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Texas Department of Transportation

Cost-Benefit Analysis in Support of TIGER II Application

Texas Department of Transportation
Sun Belt Regional Short Line Project

HDR | Decision Economics

August 18, 2010

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EXECUTIVE SUMMARY OF ECONOMIC BENEFITS AND COST-BENEFIT ANALYSIS RESULTS

The Sun Belt Regional Short Line (the Short Lines), is a privately owned rail system made up of three railroads – the Dallas, Garland & Northeastern Railroad (DGNO); the Texas Northeastern railroad (TNER); and the Kiamichi Railroad (KRR). The Short Lines run through nine counties in Arkansas, Oklahoma, and Texas, and total approximately 702 miles in length. The Short Lines are a critical transportation link for businesses located along the route, including agricultural interests, steel manufacturers, mining businesses, lumber suppliers, and other miscellaneous customers. All three short lines are owned by RailAmerica, Inc.

The rural area of the Sun Belt region has recently experienced population growth in its residential and industrial neighborhoods. Transportation infrastructure has not kept up with such growth; increased truck traffic has put a strain on highways in the corridor, and the Short Lines are nearly operating at full capacity. The Sun Belt Regional Short Line Project (the project) proposes to upgrade infrastructure on the Short Lines to alleviate the strain on the current transportation network, and to accommodate future traffic growth. The project consists of track improvements that will enable the use of 286,000 pound railcars (286K railcars) and improve interconnectivity with Class I railroads, and upgrades to highway-rail grade crossings on the Short Lines. The project is designed to expand the capacity of the Short Lines, divert freight transportation from trucking to rail, and reduce the strain on the Sun Belt Region highway corridor in turn.

The project will eliminate rail joints, replace crossties, add ballast, resurface sections of track, replace bridge components, upgrade curves, and improve grade crossings. The total cost of the project is $21.7 million. The work is scheduled for 2011 and 2012. The funds requested are $17.4 million with the additional $4.3 million to be contributed by RailAmerica. The project results in $30.2 million in benefits (discounted at 7%). This yields a benefit to cost ratio of 1.5 to 1[1].

Transportation benefits account for 61% of the total, safety 35% and environmental benefits are 4% of the $30.2 million. These benefits are around $1 million in the first year of operations, grow to approximately $3.2 million by the end of 2014, and then experience modest growth until the end of the project life.

[1] At a 3% discount rate the project produces $44 million in benefits for a benefit to cost ratio of 2.1.

1: PROJECT DESCRIPTION FOR COST BENEFIT ANALYSIS

1.1 TIGER II Discretionary Grants

This cost-benefit analysis is prepared under the guidelines of the Transportation, Housing and Urban Development, and Related Agencies Appropriations Act for 2010, for grants to be awarded by the Department of Transportation ("DOT") for National Infrastructure Investments. The guidelines are similar, but not identical to the appropriation for the Transportation Investment Generating Economic Recovery, or TIGER Discretionary Grant, program authorized and implemented pursuant to the American Recovery and Reinvestment Act of 2009. Because of the similarity in program structure, grants for National Infrastructure Investments under the FY 2010 Appropriations Act are referred to as TIGER II Discretionary Grants.

1.2 Project Description

The project consists of infrastructure improvements to the Dallas, Garland & Northeastern Railroad (DGNO), the Texas Northeastern Railroad (TNER), and the Kiamichi Railroad (KRR) (collectively referred to as "the Short Lines") including upgrades to strategic side tracks and industrial leads to accommodate current and future traffic growth and allow for the use of heavier industry standard 286,000 pound railcars ("286K" railcars). The project eliminates rail joints, replaces crossties, adds new ballast, resurfaces over thirty miles of track, and replaces bridge components. Additional rail improvements will include upgrading curves in key segments to 115-pound rail, the minimum needed to safely handle 286K railcars. The project also upgrades key interchanges that connect the short line rail traffic to Class I railroads. Additionally, this project will upgrade over 380 passive rural highway-rail grade crossings to meet current Federal standards and provide additional safety protections for highway users.

The improvements made to the Short Lines covers over 700 miles of track, and span nine counties in the States of Arkansas, Oklahoma, and Texas. For this analysis, a project life of twenty years is considered.

1.3 No-Build and Build Cases

The cost benefit analysis assesses the net benefits to society of the project to improve the rail line relative to maintaining the Short Lines in their current operational state. It is forecast that undertaking the project will yield significant diversion of freight from truck to rail and provide significant public benefits.

1.4 Economic Benefit Quantification

The public benefits of the project are derived from the diversion of freight from truck to rail. Six benefits (and dis-benefits) are estimated over a 20 year time period:

- The reduction is transportation or shipping costs to shippers;
- The change in inventory costs for shippers;
- The highway congestion relief benefits;
- The highway maintenance cost savings;
- Safety benefits; and,
- Emission savings.

1.5 Economic Costs

The total cost of the project is $21.7 Million. For the cost benefit analysis quantification, these costs have been spread equally through 2011 and 2012.

Table 1: Project Costs

Cost Categories	Current $
Funds Requested	$17,378,720
Total Cost	$21,723,400
Year 2011 Cost	$10,911,700
Year 2012 Cost	$10,911,700

1.6 Report Structure

The balance of the report is structured as follows. Section 2 provides a summary of the results of the cost benefit analysis. Section 3 provides the logic and input data assumptions for the calculation of benefits for each of the six benefit categories. Section 4 provides a sensitivity analysis that illustrates how the project's Net Present Value varies with alternative variable input assumptions.

2: ECONOMIC BENEFITS RESULTS AND DISCUSSION

The project has economic benefits that produce a 53% return on investment (ROI).[2]

Table 2: Summary of Project Economic Indicators

Economic Indicators	7%	3%
Total Costs	$19,728,552	$20,879,207
Total Benefits	$30,177,242	$43,726,717
NPV	$10,448,690	$22,847,510
ROI	53%	109%
B/C	1.53	2.09

Table 3: Summary

Benefit Category	Ben #	S&L #	PV Over 20 Years	
			7%	3%
Transportation cost saving from diverting trucks to rail	T1	T1	$11,686,616	$16,901,262
Increased inventory cost from diverting trucks to rail	T2	T2	-$363,687	-$526,054
Congestion cost saving from diverting trucks to rail	T3	T3	$1,649,569	$2,386,017
Maintenance cost saving from diverting trucks to rail	T4	T4	$5,416,787	$7,833,363
Safety saving from diverting trucks to rail	S1	S1	$10,518,168	$15,216,544
Emission saving from diverting trucks to rail	E1	E1	$1,269,789	$1,915,586
Total			**$30,177,242**	**$43,726,717**

Transportation cost saving from diverting trucks to rail is the largest single category (39%) followed by safety benefit from diverting trucks to rail (35%) and maintenance cost saving from diverting trucks to rail (18%).

As shown in Figure 1, aggregating the categories shows that transportation benefits account for 61% of the total, safety 35% and environmental benefits are 4% of the $30.2 million.

[2] At a 7% discount rate. At 3% the ROI is 109%.

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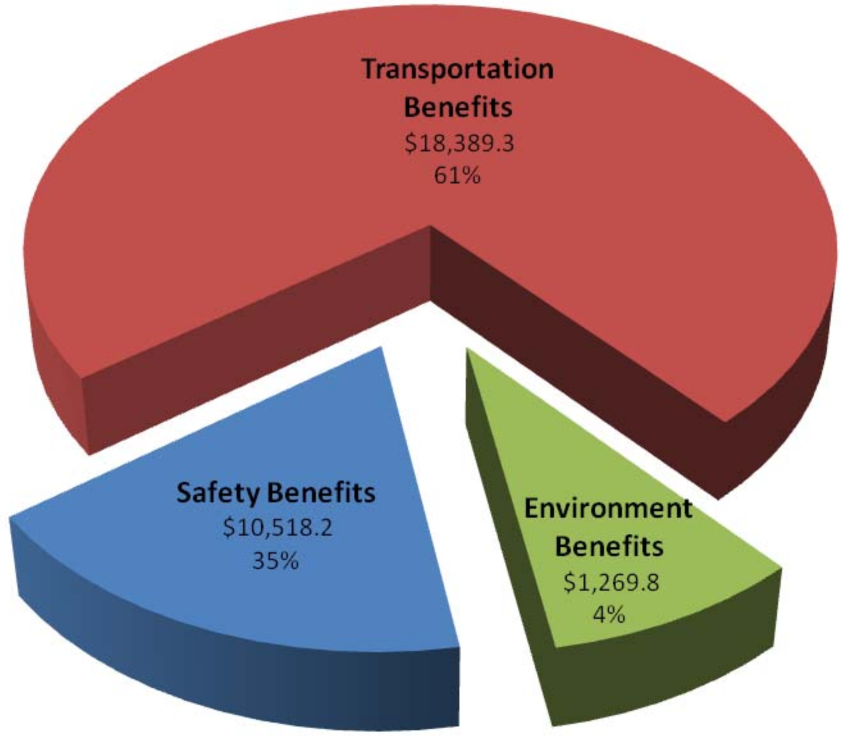
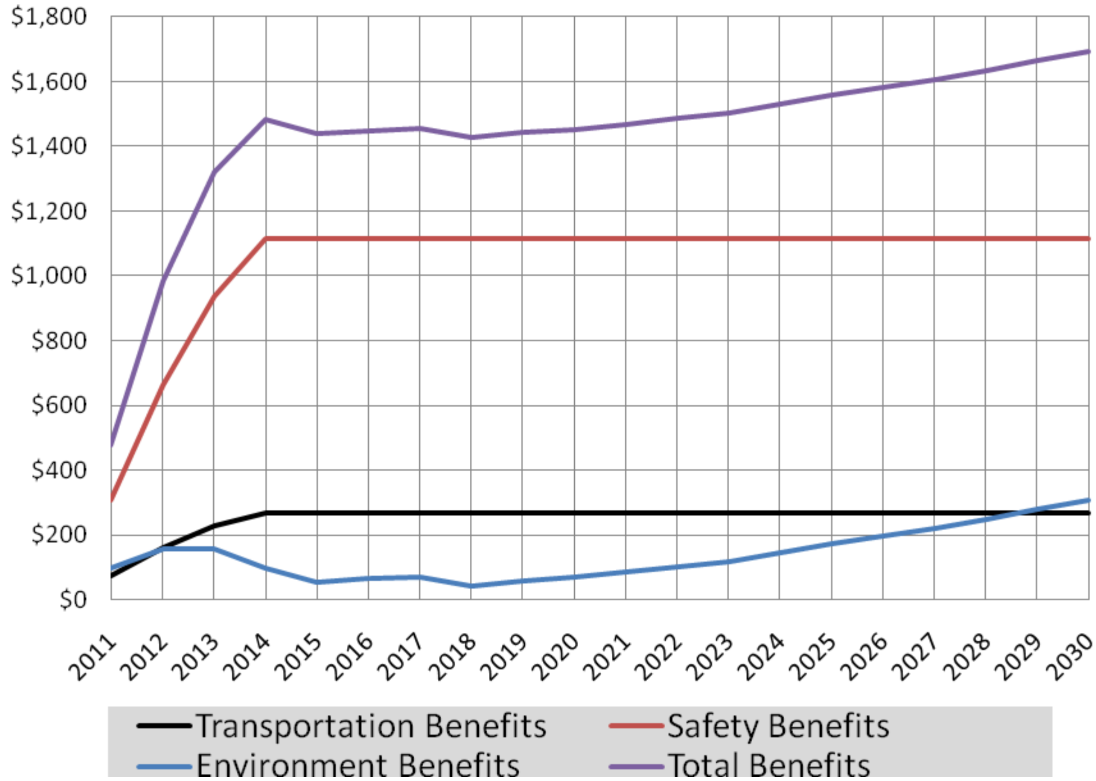
Figure 1: Present Value of Benefits by Category, in $000'(20 Years) - 7% Discount Rate



As shown in Figure 2 and **Error! Reference source not found.**, economic benefits are around $1 million in the first year of operations, grow to approximately $3.2 million by the end of 2014, and then experience modest growth until the end of the project life.

Figure 2: Undiscounted Annual Benefits by Category ($000's)



The project's benefits are largely determined by the increase in the number of carloads on the Short Lines after the rehabilitation of the line (the build or alternative case), relative to the no build or base case. It is expected that without this rehabilitation, it will be difficult to maintain existing carloads levels while the project will increase the attractiveness of the rail line and lead to an increase in carloads over existing levels. The carloads are shown in Figure 3:

Figure 3: Number of Carloads on SORR - Base and Alternative Cases

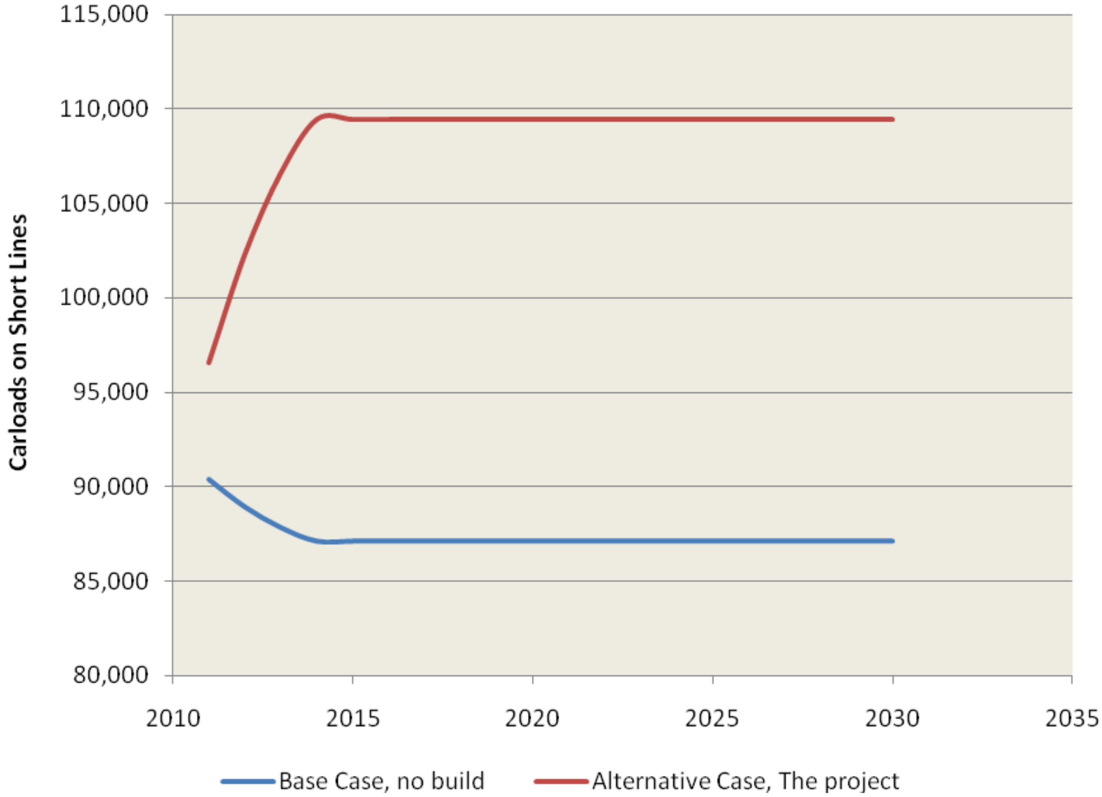


Table 3: Undiscounted Benefits of Sun Belt Regional Short Lines Project, by Year ($000's)

Benefit Category	Ben #	S&L #	Sum	Years																			
				2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Transportation cost saving from diverting trucks to rail	T1	T1	$23,169	$348	$744	$1,040	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237	$1,237
Increased inventory cost from diverting trucks to rail	T2	T2	-$721	-$11	-$23	-$32	-$39	-$39	-$39	-$39	-$39	-$39	-$39	-$39	-$39	-$39	-$39	-$39	-$39	-$39	-$39	-$39	-$39
Congestion cost saving from diverting trucks to rail	T3	T3	$3,271	$49	$105	$147	$175	$175	$175	$175	$175	$175	$175	$175	$175	$175	$175	$175	$175	$175	$175	$175	$175
Maintenance cost saving from diverting trucks to rail	T4	T4	$10,738	$161	$346	$483	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573
Safety saving from diverting trucks to rail	S1	S1	$20,864	$307	$664	$936	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115	$1,115
Emission saving from diverting trucks to rail	E1	E1	$2,749	$97	$156	$158	$98	$56	$64	$71	$43	$57	$68	$84	$102	$118	$145	$174	$198	$221	$250	$281	$307
Total			**$60,070**	**$951**	**$1,992**	**$2,732**	**$3,160**	**$3,118**	**$3,127**	**$3,133**	**$3,106**	**$3,119**	**$3,130**	**$3,146**	**$3,165**	**$3,181**	**$3,208**	**$3,236**	**$3,260**	**$3,284**	**$3,312**	**$3,343**	**$3,369**

Table 4: Discounted Benefits of Sun Belt Regional Short Lines Project, by Year, 7 Percent Discount Rate ($000's)

Benefit Category	Ben #	S&L #	Present Value	Years																			
				2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Transportation cost saving from diverting trucks to rail	T1	T1	$11,687	$325	$650	$849	$944	$882	$825	$771	$720	$673	$629	$588	$549	$513	$480	$449	$419	$392	$366	$342	$320
Increased inventory cost from diverting trucks to rail	T2	T2	-$364	-$10	-$20	-$26	-$29	-$27	-$26	-$24	-$22	-$21	-$20	-$18	-$17	-$16	-$15	-$14	-$13	-$12	-$11	-$11	-$10
Congestion cost saving from diverting trucks to rail	T3	T3	$1,650	$45	$91	$120	$133	$125	$116	$109	$102	$95	$89	$83	$78	$73	$68	$63	$59	$55	$52	$48	$45
Maintenance cost saving from diverting trucks to rail	T4	T4	$5,417	$151	$302	$394	$437	$409	$382	$357	$334	$312	$291	$272	$255	$238	$222	$208	$194	$182	$170	$159	$148
Safety saving from diverting trucks to rail	S1	S1	$10,518	$287	$580	$764	$851	$795	$743	$694	$649	$607	$567	$530	$495	$463	$432	$404	$378	$353	$330	$308	$288
Emission saving from diverting trucks to rail	E1	E1	$1,270	$91	$136	$129	$74	$40	$43	$44	$25	$31	$34	$40	$45	$49	$56	$63	$67	$70	$74	$78	$79
Total			**$30,177**	**$889**	**$1,740**	**$2,230**	**$2,411**	**$2,223**	**$2,083**	**$1,951**	**$1,807**	**$1,697**	**$1,591**	**$1,495**	**$1,405**	**$1,320**	**$1,244**	**$1,173**	**$1,104**	**$1,040**	**$980**	**$924**	**$871**

Table 5: Discounted Benefits of Sun Belt Regional Short Lines Project, by Year, 3 Percent Discount Rate ($000's)

Benefit Category	Ben #	S&L #	Present Value	Years																			
				2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Transportation cost saving from diverting trucks to rail	T1	T1	$16,901	$338	$702	$952	$1,099	$1,067	$1,036	$1,006	$977	$948	$921	$894	$868	$843	$818	$794	$771	$749	$727	$706	$685
Increased inventory cost from diverting trucks to rail	T2	T2	-$526	-$10	-$22	-$30	-$34	-$33	-$32	-$31	-$30	-$30	-$29	-$28	-$27	-$26	-$25	-$25	-$24	-$23	-$23	-$22	-$21
Congestion cost saving from diverting trucks to rail	T3	T3	$2,386	$47	$99	$134	$155	$151	$146	$142	$138	$134	$130	$126	$123	$119	$116	$112	$109	$106	$103	$100	$97
Maintenance cost saving from diverting trucks to rail	T4	T4	$7,833	$157	$326	$442	$509	$495	$480	$466	$453	$439	$427	$414	$402	$390	$379	$368	$357	$347	$337	$327	$317
Safety saving from diverting trucks to rail	S1	S1	$15,217	$298	$626	$857	$991	$962	$934	$907	$880	$855	$830	$806	$782	$759	$737	$716	$695	$675	$655	$636	$617
Emission saving from diverting trucks to rail	E1	E1	$1,916	$94	$147	$144	$87	$48	$54	$57	$34	$44	$50	$61	$72	$81	$96	$112	$123	$134	$147	$160	$170
Total			**$43,727**	**$923**	**$1,877**	**$2,500**	**$2,807**	**$2,690**	**$2,619**	**$2,547**	**$2,452**	**$2,391**	**$2,329**	**$2,273**	**$2,220**	**$2,166**	**$2,121**	**$2,077**	**$2,032**	**$1,987**	**$1,945**	**$1,906**	**$1,866**

3: MODEL LOGIC DIAGRAMS AND INPUT VARIABLES

3.1 Demand Outlook D1: Heavy Truck Diversion to Rail after Rehabilitation

This structure and logic diagram illustrates how the freight tonnage diverted to rail and the number of resulting diverted truck and truck-miles were calculated. Estimates of annual freight carloads on the Short Lines upon completion of track upgrades are compared to 2010 base figures to establish the increased railcar activity resulting from The project. Using average truck and train capacity values and typical railcar travel distances, this incremental railcar activity is used to determine the subsequent reduction in truck freight and travel. Most of The project's social benefits stem from this diversion of freight from truck to rail.

Figure 4: S&L D1 – Demand Outlook D1. Heavy Truck Diversion to Rail after Rehabilitation

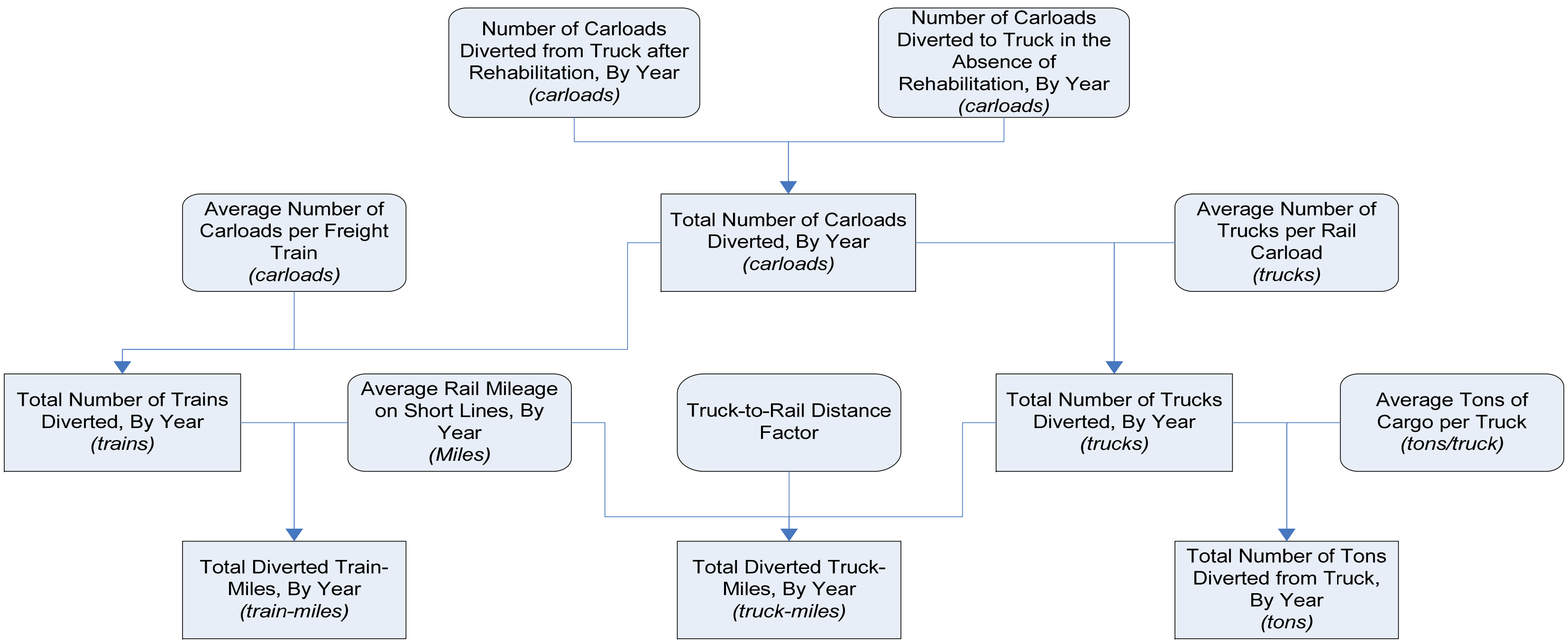


Table 5: Inputs D1. Heavy Truck Diversion to Rail after Rehabilitation

DGNO/TNER				
Input #	Input Name	Units	Value	Source/Comment
1	Project Rail Carloads on DGNO/TNER - 2011	carloads	49,621	Sun Belt Regional Short Line
2	Project Rail Carloads on DGNO/TNER - 2012	carloads	48,754	
3	Project Rail Carloads on DGNO/TNER - 2013	carloads	48,068	
4	Project Rail Carloads on DGNO/TNER - 2014	carloads	47,651	
5	Project Rail Carloads on DGNO/TNER - 2015	carloads	47,651	
6	Project Rail Carloads on DGNO/TNER - 2016	carloads	47,651	
7	Project Rail Carloads on DGNO/TNER - 2017	carloads	47,651	
8	Project Rail Carloads on DGNO/TNER - 2018	carloads	47,651	
9	Project Rail Carloads on DGNO/TNER - 2019	carloads	47,651	
10	Project Rail Carloads on DGNO/TNER - 2020	carloads	47,651	
11	Project Rail Carloads on DGNO/TNER - 2021	carloads	47,651	
12	Project Rail Carloads on DGNO/TNER - 2022	carloads	47,651	
13	Project Rail Carloads on DGNO/TNER - 2023	carloads	47,651	
14	Project Rail Carloads on DGNO/TNER - 2024	carloads	47,651	
15	Project Rail Carloads on DGNO/TNER - 2025	carloads	47,651	
16	Project Rail Carloads on DGNO/TNER - 2026	carloads	47,651	
17	Project Rail Carloads on DGNO/TNER - 2027	carloads	47,651	
18	Project Rail Carloads on DGNO/TNER - 2028	carloads	47,651	
19	Project Rail Carloads on DGNO/TNER - 2029	carloads	47,651	
20	Project Rail Carloads on DGNO/TNER - 2030	carloads	47,651	
21	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2011	carloads	3,465	Sun Belt Regional Short Line
22	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2012	carloads	7,800	
23	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2013	carloads	11,230	
24	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2014	carloads	13,318	
25	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2015	carloads	13,318	
26	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2016	carloads	13,318	
27	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2017	carloads	13,318	
28	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2018	carloads	13,318	

29	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2019	carloads	13,318	
30	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2020	carloads	13,318	
31	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2021	carloads	13,318	
32	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2022	carloads	13,318	
33	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2023	carloads	13,318	
34	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2024	carloads	13,318	
35	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2025	carloads	13,318	
36	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2026	carloads	13,318	
37	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2027	carloads	13,318	
38	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2028	carloads	13,318	
39	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2029	carloads	13,318	
40	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2030	carloads	13,318	
41	Number of Carloads Diverted from Truck after Rehabilitation - 2011	carloads	3,465	Sun Belt Regional Short Line
42	Number of Carloads Diverted from Truck after Rehabilitation - 2012	carloads	7,800	
43	Number of Carloads Diverted from Truck after Rehabilitation - 2013	carloads	11,230	
44	Number of Carloads Diverted from Truck after Rehabilitation - 2014	carloads	13,318	
45	Number of Carloads Diverted from Truck after Rehabilitation - 2015	carloads	13,318	
46	Number of Carloads Diverted from Truck after Rehabilitation - 2016	carloads	13,318	
47	Number of Carloads Diverted from Truck after Rehabilitation - 2017	carloads	13,318	
48	Number of Carloads Diverted from Truck after Rehabilitation - 2018	carloads	13,318	
49	Number of Carloads Diverted from Truck after Rehabilitation - 2019	carloads	13,318	

50	Number of Carloads Diverted from Truck after Rehabilitation - 2020	carloads	13,318	
51	Number of Carloads Diverted from Truck after Rehabilitation - 2021	carloads	13,318	
52	Number of Carloads Diverted from Truck after Rehabilitation - 2022	carloads	13,318	
53	Number of Carloads Diverted from Truck after Rehabilitation - 2023	carloads	13,318	
54	Number of Carloads Diverted from Truck after Rehabilitation - 2024	carloads	13,318	
55	Number of Carloads Diverted from Truck after Rehabilitation - 2025	carloads	13,318	
56	Number of Carloads Diverted from Truck after Rehabilitation - 2026	carloads	13,318	
57	Number of Carloads Diverted from Truck after Rehabilitation - 2027	carloads	13,318	
58	Number of Carloads Diverted from Truck after Rehabilitation - 2028	carloads	13,318	
59	Number of Carloads Diverted from Truck after Rehabilitation - 2029	carloads	13,318	
60	Number of Carloads Diverted from Truck after Rehabilitation - 2030	carloads	13,318	
61	Average Number of Trucks per Rail Carload	trucks	4.0	Sun Belt Regional Short Line
62	Average Tons of Cargo per Truck	tons/truck	25.0	Sun Belt Sun Belt Regional Short Line
63	Truck to Rail Distance Factor	Truck Mile per Rail Mile	0.83	National Cooperative Highway Research Program (NCHRP) Report 388, "A Guidebook for Forecasting Freight Transportation Demand", 1997. We assume this figure includes dray distances. This factor is applied to account for relatively longer rail routes for the same origin-destination (O-D) pair.

64	Average Carloads per Freight Train	Carloads	30	Sun Belt Regional Short Line
65	Average Carload Distance	miles	37	Sun Belt Regional Short Line

KRR				
Input #	**Input Name**	**Units**	**Value**	**Source/Comment**
66	Project Rail Carloads on DKRR - 2011	carloads	40,745	Sun Belt Regional Short Line
67	Project Rail Carloads on DKRR - 2012	carloads	40,182	
68	Project Rail Carloads on DKRR - 2013	carloads	39,792	
69	Project Rail Carloads on DKRR - 2014	carloads	39,501	
70	Project Rail Carloads on DKRR - 2015	carloads	39,501	
71	Project Rail Carloads on DKRR - 2016	carloads	39,501	
72	Project Rail Carloads on DKRR - 2017	carloads	39,501	
73	Project Rail Carloads on DKRR - 2018	carloads	39,501	
74	Project Rail Carloads on DKRR - 2019	carloads	39,501	
75	Project Rail Carloads on DKRR - 2020	carloads	39,501	
76	Project Rail Carloads on DKRR - 2021	carloads	39,501	
77	Project Rail Carloads on DKRR - 2022	carloads	39,501	
78	Project Rail Carloads on DKRR - 2023	carloads	39,501	
79	Project Rail Carloads on DKRR - 2024	carloads	39,501	
80	Project Rail Carloads on DKRR - 2025	carloads	39,501	
81	Project Rail Carloads on DKRR - 2026	carloads	39,501	
82	Project Rail Carloads on DKRR - 2027	carloads	39,501	
83	Project Rail Carloads on DKRR - 2028	carloads	39,501	
84	Project Rail Carloads on DKRR - 2029	carloads	39,501	
85	Project Rail Carloads on DKRR - 2030	carloads	39,501	
86	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2011	carloads	2,741	Sun Belt Regional Short Line
87	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2012	carloads	5,558	
88	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2013	carloads	7,508	
89	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2014	carloads	8,960	
90	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2015	carloads	8,960	
91	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2016	carloads	8,960	

92	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2017	carloads	8,960	
93	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2018	carloads	8,960	
94	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2019	carloads	8,960	
95	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2020	carloads	8,960	
96	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2021	carloads	8,960	
97	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2022	carloads	8,960	
98	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2023	carloads	8,960	
99	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2024	carloads	8,960	
100	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2025	carloads	8,960	
101	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2026	carloads	8,960	
102	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2027	carloads	8,960	
103	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2028	carloads	8,960	
104	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2029	carloads	8,960	
105	Number of Carloads Diverted to Truck in Absence of Rehabilitation - 2030	carloads	8,960	
106	Number of Carloads Diverted from Truck after Rehabilitation - 2011	carloads	2,741	Sun Belt Regional Short Line Forecast
107	Number of Carloads Diverted from Truck after Rehabilitation - 2012	carloads	5,558	
108	Number of Carloads Diverted from Truck after Rehabilitation - 2013	carloads	7,508	
109	Number of Carloads Diverted from Truck after Rehabilitation - 2014	carloads	8,960	
110	Number of Carloads Diverted from Truck after Rehabilitation - 2015	carloads	8,960	
111	Number of Carloads Diverted from Truck after Rehabilitation - 2016	carloads	8,960	

112	Number of Carloads Diverted from Truck after Rehabilitation - 2017	carloads	8,960	
113	Number of Carloads Diverted from Truck after Rehabilitation - 2018	carloads	8,960	
114	Number of Carloads Diverted from Truck after Rehabilitation - 2019	carloads	8,960	
115	Number of Carloads Diverted from Truck after Rehabilitation - 2020	carloads	8,960	
116	Number of Carloads Diverted from Truck after Rehabilitation - 2021	carloads	8,960	
117	Number of Carloads Diverted from Truck after Rehabilitation - 2022	carloads	8,960	
118	Number of Carloads Diverted from Truck after Rehabilitation - 2023	carloads	8,960	
119	Number of Carloads Diverted from Truck after Rehabilitation - 2024	carloads	8,960	
120	Number of Carloads Diverted from Truck after Rehabilitation - 2025	carloads	8,960	
121	Number of Carloads Diverted from Truck after Rehabilitation - 2026	carloads	8,960	
122	Number of Carloads Diverted from Truck after Rehabilitation - 2027	carloads	8,960	
123	Number of Carloads Diverted from Truck after Rehabilitation - 2028	carloads	8,960	
124	Number of Carloads Diverted from Truck after Rehabilitation - 2029	carloads	8,960	
125	Number of Carloads Diverted from Truck after Rehabilitation - 2030	carloads	8,960	
126	Average Number of Trucks per Rail Carload	trucks	4.0	Sun Belt Regional Short Line
127	Average Tons of Cargo per Truck	tons/truck	25.0	Sun Belt Regional Short Line

128	Truck to Rail Distance Factor	Truck Mile per Rail Mile	0.83	National Cooperative Highway Research Program (NCHRP) Report 388, "A Guidebook for Forecasting Freight Transportation Demand", 1997. We assume this figure includes dray distances. This factor is applied to account for relatively longer rail routes for the same origin-destination (O-D) pair.
129	Average Carloads per Freight Train	Carloads	30	Texas Department of Transportation
130	Average Carload Distance	miles	143	Sun Belt Regional Short Line

3.2 Benefit T1: Transportation Cost Saving from Diverting Trucks to Rail

This benefit category captures the cost savings experienced by businesses as they ship by rail instead of truck. A given amount of cargo is typically more expensive to ship by truck than by rail. The increased rail capacity stemming from the project allows cargo to be diverted from truck to rail freight, and thus shipped at a lower cost.

Figure 5: S&L T1 - Benefit T1. Transportation Cost Saving from Diverting Trucks to Rail

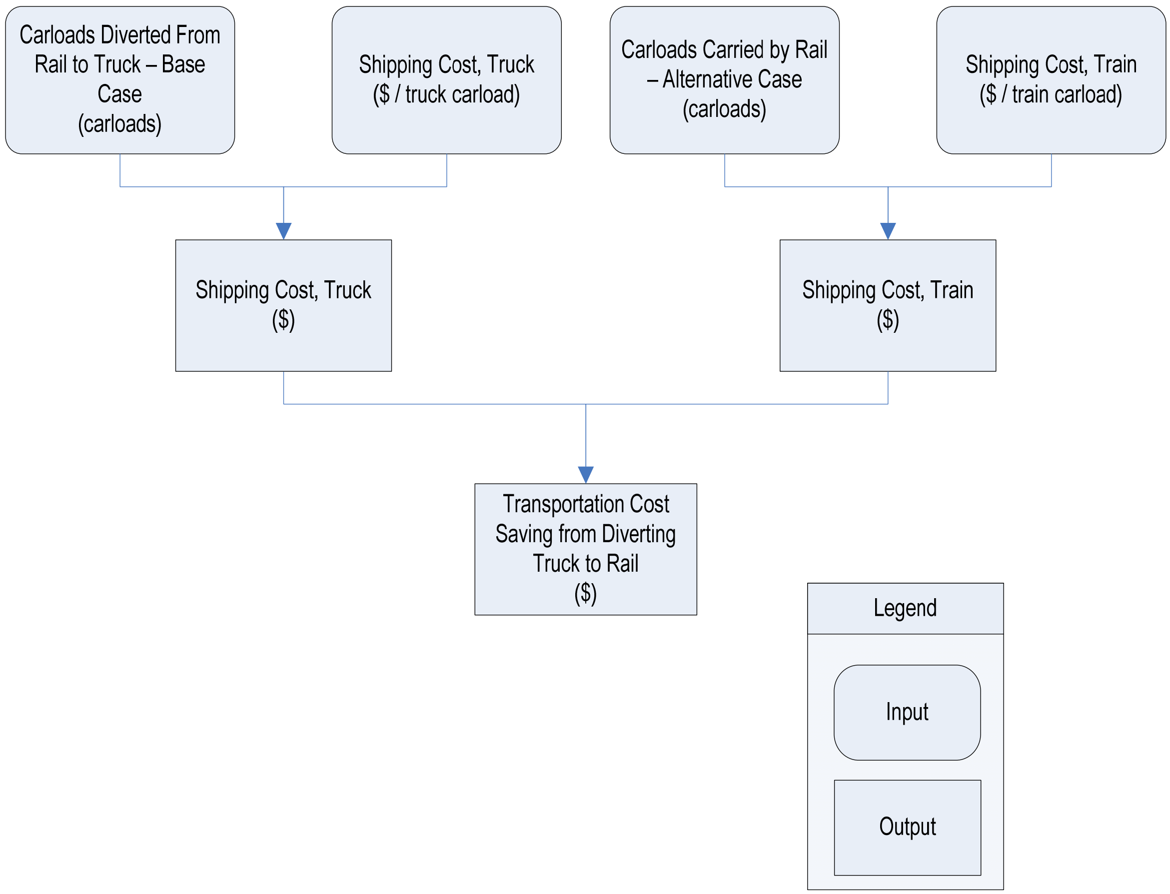


Table 6: Inputs T1. Transportation Cost Saving from Diverting Trucks to Rail

Input #	Input Name	Units	Value	Source/Comment
1	Shipping Rates per Carload, DGNO/TNER	$ / carload	$285.00	Sun Belt Regional Short Line
2	Shipping Rates per Carload, KRR	$ / carload	$359.00	Sun Belt Regional Short Line

Table 7: Results T1. Transportation Cost Saving from Diverting Trucks to Rail

Benefit Category	PV Over 20 Years	
	7%	3%
Transportation cost saving from diverting trucks to rail	$11,686,616	$16,901,262

3.3 Benefit T2: Increased Inventory Cost from Diverting Trucks to Rail

This benefit category captures the change in shipping time and resulting inventory cost that arises from the diversion of freight from truck to rail. The less time the cargo spends in transit, the quicker it is put to productive use.

Figure 6: S&L T2 - Benefit T2. Increased Inventory Cost from Diverting Trucks to Rail

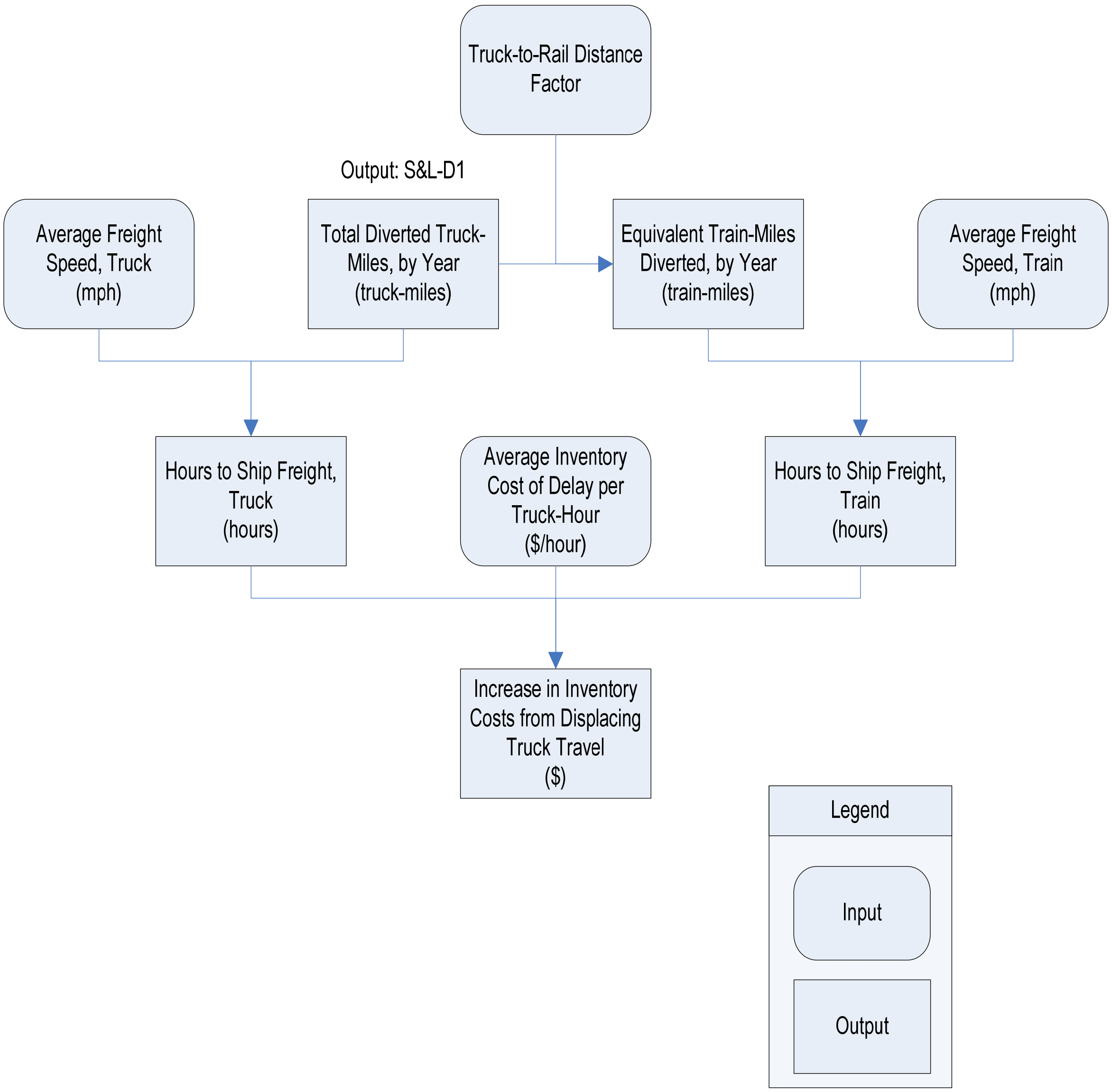


Table 8: Inputs T2. Increased Inventory Cost from Diverting Trucks to Rail

Input #	Input Name	Units	Value	Source/Comment
1	Average Freight Truck Speed	mph	30	Federal Highway Administration (FHWA)
2	Average Freight Train Speed	mph	18	Surface Transportation Board (STB) - 2007
3	Average Inventory Cost of Delay per Truck Hour	$/hour	$0.18	HDR Calculation based on a 4.25% Discount Rate
4	Truck to Rail Distance Factor	Truck Mile per Rail Mile	0.83	National Cooperative Highway Research Program (NCHRP) Report 388, "A Guidebook for Forecasting Freight Transportation Demand", 1997. We assume this figure includes dray distances. This factor is applied to account for relatively longer rail routes for the same origin-destination (O-D) pair.

Table 9: Results T2. Increased Inventory Cost from Diverting Trucks to Rail

Benefit Category	PV Over 20 Years	
	7%	3%
Increased inventory cost from diverting trucks to rail	-$363,687	-$526,054

3.4 Benefit T3: Congestion Cost Saving from Diverting Trucks to Rail

As freight is diverted from truck to rail transit because of The project, truck travel will decrease in the Sun Belt region, *ceteris paribus*. A truck takes up more physical space on the road than a car, and reducing the amount of truck travel will lead to a decrease in highway congestion and an increase in time savings for the Sun Belt Region population. The structure and logic of the decreased congestion benefit is presented below.

Figure 7: S&L T3 - Benefit T3. Congestion Cost Saving from Diverting Trucks to Rail

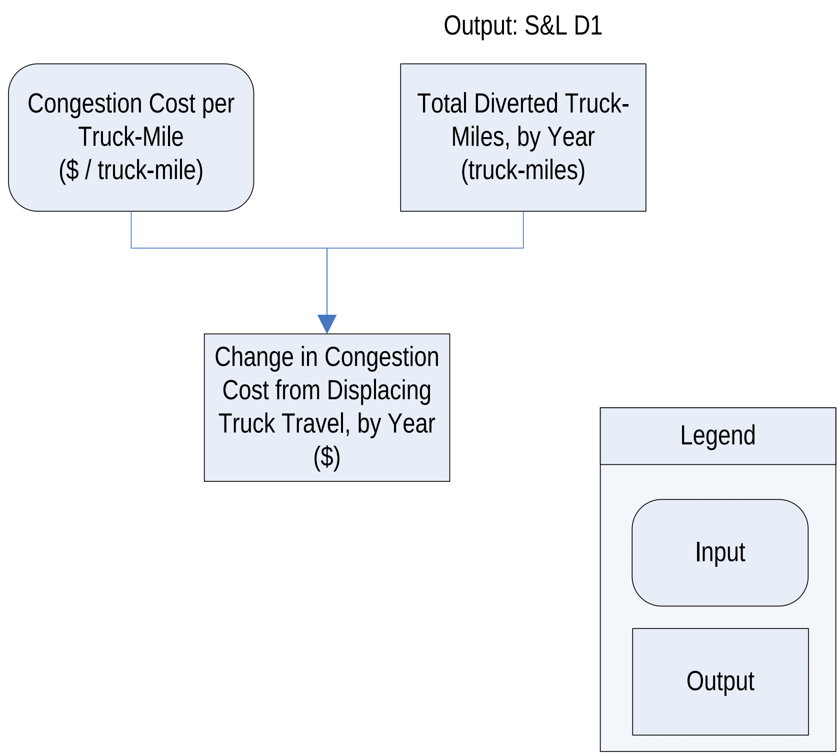


Table 10: Inputs T3. Congestion Cost Saving from Diverting Trucks to Rail

Input #	Input Name	Units	Value	Source/Comment
1	Congestion Cost per Truck Mile	$/mile	$0.0278	HDR Calculations based on the Addendum to the 1997 Federal Highway Cost Allocation Study, Final Report, U.S. Department of Transportation and Federal Highway Administration, May 2000.

Table 11: Results T3. Congestion Cost Saving from Diverting Trucks to Rail

Benefit Category	PV Over 20 Years	
	7%	3%
Congestion cost saving from diverting trucks to rail	$1,649,569	$2,386,017

3.5 Benefit T4: Maintenance Cost Saving from Diverting Trucks to Rail

Heavy trucks put a great deal of physical wear and tear on roads, and the roads must be maintained at the taxpayer's expense. Diverting freight from truck to rail and reducing the amount of truck travel will lead to less required highway maintenance and associated costs. This cost reduction benefit is quantified by taking the difference between the highway maintenance costs avoided if freight is diverted from truck to rail and the expected incremental railroad maintenance costs associated with the increased rail activity.

Figure 8: S&L T4 - Benefit T4. Maintenance Cost Saving from Diverting Trucks to Rail

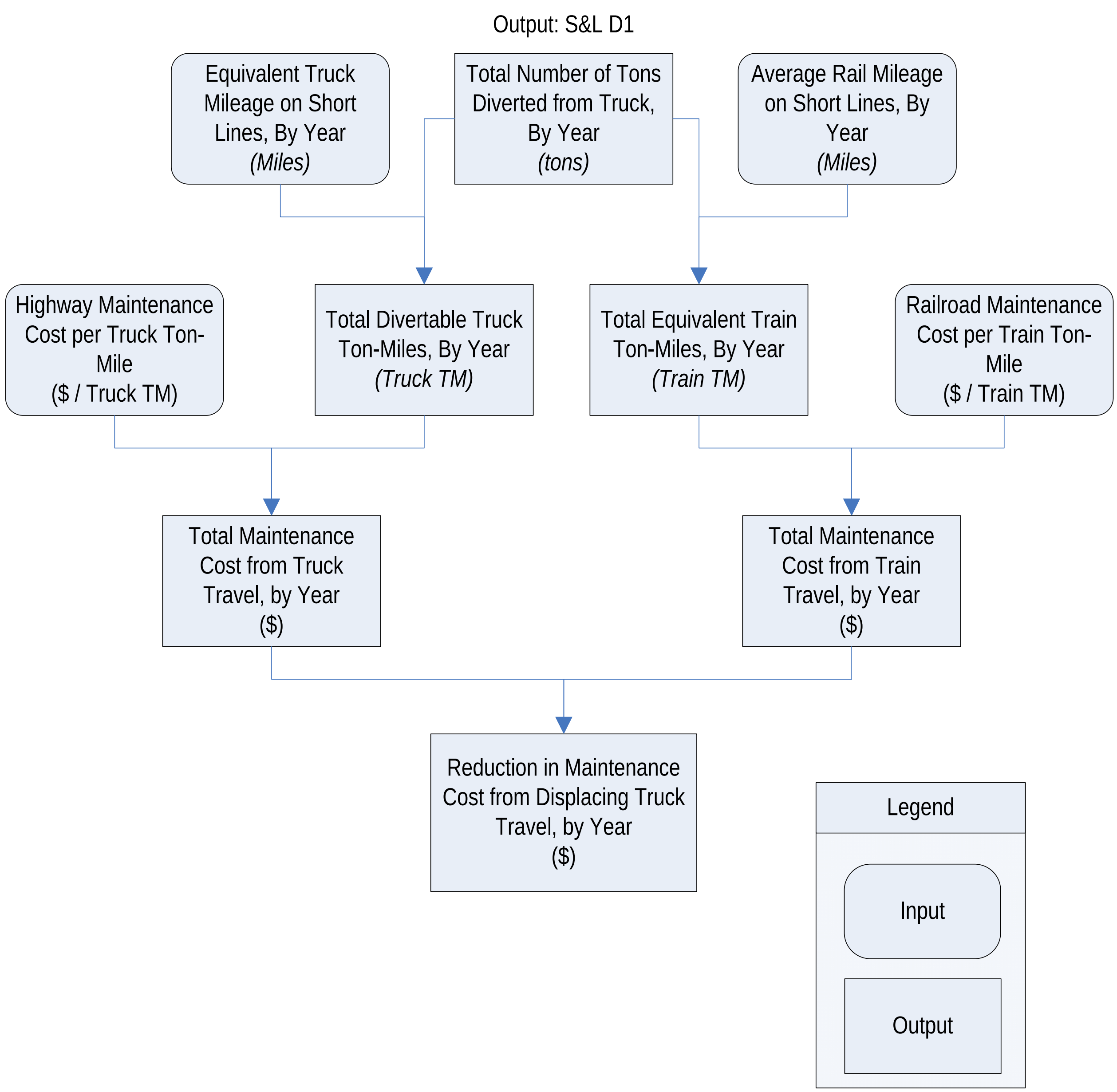


Table 12: Inputs T4. Maintenance Cost Saving from Diverting Trucks to Rail

Input #	Input Name	Units	Value	Source/Comment
1	Pavement maintenance cost per truck ton-mile	$/ton-mile	$0.00642	HDR Calculations based on the Addendum to the 1997 Federal Highway Cost Allocation Study, Final Report, U.S. Department of Transportation and Federal Highway Administration, May 2000. Assumes 90 percent rural truck traffic.
2	Pavement maintenance cost per train ton-mile	$/ton-mile	$0.00226	HDR Calculations based on George Avery Grimes, Ph.D., P.E.1; and Christopher P. L. Barkan, Ph.D. "Cost-Effectiveness of Railway Infrastructure Renewal Maintenance".

Table 13: Results T4. Maintenance Cost Saving from Diverting Trucks to Rail

Benefit Category	PV Over 20 Years	
	7%	3%
Maintenance cost saving from diverting trucks to rail	$5,416,787	$7,833,363

3.6 Benefit S1: Safety Saving from Diverting Trucks to Rail

Regardless of the mode of transportation utilized, accidents will occur while shipping cargo. Although highway accidents should diminish as freight is diverted from trucks to railcars, rail accidents should increase in turn. Rail and truck travel have their own respective accident frequency and associated cost levels, and thus the change in safety resulting from The project is monetized according to the diagram below.

Figure 9: S&L S1 - Benefit S1. Safety Saving from Diverting Trucks to Rail

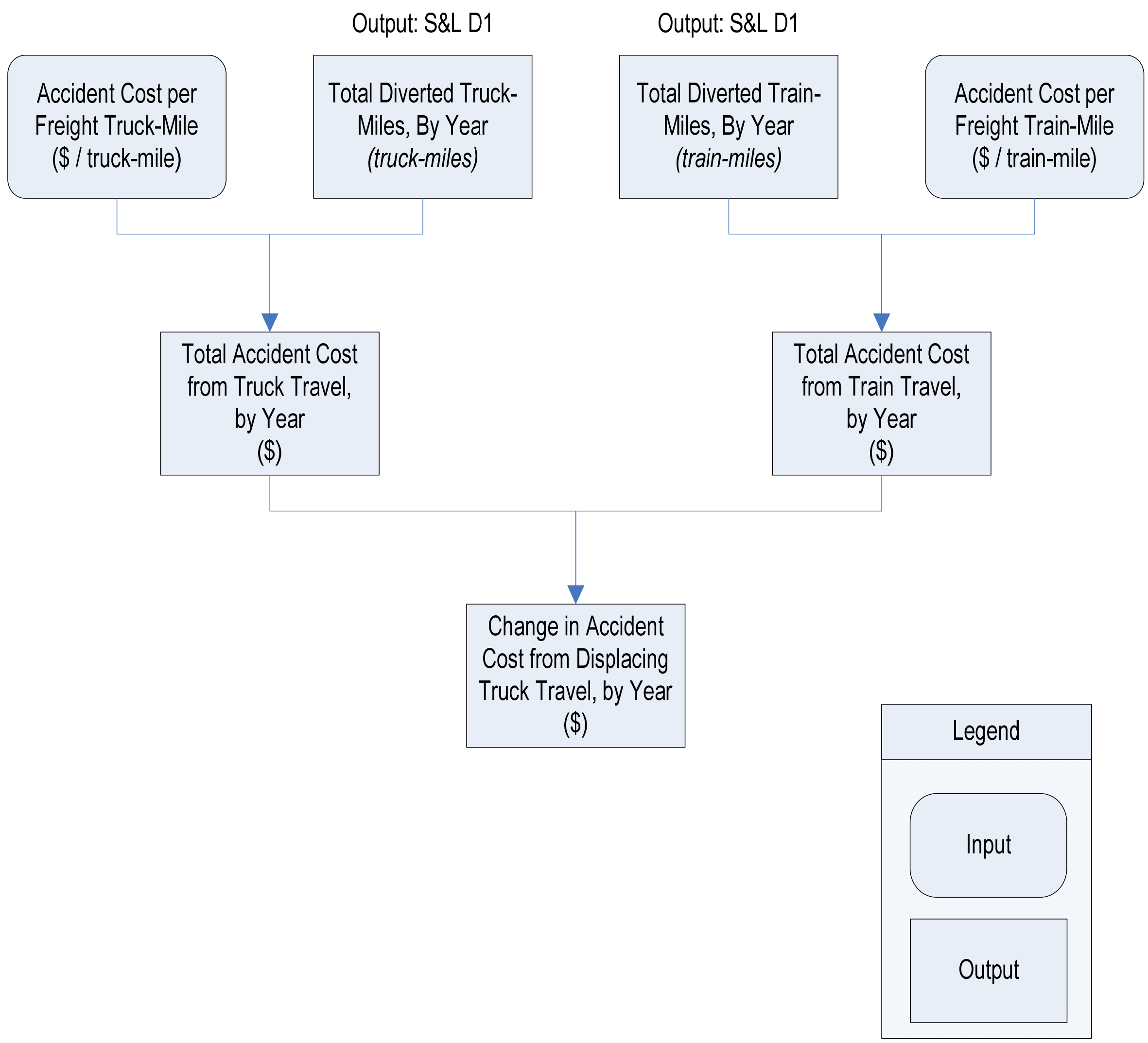


Table 14: Inputs S1. Safety Saving from Diverting Trucks to Rail

Input #	Input Name	Units	Value	Source/Comment
1	Accident Cost per Truck-Mile	$/truck-mile	$0.31	HDR Calculations based on Tiger II Guidelines for Accident Values, National Highway Traffic Safety Administration (NHTSA) for accident data and mileage statistics.
2	Accident Cost per Train-Mile	$/train-mile	$13.50	HDR Calculations based on Tiger II Guidelines for Accident Values, National Highway Traffic Safety Administration (NHTSA) for accident data, and U.S. Department of Transportation, Bureau of Transportation Statistics for mileage statistics.

Table 15: Results S1. Safety Saving from Diverting Trucks to Rail

Benefit Category	PV Over 20 Years	
	7%	3%
Safety Saving from Diverting Trucks to Rail	$10,518,168	$15,216,544

3.7 Benefit E1: Emission Saving from Diverting Trucks to Rail

This benefit category captures the emissions quantities that result from the diversion of truck freight to rail. Standard U.S. EPA and TIGER II guidance inputs were used.

Figure 10: S&L E1 - Benefit E1. Emission Saving from Diverting Trucks to Rail

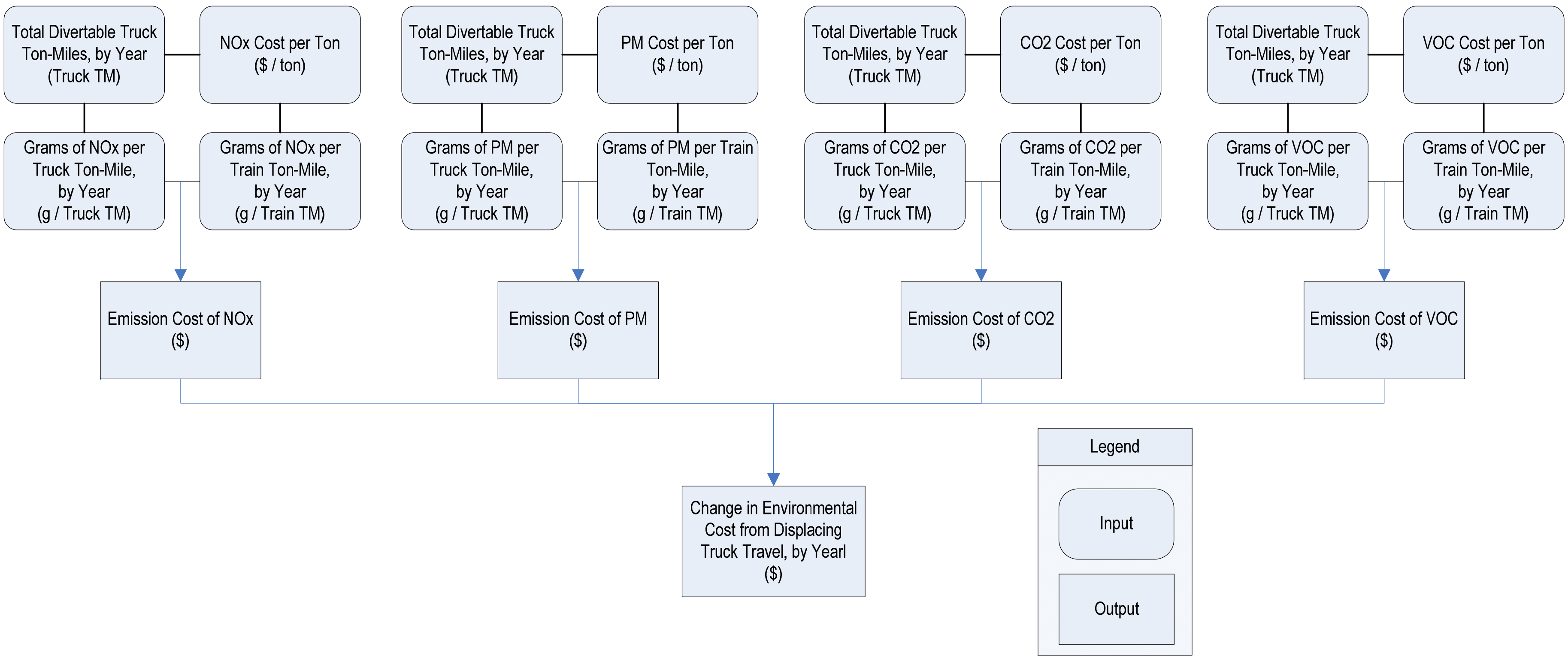


Table 16: Inputs E1. Emission Saving from Diverting Trucks to Rail

Input #	Input Name	Units	Value	Source/Comment
1	Grams of NOx per truck ton-mile - 2011	grams/TM	0.63	Mobile 6.2. Calculated grams/gallon emission factors converted to grams/ton-mile by dividing by an average efficiency of 130 freight ton miles per gallon, per the Rocky Mountain Institute, Transformational Trucking Charette. This calculation assumes a current tractor-trailer combination loaded to the legal 80,000-lb.-GVW limit and getting 6.5 mpg.No empty backhaul is assumed
2	Grams of NOx per truck ton-mile - 2012	grams/TM	0.54	
3	Grams of NOx per truck ton-mile - 2013	grams/TM	0.47	
4	Grams of NOx per truck ton-mile - 2014	grams/TM	0.40	
5	Grams of NOx per truck ton-mile - 2015	grams/TM	0.34	
6	Grams of NOx per truck ton-mile - 2016	grams/TM	0.31	
7	Grams of NOx per truck ton-mile - 2017	grams/TM	0.26	
8	Grams of NOx per truck ton-mile - 2018	grams/TM	0.22	
9	Grams of NOx per truck ton-mile - 2019	grams/TM	0.19	
10	Grams of NOx per truck ton-mile - 2020	grams/TM	0.17	
11	Grams of NOx per truck ton-mile - 2021	grams/TM	0.15	
12	Grams of NOx per truck ton-mile - 2022	grams/TM	0.13	
13	Grams of NOx per truck ton-mile - 2023	grams/TM	0.11	
14	Grams of NOx per truck ton-mile - 2024	grams/TM	0.10	
15	Grams of NOx per truck ton-mile - 2025	grams/TM	0.09	
16	Grams of NOx per truck ton-mile - 2026	grams/TM	0.08	
17	Grams of NOx per truck ton-mile - 2027	grams/TM	0.07	
18	Grams of NOx per truck ton-mile - 2028	grams/TM	0.06	
19	Grams of NOx per truck ton-mile - 2029	grams/TM	0.06	
20	Grams of NOx per truck ton-mile - 2030	grams/TM	0.06	
21	Grams of NOx per train ton-mile - 2011	grams/TM	0.31	Source for Tables 3-71 and 3-81 is "Regulatory Impact Analysis:

22	Grams of NOx per train ton-mile - 2012	grams/TM	0.29	
23	Grams of NOx per train ton-mile - 2013	grams/TM	0.28	
24	Grams of NOx per train ton-mile - 2014	grams/TM	0.27	
25	Grams of NOx per train ton-mile - 2015	grams/TM	0.26	
26	Grams of NOx per train ton-mile - 2016	grams/TM	0.24	
27	Grams of NOx per train ton-mile - 2017	grams/TM	0.23	
28	Grams of NOx per train ton-mile - 2018	grams/TM	0.21	
29	Grams of NOx per train ton-mile - 2019	grams/TM	0.20	
30	Grams of NOx per train ton-mile - 2020	grams/TM	0.19	
31	Grams of NOx per train ton-mile - 2021	grams/TM	0.18	
32	Grams of NOx per train ton-mile - 2022	grams/TM	0.17	
33	Grams of NOx per train ton-mile - 2023	grams/TM	0.16	
34	Grams of NOx per train ton-mile - 2024	grams/TM	0.15	
35	Grams of NOx per train ton-mile - 2025	grams/TM	0.14	
36	Grams of NOx per train ton-mile - 2026	grams/TM	0.13	
37	Grams of NOx per train ton-mile - 2027	grams/TM	0.12	
38	Grams of NOx per train ton-mile - 2028	grams/TM	0.11	
39	Grams of NOx per train ton-mile - 2029	grams/TM	0.10	
40	Grams of NOx per train ton-mile - 2030	grams/TM	0.09	
41	Grams of CO2 per truck ton-mile - 2011	grams/TM	78.75	Mobile 6.2. Calculated grams/gallon emission factors converted to grams/ton-mile by dividing by an average efficiency of 130 freight ton miles per gallon, per the Rocky Mountain Institute, Transformational Trucking Charette. This calculation
42	Grams of CO2 per truck ton-mile - 2012	grams/TM	78.65	
43	Grams of CO2 per truck ton-mile - 2013	grams/TM	78.57	
44	Grams of CO2 per truck ton-mile - 2014	grams/TM	78.50	

45	Grams of CO2 per truck ton-mile - 2015	grams/TM	78.44	

46	Grams of CO2 per truck ton-mile - 2016	grams/TM	78.40	
47	Grams of CO2 per truck ton-mile - 2017	grams/TM	78.36	
48	Grams of CO2 per truck ton-mile - 2018	grams/TM	78.33	
49	Grams of CO2 per truck ton-mile - 2019	grams/TM	78.30	
50	Grams of CO2 per truck ton-mile - 2020	grams/TM	78.28	
51	Grams of CO2 per truck ton-mile - 2021	grams/TM	78.28	
52	Grams of CO2 per truck ton-mile - 2022	grams/TM	78.28	
53	Grams of CO2 per truck ton-mile - 2023	grams/TM	78.28	
54	Grams of CO2 per truck ton-mile - 2024	grams/TM	78.28	
55	Grams of CO2 per truck ton-mile - 2025	grams/TM	78.28	
56	Grams of CO2 per truck ton-mile - 2026	grams/TM	78.28	
57	Grams of CO2 per truck ton-mile - 2027	grams/TM	78.28	
58	Grams of CO2 per truck ton-mile - 2028	grams/TM	78.28	
59	Grams of CO2 per truck ton-mile - 2029	grams/TM	78.28	
60	Grams of CO2 per truck ton-mile - 2030	grams/TM	78.28	
61	Grams of CO2 per train ton-mile - 2011	grams/TM	20.65	Source for Tables 3-71 and 3-81 is "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder." Gram/ton-mile values are converted to grams/ton-mile by dividing an average efficiency 480 freight ton miles per gallon. (2009 U.S. average data source in "The Economic Impact of America's Freight Railroads", Association of American Railroad (AAR), May 2010.) In addition, a conservative 1% improvement in fuel efficiency is assumed per year. EPA cited a 16% improvement in rail industry-wide fuel efficiency
62	Grams of CO2 per train ton-mile - 2012	grams/TM	20.44	
63	Grams of CO2 per train ton-mile - 2013	grams/TM	20.23	
64	Grams of CO2 per train ton-mile - 2014	grams/TM	20.02	
65	Grams of CO2 per train ton-mile - 2015	grams/TM	19.81	
66	Grams of CO2 per train ton-mile - 2016	grams/TM	19.60	
67	Grams of CO2 per train ton-mile - 2017	grams/TM	19.39	
68	Grams of CO2 per train ton-mile - 2018	grams/TM	19.18	

69	Grams of CO2 per train ton-mile - 2019	grams/TM	18.97	
70	Grams of CO2 per train ton-mile - 2020	grams/TM	18.75	
71	Grams of CO2 per train ton-mile - 2021	grams/TM	18.54	
72	Grams of CO2 per train ton-mile - 2022	grams/TM	18.33	
73	Grams of CO2 per train ton-mile - 2023	grams/TM	18.12	
74	Grams of CO2 per train ton-mile - 2024	grams/TM	17.91	
75	Grams of CO2 per train ton-mile - 2025	grams/TM	17.70	
76	Grams of CO2 per train ton-mile - 2026	grams/TM	17.49	
77	Grams of CO2 per train ton-mile - 2027	grams/TM	17.28	
78	Grams of CO2 per train ton-mile - 2028	grams/TM	17.07	
79	Grams of CO2 per train ton-mile - 2029	grams/TM	16.86	
80	Grams of CO2 per train ton-mile - 2030	grams/TM	16.65	
81	Grams of PM per truck ton-mile - 2011	grams/TM	0.01	Mobile 6.2. Calculated grams/gallon emission factors converted to grams/ton-mile by dividing by an average efficiency of 130 freight ton miles per gallon, per the Rocky Mountain Institute, Transformational Trucking Charette. This calculation assumes a current tractor-trailer combination loaded to the legal 80,000-lb.-GVW limit and getting 6.5 mpg.No empty backhaul is assumed.
82	Grams of PM per truck ton-mile - 2012	grams/TM	0.010	
83	Grams of PM per truck ton-mile - 2013	grams/TM	0.009	
84	Grams of PM per truck ton-mile - 2014	grams/TM	0.007	
85	Grams of PM per truck ton-mile - 2015	grams/TM	0.006	
86	Grams of PM per truck ton-mile - 2016	grams/TM	0.006	
87	Grams of PM per truck ton-mile - 2017	grams/TM	0.006	
88	Grams of PM per truck ton-mile - 2018	grams/TM	0.005	
89	Grams of PM per truck ton-mile - 2019	grams/TM	0.005	
90	Grams of PM per truck ton-mile - 2020	grams/TM	0.005	
91	Grams of PM per truck ton-mile - 2021	grams/TM	0.005	

92	Grams of PM per truck ton-mile - 2022	grams/TM	0.004	
93	Grams of PM per truck ton-mile - 2023	grams/TM	0.004	
94	Grams of PM per truck ton-mile - 2024	grams/TM	0.004	
95	Grams of PM per truck ton-mile - 2025	grams/TM	0.004	
96	Grams of PM per truck ton-mile - 2026	grams/TM	0.004	
97	Grams of PM per truck ton-mile - 2027	grams/TM	0.004	
98	Grams of PM per truck ton-mile - 2028	grams/TM	0.004	
99	Grams of PM per truck ton-mile - 2029	grams/TM	0.004	
100	Grams of PM per truck ton-mile - 2030	grams/TM	0.004	
101	Grams of PM per train ton-mile - 2011	grams/TM	0.011	Source for Tables 3-71 and 3-81 is "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder." Gram/ton-mile values are converted to grams/ton-mile by dividing an average efficiency 480 freight ton miles per gallon. (2009 U.S. average data source in "The Economic Impact of America's Freight Railroads", Association of American Railroad (AAR), May 2010.) In addition, a conservative 1% improvement in fuel efficiency is assumed per year. EPA cited a 16% improvement in rail industry-wide fuel efficiency over the past 10 years (EPA Publication EPA420-R-08-001, March 2008, page 1-58).
102	Grams of PM per train ton-mile - 2012	grams/TM	0.010	
103	Grams of PM per train ton-mile - 2013	grams/TM	0.009	
104	Grams of PM per train ton-mile - 2014	grams/TM	0.009	
105	Grams of PM per train ton-mile - 2015	grams/TM	0.008	
106	Grams of PM per train ton-mile - 2016	grams/TM	0.008	
107	Grams of PM per train ton-mile - 2017	grams/TM	0.007	
108	Grams of PM per train ton-mile - 2018	grams/TM	0.007	
109	Grams of PM per train ton-mile - 2019	grams/TM	0.006	
110	Grams of PM per train ton-mile - 2020	grams/TM	0.006	
111	Grams of PM per train ton-mile - 2021	grams/TM	0.005	
112	Grams of PM per train ton-mile - 2022	grams/TM	0.005	
113	Grams of PM per train ton-mile - 2023	grams/TM	0.005	
114	Grams of PM per train ton-mile - 2024	grams/TM	0.004	
115	Grams of PM per train ton-mile - 2025	grams/TM	0.004	
116	Grams of PM per train ton-mile - 2026	grams/TM	0.004	
117	Grams of PM per train ton-mile - 2027	grams/TM	0.003	
118	Grams of PM per train ton-mile - 2028	grams/TM	0.003	
119	Grams of PM per train ton-mile - 2029	grams/TM	0.003	
120	Grams of PM per train ton-mile - 2030	grams/TM	0.002	
121	Grams of VOC per truck ton-mile - 2011	grams/TM	0.015	Mobile 6.2. Calculated grams/gallon emission factors converted to grams/ton-mile by dividing by an average
122	Grams of VOC per truck ton-mile - 2012	grams/TM	0.014	

123	Grams of VOC per truck ton-mile - 2013	grams/TM	0.013	
124	Grams of VOC per truck ton-mile - 2014	grams/TM	0.013	
125	Grams of VOC per truck ton-mile - 2015	grams/TM	0.012	
126	Grams of VOC per truck ton-mile - 2016	grams/TM	0.011	
127	Grams of VOC per truck ton-mile - 2017	grams/TM	0.011	
128	Grams of VOC per truck ton-mile - 2018	grams/TM	0.011	
129	Grams of VOC per truck ton-mile - 2019	grams/TM	0.011	
130	Grams of VOC per truck ton-mile - 2020	grams/TM	0.010	
131	Grams of VOC per truck ton-mile - 2021	grams/TM	0.010	
132	Grams of VOC per truck ton-mile - 2022	grams/TM	0.010	
133	Grams of VOC per truck ton-mile - 2023	grams/TM	0.010	
134	Grams of VOC per truck ton-mile - 2024	grams/TM	0.010	
135	Grams of VOC per truck ton-mile - 2025	grams/TM	0.010	
136	Grams of VOC per truck ton-mile - 2026	grams/TM	0.010	
137	Grams of VOC per truck ton-mile - 2027	grams/TM	0.010	
138	Grams of VOC per truck ton-mile - 2028	grams/TM	0.009	
139	Grams of VOC per truck ton-mile - 2029	grams/TM	0.009	
140	Grams of VOC per truck ton-mile - 2030	grams/TM	0.009	
141	Grams of VOC per train ton-mile - 2011	grams/TM	0.016	Source for Tables 3-71 and 3-81 is "Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder." Gram/ton-mile values are converted to grams/ton-mile by dividing an average efficiency 480 freight ton miles per gallon. (2009 U.S. average data source in "The
142	Grams of VOC per train ton-mile - 2012	grams/TM	0.015	
143	Grams of VOC per train ton-mile - 2013	grams/TM	0.014	
144	Grams of VOC per train ton-mile - 2014	grams/TM	0.013	
145	Grams of VOC per train ton-mile - 2015	grams/TM	0.012	

146	Grams of VOC per train ton-mile - 2016	grams/TM	0.010	

147	Grams of VOC per train ton-mile - 2017	grams/TM	0.009	
148	Grams of VOC per train ton-mile - 2018	grams/TM	0.009	
149	Grams of VOC per train ton-mile - 2019	grams/TM	0.008	
150	Grams of VOC per train ton-mile - 2020	grams/TM	0.007	
151	Grams of VOC per train ton-mile - 2021	grams/TM	0.007	
152	Grams of VOC per train ton-mile - 2022	grams/TM	0.006	
153	Grams of VOC per train ton-mile - 2023	grams/TM	0.006	
154	Grams of VOC per train ton-mile - 2024	grams/TM	0.006	
155	Grams of VOC per train ton-mile - 2025	grams/TM	0.005	
156	Grams of VOC per train ton-mile - 2026	grams/TM	0.005	
157	Grams of VOC per train ton-mile - 2027	grams/TM	0.004	
158	Grams of VOC per train ton-mile - 2028	grams/TM	0.004	
159	Grams of VOC per train ton-mile - 2029	grams/TM	0.004	
160	Grams of VOC per train ton-mile - 2030	grams/TM	0.003	
161	NOx cost per ton	2010$/short ton	$5,590	National Highway Traffic Safety Administration, "Corporate Average Fuel Economy for FY 2011 Passenger Cars and Light Trucks", March 2009
162	CO2 Cost per Ton - 2010	2010$/short ton	$20.49	Interagency Working Group on Social Cost of Carbon, US Government for Regulatory Impact Analysis under Executive Order 12866. 2010
163	CO2 Cost per Ton - 2011	2010$/short ton	$20.92	
164	CO2 Cost per Ton - 2012	2010$/short ton	$21.36	
165	CO2 Cost per Ton - 2013	2010$/short ton	$21.81	
166	CO2 Cost per Ton - 2014	2010$/short ton	$22.27	
167	CO2 Cost per Ton - 2015	2010$/short ton	$22.74	
168	CO2 Cost per Ton - 2016	2010$/short ton	$23.21	

169	CO2 Cost per Ton - 2017	2010$/short ton	$23.70	
170	CO2 Cost per Ton - 2018	2010$/short ton	$24.20	
171	CO2 Cost per Ton - 2019	2010$/short ton	$24.71	
172	CO2 Cost per Ton - 2020	2010$/short ton	$25.22	
173	CO2 Cost per Ton - 2021	2010$/short ton	$25.78	
174	CO2 Cost per Ton - 2022	2010$/short ton	$26.35	
175	CO2 Cost per Ton - 2023	2010$/short ton	$26.93	
176	CO2 Cost per Ton - 2024	2010$/short ton	$27.52	
177	CO2 Cost per Ton - 2025	2010$/short ton	$28.12	
178	CO2 Cost per Ton - 2026	2010$/short ton	$28.74	
179	CO2 Cost per Ton - 2027	2010$/short ton	$29.38	
180	CO2 Cost per Ton - 2028	2010$/short ton	$30.02	
181	CO2 Cost per Ton - 2029	2010$/short ton	$30.68	
182	CO2 Cost per Ton - 2030	2010$/short ton	$31.36	
183	CO2 Cost per Ton - 2031	2010$/short ton	$31.92	
184	CO2 Cost per Ton - 2032	2010$/short ton	$32.50	
185	PM cost per ton	2010$/short ton	$306,092	National Highway Traffic Safety Administration, "Corporate Average Fuel Economy for FY 2011 Passenger Cars and Light Trucks", March 2009
186	VOC cost per ton	2010$/short ton	$1,377	National Highway Traffic Safety Administration, "Corporate Average Fuel Economy for FY 2011 Passenger Cars and Light Trucks", March 2009
187	Grams per Short Ton	grams	907,185	HDR obtained value

Table 17: Results E1 - Emission Saving from Diverting Trucks to Rail

Benefit Category	PV Over 20 Years	
	7%	3%
Emission Saving from Diverting Trucks to Rail	$1,269,789	$1,915,586

3 MODEL SENSITIVITIES

The greatest driver of project benefits is the amount of cargo that is diverted from truck transportation to rail freight. In the model, static values for expected diverted cargo – expressed in this section as "diverted carloads" – are used. Sensitivity analysis is utilized to determine what level of cargo diversion is required for a break-even Net Present Value at both a 7% and 3% discount rate.

In this analysis, we assume the number of diverted carloads experience the same growth rate from year-to-year, and apply sensitivity to the percentage decrease from expected to "actual" diverted carload values to yield break-even NPV's. The results are as follows:

Table 18: Reduction in Carloads Required for Break-Even NPV

	7% Discount Rate	3% Discount Rate
Break-Even Carload Reduction	34.7%	52.3%

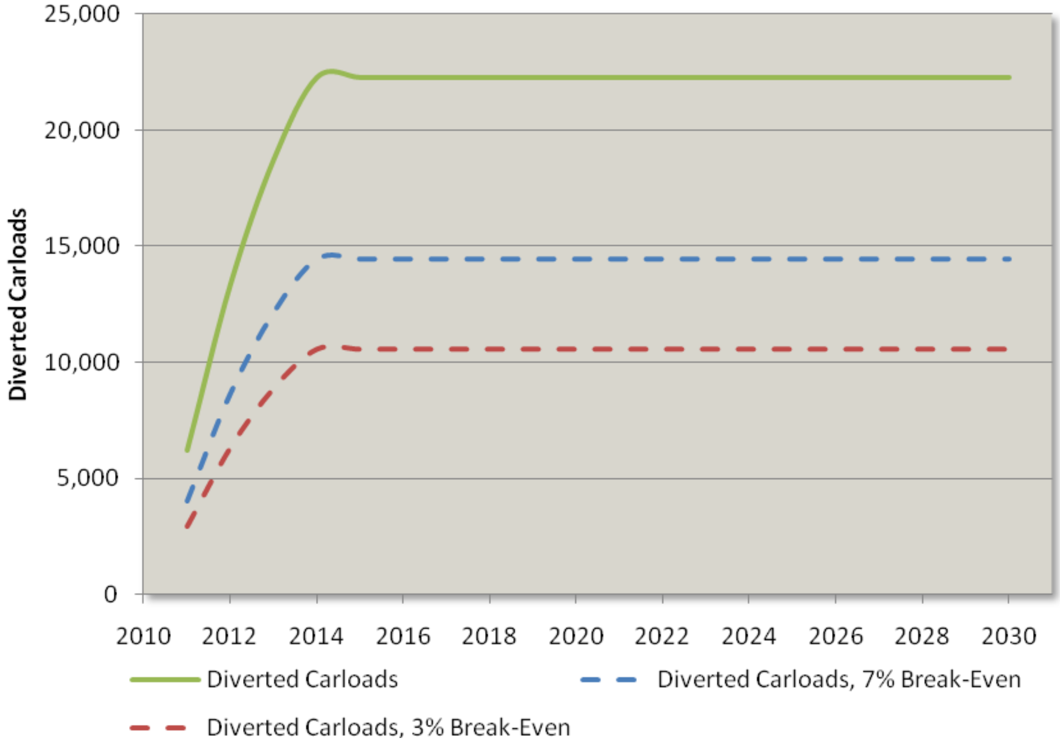
The sensitivity analysis reveals that actual diverted carloads can be 34.7% and 52.5% less than expected for he project to return a positive NPV when using 7% and 3% discount rates, respectively. The percentage decreases translate to the following year-to-year number of diverted carloads shown in Table 19, and are shown graphically in Figure 12:

Table 19: Break-Even Diverted Carloads

	Expected Diverted Carloads	Diverted Carloads, 7% Break-Even	Diverted Carloads, 3% Break-Even
2011	6,206	4,032	2,945
2012	13,358	8,677	6,339
2013	18,738	12,172	8,893
2014+	22,278	14,471	10,573

Texas Department of Transportation

Figure 11: Break-Even Diverted Carloads



Other input factors that have a relatively large effect on modeled NPV include railcar carrying capacity, and shipping cost rates. Again, sensitivity is applied to these inputs to determine the values necessary to yield break-even NPV's. It is assumed that shipping a given unit of cargo costs 17.6% more by truck than by train. The sensitivity analysis reveals that this truck shipping premium must be greater than 1.8% for NPV to break-even at the 7% discount rate. At the 3% discount rate, truck shipping rates can be 6.7% *cheaper* than rail shipping rates, and the NPV will still be greater than zero. Applying sensitivity to railcar capacity shows that an average carload must hold no less than the equivalent of 2.4 and 1.6 trucks respectively to yield a positive NPV at the 7% and 3% discount rate. These results are summarized in Table 20.

Table 20: Input Break-Even Values

	Break-Even Values	
	7% Discount Rate	3% Discount Rate
Truck Shipping Rate Premium	1.8%	-6.7%
Trucks per Carload	2.4	1.6

GLOSSARY

Carbon Dioxide (CO_2): Carbon dioxide is a heavy colorless gas that is a by-product 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 (NO_X): 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, NO_X 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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