will require a thorough assessment of the impacts, including evaluating all structural and environmental impacts along the corridor alignment. A Service NEPA Environmental Scan and estimates of structural and environmental impacts for the Virginia Crescent Line were performed in the previous Phase 2 study. The Service NEPA is designed to show the USDOT FRA the environmental issues associated with the corridor and their potential mitigation. For this update, the Service NEPA Environmental Scan will include preliminary estimates of impacts along the whole Virginia Crescent Line going from Hampton Roads to Washington D.C. Estimated costs for mitigating these impacts were included in the Capital Costs.

Virginia Crescent Line Environmental Study Area



CAPITAL COSTS

Implementation of the Vision Plan for the Virginia Crescent Line will improve freight, as well as passenger operations by fully mitigating capacity impacts on short segments of freight rail corridor rights-of-way that need to be shared. This results in almost completely separating passenger operations onto separate rail

THE VIRGINIA CRESCENT LINE HIGH-SPEED INTERCITY PASSENGER RAIL VISION PLAN

lines and corridors. This level of mitigation, which is necessary to ensure the reliability of passenger service, will improve freight rail speeds and enhance both passenger and freight rail train operation safety through initiatives such as grade crossing improvement and grade separations along the shared segments of the right-of-way.

High-Speed Electric Train on Dedicated Grade Separated Track



The preliminary estimated capital costs for the Virginia Crescent Line's High-Speed and Enhanced Intercity Passenger Rail objectives will be just under \$9 Billion, depending on the service scenarios and the rail corridors selected. These capital costs include all expenditures (in 2013\$) including equipment costs and environmental impact mitigation for all three legs of the corridor comprising the full 300-mile system: Washington-Richmond, Richmond-South Hampton Roads, and Richmond-North Hampton Roads corridors.

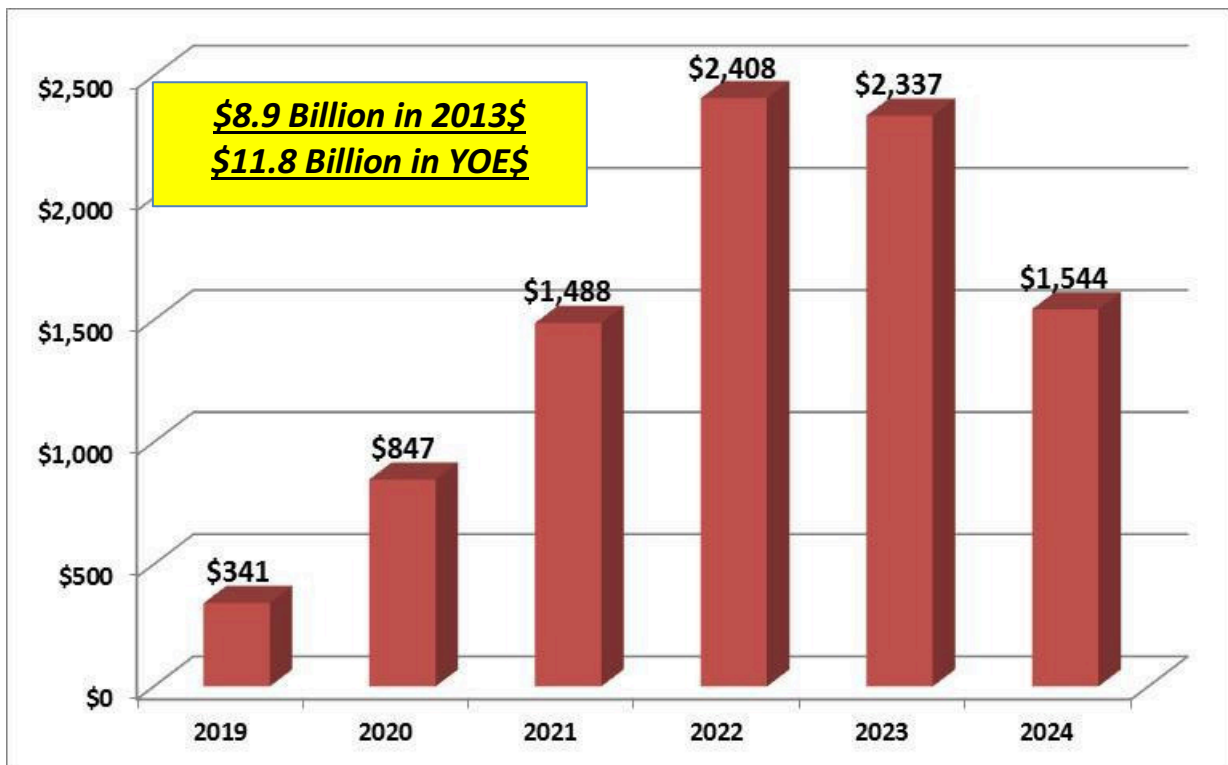
Virginia Crescent Line Route Option: Capital Cost Summary (millions 2013\$)

	VIRGINIA CRESCENT LINE CAPITAL COST
Equipment	\$806
Norfolk-Richmond	\$4,065
Newport News-Richmond	\$920
Richmond-Washington D.C.	\$3,173
Total	8,964

IMPLEMENTATION PLAN BY YEAR OF EXPENDITURE

To implement the Virginia Crescent Line Vision Plan, a Preliminary Implementation Plan has been developed. It is assumed that the implementation can be achieved by 2025 if a streamlined environmental process is used. The following exhibit shows the Year of Expenditure (YOES) Capital Cost Projection for years 2019 thru year 2024 for an implementation start year of 2025 for the project. Starting from \$8.9 Billion in 2013\$, costs for constructing the system would increase for each potential Year of Expenditure based on an HRTPO Inflation Rate of 3% a year (2034 Constrained Long Range Plan). For, example, if system implementation occurs in 2025, costs for constructing the system will increase to about \$11.8 Billion or 33% more. If implementation were delayed until 2030, the system would cost \$13.6 Billion, which is an increase of about 52% in YOES. This has implications for funding the project, since the longer the project construction and implementation is delayed, the greater the project costs will be. This lends urgency to the required tasks for locating the best alignment and securing right-of-way reservations in the master planning documents for each zoning jurisdiction at the earliest possible date.

Capital Spending Plan for 2025 Implementation for the Virginia Crescent Line



**YOES based on HRTPO Inflation Rate of 3% a year (2034 HRTPO Constrained Long Range Plan)*

THE PROPOSED ROUTE AND COSTS

PROJECT EVALUATION AND IMPLEMENTATION

FINANCIAL AND ECONOMIC RESULTS

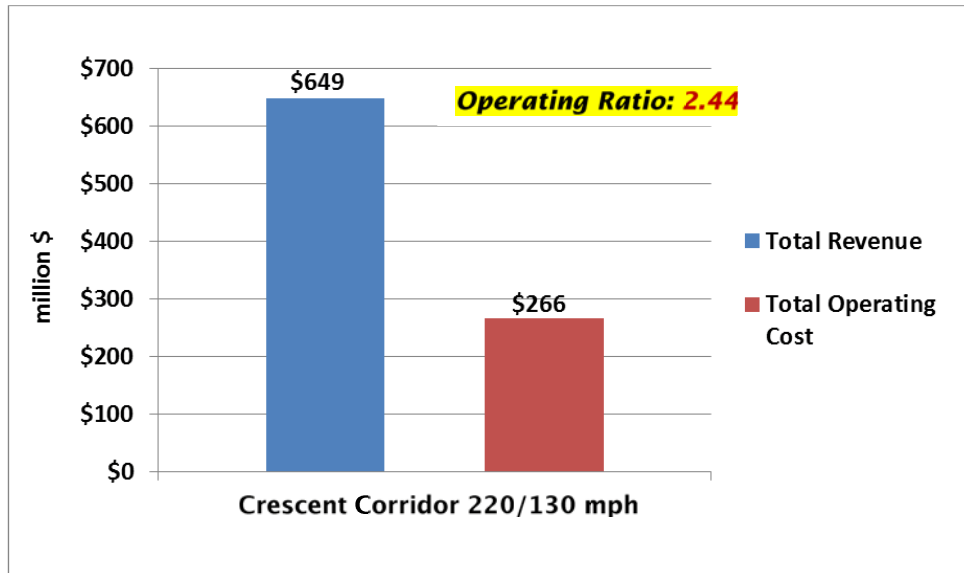
The USDOT/FRA Commercial Feasibility Study in 1997 laid out the two criteria required for a public-private partnership to develop a modern High-Speed and Enhanced Intercity Passenger Rail service. These require that:

- A fully developed high-speed rail system must show a positive Operating Ratio (i.e., greater than 1.0), which ensures that the system does not require an operating subsidy after the ramp up period. This allows the system to be franchised to Amtrak or the Private Sector and allows them to make a potential contribution towards funding a share of the capital costs.
- A fully developed intercity passenger rail system must have a positive Benefit Cost Ratio (i.e., greater than 1.0), which ensures that the revenues and benefits to the economy of the intercity passenger rail system exceed its capital and operating costs over the life of the project. The Benefits of the system include travel time savings by mode, reduced emissions, resource savings, and improved efficiency. These criteria are similar to those commonly employed for the evaluation of proposed toll highway projects; except that rail systems are typically expected to cover an even higher share of their own costs. A positive Benefit Cost Ratio shows that a project is good for the communities of the corridor, good for Virginia and good for the country.

OPERATING RATIO

The evaluation of the proposed High-Speed and Enhanced Passenger Rail System included a financial analysis of the Virginia Crescent Line using 220-mph technology for the Southside and 130-mph technology for the Peninsula. This route option had the best cash flow and operating ratio, and was the most viable of all the route options evaluated by the HRTPO Study. The financial results show a positive operating ratio of 2.44 for the rail system by year 2025. These results include the boost in revenue that would be achieved by integrating the Peninsula Service and the Southside segments into a single corridor at Roxbury. The results of this analysis also show that the Virginia Crescent Line High-Speed Rail Corridor is franchisable with a positive cash flow that is much greater than the system operating costs.

Year 2025 Financial Results for the Virginia Crescent Line



*Includes the boost in revenues that would be achieved by improving both the Peninsula and Richmond to Washington segments of the corridor.

BENEFIT COST RATIO

The evaluation of the proposed High-Speed Rail System also included an economic analysis of the route. The following exhibit shows the benefit cost ratio for the proposed Virginia Crescent Line route option at the 3% and 7% discount rates recommended by the Government Accountability Office (GAO). As can be seen in the following exhibit, the Virginia Crescent Line has a positive benefit/cost ratio (B/C) at both the 3% and 7% discount levels (B/C: 2.05, 1.42), thus proving that it is a strong viable route option for the proposed High-Speed and Enhanced Passenger Rail System and that it would be able to support such a system.

Overall, the positive economic results along with the positive financial results provide a strong clear case in favor of developing the High-Speed and Enhanced Intercity Passenger Rail System for the Virginia Crescent Line.

Benefit Cost Ratio at 3% & 7% Discount Rates (2013\$) for the Virginia Crescent Line

Discount (million 2013\$)	VIRGINIA CRESCENT LINE	
	3% Discount Rate	7% Discount Rate
System Passenger Revenues	\$7,142	\$2,399
OBS	\$571	\$192
Users Consumer Surplus	\$5,870	\$1,990
Highway Congestion Savings	\$2,934	\$952
Airport Delay Saving	\$479	\$155
Safety Benefits	\$1,101	\$372
Highway Reduced Emissions	\$244	\$81
Total Benefits	\$18,340	\$6,140
Capital Cost	\$5,737	\$3,236
O&M Costs	\$3,116	\$1,054
Cyclic Mtn	\$78	\$22
Total Costs	\$8,931	\$4,311
NPV(Surplus)	\$9,409	\$1,829
Benefit/Cost Ratio	2.05	1.42

CONCLUSIONS

The focus of the Vision Plan Study has been to assess the potential for bringing High-Speed and Enhanced Intercity Passenger Rail to the Virginia Crescent Corridor. The key finding of the study is that this corridor is one of the best in the country in terms of potential economic benefits and it has the potential to support the original goal of the Hampton Roads “Vision” as well as the objectives of the enhanced Virginia Crescent Line Vision Plan. It would provide a modern High-Speed Passenger Rail System for both the Newport News-Richmond-Washington and the Norfolk-Richmond-Washington segments of the corridor.

This capability is due to the fact that not only would the Virginia Crescent Line have “independent utility,” which means that it could support High-Speed Rail on its own right, but the demand for travel in the corridor is doubled since it is directly linked to both the Northeast and Southeast corridors of the U.S. This significantly enhances its potential for High-Speed and Enhanced Intercity Passenger Rail and strengthens to a great extent, the corridor’s ability to compete with the strongest of the other state corridors (e.g., California or Florida) for potential funding. Furthermore, it would be able to meet USDOT FRA financial and economic criteria thus establishing the business case for moving forward with further analysis and assessment as required to complete the Environmental and Engineering work that will be needed to develop the corridor.

The impact of integrating the Southside (Norfolk-Richmond) route with the Peninsula (Newport News-Richmond) route is that considerable synergies are created. The improvement in demand by the addition of the Newport News-Richmond route to the Norfolk Richmond route would be very significant. In fact, the increases in demand would be so dramatic that more train capacity would be needed for the Newport News to Richmond route over the three trains per day option planned in the earlier incremental development of the system. With a short high-speed connection to Toano, the demand for the Newport News-Richmond route increases to 8-10 trains per day, consistent with the original HRTPO Board resolution. This results in an improved Operating Ratio from 2.02 to 2.26 for the Virginia Crescent Line route option. This also improves the Benefit-Cost Ratio which increases from 1.57 to 1.97 at a 3% discount rate.

SYSTEM BENEFITS

The Preliminary Vision Plan Study results show that:

- It is possible to achieve the HRTPO Resolution #2009-05 goal by –
 - Providing “Enhanced” 130-mph service from Newport News to Washington D.C. with a travel time of just over two hours and a service of 8 to 10 trains per day.
 - Providing “High-Speed” 220-mph service from Norfolk to Washington D.C. with travel times of two hours or less and a service of 14 to 18 trains per day.

- The system would meet FRA public-private partnership, financial and Benefit Cost requirements making the system:
 - Eligible for Federal funds
 - A potential candidate for a public-private partnership (P3) that will allow the private sector to participate in the development and operation of the system.
 - A potential candidate for funding assistance through the Transportation Infrastructure Finance and Innovation Act (TIFIA) program
 - Developable using a combination of CSXT and NS rail routes within urban areas, combined with Greenfield options between the cities of Hampton Roads, Richmond, and Washington D.C. In each case, the system would provide increased rail capacity to hold the freight rail system “harmless”.
- The system will benefit our National Security by connecting numerous defense facilities and accommodating fast and rapid movement between interacting agencies. The corridor has nearly 10 percent of all uniformed military personnel of USA.
- The system would provide a strong boost to the economy of the cities located along the Virginia Crescent Line and to the overall region over the life of the project and could generate as much as:
 - 800-900 thousand person years of work or 20,000-25,000 jobs per year due to productivity
 - \$5-7 Billion gain in household income
 - \$1.5-2.0 Billion gains for joint development around the station sites in Norfolk, Newport News, Bowers Hill, Williamsburg, Richmond, Fredericksburg, Alexandria, and Washington D.C., once the project is built out.
- Extending the corridor from Washington D.C. beyond Richmond all the way to Hampton Roads, would support the financial viability of the Richmond-Washington D.C. segment of the corridor. So much so, that it would justify the development of greenfield segments north of Richmond.
- The Virginia Crescent Line gains a considerable advantage over any standalone corridor, as it has a much better Operating Ratio and Benefit Cost Ratio because of its connectivity with the NEC and SEHSR corridors.
- Within the corridor, 220-mph technology should be used for the Southside Route while 130 mph should be used for the Peninsula Route. It may well be worth considering the new Dual Mode (160-mph Electric/Diesel hybrid technology) for the Peninsula. Dual mode trains could go faster on the electrified track north of the junction at Toano.

CHALLENGES

In today's market, to advance and implement major high-speed rail improvements takes the combined resources of the region and support of all interested parties. The interested parties whose support should be sought out for the Virginia Crescent Line Rail project include the heads of local Metropolitan Organizations, local and regional political leaders including the Mayors of cities along the corridor (e.g., Norfolk, Newport News, Williamsburg, Richmond, Fredericksburg, etc.), the leaders of military installations or facilities who could benefit from or be users of the rail system (e.g., Norfolk Naval Station, NASA's Langley Research Center, the Pentagon, etc.), local chambers of commerce, community leaders, etc.

The implementation of the new High-Speed Rail System for the Virginia Crescent Line will involve a number of critical challenges:

- An effective financing and funding approach that meets USDOT FRA requirements needs to be developed.
- Given the overburdening of the USDOT and FRA with The American Recovery and Reinvestment Act of 2009 (ARRA) and The Passenger Rail Investment and Improvement Act of 2008 (PRIIA) grants and the time needed for completing environmental analyses, the processing requirements have been expanded and are having an adverse impact on project timelines. However, the FRA has suggested that some of these timelines may be shortened in the future as the USDOT FRA gears up to process High-Speed rail applications.
- The development of potential greenfield alignments should be further examined to determine the feasibility of advancing improved service and to provide alternative ways for potentially mitigating freight railroad, environmental and community concerns.
- The Project needs to maintain its currently strong base of community and regional support; and, an effective case needs to be put forth that clearly and strongly demonstrates the potential benefits of bringing High-Speed Rail to the local communities along the Virginia Crescent Line and to the overall region.

Because the identified benefits of a High-Speed Rail System are so robust while the complexity of the FRA funding process for completion of environmental analyses stresses project timelines, there is a strong benefit to continuing to push forward and advance the development of a High-Speed Rail and Intercity Passenger Rail System for the Virginia Crescent Line.

NEXT STEPS

To move towards implementing the HRTPO Objectives, the following are the next steps:

- Continue development of the Virginia Crescent Line's proposed route option for the benefit of both the North and Southside Hampton Roads communities. Feasibility work still remains to be completed for defining and refining route options from Richmond to Washington D.C. as well as

working with CSX on capacity analysis issues east of Toano and for development of a downtown Newport News station. The proposed integration of Southside and Peninsula rail services provides a very cost effective way of developing higher speed options for the Peninsula, as well as for achieving the High-Speed objectives of the Southside. It will give both communities the Higher and High-Speed options they are seeking.

- Develop a Service Development Plan and a Service NEPA in order to make application to the USDOT FRA and/or the State of Virginia for funding for a Tier 1 High-Speed Rail Environmental Impact Statement (EIS) that determines the selection of the Final Preferred Alternative for the Virginia Crescent Line.
- Develop the institutional framework to support a process for Public-Private Partnership Development throughout the Environmental Process. This involves holding regular workshops with potential P3 partners through the environmental process.
- Identify the potential financial parameters for a public-private partnership considering: Design, Build, Operate, Maintain and Finance (DBOM-F) options similar to the approach in Florida that attracted \$1.8 Billion in USDOT FRA money for a P3 project between Miami-Orlando-Tampa.
- Develop partnership with freight railroads for engaging in right-of-way and Positive Train Control discussions.
- Engage SEHSR in a discussion of the synergies and benefits potentially associated with sharing a new High-Speed alignment, particularly north of Richmond up to Washington D.C.
- Develop partnerships with the local communities regarding station development in order to evaluate potential transit connections and auto requirements.

Key documentation required for FRA application for High-Speed Rail funds includes:

- Service Development Plan/Service NEPA Environmental Documentation
- Railroad Agreements where existing rail rights-of-way will be used
- Agreements with local communities on station development
- Financial and Funding Plan
- Documentation of work with the USDOT FRA considered as part of the team to adopt 220-mph trains similar to those currently proposed for Northeast Corridor and California.
- Documentation of the need for high-speed rail operations in the Richmond to Oceanfront Mega-Region versus only doing incremental upgrades and the need for designating the Virginia Crescent Line as a “High-Speed Rail Corridor”. The documentation should clearly show strong support for the project by the Virginia Chamber of Commerce, HRTPO, DRPT, other project stakeholders and

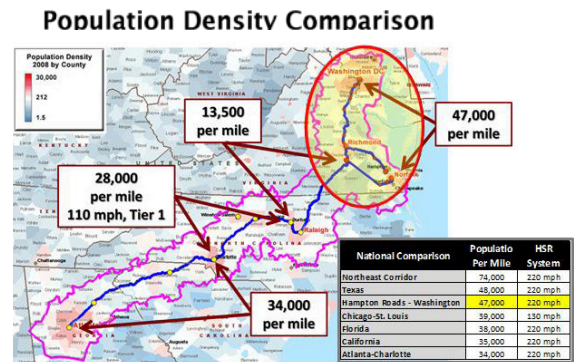
the local and regional communities that would greatly benefit from the development of a High-Speed Rail and Intercity Passenger Rail System.

APPENDIX: BENCHMARKING COMPARISONS TO OTHER CORRIDORS

Benchmarking and making comparisons with other established high-speed rail corridors is an important check for evaluating new rail projects. High-Speed rail corridor forecasts that compare well with other corridors provide a check on estimates and bring credibility to the projected trip volumes, benefits and costs of the project. As a result, the Virginia Crescent Line analysis has been extensively benchmarked to develop comparisons with other corridors.

POPULATION DENSITY COMPARISONS

The urban areas of Hampton Roads, Richmond and Washington D.C. form a corridor with a combined population of close to 10 million people. This is similar in population per mile (at 47,000 people per mile) to the best corridors in the U.S. outside the NEC, such as those in Texas, Florida and California.



DEMAND FORECAST RAIL TRIP RATE COMPARISON

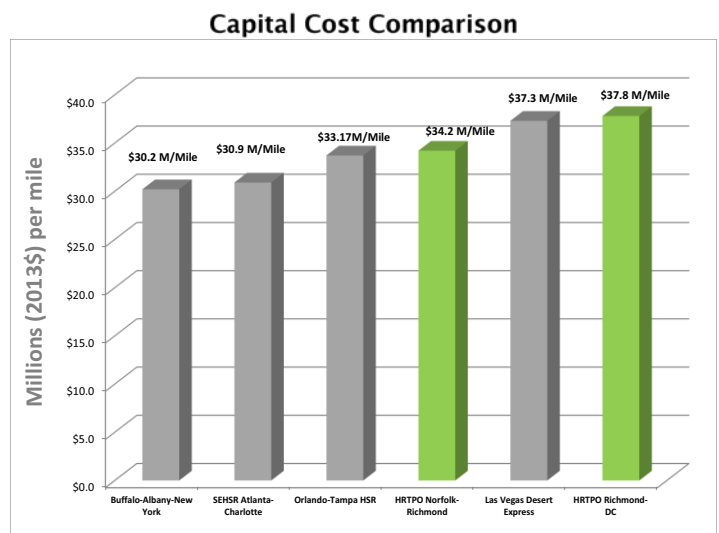
The Virginia Crescent Line’s trip rate at 10.51 trips per day per 10,000 persons (in 2030) is seen to be conservative relative to the Northeast corridor or California that are twice as high; and it is lower than forecasts even for corridors with less population such as the Atlanta to Charlotte corridor. The ridership forecasts for the corridor are clearly conservative.

Trip Rate Comparison

	2030 Hampton Roads-Washington Corridor - 220 MPH	2030 Atlanta-Charlotte Corridor - 220 MPH	2030 NEC Master Plan NYC-DC Corridor (Constrained Acela) 1	2030 NEC Next-Gen HSR NYC-DC Corridor - 220 MPH	2030 California High-Speed Rail Ridership Forecast - 220 MPH
Rail Trip Rate (trips per day per 10,000 persons)	10.51	12.06	18.86	22.19	24.27

CAPITAL COST COMPARISONS

Cost per mile comparisons with rural greenfield corridors across the U.S. were also made for the Virginia Crescent Line. The Norfolk to Richmond and Richmond to Washington D.C. segments both cost slightly more (per mile) than the Orlando to Tampa High-Speed Rail Corridor, while the Richmond to Washington D.C. segment’s costs (per mile) are even higher than Las Vegas’ Desert Express. The Virginia Crescent Line has high-range capital costs compared to other rural greenfield projects. While rural greenfields like the Virginia Crescent Line typically cost \$30-40 million a mile for a double track section, they are cheaper than urban corridors. The urban tunnels that



APPENDIX: BENCHMARKING COMPARISONS TO OTHER CORRIDORS

are needed, for example, in the NEC, can cost \$300 million a mile and underwater tunnels (for getting in and out of Manhattan) can cost \$1 Billion a mile. The cost of these bridges and tunnels can be seen in Amtrak’s average cost of \$274 million per mile for NEC improvements. The NEC has major tunnels under Baltimore, Philadelphia and New York City and as such, should not be compared to the project that has been proposed in Virginia, which does not require any tunnels.

FINANCIAL COMPARISONS

As shown in the Operating Ratio Results comparison, projects in the low speed range (79-90 mph) tend to have negative operating ratios <1.0 (e.g., require operating subsidies) whereas faster speeds (110 mph plus) make the service a lot more attractive to riders and guarantees enough revenue to eliminate the need for operating subsidies. Typically very high-speed 220-mph rail systems produce large positive operating ratios in the 2.0-3.0 range. This spins off substantial cash flows that cover a portion of the system’s capital cost.

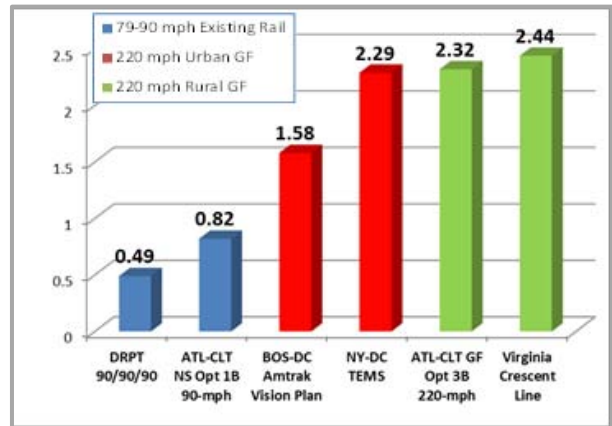
ECONOMIC COMPARISONS

A key finding is that economic results for low speed intercity services also tend to be negative <1.0, as was found to be the case for upgrades to the Atlanta-Charlotte existing NS rail line as well as independently of this analysis for the DRPT Washington D.C. to Richmond 90/90/90 plan.

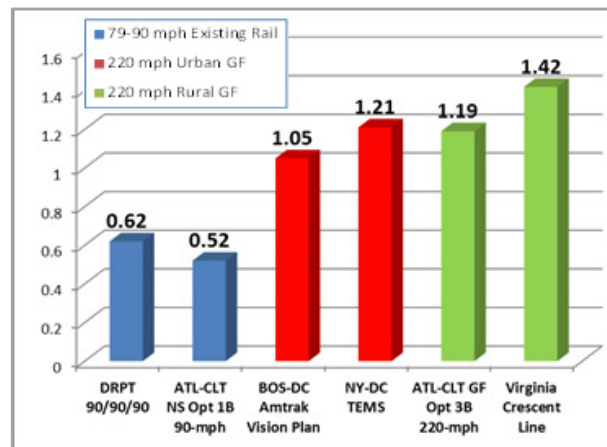
Because of the scale of travel time savings however, true High-Speed rail systems tend to produce positive Cost Benefit results >1.0. This is particularly true for rural greenfield routes between major urban areas that do not require extensive bridging and tunneling.

The key in every case is to appropriately match the infrastructure to market demand, as has been done in development of the High-Speed Rail plan for the Virginia Crescent Line. While the population density of the Virginia Crescent Line is comparable to other corridors on a stand-alone basis, the Virginia Crescent Line benefits from NEC connectivity which doubles the ridership. In the benchmarking comparison, this dramatically improves the Cost Benefit results for the Virginia Crescent Line because other corridors, such as those in Texas, Florida and California, do not have this connectivity. As a result of this proximity, the Virginia Crescent Line ranks among the best opportunities for High-Speed rail development in the United States.

Operating Cost Comparison



Cost-Benefit Comparison



APPENDIX: BENCHMARKING COMPARISONS TO OTHER