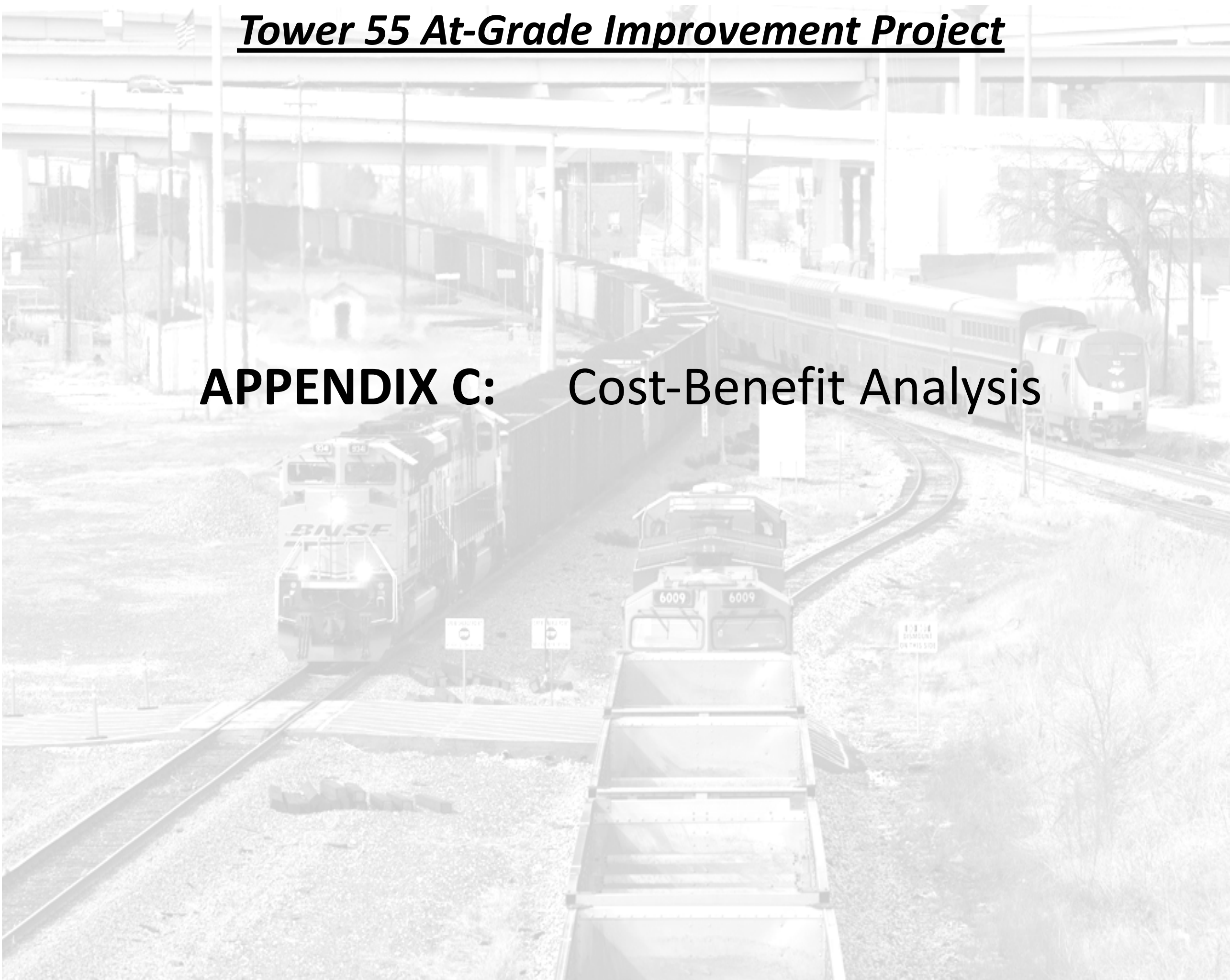
AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009

TRANSPORTATION INVESTMENT GENERATING ECONOMIC RECOVERY

“TIGER”

DISCRETIONARY GRANT APPLICATION

Tower 55 At-Grade Improvement Project



APPENDIX C: Cost-Benefit Analysis

Website: www.bnsf.com/communities/govtaffairs/tower55/intro.pdf

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Cost-Benefit Analysis in Support of TIGER Application

Tower 55 At-Grade Project, Fort Worth, Texas, for BNSF Railway and Union Pacific Railroad

HDR | Decision Economics

September 10, 2009

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INTRODUCTION AND COST-BENEFIT ANALYSIS RESULTS

This cost-benefit analysis compares the costs to the benefits for improvements to track, signalling, and railway/roadway at-grade crossings at Tower 55 of the BNSF Railway and Union Pacific Railroad near downtown Fort Worth, Texas. Tower 55 is the designation of a location where main lines of the two railroads cross at grade. This cost-benefit analysis is prepared under the guidelines of the Transportation Investment Generating Economic Recovery Act (TIGER Act) of 2009, and subsequent guidance issued by the U.S. Department of Transportation relating to the TIGER Act.

Tower 55 is a major intersection of principal north-south and east-west main lines of BNSF Railway and Union Pacific Railroad. These main lines carry trains that transport domestic and international goods and commodities across the U.S., and between Mexico, the U.S.. and Canada. It also carries passenger trains operated by Amtrak and Trinity Rail Express, a Dallas-Fort Worth area commuter authority. Tower 55 is approaching its capacity in trains it can accept per day. As it approaches capacity, the result is delays to trains, reroutes of trains on longer and more costly routes, delays to passengers, and negative effects on motorists and residents both in the vicinity of Tower 55 as well as communities adjoining the rail lines that pass through Tower 55. After the tower reaches capacity, the result is an increasing number of trains diverted to other, longer, rail routes. This study considers improvements to the at-grade crossing that reduces train delay, increases capacity for trains, and also improves roadway and pedestrian crossings of the rail lines in the vicinity of Tower 55, improving safety, reducing delays for motorists and pedestrians, and reducing air emissions in the neighborhoods surrounding Tower 55.

The cost estimate of the Tower 55 at-grade improvement project used in this analysis was prepared by BNSF Railway (BNSF) and Union Pacific Railroad (UPRR) using established engineering methods and costing methods. The benefits of the replacement project were prepared by HDR Corporation Decision Economics, using information about train operations provided by BNSF and UPRR, research conducted by HDR, and standard, peer-reviewable economic techniques and inputs. Data inputs and their source are described in Table 7. Structure and Logic Diagrams, Figures 3 through 14, detail the methodology used to calculate these benefits.

The Tower 55 at-grade improvement project has two primary benefits. The first is that it increases capacity and typical train speeds through the crossing, enabling the crossing to accept more trains and trains to transit more quickly. In turn, this decreases negative effects such as emissions from standing trains waiting their turn at the crossing, effects on motorists of trains moving slowly through grade-crossings, and effects on shippers of longer train diversion routes to avoid the crossing that increase shipment transit time and increase supply-chain costs. The second primary benefit is closure of certain at-grade road crossings in the vicinity of Tower 55 and construction of grade-separations for roadways at certain other crossings. This increases safety, decreases motor vehicle emissions, and decreases delays to motorists, and improves liveability of neighborhoods adjacent to the Tower 55 main lines. Additionally, one of these existing at-grade crossings is a principal pedestrian route for elementary-school children between a residential neighborhood on the east side of one of the main tracks, and an elementary school on the west side of the main track. This at-grade crossing will be closed and a pedestrian overpass constructed.

The benefits of building the Tower 55 at-grade improvement project are thus:

1. Reduction of train congestion at the crossing that affects passenger trains that use the crossing, resulting in:
    a. Reduced passenger-travel time and more time-value delivered to passengers;
    b. Reduced operating costs for passenger trains;
    c. Reduced fuel consumption by passenger trains; and
    d. Reduced air emissions for passenger trains.
2. Additional capacity for freight trains at the crossing, resulting in elimination of freight trains diverted to longer routes, resulting in:
    a. Reduced transportation costs for shippers compared to their goods continuing to travel to market via the Tower 55 route;
    b. Reduced time-value of inventory costs for shippers;
    c. Reduced fuel consumption by freight trains; and
    d. Reduced air emissions by freight trains.
3. Reduced delays for freight trains at the crossing, resulting in:
    a. Reduced time-value of inventory costs for shippers;
    b. Reduced fuel consumption by freight trains; and
    c. Reduced air emissions by freight trains.
4. Elimination of at-grade crossings, and construction of roadway grade-separations, resulting in:
    a. Greater safety for motorists and pedestrians;
    b. Reduced delays for motorists, and more time-value delivered to motorists;
    c. Reduced operating costs for motor vehicles;
    d. Reduced fuel consumption by motor vehicles; and
    e. Reduced emissions by motor vehicles.

This analysis considered two cases:

1. A no-build case in which the at-grade improvements were not constructed. This resulted in:
    a. Trains in excess of the current capacity of Tower 55 being diverted to longer routes;
    b. At-grade crossings in the vicinity of Tower 55 not being improved;
    c. Continued train delay at Tower 55; and
    d. No improvement in roadway/pedestrian grade-crossing safety, delay, emissions, vehicle operating costs, and emissions.
2. A build-case in which the at-grade improvements at Tower 55 and the associated roadway/pedestrian crossing improvements were constructed. This resulted in:
    a. Trains in excess of the current capacity of Tower 55 not being diverted to longer routes (until capacity of the improved crossing is reached);
    b. At-grade crossings in the vicinity of Tower 55 being improved; and
    c. Reduced train delay at Tower 55.

In the no-build case, train traffic when the Tower 55 main-line crossing reaches capacity for total train volume will continue to move, but trains in excess of Tower 55's capacity will switch to diversion routes that avoid Tower 55. The diversion routes available to BNSF and UPRR are lengthier, encounter their own restrictions due to route geographic characteristics and conflicting rail traffic, and thus present a disbenefit to the shippers that use the railway and to the public at large. The build-case, consisting of constructing the Tower 55 improvements, creates benefits that include:

1. Reduced transportation costs for the longer routes (less fuel consumed, higher equipment utilization rates, lower labor inputs, less track maintenance);
2. Reduced use of diesel fuel;
3. Reduced resulting air emissions;
4. Fewer delays for motorists waiting at roadway/railway grade-crossings for trains to pass (because more grade crossings are encountered by each train), as well as reduced motorist fuel use and reduced motor-vehicle emissions; and
5. Reduced inventory carrying costs for shippers of goods on the diverted trains.

The train-diversion mileage calculation is an important intermediate calculation used to develop the public benefits in the build case that is outlined above. To develop this calculation, the capacity of the existing Tower 55 at-grade crossing in passenger and freight trains per day was measured using the Rail Traffic Controller (RTC) model, an industry-standard tool employed by the U.S. Surface Transportation Board, Federal Railroad Administration, and most major U.S. freight and passenger railroads. The RTC model was also used to calculate the potential capacity of the proposed Tower 55 at-grade improvements. Existing freight rail traffic at the crossing was grown forward using compound annual growth rates developed by Global Insights using the USDOT Freight Analysis Framework and other economic metrics developed by the U.S. Government. Growth rates that were appropriate for each type of rail traffic were used.

The growth rates predict in each future year the number of trains that will be "presented" to the crossing for movement, if the Tower 55 crossing can handle them. If the Tower 55 crossing cannot handle them, the trains are diverted. Diversion routes were selected by BNSF and UPRR based on capacities in their systems. Total number of diverted trains per day for each diversion route, and the mileage of that diversion route, were multiplied to calculate total diversion train-miles. These diversion train-miles were then used as the basis of one input for shipper transportation cost savings, train and motor vehicle emissions savings, cost-of-inventory savings, and train and motor vehicle fuel consumption savings.

The second input to shipper transportation cost savings, train and motor vehicle emissions savings, cost of inventory savings, etc., is the amount of train delay in hours that would exist at the existing, unimproved Tower 55 crossing as opposed to the proposed, improved Tower 55 crossing. The RTC model was used to develop these hours of train delay in the same fashion it was used to develop trains-per-day capacity of the crossing. Environmental impacts for trains moving through Tower 55 were derived from the RTC model outputs for both the no-build and build cases; as with other calculations, the *net* difference is the one used to monetize public benefits. Environmental and time impacts for motor vehicles delayed at crossings in the Tower 55 area were determined using the no-build case and build-case speeds of trains over the at-grade crossings that would remain open in both cases (but would have improved train speeds), and for the motor vehicles that would use new grade-separations as opposed to at-grade crossings.

Attention is drawn to the public-benefit category “Reduction in Transportation Costs.” This benefit is captured by using the difference in 2007 national-average transportation costs for rail freight per ton-mile (2007 is the most recent year available). This category is counted as a public benefit because the additional cost of the longer diversion routes would be born by the shipper and receiver.

Table 1 below lists the benefit categories studied, and summarizes the discounted benefit cash flows for the Tower 55 improvement project, annually for 20 and 30 years at a 7 percent and 3 percent discount rate. Tables 2 through 4 detail the cash flow per year for the undiscounted, 7 percent, and 3 percent discount rates. Tables 5 and 6 summarize the fuel reductions and emissions reductions created by the difference between the no-build and build cases. The results indicate a discounted value of $695,144,018 in public benefits over a 20-year time period using a 7% discount rate, and $1,215,052,305 using a 3% discount rate.

Table 1. Summary

Benefit Category	Ben #	PV Over 20 Years ($000's)	
		7%	3%
Reduction in Transportation Costs Due to Avoidance of Future Rail Diversion to Longer Route	1	$603,366.5	$1,066,575.6
Reduction in Transportation Costs Due to Reduced Delay, Train	2	$2,814.0	$3,627.0
Reduction in Inventory Costs Due to Avoidance of Future Rail Diversion to Longer Route	3	$1,653.5	$2,922.8
Reduction in Inventory Costs Due to Reduced Delay, Train	4	$75.2	$96.9
Reduction in Vehicle Operating Costs Due to Reduced Vehicle Idling at Grade Crossings	6	$170.5	$221.3
Reduction in Vehicle Time Costs Due to Reduced Vehicle Idling at Grade Crossings	7	$7,802.8	$10,057.2
Reduction in Environmental Costs Due to Avoidance of Future Rail Diversion to Longer Route	8	$68,146.4	$117,330.2
Reduction in Environmental Costs Due to Reduced Delay, Train	9	$11,069.0	$14,157.5
Reduction in Environmental Costs Due to Reduced Vehicle Idling at Grade Crossings	10	$46.3	$63.9
Total		**$695,144.0**	**$1,215,052.3**

Table 2. Undiscounted Tower 55 Benefits, by Year ($000's)

Benefit Category	Ben #	Sum	Years																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Reduction in Transportation Costs Due to Avoidance of Future Rail Diversion to Longer Route	1	**$1,700,030.3**	$7,433.3	$15,049.3	$30,319.9	$37,901.2	$45,509.4	$53,171.3	$60,915.8	$76,126.2	$83,913.0	$91,760.9	$107,041.6	$114,941.7	$115,408.9	$115,914.5	$116,242.2	$119,081.1	$121,764.3	$126,876.0	$129,182.7	$131,476.9
Reduction in Transportation Costs Due to Reduced Delay, Train	2	**$4,441.6**	$793.6	$763.4	$680.8	$589.6	$492.6	$392.1	$290.8	$198.3	$123.0	$67.5	$32.1	$12.7	$4.0	$0.9	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Inventory Costs Due to Avoidance of Future Rail Diversion to Longer Route	3	**$4,658.8**	$20.4	$41.2	$83.1	$103.9	$124.7	$145.7	$166.9	$208.6	$230.0	$251.5	$293.3	$315.0	$316.3	$317.7	$318.6	$326.3	$333.7	$347.7	$354.0	$360.3
Reduction in Inventory Costs Due to Reduced Delay, Train	4	**$118.6**	$21.2	$20.4	$18.2	$15.7	$13.2	$10.5	$7.8	$5.3	$3.3	$1.8	$0.9	$0.3	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Vehicle Operating Costs Due to Reduced Vehicle Idling at Grade Crossings	5	**$272.6**	$43.0	$43.7	$41.0	$36.8	$31.8	$26.0	$19.7	$13.7	$8.5	$4.7	$2.3	$0.9	$0.3	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Vehicle Time Costs Due to Reduced Vehicle Idling at Grade Crossings	6	**$12,316.1**	$2,200.5	$2,116.9	$1,887.7	$1,634.8	$1,366.1	$1,087.2	$806.4	$549.9	$341.2	$187.1	$89.1	$35.2	$11.1	$2.5	$0.3	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Environmental Costs Due to Avoidance of Future Rail Diversion to Longer Route	7	**$183,423.7**	$1,184.0	$2,315.8	$4,467.7	$5,322.1	$6,086.6	$6,846.8	$7,559.1	$9,225.6	$9,927.9	$10,584.4	$12,007.4	$12,541.3	$12,247.3	$11,988.1	$11,718.2	$11,694.8	$11,690.7	$11,962.0	$11,998.9	$12,054.9
Reduction in Environmental Costs Due to Reduced Delay, Train	8	**$17,226.6**	$3,408.3	$3,199.9	$2,749.1	$2,268.9	$1,806.7	$1,386.0	$992.7	$658.0	$396.8	$211.3	$97.5	$37.4	$11.4	$2.5	$0.3	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Environmental Costs Due to Reduced Vehicle Idling at Grade Crossings	9	**$83.2**	$9.4	$8.9	$8.0	$7.6	$7.2	$6.7	$6.1	$5.7	$5.2	$4.6	$4.0	$3.4	$2.7	$2.0	$1.2	$0.5	$0.0	$0.0	$0.0	$0.0
Total		**$1,922,571.5**	**$15,113.7**	**$23,559.5**	**$40,255.6**	**$47,880.6**	**$55,438.2**	**$63,072.3**	**$70,765.4**	**$86,991.2**	**$94,948.9**	**$103,073.8**	**$119,568.3**	**$127,887.9**	**$128,002.0**	**$128,228.2**	**$128,281.1**	**$131,102.9**	**$133,788.7**	**$139,185.7**	**$141,535.6**	**$143,892.1**

Table 3. Discounted Tower 55 Benefits, by Year, 7 Percent Discount Rate ($000's)

Benefit Category	Ben #	Present Value	Years																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Reduction in Transportation Costs Due to Avoidance of Future Rail Diversion to Longer Route	1	**$603,366.5**	$5,670.8	$10,729.9	$20,203.4	$23,602.9	$26,486.9	$28,921.7	$30,966.5	$36,167.0	$37,258.4	$38,077.5	$41,512.6	$41,660.2	$39,093.0	$36,695.6	$34,391.9	$32,926.9	$31,466.2	$30,642.2	$29,158.2	$27,734.6
Reduction in Transportation Costs Due to Reduced Delay, Train	2	**$2,814.0**	$605.4	$544.3	$453.6	$367.2	$286.7	$213.3	$147.8	$94.2	$54.6	$28.0	$12.5	$4.6	$1.4	$0.3	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Inventory Costs Due to Avoidance of Future Rail Diversion to Longer Route	3	**$1,653.5**	$15.5	$29.4	$55.4	$64.7	$72.6	$79.3	$84.9	$99.1	$102.1	$104.3	$113.8	$114.2	$107.1	$100.6	$94.2	$90.2	$86.2	$84.0	$79.9	$76.0
Reduction in Inventory Costs Due to Reduced Delay, Train	4	**$75.2**	$16.2	$14.5	$12.1	$9.8	$7.7	$5.7	$3.9	$2.5	$1.5	$0.7	$0.3	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Vehicle Operating Costs Due to Reduced Vehicle Idling at Grade Crossings	5	**$170.5**	$32.8	$31.2	$27.3	$22.9	$18.5	$14.2	$10.0	$6.5	$3.8	$2.0	$0.9	$0.3	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Vehicle Time Costs Due to Reduced Vehicle Idling at Grade Crossings	6	**$7,802.8**	$1,678.8	$1,509.3	$1,257.9	$1,018.1	$795.1	$591.3	$409.9	$261.3	$151.5	$77.6	$34.6	$12.8	$3.7	$0.8	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Environmental Costs Due to Avoidance of Future Rail Diversion to Longer Route	7	**$68,146.4**	$903.3	$1,651.1	$2,977.0	$3,314.3	$3,542.5	$3,724.2	$3,842.7	$4,383.0	$4,408.1	$4,392.2	$4,656.7	$4,545.6	$4,148.6	$3,795.1	$3,467.0	$3,233.7	$3,021.1	$2,889.0	$2,708.3	$2,542.9
Reduction in Environmental Costs Due to Reduced Delay, Train	8	**$11,069.0**	$2,600.1	$2,281.5	$1,831.9	$1,412.9	$1,051.5	$753.9	$504.6	$312.6	$176.2	$87.7	$37.8	$13.5	$3.9	$0.8	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Environmental Costs Due to Reduced Vehicle Idling at Grade Crossings	9	**$46.3**	$7.2	$6.3	$5.3	$4.8	$4.2	$3.6	$3.1	$2.7	$2.3	$1.9	$1.6	$1.2	$0.9	$0.6	$0.4	$0.2	$0.0	$0.0	$0.0	$0.0
Total		**$695,144.0**	**$11,530.2**	**$16,797.6**	**$26,824.0**	**$29,817.6**	**$32,265.5**	**$34,307.2**	**$35,973.5**	**$41,328.9**	**$42,158.4**	**$42,772.0**	**$46,370.6**	**$46,352.5**	**$43,358.7**	**$40,593.8**	**$37,953.7**	**$36,251.0**	**$34,573.5**	**$33,615.2**	**$31,946.5**	**$30,353.6**

Table 4. Discounted Tower 55 Benefits, by Year, 3 Percent Discount Rate ($000's)

Benefit Category	Ben #	Present Value	Years																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Reduction in Transportation Costs Due to Avoidance of Future Rail Diversion to Longer Route	1	**$1,066,575.6**	$6,604.4	$12,981.6	$25,392.5	$30,817.1	$35,925.5	$40,751.4	$45,327.1	$54,995.2	$58,854.9	$62,484.7	$70,767.1	$73,776.7	$71,919.0	$70,130.2	$68,280.1	$67,910.3	$67,418.0	$68,202.1	$67,419.5	$66,618.3
Reduction in Transportation Costs Due to Reduced Delay, Train	2	**$3,627.0**	$705.1	$658.5	$570.1	$479.4	$388.9	$300.5	$216.4	$143.3	$86.3	$45.9	$21.3	$8.2	$2.5	$0.5	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Inventory Costs Due to Avoidance of Future Rail Diversion to Longer Route	3	**$2,922.8**	$18.1	$35.6	$69.6	$84.5	$98.5	$111.7	$124.2	$150.7	$161.3	$171.2	$193.9	$202.2	$197.1	$192.2	$187.1	$186.1	$184.8	$186.9	$184.8	$182.6
Reduction in Inventory Costs Due to Reduced Delay, Train	4	**$96.9**	$18.8	$17.6	$15.2	$12.8	$10.4	$8.0	$5.8	$3.8	$2.3	$1.2	$0.6	$0.2	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Vehicle Operating Costs Due to Reduced Vehicle Idling at Grade Crossings	5	**$221.3**	$38.2	$37.7	$34.4	$29.9	$25.1	$20.0	$14.7	$9.9	$6.0	$3.2	$1.5	$0.6	$0.2	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Vehicle Time Costs Due to Reduced Vehicle Idling at Grade Crossings	7	**$10,057.2**	$1,955.2	$1,826.1	$1,581.0	$1,329.3	$1,078.4	$833.2	$600.0	$397.3	$239.3	$127.4	$58.9	$22.6	$6.9	$1.5	$0.2	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Environmental Costs Due to Avoidance of Future Rail Diversion to Longer Route	7	**$117,330.2**	$1,052.0	$1,997.6	$3,741.6	$4,327.4	$4,804.8	$5,247.5	$5,624.7	$6,664.8	$6,963.2	$7,207.5	$7,938.3	$8,049.8	$7,632.1	$7,253.0	$6,883.2	$6,669.4	$6,472.8	$6,430.2	$6,262.1	$6,108.1
Reduction in Environmental Costs Due to Reduced Delay, Train	8	**$14,157.5**	$3,028.2	$2,760.3	$2,302.3	$1,844.8	$1,426.2	$1,062.3	$738.7	$475.3	$278.3	$143.9	$64.5	$24.0	$7.1	$1.5	$0.2	$0.0	$0.0	$0.0	$0.0	$0.0
Reduction in Environmental Costs Due to Reduced Vehicle Idling at Grade Crossings	9	**$63.9**	$8.4	$7.6	$6.7	$6.2	$5.7	$5.1	$4.5	$4.1	$3.6	$3.1	$2.7	$2.2	$1.7	$1.2	$0.7	$0.3	$0.0	$0.0	$0.0	$0.0
Total		**$1,215,052.3**	**$13,428.3**	**$20,322.7**	**$33,713.4**	**$38,931.3**	**$43,763.4**	**$48,339.7**	**$52,656.1**	**$62,844.3**	**$66,595.2**	**$70,188.2**	**$79,048.7**	**$82,086.4**	**$79,766.6**	**$77,580.2**	**$75,351.6**	**$74,766.1**	**$74,075.5**	**$74,819.2**	**$73,866.4**	**$72,908.9**

FUEL AND EMISSIONS SAVINGS

Table 5 and Table 6 below present the average annual value over the 20-year study period for fuel savings and emissions reductions.

Table 5. Fuel

Public Benefit	Over 20 Years	
	Gallons Saved (Millions)	Millions of Dollars Saved
Fuel	238	$941.2
Motor Oil	0	$0.0

Table 6. Emissions

Public Benefit	Over 20 Years	
	Total Tons Saved	Millions of Dollars Saved
CO2 emissions	1,961,493	$88.0
VOC (ROG) emissions	547	$1.0
NOx emissions	13,955	$57.4
PM emissions	327	$54.4

GRAPHS

Figure 1 below presents the annual benefits by major category in millions of dollars, over the 20 year study period.

Figure 1. Annual Benefits by Major Category ($Ms)

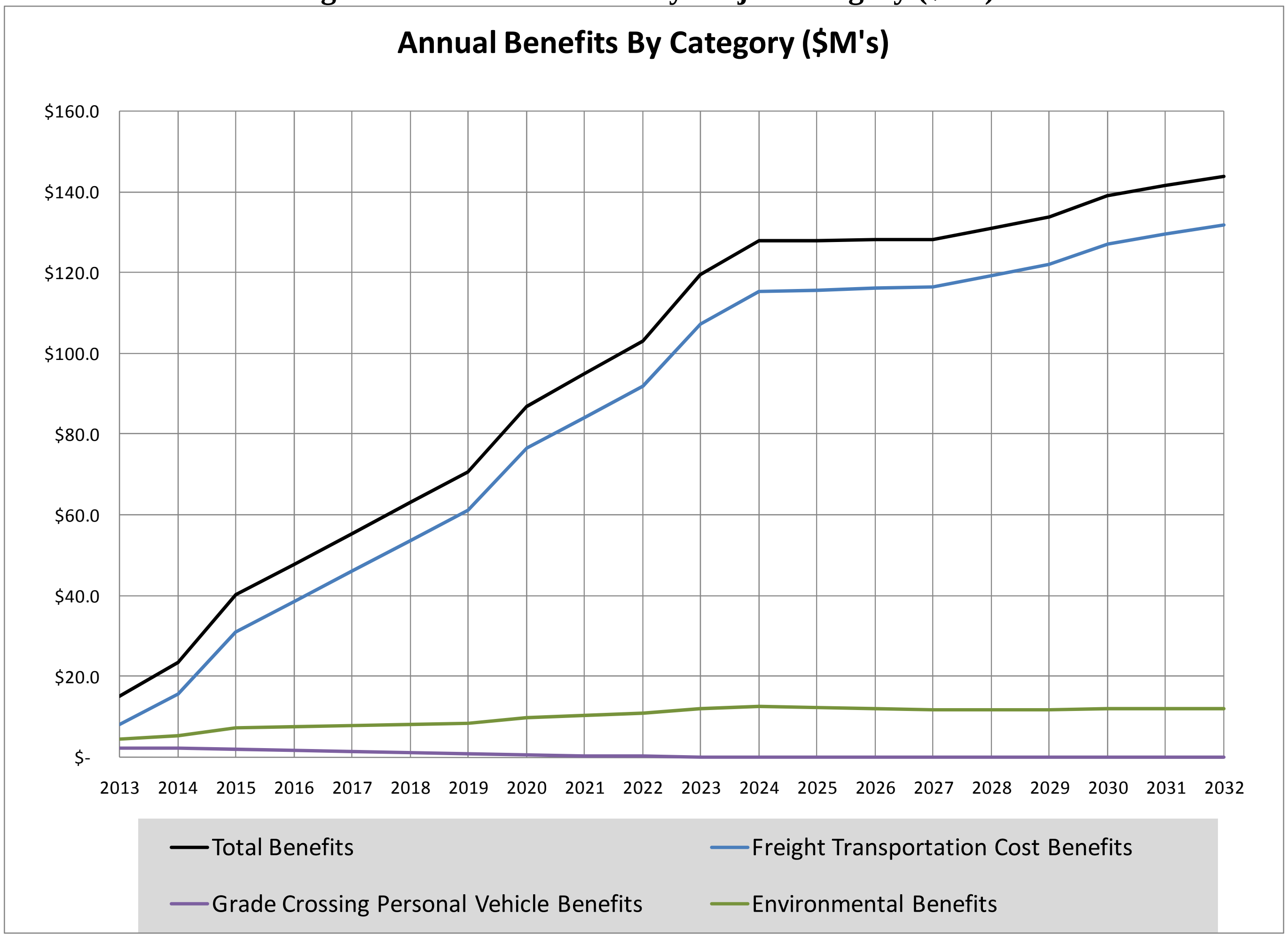
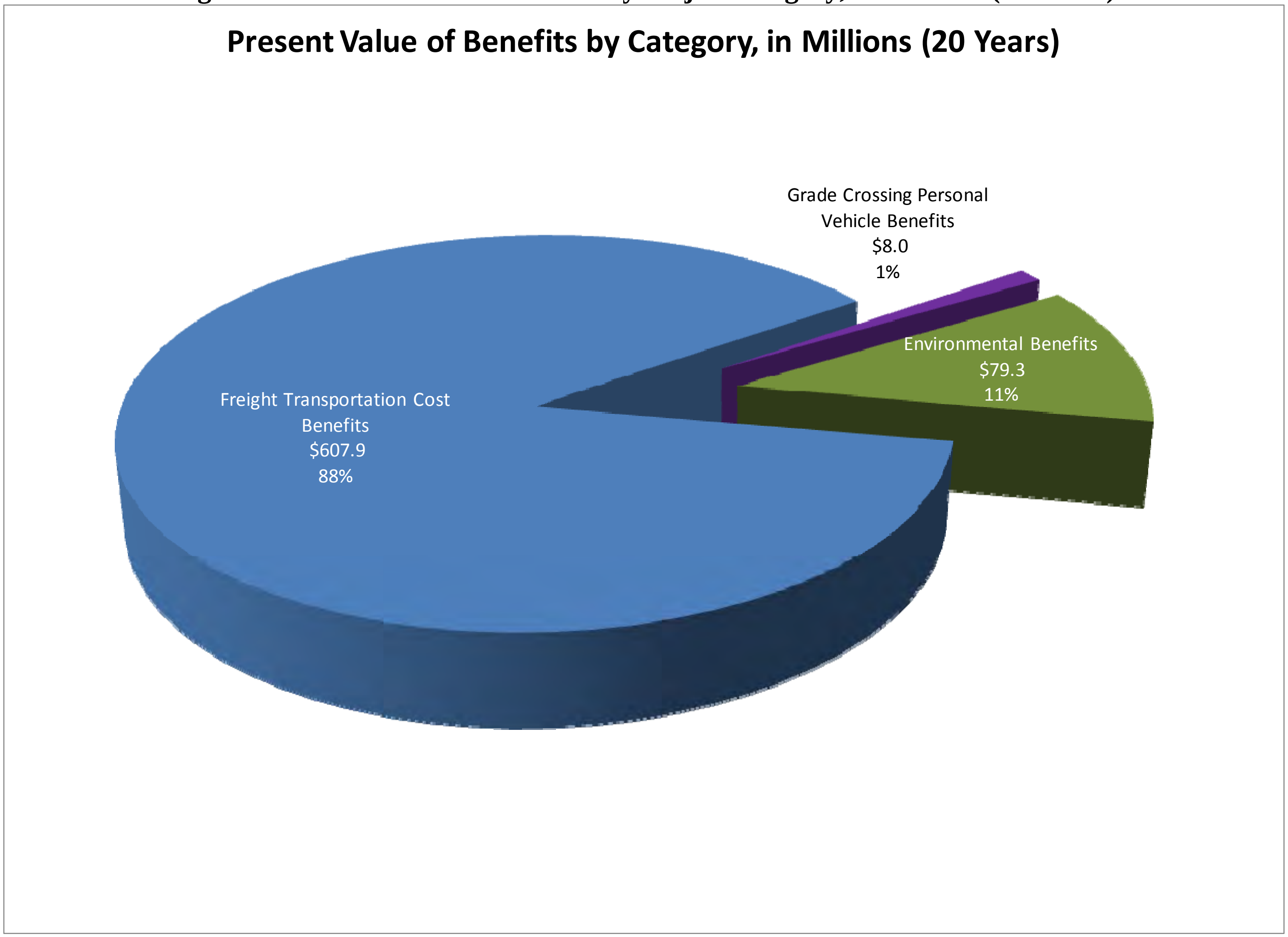


Figure 2 below displays the present value of benefits by major category, in millions of dollars over the 20-year study period.

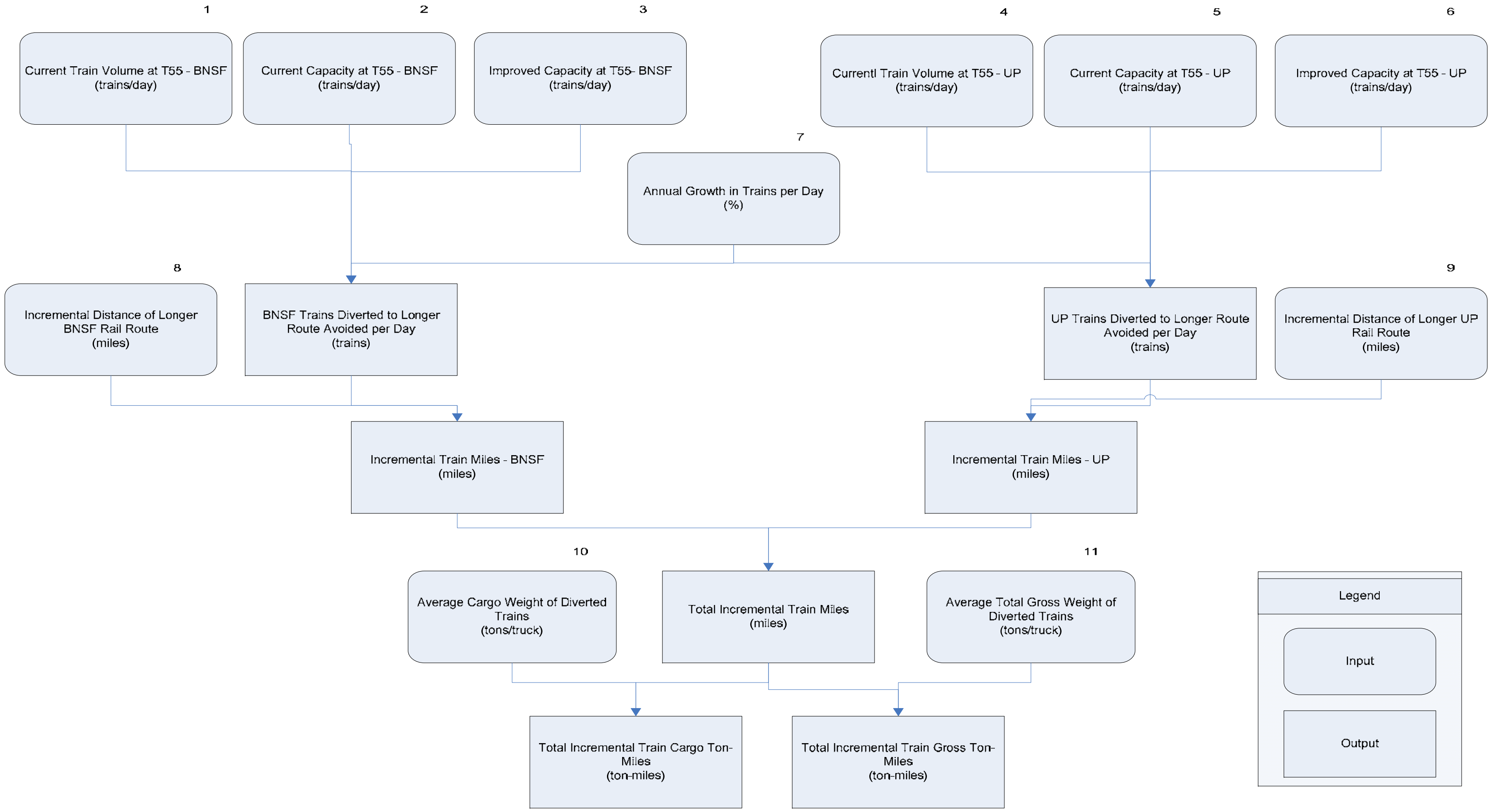
Figure 2. Present Value of Benefits by Major Category, in Millions (20 Years)



STRUCTURE AND LOGIC D1: AVOIDANCE OF FUTURE RAIL DIVERSION TO LONGER ROUTE

This structure and logic diagram illustrates the method used to calculate the number of trains diverted to longer routes, and the number of train-miles that would result for both BNSF and UPRR.

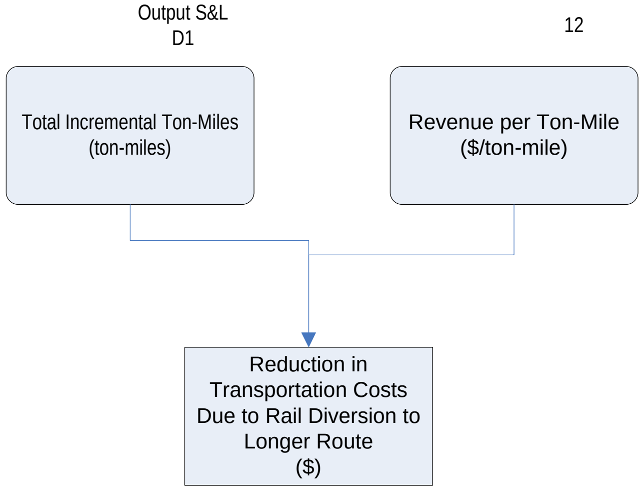
Figure 3. S&L D1 – Avoidance of Future Rail Diversion to Longer Route



IMPACT 1: REDUCTION IN TRANSPORTATION COSTS DUE TO AVOIDANCE OF FUTURE RAIL DIVERSION TO LONGER ROUTE

This benefit category captures the transportation cost impacts of transporting goods by a shorter route through Tower 55 as opposed to a longer route (the diversion routes), including gallons of fuel consumed by the longer routes.

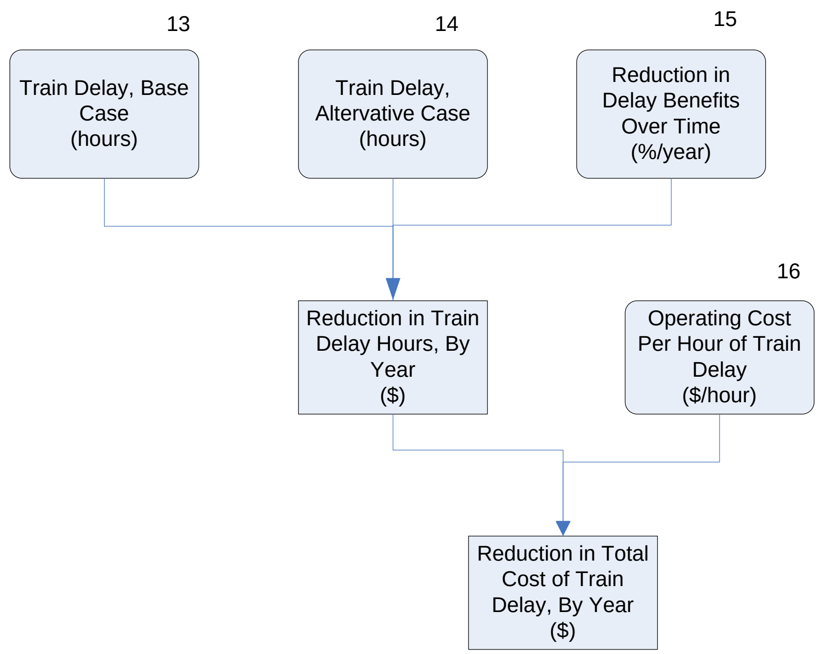
Figure 4. S&L 1 - Reduction in Transportation Costs Due to Avoidance of Future Rail Diversion to Longer Route



IMPACT 2: REDUCTION IN TRANSPORTATION COSTS DUE TO REDUCED DELAY, TRAIN

This benefit category captures the transportation cost impact of trains moving more quickly through Tower 55 after the improvements are constructed. As the number of trains grow due to general increase in the economy, however, this growth rate of this impact declines.

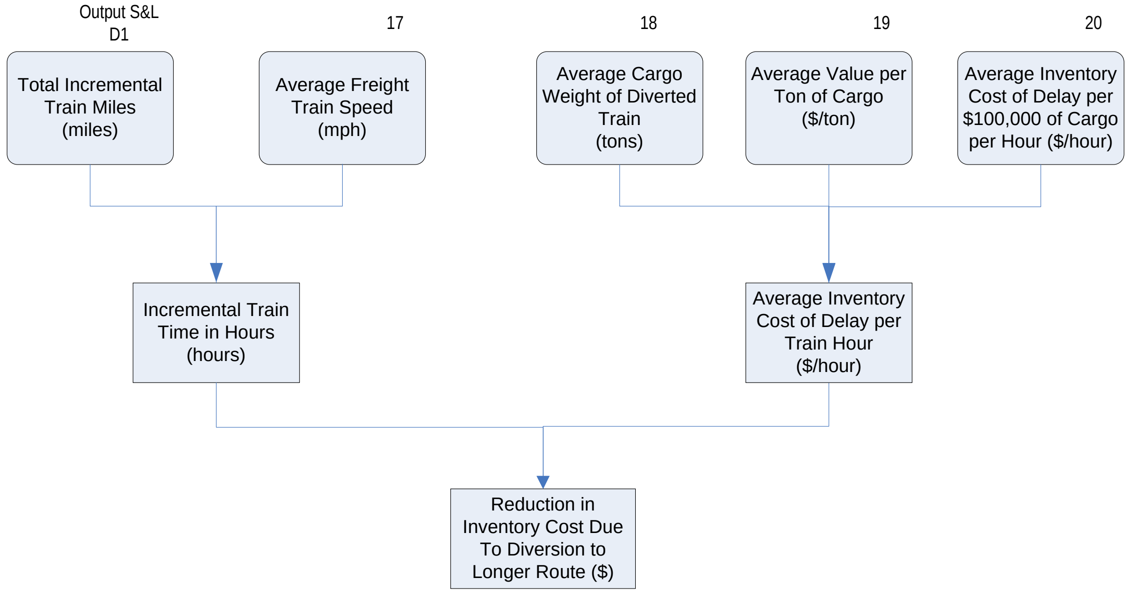
Figure 5. S&L 2 - Reduction in Transportation Costs Due To Reduced Delay, Train



IMPACT 3: REDUCTION IN INVENTORY COSTS DUE TO AVOIDANCE OF FUTURE RAIL DIVERSION TO LONGER ROUTE

This benefit category captures the inventory cost impact of trains moving on longer, more time-consuming routes, as opposed to shorter routes. As the number of trains grow due to general increase in the economy, this impact grows.

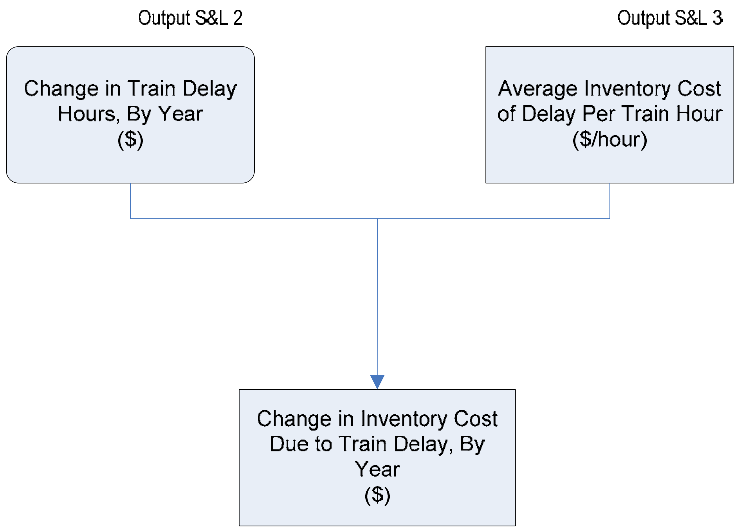
Figure 6. S&L 3 - Reduction in Inventory Costs Due To Avoidance of Future Rail Diversion to Longer Route



IMPACT 4: REDUCTION IN INVENTORY COSTS DUE TO REDUCED TRAIN DELAY

This benefit category captures the inventory cost impact of trains moving more quickly through Tower 55 after the improvements are constructed. As the number of trains grow due to general increase in the economy, however, this growth rate of this impact declines. The less time that freight spends in the transportation process, the more quickly it is delivered and put to productive use.

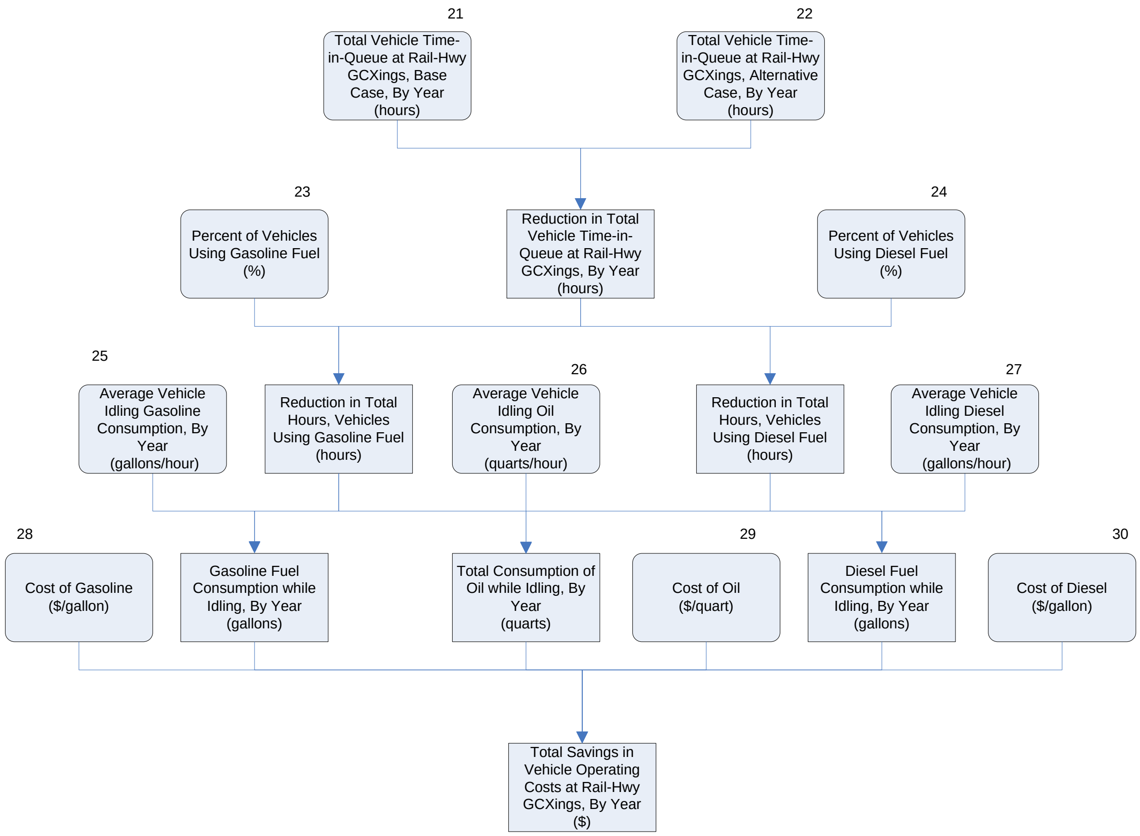
Figure 7. S&L 4 - Reduction in Inventory Costs Due To Reduced Train Delay



IMPACT 5: REDUCTION IN VEHICLE OPERATING COSTS DUE TO REDUCED VEHICLE IDLING AT GRADE CROSSINGS

This benefit category captures the reduction in vehicle operating costs when wait times at roadway/railway at-grade crossings are reduced. Wait times are reduced when trains occupy crossings for shorter periods of time. In the build-case, train speeds at Tower 55 are improved, and trains occupy crossings for shorter periods of time.

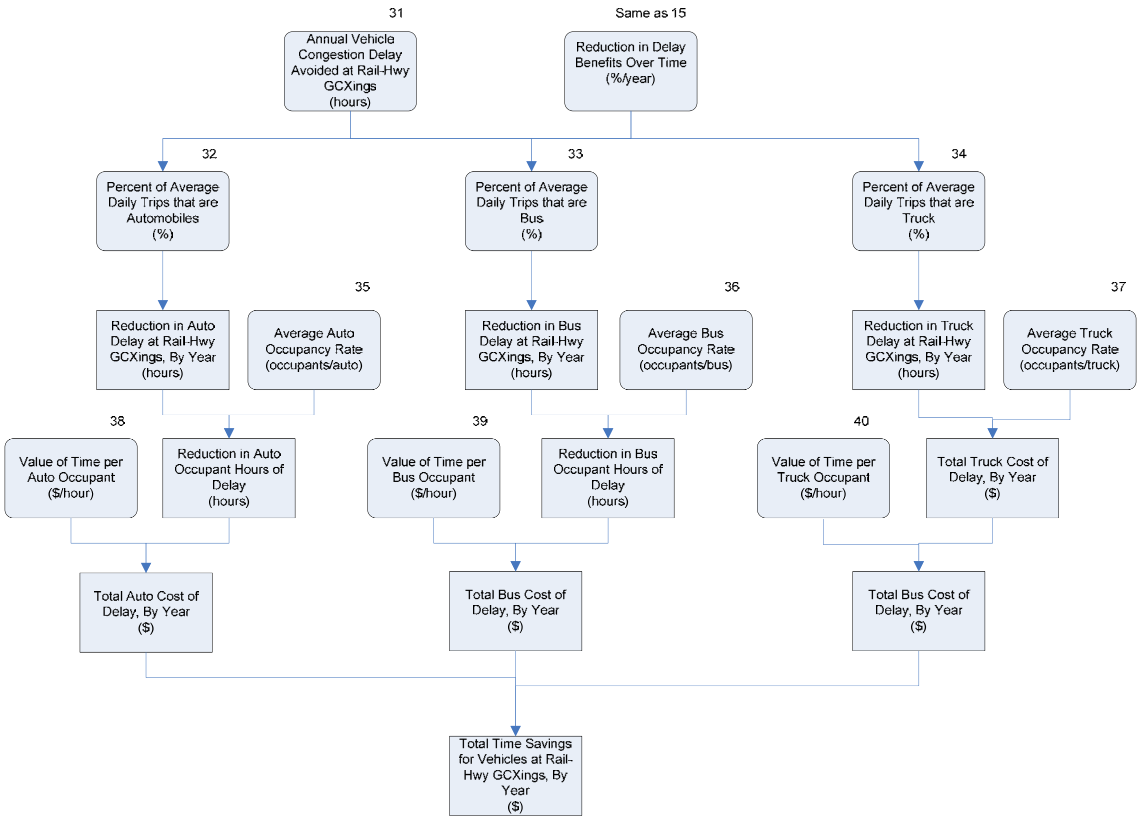
Figure 8. S&L 5 - Reduction in Vehicle Operating Costs Due to Reduced Vehicle Idling at Grade Crossings



IMPACT 6: REDUCTION IN VEHICLE TIME COSTS DUE TO REDUCED VEHICLE IDLING AT GRADE CROSSINGS

This benefit category captures the value in the reduction of people's lost time due to less time spent at roadway/railway at-grade crossings waiting for trains to pass through the crossing.

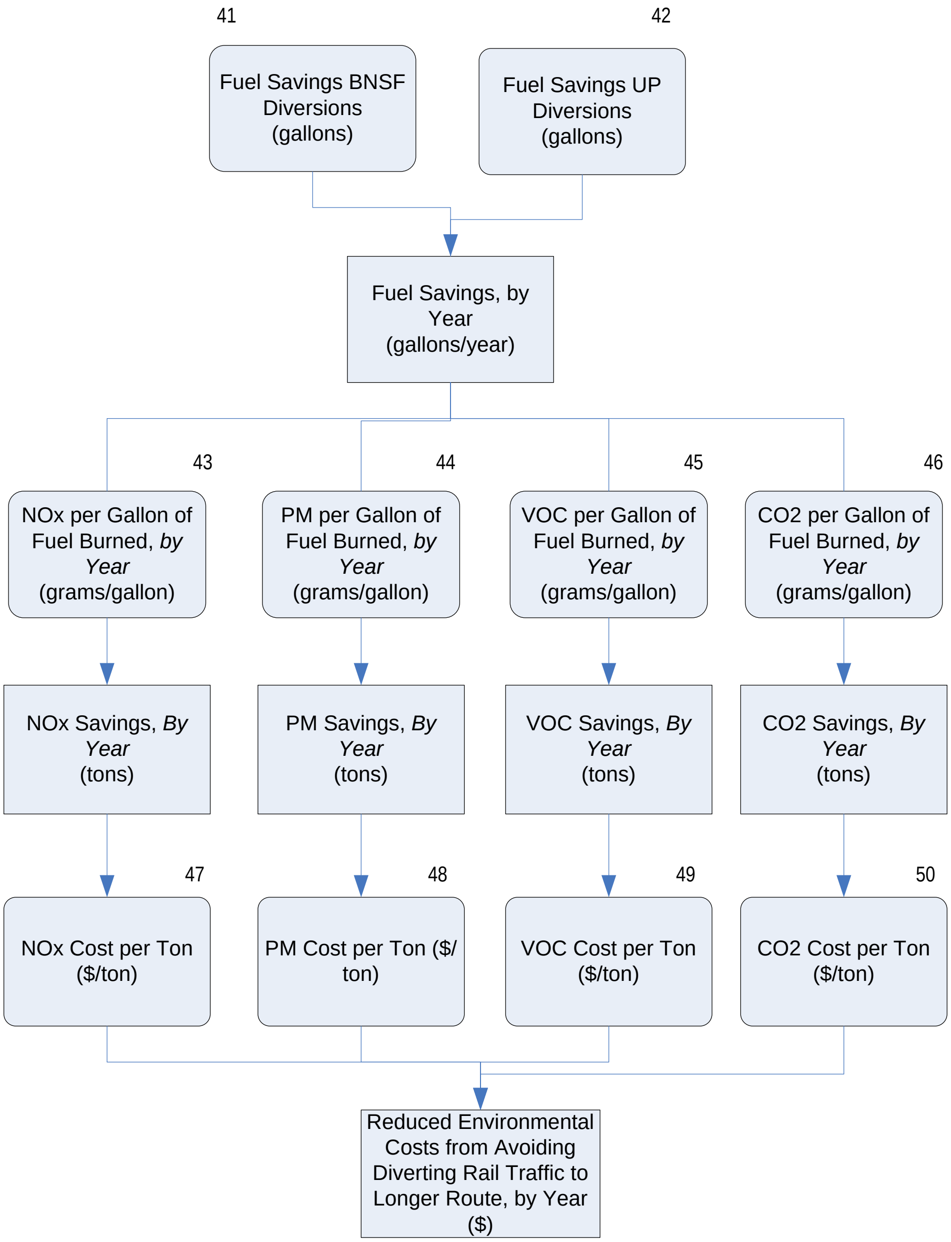
Figure 9. S&L 6 - Reduction in Vehicle Time Costs Due to Reduced Vehicle Idling at Grade Crossings



IMPACT 7: REDUCTION IN ENVIRONMENTAL COSTS DUE TO AVOIDANCE OF FUTURE RAIL DIVERSION TO LONGER ROUTE

This benefit category captures the environmental benefit from the avoidance of future train diversions to longer routes. Longer routes require greater fuel consumption; air emissions are proportional to fuel consumption.

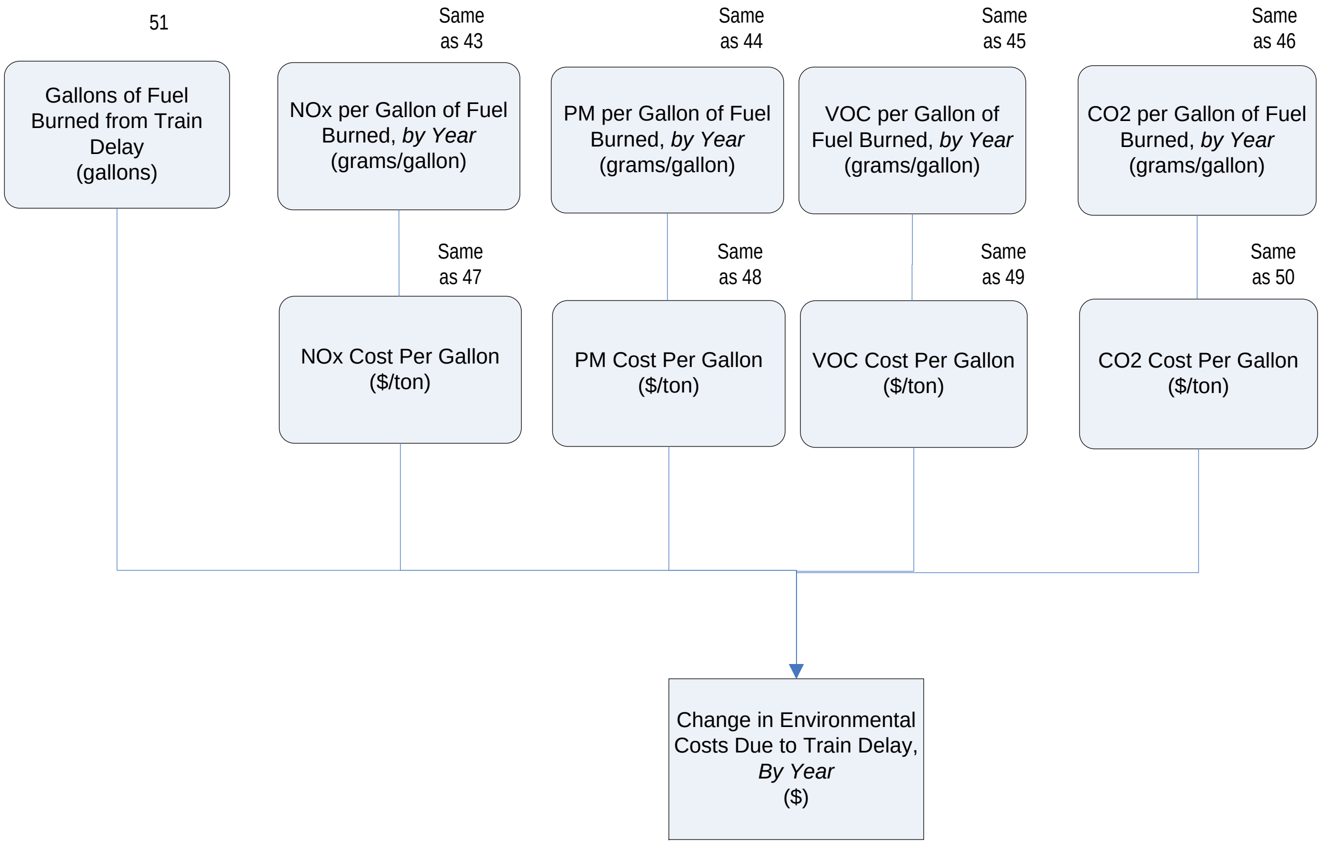
Figure 10. S&L 7 – Reduction in Environmental Costs Due to Avoidance of Future Rail Diversion to Longer Route



IMPACT 8: REDUCTION IN ENVIRONMENTAL COSTS FROM REDUCED TIME DELAY, TRAIN

This benefit category captures the environmental benefit from the reduction in delay for freight trains at Tower 55, in the build-case. Trains moving more quickly through the crossing spend less time waiting and encounter fewer deceleration/acceleration events, reducing fuel consumption and air emissions.

Figure 11. S&L 8 - Reduction in Environmental Costs from Reduced Time Delay, Train



IMPACT 9: REDUCTION IN ENVIRONMENTAL COSTS DUE TO REDUCED VEHICLE IDLING AT GRADE CROSSINGS

This benefit category captures the environmental benefit of reduced wait times by motor vehicles at roadway/railway at-grade crossings. Wait times are reduced when trains occupy the at-grade crossings for shorter periods of time.

Figure 12. S&L 9 - Reduction in Environmental Costs Due To Reduced Vehicle Idling at Grade Crossings

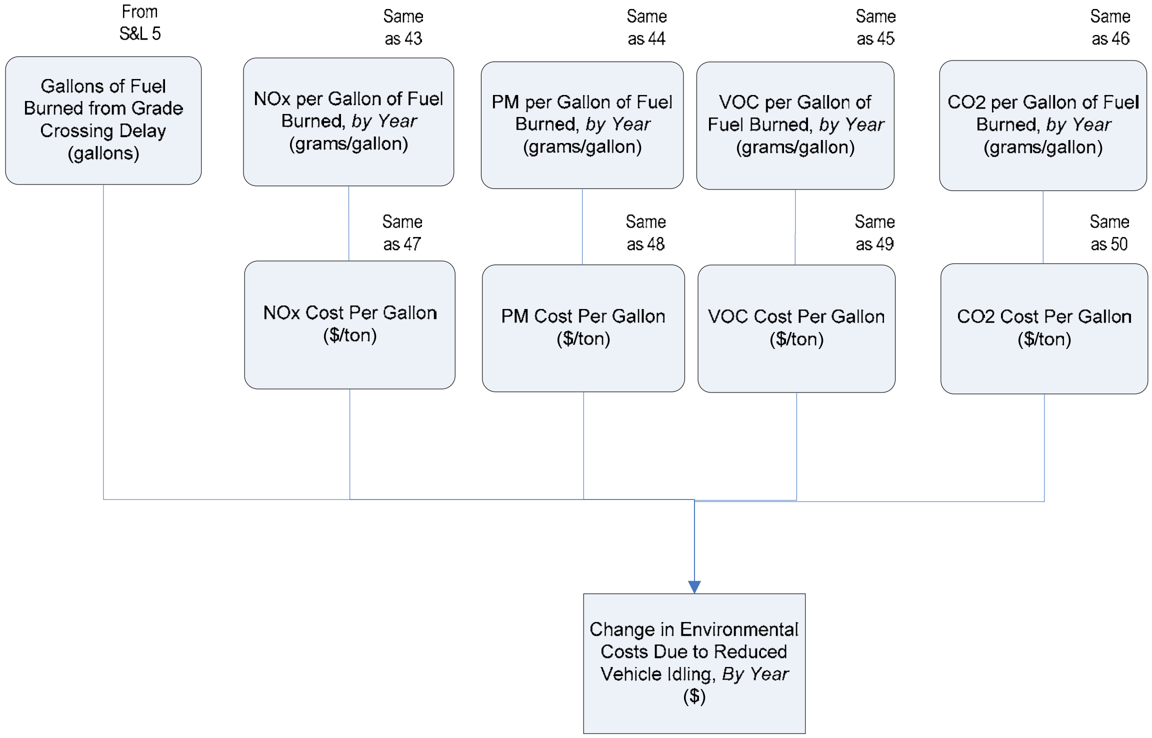


Table 7. Input Values and Sources

Input Name	Units	S&L #	Input Value	Source/Comment
T55 Capacity, Base	trains	D1	102.0	Railroad
T55 Capacity, Alt	trains	D1	124.0	Railroad
T55 BNSF Capacity, Base	trains	D1	28.0	Railroad
T55 BNSF Capacity, Alt	trains	D1	35.0	Railroad
T55 UP Capacity, Base	trains	D1	68.0	Railroad
T55 UP Capacity, Alt	trains	D1	83.0	Railroad
T55 Amtrak Capacity, Base	trains	D1	6.0	Railroad
T55 Amtrak Capacity, Base	trains	D1	6.0	Railroad
Annual growth in trains per day - 2009	%	D1	-9.8%	Global Insights
Annual growth in trains per day - 2010	%	D1	-0.5%	Global Insights
Annual growth in trains per day - 2011	%	D1	9.5%	Global Insights
Annual growth in trains per day - 2012	%	D1	1.8%	Global Insights
Annual growth in trains per day - 2013	%	D1	1.7%	Global Insights
Annual growth in trains per day - 2014	%	D1	1.7%	Global Insights
Annual growth in trains per day - 2015	%	D1	1.7%	Global Insights
Annual growth in trains per day - 2016+	%	D1	1.7%	Global Insights
Average Cargo Weight per Train - Bulk	ton/train	D1	11,550	HDR
Average Cargo Weight per Train - Manifest	ton/train	D1	7,950	HDR
Average Cargo Weight per Train - Intermodal	ton/train	D1	4,130	HDR
Gross/Net Ratio - Bulk	ratio	D1	1.23	HDR
Average Cargo Weight of Diverted Train	Tons	D1	3,937	HDR
Average Revenue per Ton-Mile	$/ ton-mile	1	$0.0299	AAR, Railroad Facts 2008
Train Delay per Day, Base Case	hours	2	88	RTC Model Results
Train Delay per Day, Alt Case	hours	2	78	RTC Model Results
Operating cost per hour of train delay	$/hour	2	$217.42	HDR
Average Inventory Cost of Delay per $100,000 of Cargo per Hour	$/hour	3	$0.49	Financing cost to carry
Average Value per Ton	$/ton	3	$ 304.00	AASHTO
Average Freight Train Speed	miles/hour	3	18	STB

Input Name	Units	S&L #	Input Value	Source/Comment
Fuel Saved due to Congestion Delay Avoided at Rail-Hwy GCXings	gallons	5	12,877	Environ
Percent of vehicles using gasoline fuel	%	5	90.21%	Environ
Percent of vehicles using diesel fuel	%	5	9.79%	Environ
Cost of Gasoline, by year - 2013	$/gallon	5	$3.20	Energy Information Administration
Cost of Gasoline, by year - 2014	$/gallon	5	$3.37	Energy Information Administration
Cost of Gasoline, by year - 2015	$/gallon	5	$3.55	Energy Information Administration
Cost of Gasoline, by year - 2016	$/gallon	5	$3.68	Energy Information Administration
Cost of Gasoline, by year - 2017	$/gallon	5	$3.80	Energy Information Administration
Cost of Gasoline, by year - 2018	$/gallon	5	$3.91	Energy Information Administration
Cost of Gasoline, by year - 2019	$/gallon	5	$4.00	Energy Information Administration
Cost of Gasoline, by year - 2020	$/gallon	5	$4.07	Energy Information Administration
Cost of Gasoline, by year - 2021	$/gallon	5	$4.08	Energy Information Administration
Cost of Gasoline, by year - 2022	$/gallon	5	$4.12	Energy Information Administration
Cost of Gasoline, by year - 2023	$/gallon	5	$4.14	Energy Information Administration
Cost of Gasoline, by year - 2024	$/gallon	5	$4.15	Energy Information Administration
Cost of Gasoline, by year - 2025	$/gallon	5	$4.14	Energy Information Administration
Cost of Gasoline, by year - 2026	$/gallon	5	$4.18	Energy Information Administration
Cost of Gasoline, by year - 2027	$/gallon	5	$4.17	Energy Information Administration
Cost of Gasoline, by year - 2028	$/gallon	5	$4.23	Energy Information Administration
Cost of Gasoline, by year - 2029	$/gallon	5	$4.34	Energy Information Administration
Cost of Gasoline, by year - 2030	$/gallon	5	$4.29	Energy Information Administration
Cost of Oil	$/quart	5	$3.26	HERS Model
Quarts Converted to Gallons	quart/gallon	5	4.00	Known

Input Name	Units	S&L #	Input Value	Source/Comment
Cost of Diesel, by year - 2013	$/gallon	5	$3.10	Energy Information Administration
Cost of Diesel, by year - 2014	$/gallon	5	$3.30	Energy Information Administration
Cost of Diesel, by year - 2015	$/gallon	5	$3.45	Energy Information Administration
Cost of Diesel, by year - 2016	$/gallon	5	$3.58	Energy Information Administration
Cost of Diesel, by year - 2017	$/gallon	5	$3.71	Energy Information Administration
Cost of Diesel, by year - 2018	$/gallon	5	$3.81	Energy Information Administration
Cost of Diesel, by year - 2019	$/gallon	5	$3.87	Energy Information Administration
Cost of Diesel, by year - 2020	$/gallon	5	$3.92	Energy Information Administration
Cost of Diesel, by year - 2021	$/gallon	5	$3.90	Energy Information Administration
Cost of Diesel, by year - 2022	$/gallon	5	$3.94	Energy Information Administration
Cost of Diesel, by year - 2023	$/gallon	5	$3.98	Energy Information Administration
Cost of Diesel, by year - 2024	$/gallon	5	$3.98	Energy Information Administration
Cost of Diesel, by year - 2025	$/gallon	5	$3.98	Energy Information Administration
Cost of Diesel, by year - 2026	$/gallon	5	$4.03	Energy Information Administration
Cost of Diesel, by year - 2027	$/gallon	5	$4.01	Energy Information Administration
Cost of Diesel, by year - 2028	$/gallon	5	$4.07	Energy Information Administration
Cost of Diesel, by year - 2029	$/gallon	5	$4.19	Energy Information Administration
Cost of Diesel, by year - 2030	$/gallon	5	$4.18	Energy Information Administration
Proportion of Oil to Diesel Fuel	%	5	0.87%	HighwayDec
Annual Vehicle Congestion Delay Avoided at Rail-Hwy GCXings	hours	6	99,630	Environ
Percent of Average Daily Trips that are Automobiles	%	6	63%	Environ
Percent of Average Daily Trips that are Trucks	%	6	37%	Environ
Percent of Average Daily Trips that are Buses	%	6	0.1%	Environ
Average Auto Occupancy Rate	occupants	6	1.15	Federal Railroad Administration. 2005. GradeDec.Net Reference Manual. Office of Policy.

Input Name	Units	S&L #	Input Value	Source/Comment
Average Truck Occupancy Rate	occupants	6	1	HDR
Average Bus Occupancy Rate	occupants	6	10.0	Federal Railroad Administration. 2005. GradeDec.Net Reference Manual. Office of Policy.
Value of Time per Auto Occupant	$/hour	6	$18.65	TIGER Guidance
Value of Time per Truck	$/hour	6	$22.81	TIGER Guidance
Value of Time per Bus Occupant	$/hour	6	$18.65	TIGER Guidance
BNSF Fuel Saved Per Year - 2013	gallons	7	0	Environ
BNSF Fuel Saved Per Year - 2014	gallons	7	2,858	Environ
BNSF Fuel Saved Per Year - 2015	gallons	7	9,181	Environ
BNSF Fuel Saved Per Year - 2016	gallons	7	11,496	Environ
BNSF Fuel Saved Per Year - 2017	gallons	7	14,232	Environ
BNSF Fuel Saved Per Year - 2018	gallons	7	17,810	Environ
BNSF Fuel Saved Per Year - 2019	gallons	7	22,680	Environ
BNSF Fuel Saved Per Year - 2020	gallons	7	60,676	Environ
BNSF Fuel Saved Per Year - 2021	gallons	7	118,220	Environ
BNSF Fuel Saved Per Year - 2022	gallons	7	185,345	Environ
BNSF Fuel Saved Per Year - 2023	gallons	7	252,436	Environ
BNSF Fuel Saved Per Year - 2024	gallons	7	327,749	Environ
BNSF Fuel Saved Per Year - 2025	gallons	7	403,178	Environ
BNSF Fuel Saved Per Year - 2026	gallons	7	484,610	Environ
BNSF Fuel Saved Per Year - 2027	gallons	7	535,277	Environ
BNSF Fuel Saved Per Year - 2028	gallons	7	537,769	Environ
BNSF Fuel Saved Per Year - 2029	gallons	7	544,943	Environ
BNSF Fuel Saved Per Year - 2030	gallons	7	547,438	Environ
BNSF Fuel Saved Per Year - 2031	gallons	7	549,957	Environ
BNSF Fuel Saved Per Year - 2032	gallons	7	552,498	Environ
UP Fuel Saved Per Year - 2013	gallons	7	4,237,362	Environ
UP Fuel Saved Per Year - 2014	gallons	7	5,649,816	Environ
UP Fuel Saved Per Year - 2015	gallons	7	6,356,043	Environ
UP Fuel Saved Per Year - 2016	gallons	7	7,062,270	Environ
UP Fuel Saved Per Year - 2017	gallons	7	7,768,497	Environ
UP Fuel Saved Per Year - 2018	gallons	7	9,180,951	Environ
UP Fuel Saved Per Year - 2019	gallons	7	9,887,178	Environ
UP Fuel Saved Per Year - 2020	gallons	7	10,593,405	Environ

Input Name	Units	S&L #	Input Value	Source/Comment
UP Fuel Saved Per Year - 2021	gallons	7	12,005,859	Environ
UP Fuel Saved Per Year - 2022	gallons	7	12,712,086	Environ
UP Fuel Saved Per Year - 2023	gallons	7	14,124,539	Environ
UP Fuel Saved Per Year - 2024	gallons	7	15,096,112	Environ
UP Fuel Saved Per Year - 2025	gallons	7	15,626,803	Environ
UP Fuel Saved Per Year - 2026	gallons	7	15,892,148	Environ
UP Fuel Saved Per Year - 2027	gallons	7	17,129,066	Environ
UP Fuel Saved Per Year - 2028	gallons	7	15,716,612	Environ
UP Fuel Saved Per Year - 2029	gallons	7	15,010,385	Environ
UP Fuel Saved Per Year - 2030	gallons	7	13,597,931	Environ
UP Fuel Saved Per Year - 2031	gallons	7	12,891,704	Environ
UP Fuel Saved Per Year - 2032	gallons	7	12,185,477	Environ
Tons of NOX Savings - 2013	tons	7	101.20	Environ
Tons of NOX Savings - 2014	tons	7	197.83	Environ
Tons of NOX Savings – 2015	tons	7	377.67	Environ
Tons of NOX Savings – 2016	tons	7	443.64	Environ
Tons of NOX Savings – 2017	tons	7	499.82	Environ
Tons of NOX Savings – 2018	tons	7	555.10	Environ
Tons of NOX Savings – 2019	tons	7	605.06	Environ
Tons of NOX Savings – 2020	tons	7	724.69	Environ
Tons of NOX Savings – 2021	tons	7	764.35	Environ
Tons of NOX Savings – 2022	tons	7	797.36	Environ
Tons of NOX Savings – 2023	tons	7	879.27	Environ
Tons of NOX Savings – 2024	tons	7	890.68	Environ
Tons of NOX Savings – 2025	tons	7	841.21	Environ
Tons of NOX Savings – 2026	tons	7	794.06	Environ
Tons of NOX Savings – 2027	tons	7	746.22	Environ
Tons of NOX Savings – 2028	tons	7	713.67	Environ
Tons of NOX Savings – 2029	tons	7	681.43	Environ
Tons of NOX Savings - 2030	tons	7	663.86	Environ
Tons of NOX Savings - 2031	tons	7	634.52	Environ
Tons of NOX Savings - 2032	tons	7	605.61	Environ
Tons of PM Savings - 2013	tons	7	2.87	Environ
Tons of PM Savings - 2014	tons	7	5.47	Environ
Tons of PM Savings – 2015	tons	7	10.27	Environ
Tons of PM Savings – 2016	tons	7	11.82	Environ
Tons of PM Savings – 2017	tons	7	13.01	Environ

Input Name	Units	S&L #	Input Value	Source/Comment
Tons of PM Savings – 2018	tons	7	14.11	Environ
Tons of PM Savings – 2019	tons	7	14.96	Environ
Tons of PM Savings – 2020	tons	7	17.67	Environ
Tons of PM Savings – 2021	tons	7	18.35	Environ
Tons of PM Savings – 2022	tons	7	18.78	Environ
Tons of PM Savings – 2023	tons	7	20.42	Environ
Tons of PM Savings – 2024	tons	7	20.38	Environ
Tons of PM Savings – 2025	tons	7	18.92	Environ
Tons of PM Savings – 2026	tons	7	17.56	Environ
Tons of PM Savings – 2027	tons	7	16.22	Environ
Tons of PM Savings – 2028	tons	7	15.24	Environ
Tons of PM Savings – 2029	tons	7	14.28	Environ
Tons of PM Savings - 2030	tons	7	13.66	Environ
Tons of PM Savings - 2031	tons	7	12.75	Environ
Tons of PM Savings - 2032	tons	7	11.87	Environ
Tons of CO2 Savings - 2013	tons	7	7,993.80	Environ
Tons of CO2 Savings - 2014	tons	7	16,019.96	Environ
Tons of CO2 Savings – 2015	tons	7	32,079.13	Environ
Tons of CO2 Savings – 2016	tons	7	40,099.13	Environ
Tons of CO2 Savings – 2017	tons	7	48,123.91	Environ
Tons of CO2 Savings – 2018	tons	7	56,158.21	Environ
Tons of CO2 Savings – 2019	tons	7	64,207.13	Environ
Tons of CO2 Savings – 2020	tons	7	80,624.82	Environ
Tons of CO2 Savings – 2021	tons	7	89,269.97	Environ
Tons of CO2 Savings – 2022	tons	7	98,023.56	Environ
Tons of CO2 Savings – 2023	tons	7	114,770.57	Environ
Tons of CO2 Savings – 2024	tons	7	123,616.84	Environ
Tons of CO2 Savings – 2025	tons	7	124,470.62	Environ
Tons of CO2 Savings – 2026	tons	7	125,392.36	Environ
Tons of CO2 Savings – 2027	tons	7	125,965.85	Environ
Tons of CO2 Savings – 2028	tons	7	128,997.51	Environ
Tons of CO2 Savings – 2029	tons	7	132,082.17	Environ
Tons of CO2 Savings - 2030	tons	7	138,117.32	Environ
Tons of CO2 Savings - 2031	tons	7	141,149.28	Environ
Tons of CO2 Savings - 2032	tons	7	144,181.49	Environ
Tons of VOC Savings - 2013	tons	7	4.92	Environ
Tons of VOC Savings - 2014	tons	7	9.24	Environ

Input Name	Units	S&L #	Input Value	Source/Comment
Tons of VOC Savings – 2015	tons	7	17.20	Environ
Tons of VOC Savings – 2016	tons	7	19.38	Environ
Tons of VOC Savings – 2017	tons	7	20.82	Environ
Tons of VOC Savings – 2018	tons	7	22.30	Environ
Tons of VOC Savings – 2019	tons	7	23.38	Environ
Tons of VOC Savings – 2020	tons	7	27.77	Environ
Tons of VOC Savings – 2021	tons	7	29.02	Environ
Tons of VOC Savings – 2022	tons	7	29.94	Environ
Tons of VOC Savings – 2023	tons	7	32.85	Environ
Tons of VOC Savings – 2024	tons	7	33.11	Environ
Tons of VOC Savings – 2025	tons	7	31.09	Environ
Tons of VOC Savings – 2026	tons	7	29.22	Environ
Tons of VOC Savings – 2027	tons	7	27.36	Environ
Tons of VOC Savings – 2028	tons	7	26.09	Environ
Tons of VOC Savings – 2029	tons	7	24.88	Environ
Tons of VOC Savings - 2030	tons	7	24.23	Environ
Tons of VOC Savings - 2031	tons	7	23.06	Environ
Tons of VOC Savings - 2032	tons	7	21.94	Environ
NOX cost per ton	$/ton	7	$4,111.83	TIGER Guidance
PM cost per ton	$/ton	7	$172,697.05	TIGER Guidance
CO2 cost per ton	$/ton	7	$30.77	TIGER Guidance
Growth Rate in the Real Cost of CO2	%	7	2.4%	TIGER Guidance
VOC cost per ton	$/ton	7	$1,747.53	TIGER Guidance
Fuel Saved Per Year - 2013	gallons	8	39,094	Environ
Fuel Saved Per Year - 2014	gallons	8	37,608	Environ
Fuel Saved Per Year - 2015	gallons	8	33,537	Environ
Fuel Saved Per Year - 2016	gallons	8	29,043	Environ
Fuel Saved Per Year - 2017	gallons	8	24,269	Environ
Fuel Saved Per Year - 2018	gallons	8	19,314	Environ
Fuel Saved Per Year - 2019	gallons	8	14,326	Environ
Fuel Saved Per Year - 2020	gallons	8	9,769	Environ
Fuel Saved Per Year - 2021	gallons	8	6,062	Environ
Fuel Saved Per Year - 2022	gallons	8	3,324	Environ
Fuel Saved Per Year - 2023	gallons	8	1,583	Environ
Fuel Saved Per Year - 2024	gallons	8	626	Environ
Fuel Saved Per Year - 2025	gallons	8	196	Environ
Fuel Saved Per Year - 2026	gallons	8	44	Environ

Input Name	Units	S&L #	Input Value	Source/Comment
Fuel Saved Per Year - 2027	gallons	8	6	Environ
Fuel Saved Per Year - 2028	gallons	8	0.38	Environ
Fuel Saved Per Year - 2029	gallons	8	0.00	Environ
Tons of NOX Savings - 2013	tons	8	291.31	Environ
Tons of NOX Savings - 2014	tons	8	273.36	Environ
Tons of NOX Savings – 2015	tons	8	232.39	Environ
Tons of NOX Savings – 2016	tons	8	189.13	Environ
Tons of NOX Savings – 2017	tons	8	148.36	Environ
Tons of NOX Savings – 2018	tons	8	112.37	Environ
Tons of NOX Savings – 2019	tons	8	79.46	Environ
Tons of NOX Savings – 2020	tons	8	51.69	Environ
Tons of NOX Savings – 2021	tons	8	30.55	Environ
Tons of NOX Savings – 2022	tons	8	15.91	Environ
Tons of NOX Savings – 2023	tons	8	7.14	Environ
Tons of NOX Savings – 2024	tons	8	2.65	Environ
Tons of NOX Savings – 2025	tons	8	0.78	Environ
Tons of NOX Savings – 2026	tons	8	0.17	Environ
Tons of NOX Savings – 2027	tons	8	0.02	Environ
Tons of NOX Savings – 2028	tons	8	0.00	Environ
Tons of NOX Savings – 2029	tons	8	0.00	Environ
Tons of NOX Savings - 2030	tons	8	0.00	Environ
Tons of NOX Savings - 2031	tons	8	0.00	Environ
Tons of NOX Savings - 2032	tons	8	0.00	Environ
Tons of PM Savings - 2013	tons	8	8.25	Environ
Tons of PM Savings - 2014	tons	8	7.55	Environ
Tons of PM Savings – 2015	tons	8	6.32	Environ
Tons of PM Savings – 2016	tons	8	5.04	Environ
Tons of PM Savings – 2017	tons	8	3.86	Environ
Tons of PM Savings – 2018	tons	8	2.86	Environ
Tons of PM Savings – 2019	tons	8	1.97	Environ
Tons of PM Savings – 2020	tons	8	1.26	Environ
Tons of PM Savings – 2021	tons	8	0.73	Environ
Tons of PM Savings – 2022	tons	8	0.37	Environ
Tons of PM Savings – 2023	tons	8	0.17	Environ
Tons of PM Savings – 2024	tons	8	0.06	Environ
Tons of PM Savings – 2025	tons	8	0.02	Environ
Tons of PM Savings – 2026	tons	8	0.00	Environ

Input Name	Units	S&L #	Input Value	Source/Comment
Tons of PM Savings – 2027	tons	8	0.00	Environ
Tons of PM Savings – 2028	tons	8	0.00	Environ
Tons of PM Savings – 2029	tons	8	0.00	Environ
Tons of PM Savings - 2030	tons	8	0.00	Environ
Tons of PM Savings - 2031	tons	8	0.00	Environ
Tons of PM Savings - 2032	tons	8	0.00	Environ
Tons of CO2 Savings - 2013	tons	8	23010.32	Environ
Tons of CO2 Savings - 2014	tons	8	22135.91	Environ
Tons of CO2 Savings – 2015	tons	8	19739.50	Environ
Tons of CO2 Savings – 2016	tons	8	17094.68	Environ
Tons of CO2 Savings – 2017	tons	8	14284.37	Environ
Tons of CO2 Savings – 2018	tons	8	11368.12	Environ
Tons of CO2 Savings – 2019	tons	8	8432.05	Environ
Tons of CO2 Savings – 2020	tons	8	5750.17	Environ
Tons of CO2 Savings – 2021	tons	8	3567.80	Environ
Tons of CO2 Savings – 2022	tons	8	1956.47	Environ
Tons of CO2 Savings – 2023	tons	8	932.01	Environ
Tons of CO2 Savings – 2024	tons	8	368.32	Environ
Tons of CO2 Savings – 2025	tons	8	115.63	Environ
Tons of CO2 Savings – 2026	tons	8	26.14	Environ
Tons of CO2 Savings – 2027	tons	8	3.65	Environ
Tons of CO2 Savings – 2028	tons	8	0.22	Environ
Tons of CO2 Savings – 2029	tons	8	0.00	Environ
Tons of CO2 Savings - 2030	tons	8	0.00	Environ
Tons of CO2 Savings - 2031	tons	8	0.00	Environ
Tons of CO2 Savings - 2032	tons	8	0.00	Environ
Tons of VOC Savings - 2013	tons	8	14.15	Environ
Tons of VOC Savings - 2014	tons	8	12.76	Environ
Tons of VOC Savings – 2015	tons	8	10.58	Environ
Tons of VOC Savings – 2016	tons	8	8.26	Environ
Tons of VOC Savings – 2017	tons	8	6.18	Environ
Tons of VOC Savings – 2018	tons	8	4.51	Environ
Tons of VOC Savings – 2019	tons	8	3.07	Environ
Tons of VOC Savings – 2020	tons	8	1.98	Environ
Tons of VOC Savings – 2021	tons	8	1.16	Environ
Tons of VOC Savings – 2022	tons	8	0.60	Environ
Tons of VOC Savings – 2023	tons	8	0.27	Environ

Input Name	Units	S&L #	Input Value	Source/Comment
Tons of VOC Savings – 2024	tons	8	0.10	Environ
Tons of VOC Savings – 2025	tons	8	0.03	Environ
Tons of VOC Savings – 2026	tons	8	0.01	Environ
Tons of VOC Savings – 2027	tons	8	0.00	Environ
Tons of VOC Savings – 2028	tons	8	0.00	Environ
Tons of VOC Savings – 2029	tons	8	0.00	Environ
Tons of VOC Savings - 2030	tons	8	0.00	Environ
Tons of VOC Savings - 2031	tons	8	0.00	Environ
Tons of VOC Savings - 2032	tons	8	0.00	Environ
Tons of NOX Savings - 2013	tons	9	0.38	Environ
Tons of NOX Savings - 2014	tons	9	0.33	Environ
Tons of NOX Savings – 2015	tons	9	0.27	Environ
Tons of NOX Savings – 2016	tons	9	0.22	Environ
Tons of NOX Savings – 2017	tons	9	0.18	Environ
Tons of NOX Savings – 2018	tons	9	0.14	Environ
Tons of NOX Savings – 2019	tons	9	0.10	Environ
Tons of NOX Savings – 2020	tons	9	0.09	Environ
Tons of NOX Savings – 2021	tons	9	0.08	Environ
Tons of NOX Savings – 2022	tons	9	0.06	Environ
Tons of NOX Savings – 2023	tons	9	0.05	Environ
Tons of NOX Savings – 2024	tons	9	0.04	Environ
Tons of NOX Savings – 2025	tons	9	0.03	Environ
Tons of NOX Savings – 2026	tons	9	0.02	Environ
Tons of NOX Savings – 2027	tons	9	0.01	Environ
Tons of NOX Savings – 2028	tons	9	0.01	Environ
Tons of NOX Savings – 2029	tons	9	0.00	Environ
Tons of NOX Savings - 2030	tons	9	0.00	Environ
Tons of NOX Savings - 2031	tons	9	0.00	Environ
Tons of NOX Savings - 2032	tons	9	0.00	Environ
Tons of PM Savings - 2013	tons	9	0.01	Environ
Tons of PM Savings - 2014	tons	9	0.01	Environ
Tons of PM Savings – 2015	tons	9	0.01	Environ
Tons of PM Savings – 2016	tons	9	0.01	Environ
Tons of PM Savings – 2017	tons	9	0.01	Environ
Tons of PM Savings – 2018	tons	9	0.01	Environ
Tons of PM Savings – 2019	tons	9	0.01	Environ
Tons of PM Savings – 2020	tons	9	0.01	Environ

Input Name	Units	S&L #	Input Value	Source/Comment
Tons of PM Savings – 2021	tons	9	0.00	Environ
Tons of PM Savings – 2022	tons	9	0.00	Environ
Tons of PM Savings – 2023	tons	9	0.00	Environ
Tons of PM Savings – 2024	tons	9	0.00	Environ
Tons of PM Savings – 2025	tons	9	0.00	Environ
Tons of PM Savings – 2026	tons	9	0.00	Environ
Tons of PM Savings – 2027	tons	9	0.00	Environ
Tons of PM Savings – 2028	tons	9	0.00	Environ
Tons of PM Savings – 2029	tons	9	0.00	Environ
Tons of PM Savings - 2030	tons	9	0.00	Environ
Tons of PM Savings - 2031	tons	9	0.00	Environ
Tons of PM Savings - 2032	tons	9	0.00	Environ
Tons of CO2 Savings - 2013	tons	9	143.59	Environ
Tons of CO2 Savings - 2014	tons	9	138.14	Environ
Tons of CO2 Savings – 2015	tons	9	128.06	Environ
Tons of CO2 Savings – 2016	tons	9	124.37	Environ
Tons of CO2 Savings – 2017	tons	9	120.01	Environ
Tons of CO2 Savings – 2018	tons	9	114.31	Environ
Tons of CO2 Savings – 2019	tons	9	106.55	Environ
Tons of CO2 Savings – 2020	tons	9	97.45	Environ
Tons of CO2 Savings – 2021	tons	9	88.20	Environ
Tons of CO2 Savings – 2022	tons	9	77.55	Environ
Tons of CO2 Savings – 2023	tons	9	67.01	Environ
Tons of CO2 Savings – 2024	tons	9	55.30	Environ
Tons of CO2 Savings – 2025	tons	9	43.69	Environ
Tons of CO2 Savings – 2026	tons	9	31.46	Environ
Tons of CO2 Savings – 2027	tons	9	19.43	Environ
Tons of CO2 Savings – 2028	tons	9	8.43	Environ
Tons of CO2 Savings – 2029	tons	9	0.00	Environ
Tons of CO2 Savings - 2030	tons	9	0.00	Environ
Tons of CO2 Savings - 2031	tons	9	0.00	Environ
Tons of CO2 Savings - 2032	tons	9	0.00	Environ
Tons of VOC Savings - 2013	tons	9	0.85	Environ
Tons of VOC Savings - 2014	tons	9	0.76	Environ
Tons of VOC Savings – 2015	tons	9	0.65	Environ
Tons of VOC Savings – 2016	tons	9	0.59	Environ
Tons of VOC Savings – 2017	tons	9	0.52	Environ

Input Name	Units	S&L #	Input Value	Source/Comment
Tons of VOC Savings – 2018	tons	9	0.45	Environ
Tons of VOC Savings – 2019	tons	9	0.38	Environ
Tons of VOC Savings – 2020	tons	9	0.34	Environ
Tons of VOC Savings – 2021	tons	9	0.30	Environ
Tons of VOC Savings – 2022	tons	9	0.26	Environ
Tons of VOC Savings – 2023	tons	9	0.22	Environ
Tons of VOC Savings – 2024	tons	9	0.18	Environ
Tons of VOC Savings – 2025	tons	9	0.14	Environ
Tons of VOC Savings – 2026	tons	9	0.10	Environ
Tons of VOC Savings – 2027	tons	9	0.06	Environ
Tons of VOC Savings – 2028	tons	9	0.03	Environ
Tons of VOC Savings – 2029	tons	9	0.00	Environ
Tons of VOC Savings - 2030	tons	9	0.00	Environ
Tons of VOC Savings - 2031	tons	9	0.00	Environ
Tons of VOC Savings - 2032	tons	9	0.00	Environ

GLOSSARY

Carbon Dioxide (C02): Carbon dioxide is a heavy colorless gas that is a byproduct of the combustion of hydrocarbon fuels. Carbon dioxide is linked to climate change.

Discounted Value: The discounted value is the present value of a future cash amount. The present value is determined by reducing its future value by the appropriate discount rate for each unit of time between the time when the cash flow is to be valued to the time of the cash flow. To calculate the present value of a single cash flow, it is divided by one plus the interest rate (discount rate) for each period of time that will pass. This is expressed mathematically as raising the divisor to the power of the number of units of time.

Nitrogen Oxides (NOx): Nitrogen oxides include a number of gases that are composed of oxygen and nitrogen. In the presence of sunlight these substances can transform into acidic air pollutants such as nitrate particles. The nitrogen oxides family of gases can be transported long distances in our atmosphere. Nitrogen oxides play a key role in the formation of smog (ground-level ozone). At elevated levels, NOx can impair lung function, irritate the respiratory system and, at very high levels, make breathing difficult, especially for people who already suffer form asthma or bronchitis.

Particulate Matter (PM): Particulate matter refers to tiny particles of solid or liquid suspended in a gas. Sources of particulate matter can be man made or natural. Some particulates occur naturally, originating from volcanoes, dust storms, forest and grassland fires, living vegetation, and sea spray. Human activities, such as the burning of fossil fuels in vehicles, power plants and various industrial processes also generate significant amounts of aerosols.

Ton: In the context of this document, is a short ton equivalent to 2,000 lbs.

Train Mile: A train mile is the one mile distance traveled by a train.

Train Ton-Mile: One train ton-mile is equivalent to transporting one ton of materials via train a distance of one mile.

Volatile Organic Compound (VOC): Volatile organic compounds (VOCs) are a large and diverse family of chemicals that contain carbon and hydrogen. They can be emitted into indoor air from a variety of sources including cigarette smoke, household products like air fresheners, furnishings, vehicle exhaust and building materials such as paint, varnish and glues.

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