Appendix A – Cost Benefit Analysis

Upper Midwest Transportation Hub

Iowa Department of Transportation

ONE COMPANY | *Many Solutions*

IOWA DOT-IOWA NORTHERN RAILWAY COMPANY

UPPER MIDWEST TRANSPORTATION HUB AT MANLY, IOWA

TIGER DISCRETIONARY GRANTS PROGRAM

ECONOMIC ANALYSIS SUPPLEMENTARY DOCUMENTATION

JUNE 3, 2013

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1. Executive Summary

This TIGER Grant application is for infrastructure construction for the Upper Midwest Transportation Hub (UMTH) Project at Manly, Iowa. It consists primarily of the intermodal portion of the UMTH Project that will provide the infrastructure for staging, trans-loading (stuffing) and loading/unloading domestic and international shipping trailers and containers. The development will serve an approximately 150 mile radius encompassing north central Iowa and southern Minnesota where little useful intermodal service is currently available.

Manly, Iowa is currently the home of an approximately 350 acre campus that already serves as a major transportation hub and the long term potential for continued growth of this transportation hub is considerable. The site currently includes a major rail support and classification yard, a grain terminal, a large liquid transload facility with over 5 million gallon storage tanks, and capacity for a multitude of both inbound and outbound products. Expansion of the liquid infrastructure is already underway, and ground has been broken for a large steel distribution facility. A nearly 15,000 foot single track loop is under construction on a 160 acre MLP parcel. Two major portions of the UMTH project remain; namely 1) construction of infrastructure that will provide rail yard support, for trans-loading highway trailers and shipping containers, and; 2) the infrastructure for a sizeable intermodal facility and container. The project planned for this TIGER Grant is all contained within the existing transportation campus.

The project will provide significant benefits to the region, state, and nation through:

1) improving freight rail efficiency and capacity,
2) diverting existing freight from truck to rail,
3) reducing truck miles traveled,
4) reducing highway maintenance costs,
5) reducing transportation costs,
6) reducing congestion costs,
7) reducing transportation costs,
8) reducing accident costs (fatalities and injuries), and
9) job creation.

The overall project is designed to provide an independent, high service and lower cost package of rail, truck and intermodal logistics for Iowa and Minnesota manufacturers, producers and consumers, with the particular portion of the project directly providing lower cost access to domestic and international intermodal service to a large and growing number of shippers/receivers that do not currently have such cost-competitive access. This project will result in reducing the time, distance and related costs for shippers and receivers in the region to access the national and international intermodal network. That will allow existing and potential shippers, receivers and consumers in this region a more equal and competitive access to the world market place.

A table summarizing the changes expected from the project (and the associated benefits) is provided below.

Table ES-1: Summary of Infrastructure Improvements and Associated Benefits

Current Status or Baseline & Problems to be Addressed	Changes to Baseline / Alternative	Type of Impacts	Population Affected by Impacts	Benefits	Summary of Results ($2012, 7% Discounted)	Page #
The region served by (UMTH) suffers from a serious lack of nearby intermodal infrastructure and service. There also exists a sever container imbalance situation from too little inbound containers, causing high dray costs. Declining truckload capacity and increasing costs has become a concern. Also, no direct, competitive, time sensitive intermodal service to US Eastern Seaboard, Texas-Mexico and California exists to this region.	Improvements to the Manly Yard, the Manly Terminal, and the Manly Logistics Park (MLP) include rehabilitation of tracks, construction of an administrative building for crew locker rooms, administrative staff and supervisory tower, conversion of a wind component area into a startup intermodal facility and container stuffing facility, the completed construction of the MLP intermodal projects, and container yard, within the loop track, and provide a second loop track .	Reduced Highway Maintenance Costs from truck diversion to rail.	Federal and State (various) Governments	Monetized Maintenance Savings.	$351,645,762.95	19
		Reduced Transportation Costs from truck diversion to rail.	Goods Shippers	Monetized Shipping Savings.	$702,799,284.62	24
		Short-Term Economic Impacts from construction/planning expenditure.	Local Citizens and Businesses	Job years, income etc.	*Pg 24*	24
		Reduction in Highway Congestion from truck diversion to rail	On Road Motorists Using Trucking Routes	Monetized Reduced Congestion Savings.	$199,737,499.41	29
		Reduced Emissions from truck diversion to rail.	Iowa	Monetized Reduced Pollution.	$162,504,842.36	38
		Reduced Accident Costs from truck diversion to rail.	Motorists/ Railway Travelers Between Fort Stockton and Fort Worth Texas.	Monetized Increased injuries and fatalities.	$392,901,882.00	42

The period of analysis used in the estimation of benefits and costs corresponds to 22 years, including 2 years of construction and 22 years of operation. The total project capital costs are $24.6M in nominal terms, and are expected to be financed by Federal (TIGER) and private funds from Iowa Northern Railway Company (IANR); Manly Terminal LLC (MT); and Manly Logistics Park LLC (MLP) according to the distribution shown in Table ES-2.

Table ES-2: Summary of Project Costs and Anticipated Funding Sources, 2012$

Funding Source	Capital/Construction	Percent of Total Capital Cost Financed by Source
Federal (TIGER)	$15,957,644	64.8%
Private (IANR-MT-MLP)	$8,655,513	35.2%
TOTAL	**$24,613,157**	**100.0%**

A summary of the relevant data as well as the calculations used to derive the benefits and costs of the project are shown in Table ES-3 (in dollars of 2012). Based on the Benefit Cost Analysis presented in the rest of this document, the project is expected to generate $1,810M in discounted benefits and $221.3M in discounted costs, using a 7 percent real discount rate. Therefore, the project is expected to generate a Net Present Value of $1,588M and a Benefit/Cost Ratio of 8.18.

Table ES-3: Summary of Pertinent Data, Quantifiable Benefits and Costs

Calendar Year	Project Year	Total Direct Beneficiaries	Total Benefits ($2012)	Initial Costs ($2012)	Undiscounted Net Benefits ($2012)	Discounted Net Benefits at 7%
2013	1	Shippers, vehicle operators, rail operators, other users of roads, and local residents	$0	$0	$0	$0
2014 (opening)	2		$11,149,195	-$25,811,676	-$14,662,481	-$13,684,781
2015	3		$69,517,264	-$8,855,231	$60,662,033	$53,202,883
2016	4		$96,521,673	-$11,256,000	$85,265,673	$70,037,796
2017	5		$113,862,840	-$15,315,750	$98,547,090	$75,830,906
2018	6		$127,043,915	-$16,990,665	$110,053,250	$79,341,043
2019	7		$141,842,403	-$18,360,617	$123,481,786	$83,415,797
2020	8		$168,216,332	-$20,119,781	$148,096,552	$93,784,342
2021	9		$185,336,198	-$20,784,142	$164,552,055	$97,724,077
2022	10		$196,462,831	-$21,482,596	$174,980,235	$97,446,007
2023	11		$200,669,369	-$21,912,248	$178,757,121	$93,384,878
2024	12		$204,590,221	-$22,263,298	$182,326,923	$89,364,260
2025	13		$208,664,316	-$22,620,498	$186,043,818	$85,581,085
2026	14		$212,811,494	-$22,983,960	$189,827,534	$81,965,903
2027	15		$217,057,559	-$23,353,803	$193,703,757	$78,540,685
2028	16		$221,377,983	-$23,730,143	$197,647,840	$75,264,781
2029	17		$225,810,633	-$24,113,104	$201,697,529	$72,153,886
2030	18		$230,199,769	-$24,456,527	$205,743,242	$69,172,396
2031	19		$234,655,260	-$24,806,125	$209,849,135	$66,316,097
2032	20		$239,198,071	-$25,162,017	$214,036,054	$63,609,534
2033	21		$243,799,298	-$25,524,326	$218,274,972	$61,012,501
2034	22		$248,560,384	-$25,893,176	$222,667,208	$58,570,579
2035	23		$253,376,806	-$26,268,695	$227,108,111	$56,223,562
Total			**$4,050,723,817**	**-$472,064,379**	**$3,578,659,438**	**$1,588,258,216**

A summary of the monetized benefits of the UMTH project are included below in Table ES-4.

Table ES-4: Summary of Monetized Benefits, in Million of 2012$

Long-Term Outcomes	Benefit Categories	7% Discount Rate	3% Discount Rate
State of Good Repair	Avoided Pavement Maintenance Costs	$351.65	$553.33
Economic Competitiveness	Shipper Savings due to Modal Switch from Truck to Rail	$702.80	$1,102.98
Livability	Reduced Road Congestion due to Modal Switch from Truck to Rail	$199.74	$314.30
Environmental Sustainability	Emission Cost Savings due to Modal Switch from Truck to Rail	$162.50	$168.06
Safety	Accident Cost Savings due to Modal Switch from Truck to Rail	$392.90	$618.25
Total Benefit Estimates		**$1,809.59**	**$2,756.93**

Note: * Excluding the short-term employment impacts of the project

In addition to the monetized benefits presented in Table ES-4, the project would generate benefits that are difficult to quantify. A brief description of those benefits is provided below.

<u>Economic Competitiveness:</u>

- *Induced Regional Benefits to Shippers and Receivers*: it is assumed that a proportion of the lifts in the build scenario will be utilized by 'induced' shipments. That is to say that some volume of the lift forecast is made up of lifts aren't currently moving in the base case (in addition to existing demand). The presence of the intermodal hub at Manly will create new business opportunities through providing access to markets that were previously non-economical. As an example, this new origin-destination hub will bring new regional opportunities to local commodity producers or processors. The induced component of the lift forecast has been excluded from the cost-benefit analysis as to be conservative. As such, it can be said that induced demand will further improve the output metrics of this analysis, as there would be no additional capital costs needed.

2. Introduction

This document provides detailed technical information on the economic analyses conducted in support of the Grant Application for Upper Midwest Transportation Hub (UMTH) Project at Manly, Iowa.

Section 3, Methodological Framework, introduces the conceptual framework used in the Benefit-Cost Analysis (BCA). Section 4, Project Overview, provides an overview of the project, including a brief description of existing conditions and proposed alternatives; a summary of cost estimates and schedule; and a description of the types of effects that the UMTH project is expected to generate. Section 5, General Assumptions, discusses the general assumptions used in the estimation of project costs and benefits, while estimates of travel demand and traffic growth can be found in Section 6, Demand Projections. Specific data elements and assumptions pertaining to the long-term outcome selection criteria are presented in Section 0,

Benefits Measurement, Data and Assumptions, along with associated benefit estimates. Estimates of the project's Net Present Value (NPV), its Benefit/Cost ratio (BCR) and other project evaluation metrics are introduced in Section 8, Summary of Findings and BCA Outcomes. Next, Section 9, BCA Sensitivity/Alternative Analysis, provides the outcomes of the sensitivity/alternatives analysis. Additional data tables are provided in Section 10, Supplementary Data Tables, including annual estimates of benefits and costs, as well as intermediate values to assist DOT in its review of the application.[1]

3. Methodological Framework

Benefit-Cost Analysis (BCA) is a conceptual framework that quantifies in monetary terms as many of the costs and benefits of a project as possible. Benefits are broadly defined. They represent the extent to which people impacted by the project are made better-off, as measured by their own willingness-to-pay. In other words, central to BCA is the idea that people are best able to judge what is "good" for them, what improves their well-being or welfare.

BCA also adopts the view that a net increase in welfare (as measured by the summation of individual welfare changes) is a good thing, even if some groups within society are made worse-off. A project or proposal would be rated positively if the benefits to some are large enough to compensate the losses of others.

Finally, BCA is typically a forward-looking exercise, seeking to anticipate the welfare impacts of a project or proposal over its entire life-cycle. Future welfare changes are weighted against today's changes through discounting, which is meant to reflect society's general preference for the present, as well as broader inter-generational concerns.

The specific methodology developed for this application was developed using the above BCA principles and is consistent with the TIGER guidelines. In particular, the methodology involves:

- Establishing existing and future conditions under the build and no-build scenarios;

[1] While the models and software themselves do not accompany this appendix, greater detail can be provided, including spreadsheets presenting additional interim calculations and discussions on model mechanics and coding, if requested.

- Assessing benefits with respect to each of the five long-term outcomes identified in the Notice of Funding Availability (NOFA);
- Measuring benefits in dollar terms, whenever possible, and expressing benefits and costs in a common unit of measurement;
- Using DOT guidance for the valuation of travel time savings, safety benefits and reductions in air emissions, while relying on industry best practice for the valuation of other effects;
- Discounting future benefits and costs with the real discount rates recommended by the DOT (7 percent, and 3 percent for sensitivity analysis); and
- Conducting a sensitivity analysis to assess the impacts of changes in key estimating assumptions.

4. Project Overview

This TIGER Grant application is for infrastructure construction for the Upper Midwest Transportation Hub (UMTH) Project at Manly, Iowa. It consists primarily of the intermodal portion of the UMTH Project that will provide the infrastructure for staging, trans-loading (stuffing) and loading/unloading domestic and international shipping trailers and containers. The project is being developed by Iowa Northern Railway Company (IANR). The development will serve an approximately 150 mile radius encompassing north central Iowa and southern Minnesota where little useful intermodal service is currently available. The total project covers approximately 350 acres of specialized transportation infrastructure and is divided into three distinct parts:

1. Manly Yard – 90 acres
2. Manly Terminal – 100 acres
3. Manly Logistics Park – 160 acres

1) Manly Yard: The IANR's 85 acre railroad yard includes 11 classification and switching tracks with adjacent car repair facility, grain staging tracks, engine house, maintenance of way material yard, food grade trans-load and support tracks and several other customer trans-load areas, including a new food grade rail-to-truck transfer station. Manly Yard is the critical support yard for IANR interchange with Union Pacific Railroad and to provide track support for Manly Terminal and Manly Logistics Park.
2) Manly Terminal (MT): The 100 acre facility built in 2007 includes substantial infrastructure for the storage and transfer of liquid commodities, such as chemicals, fuel and fuel components, feed additives and other liquids used in various manufacturing processes throughout the region, and includes 28 acres designed for the handling of heavy dimensional shipments, particularly wind turbine components and an initial intermodal facility
3) Manly Logistics Park (MLP): Currently under development, the 160 acre industrial development will handle distribution of steel products, various trans load components and commodities, and a large scale intermodal facility and container trailer staging-storage yard and an eventual cold and freezer storage warehouse and cross dock. Once

the MLP intermodal facility is in service, the smaller initial intermodal facility in Manly Terminal will continue in service in specialized container loading (called “container stuffing” in the industry) for food products, manufactured goods, export grain, distiller grains, and edible bean products for export. It is contemplated that this will eventually be recognized as a bonded area for US Customs clearance of imported goods to the region.

Manly, Iowa is currently the home of an approximately 350 acre campus that already serves as a major transportation hub and the long term potential for continued growth of this transportation hub is considerable. The site currently includes a major rail support and classification yard, a grain terminal, a large liquid transload facility with over 5 million gallon storage tanks, and capacity for a multitude of both inbound and outbound products. Expansion of the liquid infrastructure is already underway, and ground has been broken for a large steel distribution facility. A nearly 15,000 foot single track loop is under construction on a 160 acre MLP parcel. Two major portions of the UMTH project remain; namely 1) construction of infrastructure that will provide rail yard support, for trans-loading highway trailers and shipping containers, and; 2) the infrastructure for a sizeable intermodal facility and container. The project planned for this TIGER Grant is all contained within the existing transportation campus.

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4.1 Base Case, Build Case and Alternative

Base Case (No-Build Case): In the base case, the UMTH project is not undertaken. Shipping is continued via truck and other intermodal facilities farther away.

Build Case: In the build case the UMTH project is undertaken. Trucking traffic is diverted to the intermodal facility and from less direct intermodal routes. The benefits of the build case are attributed to the avoidance of truck use.

4.2 Project Cost and Schedule[2]

Calendar Year	Construction/Equipment Capital Total
2013	$0.0
2014	$21,912,314
2015	$1,019,287
Total	**$21,431,402**

4.3 Effects on Long-Term Outcomes

Reduction in Maintenance Costs from Displacing Heavy Truck Travel to Rail
An avoidance of heavy trucks on the highway system reduces highway maintenance costs and in particular pavement re-surfacing and maintenance costs. Typically, this benefit is realized in terms of increased cycle times between maintenance work orders. This benefit category captures the reduced maintenance cost associated with diverting goods from rail to truck.

Reduced Transportation Costs from Diverting Heavy Truck Travel to Rail
Rail shipping rates tend to be lower than truck shipping rates on a per ton-mile basis. As such, diversion of intermodal highway freight to rail can generate cost savings to shippers. The UMTH project allows shippers a greater choice of transportation mode. Furthermore, these improvements increase schedule reliability, one of the key challenges facing a railroad in terms of product delivery. In the absence of such improvements, some shipments would likely be carried by truck at a greater cost to producers.

Transportation cost savings are quantified using the calculation of the volume of truck ton-miles avoided and relative shipping rates. The benefits in this category are counted as public because the difference in transportation prices between rail intermodal and truckload freight accrue directly to the shipper and receiver lowering the final price consumers pay.

Shipping costs savings for existing rail users have the potential of spurring dynamic changes in land-use, manufacturing, and industrial re-organization. Research conducted for USDOT/FHWA indicated that reduced shipping costs could enable shifts in mode choice and investments in productivity in the 'medium term'. In addition, these combined savings could increase further based on industrial re-organization, and the shifting of warehousing or just-in-time

[2] All cost estimates in this section are in millions of dollars of 2012, discounted to 2013 using a 7 percent real discount rate.

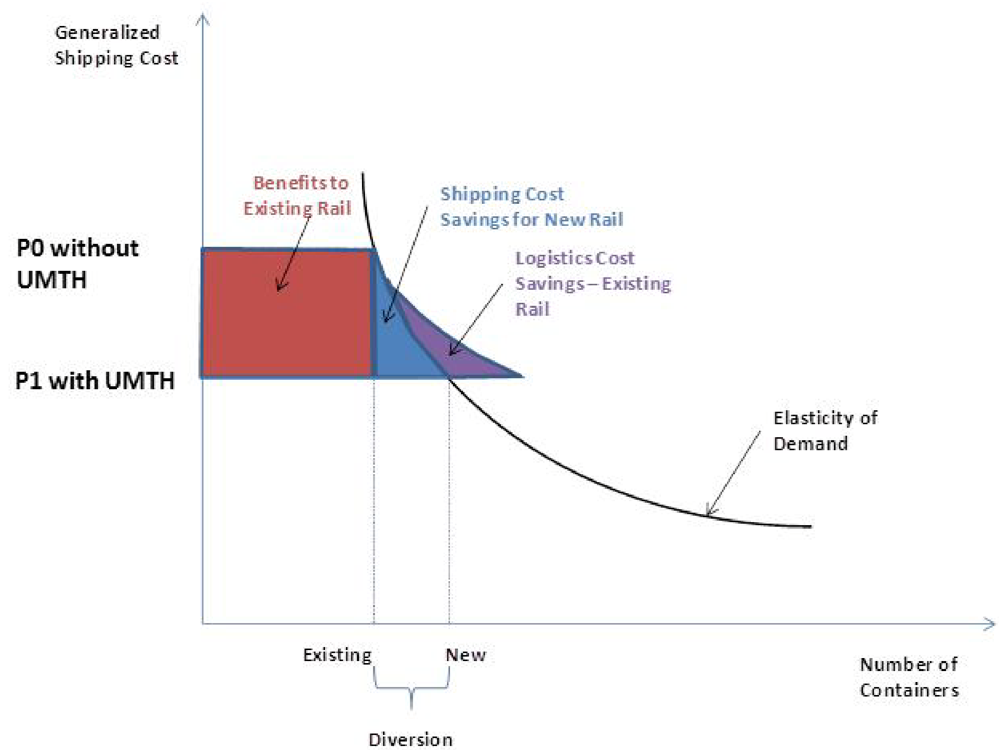
manufacturing to realize even lower transportation costs.[3] Economists call the difference between the amount people actually pay for something and the amount they would pay for the next most costly alternative, “consumer surplus.” Consumer surplus is a monetary quantity that equates to the economic value (EV) of the reduced costs to mode-shifting shippers in this project and is shown in the figure below. The change in consumer surplus is evaluated using the equation provided below. This equation assumes the “rule-of-half” is being used. The rule of half is a simplification that assumes a linear approximation of the travel demand curve. The rule of half has been used to calculate this benefit category shown diagrammatically in

– [1]

Where:

ΔCS = change in consumer surplus due to rail network improvements
t = time period
Q = train car volume during time period *t*
P = private cost of shipping (shipping rate)
0,1 = index denoting baseline scenario and improvement scenario respectively

Figure 1: Sources of Shipping Benefits



[3] (Citation: NCHRP 586. Rail Freight Solutions to Roadway Congestion—Final Report and Guidebook). These additional costs savings would be realized in the long-run through lower prices for consumers.

Reduction in Highway Congestion Costs from Displacing Heavy Truck Travel to Rail

The proposed UMTH project will divert freight from road to rail resulting in a reduction in the use of public highways by heavy trucks. This represents time savings to the remaining on-road motorists.

Emission Savings from Diverting Heavy Truck Travel to Rail

Freight carried over the rail network imposes less environmental impacts for the same amount of cargo than those imposed by trucks on the highway network. This benefit category estimates the value of the reduced environmental emissions associated with transporting goods on rail as opposed to by truck. The reduced amounts of Nitrogen Oxide (NOx), Carbon Dioxide (CO_2), Particulate Matter (PM), and Volatile Organic Compounds (VOCs) are calculated and monetized.

Reduced Accident Costs from Diverting Heavy Truck Travel to Rail

Fatality and injury rates per mile of freight carried by truck are greater than the fatality and injury rates for an equal volume of cargo when shipped by rail. This benefit captures the different accident rates per truck-mile and train-mile, and the reduced amounts of injuries and fatalities of truck diversion to rail.

The main benefit categories associated with the project are mapped into the five long-term outcome criteria set forth by the DOT in the table below.

Table 1: Expected Effects on Long-Term Outcomes and Benefit Categories

Impact #	Long-Term Outcomes	Impact Categories	Description	Monetized	Quantified	Qualitative
1	**State of Good Repair**	Avoided Pavement Maintenance Costs	Modal switch from truck to rail will reduce annual pavement O&M costs per ton-mile	√		
2	**Economic Competitiveness**	Shipper Savings due to Modal Switch from Truck to Rail	Modal switch from truck to rail will reduce shipping rate per ton-mile	√		
3		Short-term economic impacts*	Number of jobs expected to be created by the project, and related income		√	
4		Induced Localized Demand	Intermodal terminal will induce additional businesses to ship who would			√

			otherwise not			
5	**Livability**	Reduced Road Congestion due to Modal Switch from Truck to Rail	Modal switch from truck to rail will reduce congestion per truck-mile	√		
6	**Environmental Sustainability**	Emission Cost Savings due to Modal Switch from Truck to Rail	Modal switch from truck to rail will reduce emission rate per ton-mile	√		
7	**Safety**	Accident Cost Savings due to Modal Switch from Truck to Rail	Modal switch from truck to rail will reduce accident risk per ton-mile	√		

5. General Assumptions

The BCA measures benefits against costs throughout a period of analysis beginning at the start of construction (2014) and including 20 years of operations after Construction completion in 2015. The benefits start accruing within the first year of construction; therefore in actuality 22 years of benefits and costs are included in this analysis.

The monetized benefits and costs are estimated in 2012 dollars with future dollars discounted in compliance with TIGER requirements using a 7 percent real rate, and sensitivity testing at 3 percent.

The methodology makes several important assumptions and seeks to avoid overestimation of benefits and underestimation of costs. Specifically:

- Input prices are expressed in 2012 dollars;
- The period of analysis begins in 2013 and ends in 2035. It includes project development and construction years (2014 - 2015) and 22 years of operations (2014 - 2035);
- A constant 7 percent real discount rate is assumed throughout the period of analysis. A 3 percent real discount rate is used for sensitivity analysis;
- Annual demand ramps up conservatively to account for shifting demand forecasts; and
- Induced trips are have been estimated and subsequently removed from the annual lift diversions forecasts provided to be conservative.

6. Demand Projections

Accurate demand projections are important to ensure the reasonable BCA output results. The magnitudes of the long-term benefits accruing over the Upper Midwest Transportation Hub study period are a function of the number of existing and projected truck and intermodal trips diverted to rail.

6.1 Methodology

The demand projections are based on the number of truck and intermodal trips in the build scenario. One key assumption is the source of the lifts for the intermodal operations. An assumption has been made that 1) existing intermodal moves will be diverted from more distant facilities, like Chicago and 2) there will be a conversion of current truck moves to intermodal as a consequence of the opening of UMTH. A conservative approach has been taken on the truck-miles saved as a consequence of the opening of UMTH, with 1) existing intermodal moves netting a 250 mile savings and 2) conversion from other truck moves netting 1,500 mile savings (from Origin/Destination sample with rail versus highway mileage to/from Manly, Iowa).

The demand growth of diverted moves is segmented into lifts attributed to Manly Terminal and MLP. Growth estimates are conservative and based on engineering estimates and discussions with transportation companies.

The difference in diversion miles from the case base versus the build case is a function of a weighted average between the distance diverted from existing intermodal moves with longer travel distances and the conversion from truck moves. The diverted intermodal moves and conversion from truck to intermodal each have an associated distance and a percentage share of the total lifts (ex-induced traffic). The intermodal lift forecasts at this facility were then adjusted through removal of the estimated proportion of induced traffic in those lift estimates. Both the number of lifts and the estimated proportion of induced traffic vary year to year. The annual lift value is then multiplied by the proportion of lifts that are diverted intermodal moves and the proportion that comes from truck to intermodal by the estimated distance per lift saved from diverted intermodal moves and from truck to intermodal diversions to get the total truck miles diverted to rail.

6.2 Assumptions

Table 2 below lists the key assumptions/inputs used in used in the estimation of demand inputs for the UMTH project.

Table 2: Assumptions used in the Estimation of Demand

Year of Operation	Manly Terminal Lifts	MLP Lifts	Manly Lifts: Total	Non-Induced Lifts	Est pct of diverted intermodal moves	Est pct of conversion from truck to intermodal	Est pct of Induced traffic out of total lifts	Avg truck-miles saved per lift-diverted intermodal	Avg truck-miles saved per lift conversion from truck
2014	10,000	-	10,000	9,500	15%	85%	5%	250	1,500

2015	15,000	60,000	75,000	63,750	25%	75%	15%	250	1,500
2016	25,000	90,000	115,000	92,000	30%	70%	20%	250	1,500
2017	45,000	108,000	153,000	114,750	37%	63%	25%	250	1,500
2018	50,000	129,600	179,600	130,210	39%	61%	28%	250	1,500
2019	51,000	155,520	206,520	146,629	40%	60%	29%	250	1,500
2020	52,020	186,624	238,644	167,051	35%	65%	30%	250	1,500
2021	53,060	209,019	262,079	176,904	30%	70%	33%	250	1,500
2022	54,122	234,101	288,223	187,345	30%	70%	35%	250	1,500
2023	55,204	238,783	293,987	191,092	30%	70%	35%	250	1,500
2024	55,756	243,559	299,315	194,555	30%	70%	35%	250	1,500
2025	56,314	248,430	304,744	198,083	30%	70%	35%	250	1,500
2026	56,877	253,399	310,275	201,679	30%	70%	35%	250	1,500
2027	57,446	258,467	315,912	205,343	30%	70%	35%	250	1,500
2028	58,020	263,636	321,656	209,076	30%	70%	35%	250	1,500
2029	58,600	268,909	327,509	212,881	30%	70%	35%	250	1,500
2030	58,893	274,287	333,180	216,567	30%	70%	35%	250	1,500
2031	59,188	279,773	338,960	220,324	30%	70%	35%	250	1,500
2032	59,484	285,368	344,852	224,154	30%	70%	35%	250	1,500
2033	59,781	291,075	350,856	228,057	30%	70%	35%	250	1,500
2034	60,080	296,897	356,977	232,035	30%	70%	35%	250	1,500
2035	60,380	302,835	363,215	236,090	30%	70%	35%	250	1,500

6.3 Demand Projections

The resulting projections for the number of truck miles diverted (ex-induced traffic).

Table 3: Demand Projections

Year of Operation	Truck Miles Saved Per Year
2014	12,468,750

2015	75,703,125
2016	103,500,000
2017	119,053,125
2018	131,837,625
2019	146,629,200
2020	177,491,475
2021	199,016,453
2022	210,762,889
2023	214,978,146
2024	218,874,030
2025	222,843,794
2026	226,888,876
2027	231,010,742
2028	235,210,887
2029	239,490,833
2030	243,637,879
2031	247,864,652
2032	252,172,730
2033	256,563,724
2034	261,039,275
2035	265,601,059

7. Benefits Measurement, Data and Assumptions

This section describes the measurement approach used for each benefit or impact category identified in Table 1 (Expected Effects on Long Term Outcomes and Benefit Categories) and provides an overview of the associated methodology, assumptions, and estimates.

7.1 State of Good Repair

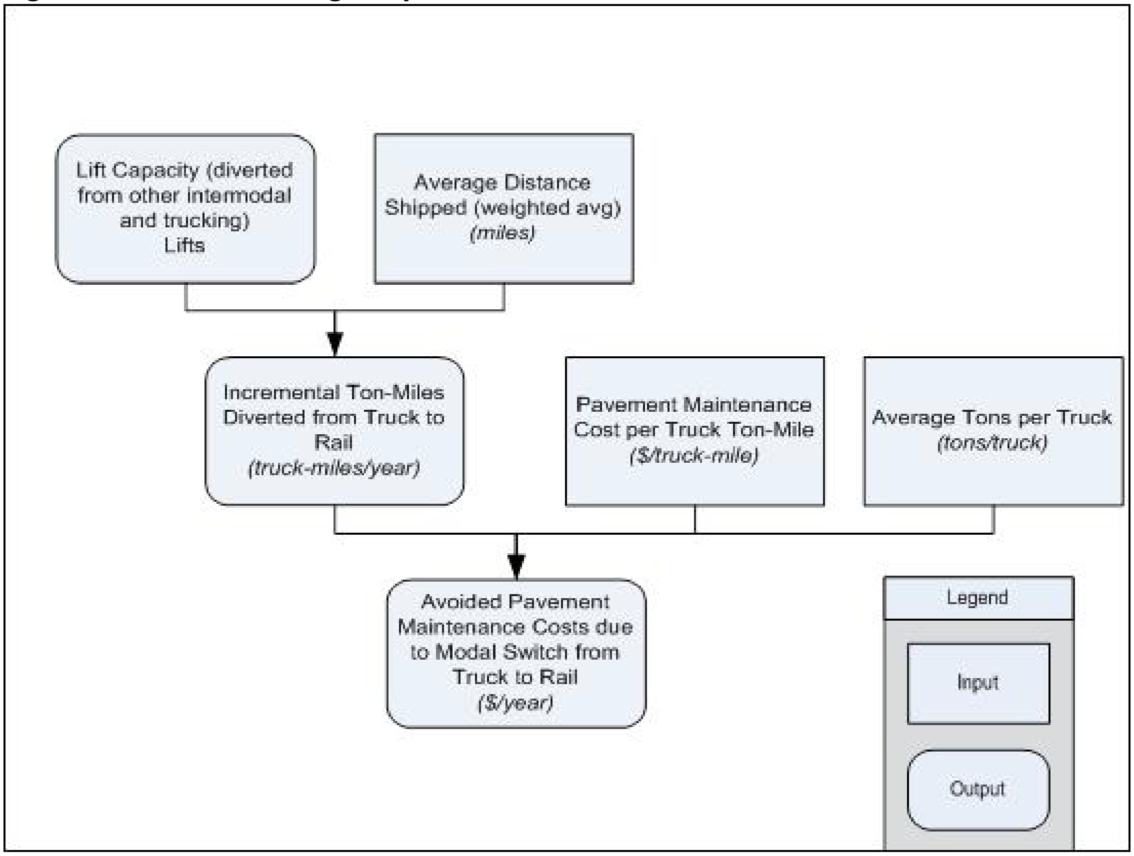
To quantify the benefits associated with maintaining the existing transportation network in a state of good repair, *Reduction in Maintenance Costs from Displacing Heavy Truck Travel to Rail* is monetized.

7.1.1 Methodology

Reduction in Maintenance Costs from Displacing Heavy Truck Travel to Rail

An avoidance of heavy trucks on the highway system reduces highway maintenance costs and in particular pavement re-surfacing and maintenance costs. Typically, this benefit is realized in terms of increased cycle times between maintenance work orders. This benefit category captures the reduced maintenance cost associated with diverting goods from truck to rail. The total diverted truck ton-miles are applied to highway maintenance cost per truck ton-mile to calculate highway maintenance costs. Figure 2 below provides the structure and logic (S&L) diagram for the calculation.

Figure 2: Reduction in Highway Maintenance S&L



7.1.2 Assumptions

The assumptions used in the estimation of State-of-Good-Repair benefits are summarized in the table below.

Table 4: Assumptions used in the Estimation of State-of-Good-Repair Benefits

Input #	Input Name	Units	Value	Source/Comment
1	Total Divertible Truck Ton-miles - 2013	truck-TM	0	Iowa Northern Railway Company
2	Total Divertible Truck Ton-miles - 2014	truck-TM	249,375,000	
3	Total Divertible Truck Ton-miles - 2015	truck-TM	1,514,062,500	
4	Total Divertible Truck Ton-miles - 2016	truck-TM	2,070,000,000	
5	Total Divertible Truck Ton-miles - 2017	truck-TM	2,381,062,500	
6	Total Divertible Truck Ton-miles - 2018	truck-TM	2,636,752,500	
7	Total Divertible Truck Ton-miles - 2019	truck-TM	2,932,584,000	
8	Total Divertible Truck Ton-miles - 2020	truck-TM	3,549,829,500	
9	Total Divertible Truck Ton-miles - 2021	truck-TM	3,980,329,065	
10	Total Divertible Truck Ton-miles - 2022	truck-TM	4,215,257,771	
11	Total Divertible Truck Ton-miles - 2023	truck-TM	4,299,562,927	
12	Total Divertible Truck Ton-miles - 2024	truck-TM	4,377,480,594	
13	Total Divertible Truck Ton-miles - 2025	truck-TM	4,456,875,880	
14	Total Divertible Truck Ton-miles - 2026	truck-TM	4,537,777,527	
15	Total Divertible Truck Ton-miles - 2027	truck-TM	4,620,214,849	
16	Total Divertible Truck Ton-miles - 2028	truck-TM	4,704,217,735	
17	Total Divertible Truck Ton-miles - 2029	truck-TM	4,789,816,664	
18	Total Divertible Truck Ton-miles - 2030	truck-TM	4,872,757,579	
19	Total Divertible Truck Ton-miles - 2031	truck-TM	4,957,293,034	
20	Total Divertible Truck Ton-miles - 2032	truck-TM	5,043,454,600	
21	Total Divertible Truck Ton-miles - 2033	truck-TM	5,131,274,476	
22	Total Divertible Truck Ton-miles - 2034	truck-TM	5,220,785,503	
23	Total Divertible Truck Ton-miles - 2035	truck-TM	5,312,021,179	
24	Average Tons per Truck	Tons	20	Iowa Northern Railway Company
25	Pavement Maintenance Cost	$/Truck Mile	$0.1893	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 13. Assuming 50/50 split of 60,80 kip and 35/65 urban/rural split.

Benefit Estimates

The benefit estimates to reduced pavement maintenance costs are shown in the table below. This benefit category accounts for roughly 19% of the total benefits of this build case.

Table 5: Estimates of State-of-Good-Repair Benefits, Millions of 2012$

	In Project Opening Year, Discounted at 7%	Over the Project Lifecycle	
		In Constant Dollars	Discounted at 7 Percent
Avoided Pavement Maintenance Costs	$2.21	$812.60	$351.65

Economic Competitiveness

The proposed project would contribute to enhancing the economic competitiveness of the Nation through improvements in the mobility of goods within and across the study area. In this analysis, one measure of mobility is presented: Out-of-pocket *Transportation Cost Savings*.

Rail shipping rates tend to be lower than truck shipping rates on a per ton-mile basis. This generates a transportation cost savings to shippers/receivers.

Also presented in this section are estimates of the short-term economic impacts of the project (*7.1.6 Estimation of Short-Term Economic Impacts*), as recommended in the Notice of Funding Availability for TIGER V.

7.1.3 Methodology

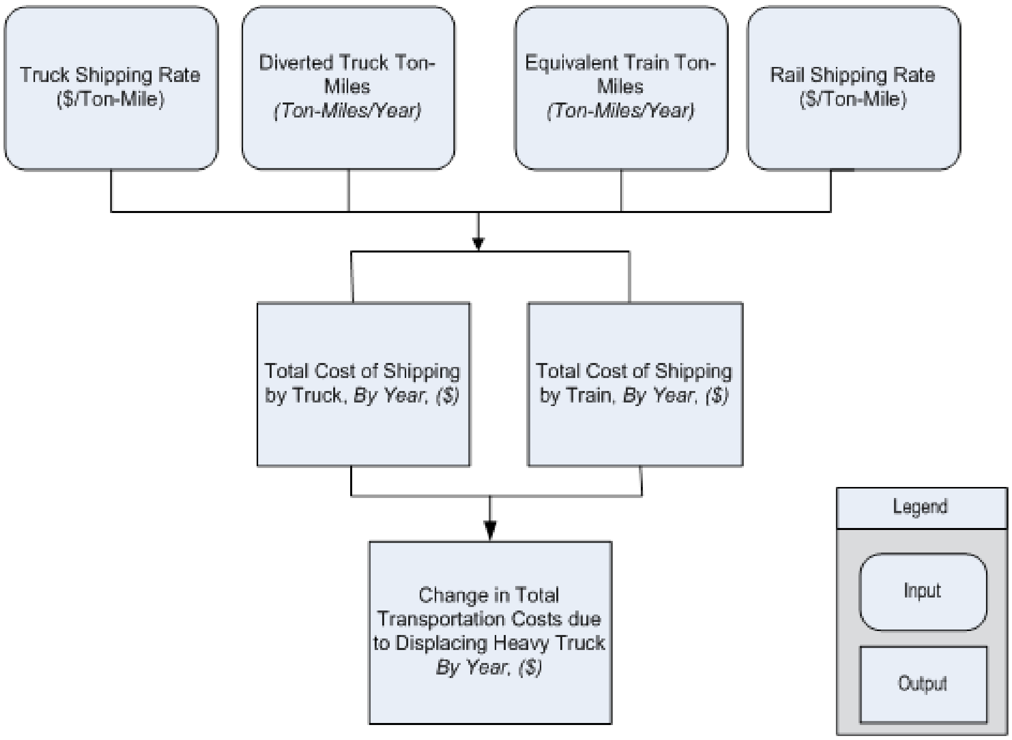
Reduced Transportation Costs from Diverting Heavy Truck Travel to Rail

Rail shipping rates tend to be lower than truck shipping rates on a per ton-mile basis. As such, diversion of intermodal highway freight to rail can generate cost savings to shippers. The UMTH facility would reduce shipping costs on a 'per lift' basis, with cost reductions attributed to diverting both existing intermodal and truck-only freight. The category of cost savings relating to the diversion of truck-only freight to rail is attributed to 'new users' of the rail system. As such, it is appropriate to apply the '50% rule' when accounting for this consumer surplus change. Consumer surplus is a monetary quantity that equates to the economic value (EV) of the mobility afforded to people by the availability of a transit system.

Furthermore, these improvements generally improve schedule reliability, one of the key challenges facing a railroad in terms of product delivery. In the absence of such improvements, some shipments would likely be carried by truck at a greater cost to producers.

Transportation cost savings are quantified using the calculation of the volume of truck ton-miles avoided and relative shipping rates. Rates were converted into a 'per lift' basis by Iowa Northern Railway Company (IANR). Florilli Logistics, an Iowa based trucking company that handles large volumes of both refrigerated and dry freight within the region and the entire country, compared the assumptions with confidential traffic flow data in-house and confirmed that the assumptions by IANR were reasonable. The benefits in this category are counted as public because the difference in transportation prices between rail intermodal and truckload freight accrue directly to the shipper and receiver lowering the final price consumers pay. The figure below outlines the methodology for quantifying this benefit.

Figure 3: Reduced Transportation Costs S&L



7.1.4 Assumptions

The assumptions used in the estimation of shipping cost reductions are summarized in the table below.

Table 6: Assumptions used in the Estimation of Out-of-Pocket Transportation Cost Savings

Input #	Input Name	Units	Value	Source/Comment
1	Total Lifts - 2013	#/year	0	Iowa Northern Railway Company
2	Total Lifts - 2014	#/year	9,500	
3	Total Lifts - 2015	#/year	63,750	
4	Total Lifts - 2016	#/year	92,000	
5	Total Lifts - 2017	#/year	114,750	
6	Total Lifts - 2018	#/year	130,210	
7	Total Lifts - 2019	#/year	146,629	
8	Total Lifts - 2020	#/year	167,051	
9	Total Lifts - 2021	#/year	176,904	
10	Total Lifts - 2022	#/year	187,345	
11	Total Lifts - 2023	#/year	191,092	

12	Total Lifts - 2024	#/year	194,555	
13	Total Lifts - 2025	#/year	198,083	
14	Total Lifts - 2026	#/year	201,679	
15	Total Lifts - 2027	#/year	205,343	
16	Total Lifts - 2028	#/year	209,076	
17	Total Lifts - 2029	#/year	212,881	
18	Total Lifts - 2030	#/year	216,567	
19	Total Lifts - 2031	#/year	220,324	
20	Total Lifts - 2032	#/year	224,154	
21	Total Lifts - 2033	#/year	228,057	
22	Total Lifts - 2034	#/year	232,035	
23	Total Lifts - 2035	#/year	236,090	
24	Percentage Diverted of Intermodal Moves - 2013	%	0	Iowa Northern Railway Company
25	Percentage Diverted of Intermodal Moves - 2014	%	15%	
26	Percentage Diverted of Intermodal Moves - 2015	%	25%	
27	Percentage Diverted of Intermodal Moves - 2016	%	30%	
28	Percentage Diverted of Intermodal Moves - 2017	%	37%	
29	Percentage Diverted of Intermodal Moves - 2018	%	39%	
30	Percentage Diverted of Intermodal Moves - 2019	%	40%	
31	Percentage Diverted of Intermodal Moves - 2020	%	35%	
32	Percentage Diverted of Intermodal Moves - 2021	%	30%	
33	Percentage Diverted of Intermodal Moves - 2022	%	30%	
34	Percentage Diverted of Intermodal Moves - 2023	%	30%	
35	Percentage Diverted of Intermodal Moves - 2024	%	30%	
36	Percentage Diverted of Intermodal Moves - 2025	%	30%	
37	Percentage Diverted of Intermodal Moves - 2026	%	30%	
38	Percentage Diverted of Intermodal Moves - 2027	%	30%	
39	Percentage Diverted of Intermodal Moves - 2028	%	30%	
40	Percentage Diverted of Intermodal Moves - 2029	%	30%	
41	Percentage Diverted of Intermodal Moves - 2030	%	30%	
42	Percentage Diverted of Intermodal Moves - 2031	%	30%	
43	Percentage Diverted of Intermodal Moves - 2032	%	30%	
44	Percentage Diverted of Intermodal Moves - 2033	%	30%	
45	Percentage Diverted of Intermodal Moves - 2034	%	30%	
46	Percentage Diverted of Intermodal Moves - 2035	%	30%	
47	Freight Savings Per Lift: Diverted Intermodal - 2013	$/Lift	$ -	Iowa Northern Railway Company
48	Freight Savings Per Lift: Diverted Intermodal - 2014	$/Lift	$ 350	
49	Freight Savings Per Lift: Diverted Intermodal - 2015	$/Lift	$ 350	
50	Freight Savings Per Lift: Diverted Intermodal - 2016	$/Lift	$ 350	
51	Freight Savings Per Lift: Diverted Intermodal - 2017	$/Lift	$ 350	
52	Freight Savings Per Lift: Diverted Intermodal - 2018	$/Lift	$ 350	
53	Freight Savings Per Lift: Diverted Intermodal - 2019	$/Lift	$ 350	
54	Freight Savings Per Lift: Diverted Intermodal - 2020	$/Lift	$ 350	
55	Freight Savings Per Lift: Diverted Intermodal - 2021	$/Lift	$ 350	

56	Freight Savings Per Lift: Diverted Intermodal - 2022	$/Lift	$ 350	
57	Freight Savings Per Lift: Diverted Intermodal - 2023	$/Lift	$ 350	
58	Freight Savings Per Lift: Diverted Intermodal - 2024	$/Lift	$ 350	
59	Freight Savings Per Lift: Diverted Intermodal - 2025	$/Lift	$ 350	
60	Freight Savings Per Lift: Diverted Intermodal - 2026	$/Lift	$ 350	
61	Freight Savings Per Lift: Diverted Intermodal - 2027	$/Lift	$ 350	
62	Freight Savings Per Lift: Diverted Intermodal - 2028	$/Lift	$ 350	
63	Freight Savings Per Lift: Diverted Intermodal - 2029	$/Lift	$ 350	
64	Freight Savings Per Lift: Diverted Intermodal - 2030	$/Lift	$ 350	
65	Freight Savings Per Lift: Diverted Intermodal - 2031	$/Lift	$ 350	
66	Freight Savings Per Lift: Diverted Intermodal - 2032	$/Lift	$ 350	
67	Freight Savings Per Lift: Diverted Intermodal - 2033	$/Lift	$ 350	
68	Freight Savings Per Lift: Diverted Intermodal - 2034	$/Lift	$ 350	
69	Freight Savings Per Lift: Diverted Intermodal - 2035	$/Lift	$ 350	
70	Percentage Diverted From Truck to Intermodal - 2013	%	0	Iowa Northern Railway Company
71	Percentage Diverted From Truck to Intermodal - 2014	%	85%	
72	Percentage Diverted From Truck to Intermodal - 2015	%	75%	
73	Percentage Diverted From Truck to Intermodal - 2016	%	70%	
74	Percentage Diverted From Truck to Intermodal - 2017	%	63%	
75	Percentage Diverted From Truck to Intermodal - 2018	%	61%	
76	Percentage Diverted From Truck to Intermodal - 2019	%	60%	
77	Percentage Diverted From Truck to Intermodal - 2020	%	65%	
78	Percentage Diverted From Truck to Intermodal - 2021	%	70%	
79	Percentage Diverted From Truck to Intermodal - 2022	%	70%	
80	Percentage Diverted From Truck to Intermodal - 2023	%	70%	
81	Percentage Diverted From Truck to Intermodal - 2024	%	70%	
82	Percentage Diverted From Truck to Intermodal - 2025	%	70%	
83	Percentage Diverted From Truck to Intermodal - 2026	%	70%	
84	Percentage Diverted From Truck to Intermodal - 2027	%	70%	
85	Percentage Diverted From Truck to Intermodal - 2028	%	70%	
86	Percentage Diverted From Truck to Intermodal - 2029	%	70%	
87	Percentage Diverted From Truck to Intermodal - 2030	%	70%	
88	Percentage Diverted From Truck to Intermodal - 2031	%	70%	
89	Percentage Diverted From Truck to Intermodal - 2032	%	70%	
90	Percentage Diverted From Truck to Intermodal - 2033	%	70%	
91	Percentage Diverted From Truck to Intermodal - 2034	%	70%	
92	Percentage Diverted From Truck to Intermodal - 2035	%	70%	
93	Freight Savings Per Lift: Diverted From Truck - 2013	$/Lift	$ -	Iowa Northern Railway Company
94	Freight Savings Per Lift: Diverted From Truck - 2014	$/Lift	$ 900	
95	Freight Savings Per Lift: Diverted From Truck - 2015	$/Lift	$ 900	
96	Freight Savings Per Lift: Diverted From Truck - 2016	$/Lift	$ 900	
97	Freight Savings Per Lift: Diverted From Truck - 2017	$/Lift	$ 900	
98	Freight Savings Per Lift: Diverted From Truck - 2018	$/Lift	$ 900	
99	Freight Savings Per Lift: Diverted From Truck - 2019	$/Lift	$ 900	

100	Freight Savings Per Lift: Diverted From Truck - 2020	$/Lift	$ 900	
101	Freight Savings Per Lift: Diverted From Truck - 2021	$/Lift	$ 900	
102	Freight Savings Per Lift: Diverted From Truck - 2022	$/Lift	$ 900	
103	Freight Savings Per Lift: Diverted From Truck - 2023	$/Lift	$ 900	
104	Freight Savings Per Lift: Diverted From Truck - 2024	$/Lift	$ 900	
105	Freight Savings Per Lift: Diverted From Truck - 2025	$/Lift	$ 900	
106	Freight Savings Per Lift: Diverted From Truck - 2026	$/Lift	$ 900	
107	Freight Savings Per Lift: Diverted From Truck - 2027	$/Lift	$ 900	
108	Freight Savings Per Lift: Diverted From Truck - 2028	$/Lift	$ 900	
109	Freight Savings Per Lift: Diverted From Truck - 2029	$/Lift	$ 900	
110	Freight Savings Per Lift: Diverted From Truck - 2030	$/Lift	$ 900	
111	Freight Savings Per Lift: Diverted From Truck - 2031	$/Lift	$ 900	
112	Freight Savings Per Lift: Diverted From Truck - 2032	$/Lift	$ 900	
113	Freight Savings Per Lift: Diverted From Truck - 2033	$/Lift	$ 900	
114	Freight Savings Per Lift: Diverted From Truck - 2034	$/Lift	$ 900	
115	Freight Savings Per Lift: Diverted From Truck - 2035	$/Lift	$ 900	

7.1.5 Benefit Estimates

The table below shows the benefit estimates of travel time and out-of-pocket cost savings due to the UMTH project. Shipper cost savings from modal switch and shorter intermodal routes accounts for roughly 39% of the total benefits generated with this project.

Table 7: Estimates of Travel Time and Out-of-Pocket Transportation Cost Savings, Millions of 2012$

	In Project Opening Year, Discounted at 7%	Over the Project Lifecycle	
		In Constant Dollars	Discounted at 7 Percent
Shipper Savings due to Modal Switch from Truck to Rail	$3.86	$1,616.58	$702.80

7.1.6 Estimation of Short-Term Economic Impacts

The Minnesota IMPLAN Group's input-output model has been used to estimate the short-term direct, indirect and induced effects of the Manly Intermodal Hub project, in terms of employment, labor income and value added.

Employment effects represent full-time and part-time jobs created for a full year (unless noted otherwise). Labor income consists of total employee compensation (wage and salary payments, as well as health and life insurance benefits, retirement payments and any other non-cash compensation) and proprietary income (payments received by self-employed individuals as income). Value added represents total business sales (output) minus the cost of purchasing intermediate products and is roughly equivalent to gross regional/domestic product.

Estimated spending on project engineering, construction, procurement and IT integration (capital expenditures) between 2013 and 2015 is used to compute short-term economic impacts.

The project is expected to generate 477.4 job-years during the project development phase. It is also expected to create $35.98 million in value added, including 25.69 million in labor income. A breakdown of short-term impacts by type of effect (direct, indirect and induced) is provided in the table below.

Table 8: Project Spending and Economic Impacts (Direct, Indirect and Induced) during Project Development Phase

Category of Impact	Spending (Millions of 2012 Dollars)	Economic Impacts			
		Direct	Indirect	Induced	Total
Employment*	$24.61	218.2	92.4	166.8	477.4
Labor Income**		$12.20	$5.64	$7.84	$25.69
Value Added**		$13.09	$8.96	$13.93	$35.98

*Note: * Employment impacts from IMPLAN reflect total employment (full time plus part time). On average, the ratio of FTE to total employment is estimated at 90 percent. **Millions of 2012 Dollars.*

Another method to estimate job-years from additional spending uses the Council of Economic Advisors' (CEA) methodology as presented in a 2011 analysis[4]. This method assumes that for every $76,923 of government spending, one job-year is created. The following table shows the difference in job-year estimates using the IMPLAN and CEA methodologies.

Note that the estimated employment impacts are lower when using CEA's approach. Specifically, the simplified computation produces a more conservative estimate of 320 job-years (including 204.8 direct and indirect job-years and 115.2 induced jobs-years).

Table 9: Project Spending and Job-Year Estimates with IMPLAN and CEA Methodologies

	Spending (Millions of 2012 Dollars)	Employment Impacts (Job-Years)			
		Direct	Indirect	Induced	Total
IMPLAN *	$24.61	218.2	92.4	166.8	477.4
CEA		204.8		115.2	320.0

*Note: * Employment impacts from IMPLAN should not be interpreted as full-time equivalent (FTE) as they reflect the mix of full and part time jobs that is typical for each sector.*

A breakdown of short-term economic impacts (using IMPLAN estimates) in terms of employment (job-hours), labor income and value added is provided by quarter in the table below.

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[4] Executive Office of the President, Council of Economic Advisers, "Estimates of Job Creation from the American Recovery and Reinvestment Act of 2009," Washington, D.C., May 11, 2009; and September 2011 Update.

Table 10: Project Spending and Short-Term Economic Impacts by Quarter

Period	Spending (Millions of 2012 Dollars)*	Economic Impacts			
		Total Job-Hours**	Direct Job-Hours**	Total Labor Income (Millions of 2012 Dollars)	Total Value Added (Millions of 2012 Dollars)
2014 - Q1	$5.85	3,911.7	1,787.9	$6.10	$8.55
2014 - Q2	$5.85	3,911.7	1,787.9	$6.10	$8.55
2014 - Q3	$5.85	3,911.7	1,787.9	$6.10	$8.55
2014 - Q4	$5.85	3,911.7	1,787.9	$6.10	$8.55
2015 - Q1	$0.62	411.8	188.2	$0.64	$0.90
2015 – Q2	$0.62	411.8	188.2	$0.64	$0.90
Total	**$24.61**	**16,470.3**	**7,527.9**	**$25.69**	**$35.98**

*Notes: * based on project spending on construction ($24.61 million); ** assuming average weekly hours of 34.5 (Bureau of Labor Statistics estimate).*

The table below presents the short-term increase in employment and labor income resulting from capital expenditures in key industries employing low-income people. 77.1 cumulative job-years (or 16.1 percent of total job-years) are expected to be created in those industries by the end of 2015, bringing in an additional $2.25 million in labor income.

Table 11: Short-Term Impacts in Key Industries Employing Low-Income People

Sectors	Employment (Job-Years)	Labor Income (Millions of 2012 Dollars)
Retail Industries	32.7	$1.04
Services to buildings and dwellings	5.2	$0.13
Other business services	4.5	$0.15
Food services and drinking places	17.9	$0.40
Hotel/accommodation services	2.4	$0.09
Personal care and other personal Services	14.4	$0.44
Total	**77.1**	**$2.25**

Note: Low-income sectors are identified in BLS, A Profile of the Working Poor, March 2009; BLS, Characteristics of Minimum Wage Workers, March 2009; and Carsey Institute, Issue Brief No. 2, Summer 2008.

7.2 Livability

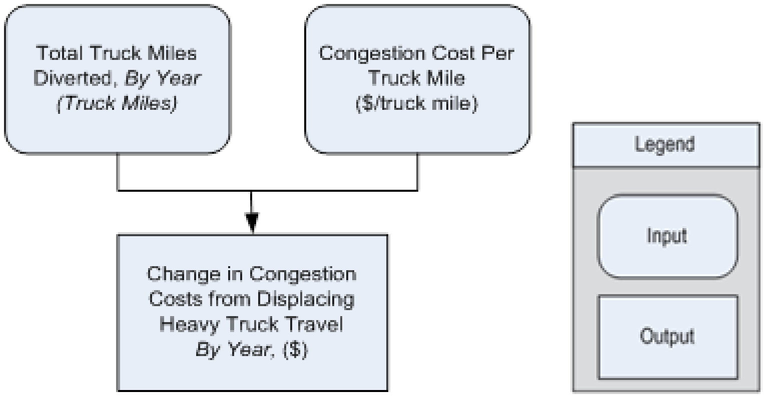
The proposed project would contribute to enhancing livability and quality of life in the study area through the reduction in highway congestion from displacing heavy truck travel to rail. This represents the time savings of the remaining on-road motorists.

7.2.1 Methodology

Reduction in Highway Congestion Costs from Displacing Heavy Truck Travel to Rail

The proposed UMTH project will divert freight from road to rail resulting in a reduction in the use of public highways by heavy trucks. This benefit category estimates the avoided highway congestion costs by applying the total diverted truck miles to a rate of congestion cost per mile. The figure below outlines the structure and logic model of the benefit calculation.

Figure 4: Reduction in Highway Congestion Costs



7.2.2 Assumptions

The assumptions used in the estimation of livability benefits are summarized in the table below.

Table 12: Assumptions used in the Estimation of Livability Benefits

Input #	Input Name	Units	Value	Source/Comment
1	Truck Congestion Cost	$/mile	$0.1075	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 13. Assuming 50/50 split of 60 & 80 kip and 35/65 urban/rural split. 8.0645 cents to $2012 at 1.333298 factor.

2	Rail Congestion Cost	$/mile	$0.00	Congestion delays occur on railroads, but costs of delays to trains are internal because one carrier is responsible for all the freight on the rail system. Therefore the cost of congestion is included in the rail rate cost. Transportation Research Board. Paying Our Way: Estimating Marginal Social Costs of Freight Transportation. 1996.
3	Truck Miles Diverted to Rail - 2013	miles/year	-	Iowa Northern Railway Company
4	Truck Miles Diverted to Rail - 2014	miles/year	12,468,750	
5	Truck Miles Diverted to Rail - 2015	miles/year	75,703,125	
6	Truck Miles Diverted to Rail - 2016	miles/year	103,500,000	
7	Truck Miles Diverted to Rail - 2017	miles/year	119,053,125	
8	Truck Miles Diverted to Rail - 2018	miles/year	131,837,625	
9	Truck Miles Diverted to Rail - 2019	miles/year	146,629,200	
10	Truck Miles Diverted to Rail - 2020	miles/year	177,491,475	
11	Truck Miles Diverted to Rail - 2021	miles/year	199,016,453	
12	Truck Miles Diverted to Rail - 2022	miles/year	210,762,889	
13	Truck Miles Diverted to Rail - 2023	miles/year	214,978,146	
14	Truck Miles Diverted to Rail - 2024	miles/year	218,874,030	
15	Truck Miles Diverted to Rail - 2025	miles/year	222,843,794	
16	Truck Miles Diverted to Rail - 2026	miles/year	226,888,876	
17	Truck Miles Diverted to Rail - 2027	miles/year	231,010,742	
18	Truck Miles Diverted to Rail - 2028	miles/year	235,210,887	
19	Truck Miles Diverted to Rail - 2029	miles/y		

		ear	239,490,833	
20	Truck Miles Diverted to Rail - 2030	miles/year	243,637,879	
21	Truck Miles Diverted to Rail - 2031	miles/year	247,864,652	
22	Truck Miles Diverted to Rail - 2032	miles/year	252,172,730	
23	Truck Miles Diverted to Rail - 2033	miles/year	256,563,724	
24	Truck Miles Diverted to Rail - 2034	miles/year	261,039,275	
25	Truck Miles Diverted to Rail - 2035	miles/year	265,601,059	

7.2.3 Benefit Estimates

The table below shows the benefit estimates of road congestion savings due to the UMTH project. Congestion savings from modal switch and shorter intermodal routes accounts for roughly 11% of the total benefits generated with this project.

Table 13: Estimates of Livability Benefits, Millions of 2012$

	In Project Opening Year, Discounted at 7%	Over the Project Lifecycle	
		In Constant Dollars	Discounted at 7 Percent
Reduced Road Congestion due to Modal Switch from Truck to Rail	$1.25	$461.56	$199.74

7.3 Environmental Sustainability

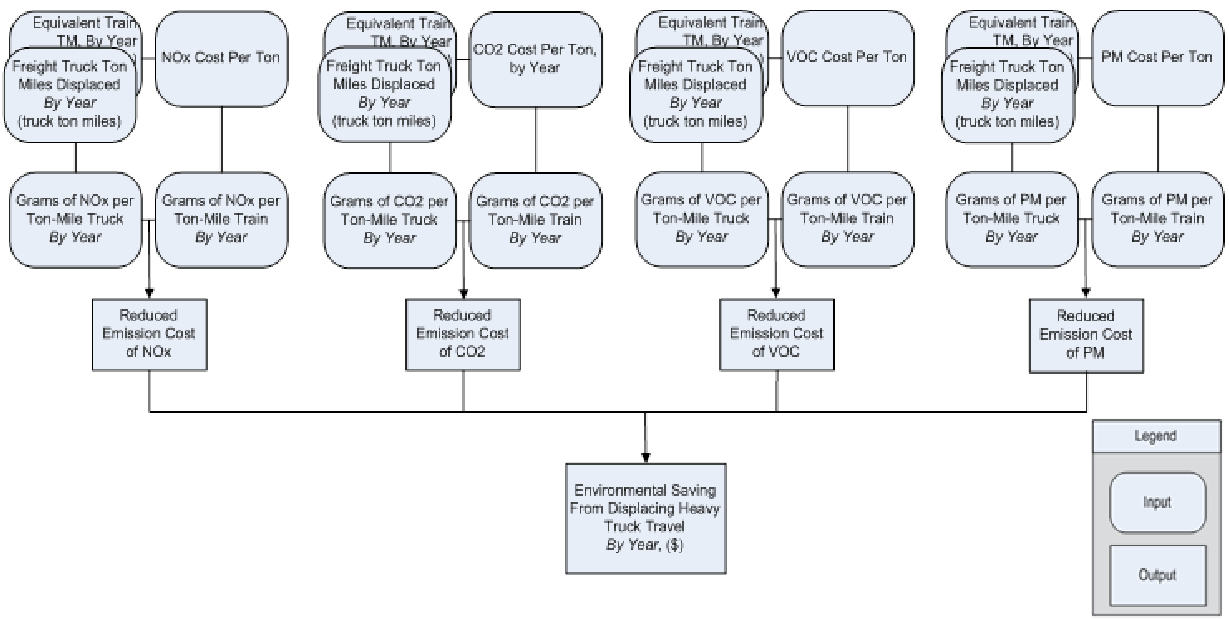
The proposed project would contribute to environmental sustainability through Emission Savings from Diverting Heavy Truck Travel to Rail.

7.3.1 Methodology

Emission Savings from Diverting Heavy Truck Travel to Rail

Freight carried over the rail network imposes less environmental impacts for the same amount of cargo than those imposed by trucks on the highway network. This benefit category estimates the value of the reduced environmental emissions associated with transporting goods on rail as opposed to by truck. The amount of greenhouse gas (GHG) and critical air contaminants (CAC) are calculated on the basis of pollutants generated per ton-mile travelled by truck and train shipping in the base and alternative cases. The monetized value of environmental savings is then calculated by applying the social cost of emissions to the relative difference in truck versus rail emissions. The structure and logic model outlining this calculation is provided in the figure below.

Figure 5: Emission Savings S&L



7.3.2 Assumptions

The assumptions used in the estimation of sustainability benefits are summarized in the table below.

Table 14: Assumptions used in the Estimation of Environmental Sustainability Benefits

Input #	Input Name	Units	Value	Source/Comment
1	Grams of NOx per truck ton-mile -	grams/TM	0.47	United States

	2013			Environmental Protection Agency, Motor Vehicle Emission Simulator, 2010.
2	Grams of NOx per truck ton-mile - 2014	grams/TM	0.42	
3	Grams of NOx per truck ton-mile - 2015	grams/TM	0.38	
4	Grams of NOx per truck ton-mile - 2016	grams/TM	0.35	
5	Grams of NOx per truck ton-mile - 2017	grams/TM	0.32	
6	Grams of NOx per truck ton-mile - 2018	grams/TM	0.29	
7	Grams of NOx per truck ton-mile - 2019	grams/TM	0.27	
8	Grams of NOx per truck ton-mile - 2020	grams/TM	0.25	
9	Grams of NOx per truck ton-mile - 2021	grams/TM	0.23	
10	Grams of NOx per truck ton-mile - 2022	grams/TM	0.22	
11	Grams of NOx per truck ton-mile - 2023	grams/TM	0.21	
12	Grams of NOx per truck ton-mile - 2024	grams/TM	0.20	
13	Grams of NOx per truck ton-mile - 2025	grams/TM	0.19	
14	Grams of NOx per truck ton-mile - 2026	grams/TM	0.18	
15	Grams of NOx per truck ton-mile - 2027	grams/TM	0.18	
16	Grams of NOx per truck ton-mile - 2028	grams/TM	0.17	
17	Grams of NOx per truck ton-mile - 2029	grams/TM	0.17	
18	Grams of NOx per truck ton-mile - 2030	grams/TM	0.17	
19	Grams of NOx per truck ton-mile - 2031	grams/TM	0.16	
20	Grams of NOx per truck ton-mile - 2032	grams/TM	0.16	
21	Grams of NOx per truck ton-mile - 2033	grams/TM	0.16	
22	Grams of NOx per truck ton-mile - 2034	grams/TM	0.16	
23	Grams of NOx per truck ton-mile - 2035	grams/TM	0.16	
24	Grams of NOx per train ton-mile - 2013	grams/TM	0.29	United States Environmental Protection
25	Grams of NOx per train ton-mile - 2014	grams/TM	0.28	
26	Grams of NOx per train ton-mile - 2015	grams/TM	0.27	

27	Grams of NOx per train ton-mile - 2016	grams/TM	0.25	Agency, Office of Transportation and Air Quality, "Emission Factors for Locomotives", EPA-420-F-09-025, April 2009.
28	Grams of NOx per train ton-mile - 2017	grams/TM	0.24	
29	Grams of NOx per train ton-mile - 2018	grams/TM	0.23	
30	Grams of NOx per train ton-mile - 2019	grams/TM	0.21	
31	Grams of NOx per train ton-mile - 2020	grams/TM	0.21	
32	Grams of NOx per train ton-mile - 2021	grams/TM	0.20	
33	Grams of NOx per train ton-mile - 2022	grams/TM	0.19	
34	Grams of NOx per train ton-mile - 2023	grams/TM	0.18	
35	Grams of NOx per train ton-mile - 2024	grams/TM	0.16	
36	Grams of NOx per train ton-mile - 2025	grams/TM	0.15	
37	Grams of NOx per train ton-mile - 2026	grams/TM	0.14	
38	Grams of NOx per train ton-mile - 2027	grams/TM	0.14	
39	Grams of NOx per train ton-mile - 2028	grams/TM	0.13	
40	Grams of NOx per train ton-mile - 2029	grams/TM	0.12	
41	Grams of NOx per train ton-mile - 2030	grams/TM	0.11	
42	Grams of NOx per train ton-mile - 2031	grams/TM	0.10	
43	Grams of NOx per train ton-mile - 2032	grams/TM	0.10	
44	Grams of NOx per train ton-mile - 2033	grams/TM	0.09	
45	Grams of NOx per train ton-mile - 2034	grams/TM	0.08	
46	Grams of NOx per train ton-mile - 2035	grams/TM	0.08	
47	Grams of CO2 per truck ton-mile - 2013	grams/TM	102.91	United States Environmental Protection Agency, Motor Vehicle Emission Simulator, 2010.
48	Grams of CO2 per truck ton-mile - 2014	grams/TM	102.92	
49	Grams of CO2 per truck ton-mile - 2015	grams/TM	102.93	
50	Grams of CO2 per truck ton-mile - 2016	grams/TM	102.94	
51	Grams of CO2 per truck ton-mile - 2017	grams/TM	102.95	
52	Grams of CO2 per truck ton-mile - 2018	grams/TM	102.95	
53	Grams of CO2 per truck ton-mile - 2019	grams/TM	102.95	
54	Grams of CO2 per truck ton-mile - 2020	grams/TM	102.96	
55	Grams of CO2 per truck ton-mile - 2021	grams/TM	102.96	
56	Grams of CO2 per truck ton-mile - 2022	grams/TM	102.96	
57	Grams of CO2 per truck ton-mile - 2023	grams/TM	102.96	
58	Grams of CO2 per truck ton-mile - 2024	grams/TM	102.96	
59	Grams of CO2 per truck ton-mile - 2025	grams/TM	102.96	

60	Grams of CO_2 per truck ton-mile - 2026	grams/TM	102.96	
61	Grams of CO_2 per truck ton-mile - 2027	grams/TM	102.95	
62	Grams of CO_2 per truck ton-mile - 2028	grams/TM	102.95	
63	Grams of CO_2 per truck ton-mile - 2029	grams/TM	102.95	
64	Grams of CO_2 per truck ton-mile - 2030	grams/TM	102.95	
65	Grams of CO_2 per truck ton-mile - 2031	grams/TM	102.94	
66	Grams of CO_2 per truck ton-mile - 2032	grams/TM	102.94	
67	Grams of CO_2 per truck ton-mile - 2033	grams/TM	102.94	
68	Grams of CO_2 per truck ton-mile - 2034	grams/TM	102.94	
69	Grams of CO_2 per truck ton-mile - 2035	grams/TM	102.94	
70	Grams of CO_2 per train ton-mile - 2013	grams/TM	21.27	United States Environmental Protection Agency, Office of Transportation and Air Quality, "Emission Factors for Locomotives", EPA-420-F-09-025, April 2009.
71	Grams of CO_2 per train ton-mile - 2014	grams/TM	21.27	
72	Grams of CO_2 per train ton-mile - 2015	grams/TM	21.27	
73	Grams of CO_2 per train ton-mile - 2016	grams/TM	21.27	
74	Grams of CO_2 per train ton-mile - 2017	grams/TM	21.27	
75	Grams of CO_2 per train ton-mile - 2018	grams/TM	21.27	
76	Grams of CO_2 per train ton-mile - 2019	grams/TM	21.27	
77	Grams of CO_2 per train ton-mile - 2020	grams/TM	21.27	
78	Grams of CO_2 per train ton-mile - 2021	grams/TM	21.27	
79	Grams of CO_2 per train ton-mile - 2022	grams/TM	21.27	
80	Grams of CO_2 per train ton-mile - 2023	grams/TM	21.27	
81	Grams of CO_2 per train ton-mile - 2024	grams/TM	21.27	
82	Grams of CO_2 per train ton-mile - 2025	grams/TM	21.27	
83	Grams of CO_2 per train ton-mile - 2026	grams/TM	21.27	
84	Grams of CO_2 per train ton-mile - 2027	grams/TM	21.27	
85	Grams of CO_2 per train ton-mile - 2028	grams/TM	21.27	
86	Grams of CO_2 per train ton-mile - 2029	grams/TM	21.27	
87	Grams of CO_2 per train ton-mile - 2030	grams/TM	21.27	
88	Grams of CO_2 per train ton-mile - 2031	grams/TM	21.27	
89	Grams of CO_2 per train ton-mile - 2032	grams/TM	21.27	
90	Grams of CO_2 per train ton-mile - 2033	grams/TM	21.27	
91	Grams of CO_2 per train ton-mile - 2034	grams/TM	21.27	
92	Grams of CO_2 per train ton-mile - 2035	grams/TM	21.27	
93	Grams of PM per truck ton-mile - 2013	grams/TM	0.018	United States Environmental Protection
94	Grams of PM per truck ton-mile - 2014	grams/TM	0.016	
95	Grams of PM per truck ton-mile - 2015	grams/TM	0.013	

96	Grams of PM per truck ton-mile - 2016	grams/TM	0.012	Agency, Motor Vehicle Emission Simulator, 2010.
97	Grams of PM per truck ton-mile - 2017	grams/TM	0.010	
98	Grams of PM per truck ton-mile - 2018	grams/TM	0.008	
99	Grams of PM per truck ton-mile - 2019	grams/TM	0.007	
100	Grams of PM per truck ton-mile - 2020	grams/TM	0.006	
101	Grams of PM per truck ton-mile - 2021	grams/TM	0.005	
102	Grams of PM per truck ton-mile - 2022	grams/TM	0.005	
103	Grams of PM per truck ton-mile - 2023	grams/TM	0.004	
104	Grams of PM per truck ton-mile - 2024	grams/TM	0.004	
105	Grams of PM per truck ton-mile - 2025	grams/TM	0.003	
106	Grams of PM per truck ton-mile - 2026	grams/TM	0.003	
107	Grams of PM per truck ton-mile - 2027	grams/TM	0.003	
108	Grams of PM per truck ton-mile - 2028	grams/TM	0.002	
109	Grams of PM per truck ton-mile - 2029	grams/TM	0.002	
110	Grams of PM per truck ton-mile - 2030	grams/TM	0.002	
111	Grams of PM per truck ton-mile - 2031	grams/TM	0.002	
112	Grams of PM per truck ton-mile - 2032	grams/TM	0.002	
113	Grams of PM per truck ton-mile - 2033	grams/TM	0.002	
114	Grams of PM per truck ton-mile - 2034	grams/TM	0.002	
115	Grams of PM per truck ton-mile - 2035	grams/TM	0.002	
116	Grams of PM per train ton-mile - 2013	grams/TM	0.008	United States Environmental Protection Agency, Office of Transportation and Air Quality, "Emission Factors for Locomotives", EPA-420-F-09-025, April 2009.
117	Grams of PM per train ton-mile - 2014	grams/TM	0.008	
118	Grams of PM per train ton-mile - 2015	grams/TM	0.007	
119	Grams of PM per train ton-mile - 2016	grams/TM	0.006	
120	Grams of PM per train ton-mile - 2017	grams/TM	0.006	
121	Grams of PM per train ton-mile - 2018	grams/TM	0.006	
122	Grams of PM per train ton-mile - 2019	grams/TM	0.005	
123	Grams of PM per train ton-mile - 2020	grams/TM	0.005	
124	Grams of PM per train ton-mile - 2021	grams/TM	0.005	
125	Grams of PM per train ton-mile - 2022	grams/TM	0.004	
126	Grams of PM per train ton-mile - 2023	grams/TM	0.004	
127	Grams of PM per train ton-mile - 2024	grams/TM	0.004	
128	Grams of PM per train ton-mile - 2025	grams/TM	0.003	
129	Grams of PM per train ton-mile - 2026	grams/TM	0.003	
130	Grams of PM per train ton-mile - 2027	grams/TM	0.003	
131	Grams of PM per train ton-mile - 2028	grams/TM	0.003	
132	Grams of PM per train ton-mile - 2029	grams/TM	0.002	
133	Grams of PM per train ton-mile - 2030	grams/TM	0.002	
134	Grams of PM per train ton-mile - 2031	grams/TM	0.002	
135	Grams of PM per train ton-mile - 2032	grams/TM	0.002	
136	Grams of PM per train ton-mile - 2033	grams/TM	0.002	
137	Grams of PM per train ton-mile - 2034	grams/TM	0.001	
138	Grams of PM per train ton-mile - 2035	grams/TM	0.001	
139	Grams of VOC per truck ton-mile -	grams/TM	0.043	United States

	2013			Environmental Protection Agency, Motor Vehicle Emission Simulator, 2010.
140	Grams of VOC per truck ton-mile - 2014	grams/TM	0.041	
141	Grams of VOC per truck ton-mile - 2015	grams/TM	0.039	
142	Grams of VOC per truck ton-mile - 2016	grams/TM	0.038	
143	Grams of VOC per truck ton-mile - 2017	grams/TM	0.036	
144	Grams of VOC per truck ton-mile - 2018	grams/TM	0.035	
145	Grams of VOC per truck ton-mile - 2019	grams/TM	0.034	
146	Grams of VOC per truck ton-mile - 2020	grams/TM	0.033	
147	Grams of VOC per truck ton-mile - 2021	grams/TM	0.033	
148	Grams of VOC per truck ton-mile - 2022	grams/TM	0.032	
149	Grams of VOC per truck ton-mile - 2023	grams/TM	0.031	
150	Grams of VOC per truck ton-mile - 2024	grams/TM	0.031	
151	Grams of VOC per truck ton-mile - 2025	grams/TM	0.031	
152	Grams of VOC per truck ton-mile - 2026	grams/TM	0.030	
153	Grams of VOC per truck ton-mile - 2027	grams/TM	0.030	
154	Grams of VOC per truck ton-mile - 2028	grams/TM	0.030	
155	Grams of VOC per truck ton-mile - 2029	grams/TM	0.030	
156	Grams of VOC per truck ton-mile - 2030	grams/TM	0.029	
157	Grams of VOC per truck ton-mile - 2031	grams/TM	0.029	
158	Grams of VOC per truck ton-mile - 2032	grams/TM	0.029	
159	Grams of VOC per truck ton-mile - 2033	grams/TM	0.029	
160	Grams of VOC per truck ton-mile - 2034	grams/TM	0.029	
161	Grams of VOC per truck ton-mile - 2035	grams/TM	0.029	
162	Grams of VOC per train ton-mile - 2013	grams/TM	0.014	United States Environmental Protection
163	Grams of VOC per train ton-mile - 2014	grams/TM	0.013	
164	Grams of VOC per train ton-mile - 2015	grams/TM	0.013	

165	Grams of VOC per train ton-mile - 2016	grams/TM	0.011	Agency, Office of Transportation and Air Quality, "Emission Factors for Locomotives", EPA-420-F-09-025, April 2009.
166	Grams of VOC per train ton-mile - 2017	grams/TM	0.010	
167	Grams of VOC per train ton-mile - 2018	grams/TM	0.009	
168	Grams of VOC per train ton-mile - 2019	grams/TM	0.009	
169	Grams of VOC per train ton-mile - 2020	grams/TM	0.008	
170	Grams of VOC per train ton-mile - 2021	grams/TM	0.007	
171	Grams of VOC per train ton-mile - 2022	grams/TM	0.007	
172	Grams of VOC per train ton-mile - 2023	grams/TM	0.007	
173	Grams of VOC per train ton-mile - 2024	grams/TM	0.006	
174	Grams of VOC per train ton-mile - 2025	grams/TM	0.006	
175	Grams of VOC per train ton-mile - 2026	grams/TM	0.005	
176	Grams of VOC per train ton-mile - 2027	grams/TM	0.005	
177	Grams of VOC per train ton-mile - 2028	grams/TM	0.005	
178	Grams of VOC per train ton-mile - 2029	grams/TM	0.004	
179	Grams of VOC per train ton-mile - 2030	grams/TM	0.004	
180	Grams of VOC per train ton-mile - 2031	grams/TM	0.004	
181	Grams of VOC per train ton-mile - 2032	grams/TM	0.004	
182	Grams of VOC per train ton-mile - 2033	grams/TM	0.003	
183	Grams of VOC per train ton-mile - 2034	grams/TM	0.003	
184	Grams of VOC per train ton-mile - 2035	grams/TM	0.003	
185	NOx cost per ton	2012$/short ton	$5,241	Tiger V guidelines. Corporate Average Fuel Economy for MY2012-MY2016 Passenger Cars and Light Trucks (March 2010), page 403, Table VIII-8, "Economic Values for Benefits Computations (2007 Dollars)"
186	CO2 cost per ton - 2014	2012$/short ton	$22.90	Tiger V guidelines. Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (February 2010), page 39, Table A-1 "Annual SCC Values 2010-2050
187	CO2 cost per ton - 2014	2012$/short ton	$23.41	
188	CO2 cost per ton - 2015	2012$/short ton	$23.91	
189	CO2 cost per ton - 2016	2012$/short ton	$24.41	
190	CO2 cost per ton - 2017	2012$/short ton	$24.91	
191	CO2 cost per ton - 2018	2012$/short	$25.41	

		ton		(in 2007 dollars)”
192	CO2 cost per ton - 2019	2012$/short ton	$25.92	
193	CO2 cost per ton - 2020	2012$/short ton	$26.42	
194	CO2 cost per ton - 2021	2012$/short ton	$27.12	
195	CO2 cost per ton - 2022	2012$/short ton	$27.73	
196	CO2 cost per ton - 2023	2012$/short ton	$28.43	
197	CO2 cost per ton - 2024	2012$/short ton	$29.03	
198	CO2 cost per ton - 2025	2012$/short ton	$29.73	
199	CO2 cost per ton - 2026	2012$/short ton	$30.34	
200	CO2 cost per ton - 2027	2012$/short ton	$31.04	
201	CO2 cost per ton - 2028	2012$/short ton	$31.64	
202	CO2 cost per ton - 2029	2012$/short ton	$32.25	
203	CO2 cost per ton - 2030	2012$/short ton	$32.95	
204	CO2 cost per ton - 2031	2012$/short ton	$33.55	
205	CO2 cost per ton - 2032	2012$/short ton	$34.25	
206	CO2 cost per ton - 2033	2012$/short ton	$34.86	
207	CO2 cost per ton - 2034	2012$/short ton	$35.56	
208	CO2 cost per ton - 2035	2012$/short ton	$36.16	
209	PM cost per ton	2012$/short ton	$ 286,714.29	Tiger V guidelines. Corporate Average Fuel Economy for MY2012-MY2016 Passenger Cars and Light Trucks (March 2010), page 403, Table VIII-8, "Economic Values for Benefits

				Computations (2007 Dollars)"
210	VOC cost per ton	2012$/short ton	$1,286	Tiger V guidelines. Corporate Average Fuel Economy for MY2012-MY2016 Passenger Cars and Light Trucks (March 2010), page 403, Table VIII-8, "Economic Values for Benefits Computations (2007 Dollars)"
211	Truck to Rail Distance Factor	#	1.12	Iowa Northern Railway Company

7.3.3 Benefit Estimates

The table below shows the benefit estimates of emissions savings due to the UMTH project. The greenhouse gas and criteria air contaminant savings account for roughly 9% of the total benefits generated with this project.

Table 15: Estimates of Environmental Sustainability Benefits, Millions of 2012$

	In Project Opening Year, Discounted at 7%	Over the Project Lifecycle	
		In Constant Dollars	Discounted at 7 Percent
Emission Cost Savings due to Modal Switch from Truck to Rail	$0.65	$252.06	$162.50

7.4 Safety

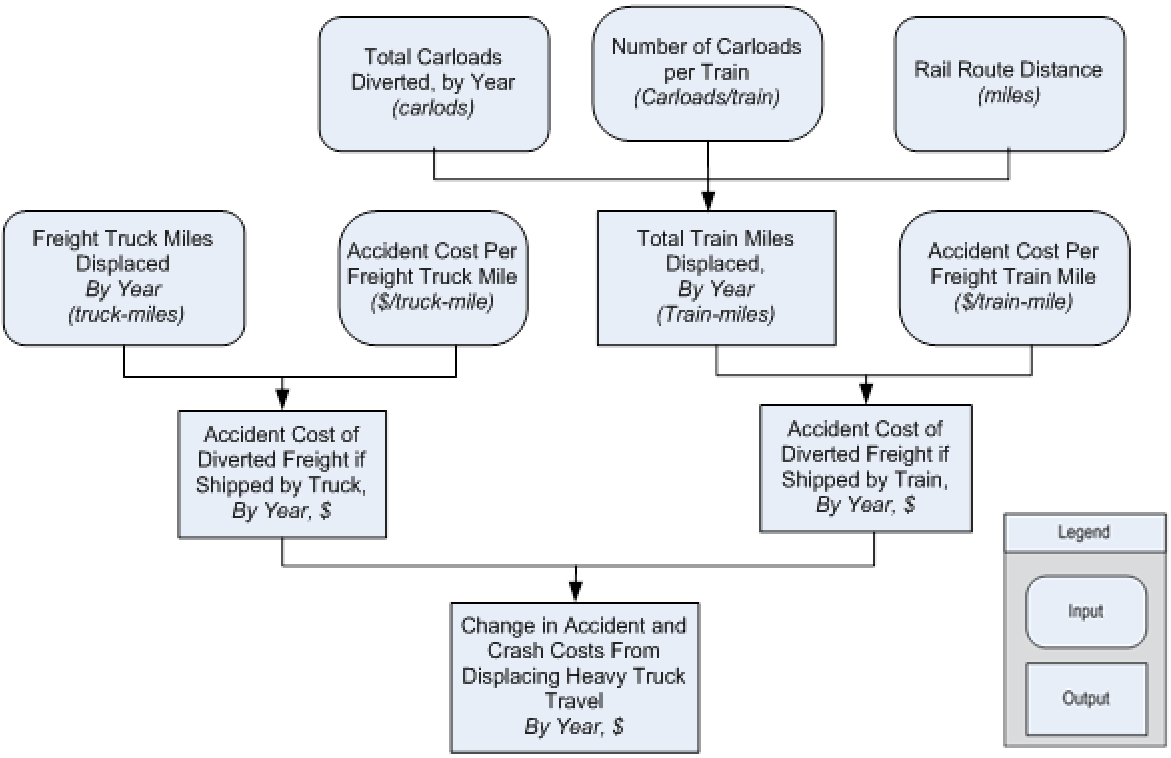
The proposed project would contribute to promoting DOT's safety long-term outcome through a reduction in accident costs (through reduced fatalities and injuries) from diverting heavy truck travel to rail.

7.4.1 Methodology

Reduced Accident Costs from Diverting Heavy Truck Travel to Rail

Fatality and injury rates per mile of freight carried by truck are greater than the fatality and injury rates for an equal volume of cargo when shipped by rail. This benefit captures the different accident rates per truck-mile and train-mile. The accident value used here is recommended by Tiger Guidelines for accident values and based on accident rate data published by the US DOT, Bureau of Transportation Statistics. The logic model outlining this calculation is provided in the figure below.

Figure 6: Reduced Accident Costs S&L



7.4.2 Assumptions

The assumptions used in the estimation of safety benefits are summarized in the table below.

Table 16: Assumptions used in the Estimation of Safety Benefits

Input #	Input Name	Units	Value	Source/Comment
1	Accident Cost per Truck Mile	2012$/truck miles	$0.225	HDR Calculations based on Tiger Guidelines for Accident Values. US DOT, Bureau of Transportation Statistics for accident data and mileage statistics.
2	Accident Cost per Train Mile	2012$/train miles	$7.439	HDR Calculations based on Tiger Guidelines for Accident Values. US DOT, Bureau of Transportation Statistics for accident data and mileage statistics.
3	Total Number of Train Miles Incurred - 2013	carloads	0	Iowa Northern Railway Company
4	Total Number of Train Miles Incurred - 2014	carloads	22,167	
5	Total Number of Train Miles Incurred - 2015	carloads	134,583	
6	Total Number of Train Miles Incurred - 2016	carloads	184,000	
7	Total Number of Train Miles Incurred - 2017	carloads	211,650	
8	Total Number of Train Miles Incurred - 2018	carloads	234,378	
9	Total Number of Train Miles Incurred - 2019	carloads	260,674	
10	Total Number of Train Miles Incurred - 2020	carloads	315,540	
11	Total Number of Train Miles Incurred - 2021	carloads	353,807	
12	Total Number of Train Miles Incurred - 2022	carloads	374,690	
13	Total Number of Train Miles Incurred - 2023	carloads	382,183	
14	Total Number of Train Miles Incurred - 2024	carloads	389,109	
15	Total Number of Train Miles Incurred - 2025	carloads	396,167	
16	Total Number of Train Miles Incurred - 2026	carloads	403,358	
17	Total Number of Train Miles Incurred - 2027	carloads	410,686	
18	Total Number of Train Miles Incurred - 2028	carloads	418,153	
19	Total Number of Train Miles Incurred - 2029	carloads	425,761	
20	Total Number of Train Miles Incurred - 2030	carloads	433,134	
21	Total Number of Train Miles Incurred - 2031	carloads	440,648	
22	Total Number of Train Miles Incurred - 2032	carloads	448,307	
23	Total Number of Train Miles Incurred - 2033	carloads	456,113	
24	Total Number of Train Miles Incurred - 2034	carloads	464,070	
25	Total Number of Train Miles Incurred - 2035	carloads	472,180	
26	Average Number of Carloads per Train	carloads/train	200.0	Iowa Northern

				Railway Company
27	Average Tons per Carload	tons/carload	63.0	Association of American Railroads (Jan 10, 2013) Class I Railroad Statistics

Input #	Input Name	Units	Value	Source/Comment
1	Accident Cost per Truck Mile	2012$/truck miles	$0.225	HDR Calculations based on Tiger Guidelines for Accident Values. US DOT, Bureau of Transportation Statistics for accident data and mileage statistics.
2	Accident Cost per Train Mile	2012$/train miles	$7.439	HDR Calculations based on Tiger Guidelines for Accident Values. US DOT, Bureau of Transportation Statistics for accident data and mileage statistics.
24	Total Number of Train Miles Incurred - 2013	carloads	0	Iowa Northern Railway Company
25	Total Number of Train Miles Incurred - 2014	carloads	22,167	
26	Total Number of Train Miles Incurred - 2015	carloads	134,583	
27	Total Number of Train Miles Incurred - 2016	carloads	184,000	
28	Total Number of Train Miles Incurred - 2017	carloads	211,650	
29	Total Number of Train Miles Incurred - 2018	carloads	234,378	
30	Total Number of Train Miles Incurred - 2019	carloads	260,674	
31	Total Number of Train Miles Incurred - 2020	carloads	315,540	
32	Total Number of Train Miles Incurred - 2021	carloads	353,807	
33	Total Number of Train Miles Incurred - 2022	carloads	374,690	
34	Total Number of Train Miles Incurred - 2023	carloads	382,183	
35	Total Number of Train Miles Incurred - 2024	carloads	389,109	
36	Total Number of Train Miles Incurred - 2025	carloads	396,167	
37	Total Number of Train Miles Incurred - 2026	carloads	403,358	
38	Total Number of Train Miles Incurred - 2027	carloads	410,686	
39	Total Number of Train Miles Incurred - 2028	carloads	418,153	
40	Total Number of Train Miles Incurred - 2029	carloads	425,761	
41	Total Number of Train Miles Incurred - 2030	carloads	433,134	
42	Total Number of Train Miles Incurred - 2031	carloads	440,648	
43	Total Number of Train Miles Incurred - 2032	carloads	448,307	

44	Total Number of Train Miles Incurred - 2033	carloads	456,113	
45	Total Number of Train Miles Incurred - 2034	carloads	464,070	
46	Total Number of Train Miles Incurred - 2035	carloads	472,180	
47	Average Number of Carloads per Train	carloads/train	200.0	Iowa Northern Railway Company
48	Average Tons per Carload	tons/carload	63	Association of American Railroads (Jan 10, 2013) Class I Railroad Statistics

7.4.3 Benefit Estimates

The table below shows the benefit estimates of improved safety due to the UMTH project. The reductions in accidents due to less truck miles accounts for roughly 22% of the total benefits generated with this project.

Table 17: Estimates of Safety Benefits, 2012$

	In Project Opening Year, Discounted at 7%	Over the Project Lifecycle	
		In Constant Dollars	Discounted at 7 Percent
Accident Cost Savings due to Modal Switch from Truck to Rail	$2.46	$907.93	$392.90

8. Summary of Findings and BCA Outcomes

The tables below summarize the BCA findings. Annual costs and benefits are computed over the lifecycle of the project (2013-2035). As stated earlier, construction is expected to be completed by the end of 2015. Benefits accrue during the full operation of the project and begin in 2014.

Table 18: Overall Results of the Benefit Cost Analysis, Millions of 2012$*

Project Evaluation Metric	7% Discount Rate	3% Discount Rate
Total Discounted Benefits	$1,809.59	$2,756.93
Total Discounted Costs	$221.33	$331.66
Net Present Value	$1,588.26	$2,425.27
Benefit / Cost Ratio	8.18	8.31
Payback Period (years)	1.24	

** Unless Specified Otherwise*

Considering all monetized benefits and costs, with a 7 percent real discount rate, the $221.3 million investment would result in $1,810 million in total benefits and a Benefit/Cost ratio of approximately 8.18.

With a 3 percent real discount rate, the Net Present Value of the project would increase to $2,425 million, for a Benefit/Cost ratio of 8.31.

Table 19: Benefit Estimates by Long-Term Outcome for the Full Project, Millions of 2012$

Long-Term Outcomes	Benefit Categories	7% Discount Rate	3% Discount Rate
State of Good Repair	Avoided Pavement Maintenance Costs	$351.65	$553.33
Economic Competitiveness	Shipper Savings due to Modal Switch from Truck to Rail	$702.80	$1,102.98
Livability	Reduced Road Congestion due to Modal Switch from Truck to Rail	$199.74	$314.30
Environmental Sustainability	Emission Cost Savings due to Modal Switch from Truck to Rail	$162.50	$168.06
Safety	Accident Cost Savings due to Modal Switch from Truck to Rail	$392.90	$618.25
Total Benefit Estimates		**$1,809.59**	**$2,756.93**

Note: * Excluding the short-term employment impacts of the project

9. BCA Sensitivity/Alternative Analysis

The BCA outcomes presented in the previous sections rely on a large number of assumptions and long-term projections; both of which are subject to considerable uncertainty.

The primary purpose of the sensitivity analysis is to help identify the variables and model parameters whose variations have the greatest impact on the BCA outcomes: the "critical variables."

The sensitivity analysis can also be used to:

- Evaluate the impact of changes in individual critical variables – how much the final results would vary with reasonable departures from the "preferred" or most likely value for the variable; and
- Assess the robustness of the BCA and evaluate, in particular, whether the conclusions reached under the "preferred" set of input values are significantly altered by reasonable departures from those values.

The outcomes of the quantitative analysis for the Upper Midwest Transportation Hub at Manly, Iowa using a 7 percent discount rate are summarized in the table below. The table provides the percentage changes in project NPV associated with variations in variables or parameters (listed in row), as indicated in the column headers.

For example, a 25 percent increase in the capital costs of the project leads to a 0.4 percent reduction in the project NPV. A 25 percent decrease raises the project NPV by 0.4 percent.

The main driver in this particular analysis is the volume of truck to rail diversion. In order to illustrate a substantially wide range of possible outcomes, the annual truck miles reduced was adjusted by 25%. The impact of these values carries through to every impact of the study which is evident by the significant changes in NPV with a 7 percent discount rate (-17.4% and +17.4% respectively). Nonetheless, the B/C ratio remains exceptionally favorable (6.93 and 9.43

respectively). **In summary, this sensitivity analysis provides compelling evidence that that this project will generate significant net benefits and a high return on investment.**

Table 20: Quantitative Assessment of Sensitivity, Summary

Parameters	Change in Parameter Value	New NPV (7% discounted)	Change in NPV	New B/C Ratio (7% discounted)
Truck Miles Saved	25% Increase	$1,864.96	17.4%	9.43
	25% Decrease	$1,311.56	-17.4%	6.93
Capital Cost Estimate	25% Increase	$1,582.53	-0.4%	7.97
	25% Decrease	$1,593.99	0.4%	8.39

10. Supplementary Data Tables

This section breaks down all benefits associated with the five long-term outcome criteria (State of Good Repair, Economic Competiveness, Livability, Sustainability, and Safety) in annual form for the UMTH project in Manly, Iowa. Supplementary data tables are also provided for some specific benefit categories. For example, tables providing estimates of annual emission reductions (in tons) are provided under Environmental Sustainability.

10.1 Annual Estimates of Total Project Benefits and Costs

Calendar Year	Project Year	Total Benefits ($2012)	Total Costs ($2012)	Undiscounted Net Benefits ($2012)	Discounted Net Benefits at 7%	Discounted Net Benefits at 3%
2013	1	$0	$0	$0	$0	$0
2014 (opening)	2	$11,149,195	-$25,811,676	-$14,662,481	-$13,684,781	-$14,235,419
2015	3	$69,517,264	-$8,855,231	$60,662,033	$53,202,883	$57,179,784
2016	4	$96,521,673	-$11,256,000	$85,265,673	$70,037,796	$78,030,170
2017	5	$113,862,840	-$15,315,750	$98,547,090	$75,830,906	$87,557,813
2018	6	$127,043,915	-$16,990,665	$110,053,250	$79,341,043	$94,932,900
2019	7	$141,842,403	-$18,360,617	$123,481,786	$83,415,797	$103,414,052
2020	8	$168,216,332	-$20,119,781	$148,096,552	$93,784,342	$120,416,049
2021	9	$185,336,198	-$20,784,142	$164,552,055	$97,724,077	$129,898,912
2022	10	$196,462,831	-$21,482,596	$174,980,235	$97,446,007	$134,107,780
2023	11	$200,669,369	-$21,912,248	$178,757,121	$93,384,878	$133,012,086
2024	12	$204,590,221	-$22,263,298	$182,326,923	$89,364,260	$131,716,848
2025	13	$208,664,316	-$22,620,498	$186,043,818	$85,581,085	$130,487,391
2026	14	$212,811,494	-$22,983,960	$189,827,534	$81,965,903	$129,263,314
2027	15	$217,057,559	-$23,353,803	$193,703,757	$78,540,685	$128,061,003
2028	16	$221,377,983	-$23,730,143	$197,647,840	$75,264,781	$126,862,627
2029	17	$225,810,633	-$24,113,104	$201,697,529	$72,153,886	$125,691,232
2030	18	$230,199,769	-$24,456,527	$205,743,242	$69,172,396	$124,478,045
2031	19	$234,655,260	-$24,806,125	$209,849,135	$66,316,097	$123,264,250
2032	20	$239,198,071	-$25,162,017	$214,036,054	$63,609,534	$122,061,771
2033	21	$243,799,298	-$25,524,326	$218,274,972	$61,012,501	$120,853,560
2034	22	$248,560,384	-$25,893,176	$222,667,208	$58,570,579	$119,694,597
2035	23	$253,376,806	-$26,268,695	$227,108,111	$56,223,562	$118,526,020
Total		**$4,050,723,817**	**-$472,064,379**	**$3,578,659,438**	**$1,588,258,216**	**$2,425,274,785**

10.2 Annual Demand Projections

Calendar Year	Project Year	Truck Miles Saved Per Year
2014 (opening)	2	12,468,750
2015	3	75,703,125
2016	4	103,500,000
2017	5	119,053,125
2018	6	131,837,625
2019	7	146,629,200
2020	8	177,491,475
2021	9	199,016,453
2022	10	210,762,889
2023	11	214,978,146
2024	12	218,874,030
2025	13	222,843,794
2026	14	226,888,876
2027	15	231,010,742
2028	16	235,210,887
2029	17	239,490,833
2030	18	243,637,879
2031	19	247,864,652
2032	20	252,172,730
2033	21	256,563,724
2034	22	261,039,275
2035	23	265,601,059

10.3 Benefit Estimates – Undiscounted Values

Calendar Year	Project Year	Avoided Pavement Maintenance Costs	Shipper Savings due to Modal Switch from Truck to Rail	Emission Cost Savings due to Modal Switch from Truck to Rail	Accident Cost Savings due to Modal Switch from Truck to Rail	Reduced Road Congestion due to Modal Switch from Truck to Rail
2014 (opening)	2	$2,360,334	$4,132,500	$678,417	$2,637,256	$1,340,688
2015	3	$14,330,602	$27,093,750	$3,941,110	$16,011,910	$8,139,892
2016	4	$19,592,550	$38,640,000	$5,269,198	$21,891,206	$11,128,719
2017	5	$22,536,757	$47,391,750	$5,952,447	$25,180,835	$12,801,051
2018	6	$24,956,862	$53,516,310	$6,510,178	$27,884,875	$14,175,690
2019	7	$27,756,908	$60,117,972	$7,187,957	$31,013,430	$15,766,137
2020	8	$33,599,136	$69,326,082	$8,665,460	$37,541,086	$19,084,568
2021	9	$37,673,815	$74,299,476	$9,870,073	$42,093,818	$21,399,017
2022	10	$39,897,415	$78,684,812	$10,640,269	$44,578,297	$22,662,039
2023	11	$40,695,363	$80,258,508	$11,130,355	$45,469,863	$23,115,279
2024	12	$41,432,854	$81,712,971	$11,616,338	$46,293,879	$23,534,180
2025	13	$42,184,330	$83,195,016	$12,190,425	$47,133,520	$23,961,024
2026	14	$42,950,064	$84,705,181	$12,771,190	$47,989,093	$24,395,967
2027	15	$43,730,334	$86,244,011	$13,383,144	$48,860,905	$24,839,166
2028	16	$44,525,421	$87,812,064	$14,000,441	$49,749,275	$25,290,782
2029	17	$45,335,615	$89,409,911	$14,659,606	$50,654,523	$25,750,978
2030	18	$46,120,650	$90,958,141	$15,392,432	$51,531,661	$26,196,884
2031	19	$46,920,779	$92,536,137	$16,121,319	$52,425,663	$26,651,363
2032	20	$47,736,298	$94,144,486	$16,865,842	$53,336,861	$27,114,584
2033	21	$48,567,513	$95,783,790	$17,595,677	$54,265,597	$27,586,721
2034	22	$49,414,735	$97,454,663	$18,410,820	$55,212,217	$28,067,950
2035	23	$50,278,280	$99,157,729	$19,205,270	$56,177,077	$28,558,450
Total		**$812,596,614**	**$1,616,575,259**	**$252,057,967**	**$907,932,847**	**$461,561,130**