Rail Enhancement Fund (REF)
User's Manual

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DRPT

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1. Purpose and Overview of This User Manual

The purpose of this Manual is to summarize the policies and procedures governing the investment of Rail Enhancement Funds (REF) in passenger and freight rail assets that benefit a region of the Commonwealth or the Commonwealth as a whole. *See* ***Code of Virginia Section 33.2-1601 Rail Enhancement Fund*** *in Appendix A of this Manual.*

The first step in the rail investment process is a determination by the Commonwealth Transportation Board that an individual project will "result in public benefits to a region of the Commonwealth or the Commonwealth as a whole that are equal to or greater than the investment of" Rail Enhancement Funds. ***Section 2 of this Manual details the methods used by the Department of Rail and Public Transportation (DRPT) to determine the public benefits of a particular project***, including:

- State and federal best practices for benefit/cost analysis (BCA)
- Directions for the use of the Virginia DRPT 2016 BCA Model
- Outputs of the Virginia DRPT 2016 BCA Model

The second step in the rail investment process is a prioritized ranking of rail projects whose public benefits exceed the proposed investment of Rail Enhancement Funds (i.e. a BCA ratio greater than 1.0). The DRPT accepts project submissions on an annual or semi-annual basis to ensure that the best projects compete for limited Rail Enhancement Fund support. ***Section 3 of this Manual lays out the process and criteria for prioritizing REF investments in individual projects.***

Based on statutory and constitutional findings, REF investments show benefits to both the overall transportation network and the Virginia system of highways. One of the most important ways to assure that these benefits can be demonstrated is to use best national BCA practices and to regularly update the data sources for the BCA Model. ***Section 4 of this Manual itemizes the data sources for the 2016 BCA Model and provides guidance for the periodic updating of that data.***

2. Benefit/Cost Analysis for the Rail Enhancement Fund

Benefit/Cost Analysis (BCA) is a widely used method of monetizing the benefits of an infrastructure project, and comparing those monetized benefits to the project cost. It is a widely used method to assist in the allocation of state and federal transportation funds.

2.1 Federal and State Best Practices for Benefit/Cost Analysis

The use and evolution of BCA practices are well documented in both academic literature and federal government guidance.

This Manual documents a state-level BCA Model for investments of the Virginia Rail Enhancement Fund and is consistent with both federal BCA guidance and industry best practices, as of 2016.

2.1.1 Federal Benefit/Cost Guidance

The Federal Office of Management and Budget (OMB) provides broad BCA guidance in circulars A-4 and A-94. The United States Department of Transportation (USDOT) provides resource information and general BCA guidance under its TIGER and Nationally Significant Freight and Highway Program (NSFHP and related FASTLANE) grant programs.

The TIGER (www.dot.gov/tiger/guidance) guidance recommends the following major benefit categories, each accompanied by examples of possible benefits and potential monetization techniques:

- Quality of Life
- Economic Competitiveness
- Safety
- State of Good repair
- Environmental Sustainability

The TIGER guidance also recommends "a life-cycle cost analysis approach in estimating the costs of the project to include operating, maintenance, and other life-cycle costs of the project, along with capital costs." However, Section 33.2-1601 of the Code of Virginia provides a more narrow definition of project cost as the investment of Virginia Rail Enhancement Funds.

The Virginia BCA Model for the Rail Enhancement Fund is therefore focused on ***Virginia Costs*** and ***Virginia Benefits*** as required by the Statue.

2.1.2 Virginia Benefit/Cost Guidance

Virginia was one of the earliest states with statutory authority to invest public funds in private rail infrastructure in order to achieve specific public benefits. The original BCA model used by Virginia served the Commonwealth well, but largely relied on aggregate, nationwide metrics to calculate Virginia benefits - both passenger- and freight-related. However, significant advances in both data availability and economic methodology have also occurred since that model was

developed. These changes allow for a BCA Model capable of analyzing public benefits at the local, regional, corridor, and statewide levels. *Appendix B summarizes the major changes from the original to the 2016 BCA model.*

Given the Virginia statutory definition of project costs as the actual amount of Rail Enhancement Funds actually invested in the project, the DRPT 2016 BCA Model is focused on six broad categories of public benefit. Each is described more fully below, including a brief description of the changes from the original model and the basic calculations underlying each benefit category:

- Travel time savings
- Safety
- Environmental Effects
- Vehicle Operating Costs
- Wider Economic Benefits
- Highway Maintenance Reductions

Appendix C graphically summarizes each benefit category, as well as its constituent factors and metrics.

As part of the Department's commitment to transparency, the data sources that comprise the 2016 BCA Model and the recommended updates for the sources are documented in Appendix D of this Manual, and the model is available for download at:
https://olga.drpt.virginia.gov/documents/forms/REF_BCA_Manual_20160930

Appendix D shows the likely schedule for updates to key data sets. The data sets for the 2016 BCA model should be updated **at least biennially** to reflect best industry practices.

The DRPT realizes that information submitted in the REF process may contain proprietary materials. Anything submitted to the department may be subject to Freedom of Information Act requests.

In the following computation examples, ^{*F} designates a field for Freight Benefits and ^{*P} designates a field for Passenger Benefits.

Travel Time Savings

A major effect of a transportation investment is often on the travel time of users. As an illustration, imagine a hypothetical rail corridor in Virginia that is parallel to a major interstate. If throughput on the rail corridor is increased following the installation of a new signaling system, both freight and passengers on the rail corridor would benefit from reduced time spent in travel. The benefit of improved throughput would extend to others.

New users diverted to the faster rail service from other modes, be they passengers formerly in automobiles or freight formerly transported by truck, would benefit from the improved infrastructure.

Travel time savings can be realized when passengers reduce travel time during their route by using rail services instead of highway travel. The 2016 BCA model requires the input of passengers per year (current and proposed), the amount of time saved, and the purpose of travel data to compute passenger travel time savings.

Travel Time Savings	=	Per trip time savings	*	Weighted Average Value of Time	*	Annual Passengers (existing)	+	Travel time Savings per trip of new passengers	*	Weighted Average value of time	*	Annual Passengers (new)

Passengers who remain in automobiles or freight that remains in trucks, as the parallel interstate is now less congested, would also benefit from the shift from truck to rail.

Congestion Reduction Benefits are realized by the reduction of vehicle miles traveled multiplied by the congestion cost on a specific highway. The benefit measures the improvement in the levels of highway congestion by reducing the number of vehicles on major highways throughout Virginia. The 2016 BCA model requires the input of routes selected, the trip length, the number of trucks per railcar* (freight), and railcar or passenger demand to compute the benefit.

Congestion Reduction Benefit	=	Reduction in Truck (or Passenger) Vehicle Miles Traveled	*	Congestion Cost per Truck or Vehicle Mile

In a typical transportation project, the value of travel time savings can be a significant part of the benefit. Traditional transportation models can estimate vehicle travel time savings. Crucial to integrating travel time savings into a BCA is determining the monetary value of time that should be attached to the estimated time savings (e.g. lost wages or productivity for passengers and fewer labor hours to deliver a product for freight). The 2016 BCA Model includes the option of more detailed corridor value of time for passengers, as well as a significantly expanded database of freight commodities (e.g. time saved delivering critical pharmaceuticals is more valuable than time saved delivering mulch).

Safety

Another important benefit of rail transportation investments is safety. Shifting passengers or freight to the rail network reduces the risks of crashes, injuries, and fatalities in measurable ways. This is an economic benefit in the same way that travel time savings are, and one which has been given a monetary value based on the observed values people place on reducing the risk of injury or death. Once monetized through the financial value of avoided crashes, injuries and fatalities, safety is usually one of the most important benefits for projects submitted to the REF program. As with value of time, a monetary value must be given to avoided injuries and fatalities for inclusion in the BCA. The 2016 BCA Model includes Virginia-specific values for avoided crashes, injuries and fatalities.

When passenger and freight traffic are reduced on the highways, a benefit from the reduction in accidents can be realized. There is also benefit from the closure of crossings along the trip

route. The 2016 BCA model requires the associated highway, number of crossings removed, diverted mileage, train mileages, trucks per railcar*F, tons per truck load*F, railcar and passenger demands as inputs.

Accident Reduction Benefit = **Truck Ton Miles** * **Accident Costs per truck ton miles** - **Train Ton Miles** * **Freight Train Accident Cost per train ton mile** + **Accident cost per rail crossing** * **Number of Rail Crossings Removed**

Accident Reduction Benefit = **Reduction in Passenger VMT** * **Accident Costs per vehicle mile** + **Accident cost per rail crossing** * **Number of Rail Crossings Removed**

Environmental Effects

Environmental effects are an important component of a BCA, and for projects that create a mode shift from roads to rail, the net impact on vehicular emissions and associated health risk is usually positive. The Clean Air Act and its associated regulations have given rise to an extensive body of economic data on the health benefits of reduced emissions and improved air quality. The 2016 BCA Model includes statewide and locality-specific values for improved air quality through reduced vehicle emissions.

Environmental improvements are realized in two ways. The first is the modal shift from truck to train. A monetized value is assigned to the difference between the emissions made by truck traffic or passenger vehicle over the route distance and the emissions made by train traffic. The 2016 BCA model requires the project applicant or sponsor to enter the routes selected, rail tons per rail car*F, railcars per train*F, number of riders*P, train route length, vehicle trip length, trucks per rail car*F, rail car or passenger demand.

Freight Environmental Improvement (Mode Shift) = **Truck VMT** * **Vehicle Air and Noise Pollution Cost** - **Train Ton Miles** * **Train Air and Noise Pollution Costs**

Passenger Environmental Improvement (Mode Shift) = **Passenger VMT Reduction** * **Vehicle Air and Noise Pollution Cost** - $\frac{\textbf{Change in Passengers}}{\textbf{Passengers per train}}$ * **Passenger trip length** * **Pollution Cost per passenger-train mile**

Environmental improvements can also be realized with a shortened route, for both passenger and freight movements. If a route is shortened due the project, emissions are reduced. The 2016 BCA model requires inputs of rail tons per railcar, the reduction in mileage and the railcar demand.

Environmental Improvement (Distance Reduction)	=	Rail Shipments or Passenger Trains	*	Reduced Train Mileage	*	Train Air and Noise Pollution Costs

Vehicle Operating Costs

Transportation investments will affect the overall vehicle operating costs in various ways. Users shifting from road to rail will benefit from not having to bear the various costs (fuel, motor oil, tire wear) from operating an auto or truck. These benefits must be compared to any additional operating costs associated with increased rail service, and both categories are included in the BCA. The 2016 BCA Model includes complete operational costs for both motor vehicles and rail equipment. In addition, passengers traveling to Washington, D.C. utilize parking services, which are accounted for in the VRE calculations.

When the shipping method is changed from truck to train, the reduction in shipping cost is shown by the difference between trucking and rail costs. The 2016 BCA Model requires rail tonnages, the number of railcars per train, the freight route length, the truck trip length, the number of trucks that can be loaded into a railcar and the railcar demand for the shipping cost reductions to be calculated.

Shipping Cost Reduction (Mode Switch)	=	Truck VMT	*	Truck Shipping Rate	-	Train Ton Miles	*	Rail Shipping Rate

Likewise, if the route is shortened due to the project, shipping costs are reduced, and the 2016 BCA Model requires similar data inputs.

Shipping Cost Reduction (Distance Reduction)	=	Rail Shipments (existing tons)	*	Reduced Freight Mileage	*	Shipping Rate

Reduced passenger transportation costs can also be calculated from the 2016 BCA Model using reduced VMT, increased passenger miles by train, and passenger fare per train mile. Parking calculations are accounted for by taking the annualized cost for land, construction and operating and maintenance costs of a parking space located in the central business district.

Reduced Transportation Costs	=	Reduction in VMT	*	Operating (and Parking) Cost per Mile	-	Increased Passenger Miles	*	Fare per Mile

Wider Economic Benefits

Wider economic benefits refer to the effect on productivity attributable to a transportation project. Essentially, transportation investments make the economy more productive by reducing the costs of transportation. Transportation investments can also create greater densities of employment around transit services and allow businesses to be more productive than just travel time savings alone would suggest. Similarly, such investments may allow businesses access to a larger and/or more qualified work force.

These wider economic benefits are included in the 2016 BCA Model for passenger and commuter rail projects. While the Department considered the possibility of wider economic benefits for freight rail projects (e.g. an intermodal facility supporting adjacent industries), there was not sufficient publicly available data to support their inclusion in the 2016 BCA Model at this time. However, the federal TIGER grant standards are sufficiently flexible to allow such considerations on a case-by-case basis.

Wider Economic Benefits are those that have not typically been accounted for in traditional cost-benefit, but are realized in the ridership's productivity. The 2016 BCA Model calculates Wider Economic Benefits from other benefits, including travel time savings, safety and reduced transportation costs.

Wider Economic Benefits = 0.05 * (Travel Time Savings + Safety Benefits + Reduced Transportation Costs)

Highway Maintenance Reduction

Transportation investments that shift passengers and freight to rail will reduce road usage. This reduced road usage will reduce pavement wear, particularly in the case of truck traffic. These savings have proven to be significant on several of the port-related rail investments. These values are significantly updated in the 2016 BCA Model, and may change as additional studies are completed and federal guidance is updated.

When vehicles, both freight truck and passenger, are removed from the highways, a savings in pavement maintenance is realized. The 2016 BCA Model requires the following inputs to calculate savings in pavement maintenance: the highways where traffic is diverted, the vehicle mileage removed from the roads, how many trucks can be loaded onto a railcar^{*F}, passenger demand^{*P}, and railcar demand^{*F}.

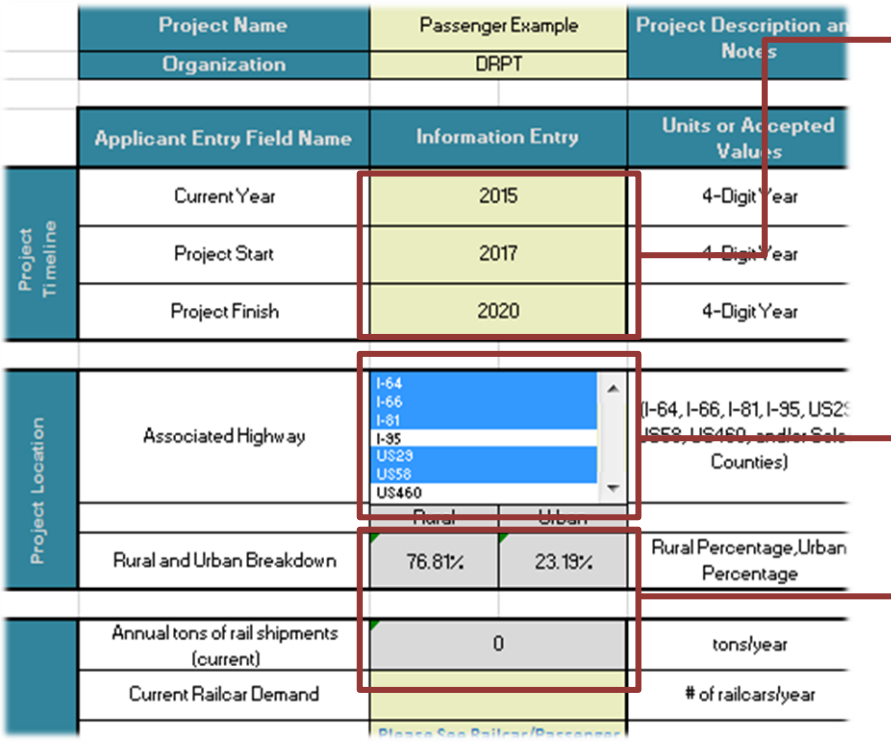
Pavement Maintenance Savings = Reduction in VMT * Pavement Maintenance cost per Mile

2.2 Using the 2016 BCA Model

The 2016 BCA Model is used to transparently conduct the first step in the REF evaluation process to demonstrate that the Virginia-based public benefits of an individual rail project exceed the costs to the REF.

The 2016 BCA Model is publicly available at:
https://olga.drpt.virginia.gov/documents/forms/*REF_BCA_Model_20160930*

2.2.1 Model-Wide User Notes

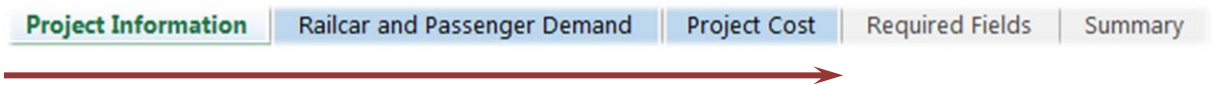


Fields that are tan in color will need the sponsor to enter values in order for the calculations to be made.

For the Associated Highway section, a highway is being used in the calculations if it is highlighted in blue. Click on the individual highways to toggle between selected (blue) and deselected (white).

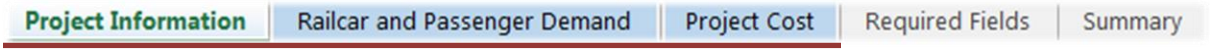
Fields that are grey in color contain a default or automatically calculated value. The value for rail tons per rail car can be overwritten if an explanation or justification is provided for the change.

Entries should be made in the worksheets from left to right (fill in the Project Information worksheet before filling in the worksheet for Railcar and Passenger Demand, then the worksheet for Project Cost).



2.2.2 Data Entry Worksheets

Data Entry Worksheets – A combination of worksheets (denoted with blue tabs, or when selected, white with green font) that allow the project sponsor to enter information about the project that will be scored using Benefit Cost Analysis.



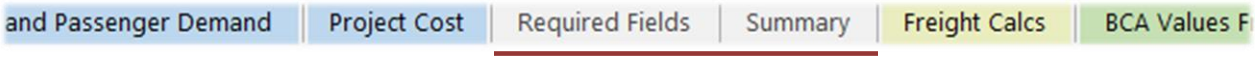
- *Project Information* – The project sponsor or applicant will provide project specific information regarding the project timeline, location, truck and rail freight information and vehicle and rail passenger information. Definitions are available on the worksheet to aid the sponsor or applicant in entering the information.

- *Railcar and Passenger Demand* – After the project information worksheet is completed, the projected number of total freight railcars and total rail passengers are entered into the railcar and passenger demand worksheet. All fields must be filled in, zero is the default value. To reset the worksheet, the "Reset Railcar and Passenger Demand Page" button can be clicked. The project start year and project completion years are highlighted when the information is entered into the project information worksheet. The Department strongly recommends a dialogue with the project sponsor or applicant to ensure the long-term reliability of railcar and passenger demand. For example, a freight sponsor or applicant might not be aware of the potential passenger benefits of a particular rail improvement, while a passenger sponsor or applicant might not be aware of a changing cargo mix over time. Many of the Virginia Class 1 railways support both passenger and freight movements, and many rail improvements benefit both passenger and freight services.

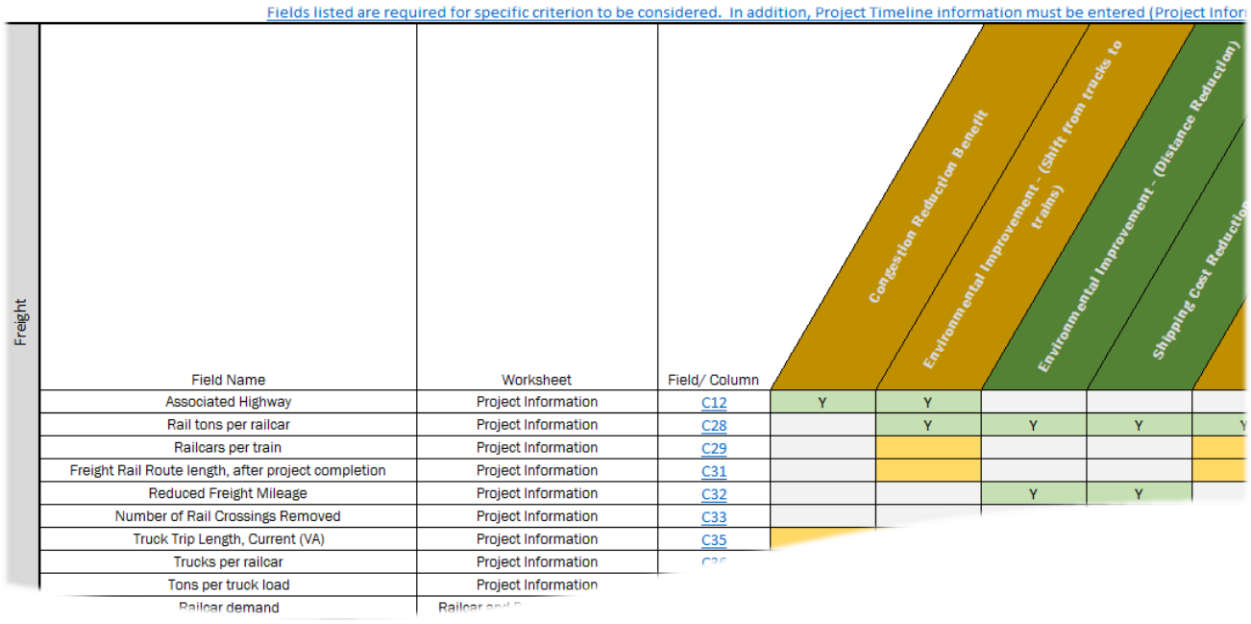
  While passenger and railcar demand forecasts are essential to calculating public benefits, the Department may or may not use such forecasts for grant administration and sanctions.

- *Project Cost* – Project sponsors or applicants should continue to the project cost worksheet to enter information into individual cost centers by year.
  The benefits will be automatically entered when the project information and railcar passenger demand worksheets are filled in. Breakdowns will also be provided after the DRPT percentage of funding is entered. In kind contributions can be entered into the spreadsheet but are not accounted for in the benefit-cost study. The benefit cost results are then provided within cells A60 through C62. More detailed results can be found on the Summary page.

2.2.3 Information Worksheets (Grey Tabs)



- *Required Fields* – The Required Fields spreadsheet shows which benefits are being realized in the model. When a benefit is realized in the calculations, the column header and individual field names that are required for the calculation will be green. If the column header or any of the individual field names are highlighted in yellow, further information must be entered in order for the benefit to be realized. Hyperlinks are provided so the user can quickly move to the fields that need to be entered. A return to required fields page link can be found to the right of the fields on the project information worksheet in two separate locations. As eluded to in the Railcar and Passenger demand section, partial benefits can be realized in the model, for example, if all of the fields for Environmental Improvement due to shift from trucks to trains are filled in, but not all of the fields for Savings in Pavement Maintenance are filled in, the Environmental Improvement due to the shift from trucks to trains will be calculated and entered into the model. This can be beneficial to the project sponsor or applicant if partial benefits of the other project type can be calculated (for example, if you know a freight improvement will cause the passenger train to be two minutes faster, you can see the other input items necessary to have the travel time savings benefit realized would be passengers per year, the number of passengers in the future, and the passenger travel purpose).

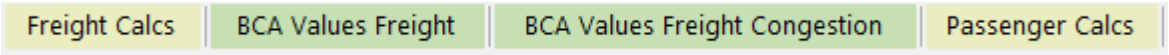

Fields listed are required for specific criterion to be considered. In addition, Project Timeline information must be entered (Project Infor

Freight

Field Name	Worksheet	Field/ Column	Congestion Reduction Benefit	Environmental Improvement - (Shift from trucks to trains)	Environmental Improvement - (Distance Reduction)	Shipping Cost Reductio
Associated Highway	Project Information	C12	Y	Y		
Rail tons per railcar	Project Information	C28		Y	Y	Y	Y
Railcars per train	Project Information	C29				
Freight Rail Route length, after project completion	Project Information	C31				
Reduced Freight Mileage	Project Information	C32			Y	Y
Number of Rail Crossings Removed	Project Information	C33				
Truck Trip Length, Current (VA)	Project Information	C35				
Trucks per railcar	Project Information					
Tons per truck load	Project Information					
Railcar demand	Railcar and F					

Summary – Provides a snapshot of the criteria that are calculated for the model. The total column is the sum throughout the project lifetime, the net present value (NPV) of 3% and 7% bring future values into current valuation. The BCA Summary is more completely described in Section 3 of this Manual.

- *Calculation and Value Worksheets* (yellow and green tabs)



Intermediate Freight Calculations and Intermediate Passenger Calculations – Tabs show the lookup values and intermediate calculations for the criteria that are calculated.

Freight Calcs and Passenger Calcs – Tabs show the values, year by year, of the criteria used in the model (congestion reduction benefit, environmental improvements, shipping cost reductions, pavement maintenance, accident reduction benefit, passenger transportation costs (passenger only).

BCA Values for Freight and Passengers – Tabs show the lookup values used in the model that are based on entries made in the data entry worksheets. With the exception of Congestion and Value of Time calculations, all lookup values are included on these worksheets.

BCA Values for Freight and Passenger Congestion – Provides the cost per highway mile saved by the number of trucks or passenger vehicles reduced.

BCA Values for Passenger for Value of Time – Provides the cost per mile by region (independent city or county) and purpose of travel.

2.2.4 Field Definitions and Sponsor/Applicant Data Entry

When thinking about the information that needs to be entered into the spreadsheet, applicants and sponsors should think about the path of the freight before and after construction of the project or the movement of people from using vehicles on the highway to using passenger rail services. REF Funds are granted due to the benefits made *to the highway* system of Virginia, so freight paths and passenger paths on both the highway and rail need to be accounted for before entering data.

The information to be completed in the spreadsheet is broken down into several categories:

Project Identification

Project Name – Short identifier of the project.

Organization – The name of the sponsoring organization.

Project Description and Notes – A brief description of the project.

Project Timeline

	Applicant Entry Field Name	Information Entry	Units or Accepted Values	Description/Definition
Project Timeline	Current Year		4-Digit Year	The current year, the year in which projects are scored.
	Project Start		4-Digit Year	The year in which project construction is slated to begin.
	Project Finish		4-Digit Year	The first full year in which project construction will be finished, project benefits will start to be realized in this year.

Current Year – The year in which the projects will be scored.

Project Start – The year in which project construction will begin. When filling out the Railcar and Passenger Demand and Project Cost worksheets, the year of the project start (if it isn't the current year) will be highlighted in yellow.

Project Finish – The first full year in which the project will be finished. Project benefits will be realized in this year. When filling out the Railcar and Passenger and Project Cost worksheets, project finish year will be highlighted in green.

Project Location

Because funding is granted based on the benefits made to highway system of Virginia, the model has the capability to correlate project location to specific highway corridor(s). Sponsors and applicants should review the project location and think of all rail service that travels over project location, corridor or region. For example, if the route was shut down, which trains would be affected? Then think about how the freight, if no longer traveling by rail, would move on the highways within Virginia. The same goes for passenger traffic. What passengers travel over the project location? What highways would they drive on if rail was not available? See Appendix E for highway corridor correlation sketch.

The default for associated highways is an average of all of the corridors listed for selection. Multiple or single corridor selection is possible. If a highway name is highlighted in blue, it is considered to be selected. If the background remains white, it is not selected and will not be included in the calculations. In the example below, I-64, I-66, I-81, US29 and US58 are selected, while I-95 and US460 are not.

Project Location	Associated Highway	I-64 I-66 I-81 I-95 US29 US58 US460		(I-64, I-66, I-81, I-95, US29, US58, US460, and/or Select Counties)	The highway(s) that new rail freight or passenger service is diverting from when switching from highway use. Click to select one or more highways from the list at left. For state average, select all highways. To select or remove individual counties from selected highways go to Detailed Location worksheet (Make Highway Selection First).
		Rural	Urban		
	Rural and Urban Breakdown	76.81%	23.19%	Rural Percentage,Urban Percentage	Percentages of Rural and Urban along the selected routes.

The Rural and Urban breakdowns are calculated automatically, based on the associated highway selections.

Rail Freight Data and Truck Freight Data

Before filling out this section, applicants and sponsors should visualize the project location and function: the amount and type of freight traveling over the project location; the amount, source and termination of its route or routes. Consider how the freight would travel if rail was not an available option. Applicants and sponsors should fill out the rail freight data and truck freight data sections of the project information worksheet these thoughts in mind. See Appendix F for a sketch of how route lengths should be visualized.

Rail Freight Data	Annual tons of rail shipments (current)	0	tons/year	The current tonnage of rail shipments being made that can be associated with the project that start in, finish in, travel within or go through Virginia.
	Current Railcar Demand		# of railcars/year	Number of rail cars hauled on the line or branch serving the project (previous year).
	Additional Annual Railcar Demand	Please See Railcar/Passenger Demand Worksheet	# of railcars/year	Projected number, in addition to the current railcar demand, of railcars needed for service, by year, after project completion.
	Rail tons per railcar	70.2	tons/railcar	The average number of tons carried by one railcar on the project route. This value can be changed if detailed information about the shipments made on this route are available and will override the default value listed for trucks per railcar. The default value is 70.2 tons/railcar.
	Railcars per train		railcars/train	Average number of railcars in a train for the freight service associated with this project.
	Freight Rail Route Length, current		mi	Length of the current route.
	Freight Rail Route length, after project completion		mi	Length of the new route after project construction.
	Reduced Freight Mileage	0	mi	Distance the track in VA has been shortened, in miles, due to the construction of the project. (current-after project completion)
	Number of Rail Crossings Removed		number	Number of rail crossings removed due to the construction of the project.

Annual tons of rail shipments (current) – The current tonnage of rail shipments that pass over the project location in one year. The field for Annual tons of rail shipments is automatically calculated when the fields for current railcar demand and rail tons per railcar are filled in.

Current Railcar Demand – The number of railcars used to haul the shipments in a year. This value will be used as the base value for calculations involving the differences for future years in railcar demand. It will automatically fill in the current year of the Railcar and Passenger Demand Worksheet.

Additional Annual Railcar Demand – Is filled out on the Railcar and Passenger Demand worksheet. The Railcar and Passenger Demand worksheet is hyperlinked to the project information worksheet in this section.

Rail tons per railcar – A calculated item that can be overwritten by the project sponsor. The default value of 70.2 tons per railcar was taken using the average value of rail shipments originating in, traveling within, terminating in, or going through the Commonwealth of Virginia. If a more detailed value is known for a particular project, the sponsor or applicant may overwrite the value and provide the resource information when applying for REF funds. If the value is overwritten, a soft warning will appear and the units box will change from "tons/railcar" into a hyperlink to the field where a short justification can be written for the overwrite. The hyperlink will appear dark red until the justification is provided.

Railcars per train – The average number of railcars traveling over the project location in a year.

Mileages (Freight Rail Route Length, current and after project completion, Truck Trip Length, Current) – The Route Length diagram in Appendix F shows a single example of what distances should be averaged for the route length values. Mileage measurements for a route should

begin with either the origin (if it starts within the Commonwealth of Virginia) or where the freight enters the Commonwealth of Virginia, continues to travel over the project location, and finishes with the location where the freight either leaves the Commonwealth or concludes travel within the Commonwealth. A weighted average of all routes traveling over the project location should be entered into the Project Information Worksheet for both the current and after project values for rail and the current value for truck travel.

Truck Freight Data	Truck Trip Length, Current (VA)		miles	Average distance traveled per trip by freight trucks, that will switch to rail after project completion. The mileage reflects highway miles driven in
	Trucks per railcar	3.41	#	The average number of trucks required to replace one railcar. The default value is based on freight movements starting in, ending in, travelling through or travelling within the State of Virginia. This value will be overwritten if rail tons per railcar and/or tons per truck load are overwritten.
	Tons per Truck Load	20.59	tons/truckload	The average number of tons carried by one truck related to the the project route. This value can be changed if detailed information about the shipments made on this route are available and will override the default value listed for trucks per railcar. The default value is 20.59 tons/truck.

Reduced Freight Mileage – This value is automatically calculated by taking the difference in the current and after project completion distances for rail.

Number of Rail Crossings Removed – If the project completion will result in closing at-grade highway-rail crossings, list the number of crossings that will be closed, otherwise enter zero (0) for this value.

2.3 Rail Passenger Data and Vehicle Passenger Data

Before filling out this section, applicants and sponsors should visualize the project location: how passengers are routed over the project location; the number of passengers; their purpose of travel; and the origination and termination of the routes. Applicants and sponsors also should consider how the passengers would travel if rail was not an available option. The passenger data and vehicle passenger data sections of the project information worksheet should be filled out with these thoughts in mind. For each category, selections for either Amtrak and/or VRE can be made.

Number of Passengers per year –The current number of passengers that pass over the project location in one year. In essence, those passengers that will benefit first-hand when the project is completed.

Additional Passenger Demand – Is filled out on the Railcar and Passenger Demand worksheet. The Railcar and Passenger Demand worksheet is hyperlinked to the project information worksheet in this section.

Number of Passenger Trains per year (Current)– The number of passenger trains that are routed over the project location during the last full year.

Mileages (Passenger Trip Length (Existing and After Project, Rail; Automobile Trip Length) – Mileage measurements for a route should begin with either the origin (if it starts within the Commonwealth of Virginia) or where the passenger enters the Commonwealth of Virginia, continues to travel over the project location, and finishes with the location where the passenger either leaves the Commonwealth or concludes travel within the Commonwealth. A

weighted average of all routes traveling over the project location should be entered into the Project Information Worksheet for both the current and after project values for rail and the current value for vehicle travel.

Rail Passenger Data					
	Number of Passengers per year (Current)		0	#	Number of passengers in the most current year. (Amtrak and VRE) This number accounts for the Virginia ridership in the current year on routes associated with the project.
	Additional Passenger Demand	Please See Railcar/Passenger Demand Worksheet		#	Number of additional passengers per year expected after project completion (Amtrak and VRE). These values are projected by year and account for Virginia ridership on routes that will benefit from project
	Number of Passenger Trains per year (Current)			#	The current number of passenger trains that can be associated with the project that start in, finish in, travel within or go through Virginia.
	Passenger Trip Length (Existing, Rail)		56.2	miles	The current average length of trip, in miles, per passenger
	Passenger Trip Length (After Project, Rail)		56.2	miles	The average length of trip, in miles after the project is complete, per passenger
	Reduced Passenger Mileage	0	0	miles	The reduction of passenger miles due to project completion, per trip.
	Travel time per trip (current train)		92	minutes	The average amount it time it takes one passenger to complete the route (current).
	Travel time per trip (After Project)		92	minutes	The average amount it time it will take one passenger to complete the route after project completion.
	Reduction in Travel Time	0	0	minutes	The travel time saved between the current and completed routes.
	Number of Rail Crossings Removed	0		number	Number of rail crossings removed due to the construction of the project.
	Passenger Travel Purpose	Breakdown in Percent for Amtrak Users	Breakdown in Percent for VRE Users	Local, Intercity, Business, Aggregated Local, Aggregated Intercity	The reason why passengers are using rail service. For each category, a percentage or value can be given. Local travel represents people travelling within the same city. Intercity travel is for travel between cities. Business travel represents passengers that are traveling for business. The aggregated values represent the combination of business and local or business and aggregated values based on county, regional or state levels. Values default to aggregated local Value of Time for VRE passengers and aggregated intercity Value of Time for Amtrak
	Local Personal VOT				
	Intercity Personal VOT				
	Business VOT				
	Aggregated local VOT		100		
	Aggregated intercity VOT	100			
	Total	100	100		Warning: Must total 100 each for Amtrak and for VRE.

Reduced Passenger Mileage – This value is automatically calculated by taking the difference in the current and after project completion distances for rail.

Travel time per trip (current train) – How long, using a weighted average, a passenger will be on the train that passes over the project location for the duration of their travel within the Commonwealth of Virginia now.

Travel time per trip (after project) – How long, using a weighted average, will a passenger be on the train that passes over the project location for the duration of their travel within the Commonwealth of Virginia after the project is completed.

Reduction in Travel Time – This value is automatically calculated by taking the difference in the current and after project completion travel times per trip.

Number of Rail Crossings Removed – If the project completion will result in closing at-grade highway-rail crossings, applicants and sponsors should list the number of crossings that will be closed, otherwise enter zero (0) for this value. This value is copied from the Rail Freight Data section and is listed here to remind the user that it can be realized as part of the safety benefits if the passenger benefits are the only ones to be realized.

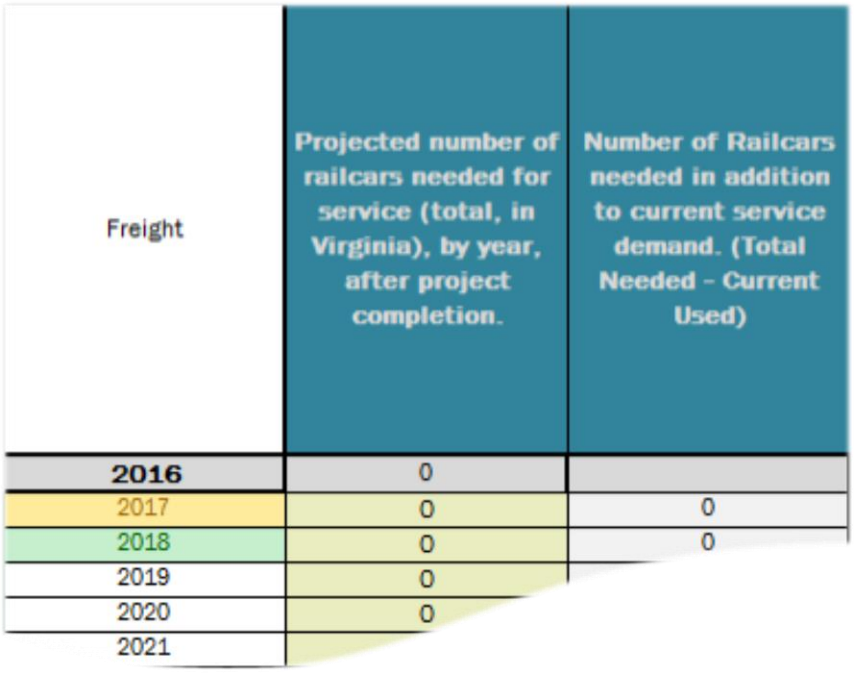
Passenger Travel Purpose (VOT = Value of Time) – Applicants and sponsors should detail the type of travel passengers are making while utilizing train service. Defaults correspond to aggregated local travel for VRE users and aggregated intercity travel for Amtrak users.

Current travel time by vehicle – This value represents the amount of time that a passenger spends in the vehicle to get from origin to destination (within the Commonwealth of Virginia) that would be replaced by travel time on the train after the project is completed.

Change in travel time for switching – This value is automatically calculated by taking the difference between the travel time before the project by vehicle and subtracting the travel time per trip after project.

Railcar and Passenger Demand

Applicants and sponsors should use the railcar and passenger demand worksheet to enter the total number of railcars and/or passengers needed for the years after project completion. The project start year, if after the first year, will be highlighted in yellow. The project completion year will be highlighted in green. These values are taken from the Project Timeline section of the Project Information worksheet. If the page needs to be cleared out, when the reset railcar and passenger demand page button is clicked the entry values will be returned to zero. Fill in the projected number of railcars needed by year after the project is completed in this section, the number of additional passengers per year will be calculated to the right of the entry values automatically.



Freight	Projected number of railcars needed for service (total, in Virginia), by year, after project completion.	Number of Railcars needed in addition to current service demand. (Total Needed - Current Used)
2016	0	
2017	0	0
2018	0	0
2019	0	
2020	0	
2021		

Passenger	Projected number of passengers per year expected after project completion (total, in Virginia) (Amtrak). These values account for Virginia ridership on routes that will benefit from project construction.	Number of additional passengers per year expected after project completion (Amtrak). (Total needed - Current used)	Projected number of passengers per year expected after project completion (total, in Virginia)(VRE). These values account for Virginia ridership on routes that will benefit from project construction.	Number of additional passengers per year expected after project completion (VRE). (Total needed - Current Used)
2016	0		0	
2017	0	0	0	0
2018	0	0	0	0
2019	0	0	0	0
2020	0	0	0	
2021	0	0		
2022	0	0		
2023	0			

3. Project Cost

3.1 Cost Breakdown

Project costs are broken down into nine categories, with an additional column for in kind contributions that are not figured into the project calculations. This section is for the total costs associated with the project. The project costs should be filled into the worksheet by year in the cells B3 to K27. That range is broken down into the following categories:

- Capital Costs
- Environmental Evaluation/Permitting
- Public Involvement
- Design Engineering
- Right of Way Acquisition/Utilities
- Construction
- Construction Management
- Lease/Acquisition of Equipment
- Other

				Capital Costs (All Costs
1) Fill in Project Costs	Capital Costs (All Costs Associated, DRPT + Other sources of funding)	Environmental Evaluation/ Permitting	Public Involvement	Design Engineerin
2015	$ 20,000.00			
2016		$ 40,000.00		
2017				
2018				
2019				
2020				
2021				
2022				
2023				
2024				
2025				

For easy reference, if not the current year, the project start year is highlighted in yellow and the project finish year is highlighted in green. Both are taken from the values listed in the project timeline section of the project information worksheet. The totals by year are then automatically added in column L and transferred to the funding sources and project cost NPV sections of the worksheet.

3.2 Funding Sources

In row 30 of the project cost spreadsheet, costs can be dispersed to the funding sources. If the percentage of funds are to be the same in every year, the percentage of funds to be provided by DRPT (maximum of 70% of the project total) can be filled into cell C31. A soft warning will

appear if a value greater than 70% is entered into cell C31. The funding values will automatically be calculated based on the totals from cells B3 to J27. If the funding is to be allocated in different percentages, the values in grey can be overwritten if justification is provided.

3.3 Net Present Value

Cells F30 through L57 are used to calculate the Net Present Value (NPV) for the Benefits and Costs by year. Cells N31 through S57 provide the NPV for funds provided by DRPT and Outside Funds. A summary of the NPV for 3% and 7% for DRPT funds and Total funds are provided in cells A60 through C62. These areas are used for calculation and cannot be edited.

	Benefit Cost NPV 3%	Benefit Cost NPV 7%
DRPT Funds	0.00	0.00
Total Funds	0.00	0.00

3.4 Number of Years to Calculate

DRPT recommends a minimum required useful life of 15 year for a project. A soft stop will appear and the cell will turn pink with red text if a value of less than 15 years is entered. While values can be entered for any number of years in the railcar and passenger demand and project cost worksheets, calculations are made for the number of years inputted into cell H61 on the project cost worksheet. This enables the applicant or project sponsor to easily edit the project horizon while looking at the NPV of the Benefit Cost Ratios immediately to the left of this entry. Please note that projected BCA Values are available until the year 2040, a message of "No Available Values" will be received for calculations attempted for years after 2040.

Number of Years to Calculate:	15

3.4.1 Outputs of the 2016 BCA Model

The Department of Rail and Public Transportation is committed to transparency and industry best practices in the allocation of Rail Enhancement Funds. The 2016 BCA Model is the first step in that process and is built on those commitments. The Department will utilize a summary sheet with sections for the following: project information; freight benefits and passenger benefits showing the benefit name, the benefit amount (with no adjustment for NPV), and the definition of the benefit; total benefits and cost broken down by funding source; and lastly, the benefit cost ratio being brought to current year value using net present value. See Appendix G for one page summary sheet.

4. Prioritizing Rail Enhancement Fund Projects

The Code of Virginia requires the Commonwealth Transportation Board to make a formal finding that the public benefits of an REF project exceed the cost of the REF investment. The Department has developed the following scorecard to guide the CTB deliberations and actions, as well as to guide any subsequent grant conditions or oversight.

Scorecard(SC) 1. Rail Enhancement Fund: Corridor Investment Scorecard

The Rail Enhancement Fund (REF) is a dedicated source of funding for capital improvements benefiting passenger and freight initiatives. This document outlines the process of and reason for evaluating the benefits of the Commonwealth's investment in freight and passenger rail infrastructure.

SC.i Purpose

Article X, Section 10 of the *Constitution of Virginia* indicates that the Commonwealth can only make internal improvements with state parks and the state highway system. Investment in rail infrastructure is not explicitly included in this article and, therefore, it has been ruled that any investment of Commonwealth funds in rail infrastructure must benefit the highway system (*Montgomery County v. Virginia DRPT*, 282 Va. 422,719). It is always important to highlight and summarize the benefits of any government program. However, the ruling in the *Montgomery v DRPT* case makes it critical to summarize and highlight the benefits of the REF program to the highways of Virginia.

In addition, in HB 1887, the 2015 General Assembly directed the Commonwealth Transportation Board (CTB) to "develop no later than December 1, 2015, a legislative proposal to revise the public benefit requirements of the Rail Enhancement Fund…." Section 427 of the Appropriations Act that same year directed the Secretary of Transportation and DRPT to summarize previous REF allocations, expenditures and transfers, as well as the long-term needs of the REF. The CTB, through its Rail Subcommittee, expanded the study to include an equivalent consideration of program policy goals for the REF program. As a result, DRPT, in conjunction with the Rail Subcommittee and an open process of stakeholder engagement, is conducting administrative improvements to simplify the grant process and to enhance overall transparency and accountability of REF activities. This REF scorecard is one initiative that will create higher accountability and transparency for the REF program.

SC.ii Process

To complete a vision of enhancing and expanding freight and passenger rail in Virginia, this Rail Enhancement scorecard will be created annually and provided to the CTB for their review and to assist with their assessment of the effects of the REF program.

1. **Step 1**—All REF grant agreements will include the requirement that grantees will provide data annually to DRPT in order to effectively and accurately complete the annual REF scorecard.

2. **Step 2**—DRPT will gather and analyze all grantee provided data, organizing the data by corridor and comparing both existing corridor-wide performance with the expected project benefits of each REF assisted project.
3. **Step 3**—DRPT will provide the REF scorecard to the CTB Rail Subcommittee annually, and will be available to discuss and dissect the report with the Rail Subcommittee members to ensure that the information is accurate and understandable.
4. **Step 4**—CTB Rail Subcommittee members and DRPT will be responsible for reviewing the scorecard information and updating the policies, procedures, and goals of the REF program according to the overall benefits to the highway system and performance of the railroads in Virginia.

SC.iii Scorecard Results

The following pages break down the REF program of investments and the resulting performance and benefits by strategic corridor within the Commonwealth of Virginia.

SC.iv Location of Strategic Rail Corridors in Virginia

Sample Rail Corridor

Key facts

- Key facts about the project and programming.
- Key statistics about amount of investment.
- Key facts about corridor operations.

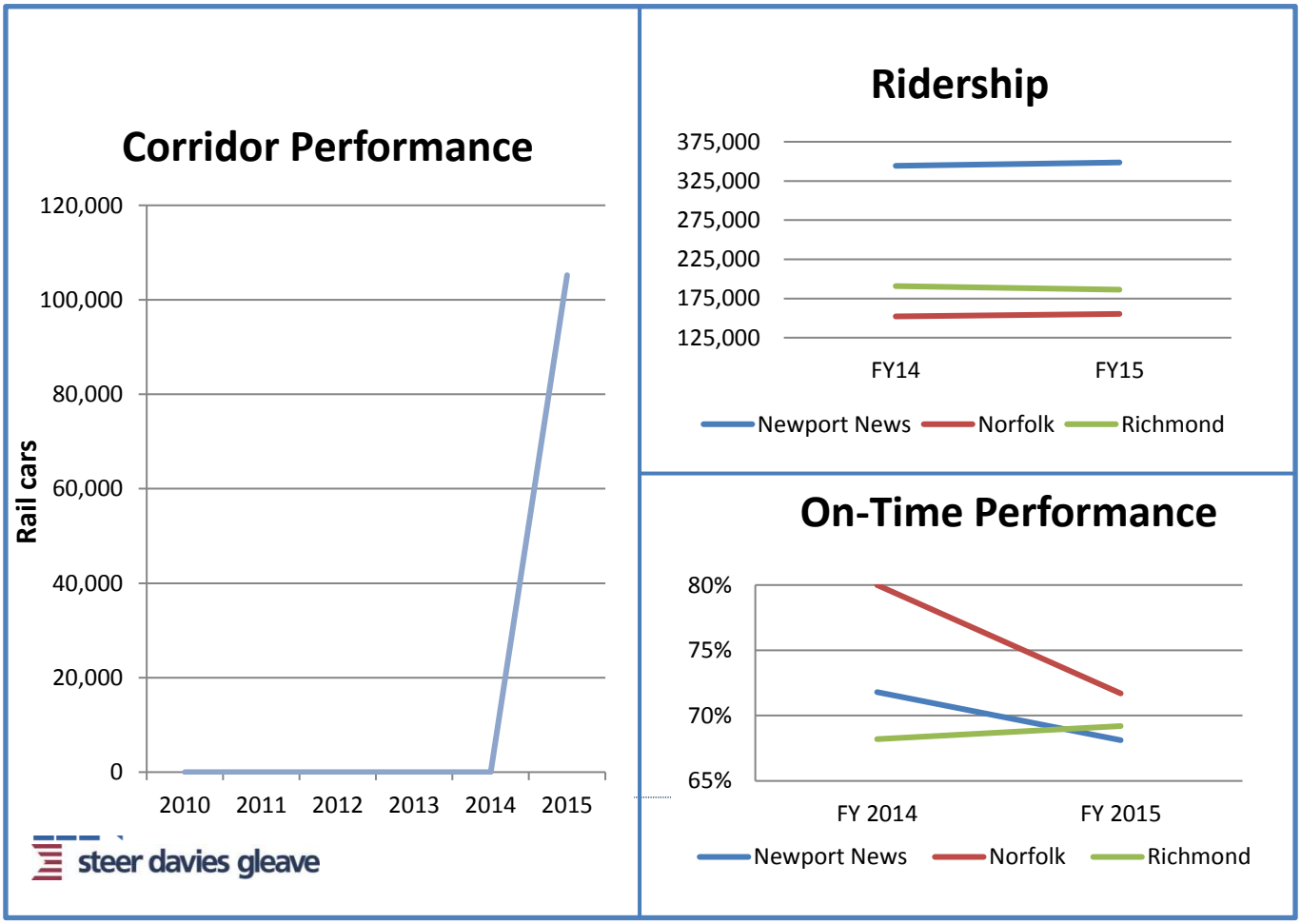
Projects

- List of Projects and Key facts.
- Project 1
- Project 2
- Project 3
- Project 4
- Project 5
- Project 6

Baseline Corridor Values

Total Carloads #	Total Passengers #
Total Highway Users Diverted #	Total Strategic Value #

Category	Benefit	Description
Congestion Cost	#	Improvement in the levels of highway congestion realized by shifting traffic from highway to rail.
Environmental	#	Benefit associated with the reduction in the level of CO2, VOCs, NOx and Particulate Matter due do highway traffic moving to rail.
Shipping Cost	#	Cost savings realized by reducing the existing route length and/or switching shipping modes; long haul shipping costs are lower by rail.
Pavement Maintenance	#	This calculates the reduction in road pavement maintenance costs due to the mode shift of highway users.
Accident Cost	#	Reduction in the probability of having an accident on the highway due to reduction of total VMT.
Economic	#	Improved labor productivity attributable to increased productivity while traveling via rail.
Corridor Velocity	#	Average freight velocity for trains in the corridor.
On-Time-Performance	#	2015 average of all passenger trains that arrived within 15 minutes of their scheduled arrival.



Appendix A: VA Code 33.2-1601

Code of Virginia Title 33.2. Highways and Other Surface Transportation Systems Chapter 16. Rail Funds

§ 33.2-1602. Shortline Railway Preservation and Development Fund

A. For the purposes of this section: "Fund" means the Shortline Railway Preservation and Development Fund. "Railway transportation support facilities" means facilities required for the loading, transfer, or additional track capacity to facilitate the shipment of goods by rail other than as provided for in § 33.2-1600 or 33.2-1601. "Shortline railway" means any Class II or Class III railroad as defined by the U.S. Surface Transportation Board.

B. The General Assembly declares it to be in the public interest that shortline railway preservation and development of railway transportation support facilities are important elements of a balanced transportation system of the Commonwealth for freight and passengers, and further declares it to be in the public interest that the retention, maintenance, and improvement of the shortline railway and development of railway transportation support facilities are essential to the Commonwealth's continued economic growth, vitality, and competitiveness in national and world markets.

C. There is hereby created in the state treasury a special non-reverting fund to be known as the Shortline Railway Preservation and Development Fund. The Fund shall be established on the books of the Comptroller and shall consist of such funds from such sources as shall be set forth in the general appropriation act and shall be paid into the state treasury and credited to the Fund. Interest earned on moneys in the Fund shall remain in the Fund and be credited to it. Any moneys remaining in the Fund, including interest thereon, at the end of each fiscal year shall not revert to the general fund but shall remain in the Fund. Moneys in the Fund shall be used solely as provided in this section. Expenditures and disbursements from the Fund shall be made by the State Treasurer on warrants issued by the Comptroller upon written request signed by the Director of the Department of Rail and Public Transportation or the Director's designee.

D. To fulfill this purpose, there shall be funding set forth each year in the appropriation act and appropriated by the General Assembly in the Rail Assistance Program of the Department of Rail and Public Transportation. These funds shall be used by the Department of Rail and Public Transportation to administer a Shortline Railway Preservation and Development Program for the purposes described in subsection B. Furthermore, the Board shall include an annual allocation for such purpose in its allocation of transportation revenues.

E. The Director of the Department of Rail and Public Transportation shall administer and expend or commit, subject to the approval of the Board, the Fund for acquiring, leasing, or improving shortline railways and the development of railway transportation support facilities or assisting other appropriate entities to acquire, lease, or improve shortline railways and the development of railway transportation purposes whenever the Board has determined that such acquisition, lease, or improvement is for the common good of a region of the Commonwealth or the

Commonwealth 1 8/28/2016 as a whole. The Director of the Department of Rail and Public Transportation may consult with other agencies or their designated representatives concerning projects to be undertaken under this section.

F. Tracks and facilities constructed, and property and equipment purchased, with funds under this section shall be the property of the Commonwealth for the useful life of the project, as determined by the Director of the Department of Rail and Public Transportation, and shall be made available for use by all common carriers using the railway system to which they connect under the trackage rights agreements between the parties. Projects undertaken pursuant to this section shall be limited to those of a region of the Commonwealth or the Commonwealth as a whole. Such projects shall include a minimum of 30 percent cash or in-kind matching contribution from a private source, which may include a railroad, a regional authority, private industry, a local government source, or a combination of such sources. No single project shall be allocated more than 50 percent of total available funds.

2006, c. 856, § 33.1-221.1:1.2; 2014, c. 805

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§ 33.2-1602. *Shortline Railway Preservation and Development Fund.* Lawlisvirginiagov. 2016. Available at: http://law.lis.virginia.gov/vacode/title33.2/chapter16/section33.2-1602/. Accessed August 28, 2016.

Appendix B: Summary of Enhancements and Updates to the Rail Enhancement Fund BCA Model

Enhanced or New Benefit Measures			
Beneficiary	**Benefit Type**	**Benefit Measure**	**Enhancement**
Highway users	Congestion Cost	Total reduction in highway congestion costs from shifting passengers or freight to rail	Developed local corridor-specific congestion measures – previously aggregate national measures
New Rail Passengers	Reduced Accident Cost	Total reduction in accident costs from shifting passengers to rail	Developed state-level safety factors – previously aggregate national measures
	Reduced Passenger Transportation Costs	Net reduction in vehicle operating costs (fuel, depreciation, etc..) for passenger shifting to rail	Incorporated complete costs – previously included only fuel
New and Existing Rail Passengers and freight	Travel Time Savings	Total travel time savings reflecting enhanced value of time estimates	Developed state-level and sub-state level values – previously aggregate national measures for passengers. Totally revamped freight values
General Public	Environmental Improvement	Reduced health costs attributable to vehicle emissions reductions	Developed local measures of health benefits – previously aggregate national measures
Shippers and General Public	Shipping Cost Reduction	Shipping cost reductions from reduced mileage and/or economies of scale	Totally revamped cost estimates
General Public	Wider Economic Benefits	Labor productivity benefits from improved accessibility	Not previously included in the BCA model

Updated Benefit Measures			
Beneficiary	**Benefit Type**	**Benefit Measure**	**Update**
Transportation Agencies	Savings in Pavement Maintenance	Reduction in road pavement maintenance costs from shifting passengers or freight to rail	Updated to reflect current cost estimates
General Public	Environmental Improvement	Reduced health costs attributable to noise reductions	Updated to reflect current dollar values

Moffatt & Nichol, Steer Davies Gleave. *Recommended Updates and Enhancements to The Rail Enhancement Fund Benefit-Cost Analysis Model* (DRAFT); 2015:6.

Appendix C: Beneficiaries of and Factors used to calculate Model Benefits

Travel Time Savings

- **Improved corridor throughput**
- **Beneficiaries:**
  - New rail users (Passenger/freight) diverted to the faster rail service from the other modes;
  - Remaining highway users on the less congested parallel highway(s)

Main Factors

- Remaining Users
  - Reduction in Truck or Passenger Vehicle Mile Travelled
  - Congestion Cost per Truck or Vehicle Mile
- New Users
  - Per trip time savings
  - Weighted Average Value of Time
  - Annual Passengers (existing)
  - Travel time Savings per trip of new passengers
  - Annual Passengers (new)

Safety

- **Rail movements are statistically safer than highway movements.**
- **Beneficiaries:**
  - New rail users (Passenger/freight) diverted to the less hazardous rail service from the other modes;
  - Remaining highway users on the parallel highway(s)

Main Factors

- Freight
  - Truck Ton Miles
  - Crash Costs per truck ton miles
  - Train Ton Miles
  - Freight Train Crash Cost per train ton mile
  - Crash cost per rail crossing
  - Number of Rail Crossings
- Passenger
  - Reduction in Passenger VMT
  - Crash Costs per vehicle mile
  - Crash cost per rail crossing
  - Number of Rail Crossings

Environmental Effects

- **Rail movements have fewer emissions per ton/passenger miles than highway movements.**
- **Beneficiaries:**
  - The general public

Main Factors

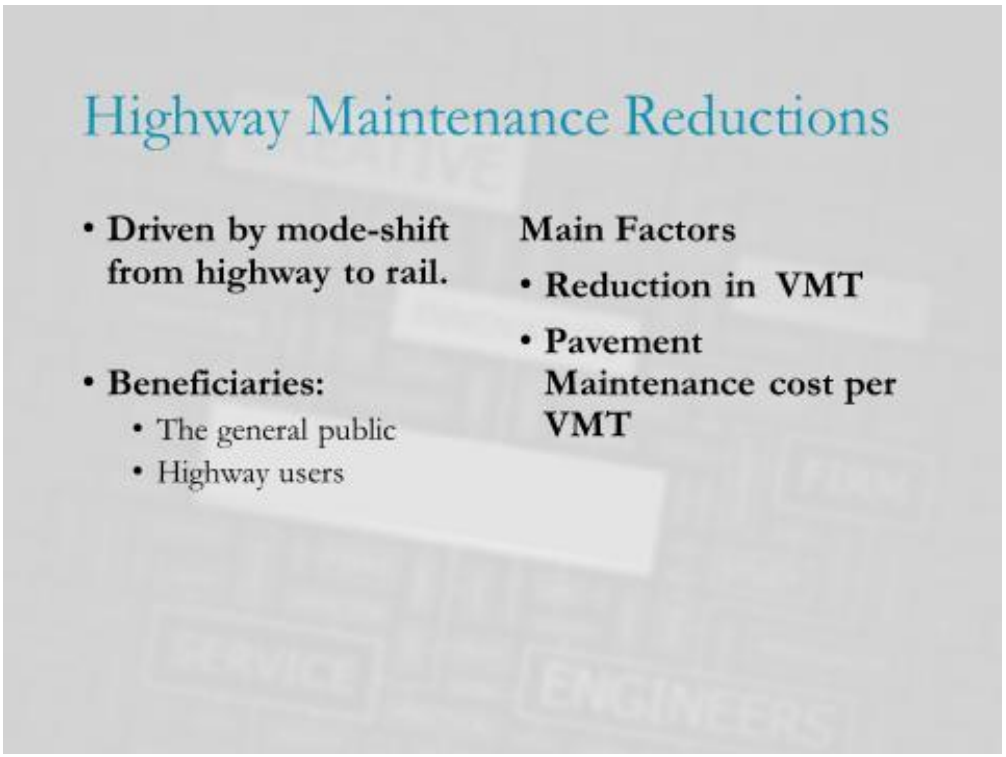
- Freight Mode shift
  - Truck VMT / Train Ton Miles
  - Truck Air and Noise Pollution Cost
  - Train Air and Noise Pollution Costs
- Passenger Mode Shift
  - Passenger VMT/Train Mile
  - Vehicle Air and Noise Pollution Cost
  - Air and Noise Pollution Cost per passenger-train mile
- Distance Reduction
  - Reduced Train Mileage
  - Train Air and Noise Pollution Costs

Operating Costs

- **Freight train movements have lower operating costs per ton mile than truck movements**
- **Beneficiaries:**
  - New freight rail users who diverted to the less costly mode
  - The general public through economic competitiveness

Main Factors

- Mode Shift - Freight
  - Truck VMT
  - Truck Shipping Rate
  - Train Ton Miles
  - Rail Shipping Rate
- Passenger
  - Reduction in VMT
  - Operating Cost per Mile
  - Increased Passenger Miles
  - Fare per Mile



Rezvani A, Mindick-Walling A, Homer P, Burke E. *CTB Rail Programs Review & BCA Overhaul*. 2016.

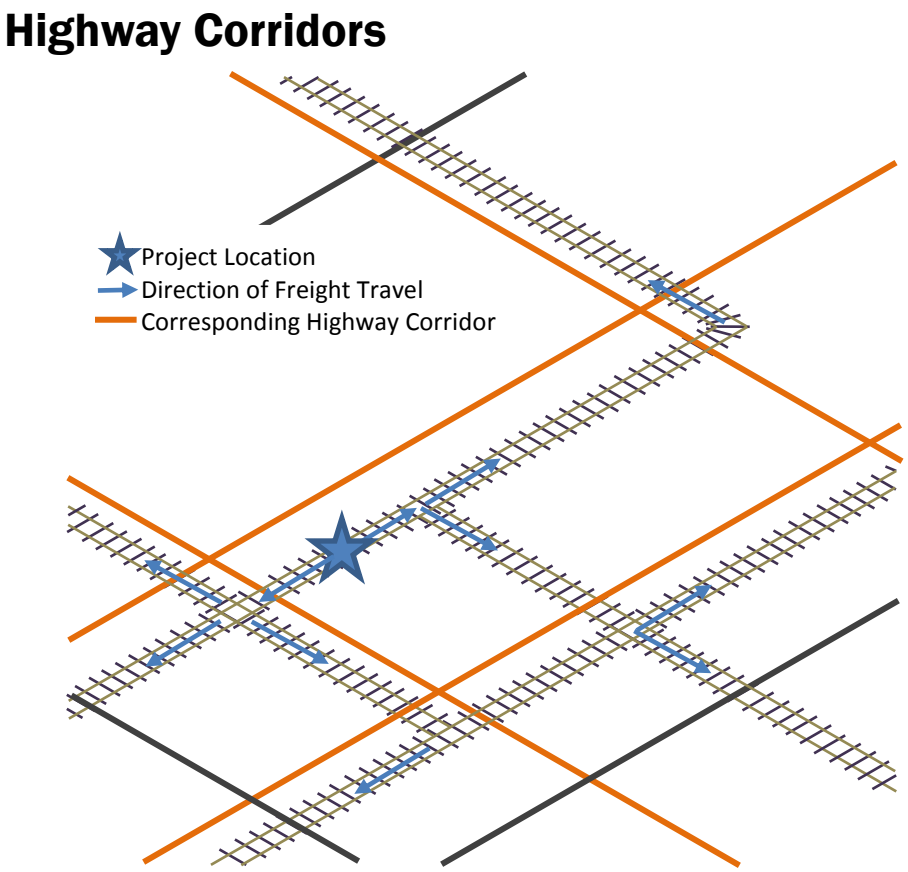
Appendix D: Source Information

Use	Term	Recommended Sources	Source Location	Selection Reason	Update Frequency
Freight	Trucks per Rail Car	USDOT, FHWA, Freight Analysis Framework (2012)	http://ops.fhwa.dot.gov/FREIGHT/freight_analysis/faf/index.htm	-Publicly Available - Virginia Specific values - Industry Best Practice	Annual
		Public Waybill Sample	http://www.stb.dot.gov/stb/industry/econ_waybill.html		
	Congestion cost	USDOT, FHWA, Freight Analysis Framework (2012)	http://ops.fhwa.dot.gov/FREIGHT/freight_analysis/faf/index.htm	- Corridor Level Values - Publicly Available - Virginia specific values for passenger and freight value of time - Clear separation of Urban and Rural based on highway characteristics - Industry Best Practice	Annual
		VDOT, Investigation of Speed-Flow Relations and Estimation of Volume Delay Functions for Travel Demand Models in Virginia (2009)	http://trbappcon.org/2009conf/TRB2009presentations/s12/TRB_App_Conf_12_100_Lee_Munn_0519_2009.ppt		
		An Analysis of the Operational Costs of Trucking: A 2014 Update (ATRI)	http://www.atri-online.org/wp-content/uploads/2014/09/ATRI-Operational-Costs-of-Trucking-2014-FINAL.pdf		
		2013 American Community Survey (BLS)	http://www.bls.gov/news.release/pdf/ecec.pdf		
	Truck Noise pollution cost	TIGER IV (National Average)	https://www.transportation.gov/sites/dot.gov/files/docs/TIGER%20BCA%20Resource%20Guide%202014.pdf	-Industry Best Practice	Annual
	Truck Air Pollution	US Department of Environmental Protection: Motor Vehicle Emission Simulator (MOVES2014a)	http://www3.epa.gov/otaq/models/moves/	- Use of a more up-to-date source - Moves 2014 is specific to metropolitan and rural areas	Survey for new research every 5 years
		Muller and Mendelsohn, "Measuring the Damages of Air Pollution in the United States" (2007)	- Not easily accessible		
	Train Air Pollution	EPA - "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Engines Less than 30 Liters per Cylinder" (2008)	http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P10024CN.TXT	- Use of a more up-to-date source - EPA source values consistent with truck air pollution -Publicly Available - Industry Best Practice	Survey for new research every 5 years
	Noise pollution cost per train ton mile	Forkenbrock (2001)	http://nexus.umn.edu/Courses/ce8214/papers/Forkenbrock2001.pdf	- Available Industry Practice -Publicly Available	Survey for new research every 5 years
	Shipping rate per train ton mile	Association of American Railroads (2013)	https://www.aar.org/data-center	- Best Industry Practice -Publicly Available	Annual
	Shipping rate per truck ton mile	DAT Solutions, DAT Trendlines, Southeast Regional Van Rates, (Spring 2015)	http://www.dat.com/resources/trendlines	- Use of a more up-to-date source - Regional values - Publicly Available	Annual
	Pavement maintenance cost per truck mile	USDOT, Addendum to the FHCA Study, 2000	http://www.fhwa.dot.gov/policy/hcas/addendum.cfm	- Industry Practice	Survey for new research every 5 years
	Accident cost per truck VMT	Virginia DMV, Accident, Fatality and Injury Frequency (2014)	http://www.dmv.state.va.us/safety/#crash_data/crash_facts/index.asp	- Use of a more up-to-date source - Publicly Available - Virginia Specific values - Industry Best Practice	Annual
		TIGER IV (Values for Crashes and Injuries)	https://www.transportation.gov/sites/dot.gov/files/docs/TIGER%20BCA%20Resource%20Guide%202014.pdf		
	Accident cost per freight train ton mile	Forkenbrock (2001)	http://nexus.umn.edu/Courses/ce8214/papers/Forkenbrock2001.pdf	- Best Industry Practice - Publicly Available	Survey for new research every 5 years
	Accident cost per rail crossing removed	VDOT, Rail Crossing Injuries (2010-2015)	http://www.virginiadot.org/sitemap/default.asp	- Use of a more up-to-date source - Publicly Available - Virginia Specific values - Industry Best Practice	Annual
		TIGER IV	https://www.transportation.gov/sites/dot.gov/files/docs/TIGER%20BCA%20Resource%20Guide%202014.pdf		
		FRA Office of Safety, Accident Reports (2010-2015)	http://safetydata.fra.dot.gov/officeofsafety/default.aspx		

Use	Term	Recommended Sources	Source Location	Selection Reason	Update Frequency
Passenger	Vehicle occupancy rate	2009 NHTS VA add-on survey	http://nhts.ornl.gov/2009/pub/usersguidev2.pdf	- Publicly Sourced Data - Use of a more up-to-date source - Virginia Specific values	Survey for new research every 5 years
	Congestion cost	USDOT, FHWA, Freight Analysis Framework (2012)	http://ops.fhwa.dot.gov/FREIGHT/freight_analysis/faf/index.htm	- Corridor Level Values - Publicly Available - Virginia specific values for passenger and freight value of time - Clear separation of Urban and Rural based on highway characteristics - Industry Best Practice	Annual
		VDOT, Investigation of Speed-Flow Relations and Estimation of Volume Delay Functions for Travel Demand Models in Virginia (2009)	http://trbappcon.org/2009conf/TRB2009presentations/s12/TRB_App_Conf_12_100_Lee_Munn_0519_2009.ppt		
		An Analysis of the Operational Costs of Trucking: A 2014 Update	http://www.atri-online.org/wp-content/uploads/2014/09/ATRI-Operational-Costs-of-Trucking-2014-FINAL.pdf		
		2013 American Community Survey	http://www.bls.gov/news.release/pdf/ecec.pdf		
	Accident cost per vehicle mile	Virginia DMV, Accident, Fatality and Injury Frequency (2014)	http://www.dmv.state.va.us/safety/#crash_data/crash_facts/index.asp	- Use of a more up-to-date source - Publicly Available - Virginia Specific values - Industry Best Practice	Annual
		TIGER IV (Values for Crashes and Injuries)	https://www.transportation.gov/sites/dot.gov/files/docs/TIGER%20BCA%20Resource%20Guide%202014.pdf		
	Accident cost per train passenger mile	USDOT Bureau of Transportation Statistics 2015	http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/index.html	- Use of a sourced value - Publicly Available - Virginia Specific values - Industry Best Practice	Annual
		TIGER IV (Values for Crashes and Injuries)	https://www.transportation.gov/sites/dot.gov/files/docs/TIGER%20BCA%20Resource%20Guide%202014.pdf		
	Accident cost per rail crossing	VDOT, Rail Crossing Injuries (2010-2015)	http://www.virginiadot.org/sitemap/default.asp	- Use of a more up-to-date source - Publicly Available - Virginia Specific values - Industry Best Practice	Annual
		TIGER IV	https://www.transportation.gov/sites/dot.gov/files/docs/TIGER%20BCA%20Resource%20Guide%202014.pdf		
		FRA Office of Safety, Accident Reports (2010-2015)	http://safetydata.fra.dot.gov/officeofsafety/default.aspx		
	Vehicle operating cost	AAA, Your driving costs 2015	http://exchange.aaa.com/wp-content/uploads/2015/04/Your-Driving-Costs-2015.pdf	- Use of a more up-to-date source - Publicly Available - Industry Best Practice	Annual
	Fare per passenger mile (Amtrak/VRE)	Amtrak	https://www.narprail.org/our-issues/ridership-statistics/	- Use of a more up-to-date source - Publicly Available - Industry Best Practice	Annual
		VRE	http://www.vre.org/service/rider/consist/		
	Weighted average value of time	Census Bureau	http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml	- Use of a more up-to-date source - Virginia Specific (Regional and Corridor) Values - Publicly Available - Industry Best Practice	Annual
	Air pollutant emission	US Department of Environmental Protection: Motor Vehicle Emission Simulator (MOVES2014a)	http://www3.epa.gov/otaq/models/moves/	- Use of a more up-to-date source - Moves 2014 is specific to metropolitan and rural areas - Not easility accessible	Survey for new research every 5 years
		Muller and Mendelsohn, "Measuring the Damages of Air Pollution in the United States" (2007)	- Not easily accessible		
	Noise pollution cost per VMT	Federal Highway Cost Allocation Study (2000) (National Averages)	http://www.fhwa.dot.gov/policy/hcas/addendum.cfm	- Industry Best Practice - Publicly Available	Survey for new research every 5 years
	Air pollution cost per train mile	EPA - "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Engines Less than 30 Liters per Cylinder" (2008)	http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P10024CN.TXT	- Use of a more up-to-date source - EPA source values consistent with truck air polution -Publicly Available - Industry Best Practice	Survey for new research every 5 years
	Noise pollution cost per train mile	2014 California High-Speed Rail Benefit Cost Analysis (2014 Statewide Value)	http://www.hsr.ca.gov/docs/about/business_plans/BPlan_2014_Sec_7_CaHSR_Benefit_Cost_Analysis.pdf	- Most recent US based report on train noise pollution - Publicly Available	Survey for new research every 5 years
	Pavement maintenance cost per vehicle mile	Federal Highway Cost Allocation Study (2000)	http://www.fhwa.dot.gov/policy/hcas/addendum.cfm	- Industry Best Practice - Publicly Available	Survey for new research every 5 years

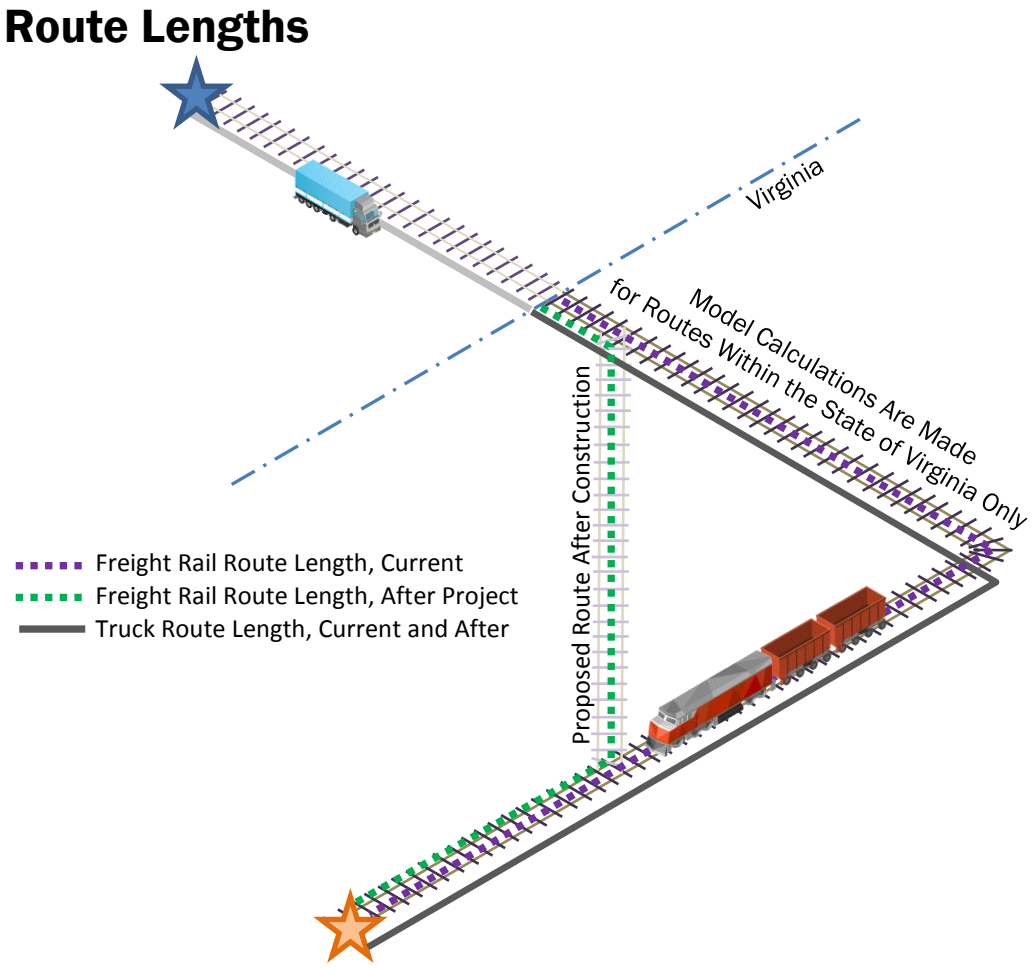
Appendix E

All route lengths should be averages of those traveled in Virginia.



Appendix F: Route Length Sketch

All route lengths should be averages of those traveled in Virginia.



Appendix G: Summary Sheet

	Project Name		
	Organization		

		Total	Definition
Freight Benefits	Congestion Reduction Benefit	$ -	Improvement in the levels of highway congestion realized by shifting freight from truck to rail, reducing the number of trucks on major highways.
	Environmental Improvement - (Shift from trucks to trains)	$ -	Benefit associated with the reduction in the level of Carbon Dioxide, Volatile Organic Compounds, Nitrogen Oxides and Particulate Matter due to truck traffic moving to rail.
	Environmental Improvement - (Distance Reduction)	$ -	Benefit associated with the reduction in the level of Carbon Dioxide, Volatile Organic Compounds, Nitrogen Oxides and Particulate Matter due the freight network being reduced in length.
	Shipping Cost Reduction - (Distance Reduction)	$ -	When an existing route is reduced in length, the cost to ship freight will be reduced resulting in a shipping cost reduction.
	Shipping Cost Reduction - (Mode Switch)	$ -	As the shipping costs per mile vary between truck and trains, a shift to rail from truck will result in a lower shipping cost per ton mile for long haul shippers. This is the benefit realized by reducing switching shipping modes.
	Savings in Pavement Maintenance	$ -	When trucks shift from truck freight to rail, the maintenance cost for the highway router will decrease. This calculates the reduction in road pavement maintenance costs due to the shift.
	Accident Reduction Benefit	$ -	Reduction in the probability of having an accident on the highway due to reduction of truck mileage.

		Total	Definition
Passenger Benefits	Congestion Reduction Benefit	$ -	Improvement in the levels of highway congestion realized by shifting passengers from highway traffic to rail routes, reducing the number of passenger vehicles on major highways.
	Accident Reduction Benefit	$ -	Reduction in the probably of having an accident on the highway due to reduction of passenger vehicle mileage.
	Passenger Transportation Cost Reduction	$ -	Benefit realized as the reduction in the cost to passengers for switching from highway vehicle use to being rail passengers. (Calculated for Amtrak and VRE)
	Travel Time Savings	$ -	The savings in time realized by existing passengers due to a reduction in length of the train route.
	Environmental Improvement - (Shift from trucks to trains)	$ -	Benefit associated with the reduction in the level of Carbon Dioxide, Volatile Organic Compounds, Nitrogen Oxides and Particulate Matter due do vehicle traffic moving to rail.
	Environmental Improvement - (Distance Reduction)	$ -	Benefit associated with the reduction in the level of Carbon Dioxide, Volatile Organic Compounds, Nitrogen Oxides and Particulate Matter due the rail freight network being reduced in length.
	Wider Economic Benefits	$ -	Improved labor productivity attributable to increased productivity.
	Savings in Pavement Maintenance	$ -	When passengers shift from vehicular traffic to rail, the maintenance cost for the highway router will decrease. This calculates the reduction in road pavement maintenance costs due to the shift.

		Total	NPV 3%	NPV 7%
Cost	DRPT	$ -	$ -	$ -
	Other	$ -	$ -	$ -
	Total	$ -	$ -	$ -
	Benefit	$ -	$ -	$ -

	BC Ratio (NPV 3%)	BC Ratio (NPV 7%)
DRPT Funds Only		
Total (All Funds)		

Reason for change in rail tons per rail car:		
Default Value = 70.2	Current Value =	70.2