ATTACHMENT 7

Benefit-Cost Analysis Technical Memorandum

Vermont Agency of Transportation
Tri-State Regional Rail Upgrade Project
Consolidated Rail Infrastructure and Safety Improvements Program 2022

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Benefit-Cost Analysis Appendix

Tri-State Regional Rail Upgrade

In Support of the Application for the Federal Railroad Administration (FRA) 2022 Consolidated Rail Infrastructure and Safety Improvements (CRISI) Program

Prepared by AECOM

December 2022

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1. Executive Summary

This memorandum describes the results of a benefit-cost analysis (BCA) that was conducted for the Tri-State Regional Rail Upgrade Project (the Project), to support the St. Lawrence & Atlantic Railroad's (SLR) Federal Railroad Administration (FRA) 2022 Consolidated Rail Infrastructure and Safety Improvements (CRISI) grant application. The Project will replace track, ties, switches and ballast, and improve the efficiency of freight movements. The Project will lead to reductions in derailment costs, freight operating cost savings, light loading savings, operating and maintenance (O&M) costs avoided, residual value and emissions reductions by both truck and train.

This analysis was conducted in accordance with the *2022 Benefit-Cost Analysis Guidance for Discretionary Grant Programs*[1] for a 20-year benefit period. The Project is expected to be completed by the end of 2026, with benefits realized beginning in 2027. All values are in 2020 dollars and discounted to 2020 using a 7% discount rate.

Table 1 presents the Impact Matrix. The Impact Matrix describes the without-Project (baseline) scenario, the with-Project (build) scenario, and the estimated results.

[1] U.S. Department of Transportation, *Benefit-Cost Analysis Guidance for Discretionary Grant Programs*, March 2022. https://aecom.sharepoint.com/sites/BR1-684BIPGrantApplication/Shared%20Documents/General/BCA/Benefit%20Cost%20Analysis%20Guidance%202022%20(Revised).pdf?CT=1659967971531&OR=ItemsView

Table 1 – Impact Matrix

Current Status/Baseline & Problem to be Addressed	Change to Baseline or Alternatives	Types of Impacts	Affected Population	Economic Benefit (Net Present Values, $2020 M) Discounted at 7%	Page Reference in BCA
This benefit-cost analysis (BCA) examines approximately 162 miles of the SLR line. This runs from the VT/Canada border to Auburn, ME. From 2013 to October 2022, 52 derailments occurred within the Project area. Without the Project, the condition of the rail in the Project area will continue to deteriorate, creating higher inefficiencies for freight shippers, as well as auto and truck users at the crossings and higher risk of derailments.	The Project will install approximately 18 miles of new continuous welded rail (CWR), 11 switches and 3,000 ties on the SLR line. The new CWR will replace rail that is over 80 years old and cannot support modern 286,000 lb. loaded railcars. The Project will also rebuild 3 deteriorating grade crossings with new ballast and surfacing. These improvements are expected to generate quantifiable benefits through enhanced safety in rail operations, improved efficiency of freight movements, and reduction in both train and truck emissions.	**Safety**			
		Reduction in derailments	SLR; rail users	$1.2	11
		Economic Competitiveness			
		Freight operating savings	SLR	$38.8	11
		Light loading savings	SLR	$1.1	12
		State of Good Repair			
		O&M Cost Savings	SLR	$1.7	12
		Residual Value	SLR	$1.2	13
		Environmental Sustainability			
		Truck emissions savings (NOx)	All system users and non-users	$0.6	13
		Truck emissions savings (CO_2)	All system users and non-users	$4.1	13
		Train emissions savings (NOx and SO_2)	All system users and non-users	$0.3	13
		Train emissions savings (CO_2)	All system users and non-users	$0.8	13

Table 2 summarizes the long-term outcomes of the Project. Taken in total, the Project provides $49.7 million in benefits — reduction in derailments, freight operating savings, light loading savings, O&M costs avoided, residual value, and emissions reductions — over the 20-year analysis period, using a 7% discount rate, a base year of 2020, and a 2020 price level. Compared to a similarly discounted cost estimate, the benefit-cost ratio (BCR) for the Project is 4.0, a solid return on this investment for the region. The net present value of the Project is $37.2 million.

Table 2 – Benefit – Cost Analysis Summary (in millions of 2020 dollars)

20-Year Analysis Period (2027-2046), Discounted at 7%	
Costs	
Capital Costs	$12.5
Total Capital Costs	$12.5
Benefits	
Safety	
Reduction in derailments	$1.2
Sub-total	*$1.2*
Economic Competitiveness	
Freight operating savings	$38.8
Light loading savings	$1.1
Sub-total	*$39.9*
State of Good Repair	
O&M cost savings	$1.7
Residual value	$1.2
Sub-total	*$2.9*
Environmental Sustainability	
Truck emissions savings (NOx)	$0.6
Truck emissions savings (CO_2)	$4.1
Train emissions savings (NOx and SO_2)	$0.3
Train emissions savings (CO_2)	$0.8
Sub-total	*$5.7*
Total Benefits	**$49.7**
Outcome	
Benefit-Cost Ratio	**4.0**
Net Present Value	**$37.2**

*Values rounded to the nearest thousandth; all other values rounded to one decimal place.

2. Introduction

The SLR is partnering with the states of Vermont (VT), New Hampshire (NH) and Maine (ME) to improve supply chain resiliency, sustainability, and environmental quality for communities along the SLR Main Line, approximately 162 miles in length. This runs from the VT/Canada border to Auburn, ME. From 2013 to October 2022, 52 derailments occurred within the Project area. Without the Project, the condition of the rail will continue to deteriorate, creating higher inefficiencies for freight shippers, as well as auto and truck users at the crossings and higher risk of derailments.

This Project will install new continuous welded rail (CWR), 11 turnouts, 3,575 ties and include rehabilitation of three grade crossings. The new CWR will replace rail that is over 80 years old and cannot support modern 286,000 lb. loaded railcars. The Project will also rebuild 3 deteriorating grade crossings with new ballast and surfacing. These improvements are expected to generate quantifiable benefits through enhanced safety in rail operations, improved efficiency of freight movements, and reduction in both train and truck emissions.

3. Framework

The benefit-cost analysis (BCA) was conducted using the *2022 Benefit-Cost Analysis Guidance for Discretionary Grant Programs*[2] for preferred methods and monetized values. The parameters of the benefits analysis follow the recommendations set by the Office of Management and Budget (OMB) Circular A-94. Generally, standard factors and values accepted by state and Federal agencies were used for the benefits calculations except in cases where more project-specific values or prices were available.

The analysis follows a conservative estimation of the benefits. By doing so, actual benefits of the Project may be greater than depicted in the results. Benefits were estimated over a 20-year analysis period that begins in 2027 and extends through 2046. All values were discounted to a 2020 base year using a 7% discount rate. The benefits are expressed in constant 2020 dollars, which avoids forecasting future inflation and escalating future values for benefits and costs. The gross domestic product chained price index from the OMB was used to adjust cost estimates or price values into 2020 dollars.[3]

[2] U.S. Department of Transportation, *Benefit-Cost Analysis Guidance for Discretionary Grant Programs*, March 2022. https://aecom.sharepoint.com/sites/BR1-684BIPGrantApplication/Shared%20Documents/General/BCA/Benefit%20Cost%20Analysis%20Guidance%202022%20(Revised).pdf?CT=1659967971531&OR=ItemsView

[3] *Historical Tables, Table 10.1, Gross Domestic Product and Deflators Used in the Historical Tables: 1940-2027, Office of Management and Budget*. Retrieved https://www.whitehouse.gov/omb/historical-tables/

4. Assumptions

A list of assumptions and inputs for the Project is provided in the BCA workbook (see Inputs tab in the file SLR Workbook.xlsx) as well as in Table 3.

Table 3 – BCA Calculation Inputs

Input	Value	Source
General		
Discount Rate	7%	Benefit-Cost Analysis Guidance for Discretionary Grant Programs – March, 2022
Base Year	2020	Benefit-Cost Analysis Guidance for Discretionary Grant Programs – March, 2022
Deflator	See "Deflator" Sheet	https://www.whitehouse.gov/omb/historical-tables/
Annualization Factor	365	AECOM
Annualization Factor (Weekly)	52	AECOM
Analysis Period (years)	20	Benefit-Cost Analysis Guidance for Discretionary Grant Programs – March, 2022
Construction Year	2024	SLR
O&M Starting Year	2027	SLR
Costs		
Annual O&M Cost Savings (2022$)	$225,000	SLR
Annual O&M Cost Savings (2020$)	$210,080	Adjusted using GDP Deflator
Annual O&M Cost Savings Rate of Growth	2%	SLR
Environmental Sustainability		
Discount Rate – CO_2	3%	Benefit-Cost Analysis Guidance for Discretionary Grant Programs – March, 2022
Grams per metric ton	1,000,000	
Nox g/bhp-hr	1.00	U.S. EPA Emission Factors for Locomotives. Table 2 – Switch Emission Factors, Emission Factors for Locomotives (Tier 4)
Conversion factors (bhp-hr/gal) – large line-haul and Passenger	20.80	U.S. EPA Emission Factors for Locomotives. Table 3 – Conversion Factors, Emission Factors for Locomotives
SO_2 (g/gal)	1.88	Emissions Factors for Locomotives[4]

[4] https://nepis.epa.gov/Exe/ZyNET.exe/P100500B.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5Cindex%20Data%5C06thru10%5CTxt%5C00000010%5CP10

SO_2 (g/bhp-hr)	0.09	Adjusted using conversion factor
CO_2 (g/gal)	10,217	Emissions Factors for Locomotives[5]
CO_2 (g/bhp-hr)	491	Adjusted using conversion factor
Horsepower per Locomotive	3,000	SLR
Number of Locomotives per Train	4	SLR
Truck Idling Nox Emission Rates (g/min)	0.2754	Federal Railroad Administration GradeDec
Truck Idling CO_2 Emission Rates (g/min)	107.4107	Federal Railroad Administration GradeDec
Safety		
Average Minor Derailment Cost (2022$)	$30,000	SLR- $30,000 per year
Average Minor Derailment Cost (2020$)	$28,011	Adjusted by GDP Deflator
Average Major Derailment Cost (2009$)	$1,600,000	SLR
Average Major Derailment Cost (2020$)	$1,909,840	Adjusted by GDP Deflator
Major Derailment Occurrence in Years	10	SLR
Average Annual Derailments	5.2	SLR
Percentage of Annual Derailments Avoided with the Project	80%	SLR
Annual Derailments Avoided	4.2	SLR
Economic Competitiveness		
Value of Time All Purposes (2020$)	$17.80	Benefit-Cost Analysis Guidance for Discretionary Grant Programs – March, 2022
Value of Time – Truck Drivers (2020$)	$32.00	Benefit-Cost Analysis Guidance for Discretionary Grant Programs – March, 2022
Value of Time – Locomotive Engineers (2020$)	$52.50	Benefit-Cost Analysis Guidance for Discretionary Grant Programs – March, 2022
Auto Occupancy	1.67	Benefit-Cost Analysis Guidance for Discretionary Grant Programs – March, 2022

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[5] https://nepis.epa.gov/Exe/ZyNET.exe/P100500B.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5Cindex%20Data%5C06thru10%5CTxt%5C00000010%5CP100500B.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

Truck Speed (mph)	60	AECOM
Without Project Train Speed (mph)	10	SLR
With Project Train Speed(mph)	25	SLR
Miles of Refurbished Track	36.4	AECOM
Time Loss Per Slow Order Per Train (hr)	0.29	SLR
Number of Trains Per Day	2	SLR- 2 trains a day, 5 days a week
Number of Trains Per Week	10	SLR- 2 trains a day, 5 days a week
Train Hourly Operating Costs (2022$)	$893	SLR
Train Hourly Operating Costs (2020$)	$834	Adjusted by GDP Deflator
Freight Operating Cost Per Carload (2021$)	$251	CSX R-1 Report; AECOM Estimation; Estimated based on the total transportation expenses ($1,982,008,000) and the number of loaded freight cars (7,892,896) as found in Tab 410 Line No. 528 and Tab 755 Line No. 120-122, respectively. https://www.stb.gov/reports-data/economic-data/annual-report-financial-data/
Freight Operating Cost Per Carload (2020$)	$244	Adjusted by GDP Deflator
Truck Operating Cost Per Mile	$0.94	Benefit-Cost Analysis Guidance for Discretionary Grant Programs – March, 2022
Light Loaded Cars	5,800	SLR
Avoided Cars from Removing Light Loadings	657	AECOM estimate based on 23 ton difference divided by 203 tons (subtracted out weight of car ~60 tons)
Service Life of Rail (years)	50	SLR
Service Life of Ties (years)	40	SLR
Service Life of Gradecrossings (years)	20	SLR

5. Benefits Analysis

The methods used to estimate the benefits of the Project are described in the following sections. Benefits include reduction in derailments, freight operating savings, light loading savings, O&M costs avoided, residual value, and emissions reductions. Qualitative benefits include the convenience of removing more freight trucks off of highways for passenger vehicles, health and quality of life improvements to communities who reside near the SLR line and the potential business expansions, specifically the forest product industry, as SLR joins the surrounding 286,000 carrying capacity rail network.

5.1 Safety

The safety benefit created by this Project is a reduction in derailment costs. The deteriorating conditions on the SLR Line have caused defects and rail flaws, generating safety concerns for rail operators, freight

shippers, and local communities. Based on SLR records, 52 derailments occurred from 2013 to October 2022 in the Project area.

5.1.1 Reduction in Derailments

The derailment records yield an average of 5.2 derailments per year with an average annual cost of $30,000 for all derailments. However, major derailments, although infrequent, in the past have cost nearly $2.0 million in 2020 dollars. The last major derailment occurred in 2009 and was used to forecast the probability of future major derailments without the Project. The analysis estimates that a major derailment will occur every ten years in the baseline scenario. The Project is expected to improve the safety of train operations in the Project area and reduce the number of derailments by 80%, resulting in an annual reduction in derailment costs of $28,011, held constant over the 20-year analysis period. For the two years with major derailments, this cost increases to $1.9 million.

The total reduction in derailment costs is $1.2 million over the 20-year analysis period, discounted at 7%.

5.2 Economic Competitiveness

The Project will result in freight operating cost savings and light loading savings.

5.2.1 Freight Operating Savings

With the Project, freight operating cost savings are anticipated from reduced train travel times and reduced truck miles.

The Project is expected to eliminate all slow orders on the SLR line. Currently, each slow order results in a nearly 20-minute delay (0.3 hour) per train. The weekly number of trains (10) and an annualization factor of 52 were multiplied by the delay avoided per train to calculate the total delay avoided by the increase in rail speeds. The hourly operating cost for a SLR freight train is $834 in 2020 dollars. This was multiplied by the annual delay avoided in hours to capture the freight train operating savings from the Project.

As rail safety and efficiency improve, a higher volume of freight is expected to be shipped by rail than truck. Based on SLRR's market forecast data, 2.5 million[6] truck VMT will be avoided annually by SLRR's existing and new customers starting in 2027. This increases to 3.3 million truck VMT in 2028 and stays constant for the rest of the analysis period. Operating cost savings are anticipated from this avoided truck VMT. The marginal operating cost of a truck per mile of $0.94[7] was applied to the total truck VMT avoided, per USDOT guidance. The value of time of $32.00 per hour was applied to the total truck hours avoided (dividing truck VMT avoided by a speed of 60 mph) to estimate the total time savings of commercial truck drivers, per USDOT guidance.

The net value of freight operating savings with the Project is $38.8 million discounted at 7%.

[6] Total truck VMT avoided were estimated by multiplying the forecasted truck loads (converted from equivalent rail carloads) and the distance travelled between the origin and destination of each truck delivery. Please see the Freight Diversion Tab in the SLR Railroad BCA Workbook for more detailed calculations.

[7] U.S. Department of Transportation, *Benefit-Cost Analysis Guidance for Discretionary Grant Programs*, March 2022. https://aecom.sharepoint.com/sites/BR1-684BIPGrantApplication/Shared%20Documents/General/BCA/Benefit%20Cost%20Analysis%20Guidance%202022%20(Revised).pdf?CT=1659967971531&OR=ItemsView

5.2.2 Light Loading Savings

With the Project, SLR will be able to haul 286,000-pounds on the line, compared to the 263,000-pound capacity it currently operates under. This creates an inefficient system that will be resolved with the rail upgrade. To capture this benefit, the current number of SLR light loaded cars is multiplied by the difference in capacity load divided by the weight of a carload. This provided the annual avoided cars from removing light loadings which is then multiplied by the operating cost per carload of $244.

The net value of light loading savings is $1.1 million discounted at 7%.

5.3 State of Good Repair

The Project will reduce operating and maintenance costs and have residual value remaining at the end of the analysis period.

5.3.1 O&M Cost Savings

In bringing the facility to a state of good repair, the Project will result in O&M costs avoided. SLR estimates that the Project will result in $210,080 in O&M costs avoided in 2027; these savings are expected to grow at 2% annually throughout the analysis period. Total O&M costs avoided associated with the Project aggregate to $1.7 million discounted at 7%. O&M Savings are presented in Table 4.

Table 4 O&M Cost Savings

Year	Annual O&M Costs Savings	Discounted
2027	$210,080	$130,827
2028	$214,282	$124,714
2029	$218,567	$118,886
2030	$222,938	$113,331
2031	$227,397	$108,035
2032	$231,945	$102,986
2033	$236,584	$98,174
2034	$241,316	$93,586
2035	$246,142	$89,213
2036	$251,065	$85,044
2037	$256,086	$81,070
2038	$261,208	$77,282
2039	$266,432	$73,671
2040	$271,761	$70,228
2041	$277,196	$66,946
2042	$282,740	$63,818
2043	$288,395	$60,836
2044	$294,163	$57,993
2045	$300,046	$55,283
2046	$306,047	$52,700

5.3.2 Residual Value

Tie, ballast, and rail replacement and grade crossing surface rehabilitation will have residual value after the end of the 20-year analysis period. The components of the Project are assumed to have a useful life of 20, 40 and 50 years for grade crossings, railway ties and rail, respectively. As a result, the remaining value at the end of the analysis period was estimated using straight-line depreciation and discounted at 7% from the last year of the analysis period. Using the costs for each of these components, the value of remaining useful life for the Project is $1.2 million discounted at 7%. The residual value breakdown is presented in Table 5.

Table 5 Residual Value

Component	2020$	Remaining Value	Discounted ($M)
Grade Crossing	$568,395	$0	$0.00
Railway Ties	$1,837,292	$918,645	$0.16
Rail	$10,055,264	$6,033,158	$1.04

5.4 Environmental

The Project will reduce slow orders on the SLR line, leading to reduced emissions through travel time savings for trains, reduced truck VMT, and reduced waiting at grade crossings. The methodology to quantify reduced VMT and total hours of travel time saved from trains are described in previous sections. Savings from CO_2 reductions are included in this amount and are discounted at 3% per *2022 Benefit-Cost Analysis Guidance for Discretionary Grant Programs*. All emissions were monetized using values provided in Table 3.

5.4.1 Train Emissions Savings

The analysis applied a NO_x emissions rate of 1.00 grams per brake horsepower-hour,[8] an SO_2 emissions rate of 0.09 grams per brake horsepower-hour,[9] and a CO_2 emissions rate of 491 grams per brake horsepower-hour[10] to a locomotive horsepower of 3,000 to the total freight train operating hours avoided to estimate NO_x, SO_2 and CO_2 emissions avoided, respectively. The number of locomotives per train (4) was also factored into the emissions calculation. A conversion factor of 1,000,000 was used to convert the unit of total amount of emissions avoided from grams to metric tons.

The train emissions savings associated with the Project is $1.0 million over the 20-year analysis period.

5.4.2 Truck Emissions Savings

This analysis applied NO_x and CO_2 truck idling emissions rates based on the California Air Resources Board (CARB) for each of the years in the analysis period, to estimate the total amount of truck emissions reduced.

[8] U.S. Environmental Protection Agency, Emissions Factors for Locomotives, April 2009.

[9] U.S. Environmental Protection Agency, Emissions Factors for Locomotives, April 2009.

[10] U.S. Environmental Protection Agency, Emissions Factors for Locomotives, April 2009.

To calculate the emissions avoided from truck VMT saved by diverting freight to rail, this analysis applied NO_x truck emissions rates and CO_2 truck emissions rates (which vary by year)[11] to the annual truck VMT saved, respectively, to estimate the total amount of truck emissions reduced. A conversion factor of 1,000,000 was used to convert the unit of total amount of emissions avoided from grams to metric tons.

Total truck emissions savings associated with the Project is $4.7 million over the 20-year analysis period.

5.5 Benefits Not Quantified

5.5.1 Auto and Truck Operating Cost Savings

Autos and trucks waiting at the grade crossings will experience less idling time due to the reduction in slow orders and gate down time. Although, this is expected to be minimal, auto and truck operating cost savings are anticipated. Due to limited data availability for vehicle idling operating costs, auto and truck operating cost savings were not quantified for the BCA.

5.5.2 Highway Congestion Savings

With the Project, a total of 78.3 million truck miles will be avoided from SLR's existing and new customers due to the improved efficiency of the freight network, reducing traffic congestion on highways. Additionally, the ease of travel with less freight trucks on the highway are an added convenience for passenger vehicles. Due to limited data availability for highway congestion costs specifically for the Project area, highway congestion savings were not quantified for the BCA.

5.5.3 Environment and Quality of Life

The SLR line crosses through a majority rural area. The emission reductions from the Project will have beneficial health impacts on the communities living near the line. This is also in addition to the improvement of safety to local roads and highways. These benefits to the quality of life for local communities were not calculated due to their complexities and limited data availability.

[11] California Air Resources Board. https://arb.ca.gov/emfac/emissions-inventory/b63464fd92fc8220a78715221ed7159727297627

6. Capital Costs Analysis

The capital costs in 2022 dollars, deflated to 2020 and discounted for the Project are summarized in Table 6. Construction will take place in 2024 through 2026. All values are rounded to the nearest thousand.

Table 6 – Capital Costs

Category	Capital Costs (2022$)	Capital Costs (2020$)	Discounted
Capital	$17,131,000	$16,170,000	$11,390,000
Contingency	$1,773,000	$1,617,000	$1,139,000
Total	**$19,505,000**	**$17,787,000**	**$12,529,000**

7. Results

Table 7 summarizes the long-term outcomes of the Project. Taken in total, the Project provides $49.7 million in total benefits — reduction in derailments, freight operating cost savings, light loading savings, O&M costs avoided, residual value, and emissions reductions — over the 20-year analysis period, using a 7% discount rate, a base year of 2020, and a 2020 price level. Compared to a similarly discounted cost estimate, the BCR for the Project is 4.0, a solid return on this investment for the region. The net present value of the Project is $37.2 million.

Table 7 – Summary of Results

20-Year Analysis Period (2027-2046), Discounted at 7%	
Costs	
Capital Costs	$12.5
Total Capital Costs	$12.5
Benefits	
Safety	
Reduction in derailments	$1.2
Sub-total	*$1.2*
Economic Competitiveness	
Freight operating savings	$38.8
Light loading savings	$1.1
Sub-total	*$39.9*
State of Good Repair	
O&M cost savings	$1.7
Residual value	$1.2
Sub-total	*$2.9*
Environmental Sustainability	
Truck emissions savings (NOx)	$0.6
Truck emissions savings (CO_2)	$4.1
Train emissions savings (NOx and SO_2)	$0.3
Train emissions savings (CO_2)	$0.8
Sub-total	*$5.7*
Total Benefits	**$49.7**
Outcome	
Benefit-Cost Ratio	**4.0**
Net Present Value	**$37.2**

*Values rounded to the nearest thousandth; all other values rounded to one decimal place.

A sensitivity analysis was conducted to evaluate the impacts of changing the distance that freight trucks travel to an alternative transload location with 286,000-lb. railcar capacity. The freight truck miles in the BCA are based on Montreal being the transload station, which averages 268 miles of truck travel. The sensitivity analysis reduced the distance to 100 miles. Even with a significantly reduced distance, the Project is cost-effective (BCR of 1.8).

8. Supporting Documents

California Air Resources Board, https://arb.ca.gov/emfac/emissions-inventory/b63464fd92fc8220a78715221ed7159727297627.

Federal Railroad Administration, Crossing Inventory Lookup, https://railroads.dot.gov/safety-data/crossing-and-inventory-data/crossing-inventory-lookup

Surface Transportation Board, *Annual Report Financial Data*, https://www.stb.gov/reports-data/economic-data/annual-report-financial-data/

U.S. Department of Transportation, *Benefit-Cost Analysis Guidance for Discretionary Grant Programs, March 2022*, https://www.transportation.gov/sites/dot.gov/files/2022-03/Benefit%20Cost%20Analysis%20Guidance%202022%20%28Revised%29.pdf

U.S. EPA, *Emission Factors for Locomotives, 2009.* https://nepis.epa.gov/Exe/ZyNET.exe/P100500B.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C06thru10%5CTxt%5C00000010%5CP100500B.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

White House Office of Management and Budget, *Historical Tables, Table 10.1 – Gross Domestic Product and Deflators Used in the Historical Tables 1940-2027*, https://www.whitehouse.gov/omb/historical-tables/

9. Attachments

Attachment 1 – SLR Railroad BCA Workbook