NOTICE:

FY25 FREIGHT RAIL GRANT FUNDING AND PROCEDURES UPDATE

- **WebGrants is DRPT's new online grants management system.**
- **The following program guidance includes procedures that were developed prior to the transition to WebGrants and should be considered illustrative; some of the specific procedures may be slightly different within WebGrants.**
- **As we continue to refine the specific procedural changes we will update this guidance documentation.**
- **The program purpose, goals, and core criteria have not and will not be impacted.**

DRPT

VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION

DRPT FREIGHT Rail Grant Funding & Procedures

Table of Contents

Introduction

The Freight Rail Enhancement to Increase Goods and Highway Throughput (FREIGHT) program is a funding program of the Virginia Department of Rail and Public Transportation (DRPT); created pursuant to § 33.2-1526.4. This section of the Code of Virginia establishes the Commonwealth Rail Fund (CRF) seven percent of which is dedicated to DRPT for planning purposes and for grants for rail projects.

This document establishes the FREIGHT program as a grant with funds sourced from CRF, and provides guidance to administer the FREIGHT grant program, evaluate and accept applications, award funds, monitor project progress, and track performance.

§ 33.2-1526.4. Commonwealth Rail Fund

"…The remaining seven percent shall remain in the Fund for the Department of Rail and Public Transportation for planning purposes and for grants for rail projects not administered by the Virginia Passenger Rail Authority."

Purpose and Mission

DRPT and the Commonwealth are dedicated to creating a competitive multimodal network that provides choices for transportation users; system redundancies to increase network resilience; opportunities for economic growth; and increased access for all users.

The FREIGHT program is dedicated to increasing the capacity and improving the functionality of the freight rail network as a vital component of the Commonwealth's multimodal network.

INCREASE GOODS MOVEMENT

REDUCE HIGHWAY MAINTENANCE

IMPROVE ECONOMY

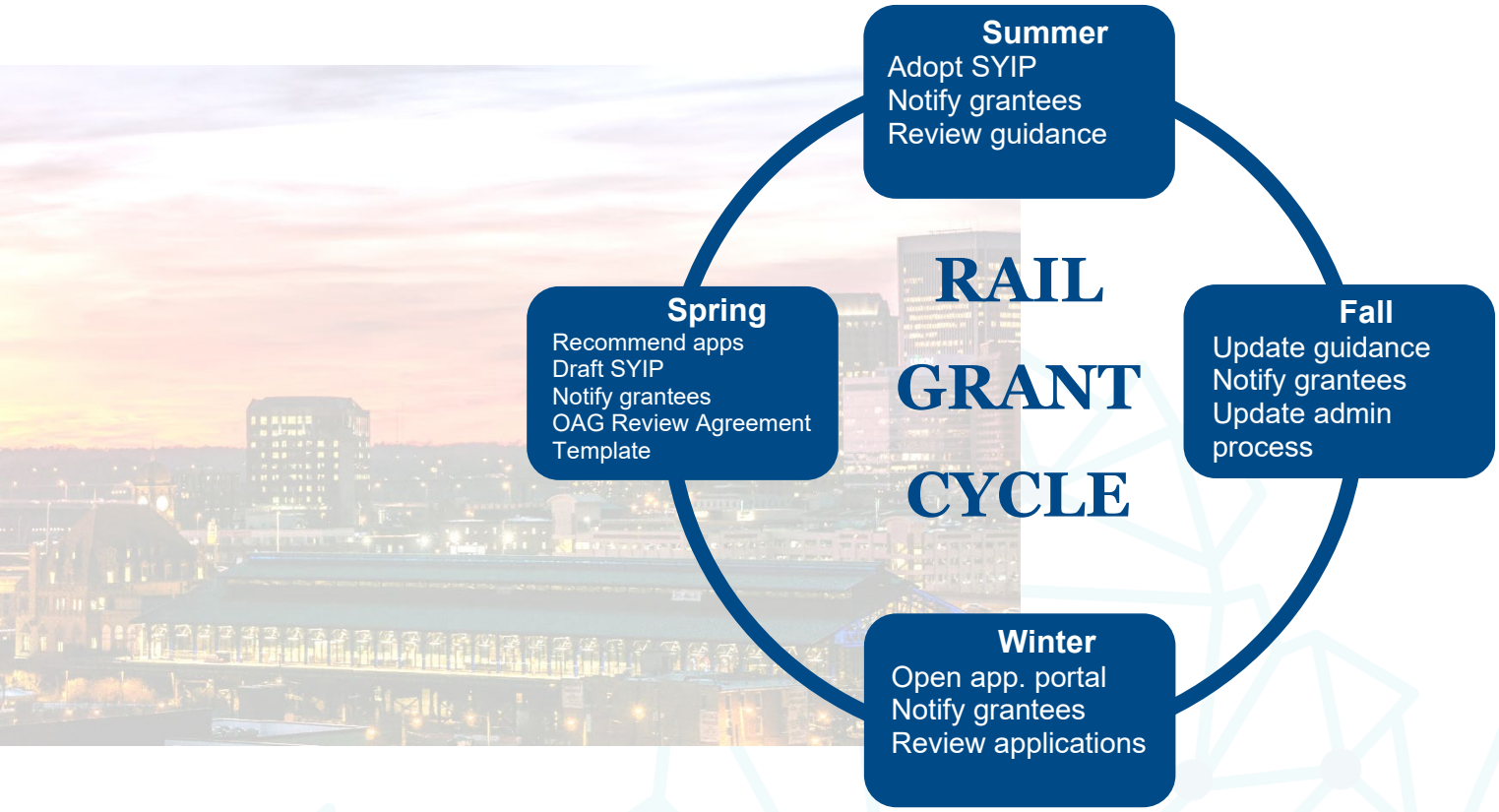
Grant Cycle

The FREIGHT program follows the existing DRPT grant cycle; aligning with established rail, transit and transportation demand management (TDM) grant programs administered by DRPT.

The grant cycle follows an annual schedule. The application period opens December 1, remaining open and accepting applications for two months, closing on February 1.

This schedules allows DRPT staff to review applications, collect additional information as needed, evaluate applications, and make recommendations to the Commonwealth Transportation Board (CTB) in advance of the adoption of the Six-Year-Improvement-Program (SYIP) in June each year.

DRPT staff communicates with grantees at multiple points throughout the grant cycle. Grantees are notified of how each application is evaluated and scored; updated on DRPT recommendations to the CTB; and provided confirmation of funding once the SYIP is adopted. In addition, DRPT staff solicits input from grantees regarding potential process improvements to be incorporated into program procedures as necessary.



Process to Safeguard Funds

The FREIGHT program includes four major elements that are outlined below and further detailed in this guidance document. The approach for each element of the program includes a methodology to safeguard the expenditure of Commonwealth funds.

Application

Applications are evaluated for eligibility and scored through an objective, data driven, process

DRPT recommends projects to the CTB based on scoring and available funding

Final decision for approval rests with the CTB and its adoption of the SYIP

Project Execution

Legal documentation to award funds to grantee

Agreement outlines the terms, conditions, and limitations of accepting funds

Grantee submits a detailed scope, schedule, and budget prior to receiving a notice to proceed for construction

Project Work

Planning, design and construction necessary to complete the project

Reimbursement based program; grantee expends their money first and requests reimbursement with proper documentation

DRPT monitors project progress through field reviews and construction oversight

Project Close

Completion and acceptance of the finished project

DRPT retains a contingent interest in the improvements, to ensure the infrastructure remains in service

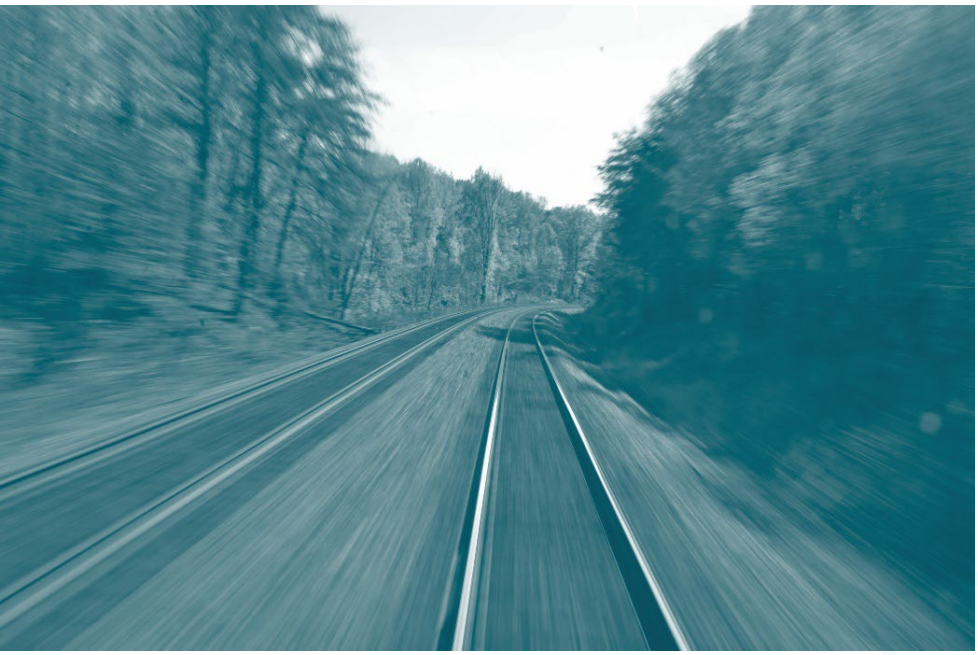
DRPT requires performance reporting to ensure the benefits outlined in the application are achieved

Application Process

Initiation

DRPT prepares announcements of the application period and requests applications. Information is also posted on the DRPT website. Applicants must submit applications within the advertisement period as identified by DRPT. The application must include comprehensive information; allowing DRPT to appropriately evaluate the application and understand the project impacts and benefits. The application form is attached as an appendix for reference.

Applications are submitted via the WebGrants system, located at: https://drpt.virginia.gov/our-grant-programs/grant-application-resources/ (a sample application form is included as an appendix for reference)
The WebGrants website includes instructions for registering an account and backs up each application electronically.



Evaluation

Using the WebGrants system, the DRPT Project Manager applies two levels of review to evaluate each application. The first level, includes an evaluation of the application eligibility and completeness. During the first level of review, the DRPT project manager will request additional information from the applicant, if needed.

The second level of review includes a scoring evaluation using the criteria outlined below.

Approval

Based on the application review, scoring evaluation, and funding availability, DRPT develops recommendations for the CTB. The CTB will approve and allocate funds to specific projects into the Six Year Improvement Plan (SYIP). Once CTB has made selections, DRPT:

- Sends notification to the Applicants of CTB's decision
- Notifies the public of approved projects
- Posts approved projects on DRPT website

Application Eligibility and Scoring

Project Eligibility

Projects must comply with the core eligibility requirements of the FREIGHT program in order to move to the second phase of the application process; scoring. The eligibility requirements include the following three criteria:

- **Align with state goals**
- **Network capacity expansion**
- **Minimum of 30% design complete**

ALIGN WITH STATE GOALS:

The purpose of the FREIGHT program is to strengthen the multimodal network in Virginia. Each project funded by the FREIGHT program must meet at least one goal of the Statewide Rail Plan (SRP). The SRP is developed in coordination with the Secretary of Transportation, and its partner agencies, to strengthen the multimodal network in Virginia, and outlines the goals and objectives to achieve that vision.

NETWORK CAPACITY EXPANSION:

To strengthen the multimodal network, the FREIGHT program seeks to increase capacity of the freight rail network, and therefore increase rail carload throughput. Capacity expansion can take the form of building rail infrastructure to increase physical capacity; improved operational capacity to increase throughput; and/or increasing customer demand through improved rail management practices. All projects must drive an increase in freight rail carload throughput.

The FREIGHT program will accept applications for study/design projects that seek to further the readiness of a project for construction. Studies must achieve at least 30% level of design, but

can also include planning, environmental analysis, and permitting, as applicable. The ultimate construction project being designed, must align with the state rail plan goals and be a rail network capacity expansion.

PROJECT READINESS:

To further safeguard Commonwealth funds, any construction projects must have at least 30% design completed prior to application. This will ensure more accurate cost estimates, reducing cost overruns and unexpected scope increases. Applications for design, or non-construction projects, do not require 30% design plans.

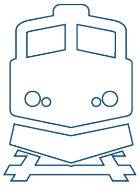
Detailed Eligibility

To further detail the core eligibility requirements, DRPT has developed a definition of common terms; and a list of eligible projects and recipients, and non-eligible projects:

- **Eligible Recipients:** Freight rail operators, Virginia Port Authority, local and regional governments, non-profit organizations, private companies, any combination thereof
- **Railways:** Permanent track that is part of a greater transportation network used for the movement of people and goods by train. Including mainline track, sidings, yards, terminals, storage tracks and all associated infrastructure necessary for operation, such as, but not limited to, signal systems; excludes industrial lead tracks and/or private storage facilities not owned by an established rail operator, or contributing capacity to the greater rail transportation network.
- **Railroad Equipment and Rolling Stock:** Any vehicles that operate on a railway that has a primary purpose of goods; excludes construction equipment or equipment with the primary purpose of loading/unloading goods.
- **Right-of-Way:** Land acquired for the direct purpose of completing an eligible project; and/or land acquired to improve operational capacity and increase network demand.
- **Facilities**: Facilities directly related to servicing rolling stock, which has the effect of adding capacity to the network.

The Applicant must, at a minimum, provide Design and Construction in accordance with the American Railway Engineer and Maintenance of Way Association (AREMA). Design and construction criteria may go beyond AREMA standards to meet any agreed upon basis of design and Grantee established standards which are compliant with FRA Track Safety Standards. The applicant also must provide or have provided continuous maintenance of the completed project.

Eligible Projects



- Railways: Mainline, siding, crossover, yards, terminals, and storage tracks
- Railroad equipment
- Rolling stock

Right-of-way acquisition
Rail facilities
Signaling
Engineering and design
Environmental
30% design complete

Eligible Recipients

Freight rail operators
Virginia Port Authority
Local and regional governments
Non-profit organizations

Private companies
Any combination thereof

Not Eligible

Railroad operating expenses
Passenger rail subsidies
Passenger rail capacity expansion

Equipment to handle, store, process, load, or unload goods

Application Scoring

All grant applications must meet the core eligibility requirements in order to move to the scoring stage of the application process. Data-driven scoring relies on objective evaluation measures that allow for comparison across multiple projects that may vary in scope, price, and benefit.

Benefit-Cost Analysis	Point Values	
3 points = BCA score below 50th percentile of applications 6 points = BCA score 50th percentile or above 7 points = project with highest BCA score	Benefit-Cost Analysis	7
Matching Funds	Matching Funds	6
2 points = 30% match 3 points = 40% match 6 points = 50% match	Project Readiness	4
Project Readiness	Statewide Goals	3
2 points = 60% design complete 4 points = 90% design complete	**Total**	**20**
Statewide Goal Alignment		
1 point awarded for each goal met in Statewide Rail Plan (up to 3 points)		

Benefit Cost Analysis

The benefit cost analysis (BCA) model was developed, used for over a decade under DRPT's previous Rail Enhancement Program (REF) grant guidance, and continually updated to use the most up-to-date metrics and methodologies. In general, the BCA evaluates the monetary benefits of diverting truck traffic off of Virginia highways, by increasing rail throughput. The complete BCA model user manual is included as an appendix for reference, and updates are housed on the WebGrants system at: **https://drpt.virginia.gov/our-grant-programs/grant-application-resources/**.

Applicants will provide the necessary information for the DRPT Project Manager to complete the BCA calculations. An application must score a benefit cost ratio of at least 1.0 – indicating that the benefit of the project exceeds the cost of the project – in order to receive any points in this category.

Matching Funds

The contribution of matching funds are critical to leverage Virginia's limited rail funding resources, and demonstrates commitment from the grantee to ensure efficient project execution. Applicants can receive more points in the scoring process by contributing more matching funds.

Project Readiness

Completing advanced design reduces the chances for cost overruns and unexpected scope expansion. For construction projects, 30% design is required, but additional design is encouraged to further project readiness. Applicants can receive more points in the scoring process by having completed higher levels of design prior to application.

Statewide Goal Alignment

The statewide goals for rail development are included in the SRP; and developed as part of an open and public process called VTrans, which is led by the Office of Intermodal Planning and Investment (OIPI), in coordination with the Secretary of Transportation and partner agencies responsible for multimodal transportation planning in Virginia. The current goals include:

- Optimize Return on Investment
- Ensure Safety, Security and Resiliency
- Efficiently Deliver Programs
- Consider Operational Improvements First
- Ensure Transparency and Accountability, and Promote Performance Management
- Improve Coordination between Transportation and Land Use
- Ensure Efficient Intermodal Connections
- Support Regional Economic Development

Further details regarding the goals and objectives of the SRP are outlined in the Executive Summary, which is attached as an appendix for reference.

Scoring Design/Study Applications

Applications that do not include a construction element are scored using only the Statewide Goal Alignment and the Matching Funds criteria. As a result, all application scores are normalized as a ratio of the total points received by the total points available. In so doing, both construction and non-construction projects can be evaluated under this process.

Project Approval

Based on the application review, scoring criteria, and available funding, DRPT develops project approval recommendations for the CTB. The CTB will approve and allocate funds to specific projects into the Six-Year Improvement Plan (SYIP).

Once CTB has made selections, DRPT:

- Sends notification to the applicants of CTB's decision
- Notifies the public of approved projects
- Posts approved projects on DRPT website
- Issues Letter of No Prejudice on specific projects with conditions, if necessary

Grant Management

The grant management process continues the process to safeguard Commonwealth funds through project execution, project work, and project closeout.

Project Execution

Contracting is a two-step process, where an agreement is written to obligate funding to the grantee, and after further development of a project scope, schedule and budget, the notice to proceed authorizes project construction.

Agreements

Grantee projects in the FREIGHT program are governed by a Grant Agreement developed in consultation with the Office of the Attorney General. This agreement outlines all terms and conditions of receiving funds, including; common rules, procedures and requirements for all projects and grantees. The agreement also includes project specific details regarding the specific scope and budget for the project.

Notice to Proceed

The execution of the Grant Agreement serves as an initial, but limited, Notice to Proceed (NTP) by DRPT for the work associated with any initial planning to further refine the scope, schedule and budget. The grantee may conduct any stakeholder outreach, environmental planning and/or design and engineering in order to complete a detailed scope, schedule, and budget for construction. Once developed, the grantee will submit a NTP request via WebGrants, including submission of the most up-to-date scope, schedule and budget for DRPT review and approval.

Upon approval of the NTP, the grantee is then authorized to proceed with construction.

Project Work

Project management is the responsibility of the grantee, and all grant expenses will be reimbursement based.

DRPT Oversight

DRPT maintains a project oversight role in grant projects, and expects the grantee to actively serve as project manager. DRPT will conduct site visits periodically throughout construction to monitor progress, ensure claims received are covered by work completed in the field, and discuss any foreseeable risks with the grantee's site manager. The grantee is required to submit a project progress report with every claim that details the project status, indicating whether the project is on-schedule and on-budget, and identifying any potential risks to either budget or schedule.

Reimbursement

Using the WebGrants system, the Grantee will create and submit claims. The Grantee can submit claims as necessary based on project progress and expenditure rates; however, no more frequently than once every 30-days. The Grantee is responsible for choosing the correct project to claim against, noting the correct claim amount, and attaching supporting documentation prior to claim submission. DRPT will review the claim documentation to ensure charges are appropriate for project work; timesheets for labor and receipts for direct expenses have been included; and Virginia travel guidelines have been followed – according to the Commonwealth Accounting Policies and Procedures (CAPP) Manual found here: **doa.virginia.gov/reference/CAPP/CAPP_Summary_Cardinal.shtml**.

If the claim is accurate and properly documented, DRPT will approve and pay the claim according to the Virginia 30-day prompt pay guidance.

Project Closeout

Upon project completion, the grantee has two primary responsibilities, maintaining the infrastructure for active service and continually reporting network activity.

Contingent Interest

The Grantee must complete the project according to the approved scope, schedule, budget and agreements. Upon project completion, the Grantee has 90 days to submit the final claim to DRPT. DRPT performs a final site review and processes final payment. The Grantee is required to maintain and make available all documentation regarding project cost for a period of three years from the date of final payment from DRPT. DRPT retains an ownership interest in the project improvements for a period of 6 years, or longer as determined by the BCA results. This contingent interest in the improvements ensures the project work remains in service, at a state of good repair, for the entire 6 year (or longer) period. Any change, sale or transfer of the project improvements must be approved by DRPT, per the terms of the signed Grant Agreement.

Performance

Upon completion of the project, the grantee is required to report its annual network activity, i.e. number of rail carloads per year. This enables DRPT to better understand the benefits of investing in the freight rail network, and evaluate future project applications from the grantee. Project reporting is required for a period of 6 years after project completion, or longer as determined by the BCA results.

Contact

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Appendices

Appendix A: Application Form

Contact Information

Application Form

* Required

1. Email *

2. Application / Project Name *

3. Grantee Contact Information (Company, Primary POC, Email, Address, Phone) *

Project Eligibility

4. Project is for design work only, or is a construction project to expand the rail network: *

Mark only one oval.

- ◯ Yes
- ◯ No

5. Project has at least 30% design: *

Mark only one oval.

- ◯ N / A (Design Project Only)
- ◯ 30%
- ◯ 60%
- ◯ 90%

6. Project meets the following goals in the Statewide Rail Plan: *

Check all that apply.

- [ ] Optimize return on investments
- [ ] Ensure safety, security, and resiliency
- [ ] Efficiently deliver programs
- [ ] Consider operational improvements and demand management first
- [ ] Ensure transparency and accountability and promote performance management
- [ ] Improve coordination between transportation and land use
- [ ] Ensure efficient intermodal connections
- [ ] Support regional economic development

Project Description

7. Project Description *

8. Detailed Scope of Work *

9. Project Location *

Budget Information

10. Total Budget by Phase (Final Design, ROW, Construction, etc.) *

11. Total Budget by Year (FY23 - FY28) *

12. Local Match Provided: *

Mark only one oval.

- 0%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%

13. Matching Fund Source: *

Project Schedule

14. Design Start *

Example: January 7, 2019

15. Design End *

Example: January 7, 2019

16. ROW Start *

Example: January 7, 2019

17. ROW End *

Example: January 7, 2019

18. Construction Start *

Example: January 7, 2019

19. Construction End *

Example: January 7, 2019

Benefit-Cost-Analysis Inputs

Project Benefits

20. Current Annual Railcar Demand *

21. Average Tons Per Railcar *

22. Average Railcars Per Train *

23. Current Route Length (In Virginia only) *

24. After Project Route Length (N/A if no additional length added) *

25. Truck Trip Distance *

26. Number of Rail Crossings Removed *

27. New Annual Rail Car Demand (Year 1) *

28. New Annual Rail Car Demand (Year 2) *

29. New Annual Rail Car Demand (Year 3) *

30. New Annual Rail Car Demand (Year 4) *

31. New Annual Rail Car Demand (Year 5) *

32. New Annual Rail Car Demand (Year 6) *

Appendix B: BCA Manual

Commonwealth Rail Fund (CRF) Benefit-Cost Analysis (BCA) Tool User's Manual

Purpose and Overview of This User Manual

The purpose of this Manual is to provide users of the BCA tool with step-by-step instructions on how to analyze their project. This document lists and defines the benefit categories included in the BCA model and describes how the model can be used.

Benefit-Cost Analysis for the Commonwealth Rail 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 also a method to assist in the allocation of state and federal transportation funds.

The use and evolution of BCA practices are well documented in both academic literature and federal government guidance. This Manual provides documentation for a state-level BCA Model for investments of the Virginia Commonwealth Rail Fund and is consistent with both federal BCA guidance and industry best practices, as of 2022.

The Federal Office of Management and Budget (OMB) provides broad BCA guidance in its Circular-94. The United States Department of Transportation (USDOT) provides resource information and general BCA guidance under its BUILD and FASTLANE grant programs.

The BCA guidance[1] lists the following major common benefit categories:

- Value of Travel Time Savings
- Operating Cost Savings
- Safety Benefits
- Emissions Reduction Benefits

The Virginia BCA Model for the Commonwealth Rail Fund is focused on Costs and Benefits for the Commonwealth. Virginia was one of the earliest states with statutory authority to invest public funds in private rail infrastructure to achieve specific public benefits. The original BCA model used by Virginia served the Commonwealth well, but largely relied on aggregate, nationwide metrics tocalculate 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 (starting with 2016 model improvements) allow for a BCA Model be capable of analyzing public benefits at the local, regional, corridor, and statewide levels.

[1] Source: https://www.transportation.gov/sites/dot.gov/files/2021-02/Benefit%20Cost%20Analysis%20Guidance%202021.pdf

Given the Virginia statutory definition of project costs as the actual amount of Commonwealth Rail Funds actually invested in the project, the DRPT 2022 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
- Inventory Carrying Cost Savings
- Reliability Benefit

The Department of Rail and Public Transportation (DRPT) realizes that information submitted in the CRF process may contain proprietary materials. Anything submitted to the department may be subject to Freedom of InformationAct 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 2022 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)

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 passengersand fewer labor hours to deliver a product for freight). The 2022 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).

Virginia Values of Time (2015 $)

VA Statewide VOT	State	North	South	West
Local Personal VOT	$17.21	$22.21	$13.68	$10.22
Intercity Personal VOT	$24.09	$31.10	$19.15	$14.31
Business VOT	$19.73	$22.14	$17.81	$17.12
All Purposes Local VOT	$17.33	$22.21	$13.87	$10.54
All Purposes Intercity VOT	$23.16	$29.18	$18.86	$14.91

Sources: American Community Survey; United States Bureau of Labor Statistics; United States Department of Transportation; United States Bureau of the Census

Congestion Reduction Benefit

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 2022 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. Monetization values for the congestion cost per vehicle mile reduced depend on the selected route (I-64, I-66, I-81, I-95, US29, US58, and US460) and the number of vehicles reduced.

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

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

CRF program. As with value of time, a monetary value must be given to avoided injuries and fatalities for inclusion in the BCA. The 2022 BCA Model includes Virginia-specific values for avoided crashes, injuries, and fatalities.

Auto Safety Costs (2015 $)

	Crash Rates per Million VMT/PMT	Fatality Rates per Million VMT/PMT	Injury Rates per Million VMT/PMT	Aggregated Benefit per VMT/PMT	Property Damage per VMT/PMT
VA Passenger Car	1.5	0.01	0.81	$0.097	$0.006
Amtrak and Commuter Rail	0.04	0.003	0.03	$0.023	$0.0015

Sources: United States Department of Transportation, Bureau of Transportation Statistics; Savage, I. (op. cit)[2]; United States Federal Transit Administration; Virginia Department of Motor Vehicles[3]; Virginia Department of Transportation[4]

Truck Safety Cost (2015 $)

Safety Benefit per VMT	Safety Benefit per Ton Mile (20 Ton Truck)
$0.08	$0.004

Sources: United States Department of Transportation; Virginia Department of Transportation

Train and Grade Crossing Safety Cost (2015 $)

Safety Benefit per Ton Mile	Safety Benefit per Crossing per Year
$0.003	$1,480

Sources: Forkenbrock, D. (op. cit.)[5]; United States Department of Transportation; Virginia Department of Transportation; United States Federal Railroad Authority, Office of Safety

When passenger and freight traffic are reduced on the highways, a benefit from the reductionin accidents can be realized. There is also benefit from the closure of crossings along the trip route. The 2022 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.

[2] Savage, I., 2013. "Comparing the Fatality Risks in United States Transportation Across Modes and Over Time", *Research in Transportation Economics*, vol. 43, issue 1, pages 9-22
[3] https://www.dmv.virginia.gov/safety/crash_data/crash_facts/crash_facts_13.pdf
[4] http://www.virginiadot.org/info/2013_traffic_data_daily_vehicle_miles_traveled.asp
[5] Forkenbrock, D. 1998. *Comparison of External Cost of Rail and Truck Freight Transportation.* Iowa City: University of Iowa Public Policy Center.

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 2022 BCA Model includes statewide and locality-specific values for improved air quality through reduced vehicle emissions.

Marginal Benefits per Ton of Emission Reduction (2015 $)

	PM25	PM10	NOX	SO2	VOC
Total	$4,712,021	$1,773,951	$491,836	$1,670,239	$391,319
State Average	$75,651	$23,659	$4,082	$16,382	$5,173
County Average	$67,432	$18,966	$2,825	$12,104	$4,139
City Average	$26,939	$15,384	$4,119	$14,022	$3,391

Source: Muller and Mendelsohn (op. cit.)[6]

Emission Cost per VMT (2015 $)

		PM25	PM10	NOX	VOC	CO2	CO	Total
Passenger Vehicles	Rural Areas	$0.0003	$0.0001	$0.0008	$0.0001	$0.0131	$0.0005	$0.0149
	Urban Areas	$0.0003	$0.0001	$0.0006	$0.0001	$0.0139	$0.0005	$0.0155
Heavy-duty Trucks	Rural Areas	$0.0097	$0.0033	$0.0139	$0.0005	$0.0700	$0.0003	$0.0977
HDDV (diesel)	Urban Areas	$0.0097	$0.0033	$0.0140	$0.0004	$0.0699	$0.0003	$0.0976

Sources: United States Department of Environmental Protection; Muller and Mendelsohn (op. cit.)

[6] Muller, N. Z. and R. Mendelsohn, 2007. "Measuring the Damages of Air Pollution in the United States". *Journal of Environmental Economics and Management.* Volume 54, Issue 1, Pages 1–14

Average Emissions per Urban Mile Traveled (grams per mile, 2015)

Pollutant/Fuel	Passenger Vehicles	Heavy-duty Trucks HDDV(diesel)	Freight and Passenger Rail
VOC	0.013	0.081	0.011
NOx	0.155	3.420	0.246
PM10	0.004	0.139	0.006
PM2.5	0.004	0.128	n.a.
CO2	326.11	1638.29	19.28

Sources: United States Department of Environmental Protection, MOVES

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 2022 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 PollutionCost**	-	**Train Ton Miles**	*	**Train Air and Noise Pollution Costs**

Passenger Environmental Improvement (Mode Shift)	=	**Passenger VMT Reduction**	*	**VehicleAir and Noise Pollution Cost**	-	**(Change in Passengers) / (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 to a project or investment, emissions are reduced. The 2022 BCA model requires inputs of rail tons per railcar, the reduction in mileage and the railcardemand.

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 2022 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 2022 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 ShippingRate

Likewise, if the route is shortened due to the project or investment, shipping costs are reduced, and the 2022BCA 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 2022 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	=	Reductionin 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 productivethan 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 2022 BCA Model for passenger and commuter rail projects. While DRPT 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 2022 BCA Modelat 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 analysis but are realized in the ridership's productivity. The 2022 BCA Model calculates Wider Economic Benefits from other benefits, including travel time savings, safety and reduced transportation costs.

$$\text{Wider Economic Benefits} = 0.05 * (\text{Travel Time Savings} + \text{Safety Benefits} + \text{Reduced Transportation Costs})$$

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 2022 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 2022 BCA Model requires the following inputs to calculate savings in pavement maintenance: the highways where traffic is diverted from, the vehicle mileage removed from the roads, how many trucks can be loaded onto a railcar[*F], passenger demand[*P], and railcar demand[*F].

$$\text{Pavement Maintenance Savings} = \text{Reduction inVMT} * \text{Pavement Maintenance cost per Mile}$$

Inventory Carrying Cost Savings

This benefit category is a new addition to the 2022 version of the BCA model.

Inventory Carrying Cost is the business expense related to holding and storing inventory during its trip from origin to destination. The CRF BCA Tool includes two situations where these costs could be applicable: a) from a change in travel time while using the same mode of transportation, or b) from a shift to a different mode of transport.

In the first case, the tool estimates the Inventory Carrying Cost as a function of the change in travel time (between a situation without investments and a situation with investments) and the value of the freight in transit.[7] First, the tool compares the length of a freight route that uses a specific transportation mode. If an investment shortens a freight route for a particular mode, there will be a reduction in Inventory Carrying Costs, which will be presented as a positive benefit.

In the second case, freight is diverted from one transportation mode to another. If the situation with investments reflects an increase in the movement of goods via freight rail (compared to the situation without investments), the tool assumes the increase represents a diversion away from truck. This generally leads to a negative Inventory Carrying Cost Benefit since the movement of goods by truck is often quicker than the movement of goods by freight rail.[8]

The user is asked to provide the inventory cost of freight as an input. This is calculated as the average value per ton of freight, multiplied by the hourly discount rate. The tool includes a Virginia average inventory cost of freight as the default, which the user may choose to keep or change.

Inventory Carrying Cost Savings = **(Average Truck Speed/ Truck miles)** * **Truck Capacity** * **Inventory Cost of Freight** * **Trucks per Year** - **(Average Train Speed/Rail Miles)** * **Train Capacity** * **Inventory Cost of Freight** * **Trains per Year**

Reliability Benefit

This benefit category is a new addition to the 2022 version of the BCA model.

The Reliability Benefit monetizes any increased predictability in travel times that result from investments. The tool uses standard deviations (provided by the user) to compare the variations of a sample of travel times to the average in the situation with investments and the situation without investments, therefore measuring the decrease in uncertainty. The percent change in travel time reliability (calculated using standard deviations) is applied to a fixed monetary value (representing the monetary impact, in dollars per million-ton miles affected) to measure the total benefit.

Reliability Benefit = - **Build Standard Deviation of Travel Times/ No Build Standard Deviation of Travel Times)+1** * **Fixed Dollar Benefit from One Percent Increase in Reliability** * **Train Ton Miles**

[7] Note that this is different from travel time savings based on change in travel time and the value of the time of those workers traveling with the freight.

[8] Note that shippers may choose to shift to a mode of transport which takes more time if the out-of-pocket fees and payments associated with that mode are cheaper.

Using the 2022 BCA Model

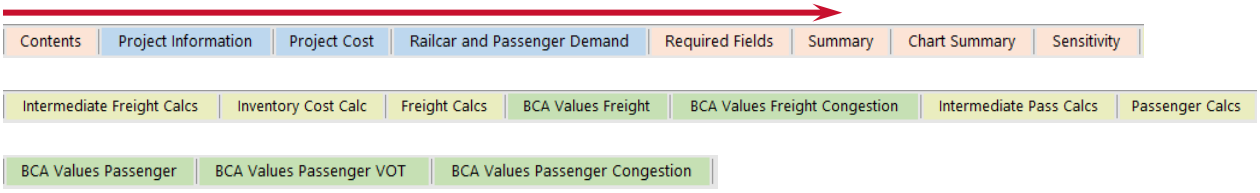
The 2022 BCA Model is used to transparently conduct the first step in the CRF evaluation process to demonstrate that the Virginia-based public benefits of an individual rail projectexceed the costs to the CRF.

Model-Wide User Notes

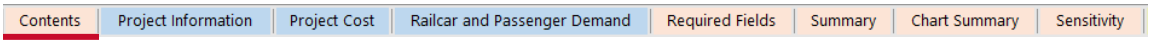
Cells throughout the model are formatted according to the following formatting definitions.

Cell Formatting Legend	
	Input Required – Ensure that all tan colored cells are filled
	Optional Input – User may change existing value
	No Input Required

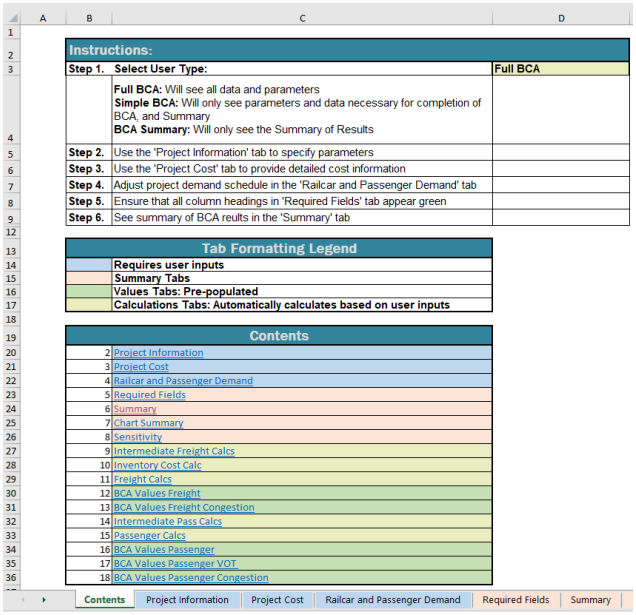
Entries should be made in the worksheets from left to right (fill in the Project Information worksheet before filling in the Project Cost and Railcar and Passenger Demand worksheets).



Contents Worksheet



A Contents worksheet has been added to the tool in 2022 to improve navigation across the workbook.



Instructions:		
Step 1.	Select User Type:	Full BCA
	Full BCA: Will see all data and parameters **Simple BCA:** Will only see parameters and data necessary for completion of BCA, and Summary **BCA Summary:** Will only see the Summary of Results	
Step 2.	Use the 'Project Information' tab to specify parameters	
Step 3.	Use the 'Project Cost' tab to provide detailed cost information	
Step 4.	Adjust project demand schedule in the 'Railcar and Passenger Demand' tab	
Step 5.	Ensure that all column headings in 'Required Fields' tab appear green	
Step 6.	See summary of BCA reults in the 'Summary' tab	

Tab Formatting Legend	
	Requires user inputs
	Summary Tabs
	Values Tabs: Pre-populated
	Calculations Tabs: Automatically calculates based on user inputs

Contents	
2	Project Information
3	Project Cost
4	Railcar and Passenger Demand
5	Required Fields
6	Summary
7	Chart Summary
8	Sensitivity
9	Intermediate Freight Calcs
10	Inventory Cost Calc
11	Freight Calcs
12	BCA Values Freight
13	BCA Values Freight Congestion
14	Intermediate Pass Calcs
15	Passenger Calcs
16	BCA Values Passenger
17	BCA Values Passenger VOT
18	BCA Values Passenger Congestion

The worksheet provides the following functionality/features:

1. ‘User Type’ selection field: the user can use the dropdown menu to select the level of information the tool will display. ‘Full BCA’ will display all tabs. ‘Simple BCA’ will hide value and calculation tabs, and some calculation fields in the user input tabs. ‘Summary User’ will only display the tabs with the summary of results.

Instructions:		
Step 1.	Select User Type:	Full BCA
	Full BCA: Will see all data and parameters **Simple BCA:** Will only see parameters and data necessary for completion of BCA, and Summary **BCA Summary:** Will only see the Summary of Results	

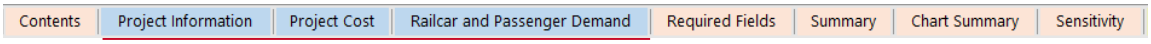
2. Instructions List: simple step by step instructions to guide the user through the tool. This automatically tailors itself based on the user type selection.

3. Tab Formatting legend: table explaining the tab coloring scheme.

Tab Formatting Legend	
	Requires User Inputs
	Summary Tabs
	Values Tabs: Pre-populated
	Calculations Tabs: Automatically calculates based on User Inputs

4. Workbook Contents Table: lists all tab titles and provides a brief description of each one (if necessary). The tab titles act as hyperlinks to the tabs themselves.

Data Entry Worksheets



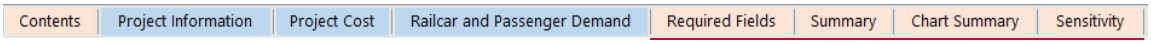
Data Entry Worksheets (Requires user input) – A combination of worksheets (denoted with blue tabs, or when selected, white with green font) that allow the project sponsor to enter information about theproject that will be evaluated using Benefit Cost Analysis.

- *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 worksheetto aid the sponsor or applicant in entering the information.
- *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 calculated 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 A92 through C94. More detailed results can be found in the Summary worksheet.
- *Railcar and Passenger* Demand – After the project information and project cost worksheets are 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.
DRPT 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, DRPT may or may not use such forecasts for grant administrationand sanctions.

Information Worksheets



- *Required Fields* – The Required Fields worksheet 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 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 the required fields page link can be found to the right of the fields on the project information worksheet in two separate locations. Partial benefits can be realized in the model, for example, if all fields for Environmental Improvement due to shift from trucks to trains are filled in, but not all 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 Information C8-10).

Freight

Field Name	Worksheet	Field/ Column	Congestion Reduction Benefit	Environmental Improvement - (Shift from trucks to	Environmental Improvement - (Distance Reduction)	Shipping Cost Reduction - (Distance Reduction)	Shipping Cost Reduction - (Mode Switch)	Savings in Pavement Maintenance	Accident Reduction Benefits
Associated Highway	Project Information	C12	Y	Y				Y	
Rail tons per railcar	Project Information	C28		Y	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	C36	Y	Y			Y	Y	Y
Tons per truck load	Project Information	C37							Y
Railcar demand	Railcar and Passenger Demand	B							

Fields listed are required for specific criterion to be considered. In addition, Project Timeline information must be entered (Project Information C8-10).

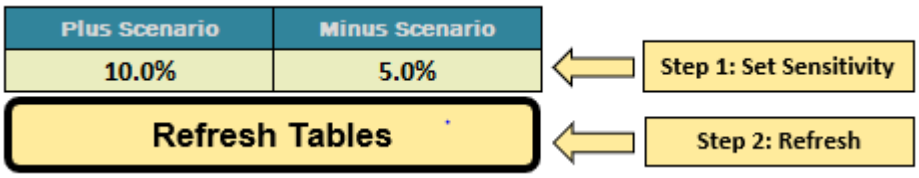
Passenger

Field Name	Worksheet	Field/ Column	Congestion Reduction Benefit	Accident Reduction Benefits	Reduced Passenger Transportation Cost	Travel Time Savings	Environmental Improvement - (Shift from cars to trains)	Environmental Improvement - (Distance Reduction)	Wider Economic Benefits	Savings in Pavement Maintenance
Associated Highway	Project Information	C12	Y	Y						Y
Rail crossings removed	Project Information	C33								
Passengers per year	Project Information	C40 or D40								
Passenger trains per year	Project Information	C42 or D42								
Passenger trip length	Project Information	C43 or D43								
Reduced passenger mileage	Project Information	C45 or D45						Y		
Reduction in travel time	Project Information	C48 or D48				Y				
Passenger travel purpose	Project Information	C56				Y				
Automobile Trip Length	Project Information	C58 or D58								
Projected Number of Riders after Project, Amtrak	Railcar and Passenger Demand	F or H								
Accident Reduction Benefits	Criterion									
Reduced passenger transportation cost	Criterion									
Time travel savings	Criterion									

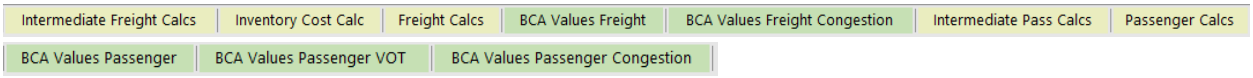
- *Summary* – Provides a snapshot of the criteria that are calculated for the model. The total column is the sum throughout the project lifetime, the net present value (NPV) of3%

and 7% bring future values into current valuation.

- *Chart Summary* – This new worksheet added in the 2022 model has a panel of three self-formatting charts. The charts show the annual cost and benefits estimations over the analysis period and self-populate based on the user inputs.
- *Sensitivity* - New worksheet added in the 2022 model that has a baseline results table (top left of the worksheet) and a customizable sensitivity table. The sensitivity table allows the user to vary key inputs and see the relative impact on the BCA results given a change to one parameter. The user selects by how much (in percent) they would like to change the parameter. Note that the user can set different sensitivities for the Plus and Minus scenarios. For example, the user can run a sensitivity analysis for a 10% increase and a 5% decrease to the parameter. The sensitivity table then populates with the BCA results given the percent change to each parameter and uses conditional formatting to show if the BCA results improve or deteriorate compared to the baseline.



Calculation and Value Worksheets



- *Intermediate Freight Calculations, Intermediate Passenger Calculations, and Inventory Cost Calculations* – These tabs show the lookup values and intermediate calculations for the criteria that are calculated.
- *Freight Calcs and Passenger Calcs* – These 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* – These 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.

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. CRF 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		Project Description and Notes	
Organization			

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 the 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 the 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 moveon 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?

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 with these thoughts in mind.

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	70.20	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	0.00	mi	Distance the track in VA has been shortened, in miles, due to the construction of the project. (current-after project completion).
	Rail Average Travel Speed		mph	The average speed of freight trains using the projected route per year.
	Standard Deviation of Freight Travel Times, current		units	Current standard deviation of travel times.
	Standard Deviation of Freight Travel Times, after project completion		units	Post-project standard deviation of travel times.
	Percent Increase in Reliability	0.00%	percent	Percent increase in reliability, scaled from the percent change in standard deviations.
	Reliability Payoff	$2,200.00	dollars/million ton miles	Benefit per 1% increase in reliability per million ton miles.
	Number of Rail Crossings Removed		number	Number of rail crossings removed due to the construction of the project.
	Inventory Cost of Freight	0.0034	dollars/ton/hour	Cost of inventory per ton, per hour in transit. Virginia freight average if $0.0034. Change if necessary.

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 CRF 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.

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

Rail Average Travel Speed – The average speed of freight trains using the projected route per year.

Standard Deviation of Freight Travel Times, current – Current standard deviation of travel times.

Standard Deviation of Freight Travel Times, after project completion – Post-project standard deviation of travel times.

Percent Increase in Reliability – Percent increase in reliability, scaled from the percent change in standard deviations.

Reliability Payoff – Benefit per 1% increase in reliability per million ton miles.

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.

Inventory Cost of Freight – Cost of inventory per ton, per hour in transit. The model includes a default value corresponding to Virginia's freight average, which is $0.0034. The sponsor or applicant can change this value if necessary.

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 Virginia.
	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.
	Truck Average Travel Speed	55.00	mph	Average speed of trucks on routes competing with rail lines.
	Trucks per Year	0.00	# of Trucks	Number of trucks per year assuming all railcar demand is diverted to trucks.
	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.

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.

Rail Passenger Data		Amtrak	VRE		
	Number of Passengers per year (Current)			#	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 construction.
	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)			miles	The current average length of trip, in miles, per passenger.
	Passenger Trip Length (After Project, Rail)			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)			minutes	The average amount it time it takes one passenger to complete the route (current).
	Travel time per trip (After Project)			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 passengers.
	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.

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.

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.

Vehicle Passenger Data	Automobile trip length			miles	Average distance traveled in automobiles by (automobile) passengers, that will switch to rail after project completion.
	Current travel time by vehicle			minutes	Current time to travel by vehicle.
	Change in travel time for switching	0	0	minutes	Time savings realized by switching to train travel from passenger vehicle.

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.

PROJECT COST

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 Assoc			
1) Fill in Project Costs	Capital Costs (All Costs Associated, DRPT + Other sources of funding)	Environmental Evaluation/ Permitting	Public Involvement	Design Engineering
2022	$ 20,000.00			
2023		$ 40,000.00		
2024				
2025				
2026				
2027				
2028				
2029				

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.

Funding Sources

In row 47 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 C48. The funding values will automatically be calculated based on the totals from cells B3 to J42. If the funding is to be allocated in different percentages, the values in grey can be overwritten if justification is provided.

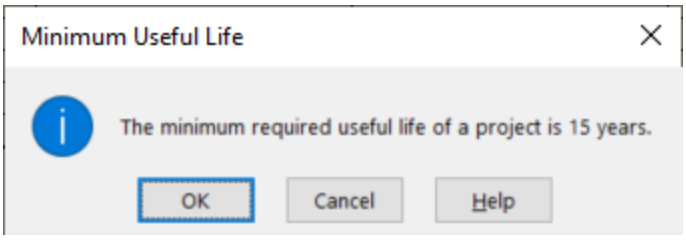
Net Present Value

Cells G47 through M89 are used to calculate the Net Present Value (NPV) for the Benefits and Costs by year. Cells O48 through T89 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 A92 through C94. These areas are used for calculation and cannot be edited.

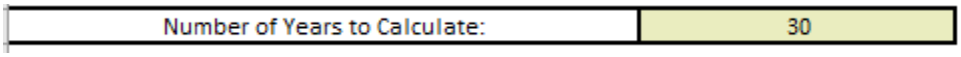
	Benefit Cost NPV 3%	Benefit Cost NPV 7%
DRPT Funds	-	-
Total Funds	-	-

Number of Years to Calculate

DRPT recommends a minimum required useful life of 15 year for a project.



An error message will appear 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 C44 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. The extended analysis period relies on forecasted inputs and assumptions in the *'BCA Values Freight'* and *'BCA Values Passenger'* tabs. These values include forecasts from emission rates, accident and value of time monetization values, etc. The model uses existing forecast values to extend the analysis period through 2040. The values are then extended further, through 2060, using a five-year moving growth rate average. The model does not support analyses beyond 2060, a message of "No Available Values" will be received for calculations attempted for years after 2060.



RAILCAR AND PASSENGER DEMAND

Applicants and sponsors should use the railcar andpassenger demand worksheet to enter the total number of railcars and/or passengers needed for the years afterproject 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 yearwill 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)
0	0	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

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)	Return to Required Fields Worksheet
0	0		0		
1					Reset Railcar and Passenger Demand Page
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Outputs of the 2022 BCA Model

DRPT is committed to transparency and industry best practices in the allocation of Commonwealth Rail Funds. The 2022 BCA Model is the first step in that process and is built on those commitments. DRPT 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.

The summary tab displays benefit totals of non-monetary measures. These tables include the following freight benefits:

- Total reduction in truck VMT
- Number of trucks replaced by rail
- Kilograms of gas emissions reduced, including CO2, NOx, etc.

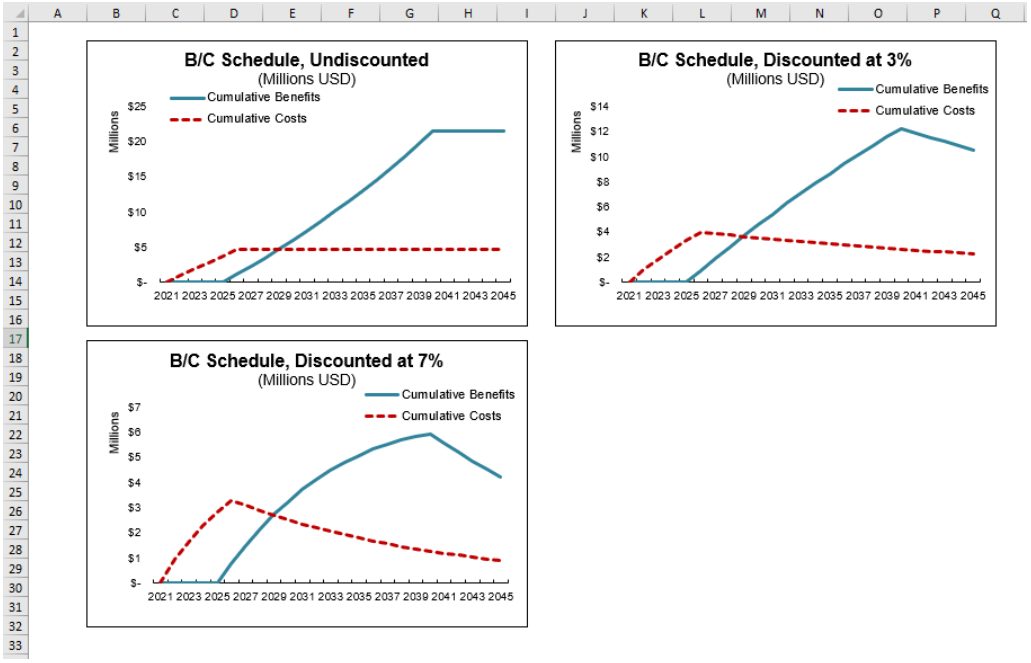
And the following passenger benefits:

- Reduction in passenger VMT
- Reduction in the number of vehicles on highways
- Number of accidents avoided
- Kilograms of gas emissions reduced

Freight Benefits	Non-Monetary Benefit Totals
Total reduction in truck VMT	
Number of trucks replaced by rail	
Kilograms of NOx reduced from truck diversion	
Kilograms of Co2 reduced from truck diversion	
Kilograms of other pollutants reduced from truck diversion (THC, CO, PM, VOC)	

Passenger Benefits	Non-Monetary Benefit Totals
Reduction in passenger VMT	
Reduction in vehicles on highway	
Kilograms of CO2 reduced from passenger vehicle diversion	
Kilograms of other pollutants reduced from passenger vehicle diversion (THC, CO, PM, VOC)	

In addition, the 2022 model displays the annual cost and benefits estimations over the analysis period in charts as part of the Chart Summary worksheet. These charts will format automatically based on the model inputs and display the benefit and cost projections at the undiscounted, 3% discounted, and 7% discounted levels.



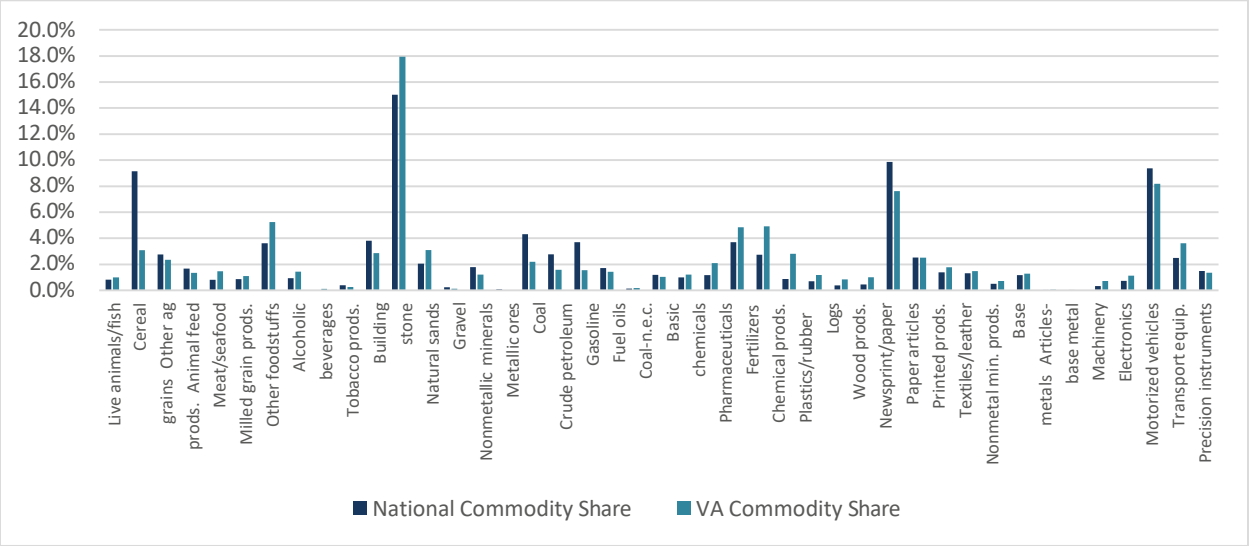
Appendix 1: Calculating the Value of Time for Freight

Time value of freight is calculated on the State level by defining an average truck moving in Virginia. This average truck is constructed using the United States Department of Transportation (USDOT) Federal Highways Administration (FHWA) Freight Analysis Framework (FAF) data and represents all truck movements that are originating and terminating in Virginia as well as the movement through and within Virginia. To calculate the time value of the cargo the average value of time per ton of the cargo is calculated based on depreciation rates suggested in a FHWA study[1]. This study suggests the following discount rates for the time value of the cargo:

- 15% per day for perishables commodities like fresh produce;
- 5% per day for bulk commodities like gravel; and
- 10% per day for other commodities.

The distribution of the truck cargo as well as its value is acquired from FAF by filtering the truck flow for the cargo originating from, terminating in, moving within or through Virginia.

Figure A1: Comparison of National and Virginia Truck Commodity Share



Source: United States Department of Transportation

Based on the FAF data average truck value per ton is equal to $995 at national level and $1,488 in Virginia. These values per tons, using the commodity specific depreciation rates, would result in $4.05 and $5.95per ton per hour respectively.

[1] Winston, C. and C. Shirley, 2004. *The Impact of Congestion on Shippers' Inventory Costs*. Washington, DC: Final Report to the Federal Highways Administration.

As it will be explained in Appendix 6, the average payload of a truck in Virginia is equal to 20.59 tons compared to the national average of 20.79 tons. These average payloads lead to time value of $84 per hour for an average truck at national level and $123 in Virginia.[2]

[2] Monetary values are updated to 2020 dollars using the USDOT Guidance for Benefit-Cost Analysis recommended GDP deflator

Appendix 2: Calculating the Value of Time for Passengers

The value of passenger travel time is a critical factor in evaluating the benefits of a transportation project. Increasing accessibility and the reduction of delay in passenger travel time is typically the major purpose of transportation investment, especially for rail projects which usually involve mode shift from automobile driving on the highway to urban transit or Amtrak due to travel time saving.

Among all the factors that influence passenger's value of time, trip purpose is the most critical one. "On-the-clock" business travel, which are usually paid at an hourly market wage, has a higher cost to the employer. Similarly, personal travel incurs a cost for the traveler in terms of the *opportunity cost* of using that time for other purposes[3]. Commuting, the greatest generator of travel, has been found to be values by traveler at a rate typically lower than the hourly earnings rate[4].

As alternative uses for time are typically closely ties to earnings, whether as work or as leisure which itself is tied to work, research has usually found the relationship to be a consistent one. In particular, as recommended in USDOT's guidance, value of time can be estimated as a relationship to wages or the annual median household income.

Besides trip purpose, travel distance also influences passenger's value of time, especially for a personal trip. As USDOT suggests, the value of time for intercity personal travel is 40% higher than that of the local personal trip while the value of time for business is not sensitive to trip distance.

For the 2016 model, the value of time for *business travel was* derived from median hourly wages after applying the ratio of average total compensation to average wages in BLS's *Employer Costs for Employee Compensation*[5]. The personal value of time was based on Virginia's county-level annual median household income from American Community Survey[6]. Then for each county, household income was scaled to an hourly rate by dividing by 2,080 hours per year. The personal value of time is the half of the calculated hourly wages. Also, the value of time for intercity personal trips, as USDOT suggested, is 70% of hourly wages, 40% higher than that of the local personal trip.

For business trips, the value of time uses median hourly wages. Since the business value of time is the cost to employers, the value should reflect the total benefit including compensations. BLS's *Employer Costs for Employee Compensation* reported the ratio for average total compensation to average, which is applied to median hourly wage to calculate the value of time for a business trip at the county level. Unlike personal trips, the value of time for business is the same for local and intercity trips.

The aggregation of all trip purpose requires a reasonable weight since personal trips take place much frequent than business trips. We use the distribution of personal and business trip from USDOT, as shown in Table A1.

[3] Vilain, P., 1996. *Harmonizing Parameter Values in Transport Project Appraisal: The Values of Time and Safety*. Luxembourg: European Investment Bank PJ Papers.
[4] United States Department of Transportation, 2022. *Departmental Guidance on Valuation of Travel Time in Economic Analysis*, Washington DC: Report prepared by the USDOT
[5] The wage/compensation ratio is reported from BLS website : http://www.bls.gov/news.release/pdf/ecec.pdf
[6] 2013 American Community Survey

Table A1: Distribution of Trip Purpose

Trip purpose	Personal travel	Business travel
Local travel by surface modes	95.4%	4.6%
Intercity travel by surface modes	78.6%	21.4%

Source: United States Department of Transportation

To further detail value of time to regions within Virginia, county-level household income data was used to reflect prevailing regional conditions. These regional details include a disaggregation into North, South and West as suggested by several sources.

To also reflect an assumption of increasing real wages, we used the 2001-2014 average annual income for Washington region adjusted after inflation, published by the Bureau of Labor Statistics, and get the annual wage growth rate of 0.22%. We currently update these results to 2020 by applying the ratio of these Virginia specific numbers to the 2016 USDOT guidance values to the values in the 2022 USDOT Benefit-Cost Analysis Guidance 2022. Table A2 illustrates the aggregated statewide value of travel time by trip purpose and by trip distance, in which the all purposes value of time is the weighted averages using distribution of travel by trip purpose shown in A2.

Table A2: Virginia Values of Time ($2020)

VA Statewide VOT	State	North	South	West
Local Personal VOT	$20.50	$26.46	$16.29	$12.18
Intercity Personal VOT	$28.78	$37.16	$22.87	$17.10
Business VOT	$22.84	$25.63	$20.61	$19.81
All Purposes Local VOT	$21.87	$28.04	$17.50	$13.30
All Purposes Intercity VOT	$27.67	$34.87	$22.53	$17.81

Sources: American Community Survey; United States Bureau of Labor Statistics; United States Department of Transportation; United States Bureau of the Census

Appendix 3: Calculating the Value of Safety

It is now understood that improved benefits may be one of the major benefits of a passenger rail project. By shifting users to a far safer mode, rail reduces crashes, injuries and fatalities. Though attaching a monetary value to personal injuries and fatalities can seem somewhat arbitrary to the uninitiated, there is now several decades of research carried out by health experts and economists that has yielded a relative consensus on the approach to this complex issue.

Essentially, the prevailing monetary values attached to an avoided fatality or injury incorporates several components: The first is a *human capital* measure that attaches a monetary value to an injury or fatality in terms of the lost productivity due to the fact that an injury or fatality results in lost work hours by the impacted party.

The second is a *willingness-to-pay* measure, namely the value that individuals ascribe to their own lives as deduced from expenditures on various safety enhancing investments (smoke detectors, seat belts, helmets).

Auto and Truck Safety Costs

In order to estimate the benefits of shifting travel to rail from auto it is essential to have quantitative measures of the accident risks and associated costs for auto travel. The existing BCA model applied a national value of accident cost per vehicle miles travelled (VMT). To customize the accidents cost to Virginia as well as to more localized regions (as was done with passenger value of time), the Team researched extensive data gathered by State and Federal agencies which form the basis for calculations of safety improvement attributable to the projects assessed here.

For this model, an overall value for benefit per VMT saved was determined by multiplying the rate of accidents by a monetized value per accident. The calculation was done for varying injury types, including fatalities at Virginia's county or independent city level. Then the dollar benefit per VMT was multiplied by the VMT saved. The implied total safety cost per VMT in auto is equal to 14 cents for passengers and 9 cents for property damage. This figure will be applied to the VMT saved from the applicants.

Table A3: Auto Safety Costs ($2020)

	Crash Rates Per Million VMT	Fatality Rates Per Million VMT	Injury Rates Per Million VMT	Aggregated Benefit Per VMT	Property Damage Per VMT
VA Passenger Car	1.4	0.01	0.70	$0.14	$0.09

Source: Virginia Department of Motor Vehicles; Virginia Department of Transportation

The base data for fatality and injury rates per VMT is derived from the Virginia Department of Motor Vehicles' injury and fatality data in Virginia[7] and the annual VMT data from the *Traffic Data Daily Vehicle Miles Traveled* from Virginia Department of Transportation (VODT)[8]. Similar to the value of time calculation, we collect crash and VMT data at the county or independent city level. Data from 2020, the most recent full year available for both crash rates and VMT, was used. In the second step, probabilities of injuries with varying severity are applied to the above value of injuries per 100 million VMT, and monetized values for each injury type, as well as for fatalities (obtained from USDOT guidance), are used to obtain an aggregate cost per VMT of roadway accidents. For property damage cost, we use the recommended monetized value of property damage only crashes applying to crash rates, also from USDOT.

Parameters for the safety costs per truck ton mile are determined based on USDOT accident cost values contained in the USDOT guidance and are only detailed at the State level. The accident rates are reported by VDOT. The truck values were calculated per vehicle mile, the tonnage per vehicle as described below is used to convert the benefit per ton mile. Parameters for the safety benefit due to a reduction in grade crossings is based on USDOT accident cost values and the accidents report by VDOT and the Federal Railroad Authority (FRA) Office of Safety.

Table A4: Truck Safety Cost ($2020)

Safety Benefit per VMT	Safety Benefit per Ton Mile (20 Ton Truck)
$0.10	$0.003

Sources: United States Department of Transportation; Virginia Department of Transportation

Passenger Rail Safety Costs

The safety costs associated with passenger rail were also estimated using national average accident and injury/fatality data for Amtrak and rail transit. The calculation of train-related accident rate used fatality and injury data divided by passenger mile traveled by both modes, published by the USDOT Bureau of Transportation Statistics (BTS)[9]. Since the majority train-related injury or fatality occur during collisions with highway users and pedestrians, recent research shows the injury and fatality for the rail passengers only account for a small percentage, 0.10%, of the total death and injures[10]. If taking public fatalities (non-suicidal) in rail accidents, the fatality rate increased to 71.61%[11]. We apply such a percentage for the Amtrak and transit accident cost calculation. The final monetization values are then adjusted to 2020 dollars using the USDOT Guidance for Benefit-Cost Analysis recommended GDP deflator. The aggregated State-level safety benefit is shown in Table A5 is reported on a per passenger mile traveled (PMT) basis for the Commonwealth of Virginia.

[7] https://www.dmv.virginia.gov/safety/crash_data/crash_facts/crash_facts_20.pdf

[8] http://www.virginiadot.org/info/2020_traffic_data_daily_vehicle_miles_traveled.asp

[9] https://www.bts.gov/product/national-transportation-statistics

[10] Savage, I., 2013. "Comparing the Fatality Risks in United States Transportation Across Modes and Over Time", *Research in Transportation Economics*, vol. 43, issue 1, pages 9-22

[11] http://www.fta.dot.gov/documents/Rail_Safety_Statistics_Report_2009-FINAL.pdf

Table A5: Safety benefit for Virginia for different modes ($2020

	Crash Rates Per Million PMT	Fatality Rates Per Million PMT	Injury Rates Per Million PMT	Aggregated Benefit Per PMT	Property Damage Per PMT
Amtrak and Commuter Rail	0.06	0.003	0.03	$0.30	$0.0015

Sources: United States Department of Transportation, Bureau of Transportation Statistics; Savage, I. (op. cit); United States Federal Transit Administration

Freight Rail Safety Costs

Reduction in accident costs due to the shifting of freight from truck to rail and due to reduction in grade crossing benefit a number of parties. Reducing the number of trucks on the road will directly improve the safety of remaining highway users as the accident rate decreases with a reduction in truck traffic. Additionally, any project that removes grade crossings from the rail and highway network would reduce the number of accidents that occur[12].

[12] The safety benefits resulting from switching freight rail are found by calculating the average accident costs per ton mile for both truck and rail.

$$R = \frac{C * 100{,}000{,}000}{VMT * 365}$$

Where *C:* Total number of roadway departure crashes in the study period. In addition to crash rates, injury and fatality rates were calculated in the same way. Once the various crash and casualty rates were obtained, the rates were used in conjunction with KABCO injury values and probabilities to obtain an aggregate accident cost per vehicle mile.

KABCO Value of Reduced Fatalities and Injuries

Injury type (AIS scale)	Unit value ($2020)
O – No Injury	$3,900
C – Possible Injury	$77,200
B – Non-incapacitating	$151,100
A - Incapacitating	$554,800
K - Killed	$11,600,000
U – Injured (Severity Unknown)	$210,300
Property Damage Crashes	$4,600

Source: United States Department of Transportation

The accident cost per ton mile for rail comes from Forkenbrock (1998)[13], and are at national level. The original values have been grown to 2015 dollars which results in a value of $0.003 per ton mile. The final monetization values are then adjusted to 2020 dollars using the USDOT Guidance for Benefit-Cost Analysis recommended GDP deflator.

Table A6: Train Safety Cost ($2020)

Safety Benefit per Ton Mile
$0.003

Source: Forkenbrock, D. (op. cit.)

The safety benefits due to reducing the number of grade crossings are found by determining the average accident cost of an average grade crossing per year. This analysis was done using data from January 2010 to May 2015. Accident data at grade crossings is recorded by VDOT, where the data collected includes classification of all injuries and fatalities. For this update, we adjust these data for inflation and as such the State-level average cost per rail crossing per year is estimated to be $1,613 in 2020 dollars.

Table A7: Grade Crossing Safety Cost ($2020)

Safety Benefit per Crossing per Year
$1,613

Sources: United States Department of transportation; Virginia Department of Transportation; United States Federal Railroad Authority, Office of Safety

To calculate the value per vehicle mile the following formula is used for each injury type and property damage crashes only.

$$Cost\ per\ VMT = \frac{R * P * V}{100{,}000{,}000}$$

Where *R*= injury or fatality rate, *P*=probability of Injury, *V*=unit value. Once the cost per VMT is calculated for each accident time, they are aggregated to determine the total accident cost per truck VMT of $0.08 in 2015 dollars. This value is applied to the reduction in truck ton miles as determined by the freight conversion rates to quantify the safety benefits of reducing truck VMT.

[13] Forkenbrock, D. 1998. *Comparison of External Cost of Rail and Truck Freight Transportation.* Iowa City: University of Iowa Public Policy Center.

Appendix 4: Calculating the Value of Emissions Reductions

According to the Federal Transportation Administration, the transportation sector is responsible for 29 percent of all greenhouse gases (GHG) emitted in the United States[14]. Over 60 percent of transportation-related emissions are generated by private vehicles. Thus, many strategies to reduce transportation-related GHG's focus on improving fuel efficiency. However, the American Public Transportation Association (APTA) argues that innovations in fuel efficiency are not enough. It is likely that drivers will respond to increases in fuel efficiency by driving more (the so-called Jevons Paradox). Thus, fuel efficiency improvements must be coupled with strategies to shift travel by private car towards greater use of public transportation.[15]

Using the latest guidance from the US Environmental Protection Agency (EPA) and the USDOT, we are able to estimate the reduced emissions of any transportation project per VMT in monetary terms. The EPA guidance provides average emissions and fuel consumption for passenger cars in terms of grams emitted per VMT. The USDOT guidance provides social costs of emissions per gram in monetary terms (primarily costs related to treatment of associated health costs).

Table A8: Marginal Benefits Per Gram of Emission Reduction ($2020/Gram)

	NOx	CO	PM 2.5	PM 10	VOC	CO2
Total	$0.005	$0.0004	$0.09	$0.03	$0.006	$0.0001

Source: Muller and Mendelsohn (op. cit.), USDOT Guidance for Benefit-Cost Analysis 2022

[14] Hodges, T., 2009. *Public Transportation's Role in Responding to Climate Change*. Washington, DC: Report submitted to the Federal Transit Administration.

[15] American Public Transportation Association, 2009. *Quantifying Greenhouse Gas Emissions from Transit*.

The next step is to identify the emissions rates of the various vehicle types. For this the EPA's Motor Vehicle Emission Simulator (MOVES) model was used to provide emissions rates. MOVES takes into account the existing Tier 3 rule as well as the impacts of other EPA rules on the vehicle fleet composition. We use Arlington and Powhatan counties as proxies for urban and rural emission rates statewide, respectively. We apply the emissions rates from MOVES and calculate the emission cost per VMT for each pollutant.

Table A9: Average Emissions per urban mile traveled (in grams per mile, 2020)

Pollutant/Fuel	Passenger Vehicles	Heavy-duty Trucks HDDV(diesel)
VOC	0.055	0.050
NOx	0.063	1.902
PM10	0.013	0.080
PM2.5	0.003	0.073
CO2	408.19	1659.99

Source: United States Department of Environmental Protection, MOVES

Combining the two sources, we can calculate an aggregate social cost of emissions. The cost per VMT would vary by year due to the social cost of CO_2, which increases as one goes further out into the future. The cost also varies by year due to the changing emissions rates of the vehicle fleet due to exist EPA rules. For the VOCs, NOx, and PM, the emission cost per VMT for Virginia's county-level average is described in Table A10. The final output is the emission cost per VMT per pollutant for both urban and rural areas for Virginia.

Table A10: Emission cost per VMT ($2020)

		NOx	CO	PM2.5	PM10	VOC	CO2	TOTAL
Passenger Vehicles	Rural Areas	$0.0003	$0.0005	$0.0002	$0.0001	$0.0001	$0.0136	$0.0148
	Urban Areas	$0.0003	$0.0010	$0.0003	$0.0004	$0.0003	$0.0204	$0.0227
Heavy-duty Trucks HDDV(diesel)	Rural Areas	$0.0069	$0.0001	$0.0045	$0.0015	$0.0002	$0.0579	$0.0711
	Urban Areas	$0.0101	$0.0002	$0.0065	$0.0022	$0.0003	$0.0831	$0.1024

Source: United States Department of Environmental Protection; Muller and Mendelsohn (op. cit.)

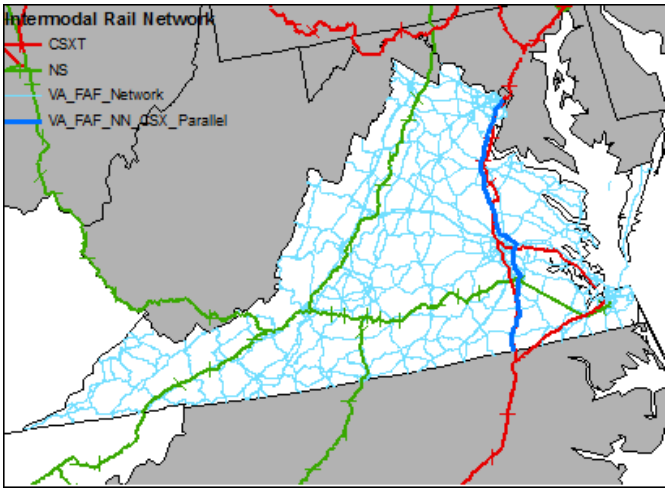
Appendix 5: Calculating Network Congestion Impacts

The enhanced estimates of network congestion are localized to a far greater degree than the existing national-level factors, in this case detailed to the corridor level. The model uses the number of reduced truck trips to update the speed and traverse time of several highways that are parallel to existing rail right-of-ways in Virginia.

For example, if a project leads to reduction in truck traffic on the I-95 corridor the travel time improvements will be calculated as follow:

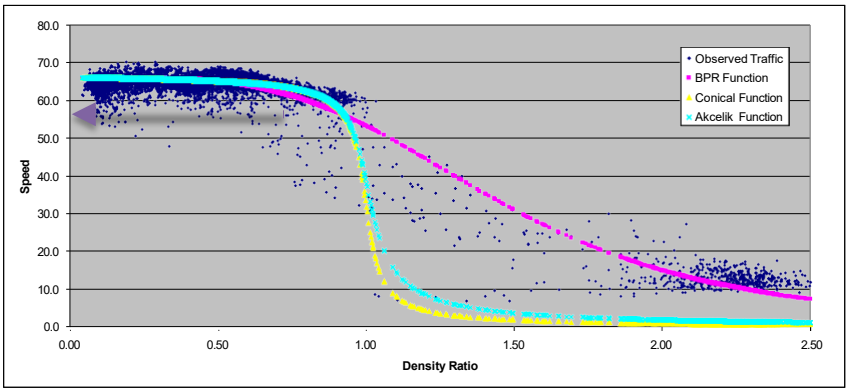
- USDOT FAF networks are used to establish the baseline conditions for Average Annual Daily Traffic (AADT), Average Annual Daily Truck Traffic (AADTT), Capacity, Volume Capacity Ratio (VCR) and speed;
- AADTT value of the impacted roadway segments is updated based on the reduction in number of daily truck traffics;
- The updated AADTT along with the baseline AADT is used to calculate an updated value for VCR;
- VDOT's functional class specific Volume Delay Functions (VDF) are used to measure the impact of changes in VCR on the travel time improvement of impacted highway links;

FigureA2: Example of an Affected Highway



Source: United States Department of Transportation

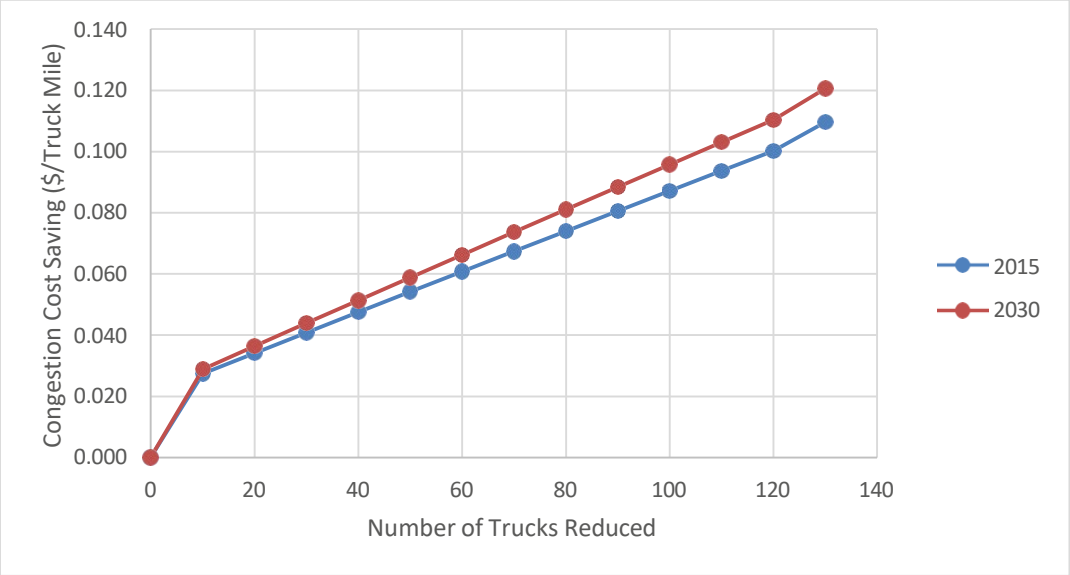
FigureA3: Volume Delay Function for Urban Interstate in Virginia



Source: Virginia Department of transportation

- Link traverse time improvements are then converted into annual time savings based on the links' AADT and AADTT;
- The travel time improvements are converted to dollar values based on cargo congestion costs and value of truck driver and passenger time;
- These values are then unitized for individual corridors. Figure A4 shows the impact of reduction in truck traffics on the unit congestion cost in I-95 corridor in Virginia;

FigureA4: Congestion Cost Savings for Virginia Portion of I-95



Source: Moffatt & Nichol, United States Department of Transportation; Virginia Department of Transportation

Appendix 6: Freight Conversion Factors

To estimate the impact of additional carloads on reduction of highway congestion the following steps have be taken:

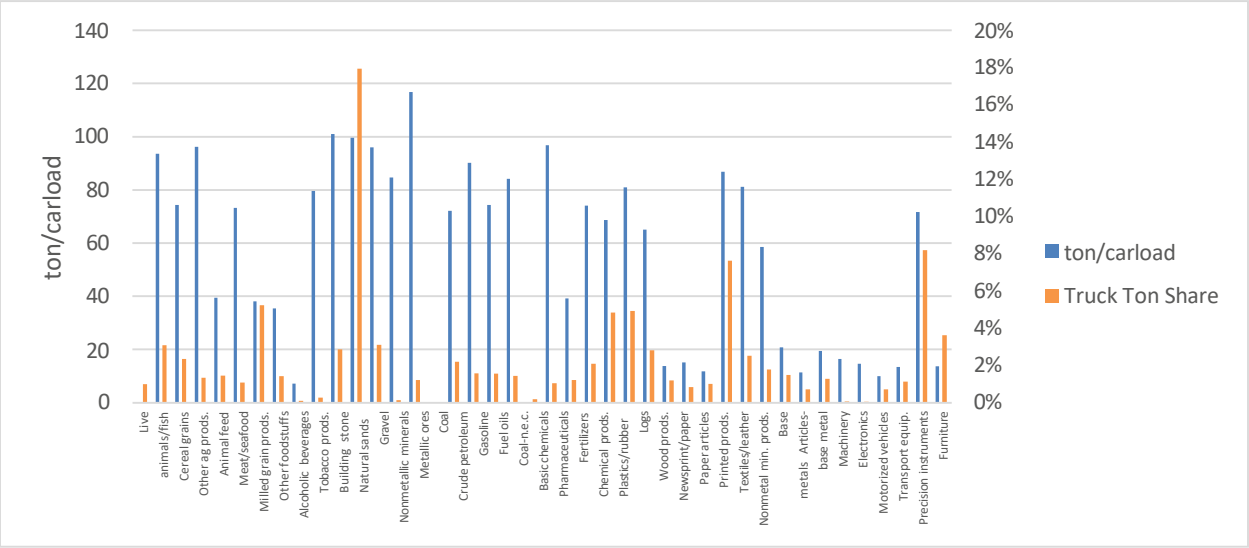
- Identify the number of carloads and the highway corridor that would be impacted by the modal shift
- Convert the rail cars to rail tonnage
- Convert the rail tonnage to equivalent number of loaded truck trips
- Estimate the number of empty truck trips resulted from the loaded trips

The diversion of cargo from truck to rail will not have equal impact on different corridors. Corridors with higher level of congestion will benefit more from the reduction of the traffic.

REF grants applicants are currently providing the number of annual carloads, total length of truck trips and the portion of the truck trip within Virginia in their applications. Providing the additional highway corridor will lead to better estimation of the impact.

The next step in identifying the impact of mode shift on the congestion reduction would be identifying the weight of a carload. Carload weight varies depending on the type of the commodity carried. In the absence of detailed information on the type of commodity shifted from truck to rail, the model uses a weighted average approach, based on the share of commodities in truck flows, to estimate the average weight of the carload.

Figure A5: Ton per Carload and Truck Commodity Share in Virginia



Source: United States Department of Transportation, Public Waybill Sample

This approach assumes that the freight moved from truck to rail will have the same proportions as the cargo being already carried on the road. Using this weighting approach the weighted average of a carload is estimated as 70.2 tons/carload. The total tonnage moved from truck to rail is calculated by multiplying average weight of carload by the number of carloads provided in the grant application.

The number of reduced truck trips is calculated based on the total tonnage diverted using the FAF approach. The FAF approach uses the Vehicle Inventory and Use Survey (VIUS) database to develop a Truck Payload Equivalent Factor to convert truck tonnage between different origins and destinations to number of full and empty truck trips. This approach considers 43 commodities, 5 configuration groups and 9 different body types. The number of truck of type ($Y_{j=1}$) used to move ($X_i\beta_{ii1k}$) tons of commodity (ii) by all body types is given by the following equation:

$$Y_{j=1} = \frac{X_i\beta_{i11}}{\omega_{i11}} + \frac{X_i\beta_{i12}}{\omega_{i12}} + \frac{X_i\beta_{i13}}{\omega_{i13}} + \cdots + \frac{X_i\beta_{i19}}{\omega_{i19}} = \sum_{k=1}^{9} \frac{X_i\beta_{i1k}}{\omega_{i1k}}$$

Where:

- i: Commodity index (1, 2… 43)
- j: Truck configuration group index (1, 2… 5). Truck configurations considered in FAF are: Single Unit, Truck Trailer, Combination Semitrailer, Combination Double, Combination Triple
- k: Truck body-type index (1, 2… 9). Truck body types considered in FAF are: Automobile, Livestock, Bulk, Flat Bed, Tank, Dry Van, Reefer, Logging and Other.
- X_i: Tonnage of commodity i
- Y_j: Number of truck in truck configuration group j;
- β_{ijk}: Fraction of commodity (i) moved by truck type (j) with body type (k);
- ω_{ijk}: Mean payload of truck type (j) with body type (k) transporting commodity (k);
- $X_i\beta_{ijk}$: The tonnage of commodity (X_i) carried by truck type (j) and body type (k);
- $\frac{X_i\beta_{ijk}}{\omega_{ijk}}$: Number of trucks of type (j) and body type (k) required to move ($X_i\beta_{ijk}$) tons;

The total number of truck trips is calculated by summing Y_j over all commodities:

$$total\ truck = \sum_{i=1}^{43} X_i \sum_{j=1}^{5} \sum_{k=1}^{9} \frac{\beta_{ijk}}{\omega_{ijk}}$$

Empty trucks are then added to the estimated long distance truck population. FAF estimates the number of empty trucks by analyzing the percentage of the miles that truck is empty in VIUS. The following empty truck factors are used in the truck count estimation:

TableA11: Percentage of Empty Truck Trips

	Single Unit	Truck Trailer	Combination Semitrailer	Combination Double	Combination Triple
Automobile	24%	21%	20%	13%	0%
Livestock	10%	8%	9%	13%	0%
Bulk	21%	14%	20%	20%	6%
Flat Bed	0%	0%	20%	16%	0%
Tank	17%	18%	20%	20%	0%
Dry Van	0%	0%	14%	0%	0%
Reefer	14%	16%	16%	20%	3%
Logging	12%	7%	10%	4%	7%
Other	10%	6%	25%	0%	0%

Source: United States Department of Transportation[16]

[16] 2015 estimates, not expected to change for 2020.

Appendix 7: Wider Economic Benefits

BCA practice has increasingly incorporated the likely improvements in productivity that can follow from an investment in transportation infrastructure. These benefits are typically described as *agglomeration benefits*, and transportation improvements play the role of allowing greater density in urban labor markets.

These productivity increases can stem from the following effects:

- **Knowledge transfers and spillovers**: Interaction between firms provide a chance of a knowledge transfer, and the closer the firms, the more interactions
- **Specialized labor markets:** Where firms needing similar types of specialized skills cluster together, this increases availability as the cluster attracts suitably qualified workers and local educational institutions respond to the demand
- **Reduced job search costs:** potential "matches" occur more often and the match between worker skills and employer needs is improved
- **Special production inputs:** When many firms cluster, possibilities for specialist inputs increase; with a larger choice of suppliers each firm can select the specific type of input that is optimal for its specific production process.

Several approaches are possible to measure the wider economic benefits (WEBs) associated with a transportation investment. A simplification that is appropriate to use in the REF BCA model is to estimate these benefits as a function of the project's user benefits (in particular, travel time savings and safety). Based on the existing research, reasonable ranges for WEBs would be to equal 5% to 7% of user benefits[17].

[17] Melo, P. D. Graham and R. Brage-Ardao, 2013, "The Productivity of Transport Infrastructure Investment: A Meta-Analysis'. *Journal of Regional Science and Urban Economics.* 43 (2013), pp. 695–706.

Appendix 8: State of Good Repair

State of good repair (SOGR) projects are always important parts of a transportation agency capital plan, but they have proven challenging to evaluate using BCA. SOGR projects then tend to be diverse, and do not typically increase capacity or lead to mode shifts. As such, they do not generate the direct travel time, safety or other benefits described previously.

Most fundamentally, what constitutes a SOGR project is not always easy to define. One definition proposed by the Federal transit Administration (FTA) states: "A state of good repair standard [is where] all capital assets are functioning at their ideal capacity within their design life"[18]. Put another way, "An asset or system is in a state of good repair when no backlog of capital needs exists – hence all asset life cycle investment needs (e.g., preventive maintenance and rehabilitation) have been addressed and no capital asset exceeds its useful life".[19]

Many infrastructure projects that improve the SOGR of transportation infrastructure can reduce long-term maintenance and repair costs. These benefits are in addition to the benefits of reductions in travel time, shipping costs, and crashes which the applicant should account for separately. Improving SOGR may also reduce operating costs and congestion by reducing the amount of time that the infrastructure is out of service due to maintenance and repairs, or may prevent a facility (such as a bridge) from being removed from service entirely.

The Team's experience with quantifying SOGR projects indicates that they are, in fact amenable to being evaluated using BCA. What is required, however, are estimates of potential asset or system failure over time specific to the asset in question. This input into the BCA is essential, and is usually required for the asset in question to reflect it age, how well it has previously been maintained, and records of past breakdowns. The difficulty of obtaining such information varies, but experience has shown that this data (or alternatively, reasonable estimates of the data) can be obtained from within the staff who routinely operate, maintain and inspect the relevant asset.

An application for funding a SOGR investment under the REF should also consider differences in maintenance and repair costs when comparing different project alternatives. For example, an applicant can compare the maintenance costs that would be required after rehabilitating an existing pier with those that would be required after building a new one. As part of the data that go into estimating the benefits of improving the state of good repair, applicants should provide accepted measures for assessing an asset's current condition. For example, applicants can use *Present Serviceability Ratings* (PSR) or the *International Roughness Index* to discuss pavement condition and bridge sufficiency ratings to discuss the condition of a bridge.

It is crucial to note that SOGR investments are essential to mitigate asset failures and the associated disruptions attributable to this asset failure. It is precisely in this manner that an SOGR project could be evaluated in the context of a BCA: By reducing the risk of system disruption, SOGR will reduce the incidence of such disruption. As transportation system disruptions can have costs (for example, added

[18] USDOT, 2008. *State of Good Repair: Beginning the Dialogue*. Washington, DC: Report prepared by the Federal Transit Administration.
[19] USDOT, op. cit.

travel time or accidents if service is unexpectedly disrupted on a commuter rail line), these avoided disruptions can form the basis for associated benefits.

The importance of SOGR investments has been increasingly stressed at the Federal level, and discretionary funding programs have developed some quite general guidance on how to assess them in a BCA framework.[20]

[20] For details see https://www.transportation.gov/sites/dot.gov/files/2022-03/Benefit%20Cost%20Analysis%20Guidance%202022%20%28Revised%29.pdf

Appendix 9: Vehicle Operating Costs and Shipping Rates

For both passenger and freight projects there will be a change in operating costs from the mode shift. For passenger rail the comparison is between auto vehicle operating costs and rail operating costs per passenger. These were calculated from several sources and are summarized below. As shown vehicle operating costs per passenger mile are considerably lower for autos than for rail.

Table A12: Auto Vehicle Operating Costs ($2020)[21]

Costs per Vehicle Mile
$0.20

Source: Automobile Association of America

Table A13: Inter-City Rail Operating Costs ($2020)[22]

Costs per Passenger Mile
$0.44

Source: Amtrak

Table A14: Commuter Rail Operating Costs ($2020)[23]

Costs per Passenger Mile
$0.45

Source: US Department of Transportation

Reduction in vehicle operating cost due to the shifting of freight from truck to rail benefit the shippers and general public. As the operating costs per mile vary between truck and trains, a shift to rail from truck will result in a lower operating cost per ton mile for long haul shippers. As the shipping rates vary between freight rail and trucks, shippers benefit from the rate reduction resulting from the switch from

[21] http://exchange.aaa.com/wp-content/uploads/2015/04/Your-Driving-Costs-2015.pdf, updated to 2020 dollars using USDOT recommended GDP deflator.

[22] http://www.amtrak.com/ccurl/243/158/Monthly%20Performance%20Report%20-%20September%202014%20(Preliminary%20and%20Unaudited).pdf, updated to 2020 dollars using USDOT recommended GDP deflator.

[23] http://www.ntdprogram.gov/ntdprogram/pubs/profiles/2013/agency_profiles/3073.pdf, updated to 2020 dollars using USDOT recommended GDP deflator.

truck to rail. Operating and maintenance costs are typically passed on to the shipped as part of the overall shipping rate.

Since operating and maintenance costs are included in the shipping rates, operating and maintenance benefits will not be computed separately. Shipping rates for freight rail per ton mile were obtained from the Association of American Railroads[24] while truck rates per vehicle mile were obtained from DAT Solutions[25]. Truck rates will be converted to ton miles using the conversion factors discussed above. The shipping Rates are shown below.

Table A15: Truck Shipping Rates ($2020

Region	Rate per VMT	Rate per Ton Mile (20 Ton Truck)
National Average	2.04	0.10
SE Regional Average	2.34	0.12

Source: DAT Solutions, updated to 2020 dollars using USDOT recommended GDP deflator.

Table A16: Train Shipping Rate ($2020)

	Rate per Ton Mile
Average for Class I Railroads	$0.04

Source: Association of American Railroads, updated to 2020 dollars using USDOT recommended GDP deflator.

[24] https://www.aar.org/Documents/Railroad-Statistics.pdf

[25] http://www.dat.com/resources/trendlines/van/national-rates

Appendix C: Statewide Rail Plan – Executive Summary

Executive Summary

Executive Summary

Key Facts and Findings of the Statewide Rail Plan

Virginia's rail network is a valuable asset that grows the economy, relieves congestion, saves lives, improves air quality, and saves taxpayer money. Continued investment in rail infrastructure will ensure the mission and vision of the Commonwealth's transportation network is achieved.

The 2022 Virginia Statewide Rail Plan (VSRP), prepared by the Virginia Department of Rail and Public Transportation (DRPT), was written in accordance with the Federal Railroad Administration (FRA) guidance and serves as an update to the VSRP adopted in 2018. This plan was developed in close coordination with the Virginia Passenger Rail Authority

(VPRA) and aligns with goals and objectives of VTrans, the Commonwealth's transportation plan.

The 2022 Virginia Statewide Rail Plan will:

Show the landscape of rail in Virginia today (**Chapter 1**)

Describe how it has changed since 2018, including events/trends shaping the industry in the nation and Virginia (**Chapter 2**)

Demonstrate the effect of Virginia's rail investments since the last rail plan (**Chapter 2**)

Document feedback from stakeholders and the public that shapes recommendations and future initiatives (**Chapter 6**)

Introduce a policy framework to guide recommendations in this plan and beyond (**Chapter 2**)

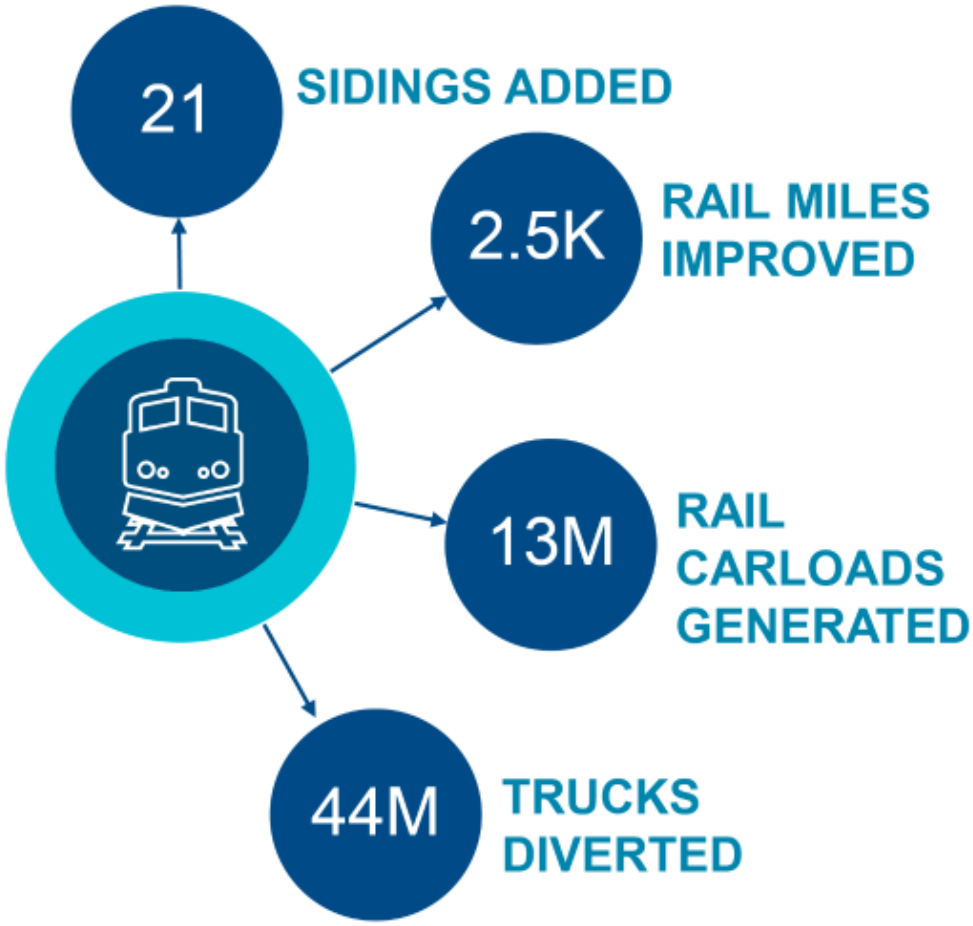
Recommend short-term and long-term passenger and freight rail projects (**Chapters 3 and 4**)

Assess the benefits of recommended rail projects (**Chapter 5**)

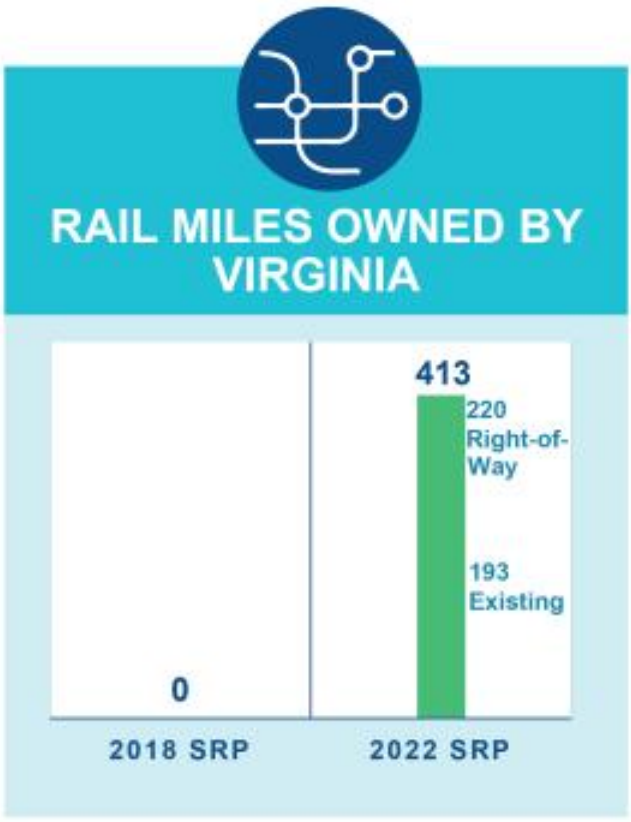
Identify opportunities for ongoing actions to identify and support rail transportation investments that contribute to the economic prosperity and quality of life in the Commonwealth (**Chapter 5**)

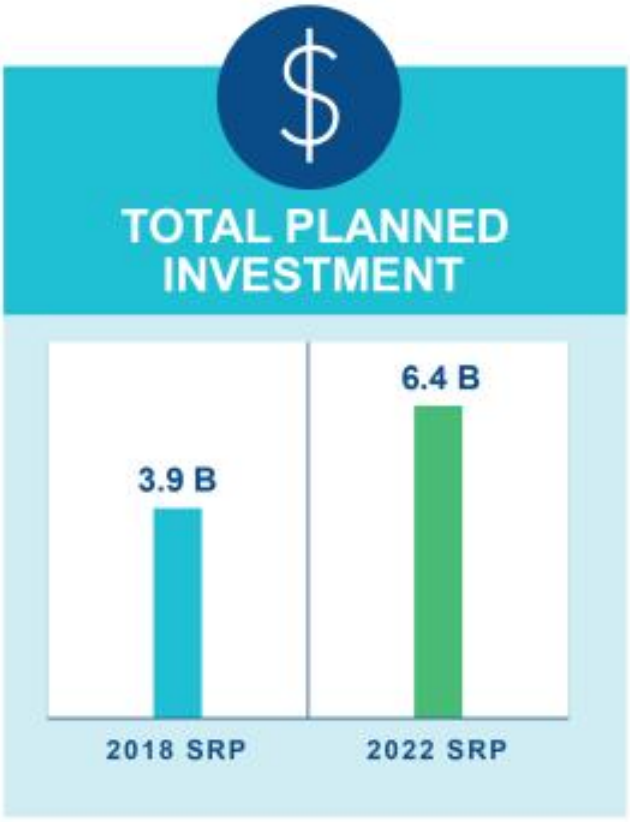
A lot has happened on Virginia's rail network since 2018.

Here are the top ten highlights, by the numbers:

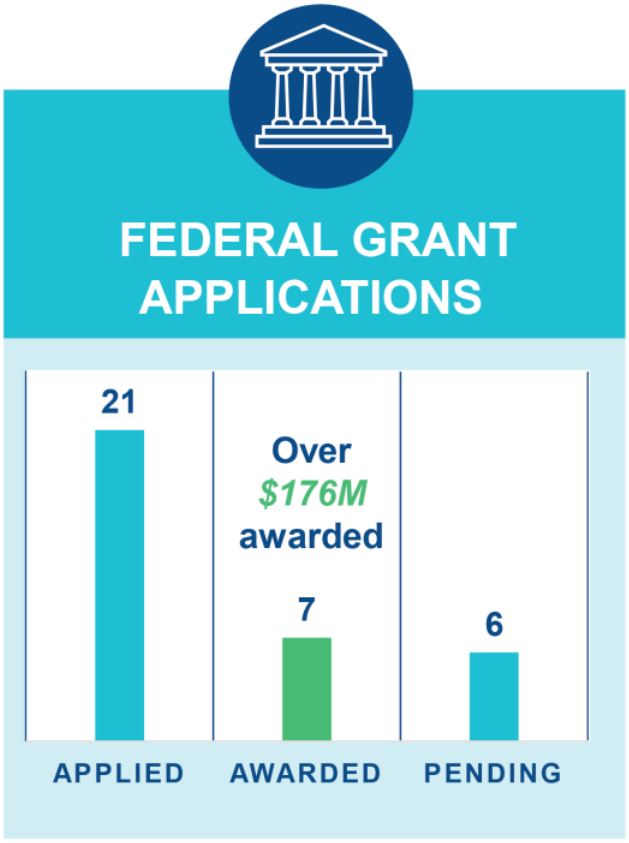


DRPT's rail programs generated the following benefits since 2018:

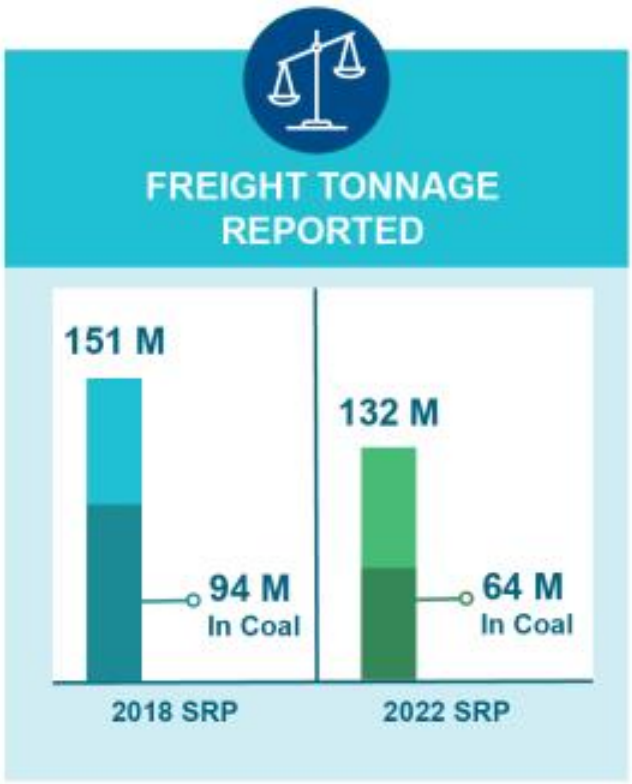




Since the last rail plan, the Commonwealth embarked on an ambitious new program to separate freight and passenger rail in the state's busiest rail corridor and expand passenger rail services in western Virginia. Known as Transforming Rail in Virginia, this effort has resulted in the newly established Virginia Passenger Rail Authority taking ownership of over 400 linear miles of rail right-of-way for passenger rail expansion and an overall increase in planned rail investment of over $2 billion.



Even before the Infrastructure Investment and Jobs Act (IIJA) was passed in 2021, the Commonwealth participated in federal programs to leverage its state investment in rail infrastructure. Since 2018, Commonwealth agencies actively pursued federal funding, which resulted in federal grant awards of more than $176 million for rail-related projects.



Decline reflects decline in coal shipments.

Data points typically reported in the VSRP reflected national trends, including the continued decline of coal shipments and continued railroad abandonments. Track miles is a new data point that DRPT was able to measure for this rail plan as a result of its rail infrastructure digitization effort, which makes it possible to calculate the number of tracks on a route and the mileage for each, not just “route miles”.

Transportation Trends

Meanwhile, there have been dramatic shifts in global transportation that have ripple effects in the Commonwealth.

COVID-19 Pandemic

Passenger rail ridership declined significantly in FY 2020 as a result of the COVID-19 pandemic. Americans made fewer trips on intercity air, rail, or bus services. As travel demand declined, Amtrak initiated measures to lower operating expenses by reducing the service levels of long-distance and state-supported trains.

Supply Chain Disruptions

North American ports experienced serious congestion in late 2021 and early 2022 due to the effects of the global supply chain crisis. Surges in demand and labor shortages coupled with dependence on just-in-time supply inventory management strained capacity at ports on the East and West coasts, causing record-breaking backlogs. Ports

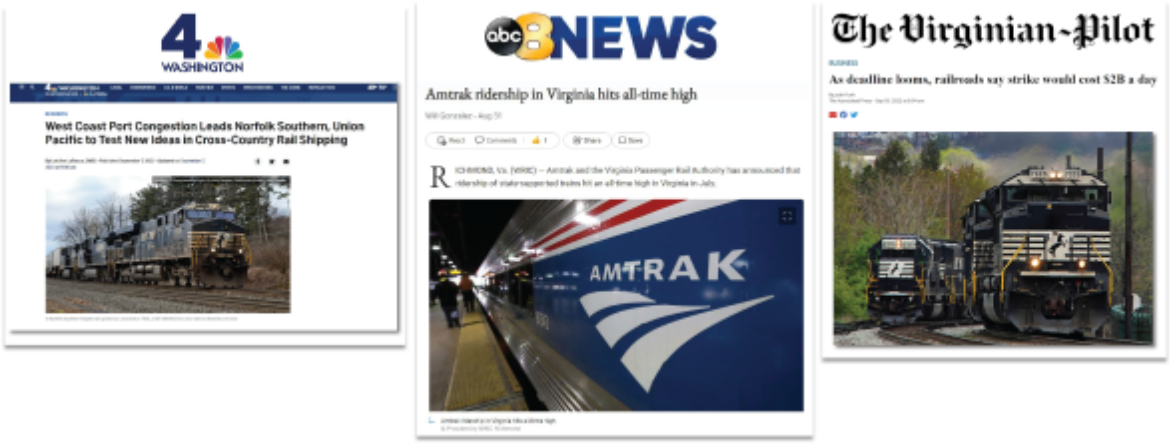
lacked sufficient chassis, ships, and trucks to move the growing number of containers.

Infrastructure Investment and Jobs Act

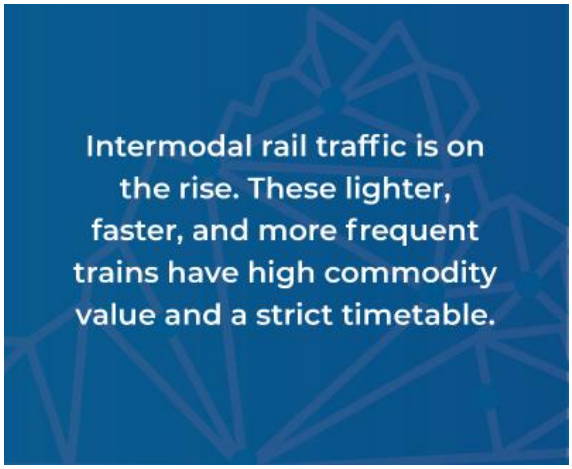
The Infrastructure Investment and Jobs Act (IIJA) enacted in November 2021 provides substantial planning, development, and funding opportunities for freight and intercity passenger rail. In total, the new investments and reauthorization provides $102 billion in total rail funding, including $6 billion from advanced appropriations and $36 billion in authorized funding.

Where does Virginia fit?

Virginia's rail transportation industry responded to these shifts with strategic actions that capitalized on its strengths.



Virginia has invested in double-stack clearance projects, network speed projects, and spot improvements to increase rail network reliability.

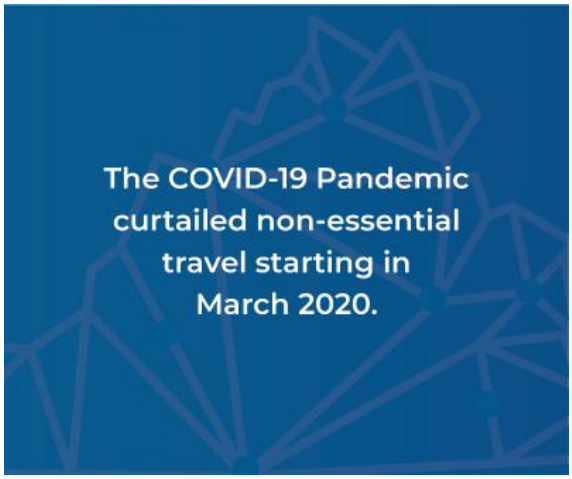


Virginia continues to invest in shortline expansion, rail industrial access, and corridor preservation to provide last-mile connections, spur economic development, and preserve rail infrastructure.

Virginia focused investment on reducing freight/passenger conflicts and capacity improvements to increase interoperability along co-mingled corridors as part of its Transforming Rail in Virginia initiative.

The Port of Virginia was able to remedy the situation in the moment and is poised to provide long-term solutions as shippers diversify their logistics options to avoid future delays. This is made possible by strategic investments to expand terminal capacity and maintain its stronghold as a leader in rail options. This has allowed the Port of Virginia to serve Midwestern U.S. markets via rail and continue to grow

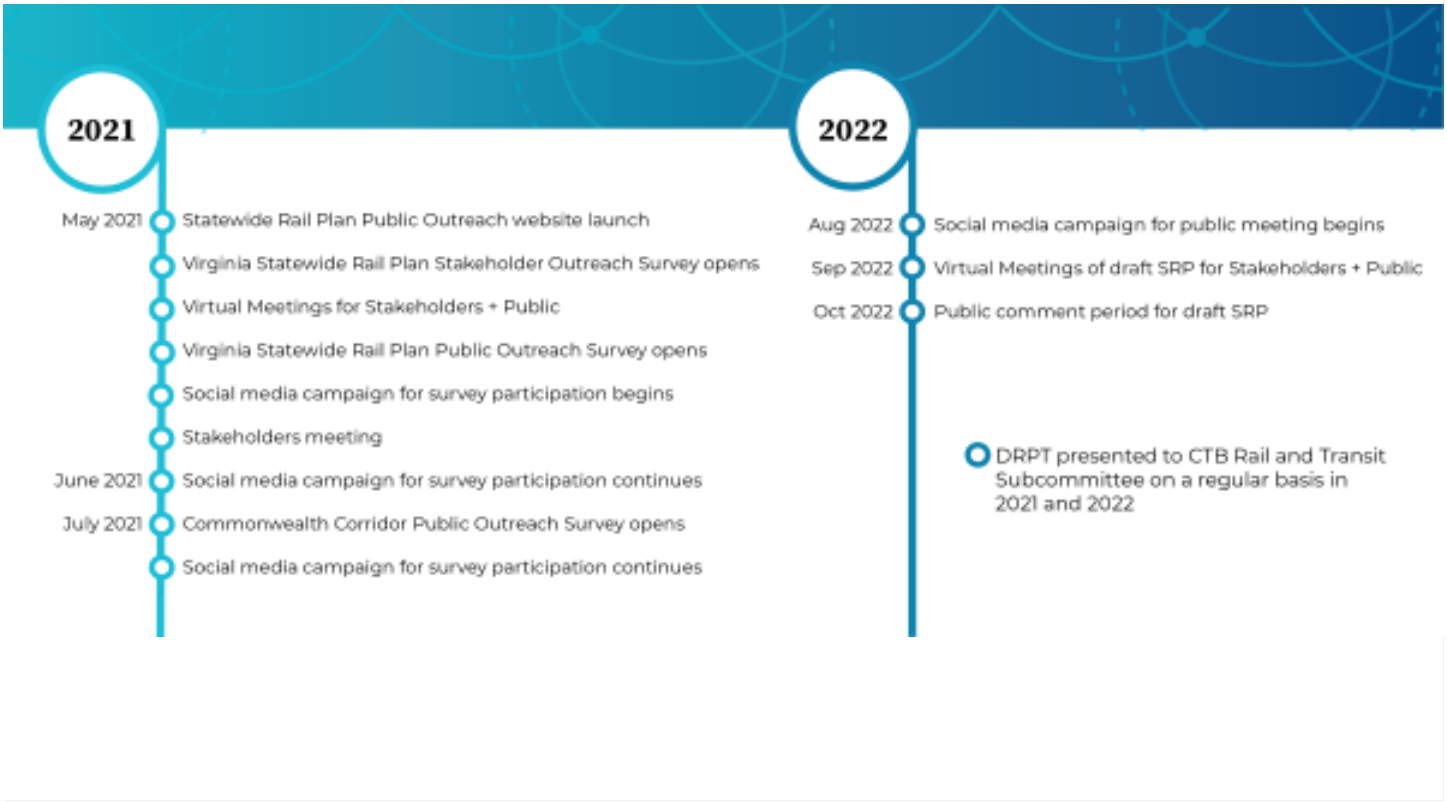
despite the supply chain crisis. (Source: Richmond Times-Dispatch)



Starting in April 2020, Amtrak scaled down passenger service frequencies in Virginia in response to the COVID-19 pandemic. VPRA and Amtrak monitor ridership and re-establish service as ridership demand rebounds. As of April 2022, Virginia ridership was close to 90% of its pre-pandemic April 2019 ridership. (Source: VPRA May 2022 Ridership Report)

In July of 2022, Amtrak state-supported service reached an all-time high for monthly ridership, with 110,256 riders. This was further surpassed in August, with a monthly total ridership of 119,280. This is a sum of all four state-supported Amtrak routes.

What we heard from Outreach



Starting in 2021, DRPT conducted a public involvement effort to solicit feedback on the VSRP planning effort. This included an online survey and virtual public meeting specific to the Commonwealth Corridor Feasibility Study, a General Assembly study conducted concurrently with the VSRP. In total, DRPT hosted three rounds of virtual public meetings, conducted three surveys, and presented to the CTB Rail and Transit Subcommittee eight times.

The VSRP recommends a program of passenger and freight rail projects based on data, trends, and input that are aligned with and contribute to achieving the Commonwealth's overarching goals for transportation

planning as established through VTrans, Virginia's multimodal transportation plan.

DRPT worked with VPRA and the Commonwealth Transportation Board (CTB) to develop a policy framework for rail investment that reflects DRPT's new role with continued focus on policy and statewide planning for both freight and passenger rail.

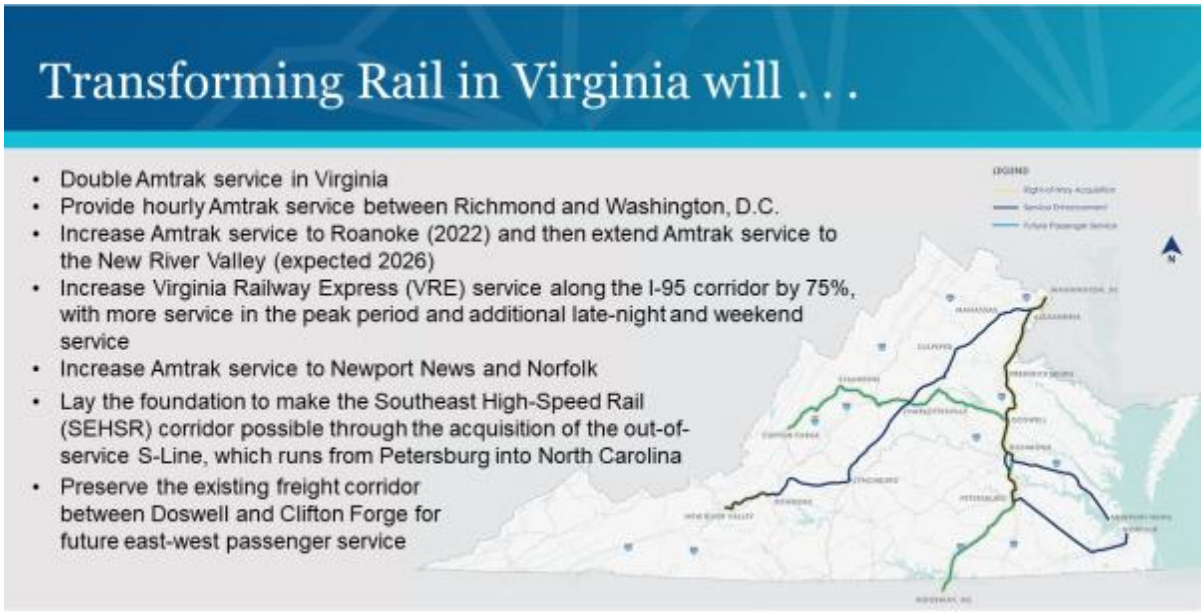
Policy Framework: Freight
Invest in the rail freight network to support rail transportation alternatives that **complement the Virginia highway system and create economic opportunities.**
Prioritize the preservation of rail right-of-way for rail and transportation use while facilitating proposals for co-located recreational uses and utility uses/fiberoptics, as appropriate.
Work with freight railroads and other stakeholders to **optimize existing freight rail infrastructure.**
Work with freight railroads and other stakeholders to **increase rail mode share at critical freight bottlenecks, including the Port of Virginia.**

Policy Framework: Stations	
Multimodal Connections	Stations are a gateway to communities and create opportunities for multimodal connections, including **passenger rail, intercity bus, transit, rideshare, bike, and pedestrian access**
Improvement Priorities	Virginia investments in passenger rail stations will support achieving compliance with **the Americans with Disability Act** design standards, maintaining **a state of good repair**, and partnering with stakeholders to fund **capacity** improvements, **new stations**, and other improvements which support multimodal access, equity, and a positive **customer experience**
Serves Unique Community Needs	Planning for passenger rail stations should recognize stations are a **regional transportation asset** to serve **unique community needs through community consensus** within a multimodal transportation network.
Location Decisions	Station location decisions should consider service levels appropriate to the **population of the region, existing stations within the region, multimodal connectivity, and statewide service planning goals.**
Funding Partnerships	The Commonwealth will partner with regions to support a funding strategy for station needs that considers potential local, state, and federal funding, plus appropriate match. Support could be in the form of **technical assistance to pursue a federal grant, or incremental funding (subject to availability) to close a project funding gap.** The strategy will help guide decisions by the Commonwealth for state funding.

*Cost estimate subject to change

The passenger rail program is dominated by projects to advance Transforming Rail in Virginia, Virginia's signature passenger rail initiative that is made up of infrastructure projects to improve reliability and increase passenger rail service in Virginia, including Northern Virginia's commuter rail service, Virginia Railway Express (VRE). Virginia led and was a partner on two major Environmental Impact Statements that set the stage for this initiative, **DC2RVA** and the **Long Bridge Study**, which received Records of Decision from FRA in 2019 and 2020, respectively.

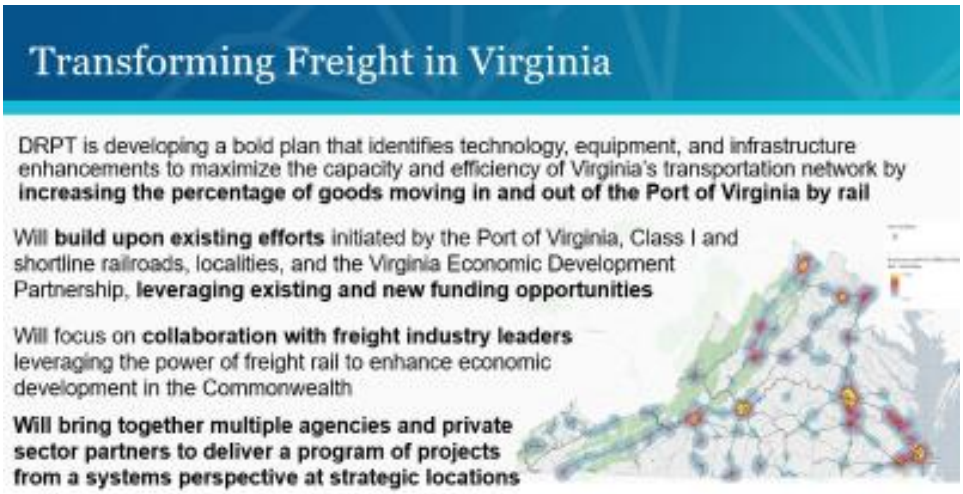
Transforming Rail in Virginia



The Commonwealth has a long history of supporting freight rail projects that benefit the transportation network by avoiding wear and tear and congestion on highways, providing last-mile connections to Virginia industries, and supporting freight capacity at the Port of Virginia. These improvements have the collective benefit of expanding Virginia's economy and improving the quality of life for its

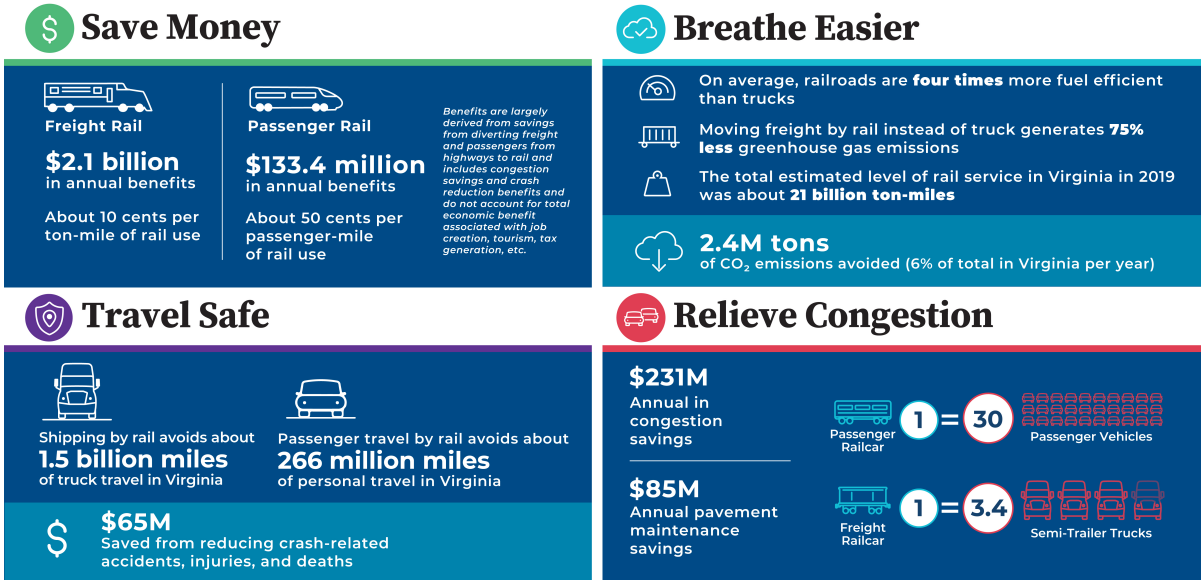
residents. Although the projects described in **Chapters 3, 4, and 5** are grouped by passenger and freight rail, in Virginia passenger and freight rail services operate on shared routes. As a result, many of the projects and initiatives ultimately benefit both passenger and freight rail.

Beyond programmed projects with defined budgets and funding sources, the Commonwealth recognizes the need for a long-term vision for passenger and freight projects that will carry Virginia's economy and its population into the future. Recognizing the needs and opportunities presented in **Chapter 2**, DRPT is developing passenger projects that go beyond the Commonwealth's commitments for Transforming Rail in Virginia and a strong freight vision that has the potential to transform freight, as well.



Benefits Summary

DRPT conducted an extensive benefit-cost analysis (BCA) for the passenger and freight projects included in the VSRP that enumerates economic, environmental, and social benefits, as shown below.



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