

PREPARED FOR

HAMPTON ROADS TRANSPORTATION PLANNING ORGANIZATION



HAMPTON ROADS HIGH SPEED PASSENGER RAIL VISION PLAN

EXECUTIVE SUMMARY



November 2014

PREPARED BY

TEMS

TRANSPORTATION ECONOMICS & MANAGEMENT SYSTEMS, INC.

PURPOSE OF STUDY

TEMS was commissioned by the Hampton Roads Transportation Planning Organization (HRTPO) to develop a Vision Plan for Enhanced and High Speed Passenger Rail Service for the Hampton Roads region. The Hampton Roads Passenger Rail Study represents an important step in the development of a Vision Plan. The Virginia Department of Rail and Public Transportation (DRPT) submitted the Richmond/Hampton Roads Passenger Rail Project Tier I Draft Environmental Impact Statement (EIS) in accordance with the National Environmental Policy Act (NEPA) to develop conventional passenger rail service in the Hampton Roads corridors. These options are being implemented as the first steps in achieving the goals of the HRTPO. To support and further develop the Commonwealth's efforts, the HRTPO Board approved a resolution in October 2009 that endorses the designation of a "high speed rail" corridor with ultimate speeds of more than 110 mph along the Norfolk Southern/Route 460 (Norfolk-Richmond) corridor and that enhances the intercity passenger rail service along the CSX/I-64 corridor (Newport News-Richmond).

The HRTPO Board Resolution #2009-05 provides an overarching vision for development of rail passenger service to the Hampton Roads region.

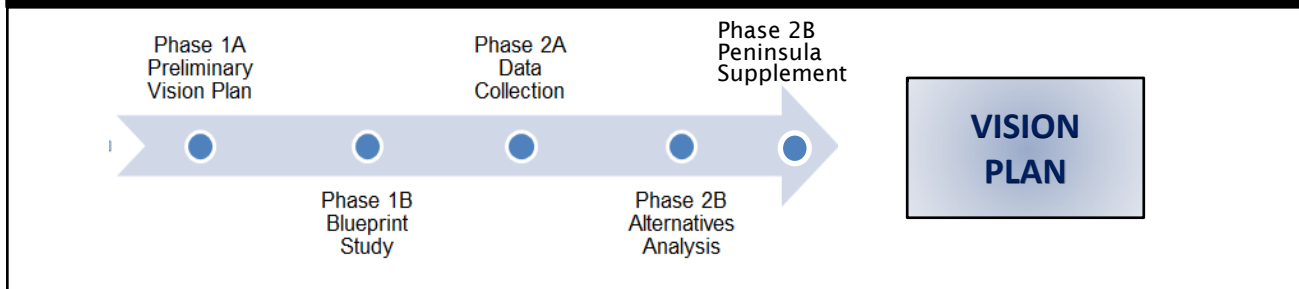
The resolution endorses:

- **Designation of a "High-Speed Rail" corridor along the NS/Route 460 corridor; and**
- **Enhancement of existing intercity passenger rail service along the CSX/I-64 corridor**

PHASE 2 ALTERNATIVE ANALYSIS AND SELECTION OF THE PREFERRED OPTION

In developing the Vision Plan for the HRTPO, TEMS has completed a number of studies designed to assess the potential for Enhanced and High Speed Rail in the Hampton Roads-Richmond-Washington corridor. In the March 2013 Phase 2A study, TEMS developed the databases needed to assess High Speed Rail options for the Norfolk-Richmond corridor. The Phase 2B study focused on identifying route options that would allow high speed rail in the Norfolk-Richmond segment. The most recent Phase 2B Supplemental study focused on the Newport News to Richmond corridor segment and identified the Richmond Direct Improved Option 4 route as being the preferred route for the Hampton Roads to Richmond corridor that specifically achieves HRTPO Board Resolution #2009-05. Specifically, the Richmond Direct Improved Option 4 combines the best of the Norfolk to Richmond and Newport News to Richmond route options that includes sharing a segment of the high speed rail line and that provides the most efficient option in terms of sharing and maximizing the benefits of the corridor while minimizing the costs.

Overview of the Study Development Process for Implementing HRTPO Vision Plan Objectives

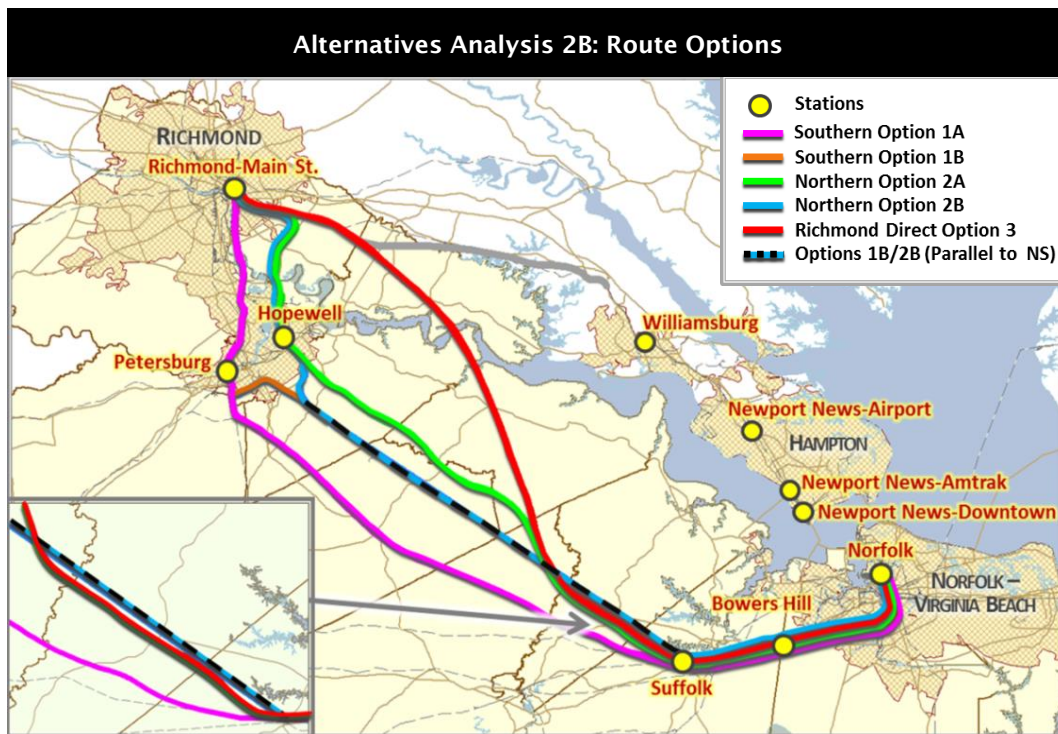


ROUTE AND TECHNOLOGY ANALYSIS

For the Norfolk-Richmond corridor segment, three initial route options were developed utilizing a combination of greenfield and existing rail rights-of-way:

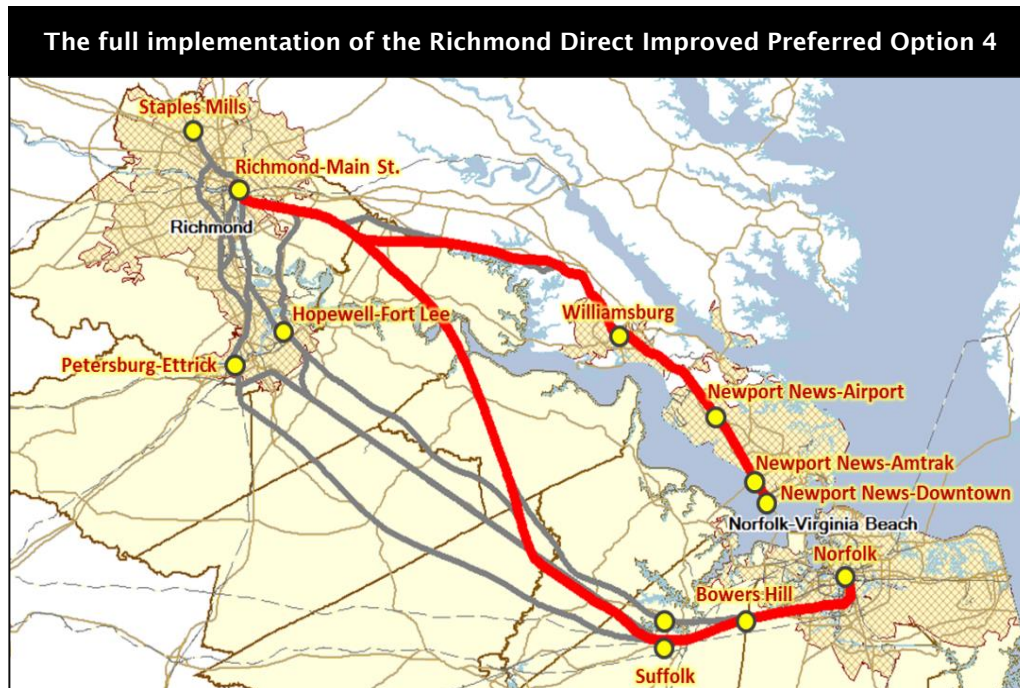
- 1) Southern Option via Petersburg,
- 2) Northern Option via Hopewell, and
- 3) Richmond Direct Option.

The Southern and Northern options each have variants based on a greenfield route (Option A) and a route parallel to the existing Norfolk Southern (NS) rail right-of-way (Option B)*. The three main route options along with their NS variants are shown below.



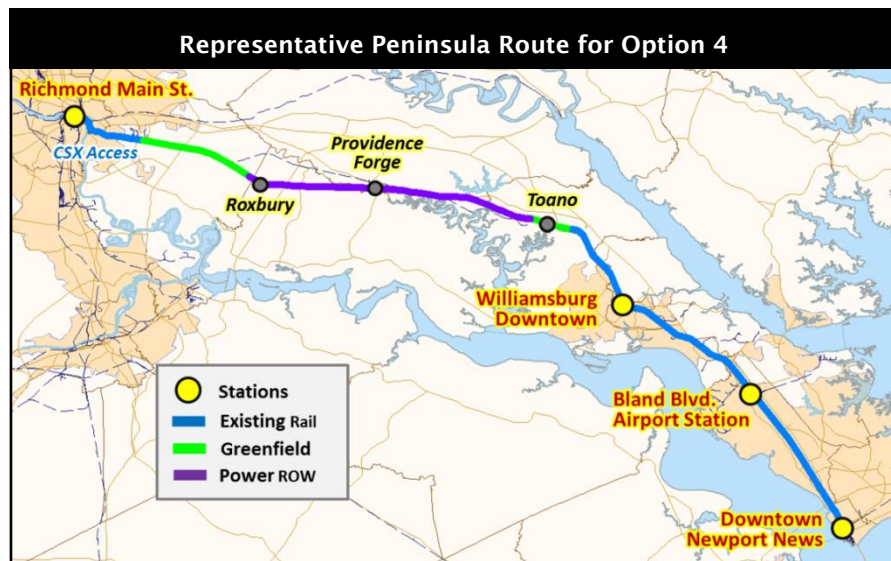
*Any use, implied, explicit, or otherwise, of NS right-of-way will be subject to the concurrence of NS, and to NS' Passenger Rail Policy which governs the speed of passenger rail trains utilizing it or encroaching upon it.

The initial Phase 2(B) assessment assumed only Amtrak service with one added daily round trip to Newport News. But it soon became apparent that development of the Richmond Direct option could offer a synergistic opportunity to add a Peninsula connection, so diesel trains from the Peninsula and electric trains from the Southside could share a common entryway into downtown Richmond¹.



The Phase 2B Peninsula Supplement looked at the development of higher speed rail service for the Peninsula, including looking at greenfield alignment issues in more detail. This was explored as Option 4 – Richmond Direct Improved. A representative route was developed from a number of potential route options that utilized different combinations of greenfield, existing rail and power line rights-of-way. The selected route used a new track along the existing CSX rail from Newport News to Williamsburg and a greenfield connection along a power line right of way from Toano to Roxbury where it connected to the Richmond Direct Norfolk-Richmond route.

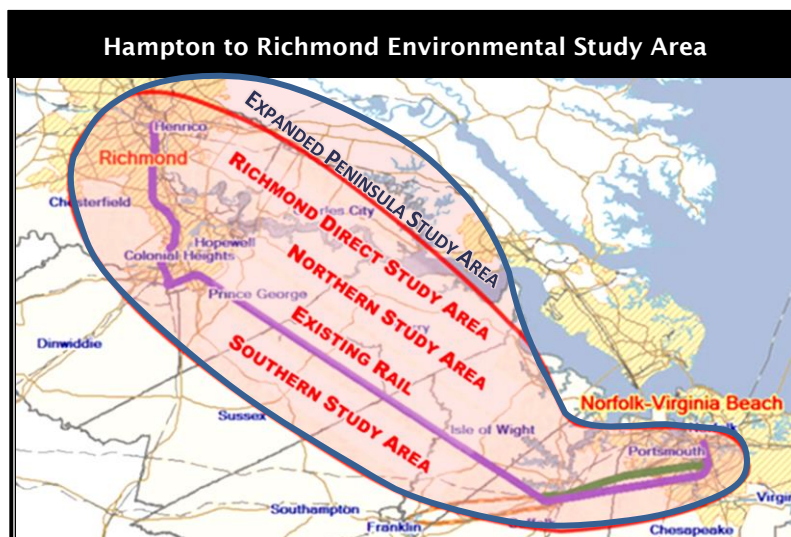
¹The potential for sharing of the Greenfield high speed track by Peninsula and Southside depends on which Norfolk option is selected during the environmental process. If the Richmond Direct Option 3 were selected then there is significant sharing potential. If the Northern Greenfield Option 2 via Hopewell were selected, then the final approach inside the I-295 beltway could be shared. However, selecting the Southern Greenfield Option 1 via Petersburg would practically eliminate the potential for Peninsula track sharing, since this alternative enters Richmond from the south rather than from the east. However, all of these options could still share the line from Richmond to Washington, D.C.



ENVIRONMENTAL SCAN


In developing route options for the study, an overview of environmental issues was made as it is a critical element of National Environmental Policy Act (NEPA) compliance. For the current study, TEMS completed a high level Environmental Scan for the purpose of identifying any major flaws and the types of mitigation that might be needed.

Environmental data collection and resulting tabulations were derived for the Phase 2B environmental study area that extended from Norfolk to Richmond, VA. For the Phase 2B supplement, the environmental Study area was expanded to include the Peninsula and an environmental scan was also performed on the segment from Newport News to Richmond. The results of the high level scan show that there are no *obvious* fatal flaws that would prevent any of the currently proposed route options from moving forward into the EIS process.




TECHNOLOGY OPTIONS ANALYSIS

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***

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***

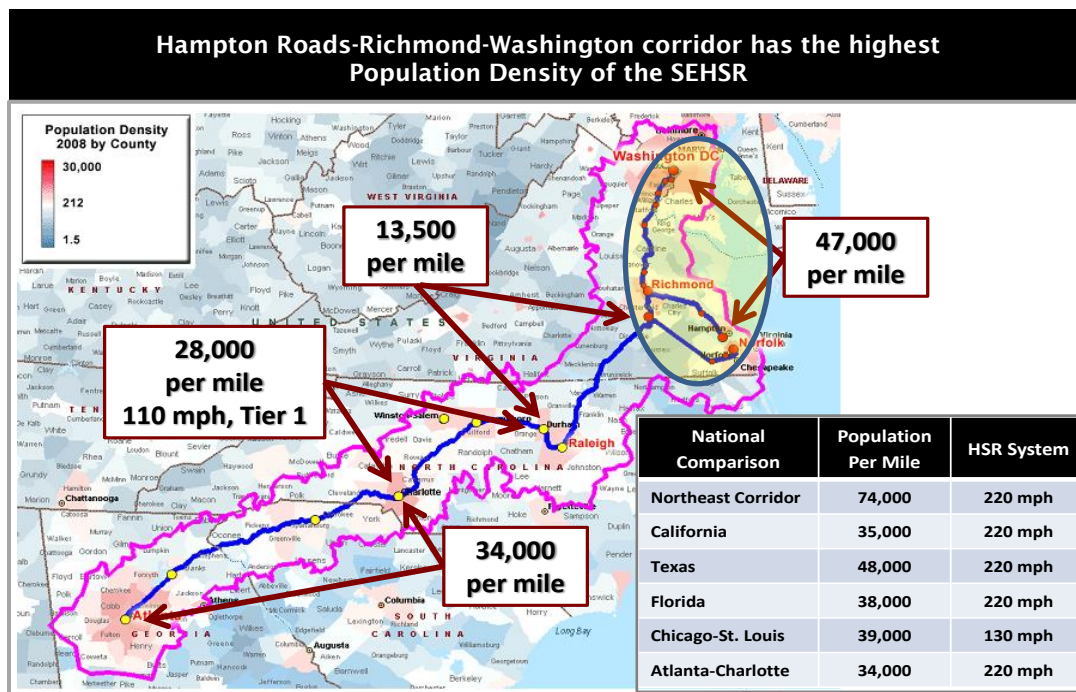
Timetable	WAS-NRF 220-mph Super Express 5 Stops to DC	WAS-NRF 220-mph Express 7 Stops to DC	WAS-NRF 220-mph Local 10 Stops to DC	WAS-NPN 130-mph Express 7 Stops to DC	WAS-NPN 130-mph Local 10 Stops to DC
Total Trains	5 trains	10 trains	3 trains	4 trains	4 trains
Schedule Time	1:38	1:43	1:58	2:00	2:10

* Maximum Speeds for Sharing Freight Rail Rights of Way in accordance with Railroad Letters of Principle

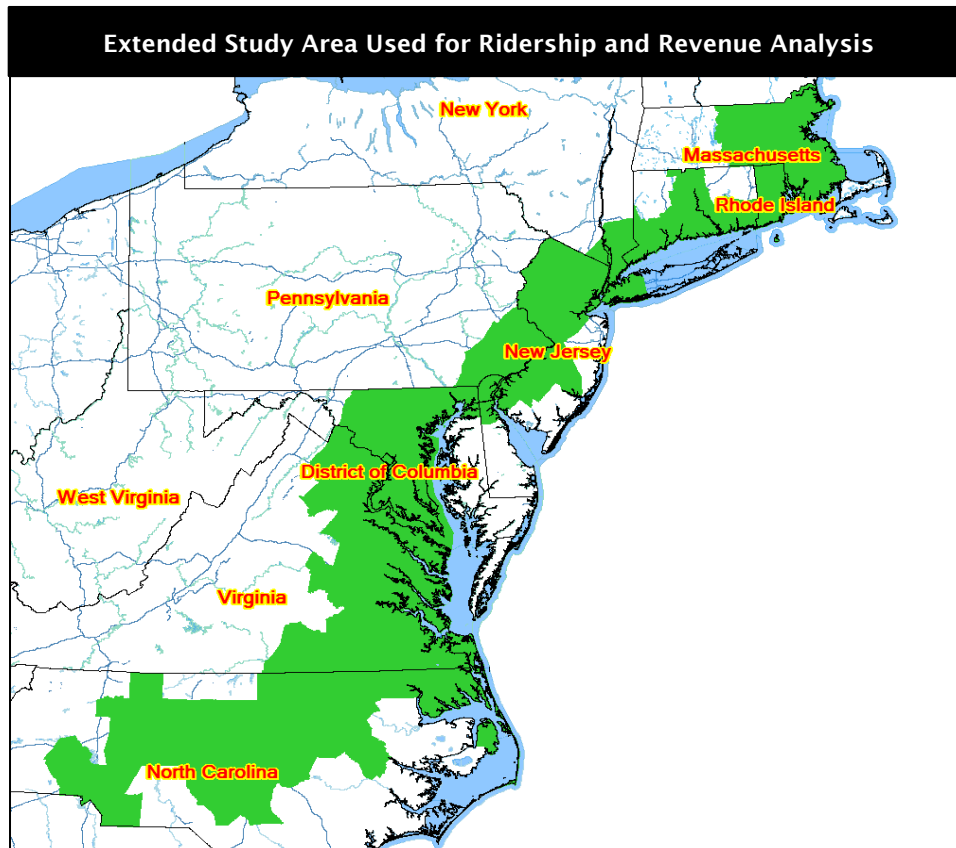
Train technology has been evolving rapidly in the last twenty years as new, faster, more efficient higher and high speed technologies have been developed. Two maximum train speeds: 130-mph diesel and 220-mph electric were selected to represent Enhanced and High Speed Rail options. The Richmond Direct Improved Option 4 which uses a combination of 130 mph diesel and 220 mph electric technology achieves the objective of HRTPO Board Resolution #2009-05 for a 2-hour express schedule for Hampton Roads to Washington DC for both the Southside and the Peninsula routes.

MARKET ANALYSIS

The Hampton Roads-Richmond-Washington corridor is one of the top intercity corridors in the U.S. – being comparable with, in terms of population density (i.e., population per route mile), California’s San Francisco-Los Angeles, Florida’s Miami-Orlando, Ohio’s Cleveland-Columbus-Cincinnati, Pennsylvania’s Philadelphia-Harrisburg-Pittsburgh, and Texas’s Houston-Dallas corridors. Furthermore, this corridor is much stronger than the other Southeast High Speed rail corridors like Atlanta-Charlotte or Charlotte-Raleigh and Raleigh-Richmond. As such, the corridor has independent utility as a high speed corridor. In addition, the Hampton Roads-Richmond-Washington corridor is logically a southern extension of the Northeast corridor and a natural part of the “East Coast Mega Region” that stretches from Boston to New York to Philadelphia to Washington and on to Richmond and Hampton Roads. The impact of being linked to this Mega Region effectively doubles the volume of trips that the corridor would have as a freestanding corridor, and thus significantly enhances its potential for High Speed and Enhanced Intercity Passenger Rail.



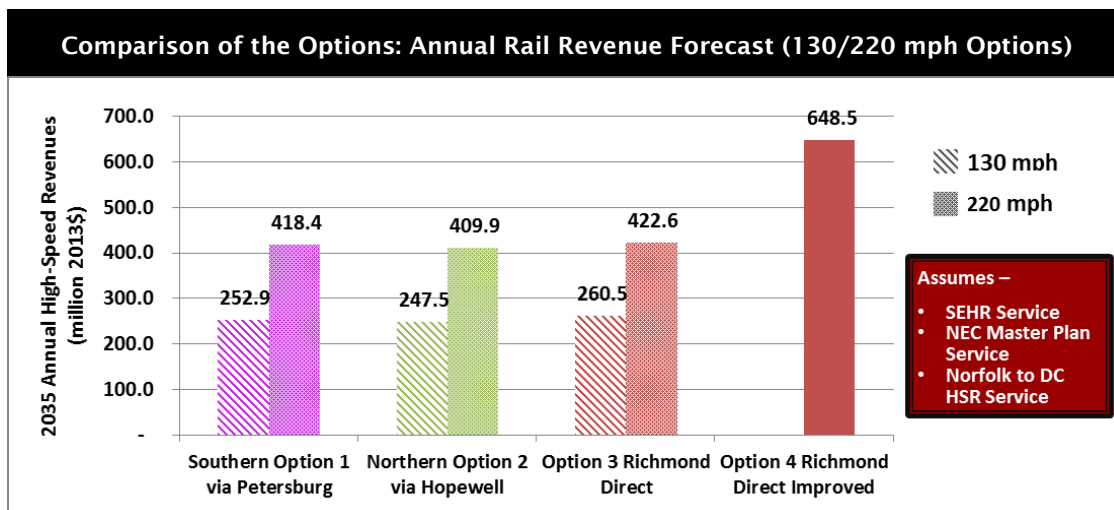
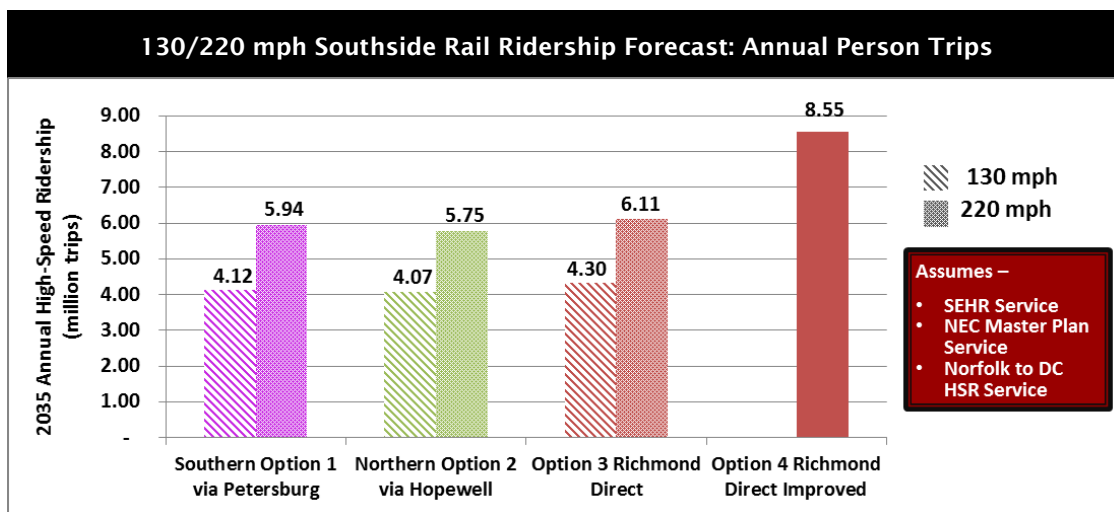
A Market Analysis was completed for the entire study area that extends from Charlotte, NC to Boston, MA, which included developing the travel demand forecast for the HRTPO study area that spans from Hampton Roads to Washington, DC. For this purpose, a 333-zone system was developed to determine the socioeconomic growth and transportation projections for the entire corridor and study area. The entire study area used for zone system development and for deriving the long-range socioeconomic and transportation forecasts is shown graphically in the following exhibit.



The demand for intercity travel in the corridor is very strong and will continue to grow. The Hampton Roads region hosts a large number of finance and business services, research and high-tech industry, government agencies and military bases; and as a result, the Hampton Roads-Richmond-Washington corridor has a high level of business, commuter, social and tourist travel between its urban areas. In 2012 the Hampton Roads-Richmond-Washington corridor had an estimated 59 million total annual intercity one-way trips (average resident takes 6.6 one way or 3.3 round intercity trips per year), with a population of nearly ten million, employment of over six million, and a per capita income of \$39,648. In 2040, the population is projected to be over 12 million; employment will be about 8.5 million; and, average per capita incomes will grow to about \$53,227 (2012 dollars). Projections, therefore, indicate that the corridor's demographic and economic growth will continue over the next several decades giving a forecasted total trip volume of 79 million trips by 2045, a growth of 34%.

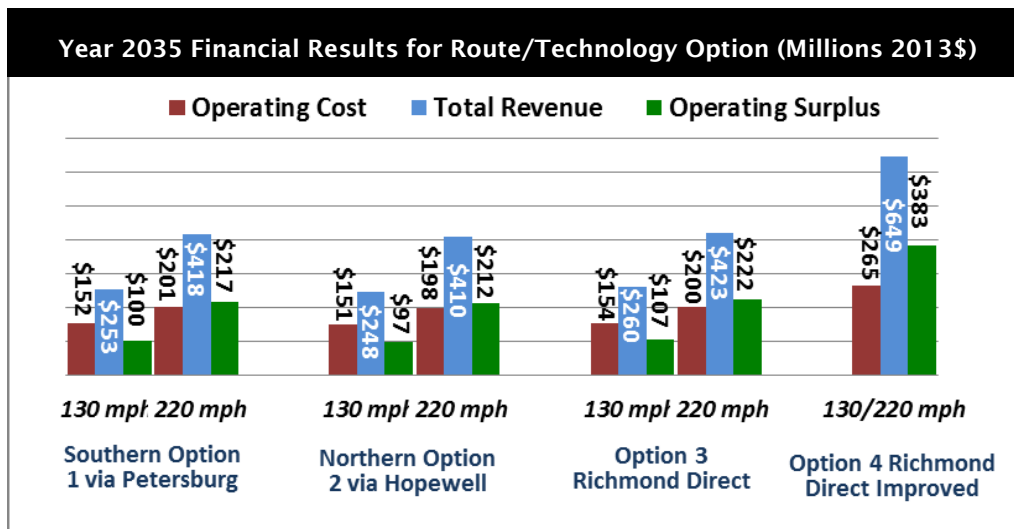
RIDERSHIP AND REVENUE ANALYSIS

As shown below, the differences in ridership for year 2035 between the Southside's three principle route options (options 1, 2, & 3) are relatively small while adding the Peninsula service in the Richmond Direct Improved Option 4 has a big impact. In addition, the selection of rail technology options 220 mph vs 130 mph is also quite significant. For the Southside, each route option has about 4 million plus trips for the 130-mph technology options and about 6 million plus trips for the 220-mph technology options. However, Option 4 which incorporates the best of the Southside Options (Option 3) with the Peninsula Route and uses 220 mph Electric technology for the Southside and 130 mph Diesel technology for the Peninsula, has the largest Ridership with 8.5 million trips and thus the best results. In terms of revenues, Option 4 again, has the best results by far with revenues of \$694 million in year 2035; a more than 50 percent increase over Options 1 to 3.

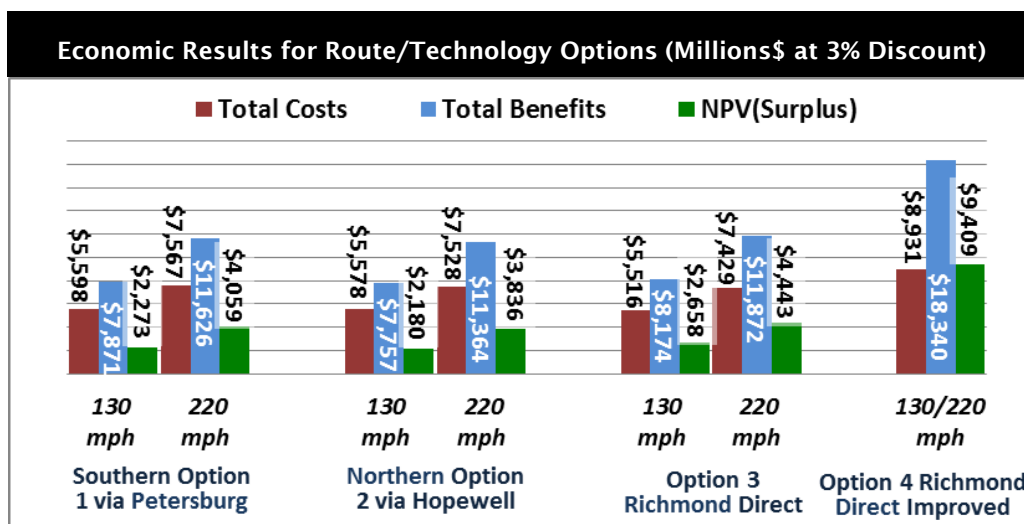


FINANCIAL AND ECONOMIC RESULTS

The financial results for the Hampton Roads-Richmond-Washington corridor show that all of the route and technology options produce positive operating ratios and as such, will not need an operating subsidy. As expected, the 220-mph options showed higher financial returns than the 130-mph options. However, the Richmond Direct Improved Option 4, incorporating both 130 mph and 220 mph technologies, has significantly better financial results than all the other options. The operating surplus for Option 4 is \$383 million in 2035 and continues to grow over the life of the project. This makes the Richmond Direct Improved Option 4 franchisable and a potential candidate for a Public Private Partnership (P3).



In Benefit-Cost terms, a similar set of results was found for the Richmond Direct Improved Option 4, which showed a significant improvement over all other route options. And, again, the results for the 220-mph trains were better than the results for 130-mph trains for all options. For Option 4, which uses a combination of 130 mph and 220 mph technology, the Total Benefits are about \$18 billion, Total Costs are about \$9 billion, and the Cost Benefit Ratio is 2.05 at a 3 percent discount rate. Option 4 remains positive at a 7% discount rate, the critical OMB requirement for USDOT funding.



KEY FACTORS FOR CONSIDERATION AND CONCLUSION

The analysis shows that the potential for developing a true high speed system for the Hampton Roads Corridor is very real. The Richmond Direct Improved Option is a very cost effective way of developing higher speed options for the Peninsula, as well as achieving the high speed objectives of the Southside. It will give both communities the higher and high speed options the HRTPO Board is seeking. It is apparent that greenfield routes can be developed that, from the initial market operations, engineering and environmental analysis, would attain USDOT FRA financial and economic requirements, have independent utility both in their entirety and on a segmented basis, and would avoid obvious² environmental “fatal flaws” that would prevent their construction.

Option 3 was the best-performing Richmond to Norfolk option, but was significantly enhanced in Option 4 by adding a Peninsula rail connection. This was shown to dramatically boost the financial and economic performance of the system, so now the Richmond Direct Improved Option 4 stands clearly above any of the other options.

STUDY FINDINGS

The projected financial and economic performance of the corridor now ranks it among one of the best opportunities for development of High Speed Rail in the United States outside the Northeast Corridor. In the case of all the options, but in particular with the Richmond Direct Improved Option 4, the results show a great potential for attracting a Public Private Partnership (P3). A P3 will be attracted by the strong financial result that suggests an operating surplus exceeding \$300 million per year could be generated by 2035 (See Exhibit 8-6). The P3 potential is also enhanced by the efficient infrastructure development approach where greenfields are maximized in rural areas where they can be economically constructed, while existing rail lines are enhanced to add the capacity needed to directly reach the urban core markets of Norfolk, Newport News, Richmond and Washington D.C. As has been shown in Europe and elsewhere this is the most cost effective approach to the development of High Speed rail systems since it makes the cost affordable as compared to highways, airports, upgrading existing rail tracks or other options for expanding intercity transportation capacity.

To move towards implementing the HRTPO Objectives, it is recommended that:

- Since as agreed with DRPT that there is no room for HRTPO high and higher speed train on the CSX route from Richmond to Washington, it is essential to clarify that a greenfield route from Richmond to Washington is the only solution if high and higher speed rail is to be a possible mechanism for improving mobility in Eastern Virginia.
- As a result, there is a need to continue development of the Richmond-Washington D.C. segment to define greenfield alternatives and develop a preliminary assessment at the feasibility level. This would lead to the creation of a Service NEPA document and in the short term, some possible additional alternatives, such as greenfield bypasses around Ashland and Fredericksburg. This might even be incorporated as useful adjuncts into DRPT’s current Tier II EIS planning for incremental rail.

² This is based on an environmental scan level of review. Environmental data has been collected and assessed at a landscape level consistent with FRA’s requirements for a Service NEPA. A landscape level of review refers to preliminary overview of the area and prospective alignments based on mapping, and aerial and ground level photographs, without detailed on-site inspection.

- For longer term development needs, establish route reservations in Master Planning documents to protect the needed rights-of-way is necessary to prevent the kinds of cost escalation that were experienced by California's system.
- Continue development of the Richmond Direct Improved Option for the benefit of both the North and Southside Hampton Roads communities. Feasibility work still remains to be completed for defining, refining and optimizing additional greenfield Peninsula route options as well as working with CSX on capacity analysis east of Toano, and for possible development of a downtown Newport News station and how that might impact CSX's Newport News terminal operations.
- Continue discussions with Portsmouth and Suffolk to advance development of the "V-Line" and Bowers Hill stations in the short to medium term.
- 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. SEHSR trains are capable of 110 to 130 mph but will be significantly constrained to a commercial speed of only 50-60 mph on the Richmond to Washington CSX route.
- 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. USDOT FRA is emphasizing the need for Public Private Partnerships as the mechanism to build High Speed Rail.
- Develop partnership with freight railroads for engaging in right-of-way discussions, and further develop line capacity simulations of shared segments east of Toano, north of Aquia and on a short stretch through downtown Richmond to confirm the adequacy of planned infrastructure for accommodating both High Speed rail and future freight capacity needs.

SUMMARY OF RESULTS OF THE VISION PLAN ALTERNATIVES ANALYSIS

Operations / Ridership/ Financial / Economic Results		SOUTHERN OPTION 1 (Via Petersburg)				NORTHERN OPTION 2 (Via Hopewell)				OPTION 3 - RICHMOND DIRECT		OPTION 4 - RICHMOND DIRECT IMPROVED	
		Southern Option 1A - Greenfield		Southern Option 1B - Norfolk Southern		Northern Option 2A - Greenfield		Northern Option 2B - Norfolk Southern					
		130 mph	220 mph	130 mph	220 mph	130 mph	220 mph	130 mph	220 mph	130 mph	220 mph	WAS-NPN	WAS-NRF
Travel Time (One Way)	Express Travel Time (Hampton Rds To DC)	2:46	1:55	2:46	1:55	2:46	1:55	2:46	1:55	2:36	1:43	2:00	1:43
Rail Ridership	Year 2035 (Million Annual Person Trips)	4.12	5.94	4.12	5.94	4.07	5.75	4.07	5.75	4.30	6.11	8.55	
Financial: Year 2035 (million 2013\$)	Total Revenue	\$253	\$418	\$253	\$418	\$248	\$410	\$248	\$410	\$260	\$423	\$649	
	Operating Cost	\$152	\$201	\$152	\$201	\$151	\$198	\$151	\$198	\$154	\$200	\$265	
	Operating Surplus	\$100	\$217	\$100	\$217	\$97	\$212	\$97	\$212	\$107	\$222	\$383	
	Operating Ratio	1.66	2.08	1.66	2.08	1.64	2.07	1.64	2.07	1.70	2.11	2.44	
Capital Cost (thousands 2013\$)	Capital Costs (Hampton Rds To DC)	n/a	\$8,024,720	n/a	\$7,967,368	n/a	\$8,026,809	n/a	\$7,941,237	n/a	\$7,827,858	\$8,964,195	
Economic NPV (Million\$ - 3% Discount Rate)	Total Benefits	\$7,871	\$11,626	\$7,871	\$11,626	\$7,757	\$11,364	\$7,757	\$11,364	\$8,174	\$11,872	\$18,340	
	Total Costs	\$5,598	\$7,567	\$5,571	\$7,530	\$5,578	\$7,528	\$5,538	\$7,473	\$5,516	\$7,429	\$8,931	
	NPV(Surplus)	\$2,273	\$4,059	\$2,300	\$4,096	\$2,180	\$3,836	\$2,219	\$3,891	\$2,658	\$4,443	\$9,409	
	Benefit/Cost Ratio	1.41	1.54	1.41	1.54	1.39	1.51	1.40	1.52	1.48	1.60	2.05	

Notes: All 130 mph trains use Diesel Technology and 220 mph trains use Electric Technology. Ridership is for rail corridor extending from Boston to Charlotte. A trip is defined as a passenger making a one-way trip and a round trip generates two one way trips. WAS- NPN = Washington to Newport News, WAS-NRF = Washington to Norfolk.