

REPORT OF THE

DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION

The Virginia Railway Express 2040 System Plan Review Report

TO THE GENERAL ASSEMBLY OF VIRGINIA



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2016**

DRPT



VRE 2040 System Plan Review

DRAFT Report

December 2016

December 7, 2016

The Honorable Aubrey L. Layne, Jr.
Secretary of Transportation
Post Office Box 1475
Richmond, Virginia 23218

The Honorable Chris S. Jones, Chairman
House Appropriations Committee
General Assembly Building, Room 948
Richmond, Virginia 23219

The Honorable Thomas K. Norment, Co-Chair
Senate Finance Committee
General Assembly Building, Room 626
Richmond, Virginia 23219

The Honorable Emmett W. Hanger, Co-Chair
Senate Finance Committee
General Assembly Building, Room 326
Richmond, Virginia 23219

The Honorable Ronald A. Villanueva, Chairman
House Transportation Committee
General Assembly Building, Room 503
Richmond, Virginia 23219

The Honorable Charles W. Carrico, Chairman
Senate Transportation Committee
General Assembly Building, Room 330
Richmond, Virginia 23219

Dear Chairmen,

Attached for your review is the requested report as required by Item 436 Subsection N of the 2016 Acts of Assembly. It directs the Commonwealth Transportation Board's rail subcommittee to:

“ . . .review the long range service plan and financial analysis of Virginia Railway Express and assess the conclusions of that analysis with respect to the long-term financial viability of the service, their ability to maintain appropriately costed-services to maintain and expand market share, and the Virginia Railway Express's impact on traffic volumes on the Interstate 66 and Interstate 95/395 corridors of statewide significance. The Board shall consult with interested stakeholders and report its findings to the Secretary of Transportation, and the Chairmen of the House Committees on Appropriations and Transportation and the Senate Committees on Finance and Transportation no later than November 15, 2016.”

Sincerely,

Jennifer Mitchell

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EXECUTIVE SUMMARY

Virginia House Bill 30 (HB30) instructed the Commonwealth Transportation Board's Rail Committee (CTB Rail Committee) to review the Virginia Railway Express (VRE) System Plan 2040 and other long range planning efforts to determine:

- Long-term financial viability of the service;
- Ability to maintain appropriately costed-services to sustain and expand market share;
- VRE's impact on traffic volumes on the Interstate 66 and Interstate 95/395 corridors of statewide significance.

As part of their planning, VRE has supplemented System Plan 2040, with a Strategic Financial Forecasting (SFF) effort. Through this exercise the agency identified a significant funding need to meet operational plans by 2040. In consultation with the CTB Rail Committee, the Department of Rail and Public Transportation (DRPT) conducted a review of VRE's System Plan 2040 and the SFF planning and forecasting efforts. This report finds that concerns regarding a future funding gap are justifiable, and a threat to maintaining VRE's ability to keep up with future growth in the I-95 and I-66 corridors. The executive summary provides a more concise version of the findings and recommendations discussed in more detail throughout this report.

Ridership

- VRE has experienced steady ridership growth over the past two decades.
- Ridership tripled from just fewer than 6,000 in fiscal year 1993 to 19,000 in fiscal year 2013, showing VRE service fills a demonstrated need.¹
- Ridership has remained above 19,000 in 2014-2015.
- Ridership is expected to grow at an annual rate of 2 percent through 2020, 1.9 percent from 2020 to 2030, and about 1 percent from 2030 to 2040.

The review of the 2040 plan finds VRE's ridership projections are consistent with regional growth expectations and utilize accepted forecasting methodology. The system is poised to see significant gains in ridership by 2040 – proportional to the level of investment in their system.

Operation & Maintenance Costs

- VRE's cost escalation assumptions are in line with historical data and assume lower cost associations that align with low inflation rates over the past decade.
- VRE's Operating Expense per Vehicle Revenue Hour (\$985.91) is close to the national average (\$913.89).
- VRE's Operating Expense per Unlinked² Passenger Trip (\$14.84) is below the national average (\$21.59).

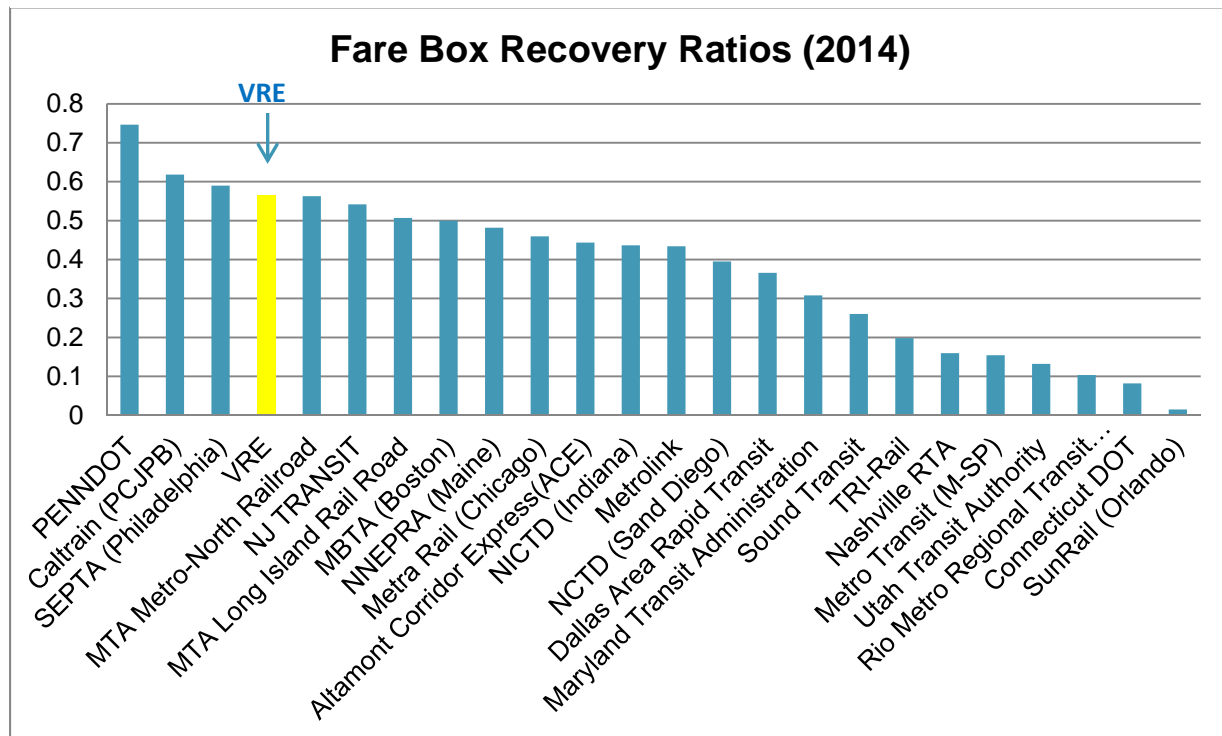
¹ <http://www.vre.org/vre/assets/File/2040%20Sys%20Plan%20VRE%20finaltech%20memo%20combined.pdf>

VRE’s current O&M costs fall within industry norms and the service maintains a strong farebox recovery ratio which, given cost comparisons with the national average, indicates an efficiently provided service. While the current costs structure and projected growth is reasonable, the growth of these costs is expected to exceed revenues in the future.

Farebox Revenues

- VRE’s farebox recovery ratio is greater than 50 percent and compares favorably with other systems. This ratio along with increasing levels of ridership indicates that VRE is providing appropriately costed-services.
- VRE assumes a 3 percent biennial growth in farebox revenues in the SFF, compared to the original System Plan 2040 5 percent biennial growth assumption. The three percent assumption is more in line with historical growth.
- The three percent fare revenue growth assumption is a significant contributor to the SFF projection that O&M expenses will outpace revenues
- When adjusted for regional income, VRE’s average fare price places in the middle third compared against 23 commuter rail agencies reported in the American Public Transportation System’s 2015 database.
- This ranking may indicate some flexibility to increase fares in the future; however fare elasticities are related to congestion, gas prices, and other factors such as High-Occupancy Toll lanes. Additional analysis is required to justify a fare increase and understand the impact to overall

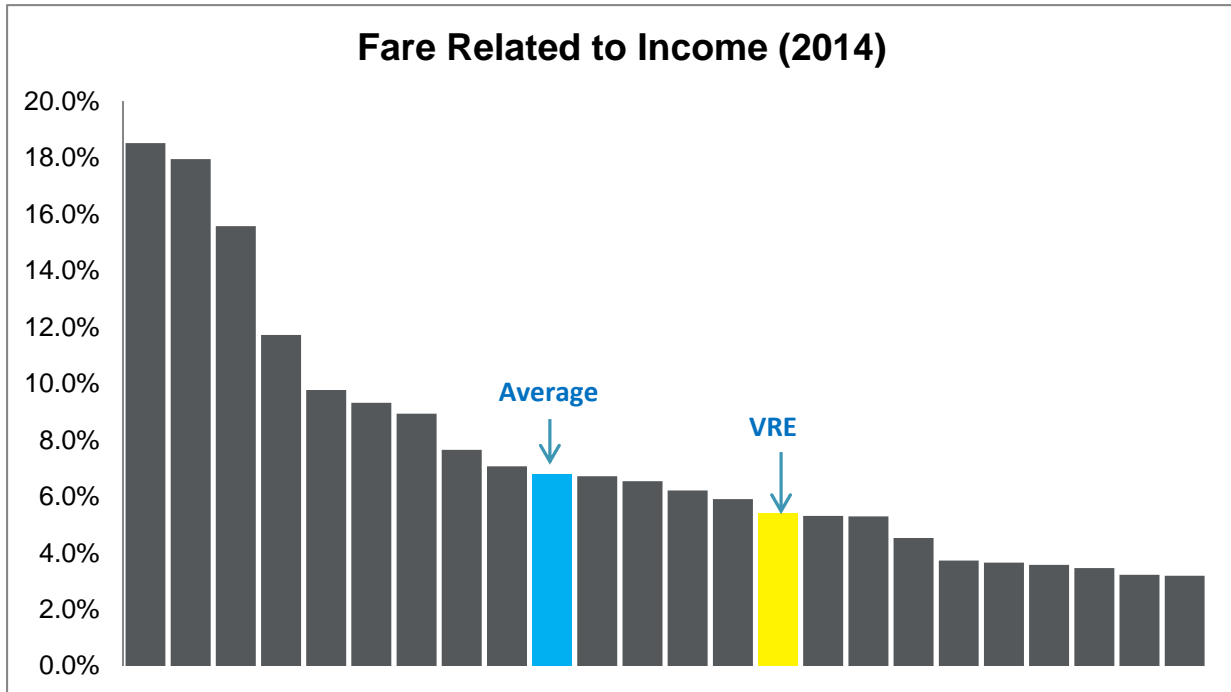
Figure 1: Fare Box Recovery Ratios (2014)



² <https://www.transit.dot.gov/ntd/ntd-data> Note: Unlinked passenger trip is a term that refers to boardings. If a person were to travel from Fredericksburg to L’Enfant Plaza and then switch trains to go from L’Enfant Plaza to Manassas, that would count as two UPT. In other contexts that journey would count as one “trip”.

ridership.

Figure 2: Fare Related to Income (2014)



Local Jurisdiction Operating Subsidies

- Growth in local jurisdiction’s subsidies has not kept pace with the growth in operating expenses. VRE has reflected this fact in their revenue assumptions.

While the System 2040 Plan assumed 5 percent growth biennially from local jurisdiction subsidies, the agency’s 3 percent revised assumption reflects recent trends. **VRE should continue to pursue increased local jurisdiction support through its Operations Board to achieve revenue growth that keeps pace with expense growth.**

State Operating Subsidies

- VRE’s assumptions hold state funding levels constant going forward.
- Approximately 9 percent of VRE ridership is from localities not contributing to VRE operations; it is clear that VRE provides a service of both regional and statewide significance.
- Ridership tripled from just fewer than 6,000 in fiscal year 1993 to 19,000 in fiscal year 2013, showing VRE service fills a demonstrated need.³

State revenues have fluctuated from year to year, but on average have remained constant. **Maintaining growth in state operating subsidies consistent with the Consumer Price Index (CPI) would help mitigate VRE’s operating funding challenges.**

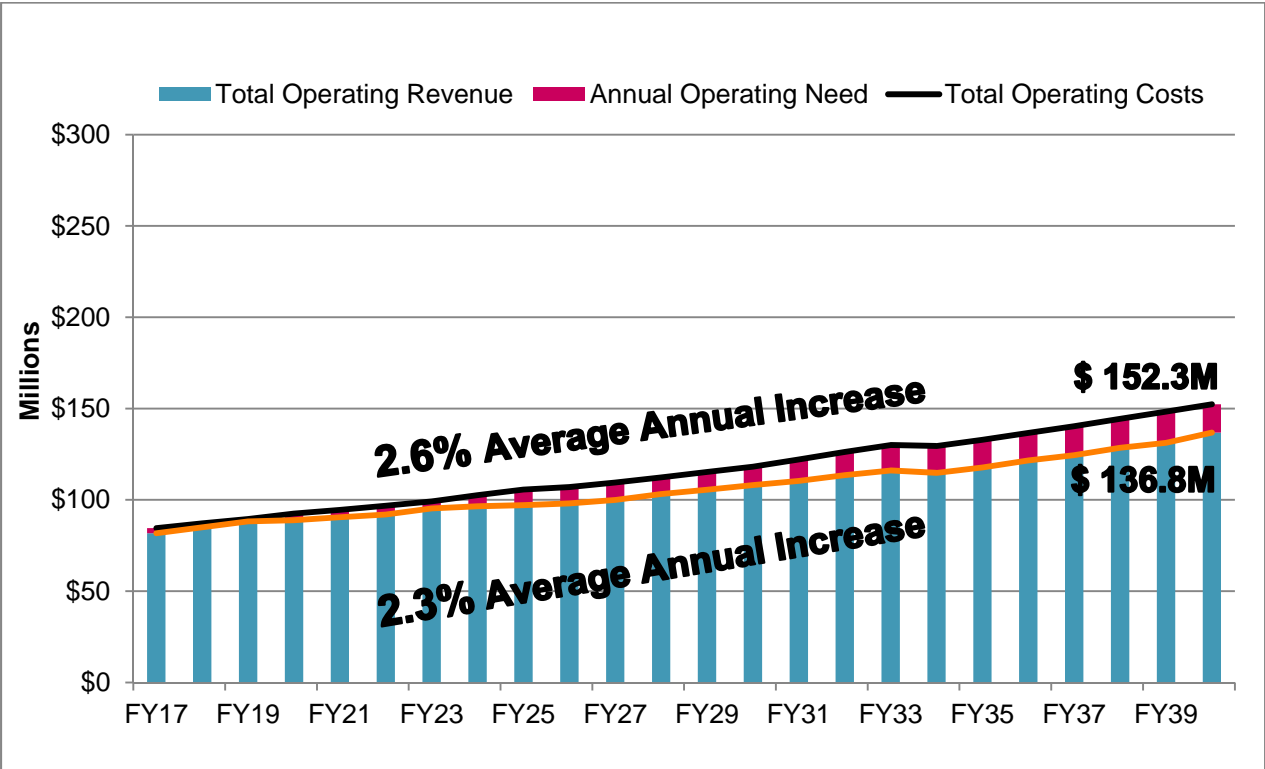
³ <http://www.vre.org/vre/assets/File/2040%20Sys%20Plan%20VRE%20finaltech%20memo%20combined.pdf>

Long-Term Financial Viability Assessment

- VRE’s concerns regarding the long-term financial viability of the service are founded.
- Just to accommodate the Natural Growth scenario (projected to be 31,100 daily riders by 2040), a proportional level of investment would require as much as \$3.2B in capital funding of which \$806M is funded, \$1.5B is potentially funded \$871M is unfunded. The need for additional annual operating funds would rise to \$15.5M by 2040.

The pending depletion of Capital Projects Revenue (CPR) bond funds threatens even existing levels of capital funding. Currently CPR funds provide a large portion of the Commonwealth’s matching percentage. These funds are scheduled to run out following FY2019. If a new source of funding is not found to support the Commonwealth’s on-going participation under SB1140, by FY2020 state transit revenues will only meet approximately 10% of the total need.

Figure 3: Annual Operating Need - Natural Growth Scenario



While some of VRE’s specific forecasting assumptions would benefit from further analysis and refinement, the current analysis is sufficiently robust to conclude refinements will not change the underlying dynamic of the system requiring capital and operating funding beyond what is currently available. **From the review, it is clear that additional capital and operating funding is needed to maintain and expand the VRE system.**

Impact on Interstates 66, 95, and 395

- Through avoided highway construction and highway maintenance costs, VRE provides an alternative transportation option to congested highway travel, which has economic benefits to the Commonwealth.
- VRE's existing ridership provides service levels similar to 36 lane miles of interstate which could be valued as high as \$3.4-5.4B based upon costs estimates for the I-66 Corridor Improvements Program.
- VRE's Natural Growth scenario provides service levels similar to approximately 58 lane miles of interstate which could be valued as high as \$5.5-8.7B.
- The full implementation of System Plan 2040 could have a significant positive effect on traffic volumes in two Corridors of State-wide Significance (CoSS): I-95 and I-66.
- This benefit equates to as much as 96 lane miles of travel demand today which could be valued as high as \$9-14B.
- In comparison, the projected capital cost for VRE's System Plan 2040, which will provide a similar service level to 96 lane miles of interstate, is \$4.1B.
- The capital investments required for the System Plan 2040 build out would also benefit freight users and allow additional Amtrak services; therefore it is reasonable to assume VRE would not be the only agency responsible the total cost of \$4.1B.
- The cost to close the funding gap (\$15.5M annually by 2040) is far less than just the construction of a mile of interstate in the I-66 corridor (\$95M/mile).

Existing VRE service is equivalent to about 36 miles of interstate capacity, worth up to \$5.4B.

Improving mobility in the I-66 corridor and I-95 corridor is about moving people and has financial benefits to the Commonwealth. Congested roadways lead to significant economic costs. The costs associated with traffic congestion typically include delays and uncertainties in expected trip times, along with fuel consumption. The Texas A&M Transportation Institute reports that the annual cost of congestion due to these factors in the U.S. in 2014 was approximately \$160B while the figure for the Washington urban area was approximately \$4.6B. As significant as these numbers are, they do not include additional costs that can also be considered as part of the full cost of congestion such as: emissions, (environmental cost), accidents (safety cost), and vehicle operations (maintenance cost), which could be as much as \$2.5B. If these costs were included, minimizing congestion along I-66 and I-95 would have an even greater value to the Commonwealth. Additionally, due to the extensive amount of adjacent development and residential neighborhoods, it is unlikely that I-66 or I-95 could feasibly be expanded to accommodate the capacity that VRE provides.

VRE provides considerable complementary capacity to two highly-congested corridors of statewide significance, both of which provide tremendous economic benefits for the Commonwealth. VRE does this at a price competitive to the cost of building additional lanes miles. In addition, VRE investments avoid significant negative consequences like extended NEPA processes, ROW acquisition, loss of tree canopy, and increased delay times for SOV users due to accidents.

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INTRODUCTION/BACKGROUND

Purpose & Approach

In 2016, the Virginia General Assembly adopted House Bill 30 (HB30), which contained the following directive for the Commonwealth Transportation Board (CTB):

The Commonwealth Transportation Board's rail subcommittee shall review the long range service plan and financial analysis of Virginia Railway Express and assess the conclusions of that analysis with respect to the long-term financial viability of the service, their ability to maintain appropriately costed-services to maintain and expand market share, and the Virginia Railway Express's impact on traffic volumes on the Interstate 66 and Interstate 95 / 395 corridors of statewide significance. The Board shall consult with interested stakeholders and report its findings to the Secretary of Transportation, and the Chairmen of the House Committees on Appropriations and Transportation and the Senate Committees on Finance and Transportation no later than November 15, 2016. (HB30 (Chapter 780), Part 1, Item 436, N)

In response to the General Assembly's request, the Commonwealth Transportation Board Rail Committee (CTB-R) tasked the Department of Rail and Public Transportation (DRPT) to perform the required review. This report provides a summary of DRPT's review and analysis.

To address the questions raised by HB30, DRPT:

- Reviewed System Plan 2040 ridership projections and assumptions;
- Reviewed System Plan 2040 financial assumptions related to system costs and revenues; and
- Formulated findings with CTB Rail Committee members.

Virginia Railway Express Overview

Virginia Railway Express (VRE), a regional commuter rail service, is a joint project between two state transportation commissions – the Northern Virginia Transportation Commission (NVTC) and the Potomac and Rappahannock Transportation Commission (PRTC), both of which are represented on the VRE Operations Board. VRE service began in 1993, with daily operations and capital costs funded through fare revenues, along with local, state, and Federal sources.⁴

VRE operates two rail lines that begin in Washington, DC and diverge after VRE's Alexandria station. The 54-mile Fredericksburg Line operates from Washington, DC to Fredericksburg, VA and the 35-mile Manassas Line operates from Washington, DC to Manassas, VA.⁵ The Fredericksburg line continues on CSX-owned track, following Interstate 95 (I-95) and the Potomac River until terminating five miles south of downtown Fredericksburg in Spotsylvania County.⁶ This line has 13 existing stations and one additional station at Potomac Shores that is scheduled to open in 2017. VRE operates 14 trains each day on the Fredericksburg line, carrying 11,000 riders a day, with a one-way trip scheduled to take 84

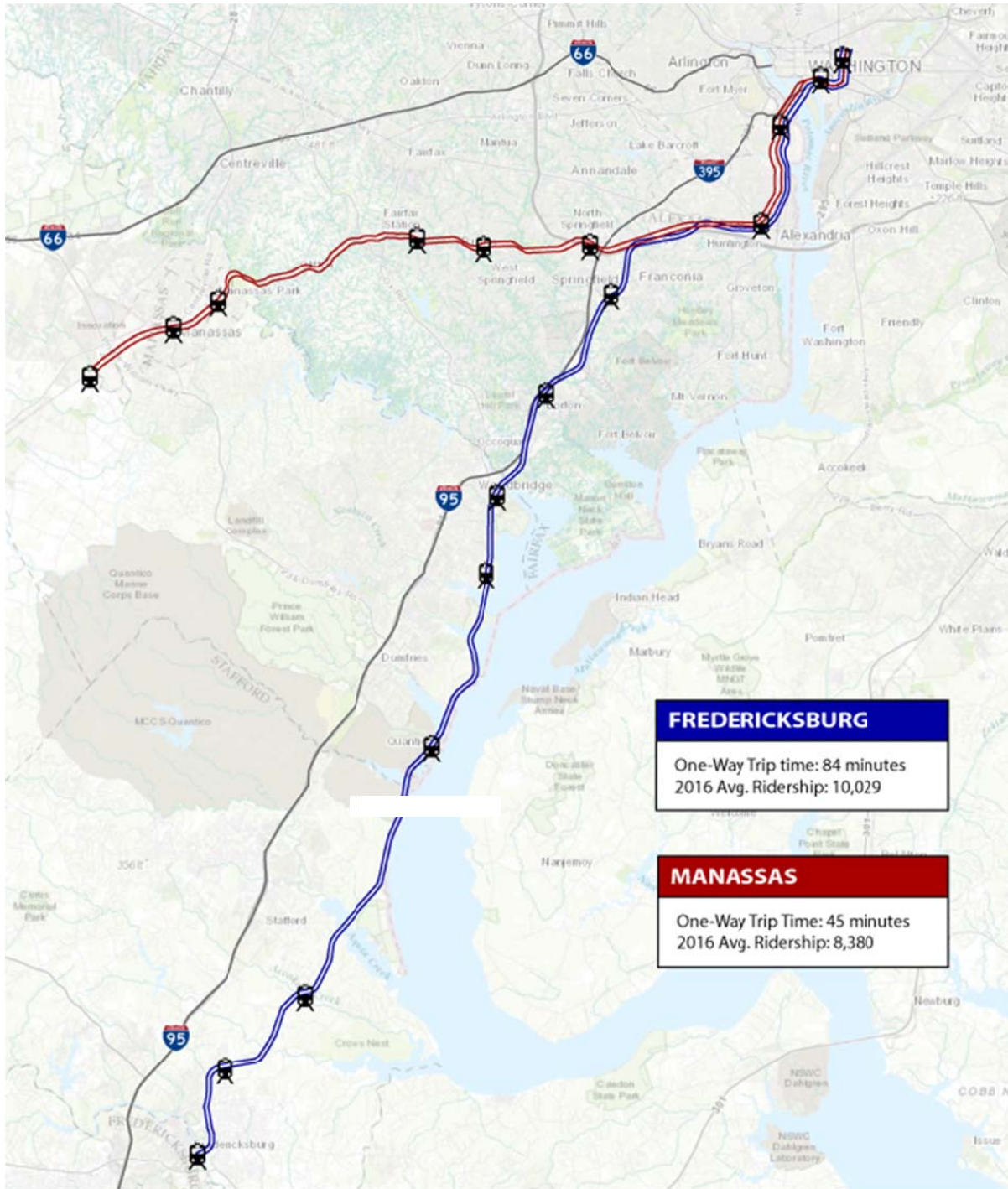
⁴ <http://www.vre.org/vre/assets/File/VRE-Chronology.pdf>

⁵ http://www.vre.org/vre/assets/File/gainesvillehaymarket/Final_AA_Report.pdf

⁶ http://www.vre.org/vre/assets/File/gainesvillehaymarket/Final_AA_Report.pdf

minutes.⁷ The Manassas Line runs west from Alexandria to parallel Interstate 66 (I-66) into the cities of Manassas Park and Manassas.⁸ The Manassas line's 16 trains per day carry approximately 9,000 riders, stopping at 10 stations. A one-way trip is scheduled to take 45 minutes.⁹

Figure 4: VRE System Map



⁷ http://www.vre.org/vre/assets/File/gainesvillehaymarket/Final_AA_Report.pdf

⁸ http://www.vre.org/vre/assets/File/gainesvillehaymarket/Final_AA_Report.pdf

⁹ http://www.vre.org/vre/assets/File/gainesvillehaymarket/Final_AA_Report.pdf

Service on both lines operates weekdays - Inbound trains to Washington, DC depart during the morning peak periods from 5:00 AM to 8:00 AM; and outbound trains depart Washington, DC during the evening peak periods from 4:00 PM to 7:00 PM. VRE's current agreement with its host railroads (CSX and Norfolk Southern) does not allow VRE to operate on weekends.

Funding Overview

Operating Funds

Operating funds for VRE come from user fares and local jurisdiction subsidies as well as state and federal sources.

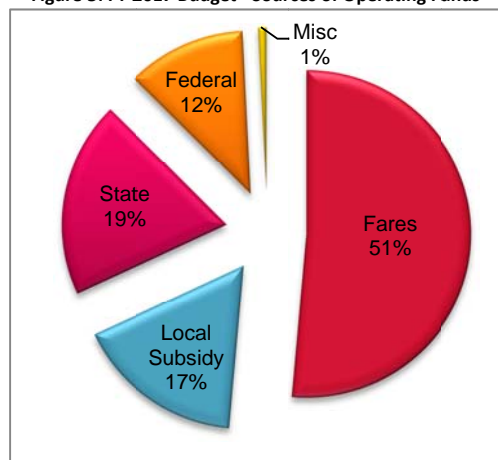
VRE has a record of strong farebox performance, recovering over 50 percent of operating costs from fares. This recovery ratio places VRE as 4th highest nationally for commuter rail systems¹⁰. Local jurisdiction subsidies are based largely upon the VRE Master Agreement. Generally, each jurisdiction within Northern Virginia Transportation Commission (NVTC) and Potomac and Rappahannock Transportation

Commission (PRTC) contribute to VRE based upon ridership from that jurisdiction. Of the areas within the Commission footprints, Arlington County and the City of Alexandria do not participate based upon the Agreement's ridership formula; however, they do provide a subsidy. Additionally, Loudoun County and the Cities of Fairfax and Falls Church do not provide any subsidy. Counties outside of the NVTC and PRTC footprints¹¹ also do not provide any subsidy, although some of their residents do use the system. According to a 2010 survey by VRE, between 8 and 9 percent of riders come from jurisdictions currently not providing an annual subsidy payments.

State operating funding for VRE is provided by the Commonwealth of Virginia through DRPT. Operating funds include annual appropriations from the Mass Transit Trust Fund for general operating support which are paid on a matching basis, as well as specific support for the payment of track access fees paid to Class 1 Railroads for use of their tracks. Federal operating funds are primarily through the Surface Transportation Program (now called the Surface Transportation Block Grant program or STBG under FAST Act) with a small amount of funding coming from other federal formula programs. Figure 5 summarizes the sources of VRE operating funds for FY 2017.

State operating funding for VRE is provided by the Commonwealth of Virginia through DRPT. Operating funds include annual appropriations from the Mass Transit Trust Fund for general operating support which are paid on a matching basis, as well as specific support for the payment of track access fees paid to Class 1 Railroads for use of their tracks. Federal operating funds are primarily through the Surface Transportation Program (now called the Surface Transportation Block Grant program or STBG under FAST Act) with a small amount of funding coming from other federal formula programs. Figure 5 summarizes the sources of VRE operating funds for FY 2017.

Figure 5: FY 2017 Budget - Sources of Operating Funds



¹⁰ <https://www.transit.dot.gov/ntd/ntd-data>

¹¹ NVTC is composed of Arlington, Fairfax and Loudoun Counties and the Cities of Alexandria, Falls Church and Fairfax. PRTC is composed of Prince William, Stafford and Spotsylvania Counties and the Cities of Manassas, Manassas Park and Fredericksburg.

Capital Funding

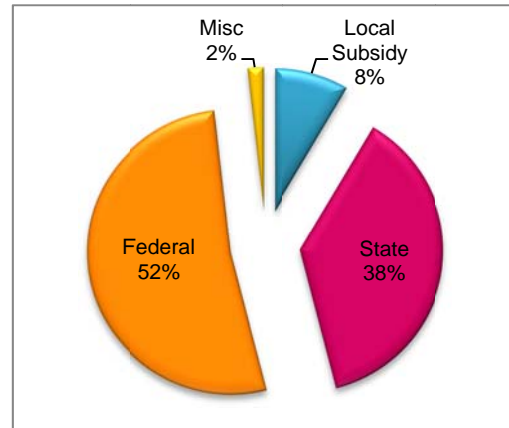
In the Commonwealth of Virginia, local capital dollars are supplemented by three primary sources: direct Commonwealth funding, regionally allocated funds and federal funds.

Direct Commonwealth transit capital funding is provided under the SB1140 tiered funding approach that applies to transit systems statewide. Currently, under SB1140 and guidelines established by the Transit Service Delivery Advisory Committee (TSDAC), Virginia House Bill 2313 (HB2313) funds can be applied to the non-federal capital share at levels of 17 percent (Tier 3), 34 percent (Tier 2), and up to 68 percent (Tier 1).

House Bill 2313 (HB2313) provides funds for regional transportation priorities. Of HB 2313 - generated funds, 70 percent are administered and competitively allocated by the Northern Virginia Transportation Authority (NVTA). As a result, it is expected that VRE, local, or NVTA revenue sources will be available to match federal and/or state sources for planned projects that fall within the NVTA area. VRE projects outside of the NVTA area would not be eligible for these funds.

Federal formula funds under the Federal Transit Administration's (FTA) 5307 and 5337 programs are administered through DRPT and serve as another annual source of federal capital funding to VRE with PRTC serving as the grantee. The chart on the previous page summarizes the sources of VRE capital funds for FY 2017.

Figure 6: FY 2017 Budget - Sources of Capital Funds



System Plan 2040

In response to growing demand for its services, VRE completed an updated system plan in early 2014. System Plan 2040 identifies a number of measures to expand system capacity and describes a logical sequence of VRE service expansion in different phases. The investments in the plan are grouped into three phases, all to be completed by 2040:

- **Phase 1** (Maximizing VRE Service with Existing Railroad Agreements) consists of projects that can be accomplished by 2020. The projects are presently a part of VRE's FY2015-20 Capital Improvement Program (CIP) and will maximize current capacity and service, as allowed by CSX and NS railroad agreements, including plans to:
 - Lengthen existing peak trains to add seats;
 - Add an additional round trip on each of the Manassas and Fredericksburg lines;
 - Increase station parking; and
 - Improve station facilities to accommodate longer trains.
- **Phase 2** lasts from 2021-2030 and includes projects to relieve capacity for VRE's key bottlenecks, such as the Long Bridge crossing of the Potomac River. These projects will allow for improved long-term system capacity through additional peak hour trains and the Gainesville-Haymarket extension.
- **Phase 3** lasts from 2031 to 2040 and includes higher-cost capital projects to facilitate continued ridership growth, such as completion of triple tracking the CSX main line between Alexandria and Spotsylvania.

The planned projects correspond to other service improvements over the three phases. As noted within the capital improvement discussion, Phase 1 would increase service and peak capacity within existing railroad agreements. Phase 2 would expand beyond existing railroad agreements and extend to new travel markets by adding reverse direction peak period trains on both lines and adding mid-day and evening trains with bi-hourly frequency. Phase 3 as described in the plan would increase mid-day and evening trains to hourly frequency, and add weekend service and run-through service with the Maryland commuter rail system, MARC. However, while weekend service was included in System Plan 2040 and reviewed as part of this exercise, the VRE Board has subsequently determined that weekend service will not be feasible in the foreseeable future and therefore the agency is not pursuing the addition of weekend service to its operations.

Phases 2 and 3 are often grouped together because they contain medium and longer-term plans which package multiple capital and service improvements together to take advantage of operating efficiencies and the capacity generated by the major railroad infrastructure investment programs. It is important to note that these major capital improvements, most notably the Long Bridge in Phase 2 and triple tracking along the Fredericksburg line in Phase 3, will add railway capacity that will not only benefit VRE's operations, but will also contribute to the reliability and efficiency of other users in the corridor such as CSX, Amtrak and future higher speed rail service.

Table 1: System Plan 2040 Capacity Investments by Phase

	Phase 1 2015-2020	Phase 2 2021-2030	Phase 3 2031-2040
Stations			
Platform lengthening	✓	✓	✓
Second platform at existing stations	✓	✓	✓
Parking expansion	✓	✓	✓
New stations	✓	✓	
Rolling Stock			
Additional passenger coaches and locomotives	✓	✓	✓
Yards and Shops			
Increase storage at Crossroads and Broad Run yards and at Washington Union Terminal	✓	✓	✓
Storage yard on Gainesville-Haymarket branch		✓	
Equipment maintenance facility expansion	✓		
VRE Service Extension			
11 miles from Manassas to Gainesville and Haymarket on Norfolk Southern rail line		✓	
Capacity in Long Bridge Corridor			
4-track mainline between Washington DC and Alexandria to handle heaviest service density		✓	
Replace or expand existing 2-track Long Bridge across the Potomac River		✓	
Reconfigure VRE stations at L'Enfant, Crystal City, and Alexandria for bi-directional service		✓	
CSX Fredericksburg Line Capacity			
Triple track remaining Fredericksburg Line segments between Franconia-Springfield and Fredericksburg	✓	✓	✓
4 th track at critical locations			✓

Potential Benefits of Plan Implementation

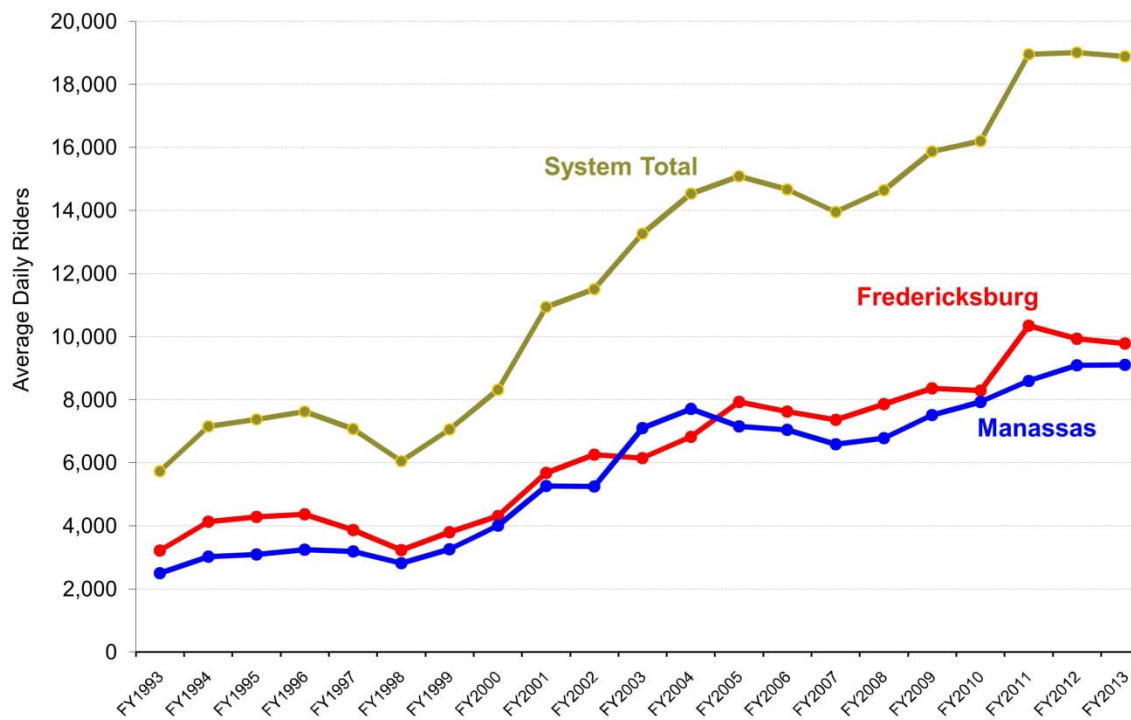
VRE has seen steady ridership growth over the past two decades. Average daily ridership more than tripled from just under 6,000 in fiscal year 1993 to around 19,000 in fiscal year 2013, showing that VRE service fills a demonstrated need.¹² Ridership levels have remained above 19,000 during 2014 and 2015. Based upon VRE's projections, the major components of all three phases of System Plan 2040 will allow the system to increase ridership levels while maintaining similar levels of efficiency as indicated by ridership levels, use of the rail facilities, and cost (farebox) recovery ratio. Table 2 shows VRE's projections.

¹² <http://www.vre.org/vre/assets/File/2040%20Sys%20Plan%20VRE%20finaltech%20memo%20combined.pdf>

Table 2: Summary of Effect of Packages on VRE Efficiency

VRE Scenario	Ridership	Rail facility efficiency	Cost recovery ratio
Short-Term Improvements to add capacity within existing agreements (Phase 1)	+30%	Similar to current	Improved
Gainesville-Haymarket Extension (Phase 2)	+10-20%	Similar to current	Improved
Medium and Longer-Term Service Improvements (Phase 2 and 3)	+75-125%	Improved vs. current	Maintainable over 50%

Figure 7: VRE Weekday Trips by Line, FY 2000-2013¹³



In addition to these efficiency claims, VRE posits that implementing System Plan 2040 will provide passenger capacity equivalent to two traffic lanes in two Virginia Corridors of Statewide Significance (CoSS; I-95 and I-66). These claims will be further discussed in the section on Ridership Analysis.

Also, as noted in System Plan 2040, railroad capacity improvements will benefit all rail users:

...the railroad capacity investments will benefit not only VRE but also the Commonwealth of Virginia and Amtrak, by enabling expansion of regional and intercity passenger service, and the freight railroads. It is expected that VRE would only be responsible for a portion of the total capital cost to expand the railroad capacity and other beneficiaries of the capacity expansion would also pay a share of the cost.

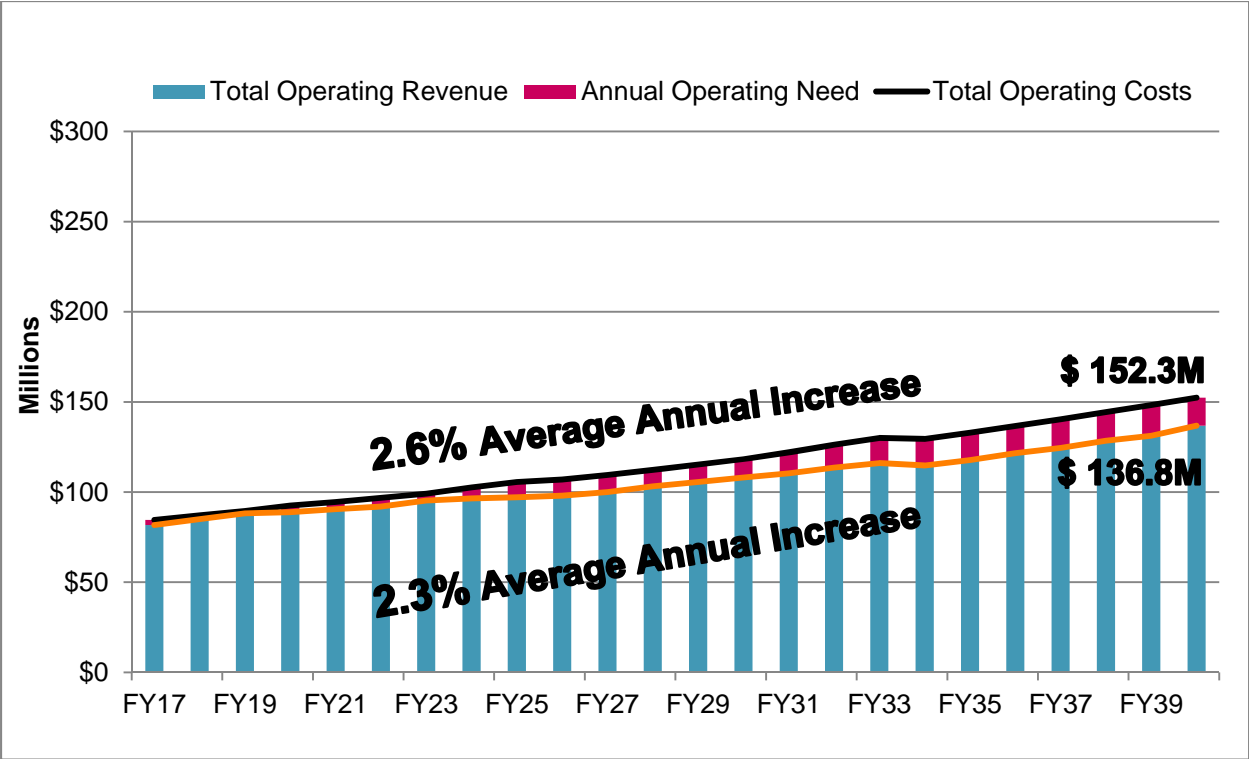
¹³ VRE System Plan 2040 Study

Financial Outlook

To plan for the future, VRE recently developed a long-term Strategic Financial Forecast (SFF) to supplement System Plan 2040. The SFF is a tool used by VRE to generate and examine the financial consequences of different scenarios. These scenarios range from full implementation of System Plan 2040 on the high end to a “Financially Constrained” model on the low end. By evaluating these various scenarios through the forecasting model, VRE intends to show the potential operating and capital requirements of the scenario. Summary results of the SFF effort were provided to DRPT for analysis as part of the overall effort related to HB30.

A primary objective of this analysis is to evaluate the long-term financial viability of VRE’s operations. It is important to note that the agency itself maintains that its financial outlook is extremely challenged. Regardless of the scenario evaluated, the SFF effort indicates VRE’s operating expenses are projected to increase faster than current revenue sources, thereby creating a need for enhanced or new sources of operating funding to maintain service on the system. As noted elsewhere in this report, VRE has generally recovered 50 percent or more of its operating expenses from fares paid by users. VRE anticipates that this level of farebox recovery will be maintained; however, the other sources of operating revenue that VRE receives (federal, state and local subsidies) are not projected to grow at a rate that will sustain the funding level required to continue to cover the other half of operating costs. The projected inability of federal, state and local subsidies to account for ~50 percent of operating expenses will ultimately result in operating deficits. Expense items that are projected to grow more quickly than revenues are contracted train operations and track access fees.

Figure 8: Annual Operating Need - Natural Growth Scenario



VRE's "Financially Constrained" scenario provides the clearest indication of this need. Under the assumptions for this scenario, it is assumed that no additional revenue is available for the system beyond minimal levels of increased fares and local government subsidies (3 percent biennially) and that service is modified to prevent operating deficits. Given these assumptions, VRE projects that the system would ultimately wind down operations by 2033, potentially diverting thousands of daily trips from rail to the I-66 and I-95/395 corridors as the agency is forced to repeatedly cut operating expenses to match more slowly growing revenues. Intended to provide forecasts over an approximate 25 year horizon (2040), the assumptions included in the SFF are made at a high level and general in nature. Therefore, the results of these scenarios should be considered with that in mind. The next section of this report will discuss the assumptions underlying the *2040 System Plan* and the SFF and provide a more in-depth look at the SFF and its scenarios to evaluate VRE's claims relative to its financial outlook.

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ANALYSIS

This analysis of *System Plan 2040* and SFF focuses on evaluating three elements: ridership forecasting, service cost assumptions, and revenue forecasting.

Ridership Forecasting Review

Ridership forecasting serves as a key foundational element for System Plan 2040 and the SFF. Ridership forecasts factor into projecting the system's future costs, revenues, and benefits. Due to the importance of these elements in understanding VRE's outlook, the analysis first examined the methodology and results of the ridership forecasts developed for System Plan 2040. While VRE continues to update its ridership forecasts, the review focuses on the most complete forecast available—the one prepared for System Plan 2040, and is consistent with assumptions for the SFF. The review was conducted at two levels:

- Overall forecasting methodology and underlying assumptions
- Ridership results in terms of general reasonableness and sensitivity to different service attributes

Each component of the aforementioned service improvements would have a positive impact on the system ridership. VRE's approach quantifies these impacts in an incremental fashion using simplified and technically defensible sketch planning methods. In any ridership forecasting method, there will always be uncertainties associated with underlying assumptions. For example, forecasted population and employment may not materialize as expected. There could be an unexpected upturn or downturn in the regional economy that could affect transit demand. It is also possible the assumed levels of service improvement may not take place due to various reasons, such as funding issues.

To account for these uncertainties, VRE assumed both conservative parameters and modestly aggressive parameters to estimate lower bound and upper bound ridership estimates. The most likely estimates are somewhere in the middle of the reported range. This type of approach in which a range of potential ridership is identified, as opposed to an absolute number, is highly recommended in the forecasting industry and endorsed by the FTA.

Ridership Forecasting Methodology and Underlying Assumptions

Transit planning studies involving line-haul systems use regional travel demand models as the basis of forecasting rail ridership. Frequently forecasts for commuter rail systems augment their ridership analysis with additional models. For VRE's System Plan, the initial analysis applied the Metropolitan Washington Council of Governments (MWCOC) travel model to estimate ridership for different phases. However, not surprisingly, it was found that the MWCOC model was not calibrated against existing MARC and VRE ridership and therefore substantially underestimated actual ridership on those services. For this reason, an alternative (sketch planning) approach was adopted by VRE to forecast ridership for the different phases.

The alternative approach adopted relies upon analyzing underlying service improvements planned for the different phases while also examining the schedule, infrastructure, and rolling stock assumptions used in the ridership analysis to assess consistency with VRE's long-term plans. Based on a discussion with VRE, DRPT's review clarified and confirmed the assumptions used in VRE's System Plan, particularly relating to hours of operation, train run times, layover times, level of Amtrak and freight service, Long Bridge capacity, commuter parking expansion, and Union Station's capacity to handle the projected ridership.¹⁴

Ridership Results

The sketch planning approach VRE used in estimating future rail demand was specifically designed to provide an order of magnitude of potential ridership to assist in conceptual planning. Accordingly, DRPT's review of ridership results was conducted at an equivalent level.

Seven sources of ridership growth were identified in VRE's System Plan 2040. This review looks at each component of the analysis to assess the soundness of the methodology.

- Natural growth attributable to demographic and land use growth
- Increased frequency (20-minute and 15-minute headway service)
- Skip-stop service
- Gainesville-Haymarket extension service
- Reverse peak service
- Off-peak hourly service
- Weekend ridership

Natural Growth

The natural growth in VRE ridership is growth attributable to the region's population and employment growth through the forecast period. This growth is more specifically tied to the projected increase in population in counties within the VRE commuter shed, as well as to the projected employment levels in the District of Columbia. System Plan 2040 assumes VRE ridership will grow at an annual rate of about 2 percent during the 2010-2020 timeframe, 1.9 percent during 2020 to 2030, and about 1 percent during 2030 to 2040. This assumption holds that in the absence of major service improvements, the current VRE commute mode share would continue into all study years. In reality, the future year mode shares may actually increase as the region's highway system becomes more congested due to demographic growth; if this were to occur, the initial estimate may actually be somewhat conservative (low).

As part of this analysis, DRPT independently summarized the population growth rates for an eight-mile buffer area around VRE rail alignments, using the demographic data contained in MWCOG's population and employment forecasts, Version 8.14. Though not identical, DRPT's estimated growth rates proved to be about the same as those used in VRE's System Plan. **Considering VRE's Systems Plan 2040 is a high level planning study, VRE's estimate of ridership attributable to Natural Growth is valid, even though there are slight changes in recent projections of MWCOG's growth rates.**

¹⁴ VRE Manager of Project Development Christine Hoeffner on June 22nd, 2016

Increased Frequency (15-min and 20-min headway service)

The average peak period headway on the existing schedule for Fredericksburg is 22.85 minutes and for Manassas it is 27.5 minutes. VRE's plan for Phase 2 and Phase 3 includes providing more frequent trains in the peak direction by reducing peak headways to 20 minutes and 15 minutes, respectively. The ridership increase associated with such headway reductions was estimated by applying headway elasticities to the base ridership. The elasticity value (-0.40) used by VRE is consistent with industry standards.¹⁵ **Therefore, the estimated ridership increase attributable to improved headways is reasonable.**

Skip-Stop Service

To estimate the effect of skip-stop service, the analysis for System Plan 2040 assumed varying amounts of travel time savings for passengers traveling from the outer and middle areas of the Fredericksburg line and from the middle areas of the Manassas line. On average, 8 percent time savings is estimated for passengers on the Fredericksburg line and 5 percent savings on the Manassas line. The ridership increase associated with the travel time savings was computed through the application of travel time elasticity. Based on the results reported, the implied travel time elasticity is -0.40. This value is consistent with empirical data. **DRPT reviewed the magnitude of travel time savings for each VRE line, the weighted average time savings, and the resulting increase in passengers and concluded they are reasonable.**

Reverse Peak Service

Reverse peak service would be successful only if there are sufficient employment opportunities within walking distances from the rail stations or if frequent and convenient transit connections to/from employment centers to/from the rail station are available. MWCOG's land use forecasts indicate the growth in employment in outer areas along VRE lines is about 72 percent between 2010 and 2040. Strong employment growth in certain areas such as Fort Belvoir, Marine Corps Base Quantico, Potomac Shores Development, Fredericksburg City, Prince Williams County Innovation Business District, and George Mason University Campus provides opportunities to increase reverse commuter trips. MWCOG's employment forecasts were used as the starting point for the reverse peak estimates. The total reverse trips attracted to the employment centers described above were taken from MWCOG model and the current VRE mode share was applied to compute the potential number of reverse trips. In general, the magnitude of reverse peak trips on most U.S. commuter rail systems is small, ranging from 5 to 10 percent. In this case, the total number of reverse peak trips is estimated 2,800 (approximately five percent) for 2040. **Reverse peak trips are projected to comprise approximately 5 percent of the line ridership and appear reasonable in comparison to other commuter rail systems.**

Off-Peak Hourly Service

Off-peak hourly service, especially during midday & evening, offers greater flexibility to passengers who choose to work schedules outside of the typical 9AM to 5PM window. The ridership estimate for this category is based on the experience of MARC and Caltrain systems for midday and evening passengers.

¹⁵ Victoria Transport Policy Institute (vtpi.org) and TRB's 2003 Transit Capacity and Quality of Service Manual, 2nd Edition.

Additional VRE ridership from off-peak hourly service is estimated to be about 2,550 passengers per day per line in 2040. The methodology relies heavily on the predicted response of commuters to hourly service. It ignores non-work trips that could take advantage of the hourly off-peak service. **DRPT believes the estimated ridership increase for off-peak hourly service may be overstated for work trips. However, if we include non-work trips also, then the estimated ridership appears reasonable.**

Weekend Ridership

The transit travel market for weekend trips is mostly made up of trips to special events, such as sporting events and conventions, museums, restaurants, and theaters. As the nation's capital, Washington, D.C. contains a large numbers of museums, national monuments, restaurants and theaters which draw several thousand trips a day to downtown core. By offering convenient and frequent train service, VRE has the opportunity to add a substantial number of riders during weekend days. Weekend ridership was estimated on the basis of empirical data available from the MARC system. MARC started weekend service on the Penn Line in December 2014, carrying 4,100 passengers per weekend. Four months later, in March, MTA reported carrying 6,500 passengers on weekends, up more than 50 percent, totaling about 26 percent of the average weekday riders on the Penn Line. MARC currently offers a fairly high level of service on weekends: nine round trips on Saturday and six on Sunday. Weekend service was included in System Plan 2040 and reviewed as part of this exercise. However, VRE has subsequently determined that weekend service will not be feasible in the foreseeable future and therefore the agency is not pursuing the addition of weekend service to its operations. If weekend service were pursued, the estimated 5,400 weekend trips by 2040 translate to about 10 percent of total weekday ridership. If we assume a modest level of service on weekends, then this estimate of 5,400 may be slightly high, but achievable.

Overall Reasonableness of Ridership Forecasts and Verification of Key Claims

To understand and verify the overall reasonableness of VRE's System Plan 2040 ridership projections, DRPT reviewed the historical growth in VRE ridership. As stated previously, VRE has had steady ridership growth, which has more than tripled over the past two decades, growing from just under 6,000 weekday daily riders per year in fiscal year 1993 to around 19,000 weekday daily riders in fiscal year 2013.

A significant portion of this increase occurred during the past 10 to 12 years, during which VRE implemented modest service expansions that included new rolling stock, expanded station platforms and parking, new equipment maintenance facilities at each storage yard, and completion of railroad infrastructure improvements. This observed ridership impact indicates there is significant latent demand in both Manassas and Fredericksburg corridors that could respond favorably to service improvements.

As shown in Table 3, Phase 1 of System Plan 2040 incorporates several relatively low cost improvements that have great potential to attract ridership. Since more than 90 percent of VRE passengers access the system through Park-and-Rides, an immediate expansion in parking and station infrastructure facilities has the potential to draw additional ridership. Providing additional and longer trains will ensure comfortable load factors can be maintained on long commutes on the VRE lines. As demonstrated earlier, the ridership response relative to such service improvements has been properly quantified through the use of industry approved ridership estimation methodologies.

Therefore, an increase of 6,000 trips in Phase 1 is reasonable and achievable, provided all the planned improvements are completed fully and the projected growth in the study area’s population and Washington, D.C.’s downtown employment materialize.

Table 3: Planned Service Improvements and Infrastructure Expansion for the VRE System

Infrastructure & Service Improvements	2013	Phase 1 2014-2020	Phase 2 & 3 2031-2040
Total weekday ridership	19,000	25,000	Up to 50,000
Incremental ridership	-	6,000	18,000
Service Levels	26 min /37 min AM/PM peak headway	-More trains -Longer train -More parking -Station expansion	-15 min peak service -30 min reverse peak service -Hourly off-peak service
Station and parking expansion		X	X
Rolling stock & yard expansion		X	X
Gainesville-Haymarket extension			X
Long Bridge expansion			X
Fredericksburg 3rd track		X	X

Source: VRE System Plan 2040

Phases 2 and 3 of System Plan 2040 incorporate several significant improvements to attract different travel markets. The most important is the reduction in peak service headway to 15 minutes. At 15-minutes headways, the commuter rail is approaching a light rail level of service with four to five times the capacity of light rail. At such a high frequency, on time performance tends to become less of a factor for commuting passengers because they know if they miss a train, another train would be arriving shortly. High frequency service also provides more flexibility to passengers regarding their arrival and departure times. Combining high frequency service with reverse peak trains and hourly service during off-peak periods provides a significantly more attractive transportation option compared to the heavily congested I-95 and I-66 corridors.

Therefore, an increase of 18,000 to 20,000 trips attributable to Phase 2 and 3 service and infrastructure improvements is reasonable and achievable, provided supporting infrastructure, such as commuter parking, track improvements, and station expansion are completed fully.

Given this finding, this review concludes that System Plan 2040 will allow the agency to increase its capture of travelers within the region. DRPT also extended the ridership analysis to evaluate VRE’s claim that expansion under System Plan 2040 would have a significant effect on the CoSS of I-95 and I-66. As mentioned earlier, the ridership forecasts were not developed using the regional travel model. Therefore, the impact of VRE service improvements on I-95 and I-66 could not be obtained directly from the travel model. However, based on some simple assumptions regarding freeway capacity, DRPT was able to equate VRE’s passenger carrying capacity to highway capacity.

As shown in Table 4, the VRE system would be capable of transporting about 7,000 passengers per hour to downtown Washington, D.C. during the morning rush period in 2040. The carrying capacity of a modern freeway can range as high as 2,300 cars per hour per lane. (Most freeways operate at levels below 2,000 cars per hour per lane, making this a conservative exercise). DRPT’s analysis shows roughly three freeway lanes (7,000 / 2,300 = ~3 lanes) would be needed to provide the same person-carrying

capacity as VRE in 2040 over an average trip length of about 32 miles. **In other words, the passenger miles traveled on the VRE system during the morning rush hour would be roughly equal to the person miles travelled on approximately 96 lane miles (32 x 3) of freeway in one hour.**

Table 4: Comparison of Person Carrying Capacity- VRE versus Freeways

2040 Ridership statistics (projected)		Freeway Parameters	Freeway Capacity
Weekday ridership	50,000	Capacity of freeway lane	2,300 vehicles per hour
Inbound ridership	25,000	Average auto occupancy	1.15
AM Peak period ridership (apply 85% of inbound ridership)	21,000	Persons carried per lane per hour	2,650
AM peak hour ridership (assume 3 hour AM peak)	7,000	Number of lane capacity needed to carry 7,000 VRE passengers	3 lanes
Average trip length on VRE system	32 miles	Average trip length on freeways (assume same as VRE)	32 miles
Passenger miles carried during AM rush hour	224,000	Number of lane miles needed	32 x 3 = 96 lane miles
		Number of persons miles traveled in 96 lane miles	254,400

Source: HDR Engineering

While the 96 lane miles of passenger capacity provided by the full 2040 Plan build-out is rather large, the benefits of the existing service are also significant. Current weekday ridership is approximately 19,000 passengers, or 38 percent of the projected 2040 ridership. Therefore, the current service provides a proportional benefit of approximately 36 lanes miles, which is roughly the distance from Haymarket to the Potomac River on I-66.

Without an appropriate level of engineering and analysis of the specific areas for expansion, it is difficult to put an estimate on the cost to implement 96 lane miles of expansion in the combined I-66 and I-95 corridors. These corridors operate in heavily developed areas and as such provide a myriad of variables that would need to be examined to produce even a planning level estimate. Nonetheless, a general idea of the potential cost of this level of expansion can be obtained by extrapolating from estimates prepared for the I-66 Corridor Improvements program (CIP). While not strictly a widening project, the I-66 CIP is representative of the level of investment likely needed to provide enhanced capacity in the I-66 and I-95 corridors. The estimate provided in VDOT’s draft term sheet indicates that 22-miles of widening and multi-modal improvements will cost between \$2.1 and \$3.3B in current year dollars. This equates to approximately \$95M-\$150M per mile. While it is difficult to create a direct mile-for-mile, lane-for-lane equivalency for the improvements being pursued in the I-66 corridor, extrapolating the I-66 budget over 96 miles (approximately 4.3 times) would produce a capital budget of \$9-14B. Similarly, replacing the approximately 36 lane miles of capacity currently provided by VRE’s service could cost \$3.4-5.4B. It is important to reiterate that these estimates do not reflect any level of engineering for a direct replacement of VRE’s current or future capacity. Rather, they provide a very basic point of reference and order of magnitude for comparing interstate expansion for commuter rail service in northern Virginia. A significant level of additional engineering should be conducted to provide the type of direct comparison between alternative improvements in interstate or rail capacity that is needed to inform a capital investment decision of this magnitude.

VRE's ability to provide this capacity during peak periods represents a significant benefit to the Commonwealth in the form of reduced congestion. This reduction would occur along two CoSS (I-95 and I-66) where peak period congestion poses a serious challenge to northern Virginia, one of the Commonwealth's main economic engines.

Congested roadways lead to significant economic costs. The costs associated with traffic congestion typically include delays and uncertainties in expected trip times, along with increased fuel consumption. The Texas A&M Transportation Institute reports that the annual cost of congestion due to these factors in the U.S. in 2014 was approximately \$160B with congestion in the Washington urban area alone totaling approximately \$4.6B.¹⁶ As significant as these numbers are, they do not include additional costs that can also be considered as part of the full cost of congestion such as: emissions, (environmental cost), accidents (safety cost), and vehicle operations (maintenance cost). If these costs were included, minimizing congestion along I-66 and I-95 would have an even greater value to the Commonwealth. An additional impact to note when comparing rail capacity to interstate expansion in northern Virginia would be the cost of right-of-way acquisition. Right-of-way acquisition would almost certainly require the use of eminent domain, resulting in schedule and cost impacts that are difficult to estimate. Additionally, potential impacts to adjacent neighborhoods, wetlands, tree canopy and other natural features could have very high costs and/or require costly and extensive mitigation measures.

While the brief analysis above indicates the potential for a significant contribution to congestion mitigation by VRE system expansion, a better understanding of the corridor's travel demand dynamics is needed for DRPT and the CTB to fully understand the impacts of VRE system expansion. One particular factor that will have an increasing impact in these corridors is the increased presence of high occupancy toll (HOT) lanes in the I-95 corridor and the introduction of new HOT lane operations on I-66. A recent working paper examining the effects of HOT lanes in Los Angeles indicates transit ridership in corridors parallel to new HOV/HOT lanes may drop by approximately 4.8 percent. Additional study in this area is needed to determine the impact of toll levels and other factors. The existing HOT lanes on I-495 and I-95 opened in 2012 and 2014, respectively. As these operations become more firmly established, they can provide data that will be useful to this analysis and helpful in understanding the potential dynamics associated with planned new HOT lanes in the corridors. Once these factors can be better understood, a more thorough analysis of the potential congestion mitigation associated with VRE service can be obtained.

In sum, VRE's projected ridership levels are reasonable and growing ridership could provide a significant positive impact on congestion levels along CoSS I-95/395 and I-66.

Long-Term Service (O&M) Costs Review

Understanding VRE's on-going service or operations and maintenance (O&M) costs is a key component of assessing long-term financial viability. As part of System Plan 2040, VRE prepared estimates for future O&M costs. Some changes were made by VRE from System Plan 2040 to the SFF effort which will form the basis of VRE's long-term financial planning going forward. Both assumptions are discussed herein.

¹⁶ 2015 URBAN MOBILITY SCORECARD. The Texas A&M Transportation Institute and INRIX August 2015.

The objective of the O&M Costs review is to evaluate the estimating processes and assumptions for reasonableness. The review was conducted at two levels:

- Overall cost estimation methodology
- O&M cost assumptions and estimates in terms of general reasonableness

Primary documentation reviewed for this task included the following:

- Virginia Railway Express System Plan 2040 Study, Parsons Brinckerhoff, February 2014
- Virginia Railway Express System Plan 2040 Preliminary Operations Analysis, Parsons Brinckerhoff, August 2014

Supporting documentation (covering the SFF) reviewed included the following:

- Strategic Financial Forecasting Presentation to the VRE Operations Board, February 19, 2016
- Strategic Financial Forecasting Presentation to the VRE Operations Board, September 18, 2015
- VRE Financial Plan Report, July 1, 2016
- VRE Financial Plan Scenario Descriptions, July 1, 2016

O&M Cost Estimation Methodology

O&M cost estimates were developed for each System Plan 2040 service scenario (Phase 1, Phase 2, and Phase 3) using a fully allocated cost model. Forecasted future unit cost estimates were derived from escalating the base year via:

- Historic costs/growth
- Contractual levels
- General inflation/CPI
- Industry sources such as the Association of American Railroads (AAR)
- Capital costs per VRE Planning estimates

A cost allocation model assumes that each expense incurred by a transit system is “driven” by a key supply variable such as revenue hours, train miles, or peak cars. Each budget expense item is assigned a supply variable, and then divided by the value of the supply variable for that year to develop unit costs. The resulting formula is then used to produce cost estimates for alternative service scenarios.

The System Plan 2040 O&M cost model was built using VRE’s fiscal-year 2013 budget data as the baseline upon which incremental costs for each service scenario were developed. Fiscal-year 2013 budget line items were allocated to one of six supply variables to develop unit costs. Quantities for each cost-driving supply input were produced based on the operating plans for each future service scenario and applied to the corresponding unit costs to arrive at the total estimated O&M cost.

Findings

The fully-allocated cost model approach is consistent with industry standards for forecasting O&M costs for existing transit modes. This approach is suitable in a long-range planning application, such as the 2040 System Plan, where the stated objective is to estimate relative change in operating cost for each service scenario against baseline costs. VRE caveats its O&M cost estimates by stating that the costs are

not to be used for budget estimating purposes, but rather to estimate relative changes in cost based on service level, as previously noted. As such, it is necessary for VRE to undertake a more rigorous O&M costing exercise for near term expenses to validate the near term budgetary implications of each scenario. The SFF was developed starting in February 2015 to provide another tool for examining future O&M costs relative to the System Plan 2040 service scenarios and the current fiscal and operating environment. While the SFF is a valuable tool for VRE’s financial planning, additional near term analyses to support the use of the SFF for near term planning may be needed.

Assessing the Reasonableness of the O&M Cost Assumptions and Estimates

The 2016 SFF model builds upon System Plan 2040. Overall, System Plan 2040 showed more aggressive cost growth assumptions than the 2016 SFF effort. Cost escalation assumptions input into the System Plan 2040 O&M cost model are summarized in Table 5, along with the assumptions input into the 2016 SFF model. To validate these figures, historical National Transit Database (NTD) data and budget was reviewed for fiscal years 2010 to 2014. According to this review, cost increase assumptions are in-line with historical data for the system or when appropriate (i.e. fuel costs) with national data. Given recent trends (past five to ten years) of low inflation and fuel prices, the decision to utilize lower cost increase assumptions for the SFF versus System Plan 2040 is a defensible approach.

Table 5: O&M Cost Escalation Assumptions

Cost Element	System Plan 2040	Strategic Financial Forecast	Notes
Track Access Fees	3.5% annual increase	CSX - 4% annual increase (contractual) NS – 3% annual increase (based on AAR growth rate) Amtrak – 3% annual increase (avg.)	AAR = Association of American Railroads
O&M Contractor Fee	3.5% annual increase	2% annual increase, driven by CPI	Contract references CPI
“Other” Expenses	3.5% annual increase	2% annual increase, driven by CPI (incl. facilities maintenance)	Also provided by contract operator
Equipment Operations	3.5% annual increase	3% annual increase (based on AAR)	
Fuel Cost	3.5% annual increase	4% annual increase	NTD fuel cost increased ~ 3.8%/ year

Source: VRE System Plan 2040, Strategic Financial Forecast

It should again be noted that planning level assumptions appropriate for a 20 year or greater horizon may not be reasonable for shorter time periods (e.g. general inflation, fuel costs). While the cost growth rates for the SFF were adjusted downward, they are still well above current levels. For instance, whereas the annual CPI growth rate (inflation) for the past two years has been less than one percent, the SFF assumes an annual inflation rate of two percent. When a broader look at historical data (over the past decade) is conducted, an average annual rate of inflation based upon the CPI is approximately 1.7 percent, indicating that an assumption of two percent annual CPI growth is reasonable for the planning period (2040) for which the forecast is being prepared. It is important to note again that long-range forecasting poses particular challenges which must be acknowledged. While the assumption provided by

VRE is reasonable and in-line with professional standards and methodologies, all forecasts pose some degree of risk. The impact of capital investments on operating expenses are an additional factor to consider when projecting future costs. VRE's analysis assumes that the capital investments required to maintain a state of good repair such as vehicle replacement are made in a timely fashion. If this does not occur, operating expenses could increase.

The basis for O&M cost estimates and the methodology for projecting future O&M cost estimates is reasonable and provides a sound basis for evaluating VRE's long-term financial viability. Additionally, VRE's actual and forecasted O&M costs are reasonable and, on this measure, the agency is providing services at an appropriate cost. To further verify the appropriateness of the agency's operating costs, VRE's Operating Expense per Vehicle Revenue Hour (\$985.91) was compared against peer jurisdictions. This analysis found that VRE is within 8 percent of the average (\$913.89) of those peer jurisdictions. VRE's Operating Expense per Unlinked Passenger Trip (\$14.84) was also compared against peer jurisdictions and found that VRE is well below the average (\$21.59).¹⁷ Finally, as the discussion on farebox recovery (below) will indicate, **VRE's strong farebox recovery ratio further indicates that the agency is efficiently providing service at an appropriate cost.**

Revenue Assumptions Review

VRE derives revenues from user (fares), local, state and federal sources. The assumptions for these revenues will be reviewed below. While not all specific sources under these categories will be discussed, the sources that are reviewed account for over 98 percent of operating revenues.

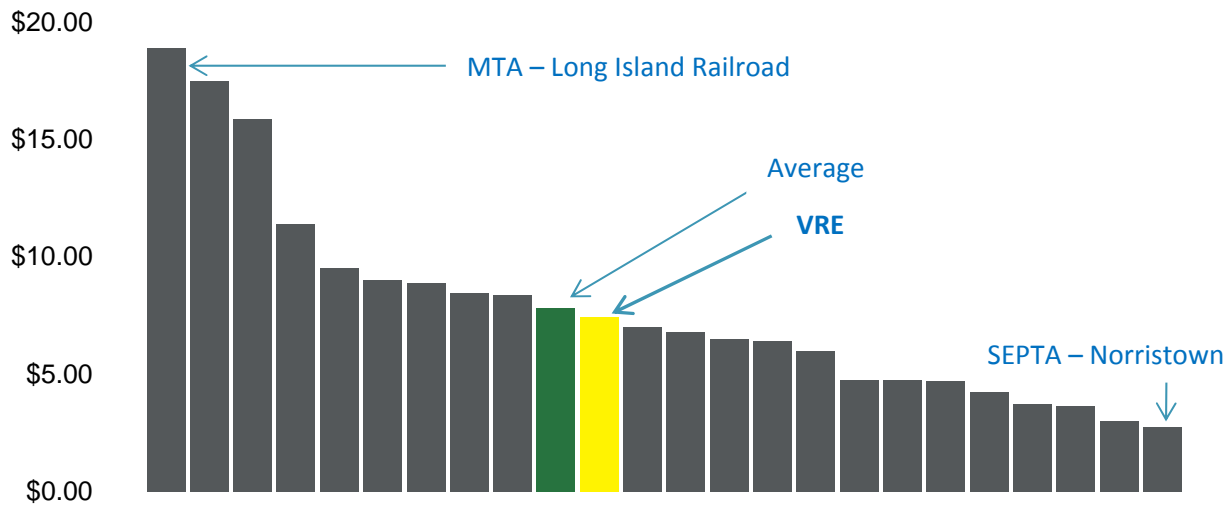
Farebox

The farebox recovery rate of a transit system indicates the proportion or percent of O&M expenses recovered from farebox revenues. As discussed above, VRE has historically performed well by this metric, achieving a farebox recovery rate of over 50 percent. A high farebox recovery rate can be indicative of an efficient operation that is carrying appropriate ridership levels while maintaining appropriate O&M costs. It can also be indicative of a high fare structure. VRE has indicated that, according to a study released by the Chicago Transit Authority (CTA), VRE's average fare is the second highest of seven systems cited in the study.

To evaluate VRE's claim, DRPT looked at NTD's 2014 data on commuter rail lines. An average was estimated based upon agency information. Using this methodology VRE's fare ranks near the middle, with the 10th highest average fare out of 23 commuter rail systems reported in the 2014 NTD. However, when regional average household incomes are taken into account, VRE falls to the 14th highest fare structure. Furthering this analysis, VRE places 4th for farebox recovery when the farebox revenue-to-overall income ratio is applied, indicating that VRE's high recovery rate is more likely attributed to its relative efficiency as opposed to having a relatively onerous fare structure. **The assertion that VRE's farebox recovery ratios are driven by an efficient operation is supported strongly by the fact that per NTD data, VRE maintains a lower operating subsidy per passenger mile than many of its peer systems.**

¹⁷ <https://www.transit.dot.gov/ntd/ntd-data> Note: Unlinked passenger trip is a term that refers to boardings. If a person were to travel from Fredericksburg to L'Enfant Plaza and then switch trains to go from L'Enfant Plaza to Manassas, that would count as two UPT. In other contexts that journey would count as one "trip".

Figure 9: 23 Average Fares of Peer Systems (not adjusted for income)



System Plan 2040 assumed farebox growth of five percent biennially (every other year). This estimate was lowered to three percent biennially for the SFF. While this reduced assumption is consistent with VRE’s actual fare increases over the past decade and does provide a more conservative forecast of revenues, it is also a significant contributor to the SFF’s projection that O&M expenses will outpace revenues.

The favorable comparison of VRE’s fare structure to peer systems indicates that some room for increased fares may exist. When discussing fare rate increases, VRE has generally cited concerns over the effects that larger increases could have on ridership. If fares are raised too rapidly, ridership could suffer significantly. Even with increased fares, significant losses in ridership would likely result in reduced total fare revenues. Lower overall farebox revenue could force VRE to make service cuts and/or otherwise degrade service. This would result in a cycle of decreasing ridership that would see the system’s operating balance degrade more rapidly. While there is the potential for this dynamic, **additional analysis of fare structure could give VRE a more complete understanding of the potential impact of various potential fare structures and fare growth assumptions.**

A fare analysis should consider: stakeholder views, the elasticity of ridership based upon fare levels, the impact of potential fare structures on transit dependent populations, and whether the effects of potential fare structures are in-line with the overall transportation goals of the state and region. Additionally, future fare analysis should consider the impact of federal transit benefits on fare affordability and ridership – for instance, the effects of the recent increase of the monthly transit benefit cap from \$130 to \$255. Finally, the impact of potential fare structures should be evaluated to determine the potential impact on vehicular congestion levels in the region, in particular on the two CoSS, I-95 and I-66. A fare structure that decreases ridership could also exacerbate roadway congestion levels.

Even with the recommendation for additional analysis of potential fare structures, the overall conclusion is made that **VRE’s farebox performance and outlook indicates the agency is efficiently providing an appropriately costed service.**

Local Jurisdiction Operating Subsidies

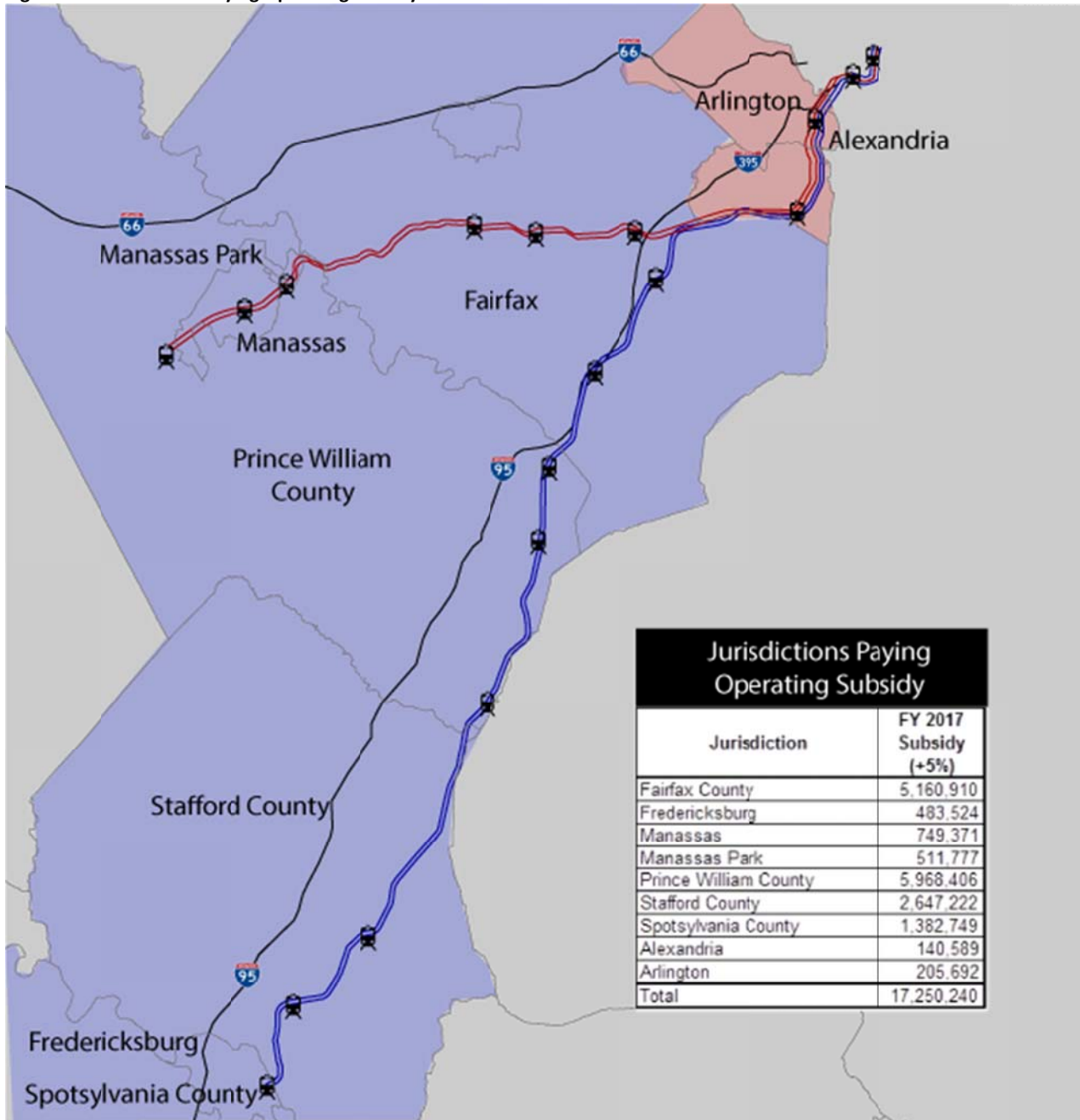
Similar to the farebox assumptions, System Plan 2040 assumed 5 percent biennial increases in local jurisdiction subsidies and this assumption was reduced to 3 percent biennially in the SFF analysis. Again, while this reduction provides a more conservative forecast of revenues, it is also a significant contributor to the SFF's projection that O&M expenses will outpace revenues. Therefore, the reasonableness of this assumption should be examined.

Based upon information provided by VRE, annual local jurisdiction funding changes have varied widely over the past 16 years. The total local subsidy provided by all jurisdictions over that period has experienced annual increases as high as 52 percent and has seen decreases of as much as 5 percent. However, it should be noted that the recent trend (from 2009 to 2016) sees changes in a much narrower range that can best be described as flat to a slight decrease. During the past 8 years, local jurisdiction subsidies have ranged from a low of \$15.9M to a high of \$17.3M, with approximately two-thirds of these amounts for operating support. The FY 2017 budget includes \$17.25M in local jurisdiction subsidies with \$14.7M in operating support. The \$14.7M in local operating subsidies accounts for 17 percent of all operating expenses.

VRE has indicated that the recent local funding dynamic is attributable to affordability issues as local jurisdictions attempt to balance their budgets and address competing priorities. VRE has also noted that the volatility associated with this funding source is itself another source of risk for the system. For these reasons, VRE argues that it is prudent to assume a modest but steady increase for jurisdictional contributions while investigating other sources of revenue.

DRPT is sensitive to local budgetary constraints and recognizes that local governments have many competing policy objectives. **This review finds VRE's assumption for local jurisdictional subsidies is reasonable as a base line. Beyond this baseline, VRE's financial forecasting and discussions with its Operations Board should consider a range of potential subsidy increases. Other potential state and federal sources of operating funding for VRE face similar constraints and will be forced to make similarly difficult decisions.**

Figure 10: Jurisdictions Paying Operating Subsidy



State Operating Subsidies (including Access Fee Subsidies)

Over the ten-year period of 2006 through 2015, operating subsidies to VRE from the Commonwealth ranged from \$7M to \$10.5M. Over this same period, total operating support (including subsidies for track access fees paid to CSX, NS and Amtrak), ranged between a low of \$10.8M in 2008 and a high of \$19.3M in 2014. The FY 2017 Budget includes \$14.7M (19 percent of operating expenses) from all sources with support from the state with \$9M for direct operating subsidies and the remainder predominantly going towards track access fee support. As with local jurisdictional subsidies, the trend towards declining and now flat funding levels from the Commonwealth is indicative of competing budget priorities and constrained resources. For this reason, VRE's SFF incorporates a conservative estimate for operating

grants from the Commonwealth. The SFF assumes 0 percent growth for direct operating subsidies or approximately \$9M per year for the entire forecast period (2040). Given the Commonwealth’s financial constraints, this assumption is reasonable as a base case. **If state operating subsidies maintain growth in line with CPI growth it could help mitigate VRE’s operating funding challenges going forward.**

Access fees for use of Class I (CSX, NS and Amtrak) railroad tracks have historically been funded through a variety of state grants and federal pass through grants with the total amount of these grants equaling approximately 84 percent of total fees. These funds are administered by DRPT and DRPT has indicated that this level of funding will decrease beginning in 2021, ultimately declining to 50 percent of access fees for the period of 2026-2040. **VRE’s SFF indicates that the agency has incorporated this funding dynamic, and this analysis concludes the SFF accurately reflects DRPT’s projected funding levels.**

Federal Operating Funding

Federal operating support flows to VRE through the Surface Transportation Program (now called the Surface Transportation Block Grant program or STBG under FAST Act) with a small amount of funding coming from other federal formula programs. The total amount of federal operating support for FY2017 is \$8.9M, or approximately 12 percent of operating expenses.

Operating Funding Outlook

The net effect of the above operating revenue outlook when combined with the long term costs discussed in the previous section is projected to lead to operating deficits for VRE by 2030 and have an average operating shortfall over the forecast period (through 2040) of \$13.7M per year. The following charts show the sources of operating funds for FY2017 (fully funded at \$75.8M) and for 2040 with implementation of the full system plan (\$257.2M total operating budget, deficit indicated):

Figure 11: FY 2017 Budget - Sources of Operating Funds

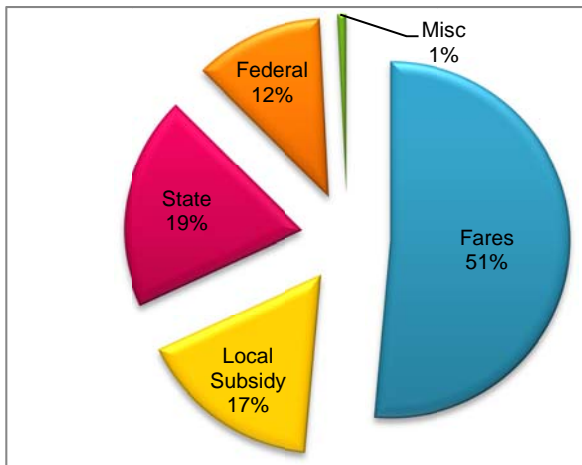
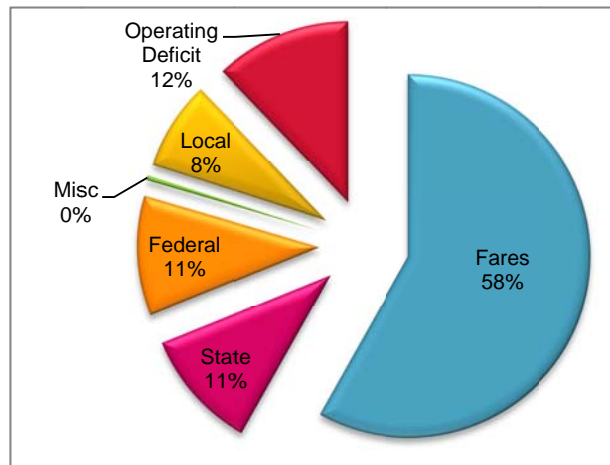


Figure 12: FY 2040 Operating Budget - Projected Sources of Funds



Federal Capital Funding

The primary sources of federal funding are the FTA’s 5307 (Urbanized Area) and 5337 (State of Good Repair) programs. Similar to local and state funding sources, these funds have been flat in recent years, with the anticipated amount of funds for 2017 equaling those received in 2016. Based upon this, VRE’s SFF assumes zero growth for these sources. In consideration of recent trends, as well as of the general

outlook provided by the FAST Act, **VRE's federal formula funding assumptions are reasonable.**

Naturally, these sources of funds should be monitored, particularly leading up to the expiration of the FAST Act authorization in 2020.

In addition to federal formula funding, federal discretionary grant programs are a potential source of funding for capital projects. The Commonwealth was recently awarded a grant through USDOT's Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FASTLANE) program for the Atlantic Gateway suite of projects. The \$165M award was the largest for the program and represents approximately 20 percent of all FASTLANE program dollars. The Atlantic Gateway project included a variety of multimodal capital improvements including enhancements to I-95, I-395 and the CSX rail corridor. Included in the application as part of the rail improvements were \$70M towards the rehabilitation and expansion of the Long Bridge. While the Long Bridge project will also benefit the DC2RVA higher speed rail project and existing operations for Amtrak and CSX, it is also a necessary component of VRE's 2040 Plan. The Commonwealth's successful application represents a promising template for future efforts. Key elements of this template are its multi-modal nature and its positive benefits for the movement of both goods and people in the corridor. While the FASTLANE award is a significant achievement for the Commonwealth, the limits of programs such as FASTLANE and TIGER (Transportation Investment Generating Economic Recovery program originally enacted as part of the American Recovery and Reinvestment Act of 2009) should be noted. As an indication of these limits, the FASTLANE program funded less than 8 percent of requested funding in 2016. The program received 212 applications requesting a total of \$9.8B and awarded just over \$759M in funds. The TIGER program also typically awards less than 10 percent of requested funding. Other FTA grant programs such as New Starts/Small Starts and Core Capacity are also potential sources of capital project funding. While these programs generally provide larger award levels than FASTLANE or TIGER, they are similarly competitive and oversubscribed. In conclusion, while federal discretionary grant programs can be an important source of funding, the limited amount of dollars allocated to these programs and their highly competitive nature make it difficult to predict potential future funding from these sources.

Capital Funding Outlook

Per the SFF, the sum of capital improvements required is \$4.1B. The core components of this requirement include VRE's agreement via a memorandum of understanding with CSX to construct a third main line track from Fredericksburg to Washington, D.C. This cost includes the replacement and expansion of the Long Bridge across the Potomac River and also includes the renewal and replacement of rolling stock over the plan period. VRE's SFF analysis indicates that the agency may be able to fund approximately \$2.8B of the \$4.1B total using projected funds from a combination of federal formula programs like CMAQ, through NVTA funds derived from HB 2313, and other funds including DRPT transit capital dollars. It should be noted that currently only six of VRE's nine member jurisdictions are also part of NVTA. NVTA funds are limited to projects within the authority's area. The NVTA's member jurisdictions are located within the boundaries of the Commonwealth's Planning District 8. The Authority includes the counties of Arlington, Fairfax, Loudoun and Prince William; and the cities of Alexandria, Fairfax, Falls Church, Manassas and Manassas Park. This restriction prevents NVTA dollars

from being used for shared VRE capital projects that may be physically located in the non-NVTA jurisdictions.

While VRE's SFF indicates the potential to fund over 80 percent of the System Plan 2040 capital budget, the current six-year capital improvement program shows that approximately \$499M of \$2.1B projects have allocated funding, leaving the rest unfunded, with yet to be determined funding sources or pending a future allocations from a funding authority. Of these projects, several are eligible for funding under Smart Scale or via NVTA's TransAction 2040. VRE has stated that the funded projects will prioritize passenger safety, state of good repair, and regulatory requirements. While these priorities are rightfully maintained, the net effect is that System Plan 2040 expansion plans generally become unfunded or yet to be determined projects, limiting the system's ability to grow to meet the demand anticipated by the plan.

One of the key drivers in the CIP funding is the availability of state provided matching funds that allow VRE to leverage federal formula capital funds. The CIP currently incorporates these funds under SB1140's Tier 2 funding level (34 percent participation). While this funding source is of great value to VRE, it does restrict the timing of the availability of these matching funds, extending the funding period for projects when compared to a scenario where the Commonwealth provides a larger match. A related and urgent capital funding dynamic is the pending depletion of Capital Projects Revenue (CPR) bond funds. Currently CPR funds provide a large portion of the Commonwealth's matching percentage. These funds are scheduled to run out following FY2019 reducing the funding available for all three tiers. If a new source of funding is not found to support the Commonwealth's on-going participation under SB1140, by FY2020 state transit revenues will only meet approximately 10% of the total need.

In examining VRE's capital budgeting outlook as previously described, DRPT recognizes the agency's challenges. While plausible sources for the majority of the capital need can be identified, most of these sources are yet to be allocated and/or are subject to a competitive, discretionary process. This situation is not atypical for major transportation (or more specifically transit) capital projects around the country. DRPT recommends that VRE continue to advance key projects into the project development process and take other steps to ensure the maximum potential for success in pursuing FTA discretionary funds and other competitive funds such as those under HB2313 from the NVTA.

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CONCLUSION

VRE's Approach

In recognition of the challenges faced, VRE has determined it will pursue a "Natural Growth Scenario" as developed for the SFF as its base strategy and the agency will also continue to pursue both capital and operating funding to achieve full implementation of System Plan 2040. The Natural Growth Scenario implements some of the Phase 1 System Plan 2040 improvements, including: lengthened trains and platforms to maintain present service levels with growing ridership, needed corridor capacity improvements such as Long Bridge, maintenance of existing peak and non-peak operations, plus one additional trip on the Fredericksburg line. It maintains the general assumptions for cost escalation and revenue growth. As such, DRPT supports the assumptions with the caveats and exceptions previously noted.

Under the Natural Growth Scenario, ridership would increase to an estimated 31,100 per day or approximately 60 percent of the full System Plan 2040 projections. Based upon a crude calculation, the system could then be expected to achieve roughly 60 percent of the benefits discussed for the full System Plan 2040. To achieve this scenario, VRE would need to identify approximately \$871M in capital funding and an average of \$9.3M per year in additional operating dollars. During the pursuit of the Natural Growth Scenario, VRE will work with its partners to further develop its funding sources.

Maintaining Appropriately Costed Services / Expanding Market Share

VRE has been providing appropriately costed services. Provided with the needed capital and operating funding, VRE has demonstrated the ability to provide appropriately costed, efficient services that attract increasing levels of ridership. The agency has achieved a high level of farebox recovery charging reasonable fares. While VRE's reasonable fares may provide some ability for upward adjustment, changes to fare policy alone will not be able to address VRE's additional funding needs.

Long-Term Financial Viability Assessment

As previously noted, this review generally finds the basis of analysis conducted by VRE through System Plan 2040 and SFF exercises to be reasonable. However, this report identified some areas where further investigation into the assumptions is advisable, particularly in the areas of fare policy and local jurisdiction subsidies. Although further investigation will better inform the discussion, it does not guarantee findings in these areas will alter the overall financial outlook for VRE; additional capital and operating funding is needed to maintain and grow the system. Without additional funding beyond current anticipated levels, VRE will face challenges to its long-term financial viability. Just to accommodate the Natural Growth Scenario, currently the recommended path by the VRE Board of Directors, up to \$3.2B in capital funding could be required to accommodate the projected 31,100 daily riders. Currently \$806M in capital needs is funded, and \$1.5B in additional funding potentially funded through identified revenue sources, however, \$871M is the unfunded capital need.

The Natural Growth Scenario will require an additional \$15.5 Million annually to maintain expanded operations – a fraction of the cost to construct an additional mile of interstate in the I-66 corridor. While slight increases to the assumptions for fares and local subsidies are not likely to eliminate this requirement, they may lessen it and make a more manageable gap and provide for a more productive discussion among all stakeholders. For capital funding, this review finds that VRE is effectively utilizing available sources and pursuing additional federal and state discretionary funding. VRE should maintain this approach and continue to advance projects to maximize their potential eligibility and competitiveness for future federal discretionary dollars.

Impact on Interstates 66, 95, and 395

As noted above, full build out of System Plan 2040 would result in service levels equivalent to 96 lane miles of interstate. Adding 96 lane miles within the highly developed and congested northern Virginia areas that is traversed by I-66, I-95 and I-395 could incur greater costs than expanding VRE. VRE's current estimate for the capital improvements included in the 2040 System Plan is \$4.1B, which includes costs for projects that will benefit freight and allow additional Amtrak services, and therefore VRE would only be responsible for a portion of that total cost.

While not a direct comparison, the 22-mile I-66 Corridor Improvements Program is expected to cost as much as \$3.3B. This equates to approximately \$95M-\$150M per mile. Similar improvements to I-66 inside the Beltway and to the I-95/I-395 corridor could easily result in a total budget number for highway improvements greater than VRE's capital plan. While it is difficult to create a direct mile-for-mile, lane-for-lane equivalency for the improvements being pursued in the I-66 corridor, extrapolating the I-66 budget over 96 miles would produce a capital budget of \$9-14B.

Using these same I-66 corridor numbers to look at the present situation, replacing the approximately 36 lane miles of capacity currently provided by VRE's service could cost as much as \$3.4-5.4B. Likewise, VRE's Natural Growth scenario provides service levels similar to approximately 58 lane miles of interstate which could be valued as high as \$5.5-8.7. It is also important to note that due to the likely severe impacts on adjacent neighborhoods, it may simply not be feasible to construct the number of lanes required to replace the capacity provided by VRE and meet growing travel demand. Put another way, given the high levels of development adjacent to the interstates, acquiring sufficient land for additional interstate right-of-way may not be practicable.

Avoided highway construction and highway maintenance costs, VRE provides an alternative transportation option to congested highway travel, which has economic benefits to the Commonwealth. In addition, congested roadways lead to significant economic costs. The costs associated with traffic congestion typically include delays and uncertainties in expected trip times, along with fuel consumption. The Texas A&M Transportation Institute reports that the annual cost of congestion due to these factors in the U.S. in 2014 was approximately \$160B while the figure for the Washington urban area was approximately \$4.6B. As significant as these numbers are, they do not include additional costs that can also be considered as part of the full cost of congestion such as: emissions, (environmental cost), accidents (safety cost), and vehicle operations (maintenance cost), which could be as much as \$2.5B. If these costs were included, minimizing congestion along I-66 and I-95 would have an even greater value to the Commonwealth.